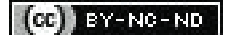


Clinical Profile of Refractive Errors Associated with Screen Time in Children Aged 5-15 Years in a Tertiary Care Hospital of Southern India during COVID Pandemic: A Prospective Study

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ABSTRACT

Introduction: Refractive errors cannot be prevented, but it is important to detect them early to improve the quality of life and prevention of blindness. Refractive errors screening in children during Coronavirus disease-2019 (COVID-19) pandemic was difficult task as they were high-risk group. Increased near activity due to online classes and smart devices usage may increase the uncorrected refractive errors. The study emphasises on the refractive errors screening during COVID pandemic.

Aim: To study the clinical profile of refractive errors of the children aged 5-15 years in a tertiary care hospital in COVID pandemic in association with screen time, outdoor activity, type of gadget, amblyopia and educational status of mother.

Materials and Methods: This was a hospital based prospective analytical study conducted in children 5-15 years attending the Ophthalmology Outpatient Department of ESIC Medical College and Hospital, Telangana, India, from May to October 2021. Children were screened for refractive errors and compared with the refractive errors data of different children of same age referred from Paediatric Outpatient Department and who attended to Ophthalmology Outpatient Department for regular eye check-up in pre-pandemic time. Unaided visual acuity of all children were measured with the help of Snellen's chart. Children with refractive errors underwent cycloplegic retinoscopy followed by

postmydriatic test. Screen time and outdoor activity duration were recorded. Interpretation and analysis of obtained results was carried out using Statistical Package for Social Sciences version 22.0 for descriptive statistics. Non parametric tests like Pearson Chi-square test were used to express the qualitative data. Data with p-value less than 0.05 was considered statistically significant.

Results: A total of 790 children were screened out of which 358 (45.3%) presented with refractive error when compared with the pre-pandemic prevalence 276 (34.9%) out of 790 children screened, presented with the refractive error. A total of 118 (33%) of the children presented with increased blink rate associated with increased screen time and dry eye. Rate of progression of more than 1D was observed in 44 (12.29%) of which myopia 28 (7.8%), astigmatism 10 (2.7%) and hypermetropia 6 (1.6%) in six months. A total of 286 (79.8%) children presented with myopia and 24 (6.7%) presented with hypermetropia, 48 (13.4%) presented with astigmatism. A total of 258 (72.06%) presented with screen time for four to seven hours and 32 (8.9%) children presented with amblyopia.

Conclusion: Refractive errors increased due to smart classes in schools or use of laptops, television viewing, computers or mobiles. Hence, this reinforces the need to screen all the school going children and children with the history of gadgets use.

Keywords: Amblyopia, Blinking, Coronavirus disease-2019, Outdoor activity, Prevalence, Progression

INTRODUCTION

Refractive errors- myopia, hyperopia and astigmatism cause blurred vision due to an inability to focus images on the retina. Uncorrected refractive errors in long run may cause harmful consequences for children, since vision is developed in the first years of life. Refractive errors cannot be prevented, but it is important to detect them early [1]. Global data shows uncorrected refractive errors (43%) are the leading cause of visual impairment followed by unoperated cataract (33%) and glaucoma (2%) [2]. The prevalence of blindness in children in India is estimated to be 0.8/1000 children in the age group of 0-15 years [3,4]. COVID pandemic and lockdown led to the restricted movement of public. Parents due to the fear of COVID contact avoided screening of children's refractive errors and follow-up of already diagnosed refractive errors. Prevalence of refractive errors increased during COVID-19 pandemic due to increased screen time, restricted outdoor activity and lack of screening [5]. As refractive errors are effectively treated by simple visual aids, the amount and pattern of refractive errors

need to be discovered and treated, to improve the quality of life and prevention of blindness.

Keeping this in mind, the proposed study was conducted to determine the clinical profile of refractive errors in children aged 5-15 years in association with increased screen time, decreased outdoor activity, increased blink rate, amblyopia, literacy of mother and compared prevalence of refractive errors before and during COVID pandemic in Employees State Insurance Corporation Medical college and Hospital, in Telangana region in South India.

MATERIALS AND METHODS

This was a hospital based prospective analytical study conducted in Ophthalmology Outpatient Department (OPD), in ESIC Medical College and Hospital in Hyderabad, India, in children 5-15 years from May to October 2021. The study was conducted after getting approval from Institutional Ethical Clearance (Approval number ESICMC/SNR/IEC-F296/05-2021, version no V01) and informed consent from the parents and guardians of the children screened.

Sample size calculation: was done by using the formula:

$n = Z^2 \times p \times q / (d)^2$ with P as estimated mean prevalence of refractive errors, which was 24%.

where, Z1-a=standard normal deviant at 95% confidence level i.e.1.96, p=prevalence=24%, q=100-p=76, d=absolute precision of 3%.

$$N = 1.96^2 \times 24 \times 76 / 3^2 = 778$$

Allowing a 2% non response rate the sample size was 778+12=790. A total of 790 children were screened for refractive error.

Inclusion criteria: Children of 5-15 years of age with refractive error 0.50 D or more were included and prior consent for examination was taken from parent or guardian of every child.

Exclusion criteria: Children below five years of age, those with ocular abnormalities of keratoconus, vernal keratoconjunctivitis, other systemic disorders and children with media opacities, history of intraocular surgery were excluded.

Study Procedure

Clinical profile and prevalence of refractive errors in children aged 5-15 years presenting to tertiary care hospital during COVID pandemic was studied and compared with pre-COVID times, prevalence of refractive errors in association with variables like age, sex, screen time of the children, education status of mother was studied. All the children presenting with diminished vision, blurring, headache, increased blinking and asthenopic symptoms were studied. Relevant personal and family history was taken. Every child underwent a standard routine eye examination. Visual acuity was measured at 6 m by an optometrist, using a digital vision algorithm of the minimum angle of resolution chart and was recorded as the smallest line read with one or no errors after converting it to Snellen equivalent. Hirschberg corneal reflex test was done in all cases. Extraocular movements, cover test and pupillary reaction was assessed in all the cases. Pupils were dilated with two drops of 1% cyclopentolate and one drop of 0.8% tropicamide +5% phenylephrine, administered five minutes apart. Light reflex and pupil dilation were evaluated after 45 minutes. Refraction was performed by an optometrist, regardless of visual acuity using a streak retinoscope and postmydriatic test was performed.

Children with uncorrected visual acuity of 6/9 or worse in either eye examined using a slit lamp and the fundus was evaluated with the help of an indirect ophthalmoscope. Amblyopia was defined as unilateral or bilateral subnormal vision, atleast two lines less than normal or two lines less than the fellow eye in unilateral cases. On the basis of unaided visual acuity, visual impairment was graded as mild (VA 6/6 to 6/12), moderate (VA 6/18 to 6/36) and severe (VA 6/60 to less than 6/60) [6]. Refractive errors were classified according to the standard definitions as myopia, hypermetropia and astigmatism. Prevalence of magnitude of refractive errors during COVID pandemic was compared with magnitude data of refractive errors recorded at one time of different children of same age group attending to Ophthalmology OPD. Before pandemic, If the child needed spectacles after the examination, prescription of glasses along with the spectacles was provided free of cost and hence, the prevalence of refractive errors during pre-COVID times were compared with their prevalence in the present study.

STATISTICAL ANALYSIS

Interpretation and analysis of obtained results was carried out using Statistical Package for Social Sciences (SPSS) version 22.0 for descriptive statistics. Non parametric tests like Pearson Chi-square test were used to express the qualitative data. Data with p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 790 children were screened out of which 358 (45.3%) presented with refractive error when compared with the prepandemic magnitude data of prevalence of refractive errors in 790 children screened, 276 (34.9%) children presented with the refractive error in the hospital. A 10% increase in refractive errors were observed [Table/Fig-1]. In 358 children with refractive error 160 (44.6%) were males and 198 (55.4%) were females [Table/Fig-2]. In the study average number of children presented in 13-15 years were 144 (40.1%). A total of 38 (10.61%) children had family history of refractive error and 320 (89.38%) children were without family history. In the study 44 (12.29%) children had past history of spectacles with refractive error and 314 (87.70%) were newly diagnosed with refractive error [Table/Fig-2]. In the study 162 (45.2%), mild refractive error, 118 (32.9%) moderate refractive error, 78 (21.7%) severe refractive error was observed. Total 264 (33%) of the children presented with blinking symptom related to increased screen time. The [Table/Fig-3] showed no significant association of refractive errors with gender. However, significant association was observed between age and refractive errors [Table/Fig-4]. Mothers of 194 (54.18%) children with refractive error were literate and 164 (45.81%) mothers were illiterate [Table/Fig-5].

Refractive error	During pandemic n (%)	Before pandemic n (%)	Statistics
Present	358 (45.3)	276 (34.9)	Chi square=17.1 p-value=0.0184
Absent	432 (54.7)	514 (65.1)	
Total	790 (100)	790 (100)	

[Table/Fig-1]: Refractive error during and before pandemic. Bold p-value is significant

Variable	n (%)
Number of male children	160 (44.6)
Number of female children	198 (55.4)
Children between 13-15 years	144 (40.1)
Family history of refractive error	38 (10.6)
Newly diagnosed children	314 (87.7)

[Table/Fig-2]: Baseline characteristics of those children with refractive error (N=358).

Gender	Myopia (n=286)	Hypermetropia (n=24)	Astigmatism (n=48)	Statistics
Male	124 (34.63%)	8 (2.23%)	28 (7.82%)	Chi-square=4.499 p-value=0.105
Female	162 (45.25%)	16 (4.47%)	20 (5.58%)	

[Table/Fig-3]: Association of refractive errors with gender (N=358).

Age in years	Myopia (n=286)	Hypermetropia (n=24)	Astigmatism (n=48)	Statistics
5-6	20 (5.58%)	4 (1.12%)	14 (3.91%)	Chi-square=40.239 p-value <0.001
>6-9	50 (13.96%)	4 (1.12%)	12 (3.35%)	
>9-12	82 (22.90%)	12 (3.35%)	16 (4.47%)	
>12-15	134 (37.43%)	4 (1.12%)	6 (1.67%)	

[Table/Fig-4]: Distribution and association of refractive errors with age (N=358).

Mother literacy status	n (%)
Literate	194 (54.18%)
Illiterate	164 (45.81%)
Total	358 (100%)

[Table/Fig-5]: Literacy status of mothers of children (N=358).

Among the refractive errors more number of children presented with myopia 286 (79.8%), followed by astigmatism 48 (13.4%) and hypermetropia 24 (6.7%). Rate of progression of more than 1D was observed in 44 (12.29%), whereas myopia 28 (7.8%), astigmatism 10 (2.7%) and hypermetropia 6 (1.3%) in six months

during pandemic. In the study, out of 358 children, 32 (8.9%) children presented with amblyopia and 326 (91.1%) children refractive error was correctable with the spectacles, counseling about working distance, posture, short breaks during online school hours, use of large screen and treated with lubricating eye drops for screen time induced dry eyes. Prepandemic prevalence of refractive errors in 790 children was observed in 276 (34.9%) children. A total of 219 (79.3%) children had myopia, 35 (12.6%) had astigmatism, 22 (7.9%) had hypermetropia. A 10% increase in prevalence of refractive error was observed from prepandemic prevalence of refractive error.

The [Table/Fig-6] depicts the type of gadget used by the children. In the study children who presented during COVID pandemic with screen time >7 hours was 74 (20.67%) [Table/Fig-7]. A total of 639 (81%) of the children used mobile, 119 (15%) used laptop, 23 (3%) used Television (TV), 9 (1%) used i-pads to attend online classes during pandemic.

Type of gadget	n (%)
Mobile	639 (81%)
laptop	119 (15%)
TV	23 (3%)
I-Pad	9 (1%)

[Table/Fig-6]: Table of type of gadget used (N=790).

Diagnosis	<3 hrs	3-7 hrs	>7 hrs	Statistics
Myopia	22 (6.14%)	198 (55.31%)	66 (18.43%)	Chi-square=6.450 p-value=0.0168
Hypermetropia	2 (0.56%)	20 (5.58%)	2 (0.56%)	
Astigmatism	2 (0.56%)	40 (11.17%)	6 (1.67%)	

[Table/Fig-7]: Association between refractive errors and screen time.

DISCUSSION

Myopia is on the rise, partially due to increased screen time in current pandemic-induced reliance on virtual classrooms and partially because of restricted outdoor activity. About (32%) prevalence rate of refractive errors has been reported among school children of age 3-18 years from South India [7]. In the study, female students (55.4%) were affected more than males (44.6%) as in Pradhan N et al., [8]. In a population based study done by Dulani N and Dulani H, in Jaipur, Rajasthan, in which female preponderance was seen [9]. Other population based studies done by Pavithra MB et al., in Bangalore and Prema N, in Tamil Nadu also reported that females are more affected by refractive errors [10,11]. The possible cause of this difference may be unawareness of the needs of female child or inhibition with spectacle usage in females. In the study, prevalence of myopia, astigmatism, hypermetropia in 5-15 years children was 79.8%, 13.45% and 6.7% respectively. Many studies done in several countries throughout the world including India reported myopia as the most common refractive error [12,13]. High rate of refractive errors in the present study population can also be attributed to different lifestyles or living conditions like watching TV for long hours or using computers due to covid pandemic and online classes, restricted outdoor activity.

In the study, mother's literacy rate of children with the refractive error is high compared to the children of illiterate mothers. This can be explained by the fact that the children from families led by parents with higher levels of education have more emphasis on studies, entail near work, which in turn could cause early detection of refractive error. In the present study, 72.06% children had three to seven hours of screen exposure per day, followed by 20.67% of children had >7 hours and 7.2% of children had <3 hours of screen exposure. This explains that outdoor restricted activity and increased indoor mobile, laptop, TV, I-pad usage in COVID pandemic. In the current study, out of 358 children with

the refractive error 8.9% were found to have amblyopic children belonged to 5-10 years' age group similar to the study of Rajput VK et al., which is more than the result of Mittal S et.al study [6,14]. Due to COVID pandemic parents avoided eye screening in children with the fear of COVID contact in the children. Hence, this reinforces the need to screen all the school going children and children with the history of gadgets use .

Limitation(s)

The present study compared only magnitude of prevalence of refractive errors before and during pandemic. It was about increased refractive errors during pandemic which is associated with increased screen time, restricted outdoor activity, increased blinkrate, increased smart phone, tablet and laptop usage. Study was conducted in small sample size in a tertiary hospital and the results cannot be attributed to large community. Further studies are needed to find an association and follow-up of refractive errors.

CONCLUSION(S)

Refractive errors increased due to online classes from school or use of laptops, television viewing and computers or mobiles. On time diagnosis can prevent complications like amblyopia, strabismus and dry eyes. Regular eye examination of children and further emphasising the need of daily spectacle wearing can lead to better prognosis. Parents, children, teachers, paediatricians awareness, education and active involvement can reduce avoidable blindness due to uncorrected refractive errors in this COVID pandemic.

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