

Refractive Errors Due To Online Classes Among School Children During The Covid-19 Pandemic

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Abstract

Aim: The current study aimed to assess the effect of refractive errors among school children due to online classes.

Materials and Method: School-going children who were attending online classes between five and fifteen years were subjected to ophthalmic evaluation. A questionnaire including sections like demographics, gadget use, on-screen time, and physical complaints was administered to collect the required data.

Results: The participants in our study had a mean age of 9 ± 2 years (range 5-15 years) of whom 48.4% (n = 140) were males and 51.6% (n = 149) were females. There was a predominance of myopia (86.5%) in children where 44.6% of them have newly developed refractive errors. Around 70 (67.8%) children with a previous refractive error have been shown to have progression of refractive error.

Conclusion: Our study reports that children were exposed to prolonged screen time which led to a rise in the number of myopia cases.

Keywords: Refractive Errors, Online Classes, Covid 19 Pandemic.

INTRODUCTION

Due to the entire lockdown imposed by the Covid-19 epidemic, the digital online method has taken over where traditional blackboard teaching was not allowed.¹ Therefore students are now accustomed to learning through a new e-learning system that eventually leads them to sit for additional hours in front of the digital device. Long-term use of a digital device causes a variety of ocular disorders in youngsters, the most prevalent of which are refractive errors². Refractive error occurs when the optical picture is not exactly focused on the retina, because of the shape of the eye. Myopia, hyperopia, and astigmatism are the three kinds of refractive errors. Nearly 20% of youngsters, however, acquire refractive defects that necessitate the use of glasses.^{3, 4}

Myopia (nearsightedness) develops when the refracting power of the eye is too high. It occurs when the eye's anterior-posterior diameter is excessively long in relation to the cornea and lens refracting power. The image's focus point is in front of the retina, and the image that reaches the retina is blurred. The prevalence of myopia in rural Indian children aged 5-10 years increased from 4.6 percent (95 percent confidence interval: 3.0–6.1) in 1980-2008 to 6.8 percent (95 percent confidence interval: 4.2–9.3) in 2009–2019. The increase was modest among urban Indian children, ranging from 7.9% (95 percent CI, 4.6–11.2) in 1980–2008 to 8.9% (95 percent CI, 7.1–10.7) in 2009–2019. The prevalence of myopia in rural children aged 11–15 years increased from 6.9% (95 percent confidence interval: 2.1–11.8) in 1980-2008 to 12.3% (95 percent confidence interval: 5.4–19.2) between 2009 and 2019. Similarly, prevalence increased from 6.8% (95 percent confidence interval: 4.1–9.4) in 1980–2008 to 15.0 percent (95 percent confidence interval: 11.2–18.7) in 2009–2019 among urban children aged 11–15 years. In the United States,

preschool children have a prevalence of 1 to 5%, school-aged children have a prevalence of roughly 9%, and teens have a prevalence of over 30%⁴. Myopia prevalence varies by ethnicity, although it is particularly common among East Asians, with prevalence rates in China and Taiwan ranging from 70 to 85 percent among adolescents⁴.

Hyperopia develops when the eye's refracting power is too low. In contrast to the refracting power of the cornea and lens, the hyperopic eye is unusually short. The retina is behind the image's focal point, and as it comes closer to the retina, the image gets hazy. With increased severity, hyperopia leads to amblyopia and accommodative esotropia. From 8.4% of children under age six to 2-3% of children under the age of 9 and 14 and roughly 1% of children aged 15 had hyperopia. Age has an inverse relationship with hyperopia⁵. Astigmatism develops when the optical system particularly the cornea, is not completely spherical. Light beams cannot be focused on a single area because the refractive power of the eye varies throughout the meridians. Astigmatism is a condition that occurs when myopia or hyperopia coexist. Astigmatism was more common among the 5-6-year-old age group (18.4%), the 10-12-year-old age group (11.65%), and the 13-15-year-old age group (14.1%)⁶. In 2022, the prevalence of astigmatism was 3.69 percent (n = 9064) and children between the ages of 6 and 10 had a 1.37 percent astigmatism rate⁷. According to the American Optometric Association, two hours of continuous use of a digital gadget every day can damage eyesight and lead to a variety of eye-related problems⁸. The prevalence of digital eye strain (DES) was estimated to range from 25% to 93%, with refractive problems being the most frequent ocular abnormality^{9, 10}. Overuse of gadgets causes dry eyes, foreign body sensations, itching, impaired vision, myopia, hypermetropia, and other symptoms. Therefore, refractive errors if left untreated shall worsen the condition¹¹.

Though quite a few studies are concentrating on and comparing prolonged usage of gadgets for online classes and visual disturbance, the outcome of the visual examination in young children was not detailed. Hence, the current study aimed to assess the effect of refractive error among school children due to online classes during the COVID-19 pandemic. The primary objective was to identify the new onset of refractive error among children attending online classes and the secondary objective was to evaluate the frequency of refractive errors among them.

MATERIALS

Before conducting the survey, the Institutional ethics committee authorized this institution-based cross-sectional research of 300 school children. Children of both genders in the age groups of 5-10 years (1st-5th grade) and 10-15 years were included in the study (6th- 10th standard). Children aged 5 to 15 years who are currently attending online classes were included in this study. Children with developmental delays and those who were unable to attend online sessions owing to other medical issues were excluded from this study. Considering the difficulties of data collection during the COVID-19 while still meeting the study requirements, a convenience sample technique was used.

METHOD

The participants were given a semi-structured modified questionnaire to fill out to obtain the necessary information. The participants were given a semi-structured modified questionnaire to fill out to obtain the necessary information and all of these participants had their ophthalmic evaluation as part of their school health camp before the start of the online classes (before Covid-19) and which was obtained from their school health records. The questionnaire is divided into four sections to correspond to the study's prerequisites (sections A, B, C, and D).

Section A corresponds to demographics, Section B corresponds to information on gadget use, Section C corresponds to the utility of screen time, and Section D corresponds to children's physical complaints, respectively). The consent of the parents and caregivers was sought in writing, and the questionnaire was explained to the parents and caregivers. The child's parents between the ages of 5 and 12 were asked to complete the semi-structured modified questionnaire, and the child between the ages of 13 and 15 was able to fill the questionnaire. Following that, the children were subjected to ophthalmic examination. The information was gathered from primary sources and analyzed statistically.

STATISTICAL ANALYSIS

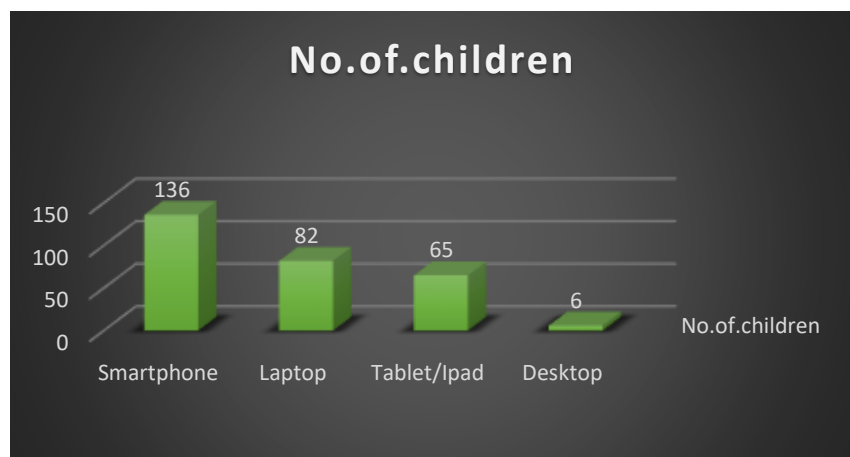
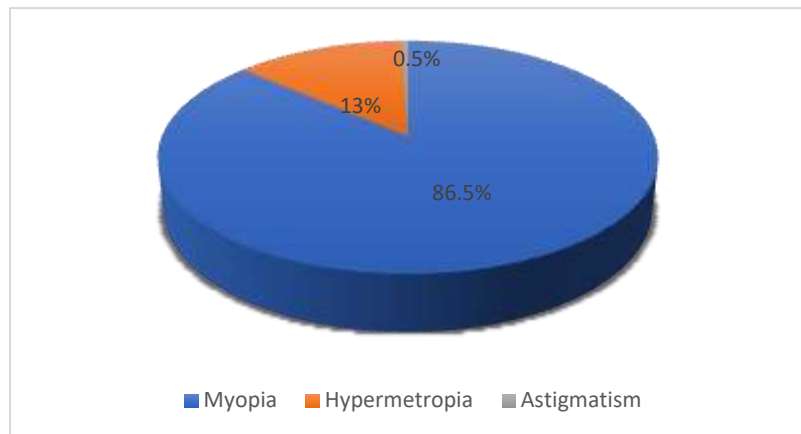
MS Excel SPSS 20.0 version software was used to carry out the analysis of the study. The data collected through questionnaires were tabulated and presented in percentages.

RESULTS

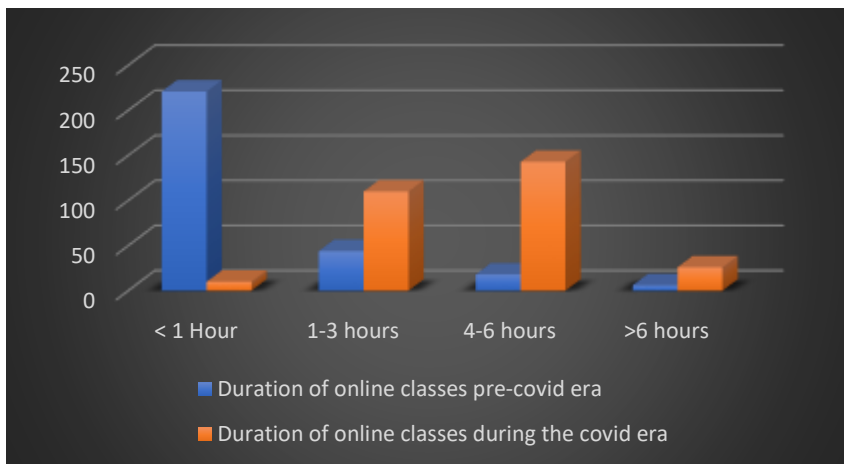
A total of 289 parents out of 300 provided a complete response to the questionnaire within the scheduled time. Therefore, only 289 participants were subjected to ophthalmic examination. The participants in our study had a mean age of 9 ± 2 years (range

5-15 years) of whom 48.4% (n = 140) were males and 51.6% (n = 149) were females. School children in the age range of 5-11 years and adolescents (12-15 years) were 109 (37.7%) and 180(62.2%) respectively.

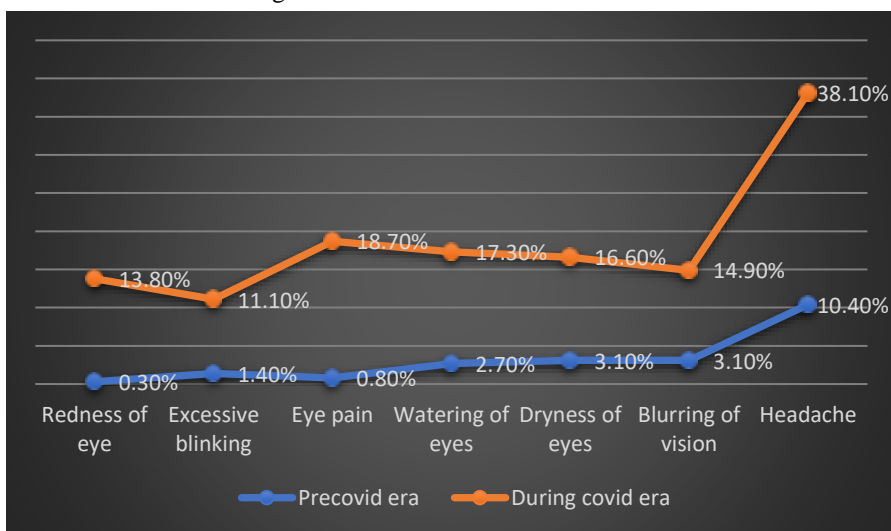
The results revealed that 186 children (64.4%) currently experiencing visual disturbance out of which 161 children (86.5%) had myopia, 24 children (13%) had hyperopia and 1 child (0.5%) had astigmatism. Most of the children were using smartphones (47%) for online classes.



The majority of the children 285 (99%) were using electronic gadgets to attend online classes. Apart from online classes, the other activities carried out using electronic gadgets were children making calls (43.6%), messaging (35.6%), reading (48.4%), and gaming (38.4%). The results revealed that the children were in online classes for a longer duration during the covid era when compared with the pre-covid era. When comparing the pre-covid era to the covid era, the average time spent attending online classes increased to 49.5 percent (for 4-6 hours) from 6.2 percent, followed by 38.4 percent (for 1-3 hours) from 15.2 percent.



The physical complaints due to online classes were found to be increased. Headache (38%) was the most common symptom that was experienced by the children (Fig 1) followed by watering of the eyes (18.7%) and dryness of the eyes (17.3%). Around 50% of children always experience ocular symptoms while using gadgets. The frequency and intensity of ocular symptoms also increased to 66.2% during the covid era.



The visual disturbance was found in most of the children (64.4%) attending online classes and 67.8% had visual changes after continuous viewing of gadgets. During the covid era, the percentage of myopia increased significantly (86.5%). The new onset of refractive errors in children was calculated as 83(44.6%) and 70 (67.8%) children with previous refractive errors were shown to have progression of refractive error (Table 1). It was also evident that physical activity declined and the number of hours in front of gadgets was increased during the lockdown. The number of hours of physical activity declined from 2.5 hours to 1 hour during the covid era due to online classes.

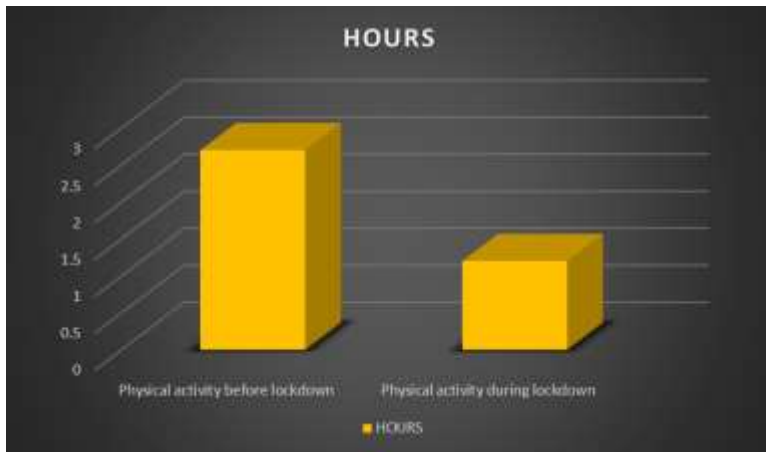


Figure 2: Depicts the number of hours of physical activity of children before and during covid era due to online classes

Out of 186 children – 83 children never used spectacles and had new onset of refractive error during online classes which was obtained from their school health records and 70 children who had previous refractive error were identified to have worsening of their refractive errors.

Table 1,2,3:

No. of Children	46	34	3
Refractive error (Myopia)	6/12	6/18	6/36

No. of Children	39	21	8	2
Refractive error (Myopia)	6/9	6/12	6/18	6/36

No. of Children	36	21	13	Nil
Refractive error (Myopia)	6/12	6/18	6/36	6/60

Table 1 represents the number of children who developed new onset refractive errors after the onset of COVID/online classes. Table 2 represents the refracting power of children who had refractory error prior to online classes and Table 3 represents the refracting power of children after online classes.

Figure 3:

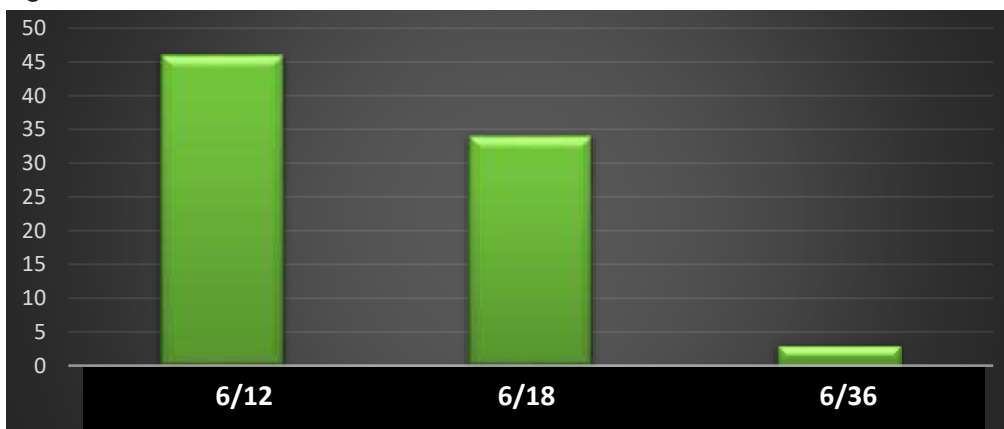


Figure 4:

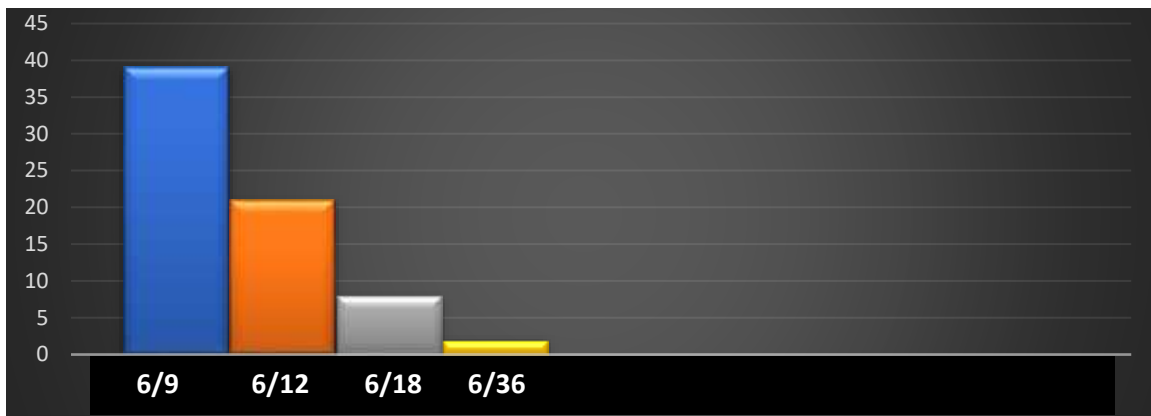


Figure 5:

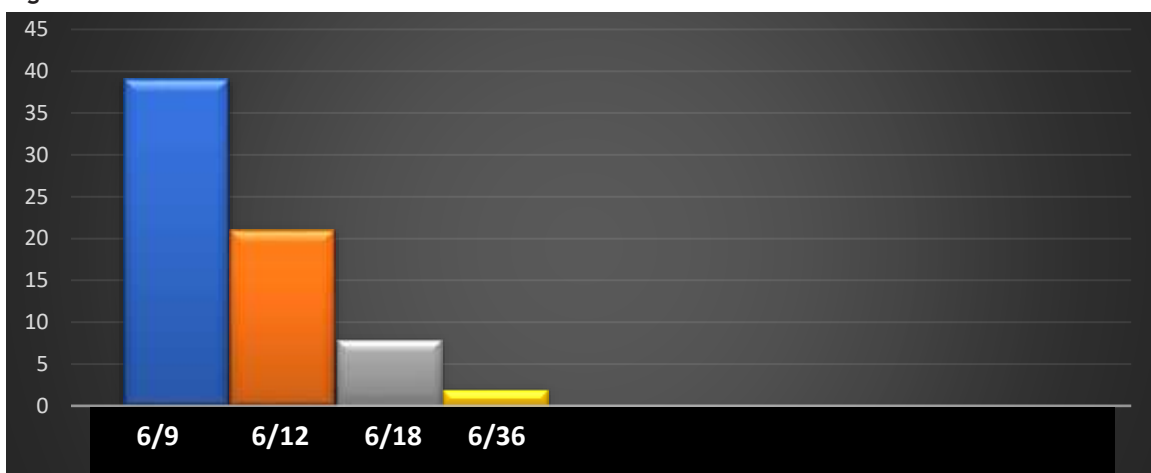


Figure 3 represents the number of children who developed new onset refractive errors after the onset of COVID/online classes. Figure 4 represents the refracting power of children who had refractory error prior to online classes and Figure 5 represents the refracting power of children after online classes.

DISCUSSION

In India, 41% of the population is in the age group below eighteen years. The majority of the participants in our study were females (51.6%) in the included age range. On the contrary, Mohan et.al reported a study where the studied participants were in the age range of 10-18 years (13 ± 2.45 years) of whom 101 (46.54%) were males.¹ In this present study, the percentage of children attending online classes was calculated to be 99. Among them, 49.5% of them fall in the category of attending for 4-6 hours followed by 38.4% of them for 1-3 hours. The results of our study were similar to a few studies conducted by Mohan et al., where digital classes were attended by 96.3%, out of which 49.8% fall in the category of attending online classes for more than 2 hours in a day¹. A study performed among children in rural western India estimated the average screen time to be 2.7 ± 1.7 .¹³ In addition, Badri et al. studied children using digital devices and expressed that 49.5% of them were using gadgets and their average on-screen time per day was 5.2 hours.¹⁴ Contradicting our study, Ambika et.al outlined that, 3 out of 5 students were from 9-10th grade and 31.9 % of students had online classes for 1-2 hours.¹⁵ A quarter of them had classes for 3-4 hours and only a few had 5-6 hours of classes per day.¹⁵ Wang et.al explained that first and second-grade school children had online classes for one hour daily and from grade third to sixth class children were attending for two and half hours per day.¹⁶

It was put forward by the Ministry of Human Resource Development (MHRD) to conduct online classes for one and half hours alone for children from grades one to eight and three hours for children from classes ninth to twelfth.¹⁷ Our study results show that 47% of the children chose to use smartphones for their online classes. Young children prefer using smartphones when compared to older children who prefer using laptops and computers and this finding was in agreement with our study outcome.¹⁶¹⁸ When multiple devices were considered, 20.3% of children were using more than one device for various tasks at the same time during online classes.¹⁸ However our study has evaluated multitasking but usage of two gadgets at the same time for online classes was not assessed.

Our study reveals that headache (38.1%) was the most common physical complaint when compared with pre-covid era symptoms (10.4%). This was in agreement with a study conducted by Ambika et.al describing that around 18% of the children presented with severe headaches and visual problems.¹⁵ Another study by Kumar et al., summarized the results as smartphones were used by 90.5% of the children attending online classes mode and found to have eye problems (57.5%), hearing problems (39%), and lack of physical activity (20%).²⁰

The refractive error (myopia) was found to be 86.5 % in our study during the covid era. Over the past 40 years, the prevalence of myopia was reported as 7.5% in children between the age range of 5 and 15 years, where urban school-going children (8.5%) were affected more than the rural school-going children (6.1%).²¹ In comparison between rural and urban India in the period 1980 – 2008 and 2009 - 2019, there was an inflation in the prevalence rate of myopia from 4.6% to 6.8% and 7.9% to 8.9% respectively.¹⁷ In 2010, the average percentage increase in myopia cases was 20 in South Asia and predicted to be ascending in 2030 and 2050 to 38% and 53% respectively.²²

In our study, online classes were attended by 49.5% of the children for > 3 hours/day compared to 6.2% in pre-Covid19 times. The increase in screen time on digital devices could have been attributed to an increased number of children experiencing visual disturbances especially, myopia. Before the outbreak, children utilized their smartphones only for study purposes (projects) and the average usage per day was calculated that was not more than five hours.²³ Few authors have studied the distance between children and screen and outlined that most of the children were at a distance of greater than 18 inches.²⁴

Our study had a few limitations where the assessment of distance between the children and the digital screen and multitasking like children using two gadgets during their online classes were not performed. This could have also contributed to visual problems in children. Nevertheless, the ophthalmic examination along with the survey served as the best possible outcome of our study.

CONCLUSION

There is a significant increase in screen time that resulted in a rise in the intensity of the pre-existing visual problem. Hence it is important to adopt measures as advised by the human resource department to limit the screen timing for online classes according to the age groups and also to maintain an appropriate distance from the screen to reduce the incidence of refractive error for upcoming generations.

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