PERIMETRY COMES ONLINE

Increasing data for low-cost, portable visual fields.

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Subjective visual field testing remains an essential part of the diagnosis and management of glaucoma. In clinical practice, these fields are often obtained with office-based static automated perimetry such as the Humphrey visual field (HVF; Carl Zeiss Meditec). The machines are relatively costly, however, so the examinations are generally performed in doctors' offices.

Low-cost and portable means of testing would provide a useful expansion of patient services in at least two ways. First, there is considerable variation in visual fields; in the Ocular Hypertension Treatment Study (OHTS), 86% of visual field abnormalities were not confirmed on repeat visual field testing.[1] Variation necessitates repeat testing, which would carry lower costs if performed at home. Second, systematic reviews of population-based studies show that most patients with glaucoma are unaware of their diagnosis[2] but that the vast majority of these individuals have significant defects on automated perimetry.[3] Low-cost visual fields may thus ultimately play a role in improving glaucoma screening programs.

HOW ONLINE PERIMETRY WORKS

Peristat online perimetry was first developed in 2002 by Dr. Ianchulev and Peter Pham, MD, both residents of Doheny Eye Institute at the University of Southern California at the time. This online visual field test requires less than 5 minutes per eye to perform on a home computer with at least a 17-inch screen. The appropriate working distance is determined by adjusting positioning until the flashing light temporal to the fixation point disappears in the blind spot. Various intensity stimuli are then presented across 20° vertically and 24° horizontally, including the blind spot. The patient is asked to press the space bar for each stimulus, allowing determination of fixation losses as well as false positive and negative results (Figure 1). These responses can then be composed into a grayscale visual

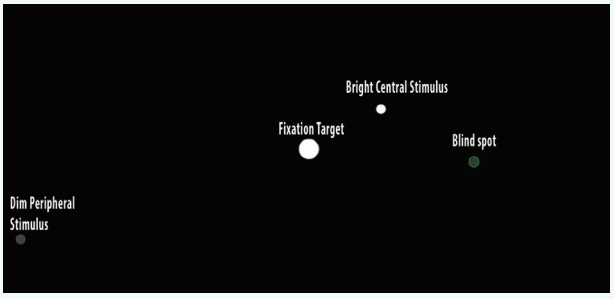

Figure 1. Visual field test of a patient's right eye. Fixation is maintained centrally under monocular conditions. Testing begins with a bright central stimulus, followed by a dim peripheral stimulus. A hollow blinking green circle is presented in the temporal portion of the visual field that is intended to align with the blind spot. Dim stimuli are intermittently presented within this green circle to record fixation losses.

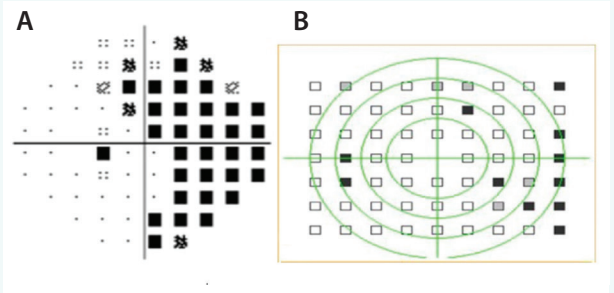

Figure 2. A 24-2 HVF of the eye of a patient with severe glaucoma (A). Results for the same eye using Peristat online perimetry (B).

AT A GLANCE

- Low-cost and portable means of visual field testing would provide a useful expansion of patient services. It could help address variable results by allowing patients to retest themselves at home, and it could bolster community screening efforts.
- Studies of Peristat online perimetry have shown a significant correlation between its results and those of Humphrey visual field testing for moderate and more severe glaucoma.

WATCH IT NOW

Chris A. Johnson, PhD, discusses glaucoma screening with a nonmydriatic camera and the visualFields easy app.

field image similar to those produced by widely used standard automated perimeters (Figure 2). The online perimeter can be accessed for free at www.keepyoursight.org.

RESEARCH RESULTS

The first study of Peristat, published in 2005, involved 58 eyes. The investigators had ophthalmologists grade Peristat visual fields for abnormalities and compared the results against same-eye HVFs as the gold standard. Sensitivities for Peristat detecting the defects found on HVF testing ranged from 80% to 86% between graders, and specificity for confirming normal results on HVF ranged from 94% to 97%.[4]

More recently, investigators compared Peristat visual fields for the detection of glaucoma with gold-standard glaucoma diagnosis on the basis of nerve changes with corresponding visual field changes. In this analysis, Peristat fields were graded by the number of abnormal points rather than via subjective expert assessment to allow automated grading. The investigators found that Peristat demonstrated a significant correlation with HVF testing. Peristat also showed reasonable sensitivity (71%-86%) and specificity (85%-94%) for moderate or worse glaucoma but a poor ability to detect mild glaucoma (sensitivity of 54%-59%).[5]

FUTURE DIRECTIONS

A growing number of low-cost methods of visual field testing have been developed. They include apps used with smart tablets (eg, Melbourne Rapid Fields [Glance Optical] and visualFields easy [George Kong softwares]; see *Watch It Now*) and computer-based programs (eg, rarebit perimetry). Unfortunately, the sensitivity and specificity of these tests for glaucoma detection remain insufficient for stand-alone screening, considering the fairly low disease prevalence of less than 2% in the United States and 4% globally, but cheap functional assessments of the optic nerve seem a likely component of any future cost-effective screening protocol.[2,6]

As with any screening program, access to care is an important consideration, especially given the expectation of increased overall demand for eye care services by an aging population. Melbourne Rapid Fields, rarebit perimetry, and the Peristat have all demonstrated a significant correlation between their results and those of HVFs.[5,7,8] This correlation is an important sign that repeating home-based visual field testing between clinic appointments might average out some of the intertest variability and thereby supplement information obtained during more detailed measurements in the clinic.

The data provided by home monitoring will necessitate computer-aided analyses that can show key summary values, highlighting the most useful clinical information out of what may otherwise be an unmanageable volume. Additional research is needed of such summative analyses as well as optimal intertest intervals. Most importantly, investigators will need to determine how home monitoring affects clinical decisions and outcomes. As the evidence supporting home-based visual fields grows, ophthalmologists may gain another tool with which to improve the timing of interventions to help reduce patients' vision loss from glaucoma. ■

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