

Repeatability and reproducibility of optic nerve head optical coherence tomography angiography (OCTA) measurements on glaucomatous and normal eyes



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PURPOSE

Determine the repeatability and reproducibility (R&R) of spectral domain OCTA metrics on optic nerve OCTA en face images in normal and glaucomatous eyes.

METHODS

- Subjects with glaucoma and healthy controls (both >18 years old) were recruited in this study.
- Each eye was imaged using the Angiography 4.5x4.5 mm scan centered on the optic disc on CIRRUS™ HD-OCT 5000 with AngioPlex® OCT Angiography (ZEISS, Dublin, CA). Scans were repeated on 3 devices (by 3 different technicians) 3 times in 1 visit.
- Two measures of blood vessels were used:
 - Perfusion Density (PD) is defined as the total area of perfused microvasculature per unit area, and ranges from 0 (no perfusion) to 1 (fully perfused).
 - Flux Index (FI) is defined as total weighted area of perfused microvasculature per unit area in a region of measurement. The weight is the normalized flow intensity corresponding to each pixel.
- Each scan is segmented into 4 sectors (temporal, nasal, superior, and inferior) for analysis, and a mean coefficient of variance (CV%) is calculated for both R&R. All statistics are estimated from two-way random-effects ANOVA model with random effects operator/device, eye and interaction between operator/device and eye.

CONCLUSIONS

All CV% (PD and FI) for normal and glaucomatous eyes are excellent, and no significant CV% difference is observed across all sectors from the scans. Given the R&R results, these parameters may be useful for monitoring disease progression or early detection of diseases. Future studies are needed to determine the clinical utility of these measurements.

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RESULTS

22 control eyes (mean age 44.7 years, SD 14.7) and 21 glaucoma eyes (mean age 68.5 years, SD 8.9) were imaged. Table 1 and Table 2 shows PD and FI mean, standard deviation (both R&R), and coefficient of variance (CV%) for normal and glaucomatous eyes. Across all sectors, R&R CV% are below 5% in normal eyes, and no more than 6.1% in diseased eyes. Mean R&R CV% (both PD and FI) are less than 3% for normal eyes, and they are less than 5% for glaucomatous eyes.

	Perfusion Density (PD)						
	n	mean	Repeat. SD	Repeat. CV%	Reprod. SD	Reprod. CV%	
Normal Eye	Temporal	196	0.469	0.009	1.9%	0.010	2.2%
	Superior	196	0.434	0.008	1.8%	0.009	2.1%
	Nasal	196	0.435	0.009	2.0%	0.011	2.5%
	Inferior	196	0.448	0.007	1.6%	0.008	1.9%
	Mean	196	0.444	0.005	1.2%	0.007	1.5%
	Flux Index (FI)						
	n	mean	Repeat. SD	Repeat. CV%	Reprod. SD	Reprod. CV%	
	Temporal	196	0.484	0.011	2.4%	0.015	3.1%
	Superior	196	0.446	0.01	2.2%	0.011	2.4%
	Nasal	196	0.462	0.013	2.8%	0.015	3.2%
Inferior	196	0.448	0.008	1.8%	0.010	2.3%	
Mean	196	0.461	0.008	1.8%	0.010	2.3%	

Table 1. Normal eyes – PD and FI mean, repeatability SD, reproducibility SD, and R&R CV%

	Perfusion Density (PD)						
	n	mean	Repeat. SD	Repeat. CV%	Reprod. SD	Reprod. CV%	
Glaucomatous Eye	Temporal	189	0.427	0.012	2.8%	0.012	2.9%
	Superior	189	0.381	0.012	3.2%	0.013	3.5%
	Nasal	189	0.405	0.014	3.4%	0.015	3.6%
	Inferior	189	0.357	0.010	2.8%	0.012	3.3%
	Mean	189	0.394	0.007	1.8%	0.008	2.1%
	Flux Index (FI)						
	n	mean	Repeat. SD	Repeat. CV%	Reprod. SD	Reprod. CV%	
	Temporal	189	0.386	0.019	5.0%	0.023	6.1%
	Superior	189	0.370	0.014	3.9%	0.017	4.7%
	Nasal	189	0.383	0.017	4.3%	0.022	5.8%
Inferior	189	0.367	0.015	4.0%	0.019	5.2%	
Mean	189	0.378	0.014	3.7%	0.018	4.7%	

Table 2. Glaucomatous eyes – PD and FI mean, repeatability SD, reproducibility SD, and R&R CV%

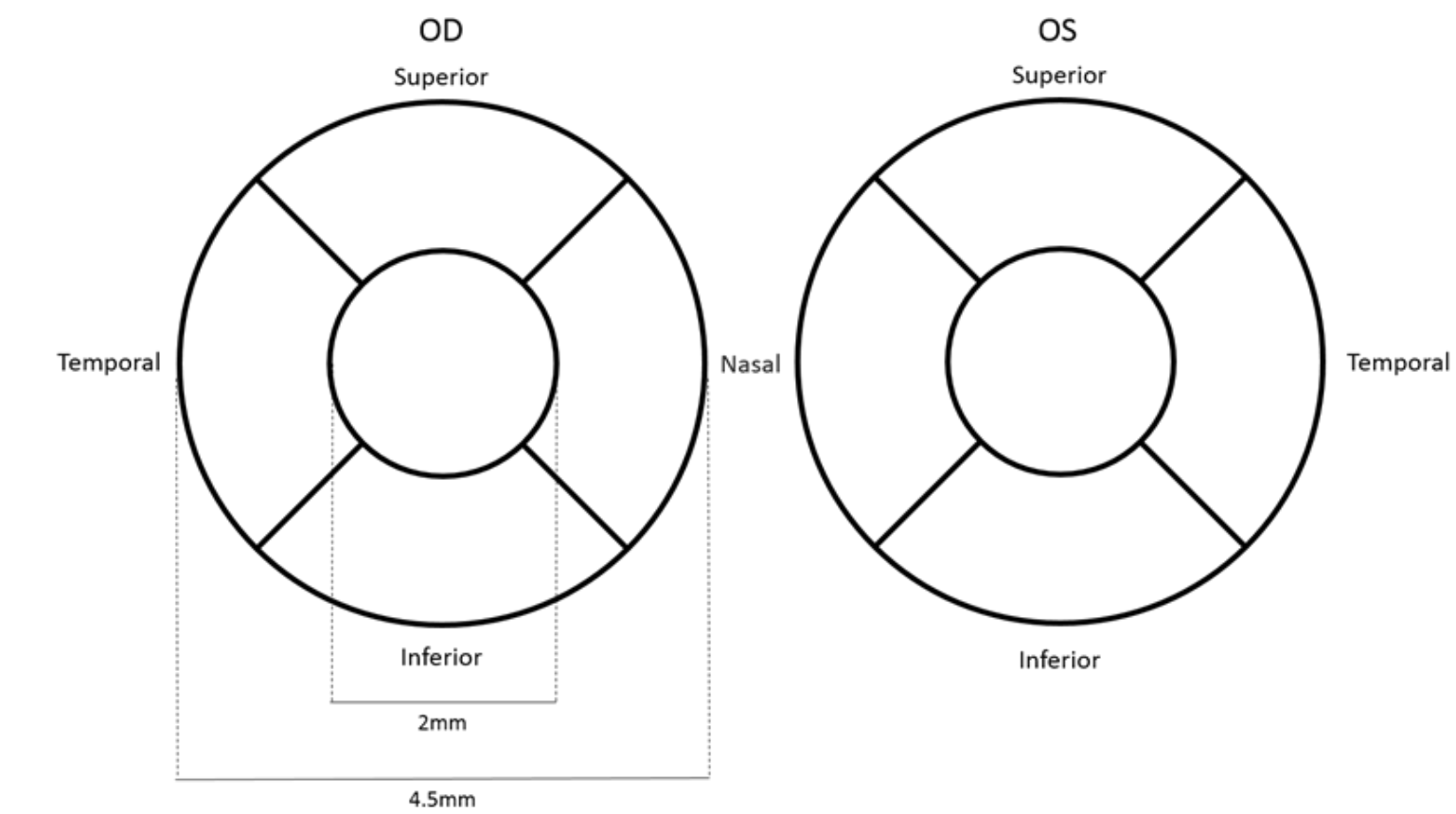


Figure 1. ONH grid and subfields

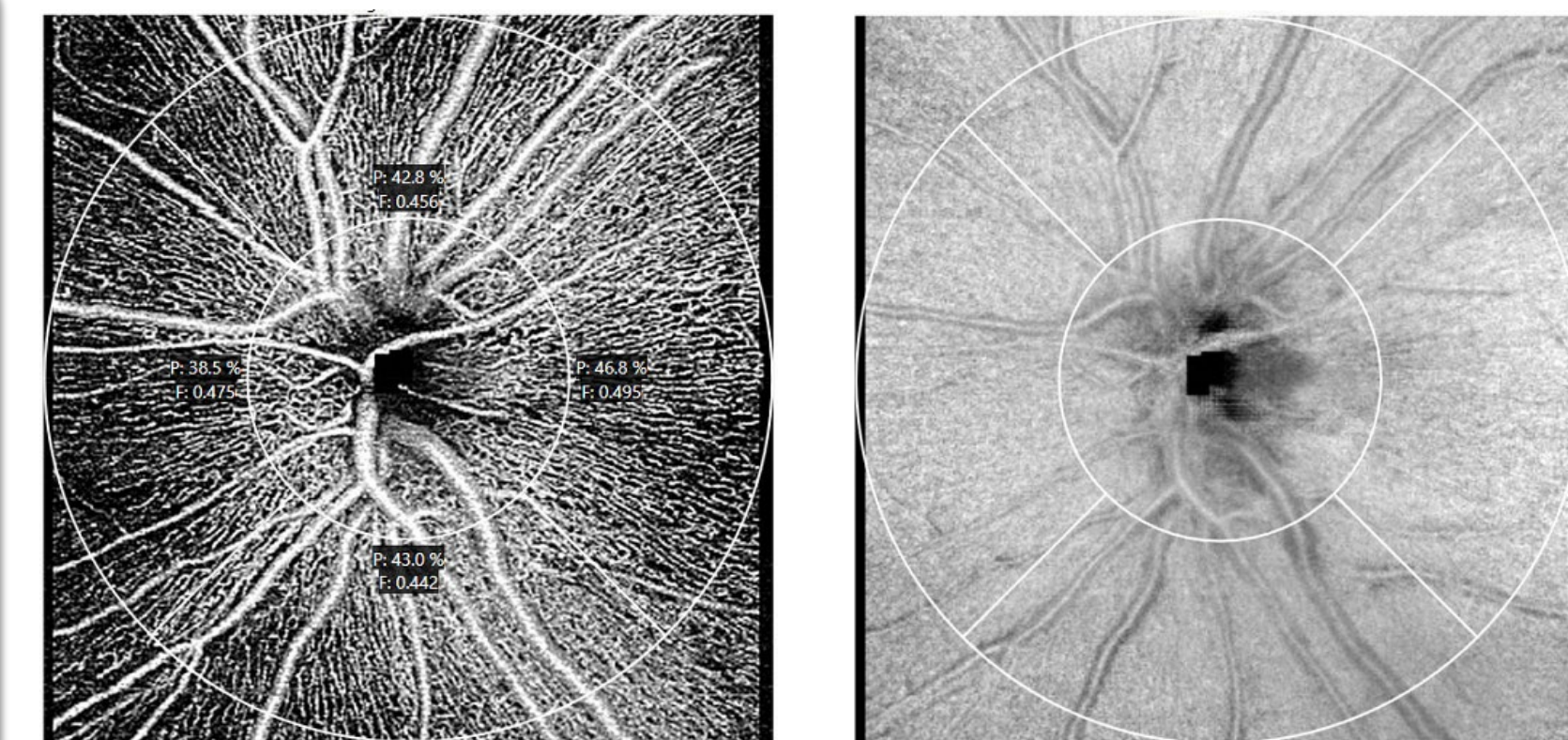


Figure 2. Example of AngioPlex and structural RPC with ONH grid overlay