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MACULAR GANGLION CELL LAYER THICKNESS MEASUREMENT BY SD- OCT IN NON GLAUCOMATOUS MYOPIC EYE AND ITS CORRELATION WITH SPHERICAL EQUVALENT AND AXIAL LENGTH

Ophthalmology

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ABSTRACT

Purpose: To evaluate macular ganglion cell layer thickness in non glaucomatous myopic eye and its correlation with spherical equivalent and axial length.

Material and methods: A Cross sectional observational study was carried out in 50 eyes who were reported myopes. A detailed ophthalmic examination was done and participants having raised IOP and field defects were excluded. The selected candidates were subjected to ganglion cell complex study by SD-OCT and their relationship against myopic refractive equivalents and axial length was evaluated.

Result: Eligible subjects were in the age group of 18- 35 years. Out of the 50 eyes evaluated, 40% showed that ganglion cell layer was thinner in myopes. Average ganglion cell layer thickness observed was 59µm ±5µm with an average axial length of 23.5 ± 2.5 mm and mean spherical equivalent of -6.00D ±4D. Females were more affected than males.

Conclusion: The thickness of the ganglion cell complex has positive correlation with myopia and axial length. With increase in spherical equivalent and axial length, ganglion cell layer thickness decreases. There are chances of patients being diagnosed as false positive cases of glaucoma and over estimation of ganglion cell layer loss. Therefore in a patient who is diagnosed as glaucoma patient, correlation of spherical equivalent and axial length with ganglion cell layer thickness should also be considered. Though only ganglion cell layer thickness cannot be a diagnostic criterion for the diagnosis of glaucoma and should be correlated with other findings.

KEYWORDS

Macular ganglion cell layer, non glaucomatous myopic eye

INTRODUCTION

Glaucoma is a progressive optic neuropathy characterized by loss of retinal ganglion cells (RGCs) and thinning of the retinal nerve fiber layer (RNFL) [1,2] . Spectral-domain Optical coherence tomography (SD-OCT) enables assessment of Retinal ganglion cell (RGC) axons. Newly developed OCT algorithm has been shown to have a high level of reproducibility in determining macular ganglion cell-inner plexiform layer (GCIPL) thickness [3]. Considering that more than 50% of the retinal ganglion cells are contained in the macular region, macular assessment offers a theoretical advantage for glaucoma diagnosis.

In myopic eyes, evaluation of glaucomatous structural change is difficult due to the considerable morphologic variations in the optic nerve head [4,5]. It is difficult due to myopic eye's characteristic disc tilting, large ovality index, shallow and large cup, and large peripapillary crescent.[6,7]

Recent studies suggest that myopic eyes show thinner GCL measurements which can lead to inaccurate diagnostic classification [8-12]. Recently, Choi et al. [9] reported that in cases of high myopia, the glaucoma detection ability of macular GCIPL thickness was high and comparable to that of peripapillary RNFL thickness. Therefore we investigated the diagnostic ability of macular GCIPL thickness parameters to differentiate glaucomatous eye from healthy eyes.

MATERIAL AND METHOD

Subjects:- This cross-sectional observational study was carried out in 50 eyes who were reported myopes. Eligible subjects were in the age group of 18- 35 years. They were divided into 3 groups- low, moderate and high myopes. Subject with informed consent were recruited at the ophthalmology department of Index Medical College Hospital and Research Centre, Indore.

A detailed ophthalmic examination was done and selected myopic candidates were subjected to Visual acuity checked by snellen's chart. Refraction was done and best corrected visual acquity was recorded. Intra ocular pressure was measured by goldmann applanation tonometer. Optic nerve status was assessed by 90D lens slit lamp biomicroscopy. Gonioscopy and Humphrey visual fields (HFA, 24–2) were done to rule out glaucomatous changes. An ocular biometer(NIDEK A scan) was used to obtain Axial length.

The following individuals were excluded:

- History of ocular trauma or previous ocular surgery
- Neurological disease that could have affected the GCL
- Those with RNFL defect
- Any ocular or neurologic disease that could cause visual disturbance
- Clinical features consistent with glaucoma or IOP greater than 21 mmHg in either eye.

Selected candidates were further evaluated for ganglion cell complex study by SD-OCT and their relationship against myopic refractive equivalents and axial length was evaluated.

Optical coherence tomography:- After pharmacologic dilation of the pupil, the subject was seated and properly aligned. Each macular (v) scan centered on the fovea was obtained using a Topcon OCT device .The OCT was performed by a single experienced examiner. Average, minimum, superior and inferior macular GCIPL thickness measurements were subsequently analyzed. We considered the normal GCIPL thickness from 78–101 µm.

Data analysis:- The refraction data were converted to spherical equivalents (SE), and the subjects were assigned to one of three groups according to their SE values: a low-myopia group (< -3.0 diopters), a moderate-myopia group (-6.0 diopters to -3.0 diopters), and a high-myopia group (> -6.0 diopters). examiner thickness values were compared among the groups using multivariate analysis of covariance (MANCOVA). Significant differences in MANCOVA were followed by post-hoc comparisons. Linear regression analysis was employed to assess the relationship of the SE with GCIPL thickness values. A statistical analysis was performed with SPSS (version 21.0, SPSS, Chicago, IL, USA), and P values less than 0.05 were considered statistically significant.

RESULT

A total of 50 eyes were included in the analysis. The mean subject age was 23 ± 3 years (range: 18–35 years). The mean SE was -6.00 ± 4.0 diopters, (range: -0.50 – -14.00), and the mean axial length was 23.5± 2.5 mm (range: 20.0 – 27.07 mm).

OCT measurements according to degree of myopia:

GCIPL thickness measurements of the subgroups, as based on the SE values, are presented in Table 1.

A MANCOVA showed GCIPL parameters were statistically significantly different for the subgroups with p value < 0.001.The OCT-measured GCIPL thickness measurements decreased with increasing myopia severity (Table 1, figure 1).

The average, minimum, superior and inferior sectors GCIPL were significantly thinner in highly myopic eyes than in moderate and/or low-myopic eyes.

TABLE 1 : Ganglion cell inner plexiform layer measurements :

	LOW MYOPE (N= 12)	MODERATE MYOPE (N=18)	HIGH MYOPE (N= 20)	P VALUE
Average	73± 4µm	70± 3µm	65± 3µm	<0.001
Minimum	72± 6µm	68±6µm	63±5µm	<0.001
Superior	74 ± 4µm	72±5µm	67±5µm	<0.001
Inferior	74± 5µm	70±4µm	66±6µm	<0.001

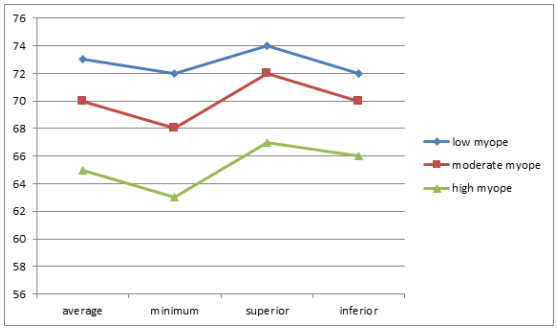

FIGURE 1: Comparison of SD- OCT ganglion cell-inner plexiform layer (GCIPL) thickness profiles among low-, moderate- and high-myopia groups. **X- AXIS – SECTORS OF GCL, Y AXIS- GCL THICKNESS VALUES IN µm**

Additionally, the linear regression analysis of the OCT GCIPL parameters showed average GCIPL thickness to be in significant correlation with SE (P < 0.001) and axial length (P < 0.001)

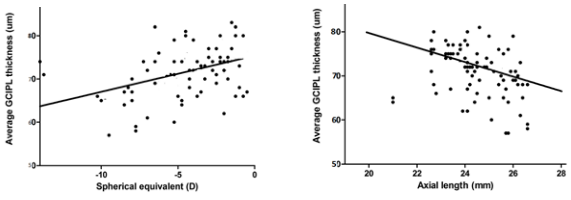

FIGURE 2: Scatterplot showing average GCIPL thickness against (d) SE (p < 0.001), (e) axial length (p < 0.001)

DISCUSSION

Previous studies have reported significant relationships between RNFL thickness and several factors such as age, gender and axial length. In the present study, we have reported significant relationships between GCL thickness and several factors such as axial length and more-myopic eyes.

The literature has offered relatively little information regarding the effect of myopia on GCIPL thickness profiles.

Choi et al. reported significantly thinner average GCIPL thicknesses in highly myopic eyes [9]. Koh et al. reported a correlation of macular GCIPL thickness with axial length[10]. Our present results showed thinner GCIPL thicknesses in myopic eyes, which effect was evenly distributed throughout the sectors. We also found a negative correlation between average GCIPL thickness and axial length.

Decreasing GCIPL thickness with increasing myopia can be explained by the stretching effect from an elongated eye [13]. That is, as the globe elongates in myopic eyes, the larger retinal surface area results in a lower ganglion cell density. This effect would be more significant toward the periphery. It is conceivable that the nasal part of the macula, which is relatively near to the center of the disc, might be less affected.

CONCLUSION

The thickness of the ganglion cell complex has significant correlation with myopia and axial length. With increase in spherical equivalent and axial length, ganglion cell layer thickness decreases. There are chances of patients being diagnosed as false positive cases of glaucoma and over estimation of ganglion cell layer loss. Therefore in a patient who is diagnosed as glaucoma patient, correlation of spherical equivalent and axial length with ganglion cell layer thickness should also be considered. Though only ganglion cell layer thickness cannot be a diagnostic criterion for the diagnosis of glaucoma and should be correlated with other findings.

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