Single bioptic telescope for low vision driving may not obscure road view of second eye

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A study by scientists at Schepens Eye Research Institute shows that a bioptic telescope on one lens of a pair of glasses used to magnify traffic signs and lights may not prevent the wider view of the road with the second eye. The study results, which will be published in the May 2011 *Archives of Ophthalmology,* are the first evidence that--under more realistic viewing conditions than in earlier studies--the second eye can detect objects in the area obscured by the magnification effect of the telescope (called the ring scotoma).

"These study results are significant because they should ease official and public concerns about the safety of bioptic telescope use for driving with visual impairments," says Dr. Eli Peli, the principal investigator of the study, who is a low vision expert, a senior Schepens scientist, and a professor of Ophthalmology at Harvard Medical School.

In previous studies, participants wearing the bioptic telescope were asked to view a blank (plain) background and focus on a simple fixation point—a cross— while detecting random visual targets presented to them, a task that requires little attention and concentration.

"Our current study required subjects to view more complex, textured backgrounds and focus on and read letters, which are more akin to visual situations encountered in real life and on the road," says Peli.

Bioptics, developed more than 100 years ago, are small telescopes that are attached above the center of one spectacle lens. A slight downward

tilt of the head and upward shift of the eyes can bring a distant road sign or traffic light into view for people with vision impairments. When looking through the telescope, a blind area (scotoma) is created due to the magnification of the telescope. The blind area is in the shape of a ring surrounding what is seen through the telescope (hence the name "ring scotoma"). For instance, a person viewing a traffic light with the telescope will see the light, but will not be able to see the surrounding intersection, with the same eye. Although bioptics were introduced as driving aids 50 years ago and are approved for driving in 39 states, safety has remained a concern, in particular the effect of the ring scotoma on detection of traffic hazards. In some states this concern resulted in restricting the telescope to one eye only, leaving the other to monitor the area of the ring scotoma during telescope use.

In the Archives of Ophthalmology study, Amy Doherty, the first author, and the research team, conducted a series of tests evaluating the ability of the second (fellow) eye to detect targets in the area of the ring scotoma on both simple and complex backgrounds, with and without the bioptic telescope on one lens.

They began by fitting 14 subjects with bioptic glasses and used a novel display system that allowed them to present visual stimuli to each eye separately while both eyes were watching the screen. The team then "mapped" or determined the dimensions and position of the blind area (ring scotoma) in each subject's telescopic eye by presenting visual stimuli only to that eye.

Next, each subject underwent four viewing conditions while wearing the telescope in front of one eye, and the same four conditions without the telescope. In all cases, both eyes were open, while a visual stimulus or target (a small checkerboard square), presented to the second eye only, appeared randomly in different parts of the ring scotoma area. The subjects pressed a button whenever they saw the target.

The four conditions were: passively viewing a cross on a gray background, passively viewing a cross on a more complex textured background, actively reading letters on a gray background, and actively reading letters on the textured background. The textured background seen magnified in the telescopic eye resulted in a rivalry (competition) effect between the images from the two eyes that could result in the brain ignoring (suppressing) the image from the second eye. Any suppression of the second eye when looking through a bioptic telescope could potentially result in a traffic hazard not being noticed.

In all cases no significant difference was found between what the second eye saw when the first eye was using the telescope and when it wasn't using the telescope. With the bioptics, the second eye was able to detect the target 86 percent of the time, while without the bioptics, it detected the target 87 percent of the time. As expected, more targets were detected on a gray background than on a textured background and while focused on a simple cross than while reading letters.

"These results suggest that the bioptic driver may not be blind to traffic when looking through the telescope, because the second eye can detect targets in the area obscured by the telescope," says Doherty.

While the study results are encouraging, Peli and Doherty agree that it is still essential to test the use of bioptics in even more realistic circumstances.

"Our next testing conditions will be with video segments that closely mimic the visual scene and attention required during actual driving situations," says Doherty, who adds that over time, the research team also hopes to gather data from driving simulators and even actual on-the-road monitoring.

Provided by Schepens Eye Research Institute