Subfoveal choroidal thickness changes after 1-week of myopia control spectacle lens wear

Alfredo Desiato[1], Reena Rani Anand[1], Inderjit Chatha[1], Nicola S. Logan[1], Amy L. Sheppard[1], James S. Wolffsohn[1], Deborah Laughton[2], Leon N Davies[1]

[1] Optometry & Vision Science Research Group, School of Optometry, Aston University, Birmingham, United Kingdom

[2] SightGlass Vision, Inc., Texas, USA

Purpose

The choroid is believed to play a crucial role in regulating visually guided eye growth, primarily through variations in choroidal thickness in response to the retinal image. It has been suggested that an increase in choroidal thickness may contribute to arresting eye growth and, therefore, the progression of myopia. Additionally, accelerated axial elongation has been associated with a smaller increase in subfoveal ChT (SFCT).

This study tests the hypothesis that short-term SFCT changes in children's eyes can be elicited by myopia control spectacle lenses irrespective of design, by assessing the alterations in SFCT.

Methods

Eligible myopic children (cycloplegic autorefraction SER >-8.00D and ≤-0.50D), aged 6 to 12 years, with astigmatism <2.00DC, anisometropia ≤ 2.00D, and best corrected VA of 0.10 logMAR or better, were dispensed three study lenses: Diffusion Optics Technology™ (DOT) lenses, designed to control myopia by modulating retinal contrast; Defocus Incorporated Multiple Segments (DIMS) lenses, designed to modulate retinal defocus; and single vision (SV) lenses, as a control. The spectacle lenses were worn in a randomized crossover design, following baseline measurements.

SFCT measurements were obtained at baseline and after 1-week of wearing each type of lens using an Enhanced Depth Imaging Mode of a non-contact SD-OCT (SPECTRALIS, Heidelberg) along six reference meridians, spaced 30° apart. Immediately preceding all SFCT measures, participants were supervised viewing a distance vision task for 30 minutes, The SFCT values for each meridian were determined using semi-automated segmentation analysis software (MATLAB, MathWorks), and averaged for each participant.

Results

Seven participants (4M, 3F), with a mean age of 10 years (ranging from 7 to 12 years) and mean cycloplegic autorefraction SER of -2.00D (ranging from -3.63D to -0.64D), completed the study. The use of DOT and DIMS lenses resulted in similar significant increases in SFCT after 1-week of continuous use compared to both baseline values and the use of the SV lens (all $p<0.05$), with an overall mean wearing time >12 h per day. Specifically, the average increase for DOT lenses was 16.94±14.51μm from the baseline and 16.33±20.11μm compared to the SV lenses. Analogously, DIMS lenses showed increases of 20.28±18.08 and 19.67±23.59μm, respectively, indicating that different strategies in modifying retinal images can elicit significant increases in choroidal thickness in myopic children.

Meridional analysis revealed that, among the six meridians investigated, the SFCT values extrapolated from the vertical (at a 90° angle) were corresponding to the averaged SFCT values in revealing the significant differences found for across the study lenses in the cohort. Moreover, the interclass correlation coefficient for average measurements between the vertical meridian and the averaged SFCT ranged from 0.996 to 0.999 (all $p<0.05$), suggesting that this measurement alone may be reliable indicator of SFCT change.

Conclusions

Both DOT and DIMS lenses produce a significant increase in SFCT after 1-week of wear, suggesting choroidal thickening can be elicited by different ways of modifying the retinal image. Furthermore, vertical meridian acquisition alone may be a reliable surrogate for overall SFCT change.

Funding disclosure: This study was funded by SightGlass Vision.