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Original Research Paper

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EFFECT OF AXIAL MYOPIA ON GANGLION CELL LAYER THICKNESS USING SD- OCT

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ABSTRACT

Introduction- In myopia, due to axial lengthening of the eyeball , retina is stretched and thinned, so to see the effect on individual retinal layer like ganglion cell- inner plexiform layer (GC-IPL) , Ganglion cell analysis (GCA) is done using spectral domain optical coherence tomography (OCT).

Methods- 196 eyes of 106 myopic patients (age>18 year) were assigned to one of three groups according to their spherical equivalent (SE) values. All underwent Cirrus HD-OCT imaging & macular scan done for Ganglion cell analysis (GCA). Effect on GC-IPL in different sectorsaa of macula was evaluated by multiple comparisons and linear regression analysis.

Conclusion- The average and all sectors GC-IPL thickness were significantly thinner in high myopia than in moderate and/or low myopia ($p<0.01$). Average GC-IPL thickness showed a significant correlation with SE ($p<0.01$).

KEYWORDS : Ganglion cell – inner plexiform layer (GC-IPL), Myopia, OCT

INTRODUCTION:

Posterior segment OCT is used for evaluation of macular and ONH changes in various retinal diseases which can be confounded by retinal changes induced by moderate to high axial myopia.[1] Spectral domain OCT is non- invasive, accurate scanning technique with much higher repeatability. It produces high resolution cross sectional images with a quantitative analysis of retinal features.[2] In healthy young myopic eyes, thinner average macular thickness, lower macular volume and thicker foveal thickness were associated with longer axial length.[3,4,5] The average superior and inferior thickness of the macular ganglion cell complex was significantly associated with both spherical equivalents and axial length.[6,7] Advanced OCT segmentation in macular region have enabled quantitative evaluation of individual retinal layers.[8,9,10] Newly developed OCT algorithm has been shown to have a high level of reproducibility in determining macular ganglion cell- inner plexiform layer (GC-IPL) thickness.[11] Considering that more than 50% of the retinal ganglion cells are contained in macular region, macular assessment offers a great theoretical advantage for assessing risk of developing glaucoma in myopia patients.[12-15]

MATERIAL AND METHODS:

This cross- sectional study was carried out on 196 eyes of 106 outdoor patients of axial myopia of age ≥ 18 year in Department of Ophthalmology, Govt. Medical College, Pali from july, 2019 to july,2020.

Inclusion Criteria:

Outdoor patients with axial length≥ 23.50 mm, spherical equivalent (S.E.)≥-1.0 diopter, age≥18 year

Exclusion Criteria:

Glaucoma, astigmatism>2.5 D, any fundus abnormality other than myopic changes, optic neuropathy, patients with history of any ocular surgery or trauma.

Informed consent was taken from all subjects. A detailed clinical examination was done including prper medical history, visual acuity assessment, subjective refraction and spherical equivalent calculation, axial length measurement using A-scan biometer and dilated fundus examination. Then all study subjects were divided into 3 groups according to their spherical equivalent, using classification system of American Optometric Association-

Group A- Low myopia group (-1 D to -3 D)
Group B- Moderate myopia group (>-3 to -6 D)
Group C- High myopia group (>-6 D)

All Subjects were scanned with Spectral Domain OCT (SD-OCT, Cirrus HD OCT Model 500). Macular cube scanning using macular cube 512 x 128 was used for measurement of macula through 6 mm square grid by acquiring a series of 128 horizontal scan lines each composed of 512 A- scan and a central horizontal B-scan. Macular thickness analysis and ganglion cell analysis (GCA) OU were performed by accessing CIRRUS HD-OCT analyses. Ganglion cell OU analysis measures the thickness for the sum of macular ganglion cell layer and inner plexiform layer (GCL+ IPL) in both eyes. The thickness map indicated measurement in 14.13 mm^2 elliptical annulus area centered on the fovea which were divided by sectors into 6 regions: 3 equally sized sectors in the superior region and 3 equally sized sectors in the inferior region and average of all. A single operator collected all measurements. One with best quality scan with signal strength of ≥6 was chosen for study.

RESULTS AND DISCUSSION:

Table 1 Demographic Profile Of Study Subjects

Age Groups	Gender		Number Of Study Subjects	Percentage (%)
	Male	Female		
18-20YEARS	12	11	23	21.69%
21-25 YEARS	20	22	42	39.62%
26-30 YEARS	16	19	35	33.01%
31-35 YEARS	2	1	03	2.83 %
36-40 YEARS	2	1	03	2.83%
Total	52	54	106	100%

Table 2 Distribution Of Eyes According To Grades Of Axial Myopia (spherical Equivalent)

	Low Myopia (-1d To -3 D) Group -a	Moderate Myopia(>-3d To -6 D Group-b	High Myopia (>- 6 D) Group-c	Total
Number Of Eyes	78	74	44	196
Percentage (%)	39.79	37.75	22.44	100

Table 3 Mean Axial Length In Different Grades Of Axial Myopia (spherical Equivalent)

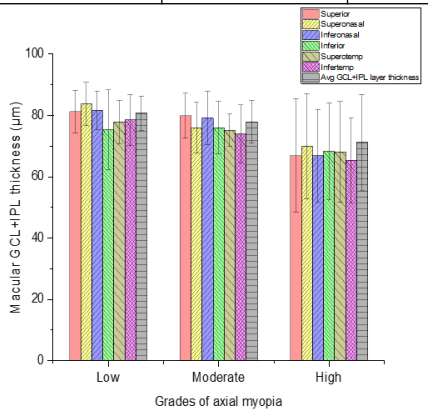
	Low Myopia (>-1D TO -3 D) n = 78 Group-A	Moderate Myopia (>-3D TO -6 D) n = 74 Group-B	High Myopia (>-6 D) n = 44 Group-C
Mean Axial Length (mm)	24.10± 0.36	25.09± 0.33	26.32±0.48

Table 4 Macular Parameters In Different Grades Of Axial Myopia (Spherical Equivalent)

Macular Parameters Mean±SD	Low Myopia (-1D TO -3 D) n = 78 Group-A	Moderate Myopia (>-3D TO -6 D) n = 74 Group-B	High Myopia (>-6 D) n = 44 Group-C	P Value (Anova)	p Value (Tukey –Kramer Multiple Comparison test)
Average Thickness(μm)	262.85±18.40	234.39±23.25	199.16±28.15	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01
Central Foveal Thickness(μm)	246.89±20.30	245.90±21.04	237.74±25.91	0.0802	Post test were not calculated as p value>0.05
Volume(mm^3)	9.45±0.70	8.18±1.02	7.31±0.91	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01

Table 5 Mean Macular Ganglion Cell Inner Plexiform Layer (GCL + IPL) Thickness In Different Grades Of Axial Myopia (spherical Equivalent)

Ganglion Cell Inner Plexiform Layer (GCL+IPL) Thickness Mean±SD	Low Myopia (-1DTO -3 D) n=78 Group- A	Moderate Myopia (>-3D TO -6 D n = 74 Group-B	High Myopia (>-6 D) n = 44 Group-C	p Value (ANOVA)	p Value (Tukey –Kramer Multiple Comparison test)
SUPERIOR	80.97± 6.71	79.52± 7.24	67.23± 18.16	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01
SUPERONASAL	83.15±6.78	76.22± 8.17	70.10±17.05	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01
INFERONASAL	81.30±6.05	78.92±8.43	67.05±15.24	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01
INFERIOR	74.89±12.99	76.18±8.35	67.97±15.69	0.0003	A vs B >0.01 A vs C <0.01 B vs C <0.01
SUPEROTEMPORAL	78.16±6.98	74.98±5.28	67.94±16.30	0.0001	A vs B <0.01 A vs C <0.01 B vs C <0.01
INFEROTEMPORAL	78.39±8.35	74.01±9.32	65.39±13.98	0.0005	A vs B <0.01 A vs C <0.01 B vs C <0.01
AVERAGE	80.59±5.56	78.01±6.89	69.94±15.49	0.0002	A vs B <0.01 A vs C <0.01 B vs C <0.01



The age of subjects ranges from 18-40 years in our study (table no. 1), Amongst which 94.32% of the subjects were below the age of 30 years. Most of them were in the age group 21-25 years (39.62%). In our study total 106 subjects were taken, out of which 52 were males and 54 were females (table no. 1) with M:F ratio of 0.96:1. In our study effect of age and gender was not studied.

Table 2 shows distribution of eyes according to spherical equivalent which shows that out of total 196 eyes, 78 (39.79%) eyes were low myopic, 74 (37.75%) were moderate myopic and 44 (22.44%)were high myopic which indicates more relative incidence of low myopia.

Table 3 shows mean axial length in different groups. Mean axial length is 24.10±0.36 mm, 25.09±0.33 mm and 26.32±0.48 mm in low, moderate and high myopia group respectively which indicates the more stretching and lengthening in high myopic eyeballs.

Table 4 shows macular parameters in different groups. We found that mean average macular thickness and mean macular volume differed significantly (p=0.0001) among the 3 groups. Thinner mean average macular thickness and lower macular volume was found in high myopic group as compared to low and moderate myopia. There was no significant variation (p=0.0802) found in mean central foveal thickness among different groups.

Our study shows that mean macular GC-IPL thickness in average (p=0.0001), superior (p=0.0001), superonasal (p=0.0001), inferonasal (p=0.0001), inferior (p=0.0001), superotemporal (p=0.0001) and inferotemporal sector (p=0.0001) was significantly thinner with increasing axial myopia, which was statistically significant (all p<0.05). Decreasing macular GC-IPL thickness with increasing axial myopia can be explained by stretching effect from an elongated eye. As globe elongates in myopic eye, the larger retinal surface area results in lower ganglion cell density. This effect would be more significant towards the periphery. GC-

IPL thickness measurements decreased with increasing myopia severity. The average, minimum and all sectors GC-IPL were significantly thinner in high myopic group than in moderate or low myopia ($p<0.05$) (table no.5).

The literature has offered relatively little information regarding effect of myopia on GC-IPL thickness profiles . *Zhao* and *Jiang* [6], *Seo et al.*[7] and *Koh et al.*[16] reported thinner GC-IPL thickness in myopic eyes with increase in axial length and degree of myopia. The effect was evenly distributed throughout the sectors (all $p<0.05$). However *Choi et al.* [17]reported significantly thinner average GC-IPL thickness in highly myopic group except superotemporal sector ($p=0.329$).

CONCLUSION:

1. This study investigated the effect of severity of myopia on GC-IPL thickness which shows thinning of GC-IPL with increasing axial myopia which was evenly distributed throughout all the sectors. GC-IPL was thinner in high myopic group as compared to low and moderate myopic group.
2. We also found a negative correlation between average GC-IPL thickness and axial length.
3. We found negative correlation between average GC-IPL thickness and axial length.

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