Measuring Visual Field Progression

Signal/Noise Ratios to Compare Tests for Measuring Visual Field Progression

With great interest, I read the article by Artes and Chauhan in the October 2009 issue. 1 In this article, signal-to-noise ratios (SNRs) were used to quantify the variability of different perimetric techniques independent of their measurement scale. For each patient, signal and noise estimates were respectively derived from the mean and SD of superior–inferior differences in each sector of the Glaucoma Hemifield Test in six visual fields. The authors found larger SNRs for frequency-doubling technology (FDT2) perimetry than for standard automated perimetry (SAP). 1 As an SNR expresses the test signal of interest in proportion to the measurement error, these results suggest that FDT2 is at least as efficient as SAP at detecting visual field loss. I support the use of SNRs because they give more information about the test’s potential than measures that include only the noise of a test, like SD values. Of note, the authors suggested that these SNRs could also be used in deciding whether tests are useful in measuring visual field progression. 1

Before SNRs are used for this purpose, one has to ask oneself what the necessary measurement properties are for tests to assess glaucomatous visual field progression. In clinical practice, the main purpose of assessing progression is to discriminate between patients who are at high risk for visual disability and therefore need a change in treatment, from patients who are optimally treated. 2 Although no gold standard or optimal cutoff point is available, a useful method should anyway be able to show differences in visual field progression between patients. These differences can only be identified if the amount of measurement error is not too high. An SNR that is used to assess the instrument’s ability to measure visual field progression should therefore consist of a signal, expressing between-patient differences in visual field change, in proportion to the amount of measurement error (noise). 3 Such a measure in fact shows the reliability of visual field change and focuses on the discrimination between patients who change a great deal and those who change little. 4

The authors proposed SNRs that assess a test’s sensitivity for cross-sectional spatial differences. These SNRs could be used as an approximation for a test’s sensitivity to visual field change over time. 1 As the focus here is on detection of true change within patients over time, its purpose is evaluative instead of discriminative. 5 Therefore, these SNRs used differences within patients as the signal of interest. 5 An index of sensitivity to change could be used for assessing the ability of a test to detect even minimal visual field deterioration, but not to assess the ability to detect clinically relevant differences between patients. 6 Although a smaller amount of measurement error (noise) results in both a higher sensitivity to change and a higher reliability of change, these SNRs are fundamentally different. It must be emphasized that the goal of measuring visual field progression (to discriminate or to evaluate patients) should be taken into account when choosing an SNR.

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References


Author Response: Signal/Noise Ratios to Compare Tests for Measuring Visual Field Progression

We thank Dr. Ernest for his interest and his thoughtful comments on our article. 1 We suggested that signal-to-noise ratios (SNRs) estimated from repeated visual field examinations provide initial guidance on whether a new test is likely be to useful in measuring visual field progression over time.

Dr. Ernest points out that the usefulness of a method for measuring progression lies in its ability to discriminate between patients who need a change of treatment and those who

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References