

Pattern of refractive error in urban and rural young adult population – A hospital based study

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Abstract

Introduction: Uncorrected Refractive errors are the second largest cause of impaired vision and blindness world wide causing considerable morbidity and economic loss to the society. Evaluation of uncorrected refractive error helps in Planning of community eye services.

Purpose: Study was conducted to know the pattern of refractive error in urban and rural young adults.

Materials and Method: Study was conducted simultaneously at an Urban and a Rural centre. All enrolled subjects were interviewed through a questionnaire regarding complaints, family history and life style. Ocular examination and refraction was done and refractive error <-0.5 , in Myopes and $>+0.5D$ in hyperopes was recorded and Data statistically analysed.

Results: Among 1784 subjects 963 were urban and 821 were Rural, M:F ratio was 1:1.13. Mean age of cases in urban and rural population was $28.8sd \pm 5.2$ and $30.2sd \pm 6.01$ years respectively. Headache and decreased vision were common presenting symptoms seen in (29.03%) and (28.02%) subjects respectively. Myopia was prominent in urban population (60.33%) and hypermetropia was common in rural population (52.50%) ($p < 0.000001$). Myopia was significantly associated with indoor activity (62.51%) ($p < 0.000001$). 16.58% of myopes had significant positive family history. ($p < 0.000001$).

Conclusion: Myopia is more prevalent in urban and hyperopia in rural population, family history and indoor activities are significantly associated with myopia.

Keywords: Blindness, Myopia, Hypermetropia, Refractive Error, Spectacles, Visual Acuity

Introduction

Refractive error if not identified or treated in time will cause substantial visual morbidity leading to decreased productivity, and physical quality of life index (PQLI). Uncorrected refractive errors can also lead to amblyopia. Most of the refractive errors can be diagnosed by screening and correction of refractive errors can be done by spectacles which improves the quality of life in an individual. Identification of refractive error pattern in a population helps in defining health strategies and planning of eye care delivery system. Refractive error is one of the most common cause of mild to moderate loss of vision in a community.⁽¹⁾ Previous studies have estimated the burden of refractive error in adult urban population of >15 years of age in India to be around 49.3 million.⁽²⁾ During last decade various studies on prevalence of refractive errors in various groups have revealed a change in the pattern of refractive errors in various age groups, depending on the race, education, gender and ethnicity of the population under study.⁽³⁾ There are many studies on the screening and relevance of refractive errors in children and elderly but very few studies have been reported with refractive error in young adults of 20 – 40 years of age. Andhra Pradesh eye disease study is one of the major studies conducted by Dandona et al⁽⁴⁾ they reported refractive error as second most common treatable blindness in the most part of the world and Andhra Pradesh as well, accounting for 16.3% of total blindness.^(1,4) Genetic

factors have shown to play a major role in the occurrence and progression of refractive errors. Myopia has been observed in cluster families.⁽⁵⁾ Recent shift is towards Environmental factors which play major role in determining the extent and progression of refractive errors, myopia is closely associated with indoor activities and near work.⁽⁶⁾ Age, Gender, Area adjusted prevalence of myopia is 34.6% and hyperopia is 18.45 in Indian population which is different as compared to white population.⁽⁷⁾ Refractive error has got its impact in all sector of the society like on individual restricting educational and employment opportunities to a youth in a community, refractive error accounts for twice as many blind person years when compared to cataract.⁽⁸⁾ Percentage of population aged 16 – 39 years globally who have decreased vision due to uncorrected refractive error is 27 million which represents 1.1% of global figure.⁽⁹⁾

Purpose of the study

This study was undertaken to know the pattern of the refractive error in young adults between 20 - 39 years of age and eye care seeking pattern in urban and rural young adults.

Materials and Methods

Inclusion criteria: Subjects aged between 20 -39 years, with complaints of

1. Decreased vision due to refractive error
2. Asthenopia

3. Headache

Exclusion criteria:

1. Subjects < 20 years of age.
2. Subjects \geq 40 years of age.
3. Pre existing corneal scar.
4. Pre existing corneal degeneration.
5. Pre senile or developmental cataract.
6. History of ocular injury.
7. History of ocular surgery.

This was prospective study conducted on 1784 subjects. 963 urban subjects and 821 rural subjects. Prior approval from institutional ethical committee was taken. Informed consent was taken from subjects willing to participate in the study. Subjects for urban center were selected from a tertiary Eye Care Centre at Hyderabad and subjects for rural center were selected from ophthalmology OPD of Rural Medical College Hospital. Age and Sex of the subject was recorded and detailed history was taken to elucidate presenting complaints, patients who had multiple presenting complaints, most prominent complaint was recorded. Family history of using glasses was enquired, family history – was taken as positive if any of the siblings or parents had been using glasses for distant vision since their younger days. Details of Present lifestyle, working pattern and number of hours spent indoors / outdoors was enquired and documented, any person spending more than 8 hours in a day indoors and involved in near work like computers workers, bank accountants, software engineers were grouped under indoor workers. Subjects who spent more than 8 hours in outside work, like marketing executives, farmers were grouped as outdoor workers. Complete ocular examination and refraction was done in all cases, refractive error was noted. Refractive errors < - 0.5 in myopes and > +0.5D in hyperopes were taken into account and grouped under myopia and hypermetropia respectively. In astigmatism spherical equivalent was taken and grouped accordingly. Data was compiled and Statistical Analysis of the results was done using EPI INFO 7 software. Chi square test was employed for data analysis and p value less than <0.5 was considered to be significant.

Results

Gender: Out of total 1784 Urban and Rural subjects examined 1034 (57.95%) were males and 750 (42.04%) were females with M:F ratio of 1:1.13. Out of 963 urban subjects 521 (54.10%) were males and 442 (45.89%) were females with M:F ratio of 1:1.17. Among 821 rural population 513 (62.48%) were males and 308 (37.51%) were females with M:F ratio of 1:1.6. **Age:** Mean age of urban subjects was 28.8 years (sd \pm 5.2 Years). Maximum subjects were in the age group of 20 – 25 years 351 (36.44%) followed by 247 (25.64%) in 31 – 35 age group. Median and Mode age of Urban subjects was 28 and 25 years respectively. Mean age of Rural subjects was 30.2 years (sd \pm 6.01

Years). Maximum subjects were in the age group of 30 – 35 years 242 (29.47%) followed by 216 (26.30%) in 26 – 30 age group. median and mode age of Rural subjects was 29 and 25 years respectively.

Refractive Error: Out of total 1784 urban and rural subjects examined 971 (54.43%) were myopes and 813 (45.57%) were hypermetropes. Among 963 Urban population 581 (60.33%) were myopes and 382 (39.67%) were hypermetropes and among 821 Rural population 390 (40.16%) were myopes and 431 (52.50%) were hypermetropes, myopia was found to be significantly prevalent in urban population with p value of $p < 0.000001$ as compared to Rural population.

Presenting Complaints: Headache was the most common Presenting Complaint observed in 264 (27.41%) of urban and 254 (30.93%) of Rural population, followed by decreased visual acuity seen in 259 (26.89%) of urban and 241 (29.35%) of rural subjects. 216 (22.42%) of urban subjects presented themselves for regular eye check up and got examined. Subjects who had multiple complaints most prominent complaint was taken into account and documented.

Family History: Family history was positive in 161 (16.58%) of Myopes and 21 (2.55%) of hyperopes, familial association of myopia was statistically significant ($p < 0.000001$).

Life Style: Life style and Work pattern enquiry revealed myopia was associated with 607(62.51%) of indoor workers and 364(37.48%) outdoor workers. Hypermetropia was seen in 354 (43.54%) of indoor workers and 459(56.46%) of outdoor workers. Association of Myopia with indoor workers was statistically significant ($p < 0.000001$).

Table 1: Gender

	Urban	Rural	Total n = 1461
Male	521 (54.10%)	513 (62.48%)	1034 (57.95%)
Female	442 (45.89%)	308 (37.51%)	750 (42.04%)
Total	963	821	1784
M:F	1:1.17	1:1.6	1:1.3

Table 2: Age

Age years	Urban (A)963	Rural (B)821
20 -25	351 (36.44%)	208 (25.33%)
26 – 30	213 (22.11%)	216 (26.30%)
31 – 35	247 (25.64%)	242 (29.47%)
36 – 40	152 (15.78%)	155 (18.87%)
Total	963	821

Table 3: Refractive Error

	Urban	Rural	Total
Myopia	581 (60.33%)	390 (40.16%)	971 (54.43%)
Hypermetropia	382	431	813

	(39.67%)	(52.50%)	(45.57%)
Total	963	821	1784

uncorrected chi square X^2 29.40 ($p < 0.000001$) significant

Table 4: Presenting Complaints

	Urban n=963	Rural n= 821	Total n=1784
Head ache	264 (27.41%)	254 (30.93%)	518(29.03%)
Decreased vision	259 (26.89%)	241 (29.35%)	500(28.02%)
Routine check	216 (22.42%)	138 (16.80%)	354(19.84%)
Eye pain/strain	151 (15.68%)	126 (15.34%)	277 (15.52%)
Watering	31 (3.21%)	26 (3.16%)	57(3.19%)
Repeated styte	42 (4.36%)	36 (4.38%)	78(4.37%)
Total	963	821	1784

Table 5: Family History

	Positive	Negative	Total
Myopia	161(16.58%)	810 (83.42%)	971
Hypermetropia	21 (2.5%)	792 (97.42%)	813
Total	182 (10.2%)	1602 (89.8%)	1784

uncorrected chi square $x^2=94.64$ ($p < 0.000001$) significant

Table 6: Life Style

	Myopia	Hypermetropia	Total
Indoor	376 (U) +231(R) = 607	179(U) +175(R) =354	971
Out door	205(U) +159(R) =364	203(U) +256(R) ==459	813
Total	581 U)+390 (R)= 971	382 U)+431(R) = 813	1784

	Myopia	Hypermetropia	Total
Indoor	607(62.51%)	354 (43.54%)	961(53.87%)
Out door	364(37.48%)	459 (56.46%)	823(46.13%)
Total	971	813	1784

uncorrected chi square X^2 64.08 ($p < 0.000001$) significant

Discussion

Gender: In present study 57.95% of cases were males and 42.05% of cases were females with Male Female ratio of 1:1.3. Damian Czepita in his study of gender occurrence of refractive errors concluded that gender influences the refractive errors in school children.⁽¹⁰⁾ Survey of National blindness and low vision in Bangladesh by Bourne et al revealed that 49.1% of subjects were males and 50.9% of subjects were females.⁽¹¹⁾ As we compared urban to rural population male female ratio varied, in rural population percentage male population with refractive error was more, this could be explained by the fact that in rural India health seeking behavior among female is delayed due to various factors like home remedies, presence RMP doctors, ignorance, cost of treatment etc.⁽¹²⁾

Age: Mean age of urban and rural population was 28. 8 years and 30.2 years respectively maximum clustering of study population was seen in 20- 25 years age group 36.44% in urban population and 31- 35 years 29.47% in rural population difference in age group could be explained due to lack of eye care facilities in rural in roads as compared to urban areas. Jabeen et al in their

study of adolescent Kashmir population reported mean age group of 14.3 years.⁽¹³⁾

Refractive Error: In present study 54.4% of subjects were myopes and 45.5% of subjects were hyperopes, myopia was more common in young urban adults seen in 60.33% of cases as compared to their rural counterparts, on the other hand hyperopia was more prevalent in rural adults, seen in 52.5% of cases, the difference was statistically significant ($p < 0.000001$). This could be attributed to increased indoor activities in urban population as compared to their rural counterparts. S Krishnaiah et al in their study concluded that prevalence of myopia in adult Indian population is higher than age matched white population.⁽⁷⁾ IP Jm et al in their study reported that myopia was more prevalent in the inner city(17.8%) regions as compared to suburban regions(6.9%).⁽¹⁴⁾ Study done in Tamilnadu by Prema et al. There was prevalence of higher myopia in rural population and there was increased prevalence of hyperopia in urban population ($p=0.001$) this was in contrast to our study results, this could be attributed to the difference in age group of study population(>39).⁽¹⁵⁾ wolfram et al in his Gutenberg Health Study reported more myopes(35.1%) than hyperopes (31.8%) in adult

population than other study cohorts.⁽¹⁶⁾ Study done by Saw SM et al in Indonesia (Sumatra province) showed higher prevalence of myopia (26.1%).⁽¹⁷⁾

Presenting Complaints: Headache was the most common mode of presentation in all subjects with refractive error (29.03%), followed by decreased visual acuity as next complaint or mode of presentation seen in (28.02%). The International Headache Society (IHS) has classified headaches seen refractive errors as headache associated with refractive errors (HARE). Gil-Gouveia R, and Martins IP interviewed 105 subjects with head ache and assessed its relation to refractive error and visual effort, they found that head ache was seen in 6.7% of cases of refractive errors as compared to 0% in controls and headache improved in 72.5% of cases after correction of refractive error.⁽¹⁸⁾ Uncorrected refractive errors are known to cause Moderate to severe visual Impairment(MVSI), Naidoo KS and his associates did a systematic review of global visual impairment secondary to uncorrected refractive error and concluded that Moderate to severe visual Impairment(MVSI) ranged from 44.2% to 48.1% in all regions except in South Asia which was at 65.4%.⁽¹⁹⁾

Family history: In present study 16.5% of myopes had significant positive family history ($p < 0.00001$) and only 2.5% of hyperopes had positive family history. Zhang X and his associate in a meta analysis identified significant association between parental myopia and risk of child developing myopia and risk was even higher when both the parents were myopic.⁽²⁰⁾ Jenny M et al in their study emphasized that family history and parental myopia was more strongly associated with spherical equivalent refraction of child.⁽²¹⁾

Life Style: In present study it was observed that myopia was significantly associated with indoor workers (62.51%) ($p < 0.00001$). Zhonglin and his colleagues in "The Beijing Myopia Progression Study" identified primary school subjects who spent more time (Hours) in outdoor activities exhibited relatively less myopic refraction than their peer group (p trend = 0.0003).⁽²²⁾ In a study of greater Beijing by Yin Guo indicated that there was a significant change in oculometric parameters and increased myopic shift in children spending less time out doors.⁽²³⁾

Conclusion

This study, we conclude that pattern of refractive error is different in urban and rural set up, urban localities show more preponderance of myopia has as compared to rural set up, myopia is significantly associated with positive family history and indoor activities. Further studies are required to substantiate the findings as it helps in planning of eye care services and in reducing the avoidable blindness of our population.

Limitations of the study

As Present study was a hospital based, results were based on the examination of eye care seeking population, refractive error pattern may vary in the population, real time survey and further population based studies are required to know the correct picture.

References

1. Dandona L, Dandona R, Naduvilath TJ, et al. Refractive errors in an urban population in Southern India: the Andhra Pradesh Eye Disease Study. *Invest Ophthalmol Vis Sci.* 1999;40:2810–2818.
2. Dandona L, Dandona R, Naduvilath TJ, et al. Burden of moderate visual impairment in an urban population in Southern India. *Ophthalmology.* 1999;106:497–504.
3. Midelfart, A., Kinge, B., Midelfart, S. and Lydersen, S. (2002), Prevalence of refractive errors in young and middle-aged adults in Norway. *Acta Ophthalmologica Scandinavica*, 80:501–505. doi:10.1034/j.1600-0420.2002.800508.
4. Dandona R, Dandona L, Srinivas M, et al. Population-based assessment of refractive error in India. The Andhra Pradesh eye disease study. *Clin Experiment Ophthalmol* 2002;30:84–93.
5. The Framingham Offspring Eye Study Group. Familial aggregation and prevalence of myopia in the Framingham Offspring Eye Study. *Arch Ophthalmol.* 1996;114:326–332.
6. Christopher J. Hammond, Harold Snieder, Clare E. Gilbert, and Tim D. Spector; Genes and Environment in Refractive Error: The Twin Eye Study; *Investigative Ophthalmology & Visual Science* May 2001, Vol.42, 1232-1236.
7. Sannapaneni Krishnaiah, Marmamula Srinivas, Rohit C Khanna, and Gullapalli N Rao; Prevalence and risk factors for refractive errors in the South Indian adult population: The Andhra Pradesh Eye disease study; *Clin Ophthalmol.* 2009;3:17–27.
8. Dandona R, Dandona L. Refractive error blindness. *Bull World Health Organ.* 2001;79:237–243.
9. Serge Resnikoff¹; Donatella Pascolini; Silvio P Mariotti; Gopal P Pokharel; Global magnitude of visual impairment caused by uncorrected refractive errors in 2004; *Bull World Health Organ.* Genebra Jan. 2008; vol. 86:63-70.
10. Damian Czepita, Artur Mojsa, Maria Ustianowska, Maciej Czepita, Ewelina Lachowicz; Role Of Gender In The Occurrence Of Refractive Errors; *annales academiae medicae stetinsensis*;2007,53,2, 5–7.
11. Rupert R. A. Bourne, BSc, FRCOphth, Brendan P. Dineen, MPH, Syed M. Ali, FRCS, Deen M. Noorul Huq, FRCS, Gordon J. Johnson, MD, FRC Ophth; Prevalence of Refractive Error in Bangladeshi Adults; Results of the National Blindness and Low Vision Survey of Bangladesh; *Ophthalmology* 2004;111:1150–1160.
12. Kulkarni RR, Shivaswamy MS, Mallapur MD. Health-seeking behavior of rural agricultural workers: A community-based cross-sectional study. *Int J Med Public Health* 2013;3:33-7.
13. Jabeen Rohul, Aakifa Maqbool, Syed Arshad Hussain, Hamid Shamila, Fazli Anjum & Zahoor Ahamad Hamdani; Prevalence of Refractive errors in adolescents in out- patient attendees of the preventive ophthalmology clinic of Community Medicine, S K I M S, Kashmir, India; *NUJHS* Vol. 3, No.1, March 2013;17-20.
14. IP Jm, Rose KA, Morgan IG, Burlutsky G, Mitchell P; Myopia and the urban environment: findings in a sample

- of 12-year-old Australian school children. *Invest Ophthalmol Vis Sci*. 2008 Sep;49(9):3858-63. doi: 10.1167/iops.07-1451. Epub 2008 May 9.
15. Raju Prema, BS, Ronnie George, MS, Ramesh Sathyamangalam Ve, Mphil, Arvind Hemamalini, MS, Mani Baskaran, DNB, Govindaswamy Kumaramanickavel, MD, McCarty Catherine, PhD, and Lingam Vijaya, MS; Comparison of refractive errors and factors associated with spectacle use in a rural and urban South Indian population; *Indian J Ophthalmol*. 2008 Mar-Apr; 56(2):139-144.
 16. Wolfram C, Höhn R, Kottler U, *et al*; Prevalence of refractive errors in the European adult population: the Gutenberg Health Study (GHS); *British Journal of Ophthalmology* 2014;98:857-861.
 17. Saw SM, Gazzard G, Koh D, Farook M, Widjaja D, Lee J, Tan DT.; Prevalence rates of refractive errors in Sumatra, Indonesia. *Invest Ophthalmol Vis Sci*. 2002 Oct;43(10):3174-80.
 18. Gil-Gouveia R, Martins IP; Headaches associated with refractive errors: myth or reality?; *Headache*. 2002 Apr;42(4):256-62.
 19. Naidoo KS, Leasher J, Bourne RR, Flaxman SR, Jonas JB, Keeffe J, Limburg H, Pesudovs K, Price H, White RA, Wong TY, Taylor HR, Resnikoff S; Vision Loss Expert Group of the Global Burden of Disease Study; Global Vision Impairment and Blindness Due to Uncorrected Refractive Error, 1990-2010.; *Optom Vis Sci*. 2016 Mar;93(3):227-34. doi: 10.1097/OPX.0000000000000796.
 20. Zhang X, Qu X, Zhou X. Association between parental myopia and the risk of myopia in a child; *xp Ther Med*. 2015 Jun;9(6):2420-2428. Epub 2015 Apr 8.
 21. Jenny M. Ip; Son C. Huynh; Dana Robaei; Kathryn A. Rose; Ian G. Morgan; Wayne Smith; Annette Kifley; Paul Mitchell; Ethnic Differences in the Impact of Parental Myopia: Findings from a Population-Based Study of 12-Year-Old Australian Children; *Investigative Ophthalmology & Visual Science* June 2007, Vol.48, 2520-2528. doi:10.1167/iops.06-0716.
 22. Zhong Lin, Balamurali Vasudevan, Vishali Jhanji, Yuan Bo Liang; Near Work, Outdoor Activity, and their Association with Refractive Error; *Optometry and vision science*;91(4): March 2014.
 23. Guo Y, Liu LJ, Xu L, Tang P, Lv YY, Feng Y, et al. (2013) Myopic Shift and Outdoor Activity among Primary School Children: One-Year Follow-Up Study in Beijing. *PLoS ONE* 8(9): e75260. <https://doi.org/10.1371/journal>.