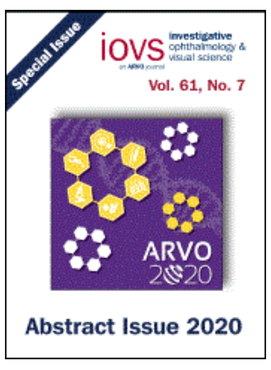

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The effect of see-through digital spectacles on eye scanning behavior of patients with peripheral visual field losses

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Abstract

Purpose : To study the effect of novel see-through Digital spectacles (DSpecs) on the eye scanning behavior while walking for patients suffering from peripheral visual field (PVF) defects in a case series study.

Methods : We developed the DSpecs as a wearable visual aid utilizing an augmented reality (AR) platform, eye tracking system, a portable mini PC, and a battery. Video processing algorithms of a scene camera in the DSpecs produced personalized visual augmentation profiles to functionally expand their limited PVF. Processed videos were displayed in real time on the AR display based on prior binocular field measurements obtained using the DSpecs diagnostic mode. Twenty patients walked with the DSpecs in a validated obstacle track once with visual augmentation being activated (with expansion) and another time without it (without expansion). The two walking conditions were repeated for each patient and gaze data were recorded and averaged. We calculated four parameters to describe the eye scanning behavior while walking. The parameters were: number of fixations per second, variance of fixation locations, central gaze location score, and mean saccadic amplitude.

Results : We found differences in the mean values of the fixation location variance parameter (21.31^0 and 36.46^0 with and without expansion, respectively) and the central gaze location score parameter (3.8 and 3.69 with and without expansion, respectively). Statistical testing showed a significant differences between these two parameters mean values (P=0.046, 0.027, respectively, ANOVA), indicating fewer stray eye scanning attempts with more directed gaze on the central path. Mean values of the fixations rate were (2.29, 2.33; fixations/sec; with and without expansion, respectively) and mean saccadic amplitudes were (4.19^0 and 5.15^0 with and without expansion, respectively).These two parameters were insignificantly different between the two walking conditions (P=0.898, 0.154, respectively, ANOVA).

Conclusions : The see through DSpecs may improve eye scanning behavior of patients with PVF defects while walking by allowing them to perform more focused scanning attempts.

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Demonstration of eye scanning behavior for two patients with gaze heat maps. Left column shows a scattered gaze as the patients walked with the DSpecs without visual field expansion. Right column shows a more centric eye scanning behavior with field expansion.