TITLE: Optical Evaluation of Contrast Modulating Diffusion Optics Myopia Control Spectacle Lenses

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BACKGROUND: Diffusion Optics Technology™ (DOT) spectacle lenses from SightGlass Vision (SGV) have been shown to slow myopia progression in children. These lenses contain a central aperture encircled by a treatment zone of light-scattering micro-diffusers to adjust contrast. As with any spectacle lenses, DOT lenses can be made of various materials and by several contract manufacturing facilities. This study evaluated the impact of lens material and manufacturing facility on the relative contrast transferred by DOT lens technology.

METHODS: The lenses evaluated were standard single vision Control and DOT lenses, of two materials: polycarbonate and Trivex, both with AR coating. Polycarbonate DOT and Control lenses were manufactured and used in clinical studies in China. Trivex DOT and Control lenses were manufactured in the UK and used in clinical studies in North America. Point-spread functions (PSFs) were digitally sampled by a high dynamic range (HDR), 12-bit (3864x2176 pixels) IDS U3-38J0XCP-M-GL monochrome detector with 1.45-micron pixel pitch. The laser light source was a single mode optical fiber (λ=636.8nm) with the output power set to 0.01 mW (Thorlabs LP635-SF8). The single pass system captured PSFs for 6mm diameter circular apertures. Alignment and focus of the system were achieved with a shear-plate interferometer. To capture the contrast modulating properties of both the central optic, and peripheral treatment optic, the PSF for each spectacle lens was sampled with 0- and 20-degrees lens eccentricity. The HDR system captured multiple images of the same source at different exposure levels (32 μs to 1.9 s). Images were linearly combined, processed, and image quality metrics were calculated using custom MATLAB software, Indiana Wavefront Analyzer (IWA). Modulation transfer functions (MTFs) were calculated by Fourier transform of the PSF.

RESULTS: Through the central sections of the DOT lenses, all lenses demonstrated MTF's similar to the Control lenses. Specifically, all lenses showed near system-limited modulation at low spatial frequencies (SFs) with gradual decreases in modulation to around 0.45 at the higher SF of 65 cpd. When measuring through the treatment sections of the DOT lenses, all DOT lenses showed decreases in modulation to around 0.60-0.65 at low SFs with further gradual decreases in modulation to levels similar to those seen in the Control at 65 cpd. Lenses made of different materials and at different manufacturing locations had similar MTFs.

CONCLUSIONS: DOT lens technology applied to lenses of differing materials and by differing manufacturing facilities reduce contrast similarly, and accordingly may be expected to control myopia progression similarly.