Distance and Near Fixation Disparity Measurement: Comparing Traditional Methods to the Vivid Vision

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Introduction

- Vivid Vision is a virtual reality software that is used in conjunction with an Oculus Rift headset, hand-held controllers, and motion sensors developed to be used in the treatment of strabismus and amblyopia.[1]
- The Vivid Vision software also incorporates standard clinical testing.[1] Recently, Vivid Vision developed a fixation disparity test.
- Fixation disparity is a small misalignment of the eyes from exact bifoveal fixation that results from an inaccurate vergence response to a stimulus. Fixation disparity produces constant vergence eye movements which allows fusion to be maintained.[2]
- Previous research revealed changes in the binocular vision system while using a virtual reality headset as well as lack of correlation of other Vivid Vision tests with traditional clinical tests.[3,4,5,6,7]
- This study was performed to address whether there is a significant difference in fixation disparity measurements using traditional exam methods and using Vivid Vision.

Methods

- A sample size of 24 first and second-year optometry students from the Michigan College of Optometry was recruited for this study, with 21 subjects included in the final study.
- Eligibility criteria included visual acuity of 20/20 for each eye individually, absence of strabismus on cover test, and 40 arc seconds of stereopsis using local near Wirt Rings.
- Data was collected in two separate sessions to minimize effects of fatigue. The first session comprised of entrance and traditional clinical testing, while Vivid Vision data was collected in the second session.
- Horizontal fixation disparity was measured on each subject at distance and near using the traditional methods of a Saladin card (40 cm) and vectographic slides (scaled to lane length).
- Measurements were compared to those taken with the Vivid Vision software. Distance and near targets were simulated using +0.75 D and -1.75 D lenses inserted into Oculus Rift headset, respectively. The subject's view of Vivid Vision is shown in Figure 1.

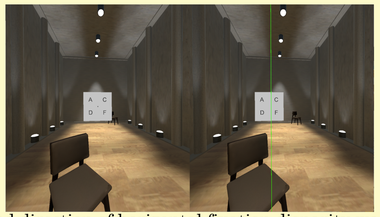

Figure 1. Vivid Vision software

- The magnitude and direction of horizontal fixation disparity was collected from each subject for all testing and analyzed using SPSS 25.0.

Results

- Descriptive statistics of the data (Table 1) include count (N), mean, standard error of the mean, standard deviation, and the lower and upper bounds of the confidence interval for all methods.

	N	Mean	Std. Error	Std. Deviation	Lower Bound	Upper Bound
Vectograph Distance	21	0.52	0.30	1.36	-0.10	1.14
Vivid Vision Distance	21	-7.54	2.90	13.27	-13.58	-1.50
Vectograph Near	21	0.14	0.75	3.45	-1.43	1.71
Vivid Vision Near	21	-9.45	3.38	15.50	-16.51	-2.40

Table 1: Descriptive Statistics

- Figures 2 and 3 compare the mean horizontal FD of the vectographic slides (distance) and Saladin card (near) to the Vivid Vision, respectively. In both figures, the error bars do not cross over each other, suggesting that the two methods are statistically different.

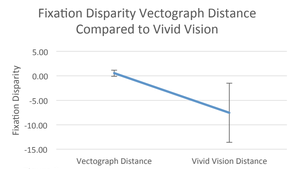

Figure 2.

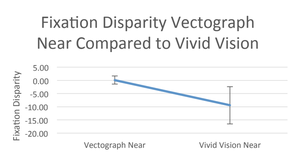

Figure 3.

- A Bland-Altman analysis, which compares the average and the difference of any two methods, was also performed to determine if the two traditional methods were similar to the Vivid Vision. As seen in Figures 4 and 5, the data points do not hover near the mean line, which demonstrates that the methods are not similar.

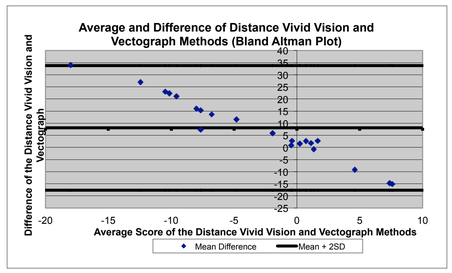

Figure 4.

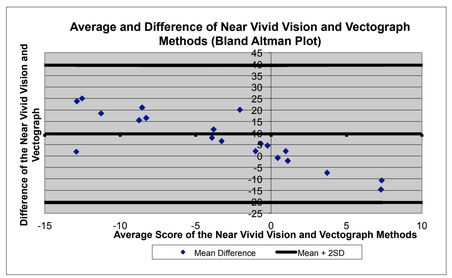

Figure 5.

Conclusions

- A statistical difference was noted in the fixation disparity measurements collected using traditional methods versus using the Vivid Vision.
- At this time, the Vivid Vision cannot be considered a comparable method to traditional methods of fixation disparity. It is important research is done to improve the accuracy of the testing software for fixation disparity before Vivid Vision is more consistently used in optometry practice.
- Possible limitations for this study include the different visual environments experienced by the subject between the two methods, differing levels of precision between the methods, human error, and the underrepresented study population.

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