

Peripheral Retinal changes in moderate to severe myopia and their relation with axial length

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ABSTRACT:

Background: The prevalence of myopia in developed countries across East and Southeast Asia has surged, affecting over 80% of children completing schooling, with high myopia rates reaching 10-20%. This refractive error leads to peripheral fundus changes such as white without pressure (WWOP), lattice degeneration, holes, pigmentary degeneration, and paving stone degeneration. Complications associated with axial elongation due to myopia rank as the sixth leading cause of blindness. Consequently, myopia has emerged as a significant health concern in East Asia over recent decades. **Materials and Methods:** This cross-sectional observational study was conducted over 18 months at a tertiary care centre and involved 105 patients aged 12 to 20 years with moderate to severe myopia (-3D to -10D). The aim was to determine the prevalence of retinal changes and their correlation with axial length. Ethical approval was obtained from the Institutional Ethical Committee. **Results:** Among the 105 participants, 54 were male and 51 were female. Moderate myopia (-3 to -6D) was present in 181 eyes, while severe myopia (more than -6D) was observed in 19 eyes. The most prevalent peripheral retinal change was WWOP, found in 11 patients (16 eyes), followed by lattice degeneration in 8 patients (13 eyes) and retinal holes in 3 patients (3 eyes). Statistical analysis revealed a significant association between axial length and the presence of WWOP (P=RE:0.02, LE:0.003), lattice degeneration (P=<0.0001), and retinal holes (P=RE:0.048, LE:0.040). The highest number of peripheral retinal changes occurred in individuals with an axial length of 26.01 to 27.00mm and myopia exceeding -6D. **Conclusion:** The study shows a significant association between peripheral retinal degenerations, longer axial length, and the severity of myopia, emphasizing the importance of early detection to prevent vision-threatening complications.

Keywords: Myopia, Axial length, Lattice degeneration, White without pressure

INTRODUCTION:

The prevalence of myopia in developed countries in east and southeast Asia has increased to more than 80% in children completing schooling, whereas that of high myopia has increased to 10-20 %.[1]. This refractive error causes changes in the periphery of the fundus like white without pressure (WWOP), lattice degeneration, holes, pigmentary degeneration and paving stone degeneration[2]. Lattice degeneration is considered the most significant peripheral retinal lesion potentially predisposing to retinal breaks and detachment [3]. Pathological myopia is associated with comorbidities that increases risks of severe and/or irreversible loss of vision, such as retinal detachment, subretinal neovascularization, dense cataract and glaucoma[4]. Complications associated with axial elongation from myopia are sixth leading cause of blindness[5]. Therefore myopia has emerged as a

major health issue in East Asia in past few decades. Besides, there is scarcity of data regarding morbidity of myopia in Indian scenario. Which makes it critically important to detect the problem at an earlier stage. Retinal changes can be studied and followed up by fundus examination in the daily outpatient department. By this study the patients having myopia among the age group of 12 to 20 years irrespective of their sex were examined for early detection of peripheral retinal changes in their eyes in relation to axial length .

OBJECTIVES:

- To estimate the prevalence of retinal changes in patients of moderate to severe myopia.
- To estimate the relationship between the degenerative retinal changes and the axial length of the eyeball.

MATERIALS AND METHODS:

This study is a cross-sectional observational research conducted over a period of 18 months at a tertiary care center. The study population included patients who consented to participate and were within the age range of 12 to 20 years. Ethical approval was obtained from the Institutional Ethical Committee prior to the commencement of the study.

A total of 105 patients, accounting for 210 eyes, were included in the study. Detailed demographic data were recorded for each patient. The visual acuity of each patient was assessed using the Snellen's chart, ensuring that the best corrected visual acuity was documented. Refractive power was evaluated through both retinoscopy and subjective assessment techniques. For the purpose of myopia grading, the spherical equivalent (SE) was used.

Each patient underwent a comprehensive eye examination. The anterior segment of the eye was examined using a slit lamp. The posterior segment was examined by indirect ophthalmoscopy after pupil dilation. The pupils were dilated using a combination of 0.8% tropicamide and 5% phenylephrine to ensure an adequate view of the posterior segment. Additionally, the axial length of each eye was measured using A-scan ultrasonography.

This thorough examination process aimed to gather extensive data on the ocular health and refractive status of the patients, contributing valuable insights into the prevalence and characteristics of myopia in this age group.

Fundus changes were evaluated for:

Abnormalities at posterior pole: Myopic crescent, Tilted disc, Optic disc pit, Posterior staphyloma, Foster fuch spot, Lacquer cracks. Peripheral retinal changes: White without pressure, Lattice degeneration, Paving stone degeneration, Pigmentary degeneration, Retinal holes and tears Retinal detachment.

Inclusion Criteria:

- Patients having moderate to severe myopia (-3D to -10D)
- Patients of the age group of 12 to 20 years irrespective of gender.

Table 1: Fundus changes and their prevalence

| Fundus changes | No. of patients | % |
|----------------------|-----------------|---------|
| Myopic crescent | 38 | 36.19% |
| Tigroid fundus | 26 | 24.76% |
| WWOP | 11 | 10.476% |
| Lattice degeneration | 8 | 7.619% |
| Retinal hole | 3 | 2.85% |
| Total | 60 | 57.14% |

Exclusion criteria:

- Patients having history of previous retinal detachment.
- Patients having anisometropia.
- Patients who do not give consent.

Statistical Methods:

- Total 105 patients were examined.
- Sample size calculated by considering positive proportion of peripheral retinal changes from previous study[6]

$$P=14.6, Q=1-P, Z \alpha/2=1.96$$

95% level of significance

$$\text{Allowable error}(L2)=7\%$$

$$n= (Z \alpha/2)^2 PQ/L2$$

$$n= 102$$

The demographic data, including gender and age, were collected and evaluated for all patients. Statistical analysis of the data was performed using the Chi-Square Test to determine the association between variables. A P value of less than 0.05 was considered statistically significant, indicating that the observed differences were unlikely to have occurred by chance. For the statistical analysis, SPSS software version 20 was utilized. This software facilitated the calculation of statistical significance and ensured the accuracy and reliability of the results.

RESULTS AND DISCUSSION:

In present study most common fundus change is myopic crescent, followed by tigroid fundus, WWOP, lattice degeneration and retinal hole. Out of 105 patients, 38(36.19%) have myopic crescent, 26(24.76%) have tigroid fundus, 11(10.476%) have WWOP, 8(7.619%) have lattice degeneration and 3(2.85%) have peripheral retinal hole. As far as peripheral retina is concerned WWOP is most commonly seen, followed by lattice degeneration and hole.

Table 2: Distribution of the eyes under study as per the axial length

| Axial length(mm) | NO. of eyes | Percentage |
|------------------|-------------|------------|
| 22.01-23.00 | 23 | 10.95% |
| 23.01-24.00 | 80 | 38.09% |
| 24.01-25.00 | 68 | 32.38% |
| 25.01-26.00 | 25 | 11.90% |
| 26.01-27.00 | 14 | 6.66% |
| Total | 210 | 100.00% |

There is a statistically significant association between axial length of the eyeball and presence of WWOP(P=RE:0.02,LE:0.003), lattice degeneration(P=<0.0001) and retinal holes(P=RE:0.048 LE:0.040). Maximum number of peripheral retinal changes are seen in the axial length of 26.01 to 27.00mm and myopia of more than -6D.

In 2018 Davi Z Chen et al conducted a study in young Asian adult males. White without pressure (46.5%) and lattice degeneration (14.6%) were the commonest findings. Temporal lattice degeneration was more common (71%) and 35% had more than one area in the same eye.[6]

In 1991 J M Celorio et al studied 436 eyes of 218 patients with myopia. Of 218 patients, 72 (33.0%) had lattice degeneration. Among these 72 patients, that greatest prevalence of lattice degeneration(40.9%) was found in eyes with axial length of 26.0mm to 26.9mm and least prevalence(7.0%) was found in eyes with axial length of 32.00mm or greater [7].

In our study, greatest prevalence of lattice degeneration(50%) was found in eyes with axial length of 26.00mm-27.00mm .

Table 3: Rivew of different literatures[7-9].

| Literature | Lattice degeneration | Retinal hole | White Without Pressure |
|--|----------------------|--------------|------------------------|
| J M Celorio et al | 33.00% | - | - |
| Dennis S C Lam et | 12.20% | 7.50% | - |
| Elnahry AG Khafagy MM Esmat SM Mortada HA | 11.80% | - | 37.80% |
| Our study | 7.62% | 2.85% | 10.48% |

The study revealed several important findings:

1. Prevalence of Fundus Changes: The most common fundus change observed was myopic crescent, followed by tigroid fundus, white without pressure (WWOP), lattice degeneration and retinal holes.
2. Peripheral Retinal Changes: Among the peripheral retinal changes, WWOP was the most frequently observed condition, followed by lattice degeneration and retinal holes.
3. Axial Length Correlation: Statistical analysis demonstrated a significant association between longer axial length and the presence of peripheral retinal changes. The highest number of peripheral retinal changes were observed in patients with an axial length

of 26.01 to 27.00 mm and myopia exceeding -6D.

4. Gender Distribution: The study included 54 male and 51 female participants, indicating a nearly equal gender distribution. Both genders exhibited similar prevalence rates for the various retinal changes, suggesting that gender does not significantly influence the occurrence of these conditions in myopic patients.

5. Comparison with Previous Studies: The findings of this study align with previous research conducted in different populations, reinforcing the importance of early detection and monitoring of peripheral retinal changes in myopic patients. The prevalence rates observed in this study are within the ranges reported by other studies, underscoring the consistency of these

findings across diverse populations.

CONCLUSION:

Early detection and monitoring of retinal changes in myopic patients are vital to prevent complications like retinal detachment. This study emphasizes comprehensive eye exams for young myopic patients to manage retinal issues. With myopia's rising prevalence, particularly in East Asia, addressing these changes is crucial for visual health. The study found a strong link between peripheral retinal degenerations, longer axial length, and myopia severity. Early identification and treatment of lattice degeneration are essential to prevent sight-threatening complications.

ABBREVIATIONS:

WWOP-White without pressure
SE-Spherical equivalent
WWP-white with pressure
RHT-retinal holes and tears

DATA AVAILABILITY: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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