New visual test devised by Caltech, USC researchers

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Additional Information on Vision Test

A new five-minute vision test using a desktop computer and touch-sensitive screen is showing promise as a diagnostic tool for a variety of eye diseases and even certain brain tumors.

Invented by California Institute of Technology physicist Wolfgang Fink and University of Southern California professor of ophthalmology and neurosurgery Alfredo A. Sadun, the 3-D Computer-Based Threshold Amsler Grid Test offers a novel method for medical personnel to evaluate the central visual field. The test is sensitive and specific enough to allow an ophthalmologist to diagnose visual disorders such as macular degeneration, and to discriminate between visual disorders with subtly different symptoms, such as macular edema and optic neuritis.

In order to take the test, the patient sits in front of a touch-sensitive computer screen displaying a grid pattern and a central bright spot. Staring at the central spot with one eye closed, the patient traces a finger around the portions of the grid he or she can see, and the computer records the information.

After the computer records the patient's tracings, the operator changes the contrast of the grid slightly and the patient again traces the visible portions of the grid. This process is repeated and information is gathered for the computer to process a three-dimensional profile of the patient's visual field for that eye. Then, the process is repeated for the other eye.

Patients suffering from macular degeneration, for example, experience a loss of vision at the central focus and thus will have trouble seeing the grid pattern near the center. Since macular degeneration sufferers have peripheral vision, they would likely trace a central hole on the screen, and if they also had a relative field defect, they might trace an ever-smaller circle as the brightness of the grid pattern intensified. Once the information was processed, the 3-D graph would provide doctors with a complete description of what the patient sees under various conditions.

The test will also be useful for diseases and conditions such as optic neuritis, detached retina, glaucoma, anterior ischemic optic neuropathy (AION), macular edema, central or branch retinal artery occlusions, and several genetic impairments. Also, the test can be used to detect, characterize, and even locate several types of brain tumors.

Thus, the new test is not only more revealing than standard visual field tests, but it is also much quicker and simpler than existing methods of characterizing the visual field, says Sadun. Likening the test to a recreational video game, Sadun says the new technology will be cheap and easily marketable, and also will be a powerful means of processing patient data.

"The patient is playing the game while the machine is digesting the information," Sadun says.

Fink created a program that permits the computer acquisition and analysis of the psychophysical techniques developed by Sadun. The computer processes patient responses into a computer profile.

Fink says the test is "a completely noninvasive way to understand and diagnose certain eye diseases."

"We can gain more information from this test than any other visual field test," Sadun says. "The test creates a greater sensitivity for detecting problems, it provides quantitative measures for monitoring, and it characterizes the 3-D visual field, which makes a big contribution to diagnosis."

The test has already been used since April on about 40 patients suffering from macular degeneration, AION, and optic neuritis. In the coming months, the researchers will begin testing the program on patients with glaucoma.

The 3-D Computer-Based Threshold Amsler Grid Test has been approved by USC's institutional review board. Fink and Sadun have applied for a U.S. patent.

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