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Retinal Nerve Fibre Layer (RNFL) Thickness Analysis in Myopic and Normal Population- A Comparative Study

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Abstract **Original Research Article**

Early detection of glaucoma can prevent vision loss. In myopic eye it is often difficult to identify the peripheral changes due to large optic disc and oval configuration. Retinal nerve fibre layer (RNFL) thickness assessed by Optical coherence tomography (OCT) can help in early diagnosis. The changes of RNFL in normal eye is consistent however, in myopes the results are variable and often inconclusive. We therefore, conducted a prospective comparative study to compare the RNFL in normal and myopic patients. We observed a strong association between average RNFL thickness and spherical equivalent in myopic eyes (r-0.6146). We also observed a strong association between average RNFL thickness and axial length in myopic eyes (r-0.3776).
Keywords: Glaucoma, Retinal nerve fibre layer (RNFL), Optical coherence tomography (OCT).

INTRODUCTION

Myopia is one of the most common health issues in Asia [1]. Risk of developing Glaucoma is higher in Myopes[2,3]. However, presence of a large optic disc with oval configuration and peripapillary atrophy makes diagnosis and management of Glaucoma difficult [4]. Therefore, other surrogate indicators like Retinal nerve fibre layer (RNFL) thickness have been investigated for early diagnosis of glaucoma. Retinal nerve fibre layer (RNFL) thickness is now considered to be one of sensitive indicator for predicting early glaucomatous changes [5-7]. *Optical coherence tomography* (OCT) is an advanced tool which has excellent ability to assess peripapillary RNFL thickness and therefore extensively used for diagnosis and monitoring of glaucoma. Although, relationship between peripapillary RNFL thickness and Myopia has been extensively studied by various investigators however, reported results are variable [8-10]. Despite thinning of RNFL being an important sign of glaucoma it is not certain whether RNFL thickness varies with myopia. We conducted this observational study to evaluate the relationship between RNFL thickness between normal population and moderate to high myopes with respect to spherical equivalent and axial length.

MATERIALS AND METHODS

This study was conducted in an industrial hospital for 6months duration on patients attending the out patients department. A total of 80 Eyes were included in the study. Two groups (Control group with normal eye and test group with moderate to high myopia) were made. Control group n= 40, with spherical equivalent (SE) +1.00 D to - 2.75 D and, Test group n=40 having moderate to high myopia S.E. ≥ -3.00 D were included for this study. Patients from both the sexes and aged between 18-45 years were included. Patients with other severe comorbidities like sever respiratory disease (COPD), uncontrolled hypertension and diabetes mellitus and who are not willing to participate in the study were excluded. Patients with macular degeneration, glaucoma suspect, with history of refractive or intraocular surgery, and having large peripapilary atrophy were also excluded from study. An ethical clearance was taken before start of study and an individual informed consent was obtained from each patient after explaining the purpose of study. A routine ocular examination including visual assessment, slit lamp examination, applanation tonometry, visual field Analysis, A-scan and OCT were done for all the patients. A scan measurements were done with Alcon machine and OCT with Topcon 3D OCT 2000 with resolution of 5-6um was done. RNFL and ONH -Optic Disc cube 200 X200 data was obtained. It gives RNFL Thickness map, RNFL Deviation Map, RNFL

comparative graph and RNFL Quadrant and clock hour's data. Statistical analysis was performed using SPSS version 16. Means were compared with independent samples't-test. Alpha error of 0.5, confidence interval of 95% and 80% power, $p < 0.05$ was considered statistically significant. RNFL thickness was analysed using linear regression analysis and expressed as Pearson efficient of correlation(r).

RESULTS

There were 21 males and 19 females in control group and 23 males and 17 females in test group (Table-1). Mean age of control group was 31.125 ± 7.75 Yrs. And in the test group 30.225 ± 7.41 Yrs. (p= 0.298) (Table-1).

Mean RNFL thickness in control group was 102.29±5.98µm and in test group 95.205±8.35µm (p<0.00002). Mean spherical equivalent in control group was -0.27±0.97D and in test group was -5.98±1.74D (p<0.00001). Mean axial length in control group was 22.1±1.233 mm and in test group it was 26.65±1.65 mm (p<0.00001) (Table-1).

There was a weak association between average RNFL thickness and spherical equivalent in control group (r-0.2601) and strong association in test group (r-0.6146) (Figure-1). There was a weak association between average RNFL thickness and axial length(r-0.2273) and strong association in test group (r-0.3776) (Figure-2).

Table-1: Demographic variables, spherical equivalents, mean RNFL thickness and axial length in both the groups

Groups	M/F	Age yrs. Mean (SD)	Mean Spherical equivalent (SE)	Mean RNFL thickness	Mean axial length (mm)
Control group	21/19	31.12±7.75	-0.27 ±0.97D	102.29±5.98µm	22.1±1.233
Test group	23/17	30.22 ±7.41	-5.98± 1.74D	95.205±8.35µm	26.65±1.65
p value	-	0.298	p<0.0000	p<0.00002	p<0.00001

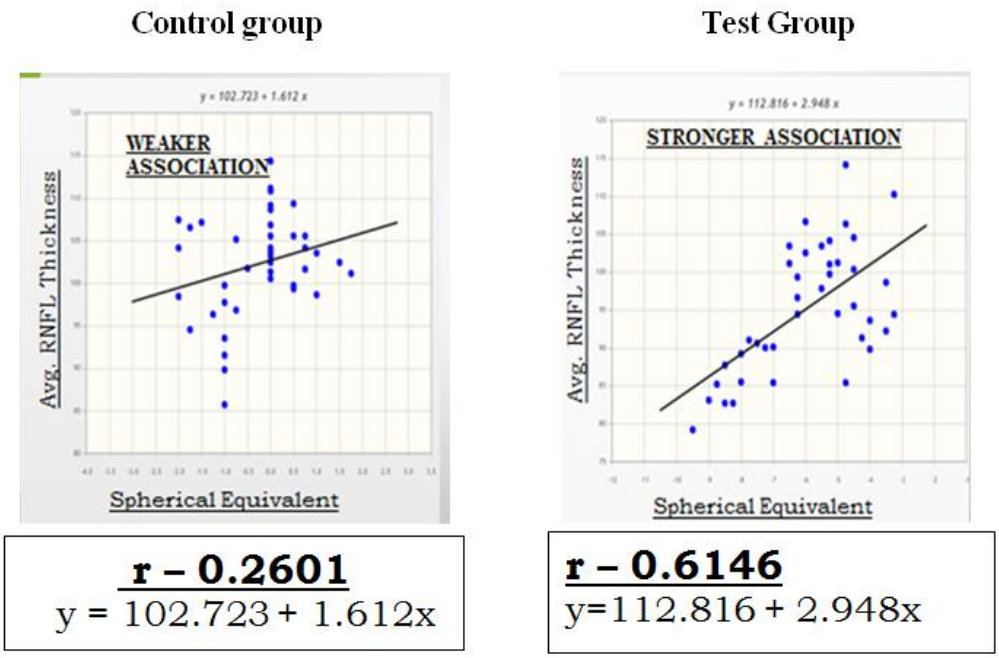

Fig-1: Association between RNFL thickness and Spherical Equivalent

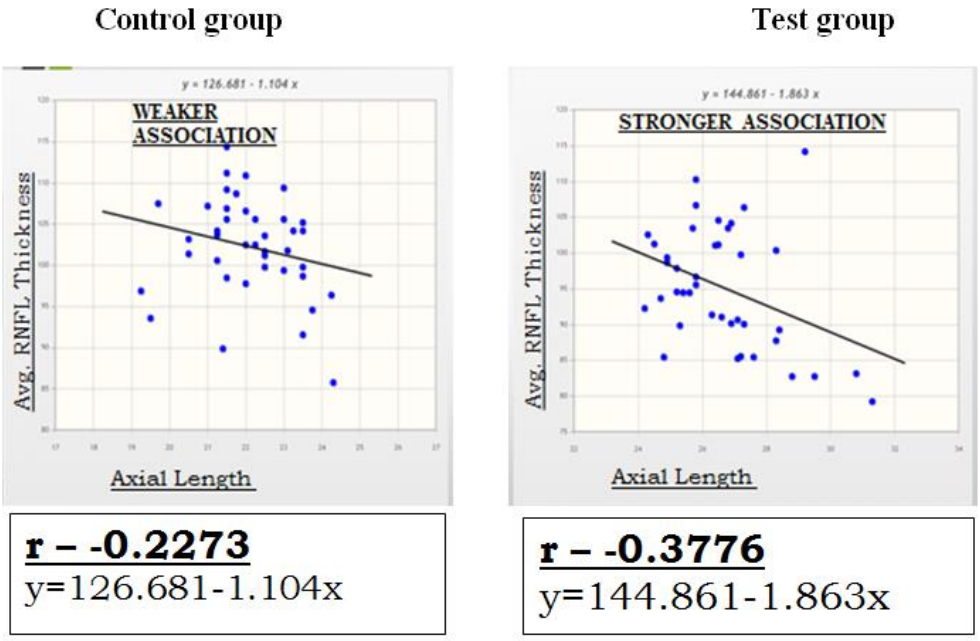

Fig-2: Association of RNFL thickness and Axial Length

DISCUSSION

OCT is an important imaging tool in the assessment of retinal and optic nerve structures. The Spectralis OCT has an eye tracking system which allows high-speed, high-resolution imaging of the retina. It improves the ability to detect the true inner and outer retinal boundaries and increases repeatability of measurements [11]. This machine presents the highest reproducibility and the best inter-operator agreement among different OCT devices in assessing RNFL thickness [12].

In our study we observed a weak association between average RNFL thickness and spherical equivalent in control group (r-0.2601) and strong association in test group (r-0.6146). We also observed a weak association between average RNFL thickness and axial length(r-0.2273) and strong association in test group (r-0.3776).

A study by Oner *et al*. [9] evaluated the RNFL thickness in myopic and emmetropic eyes by SD-OCT and observed that the overall global RNFL thickness of myopic eyes was significantly thinner than that of emmetropic eyes. A study by Lim and Chun [13] compared the peripapillary RNFL thickness of high myopic eyes (SE≤-6.0 D) with those of low myopic eyes (SE from −0.25 to −3.0 D) in children and found that the mean overall thickness of the peripapillary RNFL in the high myopic subjects was significantly lower than that in the low myopic subjects. A study by Mohammad [14] compared the peripapillary RNFL thickness of three different degrees of myopic groups and found that the mean RNFL thickness was thinner in highly and moderately myopic eyes compared with low myopic eyes. In the present study it was demonstrated that myopic eyes had a thinner average global RNFL thickness compared with emmetropic eyes, while the high myopic eye had the thinnest average global RNFL thickness. In our study RNFL thickness decreases 3.19 µm/D Spherical increases in Myopic Power. RNFL thickness decreases 2.58 µm / mm increase in axial length.

In our study the T quadrant has the greatest RNFL thickness in high myopia groups than in moderate or low myopia groups. A study by Kim *et al*. [15] tried to explain that the greater RNFL thickness in the T quadrant among subjects with highly myopic eyes is due to redistribution of the RNFL. They inferred that, with the increase of axial length, the retina was dragged toward the temporal horizon and the RNFL is compressed against the bundles originating from the opposite hemisphere at the horizontal raphe. Thus results in thickening of the RNFL in the temporal quadrant [16]. A study by Moriyama *et al*. [17] imaged the shape of the globe in 44 highly myopic eyes using high-resolution magnetic resonance images and demonstrated that myopic eyes had symmetrical or asymmetrical anteroposterior elongation and posterior protrusions, which could draw the superior and inferior RNFL bundles closer to the macula.

Oner *et al*. [9] observed a significant negative correlations between Axial length and RNFL thickness in each of the 4 quadrant of their study however correlation of magnification effect by Littmann formula eliminated the relationship between RNFL thickness and axial length in each sector of their study. Several studies in past have used magnification factor as it has been found that actual scanning radius in eyes with greater axial length could be longer than 1.73 mm due to magnification effect so using same sized scan circle

for measuring RNFL in different degree of myopia may be misleading because the RNFL thickness decreases with increase distance from optic disc.

To summarize, we have demonstrated that subjects with highly myopic eyes (myopia > 6 D) had thinner RNFL than did subjects with low or moderate myopia. Moreover, they showed a different topographic profile. No significant difference was noted in RNFL thickness profile between low (myopia < 3 D) and moderate myopia group (myopia = 3-6 D). The subjects with highly myopic eyes had significantly thinner RNFLs in the non-temporal sectors compared with the low and moderate myopia group but RNFL thickness did not show a significant decrease in the temporal quadrant. This profile should be taken into consideration while analysing RNFL thickness in subjects with highly myopic eyes, aiming to diagnose glaucoma.

Limitations of the study: Our study has limitations like small sample size, nonrandomised selection of patients and contact method of a scan. We also did not correct for magnification factor so there are chances of overestimation of RNFL after correction of Magnification factor.

CONCLUSION

RNFL thickness was lower in myopic eyes then control group. However, there was no significant difference of RNFL thickness among moderate and high myopics. A large RCT is further required before definitive conclusion.

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