Original Research Article

Frequency of refractive errors in school age children: A cross sectional study

Abstract

Aim: To determine the frequency of refractive errors in school age children

Study Design: Cross sectional study

Place and duration: Two Government and two Private schools of Hyderabad Sindh, screened by institute of ophthalmology at Liaquat University of Medical and Health Sciences Jamshoro, from January 2021 to June 2021.

Methodology: Schools and students were selected by stratified random method; total four hundred students were screened in four schools. From class one to class ten, 10 students were selected from each class. Prior written permission was obtained from parents. External ocular examination, visual acuity, pinhole test, auto refraction and fundus examination was done and recorded on proforma along with the information regarding age, sex, family history and parent's education. The data was entered and analyzed by SPSS version 22.

Results: In government schools 27 students out of 200 had refractive errors, myopia was present in 15 (55.55%) students, hypermetropia in 7 (25.93%) students and astigmatism in 5 (18.52%) students, while in private schools 25 students had refractive errors. Myopia was present in 16 (64%) students, hypermetropia in 7 (28%) students and astigmatism in 2 (8%) students. Myopia and astigmatism were more prevalent in female sex being 8.1% and 2% respectively, while in

males it was 6.4% and 1.4% cases. In this study no significant refractive error difference was found between government and private sector schools.

Conclusion: In our study the prevalence of refractive errors was 13% (52) out of 400 students. Refractive errors are the most common and easily treatable causes of decrease vision in school aged children. It is recommended that visual acuity should be checked prior to admission to school because refractive error can be easily corrected with glasses and if it is treated in time child can be prevented from amblyopia and squint.

Keywords: Refractive Errors, Government Schools, Private Schools, Myopia, Astigmatism

Introduction:

Refractive error can be defined as an optical condition of eye in which the parallel rays of light are not focused on fovea centralis when accommodation is at rest.[1] Refractive error is the commonest cause of visual impairment in world [2] and second leading cause of treatable blindness.[3] It is reported that 2.3 billion people throughout the world have refractive error,[4] only 1.8 billion people have access to ophthalmologists and optometrists and have affordable corrections [5], this leaves approximately 500 million people, including 1.5 million children, mostly in developing countries with uncorrected refractive error causing either blindness or impaired vision.[6]

Refractive error is not only uncorrected in significant number of people, but also it has been estimated that it may remain under corrected in 50% of cases.[7] Possible risk factors for myopia are family history, level of education, intelligence and amount of close work.[8] Some studies also indicate genetical and environmental factors.[9]

The world Health Organization has launched the Global initiative vision 2020 in 1999 with the slogan "The Right to sight" it has five priorities, they are chosen on the basis of burden of blindness they represent. It includes Refractive errors although other major causes of blindness like Glaucoma and Diabetic retinopathy are not included.[10] Refractive errors are usually present since childhood and continue in the adult life unfortunately they are not given much importance in our society which is evident from the fact that there is no screening system for Pre School visual examination of children either in government or in private sector.

Effective preschool health programs are available in developed countries and refractive error detections lie mainly on school health personnel as well as the optometrist.[11] Even in the presence of such effective school health services these developed countries are now taking help from community health workers and teachers for the early detection of visual disorders in school going children.

In myopia the image is focused in front of the retina, [12] this condition may result from an excess of corneal power, lens power or both for a normal axial length or the axial length being longer than normal or longer than that which is compatible with the refractive power of the normal eye. Children usually do not complain of decrease vision. They may be unaware of their problem. They adjust to poor vision or even avoid work that requires visual concentration. Defective vision due to refractive error affects education, personality development, and career opportunities, in addition to causing an economic burden on society. The current study is planned to determine the frequency of refractive errors in school age children as timely measures could be taken to prevent the preventable cause of blindness.

Methodology:

This cross sectional Study was conducted in two government and two private schools of Hyderabad Sindh, by institute of ophthalmology, Eye Unit-III at Liaquat University of Medical and Health Sciences Hyderabad from January 2021 to June 2021. Schools and Students were selected by stratified random method. School going children of 6-15 years of age were included in the study. Children having corneal opacity, congenital eye diseases like glaucoma & cataract, previous ocular surgery like cataract, glaucoma & corneal repair, history of trauma and retinal disease like retinopathy of prematurity & retinitis pigmentosa were excluded from the study. Sample size was calculated as **P** = 4.27% ≅ 4%, *n* = 369 ≅ 400, d = 0.02, http://www.openepi.com/SampleSize. Visual acuity of 6/6 & 6/9 were considered as normal visual acuity. Refractive errors in children were defined as uncorrected visual acuity equal to or worse than 6/12 in one or both eye. [2] Myopia was defined as spherical equivalent equal to or worse than -0.5 DS [4] and spherical equivalent equal to or worse than -5.00 DS was classified as high myopia. Hypermetropia was defined as refractive error equal to or worse than +2.0 DS.[4]

We took permission and complete list of public sector schools in Hyderabad from director education and divided the schools in two groups, group one comprised government schools and group two comprised private schools. We selected two schools from each group by stratified random method. Permission was taken from principals of all four schools. Visiting team comprised of one doctor and two technicians. Prior informed written consent was taken from parents. From class one to class ten, 10 students were selected from each class by stratified random method. All the selected students were examined for external ocular examination to exclude corneal opacity, cataract and previous ocular trauma. Visual acuity was recorded uniocularly in both eyes; Snellen's chart was used for visual acuity. Pin hole test, auto refraction and fundus examination was done. Subjective correction was given to Student who had visual

acuity of 6/12 or poor. Refractive errors were labeled as per operational definitions. The information regarding age, sex, family history, parent's education and refractive error was recorded on proforma.

Data was entered and analyzed on SPSS version 22. Mean with standard deviation was calculated for age of patients. Frequencies and percentages were calculated for categorical variables like sex, visual acuity, parent`s education and outcome variables (Hypermetropia, myopia and Astigmatism) in government and private schools. Age and gender wise stratification was done to study the impact of these variables on outcome through chi-square test. P-value ≤0.05 was taken as significance.

Results:

Total 400 students from 4 schools were screened out, 200 students were from government schools and 200 students were from private schools. From class one to class ten, 10 students were selected from each class randomly, the age range was from 6-15 years with mean age of 10.5 years. In government schools 99 (49.5%) students were males and 101 (50.5%) students were females. In private schools 104 (52%) students were males and 96 (48%) students were females (As shown in Table-1). Age distribution among gender is given in Table-2.

In government schools, visual acuity was ranging from 1/60-6/60 in 9 (4.5%) students, 6/36 in 4 (2%) students, 6/24 in 5 (2.5%) students, 6/18 in 5 (2.5%) students, 6/12 in 3 (1.5%) students, 6/9 in 46 (23%) students and 6/6 in 128 (64%) students while in private schools, visual acuity was ranging from 1/60-6/60 in 6 (3%) students, 6/36 in 2 (1%) students, 6/24 in 3 (1.5%) students, 6/18 in 6 (3%) students, 6/12 in 7 (3,5%) students, 6/9 in 37 (18.5%) students and 6/6 in 139 (69.5%) students (As shown in Table-3). Pin hole test results in Government schools were

6/6 in 185 (92.5%) students, 6/9 in 6 (3%) students, 6/12 in 1 (0.5%) student, 6/18 in 1 (0.5%) student, 6/24 in 1 (0.5%) student, 6/36 in 3 (1.5%) students, 6/60 in 3 (1.5%) students while in private schools pin hole results were 6/6 in 186 (93%) students, 6/9 in 8 (4%) students, 6/12 in 4 (2%) students, 6/24 in 1 (0.5%) student and 6/60 in 1 (0.5%) student (As shown in Table-4).

Refractive error corrections in Government schools were -0.5 Diopter sphere to -4.75 Diopter sphere (Myopia) in 11 (5.5%) students, -5 Diopter sphere to -15 Diopter sphere (High myopia) in 4 (2%) students, +2 Diopter sphere to +6 Diopter sphere (Hypermetropia) in 7 (3.5%) students, -1 Diopter cylinder to -4 Diopter cylinder (Astigmatism) in 5 (2.5%) students and -0.25 Diopter sphere to +1.75 Diopter sphere (Normal) in 173 (86.5%) students while in Private schools refractive error corrections were -0.5 Diopter sphere to -4.75 Diopter sphere (Myopia) in 16 (8%) students, +2 Diopter sphere to +6 Diopter sphere (Hypermetropia) in 7 (3.5%) students, -1 Diopter cylinder to -4 Diopter cylinder (Astigmatism) in 2 (1%) students and -0.25 Diopter sphere to +1.75 Diopter sphere (Normal) in 175 (87.5%) students (As shown in Table-5).

On overall basis type of refractive error in Government schools was myopia in 15 (7.5%) students, hypermetropia in 7 (3.5%) students, astigmatism in 5 (2.5%) students and no refractive error in 173 (86.5%) students while in private schools type of refractive error was myopia in 16 (8%) students, hypermetropia in 7 (3.5%) students, astigmatism in 2 (1%) students and no refractive error in 175 (87.5%) students (As shown in Table-6).

On break up of refractive error 27 students out of 200 had refractive error in Government schools, Myopia was present in 15 (55.55%) students, Hypermetropia in 7 (25.93%) students and Astigmatism in 5 (18.52%) students while in Private schools 25 students had refractive error,

Myopia was present in 16 (64%) students, Hypermetropia in 7 (28%) students and Astigmatism in 2 (8%) students (As shown in Table-7).

Table 1: Gender distribution between government and private schools

Gender distribution			School		Total
			Government	Private	
	Male	Number	99	104	203
		%	49.5	52	50.75
	Female	Number	101	96	197
		%	50.5	48	49.25
Total		Number	200	200	400
		%	100.0	100.0	100.0

Table 2: Age distribution among gender

	Gender		
Age	Female	Male	Total
6	17	23	40
7	17	23	40
8	15	25	40
9	24	17	41
10	26	14	40
11	17	22	39
12	23	17	40
13	20	20	40
14	18	22	40
15	20	20	40
Total	197	203	400

Table 3: Visual acuity (VA)

VA			School		Total
			Government	Private	
	1/60-6/60	Count	9	6	15
		%	4.5	3.0	4.0
	6/12	Count	3	7	10
		%	1.5	3.5	2.5
	6/18	Count	5	6	11
		%	2.5	3.0	2.8
	6/24	Count	5	3	8
		%	2.5	1.5	2.0
	6/36	Count	4	2	6
		%	2.0	1.0	1.5
	6/6	Count	128	139	267
		%	64.0	69.5	66.8
		Count	46	37	83

	6/9	%	23.0	18.5	20.8
Total		Count	200	200	400
		%	100.0	100.0	100.0

Table 4: Pin hole Test

Pin Hole Test			School		Total
			Government	Private	
	6/12	Count	1	4	5
		%	0.5	2.0	1.3
	6/18	Count	1	0	1
		%	0.5	0	0.3
	6/24	Count	1	1	2
		%	0.5	0.5	0.5
	6/36	Count	3	0	3
		%	1.5	0	0.8
	6/6	Count	185	186	371
		%	92.5	93.0	92.8

	6/60	Count	3	1	4
		%	1.5	0.5	1.0
	6/9	Count	6	8	14
		%	3.0	4.0	3.5
Total		Count	200	200	400
		%	100.0	100.0	100.0

Table 5: Refractive error correction

Refractive error correction			School		Total
			Government	Private	
	-0.5 To -2.75 DS	Count	7	11	18
		%	3.5	5.5	4.5
	-3.0 To -4.75 DS	Count	4	5	9
		%	2	2.5	2.25
	-5.0 To -10.0 DS	Count	3	0	3
		%	1.5	0	0.75
	-11 To -15 DS	Count	1	0	1
		%	0.5	0	0.25
	+2.0 To +4.0 DS	Count	5	6	11
		%	2.5	3	2.75

	+4.25 To +6.0 DS	Count	2	1	3
		%	1	0.5	0.75
	-1 To -4 DC	Count	5	2	7
		%	2.5	1	1.75
	-0.25 To +1.75 DS	Count	173	175	348
		%	86.5	87.5	87
Total		Count	200	200	400
		%	100.0	100.0	100.0

Table 6: Type of refractive error

Type of refractive error			School		Total
			Government	Private	
	Myopia	Count	15	16	31
		%	7.5	8	7.75
	Hypermetropia	Count	7	7	14
		%	3.5	3.5	3.5
	Astigmatism	Count	5	2	7
		%	2.5	1	1.75
	Normal	Count	173	175	348
		%	86.5	87.5	87
Total		Count	200	200	400

	%	100.0	100.0	100.0

Table 7: Break-up of refractive error

Break-up of refractive error		School	
		Government	Private
Myopia	Count	15	16
	%	55.55	64
Hypermetropia	Count	7	7

	%	25.93	28
Astigmatism	Count	5	2
Total	%	18.52	8
	Count	27	25
	%	100	100

Discussion:

Refractory errors are the most common eye problems causing visual impairment in general population. Uncorrected refractive errors in children can cause reduced visual acuity, blurring of vision, reduced reading efficiency and school performance.

In our study the prevalence of refractive error was 13% (52) out of 400 students. We divided students in two groups, in government schools 13.5% (27) students out of 200 had refractive error and in private schools 12.5% (25) students out of 200 had refractive error. In government schools 55.55% (15) were myopic, 25.93% (7) were hypermetropic and 18.52% (5) were astigmatic while in private schools 64% (16) were myopic, 28% (7) were hypermetropic and 8% (2) were astigmatic. In this study there was no statistically significant refractive error difference was found between government and private sector schools. Similarly myopia was present in 33.3% cases in an international study and astigmatism in 13.4% cases. Although they included

persons up to the age of 30 years but results were similar to us signifying the more prevalence of these visual problems in children as well as young adults [13]. Furthermore in 15-20 years old adolscents the prevalence of refractory error was 24.7%. About 10.4% children were myopic. It signifies the less prevalence of myopia in adolscents [14].

Results of our study shows astigmatism in about 26% children. This is similar to previous studies conducted on Asian and Caucasian children showing astigmatism in 3.8% - 33.6% cases. There was high prevalence in East Asian children compared to the other regions of Asia [15]. An European study had different results comparing to us showing visual impairment in just 8.9% school going children [16]. This difference may be due to environmental or genetic factors.

The results of our study showed association of refractive error with gender; Myopia and Astigmatism were more prevalent in female sex being 8.1% and 2% respectively while in males it was 6.4% and 1.4%. Hypermetropia was more common in males being 3.9% as compared to 3% in females. An unsimilar study from Saudi Arabia showed no sex difference for refractive errors, it was present in 4.2% boys and 4.9% girls. The prevalence of refractory errors was just 4.5%. This difference may be due racial and geographical factors [17]. Furthermore in another study females had slightly higher refractive error (6.93%) than males (5.9 %) [18]. A local study in 2014 showed low prevalence (3.3%) of reduced vision in school going children but like our study majority of children (65.5%) were female [19]. Another local study conducted in 2016 showed high prevalence (20.4%) of refractive errors in school going children, signifying the different prevalence in various region of Pakistan [20].

Conclusion: In our study the prevalence of refractive error was 13% (52) out of 400 students. Refractive errors are the most common and easily treatable cause of decrease vision in school aged children. It is recommended that visual acuity should be checked prior to admission to school because refractive error can be easily corrected with glasses and if it is treated in time child can be prevented from amblyopia and squint.

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