

OPTIC NERVE, PERIPAPILLARY AND MACULAR MICROVASCULATURE IN PRIMARY OPEN-ANGLE GLAUCOMA PATIENTS USING
OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY

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Introduction

Glaucoma represents a major global cause of irreversible blindness, characterized by progressive retinal ganglion cell loss and optic nerve head (ONH) damage. Primary open-angle glaucoma (POAG), comprising 90–95% of cases, demonstrates increased prevalence among African American, Latino, and Middle Eastern populations, with positive family history and systemic comorbidities (e.g., diabetes, cardiovascular disease) conferring additional risk. While elevated intraocular pressure (IOP) remains the principal modifiable risk factor, glaucomatous damage may also occur in normotensive individuals, with central corneal thickness identified as an independent susceptibility parameter. Current pathophysiological hypotheses emphasize mechanical stress at the ONH and vascular dysregulation, though both mechanisms likely contribute. Clinically, disease progression is insidious, with optic disc cupping and peripheral visual field loss manifesting only in advanced stages. Comprehensive evaluation requires multimodal assessment, including tonometry, gonioscopy, optic nerve imaging, retinal nerve fiber layer (RNFL) analysis, and perimetry. Recent advances in optical coherence tomography (OCT) and OCT angiography (OCTA) provide quantitative biomarkers, enhancing early detection, progression monitoring, and risk stratification in POAG management.

Aim of the Work

The aim of this study was to evaluate the ONH, peripapillary area, and macular microvasculature in POAG patients and normal individuals using OCTA.

Patients and Methods

This prospective cross-sectional study enrolled 80 eyes, comprising 40 with primary open-angle glaucoma (POAG) and 40 age- and sex-matched controls (18–80 years). Inclusion criteria required best corrected visual acuity $\geq 6/12$, refractive error within ± 6.0 D sphere and ± 3.0 D cylinder, and open anterior chamber angles. POAG diagnosis was based on glaucomatous optic neuropathy with corresponding visual field (VF) loss confirmed by reliable Humphrey 24-2 testing, while controls demonstrated normal intraocular pressure (IOP < 21 mmHg), optic disc morphology, retinal nerve fiber layer (RNFL), and VF parameters. Exclusion criteria included retinal pathology, diabetes, hypertension, non-glaucomatous optic neuropathies, significant disc torsion, prior glaucoma surgery, and advanced glaucoma (VF mean deviation < -12 dB).

All participants underwent comprehensive ophthalmic examination, Goldmann applanation tonometry, gonioscopy, and VF testing. Imaging was performed using Zeiss Cirrus HD-6000 OCT/OCTA. Measurements included peripapillary capillary perfusion density and flux index, RNFL thickness in four quadrants, and macular vessel density and ganglion cell layer-inner plexiform layer (GCL-IPL) parameters.

Results

Table 1: Comparison between the two studied groups according to RPC capillary perfusion density in % and RPC capillary flux index

	POAG (n = 40)	Control (n = 40)	t	p
RPC capillary perfusion density				
Min – Max.	35.0 – 46.70	43.0 – 50.10	5.577*	<0.001*
Mean $\pm$ SD.	42.77 $\pm$ 2.66	45.52 $\pm$ 1.63		
Median (IQR)	43.20(41.70 – 44.25)	45.55 (44.25 – 46.5)		
RPC capillary flux index				
Min – Max.	0.30 – 0.47	0.34 – 0.49	3.181*	0.002*
Mean $\pm$ SD.	0.39 $\pm$ 0.04	0.42 $\pm$ 0.04		
Median (IQR)	0.39 (0.36 – 0.43)	0.42 (0.39 – 0.45)		

IQR: Inter quartile range SD: Standard deviation t: Student t-test
p: p value for comparing between the two studied groups *: Statistically significant at $p \leq 0.05$

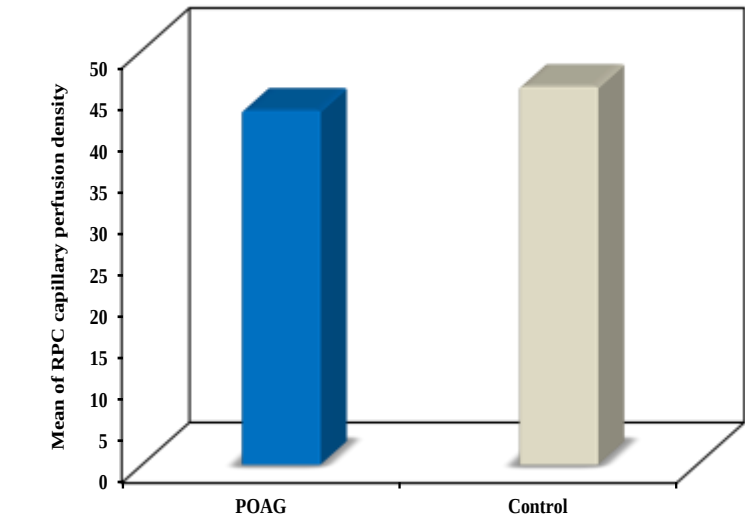


Figure 1:
Comparison between the two studied groups according to RPC capillary perfusion density

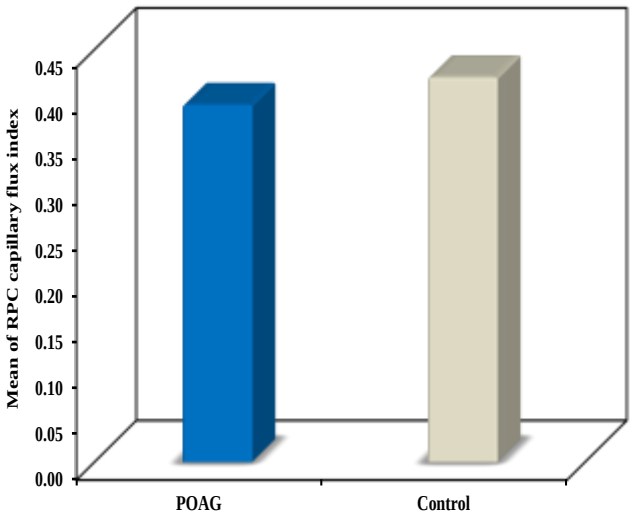


Figure 2:
Comparison between the two studied groups according to RPC capillary flux index

Conclusion

- The OCTA parameters at the disc (RPC capillary perfusion density and RPC capillary flux index) had a better diagnostic value in cases of early and moderate POAG when compared to the macular OCTA parameters (MPD and MVD).
- There was a positive significant correlation between VF (MD) in the POAG group and average RNFL thickness, average GCL + IPL thickness, minimum GCL + IPL thickness, RPC capillary perfusion density and RPC capillary flux index and there was also a significant positive correlation between average RNFL thickness and RPC capillary perfusion density and RPC capillary flux index.