Melbourne Rapid Field

Home-monitoring and sensitive clinic-based detection of vision problems

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The COVID-19 pandemic has placed a great strain on the way optometrists and patients can interact. Many patients are wary of attending clinics for fear of contracting the virus. However, eye disease continues, and the need of practitioners to follow their patients who have chronic conditions such as diabetes, AMD or glaucoma remains. Practitioners need to screen those with complaints of vision change or loss; and they need to determine who warrants a clinical work up. Likewise there is a need for a device that does not make direct contact with patients' faces and eliminates the threat of aerosolised droplets that spread between patients. This is where the Melbourne Rapid Field (MRF) comes into its own.

Developed by Glance Optical, the MRF is the world's first iPad tablet perimeter and visual acuity test. With the MRF, patients can use their own iPad, an Apple or PC computer or any other tablet, to undertake testing at home, guided by a voice-over set of instructions built into the software.

The MRF can also be used in the office, by patients waiting in reception or at home prior to coming to the clinic. The portability of the MRF means that it can be used on clinical rounds or domiciliary visits to identify eye or vision disorders that traditionally require complex and expensive equipment for testing. Even as telehealth redefines the expectations of the standard clinical work up, these novel applications provide practitioners with increased flexibility in screening and testing of their patients.

The MRF in the clinic

Several studies identify that the MRF returns similar outcomes to the Humphrey Field Analyzer (HFA, 24-2 Sita Standard and Fast) for both global (in paragraph below) or regional thresholds.[1] This was confirmed by trials undertaken in Cambridge, UK and Delhi, India in two very diverse clinics.[2] The MRF also has a retest performance that is similar to the HFA[2] implying that it can be used with confidence to monitor visual field defects over time.

We find that children can do the test easily[3] and that it can be used to identify cases of stroke within a week of hospital admission.[4]

An independent clinical trial confirmed that the MRF global index (MD) was highly-correlated with the HFA MD (r = 0.89) and that the diagnostic capacity (sensitivity and specificity) of the MRF was not significantly different from the HFA (AUC: 0.84 MRF vs 0.85 HFA, p > 0.05) in 60 cases of glaucoma and 25 controls.[5]

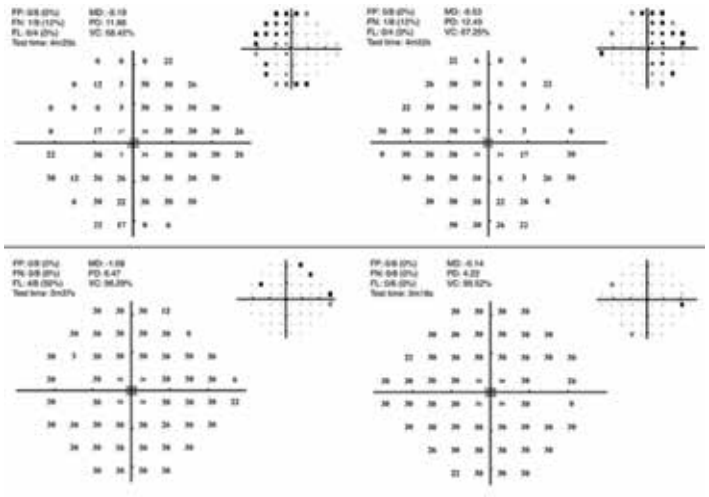

Figure 1.
The MRF visual field results for Case 1 measured at the patient's bedside. Top panels show the dense superior bitemporal hemianopia on admission to hospital. Bottom panels show the improved visual field two weeks after surgery (modified with permission of Nesaratnam et al.[6]).

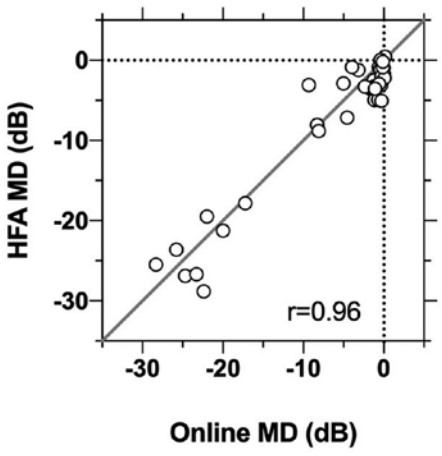

Figure 2.
The visual field global index (MD) returned by a telehealth consult online and the most recent HFA test undertaken by the same patient in the clinic (about six to 12 months ago.) The correlation between the two data sets (n = 36 eyes) is very high (r = 0.96) confirming that clinicians can be confident in the outcome returned from telehealth.

Bedside testing

The tablet application of the MRF has been used to test 110 stroke patients by their bedside. Here it was found that the majority of patients had abnormal visual fields or reduced acuity-in-noise but retained near normal visual acuity. Nesarathan et al. report the case of a 73-year-old female who was admitted to hospital with a three-week history of frontal headache and blur on her left. She had no nausea, diplopia, facial pain or paraesthesia although she had presented seven months prior with nausea and vomiting. At this previous event, magnetic resonance imaging (MRI) of the head found no obvious mass or abnormality and she was medicated and released. At the present visit, fundoscopy found normal optic discs in both eyes.

Given her report of vision disturbance, visual acuity and visual field testing was performed at her bedside using the MRF on an iPad. Her visual acuities were 6/18 OU (6/12 pinhole). A dense superior bitemporal visual field loss was noted (Figure 1, upper panel).

This finding directed her investigators to refer for MRI and pituitary hormone assays as well as an ophthalmology consult for formal vision and visual field evaluation. A Humphrey 24-2 test, performed two days later, confirmed the presence of a dense superior bitemporal visual field loss, consistent with Figure 1. MRI identified a mass in the pituitary region.

Neurosurgical intervention was undertaken two days later and two weeks post-operatively the patient's acuity was RE 6/4 and LE 6/5 with visual fields vastly improved (Figure 1, lower panel).[6]

Telehealth in action

Recently Dr Kong's office received a phone call from a 68-year-old female who reported a three-month loss of vision in her upper visual field of her left eye. She was concerned about contracting COVID-19 and preferred not to come into the clinic.

Dr Kong ordered visual acuity and 24-2 visual field testing with the online option of the MRF and sent her the URL details so that she could do the testing at home on her son's PC. She was instructed to wear her normal reading glasses for the testing and guided through the procedure by a 'voice over' assistant. She was also reminded to save the test after she had finished so that it would be stored on the cloud for the purpose of reviewing her data. (Clinicians are informed by email once the data is saved and ready for review.)

In this case, the patient's visual acuities were RE 6/4.8 and LE 6/19. Her visual fields showed a normal outcome in her RE and a superior scotoma that crossed the vertical midline in her LE. The normal RE result assured the clinician that the patient understood how to perform the test. After seeing the test results, the patient agreed to visit Dr Kong's clinic where a dilated fundus exam exposed a retinal detachment in the inferior region of her left eye. She was referred urgently to a retina specialist.

Clinicians can have confidence in the online outcome if the MRF test application is calibrated properly. A 'voice over' guides the patient through the calibration process. The same voice over guides the patient through the test(s) to ensure successful completion.

Our analysis of early data collected from the patient performing the test at home using the browser of the patient's own PC or tablet returns a strong correlation (r = 0.96) to their last HFA test undertaken in the clinic (some six to 12 months old) for the mean deviation parameter (Figure 2).

Self-monitoring for progression

One of the challenges in clinical eye care is finding early progression or changes in patients who have chronic eye disease. This has been amplified by the COVID-19 pandemic. The AREDS-2 Home study followed 1,520 participants with AMD for a mean of 1.4 years: 763 undertook self-monitoring at home and 757 were reviewed using standard clinical care.[7] The home-monitoring group were tasked with doing the test every day, and on average, they returned a result about every two days. This trial found that patients at high risk for choroidal neovascular membrane (CNVM) benefited from home monitoring as it allowed earlier detection of CNVM onset. The more timely intervention resulted in a smaller loss of visual acuity (median loss of four letters) compared with standard clinical care (median loss of nine letters).[7]

Figure 3 shows the MD for one glaucoma patient who has unilateral glaucoma in the left eye and who has been self-monitoring their visual field using an iPad on a weekly basis over four months. The RE (blue data) is normal and returns a flat slope for the linear trend: thick blue line (-0.1 dB/yr). On the other hand, the LE (orange data) gives an abnormal MD (-19.8 dB) confirming the presence of glaucoma and shows a significant downward trend (-2.1 dB/yr) in its data over the same period. This change has been identified in four months well before the next scheduled clinical review, due two months later.

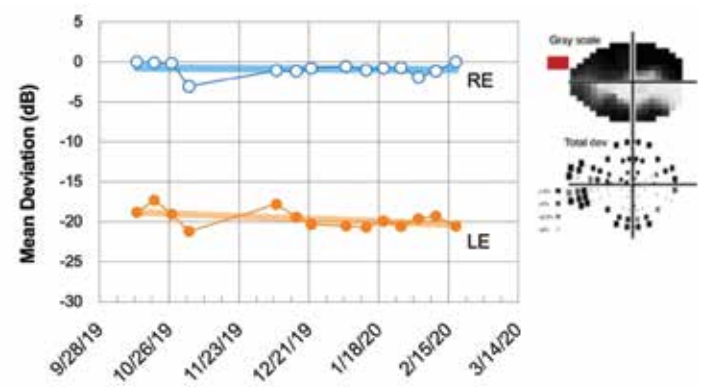

Figure 3.
A four-month time series returned by a patient having unilateral glaucoma who self-monitored using an iPad at home. The unilateral advanced glaucoma is evident from the visual field plot in the Right panel and the low MD values in the left eye over four months of data collection (LE, orange, average MD of -19.8 dB). The unaffected RE (blue) returns a normal MD and a flat linear trend (-0.1 dB per yr) over the same four months. The LE shows a progressive loss of MD over the same period (-2.3 dB per yr) despite treatment. In this case, the continuing loss was exposed two months before the next clinical review.

Conclusion

Melbourne Rapid Fields (MRF) software is registered with the Therapeutic Goods Administration (TGA) in Australia as a perimetry device. It has recently been translated to an online version that will work on most PC browsers.

Members of Optometry Australia and the New Zealand Association of Optometrists can order MRF tests (or get a free trial) through Designs for Vision at a considerable discount.

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