

An Epidemiological Study Determining the Prevalence of Refractive Errors and its Different types and Visual Outcome after Correction of Refractive Errors in School Going Children

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Abstract

Aim: The aim of the present study was to find out the prevalence of refractive errors in school going children, its different types and visual outcome after correction of refractive errors.

Methods: The present study was conducted at Department of Ophthalmology, NMCH, Patna, Bihar, India and 2000 school going children in the age group of 10 to 15 years from secondary schools for the period of 2 years

Results: In the present study age distribution of study subjects showed out of 3000 students, majority was of age 12 years (19%). Out of 2000 students screened, 960 (48%) were females and 1040 (52%) were males. Out of the total 320 cases of refractive errors, 12.5% were old cases while 87.5% were newly diagnosed cases. Overall a significantly high prevalence of refractive errors was reported in cases of 13, 14 and 15 years as compared to younger children. Mean age of cases with refractive error was significantly higher as compared to cases without refractive errors (12.85 vs 11.79 years; $p < 0.01$). Prevalence of refractive error was significantly higher among females as compared to males. The result showed relatively better visual acuity was reported in right eye ($p < 0.05$). It was observed that 97.50% of eyes improved visual acuity at 6/6, 2.18% improved at 6/9 and 0.15% improved to 6/36 and 6/60 only.

Conclusion: We found that every sixth school going adolescent children is suffering from refractive error. Majority of them were new cases who were unaware of their refractive error indicating a hidden problem of serious dimensions. So screening of school children can play an important part in detecting these hidden cases suffering from refractive errors. Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children which can be reflected on school performances. Screening of the children for vision at the time of school admission and periodical eye examination of the children is recommended for early rectification of impaired vision.

Keywords: Refractive error, school children, prevalence

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Introduction

Refractive error is a problem with focusing light accurately on the retina due to the shape of the eye. An impairment of vision is defined as a patient having the best-corrected visual acuity of less than 6/18 in the better eye. Blindness is defined by the World Health Organization (WHO) as visual acuity less than 3/60 with the best possible correction in the better eye on Snellen visual acuity chart. [1] Defective vision and childhood blindness may affect undesirably the lifestyle of a particular child for the rest of his social and educational life. Uncorrected refractive errors are the leading causes of moderate

to severe visual impairment (VI) worldwide and the second most common cause of avoidable blindness. [2,3] Childhood blindness is one of the priorities in Vision 2020: the right to sight. [4] It is estimated that there are 1.4 million blind children in the world, two-thirds of whom live in developing countries, and of all the blind children, it is estimated that 2,70,000 live in India. [5]

Childhood myopia takes the lead in some countries of Southeast Asia with the prevalence reaching 80% among adolescents, whereas hyperopia in children

may be most prevalent in the Americas. [6,7] At present, myopia, in particular childhood myopia, is a major public health issue, which in recent years has grown into an epidemic. [8-10] Refractive errors are considered an important public health problem affecting people all over the world. These errors are classified into three types: myopia, hypermetropia, and astigmatism. [11] In myopia (short-sightedness) parallel rays of light coming from infinity are focused in front of the retina when accommodation is at rest, in hypermetropia (long-sightedness) in which parallel rays of light coming from infinity are focused behind the retina with the accommodation being at rest and astigmatism, wherein the refraction varies in different meridians. Consequently, the rays of light entering the eye cannot converge to a point focus but form focal lines. [12]

The aim of the present study was to find out the prevalence of refractive errors in school going children, its different types and visual outcome after correction of refractive errors.

Materials and Methods

The present study was conducted at Department of Ophthalmology, NMCH, Patna, Bihar, India and 2000 school going children in the age group of 10 to 15 years from secondary schools for the period of 2 years. Jan 2017 to December 2018

Inclusion Criteria

All students studying in 5th to 10th standard belonging age group of 10 to 15 years.

Exclusion Criteria

- 1) Children in whom refraction could not be performed due to media opacity
- 2) Children with retinal diseases
- 3) Children not willing for examination were excluded.

Detailed Research Plan

Different secondary schools from Patna, Bihar were selected randomly. After prior permission from

respective authorities, all students were interviewed in friendly manner and examined. Visual acuity recorded unaided and aided (if spectacles+) using standard techniques for measurement of distant vision.

Visual acuity was taken using of Snellen’s chart placed at 6 meters distance and those who have failed to read 6/60 line at 6 meters distance were asked to count examiners fingers. The distance at which student counted fingers was recorded as visual acuity – finger counting, followed by visual acuity with pinhole was taken to look for improvement with pinhole. informed consent from students, those with visual acuity less than 6/6 for distant vision and those who had improvement in vision on pinhole were taken for reexamination in outpatient department of Nmch, Patna for further evaluation and correction of refractive errors.

The parameters studied were;

- 1. Visual acuity measurement with Snellen’s chart.
- 2. Gross examination of the anterior segment with a torch light.
- 3. Auto refraction and subjective correction
- 4. Streak retinoscopy and refraction
- 5. Examination of media and fundus by direct ophthalmoscope.

Retinoscopy was performed using a self-illuminating streak retinoscopy, dilating the pupil with tropicamide (0.8%) + phenylephrine (0.5%), at 2/3rd meter distance, in a dark room using distant fixation target and trial lens box. The autorefractometry was done using an auto refractor. 3 values were taken, the average of which was calculated. Detailed fundus examination of both eyes was done using direct ophthalmoscope. These tests were followed by post mydriatic test as applicable, until best corrected visual acuity was achieved.

Results

Table 1: Demographic data

Age in years	N	%
10	340	17
11	340	17
12	380	19
13	300	15
14	360	18
15	280	14
Gender		
Female	960	48
Male	1040	52
Type of Case		
Old case	40	12.5
New case	280	87.5
Total	320	100

In the present study age distribution of study subjects showed out of 3000 students, majority was of age 12 years (19%). Out of 2000 students screened, 960 (48%) were females and 1040 (52%) were males. Out of the total 320 cases of refractive errors, 12.5% were old cases while 87.5% were newly diagnosed cases.

Table 2: Distribution of refractive errors as per age

Age group	Refractive error		Total
	No	Yes	
10	310	30	340
11	295	45	340
12	320	60	380
13	250	50	300
14	296	64	360
15	209	71	280
Total	1680	320	2000

Overall a significantly high prevalence of refractive errors was reported in cases of 13, 14 and 15 years as compared to younger children.

Table 3: Mean age comparison among subjects with and without refractive errors

	N	Mean	Sd	P value
Yes	320	12.85	1.64	
Age (years) No	1680	11.79	1.70	<0.01

Mean age of cases with refractive error was significantly higher as compared to cases without refractive errors (12.85 vs 11.79 years; $p < 0.01$).

Table 4: Distribution of refractive errors as per Gender

Age group	Refractive error		Total
	No	Yes	
Female	760	220	960
Male	920	100	1040
Total	1680	320	2000

Prevalence of refractive error was significantly higher among females as compared to males.

Table 5: Distribution of eyes as per uncorrected visual acuity

Uncorrected Visual Acuity	Right	Left	Total
6/6	35	20	55
6/9	80	75	155
6/12	60	75	135
6/18	40	55	95
6/24	50	48	98
6/36	30	25	55
6/60	18	12	30
CF	7	10	17
Total	320	320	640

The result showed relatively better visual acuity was reported in right eye ($p < 0.05$).

Table 6: Best corrected visual acuity achieved

Best corrected visual acuity	N	%
6/6	624	97.50%
6/9	14	2.18%
6/12	NIL	NIL
6/18	NIL	NIL
6/24	NIL	NIL
6/36	01	0.15%
6/60	01	0.15%
Total	640	100

It was observed that 97.50% of eyes improved visual acuity at 6/6, 2.18% improved at 6/9 and 0.15% improved to 6/36 and 6/60 only.

Discussion

Eyes are mirror of the soul and the body's window to the outside world. The objective of learning begins in childhood and the accuracy of a child's vision can immensely affect or alter their learning capacity. School going years is considered as wonder years and formative years in person's life. Any problem in vision during formative years can hamper the intellectual development, maturity and performance of a person in future life. [14] Refractive error is an optical defect intrinsic to the eye which prevents light from being brought to a single point focus on the retina, thus reducing the normal vision. It is the second largest cause of impaired vision after cataract. [15]

In the present study age distribution of study subjects showed out of 3000 students, majority was of age 12 years (19%) which is similar to study by Saha, et al [16] where it was 12.4 years, also similar to study by Karavadi Sri Sai Vidusha and Damaanthi M. N [17] where it was 11.28 years. Out of 2000 students screened, 960 (48%) were females and 1040 (52%) were males. Similar distribution of males and females in study population observed by Saha, et al [16] where out of 1840 children 53.6% were boys and 46.4% were girls. Out of the total 320 cases of refractive errors, 12.5% were old cases while 87.5% were newly diagnosed cases. Similar observations found by Sarma et al [18] where 24.47% of study population were using spectacles and rest 75.53 % were unaware of their problems.

Overall a significantly high prevalence of refractive errors was reported in cases of 13, 14 and 15 years as compared to younger children. Mean age of cases with refractive error was significantly higher as compared to cases without refractive errors (12.85 vs 11.79 years; $p < 0.01$). Prevalence of refractive error was significantly higher among females as compared to males. The result showed relatively better visual acuity was reported in right eye ($p < 0.05$). It was observed that 97.50% of eyes improved visual acuity at 6/6, 2.18% improved at 6/9 and 0.15% improved to 6/36 and 6/60 only.

Conclusion

We found that every sixth school going adolescent children is suffering from refractive error. Majority of them were new cases who were unaware of their refractive error indicating a hidden problem of serious dimensions. So screening of school children can play an important part in detecting these hidden cases suffering from refractive errors. Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children which can be reflected on school

performances. Screening of the children for vision at the time of school admission and periodical eye examination of the children is recommended for early rectification of impaired vision.

References

1. Dandona R, Dandona L. Childhood blindness in India: A population based perspective. *Br J Ophthalmol.* 2003;87:263–5.
2. Flaxman SR, Bourne RRA, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al. Global causes of blindness and distance vision impairment 1990–2020: A systematic review and meta-analysis. *Lancet Glob Health.* 2017; 5:e1221–34.
3. Lou L, Yao C, Jin Y, Perez V, Ye J. Global patterns in health burden of uncorrected refractive error. *Invest Ophthalmol Vis Sci.* 2016;57:6271–7.
4. World Health Organization . Programme for the Prevention of Blindness and
5. Deafness. Geneva: WHO; 1997. Global initiative for the elimination of avoidable blindness.
6. World Health Organization . Programme for the Prevention of Blindness and Deafness, and International Agency for Prevention of Blindness. Geneva: WHO; 2000. Preventing blindness in children: Report of WHO/IAPB scientific meeting.
7. Hashemi H, Fotouhi A, Yekta A, Pakzad R, Ostadimoghaddam H, Khabazkhoob M. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. *J Curr Ophthalmol.* 2018;30:3–22.
8. Rim TH, Kim S-H, Lim KH, Choi M, Kim HY, Baek S-H, et al. Refractive errors in Koreans: The Korea National Health and Nutrition Examination Survey 2008–2012. *Korean J Ophthalmol.* 2016;30:214–24.
9. Foster PJ, Jiang Y. Epidemiology of myopia. *Eye.* 2014;28:202–8.
10. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmology.* 2016;123:1036–42.
11. Morgan IG, French AN, Ashby RS, Guo X, Ding X, He M, et al. The epidemics of myopia: Aetiology and prevention. *Prog Retin Eye Res.* 2018;62:134–49.
12. Latif MZ, Khan MA, Afzal S, Gillani SA, Chouhadry MA. Prevalence of refractive errors; An evidence from the public high schools of Lahore, Pakistan. *J Pak Med Assoc.* 2019;69:464–70.
13. Du JW, Schmid KL, Bevan JD, Frater KM, Ollett R, Hein B. Retrospective analysis of refractive errors in children with vision

- impairment. *Optometry Vision Sci.* 2005;82: 807-16.
14. W.H.O. Data on Blindness throughout the World. *W.H.O Chronicle* 1979; Vol. 33, No. 718, 275
 15. WHO (2012) visual impairment and blindness fact sheet. No 282, June 2012.
 16. Saha M, Ranjan A, Islam MN, Mukherji S. Prevalence of refractive errors among the school going children at a tertiary center of West Bengal. *International Journal of Scientific Study.* 2017;5(4):179-82.
 17. Vidusha KS, Damayanthi MN. Prevalence of refractive errors among school children in the rural field practice area of a tertiary care hospital, Bengaluru. *Int J Community Med Public Health.* 2018 Apr;5(5):1471-6.
 18. Kabindra Deva Sarma, Mousumi Krishnatreya. A Study on refractive errors among the school children of Guwahati city. *International journal of Contemporary Medical Research* 2016;3 (8):2258-2260.