CLINICAL FINDINGS OF PERIPHERAL RETINAL DEGENERATIONS IN MYOPIA OF < 6 DIOPTERS

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ABSTRACT

This study was undertaken in the department of ophthalmology at PES Medical college and Hospital, Kuppam from November 2014 to June 2016. In the present study 200 eyes of 100 patients who satisfied specific conditions were examined. Various peripheral retinal degenerations observed are analysed with respect to age, sex, degree of myopia and with axial length. Among 200 patients, 86 were male and 114 were female. The degree of myopia ranged from 0.25D to 6D and astigmatism up to -0.25 cyl. 177 eyes had best corrected visual acuity of 6/6. In myopia up to -3D, the majority of degenerative changes are seen in males and in myopia >-3D to 6D, the degenerative changes are seen in females. In <-3D myopia, lattice degeneration was seen in 5.03%, chorioretinal degeneration was seen in 4.3%, white without pressure in 4.3%. In myopia >-3D to 6D lattice degeneration was 16.3%, chorioretinal degeneration was 9.8%, white without pressure was 13.11%, paving stone degeneration was 1.63%. As the degree of myopia increases the degenerative changes also increased. The super temporal quadrant followed by infer temporal quadrant were most commonly affected. The mean axial length difference in myopia of up to -3D with and without degenerative changes was not statistically significant in our study p<0.01, whereas the mean axial length difference between >-3D to 6D was statistically significant. The present study conclude that as the degree of myopia increases, the peripheral retinal changes also increase. The axial length of the eye increases, the degenerative changes also increased.

KEYWORDS: Lesion, Retina, Degeneration & Myopia

INTRODUCTION

Myopia is one of the common optical aberrations of eye. Physiological myopia is by far the most prevalent and is considered a normal biological variation. Many patients have a relatively low degree of myopia, with no deleterious ocular changes; there is perhaps a tendency to regard myopia as a simple refractive condition without considering the serious visual problems. Myopia is associated with several retinal degenerations that can cause irreversible blindness. Peripheral retina is prone for various degeneration secondary to its anatomical dehiscence like thinness, presence of poorly developed retinal cells and absence of large blood vessels. The discovery of binocular indirect ophthalmoscope has given a big boost to the study of peripheral retina. This has been of immense help in the examination of retina of the myopic subjects who are frequently affected by dangerous pathological lesions in the periphery. These patients are predisposed to retinal detachment at any time during their lifetime. In the present study an effort is made to study the occurrence of peripheral retinal degenerative lesions in myopia up to 6D with a focus on degenerative lesions up to 3D. These changes are correlated with axial length of the eye, degree of myopia and age of asymptomatic patients (i.e., without flashes.
and floaters of light). The results will help to determine the necessity and type of ocular screening and disease preventive programs to be used in similar population. The main objective of the study is to understand presence of various peripheral retinal degenerations in myopia of less than six diopters and correlation between peripheral retinal degenerations with axial length of eye and age of patients.

**Practical Approach of Myopia**

Myopia is defined as the state of refraction in which parallel rays of light entering the eye at rest are brought to focus in front of the sentinel layer of retina.

![Classification of myopia](image)

Axial myopia – results from increase in posterior length of the eyeball curvature myopia-occurs due to increased curvature of the cornea, lens or both. Index myopia results from increased refractive index of the crystalline lens and positional myopia results from anterior displacement of the lens in the eye.

**Clinical Varieties of Myopia**

- **Congenital myopia:** It is present since birth. The error is unilateral and manifests as anisometropia. Usually error is about 8D to 10D and remains constant.
- **Acquired myopia:** Post traumatic, post keratitic, drug induced, space myopia, pseudomyopia
- **Low grade myopia:** It is the commonest variety. It is a physiological error not associated with any disease of the eye.
- **Physiological (simple) myopia.** The postnatal development of these eyes is normal; they are rendered myopic because of a correlation failure between total refractive power (cornea and lens) and a normal axial diameter.

**Intermediate Myopia:** There is an expansion of the posterior segment of the globe. The fundus changes include:
1) tigroid fundus - because of RPE thinning
2) distinctive crescent formation with or without supertraction
3) the peripheral fundus shows an increasing prevalence of changes that are associated with increased axial diameter, like white without pressure, lattice, pigmentary and paving stone degenerations.
Pathological Myopia

Degenerative myopia/progressive myopia/high myopia: It indicates a progressive error resulting in high myopia during early adult life which is usually associated with degenerative changes in the eye eg. Paving stone degeneration, lattice degeneration. Lattice degeneration is associated with one-third of retinal detachment. 6,19,20

Biomechanical Theory

According to biomechanical concept the choioretinal lesions are viewed as a consequence of excessive axial elongation. It is believed that progressive distention of posterior pole stretches the ocular coats, evidenced by the straightening of the temporal retinal vessels, the appearance of a supertraction crescent, and thinning of the retina and choroidal crescent formation and chorioretinal atrophy have been directly related to increased axial length.

![Figure 1: Fundus Periphery and Posterior Pole](image)

METHODS

This study was undertaken in the Department of Ophthalmology at PES MEDICAL college and hospital, Kuppam, for a period of 15 months starting from November 2014 to June 2016 and 200 eyes of 100 asymptomatic myopes up to -6D were examined. The following were the inclusion and exclusion criteria. Inclusion criteria; Myopia up to -6D, Age group of >15 years, Both sexes, Unilateral /bilateral and astigmatism up to -0.25D. Exclusion criteria; media opacities, retinopathy of prematurity, Children <or=15 Y, Patients who underwent refractive surgeries, non cooperative patients and astigmatism >0.25D

Study Design

A observation on a total 100 patients considered was for the study. All patients fulfilling the selection criteria were explained about the purpose of study and a written consent was obtained from them to participate in the study before enrolment. The study was approved by the institutional ethics committee. The following tests were done for the patients

- Best corrected visual acuity with Snellens chart
- Refraction
- Slit lamp examination of anterior segment
• A-scan
• Ophthalmoscope-direct - indirect - 90D

Data collected from was entered in to an excel sheet after coding of variables and appropriate analysis was done. Qualitative data were analyzed using proportion and chi-square test. Quantitative data were analysed using mean and standard deviation.

RESULTS

Present study 200 eyes of 100 patients with axial myopia were examined. Among 100 patients 86 were male and 114 were female distributed in the age group of 15-50 years as shown in table 1. The degree of myopia ranged from -0.25 to -6 D and astigmatism up to -0.25 cyl.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age in Years</th>
<th>No of Eyes</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Group 1</td>
<td>16-25</td>
<td>64(41%)</td>
<td>92(59%)</td>
</tr>
<tr>
<td>Group 2</td>
<td>26-35</td>
<td>10(41.6%)</td>
<td>14(58.4%)</td>
</tr>
<tr>
<td>Group 3</td>
<td>36-50</td>
<td>12(60%)</td>
<td>8(40%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>86(43%)</td>
<td>114(57%)</td>
</tr>
</tbody>
</table>

Among 100 patients 78 patients were in the age group of 16 to 25 years, 12 patients were in the age group of 26-35 years, 10 patients were in the age group of 36-50 years. The mean age was 22.80±7.57 years.

![Age distribution](image)

**Figure 2: Age Wise Distribution**

![Sex distribution](image)

**Figure 3: Gender Wise Distribution**
Table 2: Number of Eyes with Best Corrected Visual Acuity

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Visual Acuity</th>
<th>No.of Eyes</th>
<th>Best Corrected Visual Acuity</th>
<th>Best Corrected Visual Acuity Not Improved to 6/6</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;6/60</td>
<td>46</td>
<td>30</td>
<td>16</td>
<td>P≤0.0001</td>
</tr>
<tr>
<td>2</td>
<td>6/60</td>
<td>48</td>
<td>44</td>
<td>04</td>
<td>P≤0.0001</td>
</tr>
<tr>
<td>3</td>
<td>6/36</td>
<td>52</td>
<td>49</td>
<td>03</td>
<td>P≤0.0001</td>
</tr>
<tr>
<td>4</td>
<td>6/24</td>
<td>17</td>
<td>16</td>
<td>00</td>
<td>P≤0.0001</td>
</tr>
<tr>
<td>5</td>
<td>6/18</td>
<td>25</td>
<td>25</td>
<td>00</td>
<td>P≤0.0001</td>
</tr>
<tr>
<td>6</td>
<td>6/12</td>
<td>10</td>
<td>10</td>
<td>00</td>
<td>P≥0.0001</td>
</tr>
<tr>
<td>7</td>
<td>6/9</td>
<td>02</td>
<td>03</td>
<td>00</td>
<td>P≥0.0001</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>177(88.5%)</td>
<td>23(11.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4: Percentage of Eyes Improved to 6/6

Table 3: Correlation of Degree of Myopia with Degenerative Changes

<table>
<thead>
<tr>
<th>Degree of Myopia</th>
<th>No.of Eyes</th>
<th>No. of Eyes with Degenerative Changes</th>
<th>No.of Eyes without Degenerative Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1. up to -3D</td>
<td>139</td>
<td>19(12.94%)</td>
<td>120(87.05%)</td>
</tr>
<tr>
<td>2. &gt;-3D to 6D</td>
<td>61</td>
<td>24(39.34%)</td>
<td>37(64.05%)</td>
</tr>
<tr>
<td>P-Value</td>
<td></td>
<td></td>
<td>P≤0.003</td>
</tr>
</tbody>
</table>

From the above table it can be inferred that, as the degree of myopia increases the percentage of eyes with degenerative changes also increased, but there is no statistical significance (z <1.96), using t-test

Figure 5: Correlation of Degree of Myopia with Degenerative Changes
The percentage of lattice degeneration (LD) varies between group 1 to group 3 from 6.4% to 35%, in chorioretinal degeneration (CRD) the percentage varies from 5.1% to 20% between group 1 to group 3. The percentage of white without pressure (WWOP) lesions varies from 5.1% to 10% between group 1 to group 3. This implies that in myopes, as age advances, the degenerative changes also increases.

In myopia up to -3D, the majority of cases with degenerative changes are seen in males and in myopia > -3 to -6D, the changes are seen in females.
The maximum number of degenerative changes was seen in the supero-temporal quadrant. The next most commonly affected region was the infero-temporal quadrant.

**Table 7: Correlation of Axial Length, Age Group and Sex**

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Axial Length (mm)</th>
<th>21.5-22.4</th>
<th>22.5-23.4</th>
<th>23.5-24.4</th>
<th>24.5-25.4</th>
<th>25.5-26.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>16-25 yrs</td>
<td>52(26%)</td>
<td>56(28%)</td>
<td>34(17%)</td>
<td>11(5.5%)</td>
<td>3(1.5%)</td>
</tr>
<tr>
<td>Group II</td>
<td>26-35 yrs</td>
<td>6(3%)</td>
<td>12(6%)</td>
<td>4(2%)</td>
<td>2(1%)</td>
<td>0</td>
</tr>
<tr>
<td>Group III</td>
<td>36-50 yrs</td>
<td>6(3%)</td>
<td>6(3%)</td>
<td>5(2.5%)</td>
<td>3(1.5%)</td>
<td>0</td>
</tr>
</tbody>
</table>

The above table shows that maximum number of eyes 74(37%) are seen with the axial length of 22.5-23.4 mm, whereas the least number of eyes 3 (1.5%) are seen with the axial length of 25.5-26.4 mm. The maximum number of female patients 38(19%) were with the axial length of 22.5-23.4 mm. The maximum number of male patients (36%) belonged to the axial length range of 22.5-23.4 mm.

**Table 8: Correlation of Axial Length with and without Degenerative Changes with Respect to Degree of Myopia**

<table>
<thead>
<tr>
<th>Degree of Myopia</th>
<th>No. of Eyes</th>
<th>Average Axial Length with Degenerative Changes(mm) in No.of Eyes</th>
<th>Average Axial Length without Degenerative Changes(mm) in No.of Eyes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AXL No.of Eyes</td>
<td>AXL No. Of Eyes</td>
</tr>
<tr>
<td>Up to 3D</td>
<td>138</td>
<td>23.22 19</td>
<td>22.87 119</td>
</tr>
<tr>
<td>&gt;-3 D to 6D</td>
<td>62</td>
<td>24.35 23</td>
<td>23.54 39</td>
</tr>
</tbody>
</table>

The axial length of the eyes with degenerative changes were compared with that of the eyes without degenerative changes. Chi square test was used to analyse the data. While in the eyes with degree of myopia more -3 D upto 6D, the mean axial length difference between, the two is statistically significant ( p <0.01 ), in eyes upto 3D, the mean axial length difference between the two is not statistically significant ( p > 0.01).The mean deviation of axial length in eyes up to 3D was (23.06) while the range is (21.93-25.83).The mean deviation of axial length in eyes >3D up to 6D is 22.91 while range is (22.00-25.16).

**DISCUSSIONS**

The myopia or short sightedness occurs when the image of distant objects focussed by the cornea and lens falls in front of the sentinel layer of the retina when eye is at rest. It commonly arises from excessive postnatal eye growth, particularly in the vitreous cavity. Its etiology is poorly understood, but may involve genetic and environmental factors, such as viewing close objects, although how this stimulates eye growth is not known. It typically develops in the early school years but can manifest in early childhood. The postnatal development of these eyes is normal, as they are rendered myopic because of a correlation failure between total refractive power (cornea and lens) and a normal axial diameter. There is an expansion of the posterior segment of the globe. The fundus changes because of following reasons:1) tigroid fundus-because of RPE thinning,2)distinctive crescent formation with or without supertraction 3)the peripheral fundus shows an increasing prevalence of changes that are associated with increased axial diameter. The peripheral fundus changes can be...
classified as white without pressure, lattice, pigmented and paving stone degenerations. Degenerative myopia/progressive myopia/high myopia indicates a progressive error resulting in high myopia during early adult life which is usually associated with degenerative changes in the eye. Ex. pavingstone degeneration, lattice degeneration. Lattice degeneration is associated with one-third of retinal detachment. In high myopia, optic disc is vertically ovoid in shape and the cup: disc ratio found to be higher in moderate degrees of myopia. The term degenerative lesions of peripheral fundus refers to a group of polymorphous alterations of the peripheral retina, the choroid and the vitreous which have certain characteristics in common. The peripheral fundus is defined as the area of fundus anterior to the scleral entrance of the vortex veins to the middle of parsplana ciliaris, the anterior limit of visibility, the peripheral fundus is composed of an equatorial region and an oral region. The equatorial region is a ring shaped area of about 4DD(5.83mm)adjacent to the posterior fundus. It extends approximately 2DD on either side of the anatomic equator (which is located 2DD), 3mm anterior to the entrance of sclera canals. The main portion of each vortex vein and its ampulla is located in the region. The ora region or extreme fundus periphery is a ring extending on either side of the oraserrata, and its average width is about 3.5DD. At this site we find an intimate attachment of vitreous to the retina and ciliary body in an area known as the vitreous base. Most common peripheral retinal degenerative changes in myopia are white with and without pressure, lattice degeneration, pigmented, pavingstone, cystoids degeneration, snail track degeneration and chorioretinal degeneration. In the present study 200 eyes of 100 patients were studied and the following degenerative changes were noted. In the present study the following types of peripheral retinal degeneration were noted viz., Lattice degeneration, Chorioretinal degeneration, White without pressure, Paving stone degeneration. It shows that incidence of myopia is more common in females. This is comparable to the study of Lam DS, Fan DS study which was conducted on Chinese myopes with refraction ≤ 6D where incidence is more common in females. This is also comparable to the study of Ahmed M, Rasheed and Shajid Y, Shehab in which peripheral retinal degenerations were studied in myopic Iraqi patients in which female preponderance was seen. Similar study was reported by M.J.Venkatesan et al. clinical analysis of fundus in myopia in which observational study was conducted on 100 myopic patients among which 46 were males and 54 were females. This study shows the incidence of degenerative changes is common in the superotemporal quadrant. This is probably due to increased stretching and increased vascularity of retina in this area. Incidence of various degenerative lesions in superotemporal quadrant are lattice degeneration (52.94%), chorioretinal degeneration (83.33%), white without pressure (78.57%), paving stone degeneration (100%). This is comparable to the study of M.J.Venkatesan in which peripheral retinal degenerations showed increase in incidence in superotemporal quadrant.

CONCLUSIONS

The present study concludes that as the degree of myopia increases, the peripheral retinal changes also increases in myopes. The various lesions affecting peripheral retina showed a progression with advancing age in myopes, with a predilection for the super temporal quadrant. As the axial length of the eye increases, the degenerative changes also increased.

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