Stimulus Size for Perimetry in Patients With Glaucoma

William H. Swanson

Indiana University School of Optometry, Bloomington, Indiana; wilswans@indiana.edu

Clinical perimetry today uses a stimulus that arose from historic accident. Wall and colleagues¹ show that other stimulus choices are at least as valid. Automated static perimetry typically uses the Goldmann size III stimulus, a circular luminance increment whose diameter is 0.43° of visual angle. This choice of stimulus size was not a scientific standard, but was a choice made by the engineers of the first commercial device. Kinetic perimetry had varied both stimulus contrast and stimulus size, but those engineers chose to use a fixed size and a wider range of contrasts. Later companies copied this approach, which became the conventional perimetric stimulus. This approach led to high test-retest variability in glaucomatous defects.^{2,3}

Wall and colleagues¹ tested a large number of people with size III, size V (1.72° diameter), a custom “size VI” (3.44° diameter), and with a method that varies stimulus size for a fixed contrast (size threshold perimetry [STP]). They generated their own normative values for each test, and used these to compute total deviation, pattern deviation, and probability plots for the patients. They found the same number of abnormal locations with III, V, and STP, and slightly fewer for size VI. The shapes of defects on probability plots were similar for all tests. Defects were deeper for size III, and variability was higher, consistent with effects of ganglion cell saturation.⁴

This study is important because it shows that there is nothing special about the use of a single stimulus size, that all of these tests are measuring the same thing. New forms of perimetry are justified that choose stimuli based on desirable properties, such as lower variability and resistance to effects of blur, reduced illumination, and forward light scatter. The perimetry of the 21st century need not be shackled to a historic accident.

References

1. Wall M, Doyle CK, Eden T, Zamba KD, Johnson CA. Size threshold perimetry performs as well as conventional automated perimetry with stimulus sizes III, V, and VI for glaucomatous loss. *Invest Ophthalmol Vis Sci*. 2013;54:3975–3983.
2. Heijl A, Lindgren A, Lindgren G. Test-retest variability in glaucomatous visual fields. *Am J Ophthalmol*. 1989;108:130–135.
3. Artes PH, Iwase A, Ohno Y, Kitazawa Y, Chauhan BC. Properties of perimetric threshold estimates from Full Threshold, SITA Standard, and SITA Fast strategies. *Invest Ophthalmol Vis Sci*. 2002;43:2654–2659.
4. Swanson WH, Sun H, Lee BB, Cao D. Responses of primate retinal ganglion cells to perimetric stimuli. *Invest Ophthalmol Vis Sci*. 2011;52:764–771.