A Clinical Evaluation of a Virtual Reality Headset-Based Visual Field Test Compared to Standard Automated Perimetry in Healthy Volunteers and Glaucoma Patients

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peri vision

INTRODUCTION

Glaucoma is the second leading cause of blindness in the UK, accounting for 10% of registered cases (1). As a progressive lifelong disease, it requires continuous monitoring, contributing to 20% of ophthalmology outpatient appointments (2).

The Humphrey Field Analyser (HFA) with Standard Automated Perimetry (SAP) is the gold standard for detecting and monitoring glaucomatous visual field loss, but it is lengthy, fatiguing and resource-intensive, limiting accessibility and scalability.

Through the Small Business Research Initiative (SBRI), this study evaluates the PeriVIsion VR headset (VisionOne platform, SORS 20 strategy) against the HFA 24-2 SITA-Standard, assessing accuracy, re-testability, test duration and patient perception in healthy volunteers and patients with glaucoma to determine the feasibility of VR-based perimetry in clinical practise.

METHODS

Eligibility: participants must have visual acuity better than 6/7.5, and intraocular pressure 10-21 mmHg

Participants: 42 healthy volunteers and 3 patients with glaucoma were recruited

Underwent visual fields test in both eyes using: Test Pattern 24-2 (SITA Standard) on HFA, SORS 20 on VisionOne (VO)

Tests were repeated on a separate day. Volunteers then completed a follow-up usability questionnaire

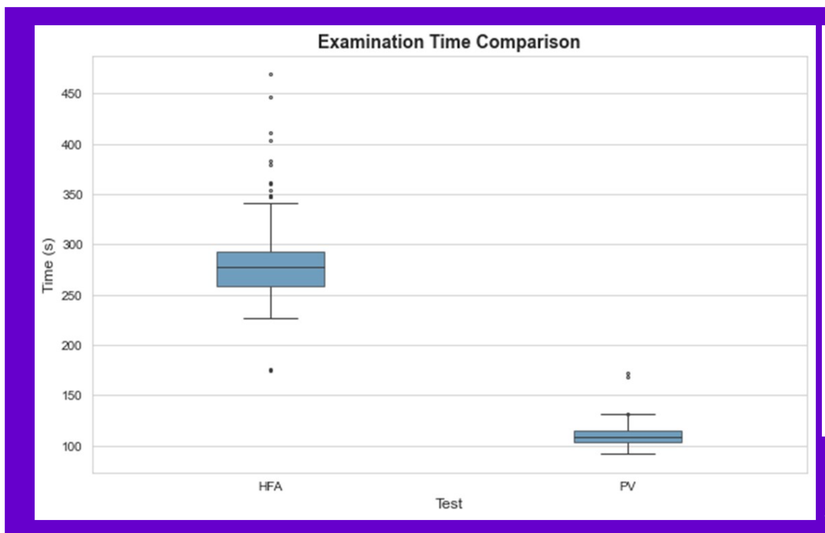

Figure 1, Box plot showing examination time comparison between the HFA and PeriVision Headset

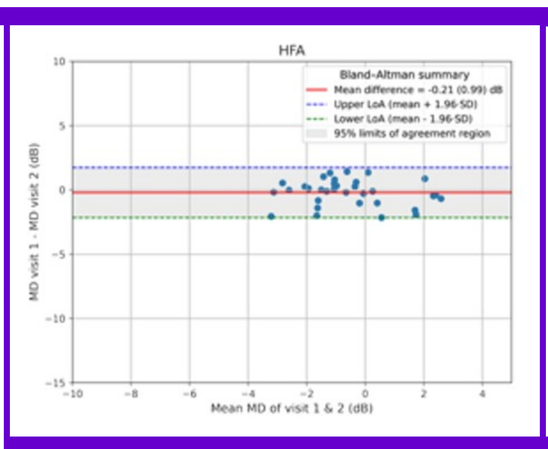

Figure 3, Bland-Altman plot showing mean deviation differences in the test-retest variability in the HFA (SITA-Standard)

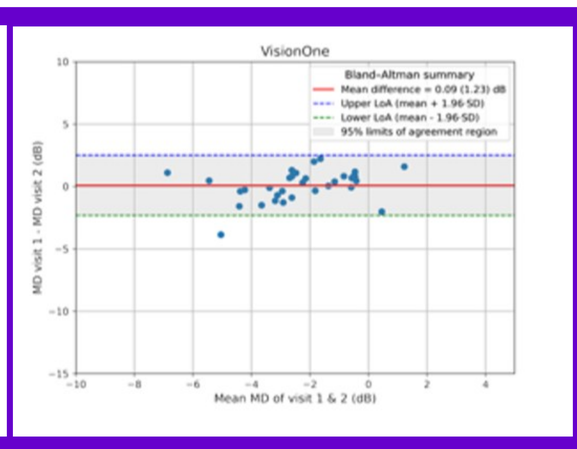

Figure 4, Bland-Altman plot showing mean deviation differences in the test-retest variability in the PeriVision headset

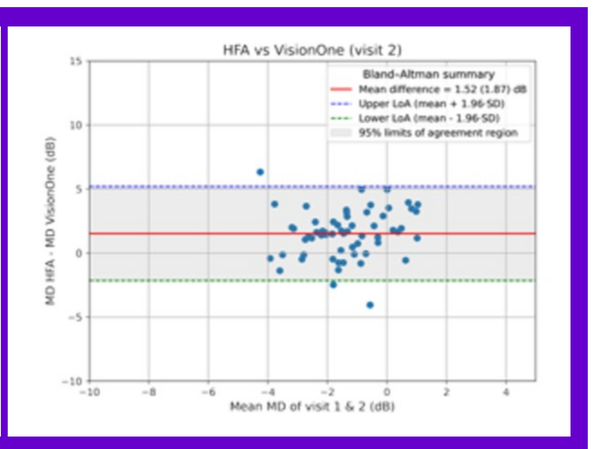

Figure 5, Bland-Altman plot showing mean deviation differences in the test-restest variability in the PeriVision headset and the HFA

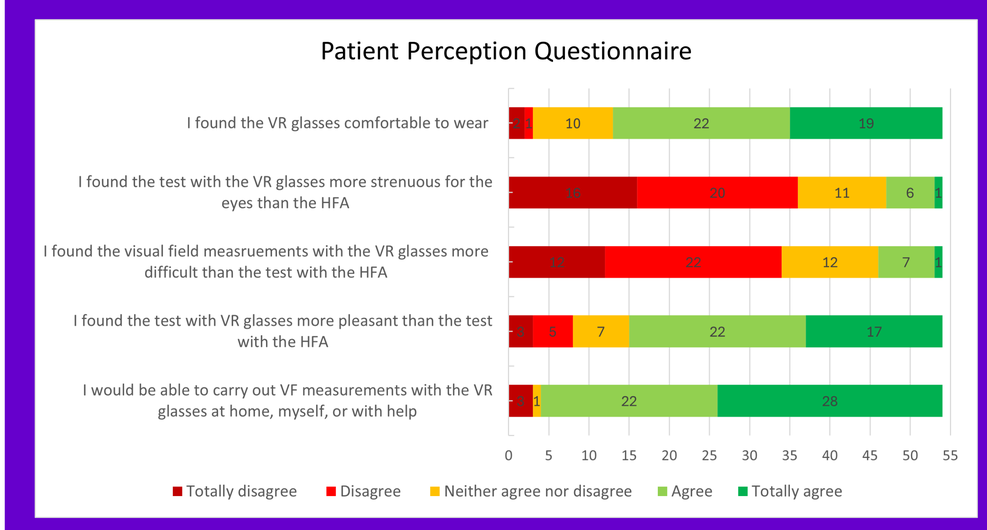

Figure 2, Stacked bar chart showing the Likert scale responses from the patient perception questionnaire

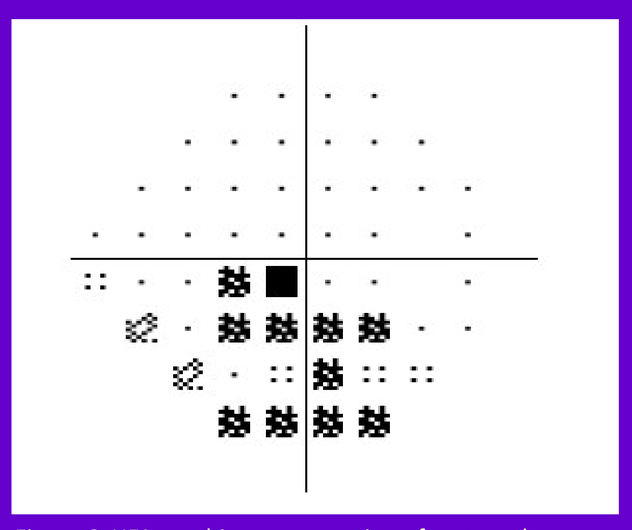

Figure 6, HFA graphic representation of pattern deviation in the numeric scale

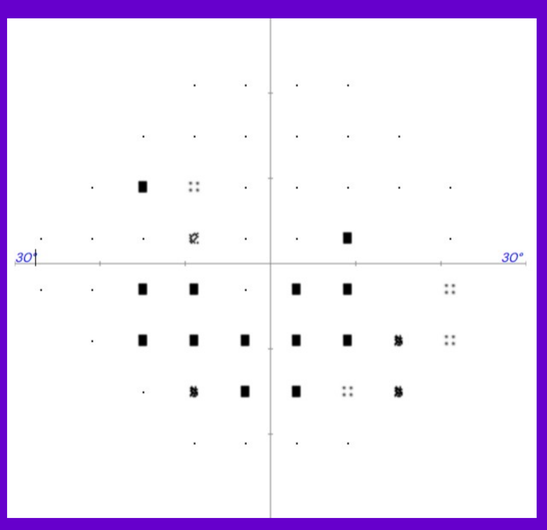

Figure 7, PeriVision graphic representation of pattern deviation in the numeric scale

RESULTS

Test-retest studies were performed on 45 participants (median age 26.5, IQR 21-42.25). Bland-Altman analysis of VisionOne's test-retest variability showed a mean difference of 0.09dB (95% LoA -2.32dB to 2.50dB) compared to the HFA's mean difference of -0.21 (95% LoA; –2.16dB to 1.73dB). Comparing the HFA to VisionOne there was a mean difference of 1.52dB (95% LoA –2.14dB to 5.19dB)

The mean completion time was 4.66 (SD 0.33min) with the HFA and 1.83 min (SD 0.16min) with VisionOne, a time reduction of 60.66%. This difference was statistically significant (paired t-test, $p<0.005$).

Overall, more participants found the VR headset comfortable (75.9% Agree or Completely Agree) and more pleasant than using the traditional perimeter (72.2% Agree or Completely Agree).

DISCUSSION

This study shows the feasibility of using a VR based perimeter in clinical practice with a significant reduction in test time and good acceptability amongst participants. Both conventional perimetry and VR based perimetry showed similar test-retest reliability.

This compares favourably with similar studies, however, further studies assessing the non-inferiority of VR perimetry, especially in glaucoma patients, are warranted.

REFERENCES

1. NICE. Glaucoma: How common is it? [Internet]. NICE, Clinical Knowledge Summaries site . 2023. Available from: https://cks.nice.org.uk/topics/glaucoma/background-information/prevalence/

2. Association of Optometrists. The role of optometry in revolutionising glaucoma care [Internet]. Aop.org.uk. 2023. Available from: https://www.aop.org.uk/our-voice/policy/position-statements/2024/05/17/the-role-of-optometry-in-revolutionising-glaucoma-care