

Correlation between Axial Length and Retinal Nerve Fiber Layer Thickness in Myopic Eyes

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Purpose: To determine the correlation between axial length and retinal nerve fiber layer thickness in myopic eyes.

Material and method: One hundred patients of myopia with best corrected visual acuity of at least 6/12 in the best eye were included in this study. Optical coherence tomography was done with dilated pupils. Axial length was measured with A-Scan. After pupillary dilation, retinal nerve fiber layer thickness was measured with optical coherence tomography (OCT) around the center of optic disc. Mean retinal nerve fiber layer thickness was generated by automated computerized program in the analysis report and compared with the built in age-matched normative database in 3D OCT.

Results: The mean age was 27.08 ± 7.85 years. There were 50 males (50%) and 50 (50%) females. The mean spherical equivalent (myopia) was $-2.95 \text{ D} \pm 1.36$. The mean axial length 23.92 ± 0.614 . The mean retinal nerve fiber layer (RNFL) thickness was $111.49 \mu\text{m} \pm 4.04$. Pearson coefficient of correlation was -0.328 .

Conclusion; In myopic patients the RNFL thickness decreases with increasing axial length.

Myopia is the most common ocular abnormality worldwide. Its exact prevalence in Pakistan is not known but different studies showed different results^{1,2} in the different areas of Pakistan. Retinal changes in persons with high myopia include peripapillary atrophy, peripheral lattice degeneration, tilting of the optic disc, posterior staphyloma and breaks in Bruch's membrane.

Although retinal nerve fiber layer thinning is indicative of glaucomatous damage, it remains uncertain whether retinal nerve fiber layer thickness would vary with the refractive status of the eye. It is therefore important to investigate whether any correlation exists between retinal nerve fiber layer thickness and axial length in myopia. For every 1 mm greater axial length, mean retinal nerve fiber layer thickness decreases by approximately $2.2 \mu\text{m}$.³

The aim of this study is very important because it measures retinal nerve fiber layer thickness changes with the increase in axial length as in myopia. The decreasing retinal nerve fiber layer thickness is a major risk factor to develop glaucoma which is a second most common cause of blindness worldwide.⁴

MATERIAL AND METHODS

100 patients fulfilling the inclusion criteria were taken from the outdoor clinic of institute of ophthalmology Mayo hospital, Lahore. Informed consent, socio-demographic data (name, age, gender, address and contact number), past medical and surgical history were recorded. The study was conducted in accordance with ethical standards approved by the hospital committee. Examination included visual acuity with Snellen's chart, refractive error with auto-

refractometer, slit lamp examination for anterior segment evaluation, indirect ophthalmoscopy using 20 D lens for fundus examination with dilated pupils.

Axial length was measured with A-Scan. After pupillary dilation, retinal nerve fiber layer thickness was measured with OCT around the center of optic disc. Mean retinal nerve fiber layer thickness was generated by automated computerized program in the analysis report and compared with the built in age-matched normative database in 3D OCT (Topcon 3D OCT-1000). To control the biases, only one expert person recorded the axial length and retinal nerve fiber layer thickness. The side of the eye was selected randomly. All the required information was collected on an especially designed proforma (attached herewith).

RESULTS

One hundred eyes of 100 patients were included in the study among which 60 (60%) were right eyes and 40 (40%) were left eyes (table 3). The mean age was 27.08 ± 7.85 years (table 2). There were 50 males (50%) and 50 (50%) females (table 1). We studied the effect of axial myopia according to the axial length of the patient on the thickness of retinal nerve fiber layer. The mean spherical equivalent of the myopic patients was -2.95 D ± 1.36 (Table 4). The mean axial length was 23.92 ± 0.614. The mean retinal nerve fiber layer (RNFL) thickness was 111.49µm ± 4.04

Axial myopia is related with increased axial length and it affects the thickness of RNFL. In our study we calculated the Pearson’s coefficient correlation between axial length and RNFL thickness by using SPSS and it was -.328 which is significant at the level of 0.01 The p value was 0.001 which is highly significant. Pearson coefficient of correlation (r) between axial length and retinal nerve fiber layer thickness was calculated - 0.314 in myopic eyes in my reference study. For every 1 mm greater axial length, mean retinal nerve fiber layer thickness decreases by approximately 2.2µm.

Table 1: Distribution of cases by spherical equivalent (Myopia) (n = 100)

Total no. of patients	100
Mean	-2.96
Standard Deviation	± 1.36

The results of our study show that given parameters in different population groups regarding axial length and RNFL thickness are also valid for our population which we are dealing in Mayo Hospital. So RNFL thickness values can be used in our population for early glaucoma detection and monitoring.

Table 2: Distribution of cases by axial length (n = 100)

Total no. of patients	100
Mean	23.92
Standard Deviation	± 0.61

Table 3: Distribution of cases by rnfl thickness (n=100)

Total no. of patients	100
Mean	111.49
Standard Deviation	± 4.04

DISCUSSION

Retinal nerve fiber layer damage invariably occurs in glaucoma.⁵ Various investigational modalities like, retinal nerve fiber layer analyzer (NFA), scanning laser ophthalmoscope (GDx, and GDx with variable corneal compensation), and OCT are used to measure the RNFL changes. OCT is a non-invasive, non-contact modality that can be used for measurement of peripapillary RNFL thickness. It is found to correlate with RNFL as measured with scanning laser ophthalmoscope (SLO) and the Heidelberg retinal tomography (HRT).⁶ OCT measured RNFL thickness is not affected by the corneal and lenticular birefringence, as is the case with confocal scanning laser polarimetry. No additional reference plane is required to calculate the RNFL thickness because OCT provides an absolute cross-sectional measurement of retina, from which RNFL thickness is calculated.

A high level of correlation between OCT generated RNFL thickness and visual function has been reported in previous studies. The RNFL may show a racial variation and the various values may be specific to the population under study. The detection of RNFL loss also varies in accordance with the imaging technology used, and the normative RNFL data of the concerned population. RNFL thickness parameters are already studied in the western population⁷.

Table 4: Pearson coefficient of correlation in axial length and rnfl thickness

Correlations			
		Axial Length	Mean Retinal Nerve Fibre Layer Thickness
Axial Length	Pearson correlation	1	-.328**
	Sig. (2-tailed)		.001
	N	100	100
Mean retinal nerve fibre layer thickness	Pearson Correlation	-.338**	1
	Sig. (2-tailed)	.001	
	N	100	100

**Correlation is significant at the 0.01 level (2-tailed)

This study is important as no study is available for Pakistani population which gives a normal data of RNFL thickness which can be used as reference in different diseases especially glaucoma in which there is loss of RNFL which can be compared with the age match control of normal population.⁸

The mean RNFL thickness in our sample population was 113.91 microns, and it is comparable to the RNFL thickness reported in the Chinese population⁹. A summary of some of the previous reports on normal RNFL thickness parameters is presented in reference studies. It shows a higher value of RNFL thickness in most of the studies in Caucasians (except those 1 reported by Bowd and Mistelberger when compared to Chinese eyes. Such a discrepancy has not been addressed earlier but might be related to the ethnicity of study group, or to the OCT model, and the analysis protocol used. Although retinal nerve fiber layer thinning is indicative of glaucomatous damage, it remains uncertain whether retinal nerve fiber layer thickness would vary with the refractive status of the eye. In a study held at Hong Kong eye hospital, Pearson coefficient of correlation (r) between axial length and retinal nerve fiber layer thickness was calculated - 0.314 in myopic eyes¹⁰. For every 1 mm greater axial length, mean retinal nerve fiber layer thickness decreases by approximately 2.2 μm .¹¹

The thinning of RNFL is a very good indicator of glaucoma but it also occurs in myopic eyes, it means measuring RNFL thickness without knowing refractive status can lead to misdiagnosis of glaucoma. We have found the relation between increased axial length and RNFL in our population, which is almost the same as concluded in others studies in the world. This fact has enabled us to use RNFL parameter for glaucoma detection in myopic eyes effectively.¹²

There was no effect of gender on the RNFL parameters measured in our study. A similar finding has been reported previously.¹³ Schuman et al showed nerve fiber layer of men were usually thinner than the females, but not statistically significant.¹⁴

CONCLUSION

In conclusion, our study provides a reliable correlation values between axial length and retinal nerve fiber layer thickness in myopic Pakistani eyes by optical coherence tomography. This can serve as a useful guideline in diagnosis, management and research in glaucoma in myopic eyes.

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