

Adding select central visual field test points increases structure-function correlation to perifoveal microvascular density



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PURPOSE

One potential reason for low structure-function correlation in glaucoma is that the most common structural and functional tests do not necessarily sample the same areas on the retina. In this preliminary study, we compared the correlations of OCT angiography (OCTA) to three commercial visual field (VF) tests patterns: two standard patterns (24-2 and 10-2) and one that added 10 new test points in the central 10° field (24-2C) that were found in literature to be highly sensitive to glaucoma.

METHODS

- Retrospective VF and OCTA data were analyzed from an ongoing VF study including 19 eyes of 19 patients in both healthy and glaucoma groups, using CIRRUS™ 5000 HD-OCT (ZEISS, Dublin, CA) and HFA3 (ZEISS, Dublin, CA).
- The last qualified 24-2C SITA Faster VF (SFR24C), 10-2 SITA Fast VF (SF10), and Angio 6x6 mm OCTA macular scan were used.
 - 24-2 SITA Faster (SFR24) VFs were extracted from SFR24C.
- Spearman correlations were calculated between structure-function pairs:
 - Structure – Full, Inner Ring, and Outer Ring Mean metrics from the standard ETDRS grid for both perfusion and vessel densities (see Figure 1).
 - Function – Mean Total Deviation (MTD) of the central 10° test locations for SFR24 (12 points), SFR24C (22 points), and SF10 (68 points).

CONCLUSIONS

The added central test points in the 24-2C pattern moderately increased the correlation to the perifoveal microvascular density compared to 24-2. Furthermore, using all test locations of the more highly sampled 10-2 pattern did not necessarily increase the strength of the relationship in the ETDRS Full or Outer Ring Means, perhaps due to the effect of lateral ganglion cell displacement [1], which was not evaluated in this study. Increasing the overlap between areas tested in structural and functional tests may be a way to increase the strength of the relationship that merits further investigation.

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RESULTS

- Mean age was 56.5 (standard deviation, SD: 7.7; range: 44.3 to 73.1) years for healthy eyes and 73.4 (SD: 9.5; range 60.6 to 97.9) years for glaucoma eyes.
- Mean SFR24 MD was 0.64 (SD: 0.97; range: -1.58 to 2.17) dB and -6.49 (SD: 6.44; range: -24.40 to 1.52) dB in healthy and glaucoma eyes, respectively.
- Moderate correlations ($p < 0.001$) were observed between MTDs (SFR24, SFR24C, and SF10) and OCTA for Full and especially Outer Ring Mean OCTA metrics (range: 0.614-0.685), respectively (see Table 1).
- Only low correlations were observed when comparing Inner Ring densities (range: 0.283-0.372).
- Correlations using SFR24C were slightly higher than those using SFR, likely due to the perifoveal locations of the 10 new test points.
- Correlations using SF10 were slightly higher than SFR24 and SFR24C in the Inner Ring, but lower for Full and the Outer Ring.

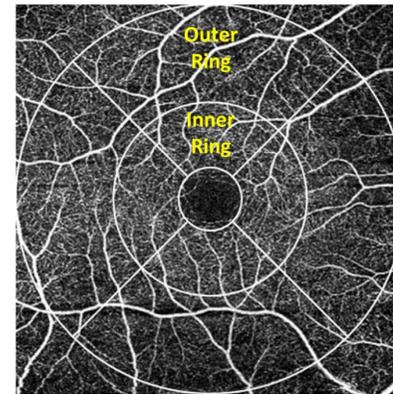


Figure 1. Inner and Outer Ring regions of the standard ETDRS grid. Full region is comprised of the entire ETDRS grid region.

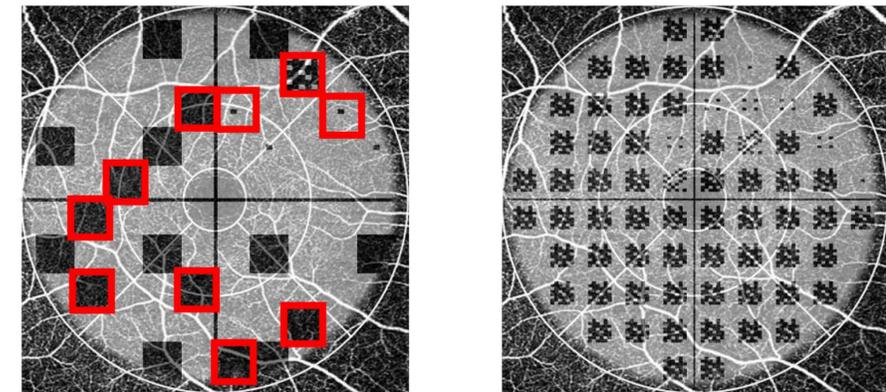


Figure 2. Example overlays of Total Deviation defects within the central 10° and angiography maps (flipped into VF view) for SFR24 / SFR24C (left) and SF10 (right). The 10 new test locations added to 24-2C are highlighted in red. Goldmann Stimulus Size III is used for all VFs and the scale of the defect symbol from the printout does not correspond to the area covered.

OCT Angiography Parameter	Correlation vs SFR24	Correlation vs SFR24C	Correlation vs SF10
Angio 6x6 mm - Perfusion Full Mean	0.632 ($p < 0.001$)	0.638 ($p < 0.001$)	0.614 ($p < 0.001$)
Angio 6x6 mm - Vessel Full Mean	0.628 ($p < 0.001$)	0.640 ($p < 0.001$)	0.626 ($p < 0.001$)
Angio 6x6 mm - Perfusion Inner Mean	0.283 ($p = 0.086$)	0.298 ($p = 0.070$)	0.313 ($p = 0.056$)
Angio 6x6 mm - Vessel Inner Mean	0.339 ($p = 0.038$)	0.355 ($p = 0.029$)	0.372 ($p = 0.022$)
Angio 6x6 mm - Perfusion Outer Mean	0.678 ($p < 0.001$)	0.685 ($p < 0.001$)	0.663 ($p < 0.001$)
Angio 6x6 mm - Vessel Outer Mean	0.672 ($p < 0.001$)	0.684 ($p < 0.001$)	0.661 ($p < 0.001$)

Table 1. Correlations (p-values) between OCTA and VF Central 10° Mean Total Deviation.

References

[1] Drasdo et al. *Vision Res* 2007; 47(22)