



ANALYSIS OF DIFFERENT TYPE OF REFRACTIVE ERRORS IN PRIMARY SCHOOL CHILDREN AT TERTIARY HOSPITAL

Dr Apurva Suthar

Dr kishan Makawana

ABSTRACT

Introduction: Approximately 12.8 million children in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors, estimating a global prevalence of 0.96%. Uncorrected refractive errors are responsible for up to 42% of the cases of visual impairment worldwide, and remain prevalent even in high income countries.

Objective: To assess the pattern of refractive errors in primary school children at our hospital. Our study aims at evaluating the pattern of refractive errors in school age children in our hospital.

Method: All school going children of both genders aged 5 to 16 years attending the eye OPD of a tertiary care teaching hospital, under the school screening programme underwent visual acuity assessment and all other basic eye investigations. The present study is descriptive cross sectional study. All the primary school children attending the eye OPD of a tertiary care hospital for six months under the school health screening programme were included in the study.

Observations: A total of 846 children between 5 and 16 years of age were included in the study. Out of these 55% were males and 45.0% were females. Of the total 108 children with refractive error, myopia was present in 37.8% cases, hypermetropia in 7.9% and astigmatism in 54.3% cases.

Conclusion: Correction of refractive errors in early childhood impacts significant effect in health of individual and growth of nation in future. Improved utilization of existing eye care services and a public-private partnership in strengthening the health services is required.

KEYWORDS : myopia, hypermetropia, astigmatism.

Introduction

In children, blindness due to uncorrected refractive error can hinder education, personality development and career opportunities in future, in addition to causing an economic burden on society. However this burden of economic loss may vary with the type of refractive error. Therefore the knowledge of pattern of refractive errors in school age children can help us in planning public health strategy. Poor vision and inability to read material on chalkboard due to refractive error can profoundly affect child's participation and learning in classroom.¹

Approximately 12.8 million children in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors, estimating a global prevalence of 0.96%.² Uncorrected refractive errors are responsible for up to 42% of the cases of visual impairment worldwide,³ and remain prevalent even in high income countries.^{4,5,6,7} Because of the increasing realization of the enormous need for correction of refractive errors worldwide, this condition has been considered one of the priorities of Vision 20-20 -The right to sight, a global initiative launched by a coalition of non government organizations and the World Health Organization.^{8,9}

Aims and objectives :

To assess the pattern of refractive errors in primary school children at our hospital. Our study aims at evaluating the pattern of refractive errors in school age children in our hospital. Aim of this study to identify different type of refractive error at our hospital and compare it with different study in India and make necessary strategies against it.

Materials and Methods :

All school going children of both genders aged 5 to 16 years attending the eye OPD of a tertiary care teaching hospital, under the school screening programme underwent visual acuity assessment and all other basic eye investigations. Children with any kind of refractive errors were evaluated and categorized according to the type of refractive error on post mydriatic examination. Children with defective vision were further examined by autorefractometer and refraction correction by manual method using trial set and also examined by streak retinoscopy after instilling 1% cyclopentolate

eye drops.

The present study is descriptive cross sectional study. Ethical clearance taken from board. All the primary school children attending the eye OPD of a tertiary care hospital for six months under the school health screening programme were included in the study. The students underwent ocular examination. An Snellen's chart was used at 6 meter distance for assessment of uncorrected, presenting and best corrected visual acuity (VA). A detailed history was taken from all the students including family history, current problems, past problems and treatment. All the children with defective vision ($VA \leq 6/12$) were selected for detailed ocular examination including VA both for distance and near, objective refraction with autorefractometer followed by streak retinoscopy under cyclopentolate 1% eye drops, anterior segment, and fundus examination. The children with any type of refractive errors on post mydriatic examination were further evaluated according to the type of refractive error. Chi-square test was used to analyze differences in the refractive errors between males and females and among different age groups. p value < 0.05 was considered significant.

The parents of all children were informed about the nature of the study and a written consent was obtained. Examination was performed by a single refractionist and ophthalmic surgeon to prevent bias. The patients with history of prior ocular surgery or any ocular disease contributing to the diminished VA, manifest strabismus and pathological myopia were excluded from the study.

observations

A total of 846 children between 5 and 16 years of age were included in the study. Out of these 465 (55%) were males and 381 (45.0%) were females. (Table-1)

Table 1: sex distribution of students.

Sex	n[%]
Males	465[55%]
Females	381[45%]

The children were divided into four groups according to their age. (Table-2)

Table 2: Distribution of students by age.

Age (years)	n (%)
5-7	135(16%)
8-10	195 (23%)
11-13	228 (27%)
14-16	288 (34%)

Table 3: Distribution of uncorrected, presenting and best corrected visual acuity (VA).

Vision	Unaided n[%]	Presenting n[%]	Wearing glasses n[%]	Best corrected n[%]
6/6	728[86%]	744[88%]	25[3%]	840[99.3%]
6/9-6/12	61[7.2%]	60[7.1%]	7[0.8%]	4[0.48%]
6/18-6/60	33[3.8%]	31[3.7%]	5[0.6%]	2[0.24%]
<6/60	24[2.9%]	11[1.3%]	0	0

Unaided VA was normal (6/6) in 728 (86%) children. Presenting VA was normal (6/6) in 744 (88%) children. 61 students (7.2%) had presenting VA 6/9-6/12 and 33 students (3.8%) had VA 6/18-6/60 (Table-3). 37 (4.4%) students were wearing glasses out of which 25 (3%) students had presenting VA 6/6.

Unaided VA worse than 6/12 was present in 57(6.7%) students. After refractive correction, visual acuity was improved to 6/6 in 840 students (99.3%).6(0.7%) students were amblyopic with VA < 6/12 after refractive correction.

Table 4: Prevalence of refractive error by age and sex.

Age[years]	Total refractive error	
	No	Yes n[%]
5-7	114	12[9.2%]
8-10	167	21[10.4%]
11-13	205	29[12.9%]
14-16	250	46[16.4%]
Male	388	60[13.1%]
Female	348	48[12.7%]
Total	736	108[12.8%]

A total of 108 children (12.8%) had refractive error. Refractive error was prevalent in 60 males (13.1%) and 48 females (12.7%). There was no significant difference between the prevalence of refractive error between males and females (p>0.05). Prevalence of refractive error which was 9.2% in 5-7 years age group increased to 16.4% in 14-16 years age group. This increase was statistically significant. (p<0.01) (Table-4)

Table 5: Distribution of type of refractive errors among cases and the study group.

Type of refractive error	No of students	%among the cases	%in the study group
Myopia	41	37.8%	4.9%
Hypermetropia	9	7.9%	1.1%
Astigmatism	58	54.3%	6.8%
Total	108	100%	12.8%

Of the total 108 children with refractive error, myopia was present in 41 (37.8%) cases, hypermetropia in 9(7.9%) and astigmatism in 58 (54.3%) cases. (Table-5)

Table 6: Association of age with the type of refractive error.

Age[years]	Type of refractive error			P value
	Myopia[n=41]	Hypermetropia[n=9]	Astigmatism [n=58]	
5-7	4[8.7%]	5[51.1%]	20[34.33%]	P<0.05
8-10	7[18.1%]	2[28.1%]	17[28.7%]	
11-13	12[28.97%]	1[13.5%]	13[22.67%]	
14-16	18[43.67%]	1[7.3%]	8[14.3%]	

The prevalence of myopia increased from 8.7% in the 5-7 years age

group to 43.67% in the 14-16 years age group. The prevalence of hypermetropia progressively decreased from 51.1% in the 5-7 years age group to 7.3% in the 14-16 years age group. The prevalence of astigmatism progressively decreased from 34.33% in the 5-7 years age group to 14.3% in the 14-16 years age group (Table- 6).

Table 7: Association of sex with the type of refractive error.

Sex	Type of refractive error			P value
	Myopia	Hypermetropia	astigmatism	
Male	23[56%]	5[57%]	28[49.1%]	p>0.05
Female	18[44%]	4[43%]	30[50.9%]	

The prevalence of myopia was 56% in males and 44% in females. The prevalence of hypermetropia was 57% in males and 43% in females. The prevalence of astigmatism was 49.1% in males and 50.9% in females as shown in Table -7.

Discussion

In India as in other developing countries, the school health services provided are hardly more than a token service because of the shortage of resources and insufficient facilities.¹⁰ Childhood blindness is a priority area because of the number of years of blindness that ensues. Data on the prevalence and causes of blindness in children is needed for planning and evaluating preventive and curative services for children.

The prevalence of refractive error in this study was 12.8% which was similar to the prevalence observed by Seema et al. in Haryana (13.65%).¹¹ However this prevalence was much higher when compared to that observed by GVS Murthy et al. in New Delhi (6.4%)¹² and Kumar et al. in Lucknow (7.4%).¹³ Similar studies from different parts of the world showed a prevalence of (8.2%) in Baltimore (USA)¹⁴ (12.8%) in Shunyi district in China¹⁵ (2.9%) in Nepal¹⁶ and (15.8%) in Chile.¹⁷ These variations in the prevalence data from studies carried out in different parts of the world are due to different operational definitions considered by investigators and also due to differences in demographic factors such as different geographical location, different socioeconomic class, different race etc.

There was an increase in the overall prevalence of refractive errors with advancing age as shown in Table-4. Our results were comparable with the study conducted by Pavithra et al.¹⁸ in Bangalore which showed the prevalence of refractive error more (7.5%) in the 13 -15 years age group compared to 6.6% in the 7-9 years age group. A study conducted in Ahmedabad city showed that the prevalence of refractive errors was highest 40% in 17 years old students compared to only 6.7% in 11 year old children.¹⁹ Mata S et al. also found that refractive error increased with increasing age especially in the age group of 10- 14 years.²⁰

There was no significant difference in the prevalence of refractive error between males and females in our study (p> 0.05) as shown in Table-4. This was similar to the results shown by Ande V R et al. in Andhra Pradesh²¹ and Krishnan V M et al. in Villupuram and Puducherry²² where no sex predilection of refractive error was noted. However some studies showed evidence of increased prevalence in female students,^{11,23} which was attributed to the earlier attainment of puberty by girls with respect to boys. This was in contrast to the findings of Sriram C et al. in Tamil Nadu which showed refractive errors to be more prevalent in male children(21.5%) than female children(17%)²⁴

In our study the single most common refractive error was astigmatism followed by myopia. Hypermetropia was least common of all as shown in Table-5. Our results were comparable with the study conducted by Rai et al. in Rupandehi district Nepal on primary school children. They found that the commonest refractive error among school children was astigmatism, followed by myopia (26%) and then hypermetropia (19%).²⁵ Pavithra et al. in Bangalore,¹⁸ Sethi S et al. among school children of Ahmedabad,¹⁹ and S Mata et

al. among the adolescents attending outpatient department of ophthalmology in New Delhi,²⁰ concluded that myopia was the most common refractive error among school children followed by astigmatism and hypermetropia.

A study conducted by Medi K et al. in Kampala district showed that the commonest refractive error was astigmatism (52%), followed by hypermetropia (37%) children and myopia (11%).²⁶ In a study of Prevalence of refractive errors in school children of Tafiya city conducted by Hussein A et al., it was found that myopia (63.5%) was the most common type of refractive error followed by hypermetropia 11.2% and astigmatism 20.4%.²⁷ In the present study, myopia showed an increasing trend with advancing age whereas hypermetropia and astigmatism showed a decreasing trend with advancing age which was statistically significant ($p < 0.05$) as shown in Table-6. Similar pattern was shown in many previous studies conducted in New Delhi,¹² Bangalore,¹⁸ Andhra Pradesh²¹ and Kolkata.²⁸ There was no significant difference in the prevalence of myopia, hypermetropia and astigmatism between males and females in our study. ($p > 0.05$) (Table-7) Similar results were shown in a study conducted in Villupuram and Pudukcherry.²² Hypermetropia was shown to be associated with female sex in some of the previous studies.^{12,18,29} In a study conducted by Pune³⁰ myopia was found to be more prevalent in females (57.35%) as compared to males (42.65%). Hypermetropia was equally prevalent in both sexes (50%), astigmatism was found only in females (100%) and myopia was shown to be associated with female gender 65% and having a father with higher level of schooling in a study conducted in Kolkata.²⁸ Myopia was shown to have no sex predilection in few other studies.^{18,21}

The presenting VA was 6/6 in 88% students, while after refractive correction 99.3% students could attain a VA of 6/6. Our results raise the need for school-based program that provides prescription of glasses when needed to students at no cost, through government and non-governmental collaborative fund. 6 (0.7%) students in our study suffered from amblyopia. Amblyopia treatment is most effective when done early in the child's life, usually before the age of seven.³¹ School screening is the best way to detect amblyopia in school children. Our study had some limitations. Detailed evaluation was done only in children with vision less than 6/12. Thus some refractive errors like latent hypermetropia might have been missed. Patients with manifest strabismus and pathological myopia were excluded which might distort the demographic data marginally. A major limitation of our study was that only school going children were included in the study. Significant proportion of the children in rural India and other developing countries do not go to schools; hence a more complete assessment of visual impairment in children would be possible with population based studies not restricted only to school going children.

Studies from all over the continents and from India suggest early screening, spectacle compliance and spreading awareness among parents to motivate students to use spectacles.³²

Conclusion

Correction of refractive errors in early childhood impacts significant effect in health of individual and growth of nation in future. Various factors are responsible for refractive errors remaining uncorrected: lack of awareness and recognition of the problem at personal and family level, as well as at community and public health level; non-availability of and/or inability to afford refractive services for testing; insufficient provision of affordable corrective lenses; and cultural disincentives to compliance. Improved utilization of existing eye care services and a public-private partnership in strengthening the health services is required. Strategies such as vision screening programmes need to be implemented on a large scale to detect individuals suffering from refractive error blindness. Refractive error is a common cause of visual impairment among school children in less income countries. Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children and adults such as lost educational

and opportunities, lost economic gain for individuals, families and societies and impaired quality of life.

References

- Negrel AD, Maul E, Pokharel GP, Zhao J, Ellwein LB. Refractive error study in children: sampling and measurement methods for a multicountry survey. *Am J Ophthalmol* 2000; 129:421-6.
- Smith TS, Frick KD, Holden BA, Fricke TR, Naidoo KS. Potential lost productivity resulting from the global burden of uncorrected refractive error. *Bull World Health Organ* 2009; 87:431-7.
- Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol* 2012; 96:614-8.
- Vitale S, Cotch MF, Sperduto RD. Prevalence of visual impairment in the United States. *J Am Med Assoc* 2006; 295:2158-63.
- Bourne RR, Stevens GA, White RA, Smith JL, Flaxman SR, Price H, et al. Causes of vision loss worldwide, 1990-2010: a systematic analysis. *Lancet Global Health* 2013; 1:e339-49.
- Bourne RR, Jonas JB, Flaxman SR, Keeffe J, Leasher J, Naidoo K, et al. Prevalence and causes of vision loss in high-income countries and in Eastern and Central Europe: 1990-2010. *Br J Ophthalmol* 2014; 98:629-38.
- Sherwin JC, Khawaja AP, Broadway D, et al. Uncorrected refractive error in older British adults: the EPIC-Norfolk Eye Study. *Br J Ophthalmol* 2012; 96:991-6.
- Thylefors B. A global initiative for the elimination of avoidable blindness [editorial]. *American Journal of Ophthalmology* 1998; 125:90-3.
- Pararajasegaram R. VISION 2020 - The Right to Sight: from strategies to action. *Am J Ophthalmol* 1999; 128:359-60.
- Park K. Text book of Preventive and Social Medicine. 20th ed. Jabalpur: M/s Banarsidas Bhanot; 2009:498-501.
- Sharma S, Vashisht BM, Kalhan M, Goel M. Magnitude of Refractive Errors among school children in a rural block of Haryana. *The Internet Journal of Epidemiology* 2009; 6:5.
- Murthy GV, Gupta SK, Ellwein LB, Muñoz SR, Pokharel GP, Sanga L, et al. Refractive error in children in an urban population in New Delhi. *Invest Ophthalmol Vis Sci* 2002; 43:623-31.
- Kumar JV, Singh PC, Ahuja J, Mohan U. Ocular morbidity among school children in Sarojini Nagar Lucknow. *Indian J Community Med* 1992; 17:109-13.
- Proslan M, Novak C. The Baltimore vision screening project. *Trop Med Int Health* 1996; 3:14-9.
- Zhao J, Pan X, Sui R, Munoz SR, Sperduto RD, Ellwein LB. Refractive error study in Children: results from Shunyi District, China. *Am J Ophthalmol* 2000; 129:427-35.
- Pokharel GP, Negrel AD, Munoz SR, Ellwein LB. Refractive error studies in Children: Results from mechi Zone, Nepal. *Am J Ophthalmol* 2000; 129:436-44.
- Maul E1, Barroso S, Munoz SR, Sperduto RD, Ellwein LB. Refractive error study in children: results from La Florida Chile. *Am J Ophthalmol* 2000; 129:445-54.
- Pavithra MB, Maheshwaran R, Rani Sujatha MA. 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. *Int J Med Sci Public Health* 2013; 2:641-5.
- Sethi S, Kartha GP. Prevalence of refractive errors among school children (12-17 years) of Ahmedabad city. *Ind Journal of Com Med* 2000; 25:181-3.
- Matta S, Matta P, Gupta V, Dev A. Refractive errors among adolescents attending Ophthalmic OPD. *Ind Joun Comm Medicine* 2006-04 - 2005-06; 31(2).
- V R Ande, R K Peeta, M R Chella, C Gujjarlupudi. Prevalence of refractive errors among school children in a rural setting. *Med Pulse. International Medical Journal* 2015; 2:98-101.
- Krishnan V M, Baba D, Poovitha R, Kumar PS. Study of Prevalence of Refractive Errors in School Children of Villupuram & Pudukcherry. *Sch. J. App. Med. Sci* 2015; 3(7B):2568-73.
- N. Prema; Prevalence of refractive error in school children. *Ind J Sci Tech* 2011; 4:1160-61.
- Sriram C, Jain Raj.R; A Cross-Sectional Study on Prevalence of Refractive Errors among School Children in Thiruvallur District, Tamilnadu. *Indian Journal of Applied Research* 2014; 4:2249-55
- Rai SK, Thapa HB, Gurung N, Bhari AM, Sharma MK. Pattern of refractive error in primary school children in Rupandehidistrict, Nepal. *Journal of Universal College of Medical Sciences Vol. 3, No. 1, 2015: 31-36*
- Medi K, Robert M. A survey of prevalence of refractive errors among children in lower primary schools in Kampala district, Uganda. *African health sciences* 2002; 2:69-72.
- Hussein A, Ahmed E. Prevalence of refractive errors in school children (12-17 years) of Tafiya city. *Sudanese journal of public health* 2008; 3:186-9.
- Chatterjee S, Biswas D, Kumar K. Prevalence of refractive errors in school children in the urban population of Kolkata, India: A prospective study. *Int J Res Health Sci* 2014; 2:1185-7.
- Kalikivayi V, Naduvilath TJ, Bansal AK, Dandona L. Visual impairment in school children in Southern India. *Indian J Ophthalmol* 1997; 45:129-34
- Kumar P, Pore P, Dixit AK, Singh N. Prevalence and demographic distribution of refractory error in school children of Pune, India. *Int J Res Health Sci* 2014; 2:58-67.
- Khurana AK. Text book of ophthalmology. 3rd ed. New Delhi: New Age International Publisher; 2006:52-59.
- Gogate P, Mukhopadhyaya D, Mahadik A, Naduvilath TJ, Sane S, Shinde A, et al. Spectacle compliance amongst rural secondary school children in Pune district, India. *Indian J Ophthalmol* 2013; 61:8-12.