Study of prevalence and socio-demographic features of refractive error in children attending secondary school

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Abstract

Introduction: Poor performance in schooling due to refractive error is a major public health concern specially in rural areas of developing countries like India and globally, refractive error being the most common cause of visual impairment following cataract.

Materials and Methods: This study is a cross sectional study conducted to determine the prevalence of refractive errors in school going children in the rural setup of Kumbhari. Two schools were randomly selected from the 5 schools in the area. 400 students from these schools were selected by stratified random sampling for proportionate representation from each category, that is, the class the pupil studies in and sex.

Results: Mean age was found to be 11.13 years, 50.5% were females while 197 (49.5%) were males. It was observed that most of the students (68.5%) belonged to middle class (class III) and 20% to lower middle class (class IV). 73% had normal vision (6/6) in their right eye while 65.5% had normal vision (6/6) in their left eye. Considering visual acuity of less than 6/6, in the right eye, most of the students presented with visual acuity 6/9 (16.8%), followed by 6/12(3.2%) and 6/6 partial(3%). Similarly in the left eye, most of the students presented with visual acuity 6/9 (24.2%), followed by 6/6 partial (3.8%) and 6/12(3%).

Conclusions: Our study proves need for timely screening of school children, and creating awareness among the parents as well as the teachers as they are in close association with the students and are aware of their activities & change in learning skills.

Keywords: Refractive error[2], loss of vision[1], school children[3], socio-demographic features[4]

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Introduction

WHO estimates that 153 million people worldwide live with visual impairment due to uncorrected refractive errors, 8 million are blind and 12.8% are in the age group of 5-15 years.[1] Globally, refractive error being the most common cause of visual impairment following cataract.[2]

These statistics are more important in scenario of rural India, because, out of the 1.4 million blind children in the world, 1 million live in Asia, the prevalence being up to 1.5/1000 children in very poor countries[3]. Next to Egypt, India has the highest incidence of blindness throughout the world, particularly in the young children[4]. Addressing the same problem nationally, a national blindness survey in 2001-2002 showed that 7% of children aged 10-14 years have problems with their eyesight[5], with treatable refractive error being the major cause of blindness in school children[6]. Under the National society of prevention of blindness, India, a survey was conducted in 1974 to assess the ocular condition of children. 67.37% of students had some form of eye disease of which refractive error was 18%.

Of all the blind in India, 30% lose their eyesight before the age of 20 years, which is why early detection and treatment of visual impairment in children in undoubtedly of utmost importance[7].

The estimated visual acuity at birth ranges from 6/120 to 6/200. By 6-9 months, the visual acuity improves rapidly to near normal. By 2 years of age, visual acuity in 6/6 (normal). Thus, after 2 years of age, an individual is expected to have normal vision. Any factors hampering the visual inputs for a prolonged time in this crucial period invariably result in a permanent decrease in vision[8].

According to WHO definition of low vision: a person with low vision is one who has impairment of visual functioning even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 to light perception, or a visual field of less than 10 degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task for which vision is essential.

Childhood eye morbidity, of which refractive errors are a significant fraction, is defined as: any disease or condition that requires ophthalmic care and treatment which if untreated can progress to serious and sight threatening disease. Any problem in vision during formative years can hamper the intellectual development, maturity and performance of a person in future life.[9]

This paper describes the salient features and results of the cross sectional study conducted to determine the prevalence of refractive errors in school going children in the rural setup of Kumbhari.

Materials and Methods

This was a cross sectional, descriptive study done over a period of 2 months to find the prevalence of refractive errors in school children in the rural setup of Kumbhari, Solapur.

Sample size was calculated using the formula,

$$z^2 * p * q / d^2$$

Expected prevalence (p) by previous studies is 6.22%[27], and with confidence level 95%, z=1.96, d=acceptable error=5%, q=1-p, the sample size would be 361, and considering dropout rate 10%, the sample size would become 397, rounded off to 400.

2 schools were randomly selected from the 5 schools in the area. 400 students from these 2 schools were selected by stratified random sampling for proportionate representation from each category, that is, the class the pupil studies in and sex.

Permission was obtained from the institutional ethics committee and from the principal of both the schools. The aims and objectives of the study, procedure of examination, and adverse effects of pupillary dilatation were explained to the principal, after which permission was sought to visit schools. The basic examination was conducted in the school premises in a large enough and well illuminated room. Questionnaire was filled by asking the students and teachers for the required information.

The first part of the questionnaire included age and sex of the students, the class in which they study, their parents' occupation and the family's average monthly income, and visual acuity. Visual acuity was measured by medical students, first of the right eye followed by the left, by using Snellen's visual acuity charts for distant vision and Jaeger's visual acuity charts for near vision. Visual acuity was recorded as the smallest line read on the Snellen's chart with one or no error, at a distance of 6 meters. All students with visual acuity of < 6/6 were taken for further examination by a pediatric ophthalmologist. Along with this, external ocular and anterior segment examination was done by torch light in all students. The socioeconomic class was calculated using the B.G Prasad classification and modified as per the All India Consumer Price Index (AICPI)[10,11]. The data in the second part of the questionnaire was entered by the ophthalmologist.

Every student was subjected to slit lamp examination and fundus examination by a direct ophthalmoscope. In selected students, indirect ophthalmoscopy was done.

Streak retinoscopy was done and best acceptable refraction was prescribed. Fogging was done for relaxing accommodation in cases of hypermetropia. Objective and subjective refraction performed till best corrected visual acuity achieved, and glasses were then prescribed.

Children having pre-existing eye diseases or ocular injuries were excluded from the study. Also, children taking drugs for other ailments were excluded as certain drugs have ocular effects too.

Data was tabulated and analyzed in a Microsoft XL spreadsheet.

Results

Table 1: Age wise distribution of students

Age	Number	Percentage
9	17	4.2
10	83	20.8
11	125	31.2
12	113	28.2
13	54	13.5
14	8	2.0
Total	400	100.0

This study was conducted among 400 secondary school children, 4.2% of 9 years old, 20.8% of 10 years old, 31.2% of 11 years old, 28.2% of 12 years old; and 13.5% and 2% in the age groups of 13 and 14, respectively. Mean age was found to be 11.13 years with Standard deviation of 1.1. Of these 400 students, 201 (50.5%) were females while 197 (49.5%) were males.

Table 2: Socioeconomic status

Socioeconomic Class	Total	Percentage
Class I	4	1%
Class II	38	9.5%
Class III	274	68.5%
Class IV	80	20%
Class V	4	1%
Total	400	100%

It was observed that most of the students (68.5%) belonged to Middle class (class III) and 20% to Lower Middle class (class IV), as calculated by the modified B.G Prasad classification.

Table 3: Refraction in right and left eye

	Right Eye (Visual Acuity)		Left Eye (Visual Acutiy)	
Visual Activity	Number	Percentage	Number	Percentage
6/6	292	73.0	262	65.5
6/6p	12	3.0	15	3.8
6/9	67	16.8	97	24.2
6/12	13	3.2	12	3.0
6/18	6	1.5	6	1.5
6/24	6	1.5	4	1.0
6/36	1	0.2	2	0.5
6/60	1	0.2	0	0
CF	1	0.2	1	0.2
Total		100.0		100.0

Of the 400 students examined, 73% had normal vision (6/6) in their right eye while 65.5% had normal vision (6/6) in their left eye. Considering visual acuity of less than 6/6, in the right eye, most of the students presented with visual acuity 6/9 (16.8%), followed by 6/12(3.2%) and 6/6 Partial (3%). Similarly in the left eye, most of the students presented with visual acuity 6/9 (24.2%), followed by 6/6 partial (3.8%) and 6/12(3%).

Less commonly seen were 6/18 and 6/24; with only 3 students presenting with 6/36, 1 with 6/60, and 2 with Finger counting.

Table 4: Prevalence of refractive error

Refractive Error	Number	Percentage
Present	111	27.8
Absent	289	72.2
Total	400	100

Prevalence of refractive error was found to be 27.8%. Refractive errors were most commonly found in the age group of 10-12 years. This association was found to be statistically significant ($p<0.05$).

Table 5: Age wise frequency of refractive error

Age	Present (%)	Absent (%)	Total (%)
10	27 (24.32%)	56 (19.6)	83 (20.75)
11	32 (28.82%)	93 (32.45)	125 (31.25)
12	24 (21.63%)	89 (30.10)	113 (28.25)
13	11 (9.91%)	43 (15.05)	54 (13.5)
14	3 (2.71%)	5 (1.75)	8 (2)
9	14 (12.61%)	3 (1.05)	17 (4.25)
Total	111	289	400

Table 6: Refractive errors and socioeconomic class

Socioeconomic Class	Present (%)	Absent (%)
Class I	0 (%)	4 (1%)
Class II	12 (3%)	26 (6.5%)
Class III	77 (19.25%)	197 (49.25%)
Class IV	21 (5.25%)	59 (14.75%)
Class V	1 (0.25%)	3(0.75%)
Total	111 (27.75%)	289 (72.25%)

Refractive errors were most commonly seen in socioeconomic class III, followed by class IV and class II, but were not found to be statistically significant.

Table 7: Distribution of refractive error according to sex

Sex	Present	Absent	Total
Male	61 (54.95)	137	198
Female	50 (45.05)	152	202
Total	111	289	400

Among the students with refractive errors, 61 boys and 50 girls were affected. Thus, no significant association was observed between refractive error and sex.

Discussion

Socio-demographic profile: The mean age of the students in the study was 11.13 years with a standard deviation of 1.1. This is similar to the North India Myopia Study[12], where the mean age was 11.6 years with standard deviation of 2.2. It was observed that of the children with a refractive error, 54% were boys, while 45% were girls. This was similar to the observations of Kalkivayi et al[13], in which they found 51% males and 49% females and of Dr. Mehzabeen Rahman et al[11] who found 51% males and 49% females. Most of the students belonged to the socioeconomic class III and IV, i.e. lower middle and middle class, respectively.

Prevalence of refractive errors: Among all the children with visual impairment and visual acuity less than 6/6, the most commonly observed visual acuity with which the children presented was 6/9. This was similar to the observation in a study conducted in Assam. The prevalence of refractive error was found to be 27.8%, which is almost similar to the study conducted by Sethi (25.32%).[14] It is much greater than that observed in a neighboring village, Akkalkot, where it was found to be 2.63%[15].

It is also more than what was observed by Madhu Gupta *et al* in Himachal (22%)[16], and by Desai *et al* in Pune (20.8%)[7]. Due to the different refractive error cutoffs, different sample population and different methodologies of previous

Indian studies, it is difficult to state whether this difference indicates an actual increase in prevalence. The difference may also be due to the fact that other studies were done in urban areas, where the overall awareness about refractive errors and the uptake of refractive services are more than that of rural areas.

The prevalence is lesser when compared to studies conducted in Tamil Nadu (30.7%)[6] and Rajasthan (30.39%).[17] In a study conducted by Dandona et al, it was observed that children in urban areas had 2.5 times higher risk of developing refractive error as compared to children in rural areas; which might be a reason for the higher prevalence in studies conducted in these urban areas.[18]

Association between refractive error and sex: This study found no significant association between refractive errors and sex, which is similar to that observed in Pune[19] and in a rural area of Delhi[20].

Association between refractive error and age: Refractive errors were most commonly found in the age group of 10-12 years, and this was found to be statistically significant. Singh et al found refractive errors to be present most commonly in the age group of 8-10years[21]; while Padhye et al found them to be present most commonly among the age group of 9-12 years.[15] In a study conducted in Sudan, refractive errors were seen most commonly in a higher age group, that is,

of 12-14 years.[22]

Conclusion

The aforementioned facts suggest the need for timely screening of school children, and creating awareness among the parents as well as the teachers as they are in close association with the students and are aware of their behavior and activities. The high prevalence of refractive error in our study may be due to the small sample size, which is a major limitation of the study. As cycloplegic refraction was performed only in all hyperopes and children with squint, cases with accommodative spasm cannot be ruled out completely. This too can be a limitation of the study.

Studies of this kind are helpful in knowing the magnitude of the problem and thus prove helpful to attain the global initiative for elimination of avoidable blindness by the year 2020.

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