



(Above) The image at the left shows a banana peel on a walkway. A patient with a scotoma in that area would not see a hole in the walk way, rather their brain would “fill in” the image (as shown on the right) so that they might slip and fall. (Bottom) Dr. Preeti Verghese

Not Seeing What is Really There—PVF Funded research Seeks Scotoma Solutions

People suffering from age-related macular degeneration (AMD) have scotomas (blind spots) in the central part of their vision, which prevent them from seeing some objects that are right in front of them. Those blind spots prevent visual input from reaching the brain, particularly when the retinas of both eyes are damaged in the same places. Dr. Preeti Verghese, Senior Scientist in the Smith-Kettlewell Eye Research Institute’s Psychophysics Lab, explains it like this: “If a person with binocular scotomas was looking at a grassy field with a rock in it, and the image of the rock happened to fall within their scotoma, they would not see it: they’d just see a plain grassy field, because their brain would fill in the space where the rock is with the grassy surroundings that the eyes can see.” Falls are more prevalent in elderly with visual impairment. Stumbling over objects that were not detected is one cause of such falls.

Dr. Verghese specializes in studying how visually impaired people interact with objects in the physical world. She and her post-doctoral fellow Dr. Christian Janssen have co-designed a yearlong pilot project funded by Pacific Vision Foundation (PVF) to help people compensate for the effects of binocular scotoma. Their innovative approach focuses on “visual search” techniques that they are the first to scientifically test. “Researchers have conducted studies to teach scotoma patients how to read,” Dr. Verghese says, “but only a few have attempted to help people cope with everyday real-life tasks at home and out in the world.”

Mobility and ability to function normally are often severely curtailed for those who suffer from scotomas. It can rob people of their ability to enjoy reading, watching television and even socializing because they may not be able to see people’s expressions during conversation or even recognize the faces of friends they pass on the street. Scotomas can be extremely dangerous as well: safely navigating stairs and crossing roads

is hazardous when you can’t see solid objects that can trip or hit you—and driving is completely out of the question. So teaching people to effectively deal with their scotoma has far-reaching implications that can dramatically improve their overall quality of life.

There is no medical, surgical or pharmaceutical cure for scotomas, so Drs. Verghese and Janssen are pioneering a therapeutic approach based on teaching people to know where their scotoma is located within their field of vision. They can then learn to move their eyes and look towards that



area—thus uncovering information that might be hidden there. They do this by showing patients images on a large screen, then using advanced imaging technology to track their eye movements and take retinal photos on which they functionally and anatomically map the scotomas’ location.

Dr. Janssen will hold five training sessions with each subject over the course of the study, and he and Dr. Verghese continually analyze the results together. Preliminary data suggests that patients retain the specific seeing skills they learn in the lab over time, but the research partners are still determining whether these abilities effectively transfer to real-life tasks.

“We are testing the effectiveness and potential of these therapeutic techniques,” Dr. Verghese points out, “and the data are compelling enough to continue exploring and developing the training method.” She and Dr. Janssen therefore hope to secure a bigger federal grant to conduct the same study on a much larger scale. “A longer investigation with a much larger pool of subjects would allow us to ask and answer new questions,” Dr. Verghese says, “while developing our techniques to benefit even more scotoma sufferers.”

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