Cutaneous and Ocular Toxicology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/icot20

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To cite this article: Buğra Karasu, Enes Kesim, Mert Kaskal & Ali Rıza Cenk Celebi (2022): Efficacy of topical dexamethasone eye drops in preventing ocular inflammation and cystoid macular edema following uncomplicated cataract surgery with or without injection of a single dose perioperative subtenon triamcinolone acetonide, Cutaneous and Ocular Toxicology, DOI: 10.1080/15569527.2022.2136193

To link to this article: https://doi.org/10.1080/15569527.2022.2136193

Published online: 29 Oct 2022.

CUTANEOUS AND OCULAR TOXICOLOGY
https://doi.org/10.1080/15569527.2022.2136193

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RESEARCH ARTICLE

Efficacy of topical dexamethasone eye drops in preventing ocular inflammation and cystoid macular edema following uncomplicated cataract surgery with or without injection of a single dose perioperative subtenon triamcinolone acetonide

Buğra Karasu[a], Enes Kesim[a], Mert Kaskal[b] and Ali Rıza Cenk Celebi[c]

[a]Department of Ophthalmology, Tuzla State Hospital, Istanbul, Turkey; [b]Department of Medical Pharmacology, Marmara University School of Medicine, Istanbul, Turkey; [c]School of Medicine, Department of Ophthalmology, Acibadem University, Istanbul, Turkey

ABSTRACT

Purpose: To evaluate the efficacy and safety of topical dexamethasone (DEX) eye drops in combination with a single perioperative subtenon triamcinolone acetonide (sTA) injection versus conventional topical DEX eye drops in the prevention of ocular inflammation and cystoid macular edema following cataract surgery.

Materials and methods: Medical records of 245 eyes of 245 patients who underwent uncomplicated cataract surgery were analyzed in this retrospective controlled clinical study. Topical DEX eye drops were administered to 128 eyes routinely postoperatively, and 117 eyes were given a single dose of sTA (40 mg/ml) together with topical DEX eye drops for postoperative care. Postoperative topical antibiotic prophylaxis was applied to all eyes. The primary outcomes were anterior chamber (AC) cells and flare, central macular thickness (CMT), best corrected visual acuity (BCVA), and intraocular pressure (IOP) measurements on day 7, day 30, day 90, and day 180 following surgery.

Results: Although CMT increased in the DEX group, no increment was observed in the DEX + sTA treated group for all follow-up periods (on day 7 ($+1.3 \pm 18.6$ and -8.7 ± 21.9 μm, $p = 0.038$), on day 30 ($+20.5 \pm 58.4$ and -4.1 ± 25.2 μm, $p = 0.009$), on day 90 ($+7.2 \pm 19.9$ and -5.7 ± 30.6 μm, $p = 0.029$), and on day 180 ($+8.2 \pm 22.6$ and -6.4 ± 32.9 μm, $p = 0.032$)). There was no significant difference in terms of AC cells and flare between the two groups during the entire follow-up period ($p > 0.05$). Significant improvement in BCVA was observed in the DEX + sTA group at day 30 ($p = 0.008$). IOP differences were comparable, and both groups had high ocular tolerance. There were no severe adverse effects recorded.

Conclusions: Topical DEX eye drops in combination with single dose perioperative injection of sTA have robust efficacy in preventing ocular inflammation and the development of cystoid macular edema following uncomplicated cataract surgery.

ARTICLE HISTORY
Received 19 February 2022
Revised 22 September 2022
Accepted 6 October 2022

KEYWORDS
Pseudophakic cystoid macular edema; uncomplicated cataract surgery; subtenon triamcinolone acetonide; topical dexamethasone eye drops; ocular inflammation

Introduction

Cataract is one of the most common causes of ophthalmic surgical procedures in the worldwide and therefore, it constitutes an important public health concern for eye diseases. Developing surgical methods have advanced therapy outcomes and thus reduced surgery-related postoperative complications. However, appropriate patient compliance is one of the most important components of surgical success. Although successful surgery has been achieved, the patient's lack of postoperative care can reverse all gains [1]. Among these emerging surgical methods, the most preferred one is phacoemulsification techniques. Recent improvements in cataract surgery including small-incision procedure and foldable intraocular lenses have led in less physical stress during operation. Nevertheless, majority of patients still have continuing ocular inflammation following cataract surgery [2]. Topical steroids are potent in reducing ocular inflammation and are typically used for a period of time after operation [3]. Overall, topical therapy has variable outcomes in terms of patient compliance issues and patient education, which can affect treatment success [4].

The most frequent postoperative consequences of cataract surgery are anterior segment inflammation and pseudophakic cystoid macular edema (PCME). After common scanning by spectral domain-optical coherence tomography (SD-OCT), the prevalence of cystoid macular edema (CME) in cataract cases has been detected up to 41% [5]. However, the incidence of diagnose to clinically significant CME by fundus fluorescein angiography (FFA) does not exceed up to 6% [6]. The most prevalent cause of sterile intraocular inflammation is surgery-related physical trauma following cataract operation [7]. Inflammatory mediators pass from the anterior chamber to the vitreous and cause increased vascular permeability by

CONTACT Buğra Karasu bugra_karasu@hotmail.com Department of Ophthalmology, Tuzla State Hospital, İçmeler Mahallesi, Piri Reis Caddesi, No: 74 Tuzla, İstanbul 34947, Turkey

disrupting the blood-retina barrier [2,8]. Collections of cystoid edema and changes have been found in almost outer layers of retina including outer plexiform and inner nuclear layers of the retina with a long time. This situation brings with a process that threatens visual acuity [9].

Corticosteroids are routinely given as medications following cataract surgery to decrease the production of numerous inflammatory mediators [3]. Triamcinolone acetonide (TA) is a moderately powerful corticosteroid with a reasonably lengthy half-life [10]. Although it has been reported in various studies that intraoperative subtenon TA (sTA) administration is an effective treatment option in controlling postoperative ocular inflammation, there are not many studies on its effectiveness in preventing PCME [11,12].

The aim of present study was to evaluate the efficacy of topical dexamethasone (DEX) eye drops in combination with single perioperative injection of sTA versus conventional topical DEX eye drops in preventing inflammation and macular edema following cataract surgery.

Materials and methods

Study design

This was a controlled clinical study that was carried out retrospectively. Patients having uncomplicated phacoemulsification surgery were enrolled in the Ophthalmology Department of a Tertiary Research and Educational Hospital between October 2018 and January 2021. The study protocol was approved by the local ethics committee and was conducted according to the Declaration of Helsinki. All patients were informed about the surgical procedure and signed an informed consent prior to enrollment.

Cataract surgery was planned for consecutive patients with non-complicated senile cataract. Cataracts are classified using the Lens Opacities Classification System III (nuclear color/opalescence (N3), cortical (C3), posterior subcapsular (P3)) [13]. No systemic anti-inflammatory drug was administered to any patient during the study period.

Study groups enrollment

Perioperative sTA application was explained to the patients in detail and the choice of procedure was left to the joint decision of the physician and patients. A total of 247 eyes of 247 patients included in the study. The topical DEX group (130 eyes of 130 patients) (1 mg/ml, Maxidex; Novartis, Basel, Switzerland) received eye drops four times daily for three weeks postoperatively, whereas the sTA group (117 eyes of 117 patients) got a single subtenon injection of 0.5 ml TA suspension at the beginning of the surgery (40 mg/mL-Kenacort; Bristol-Myers Squibb, Sermoneta, Italy) with eye drops four times daily for three weeks postoperatively. Two patients in the DEX group were excluded from the study because they did not attend their follow-up visits regularly. Finally, medical records of 128 eyes of 128 patients in the DEX group and 117 eyes of 117 patients in the sTA group were recorded. Topical non-steroidal anti-inflammatory drugs (NSAID) drops were not used in any of the patients. In the event of an unpredictable development of endophthalmitis, sTA injection may increase the risk of uncontrolled infection after surgery. Patients were told to consult a doctor immediately in the presence of symptoms such as: eye pain that worsens after the injection, red eye, discharge from the eyes with the presence of white or yellow pus, eyelids that are swollen or puffy, worsening, blurred, or decrement of visual acuity.

Inclusion criteria

The patients included in the study were eligible for cataract surgery with the small-incision phacoemulsification was implemented in the event of advanced cataracts as N3, C3, P3 or further lens opacity (LOCS III) [13].

Exclusion criteria

Age-related macular degeneration, retinal vein/artery occlusion, retinal detachment, corneal disorders, uveitis, myopia greater than six diopters, previous intraocular surgery, diabetic retinopathy, glaucoma and/or shallow angle patients, pseudoexfoliation, constant use of anti-inflammatory or immunomodulatory medicine, hypermature cataracts, known or suspected sensitivity to any of the medicines used during or after surgery, and impossibility of using topical steroids are defined.

Outcome measurements

Patients were evaluated baseline (postoperative day 1) and reviewed 7, 30, 90 and 180 days thereafter. The criteria for assessment include effectiveness, safety, and tolerability. The primary outcome measurements included anterior chamber (AC) cell counting and central macular thickness (CMT). A modified version of the Hogan et al. rating scale was used to count AC cells [14]. A slit lamp biomicroscopy (SL-3E; Topcon, Tokyo, Japan) was used to count the cells in an oblique slit beam 3-mm long and 1-mm diameter directly in front of the pupil. The AC cell was rated on a grade of 0 to 6, with grade 0 being 0 to 4 cells, grade 1 being 5 to 9 cells, grade 2 being 10 to 19 cells, grade 3 being 20 to 29 cells, grade 4 being 30 to 39 cells, grade 5 being 40 to 49 cells, and grade 6 being 50 or more cells. AC flare was evaluated on a stage of 0 to 4, with stage 0 representing total absence, stage 1 representing weak flare (just visible), stage 2 representing moderate flare (iris and lens features clear), stage 3 representing notable flare (iris and lens details blurry), and stage 4 representing strong flare (fixed, coagulated aqueous humor with a significant amount of fibrin) [14]. In this study, double-blind researchers took part in data collection and evaluation.

SD-OCT was used to assess CMT, which was delineated as the average macular thickness in the center 1.0 mm region (HRA/SPECTRALIS Viewing Module Version 6.0.9.0; Heidelberg Engineering GmbH, Heidelberg, Germany). Diagnosis confirmed if petaloid leakage pattern was found in FFA which specify to cystoid macular edema and PCME [8]. Since posterior vitreous detachment (PVD) is involved in the pathogenesis of PCME, it was classified and examined in detail [15].

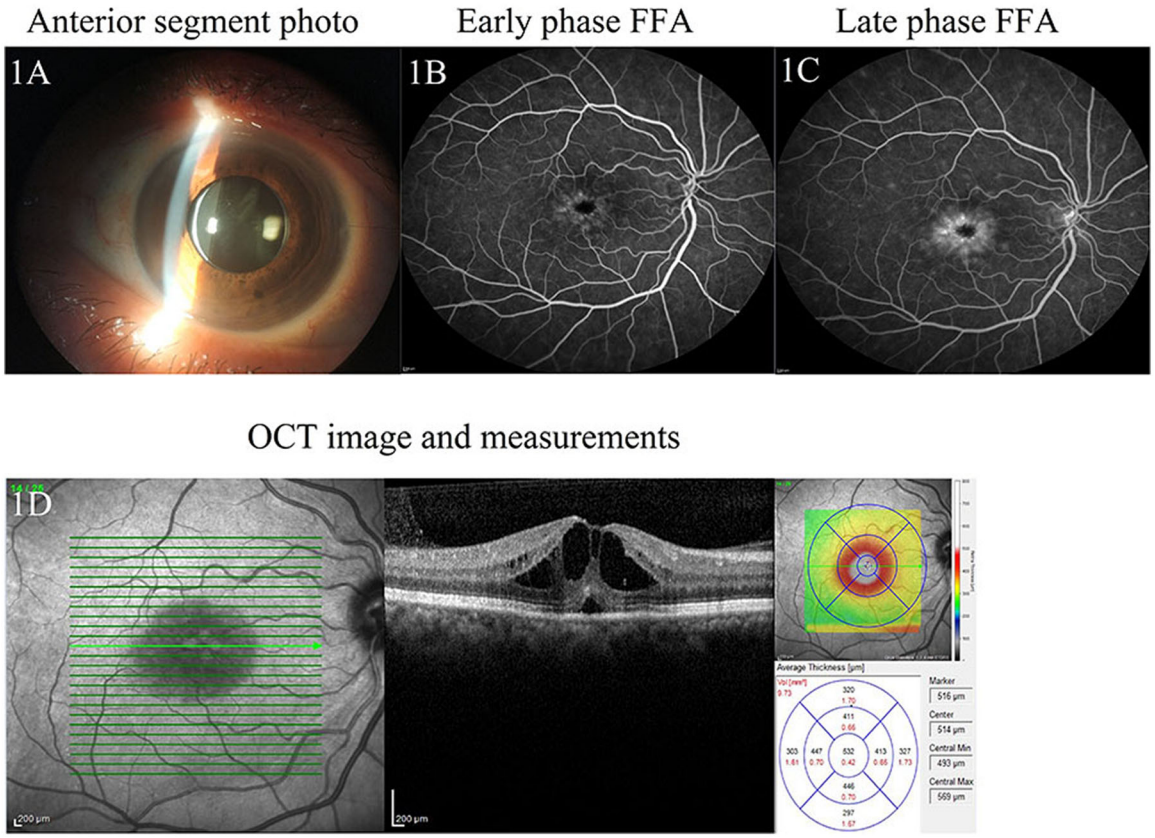

Figure 1. Anterior segment photo (1A), fundus fluorescein angiography (1B, 1C), and optical coherence tomography images (1D) of a patient with pseudophakic cystoid macular edema who had undergone uncomplicated cataract surgery.

In general, the vitreous separation process is classified into four stages; Perifoveal dissociation with vitreous adherence to the fovea observes in stage 1. In stage 2, entirely separation of the vitreous from the macula emerges. Stage 3 is defined as extensive vitreous detachment, with only the vitreous remaining attached to the disk. In stage 4, there is a complete PVD occurs [16].

Figure 1 includes anterior segment photo, FFA, and SD-OCT images of a patient with PCME who had undergone uncomplicated cataract surgery.

Clinically significant PCME was characterized as central macular thickening on OCT with cystoid alterations, with a deterioration in best corrected visual acuity (BCVA) predicted at any follow-up time point after surgery.

The safety factors were intraocular pressure (IOP), BCVA, and clinically observed adverse effects at follow-up visits. Pre- and postoperative BCVA was taken according to the Snellen chart and converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. IOP was measured with Goldmann Applanation tonometry.

Surgical technique

Before starting the cataract surgery, a subtenon incision was made at a distance of 3.5 mm from the inferonasal limbus immediately after topical anesthesia and TA (40 mg/ml) was injected into the subtenon space. All cataract operations were utilized a standardized phacoemulsification method. Patients in both groups (DEX group and sTA group) were operated by a single experienced surgeon at the tertiary hospital. Following a 2.8 mm clear corneal incision, subsequently capsulorrhexis, phacoemulsification (divide and conquer), and intraocular lens implantation into the capsular bag were implemented. Within the phacoemulsification system, an Ozil phacoemulsification hand piece and a 0.9 mm 30 degree angled Kelman tip were utilized (Infiniti; Alcon, Fort Worth, TX). Topical anesthesia was used in all surgical procedures. The ocular viscosurgical device (DisCoVisc, Alcon) was composed of 1.6% hyaluronic acid and 4.0% chondroitin sulfate. The intraocular lenses were preloaded aspheric hydrophobic single-piece for uncomplicated surgery (AU00T0, AcrySof IQ, SN60WF in UltraSertTM delivery system; Alcon; Eyecryl SERT Preloaded IOL Delivery System; Biotech). At the beginning of the surgery, 0.5 ml subtenon TA (40 mg/ml) suspension was injected into the lower nasal part of the bulbar conjunctiva with the help of a subtenon cannula. At the end of the surgery, 1 mg intracameral cefuroxime (Aprokam; Laboratoires Thea, Clermont-Ferrand, France) antimicrobial prophylaxis was administered to all patients. In addition, postoperative topical antibiotic therapy was applied as a routine practice in all of participants [17].

Statistical analysis

Statistical analysis was conducted using SPSS (version 22.0, SPSS Inc., Chicago, IL, USA). The normality of the distribution of the data was evaluated with the Kolmogorov Smirnov test. Continuous variables were denoted by mean and standard deviation, and categorical variables were expressed by

frequency and percentage. To compare continuous and regularly distributed data, unpaired Student's *t* tests (between groups) and paired *t* tests (within groups) were utilized. Non-parametric data were compared using the Mann–Whitney U test (between groups) and the Wilcoxon signed-rank test (within groups). Chi-square test was used to compare categorical variables. Pearson's correlation test was used to assess the association between non-parametric variables. $p < 0.05$ was set out as statistically significant. The study groups were compared by outcome variables mean change from the baseline at each follow-up visit.

Results

Baseline findings

Baseline patient parameters (age, gender, side, glaucoma, pseudoexfoliation) and surgical features (surgery time, cumulative expended energy during phacoemulsification, assistance of pupil dilation device) were similar among groups. The demographic data of the patients are summarized in Table 1. There was no significant difference between the two groups in terms of the presence of PVD ($p = 0.729$) and cataracts type (N3, C3, P3) ($p = 0.987$). The number of patients with DM but without diabetic retinopathy was 30 in the DEX group and 27 in the DEX + sTA group ($p = 0.994$).

Prior to cataract surgery, 196 patients had PVD, of which 100 were in the DEX group and 96 were in the DEX + sTA group ($p = 0.762$). In 49 eyes without PVD, 23 eyes were in the DEX group and 26 eyes were in the DEX + sTA group ($p = 0.812$). Stage 1 PVD was not observed in any patient. Stage 2 PVD: 10 eyes in DEX group and 11 eyes in DEX + sTA group ($p = 0.891$). Stage 3 PVD: 34 eyes in DEX group and 30 eyes in DEX + sTA group ($p = 0.674$). Stage 4 PVD: 56 eyes in DEX group and 55 eyes in DEX + sTA group ($p = 0.883$).

Efficacy and safety variables (CMT, BCVA, and IOP values) were not significantly differ from each other at baseline for study groups (Table 2).

Anterior chamber cells and flare

At all postoperative follow-ups, there was no statistically significant difference between the sTA and DEX groups in AC cells and flare ($p > 0.05$).

Table 2. Aqueous flare and central macular thickness, visual acuity, intraocular pressure and anterior chamber cells, and flare measurements.

Measurements	DEX Mean ± SD	DEX + sTA Mean ± SD	*p* Value
CMT (μm)			
Baseline	**265.4 ± 32.9**	**278.3 ± 41.8**	**0.149**
Follow-up (λ)			
Day 7	+1.3 ± 18.6	−8.7 ± 21.9	0.038*
Day 30	+20.5 ± 58.4	−4.1 ± 25.2	0.009*
Day 90	+7.2 ± 19.9	−5.7 ± 30.6	0.029*
Day 180	+8.2 ± 22.6	−6.4 ± 32.9	0.032*
BCVA (logMAR)			
Baseline	**0.71 ± 0.22**	**0.72 ± 0.23**	**0.267**
Follow-up (λ)			
Day 7	−0.30 ± 0.26	−0.31 ± 0.30	0.812
Day 30	−0.29 ± 0.28	−0.38 ± 0.30	0.008*
Day 90	−0.38 ± 0.31	−0.41 ± 0.29	0.674
Day 180	−0.39 ± 0.27	−0.44 ± 0.28	0.598
IOP			
Baseline	**14.8 ± 3.3**	**15.6 ± 3.8**	**0.071**
Follow-up (λ)			
Day 7	−2.6 ± 3.4	−3.2 ± 2.9	0.369
Day 30	−2.8 ± 3.3	−3.0 ± 3.2	0.793
Day 90	−3.5 ± 3.7	−2.8 ± 4.2	0.462
Day 180	−3.2 ± 3.4	−2.6 ± 4.6	0.689
AC cell	**Mean (range)**	**Mean (range)**	
Day 7	1.1 (1–2)	1.2 (1–2)	0.497
Day 30	0.1 (0–1)	0.1(0–1)	1
Day 90	0	0	1
Day 180	0	0	1
AC flare	**Mean (range)**	**Mean (range)**	
Day 7	0.2 (0–1)	0.3 (0–1)	0.791
Day 30	0	0	1
Day 90	0	0	1
Day 180	0	0	1

Notes: Follow-up measurements are represented as mean change from baseline (λ). Continuous and normally distributed data CMT was assessed by unpaired Student's *t* test, and non-normally distributed data (AC cells and flare) with Mann–Whitney U test. CMT, central macular thickness; BCVA, best corrected visual acuity; AC, anterior camera; IOP, intra-ocular pressure; SD, standard deviation; logMAR, Logarithm of the Minimum Angle of Resolution; DEX, dexamathasone; sTA, Subtenon triamcinolone acetonide. (* $p<0.05$)

Table 1. Demographic characteristics of the patient cohort.

Variables	DEX group n = 128	DEX + TA group n = 117	*p* value
Age (years) (mean ± SD)	64.8 ± 7.7	65.1 ± 7.4	0.971
Visual acuity (mean logMAR) (range)[a]	0.71 (0.3-1.2)	0.72 (0.2–1.3)	0.889
Intraocular pressure (mean mmHg) (range)[a]	14.4 (11-18)	14.6 (12–19)	0.943
Gender			
Female	69 (53%)	53 (45%)	
Male	59 (47%)	64 (55%)	
Controlled glaucoma (n)	8	6	0.697
Pseudoexfoliation (n)	4	5	0.712
DM without retinopathy	30	27	0.994
Nuclear density (N3, C3, P3) (LOCS 3)	52 (40^{N3}, 12^{N2}), 42 (32^{C3}, 10^{C2}), 34 (25^{P3}, 9^{P2})	46 (35^{N3}, 11^{N2}), 38 (29^{C3}, 9^{C2}), 33 (26^{P3}, 7^{P2})	0.681
Operation duration (minutes) (mean ± SD)	17.2 ± 7.8	16.4 ± 6.3	0.916
Phacoemulsification energy (seconds) (mean ± SD)	20.7 ± 11.2	19.1 ± 12.6	0.264
Pupil dilator instruments (n)	5	5	0.568

Notes: DEX: dexamtehasone eye drops; TA: triamcinolone acetonide; SD: standard deviation; DM: diabetes mellitus; logMAR: logarithm of the minimum angle of resolution; n: number; LOCS: lens opacity classification system (N: nuclear; C: cortical; P: posterior subcapsular).
[a]Baseline measurements.

Central macular thickness

An increase of CMT was observed in the DEX group, but the sTA + DEX group showed no increase on 7th day (+1.3 ± 18.6 and −8.7 ± 21.9 μm, $p = 0.038$), on 30th day (+20.5 ± 58.4 and −4.1 ± 25.2 μm, $p = 0.009$), on 90th day (+7.2 ± 19.9 and −5.7 ± 30.6 μm, $p = 0.029$), and on 180th day (+8.2 ± 22.6 and −6.4 ± 32.9 μm, $p = 0.032$). Table 2 shows the differences in CMT, BCVA, and IOP values from baseline to follow-up periods.

The difference between mean CMT values on 30th day was higher in DEX group than in sTA + DEX group (difference +24.6 μm, 95% CI: +8.05 μm to +42.8 μm, $p = 0.009$).

Throughout 180 days of follow-up period, CMT increased by more than 20% from baseline in 20% of eyes in the DEX group and 3% of eyes in the sTA + DEX group at any point in time of follow-up examinations ($p = 0.028$). Over 30% increment of CMT was seen in (12 eyes) 10% of the eyes in the DEX group but not in any of the eyes in the sTA + DEX group ($p = 0.018$) and all of these patients had CME. Table 3 shows the proportional increment of central retinal thickness according to the each groups.

Twelve eyes of PCME were found in the DEX group on the 30th day follow-up visit and no detected in sTA + DEX group throughout all follow-up periods ($p = 0.006$). Figure 2 shows central macular thickness in patients receiving dexamethasone only or dexamethasone and perioperative subtenon triamcinolone acetonide injection.

Table 3. Incidence of central macular thickness change during follow-up.

Variables	DEX group n = 128	DEX + sTA group n = 117	*p* Value
CMT, increase ≥10%	28 (%21)	8 (%6)	0.048*
CMT, increase ≥20%	26 (%20)	4 (%3)	0.028*
CMT, increase ≥30%	12 (%10)	0 (%0)	0.018*

Notes: CMT: central macular thickness. Categorical variables were examined for two-group comparisons using the Pearson chi-square test or the Fisher exact test when anticipated values were found in any cell of a group. *p<0.05

Intraocular pressure

There was no significant difference between the two groups in terms of IOP values compared to the all follow-up periods (Table 2). There were six cases which IOP increased above 6 mmHg compared with preoperatively, and these returned to normal limits with anti-glaucomatous therapy (Intermediate steroid responder).

Three individuals in the sTA group had IOPs above 25 mm Hg (28 mmHg and 30 mmHg on the first day, 27 mmHg on the seventh day of follow-up visits). Brinzolamide and timolol combination therapy was given to patients with increased IOP on day 1, and IOP values decreased below 23 mmHg on day 3. In a patient with increased IOP on the seventh day, it decreased to 22 mmHg after three days of brinzolamide and timolol combination therapy. On the fifth day after anti-glaucomatous therapy, IOP values decreased below 16 mmHg in all three patients. Combination therapy was stopped on day 14 of treatment.

Visual acuity

There was no statistically significant difference in BCVA between the DEX and DEX + sTA groups except at day 30 (at 7 days (−0.30 ± 0.26 and −0.31 ± 0.30, $p = 0.812$), at 30 days (−0.29 ± 0.28 and −0.38 ± 0.30, $p = 0.008$), at 90 days (−0.38 ± 0.31 and −0.41 ± 0.29, $p = 0.674$), and at 180 days (−0.45 ± 0.27 and −0.44 ± 0.28, $p = 0.598$)).

Correlations

A positive correlation was found between elevation of IOP values and presence of controlled glaucoma ($r = 0.746$, $p = 0.004$), initial high IOP values ($r = 0.669$, $p = 0.032$), phaco energy ($r = 0.519$, $p = 0.042$), younger age ($r = 0.874$, $p = 0.002$).

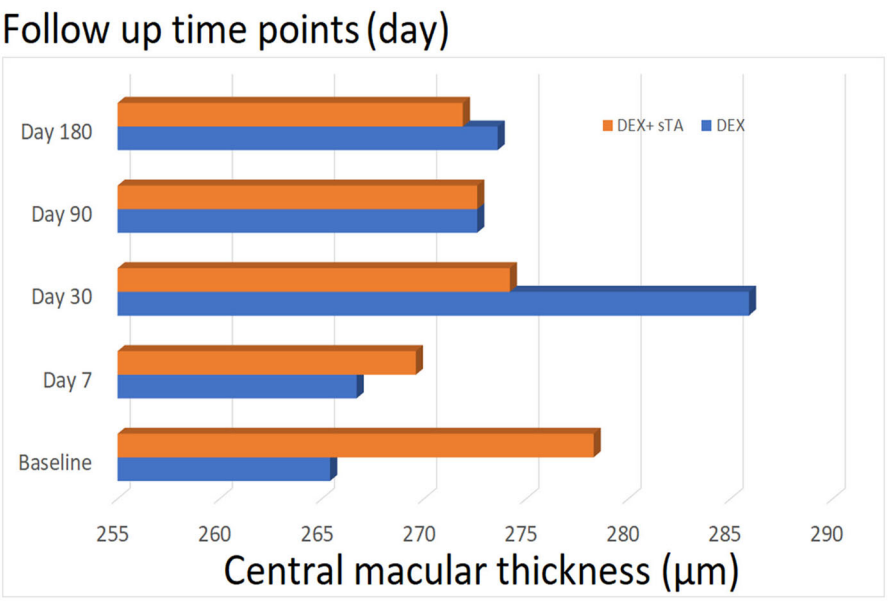

Figure 2. Graph showing central macular thickness in patients receiving dexamethasone (DEX) only or dexamethasone and perioperative subtenon triamcinolone acetonide injection (DEX + sTA). The Mann–Whitney U test was used to compare the time points between the two groups, and the student *t* test was used to compare the time periods within the group compared to the initial period.

No correlation was found between IOP increase and operation duration ($r = 0.267$, $p = 0.118$), existence of pseudoexfoliation ($r = 0.091$, $p = 0.831$), pupil dilator devices ($r = 0.143$, $p = 0.546$). No drug-related unresponsiveness and/or side effects were observed in any patient.

Discussion

Based on the current study's findings, the implementation of a single perioperative subtenon 0.5 ml (40 mg/ml) TA injection combined with topical DEX is more effective than topical DEX alone in preventing macular edema and ocular inflammation following cataract surgery. The use of topical eye drops four times a day may cause an increment of central retinal thickness at postoperative day 30, but only the excessive increase in the DEX eye drops group can be attributed to the development of PCME in eight eyes. The importance of this situation can also be explained by the significant change in BCVA between the two groups.

Today, corticosteroids are used in different spectrum eye diseases [18–21]. Corticosteroids have been widely utilized for several weeks as the medicines of choice for the preventing or treating for ocular inflammation after cataract surgery. Recently, perioperative steroid treatment has been shown to be beneficial in decreasing the burden for postoperative topical therapy [22–24]. Therefore, the long-term anti-inflammatory effects of TA have prompted clinicians to consider its therapeutic usage to reduce inflammation following cataract surgery. While perioperative administration of subtenon corticosteroids may compensate an optimal anti-inflammatory efficacy, it may provide certain advantages to reduce the problems associated with patient non-adherence to postoperative treatment. All patients in both therapy groups had moderate cell scores at baseline (postoperative first day), which subsequently reduced throughout the course of the study. There were significantly prominent reductions in AC cells from day 1 to day 7, approximately similar in both groups. The duration of action was continued until the final visit (on 180 days), and neither groups needed extra anti-inflammatory medication.

The PREMED study evaluated the results of three groups of diabetic patients who received perioperative subconjunctival TA or intravitreal bevacizumab in combination with topical eye drops or alone topical eye drops that to reduce the risk of developing CME following uncomplicated cataract surgery. The CMT was observed to be lower in the group that implemented subconjunctival TA injection at the end of the cataract surgery compared to the other two groups at postoperative periods on week 6 and week 12, and PCME did not develop in any patient in the subconjunctival TA group [25]. Among the benefits of our study are the relatively large number patient cohort and the six-month duration. Similar results were observed in our study, and we think that sTA application may suppress inflammation for a longer time than subconjunctival TA administration, perioperatively. The absence of PCME in the sTA group during the six-month follow-up period may support our hypothesis.

Accidental injection into the choroidal or retinal era [26,27], globe perforation [28,29], and central retinal artery occlusion [30] are all possible consequences of posterior subtenon corticosteroid delivery. There have also been shown of blepharoptosis, proptosis, strabismus, conjunctival and retrobulbar hemorrhage, chemosis, and infection [31,32]. None of the above complications were observed in any of the patients included in our study.

When compared to either medication alone, the combination of topical bromfenac and DEX eye drops lowered the chance of developing PCME [25,33]. Another research comparing subconjunctival injections of betamethasone acetate with topical usage of DEX found no significant change in foveal thickness or PCME between groups [34].

There are studies showing that the duration of action of a subtenon injection of TA is up to six months [35,36]. The long-term impact of subtenon usage of TA has favorable outcomes since the beginning of PCME typically occurs between 3 and 12 weeks following cataract surgery [37].

There are particular limitations to our study that should be noted when interpreting the results. Despite the fact that this is a retrospective study and the treatment method employed was not kept from the patient or the investigator, which may have influenced the measured variables. Nonetheless, major results and safety elements are constructed to be measured using objective quantitative techniques. Although a double-blind observer was used to evaluate flare and cells in AC, these criteria were evaluated subjectively.

Pupil dilation devices were employed in 10 eyes in present study, 5 in each group, and this is likely to induce further inflammation and macular alterations following surgery, which should be addressed to Taipale et al. study [38].

An increment of IOP following topical or systemic corticosteroid therapy is especially concerning [39]. Patients receiving subtenon corticosteroid injections may be unresponsive to anti-glaucomatous therapy and therefore the use of this procedure may be limited by clinicians due to a persistently high IOP values. Increased IOP may be triggered by the combined use of topical and sTA corticosteroids in patients with a predisposition to glaucoma [40]. There are also studies reporting an unpredictable lower-than-expected IOP increment following a posterior injection of 40 mg sTA [11,12]. Within 12 weeks of receiving a subconjunctival injection of TA in PREMED study, 7.1% of diabetic study participants had an IOP of 25 mmHg or higher, and one patient required surgical removal of the TA depot. And it is suggested that IOP should be monitored for at least one year following surgery because of the significant risk of evolving high IOP and long-term efficacy of TA [25]. Three eyes (sTA group) had IOP values up to 30 mmHg in this study, and recovered to normal levels using topical anti- glaucomatous eye drops.

In a multicenter retrospective cohort study with the large patient series conducted by Maeda et al. has been reported IOP elevation after administration of sTA. IOP elevation was found in 14.7% of the eyes and an IOP increase above 6 mmHg for 23.3% of eyes. Overall, 7.5% of the eyes required medication and 0.14% required glaucoma surgery. Younger age, higher baseline IOP values, and steroid dose were

among the risk factors associated with IOP elevation [41]. In our study, the predisposing risk factors for elevated IOP were the presence of controlled glaucoma, initial high IOP values, excess phaco energy, and young age. Of 3 patients with IOP values above normal limits, 2 patients were relatively younger age, and high phaco energy was used to the remaining patient during the surgery.

Routine long-acting subtenon steroid injections may worsen possible control of intraocular infection and endophthalmitis. Albeit rarely seen, side effects like as infectious scleritis [42,43], orbital abscess [44] and delayed-onset postoperative endophthalmitis [45] were reported after administration of sTA injection and uncomplicated phacoemulsification cataract surgery. None of the above-mentioned complications were reported in our study.

Based on these results, the limited sample size trial has no precise inference about efficacy or long-term safety concerns may be raised. Follow-up duration was relatively short, but elevated IOP levels occurred within the observation period. The fact that there was no difference between the groups in terms of PVD and non-PVD provided the treatment response and effectiveness of the sTA procedure more evident.

Furthermore, a more complete procedure is required to assess the effectiveness of this novel approach in patients with arduous cataract surgery. While we cannot decide clear conclusions based on our preliminary results, the data need backing with more investigation.

Subtenon corticosteroids injection is a widely used therapy for a variety of inflammatory eye disorders [46–48]. In this study, combination DEX eye drops with perioperative single subtenon 40 mg TA injection exhibited high ocular tolerance than only postoperative DEX eye drops usage as well as therapeutic effectiveness in reducing postoperative inflammation due to uncomplicated cataract surgery.

In principle, combining an antibiotic with steroid in a mechanism of controlled release and delivering it transsclerally following cataract surgery might accomplish various therapeutic goals, including the eradication of topical medications, increased patient comformity, and enhanced drug bioavailability. Although it is argued in various studies that subtenon TA can be used as dropless surgery, studies on this subject contain controversial results [11,12,49]. Therefore, we added conventional drop therapy in addition to sTA in terms of eliminating ocular inflammation in our study.

Similar to previous studies, no statistically significant change was observed between the two groups in the number of AC cells [11,12]. In current study, we may suppose that sTA may reduce retino-choroidal inflammation but not AC inflammation. In addition, triamcinolone may contribute to the management of conventional cataract surgery treatment when combined with other known therapeutic properties besides its anti-inflammatory effects.

In conclusion, this study demonstrates that the usage of DEX eye drops combined with a single perioperative injection of subtenon 40 mg TA may have superior efficacy in managing postoperative ocular inflammation and preventing PCME formation with acceptable safety profile compared to conventional DEX eye drops alone following uncomplicated cataract surgery. This treatment protocol (perioperative single dose sTA + DEX eye drops) may be preferred in selected patients and/or patients who may develop intense ocular inflammation after uncomplicated cataract surgery. Prospective studies with larger sample size are needed to confirm our results and to more accurately evaluate the preventive effect of perioperative sTA on the development of PCME.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

ORCID

Buğra Karasu http://orcid.org/0000-0001-7362-4453

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