Immersive Motion Capture Evaluation of Contrast Modulation Spectacle Lenses for Myopia Control in Children

Javier Gantes[1], Alicia Feis[1], Kelly Shim[2], William Denton[1], Elizabeth Escobedo[1], Jennifer S. Hill[3], Julie Herbert[3]

1. Arizona College of Optometry, Midwestern University, Glendale, AZ, USA.
2. Clinical Research Services, Midwestern University, Glendale, AZ, USA.
3. SightGlass Vision, Inc, Dallas, TX, USA

Purpose

Diffusion Optics Technology™ (DOT) myopia control spectacle lenses feature a central zone surrounded by a treatment zone of light–scattering elements, which are designed to slightly reduce retinal contrast. This study evaluated whether DOT lenses affect performance during dynamic visual tasks that require both foveal acuity and head movements toward peripheral targets, including locating peripheral targets, catching a baseball, and steering a bicycle around obstacles.

Methods

In this within–subject study, sixteen emmetropic children aged 6–12 years (mean 9.19 1.98) completed three tasks in a novel, immersive, simulated situation using the Computer–Assisted Rehabilitation Environment (CAREN), once wearing single–vision (SV) spectacles and once wearing DOT spectacles, in counterbalanced order. In the locate–and–fixate task, 72 targets were presented across a 110 50 visual field against dark (0.3 cd/m^2) and light (10.3 cd/m^2) backgrounds, and reaction time (RT) plus head yaw, pitch, and roll were measured. In the baseball–catching task, virtual baseballs approached from different angles and trajectories, and outcomes were recorded as catches or misses, along with reaction time. In the interactive biking task, children pedaled through a first–person virtual environment, and event–locked trajectories were recorded.

Results

In the locate–and–fixate task, head yaw increased with horizontal target eccentricity in both conditions, reaching 35–40 at 55 and remaining near 0 at the center. Head pitch followed vertical target eccentricity measuring about + 7° at 25° to –5° at –25°, while head roll stayed near zero throughout (–2.60° to +0.30°). None of these head–movement measures differed between lenses. Background luminance significantly affected RT (dark vs light, $p < 0.01$), but lens types did not: SV dark 1.25 0.35 s, and light 1.51 0.32 s vs DOT dark 1.20 0.35 s, and light 1.56 0.37 s. In the baseball–catching task, catch latency was identical between conditions (SV 0.68 0.09 s, DOT 0.68 0.08 s; $p = 0.72$), and catch rate did not differ significantly (SV 56.9 9.3 % vs DOT 59.2 8.0 %; $p = 0.21$). In the interactive biking task, children slowed similarly with both lenses when approaching obstacles (mean speed change –0.48 to –0.92 km/h across conditions; all paired $p > 0.25$), and peak steering also did not differ at the subject level (all $p > 0.25$).

Conclusions

Across all three tasks, children wearing DOT lenses performed comparably to those wearing SV lenses, with no significant difference in any measured behavior. These results support the safe wearability of DOT lenses during dynamic visual–motor activities and provide a head–movement–aware framework for evaluating future myopia–control lens designs.

Conflict of interest disclosure:

SGV provided funding for the study. JG receives a travel grant. JSH and JH are SGV employees.