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Repeatability assessment of monocular and binocular visual field measurements with a head mounted display

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INTRODUCTION

Visual field (VF) defects affect the ability of patients to perform activities of daily living. Bilateral VF defects correlate with vision related quality of life activities[2] and mobility.[3] Bilateral defects constituted 48% of the patients in the Collaborative Initial Glaucoma Treatment Study. [4] Repeated testing is essential to monitor the progress of rapid developing defects. It is estimated that detection time for rapid VF progression would be reduced by 66% if frequent home-based VF testing could be utilized. [5]

Previously, we designed and implemented a virtual reality head mounted display (VRHMD) to measure VF.[6,7,8] The measurement covered the central 80 degrees diameter area, in both monocular and binocular modes. In this study, we assess repeatability of monocular and binocular visual field measurements as compared to the standard automated perimetry (SAP).

Purpose

To evaluate the visual field (VF) measurement repeatability using a portable VF quantification tool for both monocular and simultaneous binocular measurements.

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METHODS

We examined the repeatability of our device's VF measurements by repeating the VF test two times in two different groups of patients.

The first group included 10 patients (10 eyes) with known monocular VF losses. We compared the VRHMD VF monocular testing outcomes with the standard of care: standard automated perimetric (SAP), which we used as the reference measurement.

In the second group, another 10 patients (20 eyes) with binocular glaucomatous and neurological VF losses, participants were VF tested binocularly (simultaneous VF measurement for the two eyes). Binocular test outcomes were compared with the integrated monocular SAP tests for both eyes of the participants. We compared the VRHMD VF and SAP VF reproducibility tests qualitatively using paired VF images, and quantitatively with Intraclass correlation coefficient statistical metric.

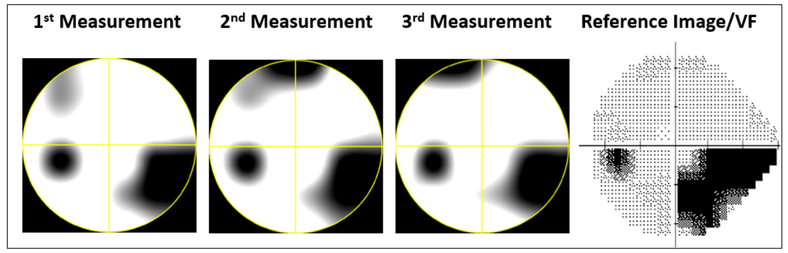

Fig.1 Three monocular visual field (VF) measurements of a patient compared to monocular SAP VF.

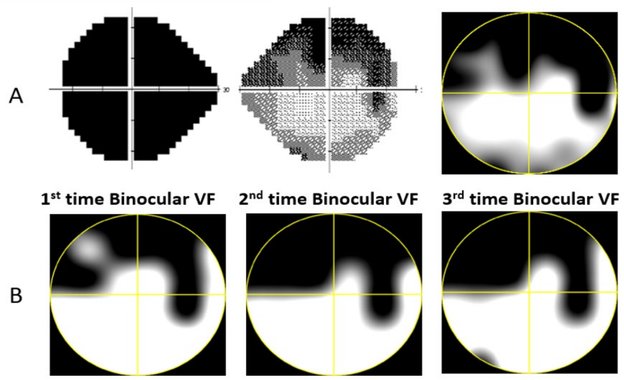

Fig.2 Repeated binocular visual field (VF) measurements of a patient compared to monocular SAP VF. A) Left and right 24-2 monocular SAP VFs, the integrated VF based on the monocular VFs. B) Three Binocular VRHMD VF measurements (both eyes simultaneously) in the central 24 degrees.

RESULTS

The VRHMD VF outcomes were qualitatively comparable to their matching references in the monocular and binocular groups of patients, as visual results show. The VRHMD VF quantitative repeatability metric for repeated testing with the ICC metric was found to be significant in the two groups (0.83 for the first test monocular group, 0.73 for the second binocular testing group) indicating excellent agreement for VRHMD monocular measurements and good agreement for the binocular measurements, respectively.

CONCLUSION

Monocular and binocular VRHMD VF measurements were found to be repeatable and statistically reproducible.

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