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TO STUDY POSTERIOR SEGMENT CHANGES IN HIGH MYOPIA PATIENTS ATTENDING TERTIARY CARE CENTRE

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ABSTRACT

Background: High myopia is a progressive refractive disorder associated with structural alterations in the posterior segment of the eye, often leading to vision-threatening complications. This study was conducted to assess the pattern and frequency of posterior segment changes and associated complications in patients with high myopia attending a tertiary care center.

Methods: A prospective observational study was conducted at the Department of Ophthalmology, Index Medical College Hospital and Research Centre, Indore, from July 2023 to June 2024. A total of 100 patients (200 eyes) with high myopia (refractive error > -6.00 D) were included. All patients underwent detailed ocular examination including BCVA assessment, refraction, slit-lamp evaluation, intraocular pressure measurement, and dilated fundus examination. OCT and B-scan ultrasonography were performed where necessary. Data were analyzed using SPSS version 26.0.

Results: The mean age was 25 ± 5 years, with 54% males. The mean refractive error was -9.0 ± 3.5 D; axial length >26 mm was seen in 68% of eyes. Posterior segment findings included tessellated fundus (49%), chorioretinal atrophy (22%), myopic maculopathy (18%), and posterior staphyloma (11%). Peripheral retinal changes such as lattice degeneration (42%) and WWOP (35%) were common. Vitreous changes, especially posterior vitreous detachment (36%), were frequent. Statistically significant associations were observed between increasing myopia severity and structural changes ($p < 0.05$). Complications included posterior subcapsular cataract (15%), glaucoma (10%), and retinal detachment (5%).

Conclusion: High myopia is strongly associated with progressive posterior segment degeneration and serious ocular complications. Early detection, systematic monitoring, and tailored interventions are essential to prevent irreversible vision loss.

Keywords: High myopia, Posterior segment, Axial length, Retinal degeneration, Optical coherence tomography.

INTRODUCTION

Myopia, or nearsightedness, is a prevalent refractive error characterized by the convergence of parallel light rays anterior to the retina when accommodation is at rest. It is among the most common ocular conditions worldwide, affecting millions of individuals and representing a significant burden on global eye health services [1]. High myopia, typically defined by a spherical equivalent refractive error of -6.00 diopters or greater, is not only an optical disturbance but also a progressive pathological condition that predisposes individuals to irreversible structural damage to the posterior segment of the eye [2]. Such damage may include myopic maculopathy, choroidal neovascularization, and retinal detachment, all of which can result in permanent visual impairment and morbidity, making high myopia a critical public health concern [3].

The past few decades have witnessed a dramatic surge in the global prevalence of myopia, particularly high myopia, with East Asian countries experiencing the highest rates [4]. However, this phenomenon is no longer restricted to that region. Increasing incidences have also been reported in Western countries and developing nations, primarily due to changing lifestyle patterns, including reduced outdoor activity, increased near work, and prolonged digital screen exposure [5]. The ophthalmic implications of high myopia are profound and include various degenerative changes such as chorioretinal atrophy, posterior staphyloma, lacquer cracks, optic disc tilt, and vitreoretinal interface abnormalities—all of which demand specialized attention and long-term management [6].

Tertiary care centers, equipped with advanced diagnostic modalities and specialist expertise, provide an ideal setting for the in-depth evaluation of these posterior segment changes in high myopia [7]. The aim of this study is to conduct a comprehensive assessment of posterior segment alterations in patients diagnosed with high myopia, attending a tertiary healthcare facility. By delineating the pattern and frequency of these changes, the study aspires to enhance clinical awareness, facilitate early detection, and guide appropriate interventions aimed at preserving vision and improving long-term outcomes [8].

Given the escalating global burden of high and pathological myopia, such studies are imperative for informing public health strategies, refining clinical guidelines, and addressing the emerging epidemic of vision-threatening myopia-related complications.

MATERIAL AND METHODS

After approval of Institutional ethical committee, this prospective observational study was conducted at the Department of Ophthalmology, Index Medical College Hospital and Research Centre, Indore, Madhya Pradesh, over a one-year period from July 2023 to June 2024. A total of 100 patients (200 eyes) diagnosed with high myopia were recruited based on predefined inclusion and exclusion criteria. All patients gave informed consent, and data confidentiality was strictly maintained.

Inclusion and Exclusion Criteria: Participants aged over 5 years with a refractive error greater than -6.00 D and who provided informed consent were included. Patients below 5 years of age, those with cataract, history of ocular trauma, or refractive error less than -6.00 D were excluded to eliminate confounding variables that could affect posterior segment assessment.

Methodology

All eligible patients underwent a detailed ophthalmic examination that included recording of demographic data, clinical history (ocular and systemic), and best-corrected visual acuity (BCVA) using Snellen's chart. Objective and subjective refraction were performed, followed by external ocular and anterior segment examination using slit-lamp biomicroscopy. Intraocular pressure (IOP) was measured using Goldmann applanation tonometry.

Posterior segment evaluation was conducted using a combination of direct and indirect ophthalmoscopy with a +20D lens, and slit-lamp biomicroscopy with a +90D lens under mydriasis. The optic disc was examined for myopic crescent, peripapillary atrophy, and disc tilt. Macular assessment focused on identifying chorioretinal atrophy, lacquer cracks, Fuchs spots, posterior

staphyloma, and signs of myopic maculopathy. Peripheral retina was evaluated for lattice degeneration, snail-track degeneration, white without pressure (WWOP), retinal holes, and tears. Optical Coherence Tomography (OCT) was performed wherever macular pathology was suspected. In cases where media opacity obscured fundus visualization, B-scan ultrasonography was employed to detect retinal or vitreous abnormalities.

Follow-Up and Outcome Measures

Patients were re-evaluated periodically for changes in BCVA, IOP, and posterior segment findings. Imaging was repeated as required. All findings were recorded systematically during each follow-up.

Statistical Analysis

Data were compiled using Microsoft Excel 10.0 and analyzed with SPSS software version 26.0. Descriptive statistics (mean, standard deviation, frequencies) were used to summarize patient data. The Chi-square test assessed associations between categorical variables, while Pearson's or Spearman's correlation coefficients evaluated the relationship between the degree of myopia and posterior segment changes. Multivariate logistic regression was conducted to identify independent predictors of posterior segment alterations, with results expressed as odds ratios (OR) and 95% confidence intervals (CI). A p-value of less than 0.05 was considered statistically significant, and graphical representations such as bar charts and scatter plots were used to illustrate key findings.

RESULTS

The study included a total of 200 eyes from 100 patients with high myopia. The mean age of the participants was 25 ± 5 years, with a slight male predominance (54% male, 46% female). All patients presented with bilateral high myopia. A positive family history of myopia was reported in 22% of cases, suggesting a potential hereditary component.

The average refractive error across the study population was -9.0 ± 3.5 diopters, indicating a predominance of severe myopia. Axial length measurements revealed that 68% of eyes had lengths greater than 26 mm, and 12% had extreme elongation exceeding 30 mm. These findings reinforce the established correlation between high refractive error and progressive axial elongation in pathological myopia.

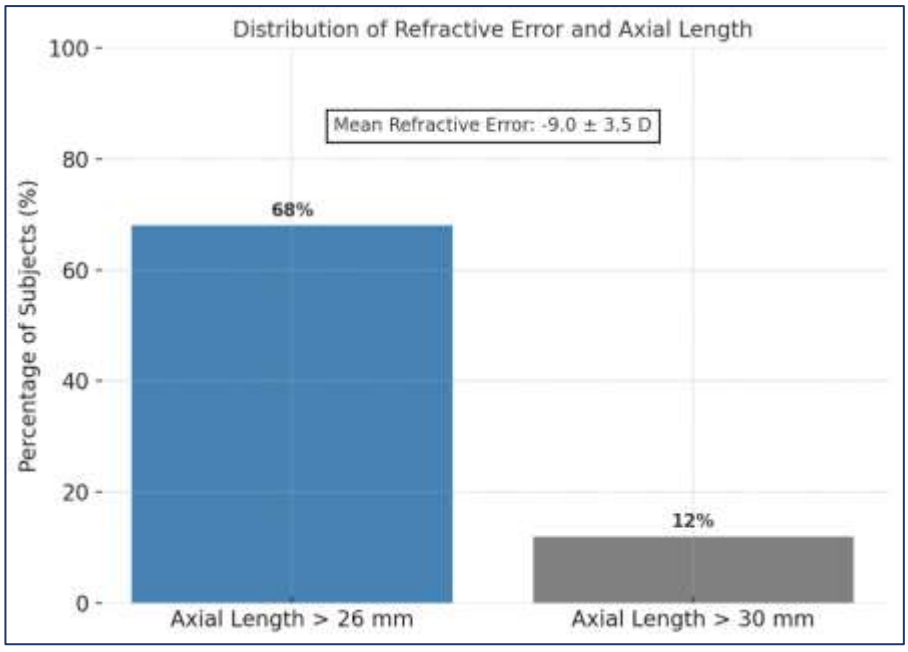

Figure 1. Distribution of refractive errors and axial length

The study revealed that high myopia significantly impairs uncorrected visual acuity (UCVA), with 98% of eyes presenting worse than 6/60. However, 60% showed marked improvement with

correction (BCVA ≥ 6/18), highlighting the benefit of optical intervention. Posterior segment changes were common, with tessellated fundus being the most frequent (49%), followed by chorioretinal atrophy (22%), myopic maculopathy (18%), and posterior staphyloma (11%), indicating progressive structural degeneration. [Table 2]

Table 1: Visual Acuity, Posterior Segment Changes, and OCT Findings in High Myopia (N = 200 eyes)

Parameter	Sub-category	Prevalence (%)
Visual Acuity Distribution		
	UCVA ≥ 6/18	0%
	UCVA 6/36–6/60	2%
	UCVA < 6/60	98%
	BCVA ≥ 6/18	60%
	BCVA 6/36–6/60	30%
	BCVA < 6/60	10%
Posterior Segment Changes		
	Posterior staphyloma	11%
	Chorioretinal atrophy	22%
	Myopic maculopathy	18%
	Tessellated fundus	49%

OCT findings demonstrated that patients with higher refractive errors (>14 D) had thinner macular thickness and increased foveal thickness, suggesting that increased axial elongation is associated with retinal thinning and foveal remodeling in advanced myopia.

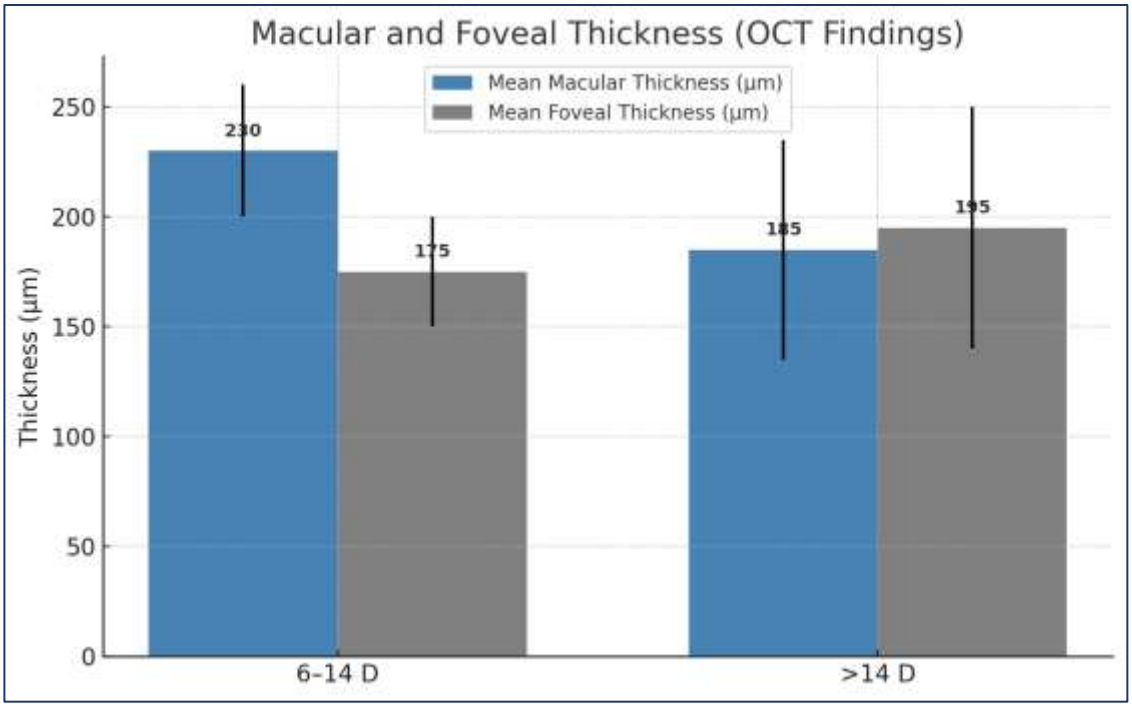

Figure 2. Macular and Foveal thickness (OCT findings)

The most prevalent peripheral retinal finding in high myopic eyes was tessellated fundus (50%), followed by lattice degeneration (42%) and WWOP (35%). Retinal tears, holes, and detachments were less frequent but clinically significant. Regarding vitreous changes, posterior vitreous detachment was the most common (36%), followed by vitreous degeneration (15%) and opacities (5%). Notably, 44% of eyes showed no vitreous abnormalities. This underscores the structural vulnerability of peripheral retina and vitreous in high myopia. [Table

Table 2: Peripheral Retinal and Vitreous Changes in High Myopia (N = 200 eyes)

Finding	Prevalence (%)
Peripheral Retinal Changes	
Tessellated Fundus	50%
Lattice Degeneration	42%
White Without Pressure (WWOP)	35%
Chorioretinal Atrophy	25%
Snail Track Degeneration	13%
Retinal Tears	7%
Retinal Detachment	5%
Retinal Hole	4%
Vitreous Changes	
Posterior Vitreous Detachment (PVD)	36%
Vitreous Degeneration	15%
Vitreous Opacities	5%
No Vitreous Changes Observed	44%

This study demonstrates a clear and statistically significant association between the degree of myopia and the severity of optic disc, posterior pole, and peripheral retinal changes ($p < 0.009$, $p < 0.005$, and $p < 0.001$ respectively). In eyes with mild myopia (-6 to -10 D), 37% had normal discs and posterior pole involvement was minimal (myopic maculopathy: 9.3%; chorioretinal atrophy: 5.6%; no staphyloma). However, with increasing refractive error (> -14 D), only 5% retained normal disc morphology, while myopic crescent and PPA were observed in 81% and 89% respectively. Similarly, tessellated fundus was noted in 86%, and posterior staphyloma in 36% of the most severely myopic eyes.

Peripheral retinal degeneration also escalated with severity: lattice degeneration increased from 14% in mild cases to 82% in severe myopia, and retinal detachment was exclusively seen in the >14 D group (18%). These findings confirm that high and pathological myopia are strongly linked to progressive and sight-threatening ocular complications. Regular monitoring and early detection are critical in preventing irreversible visual impairment in this vulnerable population. [Table 3]

Table 3: Ocular Structural Changes According to Degree of Myopia (N = 200 Eyes)

Ocular Feature	-6 to -10 D (n = 107)	-10 to -14 D (n = 49)	> -14 D (n = 44)	p-value
Optic Disc Changes				$p < 0.009$
Normal Disc	40 (37%)	16 (32%)	2 (5%)	
Large Disc	12 (11%)	10 (20%)	20 (45%)	
Myopic Crescent	10 (9%)	30 (61%)	36 (81%)	
Peripapillary Atrophy (PPA)	18 (17%)	24 (49%)	39 (89%)	
Posterior Pole Changes				$p < 0.005$
Myopic Maculopathy	10 (9.3%)	12 (24%)	14 (32%)	
Chorioretinal Atrophy (Posterior Pole)	6 (5.6%)	16 (33%)	23 (52%)	
Tessellated Fundus (Posterior Pole)	25 (23%)	36 (73%)	38 (86%)	
Posterior Staphyloma	0 (0%)	6 (12%)	16 (36%)	
Peripheral Retinal Changes				$p < 0.001$
Lattice Degeneration	16 (14%)	33 (67%)	36 (82%)	
White Without Pressure (WWOP)	12 (11%)	28 (57%)	30 (68%)	
Retinal Tear	0 (0%)	4 (8%)	10 (23%)	
Snail Track Degeneration	4 (3.7%)	10 (20%)	12 (27%)	
Chorioretinal Atrophy (Peripheral)	6 (5.6%)	14 (28%)	30 (68%)	
Tessellated Fundus (Peripheral)	25 (23%)	36 (73%)	38 (86%)	
Retinal Detachment	0 (0%)	2 (4%)	8 (18%)	
Retinal Hole	0 (0%)	2 (4%)	6 (14%)	

Among the ocular complications observed in high myopia, posterior subcapsular cataract was the most common (15%), followed by open-angle glaucoma (10%) and retinal detachment (5%), indicating a considerable risk of vision-threatening pathologies. In terms of management, spectacle correction remained the primary method of visual rehabilitation (85%), while contact lenses were used by 40% of patients. Barrage laser therapy and retinal detachment surgery were employed in 7% and 5% of cases respectively, reflecting targeted interventions for high-risk retinal complications.

Table 4: Ocular Complications and Treatment Modalities in High Myopia (N = 200 Eyes)

Category	Condition / Treatment	Prevalence / Utilization (%)
Ocular Complications		
	Retinal Detachment	5%
	Open-Angle Glaucoma (OAG)	10%
	Posterior Subcapsular Cataract	15%
Treatment Modalities		
	Barrage Laser Therapy	7%
	Retinal Detachment Surgery	5%
	Spectacle Correction	85%
	Contact Lenses	40%

DISCUSSION

High myopia, recognized as a progressive refractive disorder, is increasingly emerging as a global public health concern due to its potential to cause irreversible vision loss through structural ocular changes. This study aimed to evaluate the clinical spectrum of posterior segment alterations and associated complications in individuals with high myopia, thereby contributing to a better understanding of its pathophysiology and management.

The demographic profile predominantly consisted of young adults, with a mean age of 25 years, which is consistent with global epidemiological trends. Holden et al. (2016) [9] have previously emphasized the rapidly increasing incidence of myopia among the younger population, particularly in urban settings. While our study exhibited a slight male predominance, Yu et al. (2023) [10] corroborated the trend of myopia affecting both pediatric and young adult groups significantly. In contrast, Kavitha et al. (2021) [11] reported a threefold higher incidence among females, suggesting that regional or behavioral factors may influence sex-based distribution.

The refractive profile of our cohort revealed a mean refractive error of -9.00 D, with 68% of eyes exhibiting axial lengths greater than 26 mm. This finding reinforces the well-established relationship between high myopia and axial elongation, as demonstrated in previous research by Charm and Cho (2013) [12], and more recently by Liu et al. (2023) [13]. The association between increased axial length and progressive myopic pathology supports the view that axial elongation is not just a marker but a primary driver of myopic degeneration. Studies by Pande et al. (2020) [14] further support this correlation, identifying axial elongation as a major determinant of visual deterioration and structural abnormalities. Our results provide empirical evidence in favor of this hypothesis, emphasizing the importance of axial length monitoring in high myopic eyes.

Visual acuity outcomes in our study also reflect the debilitating nature of uncorrected high myopia. While 60% of participants achieved a BCVA of 6/18 or better, a striking 98% had UCVA worse than 6/60, indicating severe visual impairment in the absence of optical correction. These figures mirror the findings by Kavitha et al. (2021) [15], who reported similar functional limitations, thereby highlighting the importance of timely refractive management to restore visual potential in this population.

Posterior segment changes emerged as one of the most critical observations. Tessellated fundus (49%), peripapillary atrophy (40%), posterior staphyloma (11%), and chorioretinal atrophy (22%) were common findings. These are consistent with previous studies by Jonas et al. (2017) [16] and Wu et al. (2019) [17], who outlined the progressive nature of myopic maculopathy. The increasing

prominence of these degenerative changes with greater axial length was previously detailed by Pande et al. (2020) [18], who reported peripapillary atrophy in 72% and tessellation in 65% of cases. Notably, the thinning of the retinal pigment epithelium and enhanced visibility of the choroid—due to scleral stretching—explains the distinct tessellation observed, especially in advanced cases. Similar observations were made by Naik GT et al. (2022) [19], who documented posterior segment complications such as optic disc crescents, Fuchs spots, lacquer cracks, and posterior staphyloma.

Macular evaluation via Optical Coherence Tomography further substantiated these findings. The study by Solu R et al. (2020) [20] demonstrated an inverse relationship between axial length and macular volume ($\rho = -0.01$), and a positive correlation with central foveal thickness ($\rho = 0.673$), confirming that structural macular remodeling accompanies axial elongation in high myopia. This correlation aligns with the OCT findings in our study, reinforcing the concept that early imaging is invaluable in monitoring macular health and preventing irreversible damage.

Peripheral retinal alterations were equally significant, with lattice degeneration observed in 42% and WWOP in 35% of eyes. These findings are comparable to those of Lyu et al. (2020) [15] and Zhu et al. (2014) [21], who highlighted a high prevalence of peripheral changes among high myopes. Retinal tears, although less frequent (7%), represent a substantial risk for retinal detachment, which is a well-documented threat in pathological myopia. Studies by Fan et al. (2007) [18] and Dhakal et al. (2018) [22] support this observation, emphasizing the need for regular peripheral retinal evaluation in this group. Shukla M et al. [23] reported a WWOP incidence of 27.6%, while Celorio J et al. [24] found lattice degeneration in 33% of highly myopic individuals—figures that align well with our observations.

The burden of complications in high myopia is further illustrated by the presence of posterior subcapsular cataract in 15%, open-angle glaucoma in 10%, and retinal detachment in 5% of our cohort. These outcomes underscore the systemic nature of high myopia, which is associated with both anterior and posterior segment pathologies. Polling et al. (2016) [14] similarly documented these associations, drawing attention to the need for a multidisciplinary approach in managing these patients. High myopia is not merely a refractive anomaly but a progressive ocular disease requiring lifelong surveillance.

Management strategies observed in our study, including barrage laser therapy (7%) and retinal detachment surgery (5%), reflect the importance of timely intervention. The high prevalence of spectacle correction (85%) and moderate use of contact lenses (40%) underscores the importance of rehabilitative care. These practices are consistent with therapeutic guidelines proposed by Agarwal et al. (2022), who advocated for customized management protocols integrating advanced diagnostic and surgical tools to mitigate long-term visual morbidity.

Despite its strengths, this study has certain limitations. It was a single-center study with a relatively modest sample size, which may limit generalizability to broader populations. Moreover, due to its observational nature, long-term progression of posterior segment changes could not be evaluated. Future multicentric, longitudinal studies are needed to explore disease progression and assess the effectiveness of emerging therapeutic interventions over time.

CONCLUSION

This study highlights the progressive and vision-threatening nature of high myopia, characterized by its strong association with axial elongation and degenerative changes in both the posterior pole and peripheral retina. The observed complications—including posterior staphyloma, myopic maculopathy, peripapillary atrophy, retinal detachment, and open-angle glaucoma—underscore the critical need for early diagnosis, regular monitoring, and timely intervention.

The findings align with global research emphasizing the importance of integrating advanced imaging techniques like OCT, individualized refractive correction, and prophylactic measures such as laser therapy into routine care. As the global prevalence of high myopia continues to rise, especially among younger populations, this study reinforces the urgent need for comprehensive, multidisciplinary management strategies. Efforts must also extend beyond clinical care to include

public health initiatives, school-based screenings, and further research into novel therapies. Through early intervention and sustained follow-up, the long-term burden of high myopia can be significantly reduced, improving patient outcomes and quality of life.

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