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To See Difference in Quadrant Wise RNFL Thickness in Emmetropes and High Myopes

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Abstract

Background: The relationship between peripapillary RNFL thickness and myopia has been extensively studied by various investigators with variable results. The purpose of this study was to evaluate the relationship between RNFL thickness and the refractive error.

Methods: This was a prospective cross-sectional study. All subjects underwent a full ophthalmic examination, refraction and visual field analysis. Optical coherence tomography was used for RFNL thickness measurement.

Results: In superior quadrant it was found to be 101.75µ in group 1 and 120.29µ in group 2. In inferior quadrant it was found to be 98.05 in group 1 and 119.77 in group 2. In nasal quadrant it was found to be 70.70 in group 1 and 80.08 in group 2. In temporal quadrant it was found to be 71.10 in group 1 and 77.21 in group 2.

Conclusion: Quadrant wise analysis showed that in high myope group RNFL thinning was present in all the quadrants except temporal.

Keywords: Quadrants, RNFL thickness, Myopia, Emmetropes

Introduction

Myopia is a known risk factor for glaucoma. The risk of developing glaucoma is reported to be two to three times higher in myopic individuals than in nonmyopic individuals.[1] These myopic individuals often have enlarged optic disks with more oval configuration and large areas of peripapillary atrophy making diagnosis and management of glaucoma difficult in these cases.[2-3]

Retinal nerve fiber layer (RNFL) thickness is now considered as one of the sensitive indicator for predicting early glaucomatous damage.[4-6] Optical coherence tomography (OCT) because of its excellent ability to assess peripapillary RNFL thickness has been extensively used for the diagnosis and follow-up of glaucoma and other optic neuropathies.

The relationship between peripapillary RNFL thickness and myopia has been extensively studied by various investigators with variable results.[7-9] The purpose of this study was to evaluate the relationship between RNFL thickness and the refractive error.

Material And Methods

Study Site: Patients (Meeting our inclusion criteria) presenting to out-patient department of our centre (Sahai Hospital and Research Centre, Bhabha Marg, Moti Dungri, Jaipur, Rajasthan) were recruited in this study after the informed consent.

Study Population: Patients were recruited from out-patient department of our hospital (Sahai Hospital and Research centre, Bhabha Marg, Moti Dungri Jaipur Rajasthan).

Study type: Hospital based comparative analysis.

Study design: This was a cross-sectional study.

Sample size: Sample size was calculated at 80% study power and alpha error of 0.05 assuming standard deviaton of 10.37µm in RNFL thickness among myopes and 12.6µm among emmetropes as found in study of malakar et al.[2]

For minimum detectable mean difference of 10µm in RNFL thickness minimum 21 cases in each group were required as sample size which was further enhanced and rounded off to 30 cases in each group as final sample size of present study expecting 20% attrition/sample loss.

$$n = \frac{2\left(Z_{1-\alpha \div 2} + Z_{1-\beta}\right)^2 \text{ x } \sigma^2}{\left(M_1 - M_2\right)^2}$$

Here, n=sample size

$Z_{1-\alpha\div2}$ = 1.96 (corresponding to Z value of α error of 0.05)

$Z_{1-\beta}$ = 0.84 (corresponding Z value for 80% study power)

σ = assumed standard deviation

$M_1 - M_2$ = difference of means to be detected

Time frame: Consecutive cases of myopia and emmetropia presenting to our centre from May 2017 to April 2018 were included in our study.

Inclusion Criteria

- Individuals having Myopia >- 6D
- Emmetropes
- Individuals giving consent for the study
- Individuals willing to go for OCT
- Individuals with age >18 yrs and <76 yrs

Exclusion Criteria

- Patients showing any evidence of Glaucoma
- Patients with history of Refractive surgery
- Patients with history of any intra ocular surgery
- Patients with Amblyopia
- Patients with poor media clarity
- Patients with history of ocular trauma
- Patients with history of previous retinal laser treatment
- Patients with Neurological disease
- Patients with history of Diabetes mellitus
- Patients with history of Hypertension

Methodology

After obtaining clearance from institutional ethical committee, subjects were recruited from consenting individuals paying visit to out patient department of our institute.

Visual acuity was assessed using Snellen chart. Autorefraction was done after full pupillary dilatation with 0.8% tropicamide and 5% phenylepherine using Accuref-K 9001 (Shinnipon) autorefractometer. Based on refractive error subjects were divided into two groups – Group 1 – myopes(refractive error > - 6D) and group 2 – emmetropes(refractive error < ±0.5 DS).

Intraocular pressure was measured three times in each eye with the Goldmann applanation tonometer. An average of 3 measurements was computed for analysis; if they differed by more than 2.0 mm Hg, a fourth reading was taken and the average of the 3 closest values was taken. Subjects having IOP>21 mm Hg were excluded from the study.

Every patient was instilled with 0.8% tropicamide and 5% phenylepherine hydrochloride to dilate the pupil and a precise fundus examination was performed with +90D lens along with indirect ophthalmoscopy and scleral indentation after the IOP was measured.

Eye drop used was Tropicacyl plus (Sunways Pvt. Ltd.)

Axial length measurement was done by using amplitude scan (MD – 1000 A, ULTRASONIC BIOMETER MEDAco).

Optical coherence tomography for RNFL thickness measurement- Optical coherence tomography (Optovue, Inc.; Fremont, California, USA) The machine was properly aligned after seating the subject with the chin comfortably resting in the chin rest. The OCT lens was adjusted for the patient's refractive error. The subject was instructed to fixate with the eye being tested on the internal target, to enable the optic nerve head to come into focus. The Z-Offset was adjusted to view the OCT image, and polarization was optimized to maximize the reflective signal. .Only good quality OCT scans were included in the final analysis. To be acceptable for inclusion, the OCT scans had to fulfill the following criteria:

The fundus image must have been clear enough to see the optic disc and scan circle or spokes,

Signal strength should be > 6

Color saturation must have been even and dense across the entire scan, and there must have been red color visible in the retinal pigment epithelium and RNFL.

RNFL thickness was measured using Optical coherence tomography (Optovue, Inc.; Fremont, California, USA). Three circular scans were obtained at the peripapillary retina at a default radius of 3.45 mm from the centre of the optic disc, and the measurements were averaged to provide average peripapillary RNFL thickness, in addition, the peripapillary scan were devided into four equal 90 degree quadrants (superior, inferior ,temporal and nasal) and RNFL thicknes measurements in these four quadrants were also provided.[11]

Statistical analysis

- Continuous variables were summarized as mean and standard deviation and were analyzed using unpaired t-test
- Normal/categorical variable were expressed as proportions and were analyzed by chi-square test/Fisher exact test.
- P-value <0.05 was taken as significant.
- Data entry was done in Microsoft excel.
- SPSS version 20 software was used for all statistical purpose.

Results

A total number of 112 eyes of 56 patients, who fulfilled the inclusion criteria, were included in the study from the outpatient department, Sahai hospital and research centre, Jaipur from May 2017 to April 2018.

Analysis of the collected data was done using SPSS version 20. Significance of difference of RNFL between myopic (Group I) and emmetropic (Group II) were determined by using unpaired t-test and quadrantic comparison by paired t-test. P-value ≤ 0.05 was considered statistically significant.

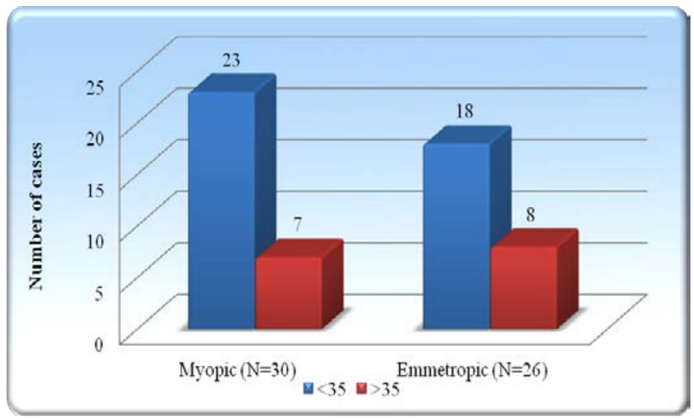

Fig. 1: Age distribution in myopic and emmetropic group

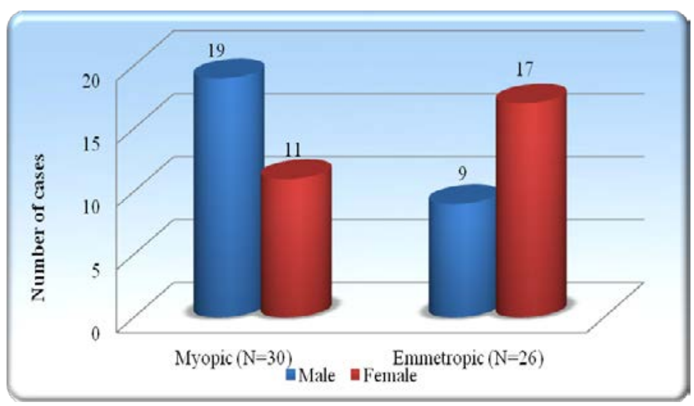

Fig. 2: Sex distribution between both groups

Age and sex difference between both groups were stastically Insignificants. Both group were comparable.

Table 1: Quadrant wise RNFL thickness

	Group 1 (N=60)	Group 2 (N = 52)	P value
	Mean (SD)	Mean (SD)	
Superior	101.75 (21.99)	120.29 (13.85)	**0.0001**
Nasal	70.70 (23.69)	80.08 (13.57)	**0.013**
Inferior	98.05 (19.37)	119.77 (15.08)	**0.0001**
Temporal	71.10 (18.77)	77.21 (12.94)	**0.051**

In superior quadrant it was found to be 101.75µ in group 1 and 120.29µ in group 2. P value was 0.0001, showing that there was significant statistical difference between both the groups, signifying that superior quadrant RNFL was thinner in myopic group.

In inferior quadrant it was found to be 98.05 in group 1 and 119.77 in group 2. P value was 0.0001, showing that there was significant statistical difference between both the groups, signifying that inferior quadrant RNFL was thinner in myopic group.

In nasal quadrant it was found to be 70.70 in group 1 and 80.08 in group 2. P value was 0.0001, showing that there was significant statistical difference between both the groups, signifying that nasal quadrant RNFL was thinner in myopic group.

In temporal quadrant it was found to be 71.10 in group 1 and 77.21 in group 2. P value was 0.051, showing that there was no significant statistical difference between both the groups.

Discussion

Importance of imaging in the diagnosis of ocular diseases has increased over the last 20 years. Out of a variety of techniques such as scanning laser polarimetry and confocal scanning laser ophthalmoscopy, optical coherence tomography (OCT) has emerged to the forefront of ocular imaging because of the wide variety of information it can provide like high resolution and the complex 3-dimensional (3D) data [12]

For measurement of RNFL thickness, OCT is the most commonly performed investigation nowadays.

we have found that there is significant average RNFL thinning, we thought that measurement and comparison of each quadrant of high myopes with emmetropes is important to find any specific thinning, like in cases of glaucoma which shows typical quadrantic pattern. As per our study there was significant thinning present in all quadrants except temporal.

In Kamath et al study of myopia[13] RNFL thickness in superior, inferior, nasal and temporal quadrant was 98.8µ, 100.5µ, 58.8µ and 64.8µ respectively. They found significant thinning in superior, inferior and nasal quadrants of high myopia. They also found thinning in temporal quadrant but it was statistically insignificant. Our study showed superior RNFL thickness was 101.75µ, in inferior quadrant it was 98.05µ, in nasal quadrant it was 70.70µ and in temporal quadrant it was 71.10µ. As per our study, in high myopes, there was significant thinning in all the quadrants except temporal. Kamath et al also noted that decrease in nasal quadrant RNFL thickness was less in comparison to other quadrants. As per their study superotemporal peak did not change with increasing degree of myopia while inferotemporal peak showed significant shift.

D Singh et al[14]observed that with increase in degree of myopia there is decrease in thickness of RNFL in superior, inferior and nasal quadrant, but in temporal quadrant there was weak positive correlation (p value = 0.0001). In our study there was thinning in all the quadrants but temporal quadrant thinning was insignificant (p value > 0.05). Their values of superior, inferior, nasal and temporal quadrant were 95.12µ, 93.24µ, 60.00µ and 66.16µ respectively while in our study it were 101.75µ, 98.05µ, 70.70µ and 71.10µ respectively.

Similar quadrantic difference was also found in studies conducted by Yi Zha et al[15] and Savini et al[15].

Kang et al[17] and Wang et al[18] found that there was thinning in superior, inferior and nasal quadrants (significant only in superior and inferior quadrants). Whereas in temporal quadrant there was significant thickening.The above mentioned studies have found that temporal quadrant is least affected in myopia, it is even thicker in some studies. We have also reported that temporal thinning is insignificant. The increased thickness in temporal quadrant might be due to redistribution of retinal nerve fibre. As the axial length increases there is dragging of retina towards the temporal quadrant and compression of RNFL against the bundles originating from the opposite hemisphere at the horizontal raphe which can cause temporal RNFL thickening. Kim et al and Hoh et al also supported this temporal dragging of retina theory.

Conclusion

Quadrant wise analysis showed that in high myope group RNFL thinning was present in all the quadrants except temporal.

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