

Type of Refractive Errors among School Going Children from District Kathua, Jammu, India

MANEESHA SETHI¹, PRIYANKA SODANI², VABITA BHAGAT³

ABSTRACT

Introduction: Worldwide refractive error remains one of the most common causes of visual impairment in children. Uncorrected refractive error can lead to long term effect on academic progression and employment opportunities. The study was conducted in remote area of district of Kathua, Jammu, India.

Aim: To estimate type of refractive error among children and its association with demographic characters.

Materials and Methods: The descriptive, cross-sectional, observational, hospital-based study was carried out in Out Patient Department (OPD) of Ophthalmology, Government Medical College, Kathua. The study of population included 351 children of age 5-16 years with complaint of diminution of vision. Examination included visual acuity recording, slit lamp, fundus examination and dilated retinoscopy. Inferential statistics was calculated using Open Epi version 3.01

Results: Out of 1582 children, 351(22.18%) children had refractive error. Their mean age was 12.52±2.87 years. The refractive errors were more common in the age group 13-16 years (61.5%), followed by 9-12 years (29.9%), and 5-8 years (8.51%). Refractive errors were more in males (56.12%) as compared to females (43.87%); 247(70.37%) children had refractive error in both the eyes, whereas 104(29.6%) had it in one eye. Astigmatism was most common (50.14%) followed by myopia (40.45%), hypermetropia (7.4%) and amblyopia (1.99%). Maximum astigmatism was seen in 13-16 years (56.25%) followed by 9-12 years (34.09%) and least in 5-8 years (9.65%).

Conclusion: A high percentage of refractive errors in the study indicate that school health services should be strengthened and implemented effectively.

Keywords: Astigmatism, Hypermetropia, Myopia

INTRODUCTION

Global estimates on childhood blindness show that there are 1.4 million and 17.52 million children suffering from blindness and moderate to severe visual impairment, respectively [1]. Approximately, 73% of world blind children live in low-income countries and 27 lacs are estimated to be in India [2]. Refractive error is one of the most common causes of treatable blindness [3]. These school going children between 6-15 years represent 25% of the population in developing countries [2].

Refractive error can affect the performance of school going children in studies, sports and other extracurricular activities. Moreover, school age group children can understand their problem and convey it [4]. Vision 2020- the right to sight initiative to estimate avoidable blindness has given high priority to correction of refractive errors and placed it with in the category of childhood blindness [5]. Moreover, the establishment of the World Health Organisation (WHO) refractive error working group, the inclusion on the task force of vision 2020 of national and international Non Governmental Development Organisations (NGDOs) and professional bodies focusing on refractive errors, and a number of population-based studies on refractive error in children, has highlighted the importance of refractive error interventions in prevention of blindness [6]. Approximately, 80% of children can be taken care of before the stage of complete blindness [7]. The common types of refractive errors in children are myopia, hypermetropia, and astigmatism [8].

There is significant variation in refractive error across geographical, racial, age, ethnic boundaries and it has extensive impact on strategies utilised in addressing uncorrected refractive errors [8]. The burden of uncorrected refractive error among children attending the ophthalmology OPD was high. This public health challenge required urgent attention and there has been lack of comprehensive data on refractive error from this region. Keeping all these in mind and to address the need of developing more sustainable eye care health services at primary and secondary level, this study was conducted.

The objective of this study was to determine frequency of refractive error among children and also to estimate different types of refractive error and their association with demographic characters like age and gender.

MATERIALS AND METHODS

The descriptive cross-sectional study was conducted in OPD of Ophthalmology, Government Medical College, Kathua, from February 2019 to March 2020. Approval for this study was taken from the Institutional Ethical Committee (IEC/GMCK/01/Pharma dated: 18-02-2020). The study was conducted in full accords with the tenets of the declaration of Helsinki.

Inclusion criteria: A 5-16 years of children who attended the ophthalmological OPD during the study period. Demographic details including age and gender of study population were recorded. All the children between the age group 5-16 years having complaints of the diminution of vision were included in the study. Children wearing spectacles complaining of diminution of vision (due to change in refractive error) were included in the study. The refractive error of the eye with worse Best Corrected Visual Acuity (BCVA) was taken into consideration.

Exclusion criteria: Children having low vision due to ocular problem other than refractive error were excluded from the study.

All the children attending eye OPD during the study period underwent routine ophthalmological examination including visual acuity recording, slit lamp examination and fundus examination. Retinoscopic examination was performed under dilatation. The eyes were dilated using homatropine eye drops administered 2 to 3 times at 10-15 minutes of interval objective refraction was carried out and documented. Postcycloplegic refraction done after three days of dilatation and type of refractive error was noted.

For the analysis, children were divided into three groups- that are 5-8 years, 9-12 years and 13-16 years based on age. Diagnosis of myopia was made if Spherical Equivalent (SE) refraction was ≥ 0.5

Dioptre Sphere (DS) in one or both eyes. Hyperopia was diagnosed when SE was $\geq +1.00$ DS and astigmatism when cylindrical power was $\geq \pm 0.5$ Dcyl in either eye.

STATISTICAL ANALYSIS

Data was entered in Microsoft excel. Descriptive statistics was expressed in form of number and percentages. Inferential statistics was calculated using Open Epi version 3.01. Chi-square was used as test of significance and p-value < 0.05 was taken as statistically significant.

RESULTS

Out of 1582 children who attended ophthalmological OPD, 22.18% (351) children (5 to 16 years of age) were confirmed to have refractive error and were included in the study. The mean age of participants was 12.52 ± 2.87 years. The refractive errors were more common in the age group 13-16 years (61.5%) and the least were seen in the age group of 5-8 years (8.51%) (p-value=0.34). The refractive errors were more in males (56.12%) as compared to females (43.87%) [Table/Fig-1]. Out of 351 participants, 247 (70.37%) had refractive error in both the eyes whereas 104 (29.6%) participants had refractive error in one eye.

| Characteristics | Frequency n (%) | |
|-----------------------------|-----------------|--------------|
| Age Range (in years) | 5-8 | 30 (8.5%) |
| | 9-12 | 105 (29.9%) |
| | 13-16 | 216 (61.5%) |
| Mean (SD) forage (in years) | 12.52±2.87 | |
| Sex | Males | 197 (56.12%) |
| | Females | 154 (43.87%) |

[Table/Fig-1]: Demographic profile (N=351).

Of all the refractive errors, astigmatism was most common (50.14%) followed by myopia (40.45%). Maximum patients of astigmatism were seen in age group of 13-16 years (56.25%) and least in 5-8 years (9.65%). Similarly, myopia and hypermetropia was common in age group of 13-16 years. Amblyopia was also common in older age groups [Table/Fig-2]. Among clinical types of astigmatism, myopic astigmatism was seen in 139 patients (39.60%) and compound Astigmatism was detected in only five patients (1.42%) out of total refractive error. Further analysis of data revealed that there was male predominance in certain type of refractive errors like myopia, hypermetropia whereas myopic astigmatism was seen more in females of age group 9-12 years as compared to males in that age group. Otherwise, Astigmatism was more common in males (52.84%) as compared to females (47.15%). Out of 7 amblyopic patients, 5(71.42%) were females [Table/Fig-3].

| Type of Refractive Error | Age | | | Total No. (%) | Significance |
|--------------------------|-----------------|------------------|-------------------|---------------|---------------------------------|
| | 5-8 years n (%) | 9-12 years n (%) | 13-16 years n (%) | | |
| Myopia | 9 (6.30%) | 36 (25%) | 97 (68.30%) | 142 (40.45%) | * $\chi^2=6.73$ p-value=0.34 |
| Hypermetropia | 3 (11.53%) | 6 (23.07%) | 17 (65.38%) | 26 (7.4%) | |
| Astigmatism | 17 (9.65%) | 60 (34.09%) | 99 (56.25%) | 176 (50.14%) | |
| Amblyopia | 1 (14.28%) | 3 (42.85%) | 3 (42.85%) | 7 (1.99%) | |

[Table/Fig-2]: Age based distribution of various refractive errors.

*Text applied-Chi-square (χ^2) test

DISCUSSION

Uncorrected refractive error and its consequences have profound effects on the overall development of children, most importantly on educational and psychological development [7]. In India, though many efforts have been put forth, there is still a big burden of visual

| Type of Refractive Error | Sex | | Total | Significance |
|--------------------------|-------------|-------------|-------|---------------------------------|
| | Male (%) | Female (%) | | |
| Myopia | 87 (61.2) | 55 (38.93) | 142 | * $\chi^2=4.48$ p-value=0.21 |
| Hypermetropia | (57.69) | 11 (42.30) | 26 | |
| Astigmatism | 93 (52.84) | 83 (47.15) | 176 | |
| Amblyopia | 2 (28.57) | 5 (71.42) | 7 | |
| Total | 197 (52.84) | 154 (47.15) | 351 | |

[Table/Fig-3]: Gender based distribution of refractive errors.

*Text applied-Chi-square (χ^2) test

impairment due to refractive errors [9]. It can be because of shortage of resources and insufficient facilities especially in rural areas [10]. In present study, the mean age (\pm Standard deviation) of study population is 12.52 ± 2.87 years. The frequency of refractive error was 22.18% in participants Kerkar S et al., and Biswas J et al., also reported 24.28% and 23.67% of refractive error among children respectively in their studies [4,11]. Both the results are comparable with current study. Higher prevalence in their studies could be due to the fact that these were hospital-based studies. Moreover, refractive error constituted 22% of ocular morbidity in a study by Gupta M et al., which was attributed to the urban setting of the population [12]. The present study also calculated a higher frequency of refractive errors which can be due to the fact that this is hospital-based study and moreover, it is recently converted from district hospital to associated hospital, New Government Medical College, Kathua. It is the first tertiary hospital for the district Kathua and all nearby villages. This could have added available medical facilities for the population. Higher prevalence can be due to lack of awareness among parents to detect them earlier. However, low prevalence rates were found by Aggarwal D et al., (5.20%) and Pavithra MB et al., (7.03%) in their studies [13,14]. Much variation in prevalence of refractive errors has been reported from abroad like 21.1 % by He M et al., 9.4% by Yared AW et al., and 11.6% by Kawuma M et al., [15-17]. Such a variation in prevalence of refractive errors in different part of India as well as other countries can be attributed to different socioeconomic class, different race, gender, geographical area and type of study population.

Higher percentage of refractive error is found in the age group of 13-16 years (61.5%) and lowest in age group of 5-8 years (8.5%) in present study. It was observed that there is an increase in the overall percentage of refractive errors with advancing age which is consistent with the studies done by Pavithra MB et al., and Shakeel T et al., [14,18]. Among study participants, overall refractive error was more common in males i.e., 197 (56.12%) as compared to females i.e., 154 (43.87%). However, the frequency of refractive error was more common in females in the age group of 5-8 years in the present study. Similarly, Padhye AS et al., and Sriram C et al., also found in their studies that boys had higher risk of uncorrected refractive error [19,20] whereas Naimi S et al., and Pavithra MB et al., showed more female preponderance for refractive errors [7,14]. In current study, most common refractive error found was astigmatism (50.14%) and followed by myopia (40.45%) and then hypermetropia (7.4%). It was comparable with the results found by John DD et al., in their study where astigmatism contributed 60% of refractive error as compared to myopia which constituted about 40% [21]. Results of current study were also comparable with the study conducted by Hazarika HN et al., which reported astigmatism as most common refractive error (55% of total) followed by myopia (34% of total) and then hypermetropia (11% of total) [22]. Based on clinical types, myopic astigmatism was more common in this study. Higher frequency of astigmatism in the present study can be related to frequent itching due to high incidence of allergic conjunctivitis in this dry and dusty area which needs further evaluation. Astigmatism was found out to be common in the age group of 13-16 years (56.2%) and the least was seen in the younger age group (9.65%). Similarly, myopia was more common in 13-16 years of age group (68%)

and was least in 5-8 years of age group (6.30%). Though there was no association between age of students and frequency of refractive errors. Pavithra MB et al., and Triveni C et al., also found high prevalence of refractive errors in older age groups [14,23]. Higher prevalence of myopia among older age groups can be related to certain factors like increase in literacy rate and increase in duration of study hours and change in lifestyle as concluded in previous studies [19,24].

Limitation(s)

The major limitation of the study is that it was hospital-based.

CONCLUSION(S)

The present study indicates that children are at high risk for developing refractive errors. Such a high percentage of refractive errors in hospital-based study indicates that school health services should be strengthened and implemented effectively. Periodic screening in school and in pre-school should be carried out to detect refractive errors as early as possible, corrective measures may be recommended at the earliest time possible. Teachers, parents and various stakeholders should be educated regarding eye health care, so that childhood visual impairment and blindness can be avoided. High frequency of astigmatism was found in this study which require further research on factors associated with it.

REFERENCES

- [1] Wadhvani M, Vashist P, Singh SS, Gupta V, Gupta N, Saxena R. Prevalence and causes of childhood blindness in India: A systematic review. *Indian J Ophthalmol.* 2020;68(2):311-15. Doi: 10.4103/ijo.IJO_2076_18.
- [2] World Health Organization. Blindness and Deafness Unit & International Agency for the Prevention of Blindness. (2000). Preventing blindness in children: Report of a WHO/IAPB scientific meeting, Hyderabad, India, 13-17 April 1999. World Health Organization. <https://apps.who.int/iris/handle/10665/66663>.
- [3] Murthy GVS, Gupta SK, Ellwein LB, Munoz SR, Pokharel GP, Sanga L, et al. Refractive error in children in an urban population in New Delhi. *Invest Ophthalmol Vis Sci.* 2002;43(3):623-31. PMID:11867576.
- [4] Kerkar S, Thombre A. An observational study to evaluate the prevalence and pattern of refractive errors in children aged 3-17 years in Mumbai, India. *International Journal of Contemporary Pediatrics.* 2020;7(5):1028-32. Doi: <http://dx.doi.org/10.18203/2349-3291.ijcp20201632>.
- [5] Gilbert C, Foster A. Childhood blindness in the context of VISION 2020--the right to sight. *Bull World Health Organ.* 2001;79(3):227-32. Epub 2003 Jul 7. PMID: 11285667; PMCID: PMC2566382.
- [6] Naidoo KS, Jaggernath J. Uncorrected refractive errors. *Indian J Ophthalmol.* 2012;60(5):432-37.
- [7] Naimi S, Aggarwal S, Sharma P, Joy J. Clinical study of refractive error in children between 10-17 years of age in Ghaziabad region. *J Evid Based Med Health C.* 2019;6(1):869-72.
- [8] Sheeladevi S, Seelam B, Nukella PB, Modi A, Ali R, Keay L. Prevalence of refractive errors in children in India: a systematic review. *Clin Exp Optom.* 2018;101(4):495-503. Doi: 10.1111/cxo.12689. Epub 2018 Apr 22. PMID: 29682791.
- [9] Resnikoff S, Pascolini D, Mariotti SP, Pokharel GP. Global magnitude of visual impairment caused by uncorrected refractive errors in 2004. *Bull World Health Organ.* 2008;86:63-70.
- [10] Pratt C, Bryant P. Young children understanding that looking leads to knowing (so long as they are looking into a single barrel). *Child Dev.* 1990;61(4):973-82. PMID: 2209200.
- [11] Biswas J, Saha I, Das D, Bandyopadhyay S, Ray B, Biswas G. Ocular morbidity among children at a tertiary eye care hospital in Kolkata, West Bengal. *Indian J Public Health.* 2012;56:293-96.
- [12] Gupta M, Gupta BP, Chauhan A, Bhardwaj A. Ocular Morbidity prevalence among school children in Shimla, Himachal, North India. *Indian J Ophthalmol.* 2009;57(2):243-47.
- [13] Agrawal D, Sahu A, Agrawal D. Prevalence of ocular morbidities among school children in Raipur district, India. *Indian J Ophthalmol.* 2020;68(2):340-44. Doi: 10.4103/ijo.IJO_1454_1.
- [14] Pavithra MB, Maheshwaran R, RaniSujatha MA. A study on the prevalence of refractive errors among school children of 7-15 years age group in the field practice areas of medical college in Bangalore. *Int J Med Sci Public Health.* 2013;2(3):641-45.
- [15] He M, Xu J, Yin Q, Ellwein LB. Need and challenges of refractive correction in urban Chinese school children. *Optom Vis Sci.* 2005;82(4):229-34. Doi: 10.1097/O1.opx.0000159362.48835.16.
- [16] Yared AW, Belaynew WT, Destaye S, Ayanaw T, Zelalem E. Prevalence of refractive errors among school children in gondar town, northwest ethiopia. *Middle East Afr J Ophthalmol.* 2012;19(4):372-76. Doi:10.4103/0974-9233.102742.
- [17] Kawuma M, Mayeku R. A survey of the prevalence of refractive errors among children in lower primary schools in Kampala district. *Afr Health Sci.* 2002;2(2):69-72. PMID: 12789105; PMCID: PMC2141567.
- [18] Shakeel T, Mittal SK. Pattern of refractive in primary school children in Dehradun City of Uttarakhand. *State J Ophthalmol.* 2016;27:106-10. www.djo.org.in/articles/27/2/pattern-of-refractive.html.
- [19] Padhye AS, Khandekar R, Dharmadhikari S, Dole K, Gogate P, Deshpande M. Prevalence of uncorrected refractive error and other eye problems among urban and rural school children. *Middle East Afr J Ophthalmol.* 2009;16(2):69-74. Doi:10.4103/0974-9233.53864.
- [20] Sriram C, Raj J. A cross sectional study on prevalence of refractive error among school children in Thiruvallur district, Tamil Nadu. *Indian J Appl Res.* 2014;4(4):2249-55.
- [21] John DD, Paul P, Kujur ES, David S, Jasper S, Muliylil J. Prevalence of refractive errors and number needed to screen among rural high school children in Southern India: A cross-sectional study. *J Clin Diagn Res.* 2017;11(8):NC16-NC19. Doi: 10.7860/JCDR/2017/25388.10476.
- [22] Hazarika H, Bhuyan D, Hazarika S, Addya S. Refractive errors in age group seven to fifteen years: North-east India scenario. *International Journal of Community Medicine and Public Health.* 2017;4(6):1928-31. Doi: <http://dx.doi.org/10.18203/2394-6040.ijcmph20172151>.
- [23] Triveni C, Divya T, Devi PR, Chowdhary NL, Sirisha G. Prevalence of refractive errors in school going children in rural and urban areas-across-sectional study. *Trop J Ophthalmol Otolaryngol.* 2021;6(2):22-27.
- [24] Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Muñoz SR, et al. Refractive error in children in rural population of India. *Invest Ophthalmol Vis Sci.* 2002;43(3):615-22. PMID: 11867575.

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Ophthalmology, GMC Kathua, Jammu, India.
2. Associate Professor, Department of Ophthalmology, GMC Kathua, Jammu, India.
3. Ex Senior Resident, Department of Ophthalmology, GMC Kathua, Jammu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Priyanka Sodani,
Associate Professor, Department of Ophthalmology, GMC Kathua, Jammu, India.
E-mail: priyankasodani1979@gmail.com

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Jul 19, 2022
- Manual Googling: Oct 25, 2022
- iThenticate Software: Dec 28, 2022 (19%)

ETYMOLOGY: Author Origin

Date of Submission: **Jul 18, 2022**
Date of Peer Review: **Sep 27, 2022**
Date of Acceptance: **Jan 03, 2023**
Date of Publishing: **Apr 01, 2023**