A B S T R A C T B O O K

0001

Regression and Stabilization of Proximal Caries Using Separation and Sealing.

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Objectives The aim of this split-mouth, randomized controlled clinical trial was to evaluate the efficacy of proximal sealing for arresting incipient caries lesions in adults in a one-visit session.

Methods A total number of 48 patients were selected, who had at least one pair of proximal initial carious lesions. At baseline the patient caries risk was analysed using the Cariogram analysis and both test and control surfaces were examined for *mutans streptococci* (ms) counts. A metal separator was inserted into the approximal space, which was slowly and gently screwed in intervals until the space between the proximal surfaces was at least 1 mm. This made it possible to diagnose the test surfaces, if a micro-cavity was present or not, before the sealing procedure. After the treatment the participants were asked to describe their pain perception during the separation procedure.

Results After 2 years, 212 surfaces in 45 subjects were examined by two external clinical observers independently, using standardized digital follow-up radiographs. The sealed test surfaces had regressed or were unchanged in 88% compared to baseline, while for the unsealed control surfaces the corresponding value was 60% ($p<0.0001$). Of these, regression was found in 67% in the test surfaces and 13% in the untreated surfaces ($p<0.0001$). There was a 5.6 higher chance for the sealed surfaces to show regression compared to the control surfaces. Neither the caries risk, the surface diagnoses, the ms counts nor the occurrence of a cavitated lesion seemed to influence the caries development. The separation treatment was well accepted by the patients.

Conclusions The method of separation for diagnose and sealing treatment in a single session seems to be a clinically applicable preventive method for proximal caries lesions.

0002

Predicting Caries Using Social and Familial Factors: A Nationwide Classification-and-Regression-Tree Analysis

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Objectives The family and social environment are likely of great importance to children's dental health. However, social and familial factors have never been evaluated as isolated caries predictors at the individual level. This nationwide study examined the discriminant ability of sibling caries and various other social and family-level factors in predicting caries risk.

Methods This study included all 15-year-olds in 2003 (index-siblings) and their biological siblings (co-siblings) born within ±3 years. For each individual, data on the outcome and risk predictors were compiled after linking the national dental, social, and population registers. The outcome was caries experience in co-siblings, measured by the DMFS index. The predictors included index-sibling caries, socioeconomic position (parental education, occupation, and income), gender, co-sibling birth order, ethnicity, and household type. The discriminant ability of the predictors was assessed using classification and regression tree (CART) analyses. Using CART, both fully-saturated and the simplest clinically-relevant decision trees that retained useful predictive power were generated. The predictive power of the models was evaluated using the Area under the Receiver Operating Characteristic curve (AUROC) statistic (AUROC: ≥0.8, excellent; 0.7–0.79, useful).

Results There were 23,847 sibling pairs (n=47,694) in the study. The prevalence of caries experience (DMFS>0) in the study population was 73.6%. The overall predictive power of the CART models ranged from useful to excellent (AUROC: fully-saturated trees, 0.8–0.82; clinically-relevant trees, 0.7). Index-sibling caries yielded the greatest influence in predicting co-sibling caries (~67% higher than parental education, the next best surrogate predictor). The simplest clinically-relevant tree contained only index-sibling caries and a socioeconomic position indicator as predictors. This model demonstrated perfect sensitivity (but poor specificity). Per this model, caries could be expected in ≥84% of co-siblings of adolescents with ≥3 caries-affected tooth surfaces (DMFS ≥2.94).

Conclusions Caries in a sibling might suggest preventive family-based approaches targeting co-siblings.

0003

1-Year Clinical Follow-up of Selective Caries Removal in Deep Dentin Carious Lesions

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Objectives Objective: This clinical study aimed to observe the success of stepwise removal or one-step excavation techniques in deep dentin caries.

Methods Method: Forty permanent teeth with caries lesions penetrating to 75% or more of dentin were included. For both one-step excavation and the first stage of stepwise removal, same procedure was applied, in which peripheral dentin was prepared to hard dentin by high-speed diamond and low-speed steel bur. Then, selective removal to soft dentin was carried out using a hand instrument over the pulp. Pure calcium hydroxide followed by zinc-oxide eugenol cement (Alganol, Kemdent®) was placed on pulpal walls of the cavities. Conventional glass-ionomer cement (KetacTM Molar Quik Applicap, 3M ESPE) was used for temporary filling.

Evaluations were performed at the sixth-month according to clinical symptoms and radiographic sings. At the same session, the cavities of stepwise group were re-entered and selective removal was applied to firm dentin via hand excavator. For one-step group, glass ionomer restorations were prepared as the base for final restorations. All cavities in this study were permanently restored with resin composite (G-aenial® Posterior, GC).

Results At the end of the one-year observation period, pulpal success of this study was 100% for one-step excavation technique while 84.21% was for the stepwise group. As a result of re-entry procedure, pulp exposure occurred on seven of teeth (37%) in the stepwise removal group, while vitally survived after one-year. Failure in this group was due to chronic inflammation of three teeth afterward they were treated with root canal therapy.

Conclusions Within the limitation of this study, it seemed that one-step excavation technique presented better performance compared to stepwise removal. Additionally, stepwise removal led to pulp exposure more than expected and it maybe better to reconsider re-entry.

0004

Infiltration of White Spot Lesions with a New Hybrid-Glass-Based Material

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Objectives The objective of this study was to compare the effectiveness of Icon (DMG, Hamburg, Germany) and two experimental, hybrid-glass-based infiltrating materials (Hybrid Glass, Wroclaw, Poland), in preventing the progression of artificial white spot lesions (WSLs), *in vitro*.

Methods Artificial WSLs were formed on 3mm-wide middle part of disk-shaped bovine enamel specimens (n=68; 8mm diameter), while the outer parts were protected and served as a reference. Samples were divided into four groups according to the treatment of WSLs: 1) no-treatment control (**NTC**), 2) infiltration with Icon (**I**), 3) infiltration with experimental hybrid-glass material (**EXP**), and 4) infiltration with experimental hybrid-glass material containing hydroxyapatite nanoparticles (1%) (**EXP-HAp**). Half of the specimens from each group were subjected to a cariogenic challenge using pH-cycling protocol. Briefly, during 5-day period specimens were incubated (37°C) alternately in demineralization (4h/day, pH=4.6) and remineralization solutions (20h/day, pH=7.2). Another half of the specimens was incubated (37°C) in distilled water and served as a control. Finally, enamel softening was assessed by measuring surface micro-hardness, enamel surface loss was determined by measuring surface roughness and profilometry, and surface morphology was analyzed with SEM. One-Way ANOVA and post-hoc LSD or Games-Howell tests were used for data comparison ($p<0.05$).

Results In all groups (**NTC**, **I** and **EXP-HAp**), except in **EXP** group, surface micro-hardness decreased significantly after pH cycling. In addition, micro-hardness in **EXP** group was significantly higher than in other pH-cycled groups ($p<0.05$). Also, surface roughness increased considerably while profilometry showed a significant tissue loss after pH cycling in all groups except in **EXP** group. This tissue loss and increase in roughness in **NTC**, **I** and **EXP-HAp** groups was also observed with SEM.

Conclusions An experimental hybrid-glass material without **HAp**-nanoparticles seems to be able to completely arrest the progression of WSLs, unlike its version with **HAp**-nanoparticles and resin-based infiltrant Icon.

0005

Caries-Preventive Effect of Fluoride and Fluoride+Chlorhexidine Varnishes *In-vitro*

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Objectives The aim of our study was to compare the preventive effect of fluoride varnish and fluoride varnish containing chlorhexidine on root caries formation.
Methods 100 bovine root dentine samples were allocated to five treatment groups (n=20/group): (1) fluoride (7700 ppm) varnish (FP), (2) placebo varnish for FP (FP-P), (3) chlorhexidine (0.3%) + fluoride (1400 ppm) varnish (CF), (4) placebo varnish for CF (CF-P), (5) untreated control. A carious challenge was provided using a multi-station, continuous-culture 3-species (*Streptococcus mutans (SM), Lactobacillus rhamnosus (LR), Actinomyces naeslundii (AN)*) biofilm model. Bacteria were inoculated 1× daily, followed by provision of 1% sucrose 5× daily and artificial saliva after each sucrose pulse. After 10 days, mineral loss (ΔZ) was measured in the effect area and adjacent to the varnished areas, and bacterial counts of the biofilms on the varnished areas were assessed. Three-dimensional biofilm architecture of exemplary specimens from the FP-, CF- and control-groups was analyzed via fluorescence *in situ* hybridization (FISH) and confocal microscopy.
Results Mean±SD ΔZ was significantly lower for FP (9133±758 vol%×µm) and CF (9835± 1677) compared to the control-group (11363±919; $p<0.05$/ANOVA), with no significant difference between FP and CF. Varnishes did not protect adjacent areas against demineralization and placebo varnishes had no significant preventive effect on ΔZ. *SM* counts were significantly lower in FP- and CF-biofilms than controls, while *LR* counts were significantly higher in FP- and CF-biofilms. *AN* counts were significantly higher in the FP-group compared to all other groups. FISH demonstrated the presence of thick biofilms containing all employed bacteria. *SM* and *LR* invaded dentinal tubules, but only in the control-group. In the CF-group, the basal biofilm layer contained only *LR*.
Conclusions FP and CF had a similar caries-preventive effect. Both varnishes have a considerable impact on biofilm structure and composition, with only minor differences between these varnishes.

0006

Cultivatable Bacteria in Deep Carious Lesion after Ozone Disinfection

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Objectives The study was aimed to investigate local effect of gaseous ozone on cultivatable bacteria in deep carious lesions after incomplete caries removal, using chlorhexidine as control.
Methods Forty-eight posterior teeth with deep caries lesions, but without signs and symptoms of irreversible pulpitis, were submitted to incomplete caries removal. The teeth were randomly allocated into two groups regarding the cavity disinfectant used: ozone or 2% chlorhexidine. Dentin samples obtained before and after cavity disinfection were microbiologically investigated for the total aerobic and anaerobic bacteria, and *Streptococcus spp*. The treatment effect was assessed by pair-t test and independent t test.
Results Significant decrease in number of aerobic and anaerobic bacteria, and *Streptococcus spp.* was observed after cavity disinfection with either ozone or chlorhexidine ($p<0.01$). Comparing reduction between two disinfectants, a significant greater reduction by chlorhexidine was seen for *Streptococcus spp.* ($p<0.01$) but not aerobic and anaerobic number ($p>0.05$).
Conclusions Ozone might serve as a suitable cavity disinfectant in inhibiting the residual bacteria in deep caries lesions after incomplete caries removal.

0007

Diffusion Reflection, a novel non-invasive nanophotonic method for early in vivo detection of oral cancer

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Objectives To develop a methodology for early in-vivo detection of oral cancer by using DR optical method in a well-known rat model of oral carcinogenesis.
Methods DR measurements of C-gold-nanorods injected systemically were recorded from the surface of rat tongue where OSCC has been induced by the carcinogen 4-nitroquinoline-N-oxide (4NQO). 26 Wistar-derived male rats were used, divided into experimental (15) and control (11) groups. C-gold-nanorods were injected systemically to the tail vein. DR measurements were taken following washout time of 96 hours interval. The results of the DR measurements were compared with the histologic diagnosis.
Results Dysplastic lesions have been found from week 4 and OSCC was detected after week 22. Following intra-venous injection of C-gold-nanorods, significantly high DR values were recorded in all rats in the area corresponding to carcinoma compare with the unaffected tip of the tongue and with the control healthy rats. As the degree of the dysplasia increased higher DR values were measured.
Conclusions The presented nanophotonic optical detection method provides a highly sensitive and simple tool for cancer detection and accurately detect tumor margins, hence, improving the outcome of oral cancer.

0008

miR-21 and TAC as Salivary Biomarkers for Oral Dysplasia

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Objectives Previous studies have demonstrated that microRNA-21 (miR-21) and total anti-oxidant capacity (TAC) could be potential diagnostic biomarkers for oral squamous cell carcinoma. However, their diagnostic potential in the early stages of carcinogenesis is not clear yet. This study was conducted to determine the salivary levels of miR-21 and TAC in patients with oral hyperplasia and dysplasia.

Methods We assessed expression of miR-21 and TAC by qPCR in whole unstimulated saliva samples of 30 patients with oral mucosal lesions demonstrating hyperplastic or dysplastic changes and 30 healthy individuals with normal mucosa. Biopsy was taken from the lesions, immediately fixed, then processed and stained with Hematoxylin & Eosin for histopathologic diagnosis. Statistical analysis was performed with IBM® SPSS® ($P \leq 0.05$) and ROC curve analysis was performed with MedCalc.

Results

miR-21 expression was higher in mucosal lesions than normal mucosa and in dysplasia than hyperplasia with significant difference ($P < 0.001$). TAC expression was lower in mucosal lesions than normal mucosa with significant difference ($P = 0.001$), and in dysplasia than hyperplasia but with no significant difference ($P = 0.093$). Diagnostic accuracy, sensitivity and specificity were higher in miR-21 (96.6%, 100%, 94.4%) than TAC (73.3%, 83.3%, 66.7%). Positive predictive value and negative predictive value were higher in miR-21 (92.3%, 100%) than TAC (62.5%, 85.7%). The cut-off value was 9.45 for miR-21 and 20.85 for TAC.

Conclusions

Oral hyperplasia and dysplasia are associated with altered miR-21 and TAC expression. Salivary miR-21 was more accurate in detecting oral dysplasia than salivary TAC. Salivary miR-21 could be potential diagnostic biomarker for screening and early detection of oral cancer. More studies are required to validate miR-21.

0009

Oral and Ocular Findings in Radiated Head and Neck Cancer Patients

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Objectives To investigate oral and ocular dryness in head and neck cancer patients after radiotherapy, and compare to age and gender matched controls.

Methods Thirty cancer patients who had completed radiotherapy in the head and neck region (RT-group) (age 64±10y), and thirty sex- and age-matched controls (age 58±17y) were recruited. All participants underwent a comprehensive oral and ocular examination. Oral testing included the Shortened Xerostomia Inventory Questionnaire (SXI), evaluation of clinical oral dryness score (CODS) and unstimulated- and stimulated whole saliva (UWS, SWS ml/min). Ocular examination included McMonnies Dry Eye questionnaire (MDEIS), tear film break-up time (TFBUT), Schirmer test (ST) and ocular surface staining (OSS with Oxford grading score). Intergroup comparisons were tested with Mann-Whitney U test and correlations were tested using Spearman's rho using SPSS Version 25. P-values <0.05 were considered significant.

Results The RT-group demonstrated worse oral objective findings compared to controls; increased CODS (5.8±1.9 vs 1.6±1.6, $p<0.001$), decreased UWS (0.1±0.09 vs 0.3±0.2, $p<0.001$) and SWS (1.0±0.4 vs 1.8±0.8, $p<0.001$). Subjective oral dryness scores were less favorable in the RT-group compared to controls (SXI: 11.9±2.4 vs 6.0±1.0, $p<0.001$). Subjective dry eye scores were worse in the RT-group (MDEIS: 8.3±4.5 vs 2.8±2.5, $p<0.001$). Objective dry eye results did not differ between the groups (TFBUT: 5.9±5.0 vs 4.9±3.6, $p=0.98$), (OSS: 0.8±1.5 vs 0.9±1.0 $p=0.225$), (ST: 13.2±10.4 vs 16.5±10.0, $p=0.161$). The subjective oral and ocular findings (SXI and MDEIS) were highly correlated within the groups ($r=0.6$, $p<0.001$).

Conclusions The post-radiation sequelae of head and neck cancer have negative consequences for oral health and may influence ocular health. A broader understanding of oral and ocular correlations is important in the interdisciplinary evaluation and follow-up of cancer patients treated with radiotherapy in the head and neck region.

0010

Cytoprotective Effects of Geranylgeraniol on Alendronate-induced MC3T3 Cell Death

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Objectives To investigate the effects of GGOH on MC3T3 cell viability and cell cycle under ALN treatment.

Methods MC3T3 cells were incubated with different doses of ALN (0-50 µM) and GGOH (0-50 µM). The viability and apoptosis of the MC3T3 treated with ALN and GGOH for 3 d were determined by MTT and annexin/PI staining assays, respectively. Cells stained with PI were used to determine cell cycle phase. In addition, cells were stained with rhodamine pholloidin to investigate cell cytoskeleton.

Results ALN reduced cell viability of MC3T3 in a dose dependent manner. GGOH at 50 µM partially inhibited the cytotoxic effects of 10 and 50 µM ALN. ALN at 10 µM increased the percentages of cell apoptosis and necrosis and arrested cells in G2M phase. Incubation with 50 µM GGOH partially reduced late cell apoptosis and significantly rescued cell cycle arrest in G2M. Furthermore, ALN altered MC3T3 morphology and decreased cell area as well as actin stress fiber density. GGOH significantly abolished the effect of ALN on cell area and actin stress fiber density.

Conclusions GGOH partially reversed negative biological effects of ALN on MC3T3 cell viability, cell cycle, morphology and cytoskeleton.

0011

Regional Effect of Epinephrine on the Microcirculation of Human Gingiva

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Objectives Spreading vasoconstriction is a known phenomenon which is described in various tissues as a locally evoked vasoconstriction which could elicit remote vasoconstriction at distant areas. Epinephrine is widely used vasoconstrictor in dentistry, but the spreading vasoconstriction has not been demonstrated yet in gingiva.
The aim of this study was to investigate the local and remote effect of epinephrine in the attached gingiva.

Methods Gingival blood flow was measured by Laser Speckle Contrast Imager in 15 healthy volunteers. In group A two wells were fabricated from orthodontic ligatures for the solutions and placed 2 mm apically from the free gingival margin at midbuccal line of 12 and 21 teeth. Blood flow was measured in the wells and apical, coronal, distal, mesial directions around the wells. In group B the wells were made on the surface of the corresponding teeth including the gingival sulcus and four measurement regions were from the gingival margin reaching to the mucogingival line close to each other. After the baseline recording either 1 mg/ml epinephrine solution (test site) and physiological saline (control site) were applied into the wells and further 15 minutes recording was done.

Results : In group A the gingival blood flow did not changed in any regions. In group B the blood flow decreased at the test site immediately after application of epinephrine and remained low for 15 minutes in all regions. The decrease was the largest close to sulcus which degree became lower to the apical direction.

Conclusions Attached gingiva seems to be impermeable for epinephrine thus epinephrine cannot evoke any vasoconstriction on the keratinized gingiva. Whereas application at the gingival sulcus could evoke strong, long-lasting vasoconstriction up to the mucogingival junction suggesting the permeability of sulcus and presence of spreading vasoconstriction in the human gingiva.

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0012

Oral Microbiota in Early Cystic Precursors to Invasive Pancreatic Cancer

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Objectives Pancreatic cancer (PC) increasingly impacts public health, being the fourth-leading cause of cancer-related death in Western countries with a low overall survival rate and rapid deterioration in quality of life. Intraductal papillary mucinous neoplasms (IPMNs) rank as the most common pancreatic cystic tumours and can progress to invasive PC. Previously, risk for PC development has been associated with poor oral health and salivary microbiome alterations. We aimed to investigate the pancreatic microbiome of IPMN and its relation to disease severity.

Methods Patients with suspected pancreatic cystic neoplasm (PCN) undergoing pancreatic resection were included in this study. Peri-operative intracystic fluid (CF) was collected from the tumours, and analysed by 16S DNA qPCR, PacBio whole-16S gene sequencing, interleukin 1-beta (IL-1β) and bacterial LPS quantification. Viable bacteria were detected by the BACT/ALERT system and characterized further. Data were correlated to pancreas diagnoses verified by histopathology examination and clinical

laboratory tests.
Results Compared to non-IPMNs, the 16S DNA and IL-1β in CF were found significantly higher among IPMNs. Interestingly, the 16S DNA and IL-1β levels were higher in IPMNs showing high-grade dysplasia (HGD) compared to IPMNs with low-grade dysplasia and other benign tumours. Although the intracystic microbial composition showed a high interpersonal variation, bacterial network analysis revealed a significant co-occurrence of oral bacterial taxa. IPMN with HGD in particular, was enriched for *Fusobacterium nucleatum* and *Granulicatella adiacens*, and the presence of viable oral bacteria were confirmed by the BACT/ALERT culture system and bacterial identification.
Conclusions Combining culture-dependent and culture-independent methods to detect oral bacteria in the pancreas can improve detection of cancerous pancreatic IPMNs. Our result addresses an important clinical need in the pancreatic tumour management. The role of oral bacteria in pancreatic CF and PCN progression remains to be elucidated.

0013

Finite Element Analysis and Fracture Resistance Testing of Multilayered Woven Fiber and Sonically Inserted Resin Composites
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Objectives The purpose of the present study was to evaluate the stress distribution and fracture type of teeth restored with sonically inserted resin composites (SIRC) reinforced by single or multiple layers of polyethylene woven fiber (PWF).
Methods Following the Class II (MOD) cavity preparation in nighty-six double rooted mandibular molar teeth, they were divided into eight groups; Group-1: the teeth were restored only with SonicFill2 (SF2), Group-2: one layer of PWF+SF2; Group-3: two layers of PWF+SF2; Group-4: four layers of PWF+SF2; Group-5: the teeth were restored only with Resin Composite inserted with a sonic instrument Compothixo (RCC), Group-6: one layer of PWF+RCC; Group-7: two layers of PWF+RCC; Group-8: four layers of PWF+RCC. Finally, the test specimens were subjected to compressive strength testing until fracture in an EMIC universal testing machine. The data were statistically analyzed using one-way ANOVA followed by post-hoc Tukey test. Specimens also were scored based on the occurrence of vertical root fracture (VRF) and the scores were analyzed using chi-square test. For the finite element method, specimens of the fracture resistance test were simulated by computer modeling to determine the stress distribution pattern in the teeth and resin composite combinations studied.
Results The highest fracture strength was observed in Group 3, followed by Group 7 and Group 4, respectively. However, there were no statistically significant differences between SF2 and RCC groups combined with same amount of PWF ($p= 0.527$). In addition, frequency of VRFs in Group 5 was significantly higher than all groups ($p= 0.012$).
The FEA model for Groups 3 and 4 demonstrated lowest stress values and highest fracture strength, being in agreement with the *ex vivo* study.
Conclusions Reinforcing the coronal restoration with two layers of PWF gave most favorable results. While four layers of PWF and stand-alone SIRC increase the stress distribution and decrease the fracture resistance.

0014

Flexural Fatigue Limit of Aged Composite Specimens
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Objectives The strength of filling materials are often characterized after a 1day soak at 36°C in water by load-to-failure tests, where a load is applied until the specimen breaks. Clinically, filling materials exist saturated with water and are not loaded with a single critical force. Under the lower repetitive forces experienced clinically, a crack forms and grows until it becomes fatal. The objective of this study is to characterize the flexural fatigue limit (FFL) of thermocycled filling composites based on different technologies.
Methods Flexural strength specimens were prepared according ISO4049. Specimens were stored for 2 months in water at 36°C. After 2 weeks they were thermocycled (TC) 10,000 times (5-55°C; 1,000 cycles a day) and placed back into 36C water. The aged specimens were fatigued at 2Hz in water at 36°C for 10,000 cycles using the staircase method (texture analyzer XT plus, stable micro systems). The resulting FFL was compared to the ISO4049 flexural strength (FS) value and FS after the aging protocol above, tested in water at 36C.
Results ANOVA analysis (Tukey) showed that at $p<0.05$, initial FS (n=10), FS after aging (n=10) and the FFL (n=21) behavior of composites can be very different. Values with the same letter in the same column are statistically not different. A correlation was found between FFL and ISO4049 FS (linear $R^2=0,76$) and between FFL and FS after aging (linear, $R^2=0,85$).
Conclusions A high ISO4049 flexural strength is a good indicator for a high FFL. Consequently, a flowable (Filtek™ Supreme XTE) can perform similar or better than highly filled universal composites. The highest initial FS value does not always mean the best performance under fatigue. Filtek™ Universal and Filtek™ One showed the highest FFL after aging. This may be attributed to 3M's nanofiller and urethane-based resin technology.

0015

Impact of Sterilization and Ultrasonic Procedures on Resin Cement Roughness

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Objectives Components of customized implant abutments are glued together by resin cements. This study investigated the impact of water storage, sterilization and ultrasonic cleaning procedures on the surface roughness of resin glues.

Methods High-gloss polished specimens (Struers-Tegramin25) of five resin cements were subjected to cleaning protocols. Protocol 1: 10min of ultrasonic cleaning with an antibacterial detergent at 60°C, 10min of ultrasonic cleaning in ethanol at 60°C, and 10min of purging in distilled water at 60°C. Protocol 2: purging in antimicrobial detergent at 25°C for 30min and autoclave at 134°C for 5min. Roughness (R_a)(KeyenceVK-X100-laser-scanner) was measured after baseline, protocol 1, 2, 90d water storage and protocol 1, 2 + water storage. Statistics: means, standard-error of means, t-test, percentage of R_a -chance compared to baseline.

Results The highest baseline R_a values were found for Attachment bond (2.4+/- 0.2µm) and after protocol 1 +water storage for Attachment Bond (6.0+/- 0.7 µm and RelyX Unicem 2 (4.8+/-0.9µm).

Conclusions Surface roughness of the resin cements was statistically significant more affected by water storage than by protocol 1 or 2. However, both cleaning protocols contribute to higher roughness values of all cements.

0016

Evaluation of CAD/CAM Polymers for Digitally Fabricated Complete Dentures

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Objectives To evaluate the mechanical properties of three prepolymerized poly(methyl methacrylate) (PMMA) resins used in the manufacturing of CAD/CAM milled complete dentures (CDs), as well as two denture base polymers used for conventionally manufactured CDs.

Methods Three CAD/CAM materials were evaluated: Degos Dental L-Temp, IvoBase CAD and Zirkonzahn Temp Basic Tissue. Two materials used for conventionally manufactured dentures were also included as control (Palapress and Paladon 65). Each material type was sectioned into bars for flexural strength, nanohardness, elastic modulus and surface microhardness evaluation (n=8/material). Half of the specimens were stored in water for 30 days while the other half was dry-stored. A 2-way analysis of variance (ANOVA) was conducted to detect the effect of material and storage on the evaluated properties (α=0.05). Statistical software (IBM SPSS Statistics v24; IBM Corp) was used for conducting all analyses.

Results Material type and storage had a significant influence on the flexural strength, nanohardness, elastic modulus and surface hardness of the materials investigated (p<0.001). The post hoc Scheffe test for flexural strength revealed a non-significant difference on the interaction between Degos L-Temp and Paladon (p=1.000). In terms of nanohardness, no difference was found when comparing Palapress with Paladon, as well as IvoBase CAD with Zirkonzahn Temp Basic (p=1.000). A non-significant interaction in terms of surface hardness was also found between IvoBase CAD and Palapress (p=0.575).

Conclusions The tested materials showed variation in their mechanical properties with satisfactory behavior of the CAD/CAM materials. However, the results obtained when testing the materials used for the conventional fabrication of complete dentures suggest that their use might still be advisable.

0017

Effects of Hydroxyapatite on the Mechanical Properties of Glass-ionomer Cements

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Objectives The purpose of this *in vitro* study was to evaluate the effects of incorporation hydroxyapatite (HA) into glass-ionomer cements (GIC) on the mechanical properties.

Methods Two commercially available GICs were used in this study: Fuji II LC and Fuji IX extra GP. Cylindrical shaped specimens (4x6 mm) were used for compressive strength (CS) testing, and 6x3 mm for diametral-tensile strength (DTS) testing. For the flexural strength (FS) testing bar shaped specimens (2x2x25 mm) were made. Four groups (n=11-18) were prepared for each material group. The first group served as a control, without addition of HA, while the other three groups were modified by incorporation of HA 2, 5 and 10 % by weight. Samples were left in distilled water for 1 week before testing and were tested on Universal testing machine, Shimadzu. Statistical analysis was performed using ANOVA and Tukey test.

Results Results showed significantly higher values in all three tested mechanical properties for Fuji II in comparison to Fuji IX. Regarding Fuji IX, control group had the highest values for CS (111.3±31.2 MPa) and FS (15.6±5.0 MPa). The only significant difference was observed in CS in comparison to group modified with 2% HA. Regarding Fuji II, the group modified with 5 % HA had the highest values for DTS (14.3±2.6 MPa) and CS (158.3±25.5 MPa), although not statistically significant. The highest average FS value for Fuji II, significantly different from the control group, was recorded in the group modified with 10 % NHA (48.4±8.7 MPa).

Conclusions Fuji II has better mechanical properties then Fuji IX. Hydroxyapatite incorporated in Fuji II and Fuji IX showed no significant impact on mechanical properties. Only Fuji II modified with 10% NHA showed most favorable results with respect to flexural strength.

0018

Evaluation of Different Predictive Modeling Strategies for Tooth Loss

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Objectives Prediction models learn patterns from available data (training) and are then validated on new data (testing). Prediction modelling is increasingly common in dental research. We aimed to evaluate how different model development and model validation steps impact on the predictive performance of tooth loss prediction models in periodontitis patients.

Methods Two independent cohorts (627 patients; 11651 teeth) had been followed over mean (SD) 18.2 (5.6) years (Kiel cohort) and 6.6 (2.9) years (Greifswald cohort). Tooth loss and nine patient- or tooth-level predictors had been recorded. The impact of different model development and validation steps were evaluated: (1) Model complexity (logistic regression/logR, recursive partitioning/RPA; random forest/RFO, and extreme gradient boosting/XGB), (2) sample size (full dataset or 10%/25%/75% cases dropped at random) (3) prediction periods (max. 10/15/20 years or uncensored), (5) validation schemes (internal, or external by centers/time periods).

Results Tooth loss was generally a rare event (880 teeth were lost). All models showed limited sensitivity, but high specificity. More complex models (RFO/XGB) had no consistent advantages over simpler ones (logR/RPA). Internal (in-sample) validation over-estimated the predictive power (the area-under-the-curve AUC was up to 0.89), while external (out-of-sample) validation found lower AUCs (ranging between 0.51 and 0.82). Reducing the sample size decreased the predictive power, in particular for more complex models. Censoring the prediction period had only limited impact. Internal validation yielded higher accuracy than external (cross-center) validation training (AUC dropped to 0.51 in the worst case). When training the model in one time period and testing it in another, model outcomes were similar to the base-case, indicating temporal validation being a valid option.

Conclusions In conclusion, none of the developed models would be useful in a clinical setting, despite high “apparent” accuracy. Various modeling steps had relevant impact on model performance. During modelling, rigorous development and external validation should be applied and reported accordingly.

0019

Prevalence of Pathogens in Periodontitis Stages in a Albanian Population

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Objectives To characterize the subgingival microbiota, qualitatively and quantitatively, in Albanian patients with different stages of periodontitis.

Methods A total of 30 subjects, diagnosed with periodontitis, between 30-60 years, were clinically evaluated and subgingival microbiological samples were taken. All samples were processed by microbiological culture. The microbiological study included total anaerobic counts, and frequency of detection, counts and proportions of target species. Periodontal status was assessed following the new classification of periodontal diseases, and staging was determined. Chi-square, Fisher’s exact and Mann-Whitney tests were used for the statistical analysis.

Results Ten patients were diagnosed with periodontitis stages I-II, and twenty subjects with periodontitis stages III-IV. The frequency of detection of main periodontal pathogens in periodontitis stages I-II and III-IV were, respectively: *Aggregattibacter actinomycetemcomitans*(0%; 15%), *Porphyromonas gingivalis*(90%; 85%), *Prevotella intermedia*(90%, 80%), *Tannerella forsythia*(40%; 25%) *Fusobacterium nucleatum*(90%; 90%), *Eikenella corrodens(*50%; 50%). The highest proportions were detected for *Porphyromonas gingivalis* (18%; 13%), *Prevotella intermedia(*1.74%; 2.95%), *Fusobacterium nucleatum*(1.10%; 2%) and *Eikenella corrodens* (0.37%; 3.83%). There were no statistically significant differences between stages I-II and III-IV with respect to the frequency of detection or counts and proportions of these target species (p>0.05).

Conclusions In patient diagnosed with periodontitis in Albania, no differences were detected between periodontitis stages I-II and stages III-IV. High frequencies of detection were observed for relevant periodontal pathogens, including *P. gingivalis, P. intermediaand F. nucleatum.*

0020

Microbiological Characterization of Different Stages and Grades of Periodontitis

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Objectives To determine to what extent microbiological profiles can distinguish among different stages and grades of the new classification of periodontitis.

Methods Thirty-three subgingival samples, coming from 11 patients without periodontitis, 11 subjects with periodontitis stages 1 and 2, and 11 patients with periodontitis stages 3 and 4, were analyzed by microbiological culture. Grades were given using indirect estimation of progression (radiographic bone loss/age): slow (A), moderate (B) and rapid progression (C). The microbiological study included total anaerobic counts, and frequency of detection, counts and proportions of target species. Association measures, chi-square test with Bonferroni correction and non-parametric methods (Kruskal-Wallis and Jonckheere-Terpstra tests) were used for the statistical analysis.

Results The frequency of detection of the main periodontal pathogens isolated were: *Porphyromonas gingivalis* (non-periodontitis, 64%; stages 1-2, 82%; stages 3-4, 91%), *Prevotella intermedia* (64%; 91%; 100%), *Tannerella forsythia* (9%; 27%; 54%), *Parvimonas micra* (18%; 0%; 0%) and *Fusobacterium nucleatum* (91%; 91%; 82%). Total counts showed statistically significant differences among groups (p=0.019), and grades (p=0.047). There were statistically significant concordant trends between total counts and stages (p=0.005) and grades (p=0.015); and between counts of *P. intermedia* and *T. forsythia* and periodontal stages (p=0.029 and p=0.028, respectively). Counts and proportions of *Eikenella corrodens* and *Capnocytophaga* spp. showed a statistically significant trend for increasing extension of periodontitis. The odds ratio (OR) for the detection of *T. forsythia* in periodontitis stages 3 and 4 was greater than in non-periodontitis group (OR= 12; 95% confidence interval >1).

Conclusions Distinctive profiles of subgingival microbiota could be discerned among stages and grades, since total counts and counts of *P. gingivalis* and *T. forsythia* have shown a significant increase as periodontal stages aggravate; and total counts have also shown a significant trend to increase as the rate of progression worsens from slow (A) to rapid (C).

0021

Periodontitis is Associated with High/Uncontrolled Blood Pressure among High-Income NHANES Participants

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Objectives Recent findings from our group indicate that a good periodontal health is associated with better systolic blood pressure (BP) profile by about 2.3-3 mmHg and with lower odds of antihypertensive treatment failure. However, disparities in socioeconomic status might affect oral health awareness or healthcare access. We aimed at testing whether the association of periodontitis and BP persists among high-income individuals.

Methods We examined mean systolic BP(±standard deviation, SD) and the odds ratio (OR) for high/uncontrolled systolic BP (>130 mmHg according to 2017 US hypertension guidelines) in NHANES 2009-2014 high-income participants who underwent complete periodontal examination. Since a poverty-to-income ratio (PIR) score of 1.00 identifies the official federal poverty threshold, we selected participants with PIR≥4 according to CDC. Crude and adjusted (age, gender, ethnicity, body mass index, smoke, glycohemoglobin, cholesterol, triglycerides, creatinine, education) models were generated using R software.

Results Of 2925 participants with PIR≥4, 2853 had complete data. Compared to participants with periodontitis (n.974, 33.9% women, mean age 58.4±13y, 86.2% non-Hispanic), those without periodontitis (n.1879, 54.5% women, mean age 49.7±13.2y, 89.1% non-Hispanic) had lower mean systolic BP (crude:120.1±15.8 mmHg vs 126.4±18 mmHg, p<0.0001; adjusted: 120.1±6.7 mmHg vs 126.3±6.5 mmHg, p<0.0001), but same mean PIR (4.8±0.3, p=1). Periodontitis was significantly associated with the risk of high/uncontrolled systolic BP compared with the absence of the disease (crude OR:1.95, 95%CI 1.65-2.30, n.2853, p<0.0001; adjusted OR: 1.26, 95%CI 1.04-1.53, n.2732, p=0.019).

Conclusions In this analysis on high-income individuals, where PIR didn't differ by periodontal status, the association of periodontitis and high/uncontrolled systolic BP persisted. Other factors might mediate this association.

0022

Comparison of the Efficacy of Titanium Platelet Rich Fibrin and De-epithelized Connective Tissue Graft in The Treatment of Gingival Recessions: A Randomized Clinical Trial

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Objectives Gingival recession is defined as exposure of the root surface due to apical migration of the gingival margin beyond the cemento-enamel junction. Although many surgical methods are available for the treatment of gingival recessions, subepithelial connective tissue graft (SCTG) is considered the gold standard. Titanium platelet rich fibrin (T-PRF) is a platelet concentrate developed in titanium tubes. The use of titanium tubes causes the membrane fibrin network to become tighter, prolong the resorption time, and a more controlled and prolonged release of growth factors. De-epithelized connective tissue graft (DCTG) is obtained by taking the epithelium on the graft extraorally after it is taken with the epithelium. DCTG is a better-performing connective tissue graft thanks to the protection of the more rigid and stable lamina propria located close to the epithelium than SCTG. The aim of this randomized clinical trial was to compare the clinical results of different autogenous graft materials (T-PRF & DCTG) in the treatment of Miller Class I / II gingival recessions.

Methods Twenty seven patients with Miller Class I / II Gingival recessions were randomly treated with T-PRF (40 teeth) or DCTG (40 teeth) with modified tunnel technique. Clinical measurements were recorded at baseline, 3 months and 6 months after the

operations. VAS (Visual Analog Scale), healing index was evaluated and material thickness was recorded.
Results The mean baseline gingival recession depth were 3.02 ± 1.15 mm in the T-PRF group and 2.81 ± 0.86 mm in the DCTG group. After 6 months, the mean root closure rate were 78.33% in the T-PRF group and 85.28 in the DBDG group, while the complete root surface coverage were 62.5% in the T-PRF group and 70% in the DCTG group. At the end of the treatment, both graft materials were increased the keratinised tissue width and gingival thickness statistically significantly.
Conclusions Within the limits of this study, it was shown that T-PRF membrane provide reliable and effective results in the treatment of Miller I / II gingival recession defects. T-PRF can be used as an important alternative to DCTG.

0023

Influence of Periodontal Diagnosis on the Efficacy of Adjunctive Antiseptics

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Objectives To answer the following PICO question: In systemically healthy humans with gingival inflammation, is there any influence of periodontal diagnosis (gingivitis [GinP] or previously treated periodontitis patients [PTPP]) on the efficacy of antiseptic agents used adjunctively to mechanical plaque control, in terms of changes in gingival (GI) or plaque indices (PII), in randomized clinical trials (RCTs) with at least 6 months' follow up?
Methods After designing the protocol, a systematic search was conducted in three databases in order to identify 6-month RCTs. Data were extracted and outcomes were summarized as means and standard deviation (SD) or standard error of the mean. The results were pooled and analyzed using weighted mean differences (WMD) or standardized mean differences (SMD). Meta-regressions were performed to identify if periodontal diagnosis affected the results.
Results Out of 1,139 references, 94 were included in this systematic review and 70 studies were included in data analyses. Regarding GI changes, although the PTPP tended to have greater reductions (n=16; SMD=-1.564; 95% confidence interval –CI- [-2.197; -0.931]; p<0.001) when compared to the GinP (n=44; SMD=-1.289, 95% CI [-1.560; -1.018]; p<0.001), meta-regression did not find significant differences between them (coefficient=-0.266; 95% CI [-1.027; 0.495]; p=0.487). Considering percentage of bleeding, meta-regression did not identify significant differences in reductions when comparing GinP vs PTPP (coefficient=-1.10%; 95% CI [-11.03%; 8.83%]; p=0.821). With regard to PII, PTPP tended to have greater reductions (n=20; SMD=-1.374; 95% CI [-1.120; -0.894]; p<0.001) than GinP (n=58; SMD=-1.043; 95% CI [-1.240; -0.841]; p<0.001). However, there were no statistically significant differences between them according to the meta-regression (coefficient= -0.323; 95% CI [-0.814; 0.169]; p=0.195).
Conclusions The antiseptic agents were similarly effective in reducing gingivitis and plaque in patients with gingivitis on intact periodontium or previously treated periodontitis patients with gingival inflammation.

0024

Three-Dimensional Volumetric Analysis of the Maxillary Sinus: A CBCT Study

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Objectives Various mechanisms have been shown to play important role in the growth of maxillary sinus cavities located beneath the orbit in the maxillary bone. The aim of this study was to determine the volumetric size of the maxillary sinus and investigate the effect of gender and age on maxillary sinus volume using cone-beam computed tomography (CBCT) images in a Turkish subpopulation.
Methods This retrospective volumetric CBCT study was carried out on 133 individuals (84 females, 181 males) between 8 and 51 years old. Maxillary sinus volume was measured using the MIMICS 19.0 software (Materialise HQ Technologielaan, Leuven, Belgium). All statistical analyses were performed using the SPSS (Statistical Package for Social Sciences, version 21) software. Mean and standard deviation of both maxillary sinuses measurements were calculated and compared to gender and age. P values <0.05 were considered to indicate statistical significance.
Results Mean volume of the right maxillary sinus was 13.173 cm^3, while for the left was 13.194 cm^3. There was no significant difference between right and left maxillary sinus volumes (p>0.05). There was no significant correlation between maxillary sinus volume and age (p>0.05). No significant difference was found between maxillary sinus volume and gender (p>0.05).
Conclusions Right and left maxillary sinus volumes were not different from each other. Gender and age were not found to be related with maxillary sinus volume.

0025

Radiological Predictors of Root Resorption in Patients with Impacted Canines

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Objectives To identify predictors of canine-induced root resorption (CIRR) in patients with impacted maxillary canines (IMCs).
Methods A retrospective study was conducted among patients referred for localization of maxillary canines and/or suspicion of CIRR. In total, 117 patients aged 9-17 years [mean (SD) age 11.5 (1.8) years; 59.8% female; 57.3% bilateral impacted canines] comprised the study population, yielding 184 IMCs as the unit of analyses. Two oral radiologists analyzed the position and root development of the IMCs on available panoramic images, and the frequency and extent of CIRR on cone-beam computed tomography (CBCT) images. Data were analyzed using logistic regression with clustered robust standard errors.
Results Of all cases, 147 (79.9%) IMCs had caused some degree of resorption on neighboring teeth. The localization of the canine cusp tip (CCT) influenced the study outcome. Vertically, when the CCT was positioned between the apex and cementoenamel junction of the neighboring incisor, it increased the odds of CIRR by 10 times (OR=10.28; p=0.028), compared to supraapical positions. Horizontally, superimposition of either the lateral or central incisor increased the odds of CIRR by 10 times (OR=10.26; p=0.005) and 19 times (OR=19.12; p=0.038) respectively, compared to a more posterior localization of the CCT. Angulation of the IMC was also associated with CIRR; canine-occlusal plane angles 31-45 degrees, and canine-incisor angles 16-30 degrees increased the odds of CIRR by 54 times (OR=54.74; p=0.004) and 21 times (OR=21.21; p=0.019) respectively, compared to angles 0-15 degrees. Root-length exceeding crown-length with open (OR=98.91, p<0.001) or closed (OR=16.02; p=0.034) apex, increased the odds of CIRR compared to when the root-length was shorter than crown-length.
Conclusions The strongest predictors for CIRR were IMCs with advanced root development and an open apex, canine-occlusal plane angles 31-45 degrees, canine-incisor angles 16-30 degrees, and when the CCT superimposed the central incisor.

0026

Evaluation of Relationship between Third-Molars and Maxillary Sinus Using CBCT

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Objectives The aim of this study was to evaluate position of the maxillary third molar and the relationship between maxillary third molar teeth and maxillary sinus by using images obtained from cone-beam computed tomography (CBCT) scans.
Methods In this retrospective and observational study, the maxillary third molar teeth of 147 patients, who applied to Cukurova University Faculty of Dentistry underwent CBCT scanning for various reasons, were examined. Evaluated parameters were the vertical position of the maxillary third molar teeth relative to the adjacent second molar teeth according to the Archer's classification, relationship between the roots of maxillary third molar teeth and the lower wall of the maxillary sinus according to Winter's classification. Pearson chi-square test was used for analysis. Significance level was determined as p = 0.05.
Results A total of 147 patients (74 females, 73 males) with a mean age of 33.32 ± 14.31 were included in the study. A total of 155 maxillary third molar teeth, 74 right and 81 left, were examined. In our study, the depth of the maxillary third molars were the most common class A (58.1%), the most common vertical (31.6%) and horizontal (53.5%) relationship between the roots of the maxillary third molars and the maxillary sinus was Type I. Also, the most common type of angulation according to Winter classification was vertical position. No significant relationship was found between these classifications and gender or location (right / left).
Conclusions The relationship between the maxillary third molars and the maxillary sinus should be carefully evaluated against various complications risks, especially during the tooth extraction. Necessary precautions should be taken before surgical procedures and CBCT scans should be used to assess the true relationship between maxillary sinus and maxillary third molar roots during treatment planning.

0027

The Relationship Between Impacted Mandibular Third Molars and the Inferior Alveolar Nerve Canal: A Comparative Study of Cone-Beam CT and Panoramic Radiography

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Objectives It is important to examine the position of the impacted third molar and determine its relationship with the mandibular canal preoperatively to minimize the risk of nerve injury. Panoramic radiographs are most commonly used for this purpose. However due to the limitations of two dimensional imaging methods, cone-beam CT (CBCT) examination is recommended for the further investigation.The aim of this study was to evaluate the relationship between the mandibular canal and impacted mandibular third molars using CBCT and to compare the CBCT findings with signs of digital panoramic radiographs (DPR).
Methods This retrospective study consisted of 200 mandibular third molars from 200 patients who showed a close relationship between the mandibular canal and third molars on DPRs and were referred for the examination of the position of the mandibular canal with CBCT. DPRs were evaluated for the interruption of the mandibular canal wall, darkening of the root, diversion of the mandibular canal, and narrowing of the root. The statistical correlations between the DPR and CBCT findings

were examined using the Chi-square test.
Results The sample consisted of 124 females and 76 males; ages ranged between 18 and 47 years (mean 25.75±6.15 years). 146 cases (73%) showed absence of canal cortication between the mandibular canal and impacted third molar on CBCT images. It was found that there was statistically significant relationship between CBCT and DPR findings (p=0.024, p<0.05). The absence of canal cortication on CBCT images was most frequent in the DPR signs of 'diversion of the mandibular canal' (%96) and was least frequent in 'interruption of the mandibular canal wall' (65%).
Conclusions CBCT examination is highly recommended when 'diversion of the mandibular canal' is observed on DPR images to reduce the risk of mandibular nerve injury more than other DPR signs.

0028

Salivary Stress Biomarkers in Dental Students

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Objectives The purpose of this study was to determine alpha-amylase and salivary cortisol and cardiovascular response in dental students under stress conditions.
Methods We studied salivary cortisol and alpha-amylase and cardiovascular response, in a group of 65, 4th year dentistry students who volunteered to participate in our study before and after performing for the first time a restorative and surgical treatment on a patient. ELISA test was carried out to determine the levels of these salivary biomarkers and cardiovascular response was tested.
Results Performing a dental treatment on a patient is considered to be a source of stress for Dental students since cortisol levels were found to be increased before conducting a procedure on a patient for the first time, to a statistically significant extent (p<0.05). Alpha-amylase levels increased prior to the procedure, however not to a statistically significant extent (p>0.05). No differences were observed in salivary biomarkers concerning gender.
Conclusions Salivary Cortisol is an efficient indicator of levels of stress in dental students, as has been confirmed by the significant increase observed when performing their first dental treatment on a patient. More studies need to be carried out in order to evaluate gender differences.
Moreover, Dentistry is one of the most stressful occupations. Due to the long-term consequences it could have on their health, the decline in the students' anxiety would be an objective to pursue. Salivary cortisol determination could help us determine whether a dental student is stressed so that he could be taught how to cope with stress in order to prevent suffering from anxiety. We conclude that saliva collection is an easier and non-invasive method that could be used for diagnostic purposes.

0029

***In situ* Evolution Pattern of Dental Plaque Through Plaque Indices by Imaging Analysis**

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Objectives This study aimed to analyse the in situ evolution of dental plaque levels for five days through several plaque indices by image analysis.
Methods An observational/longitudinal study of plaque evolution was carried out for five consecutive days in 20 subjects with good periodontal health status who did not practice any oral hygiene measure during this period. Three intraoral photographs (one front and two sides) were taken on each subject under ultraviolet light (after plaque disclosure with sodium fluorescein) at day 0 (immediately after professional cleaning), and every 24 hours until the 5th day. The plaque levels of the images were analysed using the DenTiUS Plaque software, obtaining values of the plaque area index (between 0-100), index of area per intensity (API index, between 0-100) and the growth index of area (area value/hour).
Results At the day 0, the median API index was 3.96, and this value increased significantly in the following five days (API index median range: 8.27-14.98), especially due to the increase in the area occupied by plaque (area index median range: 14.22-33.34). The growth index of plaque area decreased with the advance of the days, oscillating the median values between 0.66/h at day 1 and 0.36/h at day 5. Their patterns of evolution indicated that these subjects would need a median (IQR) of 8.13 (9.38) days to reach an area index of 100.
Conclusions The application of the DenTiUS Plaque software and its corresponding clinical indices allowed to confirm how in periodontally healthy subjects the accumulation of dental plaque for five days shows a pattern of continuous and gradual evolution, whose growth rate is heterogeneous. DenTiUS Plaque software is a promising tool for the study of the patterns of evolution of dental plaque in subjects with different clinical conditions, as well as to evaluate the effectiveness of several oral hygiene measures

0030

Post-minamata era and needs for amalgam alternatives

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With the advent of an amalgam phase-down or even phase-out in dentistry, there is need for economical alternatives to amalgam. Moreover, the expected changes both with regards to who needs restorative treatments as well as the shift from coronal to root cavities being restored will lead to increasing demand for easy-to-apply, self-adhesive bioactive materials. Glass ionomers possess many of these desirable characteristics, while their main weakness originally routed in their physical properties. In recent years, these materials have advanced, with improved physical and aesthetic properties, increasing their spectrum of application. The presentation will describe the evolution of this material class, and will assess the widened, but not infinite indication for glass ionomers. Both in vitro and clinical data for managing carious lesions but also hypomineralized ones using glass ionomers will be presented. Future directions that these materials may take and the requirements to be addressed will be discussed as well.

0031

Clinical evaluation of a glass hybrid system vs. a resin composite: preliminary findings of a multicentre trial

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Glassionomer cements (GIC) are classified as bioactive materials with strong, chemical adhesion to hard dental tissues through ion-exchange layer. However, despite these advantages, the mechanical properties of GIC have always been stated as their main shortcoming. One of the greatest breakthroughs in GIC technology, was the introduction of microlaminated system which consisted of fast-setting reinforced GIC and nano-filled resin coating applied on the GIC restoration. Clinical studies have confirmed that this EQUIA system can be used as a long-term aesthetic restorative material in the posterior region therefore offering alternative solution to amalgam restorations. The next step in evolution of restorative materials was glass hybrid technology which was released on the market by the name EQUIA Forte. This material is indicated for class I and class II restorations. Currently, split-mouth, randomized, prospective and multicentre clinical study is in progress with an aim to evaluate the clinical effectiveness of the glass hybrid material EQUIA Forte restorative system, as a long-term restorative material in moderate and large size two-surface restorations versus a nano-hybrid composite resin material. In the presentation the results of the study will be showed.

0032

Advantages of glass hybrid materials in daily practice

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Glass Ionomer Cements (GI) are very well-known dental products mainly used in restorative and luting cases. The reinforcement of the formulation created the new generation of GI, called Glass Hybrid Materials (GHM), well indicated for extended Class II direct restorations. In such case, several characteristics are useful, such as self-adhesive properties and easy handling. However, GHM's clinical indications are still under discussion, in particular when considered amongst others as alternatives to amalgam. This presentation will focus on the clinical indications of GHM: their physical and mechanical properties, the shape of cavities, the clinical steps, and the expected longevity of GHM restorations. Advantages for clinicians and patients such as cost efficiency, durability, reliability, easy handling, range of indications will be illustrated, and results of medium/long term clinical trial will be presented.

0033

Oral health status among older people in a global perspective

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Standardized epidemiological data on older people's oral health are often based on number of teeth present and/or prevalence of edentulousness. Also, based on WHO-criteria standardized data on untreated caries and caries-experience have been obtained, facilitating comparisons of results of various studies. In contrast, different methods for registration of periodontitis hamper comparisons of results obtained, however, over time a number of trends are revealed. During past decades, a general decrease in edentulousness among elderly is obvious, especially in Western European and Nordic countries, although with considerable variations. According to WHO, the average DMFT is higher among persons 65+ years in Europe than in any other WHO-region, and the component 'missing teeth' is prevailing. Thus, over time the burden of untreated caries seems to have shifted from children to older age-groups (including 70+years), and caries activity among elderly appears to have the same level as in younger age-groups. The general trend in tooth preservation seems to increase the need for maintenance and repair of earlier restorations, and to increase the prevalence of periodontitis among older individuals. Most surveys on oral diseases emphasize great variations dependent on geographical area, most pronounced between developing and developed countries. Socio-economic factors play a significant role for elderly people's oral disease level. Another challenge is the increasing number of frail elderly and/or functionally dependent elderly. Individuals living in nursing homes or receiving personal care in their homes are vulnerable patients with poor oral hygiene and substantial oral problems. Many old and frail persons are under

medication resulting in symptoms as dry mouth and reduced chewing ability. Studies of oral health in this population group have revealed very high levels of treatment needs. Consequently, the global increase in number of elderly people is a challenge to the dental care systems as well as to the responsible health authorities.

0034

Measures to promote and support oral health in older adults

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Oral health in older adults is often poor due to various barriers and misconceptions. These barriers are related to: a) personal issues such as general disease, care dependency, low educational level, poor oral health knowledge, institutionalisation, financial constraints, unhealthy habits, and limited access to dental care, b) limited education and negative attitudes of health care providers and formal carers towards oral health promotion in older people, and c) lack of effective oral health policies. The European College of Gerodontology and the European Geriatric Medicine Society have identified three major areas for promoting oral health in older people: health policy action plans, educational action plans, and citizen empowerment and involvement. A number of health policy action plans should be implemented incorporating oral health assessment, treatment, promotion, and funding into general health care policies and funding. Moreover, appropriate legislation and protocols on oral health prevention and promotion in institutional settings should be developed. Formal carers in institutional settings should be trained to identify common oral conditions, provide daily oral hygiene to care dependent patients and call a dentist when necessary. Dentists should receive more training on care provision for frail older people to feel confident treating medically compromised patients, particularly at home and in institutional settings. Empathy-building interventions should be included within gerodontology education to fight ageism. Non-dental health care providers (ie. physicians, nurses, physical therapists) should receive training on initial oral health assessment and promotion as they usually spend more time with older patients compared to dentists. Last but not least, citizen empowerment processes could directly involve the general population in actions promoting oral health in older adults.

0035

Minimal or advanced restorative dentistry? Concepts for oral rehabilitation measures in elderly patients

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Prosthetic treatment of many older adults does not differ from any other adult patient. However, oral health of older individual can change fast when the ability to maintain personal hygiene decreases. Impairment in motoric skills, vision and the onset of memory disorders should be considered in prosthetic treatment planning. Treatment plan must have realistic goal and diagnosis ought to contain careful analysis of chewing ability and occlusal conditions.

Many older adults retain their own teeth. Unfortunately this does not mean that natural dentition guarantees good chewing function. Shortened dental arch (SDA) is usually sufficient for proper chewing. SDA is often good goal for oral rehabilitation in older adults. Maintenance of SDA can be achieved with fixed prosthetic restorations combined with the use of oral implants. One advantage of SDA concept is also the fact that anterior area is easier to clean even in the case if maintenance of proper oral hygiene requires assistance from a caregiver.

SDA concept is not realistic treatment goal for all older adults. In case of poor prognosis extractions and fabrication of removable partial dentures (RPD) can guarantee sufficient chewing function. However, the decision to make RPD ought to be taken early enough so that patient still can learn how to manipulate it. This is also the case when oral conditions have changed to the level when complete dentures are the only option. If the hopeless teeth are removed early enough, one can still be good candidate for implant retained overdenture treatment.

This presentation focuses on prosthetic treatment planning of older adults. The aim is to present cases when extensive treatment is possible and how this may help prognosis in the long run. Minimal treatment goals for those whose condition does not allow normal prosthetic treatments will also be discussed.

0036

Six-year Clinical Performance of a 2-step Self-etch Adhesive in Non-carious Cervical Lesions.

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Objectives Mild and intermediately strong 2-step self-etch adhesives (2SEa) have been shown to bond efficiently to dentin. In general, their bonding efficiency to enamel is inferior to that of etch&rinse adhesives (E&Ra). Nevertheless, their application procedure is less elaborate and leaves consequently less room for application mistakes. The aim of this randomized controlled trial was to evaluate the clinical performance of an intermediately strong 2SEa, as compared with that of a 3-step E&Ra after 6 years of clinical functioning.

Methods 239 non-carious cervical lesions in 50 patients were restored with the micro-hybrid composite Herculite XRV (Kerr), bonded in random order either with the 2SEa Optibond XTR ('OXTR'; Kerr) or the gold-standard 3E&Ra control Optibond FL ('OFL'; Kerr). The restorations were evaluated after 1, 2 and 6 years of clinical service for retention, marginal adaptation, marginal discoloration, caries occurrence and tooth sensitivity. Statistical analysis was done using a logistic regression model

with generalized estimating equations (2-way GEE model).
Results The patient recall rate at 6 years was 94%. The overall clinical success rate was 81.9% and 80.7% for OXTR and OFL, respectively. In total, 42 restorations (21 OXTR, 21 OFL) failed because of retention loss, severe abfraction, severe marginal defects and/or discoloration and/or caries. A retention rate of 93.1% and 89,0% was recorded for OXTR and OFL respectively. The 6-year results for marginal integrity (in %) are presented in the Table. Six OXTR and four OFL restorations revealed caries at the restoration margin. No significant difference was observed between both groups for none of the evaluated parameters ($p>0.05$).
Conclusions After 6 years of clinical service, class V restorations bonded with the 2SEa performed clinically equally successful as those bonded with the 3E&Ra.

0037

Universal Bond Versus Conventional Bond: 18 Month Clinical Evaluation of Fissure Sealants
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Objectives This clinical study compared the retantion rates of a nanofilled fissure sealant placed with the use of universal bond with different modes compared with conventional etch&rinse system over 18 months.
Methods One-hundred and forty-four sealants were placed on the permanent premolars and molars of 13 subjects who had no restorations or sealants present on the fissures and no detectable caries. The sealants were placed with either Adper Single Bond 2 two-step etch-and-rinse adhesive or Single bond Universal adhesive with and without etching by one previously calibrated dentists, using a table of random numbers. After completion of the adhesive application, a nanofilled sealant, Fissurit FX, was applied and light-cured. Clinical evaluations were done at baseline and at 1 week, 6-, 12- and 18-month recalls. Two other calibrated examiners, who were unaware of which adhesive had been used, independently evaluated the sealants. Evaluation of the sealants on every follow-up visit involved visual examination with the aid of a dental explorer and an intra-oral mirror. Each sealant was evaluated with the following criteria: 1= completely retained; 2= partial loss; 3= total loss. The Pearson Chi-square test was used to evaluate differences in the retention rates among the sealants used with different adhesives for each evaluation period.
Results At 18-month recall 98 sealants of 13 patients were completely retained. Complete retention rates were 97.7% for the Adper Single bond 2 group, 100% for the Single Bond Universal ER and 80% for the Single Bond Universal SE groups. Retention rates of Single Bond SE group were statistically different in all periods of evaluation ($p<0.05$). No new caries formation was detected during study period.
Conclusions Fissure sealants placed with ER mode showed better retention rates than those placed with Single Bond SE mode.

0038

Clinical Comparison of a 5-mm Bulk-fill and an Incremental Composite Resin Restoration: 12-month Follow-up
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Objectives The aim of this study was to evaluate the clinical performance of a 5-mm bulk-fill and an incremental resin composite in class II restorations.
Methods Twenty-eight patients were included in the study and received at least one pair of posterior restorations. Teeth were restored with a 5-mm bulk-fill [FB] (Filtek™ Bulk Fill Posterior, 3M ESPE, St. Paul MN, USA) and an incremental composite resin [FU] (Filtek Ultimate Universal, 3M ESPE, St. Paul MN, USA) at each patient. The same universal adhesive system was used according to the manufacturers' instructions for all restorations. A total of 80 class II restorations were placed by one operator. The restorations were blindly evaluated by two examiners at baseline, six and 12 months using modified US Public Health Service Ryge criteria. The comparison of the two restorative materials for each category was performed with the chi-square test ($\alpha=0.05$). The baseline scores were compared with those at the recall visits using the Cochran Q-test followed by McNemar's test.
Results After 6 months, recall rate was 100%. Five FB restorations (12.5%) and three FU restorations exhibited bravo for marginal adaptation ($p > 0.05$). At 12-month assessments, the recall rate was 96%. Seventy-seven restorations were evaluated and four FB restorations (10.3%) and three FU restorations (7.9%) showed bravo score ($p > 0.05$). Four FB restorations (10.3%) and two FU restorations (5.3%) exhibited marginal discoloration and all of the restorations showed alpha score for surface texture, colour match and sensitivity. No statistical differences were found among the tested composite resins for any criteria evaluated ($p > 0.05$).
McNemar's test showed a significant change in marginal adaptation and marginal discoloration in both groups ($p = 0.009$, $p= 0.001$)
Conclusions The two restorative systems demonstrated similar performances during the 12-month follow-up in the restoration of posterior teeth.

0039

New Fast-cure Composite System for Posterior Restorations - 12 Months Results

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Objectives To evaluate the clinical performance of a new fast curing composite system for direct posterior restorations, consisting of a high irradiance light curing unit (3050mW/cm^2), a universal adhesive, a flowable and a sculptable bulkfill composite.

Methods 75 cavities (12 class I and 63 class II, 50 molars and 25 premolars) were treated with Adhese Universal (Ivoclar Vivadent) using etch&rinse technique. Composite fillings were placed using Tetric PowerFlow and Tetric PowerFill composite material (Ivoclar Vivadent) in large increments up to 4mm. Adhesive and composite materials were polymerized for 3 s per increment using Bluephase PowerCure (Ivoclar Vivadent). After 7-10 days, 6 and 12 months the restorations were evaluated **regarding** their aesthetic, functional and biological properties (FDI criteria). A visual analogue scale (VAS 0-10) was used to rate pre- and postoperative sensitivities and a semi-quantitative clinical evaluation-method (SQUACE) was used to document the quality of the margins.

Results 73 of 75 restorations were evaluated after 12 months (2 no shows). All restorations showed FDI ratings ranging between "excellent" and "satisfactory" (table 1). Referring to marginal staining 99% of total margin length (SQUACE) was rated "excellent". Only minor marginal irregularities were observed. 93% of total margin length was rated "excellent", 7% was rated "good". Insignificant sensitivities (FDI "good") were reported in 4 cases at 12 months, no VAS value >2 was recorded. Tetric PowerFill showed "excellent" or "good" aesthetic results in all cases. No "unsatisfactory" fractures or cracks of material or tooth occurred. Secondary caries could not be observed.

Conclusions The new fast curing composite system provides a reliable method to restore posterior cavities efficiently. No compromises regarding functional, biologic or aesthetic properties were found.

0040

25-year Prospective Follow-up of 2500 Endodontic Treatments

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Objectives The aims of the present work were 1) to assess the long-term outcome of endodontic treatments and 2) to identify the predictive factors for treatment success among a large set (>150) of potential predictors.

Methods Data were collected systematically at the School of Dentistry of the UCLouvain (Brussels, Belgium) since 1990 in a Filemaker database. All treatments (n=2500) were performed by a single operator specialized in endodontics (JPVN) in his University clinics practice.

Information was recorded among clinical, technical, radiographic, patient-related characteristics.

Outcome was considered at the tooth level, and success was defined as the absence of clinical signs and symptoms as well as the absence of periapical radiolucencies. When several controls were performed for a given tooth, only the last one was eligible for analysis.

The data were analysed by performing univariate analyses, followed by multiple logistic regression. Survival curves were generated with Cox regression to illustrate long-term treatment success. Due to the number of candidate predictors, statistical significance level was set at 0.01.

Results The follow-up period ranged from 0 to 298 months, with a mean of 77.5 months and a median of 59 months. Complete follow-up was achieved for 63.1% of the treatments. On the survival curve based on the 6 covariates significantly associated with treatment success (Fig. 1), the mean success rate was approximatively 90% at 5 years, 80% at 10 years, and 70% at 20 years. The inclusion of additional variables did not significantly improve the fit of the model.

Conclusions Endodontic treatment success is not a static outcome, but evolves with time. Over the large number of variables included, only a small proportion were significantly predictive of success. This observation, and the disease- and patient-related characteristics of these variables challenge the current byzantine considerations related to endodontic procedures.

0041

The Impact of Reciprocating and Rotary Instrumentation on Postoperative Pain

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Objectives The aim of this study was to assess postoperative pain in prospective randomized clinical trial comparing two groups using Reciproc Blue or Hyflex EDM in one visit of endodontic treatment.

Methods The study included 30 patients aged (18 and over) with asymptomatic pulp necrosis in mandibular molar and premolar teeth. Patients were randomly assigned to two groups according to instrumentation system.The single session endodontic treatment was performed by one endodontist. Mechanical preparation of the root canals was performed using Reciproc Blue or HyFlex EDM systems. Postoperative pain was recorded using verbal rating scale (VRS) with numbers related to pain levels as follows:0(no pain), 1(mild pain), 2(moderate pain), 3(severe pain) and verbal description with well-defined categories at four following time intervals: 24 h, 48 h, 72 h and 7 days after endodontic treatment. Data were analyzed by Khi-square test.

Results The patient in Hyflex EDM reported significantly lower postoperative pain levels at 48h and 72 h than Reciproc Blue group ($p<0.0005$).The incidence of postoperative pain was found 47% in 24h, 14% in 48h , 14 % in 72h and 0% in 7 days in Reciproc Blue group. However, post operative pain rate was found to be 40% after 24h and no pain in 48h, 72h or 7 days in

Hyflex EDM group. None of the patients presented severe pain at the time intervals assessed.
Conclusions Reciproc Blue system showed to more incidence of postoperative pain than Hyflex EDM in 24 h and 72 hours intervals.

0042

Efficacy of Hyaluronic Acid Dermal Fillers for Lip Augmentation: Meta-analysis

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Objectives Hyaluronic acid (HA) is widely used as a dermal filler for lip augmentation. However, its real beneficial effects are not well established. Therefore, our aim was to evaluate the efficacy of HA for lip augmentation and to assess the prevalence of rare adverse effects (AE) after HA injections.
Methods We conducted our meta-analysis according to the PRISMA protocol. We performed the systematic literature search in Cochrane, Embase, and Pubmed. Studies were considered eligible if they were randomized controlled trials (RCTs), case series and case reports written in English. For HA efficacy evaluation, published data of responder rate were extracted and analyzed form each eligible study. Bias in studies, were assessed using The Cochrane Risk of Bias Tool and the Newcastle-Ottawa Scale. From the extracted data the untransformed proportion (random-effects DerSimonian-Laird method) for responder rate was calculated. For treatment related AEs descriptive statistics were used. For data analysis we used STATA software.
Results The systematic literature search revealed 153 records after duplicate removal, 21 records were included for descriptive statistics and 12 records in the quantitative synthesis. The results indicate that the overall estimate of responders is 92% (ES=0.92, 95% CI: 0.80-0.99), (I^2=88.46%, P<0.00) for the upper lips and 90% (ES=0.90, 95% CI: 0.82-0.96), (I^2=74.02%, P<0.01) for the lower lips at 12 weeks after injection. The most frequent treatment related AE were swelling (39.8%), bruising (19.28%), erythema (6.33%) and herpes labialis (0.82%) among 1706 observants. Rare AEs (less than 0.2%) were lip exfoliation, aggregate of material, tumor like nodule, granulomatous foreign body reaction, oral dysaesthesia and angioedema).
Conclusions Our meta-analysis reveals that lip augmentation with injectable HA is efficient and safe method for increasing lip fullness up to 12 weeks after augmentation. However, further RCTs are needed to strengthen the evidence on the efficacy of HA fillers. Supported by EFOP-3.6.2.-16-2017-0006.

0042.1

Outcome of PRF Pulpotomy Using Different Calcium-silicate Based Materials in Permanent Molars with Irreversible Pulpitis: A randomized Controlled Trial

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Objectives To compare the clinical and radiographic outcomes of Platelet rich Fibrin (PRF) full pulpotmy after application of Biodentine, or Mineral trioxide aggregate (MTA), or Portland cement above PRF membrane.
Methods Sixty permanent mandibular molars with carious exposure and symptoms of irreversible pulpitis were included in the study. Full pulpotomy was done, and then PRF was prepared and applied into the pulp chamber. The included teeth were randomly allocated to three groups according to the materials applied over the PRF; which were Biodentine, MTA, or Portland cement. Pain intensity was recorded using numeric rating scale score at baseline, 24 h, one week, one month, 3 month, 6 month and 12 month. Clinical and radiographic assessments were done every 3 months for one year. Cone beam computed tomography (CBCT) imaging was done immediately post operative, and after 12 months to evaluate the thickness of calcific bridge formed, and assess the periapical area.
Results Clinical success rate was 100% at one week, 1 month, and 3 month, which dropped to 83.4% at 12 months. All three bioceramic materials were equally effective in providing pain relief after one week, one month, and three month follow-up periods, with no significant difference between them (P > 0.05 at all intervals). However,in the PRF with Portland cement group; 6.6% and 16.6% of the teeth showed slight widening of periodontal ligament space, and clinical signs and symptoms at 6 months and 12 months respectively . It was found in this study that there was no significance difference clinically between PRF with Biodentine group, and PRF with MTA group, but there was significance difference between PRF with Portland cement group, and the other two groups at 6, 12 months follow-up periods. Concerning the amount of calcific bridge formed, CBCT imaging showed that PRF with Biodentine group showed a significance difference when compared with the other two groups.
Conclusions PRF Pulpotomy using Biodentine or MTA exhibited a high clinical success rate in mature molars with irreversible pulpitis.

0044

Periodontal Symptoms During IBD: An Innovative HLA-B27 Rat Model

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Objectives An increased risk of periodontitis (PD) is reported in patients affected with inflammatory bowel disease (IBD). The underlying biological mechanisms which explain this epidemiological association have not yet been elucidated. The HLA-B27 transgenic rat presents spontaneous severe colitis and extra-intestinal manifestations similar to clinical symptoms in IBD-affected patients. This study describes the occurrence and natural progression of the periodontal disease correlated to the digestive status in this animal model.

Methods Six weeks old rats (n=14 HLAB-27+ and n=16 Wild Type rats) were included. Periodontal symptoms (clinical inflammation index) and digestive status (consistency of feces and presence of blood) were monitored twice a week. Rats were sacrified at 3 time points (6, 12 and 18 weeks; n=10 per time point), alveolar bone loss (micro-CT) and the inflammatory markers in the blood, gums and colon were determined by RT-qPCR, LUMINEX and ELISA. The data was analyzed using a Mann-Whitney test (α=0.05).

Results At 18 weeks, HLA-B27 rats presented a spontaneous severe colitis resulting in diarrhea ($p < 0.0001$), an increased gingival index ($p < 0.0001$) and an accelerated alveolar bone loss ($p < 0.05$) comparing to the WT rats. An over-expression of pro-inflammatory cytokine mRNAs was found in the colon (IL-6, IL-1β, IL-17, TNFα), the gum (IL-17, TNF, RANKL/OPG, MMP8/TIMP2, LCN2) ($p < 0.005$), and the blood (IL-1β, IL-17) ($p < 0.05$) of HLA-B27+ rats (vs WT rats).

Conclusions These results support that the HLA-B27 transgenic rats develop simultaneously a severe colitis associated with the spontaneous progression of a periodontal inflammatory condition similar to IBD and PD in humans. Thus, this innovative model could help to better understand the physio-pathological mechanisms linking PD to IBD and to develop new therapeutic approaches toward both IBD and PD. Mechanistic studies to investigate how the periodontal and intestinal conditions could influence each other are ongoing.

0045

Relationship between Periodontitis and Depression: Preclinical *In Vivo* Study

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Objectives To develop an *in vivo* preclinical model to determine whether animals with induced periodontitis and depression present higher counts of periodontal pathogens in the brain.

Methods An *in vivo* preclinical model was developed in 40 Wistar rats. Periodontitis was induced by oral gavages with *Porphyromonas gingivalis* and *Fusobacterium nucleatum* (12 weeks) followed by a period of depression induction by exposure to chronic mild stress model (3 weeks). Four groups with 10 rats per group were obtained: periodontitis and depression (P+D+); periodontitis without depression (P+D-), depression without periodontitis (P-D+) and negative control (P-D-). The sacrifice was performed and the fresh brain tissue was obtained. Brain was analyzed by real-time quantitative PCR (qPCR) targeting detection of *P. gingivalis* and *F. nucleatum.* Descriptive statistics and ANOVA test was used for data analysis. Data were expressed by means of colony forming units per milliliter (CFU/mL).

Results The groups with periodontitis (P+D+ and P+D-) showed higher values for clinical periodontal variables ($p < 0.01$). After depression, no statistically significant differences were observed for periodontal variables comparing the groups P+D+ vs P+D-, but the two groups with depression (P-D+ y P+D+) lost more weight compared to the other two groups. Presence of F. nucleatum was observed in the brain tissue of two rats in the P+D+ group ($7.69x10^1$ and $1.17x10^2$ CFU/mL).

Conclusions Presence of periodontal bacteria (*F. nucleatum*) was observed in brain of rats with periodontitis and depression, in an *in vivo* preclinical model.

0046

Effect of Vitamin D_3 on $CD4^+$ T Lymphocytes in the Presence of Human Periodontal Ligament Stem Cells and Interferon-γ

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Objectives Human periodontal ligament stem cells (hPDLSCs) possess immunomodulatory ability, which is enhanced by inflammatory cytokines. Among others, hPDLSCs inhibit $CD4^+$ T cell proliferation and stimulate Treg formation. Vitamin D_3 inhibits function of $CD4^+$ T cell and modulates the inflammatory response in hPDLCs. However, the combined effect of vitamin D_3 and hPDLSCs on immune cells has never been investigated. Therefore, we analyzed combined effect of vitamin D_3 and hPDLSCs on $CD4^+$ T cell proliferation and $CD4^+$ $FoxP3^+$ $CD25^+$ Tregs formation in an *in vitro* co-culture model in the presence and in the absence of inflammatory stimuli. Further, we investigated the influence of vitamin D_3 on the expression of immunomodulatory proteins in hPDLSCs, involved in the interplay with $CD4^+$ T cells.

Methods Allogenic $CD4^+$ T cells were activated by phytohemagglutinin and co-cultured with hPDLCs for 5 days. The experiments were performed in the presence or in the absence of IFN-γ. T cell proliferation was assessed by CFSE labelling and Tregs differentiation by CD4, CD25 and FoxP3 immunostaining, followed by flow cytometry analysis. Additionally, the expression of immunomodulatory factors indolamine-2,3-dioxygenase (IDO), prostaglandin-E2 (PGE-2), protein death ligand 1 (PD-L1) in hPDLCs was assessed.

Results $1,25(OH)_2D_3$ suppressed $CD4^+$ T cell proliferation and triggered Tregs differentiation in the absence of hPDLCs. $CD4^+$ T proliferation was suppressed by hPDLSCs and further suppressed after addition of IFN-γ. In the presence of hPDLSCs, $1,25(OH)_2D_3$ had no effect on $CD4^+$ T proliferation. Moreover, in the presence of hPDLSCs and IFN-γ, addition of $1,25(OH)_2D_3$ resulted in the activation of CD4+T cell proliferation. Furthermore, under these conditions $1,25(OH)_2D_3$ decreased $CD4^+$ $FoxP3^+$ $CD25^+$ Tregs formation. IFN-γ induced expression of immunomodulatory factors in hPDLSCs was significantly suppressed by $1,25(OH)_2D_3$ in a concentration dependent manner.

Conclusions In summary, vitamin D_3 exerts different effects on the local $CD4^+$ T cell response depending on the presence of hPDLCs and the microenvironment. Therefore, the exact role of vitamin D_3 in the local inflammatory response during periodontitis and its therapeutic potential should be further clarified.

0047

***Porphyromonas Gingivalis* Modulates TIR-domain-containing Adaptors Proteins Expression in Epithelial and Endothelial Cells**

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Objectives The overpassing of epithelial and endothelium barriers and the host-bacterial interactions are crucial in the onset and development of periodontitis. Inflammatory cascades are initiated by the recognition of periodontal pathogens such as *Porphyromonas gingivalis*(*Pg*) by Toll-Like receptors (TLRs). TLR related pathways are activated after recruitment of TIR-domain-containing adaptors (TIRs). The aim of this study was to evaluate the effects of *Pg*infection on the expression of TIRs in gingival epithelial cells and endothelial cells.

Methods TERT-2/OKF6 epithelial cells (GECs) and HUVEC endothelial cells (ECs) were cultured and then infected with *Pg*ATCC 33277 (MOI= 100) for 24 hours. TNF-αsecretion in supernatants has been evaluated with ELISA. After cell lysis, mRNA expression of the five TIRs (Myd88, Mal, Trif, Tram-1 and Sarm), TLR2 and 4 and the suppressor of cytokine signaling protein-1 (SOCS-1),was evaluated by RTqPCR. Immunofluorescence was performed for the TIRs on both cell types. Finally, the TLRs and TIRs protein-

protein interaction and its inhibitor SOCS-1, were evaluated by a Pull-Down assay, co-immunoprecipitation and WB.
Results In both cell types, *Pg*infection increases significantly TNF-αsecretionand mRNA expression of Mal, Myd88, Trif and Tram. The expression of TLR-2 and 4 was also increased at both mRNA and protein level following infection. Interestingly, *Pg* infection was mainly associated to an increased TLR-4/Mal/MyD88 interactions while interactions with the Trif/Tram complex were less affected as observed after co-immunoprecipitation in both cell types. Moreover, *Pg*infection reduced inhibitor SOCS-1 and increased the TIR SARM protein expression.
Conclusions This study showed that *Pg*modulates the expression of TIRs and their interactions with TLR-4. Mal-Myd88 protein-protein interaction associated with TLR4 was the main pathway activated during *Pg*infection, while infection was also able to decrease expression of inhibitor SOCS-1, simultaneously increasing SARM expression, implicated in the regulation of the inflammatory host response.Therefore, it is of interest to understand more precisely the role of TIRs proteins interactions in host-immune response in the context of periodontitis and to consider targeting some of them as therapeutic targets.

0048

Resistin: A Potential Biomarker for Periodontitis

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Objectives Resistin is a fat-tissue derived adipocytokine and is associated with inflammatory response. The aim of this study was to evaluate saliva resistin levels as potential biomarker of periodontitis in individuals with or without type 2 diabetes mellitus (T2DM).
Methods Thirty-two systemically and periodontally healthy individuals (H), 35 periodontitis (P) and 62 P+T2DM patients were enrolled in this study. Plaque index (PI), gingival index, bleeding on probing (BOP) %, probing depth (PD), and clinical attachment level (CAL) were recorded for all teeth. Unstimulated saliva samples were collected and concentrations of resistin were analyzed by using Luminex®-xMAP™ technique.
Results Resistin levels were significantly lower in H group compared to P and P+T2DM groups (p=0.001). No significant differences in resistin levels were observed between P groups with and without T2DM (p=0.87). The PI, GI, BOP, and CAL levels were higher (p<0.05) in periodontitis patients with T2DM than in systemically healthy individuals.
Conclusions A T2DM-independent relation between saliva resistin levels and periodontitis indicates a potential use of this adipocytokine in detection of periodontitis.

0049

Circulating MiRNAs as Biomarkers for Non-invasive Diagnostics of Chronic Periodontitis

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Objectives Despite the high prevalence and adverse systemic health effects of chronic periodontitis (CP), the etiopathological pathways of inflammation in periodontal tissues are still not definite resulting in the lack of accurate diagnostic methods and periodontitis-specific pharmacological therapy options. The discovery of epigenetic regulation has advanced the knowledge of ethiopathological pathways of multiple diseases, including CP, enabling new diagnostic and treatment alternatives. Epigenetic regulation through microRNAs (miRNAs) in periodontal disease has significant impact on periodontal homeostasis by regulating both anabolic and catabolic processes, including osteoblast and osteoclast differentiation, inflammatory cytokine production, etc. By using high-throughput technology, the current study aims to access CP-associated miRNAs and evaluate the utility of miRNA for lowly- and non-invasive diagnostic applications.
Methods Periodontitis-affected and healthy gingival tissues and liquid biopsy samples (plasma and saliva) were collected from 80 patients at Vilnius University Hospital Zalgiris and Santaros Clinics. Periodontal status was evaluated by researcher periodontist performing full mouth probing in accordance with “Centre for Disease Control-American Academy of Periodontology” guidelines. Genome-wide analysis of 24 gingival samples was performed by using Human miRNA Microarrays (8x60K format). Identified changes were validated in 80 tissues and selected miRNAs were further tested in corresponding fluids by using real time PCR method.
Results Numerous differently expressed miRNAs were observed in periodontitis-affected inflamed gingiva compared to healthy gingiva (P<0.05, fold change ≥2.0). Patients with periodontal disease had 3-fold higher plasma level of miR-31 (P=0.024) and 2-fold lower level of miR-335 (p=0.011). Level of periodontal patients’ salivary miR-31 was 15 times higher (P<0.001) in compare to plasma level.
Conclusions Genome-wide miRNA analysis contributes to a deeper understanding of etiopathological pathways of inflammation in CP while levels of circulating miRNAs accurately represent chronic periodontitis clinical status and may be considered as diagnostic markers of the disease.

0051

Tobacco Smoking Interacts with Genetic Variants to Cause Aggressive Periodontitis

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Objectives Aggressive periodontitis (AgP) is a disease of complex etiology in which smoking and the genetic susceptibility play important roles. Even though the contributions of smoking and the genetic predisposition are well established inidividual risk factors of AgP, the interactions between genetic variants and smoking in modifying disease susceptibility are not studied systematically.

Methods To identify specific gene x smoking interactions (G×S), we anaylsed 79,780,573 common genetic variants in 669 European AgP patients using imputed genotypes of the OmniExpress BeadChip. We compared never vs. ever smokers in a logistic regression analysis using a case-only approach. To explore those genes further, where statistically significant interactions with smoking were identified, primary gingival fibroblasts of healthy donors (pGF; N = 9) were exposed to cigarette smoke extract (CSE) and changes in transcript levels of the G×S associated pGF-expressed protein-coding genes were analyzed by quantitative reverse transcription PCR.

Results We identified 16 loci for which the G×S interaction analysis suggested association with AgP ($P < 5\times10^{-5}$), nine of which were previously reported to be associated with smoking related traits. Of these, genome-wide significant cis-expression quantitiative trait loci (eQTLs) were reported for the associations at *ST8SIA1* and *SOST*. Exposure of CSE to pGF cells significantly altered the expression of the associated genes *SSH1* ($P = 5 \times 10^{-07}$) and *ST8SIA1* ($P = 0.0048$). These four genes have documented functions in osteoclast regulation and tissue repair.

Conclusions The genetic predisposition to early-onset forms of periodontitis is in parts triggered by smoking, and cigarette smoke directly affects the expression of genes involved in bone homeostasis and tissue repair. The presented data help to explain why some individuals suffer an increased early-onset disease risk if they smoke cigarettes. Our study contributes to defining risk groups and improves our understanding of the pathopyhioloy of periodontitis as a result of the interaction of life-style and environmental factors with the individual genetic predisposition.

0052

Potential molecular and genetic mechanisms for the relationship between periodontitis and cardio-vascular disease (CVD)

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The relationships between periodontitis and cardiovascular disease appear to be increasingly evident. The associations have been studied in many countries over the last two decades and continue to be present. In this lecture it will be shown how various forms of cardiovascular disease phenotypes are linked with periodontal disease. Reports have found pleiotropy between periodontitis and cardiovascular diseases. The shared genetic factors suggest a mechanistic link or immunological commonalities between coronary artery disease and periodontitis. The impairment of the regulatory pathways by genetic factors may be a common pathogenic denominator of at least coronary artery disease and periodontitis. Thus, the shared genes could suggest that both conditions are sequelae of similar (the same?) aberrant inflammatory pathways. Nevertheless, and highly intriguing, the treatment of periodontitis gives positive effects on the cardiovascular system: periodontal therapy not only results in improvement of the periodontal situation, but also results in significant improvements of important and relevant clinical molecular biomarkers of the cardiovascular system. Especially in patients who already have cardiovascular diseases and in addition periodontitis, periodontal treatment is an added value for the general condition.

0053

Epidemiological evidence for the relationships between periodontitis and CVD

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Cardiovascular diseases (CVD) are the leading death cause worldwide, with ischaemic heart disease and stroke accounting for 27% global deaths according to WHO data. The atherosclerotic vascular disease is the main pathogenic mechanism behind the occurrence of myocardial infarction and cerebrovascular disease, however, its incidence can not be fully explained by the classical risk factors for CVD. Therefore, novel risk factors have been proposed such as infections and systemic inflammation. On its hand, severe periodontitis, a bacterial triggered chronic inflammatory disease, is the sixth-most prevalent disease in the global population. Several investigations have demonstrated an association between periodontitis and CVD. Epidemiological studies have shown that the prevalence of atherosclerotic disease is higher in periodontitis subjects, when compared with healthy controls, independent from other common risk factors. This association seems to be more pronounced in young

individuals.
The cause-effect relation between CVD and periodontitis has not been proven yet, however there is evidence from intervention studies that periodontal treatment can reduce the risk for CVD by improving plasma levels of inflammatory, thrombotic and metabolic markers, as well as endothelial function. This beneficial effect of the treatment of periodontitis seems to be greater in subjects suffering both periodontitis and other co-morbidities such as CVD and/or diabetes mellitus. Nevertheless, the evidence supporting the effect of periodontal therapy on CVD is limited, and there is no study evaluating its influence on the incidence of final cardiovascular events (myocardial infarction, angina pectoris, stroke...).

In conclusion, periodontitis is associated with higher prevalence of CVD, independent of other risk factors, and its treatment has proven to induce beneficial effects on surrogate markers for CVD events.

0054

Forging a cardio-dental alliance: strategies to work on to improve global health

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The world is being increasingly aware of the importance of gum health and its impact in cardiovascular diseases. On the other hand, beyond gum health, there are several medical conditions that complicate dental management such as the use of anticoagulation, antiplatelet-therapy, cardiac devices and so forth. Despite the huge medical advances that we are experiencing everyday, something as basic as collaboration between the several health professionals that are involved in this clinical issue is still lacking, and this rises conflicts in the management of all these situations and the prevention of cardiovascular diseases. During this lecture, Dr. Marco will share his insights as the responsible of the cardio-dental care in a tertiary hospital in Madrid with implemented strategies and programs to specifically address this kind of situations, and will review the several options to increase collaboration and overall cardiovascular disease prevention. Also, he will go through the rational of several cardiovascular treatments and conditions to help dental health professionals understand the risk stratification of cardiovascular patients and improve the decision-making process in these scenarios.

0056

Dimensional Accuracy of Bracket Slots: Comparison with Standard Regulations

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Objectives Standards were elaborated in order to regulate nominal dimensions of marketed brackets. The aim of this study was to compare the bracket's slot widths with the tolerated intervals.
Methods It was chosen to select maxillary right central brackets of 0.018x0.025 inch or 0.022x0.028 inch dimensions. Brackets were made of metal or ceramic, with conventional or self-ligating closing mechanism. The sample gathered a total of 740 brackets provided by seven companies (Dentsply Gac, American Orthodontics, Rocky Mountain Orthodontics, GC Orthodontics, 3M Unitek and Dentaurum). Bracket slots were measured at base and at face on both sides using the Olympus BX51 optical microscope, and then analyzed using Image J software. Slot width dimensions were compared to the tolerance limits established by the Deutsches Institut für Normung and by Proffit.
Results Comparison between the dimensions measured and the interval of size variation established by the DIN displayed that 3% to 19% of slot sizes were below the lower tolerated limit, and 1% to 19% were above the upper limit. When comparing the same measurements with the interval of tolerance established by Proffit it was shown that 0% to 1% of slot sizes were below the limit, whereas 20% to 49% were above it.
Conclusions According to our results, we can establish that part of the bracket slot widths are still inaccurate, in spite of the measures already taken to counter dimensional irregularities. Such imprecision will influence poorly the treatment outcomes, as they will prevent the wire to fill the slot properly.

0057

Upper Airway and Palatal Dimensions in Children with Obstructive Sleep Apnea

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Objectives The aim of this study was to evaluate the upper airway dimensions and palatal dimensions of children with obstructive sleep apnea (OSA).
Methods Children with OSA was confirmed by nocturnal polysomnography (PSG). Children who had OSA with apnea-hypopnea index (AHI) > 1 and having lateral cephalograms were included in this study. An age- and gender-matched control group was selected from children seeking orthodontic treatment. Pre-orthodontic lateral cephalograms were used for the controls. Sixteen distances of airway structure were measured using Dolphin Imaging software. Palatal dimensions including palatal lengths, widths, and depths were analyzed using Ortho Anlyzer™ software.
Results A total of 92 participants (31 children with OSA: 10.4 ± 3.1 years, and 61 controls: 10.4 ± 3.0 years) were included in the study. In the OSA group, the middle and inferior airway dimensions were significantly smaller ($p < 0.05$). The hyoid bone was

positioned more anteriorly ($p < 0.05$). The tongue length and thickness, soft palate length and thickness were not significantly different between OSA and control groups ($p > 0.05$).
The palatal widths in the OSA group were significantly smaller at the first and second premolar levels ($p < 0.05$). The palate was deeper at the first and second premolar levels ($p < 0.05$). However, no significant differences were observed in the palatal length ($p > 0.05$).
Conclusions Children with OSA have a smaller middle and inferior airway space, more anteriorly position hyoid bone, narrower and deeper palate at the first and second premolar levels. The palatal lengths, the tongue, and soft palate dimensions seemed not to be different between the OSA and control group.

0058

Evaluation of Gonial Angle in Panoramic and Cephalometric Radiographs

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Objectives The aim of this study is to compare the measurement of gonial angles in panoramic radiographs and lateral cephalograms of patients with skeletal patterns of class I, II and III.
Methods In this study 60 patients (38 females, 22 males) from the Institute of Orthodontics of the Faculty of Medicine of the University of Coimbra, were selected. The sample was divided considering the type of skeletal occlusion (Class I, II and III). In the cephalograms, the gonial angle was measured at the intersection of the ascending ramus line and the mandibular plane. In panoramic radiographs, it was calculated by the intersection of two lines, the tangent to the inferior border of the mandible with the tangent to the distal border of the ascending ramus and the condyle on both sides. The data obtained were statistically analysed in the IBM SPSS v.24 statistical platform, with a significance level of 0.05. The ANOVA test was used after testing normality with the Shapiro-Wilk test.
Results The mean gonial angle was 127.30 ± 8.5 and 128.28 ± 7.8 degrees on panoramic and cephalometric radiographs, respectively. The mean gonial angle in patients with skeletal Class I was 126.3 ± 7.12, with skeletal Class II was 123.7 ± 8.4 and with skeletal Class III was 132.8 ± 6.7.
Conclusions The gonial angle is an important cephalometric measure in the diagnosis and treatment in Orthodontics. Panoramic imaging is a viable radiological method in cases of poor quality of the lateral cephalometric radiographs.

0059

Comparison of Two Controls Used in WAB *In-vitro* Experiments

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Objectives *In vitro* weight approach based (WAB) loading models have been used for years to elucidate molecular mechanisms of bone remodelling during orthodontic tooth movement. In this model, static compression (CF) is applied by loading cells with a cylinder filled with lead granules placed on a glass-coverslip to assure even force distribution. Two different types of the negative controls have been described in the studies: conventional controls with unloaded cells (CC) and controls with cells covered with a glass-coverslip (GC). Aim of this study was to investigate potential differences between both negative controls concerning cell viability, cell proliferation and gene expression.
Methods Human primary periodontal ligament fibroblasts were cultured unloaded (CC) or covered with a glass-coverslip only (GC) for 1-6 days. On each day gene expression of cFOS, IL6, and COX2, was examined by qPCR and PGE2 concentrations were measured using ELISA (n=6). The independent-samples Mann-Whitney U test was applied to test significant differences between CC and GC. Cell growth and cell viability were monitored daily.
Results Increased expression of cFOS ($p \leq 0.016$) and COX2 ($p \leq 0.026$) was observed in GC group during whole experiment when compared to CC. IL6 in GC showed increased expression on the days 1-3 and 5 ($p \leq 0.010$). PGE2 was found at higher concentrations in GC than in CC in all timepoints. Cells viability maintained throughout the experiment in both groups. However, proliferation rate in GC was significantly lower.
Conclusions Our results show an increased expression of the genes and metabolites related to the mechanosensing (cFOS) and bone remodelling (IL6, COX2, PGE2) in the GC group. We suppose, that the observed differences in gene expression between GC and CC, as well as the differences in the cell proliferation might be related to mechanical stimuli originating from the glass-coverslip. The exact origin and magnitude of this stimuli remains unclear, therefore further examination is required.

0060

Dental Development and the Occurrence of Aberrant Occlusal Dental Traits

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Objectives The aim of our study is to investigate the association between timing of dental development and aberrant dental traits such as crowding, tooth impaction, and hypodontia.
Methods This study was performed using 4446 ten year old children from a multiethnic birth cohort, the Generation R Study. Dental development was defined using the Demirjian method. Crowding, impaction and hypodontia were ascertained from 2D and 3D pictures, and radiographs. We built three series of logistic regression models to test the associations of dental age with crowding, impaction and hypodontia. Similar models were built to investigate the associations of the developmental stages of

each left mandibular tooth with crowding, impaction and hypodontia.
Results Inverse associations were found between every one-year increase in dental age and the presence of crowding (OR=0.84, 95% CI: 0.79, 0.89), impaction of teeth (OR=0.66, 95% CI: 0.52, 0.84) and hypodontia (OR=0.52, 95% CI: 0.47, 0.56). Lower developmental stages of the second premolar were associated with the presence of crowding (OR=0.90, 95% CI: 0.83, 0.98). Lower developmental stages of the second premolar (OR=0.88, 95% CI: 0.79, 0.98), first molar (OR= 0.76, 95% CI: 0.65, 0.90) and the second molar (OR=0.83, 95% CI: 0.73, 0.94) were associated with the presence of tooth impaction. Lower developmental stages of all mandibular teeth except the central incisor were associated with hypodontia ($p<0.05$).
Conclusions Accelerated dental development is associated with lower occurrence of crowding, impaction and hypodontia.Future research on factors of delayed dental development might aid to find the correct timing for orthodontic treatment and to prevent the occurrence of more severe aberrant dental traits in children.

0061

Understanding the Effect of Palatally Impacted Canines on Transversal Width of Dental Arch: Quadrant Analysis of Three Dimensional Data

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Objectives The aim of this study was to evaluate the transversal width of maxillary dental arch in patients with palatally impacted canines (PIC) on three dimensional images by using quadrant analysis.
Methods The axial and coronal views of pretreatment cone beam computed tomography images of 18 patients with bilateral PIC (12 female,6 male; mean age 23.77±2.12 years) and 31 patients with unilateral PIC (19 female, 12 male; mean age 20.54±1.41 years) were evaluated. The transversal width of maxillary arch was measured at lateral incisor, premolar and molar region together with the angulation of the canines. The results were compared with a control group (n = 60; 38 female, 22 males; mean age 21.21±3.53 years) with normally erupted canines. A further quadrant analysis was performed by comparing the quadrants with PICs and normally erupted canines with each other. Statistical analysis was performed by one-way analysis of variance followed by Tukey test with Bonferroni adjustment ($p<0.05$).
Results When compared to the control group, uni- and bi-lateral PICs showed significantly more horizontal angulation in relation to maxillary midline and nasal horizontal plane. Due to the variability in location of the PICs in unilaterally affected gorup (right or left), the canine angulations were found to be significantly less horizontal when compared to bilaterally PIC group. Inter-group comparisons displayed no difference with regard to transversal arch widths and total arch perimeter. On the other hand, the quadrant analysis showed that in quadrants with a PIC, the transversal width of the quadrant in premolar region was significantly narrower than in quadrants with normally erupted canines. Additionally, the quadrant's arch perimeter was significantly less when a PIC was present in the quadrant.
Conclusions PICs are more horizontally angulated when compared to normally erupted canines. The presence of a PIC on a quadrant leads to a decrease in transversal arch width in premolar region. Particularly patients with unilateral PICs are advised to be analyzed further with quadrant analysis, since the variability of the position of the PIC may affect the results of traditional intergroup comparisons.

0062

The Spheno-Occipital Synchondrosis in Patients with Cleft Lip and Palate: A Case Control Study

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Objectives Growth of the spheno-occipital synchondrosis (SOS) influences the depth and height of the upper face, since it has a late ossification. Maturational age of a subject can be estimated by analyzing the fusion stage of the SOS. The literature suggests complete fusion for girls between 11 to 14 years and 13 to 16 years for boys. The aim of this study was to evaluate the differences in SOS fusion stage between patients with CLP and a control group, using cone beam computed tomography (CBCT) scans.
Methods The study enrolled 125 patients, divided in CLP group (n=91, mean age 11,66 years) and control group (n=34, mean age 12,47 years). Each patients SOS was analyzed in a mid-sagital CBCT scan and the fusion stage assessed by using a 5-stage system. A Kolmogorov-Smirnov test was used to verify if there were statistically significant differences between the two groups, and a Kaplan-Meyer analysis to determine the median time to reach complete ossification of the SOS. Both groups were divided according to gender and the percentage of individuals in each stage was compared.
Results No statistically significant differences were found either for boys ($p=1.000$) and girls ($p=0.945$). For boys, the median time of complete ossification was 15 years for both the CLP (IC95%[14.0, 16.0]) and control group (IC95%[14.2; 15.8]). There were no statistically significant differences between both groups ($p=0.806$). For girls, the median time of complete ossification was 14 years for the CLP group (IC95%[12.7, 15.3]) and 13 years for the control group (IC95%[11.9; 14.1]). There were no statistically significant differences between both groups ($p=0.565$).
Conclusions Our data showed that the SOS fusion time is similar in patients with and without CLP, which may suggest that we apply the same orthodontic orthopedic protocol in patients with CLP.

0063

Regeneration with Enamel Matrix Derivative: Single Vs. Double Flap Approach

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Objectives The aim of this randomized controlled clinical trial was to compare the clinical, radiographic and patient-centered outcomes of two minimally invasive surgical techniques for periodontal regeneration of infrabony defects using enamel matrix derivative (EMD): single flap approach (SFA) and double flap approach (DFA).

Methods A sample of 26 three-wall infrabony defects in 26 patients were randomly assigned to either SFA or DFA group, with the use of EMD in both groups. The main clinical parameters PPD, CAL, REC and BOP at 6 sites per tooth, mobility, as well as the radiographic parameters CEJ-base of the defect, CEJ-bone crest and the defect angle, were assessed and registered at baseline, 6 months and 12 months postoperative. Patient-centered outcomes such as pain, bleeding, swelling and hypersensitivity were also recorded using a Visual Analog Scale.

Descriptive statistical analysis included mean values and standard deviations (SD) of quantitative variables, while qualitative variables were expressed with frequencies and valid percentages. The tests used were Wilcoxon (quantitative variables), Fisher for the relationship of the qualitative variables and Mann-Whitney U test was used to analyze differences between groups.

Results Both treatment groups resulted in an improvement in clinical and radiographic parameters at 12 months follow-up. Changes between baseline and 12 months were statistically significant for CAL and CEJ-bone crest in the SFA group only. When comparing differences between both groups at 12 months, no statistically significant differences were found in any clinical parameter ($P>0.05$). Both techniques resulted in low levels of pain, bleeding, hypersensitivity and swelling with no differences between treatment groups.

Conclusions These data indicate that a SFA with EMD can be successfully applied to achieve a significant CAL gain and radiographic CEJ-bone crest change from baseline to 12 months follow-up.

0064

Clinical and Perceptional Evaluation of Crown-Lengthening Procedure with Piezosurgery: A Pilot-Study

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Objectives Crown lengthening is one of the most commonly applied surgical procedures in the field of periodontology to establish an adequate crown length for different multidisciplinary purposes. Piezosurgery is stated to be a minimal invasive technique used for osteotomy and osteoplasty, which enhances the postoperative wound healing and patient comfort. The aims of the present pilot study were to evaluate the postoperative clinical healing and patient perceptions of the crown lengthening procedure performed with piezosurgery compared to the conventional bone resection technique with burs.

Methods A total of 20 patients, requiring surgical crown lengthening for the restorative and prosthetic purposes in incisors, canines and premolars were randomly divided into piezosurgery (test) and conventional bone resection (control) treatment groups. Parameters evaluating the clinical healing as color, edema and presence of hematoma were evaluated at days 7, 21 and 42. Postoperative pain level experienced by the patient was evaluated with the Visiual Analog Scale (VAS) during the post-operative 7 days.

Results No complication was observed in both groups. However, redness and presence of edema were detected significantly higher in the control group up to day 21 ($p<0.05$). Pain level was significantly lower in the test group compared to the control during the postoperative 7 days ($p<0.05$).

Conclusions Piezosurgery group experienced lower pain, and enhanced postoperative healing compared to conventional technique.

0065

Treatment of Gingival Recessions Using Er:YAG Laser for Root Biomodification

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Objectives In the treatment of gingival recessions, Er:YAG lasers are used for removing the smear layer and biomodifying the root surface. This procedure exposes the collagen fibers on the root surface, leading to enhanced wound healing. The aim of this study was to evaluate the clinical efficacy of coronally advanced flap (CAF) + de-epithelialized Gingival Graft(DGG) with and without using Er:YAG laser biomidification.

Methods Six patients with bilateral Miller I single gingival recessions were treated with CAF+ DGG with (test) or without (control) the application of Er:YAG laser on to the root surface (30Hz, 50Mj, under water irrigation). Probing depth, recession depth, keratinized tissue height, complete coverage (CC) and mean defect coverage (MDC) were evaluated at baseline and 1-year after surgical procedure.

Results At 1-year follow-up, significant improvements were detected in the evaluated clinical parameters in both sites ($p<0.05$). MDC were 98.21% and 97.14%, at test and control sites, respectively. No significant differences were detected between the treatment sites in terms of CC and MDC ($p>0.05$).

Conclusions Findings of the present study failed to show an additional effect of Er:Yag laser for the root surface biomodification in the treatment of Miller I single gingival recessions by using CAF + DGG.

0066

Histological Analysis of the Healing of Dermal Matrices Associated with Coronal Advanced Flaps..

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Objectives Analyze the histological characteristics of the tissue resulting from the use of alloplastic and xenogenic dermal matrices. Analyze the differences in the healing dynamics of all procedures.
Methods Histological descriptive study. Three 8-month-old Sach mini-pig specimens were used.
EXPERIMENTAL PROCEDURES:
1-Recreation of experimental defects: Miller Type I recessions mucogingival defects were generated by surgical resection of the keratinized tissue of the 2nd premolars (1 per arch).
2-Experimental procedures: Two months later the experimental procedures were performed following a randomized split-mouth model . Clinical data of probing depth (PD), recession (REC), clinical attacment level and amount of keratinized gingiva were recorded.
Depending on the randomization the following procederes were done:
Control locations: Coronal repositioned flap.
Control locations 2: Coronal repositioned flap plus connective tissue graft.
Locations Test 1: Coronal repositioned flap plus DERMA
Locations test 2: Coronal repositioned flap plus MUCOGRAFT.
Two months later, all the specimens were sacrified and the histological analysis were performed.
Results In all the specimens the healing occurred without incident. In the histological analysis both materials showed a correct integration without signs of chronic inflammation, ankylosis or root resorption.
The group of collagenous matrix mucograft, showed a complete integration, the tissues are indistinguishable from the control group.
The Derma group at 2 months show evident remains of the material in the tissues, the persistence of elastin fibers and a higher density of fibers compared to the control sites and. All these phenomena without signs of inflammatory reaction.
Conclusions Both materials can be used safely in the root covering without inflamatory reaccionts
Porcine Dermal matrices of porcine persist in tissues after two months of healing.

0067

Contour Linear Changes and Volumetric Analysis after GBR with Two Different Barrier Membranes. An Experimental In-vivo Investigation

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Objectives To evaluate volumetric and contour linear changes of soft and hard tissues when using two kind of membranes associated with a xenogeneic bone graft to treat horizontal bone defects at implant dehiscence, after 4 and 12 weeks of healing.
Methods Chronic alveolar ridge defects were created bilaterally in the mandible of eight Beagle dogs. Once implants were placed, the dehiscence defects were treated with three different combinations of membrane and biomaterials, assigned randomly: (i) test group received a deproteinized bovine bone mineral (DBBM) (BioOss® Geistlich, Wolhusen, Switzerland) plus a synthetic polylactic membrane (GUIDOR®, Sunstar, Switzerland), (ii) positive control group with placement of deproteinized bovine bone mineral (DBBM) (BioOss® Geistlich, Wolhusen, Switzerland) plus a porcine natural collagen membrane (BioGide® Geistlich, Wolhusen, Switzerland), and negative control group with any biomaterial but with only the test membrane. Micro-CT analysis was used to assess volumetric changes of hard tissues, while digitised STL cast model analysis served to record contour linear changes of soft tissues at six different level from the rim of the crest.
Results After both healing periods, intragroup comparisons showed that test and positive control groups were statistically superior than negative control group in term of buccal contour changes. Intergroup comparisons of both soft and hard tissues demonstrated, after both healing periods a superiority for test and positive control groups compared to negative control, but with no statistically significant differences. Finally, while at 4 weeks more changes occurred at the apical level of the crest (5 mm below the rim), after 12 weeks of healing more changes were at the intermediate level (3 mm).
Conclusions These findings suggest the need of using a combination of both biomaterials and membrane to treat horizontal non-contained bone defects. It is also demonstrated the efficacy and reliability of this novel method of analysis.

0068

Evaluation of Alveolar-Bone Resorption with Piezo-Assisted Tooth-Extraction: A-Pilot Split-Mouth Clinical-Study

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Objectives Soft tissue trauma is one of the reasons for the post-extraction pain and compromised healing. Atraumatic tooth extraction gains attention recently to promote the healing process. Piezosurgery proposes reduced soft tissue injury and aids salvaging the bony integrity of the extraction socket. Aims of the present pilot split mouth study were to evaluate the changes of the alveolar bone and pain level after piezo-assisted tooth extraction in comparison to convetional methods.
Methods 5 patients, who were referred from Orthodontic Clinics of Yeditepe University Faculty of Dentistry for the extraction of the mandibular first premolars were included in the study. Dental volumetric tomography (DVT) of the mandibule, before and 3-month following the extractions were taken to measure the alveoler bone height and thickness. Bilateral extractions were performed either with Acteon Piezotome Cube® +the site specific forceps (test site) and conventional elevator+forceps (control site). Pain level experienced by the patient was evaluated by using the Visiual Analog Scale (VAS) thoughout the post-operative 7 days (3 hours, 6 hours, 24 hours and 7 days).
Results VAS scores were found significantly different at 24 hours as 3.2 ± 0.1 and 6.4 ± 0.5 and at 7 days as 0 and 1.3 ± 0.4 , in the test and control sites, respectively. Reported pain level in the test sites were lower than the control sites ($p<0.05$). Even though statistically not significant, amount of the bone resorption were lower at the test sites compared to the control.
Conclusions Piezo-assisted tooth extraction sites experienced less pain level compared to the control sites. Due to the increased post-operative comfort, piezosurgery may be recommended for the tooth extractions in patients with dental phobia. Further studies with larger sample sizes are needed to evaluate the changes of the alveolar bone level for conclusion.

0069

Effects of an Adhesive Containing Fluoride-doped Bioglass on Caries-affected Dentine.

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Objectives This in vitro study aimed at evaluating the effects on caries-affected dentine of an experimental adhesive system containing fluoride-doped bioglass, applied in caries-affected dentine (CAD) in self-etching (SE) or etch&rinse (ER) mode.
Methods Human molars with deep caries lesions were collected and subsequently prepared by means of selective caries excavation using CARISOLV™. The teeth were divided in main groups based on the materials tested in this study and on their mode of application: RMGIC(RIVA LC, SDI); OPT(three-step adhesive, Optibond FL, KERR); UA (universal adhesive Prime&Bond ACTIVE, Dentsply) applied in SE mode (UA-SE) ; EXP-SE (experimental adhesive applied in SE mode) and in ER mode (EXP-ER). EXP consisted in a primer containing remineralisation biomimetic analogues and a bond with 40 wt% fluoride-doped bioglass. UA-SE, RMGIC and OPT were applied and light-cured as per manufacturer's instructions, while EXP was applied in ER and SE and light-cured for 30s. Bulk-fill composite build up (SDR. Dentsply) was performed in 4mm-layers after adhesive application under simulated pulpal pressure (20cm H2O) . The specimens were then cut in match-sticks (≈1mm^2), half of them were stored for 24h and half for 12 months in artificial saliva (AS). They were submitted to µTBS, SEM-EDX mapping and confocal microscopy evaluation.
Results OPT and UA exhibited the highest bond strength at 24h, while after 1 year, EXP SE was the only adhesive to show no significant reduction in bond strength ($p<0.05$). The mineralization [EDX: Phosphorous concentration ($p<0.05$)] was only clearly evident in those specimens treated with the EXP material. Confocal microscopy supported such outcomes showing obvious mineral precipitation at the resin-dentine interface.
Conclusions Innovative self-etching ion-releasing materials may be necessary to attain a stable bonding and a therapeutic bioactive/biomimetic remineralization of caries affected dentine.

0070

Effectiveness of Various Dentine Bonding Systems for Dentine Tubule Occlusion

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Objectives It was the aim of this study to investigate the effectiveness of various dentine bonding systems to occlude dentine tubules in vitro.
Methods Two hundred dentine discs were prepared from extracted teeth and divided into 25 groups of ten teeth. Dentine bonding systems were applied according to the manufacturer instructions. The following materials were tested: MDP Bond (1), Gluma (2), Clinpro Varnish XT (3) and Scotchbond (4), Futurabond (5), Fuji Triage (6), Telio CS (7) and Adhese Universal (8). Twenty specimens of each boning system were then thermocycled for 5000 cycles at 5 and 55 °C. Then, a tooth brushing time of two and six months was simulated. Surface roughness was determined before and after each tooth brushing cycle. The discs were immersed into AgNO3 solution and silver penetration was studied using scanning electron microscopy (SEM) and electron

dispersive spectroscopy (EDS). Penetration depth was analyzed statistically using non-parametric tests.
Results Materials 1, 2 5 and 6 showed no changes of the surface roughness after thermocycling and tooth brushing. In material 2 and 4 surface roughness decreased significantly compared to T0 after thermocycling and 2 months tooth brushing and increased significantly in material 2 after 6 months tooth brushing simulation. In material 4 the surface roughness remained significantly lower compared to T0 after 6 months tooth brushing. EDS analysis demonstrated a total occlusion in materials 1 and 5 immediately after application of the bonding material The highest leakage was found in material 7. All other materials showed moderate leakage. A statistical significant difference before and after thermocycling and 2 months tooth brushing simulation was found in materials 1 and 5 and after 6 months tooth brushing simulation in materials 1 and 8.
Conclusions Only two materials occluded dentine tubules completely. Tooth brushing and thermocycling reduces dentine tubule occlusion.

0071

Bioactive Composites Prevent Secondary Caries: An In-vitro Biofilm Model.
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Objectives The biggest issue in achieving longevity of a resin-based composite (RBC) dental restoration is nowadays the onset of secondary caries (SC). This study aimed to evaluate the ability of bioactive RBCs to prevent SC formation using an *in vitro* model of cariogenic biofilm challenge.
Methods Four sound bovine incisor teeth had their root removed and their pulp chamber filled, then sixteen circular class I cavities were obtained in the labial part of each incisor. Eight sound human molars had their root removed 3mm apical to cemento-enamel junction, and their pulp chamber filled. Four Class II cavities were made in each tooth having cervical margin in dentin. Cavities were filled with: two test bioactive RBCs, ACTIVA BioACTIVE-RESTORATIVE or PRESTO, a resin-modified glass ionomer cement (positive control, RMGIC, Ionolux), a conventional RBC (negative control, Filtek Supreme XTE). Each material filled one class II cavity and four class I cavities in each tooth, accordingly. Restorations were finished, specimens were sterilized and stored in artificial saliva for one week. *Streptococcus mutans* biofilm formation on the specimens' surfaces was obtained using a continuous flow bioreactor (37 °C, 20 ml/h) and undefined mucin medium + 5 wt% sucrose for two weeks. Before and after microbiological procedures, specimens were scanned using microCT (Skyscan 1176, 9µm resolution, 80KV, 300mA); image reconstruction was performed using proprietary software.
Results In both cavity types, conventional RBC and PRESTO showed SC development while RMGIC and ACTIVA expressed protection against SC and demineralization of surrounding enamel. In dentine, conventional RBC promoted SC development, RMGIC protected against demineralization, while bioactive RBCs did not promote SC nor protect against demineralization. ACTIVA showed gap formation after the incubation period.
Conclusions ACTIVA is a promising bioactive material, able to prevent secondary caries and demineralization *in vitro*, similarly to the tested RMGIC.

0073

Chemical and Mechanical Effects of Silver Diamine Fluoride in Dentine
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Objectives To investigate the effect on the chemical structure and the bond strength of sound and demineralized dentin, after the application of two different silver diamine fluoride (SDF) products.
Methods Thirty-nine human molars were sectioned to expose their dentinal surface, they were randomly divided into 4 experimental groups: (1) sound dentin (2) pH-cycling (3) Cariestop (4) Riva Star. The specimens were subjected to a pH-cycling process for 14 days prior to the application of the products. After the application and sealing of the samples, they were sectioned in 1x1 mm bars. Microtensile bond strength test was evaluated using two adhesives (Clearfil™SE BOND 2 and OptiBond™FL). Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR) was used to evaluate the chemical composition of the dentin. Three spectra of each specimen were performed in each of the time periods studied: immediately, 24h, 48h, 72h, 5d, 7d, 10d and 15d after the application of the product.
Results Bond strength values were higher in sound dentine with both adhesives. After applying SDF on the dentine submitted to pH-cycling, it dropped significantly regarding the bond strength values, respect to the sound dentin. Cariestop and Riva Star groups, with OptiBond™FL, showed bond strength values significantly lowers compared to the pH-cycling group (p=0,001). With Clearfil™SE BOND 2, Cariestop maintained its adhesion capacity with respect to pH-cycling, but Riva Star obtained significantly lower values (p<0.001). ATR-FTIR showed an increase in the relative intensity of some peaks between 1000-1600 cm-1 with both SDF.
Conclusions The use of SDF produces chemical changes in dentine in the short-term. The application of SDF on demineralized dentine decreases immediate the bond strength of dentine adhesives.

0074

Bacterial Degradation of Resin Composite Surfaces: An In-vitro Study.

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Objectives The oral bacterial biofilm is a structurally and functionally advanced system amply able to colonize every non-shedding surface in the oral cavity, including resin composites. Microcosm biofilms thrive via effectively manipulating their living environment, thus inducing structural and topographic damage to the resin composite substrate. This study aims at investigation of a multicenter biofilm model, produced from oral inoculums.

Methods Six identical composite samples (d:1,5 cm), made from Filtek Z250 resin composite (3M ESPE), were prepared for the study. The experimental design included in vitro incubation of five samples for 15 days in a CDC Bioreactor system. These five formed the Test Group, while the sixth disk was contained in a sterile petri dish for 15 days – Control Sample. The incubation process was performed in two consequent cycles: active and passive. The active cycle included continuous flow of fresh growth medium for 72 hours, while the passive cycle included 12 days of uninterrupted incubation with pooled medium. After the successful incubation, all of the test composite samples were freed of biofilm load. All six samples (Test Group and Control sample) were subjected to SEM-analysis for evaluation of structural and topographic changes on the composite surface.

Results The observed SEM-images of all samples from the Test Group revealed patterns of increased micro roughness, increased micro porosity, layers of grooves and overall surface deterioration. These findings cannot be attributed to passive erosion or any other shear forces due to their particular pattern and followed motives.

Conclusions The observed alterations to the composite resin surface may be a result of the bacterial metabolism as their role in adhesion and interlocking of surface-associated biofilms is yet to be discussed.

0075

Direct Adhesive Restorations: Factors Affecting Long-term Intraoral Survival

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Objectives To retrospectively investigate the factors influencing the survival of direct adhesive restorations over long-term intraoral service.

Methods Clinical records from patients who received a direct adhesive restoration between the last quarters of 2008 and 2009 and a dental examination in the first two quarters of 2018 at the Dental Clinic 1 in Erlangen were retrieved. Data were pseudonymized and information were collected on: patients oral health, age, restoration survival, failure reason, surgical procedure, material used and operator. No personal data were collected. Median survival times and Annual Failure Rates (AFRs) were calculated. Survival of direct adhesive restorations were assessed by Kaplan-Meier survival analyzes. The influence of the recorded factors on survival time was analyzed by multivariate Cox regression. Data were evaluated with SPSS Statistics 25 (IBM, Armonk, USA) at a significance level of 5% ($p<0.05$).

Results A total of 242 fillings in 130 patients were evaluated with a mean observation period of 9 years. At baseline patient's average age was 56 with a DMFT of 20. Restorations AFR was 5.3% with a 5-year survival of 70.2%. The main recorded failure reason was fracture of the filling (anteriors 39.5%, posteriors 27.4%) and secondary caries (26%). Significantly lower survival predictions of fillings were found with increasing patient age ($p<0.05$) and in patients with removable dentures ($p<0.001$). Bruxism led to a 2.7 increased restoration failure risk ($p<0.001$). Restorations on endodontically treated or periodontally compromised teeth, had significantly lower survival prognoses ($p<0.001$). The material used and operative procedures did not influence restorations long-term survival.

Conclusions Within the limits of the present study it can be concluded that to increase the long-term survival of direct adhesive restorations prophylactic measures must be increased, especially for elder, periodontally compromised and bruxism patients. Fracture resistance of adhesive restorative materials has still to be increased.

0076

Dental Caries at a Public School in Portugal

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Objectives To evaluate the prevalence and severity of dental caries among the young population of a public school in the municipality of Torres Vedras (Portugal) and to relate them with socio-demographic information and sugar frequency consumption.

Methods A cross-sectional study, with sample of 109 students (43% from total), randomly selected, was carried out at the public school of Maxial, in Torres Vedras, a municipality located the west subregion of Portugal. The prevalence of dental caries was evaluated by the DMFT index and the severity was measured using ICDAS II, both gathered from basic oral observations made with disposable material. A questionnaire was used to assess the socio-demographic information (gender, age, educational level) and food frequency consumption. The consent form and questionnaire were previously completed by the parents. The ethical approval was granted by a state recognized ethical committee from *Egas Moniz*, CRL. Data was submitted to descriptive and inferential statistical analysis using SPSS Software Statistics v.24.

Results The age of the subjects ranged from 10 to 18 years, being 62.3% female. The prevalence of dental caries was 55.0% (95% confidence interval estimate: 47.9-62.0%) with a DMFT index of 1.7 (± 2.7). Regarding the severity, 23.9% of the identified

lesions were incipient, with no cavities and 12.6% had distinct/extensive cavities, with visible dentin. An association was found between the prevalence of dental caries and the educational level (p=0.025). The correlation between the number of incipient lesions with the sugar intake level was found to be positive, significant, but weak (r=0.257, p=0.007).
Conclusions The prevalence and severity of dental caries were identified as low in this population. An association between caries prevalence and educational level and a positive correlation between the number of incipient lesions and sugar frequency consumption were identified. Studies with larger samples are needed to adequately outline the oral health landscape in Portugal.

0077

Clinical Evaluation of Restorations Made of ELS Versus APT Resin Composite

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Objectives This clinical trial evaluated the performance of low shrinkage resin composites in permanent teeth.
Methods Between 12.12.2017 - 26.10.2018, 30 patients (22 females, 8 males, mean age: 25.2) referred to the Department of Restorative Dentistry, Medipol University, Dental School, Istanbul, Turkey, received randomly 30 pairs of restorations (N=60) using either ELS (Saremco, Switzerland) or APT composite (Saremco) in Class I and Class II cavities (CTRN: NCT03306576). Two operators performed all restorations and two independent calibrated operators evaluated the restorations 2 weeks after placement (baseline), at 6 months and 1 year using FDI criteria (Scores 1-5) for surface staining, marginal staining, marginal gap, marginal fracture, marginal irregularities, seconder caries, marginal tooth integrity, surface lusture, color match and translucency, fracture of material and retention, occlusal wear, approximal contact point, patient view, tooth integrity, post-operative sensitivity. The changes in the FDI parameters were analyzed using McNemar test (alpha=0.05) and Kaplan-Meier.
Results Mean observation period was 7.8± 4.2 months. Patients rated the fillings highly satisfactory after 1 year. No cases of occlusal wear or loss of contact points requiring repair, incidence of endodontic complications or post-operative sensitivity was noted with both materials. Predominantly good colour match, no difference in shade and/or translucency or minor deviations were observed. At 6-month recall, one restoration from APT showed moderate marginal staining that did not require any intervention. For surface staining criteria (Score 2a) at 1-year recall two restorations (one from ELS and one from APT composite) showed distinct but acceptable deviations (Score 2b that did not affect the aesthetic results. One debonding (APT composite) and one fracture (ELS) were observed at 1-year recall. FDI parameters did not show significant difference between ELS and APT composite (p>0.05).
Conclusions After 1-year follow-up period, both resin composite fillings tested presented good clinically acceptable results.

0078

Cytocompatibility of Total-etch and Self-etch Adhesive Systems

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Objectives Cytotoxicity of total-etch and self-etch adhesive systems was analyzed in a basic test system and in a dentin barrier test device.
Methods ScotchBond Universal Adhesive (SBU, 3M), iBond Universal (iBU, Kulzer), and iBond Total Etch (iBTE, Kulzer) were light-cured as 1 mm films. Material films were extracted in culture medium (MEMa/10% FBS) at a ratio of 0.2 g/ml for 24h following ISO 10993-12. Transfected pulp-derived cells (SV3neoB) were exposed to these extracts for 24h, and cell survival was determined (crystal violet assay). Lower cytotoxic effects observed after addition of N-acetyl cysteine (NAC, 10mM) indicated oxidative stress as a cause of cytotoxicity. In a dentin barrier test device, 3D-cultures of SV3neoB were separated from test materials by dentin slices (500 µm thickness). Total-etch and self-etch adhesive systems were applied following clinical procedures. A silicon impression material was used as a negative control (100% cell vitality) and an experimental material served as a positive reference following ISO7405. Cell viability (MTT test) was determined after a 24h exposure. Cell survival and viability rates were statistically analyzed (Mann-Whitney test).
Results Extracts of SBU, iBU, and iBTE decreased survival of SV3neoB in a dose-dependent manner. Cell survival was reduced to 40% by undiluted extracts of SBU or iBTE, and extracts of iBU were 4-fold more effective. NAC protected cells from cytotoxic effects of the materials. In the dentin barrier test, iBTE moderately reduced cell viability to 60% compared to the negative control. iBU slightly decreased cell viability in a self-etch mode but was not effective in an etch-and-rinse mode similar to SBU.
Conclusions Cytotoxic effects of SBU, iBTE or iBU were observed in a basic test system. These cell responses were not detected or were reduced in a dentin barrier test device simulating the clinical application of the materials.

0079

Biological Effect of Full-length Amelogenin Protein: Events Leading to *De Novo* Formation of Periodontal Tissues.

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Objectives To investigate the biological effect of full-length recombinant amelogenin protein (rh191), a component of enamel matrix derivatives (EMDs), on Human Oral Keratinocytes (iHOKs).

Methods Immortalized Human Oral Keratinocytes (iHOKs) were expanded in Keratinocyte Growth Medium-2 (KGM-2) and later treated with different rh191 eluates. Full-length recombinant amelogenin protein (rh191) was diluted in KGM-2, in five different concentrations (10 ng/ml, 100 ng/ml, 1.000 ng/ml, 5.000 ng/ml and 10.000 ng/ml). Samples that were not treated with rh191 dilutions served as control. Cell viability was examined by WST-1 and cell proliferation by cell doubling in three time points (Day7, Day14, Day21). Wound healing was evaluated using scratch assay. The two-dimension scratched area was digitally quantified in three time points (Day0, Day1, Day3).KRT14, KRT18, KRT19 (Keratinocyte genes) and ODAM (Odontogenic ameloblast-associated protein) gene expression was examined by RT-PCR analysis in four timepoints (Day0, Day3, Day7, Day14). Statistical analysis, with Games-Howell test was performed, and p-values < 0.05 were considered statistically significant.

Results The stimulation of iHOKs with rh191 led to dose-dependent inhibitory results, which were statistically significant in almost all experimental processes.

The inhibitory effect, present also after one week, is more evident after 14 and 21 days.

Conclusions rh191 has a significant biological impact on iHOKs. A dose dependent inhibitory effect of rh191 has been showed on iHOKs, which suggests the complexity of amelogenin proteins therapeutic mechanisms that may affect the periodontal tissues.

0080

Clinical Trial on the Efficacy of Sil-Oss® in Alveolar Regeneration

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Methods: A randomized clinical trial was conducted in study population n = 33.

26 weeks after implantation of the regenerative material in the post-extraction alveolus, a biopsy of the regenerated tissue is taken by means of a trephine bur of 3.7 mm in diameter to a depth of 6 mm, performing an osteotomy. partial of the area. Obtained the biopsies histological analysis of the same ones is realized. CT scans of the regenerated alveoli are made, evaluating the bone density in HU units by radiographic analysis. The measurements are made on sections parallel to the palatal vault: Crestal (Cc), Medium (Cm), Apical (Ca) and Orthoradial (Co). The density of the reference bone is determined from Reference Cuts 2mm from the apex of the regenerated alveolus (CRa) and in the same contralateral area (Crc).

Results: Sil-Oss® samples showed deposits of organic bone matrix on the osseointegrated particles and greater osteinductive power, with the formation of osteoblastic ossification fronts at inter and intragranular level. Evidence osteoclasts on the surface of Sil-Oss®, indicated active resorption.Bone density was significantly higher for Sil-Oss compared to Bio-Oss, the statistical analysis using the Student t-test indicates that there is a significantly higher difference, with a confidence interval> 95%.

Conclusions: The quantity and quality of bone regenerated from the implanted granules is higher in cases regenerated with Sil-Oss®. Evidencing the osteoformador potential of this new biomaterial.Higher density of sites treated with Bio-Oss® was attributed to the biomaterial itself as Sil-Oss®has a density similar to bone. The capacity of Sil-Oss to be replaced by new bone was confirmed, and no interphase between the bone and the graft was noticed.

0081

Periapical Healing After Root Canal Obturation With a Bioceramic Sealer

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Objectives The aim of this retrospective study was to compare periapical healing in teeth with apical periodontitis submitted to endodontic treatment and obturation either with an hydraulic technique with bioceramic sealer or warm vertical compaction with resin-based sealer.

Methods Patients attending an Endodontic practice during 2017 with an initial diagnosis of apical periodontitis, submitted to endodontic treatment (obturated either with an hydraulic technique and BioRoot RCS (Septodont) or warm vertical compaction with AH Plus (Dentsply) and presenting 12-month controls were selected. Patients with chronic periodontal problems or immune diseases, presenting teeth with anatomic alterations or suffering procedural accidents or complications during treatment were excluded from the study. Immediate postoperative periapical radiographs and controls were randomly mounted in a Keynote presentation for further evaluation. Two blinded calibrated examiners determined the periapical status in each radiograph using the PAI index. Kappa coefficient (K) was calculated to determine inter-observer agreement. A consensus was reached in case of disagreement. A multivariate analysis was performed to assess the impact of the obturation technique and registered preoperative factors in treatment outcome.

Results A total of 74 teeth with root canal treatments and retreatments met the inclusion criteria and were evaluated: 38 were obturated using warm vertical condensation and 36 using hydraulic technique with bioceramic sealer. Level of agreement

between examiners was high (K=0.89). No significant differences were detected in periapical healing between both obturation techniques. The only factor that significantly influenced the outcome was the type of treatment. Initial treatments showed a significantly higher rate of healing than retreatments with an odds ratio (OR)= 9.6 (95% confidence interval, 1.1–86.8).
Conclusions Hydraulic root canal obturation technique with BioRoot RCS perform similarly to warm vertical condensation with AH Plus in terms of periapical healing in teeth diagnosed with preoperative apical periodontitis after one year recall.

0082

Silica Loading Enhanced Surface Nanoproperties of Novel Nanostructured Membranes

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Objectives Novel nanostructured polymeric membranes were created by electrospinning. Functionalization of the polymeric membranes (M) with silica was performed by nanoparticles (NPs) incorporation inside the nanofibres (MS-in) or physisorbed onto the nanofibres (MS-on). The objective of the study was the surface characterization of novel matrices by means of bioactivity, nanomechanical properties and topography.
Methods Bioactivity was analyzed by Kokubo method (ISO 23317:2012) (n=3). Nanomechanical properties were tested using a Hysitron Ti Premier nanoindenter equipped with nano-DMA III (quasistatic force setpoint Fq=2 µN, sinusoidal force of amplitude FA=0.10 µN and frequency f=200 Hz), and Atomic Force Microscopy was employed for topography analysis (n=3). ANOVA and Student Newman Keuls were employed for multiple comparisons ($p<0.05$).
Results Calcium phosphate deposits were always encountered after the bioactivity testing when silica was present. Nanoroughness mean values (SRa -nm-) and standard deviations were M: 108.5 (21.6) < MS-on:142 (28.3) < MS-in: 246.8 (29.3). Mean and standard deviations of the complex modulus values in GPa were M: 10.05 (4.2) < MS-on: 12.52 (3.1) < MS-in:17.96 (4.7), and stiffnes mean and standard deviations values in GPa were M:1.0 (0.5) > MS-on:0.39 (0.09) > MS-in:0.28 (0.05).
Conclusions After silica incorporation, stiffness, complex modulus, nanoroughness and bioactivity were increased. Proteins deposition, cells growth and spreading may be facilitated upon implantation of membranes. Acknowledgments: This work was supported by the Ministry of Economy and Competitiveness (MINECO) and European Regional Development Fund (FEDER) [Project MAT2017-85999-P MINECO/AEI/FEDER/UE].

0083

Enhanced Bioactivity of Doxycycline-doped Novel Nanostructured Membranes for Bone Regeneration

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Objectives Novel nanostructured polymeric membranes were created by electrospinning. Membranes were doped with doxycycline to get antibacterial properties (Dox-M). Dox-M were loaded with silica nanoparticles inside the nanofibers (Dox-M-Si) trying to get enhanced bioactivity, nanoroughness and nanomechanical properties. The objective of the study was to analyze the changes in bioactivity, topography and mechanical properties of the experimental doxycycline loaded membranes after silica loading.
Methods Bioactivity was performed by Kokubo method (ISO 23317:2012)(n=3). Nanomechanical properties were tested using a Hysitron Ti Premier nanoindenter equipped with nano-DMA III (quasistatic force setpoint Fq=2 µN. sinusoidal force of amplitude FA=0.10 µN and frequency f=200 Hz), and Atomic Force Microscopy was employed for topography analysis (n=3). Student t test was employed for comparisons ($p<0.05$).
Results Silica incorporation enhanced membranes bioactivity. Mean and standard deviation nanoroughness values (SRa -nm-) were Dox-M:140.2 (23.3) < Dox-M-Si:205.7 (25.6). Mean and standard deviation complex modulus values in GPa were M:10.05 (3.9) < Dox-M-Si: 16.99 (3.9) and stiffnes mean and standard deviation values in GPa were Dox-M:1.1 (0.4) > Dox-M-Si:0.27 (0.1).
Conclusions The bioactivity in membranes with silica, measured after simulated body fluid immersion, was drastically increased. Silica also enhanced nanoroughness and mechanical properties of novel doxycycline doped membranes. Proteins deposition, cells growth and osteogenic cell differentiation on membranes may be facilitated upon tissue implantation. Acknowledgments: This work was supported by the Ministry of Economy and Competitiveness (MINECO) and European Regional Development Fund (FEDER) [Project MAT2017-85999-P MINECO/AEI/FEDER/UE].

0084

Chlorhexidine-supplemented Calcium Hydroxide in Endodontics: How Formulation Affects the Performance

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Objectives The addition of chlorhexidine (Chx) to calcium hydroxide paste (CH) has been proposed as a promising approach to enhance the antimicrobial activity of this intracanal medication but conflicting results exist in the literature. Physico-chemical interactions between Chx and CH may interfere with the expected clinical effect by affecting not only antimicrobial activity but also key mechanical properties of the mixture, which have been poorly studied to date. The aim of this *in-vitro* study was to

better understand the influence of Chx incorporation on both the key physical and antimicrobial properties of CH pastes.
Methods Different setting conditions for CH preparation (liquid/powder ratio: 40:60; 50:50; 40:60) and Chx loading (0.5%; 1%; 2%; 2%; 4%) was investigated. Seringeability and dynamic changes in hardening kinetic and water uptake were studied. Antimicrobial activity was evaluated with both the diffusion and kill-time test on clinical bacteria strains: *Enterococcus faecalis, Candida albicans, Streptococcus anginosus, Actinomyces naeslundi*.
Results The 50:50 liquid/powder ratio showed an optimal consistency for an intracanal injection. This formulation also presented few mass change over 7 days due to a limited water uptake/loss. The addition of important Chx loading (4%) significantly affected the syringeability of the formulation and its hardening kinetic. The addition of Chx improved the antibacterial effect of the CH paste in a dose-dependent manner (reduction of 100% *Enterococcus faecalis* in 24h).
Conclusions The addition of Chx to CH increased the antibacterial activity of the mixture but also affects the mechanical behaviour. In practice, this may impact the intracanal administration and resorption rate of the paste and finally interfere with the desired clinical effect.

0087

The Effects of the Dental Methacrylates TEGDMA, Bis-GMA and UDMA on Neutrophils

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Objectives The high usage of acrylates and methacrylates in the modern dentistry increases the need for better knowledge of their biological impacts. While there have been several studies demonstrating the effects of different acrylic and methacrylic monomers on mononuclear **white blood** cells, very little is known about the effects caused by these monomers on granulocytes. The **objective** of this study was therefore to add novel knowledge about how neutrophils are affected after exposure to triethylene glycol dimethacrylate (TEGDMA), urethane dimethacrylate (UDMA) and bisphenol A glycol dimethacrylate (Bis-GMA) alone or in combinations.

Methods Isolated neutrophils were cultured in the presence or absence of methacrylates. The formation of neutrophil extracellular traps (NETs) was investigated using Sytox green DNA stain and was confirmed with microscopic visualization of the cells. The cell death processes were analyzed using fluorescence-based cell sorting. The IL-8 production was measured using a DuoSet ELISA development kit.

Results NET structures were formed by neutrophils after exposure to UDMA alone (p=0.0043), Bis-GMA alone (p=0.0026) and the combination of Bis-GMA together with TEGDMA (p=0.0043). Exposure to UDMA in combination with TEGDMA compared to exposure to UDMA alone, suppressed the formation of NETs.

Exposure to TEGDMA, UDMA and Bis-GMA for 24 hours in combination or alone did not affect the apoptosis or the necrosis of the exposed neutrophils.

The production of IL-8 was significantly increased after exposure to TEGDMA alone and in combination with Bis-GMA compared to the unstimulated controls (p=0.0053).

Conclusions We report that exposure to different combinations of TEGDMA, UDMA and Bis-GMA affect immunological and cytotoxic events in neutrophils. These effects may be an underlying cause behind some of the previously reported adverse reactions caused by these methacrylates.

0088

Ultra-morphological Analysis of Universal Adhesives on Dentin: Self-etch vs Etch-and-rinse

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Objectives To study the ultra-morphology of dentin-resin interfaces formed with universal adhesives (UAs) applied in self-etch (SE) and etch-and-rinse (ER) mode.

Methods Middle dentin of 24 extracted human molars was exposed with a diamond saw under water irrigation. Specimens were randomly assigned to one of six UAs: (1) All-Bond Universal (AB, Bisco); (2) Adhese Universal (AD, Ivoclar Vivadent); (3) Clearfil Universal Bond (CU, Kuraray Noritake); (4) Futurabond Universal (FU, Voco); (5) Prime&Bond Elect (PE, Dentsply Sirona); (6) Scotchbond Universal (SU, 3M Oral Care). For each UA, 2 teeth were treated in SE mode and 2 teeth in ER mode following the respective manufacturer's instructions. A 1-mm layer of flowable composite was applied and light-cured for 40 sec. After fixation in Karnovsky solution and dehydration in ascending grades of ethanol followed by HMDS, the resin-dentin interfaces were decalcified with 6N HCL for 30 sec and deproteinized with 2.5% NaOCl for 10 min. After thoroughly rinsing with distilled water, specimens were embedded in epoxy resin, sectioned and processed for FESEM observation by sputter-coating with Au-Pd. Observation was carried out under a Hitachi S-4700 FESEM.

Results In SE mode, all UAs resulted in an intact submicron hybrid layer (HL), with micro resin tags and resin-infiltrated smear plugs.In ER mode, AB and AD formed a densely packed HL with well-defined lateral peritubular triangular hybridization and resin tag hybridization. For CU, FU, PE, and SU, besides areas of apparently fully-infiltrated HL, there were areas with deficient hybridization that was depleted of the characteristic fibrillar pattern of the HL. These areas of incomplete adhesive infiltration resembled a ghost-hybrid layer

Conclusions None of the UAs was able to fully infiltrate dentin simultaneously in both SE and ER modes.
The SE mode resulted in tighter interfaces in comparison with the ER mode.

0089

Is there Degradation of Methacrylates In Acidic Acetone-Water Adhesive Formulation?

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Objectives Self-etching adhesives contain acidic and di-functional methacrylates and besides water - acetone or alcohol as solvent. Shelf life depends on the chemical stability of these monomers in solution. The degradation of methacrylates is widely discussed in literature. Our study focused on the stability of 4-META and UDMA during product shelf life of iBOND Universal (Kulzer GmbH).

Methods Fresh iBOND Universal and expired iBOND Universal (stored at RT) were investigated by LC-MS, SBS and DC.
Liquid Chromatographic Mass Spectroscopy (LC-MS):
The amount of ingredients were monitored by LC-MS for fresh and expired iBOND Universal.
Shear Bond Strength Testing (SBS):

iBOND Universal was applied according to its instruction for use in self-etch mode on human dentine (n=8 for each group). Venus Diamond composite (A2) was bulk filled in cylindrical plastic molds and cured for 20s. Both, adhesive and composite were cured separately using a LED LCU (Translux WAVE, Kulzer). Shear bond strength was measured according ISO 29022 (Ultradent method) after 24 hours water storage at 37°C.
Degree of Conversion (DC) – FTIR measurement:
The DC was determined with FTIR-measurement by calculating 817cm^{-1} area before and after curing iBOND Universal using a Translux WAVE for 10s.
Results For the di-functional monomer UDMA the analyzed content in formulation was unchanged between fresh and expired material.For the acidic monomer 4-META minor degradation was found between fresh and expired material during room temperature storage.Additional bond strength testing proved the unaffected performance of shortly expired material compared with initial values of fresh material. The same holds true for the degree of conversion which shows that the initiator system stays vital over the shelf life.
Conclusions In iBOND Universal no degradation of UDMA was found during shelf life. For 4-META only minor degradation occurred, but with no relevance on product performance as proven by bond strength and degree of conversion.

0090

Influence of the stalk on the repeatability and fracture type of shear bond strength assay

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Objectives To evaluate the accuracy of the shear bond strength test using two forms of loading stalk (straight and curved) and 2 sample diameters (2,38 mm and 5 mm) and also to analyze and evaluate if there is a pattern established on the type of fracture depending on the shape of the load stem, the diameter of the sample and the position of the sample in the machine.
Methods 32 monolithic samples of Acronitrile Butadiene Styrene (ABS) were used to minimize the factors that influence adhesion,so to evaluate the precision of the Zwick Pro Line Z005 machine involving less variables. Four groups were created and the samples were divided equally: 8 for straight stalk and 2,38mm, 8 for straight stalk and 5mm, 8 for straight stalk 2,38mm and 8 for 5mm curved stalk. The stereomicroscope Stereo Discovery V8 was used for fracture analysis.
Results There were no statistically differences between the accuracy of the 4 groups. There were statistically significant differences when we compared the resistance to fracture using a straight or curved stalk. Regarding the type of fracture there was no dependence according to the diameter and the type of stalk.
Conclusions The shape of the loading stalk and the diameter did not affect the accuracy of the shear bond strength test, but they did significantly affect the resistance. The shape of the loading stalk and the diameter could not be related to the types of fracture that were found.

0091

The Efficacy of Different Surface Treatments in Composite-Composite Bond Strength

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Objectives This study aimed to investigate the most effective method in increasing composite-composite bond strength in the clinical repair procedures.
Methods A total of 224 composite (Clearfil Majesty ES-2) disks (5 mm x 3.5 mm) were prepared and stored in 37°C distilled water for 24h. The samples were randomly divided into two groups as aged and non-aged. Aged group samples were subjected to 20,000 thermal cycles. All aged and non-aged groups were divided into five different subgroups including different kinds of surface treatments (control without any surface treatment, 38% orthophosphoric acid (OA), Al_2O_3 sand-blasting (SB) with and without adhesive resin (AR) application). After these surface treatments, additional composite disks, 2 mm in diameter, were bonded to the previously prepared composite samples. Failure forces (N) were recorded with a shear bond tester (BISCO, Schaumburg, IL, USA) to then calculate the shear bond strength values (failure force divided to the bonded area). Data collected (in megapascals) were subjected to two-way ANOVA and Tukey's test (P=0.05).
Results Adhesive resin application increased the bond strength of the study groups. OA alone decreased bond strengths in aged and non-aged groups. In both non-aged and aged groups, the highest bond strength values were received with the SB groups ($P<0.05$).
Conclusions The results of this study showed that the most effective surface treatment for composite-composite bond repair was sandblasting and adhesive resin application together.

0092

Influence of Adhesives on Color Stability of *Bulk-fill* Restorations

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Objectives Evaluate the influence of different adhesive systems on the colorimetric alteration of *bulk fill* resins
Methods 240 composite resin discs were made with UD3 (Micerim, Itália) with were divided into 4 groups, one control, without

adhesive, and 6 study groups in which were applied the adhesive systems Clearfil SE Bond 2 (Kuraray, Japan), Futurabond NR (VOCO, Germany), OptiBond XTR (Xerr, USA), Clearfil Universal Bond (Kuraray, Japan), One Coat 7 Universal (Colténe, Switzerland) and Futurabond U (Voco, Germany). Subsequently, 480 discs of each bulk fill resin were made with Fill-Up (Cóltene, Switzerland) and Xtra-Fill (VOCO, Germany). The composite resin discs were adhered with the *bulk fill* resin discs with the different adhesive systems. A colorimetric evaluation was made using a spectrophotometer (VITA Easyshade® Compact, Vita Zahnfabrik, Germany). The study groups were then placed in dye solution (coffee+coca-cola) for a month and made initial measurements, day 15 and day 30. Data analysis was made using the statistical analysis program SPSS® v.25.0 (Statistical Package for the Social Sciences, IBM, EUA)

Results After both periods (15 and 30 days) the resins presented a decrease of *ΔL** and an increase of *Δb**. In a global color variation, it was observed that the Fill-Up presents no significant variation of results than the Xtra-Fill (p=0,07). In general, all the self-etch adhesives show a smaller variation against the universal group. Statistically significant differences were observed after 30 days between all adhesives except Optibond XTR and Futurabond NR, and between the self-etch adhesives. The adhesive with lower ΔE was Clearfil SE Bond 2. However, the one with the lowest variation of results was the Futurabond NR

Conclusions When using translucent resins such *bulk fill* resins, it is necessary to take into consideration the adhesive system used given the colorimetric change that appears to occur in the restoration

0093

Adhesive Application in Class II Composite Restorations Before/After Matrix Positioning

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Objectives Resin-based composite (RBC) restorations are characterized by excellent performances, yet their application is critical at the cervical margin of class II restorations. A clinical protocol suggests applying the adhesive system before positioning of interproximal matrices, to achieve better control.
This study aimed to morphologically investigate the effect of adhesive placement prior, or subsequent, to matrix positioning in direct-bonded Class II RBC restorations. Additional aim was to evaluate possible differences when using a two-step (CSE, Clearfil SE Bond2) or a one-step adhesive system (CU, Clearfil Universal Bond Quick).
Methods Standardized mesio-occlusal and disto-occlusal cavities were prepared on twenty human molars. Teeth were randomly assigned to two groups according to (n=10) contoured sectional metal matrices positioned before adhesive application (M->A), or (n=10) after adhesive application (A->M). Both adhesive systems were additioned with crystal violet dye (CV, 10 vol%). Specimen sections (0.5 mm thickness) were prepared and assessed with optical and scanning electron microscopy (SEM). Bond strength of the CV-additioned adhesives was tested by microshear bond test on enamel and dentin of 12 additional molars.
Results M->A produced a layer of adhesive both on tooth surfaces inside the restoration box and on external restoration surfaces in contact with the matrix. A->M produced a thin layer of adhesive on external tooth surfaces, well beyond cavity margins and end of RBC restoration. In all restorations, excess RBC material with uneven margins was observed over cervical margin (Figure 1). Shear bond strengths: CV addition significantly reduced adhesion forces on dentine (p=0.0015). When CU+CV was used on dentine, adhesion forces showed a 10-fold reduction.
Conclusions Both M->A and A>-M protocols showed pros and cons, expressing adhesive layers in a hard to reach area, with the risk of being poorly polymerized. To improve longevity, all cervical margins of RBC restorations should be carefully finished, no matter the clinical protocol adopted.

0094

Influence of Aging on Mechanical Properties of Translucent Zirconia

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Objectives The aim of this study was to evaluate the influence of aging and surface treatment on biaxial flexural strength (BFS), Vickers hardness and the roughness of translucent dental zirconia.
Methods One surface of 80 disc-shaped zirconia specimens (1.2mm thickness and 12mm diameter, Katana HT10, Kuraray) was polished down to 1µm. Forty of these specimens were aged in an autoclave at 134°C, under 2bar (A) for 20 h, the other specimens were not aged (N). Afterwards the specimens of each group were randomly distributed into 4 subgroups according to the treatment of the second surface: no treatment (Sin), air-abrasion using 50 µm alumina particles at 1 bar (1b) and 2.5 bar (2.5b) and polishing down to 1 µm (1µm). After that BFS, Vickers hardness, surface roughness and phase changes were evaluated using a universal testing machine, an indentation tester, a laser scanning microscope and X-ray diffraction, respectively.
Results Aging has no effect on roughness or hardness. Polishing groups either aged or non-aged showed the lowest mean value of roughness and hardness, while the other groups showed similar roughness. The average roughness (Ra) ranged from 0.002±0.001 µm (A-1µm) to 0.531±0.051 µm (N-1b). The Vickers hardness ranged from 1339±22 HV5 (N-1µm) to 1450±39 HV5 (N-Sin). No monoclinic phase was detected for three groups (N-Sin, N-1µm, and A-1µm). For the other groups the volume fraction of the monoclinic phase ranged from 9.8±0.6% (N-2.5b) to 41.5±0.3% (A-1b). BFS increased significantly with aging and air-abrasion. It ranged from 720±37 MPa (N-Sin) to 1153±92 MPa (N-1b).
Conclusions A certain amount of monoclinic phase at the surface seems strengthen the high translucent zirconia ceramic, while hardness and roughness are not influenced. The used pressure during air-abrasion did not influence the investigated properties.

0095

3D Profilometry Characterization of Zirconia Ceramic After Different Surface Pretreatments

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Objectives The aim of our study was to assess the surface roughness of zirconia after different pretreatment procedures by means of 3D Profilometry.
Methods Ten groups of yttria-stabilized KATANA™ Zirconia (Kuraray Noritake Dental Inc.) samples were prepared: one control group (no pretreatment); four groups sandblasted by 50 µm and 250 µm Al_2O_3 particles at a pressure of 2 and 4 bars; three Er:YAG laser groups irridated with energy intensity of 100, 200 and 400 mJ and two groups treated with HF (hydrofluoric acid) of 10% and 40% concentration.
Results 3D images were processed by means of 3D profilometer Zeta-20 and the roughness in all dimensions in µm was measured. For every specimen Ra (arithmetic mean roughness) and Rq (root-mean-square roughness) were estimated. The control group was heterogenic in nature (Ra 0.33; Rq 0.41) and its roughness was similar to the groups treated with 40% (Ra 0.33; Rq 0.42) and 10% HF (Ra 0.35; Rq 0.45), that confirms HF pretreatment as an ineffective protocol. Irradiation by Er:YAG

laser showed results close to the control and HF groups in different modes of applied energy: 100 µJ (Ra 0.31; Rq 0.42); 200 µJ (Ra 0.35; Rq 0.45); 400 µJ (Ra 0.35; Rq 0.45). The highest roughness was observed on samples sandblasted by 50 µm Al_2O_3 at a pressure of 4 bars: Ra 0.57; Rq 0.70. The rest of the sandblasting methods also showed high rates of performance: 50 µm Al_2O_3, 2 bars: Ra 0.45; Rq 0.57; 250 µm Al_2O_3, 4 bars: Ra 0.41; Rq 0.53 and 250 µm Al_2O_3, 2 bars: Ra 0.38; Rq 0.49.
Conclusions Within the limitations of our study, sandblasting by Al_2O_3 results in the highest roughness and seems to be an effective method for surface pretreatment of zirconia.

0096

In-vitro Comparison of Hot Pressed and Milled Feldspar Ceramic Regarding Optical Properties and Roughness

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Objectives The purpose of this study was to evaluate differences of the optical properties and roughness between a hot pressed and a CAD/CAM feldspar ceramic after immersing in artificial saliva.
Methods A total of 16 feldspar ceramic samples with medium translucency and a thickness of 1.5 mm were fabricated. 8 of the samples were obtained by hot pressing feldspar(Vita PM9 Zahnfabrick, Germany) and 8 of the samples by slicing CAD/CAM blocks (Vita Mark II, Vita Zahnfabrick Germany). The samples were polished and immersed in artificial saliva before baseline color measurements were carried out according to the CIELab color system. The L*, a*, b* values were obtained using a spectrophotometer (Vita Easy Shade 4.0 Vita Zahnfabrick, Germany). TP and OP parameters were calculated using their formulas. After evaluating the optical properties, the roughness of the samples was evaluated by measuring Ra and Rz parameters with a profilometer.
Results The highest mean translucency value was obtained in the CAD/CAM feldspar group. The highest mean opalescence value was obtained in the hot pressed feldspar ceramic group. Ra and Rz did not indicate noticeable differences between the samples.
Conclusions Based on the results of this study, there are some differences in the optical properties of the two ceramics and these have clinical implications. Both types of ceramic have an indication for polishing and the roughness values of the samples were similar.

0097

Edge-Stability of the Novel Lithium Disilicate Glass-Ceramic Block for CAD/CAM

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Objectives Lithium disilicate glass ceramics are known as clinically useful dental materials from the viewpoint of aesthetics and high strength. In accordance with the dramatic progress of digital-dentistry, various materials for CAD/CAM have been developed. The purpose of this study was to evaluate the edge stability of the novel lithium disilicate glass ceramic block for CAD/CAM.
Methods A 30-degree triangular prism was scanned using CEREC Omnicam (DentsplySirona). Initial LiSi Block (LS, GC Corp.), IPS e.max CAD (EM, Ivoclar Vivadent) and CELTRA DUO (CD, DentsplySirona) were fabricated into the prism shapes with CEREC MC XL (DentsplySirona) (n=8). Arithmetic mean surface roughness (Ra) and maximum height (Rz) of the specimen's edge were measured by 3D Measuring Microscope (VR-5000, Keyence) after the grinding (Figure1, see arrow). To analyze crystal structure of each material, SEM (SU-70, HITACHI) observation was also carried out.
Results In the following Table 1, different alphabets in the same column indicated significant difference ($p<0.05$, one-way ANOVA and Turkey test). After grinding test, LS showed lower Ra and Rz compared to EM and CD. SEM observation confirmed high density and fine crystal precipitation in LS glass matrix (Figure 2) and revealed that lithium disilicate crystals of LS were smaller than that of EM and CD.
Conclusions In this study, the crystal size affects the edge stability of dental prosthesis, and it is suggested that Initial LiSi Block as a new lithium disilicate glass ceramic block has the accurate designed edge compared to other materials after the grinding.

0098

Translucency Analysis of Monolithic CAD/CAM Ceramic Materials at Different Thicknesses.

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Objectives The aim of this study is to determine how Translucency Parameter (TP) of three different monolithic CAD/CAM ceramic blocks, changes in relation to thickness, compare the TP to natural enamel and standardize the thickness for a future study.

Methods 1 specimen for each thickness (0.3, 0.5, 0.7, 0.9 , and 1.1 mm) were cut from VITA Enamic HT, e.max CAD HT, and VITA Blocks Mark II CAD/CAM blocks. All the ceramics had an A2 shade. The TP parameter were measured with a spectrophotometer over a white and black background with a 10° Geometry. The data was analysed with 2-way ANOVA and Fisher post-hoc test.

Results Material and thickness influenced the TP, except at the comparison with the thicknesses of 0.9 mm with 1.1 mm. At these two thicknesses no statistical change was noted. With VITA Blocks and e.max having the highest amount of difference between the materials and VITA Enamic having intermediate values between the other two materials.

Conclusions The materials which most closely resemble the TP of human enamel were VITA Enamic and VITA Blocks Mark II, while e.max presented the highest translucency. For a more detailed study more preparations are necessary in addition with a precise protocol to measure TP.

0099

Comparative Evaluation of Marginal Adaptation of CAD/CAM and Press-ceramic Veneers

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Objectives One of the methods to evaluate the clinical success of cemented restorations is measuring marginal adaptation. There is a correlation between the fitting of a fixed prosthesis to problems as plaque accumulation due to an undetectable passage of bacteria between tooth structure and cemented veneer, secondary caries, postoperative sensitivity, pulpal inflammation. The aim of the current *in vitro* study is to evaluate and compare the marginal adaptation of veneers produced via CAD/CAM technology and press- ceramic technique.

Methods Preparation for veneers on 32 freshly extracted natural upper incisors is performed and they are randomly divided into two groups (n=16) according to the veneer production technique- CAD/CAM zirconium veneers and press-ceramic veneers. The specimens are vertically sectioned in sagittal direction. The cut sections are examined under a SEM. Marginal accuracy is measured as the distance between the finish line of the underlying tooth surface and the margin of the ceramic veneer at eight fixed locations- 3 on the proximal surface, 3 on the internal surface, 1 on the cervical area and 1 on the incisal area. Statistical analysis is performed via IBM SPSS Statistics v.25.

Results Mean values for 1st group are: proximal distance79,88mm±3,71mm; internal distance 79,14mm±15,70mm; cervical distance 82,39mm±28,55mm; incisal distance 86,85mm±21,72mm.Mean values for2nd group are: proximal distance 100,31mm±2,16mm; internal distance 101,01mm±12,51mm; cervical distance 91,55mm±3,31mm;incisal distance 93,76mm±2,54mm. There is a statistically significant difference for mean values of the proximal distance between 1st and 2nd groups (t=4,76 p= 0,000). There is no statistically significant difference between cervical and incisal distance when the two groups are compared.

Conclusions Both techniques for producing veneers are proven to give satisfactory marginal adaptation. CAD/CAM veneers are more accurate in proximal areas than the press- ceramic veneers.

0100

Electrochemical Behavior of Welded Stainless Steel Dental Wires

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Objectives The goal of the study was to compare nickel-free stainless steel (SS) wires with traditional SS wires with regard to their weldability and electrochemical behavior.

Methods For the experimental analyses metallic Ni-containing wires (Cr 16.0-19.0, Ni 6.0-9.5, Mn ≤ 2.0, Si ≤ 2.0, Mo ≤ 0.8, C 0.05-0.15, P ≤ 0.045, S ≤ 0.015, rest Fe) and Ni-free wires (Cr 16.0-20.0, Mn 16.0-20.0, Mo 1.8-2.5, Si ≤ 1.0, N 0.7-1.0, Ni ≤ 0.2, V ≤ 0.2, C ≤ 0.1, P ≤ 0.05, S ≤ 0.05, rest Fe) were used. They were welded using an Nd:YAG laser with the wavelength of 1064 nm, power 2.5 W, time 1 ms, frequency 15 Hz, laser spot 1.1, respective 1.3 mm, and a spot superposition of 50%. The morphology and the topography of the samples were investigated by scanning electron microscopy and atomic force microscope. The electrochemical measurements were obtained and the values for corrosion potential, corrosion current, and corrosion rate were calculated. The electrolyte was artificial saliva with pH=2.5, 3.5, 4.5, 5.5, 6.5. For each sample, the open-circuit potential vs. time was recorded over 30 minutes and potentiodynamic polarization curves were obtained.

Results Both Ni-free and Ni-containing SS wires are significant positive influenced by laser welding, relative to the corrosion behavior ($p<0.05$). Ni-free wires have better corrosion resistance, compared to Ni-containing wires, but the differences are not

significant (p>0.05). pH values had minimal and no significant effect on the corrosion behavior of all samples (p>0.05).
Conclusions Laser welding of SS wires should be acceptable for clinical use, successful joining result due to their good weldability, but in order to obtain maximum precision and high quality weldings, it is necessary to use modern analysis concepts for each particular case.

0101

Quality of Norwegian and Overseas Made Single Dental Crowns

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Objectives To investigate functional and aesthetical properties for single Fixed Partial Denture (FPD) made for Norwegian dentists
Methods Tooth 16 of a patient given his informed consent, was prepared for single FPD, porcelain fused to metal crown. The dentist made a polyether impression of the prepared tooth comprising the upper jaw, wax bite registration, and antagonist impression with same material. These were used to make epoxy models for production of identical polyether impressions, that were distributed to dental clinics (n=23) all over Norway. The dentist distributed the impressions and bite registration to their usual dental laboratories. The laboratories were not informed that the crown would be used for research purposes.
Dentists forwarded new crowns to NIOM on return from laboratory (n=54;Norwegian n=34,imported n=12,unknown n=8), including information for examination and registration of production country and evaluation of functional and aesthetic properties (presented in table).
Results Norwegian produced crowns (NC) reached 50% over-all acceptance, imported crowns (IC) 58%, and crowns of unknown origin (UO) 75%. Main reason for no acceptance (NC) was poor marginal adaption 56%, and tilting/rotation 59%.
Table below presents all other results for acceptance:
Conclusions Overall acceptance rate of single crowns was low, mainly due to marginal adaption misfit. Esthetic properties were good.

0102

Laser Melting Alloys vs. Casting Alloys: Tensile Strength Study

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Objectives The aim of this study is to analyse cobalt-chromium alloys made by laser melting on mechanical characterization. Then, compare them with traditional casting alloys to show if the forming technique has an influence on mechanical properties.
Methods The test samples were manufactured according to the ISO 22674 standard. The CoCr SLM are provided by three different dental laboratories (Bongert, CPLD-MP, OD3D Bordeaux). Two different casting CoCr alloys were tested. Mechanical tensile tests were performed on samples at room temperature in the I2M Bordeaux laboratory. The values were compared to the ISO 22674:2016 standard (Dentistry – Metallic materials for fixed and removable restorations and appliances). Metallographic analysis (optical microscopy and scanning electron microscopy) of fracture facies was then performed. Statistical analyses were performed using XLStat (Addinsoft). A one way analysis of variance (ANOVA) was used for the comparison of continuous variables in conjunction with Tukey's method for multiple comparisons.
Results For SLM alloys, ultimate tensile strength was 1258.7+/-237.0 MPa while it was 754.5+/-38.9 MPa for casting alloys. SLM CoCr samples have an elastic limit and a tensile strength significantly greater than the casting alloys. The metallographic characterization showed a dense and homogeneous microstructure. The mode of crystallographic rupture were transgranular in SLM CoCr samples.
Conclusions The mechanical characterization of SLM CoCr samples correspond to the Type 5 criteria that meets the most exigent values of the ISO 22674 standard.

0103

Different Metal Substrate Techniques in Dental Metal-Ceramic Bonding

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Objectives The objectives of the investigation was to study the metal-ceramic bond strength between dental porcelain and Co-Cr metal substrates, fabricated by different techniques.
Methods Forty Co-Cr substrates were fabricated according to ISO 9693-1 by Casting, Milling, Soft Milling and Direct Metal Laser Sintering techniques, equally. Extra substrates, were fabricated from each technique to record the modulus of elasticity of alloys. Commercial porcelain was placed on the substrates and specimens were tested for E and bond strength according to ISO 9693-1. The fractured specimens were observed in optical and Scanning Electron Microscopy using Electron Dispersive Spectroscopy to define the mode of failure. X-ray Diffraction Spectroscopy was conducted to display changes in crystalline phases after fabrication and after three point bending test. One-way ANOVA and Tukey's post-hoc test were used with $P < .05$.
Results Modulus of elasticity E was approximately 220 GPa. The metal-ceramic bond strength were Casting=44.8±7.9,

Milling=48.4±4.5, Soft Milling=44.1±9.4, Direct Metal Laser Sintering=44.5±8.7 respectively, exhibited no statistically significant differences (P=.0038). Mode of failure in all groups was cohesive. The metallographic analysis of as received substrates and After Porcelain Firing – After three Point Bending Test specimens revealed changes in microstructure. E and metal-ceramic bond strength present no statistically significant difference. Mode of failure was cohesive. The crystallographic microstructure revealed that the as received Casting, Milling and Direct Metal Laser Sintering patterns were mainly of Cr based centered cubic phase and the After Porcelain Firing – After three Point Bending Test patterns were mainly Co-Cr face centered cubic phase. The as received Soft Milling patterns were mainly Cr based centered cubic but the After Porcelain Firing – After three Point Bending Test patterns presented higher Co hexagonal closed packed phase.
Conclusions In recent years with the advanceδ technology, new techniques developed to build substrates.The CAD/CAM techniques of metal substrate construction simplifies the laboratory stages, faster manufacturing and lower costs.

0105

Organizational Research of the Dental Teaching Clinic (CODA) of La Frontera University: CODA's Internal Management Analysis Related to Typical Processes from Smart Organizations.

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Objectives The investigation's main objective was to analyze the internal management processes from the Clinica Odontologica Docente Asistencial (CODA) of the Universidad of la Frontera, related to the typical aspects of the processes that are considered part of a smart organization.
Methods The investigation was qualitative non-experimental type, which deepness level was descriptive. The members of the investigation were: 1 administrative coordinator, 3 undergraduate and postgraduate academics and 9 undergraduate students. The information gathering techniques were: 2 semi-structured interviews (coordination and academics) and three groups of students. For the interview guidelines, an operational table of variables was elaborated, and content analysis technique was used.
Results The main results were 1. CODA is not a case of smart organization, because the main aspects such as communication and power relations are way below what's typical from a smart organization. 2. There's no organizational culture which comprises certain aspects like teamwork, identity, link, shared mission and vision, however, it's reflective capacity is remarkable, which can lead to internal changes.
Conclusions In conclusion: a) The investigation developed, using the "smart" concept, a way to continue researching the internal management processes from CODA-UFRO, at a deeper level. b) There is interest from the organization in developing new studies, with the aim of creating new action strategies, so that, the CODA could provide a successful and quality customer service.

0106

The Effect of Stress Factors on Dental Students in Preclinical Programs

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Objectives The aim of this study was to evaluate the stress sources of preclinical dental students in the Istanbul University,Faculty of Dentistry.
Methods Modified Dental Environment Stress (DES) questionnaire consist of 31 items describing stressors spesifically related to preclinical dental training. administered to the 2nd class students in dental faculty (n:53).
The response to each items is rated on a four- point scale (1:not stressful, 2:slightly stressful,3:moderately stressful,4:very stressful).Frequency distribution of the results was evaluated.
Results The study demonstrated that the source of stress may vary depends on the discipline in preclinic laboratories.While "difficulty in practice that requires manual skills" and "difficulty of assignements" were found very stressful rated as 80% and 94% respectively in Fixed **Prosthodontics** Department,it was found stressful rated as 88% and 70% in Restorative Dentistry Department."The effect of the environment created by the preclinical team"was found not stressful rated as 64 % in Pedodontics and Endodontics Departments and 54% in Restorative Dentistry Department.While "The amount of work and assignement during the year" was found stressful rated as 36% in Endodontics Departments,it was not stressful (76%) in Pedodontics Department.
Conclusions Dental instructors should take into account stress factors when preparing a program for students and educational curriculum must be regularly evaluated and updated to be beneficial for the dental student who is expected to start serving the public in the near future.

0107

The Role of Educational Atmosphere on Self-perceived-efficacy Among Dental Students

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Objectives The aim of the present study was to assess educational atmosphere according to background determinants and educational information, in clinical dental students, Tehran University of Medical Sciences (TUMS).
Methods Present study was a descriptive study, in 2018. The sample size covered all clinical dental students in the third year or higher. A questionnaire was used for data gathering from the students which include demographic questions such as: gender, marital status, place of residence, parental education, self-reported economic status; in addition to educational information (year of study, acceptance quotas, total average grade and the last semester grade, working experience out of dental school, self-perceived efficacy). SPSS software (version 20) served for data analysis. In statistical analysis T-test and ANOVA were used to investigate the relationships between educational atmosphere, and background determinants and educational information.
Results About half of the dental students were female (52.6%), the majority (87.4%) were single and 50% were residents in dormitories. Half (53.2%) of the students had a moderate self-perceived efficacy and 42.1% had a good one.
Mean score (SD) for total educational atmosphere was 158.1 (±15.5), and that for students' Perception of Learning was 57.9 (SD=6.2), and 35.5 (±4.4) for students' Perception of Teaching domain, 26.1 (±3.9) for students' Academic Self-Perception, 38.7 (±5.2) for students' Perception of Atmosphere, and was 22.8 (±2.9) for students' Social Self-Perception domain.
Out of all background determinants and educational information, self-perceived efficacy had significant relationships with students' Academic Self-Perception (p-value=0.006), students' Perception of Atmosphere (p-value=0.013), and students' Social Self-Perception (p-value=0.017) domains.
Conclusions An improved educational atmosphere may conclude to a better self-perceived efficacy in dental students.

0108

Rubric for Evaluation of Endodontic Treatments Performed by Dental Students

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Objectives To evaluate the use of an analytic rubric for the evaluation of root canal treatments performed in extracted molars by undergraduate students.
Methods Fourth-year dental students of Rey Juan Carlos University (Spain) built 372 portfolios of root canal treatments performed in extracted molars during their preclinical practices. The systems used were manual preparation with K-files (Dentsply Maillefer) or rotary preparation with RECIPROC® blue (VDW) or PROTAPER NEXT® (Dentsply Maillefer) files. A random sample of 42 portfolios were blindly evaluated by four evaluators using an analytic rubric according to the following parameters: 1. Radiographic assessment (0-1); 2. Access preparation (0-2.5); 3. Instrumentation (0-2.5); 4. Obturation (0-2.5); 5. Content of the portfolio (0-1), and 6. Presentation of the portfolio (0-0.5). The maximum global score was 10 points for each portfolio. Intraclass correlation coefficients (ICC) were used to test the reliability amongst the four evaluators in each parameter of the rubric as well as in the global scores of the portfolios ($p<0.05$).
Results The ICC for presentation and content of the portfolio was poor (<0.40). Contrarily, the reliability amongst the evaluators was good for radiographic assessment, access preparation, instrumentation and obturation (ICC between 0.60 and 0.74). The overall portfolio scores for each evaluator were: A: 5.5±2, B: 5.2±1.8, C:5.3±1.6, D:4.8±1.6, with an ICC of 0.69.
Conclusions The use of an analytic rubric allows different evaluators to reach consistent global scores when grading endodontic treatments performed by dental students. However, parameters such as presentation and content of the portfolio elude a consistent evaluation, even with the adoption of a rubric. Furthermore, according to the low scores obtained, the use of an analytic rubric negatively affects students` global score.

0109

Assessment of Learning Styles among Dental Students

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Objectives The aim was to assess the learning styles in second-year students of the School of Dental Medicine in regard to gender and average grade.
Methods Cross-sectional study evaluated learning styles among 132 students using the Index of Learning Style Questionnaire. The index had four domains and each represented a combination of two learning styles (active/reflective, sensing/intuitive, visual/verbal and sequential/global).
Results In the active/reflexive domain, 80.3% of students used both types of learning, while 10.6% and 9.1% only used active and reflexive style, respectively. In all subdomains, the number of female participants was three times higher. The highest average grade was achieved with the active style. 25% of students opted for the intuitive style versus 2.3% who preferred sensing learning, while the lowest average grade was reported in 72.7% of students who used mixed sensing/intuitive learning. Both sexes have equally partaken in visual learning while female students advanced in verbal learning. Students with verbal

learning preference had the lowest average grade (8.1) versus students that used the visual style (8.62). In the sequential/ global domain, female students had a higher proclivity towards the global style (80%). At the same time, there was no difference in the number of men and women that used sequential style. Students who preferred the global style had the highest average grade (8.90) in this domain.
Conclusions The results show that female students have more preferences to one of the learning styles while male students use a combination of styles in each domain. The trend of higher grades was recorded among students who actively participate in teaching, those who use visual memory and essential knowledge, as well as those who are inclined to global learning style. All learning styles should be incorporated in teaching in order to effectively convey the information.

0110

Attitudes of Undergraduate Dental Students towards Patients with Disabilities

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Objectives Small number of dentists available to treat people with special needs is one of the reasons for poor oral health of these patients. Active and early training for undergraduate students in special care dentistry (SCD) enables increasing knowledge and confidence after graduation.
The aim of the study was to determine attitudes, confidence, and past experiences of undergraduate dental students towards people with disabilities.
Methods Eighty fifth-year dental students filled in the questionnaire of the International Association of Disability and Oral Health. The questionnaire was translated to Serbian and culturally adapted. Students were also offerd clinical scenaria and asked to make a treatment plan for special needs patients. The survey included both students who attended and did not attend the undergraduate training in SCD.
Results Although 82.5% of participants did not have any opportunity to provide dental care for persons with disabilities, almost everyone (98.8%) considered that their ethical and professional obligation is to treat patients with special needs. More students who had the training in SCD (72%) considered that they would be able to adequately take patient history, compared to students who did not have training (50%). Students who had the SCD training more easily made a decision to treat the patient from the scenery compared to colleagues who did not have the training (86% vs 63%).
Conclusions In order to improve students' confidence and achieve better knowledge and experience in SCD, it is necessary to improve the educational process and offer more clinical opportunities in which students can communicate with patients, develop empathy and remove obstacles such as fear, prejudice or insufficient knowledge.

0111

Effect of Black Cumin Seed Oil on Methionine Gamma-lyase from *Fusobacterium Nucleatum*

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Objectives Methionine gamma-lyase in which oral bacteria catalyzes methionine to produce methyl mercaptan (CH_3SH) that is a principal contributor to oral malodor. We have reported that the essential oil extracted from Black cumin (*Nigella sativa* L.) seed (BC oil) has deodorizing effects on CH_3SH at IADR 2016. In this study, we examined the effect of BC oil on the methionine gamma-lyase inhibition to clarify the mechanism of deodorizing effects on CH_3SH comparing BC oil ingredients (thymoquinone, thymol) and antibacterial agents (4-isopropyl-3-methylphenol, cetylpyridinium chloride).
Methods The recombinant methionine gamma-lyase was purified from *Escherichia coli* that was transformed with FN1419 gene that encodes methionine gamma-lyase in *Fusobacterium nucleatum* ATCC25586. The recombinant protein was incubated with or without BC oil in the presence of 10 mM methionine and 0.01 mM pyridoxal 5'-phosphate for 30 min at 37 degrees Celsius. The enzymatic activity was determined by measurement of keto acid production from the methionine using the 2,4-dinitrophenylhydrazine method.
Results
The methionine gamma-lyase activity was strongly inhibited by 0.001% BC oil as same level as 1 mM thymoquinone or 1 mM cetylpyridinium chloride. On the other hand, thymol and 4-isopropyl-3-methylphenol couldn't inhibit methionine gamma-lyase at the same concentration.
Conclusions BC oil and it's ingredient thymoquinone may be a useful material for prevention of oral malodor by inhibiting methionine gamma-lyase.

0112

Essential Oil Mouthwash Used on Oral Hygiene of Patient with Special Needs

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Objectives Periodontal diseases represent de most frequent conditions of the human body, affecting it irrespective of sex, age or geographical area. The term halitosis comes from Latine “halitusosis” meaning the pathologically modified air breath out.The aim of this study is to evaluate the effect of essential oil mouthwash on halitosis and periodontal status of patient with special needs.

Methods 26 patients aged between 16-45 were enrolled in this single-blind, parallel-group study. Informed consent was obtained. The following parameters were recorded: gingival index, plaque index, organoleptic breath assessment, and BANA test from tongue coating samples prior to treatment with essential oil mouthwash (group 1) or a placebo (group 2) at baseline and 28 days after the start of treatment**.**

Results The initial results showed significant changes after treatment, with a dramatic difference in the test group regarding the plaque index, bleeding on probing, gingival index, BANA test results and organoleptic examinations values. BANA test evidenced three anaerobe bacteriae acting on the periodontium and bad breath. In the control group the results of the test decreased by 3.68% while in the test group the decrease was more significant of 33.09%. There were significant differences ($p<0.05$) in plaque and gingival index after treatment with essential oil mouthwash compared to the placebo.

Conclusions The results provide a statistically significantly greater level of efficacy in controlling established plaque and gingival index after use of essential oil mouthwash. Therefore, it can be recommended in halitosis therapy in order to maintain a good periodontal status.

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0113

The Effect of Chlorine Dioxide on the Oral Hygiene – A Systematic Review

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Objectives There is a need for new effective and selective oral rinses. Our aim was to evaluate the efficacy of chlorine dioxide-containing mouthwashes in comparison with other mouth rinses in healthy adults using index values for oral hygiene.

Methods This systematic review was performed according to the PRISMA guideline. The database search was conducted from Cochrane Central register of Controlled Trials, Clinical Trials.gov, Ebsco, EMBASE, Pubmed, Scopus and Web of Science. We searched for “chlorine dioxide” AND “oral”, Randomised Control Trials (RCTs) were included, written English. The primary outcome was the alteration of plaque index (PI), the secondary outcome was the gingival index (GI). Bacterial counts were also investigated. The effectiveness of chlorine dioxide was compared to other previously established treatments such as chlorhexidine and herbal extracts. For the Risk of Bias assessment the Cochrane Collaboration Tools was used. Statistical analysis for data heterogeneity was performed by Q-value and I^2-tests.

Results 364 articles were found in the databases. After the selection process, only four RCTs could be included in the analysis, which did not permit to perform meta-analysis, but only a systematic review. The heterogeneity of data was low (Q-value: 0.232; p value: 0.629; I^2: 0). There were no statistical differences between the chlorine dioxide treatment and the other effective mouth rinses in PI (0.723±0.132 vs. 0.670±0.129; 95%; confidence intervals (CIs): 0.464-0.981 vs. 0.417-0.923, respectively) and in GI (0.779±0.150 vs. 0.685±0.124; 95% CIs: 0.484-1.074 vs. 0.443-0.928, respectively). Similarly, there was no difference between groups in the bacterial counts.

Conclusions The use of chlorine dioxide reduces the plaque index and gingival index as well as the bacterial count in the oral cavity similar to other effective oral rinses. But the evidence is week due to the low number of RCTs. Therefore, further investigations are needed in the field. Supported by EFOP-3.6.2.-16-2017-0006 and GINOP 2.3.2-15-2016-00048.

0114

Periodontopathogen Suppression with a Low-Concentration Chlorhexidine Mouthwash

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Objectives Chlorhexidine (CHX) is used in mouthwashes as an antimicrobial adjuvant therapy for periodontitis, given its bactericidal effects on oral pathogens present in the gingival sulcus and saliva. The use of mouthwash containing low-concentration, highly bioavailable CHX is indicated for plaque control during periodontal maintenance. The effects of these mouthwashes on the subgingival microbiota are, however, unknown. Therefore, the aim of this pilot study was to evaluate the effect of a 4-day treatment with a non-commercial 0.03% CHX and 0.05% CPC (cetylpyridinium chloride) mouthwash on the

subgingival microbiota of periodontally-healthy subjects in the absence of mechanical oral hygiene.
Methods Six individuals carried out a 4-day treatment, during which they refrained from any oral hygiene but rinsed every 12 h with the mouthwash. Baseline and post-treatment samples were collected from four Ramfjord teeth using sterile paper points. Sequencing was conducted in a MiSeq, and microbiome was characterised using a metagenomics 16S analysis. Richness was measured by the number of OTUs, alpha-diversity was calculated using the Shannon's and the Simpson's indexes and evenness by H/H_{max}. OTUs differing in relative abundance were identified with LEfSe.
Results Richness was significantly higher at baseline when taxonomic categories phylum, class, order and species were compared. The Shannon's and Simpson's indexes showed significantly lower diversity after the treatment in the taxonomic ranks order, family and genus. The same result was observed for evenness.
Baseline and post-treatment were compared in terms of relative abundance per clade, and the following was found: *Actinomycetaceae, Corynebacteriaceae, Porphyromonadaceae, Tannerellaceae, Spirochaetaceae, Comamonadaceae* and *Lachnospiraceae* were more abundant at baseline and *Flavobacteriaceae* showed increased relative abundance post-treatment.
Conclusions The use of a low-concentration chlorhexidine mouthwash, excluding any mechanical hygiene method, prevented the increased relative abundance of most periodontopathogens, including the families *Tannerellaceae, Porphyromonadaceae* and *Spirochaetaceae*, which contain species of the red complex.

0115

Changes in OHRQoL One Week After Treatment of Hypersensitive MIH-molars

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Objectives To investigate the changes in oral health-related quality of life (OHRQoL) before, and after treatment of hypersensitive molars affected by molar incisor hypomineralisation (MIH).
Methods 13 children with at least two MIH affected molars showing hypersensitivity and non-occlusal breakdowns were included. Hypersensitivity was assessed with an evaporative (air) stimulus. Affected teeth were sealed by one calibrated operator using a split-mouth design: Clinpro Sealant in combination with Scotchbond Universal, and Ketac Universal (3 M), respectively. OHRQoL was measured using the German version of the CPQ8-10 at baseline, and after one week.
Results Mean values (± SD) for the CPQ sum as well as the four subdomains before and one week after treatment are shown in Table 1. After treatment a significant decrease ($p < 0.001$, t-test) was observed in the overall CPQ sums and all subdomains except the social well-being domain.
Conclusions In conclusion, sealing of hypersensitive MIH-affected molars revealed a significant improvement of OHRQoL after one week.

0116

How to Reduce Dental Sensitivity?

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Objectives Dentine is an internal part of tooth owing numerous of tubules and usually covered by enamel. Tooth sensitivity is due to dentine exposure and stimuli transmission through tubules. One strategy to ameliorate tooth sensitivity is to block tubules by physical agent. Current questions are about ability to occlude over time and stability upon dietary acid challenge. The aim of the present work is to present an experimental Solvay silica to reduce dental sensitivity through applicative tests.
Methods Experimental silica has been formulated in a toothpaste containing abrasive and thickening silicas and tested by hydraulic conductance tests [1,2], to evaluate the degree of occlusion of human dentine (N=12) by flow reduction measurement. The resistance of treatment is evaluate with acid challenge application.
Results are compared to commercial toothpastes: 2 claiming tubule blocking properties and 2 without any sensitivity claims (N=6 to 12).Statistic evaluation has been performed with one-way ANOVA and post-hoc Tukey test.
Solvay experimental silica and competitor tubule blocking silica (market benchmark) are applied on dentine samples and SEM pictures after treatment (N=4) help understand performances, before and after acid challenge.
Silica physico-chemical properties are characterized to establish silica structure- tubule occlusion properties relationships.

[1] Pashley, 1986
[2] Morawietz M., IADR 2017

Results Hydraulic conductance results indicate that Solvay experimental silica provides a good level of tubules occlusion (80% of flow reduction), significantly higher than all negative controls and one positive control. Particularly a good level of occlusion after acid challenge is highlighted, compared to benchmark. SEM analyses after treatment support these results, confirming different action modes.
Coupled by physico-chemical characterizations, this study lets us conclude that the good performances can be explained by the unique properties of silica synthetized.
Conclusions These results open new possibilities of formulations and silica development meeting current market requests on Oral Care for sensitivity.

0117

Extrinsic Stain Removal and Protection Effect of Toothpaste Containing Sodium-Tripolyphosphate

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Objectives To evaluate the extrinsic stain removal and protection efficacy of toothpaste containing sodium-tripolyphosphate(STPP)

Methods Sixty human-tooth-enamel-specimens embedded in polymethyl-methacrylate blocks were prepared and randomly assigned to four groups (SR1, SR2, SP1 and SP2; n=15), regarding to tested protocols; stain removal(SR) and stain protection(SP) and toothpastes used in this study as control(1) and STPP-contained(2) toothpaste. The lightness values(△L) of all specimens were measured using the colorimeter (NR110, Shenzhen 3nh) at baseline, standard stain and at 7, 14 and 21 days of tooth brushing. After baseline △L measurement, all specimens were immersed in black-tea-solution(1g/L) for 7 days in-order-to create the standard stain. Then each group was scheduled brushing protocol using an electrical toothbrush with saturated-toothpaste-solution for 10s, twice-a-day. To evaluate the stain removal effectiveness, all specimens of group SR1&SR2, were stored in 37°C deionized water during experimental period. In contrast, all specimens of group SP1&SP2 were immersed in black-tea-solution(30min) after each time of tooth brushing, then stored in deionized water. The mean lightness and percentage of change in lightness between each period were analyzed using one-way ANOVA and independent paired t test ($p<0.05$).

Results For the stain removal protocol, using either the control or STPP-contained toothpaste at least 14days exhibited significantly higher△L compared to those of standard stain. Moreover, the △L after 21days tooth brushing shown no significant difference to those at baseline. On-the-other-hand , for the stain protection protocol, SP1&SP2 revealed a significantly decreased of △L compared to those of standard stained time-after-time. However, brushing with STPP contained-toothpaste exhibited the significantly lower percentage of change in lightness compared to those of control toothpaste in all periods of routinely brushing.

Conclusions STPP contained-toothpaste shown higher efficacy to protect the stain attachment significantly. However, the control and STPP contained-toothpaste had comparable efficacy to remove the extrinsic stain.

0117.1

Introducing Innovative Preventive-Based Dentistry Software in a Governmental Health System

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Objectives One of applicable ways to prevent diseases and save resources in state-supported public health systems is to accurately record patient health information and track their health over the time. The aim of this study was to develop a comprehensive software in the field of dentistry focusing mainly on prevention of oral and dental diseases.

Methods First, a paper file was designed to record the oral health status of patients using WHO indices. It was completed handwritten during two years for each volunteer patient referring to Tehran Specialized Oil Company Polyclinics and the data were entered to EXCEL software and analyzed by SPSS software. Then the unnecessary fields were removed and the data was transferred from EXCEL to ACCESS software to be structured and used as information. Finally, the software design team developed a web-based preventive dental software program in 2017 and applied it as pilot for one year in one of 13 clinics of National Iranian Oil Company in Tehran.

Results In the newest version of software, individual and therapeutic and prophylactic data of all teeth of each individual is recorded and standardized with the possibility to retrieve information and track oral health status individually and report in desired time intervals and generally based on age groups. Among the features of this software; it is possible to send SMS messages within a period of 6 months as recall, to provide a report on the occurrence or stopping of dental caries in population during the specified time period, and to report dental and gingival indices changes, etc.

Conclusions The development of this preventive software enables information management and patient tracking at desired time periods, and provides useful reports for informing patients about their oral health status and increases managers' awareness of the condition of health service delivery and relating results.

0118

Solvents and Cyclic Fatigue Resistance of Instruments in S-shaped Canals

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Objectives To evaluate the influence of an association of solvents on the resistance to cyclic fatigue fracture of WaveOne Gold, Hyflex EDM and Hyflex CM, in dynamic immersion, comparing to sodium hypochlorite (NaOCl), ethylenediaminetetraacetic acid (EDTA) and no immersion, in an artificial stainless root canal with a double (S-shaped) curvature. There was also the purpose to compare the resistance to cyclic fatigue of the different file systems.

Methods A total of 96 unused WaveOne Gold primary (25.07), HyFlex EDM (25/~) and HyFlex CM (25.04) were tested in an artificial stainless root canal with a double (S-shaped) curvature (first curve of 60° curvature and 5-mm radius and the second one of 60° curvature and 2-mm radius). The files of each brand were randomly assigned to four groups (n=8) and submitted to the following immersion protocols: no immersion (control), 3% NaOCl, 17% EDTA and solvent association (Methyl ethyl ketone + Tetrachloroethylene), being rotated until fracture. Resistance to cyclic fatigue was determined by recording time to fracture, in seconds. Statistical analysis was performed by a one-way ANOVA using a decision rule for $p<0.05$.

Results Resistance to cyclic fatigue was not significantly affected by immersion in the solvent association or different irrigating solutions (NaOCl; EDTA) ($p=0.858$). Hyflex CM had the highest cyclic fatigue resistance followed by Hyflex EDM and WaveOne Gold ($p<0.05$).

Conclusions Within the limitations of the present study, in S-shaped artificial canals, the solvent association (Methyl ethyl ketone + Tetrachloroethylene) do not influence the cyclic fatigue resistance of WaveOne Gold and Hyflex EDM or CM files. Hyflex CM file showed the highest cyclic fatigue resistance.

0119

Technical Quality of Root Fillings Varies by Tooth Type

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Objectives To study the impact of tooth type on technical quality of root fillings performed by general dental practitioners (GDPs) in a large public oral healthcare unit.

Methods The target population included all patients undergoing root filling by GDPs in Oral Healthcare of the City of Helsinki in 2010–2011. The inclusion criteria were: root filled permanent tooth, diagnosable pre- and postoperative periapical radiographs (all digital). Equal amounts (n=71) of each tooth type (anteriors, premolars, molars) by jaw were included, resulting in 426 teeth in 426 patients. A qualified endodontist assessed the root fillings. Root-filling length was recorded as short (>2mm from apex), flush (0–2mm from apex) or overfilled (excluding overextension of sealer); density was recorded adequate for homogenous root fillings with no empty root canal space visible. The technical quality of the root filling was considered adequate when root-filling length was flush and root-filling density adequate, otherwise the technical quality was considered inadequate. Patients' details included age and gender. Statistical evaluation of differences between groups utilized Chi-squared tests.

Results Patients' mean age was 44.2 years (SD 23.2; median 44; range 9–93). Of patients, 56% were female and 44% were male. In total, 57% of root fillings were adequate. The quality of root fillings varied by tooth type: adequate fillings were found in 71%, 57% and 43% ($p<0.001$) of anteriors, premolars and molars, respectively. Adequate root fillings were most frequent in mandibular anteriors (73%) and least frequent in maxillary molars (35%). There was no statistically significant difference in root-filling quality by jaw ($p=0.625$), age ($p=0.494$) or gender ($p=0.264$).

Conclusions The quality of root fillings varied considerably according to tooth type. Inadequate root fillings occurred most often in molars. Special focus should be targeted to improve the quality of root fillings performed in molars by general dental practitioners.

0120

Assessment of Extruded Endodontic-Sealer Dissolution Using *In-vitro* Model: 18-months results.

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Objectives To examine the dissolution of endodontic sealers over 18 months using 3D surface scanning and subtraction radiography (SR) in a novel *in-vitro* sealer extrusion simulation model.

Methods Fifty acrylic teeth were endodontically treated using standardized protocol involving intentional sealer extrusion. Following endodontic instrumentation, these teeth were randomly allocated to five sealer groups (n=10): Apexit Plus (APP), AH Plus (AHP), BioRoot RCS (BRCS), TubliSeal EWT (TS), and Gutta Percha (GP) (control). The root-filled teeth were immersed for 18-months in polyurethane-foam with artificially prepared cavities, mimicking the space around the root apex in a periapical lesion, and were kept under the flow of a physiologic solution with constant pH and temperature. Blinded 3D surface scans (Q800, 3Shape; resolution: ~10µm) and digital radiographs (Planmeca Romexis, Plandent) of the teeth were obtained at baseline, 1-week, and 1, 3, and 18-months. Blinded assessment of sealer dissolution was done by superimposition of the 3D-scans using the Convince-Analyse software (3Shape) and using SR (UTHSCSA Image Tool software). Root mean square (RMS) change from baseline and colour mapping of dimensional changes were noted for 3D-scans. Mixed linear regression models for repeated measures with Bonferroni adjustment for multiple comparisons were used to assess differences in dissolution among the sealer

groups (α=0.05).
Results Over 18-months, both 3D-scans and SR noted dissolution in APP and TS. APP showed significantly higher dissolution than TS (p<0.001). 3D-scans showed dimensional gain for AHP and BRCS; BRCS demonstrated significantly greater gain than AHP (p=0.008). Compared to the control (GP), 3D-scans showed significantly greater RMS change for TS, AP and BRCS (p≤0.006) but not for AHP (p>0.07). SR showed no significant difference between the control (GP) and TS, BRCS and AHP.
Conclusions Both 3D-scans and SR noted significant dissolution of APP, while the highest dimensional gain in BRCS was noted on the 3D-scans over 18-months.

0121

Evaluation of Effectiveness and Safety of Different Gutta-Percha Removal Techniques

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Objectives The aim of this study was to evaluate effectiveness, apical extrusion and time required of different instrumentation techniques during endodontic retreatment.
Methods The root canals of 72 extracted single-rooted straight premolars were instrumented with ProTaper Next® rotary instruments, before filling with laterally condensed gutta-percha and AH Plus® sealer. The samples were stored for three weeks in an incubator with saline at 37°C, and afterwards randomly divided into 3 groups (n=24) with regards to the retreatment techniques used: Hedström files with xylene, ProTaper Universal Retreatment System (PTUS) and D-RaCe. Apically extruded debris was collected during retreatment in pre-weighed Eppendorf tubes and evaluated using an electronic microbalance. Following retreatment the roots were split longitudinally and coronal, middle and apical thirds of the root canal were evaluated for remaining debris and filling material using scanning electron microscopy and a predefined scale. Time required for reaching the working length and complete filling removal was analyzed too. Statistical analyses were performed using ANOVA with Scheffe's post-hoc test and the Kruskal-Wallis test.
Results Comparing amount of extruded debris ANOVA test showed significant difference (p<0.0001). Both D-RaCe (0.0036±0.0018g) and PTUS (0.0039±0.0014g) produced significantly less extruded debris compared to Hedström files (0.0069±0.0016g) according to Scheffe's post hoc test, while between rotary instruments no significant difference was found. D-RaCe instruments were significantly more efficient in removing debris and filling material comparing to Hedström files only in coronal third of the root (P=0.0390). Differences in time required for retreatment was statistically insignificant between instrument techniques.
Conclusions Remaining debris and filling material was present in every investigated group. Although apical third was the part with more residual material, the significant difference was present only between Hedström and D-RaCe files in coronal third. Less debris was extruded apically when rotary instruments were used.

0122

Microguided Endodontics: A Conservative Approach for Fiber-post Removal.

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Objectives Guided endodontics is a new approach for challenging endodontic treatment like obliterated canals or complex apical surgery. In this work, we tested the technique for fiber-post removal procedure to assess if artifact-induced images complicate the procedure.
Methods
In the first part of the study we mounted eight molar replicas (Truetooth™Replica 18-003P) with fiber-post in the distal root and composite restoration on polystyrene model which reproduced natural arcade. At this stage, we evaluated the efficiency of each tool: merging process, the 0.75mm diameter drills and the sleeve. For the second part of the study, we mounted natural posterior teeth on ten simulated upper and lower jaw models. forty fiber-post and composite restorations were inserted on premolars and molars (4 per models). For both series, a pre-operative cone-beam computed tomography (CBCT) and optical scan planification were merged. Drilling planification was made on Blueskyplan software to produce template. Those templates were 3D-printed using V-Print SG, VOCO™. Fiber post removal was simulated using the template for guidance. Post-operative CBCT were made and merged on the same software with the planification to measure the deviation in the mesial-distal axis, in the buccal-lingual axis and between the center of the planification and the drill path coronally and apically. A descriptive statistical analysis was performed.
Results For the first part of the study, the mean deviations at the different axis between the planned and the prepared paths were ranged from 0.22±0.06mm at coronal step and 0.48±0.20mm at apical step. Microscopic observation did not show influence of the stiffness of the material on the efficiency of the drill, but the sleeve showed wear after four uses and this correlated with experimental results. First results on second serie show similar deviations.
Conclusions With minimal deviation from planification, microguided endodontics can be an interesting tool to help practitioners on fiber-post removal.

0123

Effect of Activation Protocols on Mineral-content of Root-dentin: Part 1

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Objectives Disinfection of root canal is the most important step of root-canal treatment. Several protocols can be used for this purpose. Dentin is a complex mineralized-tissue and the mineral content of dentin may change as a result of applying one of these protocols. The aim of this in vitro study was to evaluate mineral content of root dentin regionally after several activation protocols.

Methods Roots of 40 single and straight-rooted premolar teeth were embedded in molds filled with polyvinil-siloxane. The crowns were removed and the roots were vertically fractured. The Ca, P, Mg, Ca, and K levels, and the Ca/P ratio was analyzed at one half from each root by using Scanning Electron Microscopy and Energy-Dispersive X-Ray (SEM-EDX). Measurements were done from two points at three regions (coronal, medium and apical). The data was recorded and the roots were repositioned in the molds. Root-canals were prepared up to size F3 using ProTaper rotary-system. Five ml 5, 25% NaOCl followed by 17% EDTA and saline was used during the irrigation. Four groups were created (n=10): 1) Manuel irrigation using with 30G NaviTip needle simulating the clinically widely used protocol (control); 2) manuel dynamic activation with gutta-percha cone; 3)passive ultrasonic activation; 4) Er:YAG laser. Each half was minerally re-evaluated using with SEM-EDX. Sixty measurements were done for each group.The change in the mineral-ratio was recorded and statistically evaluated.

Results The tested protocols did not make a change at coronal ($p>0.05$) while a significant change for C and Na was observed in laser group at middle third ($p<0.05$). Significant change was observed in the elements at apical with the tested protocols ($p<0.05$). Gutta-active, ultrasonic and laser techniques caused more significant changes ($p<0.05$)

Conclusions Different disinfection protocols have an effect on root-dentin elements. This effect depends on the location and the protocol used

0124

Effect of Retreatment/Activation-Procedures on Mineral-content of Root-dentin: Part 2

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Objectives Nonsurgical-retreatment is a widely-accepted treatment choice when root-canal treatment fails. The aim of this in vitro study was to evaluate mineral-content of root-dentin after several retreatment procedures and activation protocols.

Methods Roots of 40 premolar-teeth were first embedded in molds filled with polyvinil-siloxane and then vertically-fractured. The Ca, P, Mg, Ca, and K levels, and the Ca/P ratio was analyzed at one half from each root by SEM-EDX at three levels. The roots were then re-positioned in the molds and root-canals were prepared up to size F3 (ProTaper rotary-system). Five ml 5,25% NaOCl, 17% EDTA and saline was used during the irrigation. Four groups were created: 1) Manuel irrigation using with 30G NaviTip needle (control); 2) manuel dynamic activation with gutta-percha cone; 3) passive ultrasonic activation; 4) Er:YAG laser irradiation. The roots were filled with sealer (AH Plus, Dentsply) using single-cone technique and kept in 100% moist-environment. The fillings were removed after 10 days and canals were prepared up to size F4 file. When no remnant was seen on the instrument, it was thought that removal was completed. Activation protocols were repeated and each half root was minerally re-evaluated with SEM-EDX. The change in the mineral ratio was recorded and statistically analyzed.

Results Manuel irrigation using with 30G NaviTip needle changed Mg, Al, Na ratios at coronal in the re-treated roots ($p<0.05$) while the other protocols changed only Na and Al elements. Control group increased only the Na elements at median while Ca and Na were increased in laser-group at median ($p<0.05$). All the protocols made a significant change at apical when compared to the manuel-irrigation technique ($p<0.05$).

Conclusions Different disinfection protocols change mineral content of root-dentin before and after re-treatment procedures. These changes are more significant at apical with manuel dynamic activation with gutta-percha, passive-ultrasonic activation or laser-irradiation.

0125

Attitudes of Young Thai Dentists Towards Implant Dentistry

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Objectives Although dental implant becomes a standard for replacing the lost natural teeth in high socioeconomic countries for a long time, it has just been widely accepted in Thailand in these few decades. Since this dental substitution modality has a higher cost than the conventional ones and is considered rather new for Thai dentists, their attitudes towards implant dentistry should be clarified. While the young generation plays roles in shaping the future of dentistry, it is interesting to investigate their viewpoints. The objective of this study was to survey attitudes of young Thai dentists towards implant dentistry.

Methods A questionnaire was distributed via an online social platform to Thai dentists graduated during 2003 and 2017. Attitudes towards implant therapy and continuous professional development on implant dentistry were assessed.

Results 318 questionnaires were returned from 1,617 graduates. Although 91% of the respondents agreed that dental implants were superior to conventional prostheses, 49.1% intended to offer implant therapy, and 22% felt confident in providing patients with implant information. Most of them agreed that implant therapy should be provided by formally trained dentists and 46.9% interested in further study about implant dentistry. The most recent graduated respondents had the most positive attitudes and

most interest to practice implant dentistry. While 52% of them considered implants were too expensive for Thai patient, 15% thought that implants were worth the cost, 37% that implants were worth the time, and 32% that implant therapy possessed minimal risk.
Conclusions Most of the young Thai dentists appeared to harbor positive attitudes and be interested to continue their future education and practice in implant dentistry; however, they felt less confident to provide information to their patients. They perceived that implant therapy was too expensive and did not worth the cost and time.

0127

Volumetric and Histologic Changes after Alveolar Ridge Preservation with L-PRF.
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Objectives To evaluate the effect of leucocyte and platelet-rich fibrin (L-PRF) with respect to the volumetric and histological changes of the tissues after its use for alveolar preservation.
Methods Twelve patients in need of tooth extraction and single implant in the anterior area were included. After extraction, patients were randomized into two groups. Patients in the experimental group received alveolar preservation with (L-PRF) according to the recommendations described by Choukroun et al. in 2001, meanwhile the control group received no treatment (blood clot). Digital impressions were taken immediately after extraction, at seven days, at one month and four months in order to assess the volumetric changes in the profile and contour of the ridge.
Changes in the underlying hard tissues were evaluated by comparing the CBCT performed immediately after the extraction and the one performed at four months. At this time, the implant was placed using a surgical stent as guide for a trephin bur, with which a bone biopsy was taken for analysis by optical microscopy in order to assess trabecular width, amount of mineralized matrix and cell density. Patient related outcomes were registered at each visit. For the statistical analysis, intra and inter-group comparisons were performed with ANOVA test and Bonferroni's corrections. Qualitative variables were analyzed with frequency distributions and chi square. The level of significance was established at $p<0.05$.
Results At 4 months, the horizontal tissue contours decreased concomitantly with an horizontal bone loss without significant differences at 2, 4 and 6mm from the bone crest, on the contrary, the soft tissue thickness increased in both groups. PROMs reported low level of postoperative pain and inflammation in favor of the test group at 7 days. Biopsies showed mature and well-structured mineralized bone in both groups.
Conclusions Despite the limitations of the study it can be considered that the use of (L-PRF) can be an alternative for alveolar preservation therapies in sites udergoing dental extraction in the anterior sector, when the volumetric changes can become a challenge both for the aesthetic point of view and for the stability of the tissues.

0128

Human-Dental-Pulp-Stem-Cells Osteogenic Differentiation Seeded on Equine-Bone-Block with Graphene and Melatonin
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Objectives Equine Bone Blocks showed biocompatibility and osteconductivity. Therefore, loading of scaffolds with osteogenic cells, like human dental pulp stem cells (hDPSCs), has been proposed to develop a biocomplex for bone defect repair, overcoming the limits of the graft materials.
Graphene-based materials have raised a growing interest in many research areas, according to their effects on cell adhesion, proliferation and differentiation. Melatonin is principally synthesized in the pineal gland and it is an important mediator in bone formation.
The aim of this *in vitro* investigation was to evaluate hDPSCs cultured in the presence of Equine Bone Blocks coated with Graphene Oxide (GO/NH_3) and of Melatonin.
Methods hDPSCs were cultured in growth medium (GM) and in differentiation medium (DM) with Blocks coated or not with GO/NH_3 at different concentration (2 and 10 mg/ml) and with or w/o 5% Melatonin. After 7, 14 and 21 days of culture, miRNAs, gene expression (Runx-2, Smad-5), and Osteocalcin levels were evaluated. Histological and vitality tests were also performed.
Results miR-133a and miR-135a were downregulated already at 7 days in GM in the presence of GO/NH_3 at different concentration and of 5% Melatonin and this decrease seems related with the higher expression of Smad5 and RUNX2. At 14 days, the increase of Osteocalcin levels confirmed the onset of differentiation also in GM. Histological evaluation showed increased cells adhesion in G2 and G10 cultures in the presence of Melatonin. This trend is similar to that found in DM (data not shown), confirming an activation of differentiation process also in GM condition.
Conclusions hDPSCs/Equine Bone Block, Graphene and Melatonin seemed to represent a promising useful tool in bone regeneration. The present data seemed to suggest that the Blocks, synergized by the simultaneous presence of Graphene and Melatonin, stimulated the early stages of cell differentiation.

0130

In-vitro Evaluation on Polyurethane Foam of NanoShort Dental Implants.

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Objectives The aim of this study was to investigate on polyurethane foam sheets the Primary Implant Stability of a NanoShort compared to self-condenser Implant and to standard, conventional Implant.
Methods Three implant designs were evaluated in the present *in vitro* investigation: Test Implant (NanoShort), Control A Implant (Self-Condenser) and Control B Implant (Standard design). The study was conducted comparing the Insertion Torque values, the Pull-out strength values, and the RFA values of Test and Control A and B Implants inserted in different thickness and density polyurethane foam models. The foam densities were 10 pounds per cubic foot (pcf), 20 pcf, and 30 pcf. Three thicknesses of polyurethane foams (1 mm, 2 mm, 3 mm) were evaluated for a total of 640 experimental sites.(Fig1-2)
Results The results were similar comparing the 2.5 and 3.5 Test Implants. Test implants had a good stability in 3 mm polyurethane sheets and 20-30 pcf densities. In 2 mm sheets, good stability of the Test implants was obtained only in the 30 pcf density. Control A Implants showed better results, when compared to Test implants, in 1, 2 and 3 mm polyurethane sheets, and in 10, 20, and 30 pcf densities. Control B Implants showed good results in 1 and 2 mm polyurethane sheets.
Conclusions The NanoShort dental implant evaluated in this *in vitro* study showed a high level of stability in some experimental conditions, and could represent a useful tool, especially in the posterior mandible in alternative to vertical augmentation procedures.

0131

The Effect of Canine Implants on Adjacent Teeth or Implants

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Objectives When an implant is placed on the canine site, a canine guidance is often avoided. In other words, the canine implant restorations do not contact with the opposite teeth in lateral excursion, and the adjacent teeth are included in the lateral movement. The purpose of this study is to evaluate the effect of canine implants on adjacent teeth or implants according to prosthetic type.
Methods This study included 60 patients in whom 75 implants were placed on the canine site by one clinician between January 2011 and November 2017. Digital panorama radiographs were taken and bone level changes around the adjacent teeth or implants. Implants were divided into three groups according to prosthetic type: (1) single (SC), (2) splinted with anterior implants (SA) and (3) splinted with posterior implants (SP). The mean bone level change was compared between three groups using the t-test.
Results 17 implants were restored with single crown, 37 implants were splinted with anterior implants, and 22 implants were splinted with posterior implants. The mean bone level change was 0.45mm in SC group, 0.20mm in SA group and 0.39mm SP group. However, the difference was not statistically significant.
Conclusions The results of this study suggested that single canine implants could affect more negatively on the adjacent teeth or implants than splinted canine implants.

0132

Recent of Biomarker Tools - Point of Care Chair Side Oral Fluid Immunotests for aMMP8 to Determine Peri Implant Diseases

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Objectives It is challenging to evaluate oral fluids such as peri-implantitis fluids (PISF). Issues relating to hosts and microbial factors could influence biomarkers expression, release and levels. To attain best results, highly sophisticated methods of analysis are required, with high levels of specificity and sensitivity. We define here a recent chair-side/point of care (PoC) lateral-flow immunotests (ImplantSafe®) for detecting active form of MMP-8 in PISF and quantitated by analyse reader (ORALyzer®). The objective of study was to show the effectiveness of promising biomarker test (ImplantSafe®/ORALyzer®) to differentiate between peri-implantitis and healthy sites.
Methods Peri-implantitis (n = 29), and healthy controls (n = 32) Both X-rays and clinical parameters have diagnosed, such as probing pocket depth (PPD), bleeding on probing (BOP), and plaque index (PI). All have diagnosed aMMP-8 by ImplantSafe® visual test, and quantitated by ORALyzer®. We analyzed quantitatively aMMP-8 by immunofluorometric assay (IFMA) and all forms of MMP-2 and MMP-9 densitometrically by quantitated gelatin zymography.
Results Level of aMMP-8 in peri-implatitis site (n = 29) analyzed by ImplantSafe visually positive (+) and quantitated by (ORALyzer®) >20 ng/ml, (124.60 ± 22.50 ng/ml) differing from health site (n = 32) all having low aMMP-8 visually negative (−) <20 ng/ml, (18.60 ± 3.46 ng/ml). PoC detected in 5 min by ImplantSafe. Likewise, elevated level of aMMP-8 detected by immunofluorometric assay (IFMA) 100% in all peri-implatitis site >20 ng/ml, whereas all healthy site were <20 ng/ml. Any forms or total MMP-9 and -2 did not significantly differentiate peri-implantitis and healthy sites.
Conclusions Based on our results, increased levels of aMMP-8 in PISF was determined to be correlated with clinical and

radiographic parameters. ImplantSafe® is and so the first clinically validated commercially available diagnostic, prognostic, and preventive chair-side/PoC -technologie for peri-implant diseases.

0133

Implant Roughness and Periimplantitis: A Systematic Review of Literature

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Objectives The purpose of this study is to systematically review the evidence to answer our research question: In subjects with dental implants, do the implant surface treatment or surface roughness characteristics lead to periimplantitis?".

Methods We identified applicable literature using 3 databases (MEDLINE, Web of Knowledge, and the Cochrane Library), applying the word combinations to the search: periimplant diseases, dental implant, and implant surface or surface treatment. With these word combinations, we identified 4690 articles. All abstracts to the articles identified in our search were reviewed and articles were either accepted or rejected for this systematic review based on inclusion and exclusion criteria. Statistical analyses (Chi2) were carried out using XLStat (Addinsoft).

Results When applying criteria to abstracts of articles, we identified 22 articles that satisfied this criteria set in the qualitative analysis and quantitative synthesis. Prospective studies were included if they met the following criteria: (1) give a clear definition of periimplantitis and (2) contain outcome data (clinical and radiological data) considering the periimplantitis rate. A systematic review was carried out to evaluate the impact of roughness on the periimplantitis rate. The full-articles of these remaining 22 identified articles were considered in this systematic review. There is a statistically significant difference in the frequency of periimplantitis between the different implant roughnesses ($P = 10^{-6}$) or surface treatments ($P = 10^{-6}$).

Conclusions This systematic review of literature concluded that implant roughness and surface treatment are significant parameters associated with periimplantitis.

0134

Air-Abrasion with Bioactive Glass Eradicates *S. Mutans* Biofilm from Sandblasted and Acid Etched Titanium Surface.

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Objectives To investigate the influence of air - BAG particle abrasion on *S. mutans* biofilm on sandblasted and acid etched titanium surface.

Methods Sandblasted and acid etched commercially pure titanium alloy discs were used as substrates for bacteria (n=107). The discs were immersed in *S. mutans* solution and incubated for 21 h to form *S. mutans* biofilm. Colonized discs were subjected to air-particle abrasion with the Bioglass®45S5, one experimental ZnO containing BAG (Zn4) and one inert glass. After the abrasion, the discs were incubated for 5 h in anaerobic chamber followed by assessment of viable *S. mutans* cells (n=20) and evaluation of the surface morphology using SEM (n=12). Reactivity of the BAG particles was verified in SBF immersion. Thrombogenicity of the glass particle treated discs (n=75) was evaluated spectrophotometrically using whole blood clotting measurement at predetermined time points.

Results Air-particle abrasion with 45S5 and Zn4 BAGs eradicated *S. mutans* biofilm. Significantly less viable *S. mutans* cells were found on discs treated with the BAGs compared to the inert glass ($p<0.001$). The rise in the pH of the SBF was significantly higher for 45S5 than for Zn4. No significant differences were found in thrombogenicity.

Conclusions Air-particle abrasion with BAG is effective in eradication of *S. mutans*biofilm from sandblasted and acid etched titanium alloy surfaces. Zn4 and 45S5 BAGs had similar biofilm eradicating effects but the Zn4 BAG could be more tissue-friendly and may thus be of benefit for the healing of the tissue.

0135

Bacteriostatic Effect of Filling Materials Used in Implant-abutment-screw-channel

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Objectives To investigate the bacteriostatic properties of frequently used filling materials in implant-abutment-screw-channel. Secondary objective of this study was to evaluate whether chitosan has bacteriostatic effect.

Methods Microbial suspension was made dissolving probiotic capsules in hydroionised water. The capsules contained strains of Lactobacillus casei, Lactobacillus rhamnosus, Lactobacillus acidophilus, Lactobacillus plantarum, Streptococcus thermophilus, Bifidobacterium bifidum and Bifidobacterium breve. 1ml suspension was spread on blood-agar-plates (BAP). In study one, samples of sterile cotton pellet, prefabricated silver zeolite containing polymerplug, cured temporary cement containing triclosan, a-siliconebased impression material and water-blocking tape consisting of polytetrafluoroethylene and chitosan-filaments derived from a rotary brush, were placed on bacteria-coated BAPs. Four identical plates were included in test group. Three plates with no samples served as negative control, whereas three plates with 2.0% Chlorhexidine served as positive control. All plates were incubated aerobically in 37°and evaluated and photographed after 24, 48 and 72 hours.
In study two, samples from same sealants were stored in 0.5ml hydroionised water and incubated 120hours. The solutions were immersed in filter paper, placed on eight bacteria-covered BAPs and same incubation procedure as first study was repeated. In addition filter paper immersed in 2.0% Chlorhexidine were placed on same BAPs as positive control. Two separate BAPs with no

test samples were included as negative control.
Descriptive statistics were performed with SPSS v.25.0 software (SPSS Inc., Chicago, IL, USA).
Results In both studies no test samples showed bacteria-free zone around filling materials. The same was true for chitosan-containing filaments. All positive controls clearly showed bacteriostatic effect.
Conclusions Within the limitations of this study, none of the included filling materials nor the chitosan-containing filaments showed bacteriostatic effect.

0136

Push-out Force of Screw-hole Filling Materials in Zirconia Implant Crowns

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Objectives The screw-retained implant crowns are preferred when possible as the excess cement can cause problems on peri-implant health. The aim of this study was to compare push-out force of screw access hole filling materials in zirconia dental implant crowns using different filling methods.
Methods Partially yttrium stabilized zirconia (PSZ) (Prettau, Zirkonzahn,Italy) crowns (cylinder shape, Ø10mm) were milled (M5, Zirkonzahn) on titanium bases (Brånemark 4.1, Zirkonzahn) and sintered in non-vacuum sintering furnace (1500°C, Zirkonofen 600/V2, Zirkonzahn). Two different design of screw hole were milled: conventional smooth hole or threaded screw hole using special thread milling burs. For smooth screw hole filling methods (n=6/group) were: 1) restorative (Filtek™ Supreme XTE universal restorative (3M ESPE)), 2) adhesive (Scotchbond universal adhesive) + restorative, 3) grit blasting (50µm, 2,5bar Renfert) + restorative, 4) grit blasting+adhesive+restorative. 5) PMMA A3 resin screw plugs were milled.for filling the threaded screw holes. The specimens were subjected to static mechanical testing with a universal testing machine (Model LR30, Lloyd, UK). Filled screw access holes were loaded until failure. Statistical evaluation was made using ANOVA.
Results ***Results:*** ANOVA revealed significant differences among filling methods ($p<0.05$). Results are presented in Table 1. Different superscript letter indicates statistical significant differences ($p<0.05$, Tukey)
Conclusions Grit blasting of zirconia surface in screw access hole increases push-out force of universal adhesive and restorative filling material. Prefabricated PMMA screw plug showed comparable force.

0137

Three-Phase Surface Treatment for Single Implants: An Observational Study.

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Objectives Implant surfaces constantly undergo modifications to enhance immediate-loading procedures and improve stability in poor-quality bone, which has allowed the rehabilitation of edentulous patients to become a predictable treatment. The aim of this study is to assess the clinical behavior of peri-implant mucosa, bone-loss, implant stability quotient (ISQ) and survival rate of three-phase-treated-surface Titanium implants over 5 years.
Methods A total of 78 patients attending the Surgery and Orofacial Implantology Service of Madrid Hospital participated in this longitudinal retrospective study. 111 implants (Defcon®, TSA, Impladent) were used. CP-12 probes, ISQ beacon and radiological equipment were used for clinical surveillance, periodontal probing, ISQ evaluation and assessment of implant survival rate. Statistical analyses were performed using SPSS 17.
Results Implants were located with greater frequency in 46 and 14 sites (11,8% and 12,7% respectively). Average periodontal probing was 1,75mm, whilst the most frequent values were 2,00 mm (32,80%), 1,00 mm (29,40%) and 1,50 mm (17,20%). Average ISQ was 68, whilst the most prevalent ISQ values were 66 (27,3%), 67 (21,2%) and 64 (15,2%). No significant correlation was found between age and bone-loss (P=0,007) or ISQ
values (P=0,04), but it was observed that periodontal probing values increased significantly with age (P=0,096). Greater bone-loss is significantly associated with poorer ISQ (P=0,00) and periodontal probing
(P=0,007). No statistically-significant differences were found for bone-loss, ISQ values or periodontal probing
regarding sex, anatomical regions of the arch or implant length. Success rate of 99,1% (1 failure).
Results are difficult to compare to those obtained in other studies due to the lack of investigations with a 5-year-long period of monitoring. Average probing in this study (1,75mm) was similar or slightly lower than data
displayed in other reports.
Conclusions All data obtained regarding clinical behavior of peri-implant mucosa, bone-loss, ISQ and survival rate provides satisfactory results.

0138

Fracture Resistance of Severely Damaged Incisors Restored with Different Types of Post-core Foundations

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Objectives The aim of this study was to determine the static load-bearing capacity and failure mode of incisors restored with different post-core foundations and complete crown made of conventional particulate-filler composite (PFC, G-aenial Anterior).
Methods Forty (n = 8/group) bovine teeth were cut and made up the root length of 15 mm. They were divided into 5 main groups. Group A had teeth restored using regular-fiber post and Gradia Core as core build-up and complete crown of PFC. Group B contained teeth restored with regular-fiber post and core made of everX Flow and complete crown of PFC. In Group C, the teeth were restored with everX Flow as post-core and complete crown of PFC. Group D, post-core-crown restorations were indirectly made from CERASMART (CAD/CAM). Group E, teeth were restored with Gradia Core as post-core and complete crown of PFC. The restorations were polymerized with a hand-light curing unit. All restored teeth were stored in water at room temperature for 48 h before they were statically loaded until fracture. Failure modes were visually examined.
Results ANOVA revealed that the restoration technique significantly affected load-bearing capacity ($p<0.05$). Restored incisors (Group B) had the highest load-bearing capacity (443 N) among all the groups tested. Restorations made from everX Flow post-core and PFC coverage (Group C) gave force value of 300 N, which was significantly higher than the values of Group E ($p<0.05$).
Conclusions Using everX Flow as core material with regular-fiber post is promising to strengthen structurally compromised incisor teeth.

0139

Fracture Toughness of Bilayered Composite Structure with Short Fiber-reinforced Base

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Objectives Bilayered short fiber-reinforced (SFRC) composite restorations comprise SFRC base and veneering layer, usually direct composite resin (CR). The aim was to investigate the crack propagation and fracture resistance of this type of bilayered composite structure upon storage in water for 6 months.
Methods Modified fracture toughness (FT) was evaluated using single-edge notched beam specimens (2.5x5x25 mm). The specimens (n=12) were water-stored at 37 degrees for 1 week (Group 1), 1 month (Group 2) and 6 months (Group 3). The SFRC (everX Posterior, GC Europe) was inserted in one increment with thickness of 2.0 mm and light-cured (Elipar S10, 3M ESPE) for 20 s in five separate overlapping portions. The veneering CR (A2, G-ænial Posterior, GC Europe) was then placed over the SFRC base in two increments (1.5 mm each). Prior light-curing the first layer (20 s/portion; 5 overlapping portions), a sharp and centrally located crack was produced by inserting a straight edged razor blade into the prefabricated slot, which extended to half the width of the mold (crack-tip located in CR). Upon storage, the specimens were tested in three-point bending mode in a universal material testing machine at a crosshead speed of 1.0 mm/min. Fracture propagation paths were analyzed with SEM. One-way ANOVA was used to analyze difference between the groups.
Results The FT of bilayered composite structure with SFRC base did not change significantly ($p>0.05$) over the observation period of 6 months in water. The FT values (in $MPam^{½}$) were 1.47 (±0.5), 1.41 (±0.2) and 1.40 (±0.4) for 1 week, 1 and 6 months respectively. None of the specimens broke into two halves.
Conclusions The FT of bilayered composite structure remained stable regardless of the time of exposure in water. SFRC base deviated or arrested the crack propagation and enabled a ductile fracture.

0140

Study on Mechanical Properties of Temporary Resin Composites.

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Objectives The aim of this study was to evaluate mechanical properties of temporary resin composites.
Methods Five kinds of temporary resin composites [Luxacrown (LC, DMG), Luxatemp (LT, DMG), Luxatemp Star (LS, DMG), Tempsmart (TS, GC) and Protemp 4 (P4, 3M ESPE)] were used, to investigate flexural strength, elastic modulus test were performed (n = 5 per group), and furthermore inorganic filler content was measured (n = 2 per group). Data were analyzed using one-way ANOVA and Bonferroni method.
Results The flexural strength of LC (118.1 MPa) was significantly different higher compared with LT (81.7 MPa), LS (93.7 MPa) and P4 (81.0 MPa), and the elastic modulus of LC (5.8 GPa) was significantly different higher than other resin composites ($p < 0.05$). The inorganic filler content values of temporary resin composites were less than 50 wt%, and that of LC (43.5 wt%) was significantly different higher than other resin composites, and that of TS (24.1 wt%) was lowest ($p < 0.05$).
Conclusions There was a low correlation between inorganic filler contents and flexural strength or elastic modulus. However, it was suggested that only Luxacrown was a high correlation between inorganic filler contents and flexural strength or elastic modulus. As a result, it was suggested that it is also related to the size or type of filler and kind of resin monomer, degree of polymerization at temporary resin composite, besides the filler content.

0141

The Characteristics of Resin-based Core Materials

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Objectives The aim of this study was to evaluate flexural strength and curing depth of the experimental and commercial resin-based core materials.

Methods The experimental resin core (LN) and Beauti core LC Injectable (BC; Shofu) as light cure type, and Clearfil DC core Automix (DC; Kuraray Noritake Dental), Esthe Core (EC; Tokuyama Dental), Luxa core (LC; DMG) and Unifil Core EM (UC; GC) as dual cure type were used. The specimens of flexural strength were prepared with size of 2mm x 2mm x 25mm. Three-points bending test were performed after each storage: storing in air at room temperature for 7 days (R group), storing in distilled water at 37°C for 7 days (W group), and storing in thermal stress (5 and 55 °C) for 10,000 cycles (T group) (n=3). The curing depth was prepared with size of 12 mm thickness and irradiated. And then a half of length of the cured body was measured (n=7). These data were analyzed using one-way ANOVA followed by Tukey's multiple comparison test (α=0.05).

Results The flexural strength of all resin core materials were equally or lower than that of dentin, and that of LN, BC, EC and LC at R group were significantly lower than after thermal stress (T group). The flexural modulus of all resin core materials were similar to dentin, and that of LN, LC and UC were no significant difference after distilled water or thermal stress. The curing depth of LN (4.0 ± 0.1 mm) was significantly higher than the other resin core except UC (5.9 ± 0.2 mm), and that of LN was significantly higher compared with BC(2.8 ± 0.1 mm) in the light cure type.

Conclusions It was suggested that LN would be useful for preventing root fracture and could be cured in the deep root canal as well as the other resin-based core materials.

0142

Compressive Strength of Two Restorative Materials After Cyclic Loading

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Objectives The objective of the study was to compare the compressive strengths of two restorative materials with or without light curing nano-filled coating, after cyclic loading.

Methods Four groups of samples (n=7): (1) Equia Fil GC (Tokyo, Japan) uncoated; (2) Equia Fil coated with Equia Coat (GC Tokyo, Japan); (3) Equia Forte Fil GC (Tokyo, Japan) uncoated and (4) Equia Forte Fil coated with Equia Forte coat, were subjected to cyclic loading (240,000 cycles) using a chewing simulator (MOD, Esetron Smart Robotechnologies, Ankara, Turkey). Compressive strength measurements were performed according to ISO 9917-1:2007 using a universal mechanical testing machine (Instron, Lloyd, UK). Other specimes than those used for compressive strength measurements were analysed using SEM.

Results Kruskal Wallis test and factorial ANOVA analysis showed that there were no statistically significant differences between Equia and Equia Forte irrespective of the coating ($p<0.05$), but a trend of increasing compressive strength in the coated samples was noticed.

Conclusions The results of this study showed that the compressive strength after cyclic loading was higher in the case of Equia Fil and Equia Forte Fil when the samples were coated prior to cyclic loading, but the difference was not significant.

0143

Fracture Behavior of Bi-structure Fiber-Reinforced Composite Restorations

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Objectives The aim of this study was to evaluate the fracture-behavior of direct composite restorations made with two different bulk composite core materials. In addition, fracture toughness (FT), flexural strength (FS) and flexural modulus (FM) of tested composites were evaluated.

Methods Twenty groups of posterior crown restorations were fabricated (n=6/group). Test groups (n=12) were made of 4-5 mm layer of composite core materials (everX Flow, GC and SDR Flow$^+$, Dentsply-Sirona) and covered by 2 mm layer of conventional composite (G-aenial Anterior, G-aenial Posterior, G-aenial Universal Injectable, Essentia, CeramX, Filtek Z500). Control groups (n=8) were only made of conventional composites or composite-core materials. Crowns were statically loaded until fracture. Failure modes were visually examined. FT, FS and FM were determined for each tested composite (n=6) following standards. Data were analyzed using ANOVA ($p = 0.05$).

Results ANOVA revealed that crown restorations made only from everX Flow composite had significantly higher load-bearing capacity (3866 ±263 N) ($p<0.05$) among all the groups tested. No statistically significant difference was found in the load-bearing capacity between crowns made with different composite core materials ($p>0.05$). everX Flow exhibited the highest FT (2.8 MPa $m^{1/2}$) and Z500 presented the highest FS values (197 MPa) ($p<0.05$) among tested composites. With regard to the failure mode analysis, crowns that have fiber-reinforced core material of everX Flow revealed delaminating of surface conventional composite from the substructure layer. While in crowns that have core material of SDR Flow$^+$ or having only conventional composites with no fiber reinforcement showed a catastrophic crushing fracture pattern.

Conclusions Restorations combining fiber-reinforced everX Flow composite core and surface layer of conventional composite

displayed promising performance related to fracture-behavior. FT value of core material has prior importance, as it influences the crack arresting mechanism.

0144

Up-take of *Porphyromonas Gingivalis* Membrane Molecules and PD-L1 Up-regulation

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Objectives Expression of PD-L1 on host cells modulates immune response. During inflammation this receptor is induced on epithelial cells and alters T-cell responses. It was demonstrated that the membrane fraction of *P. gingivalis* is able to induce PD-L1 up-regulation. After up-take of the bacterial molecules this effect is triggered by NOD1/NOD2 binding. Endocytosis is one potential mechanism for the up-take of substances into the cell and is a constitutive property of most eukaryotic cells. It allows non-specific internalization of nutrients in addition to receptor-mediated internalization of molecules. The aim of this study was to analyze the up-take of bacterial components by carcinoma cells that subsequently induce PD-L1 up-regulation.

Methods Squamous cell carcinoma cells (SCC-25) were seeded (1 x 10^6 cells) and stimulated with *P. gingivalis* W83 total membrane (TM) fraction - obtained by mechanical lysis following ultracentrifugation of *P. gingivalis* W83. After 24h cells were harvested and prepared for Western blot. PD-L1 expression was investigated by immuno-staining. For endocytosis analysis TM was coupled to the pHrodo™ GreenSTP ester. Up-take of the fluorescent TM was analyzed by flow cytometry.

Results Induction of PD-L1 protein expression was detected in dose- and time-dependent manner after stimulation with *P. gingivalis* W83 membrane fraction. After stimulation with fluorochrome-ester labelled TM the number of fluorescent cells increased from 8.3% (±3) after 20 min to 55.5% (±13) after 48 h ($n = 3$) ($p < 0.01$), indicating that the majority of cells internalized TM via endocytosis.

Conclusions We provide evidence that TM of *P. gingivalis* up-regulates the immune-regulatory receptor PD-L1 in oral carcinoma cells and that TM enters the cells via endocytotic up-take.

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0145

Activation of Gingival Fibroblasts by Bacterial Cyclic Dinucleotides and Lipopolysaccharides

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Objectives Cyclic dinucleotides (cyclic di-guanosine monophosphate (c-di-GMP) and cyclic di-adenosine monophosphate (c-di-AMP)) and lipopolysaccharides (LPS) are pathogen-associated molecular patterns (PAMPs) that stimulate an immune response in eukaryotic cells. Although their individual impacts on the selected immune cells have been documented, simultaneous actions of multiple PAMPs on gingival fibroblasts are not studied so far. In the present study, we examined the effects of c-di-GMP and c-di-AMP on cytokine and enzyme response of gingival fibroblasts in the presence and absence of *Porphyromonas gingivalis* LPS.

Methods Human gingival fibroblasts were incubated for 24 h with three concentrations of c-di-GMP and c-di-AMP (100 µM, 10 µM, and 1 µM), either in the presence or absence of *P. gingivalis* LPS. The luminex technique was used to measure the extracellular levels of interleukin (IL)-8, -10, -34, matrix metalloproteinase (MMP)-1, -2, and -3.

Results Incubating fibroblasts with LPS alone or together with c-di-AMP or c-di-GMP at all tested concentrations elevated IL-8 levels, while incubation with 100 µM of c-di-GMP alone increased extracellular IL-10 levels. The MMP-3 levels were increased when the cells were incubated with c-di-AMP (10 µM) or c-di-GMP (10 and 100 µM) in the presence of LPS. MMP-2 levels were suppressed in the stimultaneous presence of LPS and c-di-GMP (1 µM).

Conclusions Bacterial cyclic dinucleotides and LPS stimulate gingival fibroblasts to secrete cytokines and enzymes; however, variations in response profile may indicate differences in the activation of response regulatory pathways.

0146

Na-DNA Mouthwashes Reduce Cell Degeneration: Bioreactor-based Reconstituted Oral Epithelium Model

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Objectives Sodium DNA (Na-DNA) is constituted by purified, depolymerized and neutralized deoxyribonucleic acid extracted from the gonadic tissue of male sturgeons. This study aimed to investigate whether the addition of Na-DNA to a chlorhexidine (CHX)-containing mouthwash influences morphology and viability of Reconstituted human Oral Epithelium (ROE), and protects ROE against oxidative stress.

Methods Air-lifted, multi-layered 0.5 cm2 ROE coupons (SkinEthic) were positioned inside a continuous-flow bioreactor, grown air-lifted for 24h in supplemented RPMI medium then either treated with (PBS) phosphate-buffered saline or (H) 1 vol% H_2O_2 for

1 min. Immediately after, coupons were treated for 30 min with mouthwash solutions containing: (A) 0.2% CHX, (B) 0.2% CHX + Na-DNA, (C) Na-DNA, (D) PBS. Coupons were then subjected to tetrazolium-based viability assay, Confocal Laser-Scanning Microscopy (CLSM) imaging, and histological evaluation using optical microscopy and Transmission Electron Microscopy (TEM) imaging.
Results *Viability assay:* H-C elicited significantly higher viability than H-D, suggesting a significant protective activity of Na-DNA on cells viability.*CLSM:* CHX caused loss of cell junctions in the superficial layer. PBS-C and H-C showed a lower number of dead cells compared to PBS-D and H-D, respectively.*Histological evaluation (Figure 1):* CHX and, especially, H_2O_2-treatment caused alterations of cells structures. PBS-B and especially H-B showed less alterations compared to PBS-A and H-A, respectively. In H-B and H-C some cells not showing degeneration signs were found in the innermost layers, where they were probably more protected from CHX and reactive oxygen species, and where Na-DNA helped in minimizing cell damage.
Conclusions Na-DNA showed a clear and protective action against cellular degeneration due to oxidative stress and, partly, to the exposure to CHX. Its addition to chlorhexidine mouthrinses or gels could be clinically helpful in contrasting the detrimental activity of CHX on oral tissues, and in supporting preservation of cell viability, control of inflammation and wound healing

0147

The Role of Butyrate in *Fusobacterium Nucleatum* Biofilms

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Objectives To study the implication of the butyrate pathway in Fusobacterium nucleatum biofilmS, since, out of the eight enzymes that regulate the synthesis of butyrate, six of them were differentially expressed (over- and down-) when the bacteria were forming biofilms.
Methods Monospecies biofilms of F. nucleatum DSMZ 20482 [107 colony forming units (cfu)/mL] were developed on sterile hydroxyapatite slides, while planktonic cell cultures were obtained by inoculating the medium with bacterial suspensions in sterile plastic tubes. Both were incubated in anaerobic conditions at 37 C during 24 hours. The bacterial cells were recovered and disrupted by sonication. The supernatants were concentrated and the protein concentration was determined using the Bradford assay. These protein extracts were used to measure the enzymatic activity of thiolase (acetyl-CoA acetyl transferase) and 3-hydroxybutyryl-CoA dehydrogenase. All enzyme measurements were carried out in 1-cm-path-length quartz cuvettes at room temperature using a final volume of 1 mL. The thiolase activity was determined in the thiolytic direction with acetoacetyl-CoA as substrate by monitoring the decrease in absorbance at 303 nm (DA303nm) and with 500 µg protein extract from biofilm or planktonic. In the case of the 3-hydroxybutyryl-CoA dehydrogenase activity, it was determined by measuring the decrease of β-nicotinamide adenine dinucleotide reduced (NADH) absorption at 340 nm (DA340nm) and with 350 µg protein extract from biofilm or planktonic. The enzymatic assays were repeated three times on different days. For comparing the differences in DA303nm and DA340nm between both conditions, unpaired Student's t tests were performed.
Results Statistically significant differences were found in the amount of both enzymes activity (thiolase, p=0.0078; 3-hydroxybutyryl-CoA dehydrogenase, p=0.0027) between biofilm and planktonic states. These results confirm the differential expression of the same proteins previously studied with proteomics tools.
Conclusions Butyrate pathway may play a critical role in the development of F. nucleatum biofilms..

0148

Study of Differential Expression of Proteins of *Porphyromonas gingivalis* Biofilm

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Objectives To analyze the differential expression of proteins of *Porphyromonas gingivalis* when growing in biofilms, in comparison with planktonic state.
Methods Monospecies biofilms of *P. gingivalis* ATCC33277 were formed on sterile hydroxyapatite discs, immersed in the modified brain heart infusion (BHI) medium with bacteria suspension [10^7 colony forming unit (cfu)/mL], while planktonic cell cultures were obtained by inoculating BHI medium with bacteria suspensions (10^7 cfu/mL) in sterile plastic tubes. Both were incubated in anaerobic conditions at 37°C during 96 hours. To extract the proteins, biofilm and planktonic cells were disrupted by sonication. Then the samples were cleaned and solubilized. Label-free quantitative (without peptide or protein labeling) proteomics (LC-MS/MS) was applied to identify and quantify the proteins from biofilm and planktonic states. The acceptances criteria for proteins identification were a FDR (False Discovery Rate) <1% and at least one peptide identified with high confidence (confidence interval, CI<95%). In the quantification of proteins, a series of filters were applied to determine if a protein was differentially expressed between both conditions: abundance ratio variability (0-30%), p-value <0.05, q-value <0.05 and fold change ($\log_2$(ratio)≥±0.6).
Results 892 proteins were identified, among them 862 proteins (41 exclusive) were found in the planktonic state and 851 proteins (30 exclusive) were found in the biofilm state. Of these proteins, 614 could be quantified and 73 proteins were

differentially expressed. The repressed proteins were mainly involved in metabolism, biosynthesis and the fimbriae synthesis, and over-expressed proteins were involved in translation, oxidative stress, and proteins with unknown function.
Conclusions *P. gingivalis* presented differential protein expression in biofilm growth, when compared to planktonic state, and these proteins may be good candidates to be used in both diagnosis and treatment of periodontitis.

0148.1

Validation of an Intra-Oral Device for Mimicking Natural Biofilm Development

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Objectives The ability to develop an *in-situ* biofilm in its natural form is critical to obtain realistic data on biofilm functionality. Biological and physical characteristics of the artificially produced oral biofilms can be affected by several factors such as type of the device and the substrate used. We aim to construct and validate an intra-oral device for *in-situ* biofilm development.
Methods A customized intra-oral device was designed and constructed using thermoplastic material "ERKOFLEX", vacuum formed on an upper jaw model, carrying two removable transparent "polystyrene wells" of 5mm x 3mm, on each side of the jaw. Five healthy volunteers wore the device continuously for 24 hours, apart from meal times. No toothbrushing was allowed during the test period. A total of 16 biofilm samples from device and 16 supragingival biofilm samples from corresponding, contra-lateral natural sites on teeth were collected. Viability of bacteria was quantified using real-time PCR. Parametric tests were employed to compare total microbial viability of the device and the tooth biofilm, and to compare the viability of biofilm microbiota between individuals.
Results The device was able to grow viable biofilm as confirmed by viability PCR. There was non-significant difference in the total proportion of viable/non-viable bacteria collected from device and the natural tooth surface ($P>0.05$) after 24 h. (Mean {SD} delta C_t of device and tooth were 2.23 {2.11}and 1.21{1.06}, respectively). There was also non-significant difference in the proportion of viable bacteria collected from the device among individuals ($P>0.05$). However, there were marked inter-individual variations in biofilms collected from the natural tooth among individuals ($P<0.05$).
Conclusions *In-situ* biofilm growth within the new device, after 24 hours is highly representative of naturally occurring supragingival biofilms. Hence, this device could be used to evaluate natural oral biofilm development *in situ,* and the effect of various agents on biofilm development.

0149

Changes in the Composition of Radicular Dentin Using Passive Ultrasonic Irrigation

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Objectives OBJETIVE: To analyze the composition of radicular dentin with ATR-FTIR spectroscopy after immersion in different NaOCl concentrations with application or not of passive ultrasonic irrigation (PUI).
Methods METHODS: Sixteen human single-root teeth were sectioned and one slice from each radicular third was selected. Specimens were randomly distributed into four groups: (1) 2.25 % NaOCl for 1, 5 and 20 min; (2) 2.25 % NaOCl for 1, 5 and 20 min with PUI; (3) 5.25 % NaOCl for 1, 5 and 20 min; (4) 5.25 % NaOCl for 1, 5 and 20 min with PUI. Carbonate/mineral, Amide I/mineral and Amide III/CH_2 ratios were determined using ATR-FTIR spectroscopy for each specimen before and after treatment. Data were analyzed by Kruskal-Wallis, Mann-Whitney U, and repeated measures ANOVA tests ($p<0.05$).
Results RESULTS: The 2.25 % NaOCl solution did not modify carbonate/mineral ratio, although significantly decreased Amide I/mineral and Amide III/CH_2 ratios. The application of PUI significantly decreased the carbonate/mineral ratio in the coronal third after 5 min of immersion in NaOCl, and the Amide I/mineral and Amide III/ ratios, after 1 min and 20 min, respectively. 5.25 % NaOCl significantly decreased carbonate/mineral, Amide I/mineral, and Amide III/CH_2 ratios up to 5 minutes after treatment with a higher decrease with PUI application. Root third did not affect composition of radicular dentin regardless of the irrigation treatment tested
Conclusions
CONCLUSION: The organic and inorganic composition of root dentin was affected by NaOCl concentration and the application of PUI. The most pronounced change was detected after 5.25% irrigation with PUI. The activation of NaOCl significantly modified carbonate/mineral, Amide I/mineral, and Amide III/CH_2 ratios for both NaOCl concentrations even after application for one minute

0150

Expression of microRNA-21 and PTEN Protein in the Alveolar Bone of Type 2 Diabetic Patients

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Objectives Type 2 diabetes mellitus may adversely affects bone health by mechanisms still unclarified. Recently, microRNAs emerged as potential players of diabetes complications. microRNA-21, one of the most highly expressed microRNAs in a majority of mammalian cells, has been shown to control diabetes progression by regulating one of its target genes-phosphatase and tensin homolog (PTEN). Having in mind that microRNA-21 is involved in bone metabolism by promoting osteoclastogenesis, we aimed to investigate the expression levels of microRNA-21 and PTEN protein in the alveolar bone samples of type 2 diabetic patients.

Methods The thirty patients, healthy and type 2 diabetic, were referred for multi- rooted teeth extractions utilizing conventional surgical technique prior to implant placement. The alveolar bone specimens obtained during the surgery were used for the measurements of microRNA-21 expression by Real-time RT-PCR as well as of PTEN protein by ELISA

Results Expression levels of microRNA-21 and PTEN protein were higher in the bone samples of type 2 diabetic compared to healthy patients (5.273 ± 0.1163 vs 3.968 ± 0.1815 for microRNA-21, and 225.0 ± 55.13 vs 93.11 ± 23.61 pg/ml for PTEN). microRNA-21 also showed significant positive correlation with PTEN protein levels.

Conclusions microRNA-21 and associated PTEN protein expression levels are enhanced in the diabetic alveolar bone indicating altered bone metabolism in type 2 diabetes mellitus

0151

Differential Basolateral and Apical AE and NKCC Activities Demonstrate Polarization of HAT-7 Ameloblasts

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Objectives A coordinated transport of chloride and bicarbonate ions is required for enamel maturation during amelogenesis. We developed a two dimensional cellular model to investigate ion transport mechanisms using the HAT-7 rat ameloblast cell line (Racz et al, Frontiers Physiol., 2018). In the present study we compared the apical and basolateral HCO_3^-/Cl^- anion-exchanger (AE) and sodium-potassium-chloride cotransporter (NKCC) activities in HAT-7 cells.

Methods

To obtain monolayers, HAT-7 cells were cultured in differentiation medium for 4 days on Transwell membranes. We monitored transepithelial resistance as an indicator of tight junction formation and polarization. We evaluated intracellular pH changes by microfluorometry using BCECF fluorochrome. The activity of anion exchangers was tested by withdrawal of chloride-ions, and using anion exchange inhibitor DIDS. NKCC activity was monitored by the ammonium-pulse technique, after a rapid intracellular alkalization using the specific NKCC inhibitor bumetanide.

Results In HAT-7 cells grown on Transwell, the basolateral AE activity was high, and could be inhibited by DIDS (0.149±0.017 vs 0.055±0.008 dpH/dt, $p<0.05$). On the other hand, AE activity was very low at the apical side, and not significantly affected by DIDS (0.020±0.009 vs -0.006±0.006 dpH/dt, $p>0.05$). Additionally, we found a substantial NKCC activity in HAT-7 cells indicated by the rapid decrease of intracellular pH after an alkaline load (-0.084±0.005 dpH/dt). This activity was substantially inhibited by basolateral bumetanide administration (-0.060±0.004 dpH/dt, $p<0.05$), but not by apical bumetanide (-0.068±0.004 dpH/dt, $p>0.05$), indicating the presence of NKCC activity only at the basolateral but not at the apical side of the ameloblast originated cells.

Conclusions We identified differentially localized activities of AE and NKCC transporters in HAT-7 ameloblast cells, polarized on Transwell membranes. The side-specific activities of these transporters demonstrate that the HAT-7 model is useful to conduct functional studies on ion transport mechanisms of amelogenesis. Supported by EFOP-3.6.2.-16-2017-0006 and NKFIH K-125161.

0152

The Role of TRPM7 Channel in the Ca^{2+} and Mg^{2+} Homeostasis of Ameloblast Cells

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Objectives TRPM7 is a divalent cation-permeable channel, with serine/threonine protein kinase activity, which plays an important role in the regulation of Ca^{2+} and Mg^{2+} homeostasis in various cell types. TRPM7 channel activity is sensitive to intracellular Mg^{2+} and pH, and these channels are known to be expressed in ameloblasts. We have previously found that TRPM7 mRNA is expressed in rat HAT-7 cells, an established model for ameloblast epithelial transport. Thus, our objective was to functionally characterize the TRPM7 channel in HAT-7 cells.

Methods Transmembrane ion currents were measured using patch-clamp electrophysiology in the whole-cell configuration (voltage-clamp mode) in the presence of different intracellular Mg^{2+} concentrations ($[Mg^{2+}]_i$; 0, 0.9, 3.6 mM) in response to the agonist mibefradil (50 µM) as well as to TRPM7 antagonists (20 µM NS8593 and 2 µM FTY720). Changes in intracellular Ca^{2+} concentration $[Ca^{2+}]_i$ were measured by ratiometric Ca^{2+}-imaging using the fluorescent dye Fura-2.

Results Mg^{2+}-free pipette solutions significantly increased, while elevated $[Mg^{2+}]_i$ (3.6 mM) decreased the whole-cell currents

measured at +80 mV. Both NS8593 and FTY720 inhibited the TRPM7 channel activity triggered by the Mg^{2+}-free intracellular environment. Mibefradil evoked a characteristic outward-rectifying current that was significantly suppressed by elevated $[Mg^{2+}]_i$ (3.6 mM). Mibefradil elicited an increase in $[Ca^{2+}]_i$ in a dose-dependent manner which was largely dependent on the presence of extracellular Ca^{2+}. Intracellular alkalinization induced by an NH_4Cl pulse enhanced the Ca^{2+} influx from the extracellular space.
Conclusions Both the characteristic mibefradil-induced and $[Mg^{2+}]_i$-sensitive transmembrane ion currents and the mibefradil- and intracellular alkalinization-evoked Ca^{2+} influx indicate the functional presence of TRPM7 channels in HAT-7 cells. These data suggest that HAT-7 cells could serve as suitable model for the investigation of epithelial Ca^{2+} transport in ameloblasts.
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0152.1

Optimizing Post-tooth Extracted Transport Time for Pulp Stem Cell banking

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Objectives The aim of this study was to investigate the viability, function, mineralization and gene expression of Human Dental Pulp Stem Cells (HDPSCs) isolated from extracted teeth immediately (0 hr) and after 6 hours and 24 hours post-tooth extraction.
Methods Three impacted wisdom teeth were extracted from a 29 year-old healthy female in a single operation. Pulp extirpation and extraction of HDPSCs was performed immediately for the first tooth. The second and third wisdom tooth were initially stored in DMEM at 4 degree celcius and consequently underwent extraction and isolation of HDPSCs at 6 hours and 24 hours later. The three groups of cells were characterized using flow cytometry and cell morphology and proliferation were analyzed using light microscope and MTT assay. Viability, function, mineralization and gene expression of HDPSCs isolated from the extracted teeth immediately (0hr) and after 6 and 24 hours post-tooth extraction were assessed.
Results There was a slight reduction in the proliferation capacity of the HDPSCs in 24 hours post- tooth extraction group but no change in cell morphology and cell viability between groups. Flow cytometry results showed that all groups were more than 80% positive for MSC positive markers (CD44, CD106, CD90) and more than 80% negative for MSC negative markers (CD45 and CD11b). There was significant reduction in the ALP levels and 30-40% reduction in mineralization nodule formation in differentiated 24 hours post-tooth extraction group. qRt-PCR showed significant reduction in the expression levels of osteocalcin and vascular endothelial growth factor alpha in the 24 hours post-tooth extraction group.
Conclusions Our results suggest that a delay of up to 24 hours for tooth processing and HDPSCs collection does not inhibit the establishment of dental pulp cell cultures but it significantly reduces the differentiation and function of the HDPSCs.

0153

Differences in Diet Intake Reflected in Stable Isotopes in Teeth

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Objectives Depending of different diets different amounts of stable isotopes are incorporated in teeth during their formation in childhood and adolescence. The aim of this study has been to analyse differences in stable isotopes reflecting dietary intake, between different generations, genders, age groups and from different part of the world, using discarded teeth.
Methods A request was made to dentists and dental clinics to send in discarded teeth. A decision was made to start analyzing when 250 teeth were collected and teeth belonging to persons living in or from Africa, Middle East and Sweden was used in this study. Age, gender and what teeth was recorded for every tooth. As many crowns was missing due to caries, only the roots were used. They were cleaned, milled and either the collagen or the mineral was extracted. Isotope analyses were conducted on an elemental analyser coupled to an IRMS. The results were delta-values regarding ^{13}C (collagen), ^{13}C (mineral), ^{15}N and ^{34}S. Altogether 214 teeth were used in this study but ^{34}S and ^{13}C (mineral) was only analysed in subgroups. The differences were analysed in general linear models including age, gender, origin and tooth.
Results There were only some and weak generation differences, gender differences and tooth differences but all 4 isotopes differed significantly regarding origin of the persons.
Conclusions Based on these results diets in different cultures differs but seems to be stable over time regarding basic ingredients.

0154

Oral Screening of Children Living with Diabetes - Orthodontic Perspectives

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Objectives Our aim was to provide orthodontic screening, analysis, and treatment for children living with type 1 diabetes as part of the diabetes-dental working group at Semmelweis University.

Methods We participated in the Budapest Diabetes Day event with our diabetes- dental working group to provide free oral screening and dental consultation. Before every examination, the patient needed to fill a questionnaire, in order to the ethical approval of the Semmelweis University Ethical Board.

The participation in this screening was voluntary based. All the patients under the age of 18 who needed orthodontic treatment got a referral to the diabetes-dental working group in the Semmelweis University, where orthopantomogram, lateral cephalogram, impressions, and photo documentation were performed.

In January of 2019, we took part in the Children Diabetes Day and collected the data of more than 100 children.

Results Altogether 60 children were guided to the Semmelweis University for further orthodontic treatment. In 12 cases (patients with the age of 12-18) the orthodontic treatment has already been started.

Compared to the control group we expect better oral hygiene and cooperation in the type 1 diabetes group.

Conclusions There is a need for interdisciplinary cooperation with the help of an orthodontist. Diabetic patients have a higher risk for oral health problems (caries, infections) especially in the cases of dental crowding or different type of malocclusions. Orthodontic treatment may help them to have better metabolic results.

0155

Electromyographic Response in Patients Treated with Aligners and Fixed Appliance

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Objectives Invisalign system has increased popularity in recent years for its aesthetic advantage. However, this treatment is characterized by prolonged absence of contact between the dental arches, thus precluding occlusal adjustment during therapy. This study aimed to evaluate whether a difference in the activity of masseter (MM) and temporalis (TA) muscles can be highlighted between patients treated with fixed appliance and patients treated with aligners by using standardized surface electromyographic analysis (ssEMG).

Methods 13 patients (mean age 20.2±8.4) presenting dental class I or half class II malocclusion, ANB angle between 1° and 5°, cranio-mandibular divergence between 28° and 38°, crowding and diastemas <4 mm, overjet and overbite between 1 and 4 mm and no transverse skeletal deficit were recruited. 6 patients were treated with brackets (ORTO group), while 7 patients with Invisalign (ALIGN group). SsEMG (Easymyo, Udine, Italy) has been performed to assess the activity of masticatory muscles at the onset (T0), end (T1) and 3 months (T3) after the treatment.

Functional indexes including symmetry (POC) and intensity (IMPACT) of MM and TA, anteroposterior balance (ACTIVATY) and torsion (TORQUE) were detected. Descriptive analysis was carried out.

Results The time duration of the therapy was 17.8±2.3 months for ORTO group and 15.2±5.5 months for ALIGN group. At T0 (Table 1) data were similar between groups, characterized by good ssEMG indexes. At T1 (Table 2) a slight decrease in POC and ACTIVITY indexes and a mild increase in IMPACT index were observed in ORTO group, but all of them normalized at T2 (Table 3). No changes were observed in ALIGN group between each timepoint.

Conclusions Electromyographical indexes in ORTO group showed a moderate alteration at T1. However, the ALIGN group presented much higher standard deviations at T2 compared to ORTO group indicating a higher degree of variability in response to the treatment chosen.

0156

The Effect of Mandibular Advancement Surgery in the Upper Airway in Skeletal Class II Patients

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Objectives The objective of this study was to evaluate the immediate changes in superior posterior airway space in Class II patients, after mandibular advancement surgery.

Methods A cephalometric evaluation of 37 patients with skeletal Class II was performed at 2 different time intervals: Preoperative (T0) and immediate postoperative (T1), by the Arnett / Gunson FAB Surgery method, on the Dolphin Image & Management Solutions software. The statistical analysis was performed in the IBM © SPSS © program with a significance level of 0.05.The differences due to the surgical intervention were assessed with Student t-test. A Principal Component Analysis was used to evaluate the relationship between superior posterior airway space variables and mandibular advancement. Anti-clockwise and clockwise rotation groups were also evaluated with Mann-Whitney tests.

Results As an effect of mandibular advancement, an anteroposterior statistically significant increase in superior posterior airway space ($p<0.001$) was perceived at all points measured. The anti-clockwise mandibular rotation showed statistically significant differences, within the same period of time, in the upper airway.

Conclusions Mandibular advancement surgery is a viable option to increase the upper airway dimension, at the immediate postoperative period, in patients with Class II skeletal morphology.

0157

Are Dentofacial Alterations in Childhood with Obstructive Sleep Apnea Different Among Age Groups?

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Objectives To compare dentofacial features in Obstructive Sleep Apnea (OSA) children with matched control children, and to compare the development of these variables prospectively 1 year after adeno-tonsillectomy in two different age groups.

Methods 121 children age 2 to 12 years were diagnosed with OSA syndrome. The treatment for the OSA group was adeno-tonsillectomy (AT). The control group comprised 90, age and gender matched, children without breathing problems. Both groups were divided into group 1, from 2 to 5 years, and group 2, from 5 to 12 years old. Lateral cephalograms and model casts were taken for both groups at baseline (T0) and then 1 year after(T1). To compare differences between the experimental and control group at T0 and between T0 and T1, "t"-test for quantitative variables was used($p < 0.05$).

Results For group 1,neitherat T0 nor at T1 statistical differences were found comparing OSA and control children regarding: mandibular plane, ANB angle, intermolar and intercanine width, in both arches.

On the other hand, for group 2 at T0 the OSA children showed narrower maxilla and mandible (upper intermolar width p-value:0.038; upper intercanine width p-value:0.034; lower intermolar width p 0.006) than control children. At T1, no significant differences were found between OSA and control children.

Conclusions From 2 to 5 years old (group 1) the obstructive apnea does not seem to affect dentofacial structures yet, neither at T0 nor after adeno-tonsillectomy. But for group 2 (5 to 12 years old) OSA has an unfavourable effect on the development of dentofacial components, children show narrow maxilla and mandible that seems to be normalized (although still narrow) after adeno-tonsillectomy.

0158

Negative Social Comparisons and Social Discomfort in Dentofacial Deformity

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Objectives To perform a randomised trial to explore the relationship between dentofacial deformity, social comparisons and anxiety and discomfort in social situations, as well as the differences between the two samples and different skeletal patterns.

Methods This study includes two independent samples, one of 90 university students and another of 46 patients with dentofacial dysmorfosis that require orthognathic surgery. All participants completed two scales: The Scale of Social Comparison through the appearance of the Face and The Scale of Anxiety and discomfort in Social Situations due to the appearance of the Face. Person correlations were performed to analyse the relationship between age, years of education, skeletal pattern and the differences in the items of the two scales. In order to evaluate differences in the study's variables, in different skeletal classes, univariate analyses of the variance (One Way ANOVA) were performed. Post-Hoc analyses were performed with the Least Significant Difference method for multiple comparisons to explore differences between pairs of different skeletal classes. Multiple linear regressions (stepwise method), were performed separately for the two samples, to examine whether the skeletal class and social comparison are predictors of anxiety and discomfort in social situations due to the appearance of the face.

Results Clinical sample showed higher levels of anxiety and discomfort than the general population sample ($p = .004$). Furthermore, individuals with dentofacial dysmorphosis presented a greater degree of anxiety and discomfort than individuals without dentofacial dysmorphosis ($p = 0.002$). Skeletal pattern and social comparison predicted anxiety and discomfort in the general population [$F(1,88) = 7.270$; $p<.05$], but only social comparison emerged as a significant predictor of anxiety and discomfort in the clinical population[$F(2, 42) = 4.463$; $p<.05$].

Conclusions Orthodontic-surgical-orthognathic treatment can promote improvements in social and interpersonal well-being.

0159

In Vitro Bond Strength Evaluation of Digital Custom Molar Bands

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Objectives The aim of this in vitro pilot study was to test the effect of three different bonding protocols on tensile strength of digitally manufactured orthodontic molar bands.

Methods Twenty extracted human third molars were mounted through a special designed support into an Instron machine and randomly assigned to three groups, according to three different bonding protocols. Gr1: cleaning with pumice and rotating brush; Gr2: as Gr1 plus 36% phosphoric acid etching for 30 seconds; Gr3: as Gr2 plus adhesive application. The same band cement, RelyX Unicem 2 Automix (3M Espe), the same cementation pressure (measured through an orthodontic dynamometer), and the same light-curing protocol were used for all groups.

Tensile loads were applied until tooth-band separation or breakage. One-way ANOVA and post-hoc Tukey test were applied in

order to identify possible differences in tensile strength.
Results Gr1 (346.90±32.75 N) exhibited significantly (P<0.05) lower tensile strength than Gr2 (614.77±52.67 N) and Gr3 (550±61.22 N); Gr2 and Gr3 exhibited similar tensile strength (P>0.05).
Gr1 and Gr3 showed adhesive fracture patterns, between enamel and resin and between resin and inner bands surface respectively, whilst Gr2 showed a mixed pattern of adhesive fracture between the resin and the inner bands surface or between enamel and resin, with some transitional areas of cohesive fracture through the resin cement.
No band breakages were recorded.
Conclusions The bond strength of customized bands to enamel is higher when the dental surface is etched. The application of an adhesive do not increase significantly the overall bond strength, but it change the fracture pattern leading to a complete retention of the resin cement onto the dental surfaces.

0160

Bond-strength of a Single-component Ceramic Conditioner for Direct Bracket Bonding.
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Objectives To compare the shear-bond-strength (SBS) of brackets bonded to different ceramics treated with three conditioning methods, after 24h water storage and 10,000 cycles thermocycling.
Methods A crown with four identical buccal surfaces and its respective abutment were digitally designed. According to the type of ceramic evaluated, 7 groups were established: CEREC Blocs unglazed (CBU), CEREC Blocs glazed (CBG), IPS Empress CAD (EMP), IPS e.max CAD (EMA), VITA SUPRINITY PC (SUP), inCoris TZI (TZI) and VITA ENAMIC (ENA). 126 crowns were milled (18 per ceramic), sintered when required, and treated with three different conditioning protocols: (1) According to the manufacturer's instructions (MI); (2) Monobond Etch & Prime (MEP) and (3) 9.6% hydrofluoric acid + silane (9.6%HA). Then, 504 metallic brackets were bonded (4 per crown) and half of the specimens were stored in distilled water for 24h (24h) and the rest submitted to 10,000 cycles thermocycling (TC). SBS was performed in a universal testing machine and the type of failure was assessed using ARI index. Results were analyzed using Kruskall-Wallis and Mann-Whitney U tests (p<0.05).
Results The conditioning protocol applied significantly influenced immediate SBS for CBG, EMP and EMA; when TC was applied, differences in CBG, EMP, EMA, TZI and ENA were found (p<0.05). MEP conditioning of CBG and EMA showed lower SBS scores compared to MI and 9.6%HA (24h and TC). EMP conditioning with MEP after 24h obtained lower SBS values compared to MI; however, with TC, SBS was similar and higher than with 9.6%HA. After TC for TZI ceramic, MI conditioning (sandblasting) obtained higher SBS values than MEP and 9.6%HA. Treatment of ENA with MI and MEP produced similar and higher than with 9.6%HA after TC.
Conclusions SBS obtained with the three conditioning methods tested depends on the ceramic used. All conditioners showed enough and acceptable adhesive results for orthodontic bonding purposes.

0161

Effectiveness of 3D virtual brackets and Nickel Titanium Archwires in an Orthodontic Removable Appliance
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Objectives The objective of this study is to evaluate the effectiveness of movements on the transversal plane, evaluate changes of intercanine distance and interpremolar distance in adult subjects with posterior dental compression using a hybrid aligner appliance that incorporates archwires of nickel titanium.
Methods It has been selected a sample of 15 subjects where the initial intercanine distance and interpremolar distance of upper and lower arches. Then they were evaluated after 4 + 1 months of therapy with the hybrid aligner. A 3D superimposition method has been made using Orthoanalyzer Software for the evaluation of movements.
Results In posterior sectors, the hybrid aligner shows efficacy and the effectiveness of transversal movements was 86% average according the planification.
Conclusions The hybrid aligner shows the capacity to achieve expansion with efficacy. But it also shows more effectiveness according the time of treatment and number of appliances if it is compared with conventional aligners during the first phases of treatment.

0162

Measurement of Insertion and Extraction Torque of a New Miniscrew

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Objectives The successful use of orthodontic miniscrews depends on their primary stability in the bone directly after insertion. The insertion torque describes this parameter. The value should be below 20Ncm and high enough to ensure sufficient primary stability. A newly designed miniscrew was compared to commercially available mini-screws with regard to insertion torque and geometry.

Methods Commercially available miniscrews (TomasPin, ORTHOeasy, DualTopG2) and a newly designed mini-screw (NDM; Grade4 and Grade5) (each n=5) were inserted in a biomechanical test material (Sawbones®) while torque were recorded. Tests occurred with and without torque limitation of 20Ncm. Additionally, NDM was tested in iliac crest bone of pigs during insertion and extraction procedure. For statistical analysis (SPSS Version 25) Kruskal-Wallis-Test ($P<0.05$) was applied because some datasets wasn not normal distributed. Correlation of torque and screw geometry data was calculated.

Results All miniscrews exceeded the recommended value of 20 Ncm during insertion without torque limitation in Sawbones® (with limitation 18.2 ± 1.0Ncm; without limitation 25.4 ± 3.5Ncm; $P<0.05$). Miniscrew geometry data and insertion torque correlated positively for inside diameter ($P<0.05$). The NDM showed equal torque values for insertion and extraction without torque limitation in iliac crest bone (insertion Grade4 13.6 ± 3.8Ncm, Grade5 14.9 ± 4.8Ncm; extraction Grade4 -13.6 ± 4.0Ncm, Grade5 -13.6 ± 5.6Ncm). Both Grades of NDM revealed significantly lower insertion torque values in iliac crest bone compared to Sawbones® (Grade4 29.9 ± 2.5Ncm vs. 13.6 ± 3.8Ncm; Grade5 23.6 ± 1.3 vs. 14.9 ± 4.8Ncm; both $P<0.05$).

Conclusions The newly designed miniscrew (NDM) obtained comparable torque values like other miniscrews used in practice. However, both test materials demonstrated highly different results for insertion torque. Insertion in iliac crest bone fulfilled the recommended value of 20Ncm even without torque limitation. This results need to be verified with additional testing in relevant materials like within mandibles of pigs.

0163

The Study of Facial Value and the Cuspid Position in a Group of Asian Face.

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Objectives To study the relationship of alar of nose and canine position.

Methods Thai subjects (100 male and 100 female) aged from 18-25 years old who had normal aligned six upper anterior teeth were recruited. The intercanine width , interalar width , the horizontal width between canine line (L1) and both distal surface and cusp tip of upper canine, aswell as the horizontal width between the line passing from inner canthus to alar of nose (L2) and both distal surface and cusp tip of upper canine were measured . Intercanine width and interalar width were compared by the paired samples t test ($\alpha=.05$) while the others data were analyzed by one-sampled t test ($\alpha=.05$).

Results All measurement showed significantly different between male and female ($p<.05$). Interalar width is longer than intercanine width in both sexes. In male, L1 was significantly coincided to distal surface of canine but the position of left L2 was 3.52±3.60 mm lateral to distal left canine while right L2 was 3.93±3.44 mm lateral to distal right canine. Moreover , the L1 was situated between cusp tip and distal surface of upper canine but left and right L2 were lateral to distal surface 1.24±2.55 mm and 1.64±2.67 mm respectively.

Conclusions Interalar width was longer than intercanine width. In male, L1 was significantly coincided to distal surface but L2 was lateral to distal surface of upper canine while in female, L1 was situated between cusp and distal surface but L2 was lateral to distal surface of upper canine.

0164

Impact of the Prosthetic Design on the Quality of Life

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Objectives To compare implant-retained overdentures, screwed fixed partial prostheses, and cemented fixed partial prostheses concerning their impact on the patients' oral health-related quality of life (OHRQoL) and also according to sociodemographic, peri-implant, and prosthetic-related variables.

Methods A total of 143 edentulous patients were assigned to the following groups depending on their type of prosthetic rehabilitation: Group-1 (IO; *n*= 43): Implant-retained overdentures; Group-2 (S-PD; *n*= 50): Screwed implant-supported partial dentures; and Group-3 (C-PD; *n*= 50): Cemented implant-supported partial dentures. Patients completed three validated OHRQoL scales (OHIP-14sp, OHIP-20sp, and QoLIP-10). Data related to socio-demographics; prostheses' features; peri-implant health; and prosthetic complications, aesthetics, and functionality, were gathered. Descriptive and parametric probes were used (alpha = 0.05).

Results Among the peri-implant variables, the values of *Plaque index* and *Peri-implant mucosal hyperplasia* were significantly lower for both the S-PD and C-PD groups with respect to the IO group. The C-PD group recorded the significantly highest *Implant mobility*. The *assessed-by-the-patient* variables: *Aesthetics*, *Function*, and *Global evaluation*, showed the significantly worst values in the case of the IO group. The other prosthetic variables yielded no significant differences among groups. The most

common complication was *Ceramic fracture* (30%), followed by *Unsatisfactory occlusion* (16.1%). Finally, 85.3% of the subjects suffered from some kind of impact on OHRQoL. Both the OHIP-14sp and the OHIP-20sp indices attributed significantly better QoL to the fixed prosthodontic groups. The QoLIP-10 detected no significant differences among groups. The domains of the OHIP questionnaires that identified the highest impacts on OHRQoL were: `Functional Limitation', `Physical pain', `Psychological discomfort', and `Physical disability'. When using the QoLIP-10 scale, the `Dento-facial aesthetics' dimension achieved the highest impact.
Conclusions Although more research is necessary, fixed implant-supported partial prostheses seem to supply superior OHRQoL and clinical behaviour than implant-retained overdentures; including better peri-implant health, aesthetic appearance, and functionality.

0165

Quality of Life and Clinical Performance Associated to Implant Overdentures

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Objectives To investigate the differences in impact of mucosupported complete dentures and implant overdentures on the oral health-related quality of life (OHRQoL) of completely edentulous patients and to investigate the influence of the type of restoration on biological and prosthetic-related factors.
Methods A total of 85 completely edentulous patients (treated at the Complutense University of Madrid) were assigned to: Group-1 (CD): Mucosupported complete denture wearers (*n*= 42), and Group-2 (IO): Implant-retained overdenture wearers (*n*= 43). Only for the quality of life (QoL) analysis, a control group of subjects with a healthy natural dentition: Group-3 (ND) was considered (*n*= 50). Patients completed three different QoL questionnaires (OHIP-14sp, OHIP-20sp, and QoLIP-10). Data related to socio-demographics, prostheses features, soft tissue health, and prosthetic complications, were gathered. Descriptive and parametric probes were run (alpha = 0.05).
Results No significant between-group differences were found for the soft tissue health variables. The most common prosthetic-related complications were *Need for relining* (25.9%) and *Unsatisfactory occlusion* (16.5%). The most habitual soft-tissue complication was *Oral ulcers* (12.9%). *Need for relining* and *Retention* recorded significantly worse values for the CD group than for the IO group. The OHIP-14sp registered the significantly worst self-perceived OHRQoL for the control group, and detected no significant differences between CD and IO wearers. Both the QoLIP-10 and the OHIP-20sp total scores showed statistically comparable results for CD and IO groups. However, the `Psychological discomfort' and `Handicap' domains of the OHIP-20sp scale attributed the significantly worst QoL to CD bearers. When using the QoLIP-10 index, the `Performance' dimension revealed the significantly worst OHRQoL.
Conclusions When compared to conventional complete dentures, implant-retained overdentures lead to greater improvements in patients' self-perceived QoL, thus providing better retention and less need for relining. Patients with natural dentition registered the worst OHRQoL, demonstrating the highest concern for their oral situation.

0168

Investigation of Hydration, Leaching and Cushioning Effects of Denture Adhesives

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Objectives Previously, formulation understanding of denture adhesives was mainly focused on "hold". There is therefore a lack of knowledge about other properties such as speed of hydration, leachability and stress absorption capability, which could contribute significantly to in-mouth usage experience. This study aimed to investigate the hydration rate and leachability of two denture fixatives composed of different polymer systems, and assessed their cushioning effects in an artificial jaw.
Methods Denture adhesives based on either poly(methyl vinyl ether-maleic anhydride) copolymer (PVM/MA) or poly(acrylic acid) (PAA) were tested. For the hydration and leachability assessment, a strip of adhesive with fixed bandwidth was placed between two glass slides. The sample was then immersed in deionized water with images taken for up to 8 hours. Hydration bandwidths were measured hourly. Organic materials leached into water were analyzed over the 8-hour period using gas chromatography with flame ionisation detection (GC-FID). To determine the cushioning capability of the adhesives, formulations were applied between a denture and the artificial jaw. Force was applied to the denture while transferred strains on the gum mimicking layer was captured using a Digital Image Correlation (DIC) system.
Results At 4 hours, PAA based denture adhesive hydrated with bandwidth increased by a mean of 740µm, whereas PVM/MA based adhesive hydrated by 2250µm. Over 8 hours, a mean of 15.20mg/g of organics were leached from the PVM/MA based adhesive; in contrast, only 4.35mg/g was leached from the PAA based formulation. When applied onto a denture, both adhesives demonstrated a cushioning effect with less strain transferred to artificial gum compared the "no adhesive" control.
Conclusions This study enabled a comprehensive analysis of denture adhesive properties. The results allowed differentiation between distinct formulations and can potentially better predict in-mouth usage profile of adhesives.

0169

Development of a Novel Denture Adhesive Performance Test Model

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Objectives To develop an *in vitro* adhesive strength test model on a Texture Analyser imitating human mastication to determine the meaningful force required to separate two denture-like (PMMA) disc surfaces in the presence of a denture adhesive formulation, and give an indication of the clinical bite force.

Methods The Instron Texture Analyser was equipped with an automated spray system to achieve controlled hydration of adhesives between the PMMA discs through intermittent spraying upon controlled dislodgement. The adhesives underwent 24 cycles of imitated chewing and relaxation between two PMMA discs with each cycle lasting approximately 2.5 minutes, and automated spraying of deionised water to imitate saliva flow.

The maximum force, time, compressive extension, cycle count, and loop count dislodgment values were obtained through the method created in the Bluehill software. This raw data was further analysed to determine Work of Adhesion and Adhesive Layer Thickness values to give an indication of the swelling/disintegration capabilities through changes in the adhesive layer thickness as well as the adhesive performance of a denture adhesive over time.

Seven denture adhesives previously tested in clinical studies were tested in the developed in vitro system(n=3);

The mean work of adhesion integral and the mean bite force data (collated from clinical reports) integral of the selected adhesives were calculated to plot a predictive model.

Results A positive relationship was seen with the resultant graph, with a correlation coefficient, r = 0.97 (see Figure 1).

Conclusions A robust in vitro model was developed which allows early indication of adhesive performance in bite force clinical studies.

0170

Incidence of Partial Edentulism at the Egas Moniz Dental Clinic

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Objectives Evaluate the prevalence of parcial edentulism among a goup of patients of the Egas Moniz Dental Clinic, according to Kennedy classification, age, gender, and prosthodontic treatment.

Methods All clinical charts (240) of the prosthodontic clinic between September 2014 and June 2015 were evaluated and characterized by: age, sex, Kennedy classification and type of rehabilitation concluded. A descriptive statistical analysis with crosstabs procedures was applied to check frequencies using the SPSS Statistics 20.0 software

Results 73 records with fabricated removable partial dentures (RPD) were selected . A total of 95 RPD were delivered. Average age was 59. Women was the largest gender (68.4%) and younger. Kennedy's class III the most common (43 %) while class IV the most uncomon (3,2%). There was a higher incidence in the mandibular arch (52,6%). Cobalt chrome alloy(Cr-Co) was the most prevalent infrastructure (55,8%) and most used on Kennedy class III patients. The number of teeth replaced by acrylics was higher than Cr-Co regardless of gender.

Conclusions Kennedy class III and metal framework RDP are the most frequent. Average number of teeth replaced by acrylics was higher regardless of gender. Most of edentulous arches are in the mandible.

0171

Salivary Interleukin Levels in Patients with Sjogren's Syndrome.

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Objectives To determine salivary levels of interleukin 4 (IL4), 5 (IL5) and 6 (IL6) in subjects with primary Sjögren's Syndrome (pSS) and to compare them to a healthy control group (HC).

Methods A Case-control study was conducted. Patients with pSS were recruited from the postgraduate programme of Oral Medicine of the School of Dentistry at Complutense University of Madrid. All pSS patients were diagnosed according to the European-American Consensus of 2002 criteria. HC patients were matched in age and sex to the pSS group. All patients were recruited from December 2015 to March 2018.

Stimulated whole saliva was used to detect ILs levels. Levels of ILs were measured using high-sensitivity multiplex map human immunoassays (Millipore® corporation, Cat. # HSTCMAG-28SK, Billerica, MA, USA) through the Luminex-200 System and the XY platform (Luminex® Corporation, Oosterhout, the Netherlands). The obtained results were analyzed with xPonent® software and were expressed as picograms per milliliter (pg/ml). The detection limits were 1.24 pg/ml, 0.46 pg/ml and 0.11 pg/ml for IL4, IL5 and IL6, respectively.

Results Thirty-six patients with pSS and 35 HCs were included (all women, 56.58 ± 12.35 years and 54.40 ± 9.16 years,

respectively). IL4 and IL5 were not detectable in any group. IL6 was statistically higher in pSS patients than HC (9.73 ± 23.45 vs 0.93 ± 2.70, p = 0.0001). IL6 was statistically higher in pSS patients who had positive salivary gland biopsy (10.83 ± 30.41 vs 0.83 ± 30.41, p = 0.04) and a decrease in unstimulated whole saliva flow (19.11 ± 34.07 vs 3.02 ± 6.01, p = 0.02).
Conclusions The detection of IL6 in saliva is a non-invasive test that may be a useful biomarker to diagnose and monitor the progression of patients with pSS.

0172

Salivary Opiorphin is Dependent of Pain Intensity in Chronic TMD Patients

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Objectives Opiorphin is pentapeptide that inhibits pain perception in humans. It can be isolated from body fluids, including saliva. The cause of temporomandibular disorders (TMD), the most common orofacial painful condition of non-dental origin, is largely unknown. The aim of the study was to measure the level of opiorphin in whole unstimulated saliva in chronic TMD patients and to compare the results with healthy control group. We hypothesized that higher opiorphin levels, due to reaction to chronic pain, can be expected in TMD patients, and that opiorphin levels would differ among patients depending of pain intensity, determined using graded chronic pain scale.
Methods Saliva samples were obtained from 13 high pain intensity (HPI) TMD patients, 9 low pain intensity (LPI) TMD patients, and 11 pain-free control subjects. The presence of TMD was determined by DC/TMD questionnaire. Originally developed and validated LC-MS/MS method was used for opiorphin quantification.
Results There was no statistically significant difference in age (F=0.06, p=0.94) between the three groups. The mean pain intensity for the LPI group was 37.88 while for the HPI group, it was 66.75 and statistically different (p=0.013). The average concentration of opiorphin in HPI, LPI and control group were 3.23, 0.93 and 1.35 pg/ul, respectively and differ significantly between groups (Kruskal-Wallis H test p=0.013). Opiorphin in HPI TMD patients was significantly higher, compared to LPI patients (Z=-2.87; p=0.004) and to control (p<0.05). Opiorphin levels of LPI TMD and control patients did not differ significantly.
Conclusions We found significant increase of opiorphin in saliva of chronic TMD patients with high pain intensity, compared both to control group and to low intensity pain patients. Increased opiorphin secretion rate probably occurs secondary to chronic pain stimuli, and seems to be dose-dependent on the stimulus size. Study showed similar pattern of opiorphin behavior as we previously observed in burning mouth syndrome.

0173

A Protein Profiling Strategy for Periodontal Disease Applications: the Perio-SalivaPRINT

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Objectives It is known that several clinical situations have characteristic molecular deregulations. Some molecular data underlying these deregulations can be found in saliva and have been annotated in databases (SalivaTecDB). Strategies are needed to identify the phenotypes characteristic of these deregulations. Our group has developed a strategy that allows the establishment of saliva protein profiles reflecting different conditions (health and disease). These profiles can be integrated to clinical data (SalivaPRINT Toolkit). The present work aims to identify the Periodontal Diseases (PD)-specific protein profiles.
Methods Unstimulated whole saliva was collected from a group of healthy subjects and a group of PD patients (with gingivitis, periodontitis or periimplantitis). Salivary proteins were separated by the Experion™ automated capillary electrophoresis. The protein profiles of each condition were integrated with the corresponding protein data retrieved from our in-house database (SalivaTecDB).
Results The strategy used enabled the determination of a total protein profile from saliva characteristic of each PDs -the Perio-SalivaPrint. The use of the SalivaPrint Toolkit allowed the identification of molecular weight ranges altered in PD. Using SalivaTecDB we were able to suggest proteins potentially involved in the underlying dysregulated mechanisms of the disease.
Conclusions This approach enabled the determination of a Perio-SalivaPrint – protein profiles specific for gingivitis, periodontitis or periimplantitis - that could empower the use of saliva as a simple and less expensive diagnostic and monitoring fluid. The strategy presented could be an important tool for future applications in the early diagnostic/ screening of Periodontal Disease patients with applications in chairside monitoring.

0175

Effect of Smoking Intensity on Whole and Minor Saliva Secretions

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Objectives Our aim was to investigate the possible effects of smoking intensity on salivary parameters (whole saliva and minor salivary gland flow rates) among smoker and non-smoker male and female patients in different age groups in Hungary.

Methods 901 patients (age range:18-92 years, 58.3% females) were involved in the study, and were categorized into non-smoker (NS), light smoker (LS, 1-10 cigarettes per day – CPD), and moderate or heavy smoker (MHS, more than 11 CPD) groups according to self-report. Unstimulated whole saliva flow rate (u-SFR) was measured by the spitting method, while palatal (PS) and labial (LS) minor salivary gland flow rates were measured using the Periotron method. Data were analyzed using independent samples t-test, and one-way ANOVA at a significance level of $p<0.05$.

Results 35.9% of our sample were smokers (43.4% of males and 30.5% of females). Regarding smoking intensity, 51.3% of females and 60.7% of males were MHS. u-SFR values of NS, LS and MHS females were 0.39±0.30 ml/min, 0.4±0.29 ml/min, and 0.39±0.28 ml/min, respectively, while for NS, LS and MHS males were 0.52±0.4 ml/min, 0.60±0.36 ml/min, and 0.56±0.37 ml/min, respectively. A significantly lower u-SFR was measured for MHS females (0.29±0.21 ml/min) compared to NS females (0.50±0.30 m/min) in the age group of 20-29 years ($p=0.02$). Among MHS males in the age group of 30-39 years, a significantly higher palatal secretion (3.83±2.42 µl/cm^2/min) was registered compared to NS (1.42±0.21 µl/cm^2/min) and LS groups (1.33±0.95 µl/cm^2/min), respectively ($p=0.03$). No other significant differences have been recorded in the salivary parameters of NS, LS and MHS males and females in other age groups.

Conclusions According to our results, higher intensity of smoking may decrease whole saliva secretion among females in younger age groups, however, we could not detected any effect of smoking intensity on minor salivary gland secretions in other age groups.

0176

***Streptococcus Mutans* and *Lactobacillus* in Saliva of People Aged 20-35**

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Objectives A high number of the cariogenic bacteria *Streptococcus Mutans (SM)* and *Lactobacillus (LB)* ≥ 105 CFU / (number of colony forming units) in ml of saliva is one of the risk factors for dental caries. People who have caries and high levels of MS in the saliva can transmit bacteria through saliva e.g. to children by licking the teat. Early bacterial colonization of the milk teeth may cause early bacterial colonization of permanent teeth.

Analysis of the number of *Streptococcus Mutans and Lactobacillus* in the saliva in women and men aged 20-35.

Methods The studies were conducted in the group of 45 women and 29 men aged 20-35, who reported for treatment at the Chair and Department of Conservative Dentistry with Endodontics of the Medical University of Lublin. Assessment of *Streptococcus Mutans* and *Lactobacillus* was performed by using CRT bacteria test (Ivoclar Vivadent, Liechtenstein) according to the manufacturer's instructions. Statistical analysis was conducted with the use of Chi^2 test. Statistically essential were test values of $p<0.05$. The research project obtained the positive opinion of the Bioethics Board of the Medical University of Lublin.

Results In the group of women high number of SM bacteria was stated in 37,8%, low in 62,2%.

For men, the values were 24.1% and 75.9%, respectively. There were no significant differences in the number of MS in the saliva of women and men ($x2 = 1.50$, $p > 0.05$).

A high number of LB was stated in 44,4% of women and 37,9% of men. Low number in 55,6% and 62,1%, respectively. There were no significant differences in the number of LB in women and men ($x2 = 0.31$, $p > 0.05$).

Conclusions Between groups of women and men aged 20-35, there were no significant differences in the number of *MS* and *LB* in the saliva. It is desirable to conduct further research in a larger population of caries risk factors, taking into account the sex of the individuals.

0177

Buffer Capacity of the Saliva in People Aged 20-35

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Objectives The low buffer capacity of the saliva is one of the risk factors for the development of dental caries and non-carious lesions.Assessment of the salivary buffer capacity value in people aged 20-35.

Methods The investigated group included 74 people aged 20-54 (45 women, 29 men) who reported for treatment at the Chair and Department of Conservative Dentistry with Endodontics of the Medical University of Lublin. The age of people ranged from 20 to 35 years (46 people aged 20-24, 28 people aged 25-35).

The study material was mixed, stimulated saliva which was collected between 9.30-11.00 a m, 1.5-2 hours after meal. Saliva buffer capacity assessment was performed with the use of CRT buffer test (Ivoclar Vivadent, Liechtenstein). Obtained study results were submitted to statistical analysis with the use of Chi^2 test. Test values of $p<0.05$ were considered statistically significant. The research project obtained positive opinion of the Bioethics Board of the Medical University of Lublin.

Results High salivary buffer capacity was stated in 78.3% of people aged 20-24 and 53.6% of people aged 25-35. The medium

salivary buffer capacity was reported in 19.6% and 35.7%, respectively. Low salivary buffer capacity was reported in 2.2% and 10.7%, respectively. There were significant differences in the saliva buffer capacity in relation to the age of the subjects ($\chi 2$ = 5.66, $p < 0.05$).
Conclusions The saliva of people aged 20-24 had more often high buffer capacity compared to people aged 25-35.

0178

IL-1β: Determinant of Destruction Extent in Asymptomatic Apical Periodontitis

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Objectives IL-1β is a key regulator of the immunoinflammatory response to microbial infections. Marginal and apical periodontal diseases are local inflammatory reactions to bacterial challenge presented by the periodontal and endodontic microbiota, respectively. The dynamics of chronic marginal periodontitis are determined by the nature of the immunoinflammatory response, IL-1β being a potent inducer of the consequent tissue destruction. Whether it plays the same role in the pathogenesis of asymptomatic apical periodontitis (AAP), however, remains unexplored. The aim of the study was to compare IL-1β production by peripheral blood mononuclear cells (PBMCs) from patients with AAP and the destruction extent of the lesion.
Methods Patients (n=20) diagnosed with AAP were enrolled in the study. The initial assessment of the lesions' characteristics (size, volume, borders, density) was performed with limited-volume cone beam-computed tomography images (limited FOV CBCT). Peripheral blood samples were obtained from the patients for the isolation of PBMCs. The cells were cultivated in RPMI 1640 medium and stimulated with *E.coli* LPS. The supernatant was collected at 24 and 48 hours and IL-1β levels were determined by ELISA.
Results IL-1β levels were lower at the 48-hour time point compared with the 24-hour time point. IL-1β levels detected in the supernatants of LPS-stimulated cultures of PBMC correlated positively with the lesion volume ($p<0.05$).
Conclusions PBMCs isolated from patients with more extensive lesions produced higher levels of IL-1β. We suggest that increased IL-1β concentration illustrate tissue destruction and the accompanying inflammation in AAP.
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0179

How to Evaluate Bioactivity of Bioactive Glasses?

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Objectives Nowadays, the original composition and manufacturing method of bioactive glasses (BAG) are modified to create mesoporous BAG, to change particles size (nano or micro-scale) or to add additives. It is necessary to characterize these type of particles, especially their bioactivity. The objectives of this systematic review are: to identify the different methodology used to quantify bioactivity, to rank the bioactivity of different bioactive glasses and to suggest the best way to compare bioactivity of other bioactive dental materials.
Methods An electronic search was performed using PubMed database, Science direct, Web of science, Cochrane and Scopus databases by two independent reviewers. Data were collected using the equation (Dental OR tooth* OR teeth OR enamel* OR dentin* OR dentine OR cementum) AND (bioactive glass OR bioactive glasses OR bio-active glass OR nanobioactive glass OR 45S5 OR bioglass OR BAG) AND (mineralization OR mineralisation OR bioactivity) and the time interval was 1999-2019. This systematic review vas conducted in accordance with the PRISMA guidelines. The following data were recorded: BAG investigated, the objective, the criteria, the method and result.
Results On the 586 eligible papers from the initial search, 22 studies have ben find to meet the inclusion criteria and have been included.
Conclusions The bioactivity of BAG can be evaluate *in vitro*: in solutions or in contact with cells by qualitative or quantitave analysis or *in vivo*, by histological analysis. Currently, there are only two in vivo studies. To tend to clinical situations, it is essential to develop predictive studies and to compare the bioactivity of BAG with other bioactive dental materials (Biodentine, MTA, Calcium Hydroxyde…).

0180

Effectiveness of Stabilization Splint Compared to Placebo in Temporomandibular Disorders

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Objectives Stabilization splint is frequently recommended treatment for temporomandibular disorders (TMD). Although its role in TMD management is unclear, it might be attributed to various factors, including increase of vertical dimension, change of condylar position but also a placebo effect. In this randomized clinical trial aim was to compare long-term effectiveness of stabilization splint (SS) with that of placebo in TMD treatment. Differences in treatment outcomes based on diagnostic subgroups [disc displacement(DD)/myofascial pain(MP)] were also investigated.
Methods Thirty-two female patients, diagnosed with chronic TMD, were classified in treatment groups: one provided with SS (made in centric relation, 2mm thick at first-molar level) and other with placebo (0.5mm thermoforming-foil). Six-month follow-up was carried out. Treatment outcomes included spontaneous pain [visual analogue scale(VAS)], maximal comfortable mouth opening (MCO), self-perceived quality of life (OHIP-14) and level of perceived stress (PSS). Repeated-measurements ANOVA was used, with time (within factor), and treatment group and diagnostic subgroup (between factors).
Results At baseline there wasn't significant difference between groups for all measured parameters. Significant reduction of VAS and OHIP-14 scores over time was observed (p=0.0001, p=0.001 respectively); effect of treatment differed significantly between treatment groups, with greater reduction of VAS and OHIP-14 scores in SS comparing to placebo group (p=0.004, p=0.01 respectively). At all time points, MCO values were higher in SS comparing to placebo group (p= 0.03) and in MP comparing to DD (p= 0.03).
Conclusions Study showed reduction of spontaneous pain followed by improvement of self-perceived quality of life in SS and placebo group, however in SS group the improvement of VAS and OHIP-14 scores was present at all time points, while in placebo only short-term effectiveness was observed. Significantly higher values of MCO were present in SS and MP groups. Although placebo might be contributing factor in management of TMD it likely cannot maintain constant long-term positive therapeutic effect.

0181

Magnetic Nanocomposite Substrates for Bone Tissue Engineering.

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Objectives
The use of magnetic scaffolds based on polymer matrix and magnetic nanoparticles (MNPs) represents a promising strategy for bone regeneration. The aim of this research was the development of magnetic substrates based on a poly(Ɛ-caprolactone) (PCL) matrix and iron oxide (Fe_3O_4) nanoparticles to enhance hard tissue regeneration.
Methods Polymeric and nanocomposite substrates were manufactured by processing PCL/Fe_3O_4 (80/20 w/w) pellets through melting and molding. Polymeric PCL substrates were used as control. Appropriate measurements were performed to evaluate morphology, surface topography and magnetic features. Furthermore, cell-laden substrates were stimulated through a discontinuous magnetic field (6 h per day, 20 intervals - 18 min each) to assess the effects of the magnetic field on cell-material interactions. The biological performance of mesenchymal stem cells (hMSCs) seeded on magnetic nanocomposite substrates was evaluated through confocal laser scanning microscopy and AlamarBlue assay to provide qualitative and quantitative information on cell adhesion and viability/proliferation, respectively. Moreover, the ALP/DNA assay was used to evaluate the ability of the nanocomposite substrates to promote osteogenic differentiation. The significance of differences between measurements was evaluated by ANOVA test.
Results In comparison with polymeric substrates, the results showed a significant increase ($p<0.01$) of cell adhesion and proliferation for nanocomposite substrates at 14 days from seeding (28.5 % of Alamar blue reduction). With regard to stimulated and unstimulated nanocomposite structures, an early differentiation at 7 days (ALP activity 984.5 ng/[DNA]µg) and a differentiation which was prolonged over time (up to 21 days-1,360.7 ng/[DNA]µg) were observed for nanocomposite magnetically stimulated substrates.
Conclusions
These findings would seem to be the result of a synergistic effect of the surface chemistry, topography and the application of an external magnetic field. Benefiting from the obtained results, further analyses will be performed on 3D additively manufactured magnetic scaffolds.

0182

Influence of Dental Prophylaxis in Tooth Color L*a*b* Values

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Objectives To evaluate dental prophylaxis (DP) influence in tooth color L*a*b* values assessed by a spectrophotometer.

Methods For this diagnostic study, seventy volunteers were consecutively screened according to appropriate inclusion/exclusion criteria. Tooth color assessment was performed by a spectrophotometer, Spectroshade (SS) (MHT Optic Research, Italy; serial number HDL3973) in both upper incisives (11, 21) and canines (13, 23) of each patient. Previous to DP procedure, two measurements were performed to evaluate reliability and baseline ΔE for the SS. One week after DP, measurements with SS were done in order to determine changes in tooth color. Results are presented as mean ± standard deviation (SD) of CIE L*a*b* values and ΔE of global and individual teeth. SS reliability was assessed by intraclass correlation coefficient (ICC). Differences between baseline and after DP measurements were analysed with Student paired t Test with significance level set at α= 0.05. The perceptibility and acceptability thresholds values were considered as ΔE=1.2 and ΔE=2.7, respectively.

Results Sixty-six patients were included. ICC values obtained excellent reliability ranging between 0.76-0.98. Global ΔE mean value ± SD after DP was 1.68±1.47 while individual teeth values were 1.51±1.05, 1.93±1.71, 1.59±1.42 and 1.70±1.59, respectively for 11, 13, 21 and 23. Paired t test revealed a significant difference (P≤0.01) between ΔE mean value at baseline control (1.08±0.86) and after DP (1.68±1.47). After DP, a decrease in b* values was detected in all teeth, although without significant differences when compared to baseline.

Conclusions After performing dental prophylaxis, tooth color values presented a statistically significant difference in ΔE units detected by a spectrophotometer.

0183

Dentinal Temperature and Deformation in Premolars Restored by Bulk-fill Material

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Objectives The aim of this study was to compare the cuspal strain and dentinal temperature variation in mesio-occlusal-distal (MOD) cavity restored by bulk-fill technique compared to conventional incremental technique.

Methods 20 extracted premolars were collected and stored in 0.5% thymol at 5 °C. They were stabilized in metal cylinders and divided into two groups (n = 20). Specimens received standardized MOD preparations and were restored according to the following protocols: SDR flow applied in 2mm increments (Group 1); SDR flow applied in bulk fill (Group 2). K-type single-use thermocouples were used to measure temperature profiles. Thermocouples were placed in a standardized hole created within each premolar 1 mm below the cavity floor.

Each specimen was heated at 35°C through the ThermBlock system (FALC), and this temperature was kept constant during the test. An Instron extensometer was used to measure distances between cuspals during the polymerization and post-polymerization processes. The EMS Swiss Master Light lamp 1000 mW/cm^2 operating for 20 s was used for the polymerization process. Temperature, cuspal distance and light intensity signals were acquired for one hour using the Signal express software (National Instruments). Data were subjected to statistical analysis (t-test).

Results Polymerization of SDR caused an increase of dentinal temperature. No significant differences between Group 1 and Group 2 were recorded. Group 1 (SDR incremental technique) had a higher mean deformation value ($p<0.05$) than Group 2 (SDR bulk fill technique). The decrease of cuspals distance was higher in Group 1 compared to Group 2.

Conclusions Our results demonstrated that bulk fill and conventional incremental technique caused a similar temperature increase at the cavity floor which is not significant to affect pulp tissue. Moreover, we showed that the premolar cuspal deformation is related to the restoration technique used.

0184

Accuracy of Biomarkers in Gingival Crevicular Fluid and Saliva for the Diagnosis of Periodontitis: A Meta-analysis

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Objectives This study aimed to analyse, using a meta-analytical approach, the diagnostic accuracy of molecular biomarkers in gingival crevicular fluid (GCF) and saliva for the detection of periodontitis in systemically healthy subjects.

Methods Studies on molecular biomarkers detected in GCF and saliva providing a binary classification table (or sensitivity and specificity values and group sample sizes) in individuals with clinically diagnosed periodontitis were considered eligible. The search was performed using six electronic databases. The methodological quality of studies was assessed through the tool Quality Assessment of Diagnostic Studies. Meta-analyses were performed using the Hierarchical Summary Receiver Operating Characteristic, which adjusts the classification data using random-effects logistic regression.

Results Meta-analyses were possible for 4 and 5 out of 36 and 32 potential biomarkers identified in GCF and saliva, respectively. In GCF, the estimates of sensitivity and specificity were: for matrix metalloproteinase (MMP) 8, 75.8% and 92.9%; for elastase, 78.3% and 76.1%; for capthesin, 75.2% and 71.0% respectively. The worst values of sensitivity and specificity were for trypsin (69.8% and 68.2%, respectively). In saliva, the highest value of sensitivity for the diagnosis of periodontitis was obtained for

interleukin (IL) 1beta (78.7%), followed by MMP8 (72.5%), IL6 and haemoglobin (72.0% for both molecules); the lowest sensitivity value was for MMP9 (70.3%). In terms of specificity estimates, MMP9 had the best result (81.5%), followed by IL1beta (78.0%) and haemoglobin (75.2%); MMP8 had the lowest specificity value (70.5%).
Conclusions MMP8 and elastase are the most researched GCF biomarkers in the diagnostic accuracy field of periodontitis, while in saliva they are MMP8 and IL1beta. In GCF, MMP8 shows good sensitivity and excellent specificity which results in this molecule being clinically the most useful or effective diagnostic biomarker of periodontitis. In saliva, IL1beta and MMP8 present good sensitivity and specificity and clinically fair effectiveness for the diagnosis of periodontitis.

0185

Surgical and Laser-assisted Treatments of Gingival overgrowth and Inadequate Vestibular Depth

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Objectives We present the surgical and laser-assisted periodontal therapy of a case who has generalized chronic inflammatory gingival overgrowth and consequently needs orthodontic treatment.
Methods A 12-year-old female patient presented to our clinic with gingival overgrowth. She has esthetic and functional problems and is complaining spontaneous bleeding during function. In the intraoral examination, generalized gingival overgrowth was detected in four quadrants. In addition, inadequate vestibular depth in the lower jaw was also determined.After initial periodontal treatment, gingivectomy was performed in two appointments for the lower and upper jaw. Vestibuloplasty was performed for lower jaw from right first premolar to left first premolar using diode laser (wavelength: 940 nm; 400µmfiber tip, power: 5.0 W; pulse length:0.05 ms; pulse interval:0.20 ms). Clinical records for periodontal parameters and photographs were taken at baseline, after first and three months.
Results Wound healing of the cases was uneventful. Physiological gingivalcontour and gingival health was provided after surgeries. Ideal vestibular sulcus depth was obtained. After 1 month, orthodontic treatment was started. Patient maintained her oral health during orthodontic treatment. Follow-up periods were programmed every 1 month until to 6 months after surgery and then every 3 months.
Conclusions Oral and periodontal health of patient was provided with surgical and laser-assisted periodontal therapy. Continuous motivation of the patient for oral care plays a critical role for maintaining results. Periodontist and orthodontist collaboration is also very important in the success of the treatments.

0185.1

Salivary Cytokine-based Predictive Models to Estimate the Probability of Periodontitis Differentiating by Smoking Status

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Objectives This study aimed to obtain salivary cytokine-based models to predict the probability of chronic periodontitis, differentiating by smoking habits
Methods A sample of 152 participants was recruited, including 72 periodontally healthy controls and 80 subjects affected by chronic periodontitis. Twelve mediators were measured in salivary samples using the Luminex 200™ instrument: GMCSF, IFNgamma, IL1beta, IL2, IL4, IL5, IL6, IL10, IL12p70, IL13, IL17A and TNFalpha. Cytokine-based models were obtained using multivariate binary logistic regression, distinguishing between non-smokers and smokers. The area under the curve (AUC) and numerous classification measures were obtained.
Results IL1beta was the only cytokine predictor of those analysed present in the one- and two- variable models, both in non-smokers and smokers. As a single biomarker, IL1beta showed AUC values of 0.757 for non-smokers and 0.687 for smokers. In both smoking conditions (non-smokers and smokers), in the two-variable models, IL1 beta was associated with IL13 (AUC= 0.780 and 0.708), TNFalpha (AUC= 0.769 and 0.766) and IFNgamma (AUC=0.763 and 0.711).
Conclusions IL1beta in saliva shows an acceptable ability to discriminate periodontitis patients from periodontally healthy individuals, increasing this ability when associated with other salivary cytokines. The smoking status reduces the discriminatory potential of salivary IL1beta, alone or in combination with other cytokines, for the diagnosis of chronic periodontitis.

0186

Evolution of impression taking – new impression materials in digital times?

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Although the digital impression is gaining more and more importance an often discussed, it is still not widely used in daily practice. On the other hand, various manufacturers seem to revert to conventional materials and conventional impression technologies and visibly increase their efforts in their further development and improvement. Against this background, for all those working in the field, the question arises where does the journey go? Will everything be digital or will it be conventional and we are now in the transient state? Or is the future offering a split-up in between digital and conventional techniques dependent on the indication? In this field of tension, the specific problems of conventional and digital impression techniques will be analyzed and the actual developments in both areas described and their strengths and weaknesses scrutinized. In this regard, different aspects as impression accuracy, possible indications, limitations, actual improvements of conventional impression materials, digital techniques and the optimization of the entire workflow from the impression to the final restauration will be discussed. The lecture makes a position assessment and shows the essential success-relevant parameters of analog and digital impression methods.

0187

Digital technologies and monolithic materials - an ideal synergy?

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In the dental world currently two megatrends are in focus – one is the digital revolution in technology – the other one is the minimal invasive “close-to-nature-dentistry”. The current development goes far beyond intraoral scanners or the fabrication of dental restorations and is strongly supported by new innovative materials. Especially in the field of monolithic restorations in the digital workflow, dentists, dental technicians and patients have access to a wide range of new treatment strategies and potential. However whenever applying new materials and workflows, we need to understand the potential and also limitations very well to estimate, what is possible.

The presentation discusses the application of up-to-date technology, like intraoral scanners, 3D face-scanners, milling technology and 3D printers in combination with innovative polymer and ceramic materials and introduces new concepts and their integration into our daily work- and life environment. On the basis of scientific data the lecture also gives you specific, necessary clinical information and practical tips.

0188

The de-stressed smile: low shrink chemistries for modern resin composites

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Increased light transmission of modern, so-called “bulk fill” dental resin composites is primarily achieved by a reduction of pigment concentration, improved photoinitiator chemistry or optical properties and morphology of filler particles. However, materials with high translucency may not offer optimal material-tooth shade matching options and currently there are limited alternatives to improve light transmission for other shade options. Whilst conventional multi-incremental resin composites provide a better selection of shade matching options, the stress-relieving chemistry of modern bulk fill materials may significantly improve polymerisation induced shrinkage stress in the former. Consequently, the aim of the project was to examine shrinkage stress development of a new material, which utilises stress relieving chemistry and is also available in a large variety of shade options. The presentation will also discuss the main factors that contribute to limited cure depths in light polymerized resin composite systems and that the duration of light exposure is the most important aspect for effective polymerization.

0189

A clinical perspective on dentine hypersensitivity: the root of the problem

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Dentine hypersensitivity (DH) is a common oral condition with a multi-factorial aetiology in which sufferers experience a short intense pain in response to a trigger such as pressure or temperature, cold air or food most often causing sensitivity. The hydrodynamic mechanism theory is used to explain DH. For teeth to be sensitive dentine must be exposed and the dentine tubules patent thus permitting increased fluid flow in tubules on stimulation. Dentine exposure may be achieved by toothwear removing enamel from the crown or by gingival recession exposing cementum which is then rapidly abraded away. Newly exposed dentine becomes patent when the smear layer is removed from the surface of dentine which often occurs in response to an acidic challenge such as orange juice.

As with all conditions, primary prevention directed towards aetiology would be ideal. In the case of DH, dental professionals should advise their patients to limit the frequency and duration of dietary acid intake, and recommend brushing either before or

a few hours after dietary acid intake to reduce the risk of erosive toothwear.
Treatment of DH is recommended to include the following steps:
1) Correct diagnosis based on history and clinical examination
2) The ruling out of alternative or additional causes of dentinal pain.
3) Identification of dietary and oral hygiene habits relevant to erosion / abrasion and gingival recession.
4) Offering of oral hygiene and dietary advise
5) Recommendation of home-use products proven to relieve DH including those that occlude dentine tubules.
In conclusion, Dentine Hypersensitivity is a common condition which is increasing in prevalence as people live longer and maintain their natural dentition. Clinicians therefore need to be able to diagnose accurately and advise their patients appropriately.

0190

Dentine hypersensitivity and its impact on the quality of life

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When simple, daily activities, whether it is drinking, toothbrushing or even talking, can trigger short, intense tooth pain arising from the exposed dentine, it is of common sense to reason that dentine hypersensitivity can have an impact and poses significant restrictions on an individual's life. But, does it really? What do research and data tell us about the association of dentine hypersenitivity (DH) and Oral Health Related Quality of Life (OHRQoL), and can we provide our patients relief with treatment? atient-centred approach is fundamental when assessing DH. This condition, that seems to affect a third of our patients, is highly subjective. The experienced pain greatly varies according to the person's pain tolerance and perception, and thus differently affects their quality of life. OHRQoL cannot be measured with traditional tools, clinical indicators and indices - instead, we employ questionnaires, general or condition-specific, such as Dentine Hypersensitivity Experience Questionnaire (DHEQ). Current data demonstrates a clear interconnection between DH and OHRQoL impairment, as well as that a successful treatment can lead to its improvement.
While focusing on DH, we will scratch the surface of patient-centred care and give an answer to why treatment of DH encompasses much more than mechanical procedures we provide in its treatment in our daily practice.

0191

The prevalence of dentine hypersensitivity in Europe and its impact on periodontal and dental health

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DH is a clinical oral health problem that affects the adult population, and its worldwide prevalence is high.
Early research reported that all age groups are affected, with an age peak ranging from 30 to 40 years.
Regarding gender, women tend to be more frequently affected than men.
In general, maxillary teeth seem to be more affected than the mandibular ones. Supposedly, the left side is more affected due to mostly right-handed brushing. Regarding the intraoral distribution, DH is mostly associated with exposed buccal dentin in permanent teeth. The distribution among teeth shows a higher number of premolars, canines and incisors. There is also a high preference for the buccal surfaces.
The potential etiological factors of DH are tooth wear erosion or abrasion and gingival recessions, which have a prevalence close to that of DH.On the other hand, the iatrogenic DH could be due to periodontal therapy (root planing and/or surgery), bleaching, or restorative treatment.DH has a huge impact on the long-term periodontal health and esthetics producing significant impairment on patients' daily life such as toothbrushing and interdental cleaning. The periodontal inflammation due to plaque accumulation and inappropriate oral hygiene then develops into a gingivitis and periodontitis leading to gingival recession. For periodontitis patients who exhibit post-periodontal therapy DH, it can be interesting to apply a prophylaxis paste to treat or prevent DH, because this can significantly enhance oral dental hygiene and periodontal healing and health.
Because the majority of dental and facial pain had a psychological or behavioral impact. The main complaint of numerous patients with gingival recession associated with DH is to obtain complete root coverage in order to solve their esthetical deficiency and DH, at the same time. This can be obtained by combined topical treatment and surgical root coverage. DH prevention and treatment represent key-factors for a long-term good periodontal health.

0192

Micro-shear Bond Strength of MDP Calcium- Fluoride Releasing Cement after Thermocycling

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Objectives The purpose of the present study was to investigate the micro-shear bond strength and failure mode of novel "MDP calcium-fluoride releasing" self-adhesive resin cement (TheraCem) with tooth structure (enamel& dentin) and yttrium stabilized zirconia after thermocycling and comparing the results with universal "non-containing MDP" self-adhesive resin cement (Relay X Unicem as a control)

Methods Enamel and dentin specimens (20 discs each) were obtained by using diamond saw (IsoMet 4000 linear Precision saw) with copious water coolant. Twenty zirconia plates were obtained from IPS e.max ZirCad blocks and sintered in an inFire HTC speed high-temperature furnace . Micro resin cylinders were created on the bonded surface and filled with the tested cements (n= 10 /substrate) group A (control) using non-containing MDP self-adhesive cement Relay X Unicem (3M ESPE) while group B using MDP calcium-fluoride releasing self-Adhesive resin cement TheraCem .Cements were left to self-cure for 5 minutes. All the specimens were thermocycled for 5,000 cycles (Thermocycler 1100 SD Mechatronik, GmbH). Micro-shear bond strength was measured using universal testing machine and debonded surfaces were examined for failure mode analysis using Scanning Electron Microscope (Quanta 250 Field Emission Gun, Netherlands) attached with EDX Unit (Energy Dispersive X-ray Analyses). The results were statistically analysed.

Results There was no significant difference between TheraCem (tested cement) (18.96±4.36) and RelyX (control) (12.18±3.13) (P=0.177). Within enamel, TheraCem (6.46±1.37) had a significantly higher (mean±SD) µ-SBS (Mpa) value than RelyX (3.04±0.99) (P=0.002). Similarly, TheraCem in dentine (10.67±1.27) had a significantly higher (mean±SD) than RelyX (6.46±1.74) (P=0.014). As for zirconia, TheraCem (39.76±1.18) had a significantly higher (mean±SD) µ-SBS (Mpa) than RelyX (27.04±1.92) (P<0.001)

Conclusions MDP calcium-fluoride releasing self-adhesive resin cement (TheraCem) may improve bond strength to all tested substrates (enamel, dentin and zirconia).

0193

The Effect of Air Plasma on the Bond Strength of Zirconia and Resin Cement

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Objectives The purpose was to analyze the effect of non-thermal air plasma treatment on shear bond strength and failure mode of self-adhesive resin cement to zirconia.

Methods Forty-eight zirconia plates were prepared from IPS e.max ZirCad blocks and classified into four groups (n=12) according to surface treatment; group CO (control) without any surface treatment, group SD was treated with 50 µm alumina sandblasting, group PL used air atmospheric pressure plasma device & group SP which was a combination of 50 µm alumina sandblasting followed immediately with atmospheric plasma treatment. Zirconia specimens were immediately centered with Relay X Unicem resin cylinders of 3.7 mm diameter and 2 mm height. Shear bond strength test was performed after water storage using a computer-controlled material testing machine. A scanning electron microscope was used to determine failure mode. Average surface roughness (Ra) was calculated with different surface treatments. Energy Dispersive X-ray (EDX) analysis was used for chemical changes evaluation. Data were analyzed with one-way ANOVA followed by Tukey's post hoc test when the ANOVA test was significant.

Results A significant difference between different surface treatments (P=0.010) was recorded with the highest shear bond strength value in SP group and the lowest value with untreated surface CO gp. All groups showed mixed failure mode which was mainly cohesive except for CO gp. Surface roughness was increased with sandblasting and decreased after plazma treatment.

Conclusions

Non thermal air plasma treatment can be used for increasing zirconia surface treatment especially when accompanied with 50 µm AL_2O_3 sandblasting.

0194

Development of Shear Bond Strength to Dentin of Self-Adhesive Resin Cements

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Objectives Recently, several manufacturers have launched new self-adhesive resin cements (SARCs), claiming excellent bond strength to the tooth surface. Shear bond strength (SBS) methods usually compare SBS after 24h or artificial aging. However, it is still unclear how quickly the bond strength develops. Therefore, this study compared initial SBS of SARCs with SBS after 24h and artificial aging.

Methods Calibra® Universal (CU, Dentsply), Experimental Cement (EXP, 3M), G-CEM LinkAce™ (GCLA, GC), Maxcem Elite™ Chroma (MEC, Kerr), Panavia™ SA Cement Plus (PSAC+, Kuraray), PermaCem 2.0 (PC2, DMG), RelyX™ Unicem 2 Automix (RXU2, 3M ESPE) and SpeedCem® Plus (SCP, Ivoclar) were tested. All cements were used according to manufacturers' instructions. Bovine teeth were ground flat to expose dentin, polished (grit 320 sandpaper), water-rinsed, and gently air-dried. Stainless steel rods (diameter=4mm) were sandpapered, sandblasted, silanized (ESPE™ Sil, 3M ESPE) and subsequently cemented (n=6) under standardized pressure (20g/mm^2). The cement was irradiated from 4 sides (10s each; Elipar™ S10, 3M ESPE). Specimens for

initial SBS were stored for 5 min at 36°C under pressure. Specimens for 24h were stored for 10 min at 36°C under pressure followed by additional 24h (36°C; 100% relative humidity) without pressure. Part of those specimens was subjected to artificial aging (thermocycling: 5000 cycles, 5°C-55°C). Shear bond strength testing was performed (Zwick Z010; n=6; speed=0.75mm/min). Data analysis was performed using One-Way ANOVA (Tukey; p<0.05).
Results see table.
Conclusions The Experimental Cement showed significantly higher initial shear bond strength (SBS) than all the other cements tested. In general, SBS increased after 24h with the Experimental Cement showing highest SBS. After artificial aging, bond strength dropped significantly for PermaCem 2.0, Panavia SA Cement Plus, and SpeedCem Plus while the other cements kept their bond strength level. The Experimental Cement showed significantly highest SBS after artificial aging.

0195

Bonding Performance of Different Resin Luting Materials to CAD/CAM Blocks

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Objectives To evaluate the microtensile bond strength (µTBS; MPa) of flowable composite, micro-hybrid composite and dual-cure resin cement used as luting materials to composite, hybrid-ceramic and feldspatic CAD/CAM blocks with and without additional universal adhesive application.
Methods Composite (Cerasmart, CS), hybrid-ceramic (Vita Enamic, VE; Vita) and feldspatic (Cerec, Sirona; CE) CAD/CAM blocks (n=3) were cut in slabs of 4mm thickness. While the surfaces of CS specimens were sandblasted, VE and CE specimens were etched with 5% HF that were followed by ceramic primer (GC). All the specimens from each CAD/CAM material were divided into two groups (n=18) according to additional adhesive application (G-Premio Bond, GC) (UA) or not. Slabs from each group were luted together either with flowable composite (G-aenial Universal Flo; GC, UF), micro-hybrid composite (G-aenial composite; GC, G) or dual-cure resin cement (Linkforce; GC, LF) and polymerized (Demi Ultra; 1100mW/cm^2). Following storage in distilled water at 37°C for 24 hours, µTBS was determined (Instron). Data were analyzed with three-way ANOVA and post hoc Tukey's tests (p<0.05).
Results µTBS was significantly influenced by the types of CAD/CAM material (p=0.0001), resin luting material (p=0.0001) and additional universal adhesive application (p=0.0001). A significant interaction between CAD/CAM materials and resin luting was found (p=0.008). VE+UF resulted significantly in the highest µTBS with (36.64±2.02 MPa) and without UA application (35.29±4.55 MPa) (p<0.05) which were not significantly different from each other (p>0.05). UF and LF exhibited similar µTBS to CS and CE with and without UA (p>0.05), while UA application significantly increased bonding in VE+G, CE+G and CS+G groups (30.51±3.54, 28.56±3.11 and 28.19±2.33 MPa respectively) (p<0.05).
Conclusions Flowable composite and dual-cure resin cement exhibit similar bonding effectiveness to composite and feldspatic CAD/CAM materials, while micro-hybrid composite without additional universal adhesive resulted in lower bonding performance to hybrid ceramic, composite and feldspatic CAD/CAM materials.

0196

Adhesion of an Experimental Universal Adhesive to Feldspathic Glass Ceramic

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Objectives Objectives: Aim of this study was to investigate the bond strength of an experimental universal adhesive (ADH-XTE, 3M) to feldspathic glass ceramic.
Methods Methods: Feldspathic glass ceramic blocks (Vitablocs Mark II, Vita) were etched with hydrofluoric acid (HF), rinsed with water and treated with an experimental universal adhesive (ADH-XTE, 3M), Scotchbond™ Universal (SBU, 3M), and the combination of the conventional silane RelyX™ Ceramic Primer and Scotchbond™ 1XT (RCP/SB1XT, 3M) according to manufacturers' instructions. As an experimental alternative to HF treatment, blocks were sandblasted with CoJet sand (3M) and treated with ADH-XTE.
A cylindrical button of Filtek™ Z250 A3 (3M ESPE, 2.36mm diameter, 2mm height) was cured on the samples (n=5), which were stored in water at 37°C for 24h. Shear bond strength (SBS) was tested using the notched-edge method according to ISO 29022:2013.
Results Results: The table shows SBS in MPa. The standard deviations (SD) are given in parentheses. SBS data were analyzed by ANOVA and multiple comparisons using Fisher's LSD procedure (p<0.05). Means with the same letters are statistically the same. Only cohesive failures in the blocks were observed.
Conclusions Conclusion: With both pretreatments, ADH-XTE afforded similar bond strength as the controls on HF etched substrates.

0197

Bonding Effectiveness of Luting Strategies of CAD/CAM Materials to Dentin

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Objectives The aim of this study was to evaluate the effect of composite, hybrid ceramic and feldspathic CAD/CAM materials and flowable; micro-hybrid composite and dual-cure resin cement used as luting material on micro-tensile bond strength (μTBS;MPa) to dentin.
Methods Composite (Cerasmart, GC; CS), hybrid ceramic (Vita Enamic, Vita; VE) and feldspathic (Cerec,Sirona; CE) blocks were cut in slabs of 4-mm thickness. VE and CE slabs were etched with 5% HF acid whereas CS slabs were sandblasted. All the specimens were conditioned with ceramic primer (GC). Mid coronal dentin of 36 extracted non-carious human third molars were standardized and randomly divided into three groups according to the CAD/CAM material which were further divided into three subgroups (n=4) in which the slabs were bonded to dentin using; highly filled flowable composite (G-aenial Universal Flo; GC; F), micro-hybrid composite (G-aenial; GC; M) and dual-cure resin cement (Linkforce; GC; LF) after application of an universal adhesive in self-etch mode (G-Premio Bond, GC) on dentin. Following storage in distilled water at 37°C for 24 hours, μTBS was evaluated (Instron). Data were analyzed with two-way ANOVA and post hoc Tukey's tests ($p<0.05$).
Results μTBS was significantly influenced by the type of CAD/CAM ($p=0.0001$) and type of resin luting material ($p=0.0001$). No significant interaction was found between this two variables ($p<0.0001$). VE+M and CS+M resulted in significantly lower μTBS (27.09±2.89MPa, 26.53±4.16 MPa) than VE+F and CS+F (33.73±4.16 and 30.78±3.08 MPa) ($p<0.05$), while no significant differences were evaluated between VE+M, CS+M and CE+M (24.90±3.09 MPa) ($p>0.05$). With all the CAD/CAM materials, LF and F exhibited significantly similar bond strength to dentin ($p>0.05$).
Conclusions Type of luting material and type of CAD/CAM block affect the bond strength to dentin. Highly filled flowable composite exhibits similar bonding effectiveness as the dual-cure resin cement for bonding of composite, hybrid ceramic and feldspathic CAD/CAM blocks to dentin.

0199

Treatment of Peri-implant Mucositis with Decontamination and Modification of the Implant Prosthesis to Facilitate Access to Oral Hygiene

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Objectives The present investigation is a randomized controlled clinical trial with a follow-up of 6 months with the aim of evaluate the resolution of inflammation in the peri-implant tissues and the stability of results, by improving access to hygiene / control of bacterial plaque (with the modification of the prosthesis supported by implants) and by providing personalized / patient-specific oral hygiene instructions.
Methods A sample of 48 patients receive a professional prophylaxis session of the entire mouth and specifically, in implants with the presence of mucositis, the mechanical instrumentation supra and subgingival with the prosthesis. Then, the patients are divided randomly into the control group and into the test group, in the latter a modification of the implant-supported prosthesis will be carried out to facilitate access to hygiene. In addition, individualized oral hygiene instructions are given to all patients included in the study.
The baseline clinical variables of plaque index, bleeding on probing, probing depth, suppuration and recession are compared with those obtained at month, 3 months and 6 months. The unit of analysis is at the patient level and the level of significance is set at 0.05 and the power at 80%.
Results After analyzing the results, it was observed that the reduction of the bleeding index is similar for both groups per month. This variable continued to decrease at 3 months in both groups, being higher in the test statistically significant. In addition, in the comparative analysis at 6 months, in the test group a value close to zero was reached, while the control group increased the rate of bleeding.
Conclusions The periimplant mucositis resolution is stable over time when a debridement is performed, modification of the implant prosthesis supported over-contoured and oral hygiene instructions are given.

0200

One-shot Nano-device for Treatment of Peri-implantitis: Biological Proof of Concept

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Objectives To compare biological effects of experimental nano device composed of nano-hydroxyapatite loaded with clindamycin, embedded in PLGA for continual release of daily MIC against Porphiromonas gingivalis for 21 days bone healing period (CLHap) with effects of nano-hydroxyapatite (Hap) and commercial bone substituent (BioOssÒ).
Methods 6 female beagle dogs with similar characteristics underwent teeth extractions, implant placement and ligature induced PI, and were further surgically treated. Following open-flap debridement, the biomaterials were randomly allocated to ensure the serial distribution of antimicrobial material for pharmacokinetic testing of antibiotic systemic release. The biochemical and microbiological markers were compared before disease induction (baseline), before the treatment (pre-op) and 3 months (3m) following treatment. GM-CSF, TNFa, IL-6, IL-10 and OPG concentrations were estimated using Luminex method, while the RT-

PCR kit was developed for quantification of the Porphyromonas gulae. Finally, following animal sacrifice, specimens were retrieved for histological analyses. Following fracture technique, decalcified samples were sectioned and stained for histomorphometric assessment of: apical extension of barrier epithelium (aBE), infiltrated connective tissue (ICT) area and respective apical extension (aICT).
Results The pharmacokinetic test confirmed safety of the experimental material according to undetectable blood concentrations of the antibiotic. The concentrations of P. Gulae, GM-CSF, TNFa, OPG, IL-6 and IL-10 significantly decreased following treatment only in CLHap group while in other groups the changes remained insignificant. Both ICT and aICT were significantly lower CLHap when compared to both control groups.
Conclusions Results of the present study demonstrated safe and promising treatment capacity of the experimental CLHap for managment of peri-implantitis.

0201

Comparison of Four Different Instruments for the Decontamination of Implant Surfaces: An In-vitro Study
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Objectives The aim of this study is to compare four mechanical instruments to decontaminate implant surfaces during surgical treatment of periimplantitis.
Methods 96 implants were dyed with blue ink and left 24 hours to dry before placing the implants in the created defects. Defects were created using Autocad software. The types of defects included in this sample are type Ib, Ic, and Ie (Schwarz et al. 2010). Once models had been created with Autocad ® (Autodesk, USA), these were converted to an STL file and printed in resin with Formlabs 3 3D printer (Formlabs, Massachusetts, USA).4mm diameter implants (Neodent ®, Straumann Group, Basel, Switzerland) were inserted in the defects.Implants were divided into 4 groups regarding the cleaning device: EMS Airflow with erythritol powder (Electro Medical Systems, Nyon, Switzerland), Ti-Brush (Straumann Group, Basel, Switzerland), ultrasonic tip, Teflon ultrasonic tip. 8 implants in each type of defect were treated with each of the cleaning instruments.All implants were cleaned for 1 minute by 2 periodontists with experience in all the devices.Pictures of the implants were taken and processed with the software Image J. The software was calibrated for the color of the ink or the implant surface. After defining a region of interest, the percentage of uncleaned surfaces were calculated.
Results None of the methods showed complete cleaning of the implant surfaces.EMS Airflow showed a better cleaning potential than the other devices followed by Ti-brush, ultrasonic tip and teflon ultrasonic tip.All the devices performed better in the coronal face of the threads than the apical.
Conclusions EMS Airflow showed the best cleaning potential in terms of elimination of the ink from the implant surface as compared with other mechanical instruments. However, none of the tested devices achieved a complete removal of the ink stains in any of the defects.

0202

Experimental Peri-implantitis around Titanium Implants with a Modified Titanium Surface with a Phosphonic Acid Monolayer. NanoCT Results of an Experimental In-vivo Investigation.
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Objectives Implant surface modifications through biomimetic agent coatings may facilitate a stronger bond to bone. It is hypothesized that this stronger bond may be more resistant to pathological conditions such as periimplantitis. It was, therefore, the aim of the present experimental in-vivo investigation to evaluate the resistance to experimental periimplantitis of an implant with a surface modification yielding a multi-phosphonate monolayer (SurfLink®) that enhances bone to implant contact.
Methods This was a randomized, split-mouth, pre-clinical in vivo investigation in 8 beagle dogs, comparing two implants with different implant surfaces, the test with a multi-phosphonate monolayer and the control with a standard oxidized moderate rough surface. Each animal provided 8 implant sites. Once the three mandibular premolars and the first molar were extracted and the sites were allowed to heal for a period of three months, four implants were installed per hemimandible and healing abutments were secured. After a 12 weeks healing period to allow osseointegration, experimental ligature peri-implantitis was induced for another 12 weeks. Then the ligatures were removed and Peri-implantitis was allowed to become chronic for 16 weeks, when the animals were sacrificed. The obtained specimens were preserved and scanned with a Bruker Nano CT scan. Tridimensional bone loss as well as tridimensional Bone to implant (BIC) contact was assessed with Nano CT.
Results No adverse events were observed at any dog at any time point. At sacrifice, the periimplantitis lesions had a mean 360 bone loss in the test group of 44.04% ±6,11and 40,18% ±7,88 in the control. These differences were not statistically significant. Similarly, no statistically significant differences between the two groups were found in terms of 360 radiographic BIC.
Conclusions The multi-phosphonate monolayer implant surface did not demonstrate a higher resistance to periimplantitis than the standard control in terms of 360 radiographical bone loss, and 360 radiographical BIC.

0203

Modified Surface of Titanium Implants with a Multi-phosphonate Monolayer.
An Experimental Peri-implantitis In-vivo Investigation.

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Objectives: The aim of the present experimental peri-implantitis in-vivo investigation was to evaluate the resistance to experimental periimplantitis of an implant with a surface modification yielding a multi-phosphonate monolayer (SurfLink®) that enhances bone to implant contact.

Methods: This was a randomized, split-mouth, pre-clinical in vivo investigation in 8 beagle dogs, comparing two implants with different implant surfaces, the test with a multi-phosphonate monolayer and the control with a standard oxidized moderate rough surface. Each animal provided 8 implant sites. Three mandibular premolars and the first molar were extracted and the sites were allowed to heal for a period of three months, four implants were installed per hemimandible and healing abutments were secured. After a 12 weeks healing period to allow osseointegration, experimental ligature peri-implantitis was induced for another 12 weeks. The ligatures were removed and Peri-implantitis was allowed to chronify for 16 weeks. After chronification, the obtained specimens were cut by ground sectioning and stained by Levai Laczko. Both implant surfaces were assessed in terms of histological bone loss (noBIC), woven bone apposition and residual infra-bony defect size after disease development.

Results: At sacrifice, the periimplantitis lesions had a mean distance from the implant platform to the first bone to implant contact at buccal and lingual sites, respectively in the test group of 4,0 ± 0,644 and 3,4 ± 0,872 mm and in the control group of 4,0 ± 0,966 mm and 3,7 ± 0,967 mm. This difference was not statistically significant for the buccal aspect (p = 0,908). However, on the **lingual aspect** there seemed to be a moderate difference favoring the test implant (p = 0,054). In addition, the mean depth of the infrabony defects on the lingual aspect averaged at 1503.7 ± 699 µm (better contained) and on the buccal aspect at 243.8 ± 304 µm. No statistically significant differences were found between the two groups in terms of amounts of newly-formed woven bone.

Conclusions: The multi-phosphonate monolayer implant surface showed some favoring effects only in the lingual aspects of the implants. The previous might be suggestive of possible moderately improved behavior when peri-implant defects are better contained.

0204

Surgical Treatment of Peri-Implantitis with Two Different Types of Xenograft

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Objectives To compare the efficacy of two different bovine bone substitutes in the regeneration of peri-implant intra-osseous defects.

Methods Thirty nine patients diagnosed with peri-implantitis (i.e. marginal bone loss ≥3 mm diagnosed on a periapical radiograph and probing pocket depth (PPD) ≥5 mm with presence of bleeding and/or suppuration on probing (BoP/SoP)) were screened for eligibility for this randomized controlled trial. Further, all patients needed to have one 3 or 4 wall intra-osseous defect deeper than 3 mm, defect angle ≤35° calculated from the axis of the implant. Patients were randomized to receive surgical debridement and defect fill with either Endobon® or Bio-Oss®. Radiographic defect fill was the primary outcome and secondary outcomes were PPD and BoP/SoP.

Results Ultimately, 30 patients qualified and 29 patients (n=15 Endobon, n=14 Bio-Oss) completed the 12-month follow-up. The bone defects reduced on average by 3.0 ± 1.1 mm for Endobon and 3.1 ± 1.3 mm for Bio-Oss (p=0.856). The Endobon group showed a PPD reduction of 3.7 ± 1.6 mm compared with 3.3 ± 1.7 mm in the BioOss group (p=0.515). BoP was reduced from 100% to 50% and from 98% to 40% for Endobon and BioOss, respectively (p=0.185). The improvements in bone levels, PPD, and BoP between the baseline and the 12-month examinations were statistically significant for both grafting materials (p<0.001). Successful treatment outcome (i.e. no further bone loss, mean PPD <5 mm and no SoP, regardless of BoP) was identified in 10/15 (66.6%) and 9/14 (64.3%) individuals who were treated with Endobon and BioOss respectively (F = 0.018, p=0.893).

Conclusions Both bone substitutes showed similar effectiveness in terms of radiographic defect fill and PPD reduction after 12 months, and represent a viable treatment option for peri-implantitis bone defects.

0205

Natural vs Cross-Link Collagen Barrier Membranes Biocompatibility

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Objectives Barrier membranes are a fundamental element in all guided tissue regeneration techniques used today, including guided bone regeneration that can accompany the placement of an implant. The aim of this study is to know how different membranes of xenogenic collagen origin behave according to their biologic origin and structure.

Methods Cell culture in vitro study of two natural and two cross-link collagen membranes, and an analysis of cell adhesion to membranes by Q-RT-PCR (Quantitative - Real Time - Polymerase Chain Reaction) at different times of culture (2, 4 and 8h), cell proliferation by MTT assay at 24 h of culture and genetic expression, using Q-RT-PCR, of pro-inflammatory molecules:

interleukin-1 (IL-1), interleukin-6 (IL-6) and interleukin-18 (IL-18).
Results The MTT assay showed that cell proliferation in membranes of porcine origin was higher than that produced with membranes of bovine origin. The analysis of the cell adhesion to the membranes illustrated how this was favoured, in most cases, when the cells were cultivated on the rough part of the membranes, although the differences were not statistically significant. As regards the genetic expression of pro-inflammatory molecules, it was greater in the case of cells grown with membranes of bovine origin. All the results were analyzed statistically by T-Student test, confirming the differences observed between the membranes according to their biologic origin, while no differences was found between two structures membranes analyzed.
Conclusions Cell adhesion to membranes is favoured if they are grown on the rough part of the membrane, while cell proliferation and gene expression of pro-inflammatory molecules indicate that membranes of bovine origin are less biocompatible than those of porcine origin.

0206

GreenBone - Plant-derived Modified Scaffolds with Anti-inflammatory Properties
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Objectives The objective was to investigate the effect of 3D copolymer scaffolds with or without plant-derived nanocoating with Rhamnogalacturonan-I pectins (RG-I) on the inflammatory phases of bone regeneration.
Methods RG-I was isolated from potato pulp (P). Two forms of RG-I were used, unmodified (PU) and modified (PA) to coat scaffolds. The chemical and physical properties of coated scaffolds were characterized using XPS, SEM and AFM. PU and PA coated and uncoated (control) scaffolds were tested *in vitro*, using human immune cells (monocytes and neutrophils) and *in vivo* using subcutaneous rat model. Cell response was tested using real-time PCR. For *in vivo* study, scaffolds were implanted subcutaneously into each female Wistar rat and the different groups (control and PA coated scaffolds) were distributed randomly (n = 6 scaffolds per time point). Animals were sacrificed at 4 days and 4 weeks after implantation to test acute and chronic inflammatory response. Harvested samples were analysed for inflammatory markers. Data was analysed using one-way ANOVA.
Results The chemical and physical properties results indicated success of the nanocoating. The PU and PA nanocoating significantly increased expression of anti-inflammatory gene, *IL10* and decreased pro-inflammatory genes expression. In addition, inflammatory genes expression was significantly lower on PA coated scaffold compared to PU, indicating that chemical structure of the molecule affected the cell response. The *in vivo* results showed significant (3 folds) increase of anti-inflammatory gene expression, *IL10* in acute and chronic inflammatory response, compare to control. Furthermore, the results showed a significant decrease of the pro-inflammatory genes on PA coated scaffolds after 4 days.
Conclusions The nanocoating significantly decreased pro-inflammatory gene expression, indicating their anti-inflammatory properties. *In vivo* studies confirmed PA ability to not only reduce acute inflammation, but also promote anti-inflammatory process. These finding may have a crucial influence on bone repair process especially in compromised patients.

0207

Feasibility of Home Sampling by Mothers in Infants for Microbiota Analysis of Multiple Oral Niches
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Objectives Large longitudinal cohort studies in infants are needed to understand oral microbiome maturation in relation to general health. The logistics of such studies are complex and the involved costs are high. Methods like home sampling by parents would reduce these issues. This study aimed to evaluate the feasibility of home sampling by mothers and to assess which oral niche provides the most reliable sample.
Methods A cross-sectional study was done in 29 mothers and their infants aged 2-15 months. Swabs of the tongue, buccal mucosa, and unstimulated saliva of the infant were collected by the mother after watching an instruction video. Thereafter, the trained researcher repeated the sample collection. Bacterial DNA was quantified and microbial composition was assessed using 16S rDNA amplicon sequencing. Microbiome profiles were analyzed using Principal Component Analysis, Permutational Analysis of Variance, and Bray-Curtis dissimilarity. Bacterial DNA concentration and microbiome dissimilarity indexes were compared using Kruskal-Wallis, Friedman, Wilcoxon signed-rank tests, and Spearman correlation.
Results Bacterial DNA concentration in samples collected by the mothers versus the researcher did not differ ($p>0.05$). Irrespective of the operator, bacterial DNA concentration correlated with the age of the child ($p<0.05$). Microbial profiles of the tongue samples differed significantly from those of saliva ($p=0.02$) and buccal mucosa ($p=0.02$), but did not differ by the operator for any of the sample types ($p>0.05$). Tongue microbiome profiles showed the least interindividual differences and the lowest dissimilarity between the related samples collected by the two operators. In saliva, difference between samples collected by the two operators increased significantly with the age of the child ($p=0.049$).

Conclusions Home sampling by mothers is a feasible method for oral sample collection in infants. Oral samples collected by mothers resemble samples collected by a trained researcher, with tongue sample being the most similar and saliva the least.

0208

Presence of Mucosal Associated Invariant T (MAIT) Cells and the Bacterial Profile in Persistent Apical Periodontitis (AP)

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Objectives Apical periodontitis (AP) is an oral condition caused by bacterial infection of the root canal system of a tooth, often being asymptomatic and thus untreated. The presence of bacteria in AP may pose risk for systemic dissemination. Mucosal associated invariant T (MAIT) cells are innate-like T-cells that recognize bacterial riboflavin precursor metabolites. Studies have recently shown that MAIT cells are present in the oral mucosal tissue, however the involvement of MAIT cells in AP is still unknown. In this study, we investigated the relations between MAIT cells and microbiome composition in AP and compared with subgingival area.

Methods Quantitative PCR was applied for quantifying the expression of semi-invariant T cell receptors (TCRs) - Vα7.2 and joining genes Jα33, Jα12, and Jα20, as well as the 16S rRNA gene in surgically removed AP tissue compared to subgingival tissue. Secondly we examined the microbial composition in the collected tissue samples by 16S rRNA gene-based microbiome sequencing.

Results Our results show that AP tissues express significantly higher levels of Va7.2-Ja33, Va7.2-Ja20, Va7.2-Ja12, Ca and transcripts, resembling a MAIT cell signature. Unlike subgingival tissues, the AP microbiome was quantitatively impacted by factors like fistula and high patient age and had a prominent riboflavin-expressing bacterial feature. Compared to subgingival microbiome, predictive functional gene analysis indicated an elevated abundance of riboflavin-producing taxa in AP microbiome. Furthermore, sparse partial least squares discriminant analysis showed multiple bacterial taxa were negatively correlated with Va7.2-Ja33, Ca, and IL-17A transcript expressions in AP.

Conclusions In conclusion, we demonstrate the presence of MAIT cells at the oral barrier defending translocation of local oral microbiota. Our findings have implications for understanding the immune sensing of polymicrobial-related oral diseases.

0209

Bubble Formations by Sodium-Hypochlorite Limit its Penetration but not for Chlorine-Dioxide During Endodontic Irrigation

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Objectives Success of endodontic treatment depends on the microbial eradication efficiency from the complex root canal system. Irrigants used for chemical disinfection should be able to penetrate into all hidden pulpal parts. However, during irrigation gas bubbles are formed and stay trapped locking tubules or canals, therefore the irrigants are not able to pass mechanically through. Our aim of was to investigate whether irrigants are able to penetrate (evaporate into and redissolve distally) through the obstructive gas bubbles.

Methods 1) One uL of *Enterococcus feacalis* suspension (ATCC29212, $9x10^7$CFU/ml) was placed on inoculation loops above 37C° 10 mL of 2.5% sodium-hypochlorite (NaOCl) or 0.12% hyperpure chlorine-dioxide (ClO_2) or distilled water (dH_2O) in airtight bottles. One and 10 minutes later the surviving bacteria were plated and two days later the growing colonies were counted. 2) Durham tubes filled up with bacterial suspension were placed in closed Eppendorfs in which the level of irrigants was lower than the orifice of Durham. After 10 minutes in 37C° thermostat, surviving bacteria were measured by the above method. 3) The penetration depths of irrigants were determined by bleaching of stains centrifuged into dentinal tubules by microscopy.

Results 1) Gas phase of ClO_2 killed all bacteria already in one minute. NaOCl decreased initial bacterial count only with one order of magnitude, while dH_2O did not alter the bacteria amount. 2) Redissolved ClO_2 eradicated totally the bacteria, while NaOCl and dH_2O were inefficient. 3) Gas bubbles were formed during NaOCl infiltration and the reaction-diffusion front was limited around 300 µm.

Conclusions Gas bubbles produced by NaOCl reactions stop its own penetration, therefore unviolated bacteria can remain after its application. ClO_2 is volatile and have powerful antibacterial effects in both gas and redissolved phases. Therefore, we suggest to apply ClO_2 as a final irrigant for more efficient disinfection. Supported by Hungarian NKFIH_OTKA_K112364 and KFI_16-1-2017-0409.

0210

Metronidazole Resistance in Oral Anaerobic Bacteria

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Objectives Metronidazole is an antimicrobial used as an adjunct to scaling and root planing for the treatment of periodontitis. Metronidazole, like other 5-nitroimidazoles, enters the bacterial cell *via* passive diffusion and is reduced to an anionic nitro radical anion ($R\text{-}NO_2^-$), which causes damage to the DNA through oxidation. *nim* genes encode a nitroimidazole reductase, which prevents the formation of the $R\text{-}NO_2^-$. These genes can be found in mobile genetic elements and therefore can be disseminated to other susceptible bacteria and spread resistance to metronidazole. The objective of this study was to assess metronidazole resistance and the presence of *nim* genes in subgingival anaerobic gram-negative bacteria.

Methods Metronidazole resistance was assessed in 44 *Porphyromonas gingivalis* isolates, 72 *Fusobacterium nucleatum* isolates and 96 *Prevotella* spp. isolates, all pertaining to the Dentaid Research Center's strains collection. Antibiotic susceptibility was determined using E-test strips and the presence of *nim* genes was studied through PCR.

Results Resistance to metronidazole was observed in 4.35% of the *F. nucleatum* isolates and in 11.63% of the *Prevotella* spp. isolates. No *P. gingivalis*-resistant isolates were observed. MICs ranged from < 0.016 to > 256 µg/ml and MIC_{50} and MIC_{90} values were determined, observing that the MIC_{90} value for *Prevotella* spp. was of 6 µg/ml, which indicates resistance to metronidazole according to EUCAST. No *nim* genes were detected.

Conclusions Despite the common use of metronidazole in periodontics, resistance to this antimicrobial is scarce among anaerobic bacteria. However, susceptibility to this antibiotic might be decreasing, since we observed an increase of MIC values when comparing the MIC_{50} and MIC_{90} values obtained in this study with the ones provided by previous studies. Whether this reduction in susceptibility is due to geographical differences of the populations analysed or due to other resistance mechanisms not screened in this study, is yet to be elucidated.

0211

Biofilm Formation on Dental Implant Surfaces: *In Vitro* Dynamic Model

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Objectives To evaluate biofilm formation over commercially available implant surfaces using an *in vitro* dynamic biofilm model.

Methods A bio-reactor was used for the planktonic growth of initial colonizers (*Streptococcus oralis* and *Actinomyces naeslundii*), intermediate (*Veillonella parvula* and *Fusobacterium nucleatum*) and late (*Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*) in a protein rich medium. The exponential phase of growth of the bacteria was achieved in the bio-reactor. Afterwards, bacteria were flowed through a modified Robbin's device which carried 12 implants, during 96h, under anaerobic conditions, at 37'C. The biofilm was formed on Straumann® Tissue Level Standard implants with a length of 8 mm and a diameter of 3.3 mm and SLA®surface.

The morphology of the biofilms was analyzed by Confocal Laser Scanning Microscopy and Scanning Electron Microscopy. Besides, the quantification of each bacterial strain present in the biofilms was performed using quantitative Polymerase Chain Reaction and the values were expressed in colony forming units (CFU)/ml. A comparison between the implants in the first and last position of the Robbin's device was performed using a t-Student test to evaluate the reproducibility of the dynamic model intra-experiment. The experiment was repeated three times (n=3) to evaluate the inter-experiment reproducibility.

Results Biofilm development was confirmed and characterized using the microscopy techniques. On all the implant surface, the six bacterial strains were detected within the biofilm. No statistically significant differences were found regarding bacterial counts among implants in different positions for any of the bacterial strains ($p>0.05$ in all cases), indicating a good reproducibility for the mode.

Conclusions Biofilms were successfully formed over dental implant surfaces, using a modified Robbin's device in a dynamic flow system.

0212

Antimicrobial Mechanisms of L-PRF Exudate against *Porphyromonas Gingivalis*.

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Objectives To assess the antimicrobial mechanisms of Leucocyte- and Platelet Rich Fibrin exudate (L-PRF) against *Porphyromonas gingivalis* (*Pg*).

Methods Antagonistic experiments were performed using the spotting technique. 100µL of a *Pg* overnight culture (OD_{600}=0.5) was swapped on blood and modified BHI agar plates. L-PRF was exposed (30', 37°C) to peroxidase (40µg/µL), pepsin (64µg/µL) or trypsin (0.05%). Additionally, L-PRF was heat-inactivated (30', 56°C). Undiluted L-PRF, L-PRF diluted (1:1) with PBS, inactive L-PRF, pepsin-exposed L-PRF, peroxidase-exposed L-PRF, trypsin-exposed L-PRF, PBS and chlorhexidine (0.12%) were spotted (10µL) on the agar plates, followed by anaerobic incubation (48h, 37°C). Standardized calibrated images were taken and inhibition areas (IA) were measured (mm^2, ImageJ). Additionally, 150µL of a *Pg* overnight culture (OD_{600}=0.5) was inoculated in 96-well plates together with a 150µL solution of undiluted L-PRF, inactive L-PRF, pepsin-exposed L-PRF, peroxidase-exposed L-PRF, PBS, chlorhexidine 0.12% or chlorhexidine 0.2%. Following anaerobic incubation (24h, 37°C), bacterial DNA was extracted

and quantified (vitality-qPCR). Initial inoculum was equally assessed (baseline values) in order to calculate differences in bacterial numbers (Δlog(Geq/mL)). Variances in logarithmic values of bacterial numbers between conditions were statistically analyzed (STATA®).
Results On agar plates, only undiluted L-PRF (blood IA=61.2±6.7, BHI IA=92.2±19.2), diluted L-PRF (blood IA=56.4±6.4, BHI IA=69.0±16.9), trypsin-exposed L-PRF (blood IA=59.8±5.5, BHI IA=76.5±14.2) and chlorhexidine (blood IA=233.9±27.1, BHI IA=433.2±62.3) inhibited *Pg*'s growth. In planktonic cultures, undiluted L-PRF inhibited *Pg*'s growth (Δlog(Geq/mL)=-0.16±0.43) while inactive L-PRF did not (Δlog(Geq/mL)=1.74±0.19), differences resulted statistically significant ($p<0.001$). Pepsin-exposed L-PRF (Δlog(Geq/mL)=1.45±0.22) and peroxidase-exposed L-PRF (Δlog(Geq/mL)=1.65±0.37) significantly reduced the inhibition of *Pg*'s growth ($p<0.001$), there were no statistically significant differences between these two conditions and inactive L-PRF ($p<0.001$).
Conclusions The antimicrobial effect of L-PRF against *Pg* was blocked by pepsin and peroxidase, but not by trypsin. Therefore, L-PRF may release H_2O_2 and peptides that inhibit the growth of *Pg*.

0213

Identification of Adhesion-force Induced Gene Expression, Its Force Sensitivity and Height Distribution in *Streptococcus Mutans* Biofilms

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Objectives luxS quorum sensing system which coordinates communication in *Streptococcus mutans* biofilm was hypothesized to impact the extension of adhesion-force sensitive genetic programming into a mature biofilm. Therefore, this study aims to investigate how adhesion-force induced gene expression spread in a mature biofilm and to what extent quorum-sensing controls it in later biofilm inhabitants, residing further away from the substratum surface.
Methods *S. mutans* UA 159 (wild type) and *S. mutans* UA 159 *ΔluxS* (quorum-sensing deficient mutant) were used in this study. Adhesion forces between bacterial strains and four different solid surfaces were tested by using atomic force microscope. Biofilm thickness and structure on all surfaces were analyzed using optical coherence tomography (OCT) after 5 h and 24 h of growth. Biofilms were then collected and sliced. Gene expressions in whole biofilms and biofilm slices were determined using RT-qPCR.
Results The gene expression of *brpA*, *comDE* and *gbpB* in 5 h old biofilms were up-regulated with increasing adhesion forces sensed by the bacteria. In 24 h old biofilms, adhesion-force induced gene expression and emergent extracellular polymeric substances production was stronger for the parent strain than for the quorum-sensing deficient mutant, but only up to a height of around 30-40 µm above the substratum surfaces.
Conclusions Initial colonizers of a substratum surface sense adhesion forces directly, which triggers the gene expression and quorum-sensing system. Bacteria in a biofilm 40 µm away from the surface still show adhesion-force induced gene expression.

0214

Preterm Born Adolescents and Oral Health Related Quality of Life

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Objectives: In recent years there has been rising concern for the long-term wellbeing of prematurely born individuals. Oral health related quality of life (OHRQoL) is an instrument measuring oral health in relation to general health and satisfaction in all stages of life. No studies of OHRQoL in preterm individuals have been performed. The aim of this study was to map OHRQoL over a period of five years, using the Oral Health Impact Profile (OHIP-14) questionnaire in a population of Swedish adolescents born preterm and full-term.
Methods In a longitudinal study of adolescents at ages 12-14 and 17-19, changes over time in OHRQoL were measured by using OHIP-14. OHIP-14, self-reported chronic illness, TMD pain, jaw dysfunction and subjective orthodontic treatment need was compared between preterm and full-term adolescents at to different ages.
The participating adolescents were 98 Swedish prematurely born (73 very preterm, g.w. 29-32, and 25 extremely preterm, g.w. 23-28) and 93 full-term controls (g.w. ≥ 37).
Results All adolescents reported a good self-perceived OHRQoL. Nevertheless, very preterm adolescents reporting chronic illness at age 12-14, showed significantly higher mean scores of OHIP-14 compared with full-term and extremely preterm. However, at age 17-19 no significant difference was found. At age 17-19, significantly higher mean scores of OHIP-14 were reported by very preterm adolescents with TMD pain, jaw dysfunction compared to full-term controls and extremely preterm. Significantly higher mean scores of OHIP-14 were found among the extremely preterm adolescents with a subjective need of orthodontic treatment.
Conclusions Poor OHRQoL measured with OHIP-14 in very preterm adolescents at age 17-19 was related to chronic illness, TMD pain and jaw dysfunction. Furthermore, extremely preterm adolescents with subjective orthodontic treatment need also reported poor OHRQoL. These results indicate a value of evaluating OHRQoL in adolescents born prematurely.

0215

Correlation between Dental Composition and Growth Indicators in Premature Infants.

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Objectives This research quantifies mineral composition of deciduous teeth, comparing it with growth parameters in preterm children. Its objective is to evaluate the application of dental mineralization as a growth biomarker.

Methods 30 7-to-9-year-old children, born preterm in Hospital Universitario San Cecilio were included as the study group. Control group was made up of 25 at-term children. Children with systemic diseases or craniofacial dysmorphia, in addition to teeth showing caries lesions, structural defects or restorations, were excluded from both groups.Fiske-Subbarow colorimetric method and Atomic Absorption Spectrophotometry were used to determine mineral concentrations. Participants' development was quantified measuring different growth parameters.Statistical analysis was carried out using SPSS 25.0, student's t-test and Pearson's correlation test.

Results Significative lower ($p<0.01$) concentrations of P, Ca, Fe and Mg were found in the study group. Regarding to Zn and Cu content, no statistically significant differences were found ($p>0.05$). Bicipital, subscapular and suprailliac skinfolds showed significative higher ($p<0,05$) values in preterm children when compared to their at-term counterparts. This results suggest a higher proportion of fat mass in those children who were born prematurely. A significative correlation ($p<0.05$) was found amongst P and Mg content and some of the growth indicators. The rest of the studied elements did not show a correlation with more than one growth marker.

Conclusions Deciduous teeth from preterm infants exhibited lower concentrations of P, Ca, Fe and Mg. P and Mg showed a correlation with several growth indicators, being potential biomarkers on their own.

0216

Postoperative Pain Relief in Children and Adolescents: A Systematic Review

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Objectives Preventing/reducing pain in conjunction with dental treatment in children and adolescents is crucial since pain is the major concomitant factor for the development of dental fear and anxiety, and behavior management problems. There is however an uncertainty regarding how to optimally prevent and/or reduce pain after dental treatment on children and adolescents. The aim of this study was to conduct a systematic review and health technology assessment of oral analgesics administered after dental treatment to prevent postoperative pain in children and adolescents aged 3-19 years.

Methods A PICO-protocol was constructed and registered in PROSPERO (CRD42017075589). A systematic literature search of databases PubMed, Cochrane, Scopus, Cinahl and EMBASE was conducted in November 2018. Identified studies were assessed according to defined inclusion and exclusion criteria independently by the review authors reading in pairs. The PRISMA-statement was followed.

Results 3,963 scientific papers were identified of which 216 were read in full text. None of these met the inclusion criteria, leading to an empty systematic review. Screened abstracts and full text papers did not report of any serious side effects. Ethical issues were identified related to the recognized knowledge gap in terms of challenges to perform well-designed studies from methodological as well as ethical perspectives.

Conclusions As no studies meeting the inclusion criteria were identified, it was not possible to find any scientific support for the effects, nor provide any support or rejection, of postoperatively administered oral analgesics for the prevention or reduction of postoperative pain after dental treatment in children and adolescents. Thus, it is not possible to formulate clinical guidelines on this issue solely based on scientific evidence. There is an urgent need for further well-designed studies on how to prevent pain after dental treatment. This empty systematic review serves as an important starting point for research in this area.

0217

Increased Caries Risk in Children of Immigrant Parents - A Structural Equation Modeling Approach

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Objectives Children to parents with an immigrant background have a significantly higher caries experience and recent studies show that fluoride based preventive program in high risk populations are not effective. The hypothesis to be tested in this study is that the prevalence of dental caries is associated with parents' country of origin and that socioeconomic background factors, maternal health behaviors and adverse birth outcomes can explain these differences.

Methods This register-based cohort study included all children born between 2000 and 2003 and who were residing in Stockholm County, Sweden. Oral examinations were done at age 3 years (n = 74,748) at age 7 years (n=73,658) or both. Data on socioeconomic conditions, maternal health, maternal health behaviors, and birth outcomes were extracted from Swedish

national registries. structured equation modeling (SEM) was performed to test relationship between country of birth of the mother (rich and poor countries) and increase deft, and, additionally, if this association was mediated by socioeconomic factors and pre and perinatal conditions.
Results 7-year-old children who had the highest increase in deft had more often mothers with immigrant background (p<0.001). The increased caries experience in children with immigrant mothers was also mediated by socioeconomic and maternal factors such as family income, number of children in the family, maternal age at delivery and maternal obesity during pregnancy as well as being small for gestational age and the child having a health condition.
Conclusions There was an accumulation of socioeconomic and maternal factors in children to immigrant mothers. Preventive program must acknowledge these factors and give long-term support for disease prevention.

0218

Evaluation of Treatment Time for Dilacerated Impacted Maxillary Central Incisors in Mixed Dentition

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Objectives The aim of the study is to examine factors affecting the treatment of the dilacerated impacted maxillary central incisors (DIMCI) from the surgical attachment until the tooth appears into the mouth.
Methods We included 9 children (4 girls and 5 boys) aged between 8 and 11 (9,78±1,30). All children had had dental trauma history when they were 2 or 3 years old. After evaluation with OPTG image, DVT was taken to confirm the dilaceration and the position of the crown and further diagnostics. In case of the space absence, a pre-operative orthodontics for space creation was performed and a standard close surgery treatment protocol was completed with exposing and bonding the palatal surface of DIMCI with an attachment. Using appropriate forces, the appearance of all the teeth was noted in the vestibulo-labial sulcus of the mouth. The time between the surgery and the exposure in the mouth was noted for each tooth and compared with the initial position and location of the tooth using The Student t-test.
Results Interestingly 1 out of 9 DIMCI was #11 and 8 teeth were #21. The average time between the surgery and the exposure in the mouth was 9,67+3,08 months (from 7 to 16 months). Five DIMCIs were positioned horizontally, 4 were inverted and there was statistically significant difference between the duration of two different positions of DIMCI (p=0,0104; horizontal 7,66+5,55 months and inverted 12,25+2,98 months). No statistically significant difference was found between the dilaceration level of the root (p=0,8201), distance between the incisal edge and the crest (p=0,3131) or the age of the child (p=0,4614).
Conclusions DIMCI generally occurs after the traumatic injuries to the primary incisors. We found that the position of the DIMCI (horizontal versus inverted) seems to be the only factor to effect the treatment time.

0219

Effects of Feeding Patterns and Oral Health Habits on ECC in Turkish Children.

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Objectives Early childhood caries (ECC) is one of the most prevalent chronic diseases among children. The aim of this study was to assess the association of feeding patterns and oral health habits with ECC in Turkish children.
Methods The study involved a total of 200 healthy children aged 12-60 months (113 girls,87 boys) attending to Istanbul University Faculty of Medicine, Dept.of Social Pediatric Clinic for periodic follow-ups. Feeding patterns and oral health habits were analyzed by a questionnaire face to face;dental health of children was determined by a pediatric dentist. The findings were statistically analyzed by KruskalWallis, Mann WhitneyU, Spearman's correlation analysis tests.
Results Children's dft scores ranged from 0 to 20,with a mean of 2.05±3.55.The %'s of children having dft scores 0,1,2,3,4,and >5 were found as, respectively:60%,2.0%,6.5%, 7.0%, 9.0%, 15.5%. Non-significant correlations (p>0.05) were found between only breast feeding (r:0,050) or formula feeding (r:-0,078) and dft scores. No statistically significant differences (p>0.05) were determined in dft scores according to duration of only breastfeeding, total duration of bottle use or night bottle use. Significant difference (p<0.05) was found between toothbrushing frequencies of those who had fed before sleeping and mean dft values.
Conclusions The findings have demonstrated that only breast feeding or formula feeding are not significantly correlated with dft scores; and total duration of bottle use or night bottle use have shown no significancy. It has been determined that decreased frequency of toothbrushing before sleeping had significant impacts on ECC. The data have shown that the parents' knowledge on oral health habits should be improved.

0220

The Vulnerable Teeth of Child: Public Health and Nutrition, Mediterranean Area 1900-1939 and Sub-Saharan Africa 1980-2019

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Objectives we propose what happened in Mediterranean Area between 1900 and 1939 and Sub-Saharan Africa 1980-2019 because there are different public health.

Methods From the Demographic and Epidemiological Transition, conceptual framework of our research. This research examines the transition on teeth of children in Mediterranean Area and Sub-Saharan Africa from dates published.

The purpose of this study was to evaluate the associations between different causes (education, higiènic-cultural, nutrition and public assistance) and high disease infections (the infections begin with the teeth) in a Mediterranean population and Sub-Saharan Africa with SPSS.

Results In Mediterranean Area and in most developing countries, rising levels of nutrition and improvements in public health have led to incrise and quality in the population.

In Sub-Saharan Africa, the teeth of children show fault of protein and energy intake and poor public and hygienic assistance. The association between consumption of dairy products and the risk of developing infectious illnesses is unclear

Conclusions There are an emphasis on how spatial and times inequalities are associated with other key life events, such as family formation and educational attainment. This subject of research also considers rural and urban variability of these processes. The incrise of population in Sub-Saharan Africa appear to be driven by medical interventions that reduce infant mortality, rather than by broad based improvements in nutrition and public health measures.

Spatial inequalities in human development are of great concern to international organisations and governments. Using demographic and epidemiological indicators over long time periods at relatively high levels of geographical detail, we can describe the changes in spatial inequalities (Klüsener, et ali, 2014). It is necessary to take the historical improvements in good health dental of children in the Mediterranean Area for Africa. The teeth are indicative of broad based improvements in population health and nutrition.

0221

Oral Health Status among Primary School Children in Istanbul, Turkey

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Objectives The aim of this study was to obtain the current caries prevalence, treatment needs and gingival health status for primary school children.

Methods The study was planned as an epidemiological school-based oral health survey in Fatih, Istanbul, Turkey. A total of 1591 children aged 6 to 9 years were enrolled in this study. For each child, oral health status of their teeth was assessed by calibrated final year dental students with using portable equipment. Dental caries and treatment needs were evaluated according to World Health Organization's (WHO) oral survey methods. Plaque index (PI) and gingival index (GI), recorded at the six Ramfjord's teeth, were used to assess gingival health status. SPSS 20.0 (SPSS Inc, Chicago, IL, USA) was used for data compilation and statistical analysis.

Results Caries prevalence of 6 to 9-year-old children in Fatih, Istanbul was 86.99%. The mean dmft was (5.87± 4.44) and the mean DMFT was (0.51± 1.01). The highest dmft means were found among the 8-year-age group, while the highest DMFT means were scored by the 9-year-age group. The decayed and missing components accounted for >95% of the scores. The mean restorative index of children was 21.57 ± 25.27 for both primary and permanent teeth. Gingivitis was observed in majority of subjects; the mean PI and GI scores were 1.25 and 1.36 respectively. Analysis of the data showed that mean dmft/ DMFT scores increased with age in both genders and were higher in boys. In contrast to the dmft/ DMFT scores, girls presented higher PI and GI scores than boys at all age groups.

Conclusions The prevalence of caries, gingivitis and treatment needs is high among children in Fatih, Istanbul. Only 13.01% of children aged 6-to-9 were free from caries lesions. There is an immense need for comprehensive preventive programs as well as increasing the awareness about oral health.

0222

Dental erosive wear - a global condition

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Tooth wear is the results of interacting processes: abrasion, attrition, erosion, and possibly abfraction. The most important interaction seems to be the potentiation of abrasion by erosive damage to the dental hard tissues. Therefore, dental erosive wear is considered to have the combined effect of chemical dissolution of tooth surface caused by acids and mechanical wear of the acid-softened surface. Erosive tooth wear is a multifactorial condition of growing concern. The prevalence is high, particularly among children and adolescents. Even though different epidemiological survey data are difficult to compare and the actual global prevalence may be difficult to estimate, there seems to be a gender difference and an increase in prevalence with age. The clinical diagnosis "dental erosive wear" is based on typical clinical morphology and signs. In addition to a comprehensive general anamnesis, the diagnosis is supported by several clinical diagnostic tools, such as thorough clinical

examination with a detailed grading system, radiographic and clinical intra-oral pictures, and supplemented with study models. Early diagnosis of the condition is important to ensure that adequate preventive measures are undertaken.

0223

Etiology of erosive tooth wear and risk assessment

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Previously has erosive tooth wear been considered as a simple condition, however, causes of dental erosion have traditionally been categorized into acids of extrinsic or intrinsic origin. Therefore, the conception of erosive tooth wear has recently been changing towards a complex interplay between chemical, mechanical and biological factors thus contributing to a better understanding of the condition.

Newer studies have indicated that in particular the chemical properties of acids and the frequency of acidic challenges play an important role in the pure erosion process. Considering the lifestyle and eating and drinking habits of modern individuals it would be important to know which products are erosive and which are not. Considering the amount of potentially erosive products and their properties, basic guidelines are needed to assess the erosive potential of different products. This topic will be discussed during the presentation.

Risk assessment of erosive tooth wear is another issue that is often difficult and time-consuming. Recent studies have indicated that the Basic Erosive Wear Examination (BEWE) could be a useful tool in assessing the risk for erosive wear and BEWE will be shortly presented. Consuming your daily fruit piece by piece or quickly in two minutes are differences that really counts! However, it seems unlikely that one or two isolated factors are responsible for a multifactorial condition like erosive tooth wear. This presentation will concentrate on details concerning eating and drinking habits as well as erosive tooth wear in a larger scale.

0224

Non-invasive restorative treatment of warn teeth

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Currently, wear of teeth due to erosion and attrition seems to be a growing problem for both young and old, and spans from localized anterior wear to a more general condition involving the entire dentition. Non-physiological and pathological wear may require restorative treatment out of concern for biological perspectives, though most often to accommodate a patient's aesthetic needs. These kinds of treatment have often involved extensive prosthetic reconstructions with immense implications for the pulp, the marginal periodontium and not least for the patient's economy. Today, adhesive technology has allowed for restorative solutions that, following non-invasive additive principals, may be adapted to the teeth's and the individual patient's need.

Based on European consensus regarding treatment of dental wear (*Loomans B et al., J Adhes Dent 2017,*), the lecture will focus on when restorative treatment of dental wear is indicated. Functional and aesthetic needs of the patient will be estimated in comparison with the biological and economic consequences that are involved in the treatment. Different methods for treatment with and without increasing the vertical dimension of occlusion and orthodontic pre-treatment will be reviewed. Focus will be given to reconstructions where non-invasive adhesive treatment with direct resin materials and, in some cases, ceramic laminate veneers is used.

The lecture will be based on clinical cases supported by scientific literature. A discussion of what can be expected with regards to longevity of treatments using different non-invasive strategies will be given as well as a recommendation of measures to optimize the longevity.

0225

Implant biofilms and aimed therapeutics

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Objectives: Peri-implantitis involves destructive inflammatory processes around osseointegrated implants. Therapeutic approaches of peri-implant diseases are manifold and comprise mechanical scaling and root planning, sometimes even implantoplasty to smooth contaminated implant surfaces with diamond and polishing burs. Here, we investigate to what extent titanium dioxide particles produced by implantoplasty induce cellular responses such as the release of reactive oxygen species (ROS) and pro-inflammatory cytokines.

Methods: Titanium dioxide particles are produced by diamond burs on pristine implant surfaces. After thorough washing with phosphate buffered saline, macrophages, periodontal ligament cells, and gingival fibroblasts are exposed to the titanium dioxide particles. Expression of proinflammatory cytokines are assessed by Elisa assay and RT-PCR. Cytotoxicity measurements are measured with MTT assay. Oxidative stress represented by the accumulation of intracellular ROS is measured using the non-polar dye dichlorofluorescein diacetate (DCFH-DA).

Results and conclusion: Titanium dioxide particles might increase inflammatory cytokine release and oxidative stress-induced

ROS formation. Additionally, titanium dioxide particles can influence macrophages polarization in their differentiation pattern towards M1 macrophages, characterized by increased IL-1, IL-6, and IL-12 expression.

0226

Outcomes of surgical therapy of peri-implantitis. Lessons learned from in vivo studies

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Peri-implantitis is a plaque-associated pathological condition occurring in tissues around dental implants, characterized by inflammation in the peri-implant mucosa and subsequent progressive loss of supporting bone. As it is shown by latest literature reports, around 22% of implants suffer from this pathology. Once bone loss has occurred, surgical therapy is needed to arrest disease progression, however outcomes of surgical therapy are not always predictable. In the search for better therapeutic alternatives, new approaches as well as new implants are tested in preclinical in vivo models. Several studies will be presented regarding innovation in the search of better surgical therapy outcomes as well as in the search for less susceptible implants. Re-osseointegration of previously contaminated surface is targeted with biologic approaches such as the use of BMP-2 growth factor, that promotes bone regeneration. However, Peri-implantitis is a complex disease, and we don't only need to reconstruct tissue architecture, but also avoid advanced disease development. New implant surface designs aim to prove less susceptible to peri-implant bone loss. This advancements together with better understanding of adequate regeneration of the tissues prior to implant placement lead us to either minimize disease appearance and progression and to promote and understand disease development and treatment.

0227

Outcomes of surgical therapy of peri-implantitis. Lessons learned from clinical trials.

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At present there is no consensus on how to treat peri-implantitis. Recent clinical studies have provided some insight into the effectiveness of different treatment modalities. Only modest effect of non-surgical treatment has been documented, hence surgical therapy seems to be the treatment of choice to provide access for implant decontamination and inflammation control. This presentation will cover the advances in peri-implantitis treatment and its scientific evidence. The rationale for resective and regenerative surgical techniques will be discussed. The surgical approach chosen depends on several clinical and patient-related factors such as bone defect morphology, implant surface roughness, and the position of the implant. Treatment protocols and outcomes of osseous regeneration and resective surgery will be discussed.
Different means of implant surface debridement and decontamination during surgery will be reviewed. Adjunctive antimicrobial therapy may provide enhanced outcome of surgical peri-implantitis treatment, but the use may conflict with the increasing awareness of antibiotic resistance.
Finally, the future in the treatment of peri-implantitis will be discussed. Some emerging new inventions and refinements to existing instruments and methods that may improve the outcomes of surgical peri-implantitis treatment will be addressed.

0228

Bond Strength of Resin Cements to 2 Different CAD/CAM Ceramics

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Objectives The purpose of this in-vitro study was to evaluate the effect of a self-etching ceramic primer applied on different CAD/CAM ceramics on the shear bond strength (SBS) of resin cements.
Methods A total of 80 specimens were prepared from two types of CAD/CAM materials (IPS Empress CAD, Vita Enamic). Next, each ceramic specimen was polished using silicon carbide papers to obtain standardized smooth surfaces. The specimens were randomly assigned to 8 subgroups (n = 10) according to ceramic materials, surface treatments and resin cements: Gr 1 (Enamic Control+BisCem), Gr 2 (Enamic Control+G-Cem), Gr 3 (Enamic Monobond Etch&Prime+G-Cem) ,Gr 4 (Enamic Monobond Etch&Prime+BisCem) , Gr 5 (Empress Control+BisCem), Gr 6 (Empress Control+G-Cem), Gr 7 (Empress Monobond Etch&Prime+G-Cem), Gr 8 (Empress Monobond Etch&Prime+BisCem). Dual-cure resin cements were applied on the ceramic surfaces by using a cylindirical teflon mold (3 mm height, 3 mm diameter) and light-cured for 40 s. Shear bond strengths (SBS) of the specimens were determined by using a universal testing machine. The Kruskal-Wallis and Mann-Whitney U tests were used for statistical analysis (α=0.05).
Results According to the Kruskal-Wallis test there were significant differences among groups (P<0.001). All the monobond etch & prime applied groups showed statistically higher SBS values compared with non-applied ones. Gr5 exhibited the lowest and Gr3 showed the highest SBS values. Higher SBS values were found in Enamic groups compared to Empress when the same surface treatment and resin cement were applied, however the difference between Gr3 and Gr7 was not significant (P>0.05). In addition, the use of G-Cem improved the SBS values compared to BisCem (P<0.05).
Conclusions Based on the results of this study, the application of primer and the choice of resin cement are important factors to obtain increased bond strength values.

0229

Effect of Surface Treatments on Bond Strength of CAD/CAM Ceramic

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Objectives The aim of this study was to investigate the effect of surface treatments on the shear bond strength (SBS) of dual-cure resin cement to a CAD/CAM ceramic.
Methods A total of 60 zirconia reinforced lithium silicate specimens (Vita Suprinity) were cut (2 mm in thickness) and polished using silicon carbide papers. The specimens were divided into 6 equal groups (n=10) according to surface treatments used: Control, %5 Hydrofluoric acid (A), Monobond Plus (M), %5 Hydrofluoric acid + Monobond Plus (A+M), Clearfil Ceramic Primer Plus (CC) and %5 Hydroflouric acid + Clearfil Ceramic Primer Plus (A+CC). Resin cement cylinders (RelyX U200) were bonded to treated ceramic surfaces by using a teflon mold (3 mm diameter, 3 mm height) and then light cured for 40 s. The SBS of the specimens were measured by using a universal testing machine. The SBS data were statistically analyzed using 1-way ANOVA and Turkey's HSD tests (α=0.05).
Results One-way ANOVA revealed significant differences among groups (P<0.001). Combined surface treatment groups (A+M and A+CC) showed statistically higher SBS values compared to others, whereas the control group exhibited the lowest SBS values (P<0.05). Hydrofluoric acid etching alone was found to be effective treatment compared to Monobond plus, while there was no significant difference between acid etching (A) and ceramic primer (CC) groups (P>0.05).
Conclusions Primer applications combined with hydrofluoric acid etching might be promising surface treatments to improve resin bond strength.

0230

Effect of Primers on Bond Strength of Lithium Disilicate Glass-ceramic

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Objectives The purpose of this study was to evaluate the shear bond strength (SBS) of IPS e.max CAD ceramics after various surface treatment methods.
Methods 60 IPS e.max CAD ceramic samples were prepared using a precision cutter under water cooling and divided into six groups as; Control (C), application of Monobond Etch & Prime (MEP), %5 Hydrofluoric acid (HF) etching followed by Monobond Plus (5HF+MP), %5 HF etching followed by Clearfil Ceramic Primer Plus (5HF+CP), %9.5 HF etching followed by Monobond Plus (9.5HF+MP), and %9.5 HF etching followed by Clearfil Ceramic Primer Plus (9.5HF+CP). Teflon molds were used to fabricate standardized resin cylinders. A light-cure resin cement (Variolink Esthetic LC) was bonded to all groups according to the manufacturer's recommendations. The shear bond strength of the specimens was measured using a universal testing machine. The SBS data was statistically analyzed using 1-way ANOVA followed by Tamhane's T2 test.
Results ANOVA showed statistically significant differences among groups (P<0.001). Control group exhibited lower SBS values compared to surface treatment groups. There was no significant difference between MEP and 5HF+MP groups (P>0.05), whereas 9.5HF+MP, 5HF+CP and 9.5HF+CP groups showed higher SBS values than MEP group (P<0.05). HF acid concentration was not effective on the SBS values using in combination with Monobond plus or Clearfil ceramic primer plus (P>0.05).
Conclusions Monobond etch & prime application was not as effective as other combined hydrofluoric acid and ceramic primer treatments used in this study to obtain higher resin-bond strength.

0231

Effect of CAD/CAM Ceramic Thickness on Bond Strength of Resin-cement

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Objectives All-ceramic restorations are biocompatible and highly esthetic materials that are widely used in dental treatments. The aim of this study was to investigate the effect of ceramic thickness and material type on the shear bond strength of light-curing resin cement.
Methods A total of 90 specimens with thicknesses of 1, 2 and 3 mm were prepared from three different CAD/CAM materials (Vita Enamic,Vita Suprinity and IPS Empress CAD). Each ceramic specimen was ground with silicone carbide papers and the final thicknesses were controlled with a digital caliper. The surface of ceramics was treated with one-step surface conditioning system (Monobond etch & prime) for 60 seconds. Light-curing resin cement (Variolink Esthetic LC) disks were applied using a teflon mold with 3 mm height and 3 mm diameter. Similar to the clinical applications, ceramic surfaces of specimens were light cured. The shear bond strength of the specimens was measured using universal testing machine. The SBS data were statistically anayzed using two-way ANOVA and Tukey's HSD tests (α=0.05).
Results Material, thickness and their interaction had a significant effect on SBS values. IPS Empress showed higher SBS values than the other materials in each thickness. For each material, 1 mm groups exhibited higher values than the others (P<0.05). There was no significant difference in SBS values between 2 mm and 3 mm thickness groups of Enamic (P>0.05), whereas 2 mm groups of IPS Empress and Vita Suprinity were higher compared to 3 mm (P<0.05).

Conclusions Material type and the thickness were found to be effective factors on shear bond strength of light-cured resin cement.

0232

Fracture Resistance of Current Esthetic Crowns Under Chewing Simulation Using Two Finishing Protocols: In Vitro Study

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Objectives The purpose of this study was to investigate the effect of two surface finish protocols on the surface roughness and fracture resistance of monolithic CAD-CAM ceramic materials.

Methods Forty-eight teeth were prepared and divided into three main groups (16 samples each) according to the type of crown material (katana zirconia, e-max CAD and Vita enamic) Each group was further subdivided into two main equal subgroups eight teeth each according to the surface finish (Polished,Polished-ground-repolished). Chewing simulating and thermocycling were performed in a masticatory .Roughness measurements were carried out on a digital microscope image by special computer software. All the samples were tested for fracture resistance using a universal testing machine.

Results Regarding the effect of material type on the fracture resistance of crowned teeth after chewing simulation, zirconia crowns had a significantly highest mean fracture resistance value (4198.55 N ± 648.745) followed by e-max CAD crowns (2401.49 N ± 455.84), while the lowest mean fracture resistance value was recorded for vita enamic group (1784.38 N ± 459.63).Regarding the effect of surface finish on the fracture resistance of zirconia crowns, results revealed that the repolished group had a significant higher mean surface roughness (4965.01 N ± 380.04) than the polished group (3432.09 N ± 917.45).

Conclusions The surface roughness of the three tested all ceramic crowns weren't affected by grinding(occlusal adjustment) and repolishing procedures in relation to the polished crowns.Grinding followed by repolishing increased the fracture resitance of monolithic zirconia crowns compared to polished group while the fracture resistances of glass ceramic as well as hyprid ceramic crowns were not affected by grinding repolishing procedure.Chair side repolishing is a reliable technique to be used after occlusal adjustment of all ceramic tested restorations.

0233

Marginal Fit Accuracy of All-ceramic CAD/CAM Crowns; Digital sSanning Vs Conventional Impression Techniques

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Objectives The aim of this study was to compare the marginal fit of all-ceramic computer-aided design/computer-aided manufacturing (CAD/CAM) crowns fabricated using digital impression and conventional polyvinyl siloxane (PVS) impression techniques

Methods Twelve prefabricated maxillary left central incisor typodonts with standard preparation to receive all-ceramic crown were prepared. Six type IV stone casts were made from six PVS impressions. Laboratory scanner was used to digitalize the cast and allow digital design of the crown. Six digital impressions of the remaining typodonts were recorded with an intraoral scanner. The scanned files were input into digital design software for waxing and design of the definitive crown. Twelve crowns were produced by milling zirconia oxide block with a 5-axis milling. The crowns were then placed on respective typodonts to measure the marginal gap. Circumferential marginal gap measurements were made at eight fixed points: mesial, distal, buccal, palatal and associated line angles which are distolingual, distobuccal, mesiobuccal and mesiolingual. Twelve random points were also measured for each surface. Stereomicroscope with computerized image digitalization software was used to measure the vertical marginal gap at 40x magnification. The overall mean gap size between the groups were calculated and analyzed with T test.

Results A total of 672 images (2 groups, 6 crowns per group, 56 sites per crown) were recorded and measured. The overall mean vertical gap measurement for all-ceramic CAD/CAM crowns fabricated using digital technique was 38 ± 26µm, which was smaller than that for the conventional impression technique (50 ± 31µm).

Conclusions .The conventional impression technique of crown fabrication requires meticulous fabrication procedures to produce accurately fitting crown. However, the propensity of human error may result in poor marginal fit. The use of digital impression technique which is simpler as well as less technique sensitive reduces the chances of error and produces crowns with better marginal fit. Digital impression techniques can be regarded as a clinical alternative to conventional impressions for fixed prosthesis.The all-ceramic CAD/CAM crowns fabricated using digital technique has better marginal fit as compared to conventional elastomeric impression technique

0234

Validation of the X-Ray Micro-tomography New Measuring Technique by Comparison to SEM and Stereomicroscope Evaluation Techniques in Fixed Prosthodontics

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Objectives The aim of this study was to compare the accuracy of three fit evaluation techniques

Methods Three-unit FDPs were prepared on metal dies (N=12), using a typodont model (Frasaco) from maxillary 1st premolar (Z4) to 1st molar (Z6). A standardized preparation with 1.2 mm chamfer (360°) and 2mm occlusal reduction was performed on the abutment teeth. The dies were scanned and randomly divided into two groups to receive the FDPs (N=12 frameworks/24 abutments) made of a) Pre-sintered Co-Cr (Ceramill Sintron, AmannGirrbach) (CS) (n=6), b) Pre-sintered Zirconia (Ceramill Zi, AmannGirrbach) (CZ) (n=6). Each framework was seated on its model. Each abutment scanned and evaluated separately for more accuracy. Marginal and internal gaps were measured using three evaluating techniques (X-ray Micro-computed Tomography, Scanning Electron Microscopy and Stereomicroscope). 9 points were measured on each abutment, starting at the most distal point from the pontic for Z4 and Z6 (1-4: mesial, 5: Occlusal, 6-9: distal). Comparison of results was done using Levene's T-test and ANOVA (α=0.05).

Results Micro-CT reported the smallest mean gap values, followed by SEM and stereomicroscope techniques (Table1). A significant difference was found between Stereo/SEM (*P*=.025), and Stereo/CT (*P*<.001). No significant difference was found between CT/SEM (*P*=.094) (Table 2). The mean gap values obtained by the three measuring techniques were clinically acceptable for both materials tested (Table 3). No significant difference was found between the materials tested (*P*=.106)

Conclusions Significant Difference was found between Stereomicroscope and both SEM and Micro-CT techniques. Results reported by the three techniques were clinically acceptable. Micro-CT can be considered a reliable measuring technique.

0235

Feasibility of a "Smart Crown" Intended for Clinical Use: A Pilot Study

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Objectives Feasibility of molar crown fabrication including sensors enabling six-degree-of-freedom force/moment measurements ("smart crown") for clinical use which would allow long-term clinical data recording of biting habits.

Methods A smart crown requires space to include power supply, memory, and sensors. Thus, the here presented smart crown concept relies on heavily destroyed molar teeth appropriate for treatment with single crowns. Based on a suitable patient case, an anatomic crown was designed and subsequently split in two parts. Two different designs of the interface separating the two crown parts were investigated: (D1) a split along a horizontal plane, and (D2) an interface with a circumferential slope. After milling from a CoCr disk, the two parts were adhesively jointed (Epo-Tek 301-2) with each four existing stress sensor chips (size: 2.0×2.5mm^2, 32 sensors/chip) placed in-between the interface surfaces.
In this pilot study, an external power supply and data storage were used. For calibration and subsequent validation, the crown was placed on a die in a reference position with respect to an external six-degree-of-freedom force/moment-transducer (ATI Nano43) while 96 different load cases were applied (fig. 1). The number of sensors and load cases used to compute the calibration matrix were varied and validated by comparing force and moment components of the externalforce/moment-transducer with those given by the calibrated smart crown.

Results For D1, components associated mainly with vertical forces (F_z,M_x,M_y) showed increased measurements errors. This finding was much less pronounced for D2 and all six components could be assessed with an acceptable accuracy (<5-10% error) for a minimum number of 32 sensors
and 50 calibration load cases.

Conclusions The construction of a smart crown providing acceptable accuracy in measured force and moment components is technically feasible. Prospectively, chips with minimized power consumption, optimized sensor numbers and positions, integrated memory and power source should be developed.

0236

Control of Inflammation by a New Thermosensitive Statin-loaded Hydrogel

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Objectives Statins have been widely studied in the treatment of periodontal diseases because of their pleiotropic effect. Statins modulate bone metabolism, immuno-inflammatory complex and bacterial clearance. However, their systemic administration may lead to side effects and to reduce impact on *periodontium* regeneration. Therefore, their local administration has been suggested.

The aim of this study was to characterize and evaluate the potential pro-regenerative effects of a thermosensitive gel functionalized by nanomemulsions containing atorvastatin and lovastatin on *Porphyromonas gingivalis (Pg)* elicited inflammation and bone regeneration.
Methods To increase aqueous solubility and bioavailability of statins, a nanoemulsion-based drug delivery system was synthesized using vitamin E combined with Kolliphor ELP (KELP) or D-α-Tocopherol polyethylene glycol succinate (TPGS) to encapsulate statins (atorvastatine and lovastatine) in nanodroplets. Nanoemulsions were then loaded in a chitosan hydrogel. Physical properties (size, pH, electric potential) of the synthesized nanoemulsions were evaluated using dynamic light scattering, scanning transmission electron microscopy and digital PH Meter . In vitro, their anti-inflammatory effect on TNF-a was evaluated by ELISA and qPCR in *Pg* stimulated gingival epithelial cells and fibroblasts. In vivo, effects on bone regeneration and soft tissue inflammation were evaluated in a calvarial defect murine model.
Results Synthesis of leads to homogenous nanoemulsions (diameter:200nm; low surface charge). Endocytosis by epithelial cells was confirmed by microscopy. The release of active drugs from the gel was continuous allowing sustained effects after gel administration. In vitro, statin-loaded gel was able to decrease TNF-a secretion in Pg stimulated cells ($p<0.05$). In vivo, local application of functionalized hydrogel improved wound healing at calvarial site in comparison with untreated controls and mice treated with systemic statin administration.
Conclusions This study demonstrates the potential regenerative effects of a thermosensitive gel functionalized by atorvastatin or lovastatin and emphasizes the use of nanoemulsions to optimize their delivery.

0237

Antimicrobial Effect of Nanostructured Membranes for Guided Periodontal Regeneration: An *In-vitro* Study.
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Objectives Non-resorbable active nanostructure membranes have been developed to facilitate periodontal regeneration and drug release. The objective was to evaluate the antibacterial effect of nanostructured membranes doped with zinc, calcium and doxycycline in a validated *in vitro* subgingival biofilm model.
Methods The *in vitro* biofilm model included six bacterial species (*Streptococcus oralis, Actinomyces naeslundii, Veillonella parvula, Fusobacterium nucleatum, Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*) growing on hydroxyapatite discs previously covered with the nanostructured membranes (NMs), and NMs doped with doxycycline, with calcium or with zinc, a commercially available membrane of dense polytetrafluoroethylene (d-PTFE) and discs without any kind of membrane were also included in the study (control groups). All specimens were incubated in anaerobic conditions during 12, 24, 48 and 72 hours. Three replicates of the experiments were done for each time. Morphological features of the biofilms were analyzed by different modalities of microscopy. The viable bacterial load, expressed as Colony Forming Units (CFU/mL) of every bacterial species tested, was quantified through quantitative polymerase chain reaction (qPCR). To analyze the effect of the different nanostructured membranes over the CFU/mL, the general linear model and Bonferroni adjustment were applied.
Results During the 72 hours of evolution of the biofilm, the dynamic and formation of bacterial biofilm over the NMs and the control groups were very similar, although some reduction of bacteria was seen in biofilms in contact with the NMs ($p\leq0.016$ at 48 hours in all cases). Specially, NMs charged with doxycycline, promoted, from 12 hours of incubation to 72 hours of growth, a significant reduction of the six bacterial species in, at least, one time of incubation, when compared to the control groups ($p<0.05$).
Conclusions Nanostructured membranes affect the kinetic of growth in an *in vitro* subgingival biofilm model. Nanostructured membranes doped with doxycycline attained significant reduction of the bacterial load.
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0238

Antimicrobial Activity of Omega-3 Fatty Acids Against Oral Pathogenic Bacteria
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Objectives To study the antimicrobial activity of the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), in their ethyl-esters form, against oral bacteria in a subgingival *in vitro* biofilm model.
Methods Minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) of EPA and DHA for six bacterial strains in planktonic state, characterizing the initial (*Streptococcus oralis* and *Actinomyces naeslundii*), early (*Veillonella parvula*), secondary (*Fusobacterium nucleatum*) and late colonizers (*Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*) were calculated.
Based on these concentrations, 72h-biofilms with the six bacterial species, were exposed for 60 secs by immersion, to EPA and DHA to study its antibacterial activity, or to different control solutions: phosphate-buffered saline (negative control), 0.2% chlorhexidine (positive control) and ethanol (solvent).

The main variable was the number of viable bacteria (colony forming units, CFU/mL), assessed by quantitative polymerase chain reaction, previously treating the samples with propidium monoazide. Besides, the biofilms were analyzed with confocal laser scanning microscopy. For each of the products, three different independent experiments, including three disks per group, were performed (n=9). ANOVA was performed with Bonferroni's *"post-hoc"* corrections for multiple comparations.
Results EPA performed a successful reduction of, at least, one order of magnitude for all bacterial species tested. Significant reductions were observed for *P. gingivalis, F. nucleatum*and *A. naeslundii* (p<0.05). No significant impact was observed for *S. oralis*,*V. parvula*, and *A. actinomycetemcomitans*. Regarding DHA, two or more magnitude levels of reduction were observed for all bacterial species, when compared to the negative control, being those differences statistically significant (p<0.05).
Conclusions EPA and DHA demonstrated antimicrobial activity against the tested bacterial species in *in vitro* biofilm model. Further research is needed to discern the mode of action, and to assess the feasibility of including these fatty acids in forthcoming products for biofilm control.

0239

Impact of Cranberry Extract in Bacterial Vitality in Biofilm Model

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Objectives To evaluate the antimicrobial potential of cranberry extracts against *Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* in an *in vitro* biofilm model.
Methods Minimum Inhibitory Concentrations (MICs) and Minimum Bactericidal Concentrations (CMBs) of cranberry for *F. nucleatum*, *P. gingivalis* and *A. actinomycetemcomitans* in planktonic state were determined. After that, the antibacterial effect was evaluated, for the same bacterial species, in a 72-h multi-species biofilm, dipping biofilms for 30 and 60 seconds in the cranberry extracts. Biofilms (n=9) were analyzed by confocal laser scanning microscopy (CLSM) and viable bacteria [colony forming units (CFU/mL)] were measured by quantitative polymerase chain reaction combined with propidium monoazide. A generalized linear model was constructed to determine the effect of the independent outcomes (treatment and exposure times) on viable bacterial counts.
Results In planktonic state, MICs for *P. gingivalis* and *F. nucleatum* were 0.10mg/mL, and 0.25 mg/mL for *A. actinomycetemcomitans*; the CMB for *P. gingivalis* was 0.25 mg/mL, and for *F. nucleatum* and *A. actinomycetemcomitans* was 0.50 mg/mL. In biofilms, no significant effect on bacterial viability (p>0.05 in all cases) was observed, even with the highest dose of 20 g/L, on *A. actinomycetemcomitans*, *P. gingivalis* and *F. nucleatum* (11.5%, 39.3% and 75.3% of reduction of viable CFU/mL, respectively). CLSM analysis showed a slight decreased in bacterial vitality of biofilms after 30 and 60 seconds of exposure.
Conclusions While periodontal pathogens *A. actinomycetemcomitans, P. gingivalis and F. nucleatum* are susceptible to the action of the cranberry extracts in planktonic state, when organized in biofilms their viability is not affected. Although it was not possible to demonstrate antibiofilm properties for cranberry extracts, this study highlights the importance of testing new active principles, such as cranberry extracts, using *in vitro* biofilm models, since differences were observed on the effects over bacteria in planktonic state or in biofilms.

0240

ADP5 Amelogenic Peptide Enhanced Periodontal Ligament Fibroblasts Behaviour: Cell Proliferation, Remineralisation and Anti-inflammatory Profile

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Objectives To assess *in vitro* the effect of a synthetic amelogenic peptide (ADP5) on the biological behaviour of periodontal ligament fibroblasts.
Methods *In vitro* assessment was achieved on cultured primary periodontal ligament fibroblasts cells (PDLs) after direct contact of ADP5 peptide. The effect of three concentrations of ADP5 (50, 100, 200 µg/ml) on cell metabolic activity was examined by performing Alamar blue assay. Cell morphology was evaluated by confocal microscopy and Alizarin Red staining was used to detect and quantify the formation of mineralized nodules after 7 and 14 days. The inflammatory profile was studied by enzyme-linked immunosorbent assay (ELISA) by quantifying the protein levels of TNF-a, IL-11 and VEGF-A.
Results ADP5 enhanced cell proliferation; the concentration of 100 µg/ml seems to be more efficient that 50 and 200 µg/ml. After the Alizarin Red staining, the number of calcium nodules was notably higher in the presence of ADP5. At the concentration of 100µg/ml, PDLs cells showed a decrease of TNF-a production and a significant increase of IL-11 and VEGF-A production.
Conclusions
These findings provide new insights about the biological effects of the synthetic amelogenic peptide ADP5 that could inspire the development of novel peptide functionalized scaffolds for periodontal tissue regeneration.

0241

Asymptomatic Apical Periodontitis Pathogenesis: Role of IL-1β, TNF-α and PGE2

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Objectives The inflammatory response in asymptomatic apical periodontitis (AAP) is protective by intent but destructive in nature. The immunologic response is mediated by numerous cell types that produce a milieu of pro-inflammatory cytokines. They induce bone resorption and connective tissue degradation. The individual susceptibility to tissue destruction can be assessed by measuring the release of pro-inflammatory mediators by peripheral blood mononuclear cells (PBMCs) at a given bacterial challenge. Our study is focused on the assessment of the role of key pro-inflammatory mediators in the pathogenesis of AAP. Its aim is to examine IL-1β, TNF-α and PGE2 production by PBMCs from patients with AAP.

Methods A total of 20 otherwise healthy individuals diagnosed with AAP were enrolled in the study. Peripheral blood samples were collected. PBMCs were isolated and cultured in RPMI 1640 medium. Some of them were stimulated with *E.coli* LPS, while the others served as a control. The supernatant was collected at 24 and 48 hours and analyzed for IL-1β, TNF-α and PGE2 levels by ELISA.

Results We found that IL-1β and TNF-α concentrations decreased at the 48th hour time point compared to the 24th hour and control samples. On the other hand, PGE2 levels were increased with time exposure. Unstimulated with LPS PBMCs produced higher levels of IL-1β, TNF-α and PGE2 compared to stimulated ones.

Conclusions We propose that the initial release of IL-1β and TNF-α is more impactful to the inflammatory process in the first 24 hours, while PGE2 retains its significance for a longer period of time. The three cytokines tested contribute to the pathogenesis of AAP in different time points.

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0242

The Dark Art of Light Measurement

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Objectives Dental curing lights are medical devices that are intended to photocure resins. As such their light outputshould be adequately described. Unfortunately very few dental publications describe what light the specimens received. This makes replication of the studyproblematic.

Methods This presentation will explain the correct S.I. radiometric terms that should be used to better describe the light output and how these measurements can be made. The effectiveness of 'lane assist' technology in curing lights will be presented.

Results The radiant power, spectral radiant power, radiant exitance, irradiance, beam profille, and the effect of distance from the light tipdental curing lights will be presented and discussed.

Conclusions At the end of this session, the attend should know the correct terms to use when describing curing lights and know how these measurements can be made. The attendee will understand why the commonly used 'irradiance' value that is used to describe curing lights is just an average value across the light tip and gives little indication of what the specimen receives.

0243

Temperature Rise of Two Curing Lights in a Pulp Model

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Objectives To evaluate the temperature rise in a pulp model during curing of adhesive and composite resins with two curing lights.

Methods One Class-II cavity was prepared in one upper molar (mesial/distal box 6mm/occlusal 3mm deep). The three roots were cut and a temperature sensor (OMEGA CHAL-003) was luted into the palatal root in contact with the occlusal part of the pulp chamber (remaining dentin thickness 1mm). Two metal tubes were luted into the mesio-and distobuccal root. The tooth was mounted in a water bath (Gilmore, 36°C) and a pump created a flow of water within the pulp chamber of 0.025 ml/min. With a data logger (Agilent 34970A) the temperatures (pulp and water bath) were continuously recorded (2Hz) during the entire operational procedure. A metal matrix band was applied to the tooth. The cavity was isolated with glycerine gel. Two curing lights were evaluated: Bluephase PowerCure BPC (3s/3,400mW/cm^2), Bluephase Style BS (10s/1,200mW/cm^2). Operative procedure: simulated polymerization of adhesive. Group A: two increments Tetric PowerFill, polymerization of each increment 30s after start of application (aSoA). Group B: one increment Tetric PowerFlow (4mm, polymerization 15s aSoA) followed by one increment Tetric PowerFill (2mm) which was polymerized 30s aSoA. The procedure was repeated five times for each group.

Results The mean absolute temperature rise for the groups was as follows: adhesive BPC 3.4±0.3°C, BS 3.1±0.2°C; bulk-fill flowable BPC 5.5±0.4°C, BS 6.3±0.3°C; bulk-fill composite BPC 6.0±0.4°C, BS 5.9±0.2°C. Except for the flowable resin, there was no statistically significant difference in absolute temperature between the two curing lights (ANOVA, p>0,05). However, the temperature rise was 2-3 times faster in the BPC group compared with the BS group.

Conclusions Absolute temperature rise after curing of adhesive and resin composites with the high power curing light was comparable to that of the standard curing light.

0244

Mechanical Behaviour and Shrinkage Stress of Fiber Reinforced Flow Composite.

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Objectives To evaluate the mechanical properties of a newly developed flowable bulk-fill composite with fibers as a dispersed phase.
Methods experimental EverX Flow (GC corporation) (EXF), one conventional bulk-fill composite without fibers (Filtek, 3M (FBF)), and one flowable bulk composite without fibers (SureFil, Dentsply (SRD)) were tested. Samples were light-cured with Elipar DeepCure LED device (3M) and polymerization stress and volumetric shrinkage were evaluated. Samples were characterized in terms of flexural strength (ISO 4049), fracture toughness (ISO 207951) and Vickers hardness. EXF microstructure was characterized by SEM, as well as the fractured samples. Data were submitted to One-Way Anova and independent t test (α=0.05).
Results FBF showed statistically higher Vickers hardness and flexural strength than EXF and SDR, while EXF showed higher values than SDR. However, EXF showed statistically higher KIC than FBF and SDR, and samples broken parts remained attached after fracture. Polymerization stress and volumetric shrinkage of the three composites were not significantly different.
Conclusions Experimental fiber-reinforced flowable bulk-fill composite has a higher fracture toughness values than non-reinforced bulk-fill composites and higher strength than flowable bulk-fill without fibers. The obtained results provide evidence for its potential use as a restorative material in stress bearing areas.

0245

Shrinkage Vectors and Volumetric Shrinkage Percentage of Differently Applied Composites

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Objectives Bulkfill composites can be placed in 4mm thickness due to their sufficient depth of cure. The aim of this study was to investigate the effect of the application method, bulk versus incremental, on the shrinkage vectors and the percentage of volumetric shrinkage of composites.
Methods 12 teeth were divided into three groups (n=4), cylindrical cavities (diameter=6mm, depth=4mm) were prepared, etched (37% phosphoric-acid) and bonded with OptiBond_FL (Kerr). Cavities were restored with a bulkfill composite Tetric_EvoCeram_BulkFill (TBF, Ivoclar-Vivadent) in bulk of 4mm (group-1), or in two increments 2mm/increment (group-2), and with a hybrid composite Tetric_EvoCeram (TEC, Ivoclar-Vivadent) in two increments 2mm/increment (group-3). Each material application was scanned twice in the micro-CT (Micro-CT40, Scanco-Medical-AG, Switzerland) at medium resolution (16µm); once in the uncured state, and after light-curing (40s, 1100mW/cm^2), small air bubbles served as tracers. Scans were subjected to image segmentation: rigid registration followed by (1) registration for computing shrinkage vectors, and (2) subtraction of the post-polymerization scan from the pre-polymerization scan (Fiji) to obtain difference in pixels for calculating the percentage of volumetric shrinkage.
Results Significantly greater mean values of shrinkage vectors were observed in group-1, followed by group-2-increment1, with no difference between the remaining groups (ANOVA, Tamhane's-T2-test, p<0.001), while volumetric shrinkage did not differ significantly among the groups (ANOVA, Tamhane's-T2-test, p=0.759).
Conclusions Bulk application resulted in greater shrinkage vectors than in the incremental application, despite the volumetric evaluation displaying no difference regarding the application methods. The discrepancy between the evaluation methods can be explained by anisotropic shrinkage which is displayed through the shrinkage vectors but cannot be quantified by the volumetric evaluation.

0246

Degree of Conversion of Experimental Composites Based on Bioactive Glass

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Objectives To evaluate the effect of the systematically varying amount of bioactive glass 45S5 (BG) on the degree of conversion (DC) of experimental composites.
Methods Five experimental resin composites based on UDMA/TEGDMA resin (80/20 by weight) were prepared with 0, 5, 10, 20, and 40 wt% of BG and a total filler load of 70 wt%. Specimens (n=5 per experimental group) were light-cured for 20 s at 1000 mW/cm^2 in stainless steel cylindrical split-molds (h=6 mm). The DC was measured using FT-Raman spectrometry immediately after light-curing and 24 h post-cure. The DC was evaluated as a function of layer thicknesses at 0, 1, 2, 3, and 4 mm.
Results The DC values measured immediately after curing at specimen surfaces (63.0-67.1 %) were statistically similar among all materials. A significant post-cure DC increase of 11.3-12.8 % was observed in all composites. Surface DC values of all of the BG-containing composites measured 24 h post-cure (77.7-79.1 %) were statistically similar but significantly lower compared to the

material with 0 wt% of BG (75.5 %). The DC values at 1 mm thickness (73.3-77.0 %) were statistically similar for all materials. Statistical heterogeneities were more pronounced at 2 mm, where materials with 0-20 wt% of BG had significantly higher DC (68.0-73.4 %) compared to the material with 40 wt% of BG (61.6 %). Even more statistical heterogeneity was observed at 3 mm, with the DC values (%) of 66.7, 60.5, 47.6, 53.9, and 39.4 for composites with 0, 5, 10, 20, and 40 wt% of BG, respectively. The DC values at 4 mm ranged from 17.3-49.8 and were considered clinically unacceptable for all materials.
Conclusions Admixing BG fillers into a UDMA/TEGDMA resin had a minor effect on the DC of experimental composites at layer thicknesses of up to 2 mm.

0247

Marginal Seal and Pore-Volume of Direct Filling-Materials Evaluated by µCT-Analysis

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Objectives The purpose of this study was to investigate the marginal and internal adaptation as well as pore-volume of direct filling-materials immediately after placement using three-dimensional µCT-analysis.
Methods 30 extracted human molars with prepared class-II-cavities were filled with Fuji-II-LC [Fuji], GC; Equia-Forte [Equia], GC; Ketac-Universal [Ketac], 3M; TetricEvoCeram-BulkFill [Tetric], Ivoclar-Vivadent; Surefil-One [Surefil], Dentsply-Sirona according to manufacturer's instructions.
Filled molars were scanned in a µCT 50 (SCANCO-Medical, Brütisellen, CH) at 20µm isotropic voxel-size. Using Fuji, the orientation of the samples was harmonized and a mask was drawn of each cavity using the selection tools and interpolation. Oriented scans and masks were imported into Definiens Developer XD2.7 (Definiens AG, Munich, DE). The cavity-border was found at the interface between thresholded dentin/enamel and the mask and separated into horizontal and vertical surfaces. Pores were found with a combination of density thresholding and localized intensity differences and adjusted accordingly for the different attenuations of the used filling-materials. Identified marginal gaps, pore-surface (missing internal adaption), and pore-volume were expressed as percentage of the respective total length, surface, or volume. Fisher-Pitman permutation-tests were calculated using R (version 3.5.3) to evaluate statistical significance.
Results Ketac showed significantly higher percentages of marginal gaps, pores along internal cavity interfaces, and overall pore-volume within the material than the other materials tested ($p<0.05$). Significantly less small pores (10^5 -10^7 μm^3) were detected in Tetric compared to all other materials ($p<0.05$).), but more pores at the horizontal cavity floor in contrast to Fuji, Equia and Surefil (Fig.1, not statistically significant).
Conclusions µCT may be a suitable method for quality assessment of direct filling-materials by detecting voids at the cavo-surface margin, at the horizontal and vertical cavity interfaces and within the material. In this study, different patterns of pore-size and location distribution were detected in a single-paste material used with an adhesive and powder/liquid-based materials mixed in a capsule.

0248

Micro-porosities Revealed in Hybrid Dental Composites by Nano X-ray Tomography

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Objectives The microstructural characteristics of dental composites have a significant influence on the overall properties and clinical performance of these biomaterials. Technological advances makes it now possible to examine dental composites with 3D nanometer resolution. The current investigation was aimed to characterize existing dental nano and microhybrid composites through nano computed tomography (nano CT) compared with microCT and high resolution scanning electron microscopy (SEM) coupled with elemental analysis (EDX).
Methods Eight commercial dental resin composites (2 microhybrid and 6 nanohybrid) were used. Cured samples were then examined using nano CT and compared with microCT. Acquired images were reconstructed and image analysis was conducted to determine the porosity and pore morphology. High resolution SEM and EDX were also conducted to investigate the surface topography of filler and morphology and distribution to verify the findings from the nanoCT.
Results A comprehensive comparison of acquired images by scanning micrographs, micro CT and nano CT revealed that the nano CT images displayed far greater insights into the ultrastructure of cured dental composites. Microhybrid and nano hybrid dental composites had significant differences amongst them. The filler particles and their distribution could also be visualised. However, the presence of porosities in different specimens were calculated from the reconstructed images and the mean pore diameters ranged from 8 to 34 µm and filler particle diameters were from 2 to 12 µm.
Conclusions nanoCT was successfully employed for the first time to investigate ultrastructural morphology of dental resin composites with a voxel resolution of 600 nm. This was also compared with existing micro CT, and clearly the nanoscale resolution of the nanoCT revealed porosities in the material not seen before. There was a large discrepancy between the tested composites. Evidence of porosities and pores within the specimen is a critical finding and would have a detrimental effect on the material longevity.

0249

Release of Bisphenol-A from Dental Materials Due to Impurities Present in Monomers

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Objectives Several *in-vitro* and *in-vivo* studies showed that the endocrine disruptor bisphenol-A (BPA) may elute from dental composites. Even though the presence of BPA in composites is often ascribed to impurities in the monomers used in the composite and other resin-based dental materials, it should also be considered that BPA could originate from monomer degradation. In the past, only few studies focused on monomer degradation, and they concluded that BisGMA is very stable, but BisDMA rapidly degrades into BPA. However, current measuring (analytical) methods are nowadays much more sensitive, and there is no literature available regarding the other BPA-based monomers.

Methods In a first phase, the presence of BPA under the form of an impurity was determined in both BPA-based and non-BPA-based monomers from different manufacturers (n=5). In a second phase, monomers were degraded following several protocols mimicking the oral environment. 3 µmol of monomers was incubated in a rotary shaker at 230rpm for 24h at 37°C in respectively (1) water-based solvents with pH1 (0.1M HCl) and pH13 (0.1M NaOH), (2) in BHI broth for 48h containing *S. mutans* ($2x10^7$CFU/mL), and (3) in whole human pooled saliva. BPA-d_{16} was added as internal standard to all samples. BPA was purified from all degradation media with solid-phase extraction (Oasis PRiME HLB and AFFINIMIP SPE Bisphenols) and quantified with UPLC-MS/MS.

Results BPA was present as an impurity in both BisGMA (0.00054±0.0007%) and BisEMA(3) (0.00272±0.00017%), but could not be detected in other monomers. No increased levels of BPA were found upon degradation.

Conclusions These results show that BPA is already present as an impurity from the production process of dental monomers. Furthermore, the hypothesis that BPA is formed upon degradation can be rejected. Hence, optimizing the purification method during production stage may decrease the presence of BPA-impurities, or even result in BPA-free dental materials, thereby limiting human exposure.

0250

Design of a Knowledge Evaluation Questionnaire for Dental Specialists on Preservation and Extraction Indications of the First Permanent Molars

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Objectives To evaluate the extent of knowledge of dental specialists in Shiraz (Iran) on clinical guidelines for the preservation and extraction indications of First Permanent Molars (FPMs).

Methods A dedicated questionnaire for the purpose of knowledge evaluation was developed by the authors. The validity and reliability of the questionnaire were confirmed by 6 orthodontists and 15 dental specialists, respectively. The 19-item questionnaire covered topics such as demographic data, preservation criteria for FPM teeth, and indications for FPM extraction. The survey was carried out across six dental disciplines (endodontics, pedodontics, prosthodontics, orthodontics, oral and maxillofacial surgeons, and restorative dentists) in Shiraz (Iran) during July-August 2018. The data were analyzed using the SPSS software (version 22.0) with the dependent sample *t* test and one-way ANOVA. $P<0.05$ was considered statistically significant.

Results From a total of 89 dental specialists, 64 participants (53% males, 47% females) completed the questionnaire. Over 50% of the participants were graduates from Shiraz University of Medical Sciences (SUMS) and nearly 68% were dental faculty member.

The mean score of the knowledge for all participants was 10.09±3.93. The knowledge level showed the following descending order among the six disciplines: pedodontists, orthodontists, prosthodontist, restorative dentists, oral and maxillofacial surgeons, and endodontists. It had a significant and an inverse correlation with age ($P<0.001$) and years of experience ($P=0.017$). All female participants and those graduated from SUMS had the highest knowledge level ($P=0.046$, $P=0.029$, respectively). The level of knowledge had a significant relationship with dental specialty ($P<0.001$).

Conclusions The overall level of knowledge of the specialists was insufficient, except for the pedodontists and orthodontists. A re-education training program for dental specialists is strongly recommended. In addition, in support of fresh dental graduates, the inclusion of indications for FPM extraction should be considered in the dental curriculum.

0251

Effectiveness of an Educational-Video in Improving Needle-Stick-Injuries Knowledge Among Dental-Students

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Objectives The aim of this study was to determine if an intervention in the form of an educational video would enhance the knowledge of dental students regarding needle-stick injuries, their prevention and post-exposure protocol.
Methods This randomised controlled trial included 50 dental students, divided equally into control and experimental groups. Baseline data was collected using a self-administered online questionnaire to both groups, followed by which only the experimental group was exposed to an educational video. Post intervention data was again collected from experimental group to assess the comparison of knowledge against control group. Later control group was also exposed to the same video and post intervention data was collected. Data was analysed using SPSS v.22, tests used were analysis of covariance (ANCOVA), Levene's test and paired t-test with p value set at <0.05.
Results Comparative analysis at baseline showed no significance between experimental and control groups with mean value 27.28 (SD=2.49) and 27.48 (SD=3.25) respectively (maximum score being 35). Post-intervention analysis showed significant difference between the two groups with increased mean 30.60 (SD=2.00) for experimental group. Significance was also noted post intervention for control group after they were exposed to the video as part of randomization with increased mean of 29.48 (SD=3.75). These results showed that the video was effective in improving the knowledge of dental students on needle stick injuries.
Conclusions An educational video can hence be used as an effective tool to reinforce the knowledge about dangers of needle stick injuries, their prevention, and post-exposure protocol. This will help to better prepare students to practice safe dentistry at all times, and to avoid mishaps in the clinic.

0252

Effectiveness of Three Oral Moisturizers in Palliative Care Patients

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Objectives A majority of patients in palliative care have problems with dry mouth caused by medication or as a direct result of the mortal condition. Dry mouth will cause a variety of problems that commonly affect the disease negatively and contribute to reduced quality of life in the patient`s last stage of life. This RCT study aimed at comparing the effectiveness of three different oral moisturizers: 17% watery solution of Glycerol, Aequasyal and a newly developed product, Salient.
Methods The study was designed as an RCT with a crossover design. All patients were treated with all three products. Thirty cognitively functioning palliative care patients with xerostomia were recruited from palliative care units in Bergen.
Results All products showed significant improved relief from xerostomia (p<0.001), discomfort/pain (p<0.001) and speech-problems (p<0.001) right after intervention. Two hours after intervention the effect of Glycerol on xerostomia, discomfort/pain and speech-problems had dropped significantly compared with the other two products and had in fact reverted to the baseline levels (p<0.073). In contrast, the effects of Aequasyal and Salient were maintained after the same period (both p<0.001). A majority of the respondents preferred Glycerol (63%), while 20% preferred Salient and 10% preferred Aequasyal (p<0.001).
Conclusions Within the defined limitations of this study, none of the three tested products were found to be clinically completely adequate. The 17% concentration of Glycerol had the most positive effect right after application, but little or no effect after 2 hours. Aequasyal and Salient had a long-lasting effect, but were still not preferred by the patients. This may be due to the disagreeable taste of the former and the unpleasant, sticky consistency of the latter. There is a need for better products and further research, in order to improve oral care for palliative patients.

0253

Effect of Alzheimer's Disease on Periodontitis

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Objectives Alzheimer's disease (AD) and periodontitis (P) are associated with systemic pro-inflammatory status and may contribute to each other's progress. The aim of the study was to evaluate the periodontal status, oral health related quality of life, ApoEε4 allele carrier status, serum vitamin D and IL-18 levels in P patients with (P+AD) and without AD (P-AD).
Methods Forty three P+AD patients and 40 aged matched P-AD patients were included in this study. Periodontal parameters, number of teeth, geriatric oral health assessment index (GOHAI) and saliva flow rate were recorded. Blood samples were collected and analyzed for the presence of ApoE∈4 and levels of vitamin D and IL-18. ApoE gene polymorphism was carried out by real-time polymerized chain reaction, vitamin D levels by chemiluminescence immunoassay and IL-18 levels by ELISA.
Results Periodontal parameters and vitamin D levels were similar between P+AD and P-AD groups (p>0.05). Mean vitamin D levels in both groups were consistent with vitamin D deficiency. P+AD group had lower number of teeth, GOHAI score, salivary flow rate, and higher ApoEε4 allele carrier percentage than P-AD group (p<0.05). Moreover, within P+AD group saliva flow rate

was lower in ApoEε4 allele carrier patients than non-carrier ($p<0.05$). Within P-AD group saliva flow rate was lower in patients with low levels of vitamin D than patients with normal levels of vitamin D ($p<0.05$). Serum IL-18 levels were higher in P+AD group than P-AD group ($p<0.05$).
Conclusions This study shows that GOHAI scores were lower in P+AD patients which might be related to low salivary flow rate possibly affected by the ApoEε4 allele carrier and low number of teeth**.** Moreover, elevated serum IL-18 levels in P+AD patients suggest that IL-18 might play a role in the inflammatory process of AD.

0254

Observational 16-year Study of Posterior Tooth Fracture in Dental Practice

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Objectives An observational study of an approach to manage posterior tooth fracture up to 16 years in primary dental care.
Methods Posterior Tooth Fractures (PTF) were observed up to 16 years in all patients attending a dental practice in London, using a previously established recording system; Class I enamel only fracture, Class II enamel and dentine fracture, Class III enamel and dentine fracture coronal to the amelo-gingival margin, Class IV enamel and dentine fracture below the amelo-gingival margin. Teeth were in occlusion with natural tooth antagonists. Whether a fracture occurred in a Functional (F) or Non-Functional (NF) cusp was recorded. The material/s used to restore fractures were also recorded. All teeth were followed up annually up to 16 years. One skilled operator undertook all procedures.
Results At 16 years, 5273 patients of average age 74 years were observed. Most patients were caucasian (99.5%) female (68%). The total PTF recorded was 7% (n=4,473) in 63,900 posterior teeth. The proportions of PTF in these teeth were Class I 3%, Class II 37%, Class III 55%, Class IV 5%. Restorations placed following fracture included Glass Ionomer Cement (GIC) 70% (placed out of occlusion in exposed dentine fractures), Composite 15%, Amalgam 11% and full Crowns 4%. Restorations survived up to 16 years. Significantly more fractures occurred in NF cusps compared with F cusps in mandibular second premolars, and mandibular first and second molars ($p=0.04$). There were no significant differences in fracture between maxillary NF and F cusps.
Conclusions Limited posterior tooth fractures and low restoration maintenance are possible long-term in an ageing dentition with good annual recall. GIC was commonly used for restoration of PTFs in dentine and survived out of occlusion. Non-functional posterior cusps in the mandible had significantly more fractures and thus occlusion should be planned carefully to reduce fracture risk.

0255

Menstrual Variation in Pulp Sensitivity in Women with Temporomandibular Disorders

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Objectives To explore menstrual changes in dental pulp sensitivity in women with temporomandibular disorders (TMD).
Methods The study comprised 23 regularly menstruating women aged 20 to 45 with pain-related TMD. Twenty-four pain-free regularly menstruating women were recruited as controls. Two experimental pain procedures including application of electrical stimuli by electrical pulp tester and cold by refrigerant spray were performed on mandibular lateral incisors, in five menstrual phases (menstrual, follicular, periovulatory, luteal and premenstrual). TMD was assessed by Research Diagnostic Criteria for TMD. Repeated measures analysis of variance and Friedman test, with post-hoc Bonferroni correction were used to explore changes in experimental pain response over time.
Results Women with TMD showed variability in pulp sensibility to both stimuli across the cycle. Post hoc comparisons showed the significant difference for cold stimulation, with higher pain sensitivity in menstrual in comparison to follicular ($p=0.033$), periovulatory ($p=0.003$) and luteal ($p=0.007$) phases. There were no intergroup differences in response to the applied stimuli.
Conclusions Pulp sensitivity in women with TMD shows variation across the cycle for cold stimuli with peak in menstrual phase, but does not differ from pain-free controls.

0256

Association between Temporomandibular Disorder Pain and Primary Headaches – An 11-years' Follow-up

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Objectives
The objective of the current study was to asses the association between painful TMD signs and primary headaches, comprising mainly tension-type headaches (TTH) and migraine, in a follow-up period of 11 years.
Methods The current study utilized data from the Health 2000 Survey and the Health 2011 Survey (BRIF8901), conducted by the National Institute for Health and Welfare (THL) of Finland. Bayesian logistic regression with weakly informative priors was utilized to assess the association between muscle related TMD pain (mTMD) and temporomandibular joint related TMD pain (jTMD) at baseline (the Health 2000 Survey) and primary headaches at the follow-up (the Health 2011 Survey). Validity and reliability of the results was confirmed through Bayesian sensitivity analyses.
Results Given the priors, data and models described in the current study, none of the baseline TMD pain variables was associated with the presence of migraine at the follow-up (95% credibility intervals -0.44 - 0.19 for mTMD, and -0.45 - 0.47 for jTMD). Regarding TMD pain and TTH, only mTMD at baseline was associated with the presence of TTH at the follow-up (95%

credibility intervals 0.07 - 0.71 for mTMD, and -0.93 - 0.14 for jTMD). Bayesian sensitivity analyses revealed that the estimates of the regression models were stable, demonstrating the validity and consistency of the estimates.
Conclusions No association was observed between painful TMD signs at baseline and the presence of migraine during the follow-up period of 11-years. However, baseline mTMD was associated with the presence of TTH at follow-up.

0257

Multifactorial Analysis of Discoloration of Sculptable Universal Composites

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Objectives To analyze main and interaction effects of the factors 'composite', 'medium' and 'time' on color and translucency of sculptable universal composites following immersion in staining media.
Methods Cylindrical 2x10mm specimens of Essentia (Dark Enamel; GC), G-aenial (Adult Enamel; GC), Filtek Ultimate Enamel and Filtek Ultimate Body (A2; 3M ESPE) were prepared and light-cured with a high-intensity LED (Deep Cure, 3M ESPE) for 20s. Upon wet-polishing with SiC-1000 and TexMet discs, specimens (N=5/group) were immersed in red wine, coffee or distilled water (control) at 37°. Color was measured initially and at two 2.5-day intervals using VITA Easyshade 5.0 spectrophotometer (VITA Zahnfabrik) over white/black backgrounds. Color ($\triangle E_{00}$) and translucency (TP) differences were calculated using CIEDE2000. General linear model and two-way ANOVA with factorial plot analysis and post-hoc tests were used at α=0.05.
Results Significant differences in $\triangle E_{00}$ existed between different factor levels of 'composite', 'medium' and 'time' with significant interaction between 'composite' and 'medium' (p<0.001). 'Composite'*'time' interaction was not significant (p=0.8564) as was not 'medium'*'time' interaction (p=0.9510). G-aenial showed the highest $\triangle E_{00}$ ($\triangle E_{00}$=6.2±0.9), followed by Filtek Enamel ($\triangle E_{00}$=4.9±1.4) and Filtek Body ($\triangle E_{00}$=4.8±2.1) with Essentia exhibiting the lowest ($\triangle E_{00}$=2.5±0.8). Wine yielded greater $\triangle E_{00}$ than coffee in G-aenial, Filtek Enamel and Body, whilst coffee resulted in higher $\triangle E_{00}$ in Essentia (p=0.0003). Regarding TP differences, no significant interaction existed between the factors ('composite'*'medium' p=0.1552; 'composite'*'time' p=0.2962; 'medium'*'time' p=0.9804). Essentia exhibited the highest translucency (TP=9.2±1.3), followed by G-aenial (TP=6.3±1.2), Filtek Enamel (TP=4.5±1.0) and Filtek Body (TP=4.3±1.2). Wine decreased TP more than coffee in all composites (p<0.001). Longer exposure time increased $\triangle E_{00}$ but did not affect TP (p=0.2187).
Conclusions Differences in $\triangle E_{00}$ between sculptable universal composites depended on staining media. TP differences between tested composites were consistent across factors 'medium' and 'time'. Enamel and Body shades of a sculptable composite showed comparable $\triangle E_{00}$ and TP at 2mm thickness.

0259

Comparing Shade Changes of Ceramic Restorations by Using Different Translucent Resin Cements

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Objectives To evaluate the shade change of three manufacturers of translucent resin cements on the final color of ceramic veneers.
Methods 30 Disk-shaped ceramic specimens (IPS e. Max, 0.6 mm x 7.00 mm diameter) and 30 Composite Resin Background Specimen Blocks were fabricated (3mm x 10mm diameter). They were then divided into 3 groups, each group containing 10 ceramic disks and 10 composite disks. The ceramic disks were cemented on the composite resin background blocks using translucent cement from 3 different manufacturers. (**Group1** - Variolink Esthetic LC Neutral by Ivoclar Vivadent, Liechtenstein, **Group 2** - eCement Translucent by Bisco, U.S.A **Group 3** - RelyX Veneer Cement Translucent by 3M ESPE, U.S.A). A spectrophotometer (VITA EasyShade Advance) was used to measure the color parameters before and after cementation. The color differences were then statistically analyzed using one-way ANOVA. Significance was set to P<0.05.
Results The final shade of the ceramic veneers showed the most significant changes in ΔE value for the translucent shade from eCement by Bisco while Variolink and Relyx showed a less significant color change. However, all three translucent cements exceeded the clinically acceptable threshold of ΔE>3.3.
Conclusions The three brands of translucent resin cement all produced clinically noticeable shade change on the ceramic veneer with Variolink Esthetic cement having the least effect on the color of the ceramic and eCement producing the most color change.

0260

Effect of Mouthrinses on the Color Stability of IPS Epress CAD

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Objectives The purpose of our study was to investigate the effect of two commercial mouthrinses [Tantum Verde, and Klorhex];on the color stability of IPS Empress CAD (Ivoclar)after fourty eight hours.
Methods Thirty rectangular-shaped samples(12x14 mm) in 1 mm thickness were obtained from IPS Empress CADblocks. All the specimens were stored in distilled water for 24 h at 37 degrees celcius.Then, the baseline color values (L*a*b*) of each specimen were measured using a spectrophotometer (Vita Easyshade Advance 4.0) according to the CIEL*a*b color scale. Thirty ceramic samples were divided into three sample groups (n=10). The samples were immersed in the mouthrinse solutions for 48 hours. After immersion, the color values of each specimen was remeasured, and the color change value (ΔE) was calculated. Data were analyzed with IBM SPSS V23.

Results All IPS Empress specimens showed colour changes in all solutions (p<0,001).While the average value in distilled water was 0.295, it was 1.073 in Tantum Verde solution and 0.671 in Chlorhexidine solution. The specimens immersed in Chlorhexidine showed less discoloration then Tantum Verde after 48 hours.The least color change was observed in distiled water .Whereas the highest colour change was observe at Tantum Verde.
Conclusions All mouthrinses solution showed clinically acceptable color change.(ΔE This work implied that mouthrinse with lower alcohol content had less deteriorating effect on colour.The dentists may advise pateients to use mothrinse solution with lower alcohol content.

0261

A New Erythritol Containing Biocompatible Fluoride Toothpaste

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Objectives Basic functions of dentifrice and toothbrush are removal of the biofilm in order to prevent caries and gingivitis. An ideal toothpaste should provide maximal fluoride availability, optimal abrasivity, and ingredients that do not interfere with fluoride release but should have additional beneficial effects. Further, the effect of dentifrices and their ingredients on cells of the oral cavity is of importance.
Methods We investigated several chemical, physical and biological parameters of a new toothpaste (AirFlow) that contains besides fluoride also erythritol but no SLS and compared them to commercially available toothpastes (Zendium-Ze, Sensodyne-Se, OdolMed-OM, OralB-OB). Wettability and abrasion on enamel, pH, free fluoride, the half lethal concentration (LC50) as well as the proliferation behaviour on gingival (GF), periodontal ligament (PDL) and mouse fibroblasts (L929) were tested.
Results AirFlow-AF had the largest contact angle on enamel (38.4°), OB the lowest (18.4°) The abrasion on enamel after 18000 strokes was 0.02 µm (AF), 0.08 µm (Ze), 0.1 µm (Se), 0.16 µm (OM), 0.59 µm (OB). The pH of the slurries was between 5.6 (OB) and 7.7 (AF); free fluoride ranged between 1025 ppm (OB) and 1400 ppm (AF). The mean LC50 values of AirFlow on GF, PDL, and L929 were 16.2, 10.9, and 11.1, respectively. In comparison, the four commercially available toothpastes showed mean LC50 values of 1.5 (OB), 1.2 (OM), 1.4 (Se), and 27.7 (Ze) on GF. Mean LC50 values on PDL and L929 were 1.0 and 0.4 (OB), 3.7 and 0.9 (OM), 1.2 and 1.2 (Se), as well as 25.4 and 5.6 (Ze), respectively. Proliferation behaviour mainly confirmed the LC 50 values. While cells after stimulation with AF returned to almost unimpaired proliferation behaviour at 6%, cells are still strongly impaired after stimulation with all tested commercially toothpastes.
Conclusions The new toothpaste (AF) showed low abrasivity, large contact angles, high availability of free fluoride and high biocompatibility to different cell lines.

0262

Salivary Microbiome in Infants Three Years Prior the Clinical Diagnosis of ECC

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Objectives Timely identification of early childhood caries (ECC) risk is crucial for its prevention.
Objective: 1) to determine if the ECC-status is already reflected in the salivary microbial composition of the infants three years prior the clinical diagnosis; 2) to assess a relation between dietary factors and salivary microbiome.
Methods This is a part of the "Predicting Caries Risk in Underserved Toddlers in Primary Healthcare Settings" study. Unstimulated saliva was collected from 189 one-year-old orally-healthy children and their primary caregivers (94% mothers). Caries status (dmft, ICDAS) was determined at the age of 1, 2.5 and 4 years. Salivary microbial composition was assessed using 16S rDNA amplicon sequencing. Microbiome profiles were ordinated using Principal Component Analysis (PCA) and differences assessed by Permutational Multivariate Analysis of Variance (PERMANOVA). The profiles were compared using the biomarker discovery tool LEfSe and the difference in relative abundances of the zOTUs were assessed using the Kruskal-Wallis test.
Results At the age of 4 years, 70 children (37%) had dental caries (dmft>1). Their salivary profiles at one year of age differed significantly (p=0.0017) from the caries-free group (N=119). The difference was due to lower proportions of *Porphyromonas, Neisseria, Fusobacterium*, *Aggregatibacter* and *Haemophilus* and higher proportions of *Streptococcus, Actinomyces, Rothia, Alloprevotella, Prevotella, Veillonella, Gemella* and *Capnocytophaga* (p<0.05) in the caries group. Ethnicity, Medicaid status and recruitment site contributed to the observed differences. Dietary habits (e.g., overnight nursing or bottle usage, frequency of sugary drinks) of the infants had significant effects on their salivary microbiome. Interestingly, dietary habits of the caregivers not only significantly influenced their own salivary microbiome, but also those of their children.
Conclusions Ecological shift in salivary microbiome had occurred as early as three years before the clinical diagnosis of ECC. Microbial composition was influenced by dietary habits of both the infant and the caregiver.

0263

Measuring Responsiveness to Preventative Treatments for Dental Caries: Towards a Predictive Model Using Machine Learning

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Objectives Our short-term objective is to assess the comparative effectiveness of caries prevention agents and measure the re-occurrence rate of dental caries in children receiving preventative therapies for cavities. Our long-term objective is to understand the clinical and microbial determinants of re-occurrence, leading to the development of a predictive model for the "responsiveness" to care.

Methods Analyses for the longitudinal impact of prevention used binary Markov chains. Model outcomes were defined as the prevalence of untreated decay, stratified by baseline decay status (no decay versus any decay). Participants were treated with either sealants and interim therapeutic restorations or a 38% silver diamine fluoride solution on all teeth pits, fissures, and symptomatic carious lesions. Salivary samples and supragingival plaque were collected from 15 children with and without caries and analyzed using 16S sequencing.

Results Approximately 32% of participants had untreated decay (deciduous or permanent teeth) at baseline. Model results indicate a significant increase in the odds of untreated decay over time for children without decay at baseline with a large negative quadratic effect. For children with baseline decay, there was a significant reduction of decay prevalence at subsequent observations but an increasing quadratic effect over time. Further, results indicate that approximately 15% of study participants receiving care experience a re-occurrence of dental caries regardless of baseline caries prevalence within two years.

Conclusions We demonstrate a disparity in the effects of caries prevention. Further research in this area will consist of linking data from sequencing analyses to clinical and epidemiologic data in support of a machine learning algorithm to predict responsiveness to care in order to improve the targeting of caries prevention programs.

0264

Attitudes of Dental Students and Young Dentists Towards Caries-risk Assessment

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Objectives The aim of the study was to assess the knowledge and attitudes of dental students and young dentists towards the assessment of caries-risk and its impact on their choice of caries treatment.

Methods A total of 202 respondents filled in the internet questionnaire. Five questions were related to attitudes and knowledge about caries-risk assessment in clinical practice, and 15 were related to the impact of different factors on caries-risk. The choice of treatment according to caries-risk was analyzed in 7 clinical cases of smooth surface caries and occlusal caries. Chi-square test was used in statistical analysis.

Results One hundred and twenty two (60%) respondents do not perform caries-risk assessment in their clinical practice. However, 193 (95%) agreed that caries-risk should influence dental treatment. Oral hygiene was regarded as the most important factor, while the age of patient was valuated as the factor of the lowest impact on caries-risk assessment. The analysis of clinical cases showed that caries-risk affects the choice of treatment, and that more invasive treatment is chosen in high caries-risk patients. Significant differences between students and young doctors were found regarding the choice of treatment for occlusal caries ($p<0.05$).

Conclusions Caries-risk assessment is not widely performed among students and young dentists in Serbia and their knowledge is insufficient. Caries-risk influences the choice of therapy, but invasive treatment is still commonly preferred.

0265

Effect of Herbal-Toothpaste and White-Tea on Remineralization of Initial-Enamel Caries

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Objectives The aim of this *in-vitro* study was to evaluate the effect of a ginger-honey containing herbal-toothpaste and white tea used as a mouthwash on remineralization of initial enamel caries.

Methods 80 enamel specimens obtained from extracted human non-carious third molars' buccal surfaces were used and initial microhardness values (BM) were determined. Following immersion of specimens in demineralization solution for 72h to obtain initial enamel caries, demineralization microhardness measurements were performed (DM). Then, specimens were randomly divided into two groups as fluoridated (Ipana Enamel Regeneration; Procter&Gamble) and herbal-toothpaste (Gumgumix; Beka Ilac A.S.) which were further randomly divided into four subgroups according to the remineralizing agents; control, CPP-ACPF, white tea and CPP-ACPF+white tea combination (n=10). All specimens in each group were subjected to pH-cycling for 21-days and remineralization microhardness (RM) was performed. The differences of each specimens' RM-DM values were statistically evaluated with one-way ANOVA and post hoc Tukey HSD tests ($p<0.05$).

Results There were no significant differences between herbal (11,49±8.92) and fluoridated-toothpastes (11.48±10.16) RM-DM microhardness ($p=0.986$). With fluoridated-toothpaste, the combined (39.45±12.73) or separate use of white tea (49.87±12.96) and CPP-ACPF (50.04±14.06) showed significantly higher RM-DM microhardness than the separate use of the toothpaste ($p<0.05$), while separate use of agents showed similar microhardness as the combinated use ($p>0.05$). Herbal-toothpaste+CPP-

ACPF (22.75±10.84) showed significantly similar remineralization effect as the herbal-toothpaste+white tea (18.82±15.56) (p=0.109), whereas the combined use of white tea+CPP-ACPF (40.84±9.91) exhibited significantly higher RM-DM microhardness (p<0.05).
Conclusions Ginger-honey containing herbal-toothpaste results in similar effectiveness as the fluoridated-toothpaste in remineralization of the initial enamel caries lesions. The separate use of white tea and CPP-ACPF along with the fluoridated-toothpaste significantly increases the remineralization effect however, this effect does not exist with herbal-toothpaste. The combined use of agents along with both toothpastes significantly increases the remineralization effect.

0266

Cariogenic and Protective non-Cariogenic S*treptococcus* in Orthodontic Treatment with Clear Aligners

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Objectives The increased demand for orthodontic treatments has popularized clear aligners because of aesthetics and the advantage of being able to remove them to eat, drink and perform daily oral hygiene. The effects of fixed orthodontic appliances on oral health have been previously described and include an increase of bacterial plaque and induction of changes in oral biofilm with consequent risk of periodontal diseases and dental caries. Although scarce, there are studies in literature that compare the impact on periodontal health of aligners v*ersus* fixed appliances, but little is known about effects on enamel demineralization. Since caries depend on the imbalance between cariogenic (e.g., *S. mutans* and *S. sobrinus*) and commensal species (e.g., *S. mitis, S. oralis* and *S. sanguinis*), it is important to understand the impact of treatment with aligners in oral biofilm and consequent susceptibility to caries.
This prospective study assesses the fluctuations occurring in oral S*treptococci* during orthodontic treatment with clear aligners both of cariogenic and protective non-cariogenic species.
Methods Oral biofilm and saliva samples were collected in 35 patients undergoing orthodontic treatment with transparent Invisalign aligners at 3 time points: before placing the first aligner (T0), after 1 (T1) and 3 months (T3). We also collected personal data (gender, age, oral health habits) and the DMFT index was determined.
DNA was isolated both from biofilm and saliva samples and qPCR used to quantify cariogenic and non-cariogenic species.
Results The relative quantities of *streptococci* vary between individuals but not significantly between time points for the same individual.
Conclusions While having an impact on the oral microbiome of the individual, there isn't a significant increase in cariogenic species when aligners are used. The results presented are from 3 time points. Further conclusions will be possible when data from other time points (full treatment and 2 months after treatment) are completed

0267

Clinical Efficacy of Xenogeneic Collagen Matrix Simultaneous to Peri-implantitis Treatment

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Objectives Evaluate the patient perception of the procedure for augmentation of the keratinized tissues around endosseous dental implants with infectious pathology and with minimum or absent keratinized mucosa.The aim of this randomized clinical trial was to Evaluate the patient perception of the procedure for augmentation of the keratinized tissues around endosseous dental implants supporting prosthetic restorations with infectious pathology and with minimum or absent keratinized mucosa comparing a xenogeneic collagen matrix with autologous connective tissue graft
Methods In this multicentre randomized clinical trial receive treatment 24 patients per group, reaching a total amount of 48 patients. All of them receive resective periimplant surgical therapy, with implantoplasty and randomly receive a autologous connective tissue graft (CTG) or a xenogeneic collagen matrix (XCG). Peri-implant health (Bleeding on probing, plaque index, peri-implant probing depth) gain of keratinized mucosa, vestibulum depth and patient perception and satisfaction are measured pre-operatively and 6 months and 12 months post-operatively.
Results At 6 month the gain of keratinized tissue was 1,88mm in CTG Group while 1,44mm in XCG Group. There vas a similar PPD reduction and post-operative recession in both groups. The vestibulum depth was augmented 2,7mm in CTG group while in XCG group only reached 1,05mm of augmentation. Nevertheless when using a xenogeneic collagen matrix surgery time and patient morbidity was decreased and general satisfaction was higher comparing with CTG Group.
Conclusions At 6 months follow-up both collagen matrix and connective tissue graft simultaneously to the resective therapy of peri-implantitis resulted in a improvement of clinical parameters at the same time that vestibulum depth and keratinized tissue were augmented.Higher satisfaction was reported in patients who received xenogeneic collagen matrix associated to lower consumption of analgesics and surgery-time. Therefore, in the short term patients diagnosed of peri-implantitis who were treated with the proposed surgical approach achieved peri-implant health and augmentation of keratinized tissue. Longer follow-up is required to assess the stability of obtained results.

0268

Clinical, Microbiological and Biochemical Changes in Peri-implantitis Patients After Flap Surgery and Implant Surface Decontamination Using Glycine Powder Air Polishing.

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Objectives The aim of the present study was to evaluate the outcomes of a surgical procedure for the treatment of peri-implantitis.
Methods The 30 subjects included in this case series presented clinical signs of peri-implantitis and were treated with a surgical treatment based on access flap and surface decontamination with glycine powder air polishing. Patient evaluation was done after a follow-up period of 6 months. Microbiological samples were processed by culturing and biochemical samples using enzyme-linked immunosorbent assays. Outcome variables were compared using t-test, Wilcoxon and McNemar test.
Results The effect of the surgical treatment showed a significant reduction in probing pocket depth and recession of 2.14 mm (±1.07) and 1.0 mm (±0.77) respectively. Plaque presence, bleeding on probing and suppuration were also reduced in 37.78%, 35.0% and 7.78%, respectively. Minor changes were detected for the total anaerobic counts, with no significant differences between baseline and 6 months evaluation. Changes demonstrated significant differences only for the reduction of *Parvimonas micra* at 6 months evaluation. Biochemical analysis showed not statistically significant changes for any cytokine.
Conclusions The results of the present study indicated a significant clinical improvement but a limited microbiological and biochemical impact after surgical treatment of peri-implantitis.

0269

Effects of a 0.03% Chlorhexidine Mouthrinse in Controlling Gingival and Peri-implant Inflammation.

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Objectives To evaluate the efficacy of a 0.03% chlorhexidine (CHX) and 0.05% cetyl-pyridinium chloride (CPC) mouth rinse, as an adjunct to professional prophylaxis and mechanical hygiene, in the treatment of gingivitis and peri-implant mucositis.
Methods Patients in supportive periodontal therapy, showing peri-implant mucositis,at least, in one implant, were included in this randomized, triple-blinded, clinical trial. Subjects received a professional prophylaxis (with ultrasonic devices and powered air-polishing)at baseline and at the 6-month visit and were instructed to rinse, twice daily, during one year, with the test mouth rinse (with 0.03% CHX and 0.05% CPC, active ingredients) (test**group)**or a placebo mouth rinse *(*control group*).*Clinical outcomes (bleeding on probing [BOP] and plaque index [PlI]) were recorded at baseline, and after 6 and 12 months. Mann Whitney U-tests were performed considering independently implants and teeth with gingival inflammation at baseline.
Results 54 patients were included in the study and 46 attended the final visit (22 in the control group and 24 in the test group). In teeth with gingivitis, a higher reduction in BOP from baseline to 12 months was observed in the test group (24.26% [standard deviation -SD= 11.95%]) compared to the control (18.71% [SD= 12.11%]) (p= 0.12). In the analysis of the implants with peri-implant mucositis, a higher reduction was reported in the test (31.25% [SD= 16.36%]) compared to the control group (26.21% [SD=21.70]) (p=0.38). Statistically significant differences between test and control groups were only observed in the lingual sites of teeth with gingivitis (p= 0.03).
Conclusions The combined use of mechanical debridement with a 0.03% CHX and 0.05% CPC mouth rinse may offer adjunctive benefits in the management of gingivitis and peri-implant mucositis.

0270

Peri-implant Radiographic Bone Level and Related Risk Indicators in Spain.

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Objectives To evaluate radiographic bone level (RBL) at dental implants and the associated risk indicators.
Methods This cross-sectional study used a network of sentinel dentists who randomly selected 10 patients with implants placed at least 5 years before. RBL was defined as the distance from the implant shoulder to the first clearly visible contact between the implant surface and the most apical extension of bone. For transmucosal implants, the length of the transmucosal component was subtracted. All measurements were performed by two trained and experienced periodontists. Implant and patient data were also collected. Descriptive, bivariate and multivariate analysis with RBL as dependent variable was done.
Results A total of 49 sentinel dentists provided data from 474 implants in 275 patients. Mean RBL was 1.87 mm (range: 0.00-13.17 mm). Statistically significant associations between RBL and probing depth, suppuration, plaque, bleeding on probing and visual edema were found. In the bivariate analysis, statistically significant associations were found between RBL and age, previous peri-implantitis therapy, years of follow-up, implant diameter, type of prosthesis and access to interproximal hygiene ($p<0.05$). In the multiple regression analysis, statistically significant associations for RBL were found with smoking habit, implant diameter, years of follow-up and type of prosthesis ($p<0.01$).
Conclusions Radiographic bone level at dental implants was significantly associated with patient (smoking >10 cigarettes/day), implant (diameter, years of follow-up) and prosthesis (complete fixed hybrid) related variables.

0270.1

Comparative Aesthetic Analysis Between Titanium and Zirconium Implants. A Randomized Clinical Trial.

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Introduction: Pure titanium is nowadays the material of choice for dental implants. However, in certain situations of high aesthetic demand, the gray color may compromise the results. As an alternative, yttria partially stabilized zirconium dioxide (Y-TZP), has proven to have an extraordinary hardness, similar aesthetics as natural tooth and surface characteristics that has shown comparable results of osseointegration with titanium.

Objective: To compare aesthetic results between zirconium and titanium implants in the anterior superior sector.

Material and methods: A controlled, randomized and parallel clinical trial was designed. Each patient was assigned by randomization per block to each of the two treatment groups. The test group consists of Straumann® pure ceramic implants and the control group consisted in Straumann standard titanium implants. The implant placement surgery was performed following the same protocol for both study groups. In addition, provisional prostheses were placed without occlusion and a post-surgical protocol was implemented. The aesthetic, clinical and radiological variables were evaluated at 6 and 12 months after implant placement.

Results: Thirty patients with 1-year follow-up were analyzed. At one year, the titanium group obtained a value in the Meijer index of 2.50±2.82, versus 2.69±2.13 in the zirconium, not reaching statistically significant differences. In the Belser index, the zirconium group obtained a value per year of 7.62±1.19, compared to 7.63±1.74 in the control group (not significant differences). In the evaluation of the treatment by the patient, the zirconium group obtained a mean of 9.92±0.27 and the titanium group 9.81±0.40 (not significant differences). The probing depth was always lower in the zirconium group, compared to titanium, observing no significant differences in probing depth in distal sites.

Conclusions: Zirconia implants has been shown to offer peri-implant stability, both in soft and hard tissues, as well as a biomechanical behavior, comparable to titanium implants, one year after placement.

Funding: The materials (implants and abutments) were donated by Straumann (Basel, Switzerland). The presentation is one of the awards within the agreement between CED-IADR and the Spanish Society of Periodontology (SEPA).

0270.2

Non-Surgical Treatment of Periimplantitis With Systemic Metronizadole: Randomized Clinical Trial.

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Introduction: Microbial colonization of the implant surface is the main causal factor of periimplantitis. Surgical and non-surgical techniques have been developed for its treatment, but non-surgical treatment has proved to be ineffective. However, a series of cases and cohort studies have shown an additional benefit of non-surgical treatment when systemic antibiotics were used adjunctively.

Objective: To study the clinical, radiographic and microbiological results, during a period of 6 months after treatment with metronidazole as an adjunct to non-surgical treatment at implants diagnosed of peri-implantitis.

Material and methods: Subjects diagnosed with periimplantitis (probing depth ≥6 mm with bleeding on probing and/or suppuration and radiographic bone loss> 2 mm) were included in this study. Implants received a mechanical non-surgical debridement session with ultrasound and steel curettes. Systemic metronidazole was immediately prescribed (250mg, 2 every 8 hours for 7 days) or placebo with the same regimen. Clinical, radiographic and microbiological variables were evaluated at the beginning, at 3 and 6 months. Intergroup and intragroup analyzes were performed in all visits applying parametric or non-parametric tests according to the distribution of normality of the variables.

Results: A pilot study of 14 subjects (7 test group, 7 control group) is presented. From baseline to 3 months, there was a statistically significant reduction in probing depth (1.7±1.13 mm) and in bleeding on probing (43%), intragroup, and intergroup of test group versus control. After 6 months, a statistically significant improvement was found at the radiographic level of test versus control (1.01±0.85mm). At the microbiological level, there wass a significant reduction of the test group versus control.

Conclusions: Within the limitations of this study, the adjunctive use of systemic metronidazole to mechanical debridement in peri-implantitis seems to demonstrate its efficacy in terms of depth reduction and bone filling of radiographic defects, after a follow-up of 6 months.

Funding: The presentation is one of the awards within the agreement between CED-IADR and the Spanish Society of Periodontology (SEPA).

0271

An Epigenome-Wide Association Study Links *CYP1B1* to Detoxification of Tobacco Smoke in the Gingiva

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Objectives The oral mucosa has an important role in maintaining barrier integrity. Smoking is a strong risk factor for the common oral inflammatory disease periodontitis and oral cancer. Tobacco smoke affects gene methylation and expression in various tissues. This is the first systematic epigenome-wide association study (EWAS) that aimed to identify tissue-specific biologically active methylation marks associated with smoking in solid *ex vivo* biopsies of the oral masticatory mucosa.

Methods Biopsies of 18 smokers and 21 non-smokers were analysed with 802,254 DNA methylation probes of the EPIC BeadChip. Significant associations of smoking pack year (SPY) levels with changes in methylation values were assessed in an analysis of covariance (ANCOVA). Methylation patterns of smokers and nonsmokers were compared in a linear regression analysis. Gene expression was analysed by whole transcriptome RNA sequencing (RNA-Seq; 16 mio reads per sample) of the same biopsies.

Results 61 CpG sites mapping to 52 genomic regions showed significant associations with SPY levels and changes in methylation. The most significant association located to *CYP1B1* (cytochrome P450 family 1 subfamily B member 1) with $p= 4.0 \times 10^{-10}$. Nine CpGs were significantly associated with smoking compared to non-smoking. Of these, three mapped to the genetic region of *CYP1B1* ($p= 5.5 \times 10^{-8}$) and two mapped to *AHRR* (aryl-hydrocarbon receptor repressor; best $p= 5.9 \times 10^{-9}$). *CYP1B1* was significantly upregulated in smokers compared to non-smokers ($p= 2.2 \times 10^{-14}$), together with 13 other significantly upregulated transcripts.

Conclusions This study gives evidence for a major role of *CYP1B1* and the cytochrome-P450 pathway in the oral mucosa in the context of cigarette smoke exposure. It contributes to the understanding of the mechanisms that underlie cigarette smoke detoxification as a prerequisite to maintain oral health in smokers. It further shows the dynamic character of the oral mucosa to respond to environmental factors.

0272

Effects of Herbal-based Toothpastes on Cell Viability

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Objectives The aim of this study is to evaluate the effects of herbal-based toothpastes with different contents on the viability of L929 cells.

Methods Herbal toothpastes were diluted (50 w/v%) respectively (1:1, 1:2, 1:4, 1:8, 1:16, 1:32) in medium. The L929 fibroblast cells were plated into 96-well cell culture dish and incubated at 37°C and the medium was removed from the cells 24 hours later. Then, they were treated with the medium containing the herbal toothpaste extracts for 2 minutes. Cell viability was assessed by Methyl Tetrazolium Test. In statistics, one-way analysis of variance was used to compare cell survival.

Results Different degrees of cytotoxicity results were determined by the different concentrations of the experiments in the groups. The original extracts of the herbal toothpastes were statistically significant from the negative control group ($p<0.05$), except group 1 and group 3 ($p>0.05$).

Conclusions According to the results of this study, the most important cytotoxic effect was encountered Sodium Lauryl Sulfate containing group. Toothpastes with herbal ingredients may contain detergents or preservatives. For that reason, it is essential to pay attention to the contents for selecting toothpaste.

0273

Evaluation of an Oral Care Programme for Patients Undergoing Treatment for Cancer in the Head and Neck Region Regarding Mucositis

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Objectives To evaluate the effect of an oral care programme for patients undergoing treatment for cancer in the head and neck region regarding mucositis.

Methods Patients (≥ 18 years old) scheduled to undergo treatment for cancer in the head and neck region including the major salivary glands in the radiation field are recruited at their ordinary visit to the dental hygienist before starting radiation therapy. Exclusion criteria are recurrent cancer, palliative treatment and severe cognitive impairment. All patients are adviced to brush their teeth twice a day, to clean interdentally once a day, rinse with 0.2% Fluoride once a day, and to avoid smoking and alcohol. The patients are randomized to an intervention group or a control group. Patients in the intervention group are adviced to brush 3 times per day, to rinse with a sodium chloride and bicarbonate solution five times/day and to fill in an oral care diary. The

patients visit the dental hygienist once a week for professional oral care. A reinstruction in oral hygiene is given if needed. The patients in the control group follow the ordinary routines, i.e visit the dental hygienist once a week for professional oral care. Seventyfive patients are planned to be included in each group.
Results This far, 13 patients (9 men and 4 women) have been included. The mean age of the patients was 58 ± 6 years (range 51-72 years). The most common diagnoses were tonsil cancer (n=6) and tonguebase cancer (n=3). Ten of the patients was treated with both radiotherapy and chemotherapy, two patients with surgery and radiotherapy and one patient with radiotherapy. The mean stimulated salivary secretion rate pretreatment was 2.1±0.9 ml/min and only one patient had a secretion rate ≤ 0.7 ml/min. Nine of the patients were randomized to the control group and four patients to the intervention group.
Conclusions The results of the present study will contribute to the development of evicence-based oral care guidelines for patients undergoing treatment for cancer in the head and neck region.

0274

Validation of a New Surgical Score System for Conservative Surgical Treatment of Medical Related Osteonecrosis of the Jaw
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Objectives Medication-related osteonecrosis of the jaw (MRONJ) is a side effect of antiresorptive and antiangiogenetic medications. The management of MRONJ has not been completely elucidated, and its treatment can vary from no or limited surgery to more extensive surgery. Aim of the present study was to evaluate the efficacy of localized surgical treatment of MRONJ lesions in a coorte of patients and also to validate a new surgical score system in order to predict the success rate.
Methods We retrospectively evaluated all subjects diagnosed with MRONJ that had undergone localized surgery in the Department of Oral Surgery of the University of Pisa from January 2004 to December 2017. Data on demographic, health status, type and duration of antiresorptive medication and osteonecrosis characteristics were collected retrospectively. The primary outcome was a complete healing of MRONJ lesion. We performed a multiple regression analysis in order to evaluate which factors influence the surgical outcome and all variables with a level of significance $p < 0.05$ were maintain in the model. According to the score we identify three risk categories.
Results Two hundred and sixty seven patients, with 277 MRONJ lesions, were identified and included in the present study. 190 patients (71,2%) received intravenous bisphosphonates (zoledronic acid 4mg IV) for the treatment of oncologic pathologies.The MRONJ lesions were mainly symptomatic (240 lesions, 86,6%) and bone exposure was detectable in the vast majority of cases (216 lesions, 78%); 189 lesions were located in the mandible. The main event leading to MRONJ was dental extraction (153 lesions, 55,3%). The most frequent stage of MRONJ was stage II (147 subjects, 53,1%), whereas stage I (37 subject, 13,4%), and stage III (93 subject, 33,6%) were less common. 197 lesions show complete healing after surgical treatment. According to the risk score we stratified sample in three risk categories: low, medium and high. Patients with low risk had a success rate of 93%, with medium risk of 81% and with high risk of 49%.
Conclusions Our data suggest that patients with MRONJ lesions may benefit from local surgical treatment. The surgical score seems to be a suitable diagnostic tool in order to assist clinicians in the choice of the most appropriated therapy.

0275

Evaluation of Orthognathic Surgery's Effect on Maxillary-Sinus Volume with CBCT
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Objectives Aim of this study was to demonstrate the anatomical and morphological changes in maxillary sinuses by CBCT (Cone-Beam Computed Tomography) after Le Fort I osteotomy.
Methods 32 patients, with Le Fort I osteotomy performed between April 2015-November 2017 and with CBCT scans taken 3 to 12 months after the procedure, were included in this study. Surgical intervention type was dependent on specific deformity of each patient. Preoperative and postoperative maxillary sinus ventilation volumes were measured with volumetric analyzes by using a 3D software. In addition, presence of septa and maxillofacial deformity type were recorded for each patient. Descriptive statistics were calculated for each variable and paired analyzes were used to compare pre/postoperative values.
Results Data of 32 patients (17 female; 15 male) were examined (mean age 26.40±7.54; mean follow-up period 5.25 months). The patients had various maxillofacial deformities (8 patients had class II; 24 patients had class III malocclusion). In 27 patients, septa formation was observed in the right and left maxillary sinuses before the operation. Ratio of postoperative decrease in left maxillary sinus ventilation volume was % 25.01 and in right maxillary sinus ventilation volume was % 18.01. The decrease in both right and left maxillary sinus ventilation volumes after surgery was statistically significant ($p<0.05$).
Conclusions Results of the study indicate that Le Fort I osteotomies may have a significant effect on sinus health. The postoperative radiological findings of the maxillary sinus inflammatory processes in these patients point out usefulness of CBCT scans in patient follow-up.

0276

Comparison of Cell Proliferation Activity in Dental Follicle of the Asymptomatic and Symptomatic Impacted Teeth: a Preliminary Study

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Objectives The pathological changes in dental follicle are frequently associated with lower impacted third molars when compared to the upper canines. The aim of this study is to compare the proliferative activity of the dental follicles surrounding symptomatic and asymptomatic impacted lower third molar and canines and thus to investigate the differences in the pathological potentials between impacted lower third molars and upper canines.

Methods The study sample was composed of 46 patients who referred for evaluation and treatment of symptomatic and asymptomatic impacted lower third molar and canines. The participants were divided into 4 groups as follows: symptomatic impacted lower third molars; asymptomatic impacted lower third molars; symptomatic upper canines and asymptomatic impacted upper canines. Primary outcome variables were type and severity of epithelial inflammation and Ki-67, MCM-2 protein expressions to investigate the cell proliferation activity to obtain information about the potential for pathologic changes. Secondary study variables were age, gender, tooth position and smoking status. Independent-samples *t* test analyses were applied with SPSS 10.0 (SPSS, Inc, Chicago, IL), with statistical significance set at a *P* value equal to .05.

Results There were no statistical differences between the asymptomatic lower third molars and upper canines groups for variables levels of Ki67 and MCM-2. However, mean expression levels of Ki67 and MCM-2 and histopathologic parameters for symptomatic lower third molars was found higher than symptomatic upper canines.

Conclusions The location and position of impacted teeth may increase severity of the inflammation. The pathological potential of symptomatic lower third molars show significant increase when compared symptomatic upper canines. Inflammatory changes can increase the pathologic potential of dental follicles associated with impacted lower third molars. This situation showed that higher proliferative activity in dental follicles surrounding impacted lower third molars is may be due to higher severity of inflammatory changes.

0277

A Clinical Trial of color matching performance of a single shade composite.

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Recently, a new resin composite has been developed based on a concept that involves structural coloration, induced by the uniform round sized supra-nano spherical filler (260nm SiO_2-ZrO_2), claiming the chance of using only one shade.

Objective: to investigate the clinical behavior of the new product (OM) in comparison with an ormocer material (AD)consisting of an inorganic-organic network matrix formed through polycondensation. The null hypothesis was no difference with delta <1.5 between restorations and teeth.

Material & Methods: 20 patients 12 females, 8 males, age 35-60, with 26 class III and 14 class V were selected and treated with the same procedure of cavity preparation and light curing with T-LED (Cefla, Imola, Italy) with 1.000mWcm^2 x 20 s for any layer. For any subject one restoration was performed with the experimental material, the other one with the ormocer with the selected shade (A2, A3, A3.5). After 3-7 days L*a*b*of restorations and teeth were calculated by means of a calibrated reflection spectrophotometer 2x45°/ 0° (SpectroShade, Handy Dental Type 713000, Serial No. HDL0090, MHT, Verona, Italy) using the same diameter of lecture. Statistical evaluation of findings was performed with one-way analysis of variance (ANOVA) and Chi-square test by using SPSS 11.0 software program (SPSS 11.0; SPSS Inc., Chicago, IL, USA). Data of OM calculated with the sample of 3mm thickness and 5mm of diameter were L*= 63.8, a*= -3.3, b*=12.1, TP= 25.2%. After polymerization in the cavity the color changed delta E:>10.

Results: the delta E between tooth and OM was 1.2 (0.8-1.6), between tooth and AD was 1.3 (0.7-1.9) without any statistical difference. The null hypothesis was accepted.

Conclusions: this study showed that OM can cover a wide range of teeth color, trough structural coloration technology and this innovation could allow the reproduction of many shades using only a single paste

0278

Oral and Oropharyngeal Cancer Early Detection: Finding the Needle in the Haystack

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Oral cavity and oropharyngeal squamous cell carcinoma make up the great majority of cancers in the head and neck region. While traditional risk factors for these cancers include tobacco, alcohol and areca nut use, the last few decades have seen a striking increase in another major risk factor for oropharyngeal cancer, oncogenic HPV infection. Cancers caused by traditional etiologies are marked by progressive carcinogen induced mutations, leading to field cancerization and tumor progression. HPV - related tumors are driven primarily by two oncogenic viral proteins, E6 and E7, which interfere with some of the same pathways responsible for driving tobacco-associated cancers.

With improvements in smoking cessation in many developed countries, human papillomavirus infection is becoming the most important risk factor and is responsible for the increasing incidence of oropharyngeal cancer. HPV-related oropharyngeal cancers are different from traditional oral cavity cancer in critical ways. Prognosis tends to be better and age of onset is younger

with HPV-driven disease. Tobacco, alcohol and areca nut use continue to be the major risk factors for oral and oropharyngeal cancers across the world and particularly in parts of Asia.
Regardless of etiology, oral and oropharyngeal cancer would be treated more successfully if diagnosed at an earlier stage. The current gold standard for screening, physical exam has limited sensitivity and specificity. Methods for early detection and assessment of oral potentially malignant disorders include visual and tactile oral examination, the use of light based adjuncts such as autofluorescence and narrow-band imaging, vital staining, cytopathologic platforms, salivary based molecular/ proteomic tests, and other novel emerging technologies. Soluble CD44 and total protein are proteomic markers that are associated with oral and oropharyngeal cancer and poor prognosis. The markers can be elevated very early in the disease process. Studies are ongoing to determine whether these markers aid early detection.

0279

Predicting dental morbidity and demands: Why and how did we do it?

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The provision of dental services to populations emanates from a medical needs as well as further aspects like costs, availability or quality. Predicting the provision of dental services is helpful in dental workforce and further health services planning as well as resource allocation. A range of methodologies underlying services provision predictions are available; we will present in depth an advanced model for cross-sectionally and longitudinally interpolating dental morbidity data across age and time, and for combining them with utilization and population estimates to allow granular, age-, time- and also spatially specific demand estimates for the provision of different dental services (e.g. operative, prosthetic, periodontal, preventive services). This presentation will be of relevance for clinicians, epidemiologist, health services researchers and the wider public, as it will outline aspects which may be transferable to other healthcare settings or epidemiological questions, and – together with the subsequent presentations – allow a glimpse into a possible dental future.

0280

Dental epidemiology 2030: what we found

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In high-income countries, the prevalence of caries among younger population groups has been declining for decades. However, there is no clear trend in periodontal diseases. We therefore wanted to know what the most important diseases of the oral cavity in Germany will be in 2030.
Components of morbidity projection was caries, periodontitis, and tooth loss. Data were retrieved from repeated waves (1997, 2005, 2014) of the nationally representative German Oral Health Studies. Weighted means were interpolated cross-sectionally by fitting piecewise-cubic spline-curves and were then subjected to longitudinal regression and combined with population estimates.
For 2030, caries experience in children (12-year-olds) is expected with 0.2 teeth. In adults (35-44 years), an analogous decrease to 7.7 teeth is prognosed. Likewise, the mean DMFT of seniors (65-74 years) is predicted to be 14.9 teeth. While the number of missing teeth has steadily decreased in all age groups in recent decades, the number of filled and decayed teeth in older people has increased and is expected to continue to increase. For periodontal diseases, we project mean values of 3.2 teeth in younger adults with periodontal treatment needs and our projection shows 12.2 teeth in seniors. The cumulative number of teeth to be treated will increase by 2030. The mean MT in adults is expected to decrease by two thirds to 1.3 in 2030. Half of the adult population will have no tooth loss by then. The mean MT among seniors will also decrease by two thirds to 5.6 in 2030. The prevalence of tooth loss will be halved, and about one third of this age group will have no tooth loss. We predict that the prevalence of toothlessness will be reduced to 4.2% by 2030 between 60-80 years.
Our model represents trends in oral epidemiology in Germany for 2030. It provides clinically relevant data for health planning.

0281

What does it mean for research and practice?

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Demographic and epidemiologic trends display a market analysis for the future outline of dentistry notwithstanding the professional activity. Politics need to react towards an ageing European society by adapting structural conditions. Increasing demands for restorative and periodontal therapy in elderly patients require medical knowledge of multimorbidity and polypharmacy as well as structures that allow the treatment of disabled and immobile patients. Meeting the needs of socially and educationally deprived individuals will pose a highly relevant administrative challenge since these target groups are prone to oral diseases. Research also has to react manifold towards epidemiologic trends. We constantly need to reassess whether scientific research still meets the actual and foreseen future market requirements i.e. cover the most prevalent diseases and conditions relative to patients' age. Knowing that dental treatment is postponed to a later time in life, it should be doubted that common treatment strategies are fully transferable to elderly patients with special needs. Despite a general decline in caries, root decay is likely to increase which opens the field for adapted preventive and restorative measures. For clinicians it is virtually impossible not to react to demographic trends and their evolving professional requirements. Therefore, dental education has to focus on these trends, too and prepare dental students to interact with elderly and impaired patients as well as socially

deprived, migrants and patients with low oral health competence. Applied psychology, decision-making processes and improving health literacy among these focus groups are just a few aspects that will be discussed interactively.

0282

Roughness and loss of substance of tooth surfaces after biofilm removal with different processing methods

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Biofilm removal on tooth surfaces is always accompanied by a loss of substance in the areas to be cleaned. We suppose, that ideally the roughness of enamel surfaces is as smooth as possible after cleaning procedures. If achievable only the layer of subgingival endotoxin invasion should be removed along with the biofilm from the root cementum. Over-instrumentation can lead quickly to the complete loss of the cementum and the resulting defect healing with epithelial cells. There is only a reduced chance for regeneration of the periodontal tissues. The substance removal of root cementum is discussed between 6.3 and 100µm in the literature, depending on the technology used. The development of low abrasive new powders based on glycine, erythritol+chlorhexidine and trehalose is a renaissance for air polishing devices. In addition to the damage of the root surface, the roughness achieved plays a central role in periodontal healing. A systematic review with 17 publications confirms these results also in the clinical application. Erythritol+chlorhexidine powder is also found to have perfect cleaning without defects in the enamel. The necessity of additional polishing is still under discussion. The aim of the lecture is to show how the different methods of surface treatment on enamel and root cementum.

0283

Air polishing systems in the management of peri-implant diseases

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Dental implants have demonstrated high predictability and overall patient satisfaction to rehabilitate partial and full edentulism. However, in spite of osseointegration dental implants are subjected to biological complications, mainly by inflammatory processes of the peri-implant tissues (peri-implant diseases). Peri-implant diseases are caused by bacterial biofilm accumulation on the implant/abutment surfaces and include two different entities: peri-implant mucositis, defined as an inflammatory lesion limited to the surrounding mucosa of an implant; and peri-implantitis, an inflammatory lesion of the mucosa which progresses by destruction of the peri-implant supporting bone.

The main objective in the treatment of peri-implant diseases is cause-related by mechanical removal of the biofilm. However, biofilm debridement can be challenging, especially in cases in which the rough implant surface is exposed to oral medium. During the last years, air-polishing systems have been evaluated for their efficacy in decontaminating exposed implant surfaces using both in *in vitro* and *in vivo* models.

The purpose of this presentation is to critically appraise these investigations where air-polishing systems have been used to debride biofilm from the implant surface/and or its restoration.

These will be the following specific objectives of this presentation:

To evaluate the efficacy of biofilm removal at *in vitro* models comparing ultrasound tips, air-polishing systems and titanium brushes.To evaluate a protocol of primary prevention of peri-implantitis employing an air-polishing system and an ultrasound tip as part of a maintenance protocol used every 6 months over a period of 4 years.

To evaluate the clinical, microbiological and immunological effect of a surgical protocol of peri-implantitis that uses an air-polishing system together with an ultrasound tip to mechanically debride biofilm.

0284

Properties of Speed-sintered Monolithic Zirconia Ceramics

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Objectives To evaluate the optical and mechanical properties, microstructure and aging behavior of speed-sintered monolithic zirconia.

Methods Sintering in a SpeedFire furnace ('SF'; Dentsply Sirona) of 5Y-TZP Katana STML (Kuraray Noritake; sintering time/temperature: 30min/1560°C) and 3Y-TZP CEREC Zirconia (Dentsply Sirona; sintering time/temperature: 15min/1578°C) blocks was compared to sintering in a conventional furnace (Nabertherm, Germany) of Katana STML (sintering time/temperature: 2h/1550°C) and 3Y-TZP inCORIS (Dentsply Sirona; sintering time/temperature: 2h/1510°C). Translucency Parameter (TP) and Contrast Ratio (CR) were measured with a spectrophotometer (SpectroShadeTM MICRO, MHT Optic Research) (n=6/group). Zirconia-phase composition was characterized using XRD and SEM. The indentation fracture toughness (n=10), biaxial strength (n=20) and Vickers hardness (n=10) of the sintered ceramics were assessed. Aging behavior was evaluated by measuring tetragonal-to-monoclinic phase transformation after accelerated hydrothermal aging in steam at 134°C (n=2); the transformation curves were fitted by the Mehl-Avrami-Johnson (MAJ) equation. Statistical analysis involved one-way ANOVA and post-hoc Tukey's HSD test (α=0.05).

Results TP of Katana STML, sintered in both ways, was significantly higher than for CEREC Zirconia and inCORIS. XRD of Katana STML, sintered in both ways, confirmed higher cubic phase (≈50wt%) and Y_2O_3 (≈4.5mol%) in *t*-ZrO_2 phase content, as compared to CEREC Zirconia (7.9wt%) and inCoris (18.8wt%), both containing ≈3mol% Y_2O_3 in *t*-ZrO_2 phase content. SEM revealed the largest grain sizes for speed-sintered Katana STML. Although no statistical difference in hardness was measured, CEREC Zirconia revealed higher fracture toughness, biaxial strength and Weibull characteristic strength than speed-sintered Katana STML. Katana STML, sintered in both ways, revealed similar hydrothermal aging behavior and stronger aging resistance than CEREC Zirconia and inCORIS.
Conclusions Speed-sintered monolithic zirconia revealed similar optical properties and hydrothermal aging behavior as conventionally sintered monolithic zirconia grades. As expected, speed-sintered Katana STML revealed lower mechanical properties than CEREC Zirconia.

0285

Optical and Structural Properties of Speed Sintered Zirconia
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Objectives To evaluate optical properties, crystal phase composition and flexural strength of two zirconia materials designed for different chairside speed sintering processes according to manufacturer instructions.
Methods Investigated materials were 3M Chairside Zirconia(3MCZ) and KATANA Zirconia Block STML(KZB). Samples were cut from mill blanks and smoothened with P2500 sandpaper. CEREC Speedfire furnace was used for chairside speed sintering processes faster than 31min. Long term sintering was conducted in Dekema µSiC for up to 6h:48min. Samples were sintered according to manufacturer's instruction to final dimensions of 16x4x1.2mm for bending bars and 14x14x1mm platelets. Shade values (L*,a*,b*) and translucency were measured by an spectrophotometer (X-RiteColor-i7), crystal phase composition by X-ray diffraction (BrukerD6) and flexural strength(FS) according to ISO6872:2015(3-point-bending,12mm load-span,1mm/min,Instron6655). Average values and standard deviation were calculated. Shade deviation deltaE was calculated against fastest sintering cycle.
Results Shade deviation dE for 3MCZ was found between 0.8-3.2 and 2.5-4.2 for KZB comparing to fastest material specific sintering schedules. Translucency varies over all sintering programs by 24±3% for 3MCZ and 25±2% for KZBs dentin proportion. Tetragonal crystal phase composition was observed in a range of 69-75wt.% for 3MCZ and 41-77wt.% for KZB. 3MCZ shows a FS-values from 1039-1141MPa. KZBs FS of 683-841MPa is related to materials tetragonal crystal phase content which depends on the applied sintering regime.
Conclusions Both materials fulfill the FS requirement of 500MPa for ISO6872:2015 type II, class 4 materials (maximum 3-unit posterior bridges). Surprisingly the zirconia crystal phase content can be affected by sintering conditions which may lead to varying strength values of KZB. 3MCZ exhibit a higher and more constant strength level and a more constant crystal phase composition. Translucency shows a relatively stable behavior after different sintering schedules, whereas shade was found to differ either within an acceptable dE limit of ≤3.3 for 3MCZ but also to a higher extend for KZB.

0286

Influence of Sintering and Coloring on Surface Roughness of Monolithic-zirconia
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Objectives The aim of this in-vitro study was to evaluate the effect of the various sintering conditions and dipping time in the coloring liquid on the surface roughness of the translucent monolithic zirconia.
Methods Seventy-five disc-shaped specimens (12 mm diameter, 1.5 mm thickness) were cut from presintered non-colored monolithic zirconia blocks (InCoris TZI, Sirona GmbH, Germany). The specimens were randomly divided into three groups according to the sintering conditions (n=25): Classic sintering (1510°C for 120 minutes), speed sintering (1540°C for 30 minutes) and super-speed sintering (1580°C for 10 minutes). Each group was then divided into five subgroups according to coloring time by dipping method in a coloring liquid: control (no-coloring), 3 minutes, 5 minutes, 7 minutes and 9 minutes (n=5). After the coloring process, the specimens were sintered in three different conditions (classic, speed, and super-speed). The average surface roughnesses (Ra) were measured by a contact-profilometer. Data were analyzed by two-way ANOVA and Tukey HSD tests (α=0.05).
Results Mean Ra of the control groups (0.197 ± 0.048 for classic sintering; 0.224 ± 0.035 for speed sintering; 0.207 ± 0.026 for super-speed sintering) showed the lowest Ra values in all groups. However, there was no statistically significant interaction between sintering conditions and dipping time for mean Ra of the groups (P=.887). There was also no statistical difference found among the groups for sintering conditions (P=.980) irrespective of dipping time. And dipping time did not have a statistically significant effect on mean Ra of the groups regardless of sintering conditions (P=.609).
Conclusions Different sintering conditions and dipping time did not alter the surface properties of the translucent monolithic zirconia. Therefore, clinicians could select any of the appropriate sintering parameters and coloring liquid application time for their clinical requirements without changing the surface roughness of the monolithic zirconia.

0287

Stress Distribution of Partially-Veneered (Semi-monolithic) Zirconia Fixed Dental Prostheses (FDPs)

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Objectives To evaluate influence of framework design on stress distribution within tooth-supported partially veneered FDPs made of zirconia under simulated loads using 3-dimensional finite element analysis (3D-FEA).

Methods For linear FEA, simplified 3D solid models of prepared abutment teeth with different 3-unit FDPs based on designs were created. Five designs—monolithic (control); partially-veneered (semi-monolithic) with 0.3 mm veneer thickness (A); semi-monolithic with 0.5 mm veneer thickness (B); semi-monolithic with 0.5 mm veneer thickness supported with cap design (C), and semi-monolithic with 0.5 mm veneer thickness supported with wave design (D)—were analyzed using FEA. Elastic properties of the components (bone, dentine, cement, translucent zirconia, and veneering porcelain) were gained from standard references for FEA. Simulated static forces (300 N) were applied at oblique direction over occlusal surfaces. Maximum principal stress and shear stress were calculated and analyzed among the different models.

Results Model C showed lowest maximum principal stress levels in veneering porcelain compared to models A, B, and D. In zirconia framework of model C, however, maximum principal compressive stress levels were higher compared to the other models. Model A had lower maximum principal stress levels in veneering porcelain compared to model B. Maximum principal stress levels were located in veneer component of models A, B, D whereas were observed at cervical area of zirconia framework of model C. Model A had highest maximum shear stress levels while model D had lowest shear values.

Conclusions Framework designs play a significant role in stress distribution of partially veneered zirconia FDPs under loading. The FDP with cap design minimizes maximum principal stress in the 0.5 mm-veneering porcelain. The FDP with a 0.3 mm-veneering porcelain has low maximum principal tensile stress in veneering porcelain but with high maximum shear stress at zirconia-veneer interface. The FDP with wave design minimizes maximum shear stress at the zirconia-veneer interface.

0288

Comparison of the Fracture Strength of Endocrowns Manufactured from Hybrid Blocks under Axial and Lateral Forces

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Objectives The present study aimed to compare the fracture strength of endocrowns manufactured from hybrid blocks under the axial and lateral forces.

Methods One hundred permanent lower first molar teeth were root canal treated and assigned to 5 groups according to the material type. Endocrown restorations were produced from IPS e.max CAD (IPS Group) (Ivoclar Vivadent, Schaan, Lichenstein), Vita Enamic (VE Group) (Vita Zahnfabrik, Bad Sackingen, Germany), GC Cerasmart (GC Group) (GC America, Alsip, IL, USA), Shofu (SH Group) (Shofu Dental Mfg.CO., Kyoto, Japan) and Brilliant Crios (BC Group) (Coltene Whaledent, Altstatten, Switzerland) using CAD/CAD technique. Restorations were luted using self-adhesive resin cement. Following cementation all specimens were subjected to thermal cycle process. After, artificial aging the specimens were mounted on Universal test device and divided into 2 subgroups. Half of the specimens were subjected to axial and the other half was subjected to lateral forces. Loading was applied at a crosshead speed of 1 mm/min until fracture occurred. Fracture types were evaluated under stereomicroscope. Data were statistically analyzed.

Results Statistically significant differences were observed among groups regarding the fracture strength values under axial and lateral forces ($P < 0.05$). The highest fracture strength values under axial and lateral forces were detected in BC Group and IPS Group, respectively. The lowest fracture strength values under axial and lateral forces were detected in SH Group and GC Group, respectively. No statistically significant differences were detected among groups regarding the distribution of failure types under axial and lateral forces ($P > 0.05$). The fracture types under axial and lateral forces were mostly Type I and restorable fractures.

Conclusions The content of hybrid blocks was effective on the fracture strength of materials.

0289

Bond Strength Between CAD/CAM Blocks and Repairing Materials: Effect of Repairing Strategies

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Objectives The aim of this study was to compare the different repairing methods on the shear bond strength between CAD/CAM blocks and different type of composite resins.
Methods A feldspathic ceramic block and two hybrid- ceramic blocks were selected in this study. The Blocks were sliced with ISOMET 5000 (Buehler) device in 5 × 5 × 5 mm and a total of 300 samples were obtained. After the samples were subjected to 5000 cycles of thermal cycling between 5 and 55 °C, all groups were divided into five subgroups according to repairing strategy: Group CT: Clearfil Repair Kit (Kuraray), Group UT: Ultradent Repair Kit (Ultradent Products), Group DB: Diamond Bur + GC Repair Kit (GC Corporation), Group EL: Er-YAG Laser + GC Repair Kit, Group MC: Micro etcher intra-oral sandblasting device (Danville) + GC Repair Kit. Then plastic molds (2 mm high x 4 mm diameter) were inserted on the samples and filled with two different types of composite resins; G-aenial Hybrid Composite (GC Corporation) or G-aenial Universal Flo Composite (GC Corporation) and polymerized for 20 s. The samples were then subjected to shear bond test and the failure modes were examined in a stereomicroscope. Statistical analyses were performed with three-way ANOVA and Bonferroni tests.
Results The shear bond strength values of Cerec blocks (17.48 ±5.51) were significantly higher than the other blocks ($p<0.05$). In terms of repairing methods, Group MC showed significantly higher bond strength values (17.19±5.94) than the other tested groups except Group UT (15.15±5.22). G-aenial Universal Flo exhibited significantly higher bond strength values (16.93±5.40) than G-aenial hybrid composite (12.81±5.33).
Conclusions The sandblasting system can be recommended for the repair of all type of CAD/CAM blocks tested in this study. The G-aenial Universal Flo seems to be a successful repairing material for the repair of CAD/CAM materials.

0290

Color and Bacterial Accumulation of Dental Ceramics After Ultrasonic Scaling

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Objectives to evaluate the effect of scaling using different ultrasonic tips on the surface roughness, color stability and bacterial accumulation of lithium disilicate ceramic.
Methods Scaling procedure was carried out using ultrasonic scaler (Satalec, Acteon) with stainless steel tip (US), titanium tip (UT) and plastic tip (UP), on disc shaped lithium disilicate samples cemented into a cavity prepared onto the labial surface of freshly extracted bovine teeth (10 samples per group). The samples were stored in coffee solution in an incubator at 37°C for 12 days, which is equivalent to 1 year of coffee consumption. The surface roughness was measured before and after the scaling using a profilometer and atomic force microscopy. The color parameters were measured before and after scaling and staining procedures using spectrophotometer according to the CIE L*a*b* color order system. The samples were then incubated with *Streptococcus mutans* suspension. After incubation, the plates with 30 to 300 typical colonies were counted in a colony counter and mean values of colony forming units were obtained (CFU/mL).
Results The titanium scaling tip showed a statistically significant higher mean values of change in surface roughness ΔRa and bacterial count than the plastic scaling tip. Color changes (ΔE) were not a statistically significant among the groups. The results showed a statistically significant positive (direct) correlation between surface roughness and color change (P= 0.012) and also between surface roughness and bacterial count (P=0.00).
Conclusions Within the limitations of this study, titanium scaling tips cause irreversible surface alterations of lithium disilcate ceramics which was in direct correlation to the color changes and bacterial accumulation; therefore, dentists should proceed with caution when scaling lithium disilicate surfaces. The findings of the current study may indicate the need for instruments that can remove plaque and calculus without causing surface damage.

0291

Adjunctive Locally Delivered Antimicrobials in Periodontitis. A Systematic Review.

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Objectives To answer the following PICOS question: in patients with periodontitis, what is the efficacy of adjunctive locally delivered antimicrobials, in comparison with subgingival debridement alone, in terms of probing pocket depth (PPD) reduction, in randomized clinical trials with 6-9 months of follow up?
Methods After protocol preparation, a systematic search was conducted in three databases. Out of 2,184 references, 99 were selected for full-text evaluation, and 59 reporting 50 different studies, were finally selected. The comparison of 38 test and control groups, from 33 different studies, was finally included in the meta-analysis. To compare the selected studies, data on PPD changes were pooled and analysed using weighted mean differences (WMDs) and 95% confidence intervals (CI). The statistical heterogeneity among studies was assessed using the Q-test. Egger's test and Funnel plots were used to assess publication bias.

Results The overall comparison between test and control groups showed a statistically significant benefit (p<0.001) for test groups (WMD=0.365, 95% CI [0.262; 0.468]), with significant heterogeneity (I^2=96.8%). Ten different local antimicrobials were included in the analysis, with five of them demonstrating statistically significant benefits for test groups, four of them with no heterogeneity (Atridox, 2 studies, WMD=0.800; Actisite, 7, WMD=0.729; Ligosan, 3, WMD=0.525; Arestin, 6, WMD=0.279) and another with significant heterogeneity (Periochip, 9 studies, WMD=0.23). Among the other products, four demonstrated benefits for test groups, but not significant (Elyzol, 5 studies, WMD=0.140; Dentomycin, 2, WMD=0.377; Aureomycin, 1, WMD=0.600; Chlosite, 2, WMD=0.486), while Periofilm showed not significant differences favouring the control group in just one study.
Conclusions The use adjunctive locally delivered antimicrobials in periodontitis therapy results in significant benefits in PPD reductions, in a short-term basis. However, a significant heterogeneity was also detected, associated (among other factors) with the differences in the outcomes with different products.

0292

Influence of Adjunctive Azithromycin on Persisting-sites Number in Periodontitis Patients

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Objectives To determine if patients with moderate to advanced periodontitis will benefit from adjunctive azithromycin therapy to scaling and root planning in greater reduction of persisting sites per patient with probing depth (PD) > 4 mm and bleeding on probing (BOP).
Methods In a double blinded randomized placebo controlled study (Eudra CT No. 2015-004306-42), 40 patients received nonsurgical periodontal treatment in two sessions within one week. Patients than received either systemic antibiotic therapy (n = 20) (azithromycin, 1/d 500 mg for three days) or placebo (n = 20). The primary outcome variable was persistence of sites with a PD > 4 mm and BOP at 6 months evaluation. Using multilevel logistic regression, the effects of gender, age, antibiotic therapy, presence of *A. actinomycetemcomitans* or *P. gingivalis*, smoking, tooth being a molar and interdental location on the number of persisting sites were evaluated.
Results The number of persisting sites with PD > 4 mm and BOP after 6 months was similar in test (Me = 4, IQR = 0 – 11) and control groups (Me = 5, IQR = 1 – 22) (p = 0.49). In multilevel model, only sites on molars benefited significantly less (OR = 0.51, CI = 0.35 – 0.72, p < 0.001) from scaling and root planning irrespective of gender, age, smoking, antibiotic therapy, interdental location or presence/absence of *A. actinomycetemcomitans* or *P. gingivalis*.
Conclusions Patients with moderate to advanced periodontitis do not benefit from adjunctive systemic azithromycin therapy in terms of reduction of the number of persisting sites with PD > 4 mm and BOP after 6 months, irrespective of the presence of *A. actinomycetemcomitans* or *P. gingivalis*.

0293

Repeated Er:Yag Laser Application in Non-surgical Treatment of Periodontitis

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Objectives The aim was to compare the full mouth ultrasonic subgingival debridement (FMUSD) alone with the FMUSD in addition to repeated application (one and four weeks after) of Er:YAG laser, in patients with periodontitis.
Methods This double-blinded controlled randomized clinical trial included 40 patients with initial to moderate chronic periodontitis (stages II and III according to the new classification). The following variables will be recorded at at baseline, and 3, 6 and 12 months after therapy, at 6 sites per tooth: plaque score (PI), probing pocket depth (PPD), bleeding on probing (BOP), location of gingival margin (GM), relative attachment level (RAL). Patient related outcomes were registered by using a visual analogue scale (VAS). On day 0 all patients received a FMUSD (45-90 minutes) using a piezo-ceramic ultrasonic device. On day 7 patients were randomized to the test or the control group and the sites with initial PPD ≥5 mm were treated with the Er:YAG laser device with a feedback system using a periodontal sapphire tip. On day 28, the same procedure than in day 7 was carried out. Control group received the same treatment but with the laser turned off. Descriptive statistics, Student t-test and chi-squared test were used for data analysis.
Results 32 patients completed the study, 15 in test group and 17 in control group, with a mean age of 50,9 +/-9,1 years. There were no statistically significant differences between groups at any interval for PI, BOP, PPD or RAL (p>0,05). However, the change of IP between baseline and 12 months was greater for control group, and the difference was statistically significant. Pain and sensitivity during laser application was higher at 7 days than at 28 days in test group.
Conclusions Repeated application of Er:Yag laser after FMUSD does not seem to be clinically superior to FMUSD alone

0294

The Effects of a 6-month Vitamin D Supplementation During Non-surgical Treatment of Periodontitis in Vitamin D Deficient patients: a randomized double-blind placebo-controlled study

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Objectives This study aimed to assess the effects of weekly vitamin D (VD) supplementation, during 6 months (M) in VD deficient patients, on clinical and biological parameters after scaling and root planning (SRP) in the treatment of generalized chronic periodontitis (GChP). The primary outcome measure was periodontal pocket depth (PPD).
Methods The study was designed as a monocentric, randomized, double-blind, placebo controlled clinical trial with 6 months follow-up. Otherwise healthy Caucasian patients diagnosed with GChP were included if their serum VD value was below 30 ng/ml at screening (Cobas e 602 immunoassay module, Roche, Basel, Switzerland). They were randomly allocated to one of the two treatment arms: the test group (SRP + VD 25,000 IU/week) or the control group (SRP + placebo). The supplementation (25 000 IU VD/placebo per week) started one month before SRP and continued until the 6 months visit.
Results A total of 59 patients were screened, 27 were included and 26 completed the study. The test group (n=13) and the control group (n=14) had similar VD levels at baseline (17.6±7.38 vs. 14.36±5.22, respectively). After 1M of supplementation, there was already a significant difference between groups in VD levels (32.9±5.22 vs. 16.09±4.74), also seen at 3M and 6M (t-test, $p<0.001$ at each time point). Periodontal treatment was successful in both groups, since it resulted in reduction of all measured clinical parameters at 3M and 6M (PPD, clinical attachment loss (CAL), full mouth bleeding and plaque scores). However, the reduction in PPD was greater in the test group.
Conclusions In this short-term pilot study, a supplementation with vitamin D improved the treatment of chronic periodontitis in patients with initial VD deficiency. This potential advantage needs however to be confirmed in larger studies and if VD is established as risk factor for periodontitis, its serum cutoff values should be identified. NCT03162406.

0295

Effects of Periodontal Treatment on Overall Well-being

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Objectives The aim of the study was to evaluate the patients' self-perception of the impact of periodontitis on the overall health, physical, psychological and social well-being before and after non-surgical periodontal treatment.
Methods This was a prospective clinical study. Patients diagnosed with periodontitis from 18 to 70 years were included. Full-mouth periodontal clinical examination was performed prior (M0) and at 3-month after the treatment (M3). Following clinical parameters were collected by a calibrated examiner: periodontal pocket depth (PPD), clinical attachment level (CAL), recession (REC), full-mouth bleeding score (FMBS), full-mouth plaque score (FMPS). Patients completed a questionnaire of 88 items, divided into seven areas: Oral health Impacts Profile (OHIP-14), Pittsburgh Sleep Quality Index (PSQI), Memory Assessment Clinic-Q (MACQ), International Index of Erectile Function (IIEF-5), Fagerstrom-nicotine dependence test, Perio-symptoms, Perio-perception at M0 and M3. Clinical variables were analyzed with ANOVA test for repeated measures and categorical ones with Chi-square test.
Results A total number of 403 patients was included, 58.3% of them were female. Non-surgical Periodontal treatment was successful, as at M3 all measured clinical parameters improved (Table1). The psychometric tests showed statistically significant improvement at M3 ($p<0.05$), except for IIEF-5. When compared to baseline, at M3 mean OHIP-14 scores lowered from 31.30±14.07 to 12.49±11.87, MACQ scores from 7.18±3.03 to 3.62±1.51, and Fagerstrom scores form 8.08±1.63 to 7.33±1.75. The PSQI scores also improved, showing a significant improvement in patients diagnosed with severe periodontitis. At baseline, 55.3% of patients with mild, 68.2% with moderate and 62% with severe periodontitis thought that periodontitis could increase their stress. At M3, those percentages decreased to 24.4%, 30.8%, and 20.3% for mild, moderate and severe periodontitis, respectively.
Conclusions Patients perceived that non-surgical periodontal treatment exhibited positive effects on their overall well-being.

0296

Acute Phase Response After Non-Surgical and Surgical Periodontal Treatment

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Objectives The aim of the analysis was to compare the acute phase response after non-surgical (NSPT) and surgical periodontal treatment (SPT) in terms of Change in C-Reactive Protein (CRP) values 24-hours after the treatment.
Methods Two groups of systemically healthy patients affected by periodontitis have been compared. One group consisted of 19 patients treated for NSPT whilst the other group included 19 subjects with indications for SPT (i.intrabony defects ≥4 mm deep; ii.no previous SPT; iii.documented radiographic bone loss). Full-mouth periodontal examination including probing pocket depth (PPD), gingival recession (REC), full-mouth plaque score (FMPS) and bleeding on probing (BOP) have been recorded at baseline and 3-months after the treatment in NSPT-group and 6-months after the treatment in SPT-group. Blood parameters where collected at baseline, 24-hours, 3-months (NSPT-group)/6-months (SPT-group) after the treatment. The following inflammatory biomarkers were analyzed: high-sensitivity C-Reactive Protein (CRP), D-Dimer and Fibrinogen.

Results Both periodontal procedures were efficacious in terms of periodontal parameters, showing statistically significant improvements 3- and 6-months after NSPT and SPT, respectively. At 24 hours, the relative increase of CRP for the NSPT-group was of 288.52±424.79% significantly superior of the 101.70±174.44% in the SPT-group ($p<0.05$). Moreover, D-Dimer resulted in a significant inter-group difference in terms of relative increase (SPT vs. NSPT: 0.21±29.39% vs. 7.20±33.66%, $p<0.05$).
Conclusions Non-surgical periodontal treatment results in higher inflammatory response compared with surgical treatment in the immediate post-operative period.

0297

Assessment of Major Salivary Gland Ultrasonography in Sjögren's Syndrome

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Objectives Sjögren's syndrome (SS) is an autoimmune disorder, giving rise to chronic inflammatory changes in the salivary glands. Major salivary gland ultrasonography (SGUS) has emerged as a diagnostic tool in SS and may be applicable when a biopsy is inconclusive or cannot be performed. The aim of this study was to determine the preferable gland, projection and image format for reproducible SGUS image analysis and integration into clinical practice.
Methods Consecutive patients with SS (n=32) were examined using a GE LogicE9 with a linear transducer (6-15 MHz). Glandular homogeneity and hypoechogenic areas were evaluated using a simplified scoring system. Both of the parotid and submandibular glands were examined in the longitudinal and transverse planes. Representative images and videos were stored. Using a random number generator, image material was de-identified, randomized and extracted for re-evaluation. Three investigators blindly evaluated the image material at two time-points (R1 and R2). R1 results were used for interclass correlation (ICC) assessment and R2 for intraobserver reliability. ICC values < 0.40 were considered poor, 0.40-0.59 fair, 0.60-0.74 good, and ≥ 0.75 excellent.
Results Bedside SGUS determined pathological changes in 14/32 (44 %) patients, defining the gold standard. Interobserver agreement was excellent, with ICC scores 0.81-0.93 (R1) and 0.84-0.94 (R2). Intraobserver reliability scores were 0.46-0.96, depending on the gland (parotid 0.78/submandibular 0.78), projection (longitudinal 0.80/transverse 0.76) and format (image 0.81/video 0.74). Longitudinal video of the right parotid gland had the highest average ICC score compared to gold standard (0.772), transverse video of the left submandibular gland had the lowest (0.209). For storage modalities and projection, longitudinal video was better (0.683), followed by longitudinal image (0.667), transverse image (0.662), and transverse video (0.510).
Conclusions In this study, longitudinal video of the parotid glands emerged as the preferable projection, gland and storage format for diagnosis and follow-up of patients with SS.

0298

UHFUS-guided Minor Salivary Gland Biopsy in Sjogren's Syndrome Diagnostic Work-up

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Objectives Sjögren's syndrome (SjS) is a systemic autoimmune disease characterized by chronic inflammation and progressive dysfunction of lacrimal and salivary glands, causing xerostomia and xerophthalmia.
The diagnosis is based on clinical, serological, and histological tests. Minor salivary gland biopsy (MSGB) is the most sensitive and specific tool for the diagnosis of SjS, albeit with several drawbacks, including the possibility of inadequate sampling for Focus Score (FS) estimation. The aim of this study is to describe our experience in Ultra-High Frequency Ultrasound (UHFUS)-guided MSGB, and to evaluate the potential diagnostic role of UHFUS in SjS work-up. We therefore evaluated the ability of UHFUS-guided MSGB to obtain an adequate sampling area for FS assessment, and tested the diagnostic performance of UHFUS with respect to other diagnostic tests, namely major salivary gland ultrasonography (SGUS) and serological evaluation of anti-Ro/SSA antibodies.
Methods 51 consecutive patients with suspected primary SjS were enrolled in this proof of concept study. All patients underwent clinical, serological, and histological evaluation. UHFUS-guided MSGB was performed under 70MHz probe guidance. UHFUS images were then analyzed to evaluate the degree of inhomogeneity and vascularity through a dedicated score.
Results 18/51 patients were diagnosed with SjS, 12 patients had autoimmune disease (AD)-related xerostomia, and the remaining 21 patients were considered symptomatic controls (non-AD-related xerostomia). UHFUS-guided MSGB significantly increased the number of adequate samples for FS evaluation from 50.8% to 74.5% compared to the previous year. Moreover, UHFUS showed high diagnostic accuracy in differentiating SjS, AD-related xerostomia, and non-AD-related xerostomia, with sensitivity=100%, specificity=38%, PPV=49%, and NPV=100%. The concordance of UHFUS and MSGB was 0.434 (p-value=0.003).
Conclusions UHFUS could be a promising imaging method for the study and characterization of minor salivary glands. Our preliminary results show a significant improvement in MSGB performance, and suggest a possible role of UHFUS in SjS diagnostic algorithm.

0299

Chair-side Spectroscopic Analyzer to Assess Salivary Biomarkers in Periodontally Affected Patients with Type 2 Diabetes Mellitus

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Objectives To compare salivary biomarker release of C-terminal crosslinked telopeptide (CTX) and Matrix Metalloproteinases-8 (MMP-8) from saliva using a chairside Raman spectroscopic analyzer in peridontally affected patients with type 2 Diabetes Mellitus

Methods Sixty patients were included in the study to collect saliva for biomarker analysis. The groups included healthy, diabetic, chronic mild periodontitis, chronic moderate periodontitis, diabetic with chronic mild periodontitis and diabetic chronic moderate periodontitis patients. Saliva specimens were taken from subjects and assessed for MMP-8 and CTX levels using ELISA and analyzed using micro-Raman spectroscopy analyzer developed for clinical chair-side assessment. Both the markers from all groups were compared using the paired t-test to examine the effects of exposure time.

Results For Raman spectroscopic analysis, the strongest and sharpest band occurred at 1260 cm^{-1} amongst all groups. A Raman band at Amide I was observed with slight shifts ($p<0.05$) in wave numbers for all periodontal patients (1664 cm^{-1}, 1662 cm^{-1}, 1659 cm^{-1}, 1657 cm^{-1}). For ELISA analysis, the rate of CTX release was significantly higher in diabetes chronic moderate periodontitis group (14.8±3.1) compared with those from the healthy (11.2±4.4) or periodontitis groups *($p<0.05$)*. Furthermore, MMP-8 concentration for healthy groups was statistically different compared to all other groups. Groups with diabetes (16.1±4.1) and chronic moderate periodontitis (18.3±3.4) showed no statistical difference (*$p<0.05$*).

Conclusions Saliva during routine periodontal examination may be used for diabetic mellitus and periodontal patients screening in a dental office setting with the use of a newly developed Raman probe.

0300

Salivary Changes and Oral Mucositis Following Hematopoietic Stem Cell Transplantation

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Objectives A common and most debilitating complication of autologous hematopoietic stem cell transplantation (ASCT) is oral mucositis (OM). Saliva and especially salivary proteins play a major role in protecting the oral mucosa. The aim of this multicenter, longitudinal study (part of the Orastem-study) was to determine salivary changes in relation to OM in multiple myeloma patients following high-dose melphalan and ASCT.

Methods Unstimulated and stimulated whole mouth saliva samples (UWS and SWS) were collected before ASCT (during pre-transplantation dental evaluation), once a week during the hospitalization phase, and at 3 and 12 months after ASCT. During the hospitalization period OM was scored 3 times a week using the WHO scoring system. Salivary flow rate, pH, and concentrations of total protein (Nanodrop), lactoferrin, neutrophil defensin-1, total IgA and S100A8/A9 (ELISA) were determined. Mixed models were used to determine statistical differences between the OM (≥2 WHO, n=20) and Non-OM (n=31) groups ($p<0.05$ was considered as statistically significant).

Results No differences were seen between the OM and Non-OM groups ($p>0.2$, (total protein SWS $p=0.079$)). During the hospitalization phase until day 18 (ASCT is day 0) there was a trend of decreasing flow rate, pH, total IgA and neutrophil defensin-1 in UWS and SWS. At the same time there was a trend of increasing lactoferrin levels in UWS and SWS. Twelve months after ASCT, levels of the salivary proteins were similar to baseline except for total IgA, which were higher 12 months after ASCT. S100A8/A9 concentrations in UWS and SWS fluctuated over time.

Conclusions Changes in anti-microbial salivary proteins were seen in the first 3 weeks after ASCT and were similar for both OM and Non-OM patients.

0301

Effect of Periodontitis Risk Factors on Salivary Antimicrobial Peptide Levels

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Objectives Human defensins (hBD) and cathelicidin (LL-37) are antimicrobial peptides that contribute to innate and adaptive immunity, however the association between the expression of these peptides and periodontal health status is still unclear. Type 2 Diabetes Mellitus (T2DM) and smoking are the risk factors for periodontitis. The aim of the present study was to evaluate the possible effects of periodontitis risk factors on the salivary levels of antimicrobial peptides.

Methods Unstimulated whole saliva samples, together with full-mouth periodontal recordings (plaque index [PI], gingival index [GI], probing pocket depth [PPD], and clinical attachment level [CAL]), were collected from 92 subjects with stage 3 grade C

periodontitis (63 were diagnosed with T2DM and 21 were smokers) and 86 periodontally healthy controls (58 were diagnosed with T2DM and 21 were smokers). Demographic and general health parameters, including fasting blood glucose, glycated hemoglobin (HbA1c), were quantified. Salivary hBD-1, -2, -3, LL-37 and advanced glycalization end products (AGE) levels were measured by enzyme-linked immunosorbent assay.
Results Demographic variables did not show any significant difference between periodontitis and control groups. Salivary hBD-2, hBD-3 levels were decreased in subjects with T2DM ($p=0.013$, $p<0.001$ respectively) comparing with non T2DM subjects and there was a negative correlation between these peptides with AGE and HbA1C levels. ($p=0.045$, $p=0.01$, $p=0.050$, $p<0.001$ respectively). Increased levels of salivary LL-37 were observed in subjects with TD2M ($p<0.001$) and positive correlation exist between the LL-37 with AGE and HbA1C levels. ($p=0.004$, $p<0.001$ respectively). The salivary levels of hBD-3 and LL-37 had decreased ($p=0.050$, $p=0.030$) in smoker subjects while the hBD-1, and -2 levels did not differ between smokers and non-smokers ($p=0.165$, $p=0.133$ respectively).
Conclusions Alteration of salivary antimicrobial peptide levels may relate to impaired immune response in periodontitis subjects who smoke and have T2DM.

0302

Awareness and Attitudes of French General Practitioners toward Periodontal Medicine.
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Objectives Periodontal medicine is based on the evidence of interactions between periodontal diseases (PD) and overall health. According to a recent mapping of trial registers fifty-seven systemic conditions might be linked with periodontal diseases, covering nearly 2% of identified human diseases. As the first line of medical care, general practitioners (GPs) must be aware of the periodontal-systemic interaction to provide appropriate information and care to patients. This study was designed to assess knowledge, attitudes and practices of French GPs toward periodontal medicine.
Methods A cross-sectional survey was performed on the GPs practicing in the Northern of France, a large geographic area comprising nearly 10% of the French population. The data were collected via a self-administered questionnaire, which was available online for GPs in the region through local divisions of the French Medical Board.
Results 253 GPs (male 56.92%; < 50 years old 45.85%; private practice only 88.14%) completed the questionnaire. Among them, nearly 20% had a personal history of PD. Nearly 75% of the participants were aware of the PD-diabetes association when 53-59% were conscious of the impact of PD on cardiovascular diseases, inflammatory bowel diseases and respiratory infections. Few GPs (35.18%) identified PD as a possible risk factor of rheumatoid arthritis and less than 15% heard about the PD-Alzheimer potential connection. It is worth mentioning that most of the GPs (74.31%) never ask their patients about their periodontal status. They widely consider their knowledge of PD to be insufficient (71.15%) and would seek for an up-to-date training on periodontal medicine (86.56%).
Conclusions This study shows an average knowledge of GPs but discrepancies in their daily clinical routine and clearly stress out the need to reinforce collaboration between dentists and GPs in the future in France. Public health campaigns and joint continuing education training for GPs and dentists should be considered.

0303

Increasing Oral Cancer Screenings: Key Informants' Policy Recommendations
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Objectives To identify policy recommendations that dentists in Puerto Rico (PR) believe will increase the frequency and quality of oral cancer (screening) examinations (OCE) in dental offices through research methodologies.
Methods The qualitative study was conducted in four phases: systematic literature search, expert review/consensus panel, focus groups (FG), and key informant (KI) interviews (reported here) conducted with PR dentists. KI participants (n=10) were *purposefully selected* (per standard qualitative study design) in order to obtain a range of professional viewpoints. Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest" (Palinkas LA et al, 2015).
Healthcare practitioners selected for participation included a senior officer of the PR Dental Society, a community health dentist, a former dental insurance director, a public health specialist, and a consultant for curriculum and accreditation. All were involved with the dental society, academics, public health and/or insurance companies. Individual KI interviews were conducted in Spanish by two experienced qualitative researchers
Results Policy recommendations included: OCE clinical competency demonstration for licensure; OCE continuing education required for relicensing; public campaigns (i. create awareness about oral cancer (OC) and the need for frequent OCEs, and ii. conducting oral self-examinations); publicizing malpractice cases for failure to conduct an OCE in oral cancer cases; creating an oral mucosa lesion referral center; and encouraging medical professionals to conduct OCEs. Unlike the FGs' findings, KIs did not support separate fees for OCEs
Conclusions The KI dentists believe that the quality and quantity of OCS in PR can be increased through specific policies. Their recommendations were consistent with previous reports and recommendations of the study expert consensus panel, suggesting

a broader generalizability to these findings to the U.S.A. Many of these findings are likely internationally applicable across health services' models.

0304

Patient Treatments Delegated to Dental Chairside Assistants in Denmark.

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Objectives In Denmark, the health authority in 2007 advanced legislation allowing Dentist to delegate treatment of patients to Dental Chairside Assistants (DCA) subject to certain conditions.The objective of this investigation was to study to how often Dental Chairside Assistants (DCA) are performing clinical treatment of patients in private practice in Denmark. Has there been a development in delegation of tasks from Dentists to DCA since this became legal in Denmark? What are the most frequent delegated tasks? Does it influence job satisfaction of the DCA?

Methods 550 DCAs participating a dental conference were invited to fill out a questionnaire regarding delegation of patient treatments in their job in 2009. 378 DCA got at similar invitation in 2018 at a similar event this year. The response rates were 73% and 70%, respectively. At both occasions were participants from the region where the conference to place slightly overrepresented. The number of years in the profession represent that of the DCA in Denmark.

Results In 2009 24% of the DCA reported to performed delegated tasks daily or weekly. This proportion had raised to 60% in 2018. The most frequent delegated tasks was impression taking the two years, respectively 42% and 51% amongst those who did delegated tasks daily or weekly. Similarly, the number of DHAs who deliver non-operative caries treatment and supportive periodontal therapy had increased as had the proportion who made and cemented temporary restorations. The number doing other clinical tasks remained low. Amongst those who perform clinical treatment of patients 78% felt this contribute to their job satisfaction.

Conclusions The number of DCA participating in delivering simple clinical dental procedures in Denmark had been increasing since it was introduces. This might not only contribute to the cost-effectiveness of the delivery of dental service but it also add job satisfaction to those involved.

0305

Dental Health Care Workers' Intention to Use Nanomaterials

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Objectives Nanotechnology has greatly influenced the field of dentistry, however little is known about dental health care workers' attitudes towards the use of dental nanomaterials. The study aimed to report upon the extent to which the components of an extended Theory of Planned Behavior (TPB) are predictive of dental health personnel's intention to use nanomaterials in terms of their relative contributions and whether the predictive effects vary by professional status and gender.

Methods A cross-sectional survey was conducted in Norway in 2017. Electronically administered questionnaires were distributed to a census of dentists and dental hygienists employed in the Public Dental Health Service. Theoretical components - attitudes, subjective norms, perceived behavioral control and descriptive norms - were assessed in accordance with TPB. Multiple linear regression analyses by STATA SE 15 was used to assess the independent effects of the theoretical components.

Results A total of 851 dental health care workers responded, with response rate 47.5%. Attitudes towards dental nanomaterials (beta = 0.53 (0.48-0.59) 95% CI) had the strongest effect on intention to use nanomaterials in the future, followed by descriptive norms (beta = 0.23 (0.16-0.31) 95% CI) and perceived behavioural control (beta = 0.20 (0.14-0.26) 95% CI). Subjective norms had a non-significant effect on intention (beta = 0.06 (-0.01-0.13) 95% CI). Statistically significant two-way interaction effect occurred between subjective norms and gender. Stratified analysis revealed that the effect of subjective norms was beta = -0.04 (-0.16-0.10) 95% CI among men and beta = 0.11 (0.02-0.20) 95% CI among women. The extended TPB model explained 68% of the observed variance in behavioural intention.

Conclusions The findings suggest that positive attitudes towards use of nanomaterials, simplicity in their application and collegial examples were independent predictors of dental health personnel's intention to use nanomaterials in the future, pointing, thus, to the usefulness of the TPB for applied purposes.

0306

Analysis of Dental and Oral Mucosa Morbidity of Armenian Children Based on Retrospective Data on Presentation at the Two Major Armenian Dental Clinics

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Objectives In Armenia, the focus of pediatric dentists has been dental caries and their complications. To our knowledge, there is no data available so far on oral mucosal morbidity in Armenian children. The aim of this study was to identify and describe the profile of dental and oral mucosa morbidity in Armenian children presented at the two major dental clinics in the country between 2016 till 2018.
Methods A retrospective analysis of 2145 registration sheets and 1634 case histories of children aged 6 months to 8 years that presented between 2016 to 2018 to the Stomatological Clinic N.2 of Yerevan State Medical University and to the Department of General Pediatrics of Medical Center 'Surb Astvatsamayr' was conducted.
Results The most common reason for the visit to the dental clinic was acute pain (95%) and dental related morbidities (91.9%). Among these, the most frequent dental morbidity (both milk and permanent teeth) was pulp necrosis and periapical infection (62.2%), followed by dental caries (37.8%). The most affected tooth was the first permanent molar. Tooth injuries represented 2.08% of cases and enamel hypoplasia was observed in 1.5% of cases. In 120 cases (5.3%), teeth were extracted on the first visit after diagnosis. Diseases of the mucous membranes were diagnosed in 174 patients only (8.1%). Among these, the primary herpetic infection was the most common (116 cases, 66.7%). Oral candidiasis was diagnosed in 25 cases (14.4%), mainly on premature babies, followed by allergic reactions of the mucous membrane (12.1%). Traumatic lesions of the mucous membrane were diagnosed in 6.8% of cases.
Conclusions These data show that the Armenian children presented to these two dental clinics mainly for getting treatment against lesions of hard dental tissues (caries and its complications), which might indicate an insufficient level of awareness and practice of preventive activities.

0307

Tooth Brushing or Water Mouth Washing Effect on Dental Caries

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Objectives Oral health is one of the important parts of general health. Tooth brushing is an effective method to prevent dental caries. Nevertheless, mouth washing with water maybe a substitution way for oral cleaning in children. The purpose of this study was to compare the tooth brushing and warter mouth washing effect on Early childhood caries (ECC) prevention among preschool children .
Methods The present case control study was carried out among 4-6 year–old-children (n=528) in 2017 in Tehran/Iran. 24 preschools were selected by multi stage cluster random sampling. The children were examined and whom with ECC and caries free were determind as two control and case groups. The parents filled a questionnaire on demographic characteristicec and oral health behaviors as children's tooth brushing, sugar consupmtion, mother educational level and number of children in family. Logistic regression and chi square test were used for statistical analysis (p<0/05).
Results The case group included 230 caries free children and the control group compoesd of 270 children with dental caries. Totally 56.2% of children who had used tooth brush, 29.9 % of children who washed their mouths with water and 12.5% who hadn't used any method for dental cleaning,were caries free. The chance of dental caries affliction was 4.84 (OR) times more for water mouth wash users comparison with tooth brush users (P<0/01 , %95CI : 2.88-8.11).
Conclusions When children don't use tooth brushing as the most essential cleaning method, mouth washing with water can reduces dental caries among preschool children especially when they don't access to tooth brush.

0308

Oral Health Status and Dental Fluorosis in Schoolchildren in Kenya.

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Objectives Endemic fluorosis in Kenya has been previously reported. This study aimed to implement an oral health promotion programme and assess the oral health status of schoolchildren in three deprived rural and periurban areas in Kenya.
Methods An oral health promotion programme including oral health status assessment was implemented in July 2018 in two schools in Maasai area (two villages in south Kenya) and in an orphan school in the periurban area of Riruta (near Nairobi). 373 school children of different Kenyan tribes, aged 4 to 18 years (males 55%, and females 45%) participated in the programme; teachers were also involved. Oral health examination was conducted by one calibrated dentist. Children were screened for dental fluorosis, dental caries, and gingivitis, and all data were recorded in the WHO oral health assessment form for children, according to WHO guidelines (2013). Statistical analysis was performed using SPSS 20v.Descriptive statistics, correlation analysis,

x^2 square test of independence, t-test, Mann-Whitney Test and Univariate Analysis of Variance were used to analyse data.
Results Dental fluorosis was the main finding in the examined population. Recorded differences in dental fluorosis (2.99±1.59) for males and (2.92± 1.44) for females, in periurban (2.93±1.49) and rural areas (3.01±1.58), were not statistically significant. Severe enamel fluorosis was recorded in 63 children (16.9%). Dental caries were also recorded: 81.8% of permanent teeth and 64.8% of primary teeth were free of dental caries. Dental erosion was very low (enamel lesion = 1.1%, dentinal lesion = 0.5%). The dmft index was inversely correlated to dental fluorosis (p=0.005).
Conclusions There was a high prevalence of dental fluorosis in schoolchildren in deprived periurban and rural areas of Kenya due to the high natural concentration of fluoride in the water. Dental caries prevalence was low. There were no significant differences of dental fluorosis between males and females or different locations.

0309

Influence of Dietary Habits on Oral Hygiene in Children

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Objectives The objectives of this study were to determine whether there is a correlation between children's oral hygiene and dietary habits, and is this relationship changed through different age groups. Additionally, we analyzed changes of dietary habits and oral hygiene index by age groups.
Methods A total of 102 children aged between 0 and 18 participated in the study, with the ratio of female and male respondents being approximately the same. Based on the age children were divided into three groups; pre-school age children (0 to 6 years), young school-age children (7 to 10 years) and older school-age children (11 to 18 years). Two short questionnaires were prepared and participants could select only one answer to the asked question. Questionnaire on oral hygiene consisted of six questions, and the questionnaire on dietary habits of children consisted of seven questions. In order to replace questioned parameters with one variable we formed two variables, dietary habits (DH) and oral hygiene index (OHI). Score was calculated based on the responses from the questionnaire and children were divided either in a group with good or with poor oral hygiene, and in a group with good or bad dietary habits.
Results The results of the study showed there was a statistically significant difference in oral hygiene index of different age groups: the highest in children of the youngest age (up to 6 years), and lower in children in the other two age groups. Analysis of age and dietary habits of children was related to the existence of statistically significant effects of age on dietary habits, with one becoming worse with age.
Conclusions No statistically significant correlation was determined between the oral hygiene index and the dietary habits of children. In addition, oral hygiene and dietary habits correlation is not connected with the age of children.

0310

Association between Anxiety and Sleep Bruxism among Children and Adolescents

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Objectives Sleep bruxism is not only a problem of adulthood but also a common problem among children and adolescents. Studies indicated that 85% to 90% of general population experiences bruxism during their lives. Among children and adolescents sleep problems like sleep bruxism have high prevalence. This study aims to reveal the underlying effect and association of anxiety on child and adolescent bruxism.
Methods A cross-sectional study was conducted with 260 (140 boy and 120 girl) between the ages 8-14.
State trait anxiety inventory was used to evaluate the level of anxiety among children and adolescents. Additionally health history of the participants were taken and a survey including demographical data of the participants and their parents was applied. Each participant had underwent a full TMD examination. Children, in collaboration with their parents, completed the questionnaire.
Results Most participants with bruxism showed higher anxiety levels.
Conclusions The risk factors related to bruxism vary and it is important to eliminate the risk factors rather than developing symptomatic treatment methods.

0311

Students' Attitudes and Knowledge on Pain Management in Pediatric Dentistry

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Objectives Background. Pain in children is still insufficiently observed, prevented and treated during dental visits. Consequently, to study dental students' knowledge and attitudes on pain and pain management prior to the exercise of their profession is a quality assurance.
Objective. To evaluate pain management attitudes and knowledge of last semester dental and hygienist students, indicating their future praxis of pain management in children.
Methods 304 dental and hygienist students from all Swedish Universities were eligible for inclusion in the survey. Written and oral information was given about the study's aim, methods, anonymity and voluntary participation.

Questionnaire: The questionnaire included 47 closed questions, which were divided into seven categories: (A) Views on the care of children in pain, (B) Physiology of pain, (C) Pain alleviation, (D) Pain medication, (E) Sociology and physiology of pain, (F) Pain assessment instruments and methods, and (G) Non-medication methods of pain alleviation. The response alternatives were given on a Likert-type scale; Agree, Agree to some extent, Don't know, Disagree to some extent, Disagree.
Statistical analysis used the IBM SPSS software, version 22, presenting descriptive data for 11/47 (A, B, C, E) items.
Results In total 199/304 (65.4%) students from all Universities responded, (160 dental and 39 hygienist students). Among these groups, 35.8% and 28.2% respectively reported lacking knowledge on *The young child's pain vulnerability* (A6). 30.3% dental students and 25.6% hygienist students valuated *The dentist's competence higher, in comparison with the parent*, when advocating the child's pain intensity (A14).
25.8% of the dental and 17.9% hygienist students reported insufficient knowledge on *Usually the child's pain experience diminishes when the parents are present* (C4).
Conclusions As a quality assurance, dental and hygienist students, in the final phase of their education, need augmented educational efforts to improve attitudes and knowledge regarding pain and pain management in the young patient.

0312

Awareness and Practices of Oral Hygiene Among Schoolchildren in Republic of Armenia

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Objectives The purpose of this study was to identify the awareness and practices of oral hygiene among schoolchildren in Republic of Armenia.
Methods Questionnaires were randomly distributed to all regions and the capital of Republic of Armenia. A random non-repeat selection was used and one respondent completed the questionnaire only once. Data was statistically analyzed using SPSS program.
Results The source of knowledge about oral hygiene in schoolchildren from Yerevan, other cities in the country and the countryside revealed that the majority received it from conversations with parents (43%, 33.7% and 23.3% respectively), while 16.1%, 8.7% and 36.1%, respectively, reported that they did not receive any knowledge on this matter. In Yerevan and cities, 65% and 59.8% of respondents reported to have been trained to practice oral hygiene, with the majority (93.2% and 88.7%) using toothpaste as means of oral hygiene, 12% and 10.8% dental floss, 11% and 13.8% mouthwash. Among respondents in rural areas only 40.4% reported that they have been trained for oral hygiene, and from these 67.9% used toothpaste, 3.8% dental floss and 15.2% mouthwash. In Yerevan and the cities, 74.2% and 68% respectively reported to brush their teeth once or twice a day, while 4.9% and 7.1% respectively reported not brushing their teeth. In rural areas, only 47.2% reported that they brush their teeth once or twice a day and an alarming 26.2% reported not brushing their teeth.
Conclusions
This study indicates deficiencies in educational and prevention oral health work particularly in the countryside of the Republic of Armenia. The primary source of information for the schoolchildren on oral health issues was identified to be the parents, suggesting that in addition to improving the prevention work in dental clinics and schools, one of the ways to improve schoolchildrens' knowledge and hygienic skills is to provide accurate information to parents.

0314

Chemical and Mechanical Composition of Bovine and Human Dentin

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Objectives To compare chemically and mechanically human and bovine dentin subjected to a demineralization and remineralization process with different exposure times.
Methods The demineralization/remineralization process was created by the pH-cycling method. 10 sound permanent upper human incisors and 8 sound permanent lower bovine incisors were sectioned until obtaining 60 beams of human dentine and 60 beams of bovine dentin that were randomly divided into four experimental groups (sound, pH-cycling for 3 days, pH-cycling for 7 days and pH-cycling for 14 days) within each type of substrate. The mechanical analysis was determined by Three Point Bending test and the chemical composition by ATR-FTIR and Thermogravimetric test.
Results Flexion resistance (MPa) did not show differences between the groups nor between the two types of dentitions. However, the extension by compression increased with the time of exposure to pH-cycling showing significant differences between human and bovine teeth in all the time periods studied. Regarding chemical composition, the control group of bovine teeth showed lower values in most of the variables such as phosphate, amide, and collagen cross-links. In contrast, during cycling, the differences between the two substrates decreased and there were only significant concerning the amide quantity. The thermogravimetric analysis also showed a higher organic content in human teeth than in bovine in the control group, although the differences were not significant at the end of the pH-cycling process. Regarding mineral content thermogravimetric showed a higher quantity in human teeth at the end of cycling.
Conclusions Despite of the tissues showed a similar trend after the pH-cycling process, the analyses showed differences between human and bovine dentin concerning chemical composition, mechanical resistance and their behavior against the demineralization/remineralization process by pH-cycling at 3, 7 and 14 days.

0315

Caries as Dysbiosis of Sugar. An Analtyical Study.

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Objectives Nowadays caries is defined as "sugar dysbiosis": the frequent consumption of fermentable carbohydrates and its metabolism by acid-tolerant germs leads to a dysbiosis in the biofilm, favoring the development and growth of acidogenic and aciduric germs, by both, cariogenic. It has been proven that without sugar there is no decay. To minimize the risk of tooth decay throughout life, the intake of free sugars should be as low as possible in childhood.
The objectives of the work are to know in a child population the high risk of suffering from caries, and if the consumption of sugars is present in a significant way in this risk group.
Methods Retrospective cohort analytical study. The sample consists of 547 patients from 6 to 14 years of age assisted at the Faculty of Dentistry of the Complutense University of Madrid. The risk of caries was assessed individually using the CAMBRA (Caries Management by Risk Assessment) protocol. The variables to be analyzed were consumption of sugars between meals and high risk of caries. The program for the statistical processing of the data was Microsof Excel 16.24.
Results 40.5% of the patients were at high caries risk, the consumption of sugars between meals being present at 36%. The statistical analysis indicates that there is a positive association between these two variables, that is, a greater risk of caries in patients who consume sugars between meals ($p < 0.05$).
Conclusions A high percentage of patients had a high risk of tooth decay and the consumption of sugars was present to a large extent in this group. The new preventive approaches should be aimed at restoring the ecological balance of dental plaque, avoiding as much as possible the dysbiosis caused by sugars through diet control.

0316

Caries Detection on DIAGNOcam Images Using Convolutional Neural Networks

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Objectives Near-infrared-light transillumination to detect caries does not require ionizing radiation and can be performed outside of conventional dental settings. The DIAGNOcam (KaVo, Biberach, Germany), uses such transillumination. Interpretation of DIAGNOcam images, however, requires training and shows limited reliability. The aim of this study was to apply convolutional neural networks (CNN) for automated detection of caries lesions on DIAGNOcam images.
Methods We built on a dataset of 226 DIAGNOcam images. For each image with a tooth in the center of it (on average 435 x 407 pixel), caries lesions were annotated by an experienced dentist using an in-house developed digital annotation tool. The pixel-based annotations were reviewed by a senior dentist and translated into binary class levels. We trained five state-of-the-art CNNs (Resnet18, ResneXt, VGG16, DenseNet and InceptionV3) and validated them using different cross validation (CV) schemas (leave-one-out and 10-fold CV). We oversampled the minority class (caries lesions being prevalent) to compensate for class imbalance. During the training process, we applied data augmentation (random resizing, rotations and flipping) and applied different learning rates (10^{-5} to10^{-3}), however, we did not exhaustively tune the models' hyperparameters to prevent overfitting. For model evaluation, the area under the Receiving Operating Characteristic curve (ROCAUC) was used. Image Occlusion and class activated heatmaps were used for visualizing and interpreting model findings.
Results Different model architectures model hyperparameter configurations yielded similar accuracies. The best performing model was Resnet18, where we retrained the last 9 network layers, using the Adam optimizer, a learning rate of $0.5x10^{-4}$, and a batch size of 10. The ROCAUC (SD) was 0.70 (0.06) Visual inspection of model predictions found the model to be sensitive to areas affected by caries lesions.
Conclusions CNNs trained on a limited amount of DIAGNOcam image data showed acceptable accuracy to classify teeth with caries lesions. In order draw more robust and more generalizable conclusions, more annotated imagery is required.

0317

Influence of Cervical Tooth Wear on Dentine Hypersensitivity

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Objectives Dentine hypersensitivity is a common condition that is frequently encountered in dental practice. The aim of this study was to evaluate the influence of cervical tooth wear on the occurrence and extent of this condition.
Methods The study included 394 patients, both genders, aged over 18, who were clinically examined for the presence of non-carious cervical lesions (NCCLs) and dentine hypersensitivity. The degree of cervical hard dental tissue loss was determined using a Basic Erosive Wear Examination – BEWE scoring system. Presence and level of cervical dentine hypersensitivity on teeth with NCCLs were evaluated using Schiff Air Sensitivity Index. Statistical analysis was performed using the methods of descriptive statistics and the relationship between the degrees of cervical tooth wear (BEWE 1-3) and dentine hypersensitivity (Schiff 1-3) was analyzed using chi-square test.
Results NCCLs were diagnosed at 68.5% from total number of respondents, 15% from all present teeth were affected. The

average value of recorded BEWE score in this study was 2.88, with a minimum value of 0 and a maximum recorded value of 14. Certain level of dentine hypersensitivity was observed at 28.5% from the total number of participants, with the average value of the Schiff Air Sensitivity Index of 0.37. The analysis has shown that the percentage of subjects with clinically expressed dentine hypersensitivity increases with the increase of the degree of cervical hard dental tissue loss. Significantly higher dentine hypersensitivity (p = 0.0449) was recorded on teeth with the highest degree of cervical damage (BEWE 3).
Conclusions Results of this study indicate that there is a strong, progressive relationship between dentine hypersensitivity and cervical tooth wear. That is important to recognize for inclusion of preventive measures and clinical management.

0318

Knowledge and Opinions of Erosive Tooth Wear among Finnish Dentists

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Objectives This questionnaire-based study aimed to investigate Finnish dentists' general opinions, as well as knowledge on recording and diagnosing erosive tooth wear (ETW).
Methods An electronic questionnaire was sent to 3,664 Finnish dentists whose e-mail address was found in Finnish Dental Society Apollonia register in 2018. The response rate was 24% (n=866; 702 general dentists, 164 specialized or specializing dentists) after two reminders. Responses represented all provinces in Finland. Majority of the respondents (75%) had working experience for at least ten years.
Results Results indicated that almost all (98.9%) dentists recorded ETW in patient records. However, only 3.8% of them used a detailed scoring system. For the documentation of ETW, 44.4% of the dentists used clinical photographs at least occasionally, while 29.5% had casts made for monitoring the lesions. Patient's dietary history was commonly (80.9%) assessed by the dentists. Of the respondents, 79.7% never evaluated saliva secretion rate of the ETW patients. Two thirds (64.7%) of the dentists reported that they generally found the cause for ETW. The most probable causes were reported being the use of carbonated beverages (90.7%), the use of energy drinks (64.1%) and reflux (60.6%). Of those dentists who had been working more than ten years, 79.3% reported discovering ETW more often now than 10-15 years ago. One third (32.1%) reported more erosive lesions on males than on females whereas the same proportion (32.6%) reported no difference between the genders.
Conclusions To conclude, this study suggests that Finnish dentists are relatively up-to-date regarding clinical recording and diagnosing ETW. Even though dentists report detecting ETW more often now than ten years ago, they do not feel to have enough competence in detecting the cause of ETW.

0320

Long-term Results of Primary Dental Caries Prevention in School Children

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Objectives To evaluate dental caries prevalence in secondary school graduates who were part of the supervised tooth-brushing program in 1st and 2nd grades of primary school (2006 – 2008).
Methods In three randomly selected schools, out of two hundred in Minsk, Belarus, 132 1st grade children (M=68, F=64), mean age 7.4 years (October 2008) were involved in a two-year toothbrushing program, supervised by school teachers. Children were provided free commercially available toothbrushes and fluoridated toothpastes (AmF-500 ppm F- + xylitol). The daily toothbrushing program on school days was approved by Minsk Public Health Committee and parents' consent was obtained. In April 2018, the DMFT was assessed in only 67 schoolers who remained in school (M-30, F=37), 17-18 years of age (mean 17.6 yrs.). There were 65 drop-outs - 49%. The comparison group were 120 1st grade children (M=63, F-57), mean age 7.5 years (November 2008) attending school in the same districts. Those children were provided with standard oral health education. The DMFT was recorded in the control group only in 78 remaining schoolers (M=43, F=44) at the age 17-18 years (mean 17.8 yrs.). There were 42 drop-outs, 35%. The base-line mean intensity of dental caries in the initial study and control groups were DMFT 0.34±0.95 SD and 0.46±1.03 SD, accordingly. Regarding drop-outs, the base-line DMFT was estimated from previous records at 0.25±1.04 SD and 0.32±1.13 SD in the study and comparison groups, accordingly (p>0.1). For statistical analysis, the Student t-test was employed.
Results The mean DMFT of 17-18-year-old school graduates, who participated in the supervised toothbrushing program (2006, 2008) was 2.93±3.25 SD. The mean DMFT of the comparison group was 4.01±3.9 SD. The difference in DMFT group scores was 1.08, or 26.9% *(p<0.05).* Noteworthy, the M component (missing teeth) in the study group was 0 vs 0.26 in the control group.
Conclusions The above toothbrushing program had a positive long-term trace effect in reducing dental caries in 17-18-year-old school-graduates.

0321

Thioglicosydes in Treatment and Prevention of Root Caries.

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Objectives The aim of the study was a clinical examination of the efficacy of the thioglycosydes extracted from white mustard Bamberka in the prevention and treatment of root caries.

Methods The study covered 50 subjects aged 30 to 65, with at least one or more active root caries lesions. Patients were divided into two groups : test and control. In the test group patients were using twice a day experimental toothpaste containing fragmented entire mustard seeds. In the control group patients were using toothpaste containing 1450ppmF. At baseline and after 3 and 6 month the lesions were clinically assessed (activity, hardness, cavitation, and dimensions). Activity of root caries was evaluated by root caries index acc. Nyvad and Fejerskov. All patients were also instructed about oral hygiene and have professional tooth cleaning.

Results After 3 months 18,9 % lesions in the test group had became hard, compared with 8,02% of the lesions in the 1450ppmF group. After 6 month 36% lesions in the test group and 25,3% in the 1450ppmF group had became hard. Analysis of root caries index acc. Nyvad and Fejerskov showed that in the test group, after 6 month observation 22,4% yellow lesions change colour to dark yellow, and 18,6% dark yellow to brown. However in the 1450ppmF group the lesions remained similar to that at baseline. During the 6 month the study, lesions tended to get smaller in test group, but the differences were not statistically significant.

Conclusions The study showed that root caries lesions can be treated non-operatively by the use of toothpaste containing fragmented entire mustard seeds.

0322

Can Probiotic Interaction Induce Bacterial Interference in Endogenous *Lactobacilli* Species?

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Objectives To evaluate the interference capability of endogenous lactobacilli against selected oral streptococci *in vitro* before, during and after intervention with commercial *Lactobacillus reuteri* strains. A balanced oral microflora is fundamental to healthy teeth. Streptococci play different roles in this system e.g. contributing to plaque formation or promoting caries disease. Implementation of probiotic lactobacilli may restore the healthy oral microflora balance and prevent disease development.

Methods A 6-week study on 10 volunteers was conducted. Ethical approval and informed consent were obtained from each participant.

Agar-overlay interference test: Based on morphological characteristics, a *lactobacillus* colony was selected from every participant during each visit (baseline, 2 and 4 weeks of treatment with BioGaia Prodentis® drops, 2-week follow-up) for agar-overlay test against a panel of 13 different streptococcal strains. Both drops and separate *L. reuteri* strains (DSM 17938; ATCC PTA 5289) were used for comparison and no lactobacilli as a control. Tests were run in triplicates and growth inhibition was scored (0-total inhibition, 5-no inhibition).

Phosphate-buffered saline filtrate test: BioGaia drops and lactobacilli strains from a patient with the most distinct inhibition-change pattern were used for PBS filtrate tests.

Results Host lactobacilli strains promoted the growth of some streptococci up to 12% after 2 weeks of intervention and inhibited to almost 70% after 4 weeks. 2-way ANOVA test revealed a significant difference within endogenous lactobacilli strains between each visit ($p<0.05$). The positive effect was reversed at follow-up. BioGaia drops inhibited streptococcal growth from 20% (*S. gordonii*) to 100% (*S. mutans, S. salivarius, S. sanguis*).

PBS filtrate test revealed *S. oralis* to be the most susceptible and *S. gordonii* the most resistant to probiotic metabolites.

Conclusions During long-term intake, probiotics can positively balance oral microflora by reducing the number of oral streptococci. Establishing sustainable colonization of biofilm with probiotics still poses a challenge.

0323

Effects of a 0.07% Cetylpyridinium Chloride Solution on *Streptococcus mutans* Biofilms

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Objectives Polysaccharides produced by *Streptococcus mutans,* one of the primary agents involved in dental caries, are the main constituents of cariogenic biofilms and have been described as essential virulence factors.

Cetylpyridinium chloride (CPC) is a cationic surface-active agent present in some mouthwash formulations. This molecule interacts with the microbial cell wall, disrupting its integrity and inhibiting the synthesis of insoluble polysaccharides present in the extracellular matrix of *S. mutans*, thus preventing the co-adhesion of bacteria and the formation of a cariogenic biofilm.

The aim of this study was to evaluate the effect of a 0.07% CPC solution on the polysaccharides present in the matrix of *S. mutans* biofilms.

Methods *S. mutans* biofilms were incubated for 24 and 48 hours and were treated with 1.5 ml of a 0.07% CPC solution for 10 and 20 minutes at 37°C in 5% CO_2.

The biofilms were observed by confocal laser scanning microscopy using Syto 9® and AlexaFluor dextran-labelled® to stain DNA and polysaccharide matrix, respectively. Images were processed using MetaMorph® software, and the resulting data was statistically analysed using the Mann-Whitney (Wilcoxon) U test. Additionally, biofilm viability was assessed by plating serial dilutions of the biofilm on blood agar plates that were incubated at 37°C in 5% CO_2 for 36h.

Results A 25% reduction of the matrix's volume was detected in 24-hour old biofilms after 20 minutes of treatment, although no significant differences were observed versus non-treated biofilms. In 48-hour old biofilms, the matrix's volume significantly reduced by 43% and by 62.5% after 10 and 20 minutes of treatment, respectively. Viability of the biofilm decreased by 3 and 2 orders of magnitude at 24 and 48 hours, independently.
Conclusions A 0.07% Cetylpyridinium chloride solution has been proven to disrupt preformed exopolysaccharide matrix and to compromise the viability of *S. mutans* biofilms.

0324

Changes in Biofilm-pH During Exercise/Rest After Intake of Sports Drinks

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Objectives To compare pH-fluctuations in the oral biofilm after consumption of carbohydrate-containing sports drinks during exercise and resting conditions.A frequent consumption of sports and energy drinks has raised concern for consequences for oral health parameters, especially linked to dental caries and dental erosion as repeated compensation of energy and fluid is necessary for athletes during prolonged exercise.
Methods Trained cyclists/triathletes (31.2±7.7yrs) consumed three sports drinks (Maurten®, Vitargo® or Isostar®), with diverse carbohydrate composition, either repeatedly during a 3-hour cycling trial (A, N=11) or as single intakes during resting conditions (B, N=6). Plaque-pH was measured at interproximal sites using a pH indicator strip (A, Special indicator, Merck, Darmstadt, Germany) or an intra-oral electrode (B, Beetrode, MEPH-1; WP instruments, New Haven, Conn, USA), at different time intervals after ingestion. During exercise, pH-measurements were obtained every 20 min, immediately before the next intake from 0 to 180 min. From 120 to 160 min, only water was served. At rest, pH was measured before 0 and at 2, 5, 10, 15, 30 and 45 min following a single carbohydrate intake. All athletes had refrained from eating and tooth-brushing 24 hours prior to tests. Ethical approval and informed consent were obtained.
Results Exercise conditions resulted in slightly reduced pH-curves ranging from 6.20 to 6.41 for the three products (n.s). During resting conditions, a more pronounced initial pH-drop occurred and statistically significant differences in mean plaque-pH were seen at 2 min; pH 6.72 (Maurten) vs. 5.87 (Vitargo p=0.029) or vs. pH 6.28 (Isostar p=0.001). A similar trend was also seen at 5 and 10 min (Maurten vs. Isostar, p=0.034 and p=0.014, respectively).
Conclusions Differences in pH-lowering capacity of three sports drinks, with potential importance for dental health, were seen under resting conditions. Further studies during physical performance or trials are needed.

0325

Minimal Inhibitory Concentration of Different Chlorine Agents for Intraoral Use

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Objectives Antimicrobial agents have been extensively used during the years in order to reduce the risk for dental caries and periodontitis. However, seldom compared in a dose-dependent manner with the focus of the efficacy of the active substance applied. The aim of this study was to compare the outcome of different chlorine agents with antimicrobial agents routinely used in the clinic.
Methods The following five substances were compared: Dakin's solution, Perisolv gel, Carisolv gel, H_2O_2, and Chlorhexidine regarding their minimal inhibitory concentration (MIC) using micro-dilution assay, plate counting (log CFU/ml) and live/dead-staining under the microscope (Live/Dead staining kit). Agents were tested against ten different oral microorganisms related to dental caries or periodontitis and titrated in a two-fold dilution seriesholding the same starting concentration, 70 mM.
Results All agents showed antimicrobial effect. The strongest effect was found for chlorhexidine that killed bacteria at concentrations of 0.06 mM. The chlorine solutions indicated a slightly less efficiency; Dakin's, at 3.8 mM, and chloramines at 30 mM, respectively. Finally, H_2O_2 killed bacteria at 70 mM. Thus, the effect was similar among the two chloramines Perisolv and Carisolv. Analyses by the live dead kit showed that cell's viability over time were lowest for Chlorhexidine at 5 min followed by Dakin's at 10 min, which was lower than for all other agents. For all agents, a more pronounced effect was seen after 20 min. Only small differences were found when comparing the ten microorganisms, except for Lactobacilli in the MIC test, that seemed more sensitive than to all agents, opposed to A. Actinomycetemcomitans that endurance in higher doses.
Conclusions A variation in antimicrobial properties by the different agents were found with Chlorhexidine needing a lower dose and less time to kill oral bacteria than the other agents.

0326

Oral Colonization by *Lactobacillus Reuteri* after 4 Weeks of Administration

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Objectives The objectives of the present study were to investigate the oral colonization potential of *Lactobacillus reuteri* in form of drops after 4 weeks of administration, and to evaluate the short-term effect of probiotic-containing drops on salivary mutans streptococci and lactobacilli in young adults.
Methods The study group comprised of 13 young adults (M=6/F=7, aged 20-30 yrs) who volunteered after receiving verbal and written information. The short term prospective clinical trial consisted of 9 weeks: intervention period - 4 weeks; post-treatment follow-up period – 5 weeks with no probiotic consumption. Saliva and tooth biofilm were obtained immediately before (baseline) and after 4 weeks of *L. reuteri* DSM 17938 and ATCC PTA 4659 administration. Follow-up samples were collected once every week after administration was terminated on a regular basis. The presence of the two *Lactobacillus reuteri* strains was evaluated using quantitative polymerase chain reaction (qPCR) or regular culturing.
Results The study period was 9 weeks for all individuals and the dropout rate was zero per cent. The occurrence of *L. reuteri*, analysed by qPCR, in the oral cavity increased gradually in saliva during the intervention period and reached to a maximum level after four weeks of probiotic administration (ns). Positive detection of the two *L. reuteri* strains of dental plaque, identified via qPCR technique, was after 4 weeks intervention found for 92% respective 100% of the individuals. The *L. reuteri* DSM strain had better colonization features in the saliva than *L. reuteri* PTA strain at 9 weeks with proportion of 4/13 and 2/13 respectively. Baseline and 4-week samples of stimulated whole saliva showed a decrease in number of mutans streptococci and a corresponding increase in salivary lactobacilli level.
Conclusions *Lactobacillus reuteri* DSM 17938 and ATCC PTA 4659 in form of drops has the ability to colonize in the oral cavity temporarily and follow-up period should extend for more than 5 weeks considering individual variations.

0327

Shear Bond Strength of a Novel-Adhesive-Resin Cement to Glass Ceramic

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Objectives Measure shear bond strength(SBS) of a novel-adhesive-resin cement to glass ceramic.
Methods Three different adhesive-resin cements, 1-Experimental Cement(3M); 2-RelyX™ Ultimate(3M); and 3-Variolink®Esthetic(Ivoclar) were used with their correspondent primer system, a-RelyX®Ceramic Primer(3M); b-Experimental Adhesive(3M); c-Scotchbond™ Universal Adhesive(3M) and d-Monobond Plus(Ivoclar). Thirty disc-like specimens of the glass ceramic (e.max CAD) were separated into 5 groups (n=6), prepared by cutting a cad-cam block and firing. The surface of the specimens was etched with HF 5% for 20s and rinsed off with water. The restoration primer was applied subsequently. Stainless-steel rods measuring 4mm in diameter were sandpapered, sandblasted(Rocatec Plus), silanized(ESPE™ Sil) and subsequently cemented under standardized pressure (20g/mm^2) onto the etched surface. Excess cement was removed immediately after cementation and an LED curing unit (Elipar Deep Cure) was used to polymerize specimens for 10s from 4 different angles. After light curing, the pressure was relieved, specimens were washed off with distilled water and stored at 36°C in 100% relative humidity for 24h. SBS was performed in a universal testing machine (Zwick Z010) at a crosshead speed of 0.75mm/min. Results were analyzed with ANOVA followed by Tukey HSD test (α=0.05).
Results Means and standard deviations of SBS values are shown in Figure1 and Table1. All tested specimens failed in adhesive mode. There was a statistically significant difference ($p<0.05$) in SBS values between the tested groups. Subgroups are identified with letters in Figure1. The group of the Experimental Cement with a RelyX™ Ceramic Primer presented statistically significantly higher ($p<0.05$) SBS values than all other groups.
Conclusions Under the limitations of this study, it can be concluded that the Experimental Cement with RelyX™ Ceramic Primer presented SBS values statistically significantly higher than all other groups. The Experimental Cement with the Experimental Adhesive performed as well as RelyX™ Ultimate and Variolink®Esthetic with their dedicated primer systems.

0328

Tensile Bond Strength of a Novel-Adhesive-Resin Cement to Dentin

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Objectives Measure tensile bond strength (TBS) of a novel adhesive resin cement to bovine dentin compared to other adhesive resin cements in the self-cure mode.
Methods Four different adhesive-resin cements, 1(EXP)-Experimental Cement(3M Oral Care); 2(NX3)-Nexus™ NX3(Kerr); 3(PV5)-Panavia V5(Kuraray) and 4(VES)-Variolink®Esthetic(Ivoclar) were used with their correspondent adhesive system, a(EXA)-Experimental Adhesive(3M Oral Care); b(XTR)-Optibond™ XTR (Kerr); c(PTP)-Panavia V5 Tooth Primer(Kuraray) and d(ADU)-Adhese®Universal(Ivoclar) that was light cured. Bovine incisor teeth were allocated into 4 groups (n=12). Dentin was exposed and polished using a 320-grit sandpaper. Stainless-steel 4mm rods were cemented onto moist dentin. Excess cement was

removed immediately. Airblock(Dentsply/Sirona) was applied around the specimensbefore storage (10min) under pressure at 36°C. For the light-cure mode, an LED unit (Elipar Deep Cure, 3M) was used to polymerize (40s) specimens. After initial preparation, the pressure was relieved, specimens were washed off with distilled water and stored at 36°C in 100% relative humidity for 24h. TBS was performed in a universal testing machine (Zwick/Roell) with a crosshead speed of 1mm/min. Results were analyzed with ANOVA followed by Tukey HSD test (α=0.05).
Results Means and standard deviations of TBS values are shown in Figure1 and Table1. Failure modes are shown in Table2. There was a statistically significant difference ($p<0.05$) in TBS values between the tested cements. All cements presented with adhesive, cohesive and a mixture of adhesive/cohesive failures. One sample of NX3 failed before testing.
Conclusions Under the limitations of this study, it can be concluded that there was no statistical significant difference between PV5 + PTP and the new EXP + EXA in the self-cure mode. NX3 and XTR presented the statistically lowest mean values. Many samples failed due to cohesive dentin failure, indicating the limitations of the study by the strength of the dentin.

0329

Comparison of Contemporary Self-Adhesive Luting Composites

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Objectives High shear-bond-strength (SBS)-values and tolerance to different bonding conditions and materials are essential for the clinical success of self-adhesive luting-materials. Therefore, full functionality after extreme test conditions is a big advantage. In the following study, the focus was on SBS on dentin with *blot-dry*-(*bd*) and *wet*-technique of different self-adhesive luting-materials (translucent shades) compared to Speedcem Plus, both at self- and dual-cure-mode (SC/DC) and before and after thermocycling (TC).
Methods The following luting composites were employed: SpeedCEM Plus/Ivoclar Vivadent (SCP), G-CEM LinkAce/GC (GCL), Maxcem Elite/Kerr (MCE), PermaCem 2.0/DMG (PC2), SmartCem 2/Dentsply (SC2), RelyX Unicem 2 Automix/3M (RU2).
SBS was measured on bovine dentine (according to ISO-DTS 16506,n=8). Polymerized composite cylinders (TetricEvoCeram/Ivoclar Vivadent) were used for all products to adhere at the dentine specimen. The force was measured using an universal-test-machine (Z010/Zwick-Roell), only measurable samples were considered for analysis. TC was performed between 5°C-55°C and 10'000 cycles (dwell time 30sec). Statistical analysis employed ANOVA, Tukey's, $p<0.05$.
Results Of the materials tested, SBS in DC-mode in general and with *wet*-technique in special resulted in higher values by trend, except for SC2(*bd*) and MCE(*wet*). At SC-mode only SCP demonstrated good and stable results. At DC-mode SCP, GCL and RU2 exhibited similarly favourable results. SCP showed lowest deviations for SBS between SC- and DC-mode, for both *bd*- and *wet*-technique.
Conclusions The shear-bond-strength of contemporary luting composites was investigated in SC- and DC-mode, with/without thermocylcing and with *blot-dry*- and *wet*-technique. The *wet*-technique generally resulted in higher mechanical properties, except for SC2 in SC-mode. Bond strength was independent of curing mode only for Speedcem Plus. Speedcem Plus was the only luting-material that presented a good and favourable outcome on all modes before and after TC, *blot-dry* and *wet*. Within the limits of this investigation and regarding clinical efficacy, Speedcem Plus is considered to provide the best set of properties.

0330

Colloidal Platinum Nanoparticles Improve Luting Effectiveness and Durability

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Objectives Previous research reported that colloidal platinum nanoparticles (CPN) applied onto dentin for 30 s significantly improved the bonding performance of 4-META/MMA-TBB resin. In continuation, three recently introduced CPN formulations remain to be tested on their adhesion-promoting effect, being the main objective of this study.
Methods Forty caries-free human molars were randomly assigned to the following four experimental groups: CPN1: aqueous 0.02% platinum in a protective coating containing 1.69% polyacrylic acid; CPN2: idem but with the coating containing 0.29% sodium citrate; CPN3: idem but with the coating containing 0.29% sodium citrate and 0.29% γ-cyclodextrin; Ctrl (control): no CPN coating. Ground (#600 SiC-grit) dentin surfaces were etched with '10-3 solution' (10% citric acid, 3% ferric chloride) for 10 s, thoroughly rinsed and gently air-dried, upon which the three CPN formulations were applied using a rubbing motion for 30 s. After CPN application, an acrylic resin block was adhesively luted onto dentin using the 4-META/MMA-TBB resin-based cement Super-Bond C&B (Sun Medical) under a continuous 1-kg pressure. After 1-week water storage at 37°C, all specimens were sectioned into 1-mm^2sticks. Half of the sticks were tested immediately to determine the 'immediate' micro-tensile bond strength (μTBS), while the 'aged' μTBS was measured after 50K thermal cycles. The data were analyzed by two-way ANOVA and Scheffé's post-hoc test at α=0.05 (SPSS statistics ver. 24, IBM)
Results CPN improved μTBS with CPN2 achieving the highest 'immediate' μTBS, which was significantly better than that of the control (no CPN coating). Upon aging, μTBS of all CPN formulations, except CPN1, decreased but remained significantly higher than the μTBS of the control.
Conclusions This study indicated that all CPN formulations promoted the luting performance of the 4-META/MMA-TBB resin-based cement to dentin both immediately and upon aging.

0331

Ternary Solvent System for Dental Bonding Agents.

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Objectives This study aims to assess the impact on initial physico-mechanical properties of an adhesive formulated with a ternary solvent system.

Methods Solvent study was defined by Design of Experiment (DoE) using Design Expert 11, varying amounts of water/ethanol/methylethyketone (MEK) within 13 formulations at fixed total %solvent. Duplications validated model accuracy. Responses included initial shear bond strength (iSBS) (following ISO/FDIS-29022:2012(E)), pH, viscosity (distance travelled during 10sec on a glass slide at 66°), evaporation (%wt loss over 5min ambient air drying, 30sec interval weight recordings). Surface plots for the responses were generated and two sided Dunnett post-hoc test analysed iSBS data.

Results Excluding immiscible solvent mixes (not tested), iSBS ranged 13.8-25.9MPa with only these highest/lowest values significantly different. pH range was 2.81-3.24, excepted 100%MEK (1.72). Increasing %water decreased pH and increasing %ethanol or %MEK increased pH although DoE indicated weak trends. Most likely, water increases ionisation of acidic adhesive monomers, not promoted with ethanol nor MEK. However, surface plot analysis showed a lack of fit results, indicating hindrance by outliers not explained by compositional factors.Evaporation increased with ethanol or MEK. MEK presents a greater change than ethanol, possibly due to greater %water in the MEK/water azeotrope (11%) compared to the ethanol/water azeotrope (4.5%). DoE showed that decreasing %water greatly increased the extent of evaporation but decreased iSBS.
Viscosity varied matching solvent viscosities. DoE suggested decreasing viscosity (%water) results in iSBS drop. However, low viscosity should improve SBS by helping tubule penetration.

Conclusions Within the limitations of this study and specific solvents used, data showed that evaporation and viscosity are not as important as etching ability. However, this may only be true for initial SBS. Residual water may weaken the bond in the long term. These experiments need to be repeated in a long-term study.

0332

Effects of Nonthermal Atmospheric Plasma on Adhesive-Dentin Bond Strength: Meta-Analysis

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Objectives The aim of this systematic review and meta-analysis was to evaluate the short and long-term effects of nonthermal atmospheric plasma (NTAP) on adhesive-dentin bond strength.

Methods MEDLINE, Web of Science and Scopus databases were searched for *in vitro* studies comparing NTAP treatment to no plasma treatment groups. Online search was performed in March 2019. Inclusion criteria were: non-carious, intact, extracted human or bovine teeth, NTAP treated dentin and short- and/or long-term measurement of adhesive-dentin bond strength. Random effects model was used to summarize the observed treatment effect. Bond strength values were expressed as standardized mean difference (SMD) with 95% confidence interval. Subgroup analyses were performed according to different types of plasma gas.

Results Fifteen studies fulfilled the inclusion criteria and 13 of those 15 studies were meta-analyzed. The remaining two studies were excluded due to the lack of information and no response from authors.Evaluating short-term effects of NTAP on adhesive-dentin bond strength, based on all 13 studies with a total of 2052 specimens (sticks), the results showed statistically significant difference between NTAP and control group in favor of NTAP (SMD 1.87; 95% CI [1.23, 2.50]; $p<0.0001$). Subgroup analysis revealed a significant effect in studies that used He (SMD 5.11; $p<0.0001$) but not for studies that used Ar (SMD 0.11; $p=0.56$). In the long-term, NTAP presented a positive overall effect on assessing the outcome (SMD 3.76; 95% CI [2.84, 4.68]; $p<0.0001$) based on pooled results from 10 studies with a total of 1660 specimens. Subgroup analysis confirmed the effect in studies that used He gas (SMD 15.1; $p<0.0001$).

Conclusions Dentin treatment using NTAP significantly increased short- and long-term adhesive-dentin bond strength. The main proposed mechanism of NTAP-dentin interaction was improved hydrophilicity of the dentin surface through changes in polarity, leading to improved adhesive distribution.

0333

Effect of Crosslinkers on Ultimate Tensile Strength of Demineralized Dentin

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Objectives Biomodification of dentin by collagen crosslinkers improves durability of collagen matrices in hybrid layer. Aim of this study is to evaluate the effect of five different crosslinkers on dentin ultimate tensile strength (UTS) and to detect total phenolic content (TBC) of crosslinkers.

Methods Dentin beams (1 mm × 2 mm × 6 mm) were demineralized in 10% H_3PO_4 for 24 h. and, beams were divided into 17 groups (n = 10/group). Five different crosslinkers; 1% and 5% glutaraldehyde, 0,01% riboflavin-5-monophospate/UVA, 10% sumac berry extract, 1% and 5% grape seed extract, and curcumin were used. Demineralized dentin beams were pretreated with respective crosslinkers for 1 or 5 min and control (no pretreatment). The changes in tensile strength of dentin was evaluated by UTS using a universal testing machine. The total polyphenol content of the extracts was determined (as gallic acid equivalents)

using Folin- Ciocalteau assay. Data were analyzed by two way- and one way- ANOVA respectively.
Results The result of the study showed that crosslinker treated groups showed significantly higher UTS range from 14,15±2,74 and 9,92±2,82 compared to untreated control (6,7±2) . Both concentration and treatment time of crosslinker significantly increased UTS ($p<0.05$). Grape seed extract (83,2±7,4 and 349±33,2) and sumac berry extract (73,3±3,3) showed significant high total phenolic content compared to other crosslinkers ($p<0.05$).
Conclusions Collagen crosslinkers induced a significant increase in UTS and bioactivities of crosslinkers are source dependent, resulting from a combination of concentration and specific chemical constitution of the complex mixtures.

0334

Dentin Biomodification using Collagen Cross-linkers

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Objectives Dentin biomodification using cross-linkers has been proposed to improve bond durability to dentin. However, literature is not always consistent regarding their effectiveness, especially when the cross-linkers are applied in clinically realistic application times. This study investigated the effect of 2 cross-linkers on the micro-tensile bond strength (µTBS) of 4 adhesives bonded to dentin following either etch&rinse (E&R) or self-etch (SE) bonding modes.
Methods 80 molars were randomly divided in accordance to the three variables 'cross-linker', 'adhesive' and 'bonding mode' (n=8). The cross-linkers proanthocyanidin (6.5wt%; 'PAC'; Mega Natural Gold) and 1 ethyl 3 (3 dimethylaminopropyl) carbodiimide HCl (0.3M; 'EDC'; Fisher Scientific), or distilled water (control), were applied on dentin for 60s after acid-etching (E&R) or priming (SE). The 3-step E&R adhesive OptiBond FL (Kerr), the 2-step SE adhesives Clearfil SE Bond 2 (Kuraray Noritake) and Optibond XTR (Kerr), and the universal adhesive Prime&Bond Active (Dentsply), employed in E&R and SE mode, were applied following the manufacturer's instructions. Filtek Supreme XTE (3M Oral Care) buildups were made prior to 1-week storage in artificial saliva. After the teeth were sectioned into micro-specimens, sticks were trimmed at the interface to a dumbbell shape with a diameter of 1.1 mm. One half of the specimens were immediately tested ('immediate' µTBS), the other half after 100K thermocycles ('aged' µTBS). Data were statistically analyzed with 3-way ANOVA ($p<.05$).
Results When EDC was applied prior to Clearfil SE Bond 2, a higher µTBS was recorded upon aging than the control. Increased µTBS upon aging was also observed when PAC was applied before Optibond FL. The aged µTBS of Prime&Bond Active, applied both in E&R and SE modes, benefited from both PAC and EDC. However, Optibond XTR was negatively affected by collagen cross linking.
Conclusions Overall, the benefit of incorporating collagen cross-linkers in the dentin-bonding protocol appeared to depend on the adhesive.

0335

Adhesion: A Challenge For New Materials

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Objectives The universal adhesive's total etch and rinse (2-steps) and self-etch (1-step) systems promote versatile bonding. Given the lack of studies on the use of adhesives with Biodentine®, this study aimed to evaluate the shear bond strength (SBS) between Biodentine® and a composite resin, using the two universal adhesive strategies.
Methods Sixty acrylic blocks were each prepared with a hole measuring 2 mm depth x 5 mm diameter. The holes were filled with Biodentine®, following the manufacturer's instructions, and then divided in two time groups: 12 minutes (n=30) and 24 hours (n=30). Each group was then subdivided in two groups according to the adhesion strategy: 2-step (n=15) or 1-step (n=15). After application of the adhesive, composite resin (Grandio®) was applied over the Biodentine® and stored at 100 % humidity, at 37 °C, for 24 hours, before SBS test. Data were analyzed with one-way ANOVA and Fisher *post-hoc* test.
Results No statistically significant differences were observed between adhesive systems (p=0.871) regardless of adhesion time (12 minutes or 24 hours). However, adhesion time showed statistically significant differences (p=0.021), with the highest values of adhesion observed at 24 hours. At 12 minutes, the 2-step system had a higher adhesion than the 1-step. However, at 24 hours the results were reversed.
Conclusions The universal adhesive obtained good SBS results over Biodentine® at both 12 minutes and 24 hours adhesion, but superior adhesion was observed at 24 hours post- Biodentine® placement. Hence, before a restorative treatment, it is essential to consider the longest possible setting time for Biodentine®.

0336

Effect of Refractive Index Mismatch to Translucency of Dental Composite.

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Objectives When dental filling composites absorbs light from the surrounding tooth structures, it creates a color-match, which is known as “a chameleon effect”. In this study, series of co-monomer mixtures were prepared with an increasing refraction index (RI) and mixed with glass fillers. The aim of this study was to optimize mismatch of refraction index of resin/fillers to form the chameleon effect.

Methods BisGMA/TEGDMA resins were prepared with seven different mix fractions from 20 % to 80 %. In addition, 0.7%wt camphorquinone and DMAEMA as activator were added. Two different series with 0.7 micron silanized fillers (70% wt%) (Schott-RI=1.53, Esschem RI=1.54) were mixed with resins (30wt%). Disc-shaped specimens (1 mm thickness, Ø10mm) for each composite combination (n=3) were prepared after light cured for 20 seconds. Control groups were commercial dental composite (OmniChroma, Tokuyama Dental Corp., Japan). The translucency parameter (TP) was measured using a spectrophotometer (CM-700d, Konica Minolta Sensing, INC). Data was statistically analyzed using ANOVA (SPSS).

Results Composition of resin and type of fillers had statistically significant effect on TP-values ($p<0.05$). In both series the highest TP values were achieved of 50 %-50 % fractions of BisGMA and TEGDMA. With high or low BisGMA content of composite revealed more translucent composite. TP values are shown on Table 1.

Conclusions Refraction index of fillers and monomer system influenced light scattering and translucency of resin composite. By optimizing these parameters resin composite can be tailored for providing “chameleon effect”.

0337

Evaluation of Fluorescence Property of New Direct-filling Resin Composite

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Objectives Important properties of resin composite are not only mechanical properties but also aesthetics. Since natural teeth absorb ultraviolet light and emit fluorescence, fluorescence is as important as shades to obtain the aesthetics of resin composite. Recently, light sources in the near ultraviolet region (for example, purple light: 405 nm) are increasing because of development of LED lights, it is necessary to control the fluorescence of the resin composite in this environment. In this study, we evaluated fluorescence properties of new direct-filling resin composite trial GNX108 and other products.

Methods GNX108 (GC), Filtek Supreme Ultra (3M), Tetric EvoCeram (Ivoclar Vivadent), and ceram X (Dentsply Sirona) were evaluated in this study. Fluorescence properties were evaluated by spectrum measurement. Material was filled in a mold (ϕ10 mm × 1 mm height) and light-cured by G-light Prima II Plus (GC). The fluorescence of specimens and 1 mm sliced natural tooth at ultraviolet (365 nm) and near-ultraviolet (405 nm) excitation were measured by SpectraMax M2 (Molecular Devices).

Results Each product showed maximal fluorescence at 445 and 460 nm, which was similar to that of natural tooth. This result indicates that the fluorescence colors are similar in all cases. Focusing on the fluorescence intensity, each product showed significantly different intensity. GNX108 was the only material having the similar fluorescence properties at both ultraviolet and near-ultraviolet environment to natural tooth. The intensity of Filtek Supreme Ultra and ceram X is significantly lower in the ultraviolet environment, and the intensity of Tetlic EvoCeram is significantly higher in the near-ultraviolet environment than that of natural tooth.

Conclusions These results indicate that GNX108 is a material having ideal fluorescence similar to that of natural tooth and may enable higher aesthetics restoration.

0338

Effect of Polishing on Color Staining of a Composite Resin.

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Objectives The aim of this study was to evaluate the effect of different polishing systems on color stability of a new stain resistant novel filler technology composite resin material immersed in three solutions (distilled water, Coffee, Red wine).

Methods Thirty disc-shaped composite resin specimens (TPH-SpectraST ShadeA1, DENSPLY) of 5mm diameter and 1mm thickness were prepared for each of six study groups. After 24hours storage at 37°C and 100% relative humidity, the surface of each specimen was polished using one of six different finishing/polishing systems. Group1: Composite finishing burs, Group2: Finishing bur + Enhance system, Group3: Finishing bur + Enhance system + PoGo with prisma gloss, Group4: Finishing bur + Sof-Lex polishing discs, Group5: Finishing bur + ShofuDental polishing kit, Group6: Finishing bur + UltradentJiffypolishing kit. Each polished group was then randomly divided into 3 subgroups (N=10) and stored in one of the three immersion solutions. The color changes of samples before and after immersion in test solutions for 1, 5 and 10 days were evaluated with a spectrophotometer (CM700d, Konica Minolta). The color change values (ΔE) were statistically analyzed using three-way ANOVA and Pairwise Comparisons by Holm Sidak Method.

Results For all study groups, there was no significant difference in staining between 5 and 10 days results for any storage solution ($p>0.05$). No significant change was observed in distilled water samples after 10 days ($p>0.05$). Color change was

highest in group 1 for both coffee and wine. After 10 days, both polishing groups 4 and 5 showed significantly lowest color change (ΔE) in all study solutions. Wine caused more staining of the composite samples compared to coffee.
Conclusions The Sof-Lex polishing discs and Shofu Dental polishing kits are recommended for less color staining of composite resin materials with red wine and coffee consumption.

0339

The Pellicle Cleaning Ratio of One Charcoal-based Dentifrice

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Objectives Activated charcoal toothpastes claim to effectively whiten teeth. The aim of this in vitro study was to evaluate the Pellicle Cleaning Ratio (PCR) of one dentifrice with activated charcoal

Methods

54 bovine enamel specimens (Ø 6 mm, T 2 mm) were used for this study. To generate discoloration, the specimens were polished and thereafter stored in human saliva for 2 min, 4 min in 0.2% chlorhexidine and 4 min in black tea (3g/100ml water at 50°C) and left dry until the next cycle. After saliva and chlorhexidine exposition, the specimens were placed in distilled water for 30 sec. This cycle was repeated eight times per hour. Specimens were brushed with 800 strokes at a load of 1.5N. All treatments were performed on an automatic brushing machine using standard ADA toothbrushes and slurries. The two dentifrices were an activated charcoal dentifrice; Curaprox black (n=18) and a whitening dentifrice, Colgate Max White (n=18). The reference dentifrice (n=18) was a calcium pyrophosphate preparation according to ISO 11609 (PCR = 100). Specimens' colours (L indicates light / dark) were evaluated by using a chromameter (ShadeEye NCC, Shofu Inc. Kyoto, Japan) before and after discoloration (initial, i), and after brushing (final, f). Specimens' treatment effects were assessed and relative efficacy compared to the reference dentifrice was calculated as follows:

$PCR = \{(L^*_f - L^*_i) / \text{mean of } \Delta L \text{ reference dentifrice}_{(f-i)}\} \times 100$

Data analysis was accomplished using the Kolomogorov-Sminov und ANOVA Test ($p<0.05$).

Results The mean (standard deviation) PCR value was 89.56 (15.99) for Curaprox black and 89.89 (15.21) for Colgate Max white. No statistically significant differences were found between the two groups.

Conclusions The results of this in vitro study show that the activited charcoal test dentifrice is equally effective in removing surface stains when compared to a whitening dentifrice.

0340

How Do Innovative Dentifrices Affect Mineral Content of Bleached Enamel? A pilot study

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Objectives To investigate the effect of two dentifrices containing different concentration of bioactive glass with fluoride after using a whitening agent (%40 hydrogen peroxide, HP) on mineral content and surface morphology of enamel.

Methods Four freshly extracted noncarious human premolars were randomly allocated into four groups. The study groups were: Bleached test brushing with bioactive glass and <600 ppm fluoride containing dentifrice (BioMin F, UK) (**BIO**), bleached test brushing with bioactive glass and 1450 ppm fluoride containing dentifrice (Sensodyne Repair&Protect, UK) (**SRP**); bleached control (**HP**); unbleached control (**UC**) without toothbrushing. Subsequently, teeth were treated with whitening agent according to the manufacturers' instructions and were subjected to 45-days brushing according to the allocated groups. The elemental compositions (w%) of Ca, P, F, C, Si, Mg were determined by X-ray photoelectron spectroscopy (XPS) technique at five different points of each sample. The surface morphology was assessed using Scanning Probe Microscope (SPM). The data were statistically evaluated using ANOVA and Tukey post-hoc test (SPSS 25, IBM, USA). ($\alpha = 0.05$).

Results XPS failed to show statistically significant differences between the elemental levels (w%) of UC and HP; whilst Si% and F% values were higher in SRP than UC. ($p<0.05$). When compared to UC and HP, BIO was found to have higher levels of P% and Ca% (P%: BIO: 6.73 ± 1.36; HP: 3.46 ± 2.22; UC: 3.24 ± 1.59), (Ca%: BIO: 9.40 ± 1.80; HP: 5.74 ± 1.54; UC: 5.95 ± 2.17) ($p<0.05$). SPM detected surface alterations on bleached and dentrifice-treated teeth.

Conclusions The significantly higher levels of calcium and phosphate on bleached enamel after application of dentrifice containing bioglass with low concentration of fluoride might indicate the presence of a layer that is rich in calcium and phosphate providing a source for remineralisation.

0341

Color Changes in New Generation of CAD/CAM Polymers

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Objectives Most of restorative materials for gingiva imitation and artificial teeth can be fabricated in Computer-Aided-Designed/Computer-Aided-Manufacturing (CAD/CAM) technology which implies standardized manufacturing processes and restoration reproducibility. CAD/CAM high-density dental polymers provide good precision in fitting and better mechanical properties in comparison to conventional ones. Also, due to lower porosity and more compact surfaces, they provide better optical properties. However, color changes with staining solutions have not been investigated.
The aim of this study is to compare color changes of different polymers after immersion in staining solutions.

Methods Specimens were made of two CAD/CAM polymers: Vivodent CAD (Ivoclar Vivadent), IvoBase CAD (Ivoclar Vivadent), and one conventional acrylate, ProBase Hot (Ivoclar Vivadent). From each group, 5 specimens (10x10 mm) were made. Manufacturing and polishing was in accordance with the manufacturer's instructions. The samples were submerged in wine, coffee and distilled water for 67 hours. The color was measured before and after staining with VITA Easyshade V. CIEDE2000 formula was applied and T test and ANOVA for statistical difference ($p<0.05$).

Results ΔE formula showed that CAD/CAM polymers stained more in wine and coffee but less in water compared to conventional acrylate (table 1). Comparison within staining solution groups, showed significant difference between materials when staining with wine and water, while there was no difference in staining with coffee. In the wine group, the significant difference was between IvoBase CAD and ProBase Hot ($p=0.0028$), and between Vivodent CAD and ProBase Hot ($p=0.0001$). Similarly, in the water group, the significant difference was between Vivodent CAD and ProBase Hot ($p=0.0001$) and between IvoBase CAD and ProBase Hot ($p=0.0001$). ANOVA test showed statistical difference between groups ($p= 0.003$).

Conclusions Differences in color changes between CAD/CAM and conventional polymers are significant. Further investigations in terms of polymers porosity and absorption are needed in order to determine nature of those differences.

0342

Effect of Resin-based Luting Agent on Fluorescence of Feldspathic Ceramics

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Objectives To evaluate the effect of resin-based luting agenton the fluorescence on feldspathic ceramics with different thickness.

Methods Feldspathic ceramic (CEREC Blocs) discs, A2, with thicknesses of 0.5 and 0.8 mm were obtained (n=180). Resin composite discs (Filtek Supreme XTE, A3 Body) were prepared using a resin former, according to the manufacturer's instructions, which served as substrate. The ceramic samples were randomly paired with the resin disks and bonded with one of the following shade of resin-based luting agent: Variolink Esthetic (VE): shades Light, Warm, Neutral; Relyx Veneer (RV): B 0,5/white, Translucent, A3 Opaque/yellow; and flowable resin composite G-aenial Flo (GF): shades A2 and A3. After 24h of storage, fluorescence spectra were obtained on a SPEX Fluorolog2I2I, at a wavelength of 380 nm and at room temperature. Data were statistically analyzed using two-way ANOVA and Tukey test ($p< 0.05$).

Results Fluorescence emission intensity values were significantly influenced by the luting material shade and thickness of ceramic ($p<0.001$) and the restorative material ($p<0.001$). Interaction between both factors was also significant ($p<0.001$). G-aenial Flo A3 groups showed the highest values, without differences with the Variolink N and G-aenial Flo groups in 0.50-mm-thick ceramic restorations. Samples bonded with RelyX Veneer A3 and B 0.5/white, exhibited the lowest fluorescence emission intensity, regardless the thickness of feldspathic ceramic.

Conclusions Type and shade of resin-based luting agent influences the final fluorescence of feldspathic ceramic restorations.

0343

Comparison of Activated Charcoal vs. Bleaching Toothpaste Over Composite

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Objectives To assess whether brushing with whitening or non-whitening activated carbon toothpaste leads to significant changes in composite's color and surface roughness. To evaluate changes made to a composite by different types of activated carbon toothpaste.

Methods 70 composite discks (10x2) (Amaris, Voco, Germany) were produced and divided into five brushing study groups (n=14). Group 1 - Control (brushing without toothpaste); Group 2 - Conventional toothpaste (Colgate Total, Colgate, France); Group 3 - Non-whitening activated charcoal (Colgate Total Charcoal, Colgate, USA), Group 4 – Activated charcoal toothpaste (Black is White, Curaprox, Switzerland) and Group 5 - Unregulated activated carbon toothpaste (Zebra Teeth Whitening, China). Brushing protocol was done according to ISO 11609 – 2017, using an electric brush (Oral-B Pro 3000, Germany). The color and

the roughness of each disc was evaluated using a spectrophotometer (Vita Easyshade, Vita, USA) and a contact profilometer (Hommelwerk lv50, Germany) at the following periods, assuming two brushings a day: a) 24h ; b) 7 days; c) 15 days and d) 30 days. Data analysis was made using the statistical analysis software SPSS® v.25.0.
Results There was a significant increase in roughness in all groups at all periods, except in group 1 and 2 for the first day (p> 0.05). The lowest roughness values after one month were observed in groups 1,2 and the higher in groups 4 and 5. The values of ΔL*, Δb* and ΔE* were significantly altered in group 5 (p <0.005) after 7 days. An increase in Δb* and decrease in ΔL* was observed in groups 3,4 and 5 at the end of the experiment.
Conclusions Unregulated activated carbon toothpaste presents aggravated roughness and color values and should be used with caution. Whitening toothpaste creates also elevate roughness over composites. Toothpaste with activated charcoal may influence the color of restorations.

0344

Oral Health Care Among Institutionalized Elderly Given by Their Caregivers

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Objectives Assess the oral health knowledge of caregivers, nurses and medical assistants, of dependent institutionalized elderly.
Methods This was an observational cross-sectional epidemiological study with a sample of 52 caregivers from three nursing homes of the city of Viseu, Portugal. The data collection was performed through the application of two questionnaires: one self-administered to the caregivers and another applied by the researcher to the elderly. Statistical analysis was performed using the statistical program IBM SPSS Statistics 23®.
Results The great majority of caregivers know what dental caries (32.7%, n=17) and bacterial plaque (82.7%, n=43) are. Nearly 76.9% (n=40) believe that when gingival bleeding occurs, precautions should be taken during brushing. For the elderly with few or no teeth, 69.2% (n=36) caregivers clean the gingiva with a gauze. The majority of caregivers refer that 92.3% (n=48) of the elderly remove their dental prosthesis at night, before sleeping; 38.4% (n=20) perform oral hygiene of the dependent elderly once a day; 51.9% (n=27) use a tooth brush and apply toothpaste; 42.3% (n=22) do not use any oral hygiene complement product; 76.9% (n=40) hydrate the oral cavity once per shift and 63.5% (n=33) of caregivers report that there are no oral hygiene protocols in their institutions.
Conclusions Nursing homes do not have specific protocols for oral hygiene. However, caregivers have some knowledge of oral health and hygiene methods to be applied however they are general procedures and not specific for the most dependent institutionalized elderly.

0344.1

Antimicrobial Addition to Temporary Resilient Liner in Denture Stomatitis Treatment

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Objectives The long-term efficacy of a temporary denture resilient liner (Trusoft) modified by the addition of minimum inhibitory concentrations (MICs) of antimicrobial agents for *C. albicans* biofilm in the treatment of denture stomatitis (DS) was evaluated.
Methods Patients with DS and users of maxillary complete denture (MCD) were randomly assigned according to one of treatments during 14 days: Positive Control-PC (n=8): nystatin oral suspension (100,000IU/mL; 4x/day); General Control-GC (n=10): MCD relining with Trusoft, and NYS (n=8) and CHX (n=10): MCD relining with Trusoft containing nystatin and chlorhexidine diacetate at MICs, respectively. The treatment effectiveness was evaluated by cytological smears and mycological quantitative cultures taken from the palates and dentures of all patients before (T0), at the end of treatment (T14) and 15 (R15) and 30 (R30) days after its suspension. Clinical response was investigated by photographs taken from the palates at each visit. Data were analyzed with the use of a series of statistical tests (α=0.05).
Results Only mycological cultures from CHX showed a significant reduction in the CFU/mL values after 14 days (P<0.05). At T14, the palatal smears from NYS and CLX displayed no mycelial *Candida* while those of MCD showed a significant reduction in the mycelial form scores (P<0.05). At T14, clinical improvement was observed only for CHX and NYS (P<0.05), and the scores obtained were maintained at follow-up (P>0.05). Both treatments produced statistically similar long-term results (P>0.05), thus effectively reducing the recurrence proportion of mycelial forms on the evaluated surfaces at follow-up compared to the controls (P<0.05).
Conclusions Temporary resilient liner modified by nystatin and chlorhexidine at MICs was an effective method for DS treatment by eliminating mycelial *Candida* on both the palates and dentures of most patients and resulting in significant clinical improvement besides preventing the recurrence of fungal invasive forms on the surfaces evaluated within 30 days of follow-up.

0345

Light Transmittance of Experimental Bioactive Glass Composites

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Objectives To evaluate the effect of two resin systems on light transmittance of experimental composite materials containing bioactive glass 45S5 (BG).
Methods Two series of experimental composites were prepared based on a Bis-EMA/TEGDMA and a UDMA/TEGDMA resin system. Each composite series comprised five materials with 0, 5, 10, 20, and 40 wt% of BG and a total filler load of 70 wt%. After mechanical mixing, obtained composite pastes were applied in black Teflon rings (d=6 mm, h=2 mm, n=5) and pressed between two glass plates. Light curing was performed with 1000 mW/cm^{2}for 60 s and the intensity of light that passed through the specimen was monitored using a charge-coupled device array fiber spectrometer, at a datacollection rate of 20 s^{-1}. Light transmittance was calculated as the ratio of the intensity of light that passed through the specimen and the intensity of light that passed through the empty specimen compartment.
Results For all composites, a significant increase in light transmittance (1.4-5.0 %) was observed during light-curing. Therefore, light transmittance data were reported and analyzed as initial and final values. Light transmittance (%) of UDMA/TEGDMA series (initial: 1.9-4.1, final: 5.2-7.5) was generally higher than that of Bis-EMA/TEGDMA series (initial: 1.5-3.2, final: 3.2-7.5). In Bis-EMA/TEGDMA series, light transmittance declined with increasing BG amount, as shown by final light transmittance (%) of 7.6, 5.7, 4.4, 3.4, and 3.2 for composites with 0, 5, 10, 20, and 40 wt% of BG, respectively. In UDMA/TEGDMA series, differences in light transmittance were observed among materials with different amounts of BG but with no consistent trend of decline as a function of the BG amount.
Conclusions Unlike Bis-EMA/TEGDMA series, UDMA/TEGDMA series of experimental composites showed no systematical effect of the BG amount on light transmittance. For a given BG amount, UDMA/TEGDMA series showed higher light transmittance.

0346

Curing Depth of a New Fiber-reinforced Flowable Composite.

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Objectives Although the use of classical crowns supported by posts remains widespread in dentistry, their invasiveness has been largely criticized. As an alternative, conservative approach of using short fibre-reinforced composites (SFRCs) as post-core foundations have been proposed. However, the question whether the light-cured SFRC composite could have an adequate curing depth. The aim of this study was to analyze the depth of cure of a new SFRC flowable composite (everX Flow, GC Corporation) assessed by surface microhardness (VH) and degree of conversion (DC%) through different thicknesses. In addition, the curing depth was also measured under more clinically relevant conditions, inside prepared root canals.
Methods Cylindrical test specimens (Ø5 mm) were produced from both everX Flow and the conventional bulk-fill flowable composite (SDR$^+$, Dentsply-Sirona). For each material, five different incremental thicknesses (3, 4, 5, 6 and 7 mm) were considered (n=4). The specimens were prepared in Teflon molds that are open at the top and bottom sides and cured for 10 s by applying the curing unit (D-Light Pro, GC Corporation) on the specimens' top surface. Root canals of human teeth were prepared, materials were applied and polymerized (40 s) into the canals in bulk (n=3). After that, the specimens were ground with a silicon carbide paper with a grit size of 2000 and 4000, and then stored dry at room-temperature for 24 h. DC% was determined by FTIR-spectrometry and a Vickers indenter was used for testing VH. Statistical analysis was carried using ANOVA ($p<0.05$) followed by Tukey post hoc test.
Results everX Flow composite presented higher DC% and VH compared to SDR$^+$ composite (ANOVA, $p<0.05$) at different thicknesses. SDR$^+$ presented drastic decrease of VH values after 4 mm depth inside root canal, while for everX Flow this was beyond 8 mm.
Conclusions Flowable SFRC composite (everX Flow) revealed extended depth of cure at simulated root canal which indicates its potential use as post/core treatment.

0347

Effect of Preheating and Modelling Instrument Temperature on Composite Cooling

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Objectives To measure the kinetics of composite cooling, as a function of preheating and modelling instrument temperature.

Methods A Class II cavity was prepared in a human third molar. The tooth was placed in the custom-made sample holder and kept in a water bath at 36°C. A K-type thermocouple was placed at the axial-gingival wall junction through a microperforation from the inside of the pulp chamber. Depending on the composite and modelling instrument temperature, four groups were defined:

Group 1: Composite and instrument at room temperature (23°C)
Group 2: Instrument preheated to 68°C, composite at 23°C
Group 3: Composite preheated to 68°C, instrument at 23°C
Group 4: Composite and instrument preheated to 68°C

Within 7±1s of compule removal from the heater, composite (Filtek Bulk Fill Posterior, 3M ESPE) was injected to fill the entire cavity and condensed with a stainless steel dental ball burnisher. Temperature was monitored at 1 scan/s rate using a PC and a data-logger (Measurement Computing). Data were statistically analyzed using one-way ANOVA with Tukey's post-test and t-test for independent samples at α=0.05.

Results In groups 3 and 4 the highest temperatures were recorded 3-4s post-placement (mean± sd: 44.50±0.18°C; 43.19±0.11°C, respectively; $p>0.05$). At 15s and 30s post-placement, significantly higher temperature values were found in group 3 (40.25±0.44°C; 38.32±0.55°C, respectively) and group 4 (40.45±0.32°C; 38.76±0.97°C, respectively) than in group 1 (34.91±0.34°C; 35.44±0.31°C, respectively) and group 2 (36.35±0.83°C; 36.98±0.48°C, respectively) ($p<0.05$). No significant differences were found between groups 3 and 4 at all time intervals ($p>0.05$). Group 2 showed significantly higher temperatures than group 1 at 15s and 30s post-placement ($p<0.05$).

Conclusions Composite preheated to 68°C increased temperature at the cavity bottom up to 7-8°C and cooled down to around 40°C within 15s post-placement. Instrument preheating had no additional effect on temperature increase or slower cooling of already preheated composite.

0348

Effects Light-curing Procedures on Chemical-physical Characterics of Two Composite Materials

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Objectives Nowadays, nanohybrid and nanofilled composites are considered universal resin-based restorative materials suitable for the restoration of anterior and posterior teeth due to their excellent aesthetic properties. Nevertheless, their polymerization reaction can be inhibited during light-curing procedures due to the presence of oxygen. This latter acts as scavenger, which tends to convert radicals into hydroperoxides compounds able to alter the quality of the polymerization of the outer layer of resin composites. Thus, the aim of this study was to evaluate the effect of light-curing procedures on two modern resin composite using different air-inhibition coating strategies. This was accomplished by assessing the amount of monomer elution, surface microhardness and composite discoloration in different storage conditions.

Methods A total of 120 specimens were prepared using Filtek Supreme XTE (3M ESPE, Seefeld, Germany) and CeramX Universal (Dentsply DeTrey, Konstanz, Germany). Specimens were light-cured in air (Group D) as per manufacturer's instructions or in absence of oxygen. This latter condition was achieved using three different approaches: A) transparent polyester strip; B), glycerin; C) Argon gas. Specimens were assessed for release of monomers, Vickers hardness and discoloration after storage in different solutions. The results were analyzed with ANOVA one-way test

Results The amount of monomers released from the tested specimens was very low in all conditions. The presence of oxygen induced no decrease in microhardness. The highest discoloration values, for both materials, were obtained after ageing in red wine (tab1).

Conclusions In case finish and polish procedures are awkward to achieve in posteriors composite restoration, the application of a light-curing protocol performed in absence of oxygen may improve the chemico-physical properties. The use of glycerin or argon gas may be suitable for light-curing procedures of occlusal surface in posterior teeth, as well as in all those zones of the composite restoration that cannot be covered by a Mylar matrix.

0349

Microhardness and Crosslink Density of Bulk-fill Composite Resins

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Objectives In this study were evaluated the Knoop microhardness (KMH) and crosslink density (CLD) of resin-based materials.

Methods Disc-shaped specimens (n=10) were prepared using two bulk fill composites (X-Tra Fil - XTF, Voco and Admira Fusion x-tra - AFX, Voco) with 5mm of diameter and 4mm of thickness, and a conventional composite resin (GrandioSO - GSO, Voco) as control group, with 5mm of diameter and 2mm of thickness. Specimens were light cured using a polywave LED (Valo, Ultradent) during 10s for XTF, and 20s for AFX and GSO at 1000mW/cm^2. After light curing, the specimens were stored in artificial saliva for 7 days. KMH was assessed at the top and bottom surfaces, five indentations were performed in each surface using a microhardness tester (HMV-2, Shimadzu) with Knoop indenter under 50g for 15s. Then, the specimens were stored in absolute ethanol for 24h and the microhardness was again measured. CLD was obtained by the percentage of hardness reduction (%H_R) after storage in alcohol. Data were analyzed by ANOVA and Bonferroni post-hoc test (α=0.05).

Results Top surface showed higher KMH compared to bottom and ethanol immersion decreased KMH of composite resins. The highest KMH was reached by GSO, followed by XTF and AFX. GSO showed lower %H_R after alcohol storage compared to XTF and AFX composites, without significant difference between them.

Conclusions The bulk fill composite resins tested in this study showed lower hardness and crosslink density, thus further studies are required to evaluate these materials.

0350

Water Sorption and Solubility in Bulk-fill Materials

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Objectives Water sorption and solubility are two factors related to different mechanical properties and biocompatibility of resin composites. The purpose of this study was to compare the degree of water sorption and solubility of bulk fill and nanohybrid flowable composites.

Methods A total of 240 specimens (15 mm diameter; 1 mm depth) consisting of 4 bulk fill materials (SDR, Venus Bulk Fill, Filtek Bulk Fill and Sonic Fill) and 4 nanohybrid flowable composites (Premise Flowable, Filtek Supreme XT, Venus Diamond Flow, and Tetric EvoFlow) were prepared. The specimens were subdivided in 6 time groups (*n*=5): 1, 2, 3 and 4 weeks, 3 months and 6 months. Water sorption and solubility were tested according to ISO 4049:2009. Data were analysed using a Pearson's correlation test, two-way ANOVA and Tukey *post-hoc* test.

Results The Pearson correlation showed statistically significant differences for both groups of materials ($p<0.001$), but the correlation was positive for nanohybrid (r= 0.438) and negative for bulk fill materials (r= -0.289). The nanohybrid composites showed higher water sorption (WS= 24.52±5.17) and solubility (WL=2.31±2.99) than the bulk fill materials (WS=18.84±5.20; WL=2.13±2.93). The composite with the lowest water sorption was Sonic Fill (WS=12.53±3.16), and the highest was Tetric EvoFlow (WS=29.59±3.86). Regarding solubility, Venus Bulk Fill showed the lowest solubility (WL=0.22±2.69), and Sonic Fill showed the highest (WL=4.94±2.12). Both water sorption and solubility increased with time.

Conclusions In spite of the fact that the relationship between water sorption and solubility was dependent on the composition of each individual material, the nanohybrid composites absorbed more water than did the bulk fill composites, although the nanohybrids were not the most soluble.

0351

Differentiation of human *Capnocytophaga* to Species Level Using MALDI-TOF MS

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Objectives Human *Capnocytophaga* species play a significant role in health as well as in opportunistic infections. Their impact is not fully understood due to difficulties to their differentiation at species level. This may lead to delays in clinical diagnosis and selection of an appropriate treatment. Here we aimed to identify selected *Capnocytophaga* strains to species level by using matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) as a diagnostic method.

Methods Based on colony and cell morphologies, 68 oral strains of the genus *Capnocytophaga* and seven human *Capnocytophaga* reference strains were included in the tests. The strains were identified with MALDI- Biotyper (Bruker Daltonics, Bremen, Germany) according to the manufacturer's recommendation. To evaluate the ability of MALDI-TOF MS to differentiate *Capnocytophaga* at species level, a main spectral profile (MSP) dendrogram was generated, and selected spectra were analyzed and compared with colony descriptions.

Results The majority (66.6%) of the strains were identified directly to species level (ID score ≥2.00); *C. ochracea* (29/31, 93.5%), *C. sputigena* (14/25, 56%), *C. granulosa* (3/3, 100%), and *C. gingivalis* (1/1, 100%). In addition, 3 *C. haemolytica* got ID score ≥2.00 after formic acid extraction. Although *C. leadbetteri* (n=1) and *Capnocytophaga* genospecies AHN8471 (n=1) were identified correctly to genus level, their identification to species level failed, because they are missing from the current MALDI BioTyper database. The MSP dendrogram and related spectra analyses combined with colony morphologies revealed a clear differentiation between the species except for those not included in the database.

Conclusions MALDI-TOF MS in combination with colony descriptions for differentiating *Capnocytophaga* to species level is useful once the database is updated.

0352

Species-Specific Quantification of *Lactobacillus* Spp. Via Quantitative Real-Time PCR

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Objectives Previous *in-vitro* experiments at Symrise demonstrated anti-inflammatory immunomodulation and microbiome impacting capabilities of probiotics in the oral cavity. In order to investigate a causative relation between probiotics and oral health, it is important to examine the degree to which probiotics colonize in the oral cavity. Therefore Symrise currently plans to investigate these effects in a human clinical trial. Here we demonstrate that quantitative real-time PCR (qPCR) is a suitable method for this purpose.

Methods Species-specific primers targeting the 16S or 23S rRNA genes of *Lactobacillus* spp. were designed *in-silico*. Genomic DNA (gDNA) was extracted from 20 strains of the order *Lactobacillales*. Quality of gDNA extracts was analyzed by measuring absorption ratios of $A_{260/280}$, gelelectrophoresis and measuring the DNA-concentration. Primer-specificity was verified empirically by qPCR using Applied Biosystems™ TaqMan™ Gene Expression Master Mix adhering to manufacturer's cycle protocol with optimized annealing temperatures. For quantification target strains were grown in biological triplicates to late exponential phase and serially diluted over five logarithmic units. Each sample was simultaneously quantified in technical triplicates via spread plate technique (anaerobic, 37 °C, MRS-Agar) and qPCR after gDNA extraction. For qPCR a standard curve was derived from gDNA extracts of DSMZ type strains. The applicability of the method in the oral cavity was evaluated by spiking the target strains into artificial saliva samples, extracting gDNA and analysis via qPCR.

Results The developed qPCR-assays specifically detected and enumerated the target species in a fast and robust manner compared to spread plate technique. Correlation coefficients between spread plate technique and qPCR for each species-specific primer set was strong (r = 0.9424 - 0.9931).

Conclusions In conclusion the developed qPCR-assays allowed both specific identification and quantification of different *Lactobacillus* spp. in pure cultures as well as artificial saliva samples, and therefore this method is suitable for following the colonization of probiotic bacteria in clinical samples. Moreover qPCR is superior in terms of hands-on time and time needed for generation of data compared to spread plate technique.

0353

Assessment of Cariogenic Bacteria in People Aged 20-24 and 25-35

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Objectives The high number of bacteria *Streptococcus Mutans (SM)* and *Lactobacillus (LB)* is one of the factors predicting the high risk of developing carious disease. *SM* bacteria prefer hard surfaces for their growth, are present on the surfaces of natural teeth and prosthetic restorations.

Analysis of the number of *Streptococcus Mutans and Lactobacillus* in the saliva in the group of 46 people aged 20-24 years and 28 people aged 25-35.

Methods The research was conducted in the group of 46 people aged 20-24 and 28 people aged 25-35. The study material was mixed, stimulated saliva which was collected from 9.30 a.m. to 11.30 a.m., 1,5-2 hours after meal. Assessment of *Streptococcus Mutans* and *Lactobacillus* was performed by using CRT bacteria test (Ivoclar Vivadent, Liechtenstein). Statistical analysis was conducted with the use of Chi^2 test. Statistically essential were test values of $p<0.05$. The research project obtained positive opinion of the Bioethics Board of the University of Medicine in Lublin.

Results In the group of people aged 20-24 high number of *SM* bacteria was stated in 23.9%, low in 76.1%. For people aged 25-35 the values were 46.4% and 53.6%, respectively. There were significant differences in the number of *MS* in saliva depending on the individuals age ($\chi^2 = 4.03$, $p<0,05$).

In the group of people aged 20-24 a high number of *LB* was stated in 39.1%, a low number in 60.9%. In the group of people aged 25-35 the values were 46.4% and 53.6%, respectively. There were no significant differences in the number of LB in saliva depending on the individuals age ($\chi^2 = 0.38$, $p>0,05$).

Conclusions In the group of 20-24 significantly more often was reported low number of SM bacteria compared to the people aged 25-35.

0355

Feeding and Delivery Mode: Impact in the Oral Mycobiome

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Objectives The mothers' influence in the fungal colonization of their infants it is still a matter of study. Maternal and environmental fungal sources may contribute to the oral colonization of the child. However, the role of fungi as key players and the role of early events as delivery and feeding mode in the acquisition of the oral mycobiome is poorly explored. This review aimed at the assessment of the scientific evidence for the role of delivery and feeding mode on the early fungal colonization.

Methods Relevant scientific publications were searched and selected from Pubmed, the last search on the topic being performed on April 25, 2019. The inclusion criteria used were comparative studies in humans that investigated transmission and colonization of oral fungi in relation with the feeding and delivery mode. Studies regarding bacteria and virus transmission or lacking associations between fungi transmission and the delivery and feeding mode were excluded.

Results After the search in PubMed, a total of 6330 papers were retrieved, but only 12 made the final list of references. Regarding the feeding mode (N=5 articles), the outcomes were controversial: 3 articles found no significant differences between the oral microbiome of breastfed and bottle-fed children, whereas 2 articles demonstrated differences; however, the fact that these studies were cross-sectional and methodologically heterogeneous could contribute to the observed differences. As for the delivery mode (N=7 articles), 4 studies found a relation between early fungal colonization and vaginal delivery and 2 concluded on vertical fungal transmission from mother to child. *Candida albicans* was the most commonly isolated fungi species, followed by *Candida parapsilosis*.

Conclusions From this review, it can be concluded that the delivery mode might influence the early oral mycobiome. Nevertheless, more longitudinal studies using molecular methods are needed to fulfill the lack of knowledge within this field, since the results are controversial.

0356

Characterization of Human Oral Mycobiome in Oral Squamous Cell Carcinoma

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Objectives Background and aim: Human oral cavity harbors the largest diversity of microbes in the human body. An important core part of the oral microbiome is the mycobiome, though only a few species of fungi, mainly *Candida* species, were thought to constitute the human oral mycobiome. This is mainly due to the special culturing requirements for fungi, in addition to their genetic complexity. Despite the latest advances in next generation sequencing methodologies and the knowledge generated on fungi in the oral cavity, no study has characterized so far the salivary oral mycobiome and its possible changes in diseases such as oral squamous cell carcinoma (OSCC).

This study aimed to characterize the oral mycobiome of OSCC patients and matched non-OSCC controls.

Methods Seventy-four unstimulated saliva samples were collected from OSCC patients and volunteers who consented to the study. A combined enzymatic-mechanical DNA extraction protocol was used for DNA extraction. Library was prepared, normalized and pooled according to Illumina protocol. Spiked-in human and artificial saliva samples, three positive controls extracted from reference Candida strains, and negative extraction controls were included in the experiment. Qiime2 v 2019.1 pipeline was used to process paired-end, raw sequences of ITS2 amplicons.

Results Relative abundance analysis identified 486 taxa in the saliva of both OSCC and controls, the most abundant fungal classes being *Saccharomycetes, Dothideomycetes* and *Malasseziomycetes*.

Conclusions This is, to our knowledge, the first study characterizing the salivary oral mycobiome associated with OSCC and opens new avenues towards the discovery of new biological markers for this aggressive disease.

0357

Oral Urease-positive Bacteria Assessment in Chronic Kidney Disease

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Objectives Chronic Kidney Disease (CKD) is a growing health-issue, affecting 8 to 16% of the population worldwide. Decreased kidney function in these patients leads to the accumulation of uremic toxins in the organism that induce alterations in various

body sites, including the oral milieu, with increased levels of salivary urea, ammonia and pH possibly functioning as selective factors for the oral commensal microbiome. As so, this work aimed to assess oral urease-producing bacteria changes induced by CKD.
Methods Saliva samples were collected from a group of 42 adult CKD patients undergoing peritoneal dialysis, followed at the outpatient clinic of the Nephrology Department of São João Hospital Centre, and from a group of 37 healthy individuals recruited from the student body of the Faculty of Dental Medicine of Porto University. None of the participants were treated with antibiotherapy in the 3 months prior to sampling. The samples were cultured in selective culture media (MacConkey Agar and Mannitol Salt Agar) immediately after collection. After 48 hours of growth at 37°C, all distinct-looking colonies were reisolated and characterized according to urease production. Urease-positive isolates were then identified using MALDI-TOF MS.
Results Urease-positive colonization was found in 81.1% in healthy controls and 84.1% in CKD patients (p-value=0.721). However, the patients exhibited a reduction of *Staphylococcus aureus* (6.8% comparing to 35.1%, p-value=0.001), and an accentuated increase of *Raoultella ornithinolytica* (29.5% comparing to 0%, p-value=0.000). Some species, such as *Corynebacterium propinquum*, *Citrobacter koseri* and *freundii*, *Enterobacter asburiae*, *Klebsiella oxytoca* and *Raoultella ornithinolytica* were absent from the controls, while *Staphylococcus hominis* and *warneri* were not detected in the CKD patients.
Conclusions The results suggest that the biochemical alterations of the oral milieu associated with CKD might induce a dysbiosis of the commensal oral microbiome.

0357.1

Evaluation of the Effects of Antibiotic Included Root Canal Pastes on the Apical Papilla Derived Mesenchymal Stem Cells
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Objectives The aim of this study was to evaluate effects of triple(TAP), double(DAP) and modified triple antibiotic pastes(mTAP)(TAP- ciprofloxacin, metronidazole and minocycline, DAP- ciprofloxacin and metronidazole, mTAP- ciprofloxacin, metronidazole and cefaclor) on stem cells from apical papilla(SCAP) viability, apoptosis, proliferation and gene expression level during regenerative endodontic procedures.
Methods For the tissue samples to be used in the SCAP, young adult patients aged 16-22 years had impacted wisdom tooth with open apex 3. Molar teeth**.** To be able to evaluate at cellular level viability, proliferation, and apoptosis tests were applied. Osteocalcin(BGLAP), dentin sialo phosphoprotein(DSPP) and alkaline phosphatase(ALPP) levels were evaluated on the RNA side. One-way analysis of variance and Tukey test were used in the comparison of the groups*(p <0.05).*
Results According to the obtained data in this study; no significant difference was observed about changes in cell viability, proliferation, early apoptosis, late apoptosis and total apoptosis rates for each material at 14 and 28 day groups. Evaluation of gene expression levels showed a significant increase in the expression levels of osteocalcin and DSPP genes in the DAP group at 14 days of drug administration. However, a significant increase in the DSPP gene expression level was also observed in the 28 day mTAP administration group.
Conclusions Lethal indirect effect of TAP, DAP and mTAP can be largely avoided if these medicaments are used at the 0.1 mg/mL concentration. Besides, dentin conditioning with DAP and mTAP promotes SCAP survival, proliferation and odontoblast differentiation markers.

0358

Maternal Oral Health and Early Childhood Caries among Colombian Children
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Objectives The aim of this study was to examine the association between maternal oral health status and early childhood caries (ECC) in Colombia.
Methods Three hundred pairs of mothers and their 2-5-year-old children were recruited from those attending Hospital Civil in Pasto, Colombia. Mothers completed a questionnaire to provide information on their sociodemographic characteristics and their children's demographic and behavioural factors. Mothers were clinically examined for dental plaque using the simplified oral hygiene index (OHI-S), dental caries using the WHO diagnostic criteria and periodontal status using the community periodontal index (CPI). Children were clinically examined for dental caries according to the WHO criteria. ECC was measured as the sum of decayed, missing and filled tooth surfaces (dmfs index). The association between maternal clinical dental indicators and children's dmfs was assessed using negative binomial regression models adjusting for family socioeconomic position, maternal education and age, marital status and child gender, age, sugar intake, toothbrushing frequency and dental attendance.
Results About 55% of children and 68% of mothers had untreated dental caries. Among children, the mean dmfs was 5.6 (SD: 7.2, range: 0 to 40), with the decayed component representing 62%. Regarding maternal oral health status, the mean OHI-S was 1.52 (SD: 0.79, range: 0 to 3), the mean DMFS was 23.0 (SD: 21.9, range: 0 to 152) and the proportion of mothers with a CPI score>1 was 33%. Maternal DMFS was positively associated with children's dmfs (Rate Ratio: 1.01, 95%CI: 1.00-1.02, P=0.048) after adjusting for confounders. Neither maternal OHI-S (Rate Ratio: 1.14, 95%CI: 0.90-1.44, P=0.238) nor CPI (1.31, 95%CI: 0.92-1.86, P=0.137) were associated with children's dmfs.
Conclusions This study shows that the dental status of mothers was associated with that of their children, after accounting for

established risk factors for ECC. The role of maternal bacterial transmission and influence on early acquisition of favourable behaviours need to be further explored.

0359

Oral Health in Ugandan HIV Exposed and Unexposed Uninfected Children

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Objectives To estimate the likelihood of caries experience in deciduous teeth and its oral health-related quality of life (OHRQoL) impacts in HIV exposed uninfected (HEU) as compared to HIV unexposed uninfected (HUU) Ugandan children adjusted for confounding covariates
Methods This study uses data from the Ugandan site of the ANRS 12174 PROMISE-PEP trial (ClinicalTrials.gov, number NCT00640263) conducted between 2009 and 2013 that included HIV infected mother-HEU children pairs. One hundred sixty-six participants were re-enrolled in the PROMISE-PEP M&S study in 2017 and 164 HEU were included in this study. This study also included (N=181) HUU children and their HIV-1 uninfected mothers where the children were matched on sex and age. Caries experience and OHRQoL of children-caregiver pairs were recorded using the World Health Organization Decayed, Missed and Filled teeth (dmft/DMFT) indexes and the Early Childhood Oral Health Impact Scale (ECOHIS), respectively
Results Some 48% of HEU children and 60% of HUU had dmft>0. Corresponding figures for ECOHIS>0 were 12% of HEU and 22% of HUU. Adjusted mixed effect logistic regression analyses revealed no significant association between HIV exposure and caries experience and between HIV exposure and OHRQoL impacts. When the caregivers' DMFT>0, odds ratios for dmft>0 was 1.6 (95%CI: 1.0-2.6) and 4.6 (95% CI: 2.0-10.6) for having dental caries and oral quality of life impacts, respectively.
Conclusions HIV exposure was not significantly associated with caries and OHRQoL after adjustment of confounding covariates. Children's caries experience and impaired OHRQoL increased with caregivers' caries experience. Given the global expansion of the HEU child population, the present findings indicating no adverse effect of pre and post-natal HIV exposure on caries and OHRQoL are reassuring.

0360

The Measurement of Oral Health Self-Efficacy and Its Relation to Procrastination Tendencies.

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Objectives The relation between procrastination and self-efficacy may apply to the oral health domain. Several studies suggest a relationship between procrastination and general self-efficacy. However, previous domain-specific measures do not measure self-efficacy related to oral health behaviours. The aim of this study is to create and validate a new self-efficacy measurement related to general oral health behaviour, and to explore the relationship between oral health self-efficacy and procrastination tendencies.
Methods The oral health self-efficacy scale (OHSES) was validated using a paper-based questionnaire among university students (n= 88). Scale items were inspired by previous domain-specific measures, which were back translated and adapted to oral health behaviours. The scale consists of 14 statements about the participants' beliefs about their ability to take care of their oral health, to perform oral hygiene and to execute dental visits, to which they agreed or disagreed on a Likert scale (1-5). In addition, the Irrational Procrastination Scale (IPS) measured the participants' tendency to procrastinate.
Results A reliability analysis of the OHSES revealed a good internal consistency (Cronbach's alpha= 0.782) including 12 of the 14 items. Exclusion of the two items improved the internal consistency and face validity of the scale. A principal components analysis revealed that the scale accounted for 30% of the variation as a holistic measure of oral health self-efficacy. Further, a correlation analysis between oral health self-efficacy and procrastination demonstrated a negative correlation ($r = -0.386$, $p = 0.0003$). Procrastination explained 13.8% of the total variation in oral health self-efficacy when controlling for age and gender.
Conclusions The tendency to procrastinate is associated with a low oral health self-efficacy score, a finding consistent with previous literature connecting procrastination and self-efficacy. These results suggest that self-efficacy could contribute substantially to explain the relationship between procrastination and oral health behaviours, and therefore should be further explored. The OHSES seems to be a reliable measure of a patient's own belief in their ability to perform oral health behaviours.

0361

Association Between Parents' and One-year-old Children Oral Hygiene Behavior

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Objectives Aim was to study if parents' tooth brushing frequency was associated with tooth brushing frequency of their one-year-old child when considering sociodemographic factors.
Methods This cross-sectional study is part of the FinnBrain Birth Cohort Study. Data was collected using self-reported questionnaires. Participants were recruited in 2011–2015 in prenatal clinic. Of those mothers informed about the study (N=5790), 3808 (66 %) agreed to participate, and alongside agreed 2623 fathers or other partners. Of those who agreed to participate, 3095 (81.3%) mothers and 2011 (76.7%) fathers actually started in the study and returned the first questionnaire. The study population was 1677 mothers and 871 fathers who returned the questionnaire when children were 12 months old. Sociodemographic information (age, education, parity) was collected during pregnancy, whereas tooth brushing frequency was collected when child was at the age of 12 months. Tooth brushing frequency was dichotomized to favorable (twice a day or more often) and unfavorable (less than twice a day). Associations were evaluated with chi-square test.
Results Fewer than 60% of both parents reported that child's teeth were brushed twice a day or more often. Young and nulliparous mothers reported more often child's twice a day tooth brushing than older (63.4% vs. 52.1%, p=0.012) and multiparous (64.6% vs. 52.8%, p<0.001) mothers did. Results were similar according to father's age (65.5% vs. 50.8%, p=0.010), respectively. Education had no statistically significant association with child's tooth brushing frequency.
Conclusions Age of parents and number of parturitions had clear association with tooth brushing frequency of child, whereas education had no association. Hence, interventions to promote oral health of families should also be targeted at families who already have children.

0362

Family Functioning and Health-Related Quality of Life in Pre-School Children with Dental Caries.

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Objectives The aim of this cross-sectional study was to evaluate the effect of family functioning on oral health related quality of life (OHRQoL) and caries status among pre-school children in Malaysia.
Methods In this study, the ECOHIS (Early Childhood Oral Health Impact Scale) and family functioning - 12-item general functioning subscale (GF-12) were used and the caries status of the preschoolers was evaluated. This study was approved by the institutional Joint Research and Ethics Committee, International Medical University, Malaysia (number 373/2016),
Results A total of 180 pre-schoolers participated in this study. The mean score for FAD-GF12 was in the nonclinical range of less than 2, indicating normal family functioning. The mean score for ECOHIS was 0.52 (SD=0.68). The highest CIS was 20 and the highest FIS score was 12. Children with dental caries had a significantly (P = 0.014) lower mean OHRQoL score (M=0.72, SD=0.50) compared to children with no caries (M= 0.34 SD=0.39). There was a significant association between family functioning and OHRQoL. After adjusting for family functioning, the odds of a child with dental caries having poor OHRQoL was 3.17 times more compared to one without dental caries.
Conclusions Findings in this study shows that poor family functioning is associated with dental caries status which in turn effects the quality of life.

0363

Are Dentists Familiar with the Rights of Torture Survivors?

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Objectives A significant number of refugees and asylum seekers are victims of torture. The aim of the study was to explore the experiences of Norwegian dentists with providing dental treatment to torture survivors.
Methods A questionnaire based on a pilot study at the Dental Faculty in Oslo, was sent to 468 randomly selected dentists in Norway, which amounts to 10% of Norwegian dentists. The response rate was 40.0%. Chi-squared tests and logistic regression analyses were performed using SPSS.
Results Of 187 respondents, 36.4% (n=68) reported experience with treating torture victims. The main reasons the dentists discovered torture experiences was patients telling unsolicited (55.9%) or noticing anxiety reactions in the treatment situation (54.4%). Younger dentists (<45 yrs) more often asked patients about torture experience on suspicion (52.9% vs. 35.6%, p=0.022). Logistic regression analyses showed that asking about previous torture was related to the dentist's knowledge about torture survivors' rights (p=0.007), and only 47.5% of the dentists reported having such knowledge. Dentists treating torture survivors reported taking the following special precautions: Thorough explanation of procedures (95.6%), reserving extra time (92.6%), agreeing on use of stop-signal (76.5%), using interpreters (51.5%), extended medical history with focus on special needs and triggers (50.0%), dental assistant present at all time (47.1%), encourage extra follow-ups (32.4%) and avoiding waiting time (32.4%). Only 14.7% reported collaboration with other occupational groups.
Conclusions About one third of the respondents are aware of having provided dental care to torture survivors. Most of these dentists use some behavior management techniques, but there is an evident lack of knowledge about torture survivors' rights.

Documentation of torture experiences is important with regard to both dental treatment and future redress, and dentists should be encouraged to collaborate with other occupational groups, such as psychologists, physicians, physiotherapists and social workers.

0364

Do Different SES Measures Reveal Similar Health Inequalities?

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Objectives Education, income and work-based variables are commonly used in measuring socioeconomic status (SES). Income is challenging to adjust for family size and work-related categories are difficult to organize. In longitudinal setup, education cannot worsen while SES can. Accurate measures of the socio-economic status, accounting for the longitudinal status is an essential component of epidemiological studies. The measure should be at least ordinal even though SES is a complex phenomenon and not by any means one-dimensional. This study aims to compare if different SES variables detect health inequalities similarly, and if factor scores incorporating multiple dimension of the SES are usable. We considered three measures describing health inequality: toothbrushing, number of teeth and self-rated health.
Methods This study uses data from the Northern Finland Birth Cohort 1966 (NFBC66), collected when the participants were 46 years old (N=10321) via postal questionnaire (n=6894, 67%). The Ethical Committee of the Northern Ostrobothnia Hospital District approved the study. Principal component analysis was conducted for income, education, work-related 4-category SES variable, and 2 dichotomized indicators for entrepreneurs and farmers, resulting a SES factor and factor score variable. Correlations between SES variables, toothbrushing, self-reported number of teeth and self-rated health were assessed. All variables were scaled the bigger the better.
Results Education (0.802), income (0.525) and SES (0.866) correlated highly (factor loadings) with factor scores. Toothbrushing, number of teeth and self-rated health also correlated with different SES variables, mostly with factor score or education (Table).
Conclusions All SES measures detected associations with health inequalities. Factor scores allowed combining different aspects of SES, and organized the data.

0365

Oral Investigations in Head and Neck Cancer Patients after Radiotherapy

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Objectives To investigate oral complaints and findings in head and neck cancer (HNC) patients who had received radiotherapy and compare them with controls.
Methods As part of a larger study, 30 HNC patients (14 female, age 64.2±9.6y) and 26 age- and sex-matched controls (13 female, 62.9±12.9y, p=0.850) were examined at the Dry Mouth Clinic, Faculty of Dentistry, Oslo. Oral health-related quality of life (OHRQoL) was assessed using the short form Oral Health Impact Profile (OHIP-14: high score-low OHRQoL). Self-reported dysgeusia (yes/no) and sense of taste (10-point VAS: high score-good smell sense) were recorded. Taste scores were recorded using taste strips (high score-good taste function). Oral candida counts were determined from cheek and tongue swabs (0=no growth, 1=minimal, 2=moderate, 3=severe). Volatile sulphur compounds (VSC) in mouth air samples were determined by gas chromatography and related to perceptive threshold-levels (H_2S≤112ppb, CH_3SH≤26ppb). Between-group comparisons were performed using Mann-Whitney U test and Chi-square test.
Results The HNC patients reported significantly poorer OHRQoL than controls (OHIP sum-score: 18.4±12.4 vs 1.2±2.0, p<0.001). They reported significantly poorer sense of taste compared to controls (6.4±2.4 vs 7.8±1.9, p=0.018), and more often dysgeusia (26.7% vs 7.7%, p=0.087). The measured gustatory scores (20.4±6.4 vs 22.3±4.6, p=0.315) were similar for both groups. Candida scores were significantly higher in the patient group (1.6±1.3 vs 0.7±0.9, p=0.024). The percentage of HNC patients who had oral H_2S above the threshold level was significantly lower than for the controls (0% vs 27%, p<0.05). This was not the case for CH_3SH (5.5% vs 27%, p=0.105).
Conclusions After radiotherapy, these HNC patients experienced negative oral consequences of the treatment. They reported poorer OHRQoL, and had reduced taste sensation and higher oral candida counts. However, the underlying reason for less problems with halitosis in HNC patients than in controls is worth further exploration.

0366

Self-Perception of Oral Status of Pregnants and Health of Newborns

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Objectives To assess the maternal self-perception of oral health in front of its ICAOD, periodontal status, and gestational age / weight of the Newborn (NB).
Methods At 24 hours after birth, with Informative Consent, it has been surveyed and explored (intraobserver I. Kappa = 0.97), with an ad hoc WHO protocol, the oral health of 189 mothers (age = 31.0 ± 6.9 years). A 9.5% of mothers was classified as smokers. After consulting their obstetric and the NB histories, cases with maternal-fetal pathology and multiple births were excluded. The authorization of the Bioethics Committee of Hospital Universitario Clínico San Carlos, Madrid, was obtained, with File No. 15/242-E. The database has been processed with SPSS. r. 24, and Pearson correlation and $\chi 2$ test were applied.
Results Thirty-five percent of mothers, who perceived a good oral health condition, have shown an average of CAOD better qualified than those who perceived poor condition ($p=0.002$). The group with the poorest perception of oral health has a greater component of caries and absences ($p<0.001$) being lower the weight of their corresponding NB ($p=0.008$). None of the mothers with good self-perception of their oral health had severe / intense gingivitis compared to the different grades of gingivitis of those who perceived bad oral health ($p<0.001$). Mothers with lower self-perception of oral health had a higher level of dental plaque ($p=0.002$). The NB of mothers with greater gingival inflammation and plaque accumulation had lower birth weight ($p=0.019$) and higher frequency of prematurity ($p=0.022$).
Conclusions Pregnancy appears to facilitate a realistic self-perception of oral health that significantly affects the NB health parameters and it could be a suitable stage for the conscience and to establish healthy habits for their transcendence in Public Health.

0367

Disparities between Caregiver-perceived and Dentist-assessed Oral Health Status of Patients with Intellectual Disabilities

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Objectives This study compared caregiver-perceived and dentist-determined oral health status of patients with intellectual disabilities to determine factors that affect caregiver-perception of patients' oral health.
Methods A total of 297 patients [mean (SD) age = 51.9 (12.5) years] and 56 professional caregivers [mean (SD) age = 42.1 (8.2) years] from three institutional facilities was included. Data were acquired from self-administered questionnaires by caregivers and oral examination by dentists. Oral hygiene condition, numbers of decayed and missing teeth, and periodontal disease reported by caregivers and dentists were compared using paired t-test and Pearson correlation. Demographic and dental factors of the patients and caregivers were analyzed using chi square and Fisher's exact tests.
Results Caregivers underestimated decayed and missing teeth compared to dentist determination ($p<0.05$). Oral hygiene condition and periodontal disease were similarly rated by the two groups. Tooth brushing, diet type, sex, and overall oral health status of the patients were associated with caregiver perception ($p<0.05$). Career length and dental care of the caregivers were also related factors ($p<0.05$).
Conclusions Professional caregivers of adult patients with intellectual disabilities had different perceptions of patient oral health status based on patient and caregiver circumstances.

0368

Oral Health Assessment Among a Sample of Patients with Brain Paralysis

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Objectives Providing health care to individuals with special needs requires adequate knowledge, skills and facilities to allow the care of these patients. The aim of this study consisted in the assessment the oral health among a sample of patients with brain paralysis.
Methods This study is an observational cross-sectional study using a convenience sample, including 29 individuals attending a clinic at the Brain Paralysis Association of Viseu (APCV), Portugal. An intra-oral examination was performed to analyze the decayed, missing and filled permanent teeth index (DMFT index) and the Silness & Loe plaque index. A self-administered questionnaire was applied to each caregiver of the participant in the study.
Results Patient mean age was 33.14±10.54. It was observed that the mean value of DMFT was 7.79±8.38, ranging from 0 to 32 teeth with carie experience. Regarding plaque index, the mean value was 7.65±5.09, with values varying between 0 and 18 teeth with accumulation of dental bacterial plaque. As difficulties to attend a dental appointment, 25% refer that the dental appointments are expensive, 41.7% had difficulty finding a specialized dental practitioner, 45.8% said that they were denied dental treatment, 12.5% did not feel the need to visit the dentist, and 16.7% have travelling difficulties.
Conclusions The APCV is aware to the need of regular dental appointments. However, specific oral health promotion and primary prevention strategies should be defined to improve oral hygiene and oral health of these patients.

0369

Association Between Oral Health Status and Self-reported Complaints in Adolescence

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Objectives A rapid increase in prevalence of dental caries and gingivitis during adolescence is one of concern about oral health in Japan. This problem may be attributed to less awareness of oral health and oral care. In order to improve the situation, we aimed to develop a questionnaire effective to check oral conditions and promote oral health behavior in adolescence. For this purpose, we analyzed the relationships between oral examination results and responses to questionnaire in university students.

Methods Four hundred and eighty-six newly enrolled university students voluntarily underwent oral examination and answered self-administered questionnaires. Oral examination included assessment of dental caries such as decayed (D), missing (M) and filled (F) teeth, and periodontal conditions such as pocket depth and bleeding on probing (BOP). The questionnaire included the items concerning oral complaints and oral health behaviors. The relationships between oral health statuses and questionnaire responses were analyzed using the Mann-Whitney *U* test, the chi-square test and multiple logistic regression analysis. A *p*-value of <0.05 was considered to be statistically significant. This study was conducted with approvals of the Ethics Committees of the universities.

Results The mean age of participants was 18.1 ± 0.3 (SD) years. The mean DMFT was 2.63 ± 3.50. When grouping by DMFT based on the median value (≤ 1 and ≥ 2), the high DMFT group reported more frequent experiences of tooth pain and sensitive tooth to cold stimuli. Regarding gingival condition, the participants with higher BOP scores reported more frequent oral stickiness on their awakening and showed a higher ratio of respondents reporting unhealthy gum shapes such as swollen or flabby interdental papillae. In addition, usage of interdental cleaning tools was a reducing factor for BOP.

Conclusions The present results suggested that the questions concerning tooth pain and sensitive tooth to cold stimulus may be useful to check dental caries and the questions about oral stickiness on awakening and gum shape may be useful for screening of gingivitis.

0370

Oral Screening Activity in Diabetes Patient Events in Hungary

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Objectives Our goal was to organize free oral screenings for 2 national DM patient events in 2018, and also continue this initiative in 2019. Regarding to our previous experiences we are expecting to have 400 patient data from our screening activity by the end of 2019.

Methods There were a mandatory questionnaire and patient declaration that complies with applicable legislation and following GDPR (Ethical License Number: SE RKEB 204/2018). The extra and intraoral examination is performed at the screening booth of the Semmelweis University Diabetes-Dental Working Group, which is build up in the patient event, using the mobile dental chairs, and mobile walls. After the intraoral examination, DMF-T, OHI-S indexes were determined and orthodontic and TMJ examinations were performed with the help of our specialist colleagues.

Results We organized 2 oral screenings in 2018 with the cooperation of Egy Csepp Figyelem Foundation and Szurikáta Foundation for kids with DM. Our preliminary results show that free dental screenings in patient-events are popular, and it is easier to reach DM patients compared with welcoming them in the Department. We found, that patients with type 2 diabetes have to improve their oral hygiene, however, type 1 diabetes patients have better results compared with the control group.

Conclusions Oral health in diabetes needs to be controlled regularly by dentists, which should be performed in every 6 months. There is a need for our working group as an interdisciplinary connection. Oral screening should be a mandatory examination for patients with diabetes, just like annual ophthalmology check-up or lab test.

0370.1

Papillon Lefevre Syndrome: A Pediatric Case Presentation from Santo Domingo, Dominican Republic.

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Objectives The purpose of this study was to present a case of Papillon Lefevre Syndrome in a dominican child.

Methods A six year old female girl was evaluated at the Dental Pediatric Clinic, Universidad Central del Este, Dominican Republic with premature tooth loss. Patient was referred from the dermatologist who treated her for dryness of palms and soles of the feet during two years. A pedodontist and periodontist evaluation was conducted and included clinical examination, imaging, complementary tests and biopsy performance.

Results On oral examination, a marked dental mobility, bacterial biofilm, gingival inflammation, extruded teeth, suppuration and pain was observed. Imaging studies were also performed and included panoramic radiograph, evidencing generalized bone loss in primary and permanent dentition, furcation involvement grade II, confirming the diagnosis of generalized periodontitis.

Several teeth were extracted due to severe mobility and during the procedure, an excisional biopsy of gingival tissue at the extraction site was performed .The histopathological examination showed granulation tissue, chronic and acute inflammation, numerous Actinomyces colonies and hemorrhage areas
Conclusions This study represent a diagnostic case of PLS in a Dominican child with generalized periodontitis, severe mobility,premature primary and permanent dentition loss and different mode of genetic transmission, however the patient responded positive to periodontal treatment reducing bleeding, gingival inflammation and biofilm.

0371

Platelet Rich Fibrin In Management of Resistant Oral Ulcers

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Objectives Management of oral ulcers due to immunologic diseases is a major concern to the oral health specialist. These diseases are usually managed by systemic corticosteroids and the addition of topical corticosteroids may not aid to control the oral lesions. Autologous Platelet rich fibrin (PRF) with its growth factors may offer a safe, rapid and un-expensive alternative.
Objectives: evaluating the effect of PRF compared to clobetasol propionate (CP) 0.05% on oral ulceration of immunologic diseases in term of pain control.
Methods Sixteen patients with resistant immunologic oral ulcers. Four patients with Stevens-Johnson syndrome(SJS), four benign mucous membrane pemphigoid(MMP), and eight Pemphigus vulgaris(PV), receiving systemic corticosteroids, allocated in two equal groups. In PRF group 40 ml blood for each patient were obtained and centrifuged for 15 minutes on 3000 rpm. The resultant gel placed directly on the oral ulcer. The serum supernate was mixed with equal amount of orabase and used topically on the oral ulcers 3 times /day for 1 week. Control group (CP), clobetasol propionate in orabase was applied 3 times /day for 1 week. Pain score was assessed daily for the whole treatment period.
Results Statistically significant difference in mean pain score was observed between the two groups (P-value ≤ 0.05). At day 1 after treatment, the PRF group had 48% pain score reduction while, the (CP) group had almost no reduction [Mean difference(MD) -5.25, Std. Error Difference(SED) 0.66]. At day7, the PRF group had 100% pain reduction while, the (CP) group had 32.5% reduction [(MD)-6.25, (SED)0.46].
Conclusions PRF application dramatically decreased the pain score compared to topical corticosteroid application in patients with oral ulcers associated with immunologic diseases.

0372

Application of an Oral Rinse Point-of-care Assay to Aid in the Diagnosis of Oral Squamous Cell Carcinoma; Evidence from Two Independent European Studies.

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Objectives Head and neck squamous cell carcinoma (HNSCC), including oral squamous cell carcinoma (OSCC), is the 6th most common cause of cancer mortality. The ability to detect OSCC at an earlier stage including low vs. moderate to high grade dysplasias could have significant impact on overall outcome. Previous studies demonstrated that a point-of-care (POC) lateral flow assay measuring CD44 and total protein (TP) aid in the diagnostic process for OSCC. We sought to better understand the performance of the POC assay in two European centers.
Methods Oral rinses were obtained from approximately 270 consecutive patients presenting for physical exam and biopsy in a Danish high risk ENT clinic, and an oral-maxillofacial surgical university clinic in Germany. Operators were provided POC visual tools to record assay results. A positive POC test is a visible CD44 band or level of TP (i.e. color-graded scale from 1-5, recommended >/=3), with Sensitivity (Se), Specificity (Sp), NPV to evaluate correlation with biopsy. One site (Denmark) involved prospective patients and the German group was a case:control model which included OSCC cases and two control non-biopsied patient populations including a high risk cohort (>100 pack year cigarette smokers and increased alcohol consumption) and normal healthy subjects with no known risk factors.
Results The mean age range was 57-65 years for the at risk and cancer population; 30-60% were male, 100% white, 30-60% smokers (cancer group), 100% of cancers were OSCC. The average sensitivity for detection of OSCC was >/=80% and with a prevalence of ~10%, the NPV was >90% overall. The specificity in the prospective Danish cohort was 50% while the specificity for the at risk and normal healthy, non-biopsied control German population was 83 and 85%, respectively.
Conclusions POC assay performed well for identifying OSCC in a prospective and case:control European clinical trials. Additional patient studies are ongoing to further confirm performance and evaluate discrimination of oral potentially malignant disorders and degrees of dysplasia.

0373

Proliferation, Vessel Density and p16 Expression in a Cohort of Early Stage Oral Squamous Cell Carcinoma Patients from Armenia

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Objectives The aim of this study was to investigate the expression of p16 as a surrogate marker for HPV expression and its relation with proliferative and vessel biomarkers in a cohort of OSCC patients from Armenia.

Methods Available paraffin embedded formalin fixed tissue samples from patients diagnosed with OSCC in 2017 were collected from Armenian Republican Hospital, Yerevan after ethical approval (n=8). Immunohistochemistry (IHC) was performed using DAKO visualization system for the following biomarkers: p16, Ki67, FVIII and D2-40. Stained tissues were scanned and quantified using Immage J open software. Differentiation status and worst pattern of invasion (WPI) staining were evaluated semi-quantitatively manually as previously published and the data was analyzed using SPSS 25.0 program.

Results None of the investigated cases fulfilled the criteria to be considered p16/HPV positive (nuclear & cytoplasmic intense staining in 50-70% of cells). However, intense cytoplasmic expression of p16 was identified in two cases (25%) and correlated with high proliferation index (>50% of cells Ki67 positive), p=0.048. The blood vessel density ranged from 12,6 to 67,5 vessels per mm^2 and the lymph vessel density ranged from 10 to 34 vessels per mm^2, but the vessel density did not correlate to Ki67 or p16 expression.

Conclusions This preliminary study identified a positive correlation between increased expression of p16 (not related with HPV) and cell proliferation. This should be further investigated in a larger cohort of patients.

0375

Sjögren's versus irradiated head-neck cancer patients: oral and ocular investigations

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Objectives To compare oral and ocular parameters in female primary Sjögren's Syndrome (pSS) patients with sex- and age-matched head and neck cancer (HNC) patients after radiotherapy.

Methods Thirty-six pSS patients fulfilling the US/EU classification criteria of 2002 (mean age: 62.3±7.9y) and 14 HNC patients radiated towards the head-neck region (mean age: 63.3±10.3y, p=0.588) were included. They answered questionnaires about symptoms of dryness, and underwent oral and ocular examinations at the Dry Mouth Clinic and The Norwegian Dry Eye Clinic, respectively. Oral investigations included the Shortened Xerostomia Inventory questionnaire (SXI), unstimulated- and chewing-stimulated whole saliva (UWS, SWS ml/min), candida counts, and Clinical Oral Dryness Score (CODS). Objective taste function was evaluated using taste strips. Ocular evaluations included the Ocular Surface Disease Index questionnaire (OSDI), Schirmer test (ST), tear film break-up time (TFBUT), and ocular surface staining (OSS). Intergroup comparisons were performed with the Mann-Whitney test. P-values <0.05 were considered significant.

Results pSS and HNC patients had pronounced subjective symptoms and clinical findings of oral dryness (SXI 11.5±2.5 vs 12.0±2.6, p=0.468; CODS 4.7±2.2 vs 5.8±2.0, p=0.118), low salivary secretion (UWS 0.1±0.1 vs 0.1 ±0.1 ml/min, p=0.957; SWS 0.7±0.5 vs 0.9±0.4 ml/min, p=0.076), and high candida scores (1.3±1.1 vs 1.3±1.3, p=0.893). Additionally, both groups exhibited reduced taste function (8.8±2.7 vs 8.6±2.5, p=0.612). For ocular parameters, pSS patients reported more severe subjective complaints compared to the HNC patients (OSDI 31.7±19.7 vs 6.9±7.0, p<0.001) and had worse objective ocular findings (ST 6.0±4.4 vs 15.2±12.0 mm/5 min, p<0.05; FTBUT 1.8±1.3 vs 5.9±6.3, p<0.05; and OSS 3.3±2.1vs 0.9±1.7, p<0.001).

Conclusions Oral symptoms and clinical findings as well as reduced taste function were similarly present in patients with pSS and with HNC after radiotherapy. Ocular findings being significantly more pronounced in patients with pSS is in line with the autoimmune pathogenesis of pSS involving exocrine glands of multiple organs.

0376

Hyposialia Inhypertensive Patients

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Objectives To study the prevalence of hyposialia in a group of patients with hypertension and the associated risk factors.

Methods This study was carried out in a group of hypertensive patients belonging to two Health Centers in Community of Madrid (Spain). Patients with HIV, Sjögren's syndrome and patients who had received head and neck radiotherapy were excluded. Patients underwent a complete medical history, intraoral exploration, quantification of stimulated and unstimulated

saliva, and the results of the questionnaires Xerostomy Inventory (XI) and Oral Health Impact Profile (OHIP-14) were collected. Unstimulated saliva (UWS) hyposialia rate was <0.1 ml/min and stimulates saliva (SWS) hyposialia rate was <0.7 ml/min.
Results We included 221 patients (59,3% women and 40.7% men, mean age 74.33±9.38). 37% of patients suffered from UWS hyposialia and 27.5% SWS hyposialia. A statistically significant relationship was found between suffering hyposialia and to suffer anxiety and to receive anticholinergic drugs for the treatment of overactive bladder syndrome. UWS hyposialia were significantly higher in patients with arthrosis, hiatal hernia and hepatitis C. The number of medications does not influence the hyposialia. The total results of XI were significantly higher in the group of patients with USW and SWS hyposialia. However the total results of OHIP-14 were significantly higher only in the group of patients with SWS hyposialia.
Conclusions Hyposialia is frequent among patients with arterial hypertension. However, these patients are polymedicated, and have multiple diseases that may influence a reduced salivary flow.

0377

Odontogenic Keratocyst Related to Gorlin-Goltz Syndrome: a Clinico-radiological Study.
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Objectives To identify the clinical and radiological features of odontogenic keratocyst (OK) related to Gorlin Goltz Syndrome (GGS) at first presentation and treatment outcomes.
Methods This study consisted of a retrospective analysis of patients diagnosed with odontogenic keratocyst related to GGS from 2006 to 2018 in the oral and maxillo-facial surgery service of sahloul hospital (Sousse, Tunisia). Data including age, gender, number of OK, location, signs, radiographic features, treatment and recurrence were analysed.
Reslts A Consecutive 13 cases of GGS were identified.12 out of 13 cases had OK related to GGS.The first manifestation of the GGS was OK in 8 cases. Most of the patients were male (7 cases) and in the age group of 30-40 years old.5 GGS cases presented with signs arising from their OK.Four patients presented a multiple Ok and the posterior area of the mandibule was the main affected side followed by maxilla posterior region.The OK were mostly unilocular (62,5 %).Treatment option was enucleation with curetage for all patients.Recurrence after enucleation with curetage was observed in 8 patients mostly within the two first post-operative years.
Conclusions OK is a frequent manifestation of GGS and can be its first sign specially in young patients.The most frequent radiological feature was the unilocular form.The recurrence rate of OK after enucleation with curetage was important.

0378

Prevalence of Malocclusion in 12-15-Year-Old Middle School Students in Tianjin, China
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Objectives The aim of the present study was to determine the prevalence of malocclusion in 12-15-year-old middle school students in Tianjin, China.
Methods A descriptive cross-sectional survey was conducted among 4008 middle school students aged 12-15 years from junior middle schools. Several occlusal parameters were assessed, including first molar relationship, degree of overjet and overbite, crowding, and so on. All subjects were asked to fill in the oral health knowledge questionnaires.
Results The results revealed that the overall prevalence of malocclusion in 12-15-year-old in Tianjin was 90.3%. Data showed that 45.6% of the students had Angle's class I malocclusion, 24.5% had class II malocclusion, and 20.2% had class III malocclusion. Of this, 47.4% showed an increased overjet (>3 mm), 6.9% reverse overjet, 38.7% increased overbite, 2.4% open bite, 49.9% anterior crowding.
Conclusions There is high prevalence of malocclusion among middle school students aged 12-15-year-old of Tianjin. Preventive orthodontic treatment for middle school students is very necessary.

0380

The Use of Augmented Reality in Orthodontics.
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Objectives To present a new tool for augmented reality in orthodontics a systematic review of the literature was led.
Methods According to PRISMA-P guidelines the literature was screened in order to gather information on the current development of augmented reality in dentistry. The review was registered PROSPERO with RN: CRD42019120058. On the base of the information gathered a new tool was designed and tested on patient.
Results The review provided informations about: type of intervention, field of interest, clinical outcomes, precision and timing efficiency of the proposed systems, combination of software and hardware used were considered. The new tool assistance during different operations was judged useful by all the testers.
Conclusions On the base of the current development of augmented reality the new proposed tool provided important benefits to the success of different operations. However, further developments are still needed in order to increase efficiency and precision of the new proposed system.

0381

Role of c-Fos in Orthodontic Tooth Movement: An In-vivo Study Using Transgenic Mice

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Objectives The mechanosensitive transcription factor c-Fos controls the differentiation of bone-degrading osteoclasts. However, it is unclear whether c-Fos also has an effect on orthodontic tooth movement (OTM). Genetically modified mice offer the possibility to investigate the function of c-fos *in vivo*. The aim of this study was therefore to apply an OTM-model in transgenic mice with overexpression of the osteoclast differentiation factor c-Fos.
Methods Orthodontic appliances were inserted in 10 weeks-old c-Fos transgenic mice and control animals (WT) under general anaesthesia. Therefore, nitinol tension springs were attached between the left first maxillary molar and the upper incisors. The applied force was adjusted to 0,35 cN using a force gauge. The contralateral side without stimulus served as an internal control. The jaws were removed after 12 days and analyzed by micro-computed tomography scanning (micro-CT) and decalcified histology. In addition, an immunohistological staining with TRAP (tartrate-resistant acid phosphatase) was performed to visualize osteoclasts.
Results The treatment resulted in a successful mesialisation of the first molars in all mice as indicated by a significant intercoronal distance between the first and second molar. Quantification by micro-CT revealed that the distance was 62% larger in c-Fos transgenic animals as compared to WT, which suggests that toot movement is faster in c-Fos mice. The histological analysis revealed mechanically induced bone formation and bone resorption in both c-Fos transgenic and WT mice. Root resorption was observed to the same amount in both study groups. However, TRAP staining showed an increased number of osteoclasts on the unstimulated control side in c-Fos transgenic animals as compared those in WT mice.
Conclusions Higher osteoclastogenesis leads to faster tooth movement in c-Fos transgenic mice without increasing the amount of root resorption. This study shows that c-Fos has a central role in the genetic control of tooth movement in vivo and demonstrates the potential of transgenic mice in orthodontic research.

0382

Cleidocranial Dysplasia: A Case-control Study of Dentofacial Characteristics on Cephalometry

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Objectives Cleidocranial dysplasia (CCD) is rare a skeletal syndrome (prevalence of 1: 1.000.000) affecting the cranio-encephalo-maxillo-facial and oro-dental development. Despite its relevance in dentofacial orthopaedics, because of the persistence of opened fontanels and multiple dentofacial anomalies, cephalometric characteristics of these patients are not well defined due to the limited data available in the literature.
Methods Five patients 9 to 22 year-old (three females and two males), with CCD were included. Lateral-cephalograms, dental casts, orthopantomographies, and intra and extra-oral photos were retrospectively analysed. Lateral-cephalograms of normal subjects matched for age and sex were selected from an online database and used as controls. The cephalometric measurements of each patient were compared with the average values of ten respective controls using Wilcoxon signed-rank test for paired values with significance level α=0.05.
Results Mandibular prognathism characterised by both maxillary retrusion (ΔSNA = -9.8 °, p= 0.043) and mandibular protrusion (ΔSNPg = -9.8 °, p = 0.043) was present. Patients with CCD were hypodivergent showing a decreased SN/GoGn (p = 0.043) angle. Retro-inclination of the incisors was shown especially in the mandible, according to the IncInf/GoGn angle (p = 0.038), and a tendency towards the bodily retro-position of the upper incisors was also noticed, represented by the IncSup-A-Pg distance (p = 0.024).
Conclusions An orthodontic evaluation at young ages is recommended in patients with CCD in order to intercept peculiar dento-skeletal anomalies during growth. The anatomical features described in this study can help the orthodontist in the early diagnosis and treatment of CCD patients. Still, studies including larger samples are suggested.

0383

Enamel Microcracks Following Debonding: Can the Risk of Tooth Damage Be Predictable?

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Objectives To determine if the predictions about the irreversible changes in the tooth structure after debonding could be made from a set of enamel microcracks (EMCs) characteristics (severity, direction, location, age group) and type of the bracket used at the beginning of treatment.
Methods Measurements of the detailed EMCs parameters were obtained from the consolidated images (stitching of high resolution scanning electron microscopy micrographs) of the buccal tooth surface and our derived formulas (x=h/30, l=n*x) before and after metal and ceramic brackets removal. For statistical analysis the Statistical Package SPSS 17.0 was applied.
Results Severity of EMC (visible or invisible by the naked eye) and age group of the tooth had a significant effect on the extent of tooth damage during debonding. The odds of greater enamel damage were higher for pronounced EMCs (odds ratios, OR=2.633;

P<0.05) and for the teeth from the older age group (OR=3.083; *P*<0.05). The effect of bracket type, direction, and location, was also evident, but not statistically significant. Using ceramic brackets, the odds of having greater extent tooth damage increased by a factor of 1.695 (69.5%). For 1 degree more inclined EMCs (in relation to the longitudinal axis of the tooth crown), the odds of greater undesirable changes in the enamel structure decreased by a factor of 0.715 (28.5%). For an additional millimeter in the distance (i.e. from the occlusal towards cervical part of the tooth), the odds of greater enamel damage were lower by a factor of 0.659 (34.1%).
Conclusions Only visibility of EMCs before bonding is of low prognostic value for predicting EMCs increase during brackets removal. However, EMCs showing a set of specified characteristics (i.e. pronounced EMCs of the teeth from the older age group possessing vertical or oblique inclination, and located closer occlusal surface) at the beginning of treatment might predispose to higher risk of greater extent enamel damage during debonding by 21.5%.

0384

Dentofacial Differences between Syrian and Hungarian Adolescents with Class-II/1 Malocclusion
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Objectives Due to the trends of recent migration, particularly in Europe, for the correct treatments updated studies are required to compare the dentofacial characteristics of the new migrants and the population of European descent. Therefore, this study aimed to assess the differences found in dentofacial structure between Syrian and Hungarian adolescents with the most common malocclusion (Class-II/1 malocclusion).
Methods Samples consisted of 86 patients: (1) 43 Syrian patients [age:14.3$_{y}$±1.5, (mean±S.D.)], and (2) 43 Hungarian patients (age:14.3$_{y}$±1.9), including 24 females and 19 males in each ethnic group. The evaluation was based on lateral cephalometric radiographs and orthodontic models. McNamara cephalometric analysis was performed using special orthodontic software (OnyxCeph$^{3™}$), and orthodontic model measurements were undertaken using a universal digital caliper. Data were analyzed by SPSS software, statistics were performed with two-sample *t*-test, and the significance levels were established at 0.001, 0.01 and 0.05.
Results Comparisons between Syrian (Syr) and Hungarian (Hun) groups revealed that the Syrian group had steeper mandibular planes [Syr:29.8°±5.6, Hun:23.9°±5.2, (mean±S.D.), P<0.001], more proclined mandibular incisors (Syr:4.8$_{mm}$±1.9, Hun:1.5$_{mm}$±2.3, P<0.001), and larger Bolton's anterior tooth-size ratios (Syr:80.4$_{\%}$±3.0, Hun:78.6$_{\%}$±2.4, P<0.01). The Hungarian group had more protruded maxillas (Syr:0.0$_{mm}$±2.3, Hun:1.4$_{mm}$±2.7, P=0.01), and shorter mandibles (Syr:108.0$_{mm}$±5.6, Hun:105.4$_{mm}$±6.2, P<0.05). Both examined groups had decreases in maxillary intermolar widths compared to the normal; however, there was no significant difference between the two groups (Syr:33.6$_{mm}$±2.2, Hun:32.9$_{mm}$±2.8, P>0.05).
Conclusions Based on our findings, the main cause of Class-II/1 malocclusion in the examined groups was different; it reflected a horizontal problem in Hungarians whereas it was a feature of a vertical problem in Syrians. Therefore, the results of this study have significant clinical implications regarding treatment decisions to establish a long-term stability of the results for Syrian and Hungarian adolescents.
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0384.1

Bracket Design Interferes in *F.nucleatum* Levels in Gingival Crevicular Fluid.
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Objectives Fixed orthodontic appliance compromises the proper oral hygiene while increasing the plaque accumulation and microbial contamination. Different types of brackets seem to influence the disruption of microbial environment, but some of them could provide more retentive sites than others, thus increasing the amount of microbial species. Therefore, the aim of this study was to evaluate the influence of bracket design on the gingival crevicular fluid levels of *Aggregatibacter actinomycetemcomitans* (*Aaa*), *Tannerella forsythia*, *Fusobacterium nucleatum* and *Porphyromonas gingivalis* in patients under different fixed appliance design.
Methods Sixty samples of gingival crevicular fluid (11 male and 9 female; ranging from 11 to 15 years old) were analysed before 30 (T1) and 60 (T2) days after bonding either two self-ligating (In-Ovation®R and SmartClip™) or one conventional bracket, used with elastomeric ligatures (Gemini™). Total DNA from samples was extracted using CTAB-DNA precipitation method and Real-Time PCR was performed to analyse the bacterial levels. Hierarchical clustering followed by non-parametric Friedman test were used for data analysis (p value of <0.05).
Results Clusters analysis demonstrated that SmartClip™ bracket had similar distribution for *P. ginigvalis* and *T. forsythia* at T2, followed by *F. nucleatum* at T1 and T2. The *Aaa* levels at T1 and T2 were the most dissimilar. The same could be observed in the In®OvationR. In the Gemini™bracket, *F. nucleatum* at T1 presented a quite similar distribution to *P. ginigvalis* and *T. forsythia* at T2. Overall the levels of the different species were similar with exception of *F. nucleatum* after 30 days of bonding, that presented the highest level in the SmartClip™ bracket when compared with Gemini™ (p=0.018).
Conclusions The bracket design modulates the subgingival levels of bacterial species associated to periodontal disease. The self-ligating bracket SmartClip™ presented the highest subgingival levels of *F. nucleatum* when compared with Gemini™.

0385

The Influence of a Laser Modified Zirconia Implant Surface on Human Osteoblast In-vitro Behavior

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Objectives To evaluate the influence of laser passes in groove-texture zirconia implant surfaces on the in vitro response of human fetal osteoblasts

Methods Laser manufactured, meso-scale groove textured zirconia (YTZP) discs were produced using press-and-sintering techniques. All surfaces were treated with Nd:YAG laser to produce 25µm-spaced grooves. Each group had different number of laser passes (group A: 1; B: 2, C: 4 and D: 8 passes) in each groove site. Untextured zirconia discs were used as controls (UT). Sandblasted and acid-etched (SB-AE) protocol was applied to all samples to achieve 2.25 ± 0.42 µm mean surface micro-scale roughness. Human osteoblasts were cultured for 14 days by previously described methods. Cell morphology and adhesion were observed using scanning electron microscopy (SEM). Cell viability was evaluated at pre-defined time-points (1,3,7 and 14 days) using a commercial resazurin-based method. Alkaline phosphatase (ALP) activity of human osteoblasts was evaluated at 7 and 14 days using an enzymatic colorimetric assay. Collagen type I were evaluated at 3 days using enzyme-linked immunosorbent assay. All results were presented as mean ± standard deviation (SD). Group comparisons were tested using Anova (Tukey's post-hoc) using appropriate statistical software and significance was set at $p<0.05$.

Results Cell viability and proliferation increased over time for all groups, although without statistically significant differences between them ($p>0.05$), but significantly higher when compared to UT control ($p<0.05$) for 7 and 14 days evaluation. Collagen I levels were higher for all groups when compared to UT control ($p<0.05$) and ALP activity was significantly increased in group D and UT control when compared to other groups at 14 days ($p<0.05$).

Conclusions Osteoblast viability, proliferation and differentiation were significantly enhanced by laser surface groove texturing. A tendency towards an enhanced osteoblast differentiation for higher number of laser passes should be further investigated.

0386

Osseointegration of Implants with Different Surface Characteristics. Pre-clinical In-vivo Study

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Objectives The purpose of this experimental investigation is to investigate whether two dental implants with similar macro-design but with two different surface topographies demonstrate improved histological outcomes in terms of improved osseointegration and maintenance of adequate soft tissue dimensions.

Methods The study is an experimental randomized controlled preclinical study in beagle dogs evaluating two healing periods: 2 weeks and 8 weeks after implant placement. Eight animals were included in each of the healing periods contributing to 4 implants and abutments (test and control) for each healing period. Two different implants with the same macro design (MIS straight) with two different surface characteristics were tested.

Three months after mandibular premolars and mesial root of the first molar extraction implants where placed on the right side of the mandible. Following the randomization code, all implants were installed according to the manufacturer's protocol. Healing abutments were secured, and flaps sutured to allow a transmucosal healing. According to the experimental design and the sacrifice schedule, the same procedure was repeated on the left side of the mandible 2 weeks before sacrifice.

Micro CT of the specimens was performed and 360 bone to implant contact as well as the ratio between bone volume/tissue volume was evaluated. Specimens were processed for ground section analysis. Histomorphometric data were measured: Distances between implant shoulder - first bone to implant contact (I-B), implant shoulder – bone crest (I-BC) and bone crest – first bone to implant contact (B – BC) were analyzed, as well as bone to implant contact.

Results In micro CT analysis, both test and control group experienced a statistically significant increase by means of BV/TV(12,17% and 16,89%) and a significant increase ($p=0,000$) of 360BIC (16,89% and 16,89%)) when comparing with the same group T2. No significant differences were found between both groups. Histometric results concluded that the distance between BC-B is statistically significant smaller ($p=0,036$) in the vestibular aspect in test group (0.11mm vs 0.46 mm)

Conclusions Within the limitations of this study, no major differences were found in terms of osseointegration in implants with different surface characteristics.

0387

Effect of implantoplasty on the Surface Roughness and Chemical Composition

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Objectives Implantoplasty is the debridement and smoothening of the exposed titanium implant surface following peri-implantitis. The objective was to characterize the surface roughness and the chemical composition of the titanium surface and the implantoplasty debris following *in vitro* treatment.

Methods Titanium coins (height 2 mm, diameter 6 mm) were polished with one of six bur sequences. A sequence of diamond burs or carbide burs alone (in descending roughness), or followed by either Arkansas stone bur or silicone burs, were utilized for the implantoplasty procedure. Machined and sandblasted + acid-etched coins were used as control. The implantoplasty debris

was collected in a water tank. The surface topography was characterized in a profilometer. A scanning electron microscope and energy-dispersive X-ray spectroscopy was used for characterization of the topography and elemental analysis of the surface and the implantoplasty debris.
Results The carbide-bur sequences demonstrated smoother surfaces than the diamond-bur sequences. Silicon burs resulted in smoother surfaces than the Arkansas bur, but both were smoother than the use of diamond- and carbide-burs alone.
The relative quantity of titanium on the surface decreased with all implantoplasty protocols ($P<0.004$). The relative quantity of oxygen on the surface was higher after treatment with carbide burs ($P<0.012$). Implantoplasty sequences with silicon burs led to more silicone on the surface and in the debris. The relative quantity of carbon is higher in the debris than on the surface following implantoplasty.
Conclusions Implantoplasty alters the surface roughness and the elemental composition of the titanium surface. The choice of burs affects the surface roughness and the chemical composition of the titanium surface and the debris from the implantoplasty procedure.

0388

Different Root-biomodification Procedures on Root Surfaces: An In-Vitro SEM Analysis.
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Objectives Agents for root surface modification are used in an attempt to remove smear layer and exposing collagen to varying degrees. Biomodification is important for successful periodontal wound healing in terms of fibroblast migration and attachment and other cellular events. However, there is paucity of information about which modification agent is the best for root surfaces. The aim of this study was to evaluate surface changes following the application of different biomodification procedures, as mechanical instrumentations, chemical agents and Er:YAG laser on periodontally diseased root surfaces by using scanning electron microscopy (SEM) microphotographs.
Methods Seventy-five specimens, obtained from 38 periodontally, hopeless, single-rooted human teeth were randomly divided into 5 groups. Group A served as negative control with no treatment application on specimens (n=15). On specimens of Group B scalling and root planning (SRP) was performed by using hand instrument (5/6 Gracey curette) (American Eagle Instruments®) and ultrasonic scaler with a tip specifically designed for root surfaces (Acteon® H3) (n=15).
In groups C, D and E specimens were treated with the application of SRP+ Citric acid (n=15), SRP+EDTA (n=15) and SRP+Er:YAG (n=15) respectively. After the dentin treatments, the specimens were analysed for the presence or absence of smear layer on microphotographs according to the root surface and smear layer morphology index.
Results SRP+Citric acid group revealed the most efficient removal of smear layer followed by SRP+EDTA, SRP and SRP+Er:YAG laser groups respectively.
Conclusions Although all mechanical and chemical agents used for the root conditioning purposes removed smear layer, citiric acid combined with SRP was found as the best. Present findings of this study warrant further cell culture studies to evaluate the biocompability of the treated root surface.

0389

Profilometric-analysis of Periodontally-diseased Root Surfaces After Different Root Surface Instrumentation Tools.
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Objectives The topography of the root surface plays an important role in plaque accumulation cell adhesion, and periodontal healing. The aim of the study is to evaluate, root surface changes profilometrically resulting from root surface debridement with stainless-steel curette, laser chisel tip, a new ultrasonic piezoelectic device tip and titanium-nitride curette.
Methods Forty dentin blocks of buccal and lingual root surfaces were obtained from 20 single rooted periodontally diseased hopeless teeth and randomly divided into 4 groups. Each group were subjected to different root instrumentation tools: stainless steel Gracey curette (American Eagle Instruments®) (Group 1); titanium-nitride Gracey curette (TiN) (American Eagle XP® Technology) (Group 2); ultrasonic piezoelectric device with a special tip designed for root surfaces (Acteon® H3 tip) (Group 3); and laser chisel tip (Laser) (VersaWave/Hoya-Con Bio) (Group 4). A calibrated operator instrumented all surfaces in each group. The root surfaces were profilometrically evaluated before and after instrumentations.
Results There was no statistically difference between the initial roughness levels of the groups. TiN curretes revealed the most prominent effect on smoothing the surface whereas Laser chisel tip showed the highest roughness in comparison to the other root surface instrumentation tools. No significant difference was found between Acteon H3 and TiN curettes.
Conclusions Considering the importance of root surface roughness after treatment for the success of periodontal therapy TiN curretes was the most periodontally appealing tool followed by Acteon H3, stainless steel Gracey curette and Er:YAG laser.

0390

Influence of Delivery Format on the Efficacy of Adjunctive Antiseptics.

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Objectives To conduct a systematic review of randomized clinical trials (RCTs) that evaluated if the delivery format (mouthrinse or dentifrice) influences the efficacy of adjunctive chemotherapeutics in reducing gingival and plaque indices in patients with gingival inflammation.
Methods A search protocol was designed to identify 6-month RCTs that investigated efficacy of adjuncts to mechanical plaque control on gingival and plaque indices. Electronic searches were conducted in three databases. Outcomes were summarized as means and standard deviation (SD) or standard error of the mean. The results were pooled and analyzed using weighted mean differences (WMD) or standardized mean differences (SMD) and meta-regressions were performed.
Results Out of 1,139 references, 94 were included in this review and 70 studies were included in data analyses. Similar reductions in gingival inflammation were reported for dentifrices (n=36; SMD=-1.377; 95% CI [-1.770; -0.984]; p<0.001) and mouthrinses (n=33; SMD=-1.124; 95% CI [-1.374; -0.874]; p<0.001). Meta-regression did not find any significant differences in terms of gingival index reduction when comparing dentifrices and mouthrinses (coefficient=0.243; 95% CI [-0.353; 0.840]; p=0.418). However, mouthrinses yielded greater plaque index reductions (n=43; SMD=-1.231; 95% CI [-1.490; -0.973]; p<0.001) than dentifrices (n=45; SMD=-0.803; 95% CI [-1.054; -0.552]; p<0.001). Meta-regression revealed that antiseptics in mouthrinses resulted in statistically significant greater reductions in percentage of plaque (coefficient=13.80%; 95% CI [2.40%; 25.10%]; p=0.020) and almost significant reductions in plaque index (mean difference=0.423; 95% CI [-0.169; 0.864]; p=0.059) compared to dentifrices.
Conclusions Mouthrinses containing antiseptics resulted in greater reductions in plaque indices compared to dentifrices. Nevertheless, there was mixed evidence to support which delivery vehicle for antiseptics is most efficacious in reducing levels of gingival indices.

0391

Effect of Periodontal Treatment in Patients with Periodontitis and Diabetes: Systematic Review and Meta-Analysis

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Objectives To evaluate the effect of scaling and root planing (SRP) on the metabolic control and systemic inflammation of patients with type 2 diabetes (T2D).
Methods A literature search was conducted using the MEDLINE database via PubMed and the Cochrane Central Register of Controlled Trials, from their oldest records up to July 2018. Only randomized clinical trials (RCT) were considered eligible for evaluating the effect of periodontal treatment on markers of metabolic control (glycated hemoglobin [HbA1C]) and systemic inflammation (C-reactive protein [CRP]) in patients with T2D. The quality of the studies was evaluated using the Cochrane Collaboration risk assessment tool. Meta-analyses were performed for HbA1c and CRP using random effects models. The size of the overall intervention effect was estimated by calculating the weighted average of the differences in means (DM) between the groups in each study. Heterogeneity was assessed using the Q-statistic method (x^2 and I^2). The level of significance was established at $p<0.05$.
Results Nine RCT were included. SRP was effective in reducing HbA1c (DM=0.56 [0.36-0.75]; $p<0.01$) and CRP (DM=1.89 [1.70-2.08]; $p<0.01$). No heterogeneity was detected ($I^2=0\%$, $p>0.05$).
Conclusions SRP has an impact on metabolic control and reduction of systemic inflammation of patients with T2D.

0392

Effect of Probiotics on Periodontopathogenic Bacteria: Meta-analysis

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Objectives Periodontitis is a progressive, and difficult to treat disease. Oral probiotic treatment could serve as a novel promising treatment option. However, findings in the published literature are inconclusive regarding its efficacy. Thus, we aimed to evaluate the reduction of periodontopathogenic bacteria between probiotic treated and placebo groups.
Methods The meta-analysis was performed according to PRISMA guidelines. The systematic search was carried through PubMed, Cochrane Library, Embase and Web of Science databases. Randomized controlled trials (RCTs) written in English, studying periodontal disease patients without systematic disease were included in our meta-analysis. Data on changes in bacterial numbers of five species, *Aggregatibacter actinomycetemcomitans* (*Aa*), *Porphyromonas gingivalis* (*Pg*), *Prevotella intermedia* (*Pi*), *Tanellera forsythia* (*Tf*) and *Fusobacterium nucleatum* (*Fn*) up to 9 weeks after initial treatment were extracted and analyzed by using standard mean difference (SMD) and the random effects model with the DerSimonien-Laird estimation.

Heterogeneity was tested using I^2 and chi^2 tests.
Results Literature search yield 668 records without duplicates. Six studies were eligible for statistical analysis. The results revealed that the reduction of *Aa* in the probiotic group was significantly stronger than in the placebo group at 4 and 9 weeks (SMD:-0.56, 95%CI:-0.89,-0.23; I^2=0.0%, p=0.603 and SMD:-0.32, 95%CI:-0.62,-0.03; I^2=0.0%, p=0.0993, respectively). In contrast, the reduction of *Pg* in the two groups was not significantly different after 4 and 9 weeks of treatment (SMD:-0.01, 95%CI:-0.52, 0.50; I^2=79.8%, p=0.000; SMD:-0.01, 95%CI:-0.59, 0.57; I^2=86.0%, p=0.000, respectively). Similarly, no difference in bacterial counts was observed between the probiotic and the control groups for *Pi*, *Tf*, and *Fn* after 4 and 9 weeks of treatment.
Conclusions Our results indicate that orally administrated probiotics significantly reduce *Aa* counts while *Pg*, *Pi*, *Tf* and *Fn* remain unaffected. To further investigate the effects of probiotics on pathogenic bacteria, well-designed RCTs are needed.

0393

Long-term Impact of Powered Toothbrush on Oral Health: 11-year Cohort Study
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Objectives This study aims to assess 11-year longitudinal effects of powered toothbrush on periodontal health, caries and tooth loss in an adult population.
Methods Participants of Study of Health in Pomerania (SHIP) cohort with dental examinations and interview data at SHIP-1, SHIP-2 or SHIP-3 examinations were included. Mixed-effects linear regression models were constructed between the exposure (manual versus powered toothbrush) and outcome variables (periodontal status using mean probing depth (PD) and mean clinical attachment loss (CAL), caries status using DMFS and DFS scores, and tooth loss); adjusting for potential baseline covariates.
Results Final baseline (SHIP-1) study sample comprised of 2819 participants. Powered toothbrush users increased from 18.3% (SHIP-1) to 36.9% (SHIP-3); were younger; had significantly less mean PD [β:-0.09 (95% CI: -0.16; -0.02)] and mean CAL [β:-0.19 (95% CI: -0.32; -0.07)] progressions; 17.7% less DMFS progression and 19.5% more teeth retained than the manual tooth brushers'.
Conclusions In the long-term, powered toothbrush seems to be effective in reducing mean PD and mean CAL progressions, besides increasing the number of teeth retained. Short-term interventional studies have proved their effectiveness, and the findings from this long-term cohort study attest this association. Therefore widespread usage of powered toothbrushes can be recommended.

0394

Long-term Metabolic Syndrome is Associated with Periodontal Pockets and Alveolar Bone Loss
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Objectives Several cross-sectional studies have reported an association between metabolic syndrome (MetS) and periodontitis, but only a few longitudinal studies have shown that a long-term metabolic burden predisposes to the progression of periodontitis. We investigated whether a long-term exposure by MetS is associated with deepened periodontal pockets and alveolar bone loss.
Methods The Northern Finland Birth Cohort 1966 survey (NFBC1966) is a life-span cohort study of individuals born in 1966. In 2012–2013, when the cohort was 46 years old, an oral health examination including measurements of periodontal pocket depths (PD ≥ 4 mm) and alveolar bone level (BL ≥ 5 mm) were made for the first time. Based on the AHA/NHLBI definition, manifestation of MetS was defined as follows: (i) MetS at the age of 31, (ii) MetS between ages 31 and 46years: < 15 years or ≥ 15 years and (iii) MetS at the age of 46. The associations of MetS with the numbers of sites with PD ≥ 4 mm and BL ≥ 5 mm, were investigated using Poisson regression models (RR, 95% CI).
Results RRs for PD ≥ 4 mm and BL ≥ 5 mm were higher in individuals with an exposure to MetS of ≥ 15 years (RR 1.8, 95% CI 1.6–2.1 and RR 1.5, 95% CI 1.3–1.9, respectively) than in those whose exposure was < 15 years (RR 1.2, 95% CI 1.1–1.3 and RR 1.1, 95% CI 1.0–1.3, respectively). Consistently stronger associations were found in never-smokers. Females showed stronger associations of MetS with PD ≥ 4 mm than males. The association with BL ≥ 5 mm was observed only in males.
Conclusions A long-term exposure by MetS was associated independently and in an exposure–dependent manner with periodontal pockets and alveolar bone level.

0395

VDR *Fok*I Polymorphism Influences *Porphyromonas gingivalis* Levels in Subgingival Plaque

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Objectives This cross-sectional study investigated the association between the vitamin D receptor (VDR) *Fok*I polymorphism and levels of five target bacteria in subgingival plaque.
Methods *Fok*I genotyping and bacterial quantification were performed using real-time polymerase chain reaction. Regression analyses were used to examine the associations between *Fok*I polymorphism and levels of target species. Effect modification by periodontal status, smoking, or alcohol consumption was assessed.
Results The study population comprised 1,460 individuals, aged 39-66 years old. Individuals carrying the *Fok*I risk genotypes (CC+CT) had higher *Porphyromonas gingivalis* levels, compared to those with the non-risk genotype (TT) (p=0.030). No significant differences between genotypes were found for other target species (p>0.05). After multivariable adjustment, the *Fok*I risk genotypes were significantly associated with increased *P. gingivalis* levels (regression coefficient (β) ± standard error (se) =0.665±0.322; p=0.039). The magnitude of this association was similar in individuals with and without periodontitis (p for interaction=0.820). In contrast, the magnitude of this association was greater in smokers (β±se=1.876±0.763; p=0.014) compared to non-smokers (β±se=0.403±0.355; p=0.257) and drinkers (β±se=1.308±0.563; p=0.020) compared to non-drinkers (β±se=0.353±0.392; p=0.368). However, the interaction terms were not statistically significant (p for interaction=0.080 and 0.164, respectively).
Conclusions Our findings suggest that the VDR polymorphism may influence the levels of periodontal bacteria, particularly in smokers and drinkers.

0396

Caries and Periodontal Diseases Among Employed Adults in Spain

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Objectives To elucidate if there is an association between caries and periodontal diseases in a representative sample of the Spanish employed population.
Methods WORALTH (Workers Oral Health) is a cross-sectional study including 5,154 participants selected with a stratified random sampling method. Oral examination was carried out in 5,130 subjects, following the WHO criteria for Oral Health Surveys. Periodontal status was assessed by clinical attachment level (CAL)(categorized in 0-3 mm, 4-5 mm and ≥6 mm) and Community Periodontal Index (CPI) in selected teeth. Subjects were classified by the presence/absence of CAL≥6 mm or CPI≥3. For caries, each tooth (T) was classified as healthy, decayed (D), decayed filled (F), not-decayed filled or missed due to caries (M); and DMFT index and prevalence of active caries were calculated. Linear and logistic regression models adjusted for potential confounders were performed.
Results DMFT index increased with the increase in CAL category, reporting values of 7.76 (95% Confidence Interval [CI] [7.6; 7.93]), 9.59 (95% CI [9.15; 10.02]) and 10.46 (95% CI [9.81; 11.1]) for CAL 0-3 mm, 4-5 mm and CAL≥6 mm, respectively. After adjustment for confounders (age, sex, tobacco consumption, education level, occupation, level of oral hygiene), the presence of CAL≥6 mm increased in 0.26 the DMFT index (95% CI [0.04; 0.48]; p<0.001) and the presence of CPI≥3 was significantly associated with the prevalence of active caries (odds ratio, OR=1.44, 95% CI [1.24; 1.68], p<0.05)
Conclusions The presence of CAL≥6 mm and CPI≥3 were moderately associated with an increased prevalence of active caries in a representative sample of Spanish employed adults.

0397

Oral Health and Periodontal Disease: 5th and 6th Grade Medical Students' Behaviour and Knowledge

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Objectives The neccessary knowledge on oral health and periodontal disease (PD) is essential for medical students to promote their patients general health. The aim of the study was to evaluate the oral health and periodontal disease behaviour and knowledge of the 5th and 6th grade medical students.
Methods Medical students were informed that participation to the study was in voluntary basis. A written consent was required from all students. Before starting their clinical work a questionaire containing 15 questions was distributed among officially registered 283 medical students of Marmara University and was immediately collected upon completion.
Results Out of 283, only 271 (95,8%) students willingly participated in the study. Of the participants, 82% of 5th and 85% of 6th grade visited the dentist ≤1 year (P>0,05). Although 75% of the 5th grade students compared to 86% of the 6th grade ones acknowledged that brushing and flossing were essential for maintaing periodontal health (P=0,020), only about 30% of both grades student used interdental brushes. Both grades similarly experienced bleeding while brushing (36% vs. 31%) (P>0,05). However, 23% of the 5th grade students compared to 8% of the 6th grade were diagnosed with PD (P=0,001). More 5th grade students compare to 6th grade indicated that their oral hygiene knowledge was poor (P=0,009). Nevertheless, about 90% of both grades students correctly identified PD defination and its clinical findings (P>0,05). Both grades equally (P>0,05) thought that good periodontal health and oral health were an integral part of general health and treatment of PD was important.

Conclusions Although medical students had some knowledge about PD it didn't reflect on their oral hygiene behaviour. Higher knowledge found among 6th grade students was probably due to increased clinical experience.

0398

Generalized Oral Infections and Oral Health in Patients Referred to Dental Foci Eradication at Helsinki University Hospital During 2012-2017

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Objectives Bacteria entering the bloodstream through oral cavity cause bacteremia, which can further lead to septic infections or distant site infections. The aim was to study the underlying disease profile and need of dental care in patients referred to examination and eradication of oral infection foci.

Methods All patients (n = 134) between years 2012-2017 referred to department of Oral and Maxillofacial Diseases, Helsinki University Hospital, for treatment of infections suspected to be the source of bacteremia were included into retrospective analysis. Patients were identified by ICD-10 diagnoses codes for systemic or remote infections. Data was recorded from both medical and dental patient records. Patient's socioeconomic status was classified by using Skapinaki's classification for socioeconomic status: I and II for high, III intermediate, and IV-V for low. Underlying medical conditions were retrieved according to McCabe classification: 0=healthy, 1=non-fatal, 2=ultimately-fatal, and 3=rapidly fatal diseases.

Results 79% were men, mean age 56 years, socio-economic status was I 12%, II 60%, III 4%, in 24% status could not be assessed. McCabe classes were: 0 13%, I 76%, II 9% and III 2%. Comorbidities included heart disease 61%, diabetes 20%, cancer 19%, mental disease 14%, autoimmune disease 12% and rheumatic arthritis 7%. The patients were mostly referred from Depts. of Internal Medicine (40%), Infectious Diseases (40%) and Cardiology (4%) and from surrounding local hospitals (16%). Seventy-two % of patients needed dental extractions. The mean number of extracted teeth was 2.8 (range1-28). Other dental treatment's needs were 28% periodontal, 22% restorative, and 2% endodontic.

Conclusions Oral infections and need for dental care were indeed common among patients with generalized infections indicating that treating physicians should be aware of oral cavity as a potential source of infection. Need of tooth extraction in almost three fourths of patients is alarming reflecting poor oral health status in these patients.

0400

Clinical, Radiological, CBCT and Intrasurgical Comparison of Furcation Involvement Diagnosis.

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Objectives The aim of this study was to evaluate and compare the detection efficacy of different diagnostic methods for furcation involvement, including clinical evaluation, periapical (PA)and panoramic radiograph (OPG), cone beam computer tomography (CBCT),compared with the intrasurgical assessment.

Methods An observational diagnostic study was performed in patients diagnosed with generalized chronic and aggressive periodontitis with furcation involvement. A full-mouth manual probing with full-mouth PA and OPG examination were performed. Furthermore, the presence of furcation involvement (FI) was also evaluated with 3D images in a CBCT analysis. Finally, intrasurgical measurements were evaluated and compared to the other diagnostic methods.

Results A total of 51patients were recruited in the study with 31 mandibular molars and 20 maxillary molars with furcation involvement. The correlation found between the different diagnostic methods assessed was greater in the mandibular molars than in the maxilla. In the mandible, the intrasurgical measurements revealed high agreement of detection when compared to clinical, CBCT and radiographic measurements (72%, 71% and 70% respectively, with kappa index 0.80), and with better correlation in the buccal entrances. In the maxilla the agreements were lower, with higher agreements of detection for CBCT and clinical probing (60% and 63% respectively; kappa index of 0.75 and 0.71) when compared to intrasurgical. The intraoral radiographs revealed high agreement in the mandible when compared to the CBCT, but lower agreements with the other diagnostic methods.

Conclusions A high diagnostic agreement was found between clinical, intrasurgical and CBCT furcation diagnosis in the mandibular molars. Lower agreements were found in the maxilla. The clinical furcation examination seems to be the most reliable diagnostic method.

0401

Peptidoglycan Recognition Protein 1 Associates with Subclinical Periodontitis in Finnish Adolescents

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Objectives PGLYRP1, a member of peptidoglycan recognition proteins was recently identified as a ligand for TREM-1 which is involved amplifying pro-inflammatory processes in periodontal disease. However, the role and presence of salivary PGLYRP1 in adolescents suffering from subclinical periodontitis is currently unknown. We aimed to investigate levels of triggering receptor expressed on myeloid cells 1 (TREM-1), its putative ligand peptidoglycan recognition protein 1 (PGYLRP1), and their association with MMP-8, a matrix metalloproteinase responsible for the proteolytic cleavage of TREM-1, in adolescents.
Methods Whole saliva samples (n=537) were collected from 15-16-year-old adolescents at the Kotka Health Center, Finland prior to periodontal examination which included measurement of periodontal pocket depth (PPD), visible plaque index (VPI) and bleeding on probing (BOP).
Adolescents, clustered as periodontally healthy, gingivitis or subclinical periodontitis, were tested for salivary levels of TREM-1 and PGLYRP1 by ELISA and aMMP-8 by a time-resolved immunofluorometric assay (IFMA).
Results Salivary levels of PGLYRP1 and aMMP-8 were significantly higher in adolescents with subclinical periodontitis compared to individuals with gingivitis or healthy periodontium. PGLYRP1 was positively correlated with sex, BOP, PPD, VPI, aMMP-8 and TREM-1 concentrations in saliva. Further, TREM-1 levels were higher in adolescents with subclinical periodontitis compared to healthy individuals, nevertheless, the difference did not prove to be significant.
Conclusions The increased salivary PGYLRP1 levels in adolescents with subclinical periodontitis and its positive correlation with TREM-1 and MMP-8 may indicate an association of this protein with initial stages of periodontal disease. Therefore, PGLYRP1 in combination with conventional risk factors can be used for detection and monitoring of periodontal disease in adolescents. It could support early diagnosis of subclinical periodontitis in adolescents.

0403

HIV-1-infection Affects Periodontal Clinical Parameters

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Objectives To estimate the effect of HIV-1-infection (HIV-1-I) on the diagnosis of periodontitis and the periodontal clinical parameters.
Methods Two hundred seven individuals being treated at the School of Dentistry, Estácio de Sá University, were recruited: 74 HIV-1-infected and 133 non-HIV-1-infected. One hundred and ten had periodontitis and 97 did not. The effect of “HIV-1-I” on the diagnosis of periodontitis (0 = "no" and 1 = "yes") and periodontal clinical parameters [BOP (0 = "<10%" and 1 = "≥ 10%", PPD (0 = "≤ 3 mm" and 1 = "> 3 mm") and CAL (0 = "≤ 2 mm" and 1 = "> 2 mm") were estimated using binary logistic regression models.
Results All HIV-1-infected patients were on HAART and most had HIV-1 plasmatic viral load range 0 -1000 copies/ml [n = 21 (58.3%)]. T CD4 lymphocytes range 200-400 cells/mm^3 was observed in 47.5% (n = 19) of HIV-1-infected individuals. The univariate logistic regression (unadjusted), "HIV-1-I" did not show a significant effect on the diagnosis of periodontitis. The variables "HIV-1-I" (OR = 2.97, 95% CI: 1.47-6.00) and "age" [range 36-50 years old (OR = 3.39, 95% CI: 1.71-6.72); > 50 years old (OR = 4.83, 95% CI: 1.75 - 13.29)] showed an effect on the "BOP" outcome in the multivariable regression model (adjusted). The "CAL" outcome was not impacted by the "HIV-1-I" variable. The variables "smoking" (OR = 3.01, 95% CI: 1.29 - 7.03) and "age" [range 36-50 years old (OR = 5.45, 95% CI: 1.72-17.30) had a direct effect on "PBS", while "HIV-1-I" presented an inverse effect (OR = 0.055; 95% CI: 0.12-0.25).
Conclusions HIV-1-infection does not present effect on the diagnosis of periodontitis. Regarding periodontal clinical parameters, HIV-1-infection demonstrates a direct effect on BOP and an inverse effect on PPD, but not on CAL.

0404

Effect of Polishing-Wheels on Composite-Resin Surface Properties and Bacterial Adhesion

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Objectives Bacterial adhesion to composite resin restorations is the first step in biofilm accumulation that may cause gingivitis and secondary caries formation. The aims of the present study was to compare the effect of different finishing and polishing means on composite resin surface properties and bacterial adhesion.
Methods Composite resin discs were assigned to four different finishing and polishing test groups; (i) no finishing (mylar strip control), (ii) finishing burs only, (iii) Finishing burs and polishing discs, and (iv) Finishing burs and polishing wheels. Following treatment discs were evaluated for surface roughness using SEM and non-contact profilometer, surface hydrophobicity using contact angle goniometer, salivary proteins adsorption using Bradford assay and bacterial adhesion using crystal violet assay and fluorescence microscopy.
Results Polishing wheels use resulted in a significant increase in bacterial adhesion concomitant with a significant decrease in surface hydrophobicity and an increase in salivary proteins adsorption as compared with polishing discs. Whereas, no significant

difference was observed in surface roughness between the two test groups.
Conclusions Results of the present study show that the use of polishing wheels may increase bacterial adhesion that might be associated with reduced surface hydrophobicity and increased salivary proteins adsorption rather than increased surface roughness.

0405

Effect of Saliva Contamination on Microleakage of Open Sandwich Restorations

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Objectives The aim of the present study is to determine open sandwich restorations of conventional glass-ionomer, resin modified glass-ionomer and glass hybrid ionomer materials in Class II cavities in terms of microleakage with or without saliva contamination.
Methods 60 sound human molars were selected and Class II slot cavities were prepared in mesial and distal surfaces with the gingival cavosurface margins were located 1 mm below the cementoenamel junction. Teeth were then randomly divided in 4 groups(n:15): Group I: Conventional Glass Ionomer(Fuji IX) Group II:Resin Modified Glass Ionomer(Fuji II LC) Group III: Glass Hybrid Ionomer(Equia Forte), Group IV: Composite Resin(G'aenial Posterior) Glass ionomer materials were placed to gingival floor in 1 mm thickness and resin composite was applied. Cavities in distal surface of specimens were restored with the same protocol after saliva contamination. Specimens were kept in distilled water at 37^0C for 24 hours and they were thermo-cycled for 10000 cycles at 5^0C to 55^0C. Specimens were immersed in a % 0,5 methylene blue dye solution for 24 hours. They were sectioned along mesiodistal direction vertically with a water-cooled diamond saw and dye penetration was evaluated quantitatively using image analysis. Data were statistically analyzed($p<0.05$).
Results There was a statistically significant difference between gingival microleakage scores in control group($p<0.05$). In control group, significant differences were found between Group I and other groups tested. However, in saliva contaminated groups, there was no statistically significant difference between gingival microleakage scores($p>0.05$). Also, no statistically significant difference was found between the control and saliva contaminated groups independent of dental materials tested($p>0.05$).
Conclusions Resin modified glass ionomer and glass hybrid ionomers could be preferred in open sandwich technique compared to conventional glass ionomer materials and saliva contamination did not show an adverse effect on microleakage of glass ionomer restorations.

0406

Comparative Radiopacity of Different Posterior Restorative Materials

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Objectives to investigate the radiopacity of eleven commercially available posterior restorative materials according to their mean gray values (MGVs) determined by a digital image analysis method
Methods The posterior restorative dental materials evaluated in this study were: Cerasmart 270 CAD/CAM block shade A3LT (**CS**), Amalgam (**A**), Ketac Molar shade A3 (**KM**), Cention-N (**CN**), G-aenial Universal Flo shade AO2 (**GO2**) and A2 (**G2**), Ever-X Flow Dentin shade (**EXD**) and Bulk shade (**EXB**), Equia Forte HT Fil shade A2 (**EF2**) and A3 (**EF3**), Equia Fil shade A3 (**E3**). Five disc samples (5×1 mm) were prepared for each group and 1-mm thick slices were obtained from the Cerasmart 270 CAD/CAM block group. Freshly extracted and sliced molar teeth were used for the control. The MGVs of each specimen and a 10-step aluminum (Al) stepwedge were measured via histogram function of an Adobe Photoshop CS6 program. Analysis of variance (ANOVA) was used to investigate the significance of the differences among the groups. For pairwise comparison the Tamhane test was used ($\alpha=0.05$).
Results Univariate ANOVA analysis of the data revealed statistically significant differences between the test groups ($p<0.05$). Amalgam had the highest MGV and radiopacity values amongst the test materials ($p<0.05$). The radiopacity values of dentin (0.96±0.19) and CS (0.91±0.11) were close to that of 1 mm Al while EF3 (1.95±0.24); G2 (1.77±0.45); KM (1.76±0.28); GO2 (1.52±0.24); EXB (1.31±0.24) and EXD (1.18±0.25) were respectively more radiopaque than dentin. Enamel had a radiopacity value (2.03±0,29) equivalent to 2 mm Al, where CN (2.67±0.54); EF2 (2.24±0.22); EF3 (1.95±0.24) had higher radiopacity values than enamel. Glass ionomer restorative groups, except for G2, demonstrated higher radiopacity than the tested posterior resin composites.
Conclusions Radiopacity is an essential property for posterior restorations and all materials tested in this study had MGV and radiopacity values that meet ISO requirements.

0407

Acid Reflux Impact on Dental Resin Friction

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Objectives Patients that develop reflux of stomach contents have an unusual exposure of the oral tissues to hydrochloric acid, leading to dental erosion and to the degradation of restorative dental materials. Our goal is to evaluate the effect of hydrochloric acid exposure on the surface of a composite resin.
Methods 48 samples of Filtek ™ Z250 were randomly distributed into four groups (n = 12) with two solutions, 5 mL artificial saliva (group A and B) or hydrochloric acid (0.06M, pH=1.4) (Group C and D). Groups A and C were evaluated after 24 hours and 7 days for Group B and D. All samples were submitted to a nanotribological wear test with a Nano-Tribometer (CSM Instruments SA, Peseux, Switzerland). A statistical analysis via a two-way ANOVA was performed.
Results The highest friction (μ) at 24 hours was on the HCl (0.17). After 7 days the highest friction was also on the HCl group (0.14) and the lowest in the artificial saliva (0.120). Statistically significant differences between solutions were found at the second timing (p=0.017) and in between groups.
Conclusions Friction coefficient decreased in all groups. This happens due to acid effect on the surface of the resin that wears the resin making it smoother, thus reducing friction.

0410

Marginal Adaptation, Fracture Strength and Tensile Strength of Pediatric Crowns

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Objectives The aim of the investigation was to test the marginal quality, fracture strength, tensile strength and wear of pediatric crowns.
Methods Pediatric crowns were cemented on human primary molar teeth: 3M Pediatric Esthetic Crowns (3M PEC cemented with RelyX Unicem 2), NuSmile Zirconia Crowns (NuSmileZC cemented with Ketac Cem Plus), 3M ESPE Stainless Steel Crowns (3M ESSC cemented with Ketac Cem). 8 crowns of each group were stored for 24 hours in distilled water, thermocycled and mechanically loaded using steatite antagonists (Æ 10 mm) (TCML= 4,800x5°/55°, each 2 minutes, 1,920,000x100N) in an artificial oral environment. The total simulation time was 13.3 days imitating 8 years of oral service. Marginal integrity was checked before and after mechanical loading. For the semi-quantitative analysis of the marginal adaptation both the cement-tooth- and the cement-restoration-interfaces were examined before and after TCML using a 3D microscope. Tensile strength and fracture strength was determined by mechanically loading them to failure with a universal testing machine (v=1mm/min). Appearance of fracture and occlusal wear was measured optically. Statistics: Mann-Whitney U-Test (α=0.05).
Results Perfect margin (%, median) at the interface crown/cement before/after TCML:
3M PEC (wall thickness 600µm): 93,4/89,8
3M PEC (wall thickness 550µm): 97,4/96,8
NuSmileZC: 97,7/95,0
3M ESSC: 84,9/77,2
Fracture strength (N, median):
3M PEC (wall thickness 600µm): 1213
3M PEC (wall thickness 550µm): 1483
NuSmileZC: 1170
3M ESSC: 3340
Tensile strength (N, median):
3M PEC (wall thickness 600µm): 147
3M PEC (wall thickness 550µm): 160
NuSmileZC: 255
3M ESSC: 272
No fractures were detected. Less gingival wash-out using 3M RelyX Unicem 2 Cement. 3M PEC and NuSmileZC showed fewer traces of wear than the 3M ESSC.
Conclusions Within the limitations of an in-vitro study, the results indicate that 3M PEC and NuSmileZC showed similarly good results. Clinical research is needed to confirm.

0411

Hydrophilicity of Light-Bodied Impression Materials in Unset Stage

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Objectives Aim of this study was to compare the initial hydrophilic behavior of a new light-body polyether material pairwise with several (ultra) light-bodied VPS materials in unset stage.
Methods Using pairwise comparisons, six light-bodied VPS materials [Aquasil-UltraXLV FastSet, Dentsply,#160711 (AQXL), Aquasil-Ultra+XLV FastSet, Dentsply,#160727 (AQ+X), Exafast-NDS-Injection, GC,#1704211 (EXA), Honigum Pro-Light Fast, DMG,#798450 (HON), Flexitime Correct-Flow, Kulzer,#K010130 (FLX), Panasil contact-plus x-light, Kettenbach,#181081 (PAN)]

were tested against an experimental Super-Quick Ultra-Light-bodied Polyether material (ULP). Each pair of samples was prepared simultaneously by mixing both materials and coating two glass slides with a layer of 0,2mm. Subsequently the slides were placed side-by-side. 45 seconds after start of mixing a 5µl drop of water was placed on the interface of the two materials. Initially after the drop touched the surface of the materials, the horizontal spreading distance of the waterdrop on both materials was measured by using a Drop-Shape-Analysis-System (DSA-30, Krüss). The ratio between the spread distance of ULP and the spread distance of the VPS material was calculated. A ratio of 1 means equal water spread distances, a ratio greater than 1 means superior hydrophilicity of ULP. A one-sample t-test was used to compare the ratios against the value of 1.
Results The mean ratios of water spread distance of all material combinations were statistically significantly greater than 1 ($p<0,05$, see table).
Conclusions In the unset stage the experimental Super-Quick Ultra-Light-bodied Polyether material is more hydrophilic than every light-bodied VPS-materials tested in the first moment of contact with water. The superior hydrophilicity may result in more precise and reliable impressions for the clinicians.

0412

Accuracy of the Newly Formulated Fast-setting Polyether Impression Material

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Objectives Objective of this in-vitro study was to compare the accuracy of the newly formulated fast-setting polyether impression material (FS-PE) with a regular-setting polyether (RS-PE). Furthermore, the influence of the impression technique (one-step dual-viscosity, one-step monophase) was investigated.
Methods One-step polyether impressions were examined either with dual-viscosity technique (FS-PE: Impregum Penta Super Quick heavy-body / Impregum Super Quick light-body, RS-PE: Impregum Penta H DuoSoft / Impregum Garant L DuoSoft; 3M) or monophase technique (Impregum Penta Super Quick medium-body, Impregum Penta Super Quick medium-body; 3M). The accuracy of the impression materials was evaluated by measuring dimensional changes of gypsum casts/dies generated by the respective impressions to a metal reference model. This model included two crown preparations (34, 36), one inlay preparation (45), and three precision balls on the occlusal surface in region 31/41, 37, and 46. The reference model was digitized with high accuracy (µscan with CF4 sensor, NanoFocus / MarVision MS222, Mahr). Gypsum casts (esthetic-base gold, Dentona) manufactured from the impressions were scanned (D800, 3shape) and distance changes as well as surface deviations were analysed (Matlab R2015a, Mathworks / Geomagic DesignX, 3DSystems).
Results Dimensional changes of gypsum casts compared with the master model dimensions were small and of minor clinical significance (mean deviations < 100 µm). Dimensional changes of the prepared abutment teeth 34 and 36 were very small (mean trueness: 7–12 µm), less accurate results were found for the inlay preparation 45 (mean trueness: 12.5–20 µm). Regarding accuracy, no significant effect was found for factors impression material and impression technique.
Conclusions For both impression techniques, the newly formulated fast-setting polyether impression material showed a high accuracy comparable with the commercially available polyether. Within the limitations of this study it can be concluded that impressions taken with the new fast-setting polyether are suitable for clinical use.

0413

Evaluation of Microleakage in Prefabricated and Custom-Made Abutments: An In-vitro Comparative Study

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Objectives The microgap at the implant–abutment interface is inevitable. However, the choice of a suitable abutment can minimize this gap. The aim of this study is to investigate microleakage from the implant–abutment interface using five different abutments under dynamic loading conditions.
Methods In this study, five different types of abutments were used [prefabricated titanium (A), CAD/CAM custom compatible titanium (B), hybrid (C), CAD/CAM custom titanium (D), and CAD/CAM custom zirconia (E)]. Thus, the sample consisted of five abutment type groups. Each group contained 12 abutments. These were connected to a total of 60 implants via a Morse taper internal connection. The assemblies were immersed in an Enterococcus faecalis ATCC 29212 suspension and loaded into a chewing simulator for 400.000 cycles with a force of 50 N at 1.1 Hz. Following dynamic loading, bacterial samples were taken and cultured under appropriate conditions. One assembly from each group was observed using scanning electron microscopy.
Results The five groups showed different levels of microleakage at the implant–abutment interface (Group A 33.3%, Group B 16.7%, Group C 33.3%, Group D 50%, and Group E 91.7%). The bacterial count ranged from 1908.33 cfu/mL in Group B to 34,383.33 cfu/mL in Group E. A statistically significant difference was observed between Group E and the other four groups (Kruskal–Wallis test, $p = 0.001$).
Conclusions Appropriate abutment selection is essential for minimizing microleakage. In this study, CAD/CAM custom zirconia abutments showed the highest susceptibility to microcracks. We suggest that hybrid abutments may be a suitable substitute in esthetic cases. The CAD/CAM custom compatible titanium abutment combines the advantages of both prefabricated and custom-made abutments. Therefore, it may be an acceptable selection when prefabricated abutments cannot be used.

0414

Fatigue Performance of Titanium and Zirconia Implant Abutments.

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Objectives This in vitro study investigated the fatigue performance of two different proprietary titanium and one experimental zirconia abutment designs after cyclic loading at 30 angle.
Methods Internal connection implants Seven internal hex (4.2x 13 mm) (M.I.S. Implant Technology, Israel) and C1 Conical Connection (4.2x 13 mm) implants(M.I.S.) were used. Three test groups consisted of EZ-base titanium abutments (M.I.S.) for Seven and C1 implants and zirconia abutments (Experimental, MIS) for C1 implants. All the abutments were installed using a standard titanium screw and tightened to the recommended torque of 30N/cm. The abutment-implant assemblies were tested after cementing a zirconia cap with an adhesive dual-cure cement. The implants were potted in epoxy resin 2 mm below the cervical edge of the implant. The test setup specified by the ISO 14801 test standard was used. Fifteen specimens for each group were tested under 15 Hz cyclic loading (Instron E1000 with a 2kN load cell with load control) at a stress ratio of 0.1 until $5x10^6$ to determine the fatigue resistance of the abutment-implant assemblies. Loading levels were adjusted using a pre-determined maximum fracture strength. Load-failure curve was determined by plotting load versus cycles to failure. The data was analyzed using Wilcoxon Sum Rank Test (α=0.05) for fatigue data. Fracture patterns were also classified.
Results The apparent fatigue limits of the abutment-implant assemblies calculated at 10×10^7 cycles were between 328 , 319 and 288 N for C1 zirconia, C1 EZ-base titanium and Seven EZ-base titanium abutments respectively. Zirconia abutments behaved differently compared to titanium abutments and C1 EZ-base titanium abutments was significantly different than C1 zirconia abutments. ($p<0.05$) Failures commonly occurred at the implant-abutment connection regardless of the connection type. All specimens survived the cyclic loading test without obvious screw loosening.
Conclusions Within the limitations of this study, zirconia and titanium abutments covered with a cemented cap have similar apparent fatigue limits calculated at 10×10^7.

0415

Carbon Fiber Frameworks in Implant-supported Prostheses: A Mechanical Analysis.

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Objectives The aim of this in vitro study was to analyse mechanical properties of cantilevered fixed full-arch implant-supported hybrid prostheses with carbon fiber frameworks and resin acrylic suprastructureS.
Methods 15 fixed full-arch implant-supported hybrid prostheses were fabricated on 5 Bränemark type dental implants and divided into three experimental groups of 5 each. Group A consisted of carbon fiber framework with resin acrylic; group B was carbon fiber with resin composite and group C consisted of Cobalt-Chromium with resin acrylic prostheses. All samples were thermal cycled 10.000 cycles at 5 C-55 C with 30 second dwell time. After thermal cycling, specimens were subjected to a single cantilever bending test in a universal testing machine at a crosshead speed of 0.5 mm/min until failure. Data were analyzed with Kruskal Wallis test.
Results Kruskal-Wallis test showed statistically significant differences between the 3 groups. The highest failure load values were observed for Cobalt-Chromium alloy followed by carbon fiber and resin acrylic group and the lowest values were observed for carbon fiber and resin composite group.
Conclusions Prostheses with carbon fiber frameworks showed lower failure values than those with Cobalt-Chromium frameworks. More studies are needed to consider carbon fiber frameworks as an alternative material to Cobalt-Chromium alloys in implant-supported full-arch prostheses.

0417

Stereophotogrammetry - Dental Arches Stability in Cleft Patients after Rehabilitation

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Objectives The aim of this study was to evaluate the dental arches stability in patients with complete cleft lip and palate (CLP) who received orthodontic treatment and were rehabilitated with implant - supported prosthesis comparing them with noncleft patients.
Methods The CLP and the noncleft group (NCLP) were composed of 20 patients, each group (mean age: 23.5 years; in CLP group: 7 men and 13 women, and in N-CLP group: 9 men and 11 women), with anterior and/or posterior crossbite, submitted to orthodontic treatment. Forty digital dental models were obtained with a laser model scanner, immediately after the orthodontic treatment was completed (T1) and 1 year after the implant rehabilitation treatment (T2) to evaluate the stability of dental arches. The change between T1 and T2 was obtained through the following formula: Δ= T2-T1 for each of the measures: inter-canine distances (C-C'), inter-molar (M-M') and arch length (I-M). The linear dimensions were measured digitally. The independent t-test and Man-Whitney were used for statistical analysis, and the significance level was set at 5%.

Results There was a statistical difference in the comparison of the stability between the groups for inter-canine measurement (p= 0,01), but no difference in the inter-molar measurement and total arch length. On the other hand, at the separated times, T1 and T2 demonstrated a statistical difference of the arch length (T1- p=0,01 and T2 - p=0,03).
Conclusions This study concluded that in CLP group, the maxillary dimensions are not stabilized after one year of orthodontic and rehabilitated treatment if compared with noncleft patients.

0418

The dark art of light measurement

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Objectives: Dental curing lights are medical devices that are intended to photocure resins. As such their light outputshould be adequately described. Unfortunately very few dental publications describe what light the specimens received. This makes replication of the studyproblematic.
Methods: This presentation will explain the correct S.I. radiometric terms that should be used to better describe the light output and how these measurements can be made. The effectiveness of 'lane assist' technology in curing lights will be presented.
Results: The radiant power, spectral radiant power, radiant exitance, irradiance, beam profille, and the effect of distance from the light tipdental curing lights will be presented and discussed.
Conclusions: At the end of this session, the attend should know the correct terms to use when describing curing lights and know how these measurements can be made.
The attendee will understand why the commonly used 'irradiance' value that is used to describe curing lights is just an average value across the light tip and gives little indication of what the specimen receives.

0419

3-second curing: composite and curing light characteristics

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Apart from enlarging the filler size, reducing the amount of pigments and fillers, or implementing new photo-initiators, the enhanced depth of cure in bulk-fill resin composites (BFCs) was recently adjusted by altering the polymerization mechanism of the monomer matrix. Latest involves a reversible addition-fragmentation chain transfer or RAFT polymerization, and has been incorporated so far only in two commercial available BFCs.
To speed up the restorative process with BFCs even more, dentists persistently request for shortening the curing time. Curing at short exposure times with high irradiance remains, however, controversial, since the reciprocity of radiant exposure in resin-based composite has been clearly denied. In connection with the RAFT polymerization mechanism of the monomer matrix, fast curing (3 s) with very high irradiance has been proposed as an adequate polymerization. The presentation will therefore critically assess the impact of fast curing on the curing behaviour and diverse chemical and physical parameters in a recently lounged BFC with RAFT polymerization. Apart from describing the light characteristics of the new developed light curing unit, also the material's tolerance to improper, but clinical relevant curing conditions will be quantified. Latest involves an enhanced exposure distance and an angulation of the light curing unit, as it may occur in patients when the access to a restoration is limited.

0420

Clinical experience with a 3-second curing direct restorative system: one year on

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There is a clear trend to optimize process times in restorative dentistry and make processes robust and tolerant to potential misuse. In this context, light curing has proven to be an important influencing factor. The combination of new initiator systems such as Ivocerin, agents which modify the polymerization process (Addition Fragmentation Chain Transfer reagent (AFCT)) and light curing devices with a high irradiance enables very short polymerization times without compromising the clinical quality of the restauration.Physical, in vitro and clinical data will be presented for a new fast curing composite system for direct posterior restorations, consisting of a high irradiance light curing unit (3050mW/cm2), an universal Adhesive, a flowable and a sculptable bulkfill composite.The influence of rapid curing (3 s) with high irradiance on pulp temperature will be discussed as well as the results of clinical studies with observation times of up to one year to show that 3s fast curing is not significantly different from conventional polymerization protocols and bulk fill materials in terms of clinical safety and performance

0421

Principles of clinical genetics and external apical root resorption

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While external apical root resorption (EARR) may occur concurrent with orthodontia, evidence has shown that orthodontia is one of several factors that can influence EARR. In 1975, Newman noted that some families were more prone to EARR concurrent with orthodontia than others and suggested genetics as a possible etiologic factor (AJODO 67:522-39;1975). This was strengthened with the discovery that mutations in the *TNFRSF11A* gene encoding RANK were associated with an autosomal dominant trait termed Familial Expansile Osteolysis (FEO; OMIM #174810) in which the affected individuals develop cervical root resorption. These observations, combined with the finding that the genetic variation rs1143634-T (+3954) within the *IL1B* gene was associated with chronic periodontitis (CP; J Clin Period 24:72-7;1997), led to the first reported genetic associations between EARR and orthodontic treatment (J Dent Res. 82:356-60;2003; AJODO 123:242-52;2003). However, the alleles associated with EARR were the opposite of CP. These reports illustrated how different genetic variations in the same gene could explain a Mendelian mode of inheritance for one phenotype (e.g., FEO), as well as a complex mode of inheritance for another phenotype (e.g., EARR or CP). Five years passed before the next publication on genetic factors and EARR, and many studies have followed. Some have found a statistical association between several genetic variants and some have not, reflecting either the small and possibly interactive contribution of separate genes on a complex trait, the variation of allele frequency among the different ethnic populations studied, and/or the heterogeneity of the etiologic factors influencing EARR. By the mid to late 2000's, many wondered whether a predictive gene test was at hand for EARR, like one marketed for CP. Identification of only a limited number of EARR-associated markers, however, was and is not useful for the prediction of a complex trait like EARR.

0422

What do we know about orthodontic root resorption and orthodontitis?

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Orthodontics is an exhibitionistic profession. Every orthodontist is proud to demonstrate the changes in the dentition he or she is responsible to. Nevertheless, who wants to see and later to show his own patients' resorbed roots? Although hidden from the eyes, and the need of imaging technique to detect it, the post orthodontics root resorption phenomenon is one of the most popular topic among the abundance subjects the orthodontics literature is flooded with. However, what do we know about the real causes to this phenomenon, and moreover, what do we know and practically can do in order to prevent it? The lecture will present problems and issues related to what is so called 'the most devastating phenomenon of Orthodontics' and will discuss topics like 'the relations between the force level and root resorption', the understanding of Orthodontitis, and will suggest new ways to study it, as well as will discuss some legal issues related to the topic.

0423

The genome and external apical root resorption in orthodontics in 2019

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External apical root resorption (EARR) is one of the most frequent iatrogenic consequences derived from orthodontic treatment. To date, still remains to be elucidated the full etiology of this non-desired effect, although some specific treatment-related factors along with some diagnostic characteristics have shown a moderate degree of correlation. In recent years, several attempts have been made to provide insights into the "specific" gene variations in the population that may be coding for biological scenarios that predispose to iatrogenic root resorption during orthodontic tooth movement. To date, a substantial number of in vitro and in vivo molecular, genomic, and proteomic studies have supplied data that provide new insights into root resorption. This presentation is intended to sum up the most up to date scientific knowledge that might enables us to state or refute whether there are one or more genetic profiles that predispose orthodontic patients to root resorption.

0424

Investigating Endodontic Sealers Eugenol and Hydrocortisone Roles in Modulating the Initial Steps of Inflammation

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Objectives Endodontic treatment success is achieved not only when the cement provides a hermetic seal but also when the injured periapical tissue is regenerated. However, an exaggerated inflammatory reaction hinders tissue regeneration and it has been shown that dental materials affect the inflammatory response through modulation of cytokine secretion. This work was set to investigate a hydrocortisone-containing sealer (Endomethasone N) modulatory effects on the initial steps of inflammation *in vitro*.

Methods Hydrocortisone and eugenol leaching from Endomethasone N and Pulp Canal Sealer (PCS) were quantified by ELISA and spectrofluorometry respectively. The effects of Endomethasone N and Pulp Canal Sealer were studied on Lipopolysaccharides (LPS)-stimulated human periodontal ligament (hPDL) cells. Cytokine (IL-6, TNF-a) secretion from cells was

quantified by ELISA. Inflammatory cell (THP-1) adhesion to activated endothelial cells, their migration and activation were studied *in vitro*.
Results Endomethasone N decreased secretion of IL-6 and TNF-α from hPDL cells. THP-1 adhesion to activated endothelial cells (HUVECs) and migration significantly decreased with Endomethasone N while no effect was observed with PCS. Activation of THP-1 decreased with both materials' extracts but was significantly lower with Endomethasone N than with PCS.
Conclusions These results performed *in vitro* show that Endomethasone N anti-inflammatory effects are due to the presence of hydrocortisone.

0425

Platelet Rich in Grown Factors in Control of Pain, Postextraction Dental.

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Objectives To assess the effect on pain of Platelet Rich in Grown Factors (PRGF, Endoret®) in patients undergoing tooth extraction
Methods Twenty patients (n=20), 8 men and 12 women, age range between 32 and 59 years, were selected as candidates to extract a superior canine, right or left, due to cariogenic problems. Inclusion criteria: patients of legal age, indication of simple exodontia and possibility of observation during a set time (15 days). Exclusion criteria: Teeth that were not canine, severe periodontal infection or disease, uncontrolled systemic disease and have received, in the 30 days prior to the intervention, treatment with corticosteroids/anti-inflammatories. All patients received antibiotic prophylaxis 48 hours before the intervention. All the extractions were made by the same operator. The patients were divided into two groups: Group 1, patients with socket treated by PRGF Endoret® and Group 2 (control), whose socket healed by secondary intention. The main variable studied was pain (quantitative variable), by VAS at 24 h, 72 h, 7 days and 15 days. PRGF is prepared by centrifuging the patient's blood, in 5 ml tubes, with citrate as anticoagulant (PRGF SistemVR®, BTI Biotechnology Institute, 1800 rev / min).One-way ANOVA was used for data processing. All patients were given informed consent, according to Helsinki declaration. The study was submitted to the Center's Bioethics Committee
Results After 24 h the group treated with PRGF showed a percentage of pain of 3.9% vs. to 5.9% in the control group. At 72 h, 1.5%, the group treated with PRGF Endoret® vs. 3.9% of the control group. At 7-15 days, the pain had disappeared in both groups. One-way ANOVA (Newman Keuls) was significant at 24 h and 72 h $p<0.0006$
Conclusions The group treated with PRGF showed percentages of pain significantly lower than the control group

0426

Biocompatibility Investigation of Nickel-Titanium Archwires with New Nanocoating

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Objectives Biocompatibility is interpreted as the material's ability to act with the appropriate response of the host in a particular situation. The biocompatibility refers not only to the degree of cytotoxicity, but also to the material's ability to achieve the desired biological effects after its implementation. Biocompatibility of orthodontic materials is of great importance precisely because of their long-term contact with oral tissues, potential corrosion and the release of various toxic elements due to frequent pH changes in the oral cavity. The aim of this study was to investigate the biocompatibility of nickel-titanium archwires with new nanocoating using human gingival cells in comparison with nickel-titanium and stainless steel archwires.
Methods The nanocoating consiting of TiO_2, TiN, TiN+Cu was obtained by pulsed magnetron sputtering using the commercially available nickel-titanium archwires. The samples were analized using X-ray diffraction and atomic force microscopy. The release of Ni, Ti, Cu, Fe, Cr, Zn ions into DMEM and acidic solution was conducted using ICP-OES. Biocompatibility of samples' eluates (7-day, 21-day and 28-day; n=10) was investigated using Neutral red and 3-(4,5-dimethyl-2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide test.
Results The nanocoating mainly consisted of an amorphous and crystal phases of anatase and rutile. The release of nickel was statistically lower in case of nanocoated archwires both in DMEM and acidic environment ($p<0.05$). Only the release of zinc was statistically lower in the acidic environment for all the investigated groups compared to DMEM, as the copper for the nanocoated archwires ($p<0.05$). The relative cell viability was the highest regarding the 7-day eluates of nanocoated archwires ($p<0.05$). The metabolic activity of cells decreased following the extraction time, except in case of stainless steel archwires after 21-day ($p<0.05$).
Conclusions As new nanocoated archwires showed better stability in both acidic and non-acidic conditions, as well as satisfactory biocompatibility, they may be considered for further clinical investigations.

0427

Mandibular Bone Regeneration with Rat Dental Pulp Stem Cells

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Objectives The need to treat mandibular bone defects is an important issue that motivate researchers to investigate the use of biomaterials, bone substitutes, and added elements that aim to promote bone regeneration. This study investigates the effect of introducing dental pulp stem cells (DPSCs) to the bone regeneration process.
Methods 40 male Wistar rats (350 gr), in which critical bone defects, 5 mm in diameter, in the angle of right jaw.
Distributed in 4 groups: Group 1: SHAM; Group 2: bone defect with OsteoBiol® bone membrane; Group 3: bone defect with membrane OsteoBiol and bone substitute Tecnoss® Osteobiol®. Group 4: bone defect with membrane OsteoBiol plus bone substitute Tecnoss® Osteobiol® and DPSCs.
Sacrificed 3 and 6 months after surgery, radiological study (CT), histology and the variables calcitonin, PTH, endoglin, TGFβ1 and Collagen-1α2.
Results Radiographic and histologic observation of the group 2, showed isolation of the area acting like an effective barrier excluding the non-osteogenic tissues and appearing a repair by fibrous tissue. Group 3, no bone formation is shown, the particles of the biomaterial appeared occupying the defect. Group 4 showed a complete bone regeneration of the defect at 6 months. As a marker of neovascularization, we studied endoglin essential for signaling TGF-β in endothelial cells and results showed group 4, a significant increase ($p<0.0005$) in both the expression of endoglin and in production of growth factors like TGFβ1, a powerful stimulator of bone formation, enhancing osteoblastic differentiation and synthesis of osteoid matrix. In relation to calciotropic hormones (parathormone and calcitonin) our results showed a significant increase ($p<0.0005$) in the DPSC group, stimulating osteogenesis and collagen constitutive protein of bone matrix.
Conclusions All biological actions observed show that bone regeneration was significantly higher in the defects with rat dental pulp stem cells (DPSCs), compared with other experimental groups.

0428

In-vitro* Investigation of the Effectiveness of Different Endodontic Irrigation Solutions Used Alone or Combined with other Irrigants against *Enterococcus Faecalis

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Objectives The purpose of this study is to assess the antibacterial activity of both separate and combined uses of 5.25% sodium hypochlorite (NaOCl), 2% chlorhexidine (CHX), 17% ethylenediaminetetraacetic acid (EDTA), 3% hydrogen peroxide (H_2O_2), MTAD, SmearClear (SC) and 13.8% chlorine dioxide (ClO_2) solutions against *Enterococcus faecalis*
Methods 280 single-rooted permanent human lower premolars were randomly grouped into 26 test and 2 control groups; the test groups were incubated for 24 hours with *E. faecalis* (ATCC 29212). The tested solutions and combinations were as follows: NaOCl, CHX, ClO_2, MTAD, SC, EDTA, H_2O_2, NaOCl+CHX, NaOCl+MTAD, SC+NaOCl, EDTA+NaOCl, H_2O_2+NaOCl, ClO_2+CHX, CHX+MTAD, SC+CHX, EDTA+CHX, H_2O_2+CHX, ClO_2+MTAD, SC+ClO_2, EDTA+ClO_2, H_2O_2+ClO_2, SC+MTAD, EDTA+MTAD, H_2O_2+MTAD, SC+H_2O_2 and EDTA+H_2O_2. For spectrophotometric analyses, the samples were transferred to an ELISA plate, and optic density values were recorded at 0, 6, 12, 18, 24, 30, 36, 42 and 48 hours for each sample. The data were statistically analysed using the Kruskal–Wallis and Mann–Whitney U tests. In addition, bacterial growth curves were created for each solution and its combinations.
Results In *E. faecalis* elimination, the antibacterial activity of H_2O_2, H_2O_2+NaOCl and EDTA were not found to have as much activity as the ClO_2, SC, MTAD and CHX combinations. EDTA did not show any antibacterial activity either alone or in any combination, except EDTA+CHX and EDTA+MTAD. MTAD showed antibacterial activity both alone and in all combinations. SC showed antibacterial activity in all combinations, except SC+NaOCl. CHX and all its combinations showed significant antibacterial activity against *E. faecalis*.
Conclusions The H_2O_2, EDTA and SC combinations of NaOCl were not found to be effective in *E. faecalis* elimination. ClO_2 and all its combinations were found to be significantly effective against *E. faecalis.*

0429

Dental Composites - a Low-Dose Source of Bisphenol A?

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Objectives Concerns about bisphenol A (BPA) have increased in the last decades due to its hormone-disrupting effects. As dental composite materials often contain Bis-GMA-type monomers with BPA structure in their molecules, they could be a low-dose source of BPA. The purpose of this study was to determine the maximal amounts of BPA released from “BPA-free” and Bis-GMA-containing restorative composites, and the kinetics of BPA release to methanol using liquid chromatography tandem mass spectrometry (LC-MS/MS).
Methods “BPA-free” composites Charisma Diamond (CD) and Admira Fusion (AF) and Bis-GMA-containing Charisma Classic (CC) and Filtek Ultimate (FU) were used in this study. Specimens (diameter 6 mm, height 2 mm, n=3) were light-cured from one side (20 s, 1000 mW/cm^2) and stored at 37 °C in methanol which was changed after 1, 7, 15 and 30 days. BPA concentrations were measured using dansyl chloride derivatization method with LC-MS/MS detection. The amount of BPA was expressed in

nanogram per gram of composite (ng/g).
Results The total amount of BPA released from "BPA-free" composites CD (0.27±0.10 ng/g) and AF (0.37±0.05 ng/g) after 30 days were significantly lower than from CC (6.05±0.28 ng/g) and FU (5.77±0.45 ng/g). Within the first day, all materials showed a high BPA release which decreased to the minimum at 7 days followed by a slight increase. With CD, the BPA values remained close to the lower limit of quantification.
Conclusions BPA was even detected in "BPA-free" composites, although in significantly lower amounts than in the conventional Bis-GMA composites. As the total amounts of BPA released within 30 days were substantially lower than the tolerable daily intake 4 mg/kg bw/day, these materials should not pose a health risk according to the current criteria if adequately polymerized.

0430

Cytotoxicity of Daily Use Toothpastes: *In-vitro*

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Objectives *Toothpastes are daily oral care products, the chemical composition of which is constantly changing due to manufacturer's competition. The aim of this study was to evaluate the cytotoxic effects of different toothpastes used for prevention and treatment of caries lesions on L929 cells.*
Methods Colgate Total (Colgate-Palmolive, Poland), Sensodyne Pronamel (GlaxoSmithKline, UK), Ipana Total Care (Procter&Gamble, USA), Dant Kanti (Patanjali, India), Gum Gumix (Beka, Turkey) and Tebodont (Dr.Wild&Co.AG,Switzerland) toothpastes were diluted in serum-free medium (50 w/v%) and were shaken vigorously, filter sterilized, and used immediately in the experiments. L929 cells were seeded at density of 10^4 into each well of a 96-well plate and incubated for 24 hours at 37°C. L929 cells were exposed to dilutions for 24h (n=14). Cell viability was determined by enzime activity (XTT assay). Results were statistically analyzed by one-way ANOVA followed by the Tukey test for post hoc comparisons.
Results All toothpastes except Gum Gumix have cytotoxic effects on L929 cells ($p<0.05$). There was no significant difference among Gum Gumix and control groups ($p>0.05$).
Conclusions The wide selection of toothpastes and the various ingredients make it difficult for patients to choose the proper toothpaste and complicate the acquisition of dental products by professionals. Toothpastes include active components and these may be harmful effect on oral tissue.

0430.1

Evaluation of the Awareness of Turkish Dentists About Amalgam

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Objectives In the last two decades, concerns about mercury in amalgam fillings to adversely affect their health shifted resin composite based clinical practice. The objective of this investigation was to evaluate the Turkish dentists' opinion about amalgam restorations after Minamata Convention.
Methods Electronic survey was sent to the dentists in Turkey who are members of Turkish Dentists Association. Questions didn't involve personal datas. The survey consisted of 14 multiple choice and 2 open-ended questions about dental fillings. Data were analyzed statistically.
Results A total of 1211 respondents (n=533;44% female;n=678;56% male) were analyzed;. 838 (69,2%) participants do not routinely use amalgam. 860 (71%) participants had undergraduate training about resin composite placement in posterior teeth. About 664 (71,5), 23 (2,5%), 242 (26%) of the participants used "resin composite", "glass ionomer/resin-reinforced glass ionomer", "any of these" ,respectively . Major percentage of dentists do not use amalgam fillings because of aesthetic reasons and patient requests. 456 dentists (37,7%) thought that amalgam presents no harm for both patient and dentist and 271 (22,4%) responded that amalgam presents harm for both patient and dentist. 1146 dentists (94,6%) pointed out that well-restorated amalgam restorations shouldn't be replaced with resin composite. 801 dentists (66,1%) indicated that amalgam usage as a final restoration must be stopped. 941 dentists stated that they follow the amalgam controversy from scientific documents while 721 dentists stated that they follow internet/personal coomunication.
Conclusions Within the limitations of this study, tooth colored restorative materials were popular among dentists participated in this study. Shifting to resin composite focused clinical practice has taken place among Turkish dentists.

0431

Oral Polymicrobial Community and Vulnerability of Atherothrombotic Plaques: A Cross-Sectional Study in Periodontitis Patients

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Objectives An increased risk of atherothrombotic vascular events has been reported in periodontitis patients. Periodontitis is an inflammatory disease of the tooth supporting apparatus associated with oral microbiota dysbiosis and bacteremia. The aim of this study was to investigate the biological factors underlying the association of periodontitis and atherothrombotic plaques

vulnerability.
Methods In this cross-sectional study, patients admitted for carotid endarterectomy underwent a preoperative periodontal examination. Carotid-conditioned media were used to measure markers of intraplaque haemorrhage, neutrophil activation, cytokines and pathogens. Higher blood LDL cholesterol and intra-plaque haemorrhage were considered as severe signs of atherothrombosis. Severe periodontitis endpoints were clinical attachment level ≥5mm and pocket depth ≥6mm.
Results Forty-five patients with severe periodontitis were included. The genus *Streptococcus* was identified in 84% of the carotid samples, and bacterial genera periodontitis- associated (*Porphyromonas, Prevotella, Fusobacterium, Campylobacter, Capnocytophaga*) were detected in 21% of the carotid samples by microbial whole-genome sequencing. *Porphyromonas gingivalis (Pg)* was identified by immunostaining and nested PCR in 24.4% of carotid plaques. Deep periodontal pockets were associated with higher LDL cholesterol levels ($p<0.001$). Periodontal attachment loss and serum anti-*Pg* IgA levels were inversely correlated with levels of interleukin 4, interleukin 5 and interferon-γ (all $p<0.03$) in culprit carotid-conditioned media. Lipopolysaccharides levels were correlated with Human Neutrophil Peptides1-3 levels and high-volume carotid intraplaque haemorrhage (all $p<0.01$).
Conclusions Our results suggest that periodontitis-associated microbiota may lead to increased atherothrombotic carotid plaques vulnerability. In severe periodontitis patients, translocations of oral microbiota to carotid atherothrombotic plaques promote neutrophil response in intraplaque haemorrhages.

0432

The Relationship Between Periodontitis and Levels of Anti-citrullinated Protein Antibodies in Rheumatoid Arthritis Patients. A Cross-sectional Study.

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Objectives The high prevalence of periodontitis in rheumatoid arthritis (RA) is more evident in patients with high RA disease activity. The aim of this study was to determine the relationship between periodontal parameters and the presence of anti-citrullinated protein antibodies (ACPA) in RA patients and if this association is related with the level of these antibodies
Methods This cross-sectional study included 164 RA patients. Socio-demographics and RA disease characteristics including ELISA-detected ACPA (anti-CCP-2) were recorded. Exposure was assessed by periodontal parameters: plaque index, bleeding on probing, probing pocket depth, and clinical attachment levels. Outcome (presence and levels of ACPA) and exposure variables were compared by both parametric and non-parametric tests and possible associations were assessed through regression analysis with a calculation for adjusted (by sex, age and tobacco) odds ratio
Results 109 out of 164 patients were anti-CCP positive, from which 48% of them presented severe periodontitis. A non-statistically significant association was observed between the presence of anti-CCP antibodies and periodontitis (OR of 1.257 (95% CI 0.640-2.47, p= 0.506). In addition, plaque index (adjusted OR 25.47 95% CI, 2.81-230.52, $p<0.001$) and the number of pockets ≥ 5mm (adjusted OR 1.023 95% CI 0.999-1.047, $p=0.06$) were also related to anti-CCP positivity. Moreover, RA patients who have 17 pockets ≥ 5mm showed 2.04-fold risk of having high anti-CCP titres (95% CI 1.01-4.14, p 0.046). Interestingly, a significant increase of 4.73 U/mL of anti-CCP antibodies levels (95% CI 1.35-8.11, $p=0.006$) was found for each pocket ≥5mm in RA patients adjusted by age, gender and smoking. In our series, smoking did not present any impact on anti-CCP antibodies in RA patients with periodontitis
Conclusions In RA patients the severity of periodontal condition such as plaque index and number of pockets ≥ 5mm and are lineally associated with the presence and levels of ACPA, where smoking seemed to not have any impact

0433

Effects of Obesity and Periodontitis on Serum, Saliva, GCF Adipokines

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Objectives In obesity, adipose tissue leads to abnormal secretion of proinflammatory cytokines that are related to a chronic low-grade systemic inflammation. Periodontitis is also an inflammatory disease that may aggravate the existing systemic disease by changing the inflammatory parameters. The aim of this study was to evaluate the effects of obesity and chronic periodontitis on serum, saliva and gingival crevicular fluid (GCF) adipokine (interleukin-1β [IL-1β], tumor necrosis factor-α [TNF-α], leptin, resistin and adiponectin) levels in adult women.
Methods Periodontal parameters (including plaque index, gingival index, probing depth, clinical attachment loss, and bleeding on probing) and body mass index (BMI) were evaluated. According to these measurements; a total of 71 adult women were divided into the following groups; normal weight nonperiodontitis (NWNP; n=15), obese nonperiodontitis (ONP; n=31), obese with chronic periodontitis (OCP; n=25). The adipocytokines in serum, saliva and GCF were evaluated by enzyme-linked immunosorbent assay.

Results No significant differences were seen in BMI between the obese groups. There were significant differences between the three groups in terms of periodontal parameters. In serum, TNF-α and leptin levels were lower whereas adiponectin levels were higher in normal weight than in obese groups. In saliva, IL-1β, TNF-α and resistin levels were lowest in NWNP, but adiponectin was lowest in ONP group. The OCP group demonstrated higher IL-1β, resistin and adiponectin levels in GCF total concentration than other groups. In total amount of GCF, IL-1β, resistin and adiponectin levels were highest in OCP group. Besides, in concentration of GCF, IL-1β and leptin levels were significantly higher in OCP group whereas TNF-α and adiponectin level were higher in NWNP group than in others.
Conclusions This study has shown that obesity has different impacts on adipokine levels in women who have different periodontal conditions. Obesity and periodontitis negatively influence each other and thus affect human health.

0434

Vitamin D as a Subclinical Markers of Risk Of Periodontal and Coronary Heart Disease Progression

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Objectives Vitamin D has been considered to possess anti-inflammatory and antimicrobial activity which may be a link for the known interaction of periodontitis (CP) and coronary heart disease (CHD). This study investigated the association between serum vitamin D levels and periodontitis in patients with CP and with CHD. Furthermore, the objective was to determine if periodontitis and CHD had an impact on serum vitamin D levels.
Methods Using a cross-sectional design, a total of 39 patients with CP, 38 patients with CHD, 38 patients with both CP and CHD, and 37 healthy subjects were enrolled in the present study. The non-parametric Spearman correlation test was applied in order to assess the existence of significant interdependence between vitamin D and all periodontal parameters. In order to assess changes in periodontal parameters within a change in Vitamin D Levels, a p-trend for vitamin D, the Jonckheere-Terpstra Test was applied.
Results Patients in the CP (21.3±5.9 ng/ml) and in the CP + CHD (19.2±6.7 ng/ml) group presented a significantly lower mean serum level of vitamin D compared to patients in the CHD (24.3±3.5 ng/ml) and healthy control groups (28.6±5.5 ng/ml) ($p<0.001$). Vitamin D levels were positively correlated with the number of teeth and negatively with C-reactive protein (CRP) and all periodontal parameters ($p<0.001$). In all patients there was a proportional increase of vitamin D levels with a progressive increase in number of teeth (P-trend <0.001) while there was a proportional decrease in vitamin D levels with a progressive increase in clinical attachment level (CAL, P-trend= 0.001), probing depth (PD, P-trend= 0.007) and bleeding sites (BOP, P-trend <0.001) levels.
Conclusions Patients with CP and CP+CHD presented a significantly lower serum level of vitamin D compared to CHD and healthy controls. Moreover, the presence of CP negatively influenced serum vitamin D levels.

0435

Evaluation of the Relationship Between Periodontal Diseases and Manic Episode

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Objectives Manic episode is a phase of bipolar disorder characterized by elevation "highs" in the mood and behavior of the patient that are in stark contrast to the depressive "lows" of the emotional cycle. This patients may be subjected to risk factors for periodontal diseases than the general population. The aim of this study was to assess the relationship between periodontal diseases and manic episode.
Methods Twenty individuals with manic episode and twenty controls were included in this cross-sectional study. Clinical Global Impression Scale and Young Mania Rating Scale were applied. in individuals with manic episode. All individuals underwent a complete full-mouth periodontal examination. Sociodemographic data and patient complaints were recorded.
Results There were no significant differences in sex and age ($P \geq 0.05$). The BMI data were also similar ($P \geq 0.05$). While the prevalence of periodontitis was 0% among control induviduals and 60% among individuals with manic episode, the prevalence of gingivitis was 30% among control individuals and 35% among individuals with manic episode. PD, CAL, PI, GI, BOP (%) were significantly higher in the individuals with manic episode compared to the control induviduals ($P<0.001$). There was a significant difference between the groups in patient complaints which are gingival bleeding, tooth sensitivity, halitosis, and mobility ($P<0.05$).
Conclusions Manic episode may associate with increased risk for periodontal diseases. The results of this study highlight the importance of follow-up periodontal status in individuals with manic episode.

0436

Periodontitis As Early Signal for Diabetes and Cardiovascular Disease

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Objectives Diabetes mellitus (DM) and cardiovascular disease (CVD) are often undetected due to absence of symptoms and/or lack of patient awareness. We investigated whether periodontitis patients show an increased prevalence of DM and an increased 10-year risk for CVD compared with subjects without periodontitis.
Methods In this cross-sectional study, periodontitis (PD) patients and non-PD controls were recruited. The periodontal condition, as well as DM and CVD related characteristics and blood markers were assessed. HbA1c, total cholesterol, LDL, HDL and triglycerides were measured with a validated plasma finger stick analysis. The HbA1c cutoff point for diabetes was >53 mmol/mol. CVD related parameters were included to determine the 10-year-risk for (non-)fatal CVD based on the Dutch Cardiovascular Risk Management grading system. Independent t-tests and chi-square tests were performed for differences in DM prevalence, CVD risk and biochemical values between both groups.
Results Currently 69 PD patients (males 43.4%, mean age 54.3 yr, mean BMI 26.9 kg/m^2) and 74 non-PD controls (males 56.6%, mean age 53.9 yr, mean BMI 26.0 kg/m^2) were included for analysis. Significantly more PD patients show an increased HbA1c (>53 mmol/mol) compared to non-PD controls (23.2% vs. 10.8%) (p= 0.048). PD patients have significantly higher values for total cholesterol (4.69 ± 0.99 vs. 4.15 ± 0.87 mmol/L) and LDL (2.55 ± 0.86 vs. 2.11 ± 0.86 mmol/L) compared to non-PD controls (p=0.001, p=0.006, respectively). An amount of 20.3% PD patients had a high (≥20%) 10-year risk for (non-)fatal CVD, while non-PD controls had a corresponding value of 14.9% (p=0.393).
Conclusions Periodontitis patients show more often an elevated HbA1c (>53mmol/mol) than control subjects. About 20% of the periodontitis patients have a high 10-year-risk for fatal and non-fatal CVD. We suggest that the presence of periodontitis may be a useful risk indicator for DM and CVD.

0437

Periodontitis is a Risk Indicator for Obstructive Sleep Apnea

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Objectives Periodontitis (PD) is a complex, highly prevalent chronic inflammatory disease of the tooth-supporting structures. Obstructive Sleep Apnea (OSA) is a condition characterized by recurrent obstructions of the upper airway, often resulting in oxygen desaturations and arousals from sleep. Since PD and OSA share several risk factors, the aim of the current study was to investigate the associations between PD and OSA in a dental setting.
Methods For this cross-sectional, case-control study, we recruited PD patients and non-PD controls. PD patients and non-PD controls filled out a validated screening questionnaire on the risk of OSA. Based on this questionnaire, an OSA risk score was calculated and low (<35%), intermediate (35%-55%) or high-risk categories (>55%) were also determined. Independent T-tests, Chi-square tests and Odds Ratio's (OR) were calculated for the total risk of OSA as well as for the severe OSA risk category in both groups.
Results Seventy PD patients (60% male, mean age 54 years, mean BMI = 26 kg/m^2) and 77 controls (49% male, mean age 54 years, mean BMI = 27 kg/m^2) were included for analysis. The risk of OSA for the PD patients was 38.6% ± 29.7% and for the controls 34.2% ± 23.3% (NS, *P* =0.31), with an OR of 1.0 (95% CI 0.9 – 1.1). After sub-grouping individuals in the low/intermediate or high OSA risk categories, we observed significant more PD patients than controls in the severe risk category for OSA (21% vs 9%, *P* =0.036), with OR 2.7 (95% CI =1.0 – 7.2).
Conclusions Having periodontitis is more often associated with a severe risk for OSA. These findings suggest that screening for OSA in a PD population may help in early diagnosis and possibly early treatment, to prevent severe morbidities like cardiovascular diseases and diabetes, which are related with OSA.

0438

Evaluation of Combined Protocols for Risk Assessment of Suffering Undiagnosed Diabetes in the Dental Office.

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Objectives To evaluate the efficacy of a combined protocol for risk assessment in the detection of undiagnosed diabetes (DM) or prediabetes in the dental office. A second objective will be to evaluate the diagnostic capacity of the different models when discriminating healthy, prediabetic, or diabetic subjects.
Methods The study was designed as an observational cross-sectional study to assess a diagnostic protocol, and was carried out in the SEPA (Spanish Society of Periodontology) Dental Clinics Research Network. Consecutive subjects attending any center of the network, were included in the study as long as they were ≥ 40 years and had never been diagnosed of prediabetes or diabetes. Pregnant women as well as immunosupressed patients were excluded. The different models evaluated were: i) the FindRisc questionnaire, ii) the FindRisc + the Basic Periodontal Examination (BPE) and iii) the FindRisc + the BPE + the determination of HbA1c (%) by means of a portable device (A1C+now).Those subjects with glycated haemoglobin (HbA1c) values ≥5.6% were recommended to visit their doctor for confirmation diagnosis.

Results 1284 patients were screened to evaluate their inclusion in the 40 clinics within the research network. 1010 patients fulfilled the criteria and were invited to participate. Those subjects with a high risk for suffering undiagnosed prediabetes or DM received a HbA1c determination (327) and those with a code≥3 according to the BPE, received a complete periodontal examination (755). After visiting their physicians, 85 patients (8.41%) were identified as having abnormal glucose regulation; with 68 (6.73%) having been diagnosed of prediabetes, and 17 (1.68%) of DM.
Conclusions The present results demonstrate the validity of a combined protocol to evaluate the risk of suffering DM or prediabetes in the dental clinical setting, underlying the contribution that dentists can make in the early diagnosis of these diseases.

0439

Treatment planning of complex interdisciplinary cases

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Congenitally missing laterals are the second most common absent tooth, and it is a common problem encounter by dentist that have to decide within a wide range of treatment options. We present a Clinical Case Report of a patient with congenitally missing upper lateral incisors; approaching the different options in treatment planning and decision-making, based on the literature and taking advantage of the new technologies to manage interdisciplinary cases. Among the treatment options: auto-transplantation, single tooth implant rehabilitation on aesthetic area, tooth supported prosthetic restoration and space management will be discussed to develop a decision making protocol in this kind of cases. Digital set up planning advantages will be displayed as the options are evaluated and will greatly influence treatment chosen. The patient was treated by mesialization of upper arch, closing agenesis spaces with a posterior aesthetic treatment for the camouflage of upper laterals and canines. The results were satisfactory in terms of occlusion and aesthetics. In spite of the wide range of therapeutic options available on the literature for the treatment of missing teeth, the efficacy of other discussed therapies and success rates vary among different literature; and although, they are excellent options, thanks to digital planning, we can see the different outcomes of the various treatment options before initiating actual treatment and are able to choose the most conservative plan that best fits the patients needs and satisfies both aesthetic and functional requirements.

0439.1

Development of fiber-reinforced composites for dental and medical reconstructive biomaterial

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Development of dental and medical biomaterials has been limited to use only isotropic bulk materials until recently, when first clinically applicable fiber-reinforced composites (FRC) have become to the clinical use in late 1990s. Present applications of FRC can be found in all disciplines of clinical dentistry and in certain applications of bone reconstructive surgery. All of these applications are having fibers of glasses in the resin-based matrix of FRC. Orientation of fibers in the polymer matrix may vary from unidirectional to bidirectional weaves and random fibe roriented mats. On the other hands, fibers can also vary in terms of length. Continuous and discontinuous (short) fibers are both utilized in clinical dentistry nowadays. Applications of this kind are in fixed dental prostheses, periodontal splints, retainers and fillings. Other properties of FRC in relation to the direction of fibers, like optical properties and bonding properties are also having their implications in dentistry, like in root canal posts, where transmission of curing light is a desired property for polymerization of the individually formed fiber post and the luting cement. Successful use of FRC in clinical dentistry requires comprehensive understanding of the mechanism of action of components of FRCs and the loading conditions where the device will be used. Lecture will show clinical examples of the use of glass fibers in different restorative and prosthetic applications, and give an insight to bioactive surgical FRC implants.

0439.2

From bite physiology to applied orofacial neuroscience

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The understanding of dental occlusion and painful disorders in the orofacial region has changed dramatically during the past 3-4 decades. Once it was believed that malocclusion was the direct cause of musculoskeletal disorders such as pain in the masticatory muscles and temporomandibular joint. As a consequence therapy was directed towards the malocclusion justifying orthodontics, occlusal equilibration and rehabilitation. However, research and controlled studies clearly demonstrated that occlusal variables only were minor, if any, risk factor for the development or maintenance of painful orofacial problems. With this in mind, new concepts evolved based on multi-factorial biopsychosocial models and stochastic variations. The shift from a mono-causal etiology to be managed by dental treatment towards complex biological models and multi-disciplinary and multi-modal pain management approaches also necessitated further insights into orofacial neurosciences. The discoveries of the nociceptive (pain) system reveal an amazing complexity of peripheral receptors and ion-channels underlying peripheral sensitization which in the clinic is seen as local pain and increased sensitivity to various stimuli. The complexity is nevertheless multiplied once the nociceptive information from the peripheral nervous system reaches the central nervous system which displays a tremendous degree of plasticity. At present a key point is to better understand the transition from acute to chronic

persistent pain conditions in vulnerable patients and why the nociceptive system in some cases adapt but in other cases maladapt. From a broader perspective the underpinnings of successful oral rehabilitation will include a better understanding of the adaptability and neuroplastic changes in the control mechanisms of the orofacial system. The talk will describe the journey from bite physiology to the current understanding of orofacial neuroscience in terms of pain diagnostics and management and importance of functional oral rehabilitation and not only occlusal rehabilitation.

0440

Bonding to Enamel Using Alternative Enamel Conditioner/Etchants

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Objectives Phosphoric acid is standardly used to etch enamel prior to the application of dental adhesives. We aimed to investigate the enamel bonding efficacy and durability of three new alternative etchants combined with three representative adhesives.

Methods The 'immediate' and 'aged' micro-tensile bond strength (μTBS) of the 3-step etch&rinse adhesive OptiBond FL ('O-FL', Kerr), the 2-step self-etch (SE) adhesive Clearfil SE Bond 2 ('C-SE2,' Kuraray Noritake) and the universal adhesive Adhese Universal ('ADU', Ivoclar Vivadent) were measured when they were bonded to enamel following either a proprietary organic acid-containing Enamel Conditioner ('EC', Shofu), a phosphoric acid monomer-containing Multi Etchant ('ME', Yamakin: 10-methacryloyloxy tetraethylene glycol dihydrogenphosphate or MTEGP), or a metal salt-based ZON etchant ('ZON', Ivoclar Vivadent: $ZrO(NO_3)_2$). All alternative etchants were used in replacement of phosphoric acid, the latter (K-etchant, Kuraray Noritake) also being used with Opti-FL and ADU as control, in addition to C-SE2 that as control was also solely used in SE mode. The enamel-etching patterns and de-bonded fracture surfaces were examined by SEM, while the interfaces with enamel were ultra-morphologically characterized by TEM.

Results No statistically significant difference in immediate and aged μTBS obtained by combining the three alternative etchants with the three adhesives was recorded as compared with the respective controls, except for ME combined with O-FL. Somewhat unexpected, the μTBSs measured for O-FL generally underscored, though not always significantly different, those of the other etchant/adhesive combinations. Upon aging, significant reduction in μTBS was recorded for the ME/C-SE2 and ME/ADU combinations. The percentage of adhesive failures increased with aging. SEM revealed similar etching patterns produced by EC and ZON as by conventional phosphoric acid, for which also numerous micro-resin tags at the adhesive-enamel interface were disclosed.

Conclusions Durable bonding to enamel was generally obtained for all etchant/adhesive combinations with the exception of the ME/O-FL combination.

0441

New Approaches to Adhesive Interface Assessment

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Objectives The aim of the present study is to develop in vivo methods of visualization (V) and early-stage non-invasive diagnostics of the states of adhesive intetfaces (AI) between hard tooth tissues (HTT) and polymer material (PM).

Methods In the course of our experiments 350 AI between HTT and PM were tested by 3 methods.

The 1st one was a standard clinical examination including diagnostics, restorative treatment and further 4-year observation. The state of restorations was examed in accoradance with the recommendations of FDI and by using the USPHS criteria.

The 2nd method of diagnostics of AI represented itself a high-resolution digital analysis (VD) of tooth photos including the areas of AI. We used a camera NiconD3 with a set of macrolens and the system of additional
lighting (with power-controlled LEDs) from oral cavity. The images of AI were digitally processed using PTC MathCAD Express software.The method made it possble not only to visualize AI but also perform quantitative calculations.

The 3d mehod of in vivo V of AI was based on the application of OCT. To visualize the defects and hidden caries lesions in the restoration volume the experimental set including Spectral Radar OCT Imaging System OCP 930 SR022 was assembled.

Results Having developed extended USPHS criteria so that they might be suitable for the application of physical methods of diagnostics, the qualitative and quantitative analyses of the state of AI were carried out by using VD and OCT in comparison with standard clinical ones. The results of statistical analysis of experimental data of the standard method and OCT showed a singnificant correlation between these two; however, this correlation is much lower than that between the results obtained using standard methods and VD.

Conclusions It has been revealed that the results of VD tests are in full agreement with the results of clinical observations, which makes it possible to use this method as a screening one for preventive clinical examinations.

The OCT method allows in vivo, in situ, non-invasive monitoring of the state of AI between HTT and composite PM as well as revealing of hidden carious cavities and defects of restorations. It has been shown that the OCT method is more informative and reliable in comparison with standard clinical diagnostics and with VD when determining the state of AI.

0442

Evaluation of Matrix Metalloproteinase Activity at Adhesive-Dentin Interfaces

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Objectives To investigate the activity of the matrix metalloproteinases MMP-2 and MMP-9 in dentin treated with two gold-standard adhesives. Additionally, the incubation effect on the activity of MMP-2/9 was assessed.

Methods MMP activity in dentin powder and at the interface with dentin upon treatment with the three-step etch-and-rinse adhesive (3E&Ra) OptiBond FL ('O-FL'; Kerr) and the two-step self-etch adhesive (2SEa) Clearfil SE Bond 2 ('C-SE2'; Kuraray Noritake) were evaluated using gelatin zymography and *in situ*gelatin zymography, respectively. In addition, recombinant human full-length MMP-2 and MMP-9 were activated and incubated *in vitro*at 37°C, upon which the enzymatic activity after 24-h and 1-w incubation was measured using a fluorogenic DQ-gelatin assay to test the *in vitro* stability of the protease activity.

Results Gelatin zymography disclosed the presence of MMP-2 active-form (66 kDa) in dentin powder etched for 15 s with Gel Etchant (Kerr: 37.5% phosphoric acid). No active MMP-2 was detected in C-SE2-treated dentin powder, while MMP-9 was not retrieved in dentin powder upon exposure to either adhesive. A mild gelatinolytic activity (green fluorescence) within the O-FL hybrid layer was revealed by *in situ*zymography, while no obvious fluorescence signal was observed in the C-SE2 hybrid layer, indicating absence of active dentin gelatinases. The fluorogenic DQ-gelatin assay showed that the MMP-2/9 activity significantly decreased after 24-h incubation at 37°C to 18.2% and 33.3%, respectively, and to almost 0 after 1-week (one-way ANOVA: $p<0.05$).

Conclusions The 3E&Ra Optibond FL (Kerr) induced mild MMP activity, which could be related to MMP activation induced by phosphoric-acid etching, while the 2SEa Clearfil SE Bond 2 (Kuraray Noritake) generated no obvious MMP activation. MMP-2/9 activity was found to rapidly decrease to almost fully inactive after 1-w of *in vitro* incubation.

0443

Dentin Interface Characterization of Universal Adhesives by Raman Microscopy

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Objectives Objectives: Aim of this study was to investigate morphology and chemical nature of the dentin interface of an experimental (ADH-XTE, 3M) and a commercial universal adhesive (Scotchbond™ Universal, SBU, 3M).

Methods Methods: The labial surface of bovine incisors was ground to expose dentin and treated with ADH-XTE or SBU in total etch (TE) or self-etch (SE) modes according to manufacturers' instructions. A 1mm thick layer of Filtek™ Z250 (3M) A3 was placed on the adhesive and cured (Elipar S10, 3M). Samples were ground perpendicular to the bonded surface to expose the interface for confocal Raman microscopy (Witec 300R with a 100X objective, NA 0.9; excitation wavelength 532nm). Bands at 1607cm^{-1} (phenyl C=C of adhesive and composite) and 965cm^{-1} (P=O of hydroxyapatite) were evaluated for spatially resolved spectra from linescans across the interface (step size 180 nm) at different locations of the samples ($n\geq4$), to determine chemical nature and thickness of hybrid layer (HL) and adhesive layer (AL).

Results Results: The confocal Raman microscope used allows to record Raman spectra of the interface composite-AL-HL-dentin with high lateral resolution. For each sample, a distinct AL and HL was detected. Raman microscopy revealed full adhesive penetration of the HL. HL and AL thickness in µm is given in the table, with the standard deviation (SD) in parentheses. Data by column were analyzed by ANOVA and multiple comparisons using the Tukey test ($p<0.05$). Means with the same letters are statistically the same.

Conclusions Conclusion: HL was significantly thicker for TE vs SE samples. There was no significant difference for HL between ADH-XTE and SBU when used in the same etching mode. ADH-XTE afforded similar AL thickness as SBU in TE mode, and lower AL thickness in TE mode.

0444

Performance of an Experimental Universal Adhesive

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Objectives Aim of this study was to assess the shear bond strength (SBS) of an experimental universal adhesive (ADH-XTE, 3M) to enamel and dentin in total etch (TE) and self-etch (SE) application modes.

Methods Bovine incisors were embedded in cold-cure acrylic resin. The labial surface of each tooth was ground to expose enamel or dentin. A cylindrical button of Filtek™ Supreme Ultra/XTE A2E (3M, 2.36mm diameter, 2mm height) was cured on the tooth surfaces treated with ADH-XTE (3M), Scotchbond™ Universal (SBU, 3M), G-Premio Bond (GPB, GC), Prime&Bond Active (PBA, Dentsply-Sirona), Clearfil Universal Bond Quick (CUBQ, Kuraray-Noritake), Optibond Universal (OBU, Kerr), Tokuyama Universal Bond (TUB, Tokuyama), BeautiBond Universal (BBU, Shofu) according to manufacturers' instructions (n=10). SBS was measured using the notched-edge method according to ISO 29022:2013.

Results The table shows the SBS in MPa. The standard deviations (SD) are given in parentheses. All data per substrate and application mode were analyzed by ANOVA and multiple comparisons using Fisher's LSD procedure ($p<0.05$). Means with the same letters are statistically the same.
Conclusions Multiple statistically significant differences were found. ADH-XTE yielded equivalent or higher SBS than the controls.

0445

Multi-parameter Evaluation of Acrylamide HEMA-alternative Monomers in 2-Step Adhesives.

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Objectives 2-hydroxyethyl methacrylate (HEMA) is frequently added to adhesives as co-solvent and to improve surface wetting. Nevertheless, HEMA promotes water sorption and thus hydrolysis at adhesive interfaces, thereby affecting bond durability to dentin. This study investigated if two acrylamide co-monomer alternatives could replace HEMA when 2-step adhesives were applied in etch-and-rinse (E&R) and self-etch (SE) bonding modes.
Methods Bur-cut dentin was primed with the 10-MDP-based Clearfil SE Bond 2' primer ('C-SE2p'; Kuraray Noritake) prior to the application of three experimental adhesives, consisting of 50wt% BisGMA, 15wt% TEGDMA, and either 35wt% diethyl acrylamide ('DEAA'), hydroxyethyl acrylamide ('HEAA') or HEMA ('HEMA$^+$'). A control HEMA-free bonding agent consisted of 60wt% BisGMA and 40wt% TEGDMA ('HEMA$^-$'). The split-tooth design involved application in E&R mode on one tooth half versus SE mode on the corresponding half (8 teeth/group). Micro-tensile bond strength (μTBS) of half of the micro-specimens was immediately measured upon 1-week (1w) distilled-water storage ('immediate μTBS'), with the other half was measured after additional 6-month (6m) water storage ('aged μTBS'). Statistics involved a linear mixed-effects model with specific contrasts ($p<.05$). Furthermore, contact angle (adhesive drop on primed dentin), viscosity, water sorption and 3-point bending (24h, 6m) were measured.
Results Overall, LME values of the adhesives applied in E&R were significantly higher than when applied in SE mode, except for DEAA_1w, with the lowest μTBSs recorded for HEAA and HEMA$^+$ applied in SE mode. In E&R mode, 'aged' HEMA$^+$ and HEMA$^-$ revealed significantly lower LME values than their 'immediate' counterparts. Best wetting of the adhesive on primed dentin was recorded for HEMA$^-$, significantly better than DEAA, and then HEAA and HEMA$^+$, these inversely related to their viscosity. HEAA absorbed significantly more water than all other adhesive formulations. HEMA$^+$>DEAA>HEAA>HEMA$^-$ is the significant order for bending strength.
Conclusions The acrylamide co-monomer DEAA could replace HEMA, while HEAA not.

0446

Effect of Double-layer Application on Bonding of Universal Adhesives to Dentin

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Objectives The aim of this *in vitro* study was to evaluate the effect of double-layer application of a mild (Futurabond U, VOCO GmbH) and an intermediate universal adhesive (G-Premio Bond, GC), in self-etch mode on microtensile bond strength (μTBS) to dentin.
Methods Twenty extracted non-carious human third molars were ground flat with 180-grit SiC paper to expose mid-coronal dentin. After standardization of smear layer with 600-grit SiC paper, the roots were cut horizontally 2 mm below the cementoenamel junction. Then teeth were randomly assigned into four groups (n=4); 1) Futurabond U + Single layer (FBSL) 2) Futurabond U+ Double layer (FBDL) 3) G-Premio Bond + Single layer (GPSL) 4) G-Premio Bond + Double layer (GPDL). Adhesives were applied on the dentin surfaces however not light cured between the layers. Composite build-ups were performed with Filtek Z250 (3M ESPE). After storage in distilled water at 37°C for 24 h, teeth were sectioned into beams (1x1 mm) using a diamond saw (IsoMet, Buehler). Resin-dentin sticks (n=20) were subjected to μTBS test using universal testing machine (Instron). Data were analyzed using two-way ANOVA and independent t-test ($p<0.05$).
Results DL significantly affected the bond strength to dentin ($p=0.177$), while the type of the universal adhesive did not ($p=0.0001$). The interaction between these two variables was also significant. DL significantly improved μTBS for FBU ($p=0.001$) and GP ($p=0.001$) universal adhesives to dentin. GP showed lower μTBS to dentin (20.28±2.87 MPa) than FBU (22.68±3.26 MPa) in SL, while higher μTBS was obtained with GP (31.95±10.54 MPa) than FBU (26.01±2.34 MPa) in DL and the differences were significant ($p=0.018$ and $p=0.019$ respectively).
Conclusions Bonding of the mild and intermediate universal adhesives FBU and GP in self-etch mode to mid-coronal dentin are affected by double-layer application. However, the effectiveness of this technique should also be evaluated by long term bond strength tests.

0447

Does Multi-mode Strategy Affect Adhesion to Caries-affected Dentin?

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Objectives The aim of this study was to determine the micro-shear bond strength (μSBS) of universal adhesives to caries-affected (CAD) and sound dentin (SD) in self-etch (SE) and etch&rinse (ER) modes.

Methods 54 extracted human third molars with occlusal caries were ground flat to expose both sound and caries-affected dentin using 180 SiC paper. Caries infected dentin was removed with 600-grit SiC paper using visual, tactile and caries-detecting dye methods. After standardizing the smear layer on the specimens with 600-grit SiC paper, SD and CAD specimens were divided into 6 groups (n=9); intermediate universal G-Premio Bond (GPSE, GPER; GC), ultra-mild universal Prime&Bond Universal (PBSE, PBER; Dentsply, Sirona); mild self-etch Clearfil SE Bond (CSE; Kuraray) and etch&rinse adhesive Adper Single Bond 2 (ASB; 3M ESPE) that were used as controls. Adhesives were applied according to the manufacturer's instructions and flowable resin composite was used for composite build-ups (Gaenial Universal Flo A2; GC) (1x1 mm) and polymerized (Demi Ultra; 1100mW/cm^2). After 24 h of water storage at 37 ^{o}C, μSBS (Instron) was performed. Data were statistically analyzed using Tukey multiple comparison and independent t tests ($p<0.05$).

Results Bonding to CAD was significantly lower than bonding to SD ($p<0.05$) for all the tested adhesives. CSE and ASB showed the highest, GPER and GPSE showed the lowest μSBS to SD and CAD ($p=0.0001$). There were no significant differences for PBER and PBSE in CAD (9.79±1.95; 9.42±2.15 $p=0.688$) and SD (19.51±2.87; 17.81±2.37 $p=0.127$) groups, however significant increase was observed for GPER than GPSE in CAD (7.10±1.76; 5.72±0.99 $p=0.045$) and SD (15.41±2.03; 11.06±1.76 $p=0.0001$).

Conclusions Multi-mode strategy to sound and caries-affected dentin was shown to be material-dependent. Etch&rinse approach of intermediate universal adhesive to sound and caries-affected dentin could be beneficial for improved bonding performance. Similar bonding performance was observed for ultra-mild universal, mild self-etch and etch&rinse adhesives on caries-affected dentin.

0448

Investigation of Fixed Dental Prosthesis Produced with Different Materials Supported by Titanium Implants Placed According to the All-On-four Concept by Using Photoelastic and Finite Element Stress Analysis

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Objectives Dental implants are recognized as a breakthrough in functional and aesthetic rehabilitation. Treatment of the edentulous jaws with implants is often complicated by problems such as poor bone quality in the posterior region, lack of bone volume due to prolonged edentulism, and anatomical limitations of the alveolar bone. In order to overcome such restrictions, 'All-On-4 'technique has been developed. This treatment technique includes a complete arc fixed prosthesis supported by a total of 4 implants including 2 anterior and 2 posterior in the lower jaw and upper jaw.

The most important factor affecting the long-term success of implant supported systems is biomechanics. Long-term implant failures after prosthesis delivery are generally based on biomechanical complications.

The aim of this study was to investigate the prosthetic restorations designed by using different substructure materials on the implants placed according to All-On-4 technique in atrophic mandible with different stress analysis methods and compare the methods each other.

Methods For this purpose, a photo-elastic resin model with 4 implant placed according to All-On-4 concept was prepared. After taking impression, fiber-reinforced resin, PEEK, zirconia and metal substructures were manufactured with Cad/Cam. Polariscope system was prepared and a 250 N force was applied on the central fossa of the first molar tooth with universal test machine. Photos was taken of the fringe lines. On the other hand 3D virtual models of the same substructures were formed with the .stl data of the CAD. Then finite element stres analysis was applied at the same circumstances.

Results: In the photoelastic and finite element stres analysis, rigid substructures such as metal and zirconia showed lower stres values than elastic materials such as PEEK and fiber. As a facility of the finite element analysis internal stresses of the substructures were evaluated. Lower stresses were observed in fiber and PEEK infrastructures with low elastic modulus.

Results In the photoelastic and finite element stres analysis, rigid substructures such as metal and zirconia showed lower stres values than elastic materials such as PEEK and fiber. As a facility of the finite element analysis internal stresses of the substructures were evaluated. Lower stresses were observed in fiber and PEEK infrastructures with low elastic modulus.

Conclusions Lower stress values were measured in rigid infrastructures such as metal and zirconia in the implant and surrounding tissues compared to elastic materials such as fiber and Peek. As the modulus of elasticity of the material used as the infrastructure increases, stresses transmitted to the implants were reduced. When the internal stresses of the materials were evaluated, lower stresses were seen in infrastructures such as fiber and PEEK with low elastic modulus . As the elasticity modulus of the material used in the infrastructure increases, the stresses within the infrastructure were increasing. It showed stresses remained more, inside the rigid substructures and transmitted less to the implants and surrounding tissues. Photoelastic and finite element stress analyzes gave similar stress results to the implant and surrounding tissues. Therefore, the results supported each other.

0449

Effect of Cement at Crown-Abutment Margin on Peri-Implant Soft Tissue

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Objectives Effect of changing abutment design and cementation technique on peri implant soft tissue
Methods 28 titanium implants were placed in 28 patients in the premolar maxillary region. 14 crowns were cemented with the cement applied to all axial walls while in the other 14 crowns the cement was applied on the cervical 1/3 only. In each group 7 crowns were cemented on closed abutments while the other 7 crowns were cemented on vented abutments.Treatment protocol included surgical stage where the implants were placed, prosthetic stage which included placement of abutments of different designs and then, CAD/CAM provisional crowns were fabricated and cemented. In follow- up stage; periodontal and soft tissue esthetic assessments were done at the time of provisional restoration placement (base line) then at 3months and 6months intervals
Results Analysis of the results revealed that the effect of the abutment design (vented and closed) and cementation technique on the peri-implant tissues showed statistical significance between groups. Vented abutments with cement applied on the cervical 1/3 only showed the best peri-implant soft tissue esthetic results
Conclusions The good esthetic behavior with the use of vented abutment and cement applied to cervical 1/3 seems to be strongly correlated to the less amount of excessive cement extruded in this group

0450

Effect of Loading Protocol on Peri-implant Soft Tissue Health

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Objectives -The aim of this clinical study was to evaluate the effect of type of loading using CAD/CAM polymer infiltrated ceramic (PIC) on peri-implant soft tissue health using two protocols:
1-Immediate functional loading.
2-Immediate nonfunctional loading using provisional material followed by delayed functional loading.
Methods 30 Implants were placed in upper premolar area using surgical guide and divided randomly according to the loading protocol into 3 groups (n=10 each). In the day of the surgery, the final impression was taken. Patients in the control group (C) received CAD/CAM PMMA (out of occlusion for 3 months).After 3 months the crowns were replaced by CAD/CAM PIC crowns (functional loading).
Patients in group (A) received CAD/CAM PIC crowns (immediate functional loading).The occlusal parameters during the CAD procedure were adjusted to establish a light occlusal contact in centric occlusion. After the milling procedure, final adjustments of the crowns were performed inside the patient's mouth.
While patients in group (B) received CAD/CAM PMMA crowns (in occlusion for 3 months) followed by CAD/CAM PIC crowns. After cementation, Clinical photographs of the implant crowns and soft tissue were obtained at base line and follow up at 3 and 6 months. Modified pink esthetic score (MPS) were used for evaluation of peri-implant soft tissue.
Results Statistical analysis showed that group (C) has the highest modified pink esthetic score with statistically significant difference between group (C) and the other two groups (A and B). All results were within the biological and esthetic acceptable range.
Conclusions Within the limitation of the study, it was concluded that immediate functional loading using PIC material can be used after proper case selection.

0451

Load Bearing Capacity of Zirconia Crowns Screwed to Multi-unit Abutment with and without Titanium-base: An In-vitro Pilot Study

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Objectives The aim of this study was to compare the static and dynamic load-bearing capacity as well as the failure mode of 3Y-TZP (zirconia) crowns screwed to multi-unit abutments (MUA) with and without Titanium-base (T-base).
Methods Forty-eight CAD-CAM monolithic zirconia crowns were screwed to straight MUA which were torqued to laboratory analogs (6mm width) with a digital torque ratchet (30Ncm). The specimens were assigned to two groups (n=24): Group A- zirconia crowns were screwed directly to the MUA (screwed restoration); Group B- zirconia crowns were cemented to a titanium sleeve (T-base) and then screwed to the MUA (screwed-cemented restoration). All specimens were aged in 100% humidity (37°C) for one month, and then through thermocycling (20,000 cycles, 10sec dwell time, 5-55°C). After aging, the specimens were tested through static and dynamic loading, according to ISO 14801, until reaching a load in which 3 specimens survived 5,000,000 cycles. Failure mode was evaluated by stereomicroscope at 20x magnification.
Results Force vs. cycles (log no. of cycles) Regression analysis revealed that neither the group nor the interaction group-cycles were significant ($p \geq 0.233$). Only the no. of cycles causing failure was significant ($p < 0.001$). The load which the specimens

survived 5,000,000 cycles was 250N in the two groups. However, there was a difference in the mode of failure between the two groups: Group A exhibited mainly failure within the metal (MUA/screw) and only at high loading force a zirconia failure was evident. Group B exhibited failure either within the metal (MUA/screw) or adhesive failure between zirconia and T-base.
Conclusions Within the limits of this study, it is possible to assume that zirconia restoration screwed directly to a MUA is a viable procedure and the survival odds of this restoration are not inferior to that of a screwed - cemented restoration.

0452

Grit Blasting Effects on Mechanical Properties of Ceramic Coated CoCr-alloy

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Objectives The objective of the present work is to compare the effect that grit blasting with two different particles size produces on the microstructure and mechanical properties of the CoCr substrate and also in the metal-ceramic interphase.
Methods 16 rectangular specimens of CoCr alloy fabricated by DMLS (from Eyyunan) have been cut (20×3×1 mm) and each half of them have been blasted with alumina particles of 50 and 250 µm respectively, which yields to two different surface roughness. Consecutively a ceramic layer has been added following the conventional commercial procedure. Three-point bending tests with a micromachine adapted to an scanning electronic microscope (SEM) have been performed.
Results In all cases, as it can be appreciated in Fig. 1, the cracks progress through the ceramic layer and not in the metal-ceramic interfaces, leaving rests of ceramic adhered to the metal. The mode of fracture seems to be fragile, as it can be expected for a dissimilar joint in which one adherend is a ceramic material. Concerning to CoCr substrate, measurements show that samples with higher roughness present a higher flexural strength and a more brittle behavior than the less rough ones.
Conclusions Grit blasting process, apart from increasing surface roughness, induces changes in the sub-superficial microstructure and compressive residual stress in the surface of CoCr alloy. Grit blasting with bigger particles produces a higher work hardening effect on CoCr substrate and the mode of fracture between ceramic layer and CoCr alloy seems to be fragile

0453

Impact of Sterilization in Scan-Bodies Of Peek: An In-vitro Study

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Objectives The aim of this study was to evaluate if we could observe dimensional changes of the Scan- Bodies (SB), from the brand IDP, after sterilizing them 30 times.
Methods An implant impression was taken from which we obtained a plaster model. A previous scan of the model and the scan-body was taken with CAD/CAM system; and sterilization of the SB with autoclave was carried out. This process was repeated thirty times, alternating the sterilization with the scan. The first scanning was assigned as a control group. The thirty explorations and the control group were superimposed using a metrology software (Geomagnetic Control X) to identify the discrepancies.
Results The systematic error of the digitalization of the models was 4.7 µm. The difference in the discrepancy of the "Scan Bodies" between SBs was not statistically significant (p-value >0.05, Spearman test of SPSS).
Conclusions the SB of the trademark IPD can be sterilized thirty times without there being a significant dimensional change of its surface or shape.

0454

Osseoperception and Tactile Sensibility: A Review.

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Objectives Tactile sensibility is an important characteristic for evaluating the masticatory efficiency in different occlusal situations. When a tooth is extracted, relevant propioceptors from the periodontal ligament get lost; and after the rehabilitation of this abscense by means of oral prosthesis, this sensibility decreases influencing masticatory function. The aim of this investigation is studying the difference in tactile sensibility values between some prosthetic situations such as implantprosthesis and complete dentures when comparing to values in natural dentition.
Methods In order to dissect the information, a sistematic review of the available literature has been performed by analyzing articles in medical databases that are related to osseoperception and tactile sensibility. 25 articles, both review and research ones, have been included in the study; while 105 articles have been excluded as they were not related directly to tactile sensibility or osseointegration. Neither were included those articles which full text were unavailable.
Results Tactile sensibility in implantprosthesis is slightly reduced compared to natural dentition, but presents very improved values with regard to complete dentures.
Conclusions Implantprosthesis are more effective during masticatory function than complete dentures as they present an increased tactile sensibility, due to osseoperception phenomenon. Besides, values of tactile sensibility in implantprosthesis are very similar to those in natural dentition, allowing a better functional integration of the prosthesis.

0455

Hg-vapor vs LED-based Ultraviolet Irradiation to Decontaminate Ti Oxide Surfaces

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Objectives The surface chemical composition of titanium dental implants is known to be one of the main factors affecting osseointegration. This study investigated surface chemistry modifications of commercially available dental implants by using Hg-vapor and Light Emitting Diode (LED) C-range Ultraviolet (UVC) sources in order to compare the effectivity of photofunctionalization of both technologies.
Methods Two different devices, a small Hg-vapor lamp (λ=254nm) and a pair of closely placed LEDs (λ=278nm), were used to irradiate the implants for 12 minutes. X-ray Photoelectron Spectroscopy (XPS) was employed to characterize the chemical composition of the surfaces, analysing the samples before and after the lighting treatment. First of all, a wide scan was performed to find out which elements were present on the surface, and then, a narrow scan was conducted around the energy peaks of carbon, oxygen and titanium, to quantify the amounts of each element.
Results XPS analysis showed both UVC irradiating devices reduced the concentration of surface hydrocarbons, from 26.6 to 23.4 C at. % (carbon atomic concentration) in the case of Hg-vapor and from 26.5 to 23.4 C at. % with LEDs. Along with that, an increase in the concentration of oxygen and titanium was also observed, which is associated with successful osseointegration.
Conclusions LED-based UVC irradiation seems to be as effective as Hg-lamp irradiation, as far as hydrocarbons decontamination of titanium implant surfaces is concerned. This suggests that LED-based technology could be a good candidate to replace Hg-vapor lamps, considering that Hg-based devices are increasingly subject to more stringent worldwide limitations.

0456

Titanium and Zirconium Implant Osseointegration in a Standardized Preclinical Model

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Objectives The osseointegration ability of zirconium dioxide (ZrO_2) implants is controversial. Variable results were obtained in studies on structural and functional binding of bone to ZrO_2 implants depending on the variable study conditions and evaluation methods. Our goal was to compare the osseointegration ability of ZrO_2 and titanium (Ti) implants in a standardized preclinical in vivo model (Farkasdi et al. Clin. Oral Invest., 2019) using biomechanical and structural tests.
Methods The experimental animals (Wistar rats) were divided into two main groups. Group A received acid surface treated titanium implants, while Group B received zirconium dioxide implants. The Ti and ZrO_2 implants had the same geometry. Osseointegration was evaluated after one and four months of healing. Our evaluation methods included pull out tests to assess implant stability in vertical direction (measured in Newton (N)) and histomorphometric analyses (measured as a percentage of bone to implant contact (% of BIC)). For statistical evaluation unpaired t-test was applied.
Results The results showed clear evidence of osseointegration in both groups, but at strikingly different degrees. The biomechanical pull out test showed that implant stability was significantly higher in Group A compared to Group B (14.96±0.84 N and 5.66±0.69 N, respectively, $p<0.05$) after one month of healing, and also after four months (208.78±15.27 N and 70.50±9.24 N, respectively, $p<0.05$). On the contrary, there were no significant differences in BIC levels in Group A and Group B one month after implantation (27.21±3.18 % and 19.78±5.01 %, respectively), and four months after surgery (66.24±3.31 % and 75.21±5.41 %, respectively).
Conclusions According to our results, ZrO_2 implants are capable for osseointegration, exhibiting similar density of bone to implant contacts as Ti implants, but the bone bonding strength to ZrO_2 implants is significantly weaker than to Ti implants in our standardized rat preclinical screening model. Supported by EFOP 3.6.2-16-2017-00006.

0457

***In-vitro* Osteoblast Behavior on Machined Groove-textured Zirconia Surfaces**

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Objectives To evaluate the influence of a groove-textured zirconia implant surface in the response of *in vitro* human fetal osteoblasts.
Methods Machined micro-groove textured (T-YTZP) with 10, 90, and 100 µm features of depth, width and spacing respectively and untextured Zirconia (S-YTZP) discs were produced using press-and-sintering techniques. Osteoblasts cultured on treated polystyrene weels were used as control. All samples were sandblasted and acid-etched to produce a surface roughness of 2.25 ±0.42µm as confirmed by profilometry. Human osteoblasts were cultured on discs for 14 days by previously described methods. Morphology and cellular adhesion were observed using scanning electron microscopy (SEM) after 1 day. Cell viability was evaluated at pre-defined time-points (1,3,7 and 14 days) using a commercial resazurin-based method. Collagen type I and

Osteopontin were evaluated at 3 and 7 days using enzyme-linked immunosorbent assays. All results were presented as mean ± standard deviation (SD). Group comparisons were tested using Anova (Tukey's post-hoc) using appropriate statistical software and significance was set at $p<0.05$.
Results Cell viability increased over time in all groups, being higher in T-YTZP group when compared to S-YTZP at 3, 7 and 14 days ($p<0.05$). Osteopontin levels at 3 and 7 days were higher in T-YTZP (545.73±47.47 and 3582.40±644.43 pg/ml) comparing to S-YTZP (93.63±8.23 and 123.92±5.44 pg/ml, respectively) ($p<0.05$). Collagen type I was also increased in T-YTZP comparing to S-YTZP at 3 days (2771.07±121.92 versus 1976.40±510.10 pg/ml) and 7 days (2524.14±232.28 versus 193.41±201.48 pg/ml) ($p<0.05$).
Conclusions Machined groove textured YTZP with sand-blasting and acid-etching produced an enhanced osteoblast response considering viability, differentiation and bone matrix synthesis, when compared to untextured sandblasted and acid-etched surfaces with similar surface roughness.

0458

Implant-Retained Mandibular Overdentures and Oral Health-Related Quality of Life after 8-10 Years
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Objectives The positive effect of implant-retaining the mandibular denture on Oral Health-Related Quality of Life (OHRQoL) has been documented in several randomised clinical trials. In a previous RCT the existing conventional mandibular denture were turned into an implant-retained overdenture with the same positive effect. However, the long term effect has still to be verified. The aim of this follow-up study was to document the effect of implant-retaining the mandibular denture on OHRQoL 8 - 10 years after treatment.
Methods The original randomized clinical trial comparing relining the existing mandibular denture (n=26) or turning it into an implant-retained mandibular overdenture (IOD) (n=28) was done during the period 2005-2008. When the original study was ended, the relining group also got their mandibular denture implant-retained. Thus, all 54 patients in the original RCT have had their implant-retained mandibular denture in use for 8-10 years. Of the 54 patients in the original RCT 26 patients responded to a letter containing information of the study and the OHIP-20 questionnaire. The present study population hence consisted of 26 patients of the original 54 patients; 12 from the original relining group and 14 from the Implant Overdenture group.
Results The implant group in the original RCT reported a mean OHIP-20 score of 35.6 two years after implant-retaining the existing mandibular denture. This had changed to a mean OHIP-20 score of 41.0 after 10 years using the same mandibular overdenture. The change is not statistically significantly different (p = .377). The original relining group having their denture turned into a implant-retained overdenture 8 years ago scored a mean OHIP-20 score of 39.0. There is no statistically significant difference between these two groups after 8-10 years (p = .331).
Conclusions The positive effect on OHRQoL of implant-retaining the existing mandibular denture persists 8 - 10 years after treatment.

0459

Histometric and Immunohistochemical Analysis of Immediate vs. Delayed Implants
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Objectives Analyse soft tissues dimensions and immunohistochemical profiles, 2 and 8 weeks after placement of immediate and delayed implants in an experimental beagle dog model.
Methods Eight dogs received 32 immediate (test) and 32 delayed (control) implants. Test implants were placed at the mesial socket of 3P3 and 4P4. Control implants were placed 8 weeks after extraction of the mesial roots of 2P2 and 1M1. Animals were sacrificed at 2 and 8 weeks. Histometric measurements of soft tissues dimensions were performed on both ground and decalcified sections. An immunohistochemical detection of VEGF and CD4 was performed on decalcified sections (ImageJ software). Measurements were made by one examiner for histometry and one for immunohistochemistry. Intra-examiner differences were assessed via a K analysis. Comparisons were performed via a One-way Anova test with Bonferroni correction (alfa = 0,05).
Results The soft tissues height was significantly higher in tests at 2 weeks both in decalcified (mean difference 1,54mm; p=0,028) and ground sections (mean difference 1,05mm; p=0,203), and a smaller difference was kept at 8 weeks (ground: 0,165mm, p=1,000; decalcified: 1,03 mm, p=0,088). Within each subgroup, mean tissue height values were higher in calcified sections than in decalcified ones, (mean difference 0,2 to 0,98 mm). Tissue thickness was 0,69 to 1,51 mm higher in controls at 2 weeks, but a relevant contraction was observed at 8 weeks, reaching a residual difference with tests of 0,2 to 0,6mm. Expression of VEGF was highest in control implants at 8 weeks (x=0,829) while expression of CD4 was highest in control implants at 2 weeks (x=0,58)
Conclusions Immediate implants showed higher tissue height and stable tissue thickness. Delayed implants showed an initial increase in thickness and a subsequent contraction, and highest expression of CD4 (2 weeks) and VEGF (8weeks).

0460

Gingival Blood Flow at Teeth Versus Dental Implants

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Objectives The anatomical structure of the surrounding tissues of dental implants differ from the surrounding tissues of natural teeth. According to the previous studies blood flow is lower in peri-implant soft tissues. However, it is not known whether this reduced resting blood flow could influence vasodilatation capacity of the gingiva.
The aim of the present study was to compare the vasodilatation capacity of the gingiva at implants to the teeth.

Methods Fourteen healthy volunteers with single-tooth implants were involved in our study. The vasodilation capacity was assessed by post-occlusive reactive hyperaemia test developed by our group previously. After baseline measurement standardised 100 g pressure was applied for 5 seconds on the attached gingiva with an angulated instrument, especially developed for this purpose. After the compression, blood flow was monitored continuously for 20 minutes by Laser Speckle Contrast Imager at the whole surrounding attached gingiva of the implant borne crown or natural teeth.

Results No significant difference was found in baseline blood flow in either regions between teeth and implants (apical: 244±19 vs 268±17, central: 237±15 vs 269±16, coronal: 229±13 vs 260±14 LSPU). Occlusion induced ischemia and subsequently hyperaemia in all regions with similar extent at implants and at teeth (peaks of hyperaemia: apical: 113±19 vs 130±21, central: 102±19 vs 101±18, coronal: 63±12 vs 62±13 LSPU).

Conclusions According to our preliminary results there is no difference in resting blood flow around teeth or implants and vasodilatation capacity is not reduced in peri-implant soft tissues. Further investigation is necessary to reveal the effect of gender, abutment material, age, blood pressure on vasodilatory capacity.

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0461

Convolutional Neural Networks Can Offer a Platform for Decision-making in Implant Dentistry.

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Objectives Peri-implantitis is the complex inflammatory process around dental implants, and considered the main reason of their failure. Prediction of future occurrence of peri-implantitis can guide interventional treatment. Convolutional neural networks (CNNs) can be applied successfully to any type of classification if the structural information allows it. CNNs works under the assumption that points close to each other in the data share correlations/relationship, while points further apart don't share as much information. By using patient and implant characteristics, we aimed to develop a CNN to predict peri-implantitis in implants that functioned for at least 2 years.

Methods 18 patient-, implant- and prosthetic-related parameters were collected from 163 implant treated patients in a private office (mean age 61.9 ± 9.3), having 577 implants with a mean time of function 7.8 ± 4.1 years. The criteria for diagnosing peri-implantitis were a bone level ≥ 3 mm apical to the fixture-abutment connection (involving at least two threads of the implant) combined with a pocket showing probing depth (PD) ≥ 5 mm and bleeding/suppuration within 30 seconds after PD measurement. A separate group of 61 patients (mean age 60.0 ± 8.9) with 201 implants with a mean function of time 7.2 ± 5.2 years formed the validation cohort.

Results 31% of implants were diagnosed with peri-implantitis in the test cohort (in 45% of the patients) and 26% in the validation cohort (in 41% of the patients). CNN predicted peri-implantitis with a sensitivity of 99% and a specificity of 92% in the test cohort. On the validation cohort values were 94% and 89% respectively.

Conclusions CNN can successfully predict future peri-implantitis occurrence and thus provide a platform for clinical decision making in implant dentistry.

0463

Determination of a Compatible Dental Stem Cell Source for Bone Tissue Engineering

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Objectives An ideal mesenchymal stem cell source requires easy collection procedures with abudance of viable cells with availability in majority of adults. This study aims to identify an ideal and feasible dental stem cell source for bone engineering by comparing clonogenic characteristics and osteogenic differentiation capability of stem cells isolated from tooth germ, dental follicle and apical papilla tissues.

Methods Domestic pig model was used in this *in vitro* study due to its similarity to humans in anatomical, physiological and metabolic features as well as tooth development. Third molar tooth germs were removed surgically from jaws of domestic pigs and dental follicle stem cells (DFC), apical papilla stem cells (SCAP) and tooth germ stem cells (TGSC) are isolated. Cell characteristics were determined by flow cytometry whereas differentiation potential to adipogenic, chondrogenic and osteogenic lineages were compared by Alizarin Red, Alcian Blue and Oil Red O staining and osteogenic differentiation was evaluated by MTS assay, ALP activity, Calcium accumulation and von Kossa staining.

Results Flow cytometry analysis showed all three cell types to be positive for CD44, CD90, CD405, STRO-1; negative for CD14, CD34, CD45 and CD73. Alizarin red staining indicated better mineralization with SCAP and TGSCs, however all cell groups showed calcium nodules with von Kossa staining. SCAP showed faster differentiation as demonstrated by mineralized areas on 14th day of culture. However, chondrogenic and adipogenic induction of cells did not result in distinct differentiation. ALP activity was increased in osteogenically induced cells especially in SCAP cultures in the early days of culture. Calcium assay indicated successful osteogenic differentiation in all cell groups by significantly higher calcium levels compared to cells cultured in growth medium.
Conclusions SCAP, TGSCs and DFCs are valuable adult mesenchymal stem cell sources that can be used for bone regeneration studies as they are more prone to osteogenic differentiation than chondrogenic or adipogenic lineages. However, their capacity towards osteogenic differentiation are similar rendering all three sources to be a viable choice to use depending on their availabilty in patients.

0465

Comparative Analysis of Oral-derived Adult Neural Crest-related Stem Cells (oNCSCs) Isolated From Different Species and Local Sources

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Objectives Adult mammalian craniofacial tissues contain limited numbers of postnatal neural crest-derived stem cells. In the present study, we describe the presence of Nestin-positive neural crest-derived stem cells (NCSCs) within different human oral tissues and from the ovine hard palate. The oral-derived adult neural crest-related stem cells (oNCSCs) have significant perspectives for use in regenerative medicine. Therefore, the aim of this study was to compare the biological properties of human oral-derived NCSCs, and species-specific oral-derived NCSCs (ovine-derived NCSCs) after their large-scale expansion.
Methods For the isolation, oNCSCs were cultured in serum-free media in a humidified atmosphere supplemented with 10% CO_2 at 37°C. After 8–10 days primary neurospheres were dissociated resulting in an average of 2×10^6 single oNCSC per 75 cm^2 flask. The subculturing protocol consisted of neurosphere passaging every 3–4 days with whole culture media change. The studied cells were characterized by flow cytometry, multilineage differentiation ability, immunocytochemistry. Gene expression of different gene was analyzed by RT-PCR and qPCR. Immunomodulatory ability was tested in co-culture with different immune cells.
Results oNCSCs expressed characteristic surface markers and were able to differentiate into osteoblasts, adipocytes and chondrocytes. Oral-derived NCSCs express the typical neural crest markers Slug and Twist, exhibit high proliferative and migratory activity and can differentiate into smoothmuscle cells and b-III-tubulin expressing ectodermal cells. Finally, oral-derived NCSCs exhibited strong immunomodulatory ability.
Conclusions We hypothesized that different oral tissue contain NCSCs imbued with a developmental potential and immunomodulatory capacity equivalent to their rodent and human counterparts. We characterized the endogenous niches of oral-derived NCSCs (oNCSCs) histologically and immunohistochemically and successfully isolated and cultivated the cells as adherent monolayer and as self-adherent neurosphere cultures. Cultivated oNCSCs were highly proliferative with an average population doubling time of 26h. We showed that oNCSCs express typical neural crest markers and are migratory. Finally, we demonstrated that oNCSCs differentiate into ectodermal and mesodermal neural crest derivatives.

0466

Leader Genes In Osteogensis: Experimental and Bioinformatics Analysis

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Objectives Osteogenesis is central in the integration of dental implants. In previous bioinformatics and experimental studies, an algorithm was developed to identify genes, named “leader genes”, which play a key role in a given biological process given their high number of interactions with the other genes involved in the same process. We applied this algorithm to osteogenesis in order to plan targeted experimentation in a stem cell model.
Methods Genes involved or potentially involved in osteogenesis were identified with systematic interrelated queries of several databases until identification of a final set. Interactions among genes were mapped and given a significance score using web-available STRING database. Weighted number of links (i.e. weighed sum of scores for every interactions in which each gene is involved) were calculated for each gene. Genes were clustered according to this parameter. The genes in the highest cluster were termed as leader genes.

We investigated the expression of leader genes in osteogenesis by immunocytochemistry in a stem cell model.
Results In total, 176 genes involved or potentially involved in osteogenesis were identified. Only 8 of them (FN1, TGFB1, ITGB1, COL2A1, COL1A1, ITGAV, DCN, SMAD3) were identified as leader genes and represented the basis for investigation in stem cells. In particular, we focused our interest in the genes more closely related to production and differentiation of stem cells such as COL2A1.
Conclusions A validated bioinformatic algorithm was applied to increase our knowledge of molecular mechanisms of osteogenesis and to perform targeted experimentation focused on leader genes and therefore simpler than mass scale molecular genomics. Selected immunocytochemistry characterization will be reported an investigation of the peculiar role of the leader genes identified by our bioinformatic approach. This comprehensive study will provide new insights on osteogenic process after placement of dental implants.

0467

Complement C5a and Mesenchymal Stem Cell Recruitment
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Objectives Recruitment of bone marrow mesenchymal stem cells (MSC) into bone filling materials is a prerequisite for successful periodontal bone regeneration. Complement C5a fragment has been shown to be involved in pulp mesenchymal stem cell recruitment. The aim of this work was to investigate the effect of xenogenic bone grafting materials on modulating C5a secretion by injured periodontal ligament (PDL) cells and its possible influence on MSC recruitment to the bone filling material application site.
Methods Material extracts were prepared from 3 bone grafting materials: Gen-Os® of equine and porcine origins, and anorganic Bio-Oss®. Injured PDL cells were cultured with these extracts to investigate C5a secretion using RT-PCR and enzyme-linked immunosorbent assay (ELISA). C5a fixation on MSC C5a receptor (C5aR) and its activation was evaluated by ELISA. Migration of MSC was studied in Boyden chambers.
Results PDL cells production of C5a significantly increased when the cells were incubated with equine and porcine Gen-Os® materials. The activation of MSC C5aR and their recruitment significantly increased with these conditioned media. The specific involvement of C5a in MSC recruitment was demonstrated using a C5a receptor-specific antagonist (W54011).
Conclusions Taken together, these findings indicate an enhanced MSCs recruitment potential of both Gen-Os® bone grafting materials when applied on PDL cells by inducing C5a secretion.

0468

Cell Therapy in Periodontal Regeneration: A quasi- Randomized Controlled Clinical Trial
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Objectives This study aims to compare an experimental treatment consisting of $10x10^6$autologous periodontal ligament- derived mesenchymal stem cells (PDL-MSCs) embedded in a hydroxiapatite-collagen scaffold and a control treatment comprising the same scaffold with no cells, for the regeneration of 1 and 2 wall- intrabony defects, in terms of safety (absence of adverse events) and efficacy (CAL gain from baseline to 12 months).
Methods This is a double-blinded quasi- randomized parallel groups controlled clinical trial with a 1-year follow-up. 20 patients with chronic periodontitis were consecutively included in the study if presenting ≥1 tooth with a hopeless prognosis or third molar for extraction and PDL-MSCs isolation, and exhibiting ≥1 tooth with CAL loss≥6mm and a 1-2 wall intrabony defect >4mm after basic periodontal therapy. Sample size calculation was not performed, as this is a pilot study. 10 Patients were assigned to each group according to cell growth: only if after periodontal ligament scraping and culture, cells proliferated, the patient was allocated to the experimental group. A trained and calibrated examiner recorded primary outcome measure (CAL) at baseline, 6 and 12 months by means of a pressure-sensitive probe. Radiographic defect fill, patient-based outcome variables and healing parameters were also studied. Intergroup changes and treatment effect (CAL) in each group from baseline to 6 and 12 months were analyzed by repeated-measures ANOVA (SPSS 21.0; $p \leq 0,05$)
Results 19 patients completed 12-month follow-up. No serious adverse events were reported. Patients from both treatment groups exhibited CAL gain over time; however, differences between groups were not statistically significant for any of the study periods ($p > 0,05$)
Conclusions According to this study, PDL-MSCs might be considered a safety therapy. Nevertheless, the superiority of this cell therapy protocol, in terms of efficacy, could not be proven.

0469

Lipopolysaccharide and Hyperglycaemia Decrease Cell Proliferation in Periodontal-ligament Derived MSC
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Objectives The purpose of this *in-vitro* study was to ascertain effects of lipopolysaccharide (LPS) and high glucose on proliferation of periodontal ligament derived MSC (PDLSC) to simulate periodontitis in diabetic patients.
Methods Periodontal ligament tissue scraped from middle one-third of the extracted human teeth was digested with collagenase to isolate cells. Primary cells were then expanded and characterized for surface markers by flow-cytometry to establish stem cell characteristics. The cells were evaluated for tri-lineage differentiation by influencing under osteogenic, chondrogenic and adipogenic media for 28 days and staining by Alizarin red, Alcian blue and Oil Red-O respectively. Different concentrations of *Escherichia coli* derived LPS (5µgm/ml, 10 µgm/ml and 20 µgm/ml) and glucose (5.5mM/litre, 8mM/litre, 12mM/litre and 24mM/litre) were applied to PDLSC for 24, 48 and 72 hours to evaluate their effects on cell proliferation by spectrophotometer. Comparisons to Mesenchymal stem cells derived from bone marrow (BMMSC) were made.
Results The cells isolated from the roots of extracted teeth expanded successfully. On flow- cytometric analysis, cells were positive for CD105, CD73, CD90, CD166 and negative for CD34, CD45 and HLA-DR. The PDLSC under the influence of three differentiation media stained positive for all three stains after 4-weeks. Cell proliferation was significantly lower in PDLSC and BMMSC for both LPS and hyperglycaemia treatment when compared to control group after 48 and 72 hours (p<0.05).
Conclusions Based on our observations, the MSC-like cells can be successfully isolated and characterized from periodontal ligament of extracted teeth. This appears to be less invasive and a promising source of MSC. This study demonstrated the inhibitory effects of test agents on PDLSC and BMMSC proliferation. The PDLSC behave similar to BMMSC in this regard. These results establish an important foundation for probing more in the area of periodontal regeneration especially in diabetic patients.

0470

Can pulp regeneration/anti-infammatory potentials provide the rational for irreversible pulpitis treatment?

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Pulp regeneration during pathological conditions represents a real challenge in the provision of a suitable treatment that ideally leads to the induction of the dentin-pulp regeneration. However, this is highly dependent on the inflammatory degree mainly due to the pulp location within rigid and inextensible dentinal walls. Thus, while the initial inflammation is a pre-requisite for pulp healing, a rapid resolution of inflammation would favor the regenerative process which is key for a successful clinical outcome.

Recent data have shown that the dental pulp has a high regeneration capacity due to the presence of stem cells. Under pathological conditions, injured fibroblasts provide a series of biologically active molecules via Complement system activation. Among these active molecules, C5b and C5b-9 are involved in the local control of infection by killing cariogenic bacteria directly and inducing their elimination by phagoytosis. Other molecules such as C3a and C5a have shown a clear implication in pulp stem cell activation and recruitment.

In addition, the dental pulp controls the inflammatory reaction by secreting multiple cytokines and growth factors that affect the balance between pulp inflammation and regeneration. The application of tricalcium silicate-based materials directly onto the pulp modulate the inflammatory activity by decreasing both pro-inflammatory factors secretion and inflammatory cells recruitment. At the same time, the materials' hydration/by-products release and their interaction with the soft tissues induce stem cell proliferation and recruitment, thus, shifting the tissue response towards regeneration.

This presentation will explain how the combination of bioactive tricalcium silicates with the pulp anti-inflammatory/regeneration potentials can provide a rational in symptomatic carious exposure treatment as well as pulp exposure after dental trauma.

0471

Symptomatic carious exposure: reparative responses and biologically-based therapies

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Significant interest in the management of deep caries and symptomatic pulp exposure, has highlighted the importance of maintaining pulp vitality and promoting biologically-based management-strategies within Endodontics. Although presenting an exciting opportunity, vital pulp treatment (VPT) has traditionally been blighted by unpredictable results. Recent dental biomaterial advances and an evolving understanding of molecular biology and regenerative medicine have led to the development of new treatment strategies for the exposed pulp. These include partial and complete pulpotomy for the treatment of irreversible pulpitis, rather than pulpectomy. Central to the success of these techniques is understanding the dentine-pulp defensive and reparative response to irritation, including the release of bioactive dentine-matrix-components as well as careful handling of damaged pulp tissue. Notably, the development of hydraulic-calcium-silicate capping agents, while perhaps not ideal materials, has resulted in more predictable treatments both histologically and clinically. Unfortunately, new strategies are currently supported by relatively weak evidence with case-series and preliminary studies forming most of the evidence. As a result, critical questions related to the superiority of one caries removal technique over another, the prognostic importance of exposing the pulp and whether an inflammatory threshold beyond which pulpal healing diminishes, remain

unanswered. Looking to the future, new targeted-dental materials may better direct VPT, providing a rationale for further research into the cellular regulators of pulpal inflammation/repair to help identify novel therapeutic markers for diagnosis or therapy. Indeed, the beneficial use of anti-oxidant, anti-hypertensive and pharmacological inhibitors (*e.g*. GSK3, HDACis) have highlighted the potential for a focussed approach to promote pulpal-repair. Although, the scientific community has been quick to embrace new VPT strategies, dental practitioners have been more reticent, underlining the importance of educational as well as clinical and scientific progress in this area.

0472

Minimally invasive Endodontics for long-term tooth preservation

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Scientific literature has demonstrated that the most common reason for the failure of endodontically treated teeth is vertical root fracture, and when it occurs the tooth cannot be preserved anymore. Unfortunately, not only the tooth needs to be extracted; but also, a dramatic bone loss (that sometimes could have been avoided) is associated at this point. Firstly, and with the increase in life expectancy and the emergency of implants, a good prognosis assessment should be performed to determine the viability of the entire complex depending on the characteristics of a specific patient. Secondly, and considering that the main goal of Endodontics is tooth preservation, clinicians face the responsibility of minimizing the removal of dentin that relentlessly leads to the weakness of the tooth. In fact, in the era of minimally invasive dentistry, the concept should also apply to Endodontics. The use of magnification and modern instruments help to preserve dentin for both maintaining the original anatomy of the root canals and, ultimately the strength of the tooth. With a combination of case series and scientific evidence, this lecture will try to set some basis to make the proper decisions on tooth preservation and take responsibilities for the role that Endodontics should play to preserve the strength of the tooth complex and with it reducing the incidence of vertical root fracture in endodontically treated teeth.

0473

Which are the ideal bone grafts and membranes

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In this presentation, we shall review the biological pillars of bone regeneration making special emphasis on the importance of cell availability, neo-angiogenesis and space maintenance. Within these premises, we shall review the properties of the available bone replacement grafts and barrier membranes used in alveolar bone regeneration. We shall discuss on the specific properties modern bone replacement grafts should have to allow enhanced cell availability, neo-angiogenesis and space maintenance. Moreover, we shall discuss on the importance of the barrier effect to allow cell homing and to prevent soft tissue cells from occupying the space for regeneration. Special emphasis will be made on the dynamics of bone regeneration and the bio-absorbability rates of the different membrane biomaterials. Clinical cases of bone regenerative interventions will be presented using different grafting materials and barrier membranes.

0474

Bioactive factors

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The main objective of periodontal treatment is to restore the health and function of the periodontium as well as the regeneration of destroyed tissues that include alveolar bone, root cement, periodontal ligament and gingiva.
In the biological processes of regeneration there are several growth factors that regulate various repair events.
Thanks to advances in tissue engineering, it is possible to obtain, develop and synthesize these growth factors. Proteins such as morphogenetics and amelogenins, have brought benefits, demonstrating an effect on the stimulation of various events such as DNA synthesis, chemotaxis, matrix synthesis as well as cell differentiation and proliferation.
The use of different growth factors in the regeneration of periodontal defects has demonstrated predictable results and opened new lines of research. The objective of the presentation will be to present an update regarding the use of peptides in the regeneration of the periodontium.

0475

Regeneration of unconventional defects

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Periodontal regeneration and reconstruction is a well renown and predictable surgical technique in the periodontal armamentarium. The techniques that are available nowadays have been increasing the prognosis of severely compromised teeth and improve tooth survival. Yet the predictability and the indications or periodontal regenerative surgery are mainly focusing on intrabony defects. Intrabony defects are supportive defects providing a positive environment for blood clot stability. Nevertheless, intrabony defects constitute the minority of the periodontal bony defects as horizontal suprabony defects,

dehiscence, endo-periapical and furcation defects are the ones that are often frequent and draw the attention of the clinicians. Aim of this topic will be to focus on the available clinical evidence on such complex defects and thus to highlight some clinical suggestions for their management.

0476

A Human Odontoblast Phenotype Isolated from the Dentin-Pulp Interface

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Objectives The understanding of dentin formation and other functions of odontoblasts was restricted so far, because *in vitro* cultivable odontoblasts are not available. It was the aim of this study to isolate a proliferating population of cells from the dentin-pulp interface of a human third molar expressing an odontoblast phenotype.

Methods An intact third molar was obtained from a young patient (18 yrs), the pulp tissue was removed, and cells were scraped off the walls of the coronal pulp cavity. The explants were cultivated using routine culture techniques. Cell morphology or ultrastructure was studied by light microscopy (LM), scanning (SEM) or transmission electron microscopy (TEM). Protein expression was analyzed by routine Western blotting, and mineralization was observed after alizarin staining. Cell proliferation and the expression of surface markers were examined by flow cytometry. Differences between mean values were statistically analyzed by one-way ANOVA ($p<0.05$).

Results Cell polarity typical for odontoblast morphology was identified by LM, SEM and TEM. Ultrastructural analysis of cultured cells indicated high synthetic and secretory activity including the extracellular deposition of fibrillar collagen. The base of the cell contains the nucleus, mitochondria, rough endoplasmic reticulum and the Golgi apparatus while secretory vesicles were localized to the cell process. The cells express the odontoblast-specific proteins dentin sialophosphoprotein (DSPP) and dentin matrix protein 1 (DMP1), and show mineralisation after alizarin red staining. Cell proliferation was observed over a long time period with an estimated doubling time of 48h. Finally, the cells express surface markers CD90, CD29, CD73, or CD105 characteristic of mesenchyme-derived cells.

Conclusions This study presents the isolation and cultivation of a differentiated human odontoblast phenotype suitable for analyses of dentin formation, immune responses or sensory functions.

0477

Distribution of SIBLING Proteins in Human Dentin: A Pilot Study

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Objectives The SIBLING protein family is a group of non-collagenous proteins involved in biomineralisation of dentin including dentin sialophosphoprotein (DSPP), dentin matrix protein 1 (DMP1) and osteopontin (OPN). The aim of the pilot study is to examine and compare the immunohistochemical localization of these three proteins in human dentin and dental pulp.

Methods Seven freshly extracted intact third molars of healthy young individuals (mean age 22.2) were enrolled in the study. All teeth were indicated for surgery due to limited jawbone space for eruption. Immediately after extraction the molars were fixed overnight in 10% buffered paraformaldehyde and reduced in size by trimming the enamel, superficial coronal dentin and the roots up to 2mm below the CEJ. The coronal dentin-pulp specimens were decalcified in a 3% hydrochloric acid (HCl) for 6 hours and dehydrated using graded ethanol and acetone, embedded in paraffin, serially sectioned, and stained with hematoxylin and eosin. For immunohistochemistry, paraffin sections were dewaxed in xylene, rehydrated with distilled water, and then subjected to antigen retrieval (sodium citrate buffer, pH 6.0) and incubation with mouse monoclonal antibodies DMP1 (LFMb-31), DSPP (LFMb-21) and OPN (AKm2A1), Santa Cruz Biotechnology Inc., USA using Leica-Bond Max automated system (Leica Biosystems, Germany).

Results All tissue sections were positively stained for DMP-1 including both the full length of dentin and the odontoblast cells layer. DSPP was positively immunolabeled mainly in odontoblasts in less than a half of the specimens. Immunohistochemical localization of OPN showed narrow spreading only in the deepest dentin layer and odontoblast cells in most of the sections. The predentin was negatively stained in all tested specimens confirming lack of mineralization.

Conclusions The difference in the distribution of the SIBLING proteins supports the belief that these molecular species play different roles in dentinogenesis in the perspective of age-related physiological changes in pulp-dentin complex.

0478

Characterization of Inflammatory Cell Infiltrate in Human Dental Pulp

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Objectives Objective This research aimed to determine the types of lymphocytes present in human dental pulp in healthy and carious human teeth.

Methods Material and Method In this study we have examined 61 maxillary/mandibular premolars under 3 different clinical conditions: healthy teeth, shallow and deep cavities. Teeth were extracted and immediately cut longitudinally; pulp tissue was extirpated and fixed in formalin for 24 hours at 4 °C. The specimens were embedded in paraffin, according to standardized laboratory procedure. Sections were cut at 5 µm thicknesses and stained by the streptavidin-biotin complex immunoperoxidase method. Cells were identified by using the following monoclonal antibodies: pan-T lymphocytes CD3, CD4 helper and suppressor CD8 T lymphocytes and pan-B lymphocytes CD20.

Results Results T lymphocytes were observed in normal pulpal tissues with CD8 lymphocytes being predominant. Pulpal tissue in shallow cavities shows a focal accumulation of mononuclear inflammatory infiltrate, and more than 90% of the lymphocyte population was T lymphocytes with a CD4/CD8 ratio of 0.56. Higher numbers of CD3, CD4, CD8; and B lymphocytes were observed in the pulp from deep cavities. A ratio of 1.14 of CD4/CD8 lymphocytes was observed in the deep cavities. A B/T lymphocyte ratio of 1.60 suggested this ratio might be used as an index in the immunohistological diagnosis of irreversible pulpal pathosis.

Conclusions Conclusions This study suggests that immune mechanisms play important role in pulpal infection resistance. Results obtained in this study suggest about the regulatory functions of helper (CD4) and suppressor (CD8) T lymphocytes. The interaction of T and B lymphocytes and their products in the pathogenesis of pulpal disease is present.

0479

3D Electrospun Scaffolds as a Cone for Dental Pulp Regeneration

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Objectives New tissue engineering strategies aim to replace actual endodontic treatments, for diseased or necrotic pulp, by developing biomaterials able to restore the lost tissue and to maintain the ability of the pulp to prevent future injuries. Currently, the most attractive strategy involves cell transplantation. Stem cell isolation and culture are well understood, but the transposition of their use in clinic remains challenging. In this context, we developed an optimized porous cone-shaped scaffold able to recruit and activate the host's endogenous cells surrounding the root canal apex.

Methods First, porous membranes were fabricated using an original method combining electrospinning and electrospraying. Membranes were structured by an alternating deposition of nanofibers and particles on a micro-patterned collector. They were made of biocompatible polymers, poly(lactic acid) and poly(ε-caprolactone), and functionalized with tannic acid bringing

antimicrobial properties. The control of a sufficient porosity was required to ensure cell migration through the entire membrane; it was carried out by laser drilling that generate holes corresponding to open pore size of 150 to 200 micrometers. Finally, the membranes were rolled as a cone of 15 mm long to perfectly fill the root canal after endodontic preparation.
The *in vitro* potential of pulp-like regeneration was assessed by studying the capacity of dental pulp stem cells (DPSCs) to proliferate, migrate and differentiate into the plane membranes and the cone-shape scaffolds, placed into micro-bioreactors mimicking the root canal space.
Results The biocompatibility of the membranes has been demonstrated. They were no cytotoxic and DPSC proliferated and differentiated on the surface. Confocal 3D reconstructions assessed that DPSCs colonize the scaffolds in depth.
Conclusions Biocompatible 3D porous cone were developed to regenerate dental pulp by cell homing. Good results of cell colonization and differentiation demonstrated the hopeful potential of the membranes to induce pulp-like tissue.

0480

***In-vivo* Regenerative Potential of Human Apical Papilla Cells**

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Objectives Regenerative medicine and tissue engineering are critically intertwined with advances in stem cell biology. Apical papilla is considered the remnant structure of the dental papilla responsible for the dentin-pulp complex formation. This undifferentiated tissue represents a source of adult stem cells that may be involved in regenerative endodontic procedures. The purpose of this study was to evaluate the regenerative potential of human apical papilla cells (APCs) when combined with an autologous scaffold, platelet-rich plasma (PRP), in the presence of different biomaterials (ProRoot MTA and Biodentine).
Methods APCs were collected from human third molars with incomplete rhizogenesis. PRP was prepared from donor blood samples. APCs/PRP suspension was injected on monorradicular roots prepared with a diameter of 1.1mm and 6mm length. To mimic clinic application, MTA and Biodentine were compacted separately in one of the root ends. Root segments were subcutaneously implanted on the back of nude athymic rats (RNU) for four months. After this period, animals were euthanized, samples were collected and histological sections prepared.
Results APCs were successfully isolated, expanded and identified *in vitro*. Histological evaluation shows that APCs are capable of generating dental pulp-like tissue, containing blood vessels, nerves, odontoblasts and dentin-like tissue in all groups. Mineralized tissue, referred as tertiary dentin, was formed in apposition to inner dentinal walls of the empty root. This newly formed tissue presented an irregular and amorphous structure, but in some cases regular dentin with parallel dentin tubules was observed. In biomaterials presence, a mineralized tissue bridge formation was observed. No bacterial contamination or severe inflammation reaction was observed.
Conclusions This study provides evidence that dental pulp-like tissue and dentin-like tissue can be generated *de novo* using APCs combined with PRP and Pro Root MTA/Biodentine.

0481

Correlative Micro-CT and Histologic Analysis of Newly Formed Reparative Dentin

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Objectives Successful pulp capping results in the formation of a homogenous, thick and continuous mineralized dentin bridge. Due to its potential to detect radiodensity changes non-destructively in 3D, micro-CT has widely been used to calculate the thickness/volume of newly formed mineralized tissue in animal models. We aimed to evaluate the applicability of micro-CT to assess the maturing stages of dentin-bridge formation as compared with standard histologic assessment.
Methods Forty-six teeth from three minipigs were mechanically exposed and capped with five different pulp-capping materials: Exp. PPL (GC), Exp. TCS 50 (BIOMAT), Biodentine (Septodont), ProRoot MTA (Dentsply Sirona) and TheraCal LC (Bisco). Half of the teeth were scheduled for 7-day and the other half for 70-day evaluation. After sacrifice, the teeth were scanned using micro-CT and assessed histologically. The mineralization of the hyperdense zone beneath the exposure site was evaluated in 3D by micro-CT and compared to the corresponding histological sections.
Results Hard-tissue barriers, varying in thickness between 200 and 750 µm, were formed beneath the exposure sites in the micro-CT scans and were confirmed as mineralized tissue upon evaluating the corresponding histologic sections for all 70-day specimens. Initial dentin-bridge formation was recorded by micro-CT for only 63.0% of the teeth at 7 days after pulp-capping. All the hyperdense layers beneath the exposure sites, which appeared indicative of reparative dentin formation at 7 days, were not confirmed by the corresponding histology; these zones presented with pulp tissue rich in cells, collagen fibers, and capillaries. The teeth that exhibited no obvious change in radiodensity at 7 days histologically disclosed a normal pulp-tissue morphology.
Conclusions These results prove that micro-CT is applicable to evaluate dentin-bridge formation at the later stage of 70 days after pulp-capping, but not for the early stages of pulpal repair at 7 days, when histology remains the standard evaluation methodology.

0482

Effects of Carbonation on the Strength and Structure of Biodentine™

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Objectives To investigate effects of carbonation in calcium silicate-based dental restorative material-Biodentine™ when exposed to a bicarbonate rich medium mimicking physiological conditions.

Methods Cylindrical samples of Biodentine™ were prepared (N=120) and stored in deionised water (DW) or bicarbonate solution (BC). Samples were stored at 37°C for variable durations of 1, 2, 7, 14, and 28 days (n=10). After storage, samples were collected and tested for compressive strength using Universal Instron testing machine. Five samples of each group were further analysed using Fourier-Transform Infrared spectroscopy to compare their carbonate content. Two-way Analysis of Variance (ANOVA) was performed to compare the effect between various aging durations within each group, followed by Post-hoc Tukey's test.

Results Biodentine™ samples stored in BC solution exhibited higher compressive strength values at all time points. The difference between BC and DW groups was statistically significant (P= 0.017). Additionally, samples of both groups exhibited similar pattern in the change of their compressive strength with time. The compressive strength increased gradually to a maximum value then dropped, with the maximum strength (122.13 MPa) reached after 2 days in BC samples compared with samples stored in DW, which reached their maximum strength after 1 week (96.99 MPa). No statistically significant difference found in the carbonate content between the two storage solutions. However, a significant drop was noticed in both groups after 1 week of storage.

Conclusions Carbonation is a natural process that affects Biodentine in the oral environment in the presence of bicarbonate ion. This process can positively affect the strength of the cement; hence it must be considered when testing mechanical properties. Such tests are better performed under conditions as close as the oral environment, including a similar mineral content of storage media to the saliva.

Biodentine was supplied by Septodont (Saint-Maur-des-fossés Cedex, France)

0483

Indirect Capping Materials: Antibacterial/toxic Effects Balance

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Objectives The minimally invasive approach of deep caries management suggests infected soft carious tissue removal while preserving the affected dentin. After the cavity preparation, a liner is placed on the thin residual dentin. Ideally, this "indirect pulp capping" material should stimulate tertiary dentin production, neutralize bacteria, and protect the pulp from potential toxicity of restorative biomaterials. This study aims to assess *in vitro* the effects of indirect pulp capping materials on *streptococcus mutans* growth and pulp cell viability.

Methods Media containing material eluates (Biodentine™, TheraCal®, IRM®, Xeno® III, Fuji II-LC®) were prepared by incubating set samples in bacteria culture medium (2, 1, 0.5 and 0.05cm2/mL). The bacterial growth in each material eluate was measured using the turbidity assay. Freshly prepared materials were spread to cover the Boyden chamber insert porous membrane (2 mm thickness). These inserts were then placed onto the Boyden chambers plated with bacteria or human pulp cells isolated from third molars. After 24H, pulp cells viability was assessed by MTT assay and bacteria count using CFU assay.

Results Bacterial growth was inhibited with Biodentine (at 2 and 1cm2/mL), IRM and Fuji II-LC at 2cm2/mL. A delay in bacterial growth was observed with Theracal (2cm2/mL) and Xeno III (at 2 and 1cm2/mL). No effect was observed with the other conditions. Using Boyden chambers, we observed a drastic decrease of bacteria viability with all materials. The effect was significantly higher with Biodentine, TheraCal, and IRM. Finally, using freshly prepared materials, a significant decrease of pulp cells viability was observed with all materials but to a significantly lesser extent with Biodentine.

Conclusions These *in vitro* results demonstrate that all freshly prepared materials affect bacterial growth immediately after their application. When the materials are set, only Biodentine, IRM and Fuji II-LC maintained antibacterial effects suggesting their potential efficiency on residual bacteria within the residual dentin. When the eluates of freshly prepared materials diffuse through the dentin, they reach the pulp tissue and affect underlying pulp cells. Our results show a potential pulp cell toxicity with all materials but to a lesser extent with Biodentine.

0484

Phosphopullulan-containing Hydraulic Calcium-silicate Cement Exhibits Antimicrobial Capacity against *S. Mutans.*

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Objectives To evaluate the antibacterial activity of freshly mixed phosphopullulan-containing ('Exp.-PPL'; GC) hydraulic calcium-silicate cement (hCSC) as compared to that of the commercial hCSCs Pro-Root MTA ('MTA'; Dentsply Sirona) and Biodentine (Septodont), versus that of set cements, this by means of turbidity and colony-forming unit (CFU) assays (n=3 per experimental group/condition). Ca/Si release and pH were also measured.
Methods 1.5-cm^3 hCSC disks, placed in 24-well plates under sterile conditions, were allowed to set at 37°C/5%CO_2 for 24h. In addition to set hCSCs, freshly mixed hCSCs were immediately exposed to 1.5-ml brain heart infusion (BHI) per sample. Eluates from both conditions were collected after 24h and inoculated with *S. mutans* in 96-well plates, achieving a final bacterial concentration of $2x10^7$/ml. At 3h, 6h, 9h and 24h of incubation (37°C/5%CO_2), turbidity of cultures was measured spectrophotometrically (Varioskan, Thermo-Fisher). Fresh BHI, glucose-supplemented BHI, antibiotics-supplemented BHI and sterile material eluates served as controls. Subsequently, blood-agar plates were inoculated with 50 µl dilutions of the 24h cultures; after 48h of incubation (37°C/5%CO_2), CFU count was determined. To measure Ca/Si release and pH, the same setting was used as for the antibacterial assay but using sterile-deionized water instead of BHI. Ca/Si release and pH were measured with ICP-OES (Varian 720-ES, Agilent) and with a pH meter (3210 WTW, equipped with a Hamilton MiniTrode electrode) respectively, both at 1h, 24h, 72h, 1w, 2w and 4w.
Results Freshly-mixed Exp.-PPL exhibited antibacterial activity against *S. mutans* following both the turbidity and CFU assays, in this order: Biodentine>Exp.-PPL>MTA ($p<0.05$). Fresh cements were more antimicrobial than set hCSCs ($p<0.05$), corresponding to a higher pH and higher Ca/Si release from the freshly-mixed than from the set hCSCs ($p<0.05$).
Conclusions Exp.-PPL revealed antimicrobial activity against *S. mutans*, which was related to its Ca/Si release and alkaline pH.

0485

BioRoot™ RCS Modulates the Regeneration Mechanisms Initiated by Periodontal Ligament Fibroblasts.
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Objectives Endodontic treatment is required to prevent root canal infection. After removal of necrotic/infected tissues, regeneration is required to promote the periapical healing to achieve the endodontic treatment success. This *in vitro* study was designed to investigate the effect of silicate-based root canal sealer BioRoot™ RCS (BRCS) on modulating the early steps of regeneration initiated by human periodontal ligament (PDL) fibroblasts.
Methods Human PDL cells were obtained by the explant outgrowth method and were sorted and characterized by immunofluorescence and RT-PCR as PDL fibroblasts and PDL stem cells. Samples of BRCS and Pulp Canal Sealer (PCS), a zinc oxide root canal sealer were incubated in culture medium to obtain material extracts. To simulate bacterial infection and endodontic sealer use, human PDL fibroblasts were stimulated with lipopolysaccharides (LPS) and cultured with material extracts. Expression of Transforming Growth Factor-β1 (TGF-β1) by PDL fibroblasts was evaluated by immunofluorescence and its secretion was quantified by ELISA. PDL fibroblast proliferation was quantified by MTT while PDL stem cell migration was investigated using Boyden Chambers.
Results Isolated PDL stem cells expressed mesenchymal stem cell markers such as STRO-1, CD44, CD90, CD105, CD106 and CD166 and characteristic transcription factors genes KLF4, NANOG, OCT3/4 and SOX2. These were not expressed in the sorted PDL fibroblasts which expressed Fibroblast Surface Protein (FSP). TGF-β1 expression and secretion increased when PDL fibroblasts were incubated with BRCS as compared to PCS. PDL fibroblast proliferation increased with BRCS without affecting PDL stem cell migration. By contrast, PCS decreased PDL fibroblast proliferation and PDL stem cell migration.
Conclusions This work shows that the endodontic sealers modulate the PDL regeneration potentials *in vitro.* It demonstrates that, BRCS has the capacity to promote tissue regeneration. This could enhance the endodontic treatment outcome.

0486

Antibacterial and Remineralizing Base Material for Vitality Preservation Treatments: 10 Years Clinical Observations
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Objectives Inspired by the therapeutic benefits of inorganic cements combined with a contemporary biomimetic rationale, a synergy seeking for predictable long-term pulp vitality preservation and increased mechanical resistance, suggest a restorative paradigm-shift. While conservative concepts are advocating partial caries excavation, clinical evidence still lacks, particularly in relation to deep decay and Caries Affected Dentin (CAD) management. This clinical study evaluated the performance of a base material, functioning as "slow ion delivering device", offering a long-lasting protection against biofilms and promoting interface remineralisation.
Methods According to Intermediary Therapeutic Restoration (ITR) and ART, particularly in avoiding anesthetics, a self-established unconventional protocol has been developed, reintroducing Zinc-Oxy-Phosphate with Copper-salts added (Cu-ZOP) and Copal-Varnish (Cu-Seal). Permanent teeth (N=15) restored between 2007 and 2012, presenting deep caries lesions and some extreme deep caries reaching the pulp, showing signs of reversible pulp-inflammation or asymptomatic, have been selected and regularly followed to asses vitality, function, integrity and radiological status. Twelve cases were excavated stepwise, the entire defect was filled with Cu-ZOP Cement, while at the 2nd visit Cu-ZOP base was covered with composite. Three other cases were excavated selectively to the soft dentine, of which 2 were restored in one session with Cu-ZOP /composite and one filled with Cu-ZOP and never covered.

Results The pulp-vitality could be preserved in all of the 15 cases and the visible dentine thickness increased radiographically confirming the remineralization efficacy. Depending on the extension of the lesion, residual dental-tissue showed excellent functional performance. Despite mechanical resistance remains a major risk, the obtained results should be encouraging future materials development and ultra-conservative approaches, even for the most doubtful deep-caries situation.
Conclusions Based on favorable results obtained, dentinal fluid physiology and pulp-homeostasis, supporting self-healing potential and effective biomimetic remineralization should be reconsidered which could prevent enzymatic degradation and iatrogenic trauma at the dentin-restorative interface.

0487

Bonded non-retentive ceramic partial crowns: materials, concept and simplified protocol for long-lasting restorations

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Adhesively luted partial ceramic crowns have been documented to be clinically more durable than direct composite restorations when minimally invasively restoring large defects in posterior teeth. The clinical longevity of such restorations is largely determined by the tooth-preparation design, material selection and adhesive luting procedure. The most frequently recorded failure in medium- to long-term clinical trials is fracture of the restoration. The clinical protocol of adhesively luted partial ceramic crowns can be optimized by taking the etiology of these restoration fractures into account. In this lecture, a simplified non-retentive bonded ceramic partial crown concept is presented that aims to achieve an adhesively luted ceramic restoration – composite cement – residual tooth structure biomechanical unit that maximally resists functional aging. Therefore, the three primary components of the bonded restoration-cement-tooth complex must function in synergy. The clinical protocol starts with a tooth preparation designed to optimally absorb chewing stress. A stable, internally rounded and gently sloping tooth-preparation design with all outer margins inclined towards the tooth centre assures a favourable and homogenous stress distribution with low cyclic fatigue subjected to the adhesive interface. This preparation form additionally enables the dental technician to fabricate a well-seating and -fitting ceramic restoration of uniform thickness. As restoration material, the monolithic lithium-disilicate glass ceramic is sufficiently strong for the partial crown indication and preferred in order to decrease the fracture risk. Clinically essential for a long-lasting restoration is the optimal bond that can be obtained by combined micro-mechanical interlocking and chemical binding of composite cement to hydrofluoric acid-etched and silanized glass ceramic. The clinical effectiveness of this non-retentive bonded ceramic partial crown concept is confirmed by the overall high success rate and very low fracture and de-bonding rate, as was recorded in long-term clinical trials.

0488

Diabetes and oral health: the complications, mechanisms and quality of life

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The two-way relationship between periodontitis, on the one hand, and diabetes, on the other hand, has becoming even more clear over the last 5 years. Among patients with severe periodontitis in the specialized periodontal clinics, we see that one in four also has diabetes, often yet undiagnosed. In addition, we see that the treatment of periodontitis improves the metabolic state in the diabetic patient. The medical profession is more and more aware of the importance of oral health: subjects with diabetes in the medical offices are now being checked for oral problems and periodontitis, by the use of a simple questionnaire in an App. Those with the risk of periodontitis are encouraged by their physicians to seek regular dental care, dental prophylaxis or periodontitis treatment. Recent new data showed improved quality of life among diabetes patients when special attention was paid to oral health by the physicians. Conclusion: diabetes and periodontitis are linked and the early diagnosis and proper treatment for both is highly beneficial for the patient, not only in terms of clinical parameters but also in terms of improved quality of life.

0489

Cardiovascular diseases

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During the last three decades, attention has focused on a potential link between periodontal disease and cardiovascular disease (CVD), two widespread inflammatory conditions, the latter been the leading cause of death worldwhile. Observational studies indicate that periodontitis may confer an elevated risk for myocardial infarction, stroke and peripheral artery disease. Clinical studies provide evidence that periodontal disease triggers a systemic inflammatory response, as evidenced by the elevation of systemic inflammatory markers, such as C-reactive protein, as well as endothelial dysfunction, which are both prognostic factors for cardiovascular events. The identification of periodontal pathogens in atheromatous plaques suggests that hematogenous dissemination of oral microbes may be involved in the pathogenesis of atherosclerosis. Recently, specific periodontal pathogens, as well as systemic antibody responses to periodontal pathogens have been associated with subclinical atherosclerosis. Data from experimental studies render support to the clinical findings and provide evidence that pathogens like Porphyromonas gingivalis may accelerate the atherosclerotic process. Primary intervention studies are lacking, but pilot studies focusing on surrogate outcomes, such as systemic inflammation and endothelial function, provide evidence for a beneficial role of

periodontal therapy. Further observational and intervention studies are required in order to establish causality between periodontitis and CVD,

0490

Alzheimer's disease

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Recent epidemiologic, microbiologic and inflammatory findings strengthen an association between periodontitis and increased risk for Alzheimer's Disease (AD), a common cause of dementia. The immune system is implicated in the initiation and progression of AD. With ageing, the nonspecific (innate) immune system plays an increasing role in infection control. Aβ (in amyloid plaques) may be triggered by the presence of bacteria as part of an innate immune response and amyloid plaques are at higher density in AD brains. One source of chronic bacterial infection is the mouth, an area generating systemic immune tolerance. It has been proposed that deep seated anaerobic bacteria in the gingival margin may ultimately pose a threat to cognitive function. These anaerobes may trigger the release of inflammatory cytokines from human innate cells which may increase the permeability of the blood-brain-barrier to bacteria and their toxins. Once in the brain, bacteria activate microglia and other cells which release toxic levels of Aβ, exacerbating neuronal damage. Long-term reduction of bacteria by effective dental hygiene may help prevent further neuronal degeneration. The aim of this presentation is to present contemporary evidence of this association.

0491

Polymers Against Dental Infections

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Objectives Based on the literature, in medicine, the importance of the antimicrobial polymers against the dental pathogens are increasing. Previous studies showed that the Polyethyleneimine (PEI) is a promising molecule because it has antibacterial and antifungal properties. For gaining better antimicrobial effect we added nanosilver components to the polymers. After the basic characterization, we measured the release of active components and found it proper for dental applicability.
Methods Our material was prepared with Electrostatic Self Assembly (ESA). We measured the released components with fluorescent spectroscopy and detected the absorbance. Besides this direct method, we invented an indirect way by using stains. For measuring the released particle sizes, we used Dynamic Light Scattering (DLS) method.
Results Our polymers are synthetized and characterized. With the DLS method, we measured the size of the ingredients and the released particles. For the quantitative determination of PEI, we used a direct (spectrofluorometric measurement) and an indirect way (by staining).
Conclusions The ingredients and the final polymer-complex are also in the nano range. The absorbance and the fluorescent spectroscopy are able to detect the quantity of the PEI molecules in a solution. From a formed antimicrobial layer, we can detect the released PEI components. With the indirect method, we could verify that the PEI is able to use simply in periodontology as well.

0492

How Do Size and Matrix Matter - Properties of Experimental Composites

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Objectives The improvement of dental composites regarding their in situ stability needs systematical understanding of the influencing parameters. Therefore, the objective of this study was to assess the effect of filler size and matrix composition of experimentally designed composites on their mechanical and physicochemical properties.
Methods Six experimentally designed nanohybrid composites with fixed filler volume but varying filler size (coarse/fine) and varying matrix composition (2:1 BisGMA:TEGDMA, 1:1 UDMA:TCDDMA, Ormocer) and three commercially available composites (GrandioSO, FiltekSupremeXTE, TetricEvoCeram) were processed according to the manufacturers` instructions. Standardized bar-shaped specimen were prepared for three-point bending test (flexural modulus and flexural strength). Cylindrical specimen were used for compression and diametral tensile strength testing (DTS). In addidtion, cubical specimen were produced to measure an alternative compression strength and disc-shaped specimen were produced for determining water sorption and microhardness. Statistics: Kruskal-Wallis test ($p<0.05$).
Results No significant differences could be found between materials with different filler size for all evaluated parameters. In contrast, varying matrix composition provided significant differences. Results concerning compression testing differed depending on the specimen geometry. The Ormocer materials provided smaller flexural strength, flexural modulus, microhardness and compression strength using cubical specimen. The results of the commercially available composites served as control group and displayed significant differences among each other regarding flexural strength, flexural modulus, hardness, compression strength and DTS, as well as water sorption and solubility. Especially water sorption of FiltekSupremeXTE was significantly higher compared to all other materials.
Conclusions The experimentally designed composites with varying filler size and matrix composition but with constant filler

volume show significant differences regarding their mechanical and physicochemical properties. It can be concluded, that coarse or fine filler size provides no significant influence. In contrast, the composition of hydrophilic, hydrophob or ormocer matrices show significant influence on the materials properties.

0493

Restoration Wear During Exercise

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Objectives Our goal is to evaluate the effect of lactic acid exposure on the surface of a composite resin

Methods Samples of Filtek ™ Z250 (n=48) were randomly distributed into four groups (n = 12) with two solutions, 5 mL artificial saliva (group A and B) or lactic acid (pH=4) (Group C and D). For Group C and D the protocol followed an 8 hour immersion in the testing solution followed by 8 hours in artificial saliva.Groups A and C were evaluated after 24 hours and 7 days for Group B and D All samples were submitted to a nanotribological wear test with a Nano-Tribometer (CSM Instruments SA, Peseux, Switzerland). A statistical analysis via a two-way ANOVA was performed.

Results The highest friction (μ) was on the acid lactic group (0.19) and the lowest in the artificial saliva (0.16) at 24 hours (Table 1). After 7 days the highest friction was on the lactic acid group (0.15) and the lowest in the artificial saliva (0.12). Statistically significant differences between solutions were found at 24 hours (p=0.031) and 7 days (p=0.036), and between the two timings in each group.

Conclusions Friction coefficient decreased in all groups. Lactic acid abrades the surface of the resin smoothing the resin surface making it polished, thus reducing friction.

0494

Different Finishing/polishing systems' Effects on Surface Roughness of Restorative Resins

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Objectives To evaluate the effect of different finishing/polishing (F/P) systems on surface roughness of different restorative resins.

Methods Four restorative resins were investigated: Three nanohybrid, TPH Spectra (HV), TPH Spectra ST (HV), TPH Spectra ST (LV) and a microhybrid Esthet-X HD. Ten disc-shaped specimens (10mm in diameter, 2mm thick) from each material were prepared under Mylar strip polymerization. Specimens were randomly divided into two groups according to finishing/polishing systems; Enhance/PoGo, Sof-Lex XT (Coarse, Medium, Fine and Super Fine). All F/P systems were applied according to the manufacturers' instructions after being ground wet with 320-grit SiC paper. Surface roughness (Ra) was assessed using contact profilometer before (baseline) and after finishing and polishing. The data were analyzed using generalized linear model ($p<0.05$).

Results Mean Ra and SD (in parenthesis) for the restorative resins tested are listed in the table.

There is no significant difference between restorative resins before F/P (baseline) ($p>0.05$). No significant differences were found among F/P for Esthet-X HD and TPH Spectra (HV) ($p>0.05$). TPH Spectra ST (LV) exhibited the smoothest surface with both F/P systems but was not significantly different from TPH Spectra ST (HV) for Sof-Lex XT ($p>0.05$).

Conclusions The roughness of restorative resins differ according to the F/P systems and their effects seems to be material dependent.

0495

Influence of 9.3 mm CO_2 and Er:YAG Laser Preparations on Marginal Adaptation

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Objectives The aim of this study was to examine the marginal adaptation in enamel and dentin of mixed class V saucer shaped restorations where cavities were prepared by two recently developed lasers, a handpiece-integrated Er:YAG laser 2,94 μm and a 9.3 CO_2 laser 9.3 μm. Diamond bur preparation served as the control.

Methods For each of the six experimental groups, eight saucer shaped class V cavities were prepared (Er:YAG (LiteTouch III, Light Instruments, Israel): 4,5 W, 300 mJ, 15 Hz; CO_2 (Solea 9.3 mm, convergentdental, USA): 12,95 W, 19,3 mJ, 671 Hz; diamond bur (25 μm, Intensiv, Switzerland) in a red handpiece @ full speed) and their surfaces finished (Er:YAG: 0,75 W, 50 mJ, 15 Hz; CO_2: 4,1W, 6,11 mJ, 671 Hz; diamond bur 25 μm in a red handpiece @ low speed). Restoration took place under simulation of dentinal fluid with a one bottle universal adhesive (One coat 7 Universal, ColteneWhaeldent, Switzerland) with self-etch and selective-etch technique and a nanohybride composite (Everglow, ColteneWhaledent), applied in 2 layers and light cured. Marginal analysis was performed immediately after polishing (initial) and after simultaneous thermal (5-50°C, 2 minutes each) and mechanical (max. 49N; 200000 cycles) loading (terminal) by using a SEM @ x200 magnification.

Results Significant differences were found for all groups between initial and terminal results ($p<0,05$, Wilcoxon test) and between the groups as well ($p<0,05$, Kruskal-Wallis-test and Mann-Whitney-U-test). The bur prepared group with selective-etch technique showed the best overall results after loading, followed by Er:YAG prepared self-etch group and CO_2-prepared selective-etch group.

Conclusions This leads to the conclusion that a combination of different parameters determined the results of marginal adaptation.

0496

Bacterial Reduction During Rotation vs Reciprocation: A Systematic Review of Preclinical and Clinical Studies

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Objectives The purpose of this study was to systematically review the effectiveness of reciprocating and rotary instrumentation on microbial load reduction in *in vivo* and *in vitro* studies.
Methods A protocol was prepared and registered on PROSPERO. The PubMed, Ovid, Web of Science, Scopus, Cochrane library and gray literature were searched. The research question was developed according to the PICO strategy. A comprehensive literature search was performed in the electronic databases PubMed, Ovid, Web of Science, Scopus, Cochrane library and grey literature. The main search terms were reciproc, waveone, bacteria, microorganism, colony forming unit, polymerase chain reaction, toxin, infection. A hand search of the reference lists of identified articles was performed to isolate relevant articles. Two reviewers evaluated the studies for eligibility criteria, performed data extraction and risk of bias evaluations.
Results Twenty studies were included. Three of these studies were randomised clinical trials and 17 were in vitro studies. According to the results, both reciprocating and rotary systems were highly effective in reducing the level of microorganisms from infected root canals with no statistical differences between them. Neither technique provided complete removal of microorganisms from the root canals.
Conclusions On the basis of available evidence, the disinfection effectiveness of reciprocating systems is comparable with rotary systems. Further randomized controlled trials with a proper sample size and a comprehensive design are needed to evaluate the disinfecting ability of reciprocating and rotary instrumentation.

0497

Orthodontic retention: not only keeping teeth stable

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One of the least understood aspects of retention is how to prevent skeletal relapse. The interesting aspect of this type of relapse is that is not necessarily about the tendency of the skeletal components to return to their pre-treatment positions but in some cases about how to account for craniofacial growth that has yet to occur. In this regard this presentation would focus on the proposed/available retention alternatives form the sagittal, vertical and transverse skeletal perspectives.

0498

Orthodontic Retention: current trends and implications

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Orthodontic relapse can be defined as an excessive post-treatment displacement of tooth alignment and occlusion accompanied by esthetics and/or functional concerns. The etiology of instability following orthodontic treatment is still obscure and influenced by individual predisposing factors and retention protocols. Given the high incidence of relapse, dentists need to make treatment decisions that balance scientific information, patient preferences and clinical expertise. Unfortunately, the literature is full of ambiguous findings regarding post-orthodontic retention and stability, which further increase the gap between scientific evidence and clinical practice. Thus, the main purpose of this presentation is to review emerging trends related to orthodontic retention and update practitioners on new findings that can impact retention management decisions. Insights into new areas of research on retention will also be discussed.

0500

Investigation of Skeletal Effects on Posterior Airway Space Using TPD

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Objectives Objectives: To determine by cephalometric investigation the dento-skeletal effects on posterior airway space using Transpalatal Distraction Osteogenesis (TPD) to correct transverse maxillary hypoplasia.
Methods Materials and Methods: Thirteen patients (5 males, 8 females; mean age: 24; range 15-40) undergoing TPD were retrospectively investigated by means of digital and radiographic analysis and mathematical evaluation. Lateral cephalograms were taken of each patient at the start of functional upper jaw TPD treatment (time point T1) and at its completion stage (time point T2). Standardized lateral radiographs were taken, cephalometric landmarks identified and processed by the software programme FR-WIN (Computer Konkret AG, Falkenstein, Germany).
Results Results: All patients completed the study. The results suggest that several parameters, including maxillary inclination (0.75°+1.64), facial depth (0.19°+1,57), posterior/anterior (0.01992%+0.2350) and lower/total facial height (0.00546%+0.02554) did not change significantly.
Conclusions Conclusions: TPD may be viewed as a predictable method for treating transverse maxillary hypoplasia in adulthood providing skeletal stability. Buccal tipping of posterior teeth commonly seen in tooth borne surgically assisted rapid maxillary/palatal expansion (SARME/SARPE) does not appear to occur during TPD. Future well-conducted controlled longitudinal

clinical studies on non growing patients are required to establish the evidence base for the use of TPD to increase the upper airway.

0501

Anatomy of the Maxillary Sinus Septa: A Cadaveric Study

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Objectives Undertake the prevalence, location and height of antral septa, offering the clinician, thanks to an accurate investigation of the cadaveric dissection of the maxillary sinus region, some tool to avoid complications when performing sinus-lift procedures.

Methods A total of 50 sinuses, from 25 human cadavers, were dissected, locating and measuring the morphology and height of the antral septa.

Results A total of 30% of the sinuses examined presented antral septa. The anatomical location showed that 25% were located in the anterior, 45% in the middle and 30 in the posterior region. The septa height presented an important variability, being the overall mean 7,90mm.

Conclusions Few studies presented a direct cadaveric dissected overview of the antral septa. This direct view allowed the clinician to improve their knowledge of the maxillary sinus anatomy, being essential to prevent complications during surgical procedures.

0502

Young Basketball Players Use of Protective Equipment

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Objectives Practicing sports places the human body at constant risk of injury. The most vulnerable and less protected body area is the face, thus, a greater risk for orofacial injury exists, being the most common: dental injuryThe aim of this study was to evaluate dental injury in young basketball players and the use of protective mouthguards.

Methods A sample of 97 individuals with ages between 12 and 17 from a total of 141 Sport Lisboa e Benfica basketball team's players were selected. These were evaluated and characterized by: age, sex, injuries use of mouthguard. Informed consent from parents was obtained. Prior to data collecting the ethics committee of the Instituto Universitário Egas Moniz approved the study. A descriptive statistical analysis was applied to check frequencies using the SPSS Statistics 20.0 software.

Results Average age was 13.6. 42.3% of the population were women with an average age of 13.6 years and 13.7 for the men. Mouthguard use was scarce (4.1%). Oral trauma occurred to 13.4% and twice as much in men (Table 2). Uncomplicated tooth fracture were the most common finding (38.5%). No complicated tooth fracture were found in girls

Conclusions The low number of orofacial lesions found in this study and the low use of mouthguards is lower than previous reported. It is necessary to educate and inform through dentists, both players and coaches, for sports dentistry to be improved. A dentist should be part of the teams to raise awareness about oral injuries and to increase prevention.

0503

Knowledge and Practices Towards Oral Cancer Prevention Among Moldovian Dentists

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Objectives The study aimed to assess the knowledge attitudes and practices regarding oral cancer prevention, oral mucosal examination and referral among dentists in Chisinău, Moldova. The study aimed also to assess the perceived barriers to performing oral mucosal examination.

Methods A self-administered questionnaire was developed and translated to Moldovan. All practicing dentists in the city of Chisinau during July/August 2018 were invited to participate. Ethical approval was gathered from both the Norwegian Centre for Research Data and the Ethical Committee in Moldova. A sum score of knowledge was constructed based on knowledge of risk factors, knowledge of pre-cancerous lesions and clinical properties of early cancer lesions.

The study was part of a project funded by The Norwegian Agency for International Cooperation (Direktoratet for internasjonalisering og kvalitetsutvikling i høgare utdanning - Diku) (CPEA-LT-2016/10106).

Results The response rate was 34.5% (n=275). As risk factors for oral cancer tobacco was mentioned by 88.8% of the respondents, while alcohol was mentioned by 69.7%. Tongue and floor of the mouth were identified as the most common sites by 40.0% and 31.6% dentists, respectively. Leukoplakia was identified by 68.7% as the most common malignant lesion. The mean knowledge score was 5.7 (range 0-10). Dentists working at non-solo practices showed statistically a much higher knowledge score than those working at solo practices. Half of the respondents (50.9%) had detected a suspicious lesion for oral cancer, and 58.4 % had referred to a specialist for a suspicious lesion for oral cancer. The most commonly listed barriers to

perform oral mucosal examination were lack of training, knowledge and experience.
Conclusions Almost half of the Moldavian dentists scored high on knowledge for oral cancer. Lack of knowledge, training and experience were the most common barriers to perform oral mucosal examination. Future efforts should be made towards increasing the level and quality of the curriculum and continuing education to increase and maintain adequate knowledge on oral cancer prevention and oral cancer screening.

0505

Proteomics in Oral Health: A Scoping Review

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Objectives Proteomic is widely used in biomedical sciences. It helps to understand the life processes at the molecular and cellular levels, in distinguishing the variability between protein properties in various physiological or pathological conditions. This study aimed to report a comprehensive overview of the use of proteomics in dentistry and its contribution.
Methods A scoping review was conducted, following an established methodological framework. Four databases were searched (Pubmed, Cochrane Library, Web of Science and Clinicaltrials.gov), using keywords related to “proteomics” and “dentistry”, up to April 2018. Studies were included when proteomics was employed for a dental, periodontal or oral related issue. Two authors independently screened studies and extracted data. Studies were classified by dental field, then samples type, studied disease and outcome types were noted.
Results After titles and abstracts review, and exclusion due to duplication, 198 articles were selected. Proteomics was used in various dental fields: especially in oral biofilm/cariology, periodontal diseases, oral cancer and salivary gland diseases; but also, in a lesser extent, in endodontics, implantology and orthodontic tooth movement. In addition, proteomics was used to analyse structural tissue formation. Various types of non-invasive samples were collected: mainly, saliva (whole, parotid/submandibular and sublingual secretion), but also gingival crevicular fluid, microorganisms, acquired enamel pellicle and tissues (enamel, dentin, pulp, gingiva, alveolar bone, ligament, cementum and mucosa). Risk factors, diagnosis and pathogenesis, with identification of biomarkers, were more developed than prognosis or treatment, whatever the dental field.
Conclusions Proteomics have given many data regarding molecules and molecular pathways involved in structural tissue formation and oral diseases. Its development should deepen knowledge on tissue responses to dental treatments and procedures.

0506

Antimicrobial Effectiveness of Sodium Hypochlorite and Chlorhexidine Irrigation: A Meta-Analysis

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Objectives We aimed to compare the antimicrobial efficacy of two most commonly used irrigants, sodium hypochlorite (NaOCl) and chlorhexidine (CHX) during endodontic treatment in permanent tooth by meta-analysis.
Methods The methodology followed PRISMA guideline. Electronic databases including PubMed, EMBASE, Web of Science, and Cochrane Library were searched for randomized controlled trials (RCTs) published until November 2018 which compared the antimicrobial effectiveness of these two irrigants. Deduplicated studies were independently assessed for eligibility, extracted and performed quality assessment using the Cochrane tool by two reviewers. The incidence of positive bacterial samples after irrigation and standardized mean difference (SMD) for bacterial reduction with 95% confidence interval (CI) were compared using a random effect model. Culture and molecular methods were also used to assess the inhibition of bacterial growth.
Results From deduplicated 1752 studies, 7 RCTs were eligible for systematic review. Two studies revealed a low risk of bias, while 3 studies revealed unclear and 2 studies revealed a high risk of bias. The meta-analysis was conducted for risk ratio (RR = 1.00, 95% CI: 0.72 – 1.37, p = 0.987) and for SMD (SMD = 0.311, 95% CI: -0.368 – 0.991, p = 0.369), indicated no differences between NaOCl and CHX for overall detection method as well as subgroup analysis for culture and molecular subgroup. Low heterogeneity was observed among studies for RR (I^2 = 0%, p = 0.666) while there was considerable heterogeneity for SMD (I^2 = 76.336%, p = 0.005).
Conclusions Surprisingly, only very few RCTs were complied with the strict requirements of our statistical analysis. The evidence suggested that both NaOCl and CHX powerfully reduce endodontic infections; however, there is no significant difference between their effectiveness. Additionally, molecular methods are more reliable than cultivation methods for bacterial detection in the root canal system. Supported by Hungarian EFOP-3.6.2-16-2017-00006, KFI 16-1-2017-0409 and NKFIH K112364.

0507

Effects of Bicarbonate on Members of Periodontal Microbiota Causing Chronic Lung Disease

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Objective: The periodontal microbiota may be a reservoir for pathogens causing chronic airway diseases, such as cystic fibrosis (CF) and chronic obstructive pulmonary disease (COPD). In CF lung, defective HCO_3^- secretion causes acidification of the airway surface liquid (ASL) and contributes to increased mucus viscosity. The altered airway milieu favors the growth and colonization of pulmonary pathogenic bacteria, such as *Pseudomonas aeruginosa* (PA) and *Staphylococcus aureus* (SA). They are also present in saliva and subgingival plaque and regardless of their role in periodontal health or disease, dissemination of PA and SA may contribute to the progress of lung infection. Our aim was to investigate the effects of bicarbonate on the growth and biofilm formation of PA and SA in media whose composition resembles the CF sputum.

Methods: Artificial sputum medium (ASM) was prepared with and without $NaHCO_3$. The media containing 25 mM and 100 mM $NaHCO_3$ were incubated in the presence of 5% CO_2 resulting pH 7.4 and 8.0, respectively. Without $NaHCO_3$ media pH was set to 7.4 or 8.0. Both PA (ATCC27853) and SA (ATCC29213) strains were grown in BHI overnight. Equal amounts of bacterial suspensions were inoculated into ASM in a 96-well plate and incubated at 37°C. The colony forming unit (CFU) assay of PA and SA was performed after 8h. Biofilm formation of SA was detected after 48h.

Results: Bicarbonate decreased CFUs of both PA and SA in a concentration-dependent manner. Biofilm formation of SA was significantly inhibited only in the presence of 100 mM bicarbonate. Inhibitions of bacterial growth and biofilm formation were not due to alkalinizing effects of bicarbonate.

Conclusion: Bicarbonate inhibits the growth and biofilm formation of members of periodontal microbiota which are predominantly involved in CF airway inflammation.

0508

Melatonin As a Potential Perioceutic Agent

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Objectives "Perioceutics", including antimicrobial and host modulatory therapy, have emerged as relevant adjunctive treatments for periodontitis. A recent experimental study from our research group has demonstrated a positive effect of adjunctive melatonin therapy in reducing alveolar bone loss and exerting a protective anti-inflammatory effect, but there is no evidence of the potential antibacterial effect of this molecule. This study aims to investigate the effects of melatonin on the growth of *Aggregatibacter actinomycetemcomitans*, one of the most relevant pathogens associated with periodontitis.

Methods Different concentrations of melatonin were tested in planktonic culture of *A. actinomycetemcomitans* by a 1.5-fold serial dilution method. A volume of 190 µL of *A. actinomycetemcomitans* suspension at final concentration of $1x10^7$ colony-forming units and 10 µL of the melatonin dilutions (2.5-0.065 µg/µL) were added in a 96-well microplate, that were incubated under anaerobic conditions for 48h at 37C. Bacterial growth was monitored at the wavelength of 540 nm at six different time points (0, 3, 6, 18, 24 and 48 hours). Positive and negative controls were prepared adding 10 µL of buffer phosphate or bleach (5%) to the inoculum. Statistical analysis was performed with the Student t-test and ANOVA followed by Dunnett's post hoc multiple comparison test.

Results After the first 3 hours of incubation, the three highest concentrations of melatonin produced a significant inhibition of bacterial growth, 40%, reaching after 24 h to inhibit 87% of bacterial growth compared to the positive control. The absorbance values for these concentrations were similar to negative controls, treated with bleach. The lowest concentrations of melatonin showed a significant inhibitory effect on bacterial growth from 24-48 h of incubation, but they could not reach bactericidal concentrations.

Conclusions The obtained results suggest that melatonin could have an important antimicrobial activity, becoming a potential "perioceutic" agent.

0510

Antibacterial Effects of Polyethylenimine, Nanosilver-Polyethylenimine Complex on Selected Oral Microorganisms

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Objectives Polyethylenimine (PEI) is a highly branching, polycationic polymer with antibacterial property because of its large number, positively charged, terminally positioned amino groups. The aim of this study was to test the antimicrobial effects of PEI and nanosilver-PEI complex (Ag-PEI) on selected oral test microorganisms.

Methods Minimum inhibitory concentrations (MIC) of agents were determined by broth microdilution assay. Well diffusion technique and disk diffusion test were also applied to measure the 24 hours inhibitory zones of different concentrations of agents on Mueller-Hinton and blood agar for *Enterococcus faecalis* (ATCC29212), with additional 4% of glucose for *Candida albicans (*ATCC66027), Mitis-Salivarius and blood agar for *Streptococcus mutans* (ATCC35668) in 37C° thermostat and 5% CO_2.

Results MIC values for PEI and Ag-PEI were at *E. faecalis*: 0.125% and 0.2%, *C. albicans*: 0.05% for both agents, and *S. mutans:* 0.125% and 0.2%, respectively. Both drugs increased in a similar way the diameters of the inhibitory zone in a concentration-

dependent manner at all tested microorganisms. However, out of the three investigated microorganisms, the agar plates with *C. albicans* formed consequently the highest inhibitory zone at the same drug concentrations.
Conclusions PEI and Ag-PEI were found to inhibit the growth of microorganisms by similar extent and the fungi seemed more sensitive than bacteria. Different dental materials such as dental acrylic, composite resins or endodontic sealants incorporated or coated with PEI or Ag-PEI may prevent and reduce the diseases causing bacterial and fungal growths and infections.
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0511

Cranberry Extract Reduces Adhesion of Pathogens in *In-vitro* Biofilms
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Objectives The aim of the present study was to evaluate the possible capacity of cranberry extracts to inhibit the adhesion of different subgingival bacterial species on hydroxyapatite surfaces, developed in a multispecies biofilm *in vitro*.
Methods The present study evaluated the effect of a low concentration of cranberry extract, 0.2 mg mL^{-1}, in the first six hours of evolution of a multispecies biofilm *in vitro* on hydroxyapatite surface, including initial (*Streptococcus oralis* and *Actinomyces naeslundii*), early (*Veillonella parvula*), secondary (*Fusobacterium nucleatum*) and late colonizers (*Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans*). Phosphate buffer saline and 4% dimethyl sulfoxide (used to dissolved cranberry extract in distilled water) were used as controls. Morphological characteristic of the biofilms [thickness (µm) and bacterial viability] were studied by different microscopy modalities. Quantitative Polymerase Chain Reaction was used to assess the effect of the extract on bacterial load: colony forming unit per milliliter (CFU mL^{-1}). Experiments were repeated two times with trios of biofilms for each analysis (N=6). Analysis of variance and post-hoc testing with Bonferroni correction were used. Results were considered statistically significant at $p<0.05$.
Results The incorporation of the six bacterial species was reduced by the action of cranberry extract in the first hours of evolution in an *in vitro* biofilm model. Reductions above 90.0% in bacterial counts were observed in the biofilms in contact with the cranberry extract, without affecting bacterial viability. *P. gingivalis* was the bacterial species whose adhesion was most affected by the action of the extract, reaching $1.9x10^3$ [standard deviation (SD) = $8.9x10^2$] CFU mL^{-1} when it was in contact with the cranberry, compared to $2.0x10^5$ (SD = $1.2x10^5$) CFU mL^{-1} in control biofilms (p=0.03).
Conclusions The result revealed that cranberry extract significantly reduced bacterial adhesion in the first hours of evolution of biofilms, without affecting bacterial viability, so its use could have beneficial effects on oral health.

0512

Effects of Caffeic Acid Phenethyl Ester (CAPE) on *Candida* Biofilms
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Objectives Currently, treatment options for fungal infections, such as oral candidosis, are limited due to the low availability of antifungal drugs and the emergence of drug resistant strains. Thus, the development of new antifungal compounds and new therapeutic approaches are in great need for the control of these infections. The caffeic acid phenethyl ester (CAPE), compound of propolis, has been considered to be promising due to its antifungal, immunomodulatory and anti-inflammatory action through the inhibition of transcriptional factor NF-kB and enzymes involved in the inflammatory process. Therefore, the present work evaluated the antifungal effect of CAPE on biofilms of *Candida albicans.*
Methods Initially, 40 clinical strains of *C. albicans* isolated from lesions and saliva of patients with Human Immunodeficiency Virus (HIV) were submitted to the Minimum Inhibitory Concentration (MIC) test for fluconazole, amphotericin and CAPE. Next, different concentrations of CAPE (1X, 2X and 5X MIC) were tested on mature biofilms formed by strains of *C. albicans* resistant to fluconazole. The antifungal effect of this compound was evaluated through colony-forming unit (CFU) count, quantification of the total biomass and scanning electron microscopy (SEM). Student's *t*-test was used to evaluate the data
Results CAPE exhibited a MIC value between 64 and 16 µg/mL against *C. albicans*. All CAPE concentrations tested significantly reduced the CFU count ($p<0.005$) and the biomass ($p<0.005$) of *C. albicans* biofilm. In addition, SEM images at concentration of 5x MIC CAPE showed predominance of yeast form compared to the control group formed with numerous hyphae
Conclusions CAPE had antifungal activity against *C. albicans*. All tested concentrations of CAPE have anti-biofilm action.

0513

Biocompatibility Testing of Bone Grafts by Fluorescent Microscopy

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Objectives The aim of this work is to present the method of *in vitro* - examining the impact of two different bone grafts on the cell methabolism and proliferation by cytological testing methods and with fluorescent staining.

Methods To investigate the cytotoxicity of two tested materials with different constituition and different production technology (Bio-Oss® (Geistlich) and SmartBone® (Ibi)) in vitro study was performed on MRC-5 human lung fibroblasts cell line. Three tests were performed: Dye exclusion test (DET), Colorimetric test with tetrazolium salts (MTT test) and Agar diffusion test.The adhesion of the cells to the material was tested with fluorescence microscopy. After incubation of cells with tested material, 100 µL solution of fluorescent stain etidium bromide was added to the medium of each culture and incubated 15 min. Cultures were then washed with PBS and immediately observed under a fluorescence microscope. Cells adhered to the material were detected by the signal of incorporated fluorescent dye. Microphotographs of cells on the material are obtained by overlapping double exposures: the inverted bright field exposure with the material and the fluorescent cell signal. Images were processed in the ImageJ computer program (NIH Image, http://imagej.nih.gov).

Results The results of DET, MTT test and agar diffusion test are negative. Microscopic photographs of the MRC-5 cells stained with etidium bromide fluorescent dye reveal good contact between cells and both applied materials which also indicates that the materials are not cytotoxic, although SmartBone® is reinforced with acrylic resin. The fibroblasts growing on the surface of tested bone substitutes are shown in Figures 1 and 2.

Conclusions Examining the biocompatibility of implantation materials in vitro using continuous cell lines and fluorescent microscopy, it is possible to determine the adhesion of cells to the implanting material and predict in a certain degree the success of reconstruction and remodeling of bone defects.

0514

Toxicity of Particles Released from Dental Materials During Grinding

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Objectives The purpose of this study was to evaluate the release of particles from dental materials after grinding and test their toxic effects on human lung cells.

Methods Four dental restorative materials were used: two composite-materials (ceram.x universal & Filtek Supreme XTE), a hybrid material (Lava Ultimate) and a ceramic (Vitablocks Mark II). Composite samples (n=50; 6mmx2mm) were prepared according to the manufacturer's instructions. The other materials were used as blocks. All samples were ground to powder under standardized conditions with and without water. The particle size distribution was measured by Dynamic Light Scattering and Nanoparticle Tracking Analysis. In order to evaluate effects of the dust on alveolar human lung cells (A549), the WST viability assay and the LDH cytotoxicity assay were applied. Expression of Interleukin-8 (IL-8) by using ELISA was evaluated after 24h exposure. Concentrations of 300, 100, 30, 10, 3, 1 µm/mL were used. One-way-ANOVA und Dunnett`s post hoc Test were used for statistical analysis.

Results The particle size distribution differed among the materials. However, grinding of the materials led to formation of particles with similar size distributions (D50≈100 nm). LDH-assay revealed a significant effect on the integrity of the cells for all materials but only at concentrations higher than 100 µg/mL ($p<0.05$). WST-assay showed a concentration-dependent decrease ($p>0.05$) of cell viability. Exposure to wet-ground samples affected the cell viability at 3 µg/mL, whereas dry-ground dust at 30 µg/mL. A dose-dependent increase of IL-8 was detected after exposure of cells to suspended dusts. Only at 300 µg/mL materials induced significant inflammatory responses except the ceramic.

Conclusions Dental grinding procedures of materials result in release of fine and ultrafine particles. The obtained particle size seems to be more affected by the grinding procedures than by the material composition. However, toxicological effects are limited to exposure to high particle concentrations.

0515

Evaluation of Cell Responses towards DMSO- solvated Experimental Adhesives.

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Objectives To evaluate the cytotoxicity of experimental resins with various concentrations of DMSO in a dentin barrier test simulating the clinical circumstances.

Methods Several ascending concentrations of DMSO (0, 0.01, 0.1, 1, 5, and 10 w/w %) were used to solvate a hydrophobic (R2: 70% BisGMA, 28,75% TEGDMA, 0,25% CQ, 1% EDMAB) and hydrophilic (R5: 40% BisGMA, 28,75% HEMA, 30% 2MP, 0,25% CQ) experimental methacrylate-based resins. Three dimensional cultures of SV40 transfected pulp derived cells (Thonemann and Schmalz, Arch Oral Biol, 45, 857-869, 2000) were transferred into an in vitro dentin barrier test device with dentin slices of 400

µm thickness (n=8/experimental group). After 24 h incubation at 37°C, the solvated experimental adhesives were applied into the cavity part of the device for 10 s and light cured for 10 sec. A glass ionomer positive control and non-toxic polyvinylsiloxane negative control (100% cell vitality) were used as control groups. Cell viability after exposure to the bonding agents was determined by dimethylthiazolediphenyltetrazolium bromide (MTT). Data were analyzed by ANOVA and Tukey test (α=0.05).
Results The cell viability of experimental test groups were not significantly different compared to negative control (p>0.05) but was significantly higher than positive control (p<0.05). Incorporation of 5-10% DMSO to R2 or R5 showed a slight reduction in cell viability compared to lower concentrations (p>0.05).
Conclusions With the residual dentin barriers of 400 µm, the incorporation of DMSO to hydrophilic or hydrophobic methacrylate resins did not show any cytotoxic effects on transfected pulp derived cells.

0516

Cytotoxicity of Experimental Hydrophilic and Hydrophobic DMSO-solvated Adhesives after Polymerization

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Objectives The aim of this study was to evaluate the cytotoxic effects of two experimental adhesive resins modified with various concentrations of dimethylsulfoxide (DMSO) on human gingival fibroblast (HGF) cells.
Methods Experimental hydrophobic adhesive resin containing BISGMA/TEGDMA or hydrophilic adhesive resins containing BISGMA/HEMA were solvated in ascending DMSO concentrations (0.01, 0.1, 1, 5, and 10 w/w %). Resin discs (n=10/group) (0.5mm thick, 6mm diameter) were prepared from each group using a custom-made mold and cured with LED light curing unit (Elipar, 3M ESPE, Seefeld, Germany) for 20 s. Neat resins (0 w/w % DMSO) were used as controls. The resin discs were eluted at 37 C in with culture medium for 24 h. After standardization and calibration, the HGF cells (2 X 10^6 cells per well) were exposed to eluates for 24 hrs. The cell viability was assessed by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) test according to ISO 10993-5 procedure. The data were statistically analyzed by ANOVA and Tukey test (α=0.05).
Results After 24 hrs storage, all adhesives showed cytotoxic effects. The cell viability with hydrophobic resins ranged between 77-91% whereas hydrophobic resins between 3-5%. The cell viability of hydrophilic experimental test groups were significantly lower (p<0.05) compared to hydrophobic experimental groups. The incorporation of various concentrations of DMSO did not affect the cytotoxicity of hydrophilic resins, whereas between 0.01%-1% DMSO concentrations slightly improved the cell viability in hydrophobic resins.
Conclusions The addition of 0.01-1% DMSO to hydrophobic experimental adhesives showed slightly better cell viability compared to neat resins. This improvement might be related to the increase in degree of conversion of the resins with DMSO modification.

0517

Protein Adsorption and Bioactivity of Nanostructured Membranes for Bone Regeneration

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Objectives The first interaction between an implanted biomaterial and bone are salt ions followed by blood proteins. These proteins may affect the behavior of the recruited cells within the healing site. A protein adsorption assay and a bioactivity test were implemented on novel nanostructured polymeric membranes with different surfaces chemistry (COOH and NH2 terminal sequences) (COOH-M and NH2-M respectively); a commercial membrane (cytoplast -C-) was employed as control group. The objective of the study was to determine the bioactivity and the proteins adsorption capability of membranes.
Methods Bioactivity was analyzed by Kokubo method (ISO 23317:2012)(n=3). For protein adsorption testing, a BCA Protein Assay colorimetric test was employed. Membranes were immersed in proteins during 30 min (total plasma proteins, albumin, fibrinogen and fibronectin) solutions. After desorption, proteins were quantified in supernantans (n=3). ANOVA and Student Newman Keuls were employed for multiple comparisons (p<0.05).
Results Bioactivity was only demonstrated for COOH-M. Proteins adsorption was, in general, similar on COOH-M and NH2-M. Mean and standard deviation (micrograms of protein/mg of membrane) were as follows: Plasma- NH2-M 8.6 (1.5) > COOH-M 6.3 (1.5) > C 0.3 (0.1); albumin- COOH-M 12.0 (1.8) > NH2-M 4.3 (0.04) > C 0.4 (0.1); fibrinogen- NH2-M 7.9 (0.1) > COOH-M 3.4 (0.5) > C 0.5 (0.1); fibronectin- COOH-M 8.71 (1.3) > NH2-M 7.3 (1.3) > C 0.5 (0.03). The commercial membrane did not possess bioactivity or protein sorption ability.
Conclusions COOH-M and nanostructured membranes are bioactive and facilitate proteins deposition. They are the most suitable as bone regenerative materials.
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0518

Chlorhexidine-Delivery-System Based on Acrylic Resins - Microbiological and Biocompatibility Studies.

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Objectives To evaluate the antimicrobial activity against *Candida albicans* and *Streptococcus oralis* and to assess the cytotoxic potential, using cultures of fibroblasts, of acrylic reline resins loaded with chlorhexidine.
Methods Three acrylic reline resins were loaded with a chosen concentration of chlorhexidine: Kooliner was incorporated with 2.5% (w/w) while Ufi Gel Hard and Probase Cold were loaded with 5% (w/w). All materials also included a control group (0% chlorhexidine). Two distinct microbiological tests were carried out: agar diffusion and antibiofilm assay. For the agar diffusion assay, resin disks were placed on agar plates inoculated with *Candida albicans* (ACTT 10231) and *Streptococcus oralis* (ATCC 3507), separately, and after 48 hours at 37°C, the diameters of inhibition zones were measured. To determine the antibiofilm activity, resin discs were placed in inoculated medium with *Candida albicans* and incubated for 48 hours at 37°C. Specimens with biofilm on the surface were fixed with different ethanol solutions, analyzed and photographed using a scanning electron microscope. To assess the cytotoxic potential, extracts were obtained by incubating the specimens in 1 mL of distilled water for 24 hours at 37°C. Afterwards, cultures of L929 fibroblasts (ATCC1 CCL-1TM) were exposed to the extracts and cell viability was determined by the spectrophotometric tetrazolium bromide reduction assay. Negative and positive control groups were used. Data were analyzed using parametric *t*-test (α=0.05).
Results All resins loaded with chlorhexidine showed an inhibition halo in both strains. However, only Probase Cold with 5% chlorhexidine showed antibiofilm activity, no microorganism was observed on the surface of the material whereas all the other tested groups demonstrated the existence of a biofilm layer of *Candida albicans*. The incorporation of the drug decreased cell viability in the three tested resins ($p<0.001$). When compared to each other, Probase Cold was the less cytotoxic resin (70.6±6.17%).
Conclusions The best option of a chlorhexidine-delivery-system is Probase Cold containing 5% of the drug. This presented antimicrobial activity against *Streptococcus oralis* and *Candida albicans*, including high antibiofilm effect against the fungal, being, at the same time, the less cytotoxic resin under evaluation.

0519

An Experimental Semi-natural Composite Material

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Objectives The aim of this study was to investigate the effect of thermotreated oak particles as a lignocellulosic-derived filler in a PMMA-based matrix polymer composite. Thus, these kind of fillers have shown some promising information of biocompatibility in some previous studies.
Methods The semi-natural composite materials made from polymethylmethacrylate (PMMA) based polymer and thermo-treated oak flour with two particle size of <500mm and 500-1000mm (mesh) were prepared. The mechanical properties of these PMMA based resins with incorporated flour at ratios of 30wt% were examined. The measured properties were flexural and compressive strength and moduli, which were analyzed in dry conditions and after 1-week soaking in distilled water.
Results The composites containing larger particle size exhibited also higher flexural and compressive strength and moduli both in dry and wet conditions. Nevertheless, the addition of oak flour did not increase the strength of PMMA. However, the specimens in the group containing larger size had higher flexural modulus than control group's moduli. Obviously, the lower mechanical strengths of the composites were caused by the formation of porosity after fiber implication. This biphasic behavior under flexural loading resulted in a range from a minimum of 40.4±6.1MPa to a maximum of 53.3±4.2MPa for composite with longer fiber length in dry conditions, and from 12.8±6.7MPa to 24.7±5.0MPa in wet conditions. Control group had significantly higher flexural and compression than all the composite groups. In wet conditions, the flexural properties reduced significantly all the groups tested.
Conclusions The results showed that the tested oak fillers did not reinforce PMMA polymer. Since, the fillers increased the capability to absorb water.

0520

3D-Printed Nano-hydroxyapatite-based Composites for Bone Regeneration: *In-vitro* Characterization

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Objectives Nano hydroxyapatite (HA) is chemically and physically comparable to the mineral component of natural bone and has shown to promote bone regeneration capacity. However, 3D-templates of HA are inherently brittle and difficult to be shaped according to complex bone defects. On the other hand, synthetic copolymers poly(lactide-co-trimethylene carbonate) (L-TMC) have elastic mechanical properties, potential to support mesenchymal stem cells (MSC) attachment and proliferation, and found to induce blood vessels growth *in vivo*. Therefore, the present study was aimed to develop 3D-printed composite templates of L-TMC with different ratios of HA, for bone tissue engineering applications, and to characterize their mechanical and biological properties *in vitro*.
Methods Using solvent-precipitation method, L-TMC/HA composites were prepared by mixing medical grade L-TMC (Resomer® LT 706 S, Evonik - Germany) with HA (<200 nm particle size, Sigma - USA) at 10, 30 and 50% ratio. Three groups of templates were printed (Bioplotter, Envisiontec – Germany) at around 200°C; L-TMC/HA with 10, 30 and 50% HA. Pristine L-TMC printed templates were used as a control. The printed templates were tested for their tensile mechanical properties (ASTM-D638). Furthermore, human bone marrow-derived MSC were cultured on the developed composite templates for up to 21 days.
Results HA was homogenously distributed among composite samples, and good tensile strength was maintained in composites with 10% and 30% HA, compared with pristine templates. MSC attachment, proliferation, and osteogenic differentiation were enhanced on composite printed templates up to 30% HA up to 21 days. Biological and mechanical properties were reduced in 3D-printed templates with 50% HA.
Conclusions 3D-printed L-TMC/HA composites demonstrated promising mechanical and biological properties towards bone tissue regeneration, proportional to increasing HA ratio (up to 30%).

0521

Dynamics of Biofilm Development on Different Dental Restorative Materials in the Oral Cavity

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Objectives The aim of the study was to investigate the development of oral biofilm on various dental restorative materials and to characterize the biofilm composition.
Methods Samples of different restorative materials Lava Plus (3M Oral Care); IPS e-max (Ivoclar-Vivadent); Ceram X (Dentsply); Vita enamic (Vita); Sintron (Armann-Girrbach) and human enamel as control were mounted on dental splints and worn by volunteers for 3, 24, and 72 hrs. Prior to the experiments the surface roughness of the materials was determined. Biofilm was investigated by scanning electron microscopy (SEM) and characterized microbiologically.
Results Surface roughness was significantly higher in enamel and Lava Plus than in the other materials. The results showed remarkable differences in biofilm growth and differentiation on the various materials. After three hours on most materials an organic matrix of varying morphology with only a few bacteria was found whereas on enamel biofilm growth already started. After 24 hours scattered bacterial growth could be found, but no biofilm. After 72 hours in a closed biofilm was found on most materials except Sintron. Microbiology demonstrated mainly the same bacterial composition of the biofilms on the different materials. The thickest biofilm developed on the enamel surface.
Conclusions From the results it may be concluded, that biofilm development on dental restorative materials is primarily dependent from the underlying dental material, from the developing biofilm organic matrix and from time, but not from the surface roughness of the dental material. Biofilm variability and growth speed is higher in the biofilm grown on the enamel surface than on the dental materials.

0522

Study on Characteristics of High Toughness Hybrid Resin for CAD/CAM

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Objectives The objective of this study was to evaluate flexural strength and staining property of high toughness hybrid resin composite for CAD/CAM.
Methods The high toughness hybrid resin composites for CAD/CAM used in this study were Cerasmart 300 (C300; GC), Estelite P Block (EPB; Tokuyama Dental), Katana Avencia P Block (KAPB; Kuraray Noritake Dental) and KZR-CAD HR 3 (KZR3; Yamakin). The specimens were prepared with size of 1.2-mm x 4.0-mm x 14.0-mm for three-points bending test (n=10), and size of 1.0-mm thickness for colorimetric measurement (n=3). Three point bending tests were performed after polishing with silicon carbide

paper until #2,000 grid and storing in distilled water at 37 °C for 7 days. Colorimetric test specimens were polished with the silicon carbide paper until #4,000 grid and finished with buffing. Staining solution of colorimetric measurement was used a coffee solution. The specimens were immersed into coffee solution at 37 °C. The value of color difference ($\triangle E^*_{ab}$) was measured by a color difference meter (CR241, Konica Minolta) after 1, 2, 3, 7, 14 and 28 days, and calculated by $\triangle E^*_{ab}=(\triangle a^2+\triangle b^2+\triangle L^2)^{1/2}$. These data were analyzed using two-way ANOVA followed by Tukey's multiple comparison test (α=0.05).
Results The flexural strength before stored water was not significantly different between each material, and that of KAPB showed the highest (263.3 MPa), and significantly higher compared with EPB (242.4 MPa) after stored water. Color difference of KZR3 after 1 day showed the lowest (0.43), and that of EPB showed the highest (1.20). Color difference of C300 after 28 days showed the lowest (1.30), and that of EPB showed the highest (2.96).
Conclusions The results of this study suggested that the mechanical and physical properties were difference between each hybrid resin composite.

0523

Three-body Wear of CAD/CAM Restorative Materials against Zirconia

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Objectives To evaluate three-body wear of different CAD/CAM and direct restorative materials opposed to zirconia (ZrO_2) antagonist wheels in an ACTA wear machine.
Methods Specimens (n=10) suitable for the compartments of the ACTA wear machine were prepared from bovine enamel, amalgam (Silber70-Solo, DMG), six CAD-CAM based composite and hybrid-ceramic blocs (Grandio blocs, VOCO/ Tetric CAD, Ivoclar Vivadent/ Lava Ultimate, 3M OralCare/ Brilliant Crios, Coltene/ Cerasmart, GC/ VITA Enamic, VITA), one lithium disilicate ceramic CAD-CAM material (IPS e.max CAD, Ivoclar Vivadent) and three direct composite resins (Clearfil majesty posterior, Kuraray/ Grandio SO, VOCO/ Filtek Supreme XTE, 3M OralCare). After storage (28d, aqua dest., 37°C) 200,000 wear cycles were performed against an antagonist wheel (Y-TZP, Prettau, Zirkonzahn, d=20mm, h=6mm, F=15N, f=1Hz, 15% slip) in millet seed suspension as third medium in the ACTA wear machine. Mean wear depth and roughness (Ra) were analysed in a 3D optical non-contact profilometer (CT100, CyberTechnologies) equipped with a confocal white-light sensor CHR-600 (CyberTechnologies (z-res.=0.02µm)). Vickers hardness (HV) was measured using a Vickers indentation tester (15s indentation time, HV2, Zwick Roell). Statistical analysis was performed using non-parametric statistics (Kruskal-Wallis and Mann-Whitney-U test).
Results Bovine enamel showed the significantly highest wear depth opposing the ZrO_2 antagonist. The ZrO_2 wheels had no signs of abrasion. Similar wear resistance was tested for direct and indirect resin based materials with analogous filler configurations. The lithium disilicate ceramic IPS e.max CAD showed the significantly highest Vickers hardness, which led to the best ACTA wear-resistance. No correlation between mean wear depth and roughness or Vickers hardness could be found.
Conclusions Among the materials tested, composites performed amalgam-like, while the lithium disilicate ceramic showed the highest and bovine enamel the lowest three-body wear-resistance. The high Vickers Hardness of the lithium disilicate ceramic and the prismatic structure of enamel may influence the differing wear behavior.

0524

Coefficient of Friction of CAD/CAM Restorative Materials Against Zirconia Antagonists

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Objectives To describe time-dependent wear behavior by evaluating the coefficient of friction of CAD/CAM and direct restorative materials opposed to a zirconia antagonist in a pin-on-disc setup.
Methods Flat specimen discs (n=3; d=35mm) were prepared from two direct composite resins (Grandio SO, VOCO/ Filtek Supreme XTE, 3M), four CAD-CAM based composite and hybride-ceramic blocs (Grandio blocs, VOCO/ Tetric CAD/ Lava Ultimate, 3M/ VITA Enamic, VITA), one lithium disilicate ceramic CAD-CAM material (IPS e.max CAD, Ivoclar Vivadent), and bovine enamel. Specimens were used in segments, luted onto holders and levelled plane parallel using a cup grinder up to D15 roughness. After storage (28d, aqua dest., 37°C), testing was performed in a pin-on-disc setup according to EN 1071-13 (50,000cycles, 120rpm, F=31,3N) in 60ml mucine based saliva (Saliva Orthana, AS Pharma, Salisbury, UK) opposed to a zirconia-pin (Y-TZP, Frialit, d=3mm). Mean vertical substance loss, volume loss and coefficient of friction (initial/steady-state) were analysed using a 3D optical non-contact profilometer (CT100, CyberTechnologies, Eching-Dietersheim, Germany) equipped with a confocal white-light sensor CHR-600 (CyberTechnologies (z-res.=0.02µm)).
Results Mean values for the coefficient of friction varied between 0.165 (Tetric CAD) and 0.490 (IPS e.max CAD). The lithium disilicate ceramic showed the significantly greatest wear loss while hybride or composite materials performed comparable to enamel or amalgam. Vertical substance loss thereby correlated (r^2=0.995) with volume loss. A principal correlation of wear rates and surface hardness can be postulated. The zirconia pin did not experience any degradation.
Conclusions All tested materials showed considerable wear facets against the zirconia antagonist. The combination of two hard restorative materials seems to be deleterious in terms of material degradation. Hybride or composite materials showed wear resistance in the range of enamel and amalgam.

0525

Surface Roughness Modification and Bond Strength of Hybrid CAD/CAM Materials

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Objectives To investigate the effect of different surface roughness treatments on the bond strength of different hybrid CAD/CAM materials.
Methods Four hybrid CAD/CAM blocks (Shofu Block HC, Shofu; Lava Ultimate, 3M; Brilliant Crios, Coltene;Enamic, Vita Zahnfabrik) were cut in slabs of 4-mm thickness, divided into four groups, and subjected to the following surface treatments: group 1: no treatment; group 2: sandblasting with 29µm Al2O3 (SB) (Aquacare, Twin, Veloplex Int, London UK); group 3: 5% hydrofluoric acid etching (HF) + Si; and group 4: tribochemical silica coating (CJ) (Cojet, 3M ESPE). SEM and AFM analysis of the surfaces were performed (magnifications ≤ 3000x). Sections of the same group were luted together (2 sandwich specimens/group) using a dual-cure self-adhesive cement for all groups.After two days storage in 0.5% chloramine at 37°C, the sandwich specimens were sectioned in rectangular microspecimens. One half of the specimens were subjected immediately to a microtensile bond strength (µTBS) test, and the other half were tested after 4 month water storage (artificial aging). The statistical methodology followed was the General Linear Full Factorial Model.
Results SEM and AFM analysis indicated that surface roughness modification protocols had different effect on each material. Micro-tensile bond strength tests indicated that the lowest µTBS values were obtained in the absence of any surface treatment, whereas highest µTBS values where obtained after either mechanical or chemical surface roughening. The results indicated that bond strength values depended on the type of surface treatment and on the interaction between the material and surface treatment.
Conclusions Surface roughness modification treatments contribute to a higher bond strength of hybrid CAD/CAM materials. However, optimal surface treatment appears to be material dependent.

0526

Analysis of the Internal Fit of CAD/CAM-restorations: A New Digital Approach

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Objectives Studies analyzing the internal fit of FDPs normally rely on conventional methods (replica technique). Nevertheless, with this technique, the number of measurement points is limited and the entire procedure is time-consuming. Furthermore, the copings are often made of zirconia, which requires a sintering after milling and entails high manufacturing costs. Therefore, it was the aim of this study to develop a new digital method and compare this technique with the replica technique using different coping materials.
Methods Two models, representing a partial upper jaw with the first molar(26, FDI) prepared, were fabricated. In model A both adjected teeth(25,27) were presented, whereas in model B only the adjected premolars(24,25) were there. Digital impressions were conducted with a Trios3(3Shape) and copings were made of three different materials (CAD/CAM-composite(LuxaCamComposite), zirconia(LavaPlus), non-precious(FinoframeCoCr)). First, the replica technique(EXA'lence,GC) was carried out. Each specimen was sliced and analyzed under a microscope(Smartzoom5,Zeiss) at 16 measurement points. For digital inspection each coping were set on the dye with a high-viscosity silicone(FitTestC&B,Voco). After removal of the coping the dye with the adherent silicone layer was scanned. For digital inspection a 3D-software(GOM-Inspect) was used. Statistical analysis was performed by a Kruskall-Wallis-test.
Results No statistical difference could be shown between the digital and conventional method (p=.997) and the two models (A,B) (p=.234). Whereas, occlusal measurement points (means±SD, 198±36µm) displayed significant higher internal discrepancy (ID) compared to axial (170±74µm) and marginal (53±24µm) measurement points (p < .00). Between the three coping materials no significant difference was observed, but CAD/CAM-composite showed the lowest ID (136±70µm), followed by zirconia (152±74µm) and non-precious alloy (157±93µm).
Conclusions Overall, the results demonstrate that the digital methods is a valid alternative to conventional replica technique. Additional, it offers the possibility to make a full 3D-analysis. Furthermore, manufacturing costs can be reduced by using new materials such as CAD/CAM-composites.

0527

New Digital Protocol for Standardization of Endocrown Preparation.

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Objectives One of the most important variables that should be standardized is the cavity preparation of the tested samples in the in vitro studies, the purpose of this study is to produce an accurate technique for standardization of cavity preparation by using CAD\CAM.

Methods : ten selected non carious recently extracted for orthodontic treatment plane purposes of upper premolars had been used in this study. All extracted teeth received endodontic treatment by the same operator, then immersed in auto polymerizing resin at the level of 2mm below of the cement enamel junction. First, we design the standard cavity preparation parameters through 3D Design software (Rhinoceros 3D; Robert McNeel & Associates, North America, USA) as follow: (Buccolingual width 4mm , Miseodistal width 3mm, Total depth 4mm, Degree of convergence 20 degree). Then, we send the cavity design as an STL file to the milling software ((*hyper*DENT®, Follow-me, Technology Group, Munich, Germany) in order to select job procedures needed to produce our predetermined cavity design. At the last, to hold the tested samples within the milling machine we designed a special holder

Results By using this technique, we had the ability to use CAD/CAM system to perform a standard intracoronal cavity preparations for total 10 upper extracted premolars which resemble perfectly our digital designed cavity preparations. This study will give us opportunity to use this technique to standardize any cavity design accurately.

Conclusions through using 3d designing software we could design any cavity preparation for any cavity preparation either intracoronal or extra coronal, full coverage or partial coverage and send it accurately to the milling software (*hyper*DENT®, Follow-me, Technology Group, Munich, Germany) which give us the opportunity to select the job procedures from simulation process that will produce this specific cavity preparation in all specimens , in order to standardize the position of the cavity within the specimen , we can use the special designed holder to determine the central position within the specimen at which the cavity preparation will be obtained.

0528

Fracture Resistance of Adhesive Endocrowns with Different Designs and Materials

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Objectives The aim of this study was to evaluate the effect of three endocrown designs and two monolithic ceramic materials on the fracture resistance of endodontically treated upper first premolars, in comparison to a post-crown control group.

Methods *S*ixty-five human extracted maxillary first premolars were endodontically treated and shortened to a level of 2 mm coronal to the cemento-enamel junction. The specimens were randomly divided into six endocrowns groups and one post-crown control group (n=8); ZrE1, ZrE2, ZrE3, LDE1, LDE2, LDE3, and PC. All endocrown groups had a pulpal inlay with 2 mm depth, 3 mm buccolingual length and 1.8 mm mesiodistal width. According to external preparation, three different designs were used: E1; flat occlusal table (without ferrule), E2; endocrowns with 1.5 mm ferrule, E3; endocrowns with flat occlusal table and 1.5 mm buccal preparation. Two monolithic ceramic materials were used: Zr; Zirconia and LD; Lithium disilicate. The control group (PC) was restored with zirconia posts and a composite build-up, and lithium disilicate crowns. Panavia V5 resin was used as luting agent. Specimens underwent a thermo-mechanical fatigue with a dynamic load of 10 kg for 1,200,000 cycles and thermocycling between 5 and 55 degree Celsius. Thereafter, the specimens were quasi-statically loaded to fracture. The results were analyzed using one way ANOVA with a post hoc test, and Sample T-Test.

Results None of the specimens showed any signs of debonding caused by the fatigue test, The fracture resistance of PC control group showed no statistically significant difference in comparison to groups ZrE1, ZrE2 and LDE2 ($P > 0.05$). However, it was statistically significant different from groups LDE1, LDE3, and ZrE3 ($P < 0.05$).

Conclusions The fracture resistance of endocrowns was affected by different designs and materials. The results showed superiority of the post-crowns, endocrowns with 1.5 mm ferrule and zirconia endocrowns with the flat occlusal table.

0529

Change in dental Treatment Mix Following a Change in the Payment Method. A Pilot Study

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Objectives The nature of dental services provided is related to the type of services needed by a population, and treatment decision making by dentists. The aim of this descriptive study was to compare the dental service mix in two different payment systems (salary and fee for an item or service (FFS).

Methods : The dental records of a long established Tehran dental clinic were reviewed. Treatment performed, during October 2012 and October 2013, by four dentists, who had worked for the first year for a fixed salary and for the second year under the FFS system, was analyzed. All dental records for patients who attended the clinic during October 2012 and October 2013 and with an equal number of records for each dentist were reviewed. The type of treatment provided was divided into three groups, which were: special (orthodontics, implants), general (extraction, restoration, root canal therapy (RCT) and fixed prosthesis), and prevention (scaling and prophylaxis, fluoride therapy and fissure sealant). The number of referrals by the four general dentist s for specialist care was recorded and special services and visits provided by the specialists were excluded from the analysis. A

total of 1,000 general and preventive treatments, provided during the two periods were then analyzed.
Results When the payment method changed to FFS, for general treatment there were increases in the number of treatments for RCT (FFS = 288, Salary = 95), impacted wisdom teeth surgery (FFS = 31, Salary = 5) and fixed prostheses (FFS = 89, Salary = 29). In contrast they decreased for: referrals (FFS = 29, Salary = 91), restorative dentistry (FFS= 89, Salary = 157) and tooth extraction (FFS = 149, Salary = 238). For preventive treatments the numbers were higher for salary and these were scaling (FFS = 27, Salary = 55), fissure sealant (FFS = 3, Salary = 13) and fluoride therapy (FFS = 0, Salary = 9).
Conclusions As far as the four dentists, who were studied were concerned, in a salary system, the dentist was more likely to refer and perform preventive treatments, while, in the FIS payment system, the dentists choose more aggressive treatments.

0530

Surgical-orthodontic Treatment of Facial Asymmetry Patient with Hyperdivergent Pattern.
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Objectives Facial asymmetries could have pathological, traumatic, functional or developmental causal factors. Pre-surgical orthodontic treatment must be employed to correcting potential dental compensations in the three planes of space. Treatment objectives were as follows (1) improve the facial asymmetry; (2) eliminate the dental compensation; (3) correct the irregularity of the teeth.
Methods A 18-year-old woman was referred to the orthodontic department with the chief complaint of chin asymmetry and dental crowding. She was diagnosed as facial asymmetry, constricted maxilla with dental crowding. Miniscrew-assisted rapid palatal expansion (MARPE) and extraction of the maxillary first premolars were used to improve transverse deficiency and irregularity of the teeth. Le Fort I osteotomy and bilateral sagittal split ramus osteotomy (SSRO) was performed to correct the asymmetry of the maxilla and correct the mandibular deviation.
Results The patient's chief complaint was corrected after 34 months of active orthodontic treatment with orthognathic surgery. Facial asymmetry was corrected and harmonious facial profile was obtained. The patient finally got to have class I canine and class II molar relationship with proper overbite and overjet. Although she had TMJ noise before the orthodontic treatment, there was no TMJ symptom during and after the treatment. No specific root resorption was observed and acceptable root parallelism was achieved. During post-operative orthodontic treatment, skeletal relapse tendency was not observed and her facial profile was well maintained.
Conclusions Facial asymmetry is easily perceived by the patient and often degrades life quality of patients. If orthognathic surgery is planned, dental decompensation and arch coordination should be done before the surgery. Often transverse deficiency is found during the process so it should be considered thoroughly. The expansion of the maxilla through MARPE was well maintained during the preoperative and postoperative correction. Because the patient has a problem of dislocation of the disc, we will continue to observe whether it is maintained or not.

0531

Endodontic Management of TipIII Dens Invaginatus in a Mandibular Canin with Open Apex: A Case Report
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Objectives Dens invaginatus (DI)is a developmental anomaly that causes the enamel organ to deepen or spread to the tooth papillae before mineralization of the tooth tissue.This is unfortunate, as the presence of the invader is considered to increase the risk of caries, pulp and periodontal inflammation. Early diagnosis of a tooth affected by dens invaginate is important. The prevalence of DI ranges 0.3-10%. The most commonly affected teeth are lateral,maxillary lateral incisors, followed by canines, premolar and molar teeth. Mandibular formation of this anomaly is rare.
Methods A 42-year-old male patient was referred to the Endodontic Department of Ondokuz Mayis University with the complaint of discoloration of the tooth #43. In the clinical examination, there was no pathology in the tooth and surrounding soft tissues. The tooth did not respond to the dental vitality tests and the radiographic examination revealed radiolucency in the periapical region. Cone-beam computed tomographic (CBCT) imaging was used in the diagnosis and management of the unusual anatomy of dens invaginatus. Type III DI with open apex was diagnosed. MTA was applied for apical plug and thermoplastic gutta-percha obstruction technique was used for ortograde root canal treatment.The final restoration of the tooth was completed using composite resin material.
Results After endodontic treatment, clinical and radiographic follow-ups were performed at the 1st, 3rd and 6th months of the tooth.
Conclusions DI is a relatively easy to diagnose dental malformation. However, it is necessary to know its radiographic aspects. The treatment results demonstrated that, although the cases of dens invaginatus of high complexity are challenging, an accurate diagnosis accompanied with proper endodontic treatment can avoid unnecessary surgical intervention and allow great chances of favorable prognosis in long term.

0532

Non-invasive Treatment of Pulp-Calcified Teeth with External Bleaching

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Objectives To describe the aesthetic treatment with external bleaching using carbamide peroxide of teeth with an alteration in color appearance due to pulp canal obliteration after dental trauma.

Methods Five patients demanding esthetic treatment of an anterior discolored tooth with history of trauma at least 10 years before were treated. All teeth exhibited a yellowish appearance and obliteration of the root canal without other alterations nor apical lesions. Patients manifested no response to thermal pulp testing. In all cases, color was selected before treatment with the color guide VITA toothguide 3D MASTER (VITA). Also digital photographs were taken (Canon EOS 60D) to assess fluorescence (INECSA SUPRA 230W DS 530-4 / 6/8) and with a croos polarization filter (Polar_eye Canon MT-24EX). External whitening was performed with a customized tray of 0.5mm thickness with windows cut out of the tray adjacent to the tooth to be treated. All patients used 16% carbamide peroxide (Prevdent nHApTM repair Whithening) during night with a minimum of 6 hours. Changes in color were clinically assessed every two weeks.

Results All teeth treated showed an improvement in their aesthetic appearance with a decrease in saturation and an increase in opacity that was perceived as successful for the patients without requiring other treatments.

Conclusions At-home external whitening with 16% carbamide peroxide is an efficient and minimally invasive solution to reduce saturation in teeth with pulp canal obliteration due to trauma.

0534

Surgical and Endodontic Treatment of Parakeratotic Keratocyst: A Case Report

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Objectives An odontogenic keratocyst (OKC) is categorized as a developmental, noninflamatory odontogenic cyst that derives from residuals of dental lamina. OKCs have a high recurrence rate and develop more aggressively than any other jaw cysts. They are generally seen in the mandibular molar ramus region. In this article a case of OKC in the mandibular region is described.

Methods A 41-year-old female patient visited the Department of Endodontics in the Faculty of Dentistry at Süleyman Demirel University with complaints of repeated swelling and pain between the right and left mandibular second molars at the mandible. Clinical examination revealed swelling of the vestibular sulcus. The subsequent radiographic examination showed a uni-locular radiolucency between the mesial of tooth number 38 and the mesial of tooth number 47. The electrical pulp test was performed. The treatment plan was described to and approved by the patient. Root canal treatment was applied to the teeth that responded negatively to the electric pulp test, and radical curetage was performed surgically on the lesion region.

Results Histopathologic examination showed that the lesion was a parakeratotic type of OKC. The patient was recalled after one year and there was no recurrence. However, at the end of the sixteenth month, new radiolucency was observed on the left mandibular region and surgical curetage was applied. One year later, the cystic region had improved significantly. Two and a half years after the first surgery, bone formation was complete in a large part of the mandibular region. Follow-up continues.

Conclusions

Further long-term follow-up is needed to determine whether recurrence of the OKC in this patient has been successfully prevented. Conservative treatment of our patient showed good treatment efficacy with low risk of recurrence.Treatment procedures were presented at a congress before follow-up of this case.

0535

Bisphosphonates: A Case Report of Non-Surgical Periodontal Therapy

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Objectives Bisphosphonates are drugs used for the inhibition of osteoclastic bone resorption. Their therapeutic use is indicated for Paget's disease, hypercalcemia of cancer, bone metastases, and osteoporosis. The main side effect of these drugs is osteonecrosis of the jaw, which is difficult to control. This type of osteonecrosis is characterized by necrotic exposure of maxilla and mandible, without clinical evidence of healing for at least 8 weeks in patients. These lesions are usually asymptomatic, but may be associated with pain, purulent secretion, swelling, tooth mobility, and paresthesia.

Methods A 43 year-old woman was referred to Yeditepe University Faculty of Dentistry, Periodontology Department due to generalized gingival bleeding, third degree of mobility on her mandibular incisors and pain on tooth #16. She was diagnosed with osteoporosis and received ibandronic acid (Bonviva® 150 mg.) orally once a month for 4 years. She has not been received ibandronic acid since 8 months.

Results A multidisciplinary approach has been performed at first appointment. Due to consultation with patient's medical doctor, extractions were avoided. So, invasive procedures were performed. Root-canal treatment applied to #31 and a fiber splint applied between #33-43 following the initial periodontal therapy performed with antibiotic prophylaxis.

Conclusions Appropriate recall interval was determined as 3 months for the patient and follow-up appointments have been kept under control since 18 months.

0536

Microcirculation of Apical Periodontitis before Nonsurgical and During Surgical Laser Treatment. Case report.

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Objectives Evaluate tissue perfussion of periapical lesion before nonsurgical treatment and during surgical endodontic treatment with ER:YAG laser with the help of laser doppler flowmeter.

Methods Laser Doppler flowmetry is a non-invasive method of measuring microcirculatory blood flow in tissue. Using laser doppler flowmetry MOORVMS-LDF1-HP and CP1T-HP probe combined with moorVMS-PC Software to evaluate the state of periapical lesion(cyst) before nonsurgical endodontic treatment with bioceramics (Well Root SP) and compare it to a healthy vital tooth of the same type with no periapical lesions. Later the bony crypt of the cyst was evaluated with MOORVMS-LDF1-HP and VP7BS-HP probe during periapical surgery, after the cyst was ablated with ER:YAG laser Light Touch(Sineron, Israel) and retrogradely obturated with TheraCal LC. Then the cyst received a bioceramic bone graft. To our knowledge this is the first time that laser doppler is used during periapical surgery to evaluate tissue perfussion. Lesion type was confirmed with histological examination after surgery.

Results Laser doppler flowmetry shows that cyst has a decreased blood flow(flux), decreased concentration, direct current, speed, less temperature, compared to a healthy tooth of the same type. During periapcal surgery the direct laser blood flow evaluation of the surgical crypt shows different values of flux, speed, direct current, concentration, temperature which could be attributed to the mechanical trauma, adrenaline in local anaesthetic or laser influence.

Conclusions Laser doppler flowmetry is a valuable method to perform tissue evaluation before, during and after treatment. It allows us to follow up the healing and pathological dynamics of microcirculatory tissue changes as well as evaluate and compare different methods and materials for treatment of apical periodontitis.

0538

Apexification of an Endodontically Treated Tooth with Immature Apex: A Case Report

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Objectives Most of the dental injuries happen in childhood and they are most frequent in the age group 6–12 years. In cases of confirmed necrosis the treatment options are apexification or revascularisation. The aim of this report is to present a case of retreatment follow-up of a tooth with an open apex and a poor endodontic treatment previously performed because of a trauma.

Methods A 11-year-old male patient came to the dental office one month after an acute trauma with symptoms of pain on percussion. X-Ray displayed a central upper incisor with an immature apex and several gutta-percha points present in the canal, one of which was extruded beyond the apical foramen. On the same visit we managed to remove the existing root canal filling and achieve clean canal walls. Calcium hydroxide was placed as an intracanal medicament and the tooth was sealed with composite to ensure a tight seal. In 3 weeks pain complaints had disappeared. Apical plug of 5mm MTA was obtained. A moist cotton pellet was placed in the canal to ensure the proper setting of the MTA, and an X-Ray was taken. Composite was used as temporary obturation to ensure proper seal again. On the third visit cotton pellet was removed and the setting of MTA was confirmed clinically under magnification. The coronal portion of the canal was filled with conventional glass-ionomer cement and conventional LC composite was used to restore the access cavity.

Results The case was followed for six months. The tooth remained asymptomatic and no signs of periapical inflammation were observed radiographically.

Conclusions MTA has been proven to be the best material for apexification. The remaining part of the canal was filled with conventional glass-ionomer cement, that ensures chemical adhesion to the dentinal walls and the absence of remaining resin monomers.

0539

Multidisciplinary Use of Surgical Navigation Systems in Cranial and Oral and Maxillofacial Surgery

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Objectives We describe the use of surgical navigation systems in a multidisciplinary setting in cranial and oral and maxillofacial surgery.

Methods Seven patients with varying etiology (meningioma, osteoma, osteoradionecrosis, mid facial deformity, skull base tumor) were treated using either optical or electromagnetic surgical navigation systems. Tumor resections were performed using biomodels, virtual and physical biomodel simulated surgery, poly methyl methacrylate (PMMA), and poly ethyl ether ketone (PEEK) custom-made prostheses. Working methods were multidisciplinary and were minimally invasive and minimally aggressive thanks to the use of optical and electromagnetic surgical navigation systems.

Results Minimum follow-up was of 5 years and maximum 7 years. No complications occurred in terms of infection, hematoma,

seroma or malpositioned prostheses. Multidisciplinary usage of SNS, sharing the equipment across departments and disciplines, increases its cost effectiveness.
Conclusions Surgical navigation systems makes a positive contribution to minimally invasive, minimally aggressive, and individualized in cranial and maxillofacial surgery.

0540

Contemorary Methods to Diagnose Osas in Children. A Pilot Study

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Objectives Obstructive sleep apnea syndrome (OSAS) in children, characterized by partial or complete obstruction of the upper airway during sleep, is related to multiple adverse neurodevelopmental and cardiometabolic alterations. Although polysomnography (PSG) is the gold standard method to diagnose and know the severity of childhood OSAS, there is a discussion about its efficiency in children. The aim of this systematic review is to report the methods used to diagnose OSAS in children.
Methods A systematic research of electronic databases and reference lists of relevant studies was performed.
SELECTION CRITERIA: No restrictions were placed on publication language. Observational studies were selected. Studies with adult, syndromic and treated patients were excluded. The data obtained were selected according to the Strengthening the Reporting of Observational Studies in Epidemilogy (STROBE) statement for reporting observational studies.
DATA COLLECTION AND ANALYSIS: The data were collected by the Preferred Reporting Items for Systematic Review (PRISMA checklist).
The Cochrane Risk of Bias tool was used to evaluate the methodological quality of the included papers.
Results The initial search yielded 2117 papers, of which 22 articles could be included. The most used methods for detecting OSA in children were the cephalometry (81%) and polysomnography (72,7%), followed by clinical examination by a orthodontics or an otorhinolaryngologist (41%). The less applied tools were nasendoscopy (9%), nasal fibroscopy, plethysmography, MRI scanner and anthropometry (4,5%).
Conclusions Based on these evidences, we suggest the importance of the interdisciplinary evaluation in the management of OSAS in children. Not only are the detection responsibility of the otorhinolaryngologist and pediatricians, but also the dentist, especially the orthodontics, play a relevant role in the detection of this syndrome.

0541

Buccinator and Its Fascial System: Functional Hypothesis

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Objectives During mastication, buccinator compresses the cheek against the teeth and gums, and assists the tongue in directing food towards the teeth. This work aimed to study the buccinator development and the relationships of the muscle with its fascial system and the connective tissue surrounding to deepen in the knowledge of its function.
Methods The study was performed in accordance with the Declaration of Helsinki. Briefly, cheek area from 12 human fetuses measuring 100-150 mm (13-17 weeks post-conception) was histologically studied bilaterally. All specimens were part of the Collection at the Department of Anatomy and Embryology (UCM). Additionally, we bilaterally dissected the cheeks of 2 adult cadavers at the Centre for Body Donation (UCM). Subsequently, tissue was also evaluated with different histological techniques.
Results At 13th week post-conception, the collagen fibers from the submucosa of the cheek started to develop blending with the perimysium of buccinator. In addition, the perimysium continued with the conjunctive capsule of the buccal fat pad and the connective tissue surrounding the parotid duct. In this area picrosirius red staining revealed both type I and III collagen. From 14 to 17 weeks post-conception, collagen septa appeared perpendicular to the buccinator fibers, in continuity with its perimysium, reaching the dermis. These septa were found between the opening of the parotid duct and the nasolabial fold. Similarly, we observed the development of fibrous chambers embracing fat tissue lobules on the surface of buccinator which consisted mainly of type III collagen. Such fibers were also visible in adult cheeks.
Conclusions Our findings suggested that buccinator function is more complex than previously suggested. Its contraction entails traction of the mucosa and skin of the cheek. Moreover, the interconnecting fascia would help to hold the buccal fat pad and fix the position of the parotid duct‘s opening enabling the salivary secretion.

0542

Mandibular Border Movements and Chewing in Subjects with Different Skeletal Classes Through 3D Electromagnetic Articulography

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Objectives To describe mandibular border movements and chewing in three planes of space using electromagnetic articulography in volunteer with skeletal class I, II (1), II (2) and III.
Methods Descriptive study approved by the Scientific Ethics Committee of the University of La Frontera by decision No.

078/2017. Thirty participants of different skeletal classes were included. Chewing was evaluated with 3.7 gram of peanut and the mandibular border movements through EMA 3D AG501. All data were recorded, labelled and transferred from the AG501 to another computer to data processing. Data were processed with the MATLAB software.
Results Regarding mandibular border movements, the Posselt polygon was analysed in the frontal (table 1), sagittal (table 2) and horizontal plane (table 3). For all skeletal classes, the frontal plane area was the largest, followed by the sagittal plane, but for the horizontal plane, it had a statistically significant difference between class III and class I. Of mastication (table 4), was evaluated the area, speed and frequency. Skeletal class III had the higher average mastication area on sagittal, frontal and horizontal planes. The masticatory speed and frequency were consistent with described in the literature for class I normoocclusion subjects. Speed was correlated with chewing area and frequency and a positive correlation was observed for all classes.
Conclusions Unlike skeletal classes I and II, subjects with skeletal class III have a chewing pattern with greater lateral movements, with a greater area in the horizontal plane than in the sagittal plane. With the increase in chewing speed, the frequency and area for all classes increased, observing a greater increase in mastication area for skeletal class I.

0543

Immunohistochemical Identification of Striated Muscle Cells within the SMAS Fibers

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Objectives The superficial musculoaponeurotic system (SMAS) connects the mimic muscles to the skin determining the facial mimics. Human mimics is highly variable and the physiological mechanism of its fine tuning is poorly understood. The aim of this study was the immunohistochemical analysis of the SMAS fibrous septa of the midfacial and periorbital region to study the SMAS fibers and their connection to the mimic musculature.
Methods Seven patients with midfacial and periorbital skin neoplasia planed for surgical intervention were included in the multicenter study. After written and verbal patient consent eight histological serial sections were taken from the tumour free margins of seven in sano resected neoplasia. Immunohistochemical analysis was performed using antibodies against smooth and striated muscle cells. The study has been approved by the ethical committee of Witten/Herdecke University (84/2018).
Results Four of the seven samples showed the tissue layers skin and SMAS. SMAS consisted of fibrous septa which devided the subcutaneous univacuolar fatty tissue into different compartments. Striated muscle cells have been demonstrated histologically and immunohistochemically in three of the four SMAS tissue samples. They were located within the SMAS fibers.
Conclusions SMAS consist of a fibro-muscular meshwork bolstered with univacuolar fatty tissue. The striated muscle cells within the SMAS fibrous septa may determine punctual skin relief changes and therefore be responsible for the fine tuning of the mimics. According to the immunohistochemical findings two mimic expression patterns are proposed: macromimic expression induced by the mimic muscle contractions and the micromimic expression caused by the isolated muscle cells in SMAS fibrous septa.

0544

Use of Scales in the Evaluation of Postoperative Patient Morbidity: Two Case Reports

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Objectives Free gingival graft operation (FGG) is the most predictable method for the augmentation of the keratinized gingiva. However, FGG has also some limitations that may cause adverse effects of postoperative patient comfort. In this case report, the comfort of the two patients was evaluated with a horizontal scale and quality of life (QoL) scale in the first month after FGG operation.
Methods FGG operation was performed due to the lack of keratinized gingiva in the mandibular anterior region for two patient who are systemically healthy and non-smokers, apply for the periodontology clinic, one female (Patient 1) is 27 years old and the other male (Patient 2) is 43 years old, Graft thickness (GT), graft vertical height (GVH) and graft horizontal width (GHW) were recorded during surgery. Oral Health Impact Profile (OHIP-14) questionnaire was used to evaluatin of QoL of the patients, just before surgery (baseline) first 7 days, and first month postoperatively. Pain level was assessed by Visual Analog Scale (VAS) for the first 7 days postoperatively. The number of analgesic drugs taken was also recorded.
Results Measurements of GT and GVH were similar but GHW of patient 1 was higher than patient 2. OHIP-14 and VAS scores was given in Table 1 and 2. QoL scores of patient 1 were more influenced adversely than patient 2 especially for the first 4 days postoperatively. QoL scores of patient 2 has not changed according to baseline for the first week and month. Analgesics consumption and VAS values of patient 2 was higher than patient 1 unlike OHIP-14 scores.
Conclusions The use of the OHIP-14 scale might be more reliable for patient-centered evaluations in addition to clinical measurements for evaluation of patient comfort after FGG operation.

0545

Soft Tissue Augmentation via Free Gingival Graft Around Dental Implants: A Case Report

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Objectives The absence of adequate keratinized mucosa around implants has been found to be associated with higher plaque accumulation, gingival inflammation, bleeding on probing, and mucosal recession. In patients exercising good oral hygiene and receiving regular implant maintenance therapy, implants with a reduced width of <2 mm of periimplant keratinized mucosa were more prone to plaque accumulation, bleeding, mucosal stress and soft tissue recession
Our aim is to increase the chances of implant survival by increasing keratinised tissue in the patient with inadequate tissue width.

Methods A 47-year old female patient in good general health conditions implanted in the area of number 35, number 36 , with inadequate keratinized tissue, the patient was referred to our clinic by a prosthodontist colleague. 1 mm keratinized gingiva and 0.61 mm in number 35,0.69 mm in number 36 mucosal thickness were measured in clinical examination. Free gingival graft was planned to increase the keratinised tissue width, deepen the vestibule sulcus and to ensure the efficacy of oral hygiene. The recipient area around dental implants was prepared. FGG was taken from palate. The graft was sutured. Periodontal dress was used. 14 days after the surgery sutures were removed.

Results No complication occurred during the healing period. The keratinized gingiva height and mucosal thickness were increased. The keratinized gingiva height were 4 mm at number 35 and 4.5 mm at number 36.While the mucosal thickness was 1.44 mm at number 35, it was 1.76 mm at number 36.After surgery, the patient had no complaints about providing oral hygiene. There was no bleeding and mucosal mobility. The tissue formed was tight and adherent.

Conclusions Conclusion:
Free gingival graft surgery is a predictable treatment option for promoting keratinized gingiva width around dental implants to provide oral hygiene easier and to maintain the periimplant tissue health. .

0546

Multidisciplinary Approach to Treat Severe Periodontitis: A Case Report

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Objectives Periodontitis often leads to occlusal trauma that deteriorates the destructive process entailing functional and esthetic impairments. This case report describes two cases of periodontally compromised patients treated by a conservative orthodontic-periodontal-implant treatment.

Methods A 40-year-old male patient complained about gingival swelling and high mobility on the upper anterior teeth and right first molar area. Generalized severe periodontitis was treated by non-surgical and surgical methods including regenerative therapy using enamel matrix derivatives and alloplastic materials. When periodontal disease had been resolved, the orthodontic treatment began to correct the traumatic position of the lower right central incisor. After the maxillary central incisors with high mobility and the impacted mesiodens were extracted, alveolar ridge preservation procedure was performed to obtain enough bone for implantation. The orthodontic treatment achieved general stable occlusion and the implant placement was completed with the prosthetic treatment.
A 46-year-old female patient had a missing area on the upper right second premolar and angular bony defects on the lower posterior areas. After the periodontal treatment including non-surgical and surgical methods with extraction, the orthodontic treatment was performed to correct the poor position of the lower right posterior area. Once the orthodontic treatment was completed, two implants were placed on the missing areas. The patient had periodontal maintenance care every 3 months after treatment finalization.

Results Periodontal control after the multidisciplinary treatment showed stable pocket depths in both cases. In the first case, the patient declined extraction of the upper right first molar in spite of severe alveolar bone loss. A stable occlusion was established and no specific complaint was appeared.

Conclusions A combined good coordinated periodontal-orthodontic-prosthetic approach is important to solve the functional and esthetic problems in patients with periodontal disease.

0547

Ligneous-gingivitis Patient with Ligneous Conjunctivitis due to Plasminogen Deficiency:A Case-report

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Objectives Ligneous conjunctivitis is an autosomal recessive disease, which is a rare form of chronic conjunctivitis due to the plasminogen deficiency. It is characterized by recurrence of white, firm, avascular, fibrin-rich pseudomembranous lesions on the tarsal of the conjunctivae. Ligneous conjunctivitis is also associated with other mucous membranes such as gingival mucosa, respiratory tract, intestines, female genital tract. Ligneous gingivitis is characterized by ulcerations and whitish nodular gum lesions. The purpose of this case report is to present intraoral clinical findings and the treatment of ligneous gingivitis patient with ligneous conjunctivitis due to plasminogen deficiency at 6-month follow up period.

Methods A 7-year-old male patient was referred to Yeditepe University Faculty of Dentistry, Periodontology Department due to

widespread nodular gingival enlargements covered with white membranes on both vestibular and palatal/lingual surfaces of the maxillary and mandibular gingiva. He was previously diagnosed as ligneous conjunctivitis and was using prednisolone ophthalmic solution (Pred Forte®), moxifloxacin hydrochloride ophthalmic solution (Vigamox®0.5%) and cyclosporine ophthalmic emulsion (Restasis® 0.05%). At first visit, oral hygiene instruction including modified Bass tooth brushing technique was shown on a model. Supragingival prophylaxis was performed and 0.2 % Hyaluronic acid gel (Gengigel® Baby) was topically applied to gingiva and oral mucosal surfaces to enhance healing, and prescribed as 3-5 times daily for 3 months to relieve pain.
Results The patient was kept under control with monthly recall intervals and his periodontal relief was stabilized up to 6-month follow up.
Conclusions Longer follow-up periods are necessary in order to maintain the obtained treatment outcomes since there is no validated therapeutic protocols for this inherited disease.

0548

Diode Laser Removal of Puberty Induced Gingival Enlargement: A Case Report

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Objectives Puberty induced gingival enlargements are unusual inflammatory tissue responses caused by plaque accumulation due to hormonal changes. The aim of this case report is to describe the treatment and 3 month follow-up of a 12 years old male patient with a pubertal gingival enlargement lesion, which was excised by iLase diode laser.
Methods A 12 years old, healthy, male patient was diagnosed with a gingival enlargement on the buccal and lingual aspects of the tooth 23 and referred to the periodontology department. The erythematous and highly vascular enlarged tissue impaired the masticatory function of the patient and was an esthetic concern affecting his self esteem. The medical history of the patient was reviewed and it was confirmed that the patient did not take any drugs, which are known to cause gingival enlargement. The tissue was excised by a diode laser and the biopsy was sent to pathological examination for final diagnosis. The area was anesthetized by the injection of 2 ml Ultracain DS solution. An excisional biopsy was taken using iLase, diode dental laser with the excision mode of the laser. Peak power was 1.8W, average power was 0.9W, pulse length and interval were 1.0 ms each. The enlarged tissue was removed as two parts; from the buccal and the lingual aspects. The excised tissue was placed in formalin solution and sent to the pathology department for final diagnosis.
Results The site from which the biopsy was taken healed uneventfully and the patient did not report any discomfort after the procedure. Pathology report has revealed that the site did not contain any neoplasms. Fibromatous and vascular proliferations were reported and ossification was observed in focal sites and diagnosed as ossifying fibroma.
Conclusions Diode laser can be used for the treatment successfully of such gingival enlargement lesions presenting ossification. There is no recurrence of the lesion in 3 months follow up.

0549

Topically Applied Hyaluronan Gel on Pain and Palatal Wound Healing

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Objectives Pain, burning sensation and delayed wound healing are most common post-operative complications on donor site following free gingival graft (FGG) operations. The improvement of postoperative morbidity together with successful treatment outcomes has been a major gole of the periodontal treatment favoring patients' state of health. Hyaluronan (HA) has been introduced as an alternative approach to enhance wound healing. This report aims to evaluate the effect of topical polivynylpyrolidone sodium hyaluronate gel on post-operative patient discomfort and wound healing of palatal donor sites after FGG surgery.
Methods Four patients requiring FGG at lower anterior and premolar area were randomly assigned in two groups to provide data for further research. FGG was performed in all patients. In two patients, topical HA gel were applied on donor areas and preserved with periodontal dressing. Wound area was closed with only periodontal dressing in the other two patients as control. Post-operative pain and burning sensation were recorded using a visual analog scale (VAS) on days 3, 7, 14, 21. Complete epithelization (CE) and color match were also recorded on days 3, 7, 14, 21 and 42 as secondary parameters.
Results HA group showed less pain and burning sensation than the control group on days 3 and 7. However, there was no differences in pain and burning sensation on days 14 and 21. CE was achieved on day 21 in all patients. HA group showed higher color match scores than the controls on days 3, 7, 21 and 42.
Conclusions Within the limits of this pilot study, topical HA gel provided positive contribution to post-operative patient pain.

0551

A Prospective Double-blind Randomized Study of Topical Anesthetics

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Objectives Pain is defined as an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage. Usually, discomfort and pain are associated with dental work. Pain control can be achieved by using anesthesia. The injection is the most common cause of anxiety in patients which affects the quality of dental treatment. Ointments, anesthetic sprays, gels, or adhesive patch are the topical application of local anesthetic which is utilized to reduce the pain of local anesthetic injections, but these methods have their own limitations. The aim of the present study was to compare and evaluate the effectiveness of lidocaine 10% and placebo in reducing pain during the administration of local anesthesia in dental patients.

Methods A prospective double-blind, randomized unicentric controlled observational study was conducted, which included 75 patients, aged between 18 and 80 years. The patients are divided into two groups: group A (women 13, men 12) of 25 patients who required anesthesia in the anterior upper maxilla and group B (women 29, men 21) of 50 patients who needed anesthesia in posterior upper maxillar (right or left side). Lidocaine 10% jelly. Xilonibsa®10%, INIBSA Dental. Each ml contains: Lidocaine (D.C.I.) 100mg + Ethanol 96° 30,0% + menthol, saccharin, macrogol 400, banana flavour purified water). Application during 2 minutes in the oral mucosa. The pain was compared using the Verbal Descriptor Scale (VDS) and Visual Analog Scale (VAS) as subjective criteria after administration of an injection by a trained assistant who was blinded to the procedure.

Results The Statistical method used was SPSS v. 15.0 (student t). The mean pain by VAS is 0.95 ± 1.52, the data agree with those collected using the VDS. Although the other factors analyzed do not obtain statistically significant differences, a trend is observed with the age and the sex of patients, towards a lower perception of pain by women patients older than 45 years old.

Conclusions The data analyzed show that there are no statistically significant differences in the perception of the pain of the injection between the group with topical anesthesia and the control group with a placebo.

0552

Success Rate of Nitrous Oxide Conscious Sedation: A Systematic Review

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Objectives To determine the success rate of nitrous oxide conscious sedation (NOS) in dentistry.

Methods A systematic search was conducted in the PubMed/MEDLINE, Scopus, Cochrane Central Register of Clinical Trials (CENTRAL), EBSCO Discovery, LILACS via BIREME and Database of Abstracts of Reviews of Effects (DARE) databases in English and filters (e.g., articles published from 1999) were used. Abstracts were screened for suitability, and full-text articles were obtained for those complying the inclusion and exclusion criteria. Only randomized controlled trials (RCTs), both with parallel groups or with a cross-over design, were included. The quality of the studies was assessed using the revised Cochrane risk-of-bias tool (RoB 2).

Results Among 413 screened articles, a total of 17 RCTs, which evaluated 641 patients who underwent dental treatment with NOS, were included in this review. Of said studies, thirteen (76.5%) were at high risk of bias, three (17.6%) were at unclear risk of bias, with just one assessed as at low risk of bias. Four studies were conducted on adult patients, while the remaining studies on the pediatric population. Heterogeneity within studies was moderate (I^2=57.85%), so the success rates of NOS were pooled with a random effect model. The estimated success rate of NOS was 88.36% (95% CI: 76.75–99.98%). Completion of treatment and Houpt scale score were the most used success criteria.

Conclusions Taking into consideration the distinct outcome measures employed to assess NOS performance, within the limitations of this systematic review and meta-analysis, this study could provide important information on the success rate of NOS. There is a need for further well-designed and well-reported clinical trials to evaluate NOS performance. Further recommendations for future research are described and it is suggested to standardize the criteria used to prospectively define efficacy. The indications of NOS should be strictly followed.

0553

Virtual Reality Relaxation to Decrease Preoperative Dental Anxiety: An RCT

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Objectives to study if short-term virtual reality relaxation reduced dental anxiety in public health setting.

Methods This randomized controlled single-center trial was conducted in the public Oral Health Care Unit of Kalasatama, Helsinki, Finland with two parallel arms: Virtual Reality Relaxation (VRR) and Treatment As Usual (TAU) groups (allocation ratio 1:1). Adult patients who were attending a dental appointment, consented, and completed the questionnaire without assistance, were eligible participants. Power calculation determined the sample size to 270 participants. Recruitment stopped at 277 patients. Interventions were conducted in similar settings in small alcoves with a seat and a table. VRR group participants chose one 1-3 minute 360° video immersing them in peaceful virtual landscape with audio features supporting the relaxing experience.

TAU group participants remained seated for 3 minutes. Dental anxiety was assessed with Modified Dental Anxiety Scale (MDAS) before and after the intervention. Mean changes in MDAS total and factor scores (anticipatory and treatment related) between the groups and stratified by gender were analyzed using independent samples t-tests. City of Helsinki provided ethical clearance (HEL 2018-008940).
Results MDAS total and anticipatory factor scores decreased more in the VRR than the TAU group; among females, also in treatment related dental anxiety. Among men difference was observed only in the anticipatory dental anxiety. (*p-values for t-tests)
Conclusions Short term VRR is feasible in reducing preoperative dental anxiety in public health setting.

0554

Reporting by Mobile Phone of Adverse Reactions after Dental Treatment

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Objectives A large number of dental materials is available on the market and some materials can cause allergic reactions. The frequency and nature of possible reactions is not well known since there are few prospective studies regarding adverse reactions from these materials. The aim of this study was to test the feasibility of reporting of experienced adverse reactions related to dental treatment using cost effective technology. In addition, the project should have minimal impact on the daily work at the participating dental practices.
Methods Following treatment, patients were invited by the dentist to participate in the study. All patients who accepted to participate signed an informed consent form. At the end of the day, the dentist sent an encrypted photo to the study office of the patient list of the day, including names and mobile phone numbers of the participants. The photo was sent via the mobile phone app “Signal” (Cohn-Gordon, et al 2017). Three days after the treatment day, a text message was sent to the participant’s mobile phone including a question about experienced adverse reactions after the dental treatment three days earlier. The participants replied with a “YES” or “NO”. Participants who confirmed adverse reactions were contacted a week after treatment for a standardized interview via mobile phone.
Results The pilot study was conducted during a period of three weeks at one dental practice, with two participating dentists, and 86 participating patients. Of these 81 (94 %) responded to the text message. The method for collection of data worked as planned, and had minimal impact on the daily work at the dental practice.
Conclusions The method used to collect data regarding the patient’s experience of adverse reactions related to the dental treatment was useful and can be used to collect experiences from a large number of patients.

0555

Determination of the Patient Profile Most Likely to Quit Smoking

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Objectives Smoking cessation programs are widely used in dental clinics to reduce the tobacco use of smokers and to prevent uptake in non-smokers. Dentists play an important role when it comes to informing and motivating patients but it is also necessary to recommend them to treat the addiction. Every patient has a different degree of addiction and the approach to quit smoking is different depending on it. For this reason, it is important to know the patient profile most and less susceptible to quit smoking and apply the best protocol to each one.
The aim of this study was to determine which patients were more susceptible to smoking cessation depending on their sex, level of stress and age at the International University of Catlunya.
Methods The protocol of smoking cessation with the inclusion of a mobile application was applied to the patients. Data was collected from 67 smoking patients distributing surveys including filiation data, level of stress, number of cigarettes smoked, other information about the tobacco smoked and the Richmond and Fagerström tests.
Results A follow-up of 3 months was completed by 42 patients who answered the survey in 6 different times. The number of cigarettes, Richmond test values and Fagerström test values variation in time was evaluated for both genders and the different levels of stress. The data for the age could not be evaluated
because of the homogeneity of the sample. The three variables analysed for sex showed statistically significant differences. For the levels of stress only the levels of 3 and 4 showed statistically significant differences in the three different variables.
Conclusions From the data obtained in the study and the analysis of the results, women with levels of stress of 3 and 4 (in a scale from 0-6) were the profile of patients more susceptible to quit smoking.

0556

Dental Staffs' Experiences of "Difficult" Patients

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Objectives Dental staff encounters from and to patients experienced as "difficult". These patients are theorised to affect the dental staff in different ways and induce unwanted feelings, thoughts and behaviours, such as discomfort, frustration and stress. The aim of this study was to gain a deeper understanding of dental staffs' experiences of "difficult" patients. Who are they? What distinguishes these patients from other patients? In what way do they affect the dental staff?
Methods Ten informants consisting of dentists, dental hygienists and dental nurses from various public dental clinics in the region of Västra Götaland, Sweden, were strategically selected and interviewed after giving informed consent. All interviews were audio recorded. Transcriptions of the in-depth interviews were analysed in line with the principles of qualitative content analysis.
Results The study result indicates that "difficult" patients are perceived to have deficiencies in the ability to *interplay*; including subcategories described as difficulties in *communication and understanding*, lack of *compliance and cooperation* and difficulties in *trust and respect* for the dental staff and their professional competence. Another characteristic of "difficult" patients is the need for *longer treatment times*, which in turn can lead to unforeseen treatment delays. This altogether affects the dental staffs' *thoughts, feelings* and *behaviours* negatively, which further influences their abilities to *get to know* and *treat* "difficult" patients.
Conclusions "Difficult" patients are patients difficult to treat and help, as they affect the dental staff negatively. The findings contribute to new understanding of "difficult" patients in dentistry by an interactionist approach. This indicates that the experience of "difficult" patients results from complex interactions rather than attributing to specific groups of patients, medical conditions or treatment procedures.

557

Dental Anxiety: Dentist-administered CBT-treatment (D-CBT): A Pilot Study

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Objectives Dental anxiety is a risk factor for oral health problems. Thusly, evidence based treatment methods developed for use in primary care can reduce dental anxiety and risk of poor oral health. The aim for the first step in establishing a scientifically tested treatment method to be delivered in primary care by dentists, was to develop and pilot-test a 3-5 session manualized psychological intervention based on cognitive behavioral therapy (D-CBT).
Methods The manual for D-CBT was developed in four steps: (i) Based on literature reviews and clinical experience the 3 main researchers developed a first manual draft describing the intervention in detail. (ii) The manual was evaluated by 2 professors of psychology and by an expert group consisting of 3 clinical psychologists and 3 dentists with a high level of clinical experience. Based on the corresponding feedback, the final D-CBT-manual was developed. (iii) A pilot-study including 10 patients suffering from dental anxiety received 5 x 60 minutes manualized D-CBT consultations. Dental anxiety was measured before and after the treatment using Modified Dental Anxiety Scale (MDAS), a 5-point questionnaire with a total score ranging from 5-25.
Results The final D-CBT manual included 4 main components: A. Building a good relationship with the patient B. Psychoeducation in anxiety symptoms C: Exploration of individual symptoms of anxiety D: Exposure to the frightening stimuli. MDAS score at baseline ranged 15-25, mean 21 (sd. 3.5) after treatment the mean MDAS-score was reduced to 14 sd. 2.8. (range 10-20). The mean reduction was 7 (sd 3.6), range 5-7. All patients reported benefit from the treatment.
Conclusions The D-CBT-manual used by a dentist in a regular dental general practice setting show promising results in the treatment of dental anxiety and will be tested in a population with sample size calculation based on the pilot study.

0558

Long-term Bond-strength of a Fast-curing Composite and a Universal Adhesive

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Objectives In direct restorative treatment, clinical success of the bonding-system is often correlated with shear-bond-strength (SBS). However, initial SBS offer little information regarding long-term-stability of the bonded interface. To ensure a clinically performing composite-restoration, stable SBS provided by the adhesive and filling-materials employed is paramount.
This study evaluated the new PowerCure System (Ivoclar Vivadent) consisting of a fast-curing composite, a light-curing unit (LCU) and a clinically well-established universal-adhesive.
Here we investigated the effect of up to 24 months water-storage on SBS.
Methods SBS in self-etch-protocol (SE) was tested according to ISO-29022. Bovine-teeth were ground with SiC (p120 + p400) until superficial enamel or dentine was exposed. The tooth-surface was then contacted with Adhese Universal ("AU", Ivoclar Vivadent) under 20s of microbrush-agitation. Afterwards AU was thinned to an immobile layer with compressed air (4bar). Finally AU was light-cured. The specimen was then carefully insert into the sample-jig. Tetric PowerFill ("TPF", Ivoclar Vivadent) was applied to the bonding-surface via the jig-mould. Bluephase PowerCure (3050 mW/cm^2) was used as LCU. Adhesive and filling-material were light-cured for 3s each.
Specimens were aged (up to 24 months, 37°C, water) before testing SBS (ZWICK-ROELL-Z010, 1mm/s crosshead-speed).

Results This investigation showed that TPF and AU provided stable high values for at least 24 months. For both substrates there was no discernible influence of storage-period on bond-strength-performance.
Conclusions Within the limitations of this investigation SBS obtained with Tetric PowerFill and Adhese Universal, after curing for 3s, proved to be stable to at least 24 months of water-storage.

0559

Comparison of Self-etch vs. Etch-and-rinse Modes of Universal Adhesives: Microtensile Bond Strength to Enamel

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Objectives To compare the immediate microtensile bond strengths (μTBSs) of four mild self-etch universal adhesives applied to enamel with self-etch (SE) and etch-and-rinse (ER) techniques.
Methods A total of 104 human teeth were used to obtain two enamel fragments from another 104 human teeth were randomly distributed into eight groups according to the various adhesive systems used: Scotchbond Universal (SBU)[etch-and-rinse mode vs. self-etch mode]; Optibond XTR (OPT) [etch-and-rinse mode vs. self-etch mode]; Clearfil Universal Bond Quick (CL) [etch-and-rinse mode vs. self-etch mode]; and Adhese Universal (ADH)[etch-and-rinse mode vs. self-etch mode]. After 24 h of water storage, the bonded sticks were tested for μTBS. The differences in the pre-test failure and fracture-failure modes were tested by a two-way ANOVA and GEE model analysis. Bond-strength data were analyzed with a two-way ANOVA and mixed-model analysis.
Results The mean μTBS was statistically different among the four adhesives, as was the application mode. The μTBSs was significantly lower for OPT (11.99±3.87 MPa in the SE mode and 11.55±6.56 MPa in the ER mode) than for ADH (16.09±7.09 MPa in the SE mode and 19.26±5,18 MPa in the ER mode) (p=0.0008), whereas SBU (14.62 ±6.29 MPa in the SE mode and 20.37±5.79 MPa in the ER mode) and CL (16.06±3.21 MPa in the SE mode and 26.72±4.62 MPa in the ER mode) did not differ significantly from ADH. GEE model analysis on adhesive failure showed that the adhesive failure rate differed among the 4 adhesives (p=0.0114), suggesting that OPT (64.7% and 57.6%) and CL (80% and 22.66%) had higher adhesive failure, which was significantly higher than ADH (p=0.0012).
Conclusions The μTBS was significantly lower for CL than for SBU and ADH. The mean μTBS of adhesives to enamel differed when the adhesives were applied by the self-etch or the etch-and-rinse technique.

0560

Notched-edge Shear Bond Strength of Universal Adhesives on Tooth Substrates.

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Objectives To assess the bond strength on enamel and dentin of novel Universal adhesives in combination with a resin composite.
Methods Six Universal adhesive/composite combinations were tested: OptiBond eXTRa Universal (KavoKerr; O); AdheSE Universal (Ivoclar; A); Clearfil Universal Bond Quick (Kuraray; C); Scotchbond Universal (3M; S); Prime&Bond Elect (Dentsply; P), Futurabond U (Voco; F). All the adhesive systems were tested in combination with Harmonize resin composite (KavoKerr).
The bond strength to enamel and to dentin was measured with the notched-edge shear bond strength test (ISO 29022/2013). Extracted molars were sectioned with a low-speed saw to obtain 3mm thick slices. The slices were positioned on one side of a cylindrical mold of 25mm in diameter, 25mm height, and hold in position with a self-adhesive tape. Acrylic resin was then poured from the opposite side of the cylindrical mold, so that one side of the tooth slice was exposed at the surface. A clinically relevant smear layer was created by grinding with a wet 600-grit SiC paper. The bonding procedure was then performed according to the manufacturers' instructions. After the bonding procedure, the specimens were inserted in a bonding clamp. The resin composite was layered into the hole of the bonding mold insert to obtain 1.2mm diameter cylinders bonded onto the tooth slice surface. The resin composite was then cured for 20s. After removal from the mold, the specimens were stored for 24 hours and then tested in a UltraTester Machine (Ultradent). The bond strengths were recorded in MPa, and then were statistically analyzed for enamel and for dentin (Kolmogorov-Smirnov test, Levene test, One-Way Analysis of Variance, Tukey test at p<0.05 level of significance).
Results The following bond strengths were recorded in MPa (mean±standard deviation)
Enamel (p<0.001): O 33.2±3.8^{a}; S 24.3±2.1^{b}; A 22.4±3.9^{bc}; P 21.0±3.6^{bc}; C 19.4±2.7^{c}; F 17.4±3.0^{c}.
Dentin (p<0.001): O 43.1±3.3^{a}; A 34.2±2.5^{b}; S 33.7±4.2^{b}; F 31.8±1.3^{b}; C 31.2±2.6^{b}; P 26.8±1.5^{c}
Conclusions OptiBond eXTRa Universal achieved statistically significant higher bond strength than all the other materials tested, both on enamel and dentin substrates.

0562

Effect of Surface Treatment Methods on Adhesion of Aged Resin-composite Repair

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Objectives To evaluate the effect of surface treatment with mechanical and/or chemical protocols on the microtensile bond strength (MTBS) of a repaired aged-resin-composite.

Methods Forty-eight half-hourglass shaped resin-composite blocks (Clearfil™AP-X ES-2, shade A2) with surface area at the narrowest part of 1.5x8.0mm. were prepared using metal-split-mold. All specimens were divided into six groups(8/gp). Group1, specimens were stored in 37°C water, 24hours. The others (Groups2-6) were subjected to 15,000cycles of thermocycling, then stored in 37°C water for 6months. Specimens were treated with different procedures: Group.1(-SE) and Group.2(+SE) as negative and positive control respectively, were bonded using self-etch adhesive (Clearfil™SE Bond); Group.3(+CoSE), CoJet™ then bonded; Group.4(+CoSiB), CoJet™ followed by silane-coupling-agent which was a mixture of Clearfil™porcelain bond activator and primer of Clearfil™SE Bond, then bonding; Group.5(+HFSE), 9.5%HF (hydrofluoric acid), 60s then bonded; and Group.6(+HFSiB), 9.5%HF, 60s, followed by silane-coupling-agent, then bonding. After surface treatments, each specimen was repaired into hourglass-shaped by mean of a split-mold using Clearfil™AP-X ES-2, shade A4, to simulate the repair of old restoration. After 24hours of 37°C water storage,all specimens were sectioned to achieve a surface area at the bonded interface of 1.5x0.7mm, 5pieces/specimen (n=40). MTBS between the resin-composites was determined using a universal testing machine. All bond strength data were statistically analyzed (One-way ANOVA, Dunnett's T3, $p < 0.05$).

Results The various surface treatments combined with the aging conditions exhibited significant effects on MTBS. Negative control group(-SE) showed the highest MTBS (43.18±3.11MPa). On-the-other-hand, the MTBS of all aged groups were decreased; however, two of the treatments (+CoSiB and +HFSE) showed significantly greater MTBS than did the other treatments (36.53±3.58 and 37.02 ± 3.68 MPa, respectively).The +CoSE exhibited the lowest MTBS (26.65±5.29 MPa).

Conclusions Surface treatment with 9.5%HF, 60s, followed by Clearfil™SE Bond and CoJet™, followed by silane coupling agent then bonding, significantly improved the MTBS of a repaired, aged resin-composite

0563

A New Universal Simplified Adhesive: 18-month Randomized Multi-center Clinical Trial

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Objectives This multi-center double-blind, split-mouth randomized clinical trial evaluate the clinical performance of a new universal adhesive system (Futurabond U, Voco GbmH, Germany) when applied using different application strategies over a period of 18-month.

Methods Fifty patients participated in this study. Two hundred non-carious cervical lesions were restored using the adhesive Futurabond U according to four adhesive strategies (n = 50 per group): only self-etch (SEE); selective enamel etching + self-etch (SET); etch-and-rinse with dry dentin (ERDry) and; etch-and-rinse with wet dentin (ERWet). After adhesive application, cavities were restored using Admira Fusion composite resin (Voco GmbH). These restorations were evaluated according to FDI criteria in the following items: retention/fracture, marginal adaptation, marginal staining, postoperative sensitivity and caries recurrence.

Results After 18-month, four patients (12-month; one patient; n=4 restorations and 18-month; 3 patients; n=12 restorations) were not evaluated. Fourteen restorations were lost after 18-month of clinical evaluation (4 for SEE, 3 for SET, 3 for ERDry and 4 for ERWet). The retention rates for 18-month (95% confidence interval) were 92% (81%-97%) for SEE, 94% (83%- 97%) for SET, 94% (83%- 97%) for ERDry, and 92% (81%-97%) for ERWet ($p > 0.05$). Thirty-eight restorations were considered to have minor discrepancies in marginal adaptation at the 18-month recall (13 for SEE, 13 for SET, 6 for ERDry and 6 for ERWet; $p > 0.05$). Fourteen restorations were detected as a minor marginal discoloration at the 18-month recall (6 for SEE, 6 for SET, 1 for ERDry and 1 for ERWet; $p > 0.05$). However, all of them were considered clinically acceptable. No restorations showed postoperative sensitivity and caries recurrence at this time.

Conclusions The clinical performance of the Futurabond U did not depend on the bonding strategy employed and it was considered reliable when used associated to Admira Fusion unidoses resin composite after 18-month of clinical evaluation.

0564

Evaluation of Non-carious Cervical Lesion Restorations on Different Operator Experience and Adhesives: A Retrospective Clinical Study

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Objectives to evaluate the clinical success rate of non-carious cervical lesion (NCCL) restorations on different operator experience and adhesive systems.

Methods Patients were routinely treated by an undergraduate or postgraduate student and randomly received a recall evaluation. Two experience examiners were calibrated for evaluating NCCL using the modified USPHS criteria, which including the key parameters of retention, marginal discoloration, marginal integrity, and caries. The factors related to the survival of

restoration were including; gender, age, arch site, tooth position, tooth types, occlusion, wear facet, caries risk, operator, adhesive, and composite. The key parameters data were analyzed using the Kaplan-Meier test. The comparison between key parameters and factors were performed using the Pearson Chi-square or Fisher's Exact test.
Results A total of 460 cervical restorations from 96 patients were evaluated with a mean age of 60.9 years (ranged from 37 to 83). The overall retention success was more than 90 % over 60 months in all adhesive systems. After 60 months, the success rate was dropped for both the 2-step etch and rinse and 2-step self-etching adhesive, while the selective enamel etching technique remained at the high success rate. The main reason failures were marginal integrity and marginal discoloration. The retention failure was related to the wear facets (p =0.03) and adhesive (p =0.02). The marginal failure on discoloration and marginal integrity were under the influenced of operator and adhesive.
Conclusions Recently adhesives and composites are well accepted for long term restoration. The short term clinical success rate of NCCL was not depended on operator and adhesive, even though the operator experience and adhesive influenced to the high success rate in the long term clinical success.

0565

14-year Clinical Evaluation of RelyX Unicem for Luting IPS-Empress Inlays.

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Objectives Aim of the present prospective study was to evaluate clinically the adhesive performance of two different luting materials for leucite-reinforced glass-ceramic inlays and onlays after 14 years in vivo.
Methods 83 IPS Empress (Ivoclar Vivadent) inlays and onlays were placed in 30 (19 females/11 males) patients under rubberdam. The inlays and onlays were luted in two different ways: 43 restorations were fixed with a self-adhesive resin cement (RelyX Unicem, RX, 3M ESPE) and 40 restorations were inserted with Variolink II low (SV, Ivoclar-Vivadent) after pretreatment of the cavities with an etch-and-rinse multistep adhesive (Syntac Classic, Ivoclar Vivadent). Recalls were performed after 2 weeks (n=83), 6 months (n=83), 1 year (n=82), 2 years (n= 82), 3 years (n=82), 4 years (n=74) and 14 years (n=58). Two independent calibrated examiners evaluated all restorations using modified USPHS criteria.
Results After 14 years 58 restorations could be evaluated. Eight patients (including 25 inlays) missed the 14 years recall. Seven of the 83 restorations had to be replaced (failure rate 8%; Kaplan-Meier). Three of them (SV group) suffered bulk fractures at the 14 years recall. After 14 years of clinical service, SV revealed significantly better results regarding discoloration of the luting gap (Mann-Whitney U-test, $p<0.05$). No statistically significant differences were computed between SV and RX for the remaining criteria (Mann-Whitney U-test, $p>0.05$). Over the 14-year period statistically significant deteriorations were found for colour match, marginal integrity and integrity of the tooth for both luting procedures (Friedman-test, $p<0.05$).
Conclusions Within the limitations of this study, the self-adhesive resin cement RelyX Unicem showed a similar clinical performance compared to the combination of multistep etch-and-rinse adhesive and Variolink II low after 14 years.

0566

Two-year Retrospective Clinical Study of Nanohybrid Ceramic Crowns

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Objectives The aim of this study is to assess the survival probability and marginal adaptation of Mazic duro (Vericom, Anyang, South Korea), the nanohybrid ceramic crowns at 2 years cemented with dual-cure resin cement.
Methods This retrospective study consisted of a clinical follow-up examination of 23 patients between 24 and 76 years of age who had been given single crowns with nanohybrid ceramic CAD/CAM block at the department of conservatives, Seoul national university dental hospital. 25 restorations were placed between July 2016 and September 2018. The inclusive criteria were that the period of follow up could be at least 10 months. The exclusive criteria were that the crown was failed due to periodontal problems. Any clinical failures were categorized as: crown fracture, crown chipping, crown debonding, and secondary caries.
Results At the 2-year recall check, 18 cases were remained, but 1 case was exclusived because of failure by periodontal problem. Among 17 cases, 3 cases were failed due to debonding and interestingly there were no crown fracture or crown chipping. Based on these failures, the survival rate of Mazic duro crowns cemented with resin cement was 100% after 1-year, and 87.5% after 2-year. The estimated by Kaplan-Meier survival analysis with statistic software (SPSS, version 23; SPSS, Inc), the expected survival period was 24 months. Marginal integrity was evaluated with modifed USPHS level, and all cases showed level A in latest F/U.
Conclusions At 2-year evaluation, bonded nanohybrid ceramic full-coverage crowns have a favorable short-term survival rate with good clinical performances.

0567

Clinical Performance of a Glass Ionomer for Restoration in Adolescents

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Objectives This is a longitudinal prospective split mouth randomized controlled clinical trial with the objective to study two different glass ionomer restorative materials, Ketac Molar (KM) and Ketac Universal (KU), for Class II restorations in the adolescent population during three-year follow-up. Funding for this project was provided by 3M Oral Care.

Methods Sixty adolescents, ages 12 to 17 years old, who were in need of two Class II restorations were enrolled in this study.After 120 Class II lesions in permanent teeth wererestored with Ketac Molar or Ketac Universal, the patients are being seen at annual follow-ups.

Results *Year 1 Results*: At the 1-year recall, 25 patients (41.6%) have been evaluated. The remaining 35 patients did not show for their 1-year recall. 17 (68%) of the evaluated KU and 22 (88%) of the KM restorations showed unchanged scores compared to Baseline, while 8 (32%) of the KU and 3 (12%) of the KM showed a performance decline in 1 or more categories while still being clinically acceptable (in most cases due to limited wear or minor chipping). 2 (8% failure rate) of the KU due to retention loss and none of the KM failed. There were no statistically significant differences between KU and KM ($p>0.05$).

Conclusions Both materials show acceptable performance at the 1-year recall. Since the study is ongoing, no further conclusion can be made at this time.

0568

High-Viscosity Glass Ionomer Used With Selective Cavity Preparation in MIH

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Objectives The aim of this study was to assess the clinical performance of glass ionomer(GI) restorative system in selectively prepared cavities in the treatment of MIH affected posterior teeth.

Methods 134 teeth belonging to 58 patients satisfying the inclusion and exclusion criteria were selected among a group of patients seeking routine dental care and recruited by the Marmara University, Dental School.134 (69 upper;65 lower) first permanent molars affected by severe MIH status were restored. The carious removal process followed the principles of Minimum Intervention Dentistry, where the tissue was removed selectively, depending on the cavity depth. Restorations were performed using a high-viscosity glass ionomer cement (EQUIA forte GC Europe). Direct clinical evaluation of restorations was performed using the Modified USPHS criteria. The data were analysed by using the LogRank-test for discrete random variables and simple Cox-regression for continuous random variables with Kaplan-Meier survival analysis.

Results Restorations placed over selective caries removal with GIC presented high survival rates. Within 24 months of evaluation, unsatisfied teeth were recorded and classified as unsatisfied using the Modified USPHS criteria, which characterizes *Charlie* for marginal adaptation, retention, secondary caries and postoperative sensistivity of the restored tooth.
The probability of being satisfied at 12 months and 24 months were found respectively 88,2%,78.6%. No statistically significant difference in satisfaction comparison rate was found between 12 and 18 months($p > 0.05$). According to the univariate of survival analysis of the prognostic random variables were found statistically insignificant($p>0.05$).

Conclusions GIC placed in teeth with MIH patients have a high survival rate in 2-years follow-up time. Hypomineralised enamel and also post-eruptive breakdown (PEB)may influence the performance of GIC. Long-term clinical trials are needed, because they remain the ultimate way to collect scientific evidence on the clinical effectiveness of glassionomer restorative treatments.

0569

Clinical Assessment of Posterior Composite Restorations` Wear: One-Year Results

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Objectives Due to the increased prevalence of parafunctions in the world population more often patients with both occlusal tooth wear and caries on posterior teeth need specific treatment decisions regarding the type of resin-based composite material for restorations. The objective of our study is to assess clinically the posterior composite restorations` wear in patients with extreme masticatory forces.

Methods Total of 30 direct restorations by Gradia Direct Posterior (GC) were evaluated in Class I and Class II caries lesions in preselected patients (mean age 25 years) with clinical and anamnestic signs of bruxing and clenching habits at 6-month and 12-month follow-ups. The gypsum replicas of the restored teeth were prepared immediately after restorative procedure (baseline) and at every recall. Control reference points were marked on the restored occlusal surface of the gypsum models at baseline and custom-made plastic matrix were fabricated for every case. An accurate reproduction of control reference points on models at follow-ups were made by the prepared plastic guides. All replicas were digitally scanned by 3ShapeTrios. By means of CAD module of CAD-CAM system the area of the sagittal section of restoration between the reference points was measured and compared at every evaluated period. The statistical analyses was performed by SPSS 17.0, $p<0.05$.

Results No statistically significant differences were evaluated in restorations` wear at 6-month and12-month recalls (χ 2 = 464.3) in comparison to the baseline data (χ 2 = 409.8). Most of the measured regions were not affected by the location of the restorations, patients' age and gender.

Conclusions Within the limitations of our study, all restorations made of Gradia direct posterior (GC) showed high resistance to extreme forces. Suggested method for measurement of wear resistance can be used in assessment of biomaterials and dental tissues (enamel and dentin) in various in vivo circumstances.

0570

Success Rate of a New Calcium Silicate Root Canal Sealer

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Objectives The aim of this non randomized clinical trial is to compare the success rate of root canals obturated using either a calcium silicate root canal sealer in combination with a single cone technique or with resin based sealer in combination with vertically condensed gutta-percha.

Methods 150 Teeth diagnosed with irreversible pulpitis or necrotic pulps included in a larger prospective trial,were selected for the study(REC: 08/H0804/79).The operators were allowed to choose between the two obturation techniques. Primary root canal treatments were carried out using ProTaper®Next nickel-titanium rotary instruments (Dentsply Sirona) in a crown-down approach to prepare each root canal to at least a X2 master apical rotary file. The canals were obturated using warm vertical condensation of gutta-percha and AH plus (Dentsply Sirona) or BioRoot™ RCS (Septodont) and a single cone technique. The teeth were then restored with permanent glass ionomer cores (Fuji IX® glass ionomer cement) or composite resin (Herculite ultra®; Kerr corporation, Orange, CA, USA). CBCT and PA radiographs were made at baseline and at 12 months recall.
The increase or decrease in the size of preoperative periapical radiolucencies and development of new radiolucencies were assessed by a consensus panel consisting of two pre-calibrated examiners.
Statistical analysis was undertaken using fisher Exact Test

Results At 1 year recall 104 teeth were assessed (51 Ah plus, 53 BioRoot™ RCS). The success rate using loose criteria for the CBCT images and PA Radiographs was respectively 80% and 89% in the Ahplus/Warm vertical condensation group, 84% and 90% in the BioRoot™ RCS single cone group. Difference between two groups was not statistically significant and no adverse event were observed.

Conclusions Within the limitations of this non-randomized trial, BioRoot™ RCSin combination with single cone technique resulted in a proportion of successful outcomes similar to that of warm vertical condensation and AH plus.

0571

A Comparison of Representative Dental Disease Codes between ICD-10 and ICD-11

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Objectives The 11th Revision of International Disease Classification (ICD - 11) was released in 2018. ICD-11 has a content model that describes comprehensive disease concepts with symptoms and causes. Newly introduced extension codes (X chapter), which have been designed to standardize the way additional detail information: anatomic site, severity and time axis, is added to stem codes, provide a more detailed disease explanation than ICD-10. ICD-11 is expected to be useful also in dentistry for statistical, clinical, and research purposes. In this study, we compared the characteristics of the ICD-10 and ICD-11 for typical dental diagnostic terms classified as code K (digestive disease) in ICD-10.

Methods We searched how minimum codes (K00 to K14) of dental and oral diseases in ICD-10 have changed in ICD-11 using ICD-11 web browser and ICD-10/11 mapping tables released as of March 12, 2019 (https://icd.who.int/browse11/l-m/en). We compared the correspondence of terms and codes in ICD -10 and ICD-11 for 666 dental diagnostic terms (K code) used in the Health Care Insurance System in Japan.

Results In ICD-10, dentistry diagnostic terms of code K included 14 categories, while in ICD-11 these are encoded in 24 categories. Gum and periodontal diseases are classified in a category K05 of ICD-10, while they are divided into DA0B “Gingival diseases” and DA0C “Periodontal disease" in ICD-11. K02 “Dental Caries” and K03 “Other disease of hard tissues of teeth” in ICD-10 are aggregated into a category DA08 “Diseases of hard tissues of teeth” in ICD-11 and stages of tooth decay are not categorized. In ICD-10 there were 21 cases where terms and ICD codes corresponded one-to-one. This decreased to 14 in ICD-11. Cementum caries is coded with K022 of ICD-10 and DA08.0 of ICD-11, but DA08.0 applies also to 17 other caries related terms. Extensions coded such as XA4KC7 (cementum) and XA5R09 (enamel) enable representation of the progression of caries. Furthermore, by using extension code XT44 (secondary), ICD-11 enables representation of the secondary caries which was not distinguished from primary caries in ICD-10.

Conclusions The number of chapters in ICD-11 for typical dental diagnostic terms increased, however the number of cases where terms and ICD codes corresponded one-to-one decreased. Using extension codes suggest being effective for representation several terms. We need to examine other dental terms in ICD-10 and consider the specific rules of using extension codes.

0572

Transcriptomic Analysis of PBMCs in Oral and Orophayngeal Cancer Patients

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Objectives We hypothesized whether oral and oropharyngeal cancer's secretion affected peripheral blood mononuclear cells (PBMCs) expression levels. Therefore, the aim of this study was to characterize transcriptions change in PBMCs of both cancers.

Methods RNA was isolated from PBMCs of eight oral and oropharyngeal cancer patients and four healthy controls to perform next-generation RNA Sequencing. After analysis, we validated some prominent genes by quantitative real-time PCR in PBMCs of 15 healthy controls, 15 oral cancer patients and 15 oropharyngeal cancer patients.

Results The RNA sequencing data displayed 205 up-regulated genes and 46 down-regulated genes in both cancer's PBMCs significantly (P<0.001). A remarkable gene x showed expression level in healthy controls, oral cancer patients and oropharyngeal cancer patients as 1.25 ± 0.09, 2.22±0.19 and 2.23 ± 0.29, respectively. Expression level of this gene were significantly different between control group and both cancer groups (P<0.001). Regarding to diagnostic purpose, this expression marker demonstrated very high percentages of sensitivity and specificity to distinguish both cancers out of healthy controls

Conclusions Our preliminary study exhibited some different transcripts in PBMCs of oral and oropharyngeal cancer compare to healthy controls. Moreover, expression level of gene X may use as oral and oropharyngeal cancer screening. However, further studies with enlarge sample sizes are needed to confirm this findings.

0573

Mandibular Basal-symphysis Morphometry in Forensics - A 3-Dimensional CBCT Study

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Objectives Human identification by determination of age, sex, stature, ethnicity, etc. is a challenging task in forensic sciences. Mandibular basal symphysis is one of the anatomical structures that may be used as a landmark in forensic anthropology.The purpose of this study was to evaluate the mandibular basal symphyseal morphometry in assessing the age and gender among Malaysian population.

Methods Randomly selected 168 CBCT images of the mandible were analyzed for the mandibular basal symphyseal parameters such as the height, width and depth. They were assessed for sexual dimorphism and correlated with chronological age of the individuals. The variations with regards to ethnicity were also tested. Following correlation, a population specific equation was derived for age estimation using linear regression. The equation was further validated on a test sample of 30 CBCT images.

Results When assessed for sexual dimorphism, the height of the mandibular basal symphysis showed a statistically significant difference between the two genders (p=0.02). The Pearson Correlation Coefficients (R value) between the three symphyseal parameters (height, width and depth) and chronological age were 0.171, 0.050 and 0.004 respectively. Among the three parameters, only the height showed a statistically significant, but a weak positive correlation (p= 0.027) in relation to age. The linear regression equation was validated on a test sample of 30 CBCT images. Different ethnical groups showed no variations in the symphyseal morphometry.

Conclusions Based on our observations, we hypothesize that mandibular basal symphyseal height may be a useful parameter in forensic age and gender determination among Malaysian adults.

0574

Serious Game In Oral Health: A Scoping Review of Their Effectiveness

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Objectives The purpose of this study was to systematically reviewing Apps containing gaming elements to improve oral health outcomes to: identify target populations; assess their embedded theory for change; assess the effectiveness in promoting/improving oral health outcomes; and the quality of the evidence provided.

Methods A systematic search was conducted to identify games applied to oral health and the ability to improve oral health outcomes (i.e., knowledge). The following electronic databases were reviewed with the indicated timeframe: MEDLINE (1966-2018); Embase (1980-2018); Cochrane Register of Controlled Trials (December-2018); LILACS (December-2018); and Scopus (December-2018). In this review, the Critical Appraisal Skills Programme criteria were used to assess the quality of the evidence of each selected paper.

Results Initial searches identified 787 records. After screening, and elimination by full text review, 14 articles were selected. Games were divided into two categories: seven were developed for specific educational purposes and seven for oral health promotion. Most studies involved oral health professions' students (n=7); or children (n=5); two involved parents/adults. The

most common studies design was quasi-experimental design (n=6) and four were RCT. Another four studies were qualitative evaluations. For most cases, Interactive serious games were as effective as traditional, non-interactive methods in improving oral health outcomes. Nonetheless, participants' feedback reflected a higher level of satisfaction in learning through games. The quality of the studies was limited due to small samples, limited age range of participants, lack of use of comparison group, and poor follow-up periods to review knowledge retention.
Conclusions Educational games are used scarcely in the promotion of oral health, and little valid empirical evidence available to confirm their efficacy. While gamification has been successful, further studies are required using more rigorous designs, evaluation and follow-ups. Additionally, because of differing learning styles, more studies involving adults are recommended to identify effective gamification strategies..

0575

Radiographic Tooth Classification using Convolutional Neural Networks and Context Information
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Objectives We aimed to apply deep neural networks (NNs) to classify (label) individual teeth from dental panoramic radiographs. Our hypothesis was that providing the NNs with image context information would significantly improve the classification performance.
Methods Our dataset consisted of 1,315 dental panoramic radiographs with a mean number of 28.7 teeth/image. On each scan all teeth were labelled and for each tooth a bounding box was drawn using an in-house developed annotation tool, resulting in 37,706 image segments, each showing a unique tooth. A residual NN (ResNet34), a state-ot-the-art deep convolutional NN, was applied for tooth classification (labeling). Different degrees of regional image context information were provided to the model by increasing the area of the bounding box by 20, 50, 100, and 300%. The model performance was evaluated using classification accuracy and overall F1-score. For modelling we used Python 3.7 and the PyTorch 1.0.1 deep learning framework. The models were trained on NVIDIA GTX 1080Ti graphic cards. The Mann-Kendall test, a nonparametric test for monotonic trends, was applied for hypothesis testing.
Results Classification accuracy/F1-score were 0.88/0.88 for the baseline model (no additional regional context beyond the bounding box provided), and increased to 0.91/0.90, 0.93/0.92, 0.95/0.94 and 0.97/0.97, respectively, when 20, 50, 100 and 300% additional context was provided (p=0.017/0.017).
Conclusions Tooth classification (labeling) using deep neural networks, and in particular the ResNet34 architecture, was highly accurate. Providing regional image context information significantly improved the model performance.

0576

The Effect Evaluation of an Online Cognitive Behavioral Therapy Program for Children's Dental Anxiety
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Objectives Recently, Gomes et al. (2018) perfomed a systematic review and concluded that cognitive behaviour therapy (CBT) produces better anxiety reduction than diverse behavioural management techniques, but the evidence was of low quality and further studies in children are needed. The aim of this study was to evaluate the effects of an online CBT program on improving childrens' dental anxiety and Quality of Life (QoL).
Methods Three hunderd children (aged 12-18) were recruited from pediatric dental clinics in Qazvin. This study adopted a three-arm randomized-controlled trail design, consisting of a children only online CBT group, children plus involvement of parents and dental professionals online CBT group, and waiting-list control group. The online CBT comprised text, videos, exercises and online guidance from a psychologist. A combination of cognitive and behavioral techniques was used to reduce dental anxiety. Children completed questionnaires, which assessed dental anxiety (MCDAS) and Self-Efficacy regarding Specific Phobias, QoL at baseline (T0), three month post-intervention (T1) and six-months post-intervention (T2). Data were analyzed with mixed models.
Results Decreases in children's dental anxiety and increases in self-efficacy and QoL at 3-months and 6-months follow-up in both intervention groups compared to the control group were observed. For the children only CBT group, the mean MCDAS score at baseline was 28.2 (SD, 6.2) and at follow up (T2) 16.81 (SD, 5.9). For the online CBT group plus involvement of parents and dental professionals, the mean MCDAS score for the CBT+ group was 27.4 (SD, 6.6) at baseline and 15.11 (SD, 5.7) at follow up. The control group showed no significant changes. Children in CBT group that involved significant others showed significant greater decreases in their dental anxiety, self-efficacy and QoL than the children in the CBT group (p<.001).
Conclusions This online CBT program led to decreased dental anxiety, higher self-efficacy with regards to phobias and better QoL of children. Involving parents and dental professionals can confer additional benefit for children's dental fear.

0577

Remineralisation Induced by Modern Ion-releasing Materials Applied onto Demineralised Dentine

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Objectives To evaluate the dentine remineralisation ability of modern ion-releasing materials in demineralised or bacterially-mediated simulated caries-affected dentine.
Methods Class I cavities were created in fifty extracted human molars which were submitted to a bacterial cariogenic challenge (24 days/37°C). The specimens were divided into five groups (n=10) based on materials: GIC (Ionostar, Voco); MTA (ENDOPASS, DEI-Italia); RMTA (Resin-modified MTA, Theracal, BISCO); BIO (Bioactive PRESTO, Pulpdent); Control (Aura flowable composite, SDI). The specimens were immersed in simulated body fluid (SBF) for 28 days under simulated pulpal pressure, cut into slabs (1.5mm), polished and submitted to KHN assessment. The first indentation (25 gf; dwell time 30s) was performed 50µm away from the material-dentine interface, while further three indentations were performed at 100µm intervals. Three dentine discs (1mm thick) for each group were created and demineralized in EDTA 37% for 5 days and covered on the occlusal side with each respective material. The specimens were submitted to FTIR assessment after 0, 3, 7, 15 and 28 days of immersion in artificial saliva. Finally, the specimens were processed and analysed with FEG-SEM. The results were submitted to statistical analysis ($p<0.05$).
Results Ion-releasing materials were able to induce dentine remineralisation. The highest ($p<0.05$) KHN values were obtained with the calcium silicate-based materials (CaSi: MTA and RMTA). Conversely, GIC and BIO showed higher KHN values compared to control composite; these values were lower ($p<0.05$) than MTA and RMTA. MTA and RMTA showed clear apatite precipitation after 3 days of AS storage. GIC and BIO showed only CaPO precipitation after 28 days of immersion in AS.
Conclusions CaSi-based materials may provide immediate apatite precipitation and microhardness recovery in dentine carious lesions; these might be indicated for pulp protection in ART procedures. Conversely, although GIC and bioactive composites induce moderate dentine remineralisation compared to CaSi-based materials.

0578

Quality of Proximal Surfaces of Posterior Restorations in Primary Molars

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Objectives To evaluate *in vitro* the influence of matrix system and the restorative material selected on proximal contact tightness and proximal morphology of class II restorations in primary molars.
Methods Second primary artificial molars mounted on a typodont (Frasaco) were used to restore class II occluso-mesial restorations with standardized dimensions. Cavities were randomly divided in four groups according to the matrix system used: 1. Circumferential matrix combined with a Tofflemire retainer (KerrHawe), 2. Automatrix System (Dentsply Sirona), 3. Contoured sectional metal matrix band (Composi-Tight Pediatric M-series, Garrison), 4. Straight sectional matrix and separating ring (Composi-Tight Clear ring, Garrison), Afterwards, in each group, cavities were randomly restored with: 1. A nanohybrid resin composite, Filtek Z500 (3M Oral Care), 2. A bulk-fill resin composite, Filtek Bulk Fill Posterior (3M Oral Care), 3. A glass ionomer cement, Ketac Universal Aplicap Glass Ionomer Restorative (3M Oral Care) (n=12). The proximal contact tightness was measured using a custom-made device placed in an universal testing machine (Instron 3345) and the proximal surface morphology was examined after scanning (True Definition intraoral scanner, 3M Oral Care). Data were statistically analyzed using two-way ANOVA and Tukey test ($p<0.05$).
Results Proximal contact tightness values were significantly influenced by the matrix system ($p<0.001$) and the restorative material ($p<0.05$). Interaction between both factors was also significant ($p<0.01$). None of the matrix system tested provided adequate proximal morphology.
Conclusions In primary molars, conventional and bulk-fill resin composite restorations achieved worse proximal contact tightness when the circumferential matrix combined with a Tofflemire retainer were used. Glass-ionomer restorations exhibited similar results regardless the matrix system selected.

0579

Shade Match of Prefabricated Pediatric Crowns

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Objectives In this in-vitro study, the shade match of different preformed esthetic pediatric crowns was visually assessed compared to VITA classical A1-D4® shade guide (VITA Zahnfabrik).
Methods Preformed anterior pediatric crowns from NuSmile - ZR Zirconia light (NU) and 3M experimental composite material (EXP) were cemented on a VITA 1M1 S shaded tooth stump. The crowns were filled with RelyX™ Unicem2 – shade A2 (3M Oral Care) and seated on the stump with gentle pressure. Excess cement was removed, and the cemented crown was finally light cured from vestibular and lingual side for 10 sec (Elipar™ S10, 3M Oral Care). The shade was visually assessed by 3 different operators and compared to VITA classical A1-D4® shade guide in a light box with standardize D65 light conditions. All operators have a dental background and full ability in color discrimination (superior with less than 16 failures in the Farnsworth-Munsell-100-Hue Test). The code of Ranking is outlined in Tab 1.

Results Shade of EXP was assessed to match closest a Vita A1 with a ranking code of 1.3 ± 0.6. Shade of NU was assessed to match closest a Vita B1 color with a ranking of 3.7 ± 0.6. Both groups are statistically different (t-sample t-test; p-value = 0.008).
Conclusions Shade match of cemented EXP crown is closer to a Vita classical shade compared to cemented NU crown. As natural teeth, the Vita classical shade guide exhibits a translucency and color gradient from enamel to dentin. Due to an observed higher translucency of the EXP crown compared to NU crown, the overall visual appearance is closer to the Vita classical shade guide.

0580

Impact of Oral Health Education in Outpatient on Children's Dental Health on and Pit and Tissure Sealing Effect

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Objectives To investigate the impact of oral health education in outpatient on children's dental health and pit and fissure sealing effect.
Methods 158 children given infusion in outpatient clinic transfusion room from July to September 2017 in Tianjin Stomatological Hospital were selected and were randomly divided into education group (76 cases) and non education group (82 cases) according to the random number table method. Patients in education group were given dental health education. There was no propaganda and education in non education group. After 1 year, the included children were followed up. The same questionnaire was filled by test children and took back. The survey results were counted.
Results Understanding rate of dental health care knowledge and dental hygiene situation in education group children were obvious better than those in non education group, and the difference was statistical significant (P<0.05). The detection rate of calculus, dental caries rate, incidence rate of gingivitis, plaque index and pit and fissure sealing in children of education group were obvious better than those in non education group,and the difference was statistical significance (P<0.05).
Conclusions Outpatient oral health education for children can correct bad habits, improve oral health status and is worth to be popularized in clinic.

0581

Protein Analysis of Mature Dental Enamel by Means of Liquid Chromatography-Mass Spectrometry

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Objectives In developing enamel, several proteins act in the process of mineralization of the dental enamel matrix. These comprise, e.g., amelogenins, enamelin, ameloblastin and tuftelin, in addition to proteases such as kallikrein. In mature dental enamel, most of these proteins are degraded and replaced by inorganic hydroxyapatite, leaving less than 1% of residual organic components. In cases with mineralization disturbances, this residual organic component is assumed to be higher than normal. The aim of the study was to evaluate a dental enamel grinding dissection technique, and to obtain a reference proteomic profile for normal, mature dental enamel.
Methods Dental enamel from healthy premolars, obtained from a biobank (Sahlgrenska Biobank 830), was dissected off by means of a grinding technique. The outer half of the enamel was drilled off with high-speed during water-cooling. The collected enamel slurry was immediately centrifuged in a cooled centrifuge at 150 x g for 5 min. The supernatant was discarded and the enamel chip pellet was stored in -80o C until protein analysis. Liquid Chromatography-Mass Spectrometry was performed to obtain dental enamel proteomes.
Results Complex proteomic analysis mappings were obtained. A list with protein accession number data is presented.
Conclusions Dental enamel can be dissected off by means of a grinding technique.
The organic part of mature dental enamel comprises a complex protein composition.

0582

Humoral Response to *Fusobacterium Nucleatum* in Patients Diagnosed with Early Pancreatic Cysts to Pancreatic Cancer

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Objectives Intraductal papillary mucinous neoplasms (IPMNs) are pancreatic cysts that can progress to invasive pancreatic cancer. Our earlier work shows that presence of intratumoural *Fusobacterium nucleatum (F. nucleatum)* in IPMN is associated with early cancerous IPMN lesions. Whether there is an immunity against this bacterium in IPMN patients is not known. The objective of this study is to examine the quantity and quality of circulating antibodies to *F. nucleatum* in IPMN patients.
Methods Patients undergoing pancreas surgery (n=102) for pancreatic cyst tumours were included at the Karolinska University Hospital. Plasma antibody reactivity to the *F. nucleatum* Fap2 or the bacterial whole cell antigen were measured by solid-phase ELISA assays. Control bacteria included were *S. gordonii, S. constellatus, and E. coli*. Pancreas diagnosis was validated by histopathology obtained post-surgery and was used to assign patient groups for data analysis. Clinical and laboratory variables for correlation analysis included systemic and pancreatic inflammation markers and dental health parameters.
Results Plasma IgG binding reactivity to *F. nucleatum* or control bacteria of whole cell antigens were detected in vast majority of patients diagnosed with pancreatic cystic tumour. The reactivity did not differ between patients diagnosed with benign tumours (serous cyst adenoma, IPMN low grade dysplasia), and malignant tumours (IPMN with high grade dysplasia or with invasive

cancer), or healthy controls. However, compared to healthy controls, the reactivity to the Fap2 region of *F. nucleatum* was found to be weaker in majority of pancreatic IPMN patients (p=0.0056). Moreover, the Fap2 peptide reactivity in general was positively correlated to their reactivity to *F. nucleatum* whole cells (r = 0.33, p=0.0024).
Conclusions Our findings showed that patient diagnosed with pancreatic IPMN tumours have significant levels of plasma IgG reactivities to *F. nucleatum* whole cell antigen but their reactivity to the Fap2 immmunogenic region appear impaired in comparison to healthy controls. No significant correlation between dental health variables and severity of pancreatic tumour lesion was found.

0583

Oral Health in High-risk Women for Gestational Diabetes Mellitus

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bjectives To investigate, 5 years after delivery, oral health in women with gestational diabetes (GDM). Our hypothesis was that GDM reflected in long-term poor oral health.
Methods Women at high risk for GDM participated in an intervention study in 2008-2012 (n=720). 5-years post-partum an oral health examination was performed in 115 women out of 348 participating in a follow-up. Number of teeth, total dental index (TDI) and diseased, missed, filled teeth (DMFT) index were calculated. Bleeding on probing (BOP), probing depth (PD), visible plaque index (VPI), and clinical attachment level (CAL) were recorded. Periodontal inflammatory burden index (PIBI) was calculated. Panoramic radiographs were taken and signs of infections recorded. Oral health habits, symptoms, and subject's own opinion of oral health were assessed with questionnaire. Findings from GDM women were compared with those with no GDM.
Results 45% of the women had a history of GDM. In women with and without GDM, periodontitis was diagnosed in 22% *vs.* 32% (p=0.31), respectively. Mean BOP score was 45% *vs*. 47% (p=0.22), mean VPI score 13% *vs.* 17% (p=0.009), and mean PIBI score was 13.1 *vs.* 17.5, (p=0.041), in women with *vs*. without history of GDM, respectively. There was no difference between groups in DMFT scores (8.92 *vs.* 9.80), or in the number of radiological signs of oral infections. All women considered their oral health as good, reported no oral symptoms, and had good oral health habits. Of the women with a history of GDM, 70% brushed their teeth twice daily compared with 66% in the non-GDM women (p=0.42).
Conclusions Contrary to our hypothesis, women with a history of GDM showed better oral health parameters than women without. Hence, having GDM might have prompted the women to take better care of themselves, including their oral health.
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0584

Influence of Acute Renal Failure on the Severity of Apical Periodontitis

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Objectives The aim of this study was to evaluate the influence of Acute Renal Failure (ARF) on the severity of apical periodontitis (AP) in Wistar rats.
Methods Sixty-four rats were divided into four groups and two periods of analysis (n = 8): Group C - control rats; ARF group - rats with ARF; AP group – rats with AP; ARF+AP group - rats with ARF and PA. ARF was induced by daily application of Gentamicin (100 mg/kg/day) for 8 days, subcutaneously. AP was induced by the pulp exposure of the upper and lower right first and second molars. After 15 and 30 days of AP induction, the animals were killed and the jaws removed and processed for histomorphometric and immunohistochemical analysis for IL-6, IL-17, IL-23 and TNF-α.
Results In the histometric analysis, the AP group presented greater bone loss at 15 days when compared to the ARF+PA group ($p<0.05$). In the second experimental period, both groups with AP did not present statistical differences ($p>0.05$), although the bone resorption of the AP group was higher. In the immunohistochemical analysis, IL-6 had a higher immunostaining pattern in the ARF+AP group when compared to the AP group in the 15-day experimental period ($p<0.05$). For the IL-17, IL-23 and TNF-α there were no statistical differences between the AP and ARF+AP groups in both experimental periods ($p>0.05$).
Conclusions From the results obtained,it was observed that the association of apical periodontitis with acute renal failure leads to alterations in the inflammatory profile and periapical bone loss.

0585

Chlorhexidine Mouthrinse Evaluation in Periimplant Mucositis: Adverse Effects and Compliance

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Objectives To evaluate patient-reported outcome measures (PROMs) and compliance of a 0.03% chlorhexidine (CHX) and 0.05% cetyl-pyridinium chloride (CPC) mouth rinse, as an adjunct to professional prophylaxis and mechanical hygiene, in the management of peri-implant mucositis.
Methods Patients in supportive periodontal therapy, displaying peri-implant mucositis in at least one implant, were included in this randomized, triple-blinded, clinical trial. Subjects received a professional prophylaxis at baseline and 6-month visits and were instructed to rinse, twice daily, during one year with the test mouth rinse or a placebo. A questionnaire for PROMs was

filled and staining of teeth was scored using a modification of the Lobene index, every three months, together with the evaluation of compliance with product usage. Mann-Whitney U-tests were used to compare both groups
Results 54 patients were included in the study and 46 attended the final visit (22 controls and 24 test patients). Overall compliance and patient's satisfaction were good in both groups ($p>0.05$) except for the presence of staining (referred by the patient) in the test group ($p<0.001$). The extension and intensity of staining was higher in the test group at the 12-month visit ($p<0.05$), both in terms of extension and intensity. The presence of staining, as perceived by the patient, showed a significant higher score for the test group ($p=0.01$).
Conclusions The daily use of 0.03% CHX and 0.05% CPC mouth rinse in patients with periimplant mucositis for 1 year showed good compliance and patient's satisfaction, despite the higher degree of staining in the test group.

0586

Gracey Curettes and Air-Polishing: Preliminary In Vivo Results

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Objectives In the last 20 years the trend of abandoning hand-hend tools for mechanical ones is spreading, due to their lower soft tissue damage. The aim of this study was to evaluate clinical parameters after Gracey curettes (GC) and air-polishing (AP).
Methods Subjects with chronical periodontitis were selected by choosing pocket probing depth (PPD) ≤ 5mm and good health generally. A *cross-head* protocol was applied treating half mouth with GC and half with AP with bicarbonate powder (250µm) after informed consent. Full Mouth Plaque Score (FMPS), Full Mouth Bleeding Score (FMBS) and PPD were collected before scaling, after 7 days GC and AP were performed, after 3 months clinical parameters were collected again. Absolute and mean values underwent statistical analysis.
Results There were no statistically significant differences between GC and AP absolute values, excepted for PPD which was significant ($p<0,05$) for GC.Among mean values for each system, both FMPS and FMBS pre-post AP and GC were not significant, but both PPD values pre-post AP and GC were significant.
Among mean values for AP vs GC, there were no statistically significant differences, only mean PPD value was significant for GC. Lack of significance was due to small sample size, maybe representing a false negative.
Conclusions Both methods are effective in removing tartar and improving clinical parameters, *in vivo* comparison between GC and AP requires further investigation by expanding the sample size. Future working hypothesis will include a satisfaction survey for patients, a wider sample and microbiological cultures.

0587

Nitrate-rich Diet Changes the Composition of the Subgingival Microbiota

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Objectives This study evaluated changes in the composition of the subgingival microbiota of periodontal recall patients after 14 days of consuming a nitrate-rich diet, which led to a marked decrease of gingival inflammation as shown by a previous investigation*.
Methods Subgingival biofilm samples of 37 periodontal recall patients (18 test/19 placebo) suffering from mild to moderate chronic gingivitis were taken at baseline and two weeks after the consumption of a lettuce juice beverage which contained either high levels of dietary nitrate (test group) or was depleted of nitrate (placebo group), resulting in the daily uptake of 200 mg nitrate in test group. The characterization of the oral microbiota was done with Illumnia Miseq 300 paired end sequencing with marginally overlapping primers of the V3-V4 region of the 16S rDNA. Sequences were inferred and denoised using agglomerated ribosomal sequence variants (aRSVs) with DADA2. Alpha- and beta-diversity was analyzed using Wilcoxon Signed-Rank Test and PERMANOVA, respectively.
Results At baseline there were no significant differences regarding bacterial diversity-parameters between groups. At day 14 however a significant decrease in alpha diversity from an average of 116 ± 24 to 96 ± 24 aRSVs /sample ($p=0.04$) was observed for the test group, accompanied by a significant change in beta-diversity ($p<0.001$). In the control group by contrast bacterial diversity parameters did not change significantly between baseline and day 14.
Conclusions The regular consumption of a nitrate-rich diet has a significant impact on the composition of the subgingival oral microbiota in periodontal recall patients.

*Jockel-Schneider et al. 2016 *J Clin Periodontol* **2016**; 43: 603–608 doi: 10.1111/jcpe.12542

0588

Stimulation of the Nitrate-nitrite-NO-Metabolism in Periodontal Recall Patients

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Objectives Assessment of the impact of increased dietary nitrate consumption on salivary nitrate/nitrite levels and the stimulation of bacterial nitrate reduction.
Methods This is an exploratory subanalysis of a prospective, randomized, double-blind parallel-group trial evaluating the influence of increased dietary nitrate consumption on gingival inflammation in periodontal recall patients with chronic gingivitis. Saliva samples of 44 study patients (23 test/21 placebo) were taken prior and after 14 days of daily consumption of a 200 mg nitrate-containing (test) or a nitrate-depleted lettuce juice (control). They were analysed by high-performance anion-exchange chromatography with suppressed conductivity detection. Furthermore nitrate loading tests were carried out at baseline and at re-evaluation
Results At the start of the study salivary nitrate/nitrite levels were not significantly different between the two groups. At re-evaluation, participants of the test group showed significantly higher salivary nitrate and nitrite levels when compared to the placebo group. Furthermore a nitrate loading test in the test group proved a significant increase in the reduction velocity of salivary nitrate.
Conclusions Increased consumption of dietary nitrate is accompanied by an increase of salivary nitrite known to be bactericidal and the essential precursor molecule for physiological nitric oxide formation in the stomach.

0589

Reduction of the Periodontal Inflammatory Burden with Adjuvant Systemic Antibiosis

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Objectives The PISA (Periodontal Inflamed Surface Area) score allows the extent of the periodontal inflammatory burden to be quantified and visualized for the patient. The aim of the present analysis is to show the potential benefit of the PISA score for long-term studies.
Methods In this retrospective data analysis, the benefit of adjuvant antibiotic therapy in addition to scaling and root-planing in patients suffering from periodontitis was examined with the help of the PISA score. For this purpose, data from 80 patients with moderate to severe chronic or aggressive periodontitis were analyzed. The patients underwent anti-infective systematic periodontal therapy including scaling and root planing and adjuvant antibiotics (400mg metronidazole and 500mg amoxicillin for seven days) or placebo were administered. The patients were followed up subsequently in 3 months Intervals for supporting periodontal follow-up therapy.
Results The calculation of the PISA score was based on the periodontal status data collected before the start of treatment and 3, 12 and 24 months after the therapy. While there was no significant difference between the two experimental groups at baseline, the PISA value after therapy was significantly reduced in both groups. In the verum group, the median PISA score decreased from 870mm^2 to 58mm^2 24 months after therapy, and decreased from 875mm^2 to 176mm^2 in the placebo group. The observed differences between the two groups were significant.
Conclusions The results of the PISA analysis show that adjunctive antibiotics in the current cohort of patients significantly improved the anti-inflammatory efficacy of anti-infective systematic periodontal therapy over a 24-month period. However, in order to be able to pronounce general recommendations for treatment, the present findings should be verified by further studies on larger patient collectives.

0590

Perio Therapy Improves Diabetes Control: Preliminary In-vivo Results

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Objectives Uncontrolled diabetes is often related to gingival inflammation and periodontitis, and periodontitis is related to a greater risk of hyperglycemia. The purpose of this study was to evaluate blood inflammation parameters changes after scaling.
Methods After an informed consent, diabetic patients ran blood tests for glycemia (G), glycated haemoglobin (HBA1c), erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), then they underwent dental examination collecting pocket probing depth (PPD), bleeding on probing (BOP) completing periodontal chart model of University of Berna. Subjects received scaling procedure and oral hygiene instructions. After 3 months a new periodontal chart and blood parameters were collected again. Data were statistically analysed and divided in cases/controls according to periodontitis presence at baseline.
Results G reduction was 4% in controls and 19% in cases;
HbA1c reduction was 8% in controls and 7% in cases;
ESR reduction was 20% in controls and 28% in cases;
CRP reduction was 63% in controls and 8% in cases;
PPD reduction was 10% both in controls and in cases;
BOP reduction was 79% in controls and 67% in cases.
Conclusions The trend to lower inflammation blood levels after scaling was observed both in cases and in controls. These conclusions should be interpreted carefully because, even though a glycaemic control improvement is found after scaling, we need more randomized clinical trials before we come to any final conclusions. Future work hypothesis will be to increase sample size and extend observation time.

0591

Gestational Diabetes and Periodontal Disease in Trinidad: A Pilot Study

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Objectives To determine the prevalence of periodontitis in patients with and without gestational diabetes in Trinidad and Tobago.
Methods A convenience sample obtained from antenatal clinic collaborating sites, with a proposed sample size of 150 consecutive attendees were invited to undergo oral examinations (50 with Gestational Diabetes (GD) and 100 without) at the University of the West Indies (UWI) Dental School. The basic periodontal examination (BPE) was used to assess periodontal disease status in all patients with the examiner blinded to the GD status of the patients.
Results 65 women participated in the study (13 with Gestational Diabetes GD and 52 without) . Mean age 34.32 years, with the major ethnic groups showing 43.1% Afro-Trinidadian, 35.4% Indo-Trinidadian and 21.5% Mixed. Most (70.8%) had last attended a dental clinic more than a year before this examination and 61.5% did not have a dentist. Reversible stages of periodontal disease were present in the majority of participants who had gingivitis or plaque retention factors in 63.1%. Signs of severe periodontal disease (BPE scores 3 and 4) was more prevalent in the non-GD group and the Afro-Caribbean group.
Conclusions These data provide the first insight into the periodontal status of patients with and without gestational diabetes. In this sample, the non-GD group showed a higher prevalence of severe periodontal disease compared to the group with GD unlike what is known for patients with diabetes who have a higher prevalence of periodontal disease.

0592

Detection of Periodontal Pathogens in Blood Samples after Periodontal Treatment

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Objectives This randomized controlled trial aimed to compare the levels of *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans* in blood samples after coronal scaling [CS] or subgingival scaling and root planing [SRP] in patients with periodontitis, using a culture based technique (direct anaerobic culture [DAC]) and a molecular based approach (real-time quantitative PCR [qPCR]). Preliminary results are presented.
Methods A full mouth periodontal evaluation was performed and subgingival samples were collected. Subjects were randomized to CS or SRP treatment. Blood samples were taken before, at 3 and at 10 min during the periodontal procedures. Samples were analyzed by DAC and qPCR, targeting detection of *P. gingivalis* and *A. actinomycetemcomitans.* Descriptive statistics, Student t-test and chi-square tests were used for data analysis. Data were expressed as mean and standard deviation (SD) of colony forming units per milliliter (CFU/mL).
Results 25 patients were included, 14 in CS group and 11 in SRP group. No statistically significant differences were observed in periodontal clinical or subgingival microbiological outcomes between groups (p>0.05).*P. gingivalis* and *A. actinomycetemcomitans* were only detected in blood samples from SRP group by qPCR methods, but not with DAC. In 3 patients, *P. gingivalis*was observed at baseline ($1.61x10^2$ CFU/mL [SD=$7.47x10^1$]) and at 10 minutes after treatment ($1.95x10^2$ CFU/mL [SD=$4.83x10^1$]). In 1 out of these 3 patients, *A. actinomycetemcomitans* was also observed at baseline ($4.97x10^3$CFU/mL), 3 min ($2.29x10^3$CFU/mL) and 10 min ($3.71x10^3$CFU/mL) after SRP. No statistically significant differences were observed between groups at baseline (p=0.82), 3 min (p=0.34) or 10 min (p=0.08) of the periodontal treatment.
Conclusions Patients with periodontitis may have bacteremia with *A. actinomycetemcomitans* and *P. gingivalis*. However, the frequency of bacteremia did not increase after CS or SRP.

0593

Characterization of Subgingival Microbiota in Different Stages of Periodontitis in a Colombian Population.

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Objectives To characterize the subgingival cultivable microbiota in different stages of periodontitis in a Colombian population, according to the last World Workshop on Classification of Periodontal Diseases and Conditions.
Methods A descriptive, cross-sectional study was carried out in a non-probabilistic sample. Microbiological samples from 33 patients with periodontitis (stages I-II and III-IV) or health/gingivitis were collected and the samples were processed by bacterial culture. Findings were compared, between the groups, using the Chi square/Fisher's test and the Kruskal Wallis-U/Mann Whitney test. A 5% statistical significance was used in all the analysis.
Results *Aggregatibacter actinomycetemcomitans*was not found in any of the analyzed samples. A low frequency of detection of *Porphyromonas gingivalis* was found (healthy/gingivitis: 0%, Stages I-II: 43,75% and Stages III-IV: 27,27%), and no statistically significant differences were encountered between patients with periodontitis and the control group. The frequency of detection of *Tannerella forsythia*(p=0.05) and *Prevotella intermedia*(p=0.002) was significantly higher in periodontitis groups, when compared with the health/gingivitis group. No statistically significant differences were observed between the stages and periodontitis for any of the cultivable bacteria.

Conclusions Overall, there were no differences in the cultivable subgingival microbiota among different stages of periodontitis; however, differences were observed between healthy/gingivitis and periodontitis.

0594

Lead Intoxication Impairs Bone Mineral Properties in Rat Alveolar Process

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Objectives Lead exposure may exert both direct and indirect effects on the bone turnover mechanisms altering the normal process of mineralization and structural organization of tissues. Alveolar bone is one of the tissues that structurally support the tooth together with the periodontal ligament and the cementum.The aim of the present study is to evaluate the impact of lead exposure in alveolar bone tissue by giving detailed analyses of its mineral properties.
Methods For this purpose, Wistar rats were exposed (n = 8) to 1000 ppm lead acetate in drinking water for 90 days while control group (n = 5) were treated with sodium acetate. Hemimandibles were dissected and examined by a combination of analytical techniques including, inductively coupled plasma optical emission spectrometry (ICP-OES), attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR), X-ray diffraction (XRD), and micro-Computed Tomography (microCT) to investigate the effects of lead exposure on tissue mineralization in alveolar process. Additionally, three-point bending test was performed.
Results Decreased flexural displacement at fracture in lead exposed hemimandibles was observed. At morphological level, the bone volume and trabecular distribution (i.e. trabecular pattern factor and number) were decreased in alveolar bone in lead exposed rats. Furthermore, lead exposure significantly altered the chemical composition of alveolar bone mineral at the molecular level reducing the carbonate to phosphate content. The crystallite size values of apatite crystal obtained by XRD were increased in alveolar bone mineral by means of lead exposure.
Conclusions These overall bone compositional and structural modifications can impact bone functionality and mechanical properties indicating a pathological bone mineral condition due to lead exposure. The application of the complementary analytical techniques used herein could constitute a suitable procedure to offer insights into bone morphological and compositional alteration on alveolar bone tissue as a result of exposition to other contaminants.

0595

Analysis of Calcium Blood Levels in Patients with Medication-Related Osteonecrosis of the Jaw

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Objectives To determine through analysis if there are differences in blood plasma levels of calcium in patients with resolved medication-related osteonecrosis of the jaw (R-MRONJ), compared with patients with non-resolved medication-related osteonecrosis of the jaw (NR-MRONJ).
Methods A group of 25 patients with medication-related osteonecrosis of the jaw (MRONJ) were selected, analyzing their medical histories to identify the reasons for medication, the drug administered, dose, duration, and administration route. Inclusion criteria were patients currently diagnosed with MRONJ according to criteria established by the American Association of Oral and Maxillofacial Surgeons (AAOMS) in 2009. All patients underwent blood analysis to evaluate levels of calcium. After 6 month under medical treatment the patients were divided in two groups, MRONJ-R group with 13 patients and MRONJ-NR with 12 patients, to determine if there was difference in the biomedical parameter analyzed in comparison between groups. Statistical analysis compared means between the experimental group and the control group by means of Mann-Whitney test.
Results Mean calcium value was 9.9 (SD=0.5) mg/dL in R-MRONJ patients and 9.5 (SD=0.5) mg/dL in NR-MRONJ patients (P=0.03).
Conclusions According to the present findings, calcium levels in blood plasma could be a biomarker related to the treatment outcomes of MRONJ.

0596

An Observational Case Control Study to Validate the Association between RBMS3 and Osteonecrosis of the Jaw in Cancer Patients Receiving Intravenous Bisphosphonates or Denosumab

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Objectives A previously conducted genome wide association (GWAS) study identified several potential markers of susceptibility to develop osteonecrosis of the jaw in individuals with cancer receiving intravenous bisphosphonates. The current study attempts to validate results from the GWAS study by genotyping the best candidates in a new case control study.
Methods Osteonecrosis of the jaw cases who had all received intravenous bisphosphonates or denosumab at a New York City hospital and had signed a consent to provide blood for research purposes were selected to participate in this study. Serum from all cases were identified and DNA was extracted. Several SNPs were typed using standard PCR methods. A total of 59 samples of DNA were analyzed for Single Nucleotide Polymorphisms (SNP) for the following RS numbers: rs5768434; rs11064477; rs1886629; rs7588295; rs4431170; rs7740004; rs11189381; rs12903502; rs17751934; rs17024608.

Genotyping results were compared and statistically analyzed using STATA 14 with SNP frequencies obtained from the general population in a case-control manner. Chi Square statistics and p-values are reported below. For the SNPs that were found statistically significant, the Odds Ratio and corresponding 95% Confidence Intervals are also reported.
Results Two single nucleotide polymorphisms were confirmed to be associated with increased susceptibility to develop osteonecrosis of the jaw among cancer patients treated with intravenous bisphosphonates. Rs4431170 and Rs17024608 (RBMS3) were both found to be statistically significant.
For Rs4431170, the minor Allele 2 (G) seems to be increasing the risk. When looking at the risk of cases as compared with data from the 1000 Genome Project, individuals harboring Allele 2 had an OR of 3.06 with 95% C.I between 1.2 – 6.97 (p= 0.004). This significant increased risk persists in the CEPH CEU data (OR=8.0, p<0.005)
For RS17024608, Allele A seems to lead to a statistically significant increased eleven-fold risk of osteonecrosis of the jaw among those who have received intravenous bisphosphonates (p<0.05).
Conclusions This study validates a previously reported association between RBMS3 and osteonecrosis of the jaw in patients with cancer who have received intravenous bisphosphonates.

0597

Influence of Sensory and Autonomic Denervation on Pulp CGRP Level

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Objectives Sensory and sympathetic nerves both control neurogenic inflammation by releasing calcitonin gene-related peptide (CGRP) and other neuropeptides from axon terminals. However, the overlap and interplay of these nerve activities in pulp inflammation remains obscure. We aimed to evaluate the influence of somatosensory and sympathetic innervation on CGRP level following electrical stimulation evoked inflammation.
Methods Eighteen Wistar rats were randomly divided into sensory axotomy and sympathectomy groups. Inferior alveolar axotomy was performed intraorally and sympathectomy was done by removing superior cervical ganglion. The left side of each animal was used as a control. After three days of postsurgical recovery, all animals were subjected to electrical stimulation of the molar teeth. Three animals from each group were randomly sacrificed on the first, second and third week after stimulation. Histological slides of tooth were prepared and CGRP was visualized by immunohistochemical technique. The amount of CGRP boutons were determined using the Fiji® software. The Mann-Whitney U test, Kruskal-Wallis test and pairwise comparison were used for statistical analysis.
Results The amount of CGRP immunoreactive boutons (number/area of interest) on the side of axotomy was significantly decreased (P<0.05) compared to the control side during the first (0.67±1.06 vs 1.00±1.01) and the second week (1.03±0.98 vs 1.33±1.26). Then these values significantly increased from the first week to the second week (P<0.05) in control sides (1.00±1.01 to 1.33±1.26) and axotomized side (0.67±1.06 to 1.03±0.98). However, there was no significant change in the number of CGRP immunoreactive boutons between sympathectomy and control side within the time frame of the experiment. There were significant differences of CGRP count between axotomy and sympathectomy groups in the first (0.67±1.06 vs 0.47±0.30) and second (1.03±0.98 vs 0.63±0.51) weeks (P<0.05).
Conclusions Sensory nervous system may play a major role in CGRP regulation during the first two weeks after electrical stimulation evoked pulpal inflammation. Supported by EFOP-3.6.2.-16-2017-0006.

0598

Mean Values of Pulp Blood Perfusion for Vital Lower Incisors

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Objectives The aim is to measure and calculate the mean values of pulp blood perfusion for vital first and second lower incisors.
Methods Lower first and second incisors pulp blood perfusion was monitored and measured by laser doppler flowmetry device. Teeth, included in this study, were only vital, which was proven by classical clinical vitality testing, without any carious lesion, trauma or restoration. The measurements were done for at least three minutes monitoring and recording through hard dental tissues with the help of needle probes, fixed at the vestibular tooth surface. The pulp perfusion mean values were calculated for every tooth for a period of one minute using the licensed software of the device.
Results The number of monitored and measured vital lower incisors blood perfusion was 79. The central lower incisors included into this research were 37 and lateral lower incisors were 42. All the volunteers were young, the mean age was 24,8 years. The calculated mean value for vital lower central left incisors was 15,4 PU, for lower central right incisor was 13,8 PU, for lower lateral left incisor was 15,5 PU, for lower lateral right incisor was 14,3 PU. The mean value for all measured vital lower incisors was 14,8 PU. The mean value for female was 15,3 PU and 13,9 PU for male. There was no statistically significant difference between mean values of first and second lower incisors (p>0,05), neither between left and right lower incisors (p>0,05); no statistically significant difference was found between male and female (p>0,05).
Conclusions When an objective, precise and noninvasive assessment of dental pulp status of lower incisors is required for the clinical treatment plan or scientific research, the determined by laser Doppler flowmetry blood perfusion mean values of the studied teeth in this research can be taken in consideration.

0599

Revascularization of Mature Teeth in an Animal Model.

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Objectives To evaluate revascularization of pulpectomized mature-teeth that have been treated with a regenerative endodontic approach and to evaluate the presence of odontoblasts-like cells in teeth treated with or without ameloblast-conditioned medium

Methods This study was approved by the Ethical Committee for Animal Experimentation of the Universitat de Barcelona. Preameloblast-conditioned medium was obtained from the apical buds of 4 days-old rats. Twenty-two mature canines from ferrets were pulpectomized, the apical foramen was enlarged, the canals were irrigated with 17% EDTA, 2% sodium hypochlorite and dried with paper points. A blood clot was induced by overinstrumentation and a collagen sponge with or without preameloblast-conditioned medium was placed over the blood clot. Teeth were restored with composite. Animals were euthanized after 8 weeks, samples were histologically processed and stained with HE and toluidine blue.

Results 50% teeth presented a vascularized connective tissue, which occupy only the apical third of root canals. Moreover, the newly formed tissue did not have the characteristic organization of the mature pulp, and no odontoblast-like cells were observed. Fibroblast, chronic inflammatory infiltrate and debris from biomechanical instrumentation were present in the intracanal tissue. No differences between groups were observed.

Conclusions Revascularization of the root canals of mature teeth is possible, however further research in preclinical studies is needed before applying regenerative endodontics approach in the clinical practice.

0600

Protein-rich Fluid Dynamics from the Periapical Mandibular Area in Rats

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Objectives The lymphatic vessels are important for drainage of protein-rich interstitial fluid and for immune cell transport to the lymph nodes. The existence of lymphatic vessels in the pulp has been under debate, but new evidence shows that the dental pulp and apical area lack lymphatic vessels. The objective was to investigate the transport route of protein-rich fluid from the apical area of molars and observe the wash out rate from the jaws.

Methods The lower first molars in rats were exposed and the pulp removed with files (manual K-files and SX, ProTaper). The pulp chambers were filled with 3-5 µl ^{125}I labelled human serum albumin and sealed with Cavit. The rats were kept awake for 4, 6, 8, 24, 48 or 72 hours and the jaws, lymph nodes and blood samples were collected. Rats immediately sacrificed after application of tracer were used as controls (starting points). The jaws were separated in parts: 1. molar, 2+3.molar and the posterior fragment of corpus and ramus including the foramen mandibularis. All samples were counted in a γ-counter.

Results The radioactive tracer was distributed in the mandibular canal immediately after application in all three parts of the jaw. Most of the tracer remained in the 1. molar for all observation periods, but a wash out from the posterior parts of the jaws was observed from 24 hours up to 72 hours. In the lymph nodes and serum some tracer appeared after 4 hours and remained relatively stable until 72 hours when it declined to almost negligible levels.

Conclusions When protein rich fluid is flushed into the apical area it flows fast and distributes immediately in the mandibular canal, probably due to low viscosity in the tissue. The wash out rate from the canal is relatively slow. That may be explained by small changes in fluid pressure within this bone-embedded soft tissue. Lymphatic vessels that are confined within the canal will therefore drain the fluid slowly.

0601

Penetration of Dye into Differently Stored Root Canal Dentine

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Objectives The dye penetration into the site of action (dentinal tubules) and the presence of oxygen are crucial factors for the success of the Photodynamic Therapy (PDT). In vitro studies focus on the penetration of dye into dentinal tubules as an indicator for the efficacy of the PDT in root canals. However, a great variability of the penetration values can be found in literature. Therefore the aim of the present study was to evaluate the influence of the time gap between tooth extraction and staining and the influences of different storage conditions during that time on the dye penetration.

Methods 80 molars with at least 3 root canals each were randomly assigned to four treatment groups. In one group access cavities were prepared and the root canals were enlarged immediately after extraction using Mtwo files (VDW GmbH, Germany) to a size of 30/.05, treated with 5ml toluidine blue (0.5%) and rinsed with 5ml saline solution. The other 3 groups were stored either dry, in saline solution or in thymol solution for 21 days and then treated as described above. After staining the teeth were sectioned in the coronal, mid an apical part of the root. To measure the dye penetration photos were taken (Olympus SZH10) and analysed using cell-p (both: Olympus, Japan). To consider the individual morphology of each root the penetration depth and the penetrated area were calculated in relation to the root diameter and the cross-sectional area.

Results In all groups the highest penetration rates were found in the coronal sections of the roots followed by the mid and the apical sections of the roots. Significantly lower penetration values were found in roots treated immediately after extraction. No

differences were found between the groups after 21 days. Interestingly the dye penetration observed in the cross-sections was very inhomogeneous in all groups regarding the intensity and the penetration depth.
Conclusions The time gap between the extraction and the root canal treatment seems to have a larger impact on the dye penetration than the storage conditions. This should be considered in future studies. Further studies should evaluate possible reasons for the inhomogeneous dye penetration into root canal dentine.

0602

Dental Pulp Stem Cell Culturing and Scaling Up Using Microcarriers

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Objectives Dental pulp stem cells (DPSCs) are promising sources for cell therapy, tissue engineering, drug discovery and disease modeling due to their accessibility and capability of multi-lineage differentiation. There is an urgent need to develop effective, reproducible and safe scaling-up methods producing large amount of therapeutically active cells. Microcarrier based culturing in bioreactors is a promising technology combining a required large growth surface area with an automated process control. Our objective was to test the suitability of two commercially available microcarriers for culturing DPSCs in bioreactors.
Methods DPSCs were cultured on non-porous Cytodex1 and porous Cytopore 2 microcarriers in 96/48 well plates and in spinner flasks (scaling-up experiments). Cell viability was measured at days 1, 4, 7 and 14 using Alamar Blue reagent. The presence of the cells on the microcarriers was studied by two photon microscopy. Metabolic activity was monitored by measuring glucose consumption in the culture media using a glucose oxidase/Clark-electrode based method.
Results DPSCs were able to adhere and grow on the surface of both microcarriers and were found in the pores of Cytopore2 as well. In both microcarrier types the maximal living cell numbers were observed at day 7, which was an 11-13 fold increase. In spinner flasks, a 12-hour-long static incubation period was needed to promote the cell adhesion on microcarriers. Metabolic activity measurements showed that, depending on the proliferation rate, the cells run out of glucose after 7-11 days without fed-batch feeding.
Conclusions Microcarriers are suitable for culturing DPSCs, thus enabling the use of bioreactors in scaling-up processes. The use of bioreactor systems may provide a safe and effective technology to supply routine cell therapeutic applications. Monitoring glucose consumption is important to optimize culturing parameters of DPSCs grown in bioreactors. Supported by the EFOP-3.6.2.-16-2017-0006 and NKFIH K-125161.

0603

Photobiomodulation and Adipose Derived Stem Cells for Rats bone Defect

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Objectives Photobiomodulation (PBM) encompasses a light application aimed to increase healing process, tissue regeneration, reducing inflammation and pain, and alteration in immunologic activity. This study aimed to evaluate the effect of low-level laser therapy (LLLT) combined with adipose derived stem cells (ADSCs) for bone regeneration of critical-sized cranial defects in a rat model.
Methods Sixty Wistar rats were randomly allocated into five groups; 1) natural bovine bone mineral (NBBM); 2) NBBM+LLLT; 3) NBBM+ Allogenic ADSCs; 4) NBBM+ Allogenic ADSCs+ LLLT; 5) defect only (n=12) (for two time-points: 2 or 4 weeks). During the surgery, an 8-mm critical-sized calvarial defect were created in each rat. Continuous diode laser (wave-length 808 nm, power 100 mW, energy-density 4 J/cm^2) has been used immediately after surgery, then every two days for whole follow-up period. All bone specimens were evaluated histologically and histomorphometrically after hematoxylin and eosin (H&E) staining.
Results The amount of bone formation after two weeks was 2.94%±1.00 in group 1, 5.1%±1.92 in group 2, 7.11%±2.82 in group 3, 7.34%±2.31 in group 4, and 2.01%±0.83 in group 5 ($p<0.05$). Moreover, residual foreign body in groups which had scaffold was more than 23% after two weeks ($p>0.05$). After four weeks, 6.74 %±1.95, 13.24%±1.98, 15.76%±1.19, 15.92%±3.4, and 3.11%±1.00 of bone formed in group 1 to 5, respectively ($p<0.05$). In general, there were no statistical difference between group 2, 3, and 4 based on the type of newly formed bone, type and the amount of inflammation.
Conclusions Considering the limitation of our study, PBM administration with ADSCs demonstrated promising results for bone tissue engineering of large bone defects in rats. In addition, quality of the newly formed bone was enhanced by PBM.

0606

Biological aspects: How can new technology (OMICs) era contribute to oral health?

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The past decade will enter the history books as the advent of the OMICs technologies - a common term for high-throughput methods such as 16S RNA gene amplicon sequencing for microbial profiling (microbiome analyses) of the clinical samples. In this presentation the basic principles of this method will be explained, as well as the advantages and shortcomings in comparison to the older, more traditional methods. Finally, examples on how recent microbiome research has enhanced our understanding of microbial dysbiosis in relation to oral diseases will be discussed.

0607

Clinical Aspects: How can dental professionals use this knowledge?

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As modern dentists, we have access to a range of modern technologies to diagnose our patients, of which OMICs are one. The aim of these methods is to help dentists to define what the definition of a healthy mouth is and how patients can be aided to keep their oral cavity healthy. Since personalized prevention is an emerging topic in general healthcare, also dentist have to consider how to use various tools to achieve 'personalized preventive dentistry'. However, some of these methods are time consuming, expensive or have other limitations. The advantages and disadvantages of various diagnostic options will be discussed to come to a thorough overview of the different choices with which we can help our patients.

0608

Precision (oral) medicine

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Permanent goal of medicine is to differentiate patients into maximally homogeneous groups, within which, we believe, patients would respond equally to our treatment. We are daily reminded that "one-size-fits-all" is neither a case for a disease onset, not will yield same treatment results. Patient stratification is thus pertinent to developments of medicine and dentistry. For decades now, pharmacogenomics has been utilized to anticipate drug efficacy or safety, as dependent on particular enzyme(s) activity. Current technological advances, such as next generation sequencing coupled with bioinformatics will make shift from usual diagnostic setting (and starting the usual treatment), towards the intention to seek for complex genetic and environmental determinants in each individual patient, which could help us indicate safer and more effective approach. The same goes for prevention: our hope is that detecting individuals with higher risk for development of condition or those whose condition will be particularly severe or progressive will also be thus facilitated. Within dentistry, oral medicine and periodontology would be the two specialties in which big data analysis might represent the game changer in order to uncover novel therapeutic targets, particularly in immune-mediated or/and potentially malignant oral lesion, oral cancer, orofacial pain and patients with recalcitrant periodontitis. We also need to be alert of the potential pitfalls that huge amount of information that new era brings, including inherent big data noises and less focused research lacking specific hypotheses.

0609

Nanotechnology and delivery of dental therapeutics

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Nanotechnology is science and engineering conducted at the nanoscale. Nanotechnology in Medicine is offering exciting opportunities in health care, and one of them is drug delivery. The fact that a majority of biological processes occur at the nanoscale gives scientists models and templates to imagine and construct new processes that can enhance their work not only in medicine but also in imaging, computing, printing, chemical catalysis, materials synthesis, and many other fields. Working at the nanoscale enables scientists to utilize the unique physical, chemical, mechanical, and optical properties of materials that naturally occur at that scale. Nanoscaled materials have far larger surface areas than similar masses of larger-scale materials. As surface area per mass of a material increases, a greater amount of the material can come into contact with surrounding tissues or cells, thus increasing bioactivity. Moreover, nanomaterials permit surface functionalization to be very effective. It is then possible, designing tools, treatments, and therapies that are more precise and personalized than conventional ones and that can be applied earlier in the course of a disease and lead to fewer adverse side-effects. However, the most important point is that not all nanomaterials are able to produce nanodelivery. It all will depend on the nanoparticle design, size and kind of chemical functionalization. Acknowledgements: Supported by the Ministry of Economy and Competitiveness (MINECO) and European Regional Development Fund (FEDER) MAT2017-85999-P.