MEDICAL CHANNEL

Original Article

REFRACTIVE ERRORS AND THEIR RELATION TO AGE AND SEX

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ABSTRACT :

Objective: To see the prevalence of different refractive errors and their relation to age and sex in our community.
Study design: Hospital based cross sectional study
Place and duration of study: Out-patient department of Ziauddin University Hospital, from April 2009 to September 2009.
Results: Total of 1824 patients were included in the study. Mean age was 28.12 ±14.174 years. Males were 776 (42.5 %) and 1048 (57.5%) were females. In both sex the most frequent refractive error was myopic astigmatism which was found in 740 (40.6%) patients with equal frequency in both sex and the second frequent refractive error was myopia in 570 (31.3%) of patients with males accounting for 28.4% (220 patients) and females 33.4 % (350 patients) (p-value 0.003). Myopia and myopic astigmatism was the most frequent refractive error in age group ranging from 16-30 years i.e. 39% and 51.1% respectively (p-value 0.001).

Key words: refractive error, myopia, hypermetropia, refraction

INTRODUCTION

Correction of refractive error is cheap and effective with corrective spectacles and result in high functional improvement.[1] Persons who access treatment for refractive error generally are not disabled thus it is the most important factor for the elimination of avoidable blindness.[2] Refractive errors are among the most common cause of visual impairment worldwide. As its onset is earlier as compared to cataract, it can account for twice as many blind person year. It has severe social and economic effects on individuals and communities, restricting educational and employment opportunities of otherwise healthy individuals.[3]

In Pakistan errors of refraction account mostly for low vision and visual handicap and is the third largest cause of preventable / curable blindness, so it is one of the priority areas of vision 2020 intiative.[4] The impact of blindness due to refractive error is very high as compared to cataract as it start at young age and would place a great socioeconomic burden on society.[5] The aim of our study is to see the frequency of different refractive errors prevailing in our patients and provide correction with spectacles.

MATERIAL AND METHOD:

All patients, age ranging from 6 to 75 years attending the out-patient department of Ziauddin University Hospital were screened.

Visual acuity was performed with Snellens chart in all patients and auto-refraction was done with HUVITZ MRK-3100 Premier Autoref/Keretometer. Retinoscopy was performed in cases where auto-refraction was doubtful, cycloplegic refraction was done in young children. Complete ocular examination, distant direct ophthalmoscopy, fundoscopy and slitlamp examination was performed.

TABLE 1.
Relation of refractive error to sex

sex	Myopia N=570	Hypermetropia N=220	Myopic Astigmatism N=740	Hypermetropic Astigmatism N=164	Mixed Astigmatism N=48	Anisometropia N=82	p-value
Male	220(28.4%)	94(12.1%)	312(40.2%)	84(10.8%)	18(2.3%)	48(6.2%)	0.003
Female	350(33.4%)	126(12.0%)	428(40.8%)	80(7.6%)	30(3.2%)	34(3.2%)	

TABLE 2
relation of refractive error to age

Age group	Myopia N=570	Hypermetropia N=220	Myopic Astigmatism N=740	Hypermetropic Astigmatism N=164	Mixed Astigmatism N=48	Anisometropia N=82	p-value
6-15 yrs	192(42.5%)	06(1.3%)	214(47.3%)	12(2.7%)	18(4.0%)	10(2.2%)	
16-30 yrs	244(39%)	20(3.2%)	320(51.1%)	14(2.2%)	10(1.6%)	18(2.9%)	0.001
31-45 yrs	106(20.6%)	128(24.9%)	150(29.2%)	76(14.8%)	12(2.3%)	42(8.2%)	
46-60 yrs	24(11.2%)	62(29%)	50(23.4%)	62(29%)	4(1.9%)	12(5.6%)	
61-75 yrs	4(22.2%)	4(22.2%)	6(33.3%)	0(0%)	4(22.2%)	0(0%)	

Inclusion criteria:

1. All patients, age ranging from 6 to 75 years.
2. Those having refractive error were included in the study.

Exclusion criteria:

Patients with corneal problems, cataract, glaucoma, pseudophakia, retinal and optic nerve problems were excluded from the study.

RESULTS:

Total of 1824 patients were included in the study. Mean age was 28.12 ±14.174 years. In age group 6-15 years there were 452 (26.05%) patients, in age group 16-30 there were 626 (34.32%) patients,31-45 years age group had 514(28.17%),46-60 years age group had 214(11.73%) and 61-75 years had 18(0.98%) patients. Out of 1824 patients, 776 (42.5 %) were males and 1048 (57.5%) were females. In both sex the most frequent refractive error was myopic astigmatism which was found in 740 (40.6%) patients with equal frequency in both sex and the second frequent refractive error was myopia in 570 (31.3%) patients with males accounting for 28.4% (220 patients) and females 33.4 % (350 patients) (p-value 0.003). The frequency of different refractive errors is given in table No.1.

Myopia and myopic astigmatism was the most frequent refractive error in age group ranging from 16-30 years i.e. 39% and 51.1% respectively (p-value 0.001). Relation of different age groups to different refractive errors is given in table No.2.

DISCUSSION:

This study was designed to see the prevalence of different refractive errors and their relation to age and sex in patients attending out patient department of Ziauddin University Hospital. Myopic astigmatism and myopia was the most frequent refractive error found in the patients. Similarly according to Shah SP et al the crude prevalence of myopia, hypermetropia and astigmatism was 36.5%, 27.1%, and 37%, respectively.[6]

Refractive error and age:

With regards to age myopia and myopic astigmatism were more common in patients of age group from 6 years to 45 years with peak prevalence in ages 16 to 30 years. Its frequency declined after 45 years of age. Whereas study done by S Sethi et al in children with mean age group 6 years found astigmatism in 46.6% (140 of 300) patients with refractive error, mixed astigmatism was more common.[7] On the other hand High prevalence of myopia and hyperopia were found in a large black adult population, but the prevalence of myopia increased and hyperopia decreased after 60 years, Which was attributed to the high prevalence of age related cataract, glaucoma and other eye conditions.[8] According to Rakhi Dandona et al, In urban population above 15 years, myopia was the most common refractive error and in children refraction done under cycloplegia again myopia was more common.[9] Study done on Segovia population More than 60% over 40 years of age has a refractive error, with 25.4% myopic and 43.6% hyperopic. Astigmatism was present in over half of the population and the types change with age.[10]

In accordance to our study, Hyperopia and/ astigmatism was more common in persons above 60 years of age whereas myopia was the most common refractive error amongst younger persons. In US population, prevalence of myopia by age and sex was similar. Hyperopia was more common in persons above the age of 60 years, affecting women (12.9%) than in men (6.6%) ($P < .001$).[11] Study done by Hashim SE for prevalence of refractive error in primary school children the ethnicity-specific prevalence rate of myopia was the lowest among Malays in Kota Bharu, followed by Kuala Lumpur, and was the highest among Singaporean Malays. Better socio-economic factors could have contributed to higher myopia rates in the cities, since the genetic background of these ethnic Malays are similar.[12]

We found hypermetropia and hypermetropic astigmatism more in age group 31-60 years. According to John H. Kempen etal, With

increasing age prevalence of hyperopia was higher and myopia is the most common disorder in age group (31-60years). This study also indicated that the crude prevalence of myopia is the highest of any eye disorder in this age group, affecting about 1 in 4 persons in the United States and Western Europe, and about 1 in 6 Australians.[13] We found that the prevalence of myopia was lowest in participants 60 years and older, consistent with other population-based studies.[14, 15] Although it is possible that the lower prevalence of myopia in those 60 years and older is because of a cohort effect, as reported in other, younger populations.[16, 17] This observation may also be because of intrinsic, age-related changes in the refractive components of the eye.[18,19]

Refractive error and sex:

Myopia was more frequent in females (33.4%) as compared to males (28.4%), whereas myopic astigmatism was found to be equally prevalent in both males (40.2%) and females (40.8%). Whereas study from Mashhad Iran showed the prevalence of myopia was 27.2% (95% confidence interval (CI) 24.8–29.5); 29.6% in men and 22.5% in women (P < 0.001). The rate of myopia showed an increase with age. On the other hand hyperopia was more common in women than in men and its prevalence significantly decrease with age. The prevalence of astigmatism in the studied sample was 37.5% (95% CI, 34.9% to 40.0%).[20]

According to Robert N Ket, study of refractive error in children, only the prevalence of myopia differed significantly by sex, but using the predetermined 5% criterion for clinical significance, these sex differences were not considered clinically.[21]

In the Regional Institute of Ophthalmology, Kolkata. Among 2317 students examined, myopia being the commonest (n = 325; 14.02%). Astigmatism affected 91 children (3.93%). There was an increase prevalence of refractive errors with increase of age, but it was not statistically significant. There was also no significant difference of refractive errors between boys and girls.[22]Study on Singapore medical students, there was a higher rate of myopia in males (33.3%) compared to females (19.2%), though this relationship was only found to be of borderline significance. The overall prevalence rate of astigmatism was 82.2%, 85.7% of male medical students and 75% of female medical students were found to have astigmatism (cylinder of at least - 0.50 D).[23]

In a Malysian study in primary school children myopia detected in 38 students, contributing 77.5% of total refractive error. More girls were noted to have myopia approximately with a ratio of 2:1.[24]In Barbados eye study The incidence of myopia was 21.9% whereas hyperopia was 46.9%.[26] The prevalence of myopia was 6.8% in Chile,[27] substantially lower than the 16.2% in China[28] and more than the 1.2% in Nepal[29] or the 4.1% in rural India.[30] Myopia of any severity was associated with female gender in rural india and china.[31]Hypermetropia and hypermetropic astigmatism was equally prevalent in both sex. On the other hand anisometropia was more prevalent in males (6.2%) as compared to females (3.2%). In Andra Pardesh study, incidence of hyperopia was more common in females than in males, it may be due to smaller sized eyes in females.[32]

In rural India the incidence of myopia was 26.99% and increased significantly with age. The hyperopia was more common in women than men and amongst diabetics. Hyperopia increased until the age of 60 years and then decreased.[33] The prevalence of hyperopia was 3.5% and 16.3% reported in China[28] and Chile[27] respectively, 1.4% found in rural Nepal[29] and the 0.8% in rural India.[30]. The association between female gender and hyperopia was also found in China, Nepal, and Chile.

In summary refractive error of magnitude expected to require refractive correction was present in our study group of patients and there was a strong correlation of refractive error to age and sex.

CONCLUSION:

Most common refractive error in our study was Myopic astigmatism and Myopia followed by hypermetropia. Myopic astigmatism and Myopia was more common in younger age group and its frequency decreased with age whereas hypermetropia was found to be increased with increasing age. There were more females with myopia and myopic astigmatism but hypermetropia did not differ in both genders. Refractive error can be corrected with properly fitted corrective glasses & contact lenses. Eyeglasses are the simplest, commonest and safest way to correct refractive errors. A variety of refractive surgery procedures are available to correct refractive error. The most appropriate correction depends on eyes and lifestyle of individual. Persons who got correction for the refractive error are no more disabled. Inadequately corrected refractive error is a very common cause of the problems in the case of high refractive errors because it changes high refractive error into lower one and causes mild visual impairment.

REFERENCES:

1. Kempen JH, Mitchell P, Lee KE, Tielsch JM, Broman AT, Taylor HR, Ikram MK, Congdon NG, O'Colmain BJ. The Prevalence of Refractive Errors Among Adults in the United States, Western Europe, and Australia. Arch Ophthalmol. 2004 ;122(4):495-505.
2. World Health Organization: Programme for the Prevention of Blindness and Deafness. Global Initiative for the Elimination of Avoidable Blindness. 1997;1–7. Dandona R, Dandona L. Refractive error blindness. Bull World Health Organ. 2001;79(3):237–243.
3. Durani J. Blindness statistics for Pakistan. Pak J Ophthalmol. 1999; 15:1-2.
4. Dandona R, Dandona L. Refractive error blindness. Bull World Health Organ. 2001;79(3):237–243.
6. Shah SP, Jadoon MZ, Dineen B, Bourne RR, Johnson GJ, Gilbert CE, khan MD. Refractive errors in the adult pakistani population: the national blindness and visual impairment survey. Ophthalmic Epidemiol. 2008;15(3):183-90.
7. Sethi S, Sethi MJ, Hussain I, Khan T. Refractive errors in children attending out-patient department of ophthalmology, khyber teaching hospital, peshawar . Pakistan Armed Forces Journal. 2008:4
8. Wu SY, Nemesure B, Leske MC. Refractive Errors in a Black Adult Population: The Barbados Eye Study. Investigative Ophthalmology and Visual Science. 1999;40(10):2179-2184.
9. Dandona R, Dandona L, Naduvilath TJ, Srinivas M, McCarty CA and Rao GN. Refractive Errors in an Urban Population in Southern India: The Andhra Pradesh Eye Disease Study. Investigative Ophthalmology and Visual Science. 1999;40(12):2810-2818.
10. Antn A, Andrada MT, Mayo A, Portela J, Merayo J. Epidemiology of Refractive Errors in an Adult European Population: The Segovia Study. Ophthalmic Epidemiology. 2009;16(4):231 – 237.
11. Vitale S, Ellwein L, Cotch MF, Ferris FL, Sperduto R. Prevalence of Refractive Error in the United States 1999-2004 Arch Ophthalmol. 2008;126(8):1111-1119.
12. Hashim SE, Tan HK, Wan-Hazabbah WH, Ibrahim M, Prevalence of refractive error in malay primary school in suburban area of Kota Bharu, Kelanttan. Annals Academy of Medicine Singapore, 2008; 37 (11): 940-6
13. Kempen JH, Mitchell P, Lee KE, TielschJM, Broman AT, TaylorHR, Ikram K et al. The prevalence of refractive errors among adults in the united states, western europe, and Australia. Arch Ophthalmol. 2004;122:495-505.

14. Shufelt C, Fraser-Bell S, Ying-Lai M, Shufelt C, Fraser-Bell S, Ying-Lai M, Torres M, Varma R. Refractive error, ocular biometry, and lens opalescence in an adult population: the Los Angeles Latino Eye Study. Invest Ophthalmol Vis Sci. 2005;46(12):4450-4460.
15. Lee KE, Klein BE, Klein R. Changes in refractive error over a 5-year interval in the Beaver Dam Eye Study. Invest Ophthalmol Vis Sci. 1999;40(8):1645-1649.
16. Bar Dayan Y, Levin A, Morad Y, et al. The changing prevalence of myopia in young adults: A 13-year series of population-based prevalence surveys. Invest Ophthalmol Vis Sci. 2005 Aug;46(8):2760-2765.
17. Rose K, Smith W, Morgan I, Mitchell P. The increasing prevalence of myopia: implications for Australia. Clin Experiment Ophthalmol. 2001;29(3):116-120.
18. Mutti DO, Zadnik K. Age-related decreases in the prevalence of myopia: longitudinal change or cohort effect? Invest Ophthalmol Vis Sci. 2000;41(8):2103-2107.
19. Hemenger RP, Garner LF, Ooi CS. Change with age of the refractive index gradient of the human ocular lens. Invest Ophthalmol Vis Sci. 1995;36(3):703-707.
20. Yekta AA, Fotouhi A, Khabazkhoob M, Hashemi H, Ostadimoghaddam H, Heravian J and Mehravaran S. The prevalence of refractive errors and its determinants in the elderly population of mashhad, iran. Ophthalmic Epidemiology 2009;16(3):198-203.
21. Kleinstein RN, jones LA, hullett S, kwon S, lee RJ, friedman NE, many RE, mutti DO, yu JA, zadnik K. Collaborative longitudinal evaluation of ethnicity and refractive error study group. Arch Ophthalmol. 2003;121(8): 1141- 1147.
22. Himadri D; Gautam B ; Ajay D; Krishnendu S ; Manas B. A study on refractive errors among school children in Kolkata. J Indian Med Asso. 2007; 105 (4): 169-72
23. Woo WW, Lim KA, Yang H, Saw SM, Lim XY, Liew F, Lee YS. Refractive errors in medical students in Singapore. Singapore Med J. 2004;45 (10):470-74.
24. Hashim SE, Tan HK, Hazabah W, Ibrahim M. prevalence of refractive error in Malay primary school children in Suburban area of K ota Bharu,Kelantun Malaysia. Ann Acad Singapore 2008;37:940-6.
25. Onal S, Toker E, Akingol Z, Arslan G, Ertan S, Turan C, Kaplan O.Refractive error of Medical studdentts in Turkey. one year followup of refraction and biometry. Optm vis sci, 2007; 84 (3): 175-80
26. Wu SY, Nemesure B, Leske MC. Refractive errors in a black adult population: the barbados eye study investigative ophthalmology and visual science. 1999;40:2179-2184.
27. Maul E, Barroso S, Munoz SR, Sperduto RD, Ellwein LB.Refractive error study in children: results from la florida county, chile am j ophthalmol 129:445-454
28. zhao, j, pan, x, sui, r, munoz, sr, sperduto, rd, ellwein, lb. Refractive error study in children: results from shunyi district, china. am j ophthalmol 2000;129(4):427-435.
29. Pokharel, GP, Negrel, AD, Munoz, SR, Ellwein LB. Refractive error study in children: results from mechi zone, Nepal. am j ophthalmol 2000;129(4): 436- 444.
30. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Muñoz SR, Pokharel GP, Ellwein LB. Refractive error in children in a rural population in India. invest ophthalmol vis sci. 2002;43(3):615-622.
31. G. V. S. Murthy, Gupta SK, Ellwein LB, Munoz SR, Pokharel GP, Sanga L and Bachani D. Refractive error in children in an urban population in new delhi. investigative ophthalmology and visual science. 2002;43:623-631.
32. Dandona R, Dandona L, Naduvilath TJ, Srinivas M, Mccarty CA and Rao GN.Refractive errors in an urban population in southern india: the andhra pradesh eye disease study. Investigative Ophthalmology and Visual Science. 1999;40(12):2810-2818.
33. Raju P, Ramesh SV, Arvind H, George R, Baskaran M, Paul PG, Kumaramanickavel G, Mccarty C, and Vijaya L. Prevalence of refractive errors in a rural south indian population. investigative ophthalmology and visual science. 2004;45:4268-4272.