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Correlation Between Retinal Nerve Fibre Layer Thickness And Axial Length In Non-Glaucomatous Myopes

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Abstract

Objective: To assess the correlation between retinal nerve fibre layer thickness and axial length in non-glaucomatous myopes.

Methods: This cross-sectional Study was conducted from May to October 2023 in the Department of Ophthalmology of Fauji Foundation Hospital, Rawalpindi. Eighty-five (85) patients with myopia 1D to −10D who visited the ophthalmology outpatient department underwent ocular examinations for the measurement of refraction, axial length, and OCT RNFL thickness. After pupillary dilatation, the thickness of the retinal nerve fibre layer surrounding the middle of the optic disc was assessed using optical coherence tomography (OCT). An automated computer program produced the analysis report of mean retinal nerve fibre layer thickness, which was then compared to the age-matched normative database that was integrated into 3D OCT.

Results: The mean age was 18.88 ± 5.4 years. The male: female ratio was almost the same. 47 (55.3%) were female and 38 (44.7%) were male. Most of the patients had moderate myopia, i.e. 48 (12.9%). The mean axial length was 25.89 ± 1.42. The mean retinal nerve fibre layer (RNFL) thickness was 138.65 ± 18.68. Pearson's coefficient of correlation was -0.586.

Conclusion: As axial length increases in myopic patients, the RNFL thickness decreases.

Keywords: Refractive error, Myopia, Optical coherence tomography, Astigmatism.

Introduction

Myopia is one of the most prevalent eye conditions in the world, which is widely known to be linked to glaucoma. Although its precise incidence in Pakistan is unknown, many studies conducted in various parts of the country have produced varying findings.[1] People who suffer from ocular hypertension, normal-tension glaucoma, or primary open-angle glaucoma are more likely to have myopia.[2] According to the results of numerous studies, myopia is thought to be a risk factor for open-angle glaucoma, and the risk of getting glaucoma is two to three times higher in myopic people than in non-myopic people. On the other hand, myopia might complicate the diagnosis of glaucoma.[3]

Due to disc changes in myopes, it may be challenging to distinguish glaucomatous optic neuropathy from myopia-related optic nerve and retinal abnormalities, which could make diagnosing and treating glaucomatous disease more challenging.[4] It is an intricate job to identify glaucomatous optic disc abnormalities in myopic eyes due to the presence of optic disc tilt and torsion as well as peripapillary atrophy.[5] The diagnosis of glaucoma depends on identifying progressive optic nerve injury accompanied by a thinning of the peripapillary nerve fibre layer and impairment of the visual field. It is particularly difficult to diagnose glaucoma when there are optic nerve and retinal features of moderate or high myopia. Understanding how excessive myopia affects RNFL thickness is so crucial.[6] Myopia-related RNFL thinning can resemble glaucoma-related RNFL thinning, which could result in a misleading diagnosis. Age and gender-related differences in OCT RNFL thickness must also be taken into account.[7]

Contributions:
E.N, I.U.H, B.U.A.N, A.A, T.N, N.O - Conception of study - Experimentation/Study Conduction
E.N, I.U.H, B.U.A.N, A.A, T.N, N.O - Analysis/Interpretation/Discussion
E.N, I.U.H, B.U.A.N, A.A, T.N, N.O - Manuscript Writing
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All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

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Myopia is currently becoming more common in various parts of the world.[4-7] This warrants cautious consideration since it will result in a rise in instances with a challenging diagnosis between RNFL abnormalities brought on by myopia and glaucoma. Different sample demographics, OCT tools, and altered magnification all affect the reported relationships between AL and RNFL.[8] According to some research, AL or negative refractive power is inversely correlated with the average RNFL thickness.[9,10] However, several studies have shown that AL and RNFL thickness are positively correlated.[1,2] This study aimed to assess the association of axial length and degree of myopia with RNFL thickness in our population.

Materials And Methods

This cross-sectional study was carried out over six months from May to October 2023 in the Department of Ophthalmology of Fauji Foundation Hospital, Rawalpindi, after obtaining approval from the ethical review committee of the hospital. Using a non-probability sampling technique, 85 individuals of either gender, aged 18–45, with myopia ranging from 1D to 10D, were included in the study. The study did not include patients having a history of any systemic disorders, glaucoma in their family, ocular trauma, intraocular surgery, laser therapy, or extreme astigmatism greater than one dioptre. Any pathology seen in the anterior or posterior segments during the ocular examination was also ruled out. Given that RNFL thickness declines with age, a higher age group was excluded. The sample size was calculated using the OPENEPI calculator by taking the prevalence of myopia, i.e. 17%,[11] margin of error = 8%, confidence interval = 95%, then at least a sample of 85 was required. The patients were divided based on myopic refraction into 3 groups: low (<-3D), moderate (-3 to -6D), and high (>-6D).

A thorough ophthalmological examination was performed in addition to taking a thorough history. Indirect ophthalmoscopy with a 20 D lens for fundus examination with dilated pupils, visual acuity using a Snellen chart, refractive error with objective and subjective refraction, and slit lamp examination for anterior segment evaluation were all part of the examination. A-Scan (Quantel Medical Ophthalmic A-Scan Model compact II) was used to measure the axial length. OCT was used to determine the thickness of the RNFL surrounding the optic disc's centre following pupillary dilatation. An automated computer program produced the analysis report's mean retinal nerve fibre layer thickness, which was then compared to the age-matched normative database that was integrated into 3D OCT (Optopol Revo80). The AL and RNFL thicknesses were measured by a single expert to compensate for biases. Good quality index scans were taken into consideration. The patients' two eyes were scanned.

SPSS-26. Mean + SD was calculated for age, RNFL, and AL. Frequency and percentages were calculated for gender. Pearson's correlation coefficient was calculated to see the correlation between axial length and RNFL thickness.

Results

A total of eighty-five patients were included. The mean age of the participants was 18.88 $\pm$ 5.4 years. Data shows 47 participants (55.3%) were female and 38 (44.7%) were male. Most of the patients had moderate myopia, i.e., 48 (12.9%), as shown in Table 1.

Table 1: Baseline data of the Patients

Baseline Data	
Age (Years)	18.88 $\pm$ 5.4
Gender	
• **Male**	38 (44.7%)
• **Female**	47 (55.3%)
Degree of myopia	
• **Low**	26 (30.6%)
• **Moderate**	48 (56.5%)
• **High**	11 (12.9%)

Significant association has been found between the degree of myopia and RNFL a p-value = 0.000, as shown in Table 2.

Table 2: Association between degree of myopia and RFNL

Degree of myopia	RFNL	P-value
Low	144.7 $\pm$ 13.91	0.000
Moderate	137.48 $\pm$ 21.68	
High	129.36 $\pm$ 7.44	
Overall mean RFNL	138.64 $\pm$ 18.68	

Table 3: Correlation between axial length and RNFL thickness in non-glaucomatous myopes

Parameters	Mean ± SD	r-coefficient
Axial Length	25.89 ± 1.42	-0.586
RNFL thickness	138.65 ± 18.68	

Pearson's coefficient of correlation (r) between AL and RNFL was -0.272 in myopic eyes. The mean thickness of the RFNL drops by about 2.2µm for every 1 mm increase in axial length.

Pearson's coefficient of correlation (r) between AL and RNFL thickness was determined to be -0.586. The mean thickness of the RNFL drops by around 2.2µm for every 1 mm increase in axial length, as shown in Table #3 & Figure 1.

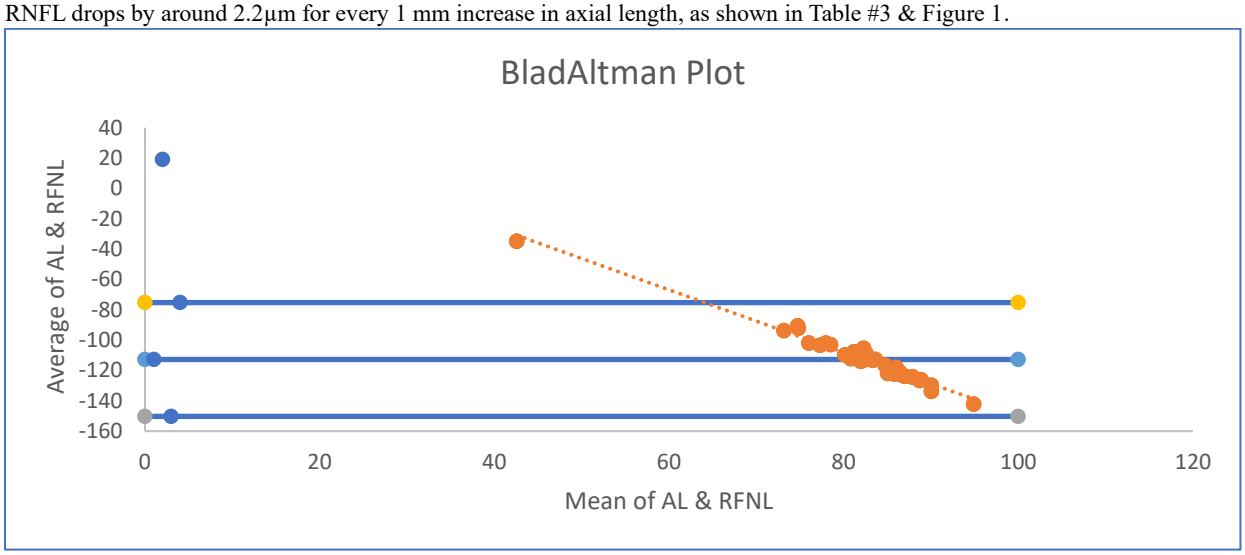

Figure 1: Correlation between axial length and RNFL thickness in non-glaucomatous myopes

Discussion

To determine whether there is a relationship between the increase in the AL of the eyeball and the thickness of the RNFL in axial myopia, 85 eyes belonging to patients aged 21 to 45 were examined. The corneal radius of curvature and AL's interaction have been crucial in helping the eyeball's optical components make compensating modifications to achieve a normal refractive state. AL is not the only factor influencing the increase in myopic power. This indicates that a greater axial length will not result in a corresponding rise in myopic power, which the corneal curvature can offset. It has been shown that the biggest determinant of the stretching of the posterior pole of the eyeball is an increase in the AL.[12-15] As a result, the study's design solely assesses the relationship between AL and RNFL thickness.

We found that as myopia and AL increased, the average RNFL thickness significantly decreased. Porwal et al. demonstrate similar results, showing that the RNFL thickness significantly decreases throughout the different grades of the axial length and refraction error.[16] In a similar view, Sachow et al. reported that refraction negatively impacted the children's RNFL thickness in their study.[17] Of the 48 myopic patients in the Kim et al. study, the higher myopia group had smaller RNFLS than the lower and intermediate myopia groups in the non-temporal quadrants; in contrast, the higher myopia group had thicker RNFLS in the temporal quadrant.[18] Additionally, our research demonstrated that a statistically significant drop in the average RNFL thickness and the RNFL thickness of each quadrant was caused by an increase in the AL and degree of refractive error; multiple additional investigations reached the same conclusion.[16,18]

Although RNFL thinning is a highly reliable sign of glaucoma, it can also occur in myopic eyes. As a result, determining RNFL thickness without knowing refractive status can lead to hoodwinking the actual diagnosis of glaucoma. In our population, we have discovered a relationship between RNFL and increasing axial length that is nearly identical to the findings of other research conducted worldwide. This fact has made it possible for us to successfully use the RNFL parameter for glaucoma identification in myopic eyes.[19]

One of the strengths of our investigation was the single-operator, high-quality, high-repetition scanning using the most recent generation of OCT equipment. Because we employ the widely used pre-loaded Fast RNFL algorithm (without disc size correction), we think our data are immediately applicable to clinical usage. Furthermore, our participants' uniformity and youth improved sensitivity by adjusting for additional variables that might have impacted RNFL readings.

Our very small sample size was one of our limitations, even if the significance and power of the results show that a petite sample is all that is required to be adequately powered. The fact that the present results in a different cohort supported our previous findings, which also appeared to negate the necessity for more extensive recruitment.

Conclusions

In conclusion, patients with longer axial lengths and higher degrees of myopia have noticeably smaller RNFL thicknesses as assessed by OCT. Additionally, we discovered that the degree of myopia may have an impact on the RNFL thickness; RNFL measurements were lower in high and moderately myopic eyes than in low-myopic eyes. As a result, normative databases corrected for axial length and refractive error should be included, and excessive myopia should be considered when interpreting OCT results because of the thinning of RNFL thickness.

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