Published online: 5 May 2022

DOI: 10.1111/opo.12993

OPO THE COLLEGE OF OPTOMETRISTS

AUTHOR'S REPLY

We would like to thank Dr. Reda and colleagues for their interest in our recently published study assessing choroidal vascularity index (CVI) changes during the Valsalva manoeuvre (VM).[1] Reda et al. stated their concerns as to whether the reflectivity or contrast of the enhanced depth imaging (EDI)–optical coherence tomography (OCT) images captured before and after the VM might have effects on the observed difference in CVI by referring to the blooming effect seen in ultrasonography (USG).[2] Although this concern appears valid, the blooming effect seen in USG occurs when the gain setting, and therefore the resolution, is not standardised while acquiring B-scan images.[2] Moreover, the axial and lateral resolution of spectral-domain OCT (SD-OCT) is approximately 100 times greater than USG with a standardised technique in different OCT devices.[3] Therefore, images captured by the same OCT device used in our study (Spectralis, Heidelberg Engineering, heidelbergengineering.com) should have been less affected by the so-called blooming effect.

However, the images captured at different times from different participants may be affected by several other conditions such as uneven illumination, a difference in focusing and even differences in the direction of light, resulting in variations in image contrast and brightness.[4] An example of such variation is seen in Figure 1 of our paper,[1] which also gave rise to the subject matter of this correspondence. Dr. Reda and colleagues suggest that the contrast variation in Figure 1c,d could explain our findings of increased luminal areas during VM (Figure 1a,b). However, the increased luminal areas, and therefore CVIs, also have been found in different subjects without such variation. Examples of other subjects and their CVI values, as well as the CVI values of our previously published case, are shown in Figure 1 below.

As described in the Method section of the paper,[1] we adopted the binarisation method of Agrawal et al. using the open access Fiji software (fiji.sc).[4,5] From Otsu's global, Bernsen's local, Phansalkar's local and Niblack's local thresholding techniques, Agrawal et al. chose Niblack's autolocal thresholding technique to binarise greyscale EDI-OCT B-scan images to overcome the previously mentioned contrast and brightness variations found in different individuals without any brightness adjustment.[4,5] Niblack's autolocal threshold technique considers all pixels' mean and standard deviation in the region of interest. Therefore, it produces a distinct binarisation threshold for all individual images, eliminating the risk of bias caused by contrast and brightness variations resulting from the conditions previously mentioned.

Taking all of this into consideration, it is safe to say that even if the variations in images captured at different time points affected the parameters being compared such as CVI, these effects should be negligible given the described characteristics of the study.

CONFLICT OF INTEREST

All authors certify that they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript.

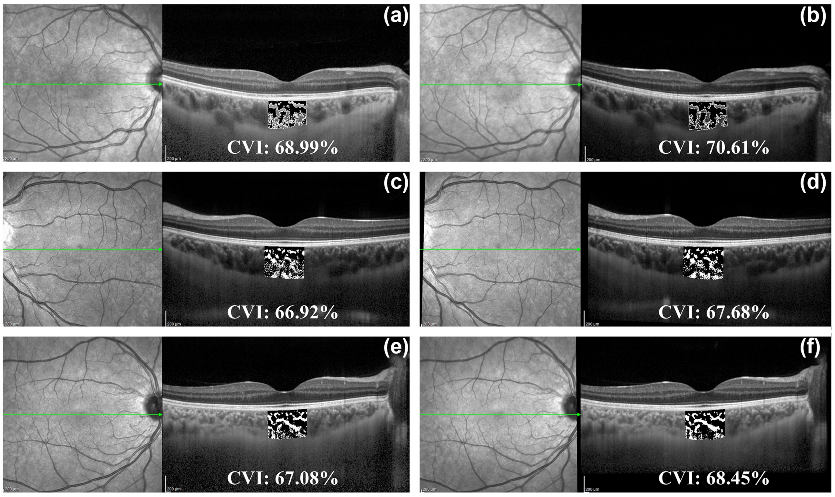

FIGURE 1 Enhanced depth imaging (EDI)–optical coherence tomography (OCT) infrared images, B-scans with superimposed images of binarised 1500-µm subfoveal choroidal areas and measured choroidal vascularity index (CVI) values of the subjects in our study before (a, c and e) and after (b, d and f) the Valsalva manoeuvre. Figure a and b is from the previously published case. Figure c and d shows the left eye of a 29-year-old female subject. Figure e and f shows the right eye of a 31-year-old female subject

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REFERENCES

1. Sevik MO, Çam F, Aykut A, Dericioğlu V, Şahin Ö. Choroidal vascularity index changes during the Valsalva manoeuvre in healthy volunteers. *Ophthalmic Physiol Opt*. 2022;42:367–75.
2. Capasso L, De Bernardo M, Vitiello L, Rosa N. Ultrasound options for measuring optic nerve sheath diameter in children. *Pediatr Crit Care Med*. 2021;22:e329–30.
3. Aumann S, Donner S, Fischer J, Müller F. Optical coherence tomography (OCT): principle and technical realization. In: Bille JF, editor. High resolution imaging in microscopy and ophthalmology: new frontiers in biomedical optics. Cham: Springer; 2019. p. 59–85.
4. Agrawal R, Gupta P, Tan KA, Cheung CM, Wong TY, Cheng CY. Choroidal vascularity index as a measure of vascular status of the choroid: measurements in healthy eyes from a population-based study. *Sci Rep*. 2016;6:21090. https://doi.org/10.1038/srep21090
5. Agrawal R, Salman M, Tan KA, Karampelas M, Sim DA, Keane PA, et al. Choroidal Vascularity Index (CVI)–a novel optical coherence tomography parameter for monitoring patients with panuveitis. *PLoS One*. 2016;11:e0146344. https://doi.org/10.1371/journal.pone.0146344