

THE NEXT STEP IN VISUAL FIELDS

Home testing procedures and real-world, task-related performance methods are needed.

BY CHRIS A. JOHNSON, PhD, DSc



Although the basic visual field test procedure of detecting a small target superimposed on a uniform background has been used for more than 2,000 years,¹ there have been major advances in the standardization and optimization of testing procedures and analytical methods. Additionally, there is a growing need for the ability to perform diagnostic procedures such as perimetry in a variety of settings (waiting rooms, homes, remote clinics with limited resources, etc.) as well as for tests that provide information on the performance of tasks. This article provides a brief overview of these innovations.

NEW TEST PROCEDURES

Standard automated perimetry (white-on-white perimetry) is still the most common method of performing visual field testing in ophthalmic clinics. Many procedures have been developed, however, to test the spatial, temporal, color, and other properties of the peripheral visual field, including short-wavelength automated perimetry, frequency doubling technology and

Humphrey Matrix perimetry (Carl Zeiss Meditec), Pulsar perimetry (Haag-Streit), motion perimetry, flicker perimetry, Heidelberg Edge perimetry (flicker-defined form; Heidelberg Engineering), and Rarebit perimetry.^{2,3} These tests provide the opportunity to evaluate specific visual functions that may be damaged earlier or more extensively than standard automated static perimetry results are able to convey. Standard automated perimetry, however, remains the most common test procedure that is used by practitioners worldwide.

As clinicians and investigators learn more about the consequences of the impairment of specific color, spatial, and temporal properties of vision by ocular and neurologic diseases, these newer tests may help to clarify the underlying basis of problems that patients encounter in terms of their quality of life and activities of daily living.

NEW ANALYTICAL PROCEDURES

Although event analysis (change from baseline) and linear regression have been used for the analysis of visual field data and glaucomatous progression in longitudinal studies,⁴ more recent analytical procedures have been developed, many of them using variations of Bayesian strategies.⁵⁻¹⁰ These procedures have generated methods of enhancing the performance of visual field progression techniques that have improved sensitivity and specificity, reduced the number of tests required for



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Pradeep Ramulu, MD, PhD, describes how eye care providers can assess glaucoma's impact on patients' quality of life and use this information to provide better care.

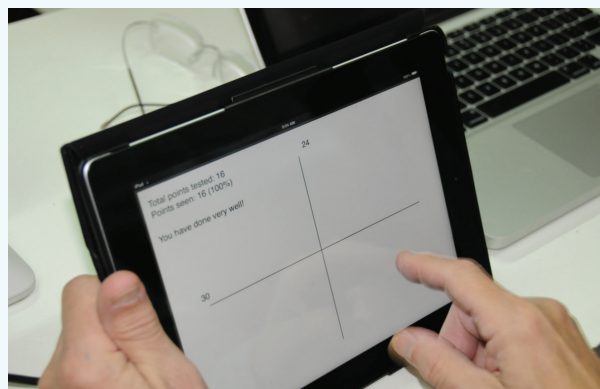


Figure 1. A tablet is being used for vision testing.

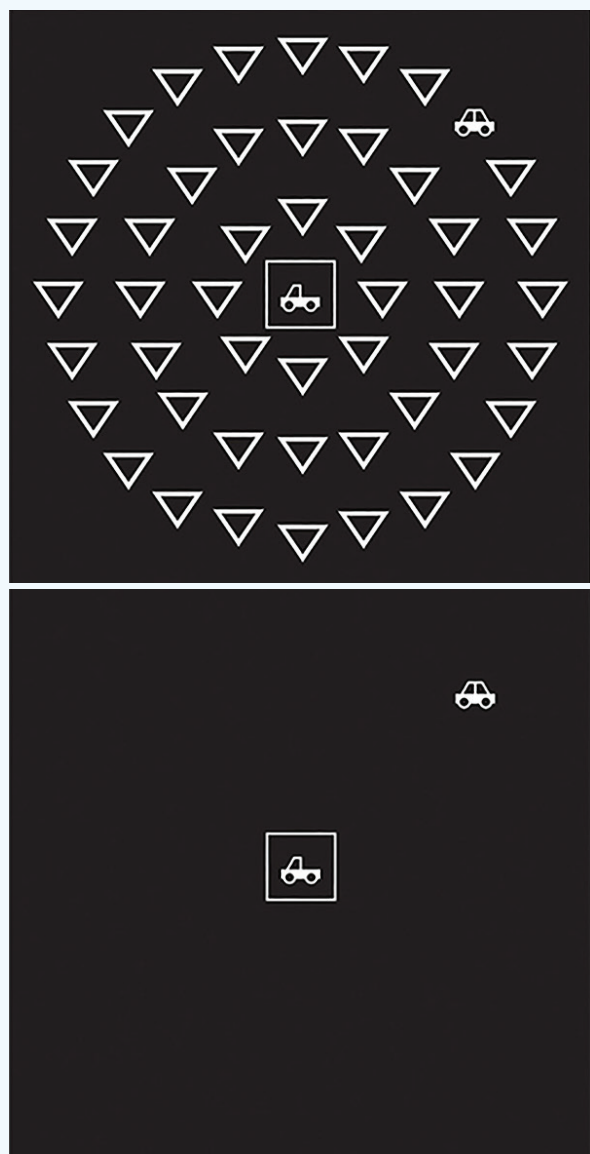


Figure 2. An example of the display presented on a computer monitor for testing the Useful Field of View.

a definitive analysis, and decreased the amount of time needed for an informed decision. Further refinements can be achieved by providing the analysis program with findings from an independent subset of participants or from earlier test results of the same participant that will allow the analytical method to “learn” specific patterns and sequences of visual field changes.

Additionally, there is a growing awareness of the importance of combining visual field information with other clinical results (optic disc and retinal nerve fiber layer measurements, IOP, family history, other risk factors, etc.) in order to generate a more comprehensive quantitative model of the pathologic course of glaucoma and the influence of various treatment regimens.



AT A GLANCE

- There is a growing need for the ability to perform diagnostic procedures such as perimetry in a variety of settings and for tests that provide information on the performance of tasks.
- Investigators are developing diagnostic vision testing procedures that can be performed with smartphones and tablets. The technology provides an opportunity to make ophthalmic diagnostic tests available to individuals with limited access to traditional health care.
- Standard visual field testing is useful and important for monitoring the status of glaucoma patients, determining whether their condition is stable or progressing at a particular rate, and making treatment decisions. These procedures are less helpful for determining whether a patient is able to perform activities of daily living and how visual impairment affects his or her quality of life. Newer tests may help in this regard as clinicians and investigators learn more about the consequences of vision impairment from ocular and neurologic diseases.

HOME TESTING

The technological advances evident in smartphones and tablet displays have led many investigators to develop diagnostic vision testing procedures that can be performed with these instruments.¹¹⁻¹⁵ These devices have appropriate spatial and temporal properties and a suitable dynamic intensity range, they are easy to use for rapid testing, and they are quite cost-effective. The technology thus provides an opportunity to make ophthalmic diagnostic tests available to individuals with limited access to traditional health care by allowing testing to be performed in different settings (eg, waiting rooms) and making it possible for people to test themselves at home.

Because this is a relatively new approach to visual function testing, it is still in an early stage of development. Given the demands placed upon health care, particularly in underdeveloped countries and rural areas, however, interest in this area will grow rapidly in the next few years and will have a meaningful impact on the manner in which ocular and neurologic diseases are detected and monitored (Figure 1).

REAL-WORLD PRACTICAL TESTS

Standard visual field testing procedures are useful and important for monitoring the status of glaucoma patients, determining whether their condition is stable or progressing at a particular rate, and making treatment decisions. These procedures

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are less helpful for determining whether a patient is able to perform activities of daily living (such as driving, walking, shopping, and reading) and how visual impairment affects his or her quality of life.^{10,16} Tests such as the Useful Field of View (Visual Awareness Research Group)¹⁷ that incorporate attention, navigation pathways, and tests that include multitasking¹⁸ will provide greater assistance for these determinations (Figure 2).

Many subtle performance issues that have limited investigational findings (eg, hand-eye coordination¹⁸) may also lead to the development of new procedures that can be performed in the clinic.

CONCLUSION

Practitioners are entering a new era in which they will receive lower compensation for their services, clinical time with patients will be more limited, diagnostic testing will be less available in clinics, and the impact of vision impairment on daily activities will receive greater emphasis. New and different approaches to managing patients with glaucoma or at risk of developing the disease will therefore be a welcome and much-needed advance. ■

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