



Errors of Refraction among School Children in an Urban School in North India

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Introduction

Children are the backbone of a country and the well being of a nation depends on the health and well being of its child. Refractive errors are a well established menace afflicting children and if left unattended, can lead to consequences of disastrous nature. Approximately 12.8 million children in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors¹. Since refractive error is an avoidable cause of visual impairment, it becomes all the more imperative that this problem should be dealt with appropriateness. It has been proved that early correction of refractive error results in a reduction in the number of school children with poor sight². Many factors have been incriminated as contributory causes as far as refractive errors in children are concerned³. Alluring media influence like television, computer games and diminishing parental care etc have all been blamed from time to time. The effects of these refractive errors in children can be distressing. Children who have been affected cannot concentrate on studies thus severely affecting their academic performance⁴. It

can be a potential cause of social maladjustment and may affect a child's overall personality development⁵. They also find it difficult to indulge in extracurricular or recreational activities thus precluding their active participation (e.g in sports). This may greatly affect their overall growth as well as be a safety concern⁵.

Diagnosis and treatment of refractive errors is the simplest and most effective forms of eye care⁶. Since children usually do not complain of visual difficulties, early detection and prompt treatment of eye diseases is important to prevent vision problems and eye morbidities which could affect the various aspects of their growth as already described.

In consistence with the above facts, this study was carried out to find the prevalence of refractive status among school children in an urban school in North India.

Material and Methods

Objectives of the study

Ours is a descriptive study carried out at one of the most prestigious higher secondary schools

(from kindergarten to 12th standard) of Jammu and Kashmir in northern India. After seeking proper permission from the school authorities, all logistics (starting date, duration etc) for holding 'Refractive Error Camp' within the school premises were decided. A week before, the teaching staff communicated the details of our visit with parents and explained the benefits as well as the importance of refractive examination in children. All this was done to maximize participation and reduce absenteeism. The camp was held daily over a period of two weeks and two classes (four sections each) were examined in a day. This reason for such protraction was to avoid overcrowding and allot sufficient time for a thorough examination of each child.

The camp was run by team from the Department of Ophthalmology, Government Medical College and SMHS Hospital, Srinagar, Kashmir and comprised of ophthalmologists, optometrists, ophthalmic assistants and nursing orderlies.

The main objectives of this study are as follows:

- 1) To determine the magnitude of refractive errors among school children of different age groups.
- 2) To find out the frequency of various types of refractive errors.
- 3) To know the percentage of students who wore glasses.

The distant vision of a child was tested using Snellen eye chart. If uncorrected vision was <6/9 in either eye, the child was declared to have defective vision. All students with defective vision were examined by the refractionist. Visual acuity was measured by using Snellen chart at 6 meters in a properly illuminated room. Each eye was tested separately three times, and the best score was taken. Those who had low vision were further evaluated by an ophthalmologist to know the diagnosis and for proper management. Objective refraction was performed with retinoscope which was followed by subjective refraction till the best corrected visual acuity was achieved.

Hypermetropes, Children with BCVA less than 6/6 and those in whom BCVA was 6/6 but accommodation symptoms like head ache, eye pain were present, were subjected to cycloplegic refraction with cyclopentolate 1% eye drops. Children already wearing spectacles were also examined and change in power was noted.

Myopia was considered when the measured refraction was more than or equal to -0.5 diopter spherical equivalent in one or both eyes. Hypermetropia was considered when the measured objective refraction was greater than or equal to +1.0 D spherical equivalent in one or both eyes. Astigmatism was considered to be visually significant if more than or equal to 1.00 diopter cylindrical equivalent in one or both the eyes.

Results

Table 1) Socio demographic parameters of the study population

Parameter		Number	Percentage
1.Age (years)	6-7	154	11.26%
	8-9	172	12.58%
	10-11	285	20.84%
	12-13	276	20.19%
	14-15	214	15.65%
	16-17	266	19.45%
	Total	1367	100%
2.Sex	Male	732	53.54%
	Female	635	46.45%
	Total	1367	100%
3.Socio Economic Class (Kuppuswamy class)	I (Upper)	483	35.33
	II (Upper middle)	822	60.13
	III (Lower middle)	62	4.53
	IV (Upper lower)	0	0
	V (Lower)	0	0
	Total	1367	100

Table 2) Prevalence of refractive errors in total study population.

Number of students screened	Number of students with refractive error	Prevalence
1367	552	40.38%

Table 3) Frequency of students using glasses

Students using glasses	Percentage
Yes	24%
No	76%

Table 4) Sex wise distribution of refractive error.

Gender	Number of students	Number of students with refractive errors	Prevalence
Male	732	270	19.75%
Female	635	282	20.62%
Total	1367	552	40.37%

Table 5) Age wise prevalence of refractive error.

Age	Number of students	Number of students with refractive errors	Prevalence
6-7	154	42	27.27%
8-9	172	65	37.79%
10-11	285	120	42.10%
12-13	276	115	41.66%
14-15	214	93	43.45%
16-17	266	117	43.98%
Total	1367	552	40.38%

Table 6) Frequency of distribution of various types of Refractive Errors

Total number of students with refractive error	Number Percentage	
Myopia	256	18.8%
Hypermetropia	112	8.4%
Astigmatism	181	13.3%

Table 7) Types of astigmatism

Types	Percentage
Simple hypermetropic	2.20%
Compound hypermetropic	1.65%
Simple myopic	5.72%
Compound myopic	3.20%
Mixed astigmatism	0.61%
Total	13.3%

Discussion

This study was carried out to find out the burden of refractive errors in a typical school in Northern India. Numerous studies carried out in various parts of the world have already established that refractive errors are present in a sizeable proportion of school children. The prevalence of refractive errors in our study was a whopping 40%, not reported previously in literature. The study with a figure nearest to ours is by Pant BP *et al*⁷, who described a prevalence rate of 32% in a

study carried out in Nepal. The other studies carried world over have shown a far lower prevalence rate varying from 3.8 % in Iran⁸ to 8.9 % in Pakistan⁹. Even a previous study from India have shown a lesser prevalence rate of 13.9 %¹⁰. One possible cause of such higher prevalence of refractive errors in our study may be the increased exposure of children to gadgets like smart phones, tablets and laptops.^{11,12} All the above mentioned studies are five to ten years old and the sharpest increase in internet penetration and availability of electronic gadgets has been in the last five years. In addition, factors like genetic predisposition to refractive errors may also have a role to play and thus lead to different rates in different races.^{13,14}

The percentage of students wearing spectacles was found to be 24%. Again this figure is far higher than reported in other studies.^{15,16} This reasons for this finding of our study are almost synonymous with the reasons for a higher overall prevalence of refractive errors in our study. As most of our study population comprised of families from higher socio economic strata, there were no financial constraints in buying glasses and probably the stigma associated with wearing of glasses was less prevalent as well. These two factors have been postulated by some authors as a reason for lower usage of spectacles.¹⁷

One significant finding of our study was that out of the 40 % students detected with refractive errors, 76 % remained undiagnosed and were not wearing any glasses. This finding is ironical, considering that most of our subjects belonged to higher socio economic strata. Subsequently factors like ignorance, illiteracy, monetary constraints or lack of access to health facilities don't seem to be a causative factor for the lack of diagnosis in our patients. Whether the current pre occupation of parents of such affluent groups (as ours) with their jobs and careers and the consequent neglect is responsible for this needs to be found out. In our opinion, it is a question with more social and lesser scientific aspects.

The commonest type of refractive error in our cases was myopia with 18.8% followed by

astigmatism at 1.3% and hypermetropia at 8.4%. In this regard, our study is similar with various other studies that also point out myopia as the commonest refractive error in school children.^{18,19.}

In addition, our study also found out that there was an increased frequency of myopia in the older age group (12-17 years), in comparison to the younger age group.

There was no predilection of sex with refractive errors in our study as both sexes were equally affected by this menace. This is in contrast to some studies which have reported a higher incidence of refractive errors in females.²⁰

In our study, 24 students (1.75%) were found to have amblyopia. This is similar to another study done by Asad A Khan *et al* where they found 1.5% students having amblyopia²¹. We did not find any cases of corneal ulcer, squint, Vitamin A deficiency, lid anomalies etc. As our subjects were mostly from affluent societies, many of these conditions related with malnutrition and illiteracy were expectantly not found.

In conclusion, our study was successful in reiterating the fact that refractive errors in schoolchildren remains a persistent problem of increasing proportions. Our study was divergent from previous studies regarding the relatively higher prevalence rates of refractive errors. These differences cannot be explained on genetic and ethnic reasons alone. In our opinion, as most of the previous studies were conducted 5-8 years ago and before the advent of the smartphone revolution, the role of increased gadget use by children needs to be thoroughly looked at as an amplification factor for causation of refractive errors in children. The hectic life style of affluent socio economic groups (who formed a major part of our study) and the resultant decrease in attention towards the health of their children also needs to be looked into. This point was highlighted by the high percentage of subjects diagnosed with refractive errors and not wearing spectacles.

A possible shortcoming of this study may be the narrow format, as our study was confined to a

single school and was not a broad population based study. Even then the large number of participants (1367) attaches enough merit to our study results to be taken with diligence. Another possible shortcoming may have been the affluent socio economic status of most of our study population, which may have decreased the homogeneity to some extent.

Conflicts of interest: None

References

1. Accuracy of noncycloplegic auto refraction in school-age children in China. Zhao J, Mao J, Luo R, Li F, Pokharel GP, Ellwein LB. *Optom Vis Sci.* 2004 Jan; 81(1):49-55.
2. Preschool vision screening: outcome of children referred to the hospital eye service. D K Newman, A Hitchcock, H McCarthy, J Keast-Butler, and A T Moore. *Br J Ophthalmol.* 1996 Dec; 80(12): 1077–1082.
3. Child Development and Refractive Errors in Preschool Children. Josephine O. Ibiro, OD, MPH, David S. Friedman, MD, PhD, Michael X. Repka, MD, Joanne Katz, ScD, Lydia Giordano, OD, MPH, Patricia Hawse, MS, COMT, and James M. Tielsch, PhD. *Optom Vis Sci.* 2011 Feb; 88(2): 181–187.
4. Prevalence and associated factors of myopia among primary and middle school-aged students: a school-based study in Guangzhou. L Guo, J Yang, J Mai, X Du, Y Guo, P Li, Y Yue, D Tang, C Lu, and W-H Zhang. *Eye (Lond).* 2016 Jun; 30(6): 796–804.
5. Atkinson J, Anker S, Nardini M, Braddick O, Hughes C, Rae S, Wattam-Bell J, Atkinson S. Infant vision screening predicts failures on motor and cognitive tests up to school age. *Strabismus.* 2002;10:187–98

6. A study on the prevalence of refractive errors among school children of 7-15 years age group in the field practice areas of a medical college in Bangalore. Pavithra MB, Maheshwaran R, Rani Sujatha MA. *Int J Med Sci Public Health*. 2013; 2(3): 641-645
7. Pant BP, Ghising R, Awasthi S, Pant SR, Batha RC. Refractive status among the students presenting in Geta eye hospital khailali Nepal. *Nepal Med Coll J*. 2010; 12(2):95-99.
8. Fotouhi. A, Hashemi H, Khabazkhoob M, Mohammad K. The prevalence of refractive errors among schoolchildren in Dezful, Iran. *Brit J Ophthalmol*. 2007; 91(3): 287-292.
9. Prevalence of refractive error in school children of Karachi Haseeb Alam, M. Irfanullah Siddiqui, Syed Imtiaz Ahmed Jafri, Abdul Sattar Khan, Syed Ishtiaq Ahmed, Mohammad Jafar. *Journal of Pakistan Medical Association* 58:322;2008
10. Singh H, Saini VK, Yadav A, Soni B. Refractive error in school going children data from a school screening survey program in Bhanpur, Bhopal. *National J Comm Med*. 2013; 4(1):138-140.
11. Murthy GVS. Vision Testing for Refractive Errors in Schools 'Screening' Programmes in Schools. *Journal of Community Eye Health* 2000;13: 3-5.
12. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Munoz SR, et al . Refractive errors in children in a rural population in India. *Invest Ophthalmol Vis Sci* 2002;43:615-22
13. Limburg H, Vaidyanathan K, Dalal HP. Cost effective screening of school children for refractive errors. *World Health Forum* 1995;16:173-78.
14. Pacella R, McLellan J, Grice K. Role of genetic factors in the etiology of juvenile-onset myopia based on a longitudinal study of refractive error. *Optom Vis Sci* 1999;76:381-6.
15. Naidoo KS, Raghunandan A, Mashige KP, Govender P, Holden BA, Pokharel GP, Ellwein LB. Refractive error and visual impairment in African children in South Africa. *Invest Ophthalmol Vis Sci*. 2003; 44: 3764-3770.
16. Mehari ZA, Yimer AW. Prevalence of refractive error among school children in rural central Ethiopia. *Clin Exp Optometry*. 2013; 96:65-69.
17. Refractive errors among school children in Addis Ababa, Ethiopia. Nebiyat K, Alemayehu W and Tigist SW. *Journal of Ophthalmology of Eastern Central and Southern Africa* .December 2015.
18. Prevalence of Refractive Error in Malay Primary School Children in Suburban Area of Kota Bharu, Kelantan, Malaysia .Syaratul-Emma Hashim, Hui-Ken Tan, Wan-Hazabbah WH, Mohtar Ibrahim. *Ann Acad Med Singapore* 2008;37:940-6.
19. Fan DS, Lam DS, Lam RF, Lau JT, Chong KS, Cheung EY, et al. Prevalence, incidence and progression of myopia of school children in Hong Kong. *Invest Ophthalmol Vis Sci* 2004;45:1071-5.
20. Wu LJ, You QS, Duan JL, Luo YX, Liu LJ, Li X et al. Prevalence and associated factors of myopia in high-school students in Beijing. *PLoS One* 2015; 10(3): e0120764.
21. Prevalence of Amblyopia among Government Middle School Children in City Of Lahore, Pakistan. Khan A Asad, Awan A, Ahmad Imran; *IJAVMS* 2010;4(2):41-46.