

Prevalence and Pattern of Refractive Errors in School Children (Aged 5-15 Years) of Kolar City

S. M. Darshan¹, T. Sangeetha², K. Kanthamani³, Borra Harish Laxman⁴

¹Senior Resident, Department of Ophthalmology, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, India

²Assistant Professor, Department of Ophthalmology, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, India

³Professor and HOD, Department of Ophthalmology, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, India

⁴Junior Resident, Department of Ophthalmology, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, India

Abstract: Purpose: Refractive error is the most common cause of visual impairment in school aged children. Defective vision will hinder the learning capabilities & academic growth of children with consequent reduced employability & impaired quality of life. Considering the fact that 30% of India's blind lose their sight before the age of 20 years, the importance of early detection and treatment of ocular morbidity and visual impairment in young children is obvious.

Materials and methods: This cross sectional study was carried out on primary school pupils in Government and private schools located in Kolar district. The schools were selected using a simple random sampling technique by balloting, two schools were selected from each taluk making a total of ten schools. Approval was obtained from Ethics Committee of Sri Devaraj Urs Medical College, Kolar. This study evaluates the prevalence and type of Refractive errors among school children in Kolar district for a period of 12 months. About 677 children were examined. Visual acuity, examination of anterior and posterior segment, cycloplegic refraction followed by subjective correction.

Results: The prevalence of refractive error was found to be 10.9% (220 students) which was more among girls (54.1%) than for boys (45.90%). Prevalence of myopia, astigmatism and hypermetropia was 79.7%, 12.2% and 8.1% respectively. The prevalence of anisometropia and amblyopia was found to be 2.7% & 0.83% respectively. The increased prevalence of myopia was correlation with increasing age.

Conclusion: The present study indicates that the school age is a high risk group for developing refractive errors. Hence more studies to determine the extent of the problem, screening programmes and provision of corrective services will solve the problem of uncorrected refractive errors and help to achieve the goal of vision 2020 "The Right to Sight".

Keywords: refractive errors, myopia, astigmatism, hypermetropia, cycloplegia

1. Introduction

School children are affected by various eye disorders like refractive errors, Vitamin-A deficiency and eye infections. Refractive error is a major contributor to visual impairment which is a significant cause of morbidity in children worldwide. Refractive errors are the most common cause of visual impairment and the second major cause of blindness in India after cataract [1].

Vision in preschool children is important because their visual system is still developing and they are at risk of developing amblyopia from uncorrected high ametropia or anisometropia. Children do not complain of defective vision, and may not even be aware of their problem and adjust to the poor eyesight by sitting closer to the blackboard, holding the books closer to their eyes, squeezing the eyes and even avoiding work requiring visual concentration.

Refractive error in children is one of the priorities of the world health organization.

(Vision 20/20 the right to sight) [2]. Visual impairment caused by refractive error in children accounts for 3% of blindness in southern Indian school children and much higher (prevalence of myopia 21.6% and hyperopia 2.7%) in china [3]. According to UNICEF, a child is defined as an individual aged less than 16 years old. The WHO defines blindness as visual acuity in better eye of less than 3/60, and severe visual impairment as a corrected acuity in the better eye of less than 6/60 [4].

Childhood blindness hinders the child's development, affects quality of life, education and socioeconomic development of the child. Uncorrected refractive error is of main cause of visual impairment in children. The school going years are formative for children in determining their physical, intellectual and behavioural development. Hence poor vision in childhood

affects the performance in school and has a negative influence on their development and maturity. This needs early detection and treatment of refractive errors to prevent possible disabilities.

Due to the large magnitude of childhood blindness, it has been recognized as one of the major challenges of Vision 2020, "The Right to Sight". It is estimated that there are 1.4 million blind children in the world. 75% of world's blind children live in developing countries. 50,000 children become blind each year, most in developing countries [5].

In India a prevalence of blindness, is estimated to be 0.8/1000 children between 0-15 years. Currently, there are an estimated 270,000 blind children in India [6]. About 80% of it is avoidable blindness. Uncorrected refractive errors are responsible for about 19.7% of blindness. About 13% of the Indian population is in the age group of 7-15 yrs. And about 20% of children develop refractive error by the age of 16years [7].

In view of early detection of refractive errors in school children, effort was made in this study to find the extent of problem of refractive error which would help to plan for the primary eye health care in the region.

2. Materials and methods

This two year cross sectional and time bound study was conducted in various schools of Kolar district by simple random cluster sampling method. All the children between 7 to 15 years of age in the selected school were examined for visual impairment. Children with decreased vision due to other pathologies in the anterior segment and posterior segment like

corneal opacities, Lens opacities, Retinal diseases and Optic nerve disease were excluded. A total number of 677 students between 7 to 15 years of age were included in this study.

The purpose and method of examination of the students were explained to the Head of the schools concerned. With the help of concerned physical training teacher and respective class teacher each student was subjected to, Visual assessment with Snellen's chart, Anterior & posterior segment examination, Cycloplegic retinoscopy and subjective refraction.

The diagnosis of amblyopia was made if visual acuity was worse than 6/9 after meticulous refraction in the absence of any ocular pathology. The diagnosis of strabismic amblyopia was made if the reduced visual acuity was due to the strabismus.

Similarly, the diagnosis of refractive amblyopia was made if there was anisometropia of 1.00D of hypermetropia or 4D of myopia. The students that required further evaluation and treatment were referred to the base hospital.

After evaluation, all findings were entered in an Excel spreadsheet & analysed. The results were compared with previously published studies.

3. Results

A total of 677 school children were screened for the prevalence of different types of refractive error in the age group of 5 to 15 years which was 10.9 % (74 children). Among the screened 295 (43.5%) were boys and 382 (56.5%) were girls. Out of 74 children with refractive error 34 (45.9%) were males and 40(54.1%) were females which was statistically insignificant. (Table 1)

Table 1
Prevalence of refractive error in the study

No. of children examined				Total no of RE cases detected			Percentage
677	Male	295	43.5%	74	Male	34	45.9
	Female	382	56.5%		Female	40	54.1
				p value-0.317			Prevalence
				Chi square value- 0.157 df-1			
							10.9

Table 2
Distribution of the Study Subjects with refractive error based on age group

S. No.	Age	Screened		Refractive error	
		N	%	N	%
1	5-8	135	20.2%	14	18.9%
2	9-12	223	31.6%	25	33.7%
3	13-15	319	48.2%	35	47.4%
4	Total	677	100	74	100

Table 3
Type of Refractive errors in the study

Refractive errors	N	N	%	Prevalence	
Myopia	59	Male	27	45.8	8.6
		Female	32	54.24	
Hypermetropia	06	Male	04	66.7	0.88
		Female	02	33.33	
Astigmatism	09	Male	04	44.44	1.32
		Female	05	55.6	
Amblyopia	03	Male	1	0.15	0.44
		Female	2	0.29	
An isometropia	08	Male	3	4.05	2.7
		Female	5	6.75	

Table 4
 No. of children with diminution of vision due to refractive errors

Visual acuity	No. of children	Percentage
6/9	34	45.9%
6/12 to 6/18	23	31.00%
6/24 to 6/36	15	20.2%
6/60 and below	02	2.7%
Total	74	100.00

Table 5
 Type & grading of refractive error among study subjects

Type of refractive error	Grade	N	%
Myopia	Mild (< -2.0D)	42	71.1%
	Moderate (-2 to -6D)	15	25.4%
	High (> -6D)	02	3.3%
	Total	59	100
Hypermetropia	< 1 D	04	66.7%
	> 1D	02	33.3%
	Total	06	100
Astigmatism	<1.5DC	07	77.8%
	>1.5DC	02	22.2%
	Total	09	100

Table 6
 Table showing incidence of symptomatic children

Total no. of children	Total no. of children with Refractive error	Particulars	No. found	Percentage
677	74	Children already wearing glasses	11	14.86
		Children who had complaints	43	58.1
		Children without any complaints	20	27.4
		Total	74	100

Table 7
 Pattern of refractive error according to different age groups

Refractive error		Age group			Total	p value
		5-8 yrs	9 - 12 yrs	13 - 15 yrs		
Myopia	Mild	7 (63.6%)	16 (72.72%)	18 (69.23%)	41 (69.49%)	0.199
	Moderate	3 (27.3%)	05 (22.72%)	08 (30.76%)	16 (27.11%)	
	High	01 (9.1%)	01(4.54%)	0	02 (3.38%)	
	Total	11 (100%)	22 (100%)	26 (100%)	59 (100%)	
Hypermetropia		03(50%)	02 (33.33%)	01(16.66%)	06(100.00%)	0.157
Astigmatism		02(22.22%)	02(22.22%)	05(55.55%)	09(100)	

Out of 677 screened 135 (20.2%) children were in the age group of 5-8, 223(31.6%) children were in the age group of 9-12 and 319(48.2%) children were in the age group of 13-15yrs. Among 74 children who had refractive errors 14 (18.9%) were in the age group of 5-8 years, 25(33.70%) were in the age group of 09-12 years, 35(47.40%) were in the age group of 13-15 years (Table 2).

In the present study myopia, astigmatism, hypermetropia, Amblyopia & An isometropia were observed in 59 (79.7%), 09 (12.2%) & 06(8.10%), 3(0.44%) in 8(10.8%) children respectively. Among 59 (6.86%) myopic children, females (54.24%) had higher incidence than males (45.76%), 6 (0.88%). Higher incidence Hypermetropic was observed more among males (66.66%) than females (33.33%) and 9 students with astigmatism showed males lesser 44.44% than females 55.55%. (Table 3).

In the present study, 34 children had vision of 6/9. 23 children had 6/12 to 6/18, 15 had vision of 6/24 to 6/36 and 2 children had <6/60 vision (Table 4).

Among the 74 students 42 children had myopia of < -2D and

15 children had myopia of -2 to -6D, about 4 children had hypermetropia of <1.0D and 2 students had hypermetropia of >1.0D, 07 children had astigmatism of <1.5DC and 02 children had astigmatism of >1.5DC (Table 5).

The present study shows that out of 74 children who were found to be having refractive errors in 11 students (14.86%) were already using spectacles at the time of screening, and 43 (58.1%) students had symptoms and 20 (27.04%) were without symptoms (Table 6).

In the present study myopia was found in 59 (71.15%) children. 18.86% were in the age group of 7-9 years, 36.57% in 10-12 years and 44.57% in the 13-15 years group. Six children, 3 were b/w 5-8yrs, 2 were b/w age of 9 - 12yrs, and 1 were b/w 13 - 15 years had hyperopia. 9 children had astigmatism among them 22.22% were in the age group of 5-8 years. 22.22% in 9-12 years and 55.55% in the of 13-15 years age group (Table 7).

4. Discussion

An unaided visual acuity of 6/9 or worse was present in one or both eyes in 74 children. The total prevalence of different

pattern of refractive errors which includes hypermetropia, myopia and astigmatism was 10.9% which falls within the WHO prevalence of 2-10% worldwide and this is comparable to other studies conducted by Dandona Rakhi et al (8.6%), Haseeb et al (8.9%), Gurumurthy et al (6.4%) and Lucknow showing 7.03% [8]-[10].

Refractive errors were more prevalent in female children (54.1%) compared to male children (45.9%) unlike Seema Sharma et al study that found that prevalence of refractive error to be greater in girls (23.7%) than boys (12.2%) [11]. This high prevalence was related to the higher rate of growth in girls and attainment of puberty earlier than boys.

About 14 children with refractive errors were in the age group of 5 to 8 years, 25 were in the age group of 09 to 12 years and 35 were in the age group of 13 to 15 yrs. Higher prevalence (3.92%) of refractive error in children of class 8th to 10th in Ahmedabad city, there by showing that ametropia is related to number of years of schooling.

The prevalence of myopia in the study was 8.71% which can be compared to study conducted by Murthy G V which showed prevalence of 7.4% and by Dandona R and Dandona L a study conducted in LVEP Hyderabad (in the year 2001) which showed an prevalence of 4.1%. Myopia was found most frequently in the age group of 13 to 15 years and the prevalence of myopia has increased from 18.85% at 5 to 8 years to 44.57% at 13 to 15 years [12]. This can be attributed to the risk of developing refractive errors because at this age they are actively growing and subjected to the strain of near work due to demanding academic schedules.

In the present study females have more prevalence (54.24%) of myopia than males (45.76%) which can be compared to a study conducted by Venkataraman and Kallikavayi in the year 1997 Hyderabad, India and also study conducted by Zaho, Xiangjun et. al which showed a female prevalence of 55.0% and male prevalence of 45% [13], [14].

The prevalence of hypermetropia in the present study was 1.88% which can be compared to a study conducted by Mamata Kuzvae GN [15] which showed a prevalence of 2.6% and a study conducted in the Shunyi district of China which showed an prevalence of 3.5% and a study conducted showed a prevalence of 1.4% [16]. Our study differs from study conducted by Kallikavayi (1997) which showed a prevalence of 22.6% and a study in Chile showed a prevalence of 16.3% and a study in Ahmedabad showed a prevalence of 7.7%.

A study on school children aged b/w 5 - 15 years, prevalence of hypermetropia was more in younger children (77%). This is probably due to the myopic shift seen due to the growing eyeball [17].

In the present study males (8.2%) have more prevalence of hypermetropia than females (4.1%) which is not significant. G V S Murthy et al also found that there was an age related shift in refractive error from hypermetropia in young children (15.6% in 5yrs olds) toward myopia in older children (10.8% in 15 years old) and also that hypermetropia was more common in females [18].

The prevalence of astigmatism was 12.2% which is closely related to study conducted by Kallikavayi (10.3%) and Jialiang Zaho (10.1%) also astigmatism was most frequently found in the age group of 13 to 15 years (50.0%) and the prevalence of astigmatism has increased from 5 to 8 years (28.13%) to 13 to 15 years (50.0%). In the present study females have more astigmatism (55.37%) compared to males (44.4%) and the commonest type of astigmatism found in the study is mixed type (55.6%).

The prevalence of anisometropia in the study was 2.7% which can be compared to a study conducted by Akbar Fouthi et. al., which showed a prevalence of 3.6% [19]. The prevalence of amblyopia in the study was 0.50% which can be compared to study conducted by Lithander J in Oman which showed a prevalence of 0.92% [20] and a study conducted in Akbar Fouthi et. al., which showed a prevalence of 0.91%.

Keeping in mind the observations of our study findings, it is worthwhile to make the aim of all Blindness control programmes to propagate awareness and importance of ocular hygiene to the public, school children and teachers.

5. Conclusion

Present study shows that significant proportion of children of this area had uncorrected refractive error. Most of the children and parents were unaware of the refractive status that detected during the screening.

Unless corrected they cause low vision and even blindness. This warrants an urgent action to correct i, e regular screening and correction of refractive error. This will help to improve vision, enhance learning, Social participation and psychosocial development. Thus screening process helps to prevent worsening of vision and blindness and amblyopia.

In conclusion, significant visual impairment due to Refractive errors are frequent among school aged children living in the area. Hence eye screening programmes become more useful in early diagnosis and proper correction of refractive errors and even other eye ailments. They can be easily diagnosed, measured, and corrected with spectacles and other refractive corrections to obtain normal vision.

References

- [1] Dandona R.Dandona L. Refractive error blindness Bull eye organ 2001;79: 237- 243.
- [2] World Health Organization. Global initiative for the elimination of avoidable blindness. Programme for the Prevention of Blindness and Deafness. Geneva; WHO, 1997.
- [3] World Health Organization, Elimination of avoidable visual disability due to refractive error Report of an informal planning meeting WHO /PBL / 00.79 pp:6-10.
- [4] Childhood blindness in the context of vision 2020-The right to sight. Clare Gilbert and Allen Foster. Bulletin of WHO,2001,79(3).
- [5] World Health Organization/IAPB scientific meeting. Programme for the Prevention and Blindness, and International Agency for Prevention of Blindness. Geneva; WHO,2000.
- [6] Global initiation for elimination of avoidable blindness, vision-2020.WHO-PBL-97.61 Rev-1.1

- [7] Sethi S, Kartha GP. Prevalence of refractive errors among school children (12-17years) of Ahmadabad city. *Ind Journal of Com Med.*2000; 25;181-83,10-15
- [8] Wedner SH, Ross DA, Balira R, Kaji I, Foster A. Preventive of eye diseases in primary School children in rural area of Tanzania. *Br J Ophthalmol.*2000;84: 1291-7. PubMed /Google Scholar.
- [9] Dandona R, Dandona L, M Shrinivasa, P Giridhar, Catherine A, Rao G.N. Population-based assessment of refractive error in India - the Andhra Pradesh Eye Study. *Clinical and Experimental Ophthalmology* 2002;30:84-93.
- [10] Murthy GVS, Gupta. K Sanew et al. 2002 principle and practice of community ophthalmology pp. 116- 120
- [11] Sharma P Strabismus Simplified The Physiology of Binocular vision, Amblyopia, Anomalous Retinal Correspondence 1st Ed., New Delhi, Modern Publishers.41-49
- [12] Dandona R, Dandona L, M Shrinivasa, P Giridhar, Catherine A, Rao G.N. Population-based assessment of refractive error in India - the Andhra Pradesh Eye Study. *Clinical and Experimental Ophthalmology* 2002;30:84-93.
- [13] Kalkivayi V, Naduvilah TI, Bansal AK, Dandona L. Visual impairment in school children in Southern India. *Indian Ophthalmol.* 1997; 45:129-34.
- [14] Zhao J, Pan X, Sui R et al. Refractive error study in children: results from Shunyi District, China. *American J Ophthalmol.*2000;129:427-35.
- [15] Mamattkhakuzawea G.N prevalence of Refractive anomalies among school children. *vestren ophthalmal* 2002; 118:47-49.
- [16] Agarwal AK. Social Classification: The Need to Update in the Present Scenario. *Indian J Community Med.* 2008; 33(1):50-51.
- [17] Bhatt, Janardanl; Trivedi, Vivek and Zalavadi, Sandeep: Pevalence of refractive errors in children (age group 7-15 yrs) of rural and urban area of Gujarat: A population based study. *Journal of Applied Basic Medical sciences*, 2006; 8(1): 128-135.
- [18] Murthy GVS. Vision testing for Refractive errors in schools 'screening' programmes in schools. *I comm Eye health* 2000, 13(33):pp. 3-5.
- [19] Akbar Fotouhi, Hassan Hashemi, Mehdi Khabazkhoob, Kazem Mohammad, The prevalence of refractive errors among school children in Dezfoul, Iran. *Br J Ophthalmol*, 2007; 91: 287-292.
- [20] Lithander J. Prevalence of Amblyopia with anisometropia or Strabismus among school children in the sultanate of Oman. *Acta ophthalmol Scand.* 1998;76:658-62.