Comparison of a Virtual-Reality Perimeter to Standard Humphrey Visual Field in Normal Children

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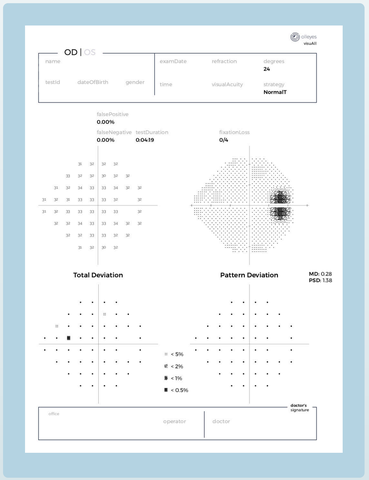
Introduction

Perimetry in children is an invaluable modality for assessing afferent function. Current threshold perimeters demonstrate relatively poor reliability and satisfaction. The Olleyes VisuALL (OV) is a commercially available **video-game based** automated static threshold perimeter that uses a Virtual Reality headset, and a wireless remote.

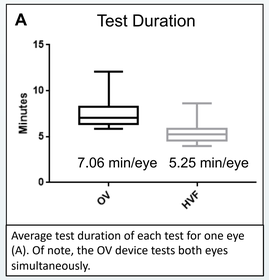
Olleyes Headset and wireless remote (left); 9-year-old child completing the VRP in clinic. (right) Sample report (below).



Methodology

- 50 normal subjects ages 9-17 (mean=13 years, 50% female)
- Performed Humphrey Visual Field (HVF) 24-2 and Olleyes VisuALL pediatric threshold perimetry.
- Test time, reliability parameters, and effects of age, gender, and ethnicity were evaluated.
- Normative threshold sensitivities were established by percentile.
- Mean inter-subject variability measured by Gini's Mean Difference
- Patient satisfaction surveys were administered
  - 1-5 scale, Wilcoxon matched-pairs signed rank test

Results



Average test duration of each test for one eye (A). Of note, the OV device tests both eyes simultaneously.

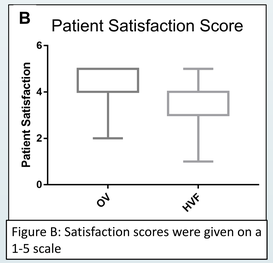


Figure B: Satisfaction scores were given on a 1-5 scale

Patient satisfaction scores favored the OV device experience (p<0.01).

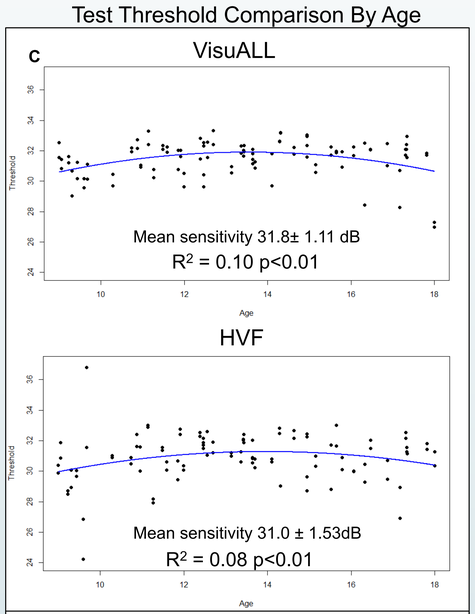
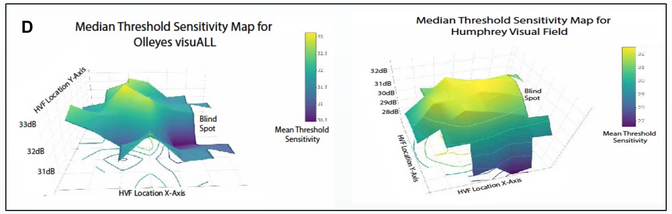


Figure C: Parametric regression of mean threshold sensitivity by age found similar small age-effects with the OV and HVF devices.

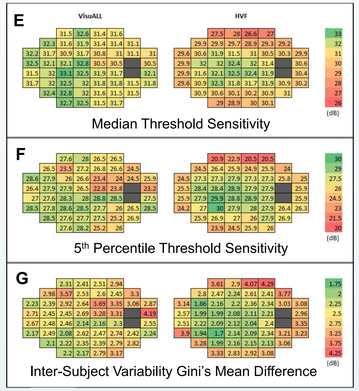
We were unable to detect any effect of gender or ethnicity.

Results

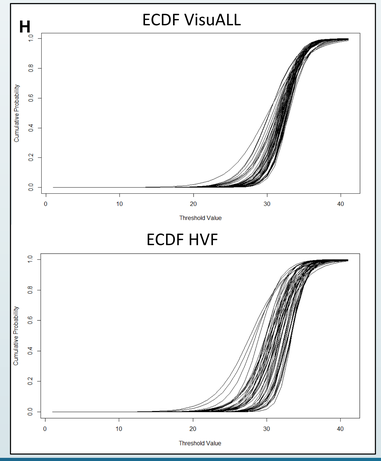


Figures D-G: Comparison of median threshold sensitivity (D&E) with surface plot illustrating the "hill of vision" (D) and numeric heatmap (E). 5th percentile threshold sensitivity (F), inter-subject variability (G) at each location in the visuALL and the HVF.

There was no significant difference in overall inter-subject variability (p>0.25) between the devices.



Geographic effects on sensitivity and variability were concentric in the HVF as expected, and overall flatter and more sporadic for the OV.



Empiric cumulative distribution functions (ECDF) for all participants at each location in each test are plotted together (H) to illustrate that threshold sensitivity distributions were similar in each modality.

Conclusion

Attention to the task has long been a challenge in pediatric visual field testing. This game-based perimeter has higher patient satisfaction as well as tight correlation to the standard of care perimeter. Direct comparison of the two demonstrates less variability and tighter thresholds with the portable instrument which should translate into better ability to detect defects. The portability of the test allows it to be done in myriad environments lending to flexibility that can benefit children.

This commercially available head-mounted perimeter can be used reliably in children and is associated with higher patient satisfaction than HVF. A normative dataset is now available and the device can be used in clinic, hospital, or home settings.

References

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