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Driving with glaucoma? Some patients increase scanning to adapt for impaired vision

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Some people with glaucoma-related binocular (both eyes) vision loss can pass a standard driving test by adopting increased visual scanning behavior, reports a study in the October issue of *Optometry and Vision Science*, official journal of the American Academy of Optometry.

Increased scanning—particularly more frequent head and eye movements—was a key strategy to compensate for visual impairment due to glaucoma, reports the study by Enkelejda Kasneci, PhD, of University of Tübingen, Germany, and colleagues. "Like most people, many glaucoma patients with binocular peripheral visual field loss can make useful adaptations for their condition," comments Anthony Adams, OD, PhD, Editor-in-Chief of *Optometry and Vision Science*.

Drivers with Glaucoma Adapt by Moving Their Eyes and Head

In a state-of-the-art virtual reality driving simulator at a Mercedes-Benz technology center, six patients with glaucoma and binocular vision loss performed a simulated driving test. With real acceleration, 360-degree visual projection, and a real car body, the moving-base simulator provided a "close-to-realistic driving experience."

During the 40-minute test, drivers encountered various traffic situations and nine different hazardous situations—for example, pedestrians

suddenly appearing behind parked cars or risky passing maneuvers by oncoming cars. Subjects who failed any of the nine hazardous situations failed the driving test.

Eight subjects with normal vision were studied for comparison. In both groups, sophisticated measures of the subjects' eye- and head-tracking movements were obtained and compared with performance on the driving simulation.

Three of the six glaucoma patients passed the driving test, with performance indistinguishable from that in subjects with normal vision. Compared to patients who failed, passing drivers showed "increased visual exploration"—they made more head movements and more eye movements.

The successful drivers changed fixation (where they looked) more often, and had shorter fixation times than those who failed the driving test. "Such behavior indicates an increased scanning activity in glaucoma patients who passed," Dr. Kasneci and coauthors write.

In contrast, glaucoma patients who failed the driving test had reduced head and eye movements, with a tendency to a more straight-ahead eye position. Patients who passed the driving test also drove more slowly—perhaps giving them more time to visually scan their environment.

The pilot study was limited by the small number of patients—reflecting the complexity and cost of testing in the virtual reality simulator. Although vision loss varied, all of the glaucoma patients would be ineligible for a driver's license in many European countries because of their binocular visual field defects. In other countries, and in some US states, patients with binocular visual field loss can be granted a driver's license after passing an on-road test.

The results add new evidence on the "compensatory gaze strategies" that some patients adopt to help them drive safely despite binocular vision loss. Dr. Adams adds, "For these patients, their successful adaptations appeared to involve making increased numbers of head and eye movements to the location of objects in what would normally be their peripheral vision."

"This type of compensation improves traffic safety and may have practical implications in planning individualized driving fitness tests and driver rehabilitation programs," Dr. Kasneci and colleagues conclude. They recommend more individualized driving assessments, taking into account the patient's ability to compensate for binocular visual field loss.

More information: Thomas C. Kübler et al. Driving with Glaucoma, *Optometry and Vision Science* (2015). DOI: 10.1097/OPX.0000000000000702

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