Original Article

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Refractive Errors of Patients between 20 and 40 Years and its Correlation with Axial Length

R Kumaraswamy[1], N Sivakumar[1], Heber Anandan[2], Mahammad Khaja Ramiz Uddin[3]

[1]Associate Professor, Department of Ophthalmology, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, [2]Senior Clinical Scientist, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India, [3]Clinical Research Coordinator, Dr. Agarwal's Eye Hospital, Hyderabad, Telangana, India

Abstract

Background: Refractive error is a common eye disorder. The result of the refractive error is a blurred vision which is sometimes so severe that it causes permanent visual disability due to amblyopia and complications such as retinal detachment in high myopia. Refractive errors cannot be avoided but identifying such errors is useful in planning appropriate correction early.

Aim: To study refractive errors in patients between 20 and 40 years of age and to correlate them with the axial length of the eyeball. The study also aims to find out the common refractive errors among this age group and to compare them with previous studies.

Materials and Methods: Patients between 20 and 40 years coming to the outpatient department in tertiary care hospital with complaints of defective vision were included in the study. The visual acuity and visual acuity with pinhole were assessed using Snellen's chart. Near visual acuity was also assessed. Retinoscopy and auto refractometry was used to assess the refractive status objectively. Subjective verification of refraction was done. Axial length of eyeballs was measured using A-scan ultrasonogram. Slit lamp and fundus examination was done to rule out other eye pathology.

Results: Refractive errors are more common in females. Myopia was more common than hypermetropia. Prevalence of astigmatism was high. Presbyopia affects adults >35 years. Females had slightly longer axial length than males. Axial length was longer than normal in myopes and shorter in hyperopes.

Conclusion: Refractive errors are commonly present among the economically productive age group. Early detection is needed for the effective correction of such errors to prevent morbidity.

Key words: Astigmatism, Axial length, Hypermetropia, Myopia, Presbyopia, Refractive errors

INTRODUCTION

Refractive error is a very common eye disorder. The result of the refractive error is blurred vision which is sometimes so severe that it causes permanent visual disability due to amblyopia and complications such as retinal detachment in high myopia. The common refractive errors occurring in our population include myopia, hypermetropia, astigmatism, and presbyopia. The number of people globally with refractive errors has been estimated from 800 million to 2.3 billion.[1] Refractive errors cannot be avoided but identifying such errors is useful in planning appropriate correction early. Refractive errors can occur due to various causes like change in axial length of eyeball; change in curvature of cornea and lens; change in refractive index of lens. Hypermetropia can occur congenitally whereas presbyopia is strongly related with age. This study is mainly based on changes in the axial length of the eyeball associated with refractive errors between 20 and 40 years of age. The study also aims to find out the common refractive errors among this age group.

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MATERIALS AND METHODS

In this prospective observational study, patients between 20 and 40 years coming to tertiary care hospital with complaints of defective vision were included. Institutional

Corresponding Author: Heber Anandan, No.10, South By-Pass Road, Vannarpettai, Tirunelveli - 627 003, Tamil Nadu, India. Phone: +91-9894067910. E-mail: clinicalresearch@dragarwal.com

Ethics Committee approval was obtained. 20-40 years was chosen because they are economically productive age group and the study aims to find out the prevalence of refractive error in such population. A total of 37 cases were taken for study after informed consent. The study was done during the period of August and September, 2013.

The visual acuity and visual acuity with pinhole was assessed using Snellen's chart. Near visual acuity was also assessed. Retinoscopy and auto refractometry was used to assess the refractive status objectively. Subjective verification of refraction was also done to arrive at the final distant and near refractive error and the best corrected visual acuity. Axial length of both eye balls was measured using A-scan ultrasonogram. Slit lamp examination and fundus examination was done to rule out other eye pathology. At the end of the study, statistical analysis was done on the number of patients affected by each refractive error and compared with standard results. Axial length between different refractive errors was also compared.

RESULTS

Based on age-wise distribution, most refractive errors occurred in age groups between 20 and 25 years (12 patients) and 31 and 35 years (12 patients). 9 patients were found between 36 and 40 years of age. Only four cases with refractive errors were seen between 26 and 30 years (Table 1).

3 cases of hypermetropia were reported among which 1 male and 2 female patients, these 3 cases had bilateral involvement of the eye (Table 2).

21 patients were diagnosed with Astigmatism, 15 female and 6 male patients, patients, 18 cases had bilateral involvement of the eye (Table 3). Out of these 21 cases, 6 had simple myopic astigmatism, 13 had compound myopic astigmatism, and 2 had mixed astigmatism. No case of simple hypermetropic astigmatism and compound hypermetropic astigmatism. Astigmatism more commonly affected persons between 31 and 35 years of age (8 patients) followed by patients between 20 and 25 years of age (7 patients). Age groups between 26 and 30 years and 36 and 40 years were least affected.

7 cases were diagnosed to have presbyopia. Among these 3 were males and 4 were females (Tables 4 and 5). Between 36 and 40 years 6 cases were reported. One case was found between 31 and 35 years.

Axial lengths of all the patients were recorded. Out of 6 myopes, four had their axial length within normal range and two had it longer than the normal value. 2 hypermetropic patients had shorter axial length, and one had it within the normal range. Axial length of the astigmatic patients

Table 1: Age-wise distribution of refractive errors in study population

Age (years)	Myopia (%)	Hypermetropia (%)	Astigmatism (%)	Presbyopia (%)
20-25	4 (66.67)	1 (33.33)	7 (33.33)	0 (0)
26-30	1 (16.67)	0 (0)	3 (14.29)	0 (0)
31-35	1 (16.67)	2 (66.67)	8 (38.1)	1 (14.29)
36-40	0 (0)	0 (0)	3 (14.29)	6 (85.71)

Table 2: Gender wise distribution of refractive errors in study population

Refractive error	Male (%)	Female (%)
Myopia	2 (16.67)	4 (16.67)
Hypermetropia	1 (8.33)	2 (8.33)
Astigmatism	6 (50)	15 (62.5)
Presbyopia	3 (25)	4 (16.67)

Table 3: Distribution of eye involvement in refractive errors in study population

Refractive error	Bilateral eye involvement (%)	Unilateral eye involvement (%)
Myopia	5 (83.33)	1 (16.67)
Hypermetropia	3 (100)	0 (0)
Astigmatism	18 (85.71)	3 (14.29)
Presbyopia	7 (100)	0 (0)

Table 4: Age-wise distribution of female patients who had refractive errors

Refractive error	Females-age group (years)			
	20-25	26-30	31-35	36-40
Myopia	2	1	1	0
Hypermetropia	0	0	2	0
Simple myopic astigmatism	0	0	3	1
Simple hypermetropic astigmatism	0	0	0	0
Compound myopic astigmatism	4	1	3	1
Compound hypermetropic astigmatism	0	0	0	0
Mixed astigmatism	0	0	2	0
Presbyopia	0	0	1	3

Table 5: Age-wise distribution of male patients who had refractive errors

Refractive error	Male age group (years)			
	20-25	26-30	31-35	36-40
Myopia	2	0	0	0
Hypermetropia	1	0	0	0
Simple myopic astigmatism	1	1	0	0
Simple hypermetropic astigmatism	0	0	0	0
Compound myopic astigmatism	2	1	0	1
Compound hypermetropic astigmatism	0	0	0	0
Mixed astigmatism	0	0	0	0
Presbyopia	0	0	0	3

Table 6: Distribution of axial length of refractive errors in study population

Refractive error	Number of patients (%)	
	Normal axial length	Abnormal axial length
Myopia	4 (66.67)	2 (33.33)
Hypermetropia	1 (33.33)	2 (66.67)
Myopic astigmatism	11 (52.38)	8 (38.01)
Presbyopia	7 (100)	0 (0)

did not show significant changes, but myopic astigmatic patients showed variations (Table 6).

The analysis was made with the mean values. With reference to age, mean age of occurrence of different refractive errors were found. Out of 24 females, the mean age of affected female was 30.8 years. Of 12 males, the mean age of affected male was 28.25 years. The median age for myopia was 25 years and for hypermetropia was 30 years. Patients with astigmatism and presbyopia had the mean age of 28.95 years and 38.57 years, respectively.

DISCUSSION

In this study, based on age-wise distribution, most refractive errors occurred in age group between 20 and 25 years (33.33%) and 31 and 35 years (33.33%). No standard study results are available to support these results as most of the studies are conducted only in school children and adolescents unil 18 years of age. 20-40 years is chosen in this study because they are the economically productive age group. There is a significant female preponderance for refractive errors with male:female ratio of 1:2.[2,3] 16.67% of the total cases were myopes.

33.33% of myopes were males, and 66.67% were females. Myopia was more common among females. This result was in concordance with the standard study results.[1-6] 66.67% of the myopes were between 20 and 25 years of age.

Myopia was common among employed (83.33%) than the unemployed (16.67%). This result was found to be in concordance with the study conducted in Bangladesh by Bourne *et al.*[7] 83.33% of the myopic patients had bilateral eye involvement and 16.67% had unilateral eye involvement.

Hypermetropia was less prevalent in this age group (8.33%). Among them, 33.33% were males and 66.67% were females. Hypermetropia was more common among females. Standard studies have proved that 4-7% of the population between 15 and 20 years are affected by hypermetropia, the trend remains constant through early middle age and increases after 45 years of age.[8] Studies have also shown a preponderance of hypermetropia toward females.

58.33% of the total cases were astigmatism. Among them, 28.57% were males and 71.43% were females. The prevalence of astigmatism is high in this study as shown by standard study results[1-3,9,10] 61.90% of the patients had compound myopic astigmatism, and 28.57% had simple myopic astigmatism. The most vulnerable age groups were between 31 and 35 years (38.1%) and 20 and 25 years (33.33%). Among 21 cases, 85.71% had bilateral eye involvement, and 14.28% had unilateral eye involvement.

Among 37 cases, 19.44% had presbyopia. 42.86% of these were males, and 57.14% were females. All the presbyopic patients were above 35 years of age. Standard studies have proved that presbyopia affects most adults over 35 years of age,[11,12] International study by Lourdes LI Llorente *et al.*, have shown that presbyopic changes occur early in hyperopes than myopes.[13] All the cases showed bilateral eye involvement. When myopia and hypermetropia are compared, myopia (16.67%) more commonly affects population between 20 and 40 years than hypermetropia (8.33%). This result coincides with the study conducted in rural South Indian population by Raju *et al.*, which proved that prevalence of myopia was more than that of hypermetropia.[8]

Axial lengths of all the patients were recorded. They were found to vary significantly in myopic and hypermetropic patients. In our study, we found that females had slightly longer axial length than the males. This is in concordance with the study conducted in UK University and Central India.[14,15] 33.33% of the myopes had longer axial length. 66.67% of hypermetropes had shorter axial length. This fact has been proved by many studies.[13-16] 38.01% of the myopic astigmatism patients had longer axial length. The axial length did not vary significantly with presbyopic patients proving that it has no relationship with axial length. Presbyopia develops due to loss of power of ciliary muscles and change in curvature of the lens.[11,13,16] 66.67% of the myopes and 33.33% of the hyperopes had normal axial length. This indicates that refractive error could have resulted from causes other than change in axial length like change in curvature of cornea, lens; change in refractive index of lens.[5,17-19] Axial length change was an important risk factor for the development of hypermetropia and not so with myopia.

In our study, 66.67% of the myopes and 33.37% of the hyperopes had normal axial length. The refractive error could have occurred due to reasons like change in curvature of the cornea, lens; change in refractive index of lens. Axial length has no correlation with presbyopia, and it remains normal.

With reference to age, the mean age of occurrence of refractive errors among males was 28.25 years (standard deviation: ±7.81) and among females was 30.8 years (standard deviation: ±6.30). Mean age for developing myopia was 25 years (standard deviation: ±5.48) and for hypermetropia was 30 years (standard deviation: ±6.24). Patients with astigmatism and presbyopia had the mean age of 28.95 years (standard deviation: ±6.38) and 38.57 years (standard deviation: ±1.9) respectively. All patients with refractive errors were corrected with appropriate lenses. Most of the patients regained 6/6 vision following correction with lens.

CONCLUSION

Among the refractive errors astigmatism and myopia are common between 20 and 40 years of age with female preponderance. This being the economically productive age group needs special attention for early detection of refractive errors so that they can be effectively corrected to regain normal vision and prevent morbidity. Hence, the need for screening at this age group should be emphasized.

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