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Original Article

Posterior Segment Changes in Myopic Patients – An Observational Study

S Kavitha[1], M Deepa[2], V Jeyanthi[2], Heber Anandan[3]

[1]Assistant Professor, Department of Ophthalmology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, [2]Postgraduate Scholar, Department of Ophthalmology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, [3]Senior Clinical Scientist, Department of Clinical Research, Dr. Agarwal's Eye Hospital, Chennai, Tamil Nadu, India

Abstract

Introduction: Myopia can be classified by etiology and by its clinical presentation. Pathological myopia forms a major component of the uncorrected refractive errors. The prevalence of pathological or degenerative myopia globally is unclear.

Aim: This study aimed to observe changes occurring in the posterior segment of the eye in high myopic patients and evaluate the correlation between the degree of myopia and the incidence of various posterior segment changes.

Materials and Methods: A hospital-based study was conducted on 100 patients between October 2018 and July 2020. Detail demographic data, ocular history, and family history were collected from patients. Data from all diagnostics investigations were obtained and analyzed.

Results: The study revealed that females showed an increased prevalence of myopia 1.3 times more than males. The prevalence of myopia was 95.6% bilateral and 4.4% unilateral in this study. Among the peripheral retinal changes, lattice degeneration is the most common manifestation noted in both eyes, accounting for 36%. Study results also showed that the severity of myopia is correlated with axial length and visual acuity.

Conclusions: Study findings revealed a strong correlation existed between the presence of parapapillary atrophy and high myopia. There was also a strong positive correlation between axial length and visual acuity in myopic patients.

Key words: Axial length, Myopia, Peripapillary atrophy, Posterior eye segment, Visual acuity

INTRODUCTION

Myopia in Greek words "muopia" is commonly known as nearsighted or short sighted. It is a condition of the eye where the light rays that should come directly on the retina do not directly focus on the retina but in front of the retina. Most professionals commonly correct myopia through the use of corrective lenses such as glasses or contact lens. Myopia is an important public health problem in Asian countries such as China, Japan, and Singapore, where myopia rates increase over the past few decades. This condition has become a benign ocular disorder associated with potentially blinding conditions such as pigmentary degeneration, retinal detachment, premature cataract, glaucoma, and macular choroidal degeneration.[1-3]

Uncorrected refractive errors account for almost 21% of the global burden of blindness, rising steadily from 19.9% in 1990. Along with South Asia, India shares a major part of this burden – 36% of blindness in South Asia is accounted for by uncorrected refractive errors.[4,5]

Myopia can be classified by etiology and by its clinical presentation. Pathological myopia forms a major component of the uncorrected refractive errors. The prevalence of pathological or degenerative myopia globally is unclear. A wide range has been reported, starting with a survey by Fuchs before 1960 that revealed the prevalence to be in the range of 0.2–9.6% with a higher prevalence in the Middle Eastern population. More recent studies show the prevalence to be in the range of 1–5%, with higher rates in Asians and much lower in those from the United

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Corresponding Author: Dr. M Deepa, Department of Ophthalmology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India.

States, perhaps suggesting the influence of geography or ethnicity.[4-6]

The study of the severest form of myopia, pathological or degenerative myopia, acquires a special significance given the high rates of myopia globally (80% worldwide in the general population) and the varied complications that can result in patients suffering from this dreaded condition. The numerous complications that can arise in pathological myopia include degenerative changes in the sclera, choroid and Bruch's membrane, damage to the retinal pigment epithelium and neural retina, glaucoma, retinal detachment, myopic maculopathy, myopic retinopathy, and premature cataracts.[7,8]

The clinical presentation of pathological myopia is complicated by the numerous changes in the posterior segment of the eye. Apart from the anticipated deterioration of vision, characteristic changes such as liquefaction, condensation, posterior vitreous disease, lacquer cracks, pigment epithelial atrophy, staphyloma, Fuchs spots, lattice degeneration, peripapillary changes, and many others are seen in typical cases of pathological myopia. However, the distribution, pattern, and frequency of these features can be varied in different populations.[5]

Aim

1. This study is intended to study the posterior segment changes of myopic patients
2. The study analyzes the correlation between the degree of myopia and the incidence of various posterior segment changes.

MATERIALS AND METHODS

This is a prospective, observational case series study design. This study was carried out at the Department of Ophthalmology Outpatient block of Government Tirunelveli Medical College and Hospital from October 2018 to July 2020. The patients were registered, detailed history taken, evaluated, and analyzed. Randomly selected 100 patients who fulfilled the inclusion and exclusion criteria were enrolled into the study after obtaining the written informed consent.

Inclusion Criteria

The following criteria were included in the study:

- Patients with myopic refractive error
- Patients in the age more than 5 years.

Exclusion Criteria

- The following criteria were excluded from the study: Subjects with index myopia (as seen in senile cataract)
- Other ocular associations such as microphthalmos, aniridia, megalocornea, and congenital separation of the retina
- Acquired causes of myopia such as post-traumatic, post-keratic, and drug induced
- Subjects with age <5 years who are not able to answer the Snellen's visual acuity charting.

The patients for the study are randomly selected from the general population. Informed consent regarding the study was obtained from the patient. History taking was done regarding the age, gender, occupation, family history, duration of spectacle usage, and frequency of spectacle change. Visual acuity was recorded in both eyes for the patient using a 6 m Snellen visual acuity chart.

Refraction was done for the patient based on retinoscopy and subjective correction given. Based on the degree of refractive error in spherical equivalent, the eyes are categorized as low myopia (−0.25 DS–−2.75 DS), moderate myopia (−3.00 DS–−6.00 DS), and high myopia (>−6.00 DS).

Ocular examination for squint, anterior segment examination to rule out other congenital anomalies was done.

Dilated fundus examination was done by slit-lamp biomicroscopy with +90 D lens and indirect ophthalmoscopy with +20 D lens. The findings were recorded in diagrammatic representation in pro forma. Cases that required diagnostic confirmation were further evaluated with fundus fluorescein angiography, optical coherence tomography, and ultrasound B-scan. All patients were done axial length measurement by A-scan.

RESULTS

A total of 100 patients were enrolled in this study. The majority of patients were from the age group above 45 (46%). About 43% were male and 57% were female. A slight female preponderance of high myopia was seen. It was found that 22% of patients had a positive family history, of which 96% of patients were affected by bilateral myopia. The study also showed that the duration of myopia increases with increasing age. The study shows that the visual impairment of myopic patients increases with the increasing degree of refractive error. Furthermore, the impairment is larger in the high myopia category [Table 1]. Table 1 shows the distribution of myopia based on the final visual outcome after the best correction of refractive error.

As the degree of myopia increases, disc changes were observed in both eyes. The most common disc finding was peripapillary atrophy (PPA) followed by myopic crescent in both eyes [Table 2]. Among the posterior pole changes,

tessellation (54% and 46% in the RE and LE, respectively) was the most common change, followed by chorioretinal atrophy (CRA) and posterior staphyloma in high myopia [Table 3]. The study showed that CRA was predominant among higher degrees of myopia and was absent in low myopia. The CRA was categorized based on different classifications. According to Tokaro's classification, in the RE, 20% had patchy CRA and 13% had diffuse CRA, whereas in the LE, 13% had patchy CRA and 15% had diffuse CRA among the high myopia category [Table 4].

Based on Steidl and Pruett's classification of CRA,[9] Grade-0 CRA (no atrophic changes) was present in 63% in the RE and 60% in the LE. The next common occurrence is Grade-2 CRA (total area of CRA ≤2 optic disc areas) which is 24% in the RE and 22% in the LE [Table 5].

Based on International Photographic Classification and Grading System for Myopic Maculopathy,[10] category-0 (no macular lesions) was found in 23% in the RE and 25% in the LE. Out of which 13% and 15% belonged to the low myopia category of the RE and LE, respectively [Table 6].

Among the peripheral retinal changes, lattice degeneration is the most common manifestation noted in both eyes, accounting for 36% in both eyes, followed by retinal tear, which was 5% in the RE and 3% in the LE [Table 7].

Various vitreous changes have been seen in the posterior segment of both eyes and posterior vitreous detachment was seen with high myopia [Table 8].

Axial length >30 mm was observed in 6% of high myopes in the RE and 2% of high myopes in the LE. Axial length >26.5 mm was observed in 43% of myopes in the RE and 33% of myopes in the LE.

DISCUSSION

One hundred subjects who were having myopia enrolled in the study. All subjects fulfilling the inclusion criteria and willingness to participate in the study were enrolled. In a study done by Venkatesan *et al.*,[11] the incidence of high myopia was seen highest in the 2nd decade. In contrast, in this study, the incidence increased steadily up to the 3rd decade. The highest incidence was seen in the age group of above 45 years. About 4% of cases had unilateral myopia, similar to 7% incidence seen in the study by Venkatesan *et al.*[11] The study revealed that females showed an increased prevalence of myopia 1.3 times more than males. Family history is present in only 22%, which was much higher than in the study by Venkatesan *et al.* (7%).[11]

About 80% of subjects had their uncorrected visual acuity between 1/60 and 6/60 of Snellen visual acuity chart in both the eyes. All patients belonging to the low myopia category had their best-corrected visual acuity improved to the category of 6/6–6/12 on the Snellen visual acuity chart. About 27% of subjects belonging to moderate myopia and 18% of subjects belonging to high myopia improved with refraction to the best-corrected visual acuity category of 6/6–6/12 in the RE. About

Table 1: Association of uncorrected and corrected visual acuity of the right and left eye (LE) with the degree of myopia

VA	Degree of myopia right eye (RE)			Degree of myopia LE		
	Low myopia	Moderate myopia	High myopia	Low myopia	Moderate myopia	High myopia
Uncorrected visual						
<1/60	0	0	1%	0	1%	3%
1/60–6/60	0	26%	54%	6%	31%	43%
6/18–6/36	11%	6%	0	8%	5%	0
6/6–6/12	2%	0	0	3%	0	0
Best-corrected visual acuity						
<1/60	0	0	0	0	1%	2%
1/60–6/60	0	0	12%	0	0	11%
6/18–6/36	0	5	25%	0	11%	17%
6/6–6/12	13%	27%	18%	17%	25%	16%

RE: Right eye, LE: Left eye

Table 2: Comparison of various disc changes with degree of myopia

Degree of myopia	Normal size disc		Large disc		PPA		Myopic crescent		Nasal super-traction	
	R	L	R	L	R	L	R	L	R	L
Low myopia	13	17	0	0	0	2	1	8	0	0
Moderate myopia	30	29	2	8	26	31	16	18	6	6
High myopia	22	21	33	25	49	41	23	20	12	13

25% of subjects belonging to moderate myopia and 16% of subjects belonging to high myopia improved with refraction to the best-corrected visual acuity category of 6/6–6/12 in the LE.

The most common disc finding in this study was PPA, seen in 49% in the RE and 41% in the LE of cases, while myopic crescent was seen in 23% RE and 20% in the LE. In contrast, in a study by Chang *et al.*,[12] the most common myopia-related macular finding in adults with high myopia was staphyloma (23%) followed by CRA (19.3%). Based on disc size comparison, 35% had a large disc in the RE and 33% had a large disc in the LE.

Table 3: Comparison between the various posterior pole changes and the degree of myopia

Degree of myopia	Tessellation		CRA		Myopic maculopathy		Posterior staphyloma	
	R	L	R	L	R	L	R	L
Low myopia	0	2	0	0	0	2	0	0
Moderate myopia	28	32	4	10	23	27	1	2
High myopia	54	46	32	26	54	46	22	21

CRA: Chorioretinal atrophy, PPA: Peripapillary atrophy

Table 4: Analysis of the different types of CRA in various degrees of myopia

Degree of myopia	Type of CRA RE (%)		Type of CRA LE (%)	
	Patchy	Diffuse	Patchy	Diffuse
Moderate myopia	4	0	9	1
High myopia	20	13	13	15

CRA: Chorioretinal atrophy, PPA: Peripapillary atrophy, RE: Right eye, LE: Left eye

Table 5: Analysis of various grades of CRA in the RE and LE according to Steidl and Pruett's classification

Degree of myopia	Grade of CRA									
	Grade-0		Grade-1		Grade-2		Grade-3		Grade-4	
	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
Low	13	15	0	2	0	0	0	0	0	0
Moderate	28	27	0	0	4	9	0	1	0	0
High	22	18	0	0	20	13	11	13	2	2

CRA: Chorioretinal atrophy, RE: Right eye, LE: Left eye

Among the posterior pole changes, tessellation was the most common change, followed by CRA, followed by posterior staphyloma. In mild degrees of myopia, the severity of retinal background tessellation was not prominent and as myopia increased, gross tessellation was noted. This may be due to the thinning of the retinal pigment epithelium, which exposes the underlying choroid secondary to the elongation of the globe.[5]

Based on Tokaro's classification of CRA, patchy atrophy was predominant than diffuse atrophy. In the RE, patchy atrophy was 64.86% and diffuse atrophy was 35.14%. In the LE, patchy atrophy was 57.9% and diffuse atrophy was 42.1%. The CRA was also analyzed based on Steidl and Pruett`s classification of CRA[9] and International Photographic Classification and Grading System for myopic maculopathy.[10]

Peripheral retinal degeneration changes were common in moderate to higher degrees of myopia in a cross-sectional study, up to 61.7% of highly myopic eyes were found to have peripheral retinal change.

Among the peripheral retinal changes, lattice degeneration is the most common manifestation noted in both eyes, accounting for 36% in both eyes, in contrast to a study done by Pierro *et al.*[13] Among the peripheral retinal changes, the second most common was retinal tear which was 5% in the RE and 3% in the LE. High myopia was also suggested to be associated with bilateral retinal detachment, a condition of very severe visual morbidity.[14] In the LE, 2% of subjects had retinal detachments along with retinal tear. Posterior vitreous detachment is found in 33% of patients in the RE and 34% of patients in the LE.

The study analysis showed the correlation between the degree of myopia and the range of axial length. With the increase in axial length, the degree of myopia increases.

Table 6: Analysis of various categories of myopic maculopathy in the RE and LE according to International Photographic Classification

Degree of myopia	Myopic maculopathy											
	Category-0		Category-1		Category-2		Category-3		Category-4		Category-4 plus disease	
	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
Low	13	15	0	2	0	0	0	0	0	0	0	0
Moderate	9	10	19	17	0	0	4	9	0	0	0	0
High	1	0	21	18	11	13	20	12	1	1	1	1

RE: Right eye, LE: Left eye

Table 7: Comparison between the various peripheral retinal changes and the degree of myopia

Degree of myopia	Lattice degeneration		Snail track degeneration		Retinal tear		Retinal hole		Retinal detachment	
	R	L	R	L	R	L	R	L	R	L
Low myopia	0	1	0	0	0	0	0	0	0	0
Moderate myopia	11	13	2	2	0	1	1	1	0	1
High myopia	25	22	2	3	5	3	1	3	0	2

Table 8: Analysis of posterior vitreous detachment in various degrees of myopia in the right and LE

Degree of myopia	Posterior vitreous detachment			
	RE		LE	
	Present	Absent	Present	Absent
Low	0	13	2	15
Moderate	6	26	11	26
High	27	28	21	25

RE: Right eye, LE: Left eye

CONCLUSIONS

This study concludes that females have an increased prevalence of myopia than males. Family history is not a significant correlation for myopia. Almost all cases report bilateral presentation of myopia. With the increase in the degree of myopia, the visual acuity worsens. The presence of posterior pole changes contributes to a significant reduction in visual acuity. Furthermore, the prolongation of axial length contributes to an increase in the degree of myopia and ocular morbidity.

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