Validation of an iPad visual field test to screen for glaucoma in rural & remote settings

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Background

- Visual field testing is a key part of assessing patients with suspected glaucoma
- Current methods of visual field testing are time-consuming and require large and expensive equipment. This makes it impractical to perform these tests routinely on all patients referred to eye services, particularly in rural areas
- Many eye services instead rely on simpler procedures to screen for glaucoma, such as slit lamp examination of the optic disc and measuring intraocular pressure
- Melbourne Rapid Fields (MRF) is an iPad application which was designed as an inexpensive and portable method of assessing visual fields.[1,2] The application allows visual field assessment in two modes: a full threshold test of 4-5 minutes and a screening test of approximately 90 seconds duration

Aim

The purpose of this study is to assess the utility of the MRF fast screening module tool in detecting manifest glaucoma in rural patients referred to ophthalmology services

Methods

Design
Prospective, multi-centre, cross-sectional validation study

Participants
- Patients were recruited from several rural sites through two separate clinical services: Lions Outback Vision (LOV), Western Australia and Outback Eye Service (OES), New South Wales
- LOV is a visiting mobile ophthalmology clinic which services rural towns across WA. OES is the sole public ophthalmology service for western NSW, providing an outreach service from the Prince of Wales Hospital Department of Ophthalmology
- Inclusion criteria: (1) Age over 50 or age 40-50 with a family history of glaucoma (2) best-corrected visual acuity≥6/12, and (3) no history of intraocular surgery within the last 3 months

Procedure
- Participants had a basic routine clinical history and examination according to usual clinic procedures, including optic disc examination, ocular coherence tomography of the optic disc, gonioscopy, and Goldman's applanation tonometry
- Each patient then completed the 90 second screening version of the MRF iPad test (Figures 1 and 2) as well as a reference test for comparison: either the Humphrey Field Analyzer SITA 24-2 (HFA) or Haag-Streit Octopus 24-2 (HSO) depending on the site of recruitment
- Feedback was obtained using Likert scales to determine user acceptability

Statistical Analysis
- Data analysis was performed using Stata IC Version 15
- An abnormal MRF test was considered to be >25% risk of abnormality. We calculated the performance of MRF at detecting a moderate or advanced field defect on the reference test (≤-6 Mean Defect)
- Tests with poor reliability, defined as >25% false positives, were excluded from the analysis

Figure 1. Photograph of Melbourne Rapid Fields testing procedure

Figure 2. Example output of Melbourne Rapid Fields compared with Humphrey Field Analyzer
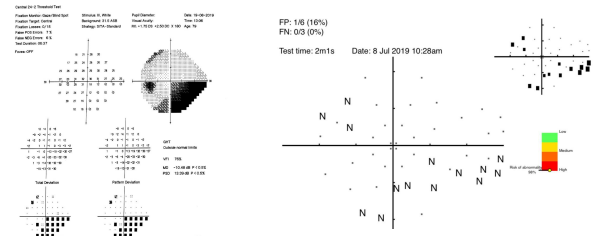
Results

- Our study included 250 eyes of 141 patients. Measures of test performance are presented in Table 1.
- In the LOV cohort we tested 111 eyes of 56 patients. The cohort consisted of 22 patients with glaucoma, 18 glaucoma suspects, and 16 normal individuals. 10 eyes were excluded due to poor reliability.
- In the OES cohort we tested 139 eyes of 85 patients. The cohort consisted of 67 patients with glaucoma and 18 glaucoma suspects. 4 eyes were excluded due to poor reliability
- Results of our survey of 33 randomly selected participants are presented in Figure 3, demonstrating a generally positive test experience compared to traditional field machines
- Mean test durations were 2:17min for MRF, 5:52min for HSO, and 6:38min for HFA

Table 1. Test performance of Melbourne Rapid Fields compared to reference tests

	Haag-Streit Octopus 24-2 (Lions Outback Vision)	Humphrey Field Analyzer 24-2 (Outreach Eye Services)
Sensitivity	86.2%	94.6%
Specificity	84.7%	66.3%
Negative Predictor Value	93.8%	94.8%
Positive Predictor Value	69.4%	65.4%

Figure 3. Patient-reported experience compared with traditional field testing
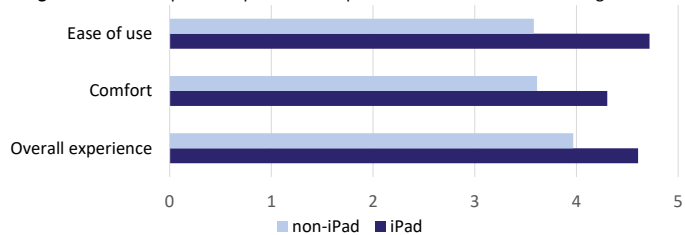
Conclusion

- The screening module of the MRF iPad test is useful as a screening tool for glaucoma within rural areas
- The test is rapid, provides acceptable measures of test performance compared with reference standards, and delivers a positive test experience in contrast to conventional field test perceptions
- MRF has particular application within rural and remote areas where cost, usability, and transportation logistics are of relevance

References

1. Johnson, Chris A., et al. Performance of an iPad application to detect moderate and advanced visual field loss in Nepal. *Am J Ophthalmol* 182 (2017): 147-154.
2. Kong, Yu Xiang George, et al. A comparison of perimetric results from a tablet perimeter and Humphrey field analyzer in glaucoma patients. *Trans Vis Sci Techn* (2016): 2-2.

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