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Comparing Visual Field Assessment Tools: Virtual Reality and Humphrey in Primary Open-Angle Glaucoma

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INTRODUCTION

Virtual reality perimetry testing is becoming more accessible as a tool to complement glaucoma diagnosis and management. Office-based standard automated perimetry retains its pivotal role in glaucoma management, serving as a cornerstone for assessing visual function and forecasting disease advancement. Nonetheless, these conventional in-office devices are encumbered by drawbacks such as labor-intensive costs, space constraints, and patient dissatisfaction. **Virtual reality headsets may overcome some of these limitations of gold standard perimetry.**

AIM

This pilot study is to **analyze the correlation between the reliability indices, time taken to test, global indices, and satisfaction of the PalmScan VF2000 virtual reality visual field headset and gold standard Humphrey visual field analyzer**

METHOD

Participants (n = 22) for this investigation were being monitored for primary open angle glaucoma as either suspects or early disease. Participants completed a perimetry visual field testing using the PalmScan (PALM) VF2000 G2 headset in lieu of a Humphrey Visual Field (HVF) test during a follow up exam.

Inclusion criteria

- patients who had undergone a minimum of 5 Humphrey 24-2 or 30-2 SITA standard visual field in total with the most recent HVF completed within the preceding 6 months

Reliability indices of FL, FP, FN, and the global indices of MD, PSD, VFI, and time taken to complete the examination were analyzed for both the PALM and HVF.

Intraclass correlation coefficient was used as a measure of reliability for all indices. A p-value of < 0.05 was considered statistically significant. Correlation coefficients were calculated using parametric testing.

A patient satisfaction 5-point likert scale questionnaire was also analyzed to compare HVF to PALM and analyzed using Wilcoxon signed-rank test.

RESULTS

Agreement between PALM (VRVF) and HVF (Figure 1):

- Good agreement for MD and PSD
- Moderate agreement for FL
- Poor agreement for VFI, FP and FN

Correlation between PALM (VRVF) and HVF (Figure 1):

- Moderate correlation MD, PSD, and FL
- Poor correlation: VFI
- No correlation between the two machines for FP and FN

Time to completion

- Less time to completion when comparing PALM (mean change ± SEM: 271.27 ± 14.50s) vs HVF (390.87 ± 20.41s) | ($Z = 4.07$, $p < 0.05$) (Figure 2)
- Less reported fatigue ($Z = 2.80$, $p < 0.05$) and apprehension ($Z = 2.20$, $p<0.05$) on PALM (Figure 3)

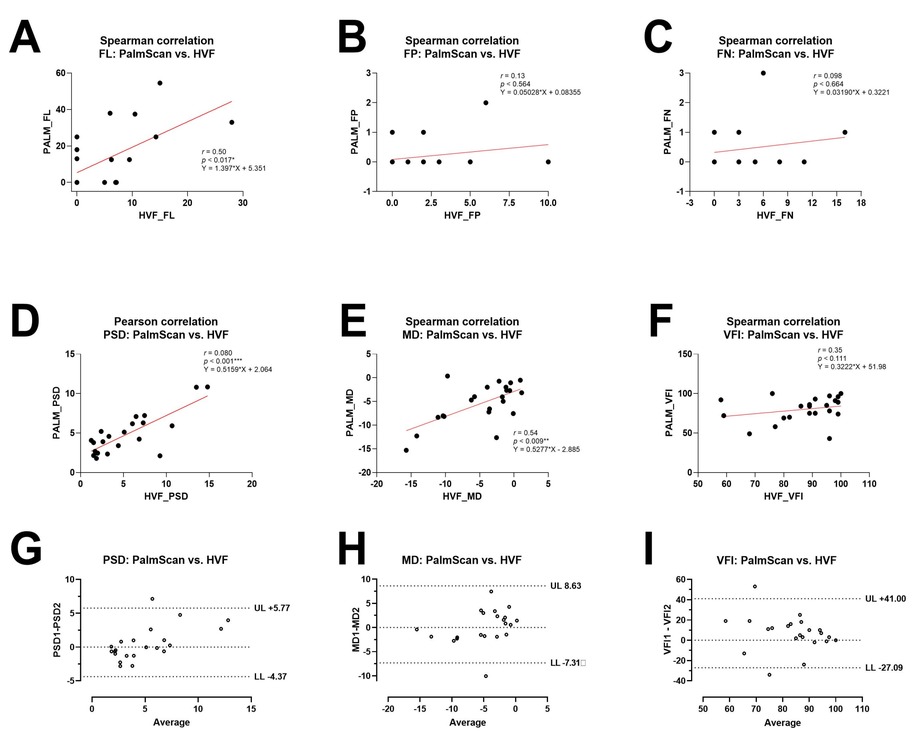


Figure 1. Bland Altman and Pearson parametric or Spearman non-parametric correlation plots comparing correlation of global indices and reliability indices between VRVF and HVF.

A) Bland Altman plot comparing MD values B) Bland Altman plot comparing PSD values C) Bland Altman plot comparing VFI D) Spearman non-parametric correlation plot comparing MD values E) Pearson non-parametric correlation plot comparing PSD values F) Spearman non-parametric correlation plot comparing VFI values. G) FL correlation between PalmScan and HVF H) FP correlation between PalmScan and HVF I) FN correlation between PalmScan and HVF. MD = mean deviation, PSD = pattern standard deviation, VFI = visual field index, FL = fixation loss, FP = false positive, FN = false negative. Upper (UL) and lower limits (LL) for the Bland Altman plots are denoted as doted lines. Correlation coefficient (r) and slope (Y) are denoted in the graph along with a linear regression (red). * ($p < 0.05$) ** ($p < 0.01$) *** ($p = < 0.001$).

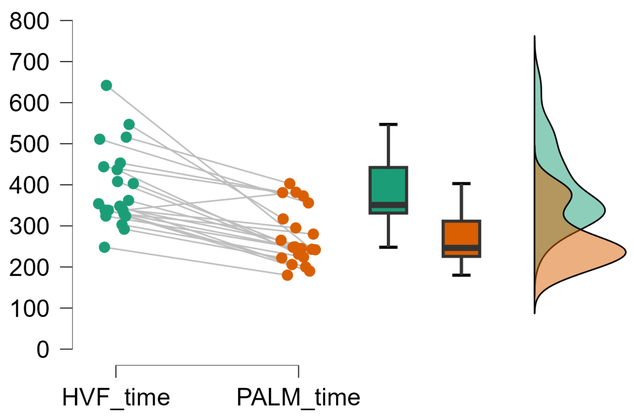


Figure 2: Box and raincloud plots illustrating the total time taken (seconds) to complete visual field with HVF (green) versus PalmScan (PALM, orange).

A) shows individual data points, B) box plots, and C) density distributions for each category. Bold black lines within the box plots represent the median, with hinges marking the 25th and 75th percentiles, and whiskers extending 1.5 times the interquartile range beyond the hinges. Density estimates are calculated using a Gaussian kernel with the 'nrd0' bandwidth selection method.

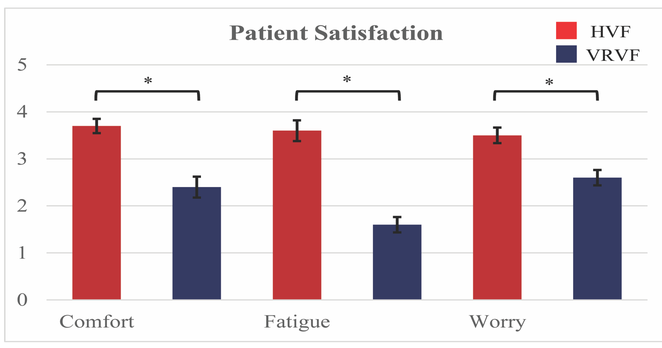


Figure 3: Patient satisfaction parameters comparing HVF vs VRVF on each of the categories.

Y axis represent the likert scale. X axis denotes the three categories of fatigue, worry, and comfort. Statistics were complete with the Wilcoxon-signed ranked test where * ($p < 0.05$)

CONCLUSIONS

Compared to HVF, **The PALM showed:**

- **Good agreement between VRVF (PalmScan VF2000 VR visual field analyzer versus Humphrey visual field analyzer) when comparing global indices values**
- **Greater patient satisfaction**
- **Lesser time to completion**

Our study further highlighted that the VRVF outperformed in key areas, notably reducing patient fatigue and shortening test duration, which aligns with existing literature emphasizing its patient-centric benefits (1). Consistent with previous findings, we observed a robust correlation between the devices for MD and PSD values, reinforcing the clinical utility of the head-mounted VRVF (2).

REFERENCES

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2. Glen, F. C., Baker, H., & Crabb, D. P. (2014). A qualitative investigation into patients' views on visual field testing for glaucoma monitoring. BMJ open, 4(1), e003996.

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PalmScan VF2000 Visual Fields Analyzer (Micro Medical Devices, Calabasas)

CONTACT INFORMATION

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