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ASSESSMENT OF MACULAR PARAMETERS IN PATIENTS WITH AXIAL MYOPIA USING SD- OCT

Ophthalmology

Dr. Nahar Singh Choudhary Senior Resident, Department of Ophthalmology, Govt. Medical College, Pali

Dr. Vipul kumar Nagar* Assistant Professor & Head of Department, Department of Ophthalmology, Govt. Medical College, Pali *Corresponding Author

ABSTRACT

Introduction- In myopia, due to axial lengthening of the eyeball , retina is stretched and thinned, so to see the effect on macular parameters i.e. average macular thickness, macular volume and foveal thickness, macular analysis 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 analysis of macular parameters i.e. average macular thickness, macular volume and foveal thickness . Effect was evaluated by multiple comparisons and linear regression analysis.

Conclusion- The study showed thinner average macular thickness and lower macular volume in high myopia than in moderate and/or low myopia ($p<0.01$)with no significant difference in mean central foveal thickness ($p=0.0802$).

KEYWORDS

Macular parameters i.e. average macular thickness, macular volume and foveal thickness, Myopia, OCT

INTRODUCTION:-

OCT is used for evaluation of various posterior segment parameters i.e.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] Myopia is associated with pathological retinal conditions such as macular and retinal degeneration, foveoschisis, macular hole and rhegmatogenous retinal detachment.[3,4] Although retinal changes occur due to mechanical stretching caused by axial elongation[5], many studies have used the spherical equivalent (SE) of the refractive error to define the degree of myopia.[6,7] The average superior and inferior thickness of the macular ganglion cell complex was significantly associated with both spherical equivalents and axial length.[8,9] Advanced OCT segmentation in macular region have enabled quantitative evaluation of individual retinal layers.[10,11,12] 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.[13-16] The objective of this study was to define high myopia better by using polynomial regression analysis to characterize associations between macular profiles and axial length.

MATERIALAND 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 (MTA) was performed by accessing CIRRUS HD-OCT analyses. Protocol of macular thickness measurement consists of 256 x 256 (vertical x horizontal) axial scans in macular region. Macula is divided into 9 regions with 3 concentric rings: the innermost 1 mm diameter ring represents the fovea, the 3 mm diameter ring represents inner macula and the outermost 6 mm ring represents the outer macula. The macular thickness of every sector by ETDRS map were averaged for the purpose of analysis. 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

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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

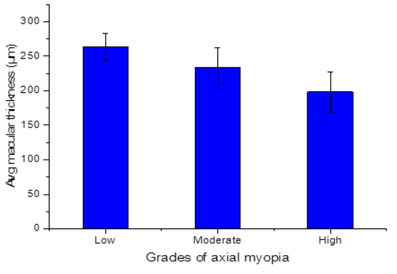

Chart1Comparison of mean average macular thickness among different grades of axial myopia (spherical equivalent)

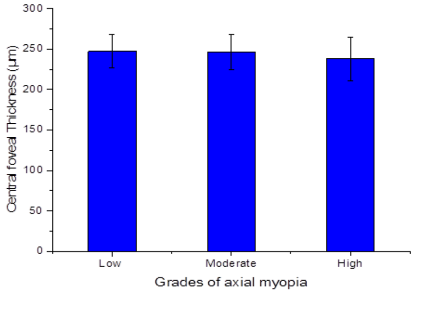

Chart 2 Comparison of mean central foveal thickness among different grades of axial myopia (spherical equivalent)

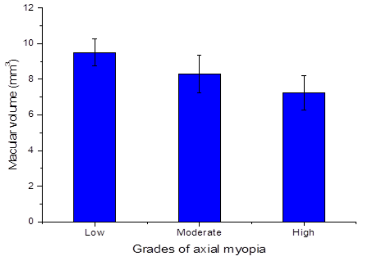

Chart 3 Comparison of mean macular volume among different grades of axial myopia (spherical equivalent)

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 i.e. average macular thickness, macular volume and central foveal thickness in different groups. We found that mean average macular thickness and mean macular volume differed significantly (p=0.0001) among the 3 groups. The mean average macular thickness was found to be significantly thinner in high myopia when compared with low and moderate myopia groups (p< 0.01) (chart 1). There was no significant variation (p=0.0802) found in mean central foveal thickness among various grades of axial myopia (chart 2). The mean macular volume was significantly less in high myopia when compared with low myopia and high myopia groups (p<0.01) (chart 3).

Our study findings are consistent with results from earlier studies. *Hwang and Kim.*[17]*,Luoet al.*[18]*, and P-C Wu et al.*[19]reported thinner macular retinal thickness (p<0.05), lower macular volume (p<0.05) as the degree of myopia and axial length increases. *Wakitani et al*[20]conducted similar study and there was no statistically significant difference found between the average thickness in emmetropic and low myopic, mildly myopic and highly myopic eyes in the central fovea (P = 0.35).However in previous studies of *Hwang and Kim.*[17]*, Luoet al.*[18]*, and P-C Wu et al.*[19]they found greaterfoveal thickness (p<0.05) as the degree of myopia and axial length increased. They explained thickening by the hypothesis that the stretching and flattening tendency of the internal limiting membrane and the centripetal force of the posterior vitreous result in elevation of the foveola and fovea.

CONCLUSION:

1.This study assessed the effect of severity of myopia on various macular parameters which shows thinning of average macular thickness and lowering of mean macular volume with increasing axial myopia which was evenly distributed throughout all the sectors. Effects were more in high myopic group as compared to low and moderate myopic group.
2.We also found a negative correlation between average macular thickness and axial length.
3.We found negative correlation between average macular thickness and axial length.

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