

Subfoveal Choroidal Thickening After Short-Term Wear of Contrast and Defocus-Modulating Myopia Control Spectacle Lenses

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Purpose

Short-term subfoveal choroidal thickness (SFCT) variation may serve as an early indicator of the potential efficacy of myopia control interventions, as these changes can act as a biomarker for the success in controlling eye growth and further myopia progression. Accordingly, this study evaluated the short-term changes in SFCT of myopic children's eyes in response to wearing myopia control spectacle lenses designed to modulate retinal image contrast or defocus.

Methods

This prospective multi-visit randomised crossover study included the measurement of SFCT at baseline and after 1-week of full-time wear of contrast-modulating Diffusion Optics Technology™ (DOT) lenses, defocus-modulating Defocus Incorporated Multiple Segments (DIMS) lenses, and single vision (SV) lenses, on myopic (SER >-8.00D and ≤-0.50D, astigmatism <2.00DC, and anisometropia ≤ 2.00D, assessed by cycloplegic autorefraction) children with best corrected VA ≤0.10 logMAR.

SFCT measurements were obtained using Enhanced Depth Imaging Mode (along six meridians, spaced 30° apart) of a non-contact SD-OCT (SPECTRALIS, Heidelberg), immediately after 30-minute supervised distance vision task for stabilisation. A masked software-assisted (MATLAB, MathWorks) semi-automated image segmentation protocol was used to determine averaged SFCT data for each participant. A repeated measures general linear model was constructed with test lenses as a within-subjects factor, and test group and gender as between-subjects factors, to determine estimated marginal means (EEM) (±SE) for comparisons. Correlations between lens dependent SFCT variations and baseline participant characteristics were also analysed.

Results

Thirty-one participants (12F; Median age: 10 years [6 to 12]; mean SER: -2.13D [-5.76D to -0.50D]) completed the study. DOT and DIMS wear (12 hours/day) increased SFCT after 1-week, compared to both baseline and SV lens use (all $p < 0.01$). Specifically, the EMM increases for DOT lenses were $13.22 \pm 2.16 \mu\text{m}$ from baseline and $13.04 \pm 2.23 \mu\text{m}$ compared to SV lenses, while DIMS lenses showed increases of 9.79 ± 2.28 and $9.61 \pm 2.61 \mu\text{m}$, respectively. Additionally, a positive correlation was found between SFCT responses to DOT and DIMS lenses wear, ($r = 0.731$, $p < 0.001$). No significant correlations were found between SFCT variations and baseline SFCT, age, or cycloplegic SER.

Conclusions

One-week wear of both DOT and DIMS lenses elicit significant increases in SFCT, suggesting both contrast and defocus modulation of the retinal image can help to arrest myopia progression in children.

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