Treatment zone visual acuity with myopia control spectacle lenses

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Purpose: To profile the immediate effect of spectacle-based myopia management interventions on high- and low-contrast foveal visual acuity (VA) through lens centre and periphery at two distances in adults.

Methods: Twenty myopic (MSE -4.25D to -0.50D) adults (16F); aged 18-30 years, rendered functionally emmetropic with spherical soft contact lenses wore, sequentially, lenses with Diffusion Optics Technology (DOT), Defocus Incorporated Multiple Segments (DIMS), Highly Aspherical Lenslets (HAL) and single vision (SV) plano spectacle lenses in a prospective, single-visit, double-blind, four-way randomised crossover study. Measures of foveal VA were taken through the lens centre and periphery (decentred 10mm from the optical centre). All participants completed eight monocular tasks: high- (96%) and low-contrast (10%) logMAR foveal VA at distance (4 m) and near (40 cm) through the lens centre and periphery.

Results: Central- distance VA was similar across all lenses for high- ($p=0.06$) and low-contrast ($p=0.74$) letters, whilst central near DIMS lens high-contrast VA reduced by 0.06±0.02 logMAR and HAL low-contrast VA by 0.05±0.01 logMAR compared with SV (both $p<0.05$). Peripheral - distance high-contrast VA was worse with the DIMS lens than SV ($p<0.001$), DOT ($p<0.001$) and HAL lenses ($p<0.05$). DIMS lens high-contrast VA reduced by 0.16±0.02 logMAR (distance) and 0.13±0.01 logMAR (near) compared with SV. HAL also reduced high-contrast VA versus SV (distance: 0.08±0.019 logMAR, $p<0.01$; near: 0.05±0.017 logMAR, $p<0.05$). DOT lenses had no significant impact on distance ($p=0.85$) or near ($p=0.09$) high-contrast VA through the peripheral treatment zone. For low-contrast measures, all lenses reduced distance VA [by 0.09 (DOT), 0.12 (HAL) and 0.17 (DIMS) logMAR] and near VA [by 0.11 (DOT), 0.10 (HAL) and 0.14 (DIMS) logMAR] with reference to the SV control (all $p<0.001$).

Conclusion: Whilst all three myopia management lenses performed relatively well centrally against a SV comparator, the results suggest wearers' foveal VA is differentially affected through peripheral treatment zones. Specifically, the results indicate DOT lenses provide superior visual acuity in the treatment zone, equivalent to SV lenses. Clinicians should be aware of these differences in peripheral VA between myopia management lenses, and carefully consider visual requirements when discussing treatment options with patients and carers.

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