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Evaluation of macula in high myopic fundus using optical coherence tomography

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ABSTRACT

Context: High myopia is a risk factor for a number of retinal pathologies. OCT is very useful in eyes with high myopia and allows the detection of subtle macular changes that are otherwise undetectable.
Aim: To evaluate relationship between the axial length, refractive error and macular thickness in subjects with high myopia.
Study Design: Cross sectional observational single centric study.
Materials and Methods: 50 diagnosed patients of high myopia(refractive error>= -6 dioptres and/or axial length>=24 mm) along with a control of 50 emmetropic patients were included. Patient's anterior segment evaluation was done by slit lamp. Detailed fundus evaluation was done with indirect ophthalmoscopy and with +78 Dioptre lens along with measuring BCVA (Best corrected Visual Acuity). Axial length was measured using contact biometry. OCT was performed with TOPCON SD-OCT. Average macular thickness, central foveal thickness and total macular volume measured using 3D macula scan of all the cases and controls.
Statistical Analysis: Unpaired t test.
Results: The mean axial length was 27.40 mm among cases (SD±0.99) and 22.84 mm among controls (SD±0.422). The mean macular volume in cases was 6.90 and in controls was 7.82. The macular volume decreased with increasing axial length (ρ=-0.673) and increasing spherical equivalent (ρ=-0.035). The average macular thickness was inversely correlated with axial length (ρ=-0.605) and directly correlated with spherical equivalent (ρ=-0.049).The mean central subfield foveal thickness was 170.10 μm amongcases and 158.34μm among controls. The axial length and central foveal thickness were found to be positively correlated (ρ=0.727).
Conclusion: Average macular thickness and total macular volume are inversely correlated to the degree of myopia, whereas central foveal thickness is positively correlated to the degree of myopia.

1. Introduction

Myopia is one of the major causes of visual impairment especially in Asia and Europe and has becoming increasingly prevalent.[1,2] High myopia affects up to 3% of the world population. The prevalence of myopia is reported to range from 17% to 43% among Asian population. The prevalence of high myopia is also greater in Asian population compared to that in Whites ranging from 1.7% to 9.1%.[3–16]

Vision loss related to high myopia is of great clinical significance as it is irreversible and affects individuals during their most productive years. High myopia is defined as refractive error of at least -6.00D *or* an axial length of 26.5mm or more. Pathological myopia is defined as myopia associated with posterior segment changes along with progressive and excessive elongation of the globe.[17] High myopia can lead to complications such as posterior vitreous detachment (PVD) and abnormal vitreoretinal interface, retinal detachment (RD), posterior staphyloma, macular hole, lacquer cracks, subretinalhemorrhage. All these can lead to visual disability. Apart from these

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pathologies, high myopic fundus also has higher incidence of epiretinal membrane (ERM) or vitreomacular traction. This can lead to myopic traction maculopathy (MTM) such as retinoschisis, lamellar holes, or shallow detachment.[2]

The purpose of this study was to evaluate various posterior segment changes in high myopia using spectral domain OCT. We have studied the relationship of the refractive error, and axial length of the eye with variations of macular thickness.

2. Materials and Methods

This was a cross-sectional study carried out in a tertiary care centre in South Gujarat. Informed written consent was taken from each enrolled patient. A total of 200 eyes of 100 healthy young patients were evaluated in the study and patients were divided into two groups: Group I had 50 patients with emmetropia [spherical equivalent (SE) =0D] and group II had 50 patients with high myopia. Exclusion criteria consisted of known glaucomaor with positive family history, other ocular pathology, past history of refractive surgery, neurological disease, diabetes mellitus. All subjects underwent a comprehensive ophthalmic evaluation which included visual acuity measurement by Snellen's chart, slit lamp examination, fundus examination by slit lamp bio-microscopy and indirect ophthalmoscopy. The refractive error from the manifest refraction was adjusted to the SE. Axial lengths were measured using A scan biometer (EchoruleBiomedix). OCT was performed with TOPCON SD-OCT after pupillary dilation to a minimum of 5 mm diameter. Average macular thickness, central foveal thickness and total macular volume measured using 3D macula scan of all the cases and controls. Analysis of the collected data was done using *SPSS version 23*. Variables were expressed as mean± standard deviation. Data was compared using unpaired t-test.

3. Results and Discussion

The present study was conducted in a tertiary care center in south Gujarat. In this study we included 50 cases (100 eyes) and 50 controls (100 eyes).

In the present study, the mean age among the cases was 24.24 years (SD±4.706 years). The mean age among controls 25.88 was years (SD±5.630 years). The age of cases ranged between 17 to 36 years and in controls it was between 15 to 36 years. There was no significant difference among the ages of participants in both the groups (t=1.58, p=0.117). Leung C et al studied 115 myopic eyes of 115 subjects. The mean age was 35.9 ± 9.6 years and there was no significant difference of age among subjects.[18] In study conducted by Song AP et al, theyincludeda total of 82 eyes of 82 subjects in their study out which 43 were males and 39 were females. They were divided into three groups according to their refractive status. The average age of the low and medium myopia group (LMMG), high myopia group (HMG) and super high myopia group (SHMG) was 26.62±5.38, 24.33±5.70 and25.82±5.68 old years, respectively.[19]

In present study the mean spherical error among cases was -8.76 D (SD±-1.13D). While controls were emmetropic. In study conducted by Song AP et al the mean refractive error in the low and medium myopia group (LMMG), high myopia group (HMG) and super high myopia group (SHMG) groups was -2.49±1.38D, -8.53 ±1.95D and -13.88 ±1.76D, respectively.[19] In study conducted by Leung C et al, the mean spherical equivalent was -7.31 ± 3.04 D (range -0.75 to -13.88).[18]

In present study, the mean axial length among cases was 27.40 mm (SD±0.99) and among controls it was 22.07 mm (SD±0.59). In study conducted by Song AP et al the mean axial length was 25.81mm (SD ±2.31). The AL was ranging from 22.72mm to 31.50mm.[19] In study conducted by Leung C et al, the mean axial length was 26.08± 1.33 mm (range, 22.73–28.79 mm).[18]

In present study the difference of macular volume, average macular thickness and central foveal thickness were found to be statistically significant between cases and control groups. Here macular volume and average macular thickness was less as compared to emmetropic subjects while central foveal thickness was increased in myopic subjects as compared to emmetropic subjects. Similarly, Waris A et al's study showed that the mean macular thickness was significantly less in myopic eyes as compared to emmetropic eyes. The fovea was significantly thick ($p<0.0001$) in myopic eyes as compared to emmetropic eyes.[20] Similar results were also seen in study conducted by Song AP et al macular thickness was significantly less in high and severely high myopic group as compared to low myopic group. But central foveal thickness was increased in high myopic group as compared to low myopic group.[19] In study conducted by Wu PC et al, they found that highly myopic eyes had smaller mean macular volume than normal eyes. And high myopic subjects had greater central foveal thickness compared to normal subjects.[21]

In present study the spherical equivalent and central foveal thickness were found to be negatively correlated (ρ=-0.452) and this was statistically significant (p=0.00). Similar results like of our study were seen in studies conducted by Choi S et al,[22] Lim MCC et al,[23] Song AP et al.[19] and Hwang Y et al.[24]

4. Conclusion

Spectral Domain Optical Coherence Tomography (SD-OCT) allowed detailed evaluation of the macular area in eyes with high axial myopia & could even detect subtle myopic changes.

Average macular thickness and total macular volume decreases with increase in axial length and degree of

Table 1: Mean spherical equivalentand axial length among cases and controls

Characteristics	Cases	Controls
Mean SE	-8.76 D (SD ±-1.13D)	Emmetropic
Mean Axial Length	27.40 mm (SD±0.99)	22.07 mm (SD±0.59)

Table 2: Comparison of macularvolume, average macular thickness, central macular thickness and axial lengthin cases and controls

	Case/Control	N	Mean	Std. Deviation	t	P value
Macular Volume	Case	100	6.905	.72	12.008	.000
	Control	100	7.8175	.23		
Central Foveal Thickness	Case	100	170.10	11.69	9.01	.000
	Control	100	158.34	5.79		
AVG Macular Thickness	Case	100	214.67	45.75	12.58	.000
	Control	100	274.34	12.49		
Axial Length	Case	100	27.40	.99	45.84	.000
	Control	100	22.07	.59		

myopia. Central foveal thickness increases with increase in axial length and degree of myopia.

The current normative database of OCT machines does not take refractive error in account, clinicians should be aware of the effect of this parameter and consider other clinical features while evaluating macular thickness in the diagnosis and monitoring of diseases such as diabetic macular edema, or after-cataract maculopathy.

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6. Conflict of Interest

None.

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