Early detection of retinal dysfunction in eyes with pre-perimetric Glaucoma using a Virtual Reality Platform

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Purpose

To evaluate the rate of VisuALL VRP visual field test defects among individuals with a previous diagnosis of pre-perimetric glaucoma.

Methods

Retrospective, descriptive study of visual field function in eyes with pre-perimetric chronic open angle glaucoma (COAG). From August 2020 to August 2021, 1,757 patients were tested with the VisuALL VRP (Olleyes, Inc., Summit, NJ) at Glaucoma Associates of Texas (GAT). 128 patients had the diagnosis of pre-perimetric COAG. VRP is a relatively new perimetric modality that uses Virtual Reality (VR) headsets (Figure 2) to measure the retinal sensitivity among other eye functions.[1,2] The probabilistic plot data (Figure 1A & B) of both, the VRP and the HFA, were compared with the corresponding GCC areas on OCT (Figure 1C) to evaluate the structure-function relationship of both perimeters.

Results

From the total of 256 eyes, we found 38 eyes with abnormal GCC. The correlation between retinal sensitivity of the superior hemifield as measured by the VRP and the HFA correlated significantly with the corresponding inferior GCC thickness. Interestingly, the retinal sensitivity of the inferior hemifield as measured by both the VRP and the HFA, did not correlate with the corresponding superior GCC thickness. Table 1 compares the VRP and the HFA ability to detect locations with high probability of abnormal retinal sensitivity. The VRP detected a greater number of visual field defects than the HFA in eyes with pre-perimetric glaucoma.

Table 1: Percentage of locations with <1 and < 0.5 percentile in the Pattern Deviation Plot.

Percentile	VRP	HFA
< 0.5%	52%	25%
< 1%	16%	16%

References

1. *Razeghinejad R, Gonzalez-Garcia A, Myers JS, Katz LJ. Preliminary Report on a Novel Virtual Reality Perimeter Compared With Standard Automated Perimetry. J Glaucoma. 2021 Jan 1;30(1):17-23.*
2. *Montelongo M, Gonzalez-Garcia A, Morgenstern F, Donahue SP, Groth SL. A Virtual Reality-Based Automated Perimeter, Device and Pilot Study. Transl Vis Sci Technol. 2021; Mar 1;10(3):20.*
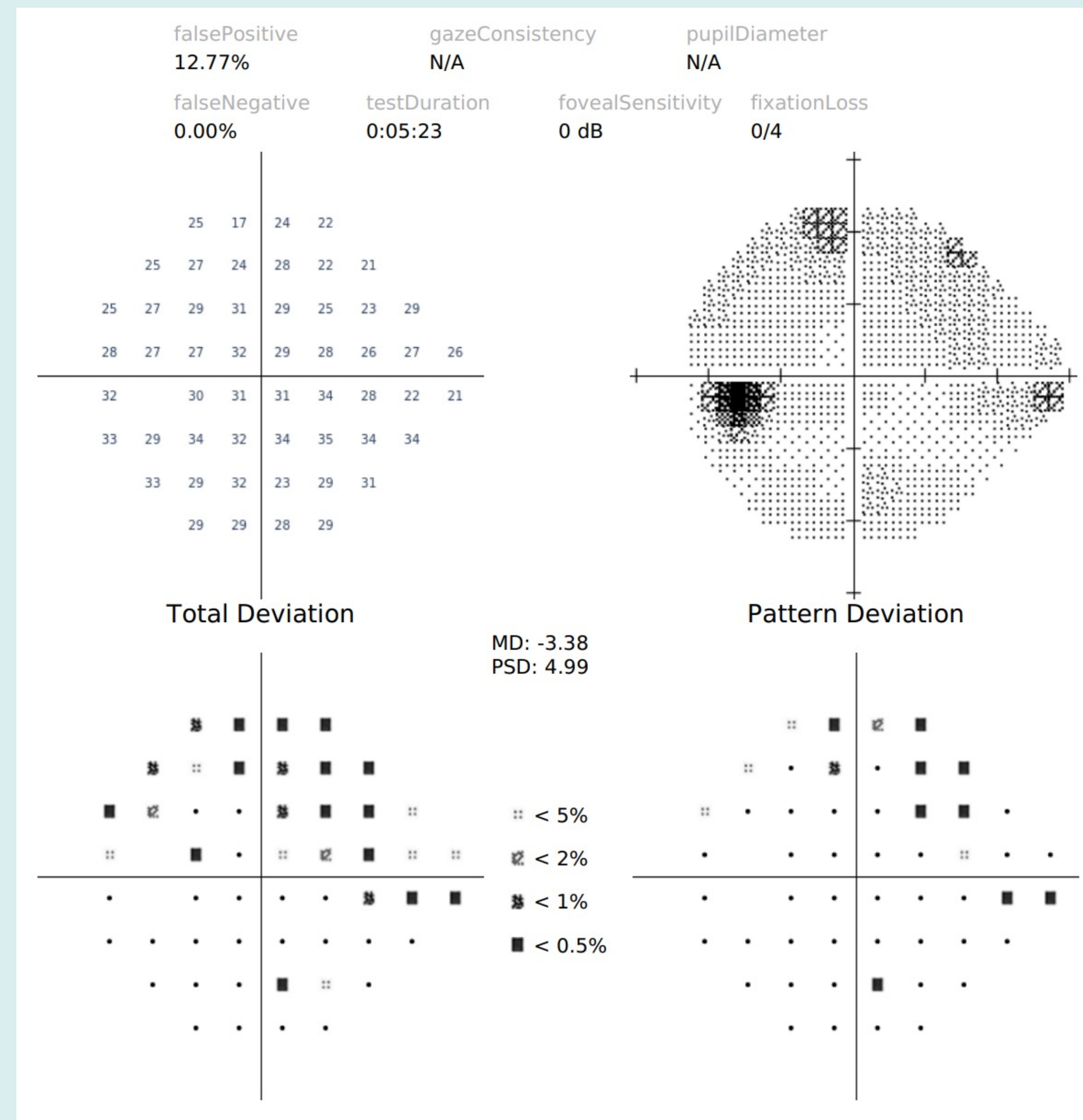
Figure 1A: VisuALL Perimetry report

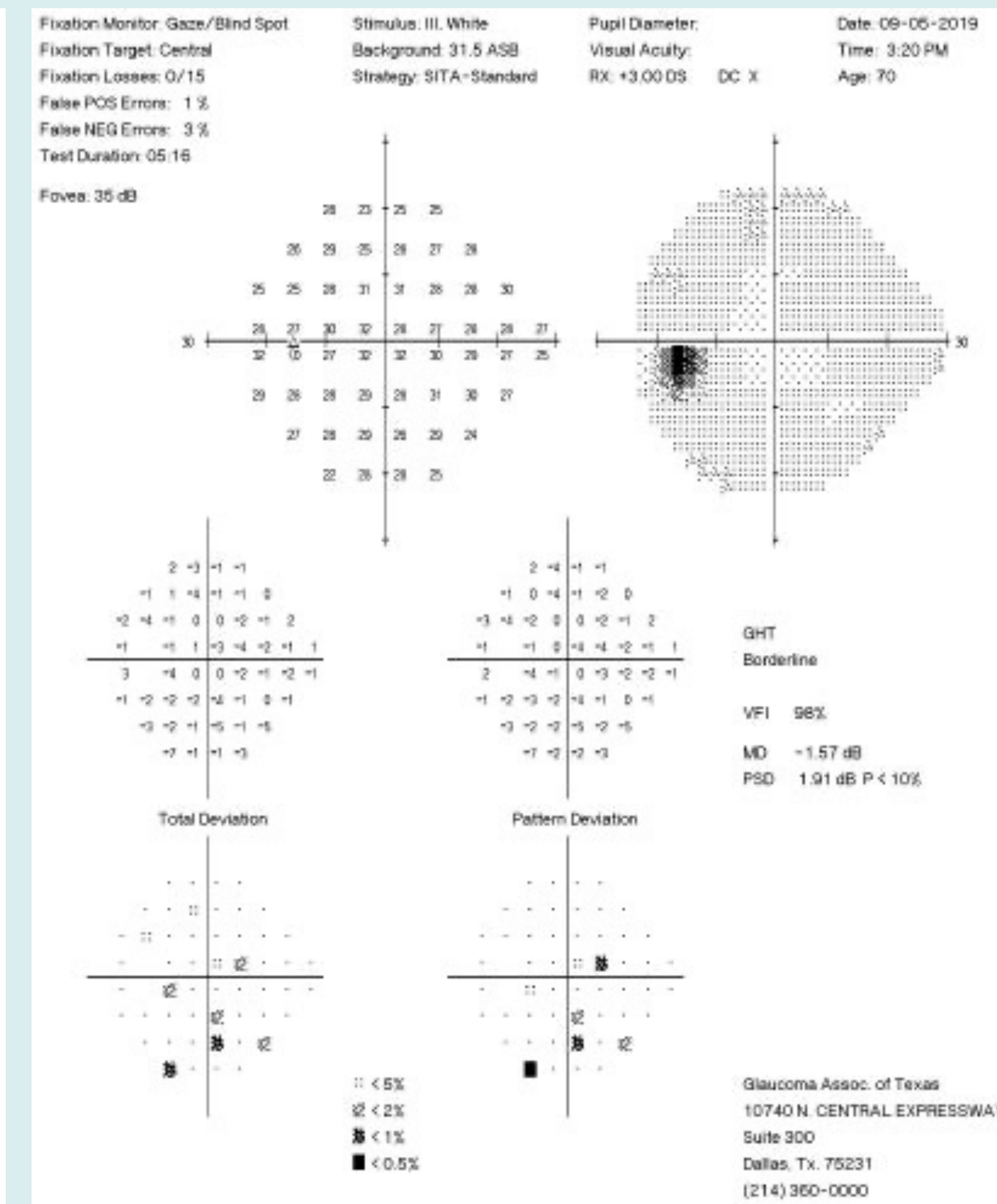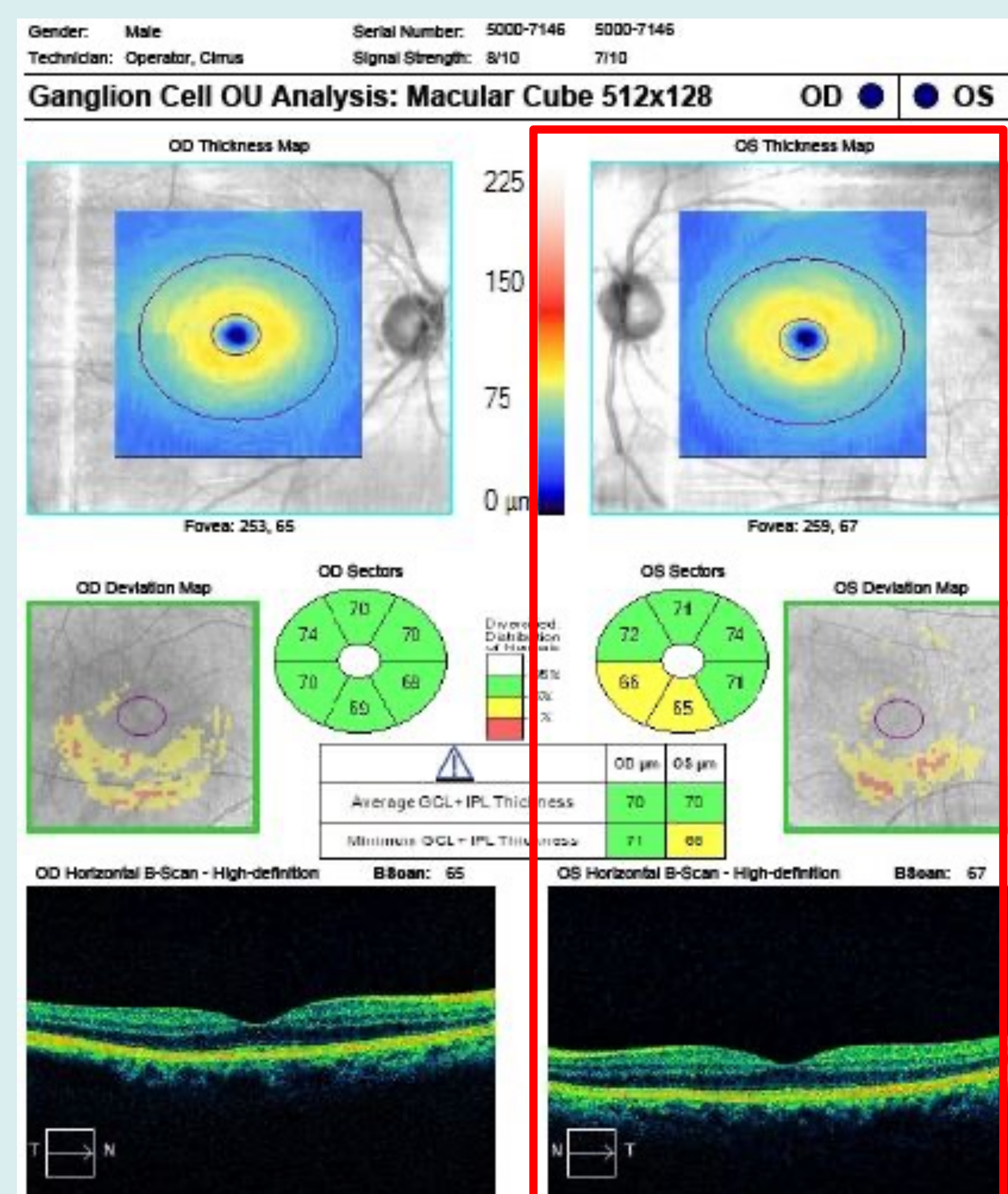### Figure 1B: Humphrey Field Analyzer (HFA) Perimetry report

Figure 1C: Cirrus GCC

Figure 2: VisuAll Virtual Reality Platform (VRP)

Discussion

The VRP detected twice the number of eyes with decreased retinal sensitivity and corresponding retinal ganglion cell layer thinning (as measured by OCT) when compared to HVF. This finding supports previous peer-reviewed articles showing VisuALL VRP has greater sensitivity than HFA to differentiate healthy individuals from glaucoma patients.[1] This early detection capabilities could be due to the VRP stimulus characteristics and the greater testing comfort that VR headsets provide.[1,2] The correlation between GCC and VF parameters was not significantly different between the VisuALL and the HFA.

Conclusion

VisuALL VRP may detect definitive glaucoma earlier than HFA, since the VRP detects a greater number of retinal locations with abnormal sensitivity than the HFA, in eye with pre-perimetric glaucoma based on structural criterion.