Current Perimetric Procedures have Low Probability of Detecting Glaucomatous Progression in Moderate to Advanced Disease

Andrew Turpin[1], Allison M McKendrick[2]

Departments of [1]Computing & Information Systems and [2]Optometry & Vision Sciences, University of Melbourne, Victoria, Australia.

3922 - A0208

THE UNIVERSITY OF MELBOURNE

Purpose

To find the probability of detecting a small decrease in sensitivity in subsequent tests at one location in the visual field for white-on-white perimetry with Size III stimuli.

Background

While it is well established that perimetric measurements below about 20dB are highly variable, recent literature has questioned whether traditional "T50" thresholds in this range even exist [3,4]. In this study we take the conservative assumption that they do, and examine the probability of detecting a small decrease in threshold using existing and new perimetric procedures.

If the T50 thresholds are measurable, as is currently assumed in all commercial devices offering a "standard" threshold test, this work looks at their utility in discovering change in visual fields. It also introduces a new procedure that is better at detecting small changes in normal and slightly damaged fields.

Methods

Using the in-built simulation procedures of the OPI package [1], we simulated a drop in sensitivity of 2dB and 4dB from first sensitivities varying from 1 to 35dB. The simulations assumed a 3% false response rate, and frequency-of-seeing curves as described by Henson et al [2]. Two existing and one novel, short perimetric procedure (used in ARREST – poster 3923) were simulated as follows.

FT-25

A 4-2 staircase beginning at 25dB, terminating after 2 reversals. If the final estimate (last seen) is more than 4dB away from 25, a second 4-2 staircase is completed beginning at the estimate returned from the first. This is Full Threshold, which has the same error characteristics as SITA.

ZEST

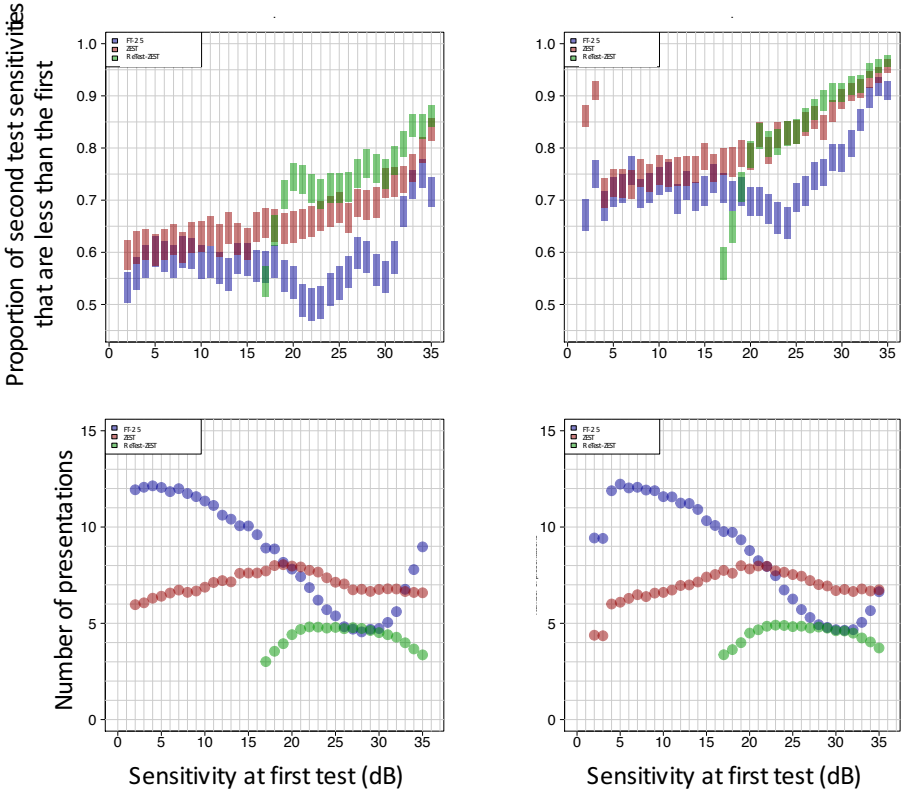
A ZEST procedure using a bi-modal prior over the domain [-5dB, 40dB] as used in many of our previous studies.

ReTest-ZEST

The first threshold is determined using a ZEST procedure with a uniform prior, and the second using a Gaussian prior centered on the result from the first test less 2dB and with a standard deviation of 5dB. The domain for both procedures is 9dB to 37dB in steps of 2dB. This procedure is used in the ARREST algorithm of Poster 3923.

True sensitivities at the second test are 2dB less than the first test

True sensitivities at the second test are 4dB less than the first test



Conclusions

Using typical perimetric procedures, once sensitivities drop below about 20dB the chance of detecting a

- 2dB decrease in sensitivity is below 70%; and
- 4dB decrease in sensitivity is below 80%.

Our new procedure is faster, and better at detecting 2dB decreases for thresholds above 20dB than existing procedures, but it does not test below 17dB. The presentations saved from not testing below 17dB can be used to improve spatial resolution: see Poster 3923.

References

[1] Turpin, A et al. (2012) "The Open Perimetry Interface: an enabling tool for clinical visual psychophysics." J Vis 12(11). http://www.perimetry.org/opi
[2] Henson, DB et al. (2000) "Response Variability in the Visual Field: Comparison of Optic Neuritis, Glaucoma, Ocular Hypertension, and Normal Eyes", IOVS 41(2).
[3] Gardiner, SK. (2016) "The Effect of Limiting the Range of Perimetric Sensitivities on Pointwise Assessment of Visual Field Progression in Glaucoma", IOVS 57(1).
[4] Gardiner, SK. (2014) "Assessment of the Reliability of Standard Automated Perimetry in Regions of Glaucomatous Damage", Ophthalmology 121(7).

Support ARC LP150100815 ***Commercial Relationships*** Haag-Streit (FR), Heidelberg Engineering (F), CenterVue (F)

aturpin@unimelb.edu.au