

# To ascertain the effect of digital eye strain on ocular health among school children during COVID Pandemic: A cross sectional study

Dr Aditya Kashyap<sup>1</sup>, Dr Minakshi Sumbria<sup>2</sup>, Dr Smriti Sharma<sup>3</sup>, Dr Rashmi Kashyap<sup>4</sup>

<sup>1</sup>Assistant Professor, Department of Ophthalmology, PJLNGMC Chamba, HP

<sup>2</sup>Assistant Professor, Department of Pharmacology IGMC Shimla, HP

<sup>3</sup>Senior Resident, Department of Ophthalmology, PJLNGMC Chamba, HP

<sup>4</sup>Assistant Professor, Department of Community Medicine, Dr. YS Parmar Govt Medical College, Nahan, HP

## Corresponding author

Dr Rashmi Kashyap, Assistant Professor, Department of Community Medicine, Dr. YS Parmar Govt Medical College, Nahan, HP

## Abstract

**Background:** The present study was conducted to assess the effect of digital eye strain due to online mode of teaching in school children during COVID Pandemic.

**Materials & methods:** A cross sectional study was conducted among school children during the period 2020-2022 to assess the refractive errors during COVID Pandemic. A total of 4393 (1442, 1532, 1419) school children were enrolled and examined for refractive errors during the year 2020, 2021, 2022 respectively. Prevalence of various refractive errors was assessed based on refractive error study in children (RESC) survey group.

**Results:** There were 2324 (52.9%) male and 2069 (47.0%) female students. Ocular examination depicted enhancement of refractive errors in all the age groups. However among the children in the age group of 9 to 12 years, refractive errors were detected among 612/1507 (43.1%) children.

**Conclusion:** There has been an increase in use of digital devices after the initiation of the COVID-19 lockdown, and has resulted in deterioration of ocular health of school going children.

**Key words:** Refractive errors, COVID-19.

## INTRODUCTION

The latest WHO report indicates that refractive errors are the leading cause of visual impairment throughout the world. In children, refractive errors are the leading cause of amblyopia. Although these errors are easily correctable with eyeglasses, various studies in children and adults report a considerable lack of correction. Since the year 2000 when Negrelet al presented a protocol for studying refractive errors in children, many studies around the world have studied 5–15 yr olds using cycloplegic refraction.<sup>1-4</sup>

With time and the advent of technology, the usage of computers, laptops, tablets, and smartphones has seen a steady increase in the past few years. These digital devices require to be held at a distance that is intermediate between near and distance vision, thereby causing strain on the visual system, which is designed for comfortable near and distant vision. The

emergence of the COVID-19 pandemic and the worldwide lockdown was immediately followed by a drastic increase in the amount of time spent on these gadgets.<sup>5-7</sup> Hence; the present cross sectional study was conducted for assessing the effect of digital strain on refractive errors among school children during COVID Pandemic.

## MATERIALS & METHODS

Cross sectional study was conducted among school going children in the hilly terrain of north India in the year 2020,2021 and 2022 respectively. The study period in the year 2020 was the beginning of Covid 19 pandemic prior to lockdown. Strict Covid related protocol was followed during the entire study period. Convenient timing was selected for study based on opening of schools. Permission from school health authorities was sought prior to initiation of study. Written informed consent was taken from the parents/guardian of the students. The survey was conducted by ophthalmologist and trained staff. School children in the age group of five to sixteen years were enrolled in the study. Prevalence of various refractive errors was assessed based on refractive error study in children (RESC) survey group<sup>4</sup>- Myopia (spherical equivalent refractor [SER]  $\geq -0.50$  diopter [D] in either eye, Hyperopia (SER  $\geq +2.00$  D), Astigmatism (cylinder value  $\geq -/+0.75$  D) . Data was entered and analysed using SPSS-23version.

## RESULTS

A total of 4393(1442,1532, 1419) school going children were enrolled and examined for refractive errors during the year 2020,2021,2022 respectively. There were 2324(52.9%) male students 2069(47.0%) students were female. Age distribution showed majority 1665(37.9%) in the age group of 9 to 12 years [Table 1]. Year wise comparative data showed increase in refractive errors amongst all age groups. The various refractive errors assessed were myopia, hyperopia and astigmatism. Comparative data for the year 2020 and 2022 showed the similar status for myopia cases, decrease in hyperopia cases and increase in number of astigmatism cases with 206/1278(16.1%) cases in the year 2020 to 612/1652(41.8) cases in year 2022.[Table 3]

Table 1: Age and sex distribution of school children (n=4393)

Variable	Frequency n(%)
Sex	
Male	2324(52.9)
Female	2069(47.0)
Age group (years)	
5-8	1665(37.9)
9-12	1507(34.3)
13-16	1221(27.7)

Table 2:Prevalence of refractive errors among school children during study period (2020-2022)

Age group n(%)		Sex n(%)		Refractive error n(%)		
		Male	Female	2020	2021	2022
5-8	1665(37.9)	917(55.0)	748(44.9)	477(28.6)	586(35.1)	602(36.1)
9-12	1507(34.3)	642(42.6)	865(57.3)	436(28.9)	459(30.4)	612(40.6)
13-16	1221(27.7)	765(62.6)	456(37.3)	365(29.8)	418(34.2)	438(35.8)
Total	4393	2324	2069	1278(29.2%)	1463(33.3%)	1652(37.6%)

Table 3:Various refractive errors among school children

Year	Myopia n(%)	Hyperopia n(%)	Astigmatism. n(%)
2020 (n=1278)	323(25.2)	749(58.6)	206(16.1)
2021(n=1463)	366(25.0)	485(33.1)	656(39.7)
2022(n=1652)	437(26.4)	559(33.8)	612(41.8)
Total (n=4393)	1126(25.6)	1793(40.8)	1474(33.5)

Overall astigmatism was present in 33.5 % subjects.

## DISCUSSION

Vision plays an important role in a child's development for learning and communication. Uncorrected refractive errors has become a major challenge to the health care policymakers. An estimated 19 million children are visually impaired worldwide of which 12 million are due to refractive errors which could be easily corrected. While many screening programs in schools are being carried out, there is a lack of accurate data in the prevalence of visual impairment. Hence; the present observational study was conducted for assessing the increase in childhood refractive errors during COVID Pandemic.<sup>6-9</sup>

A total of 4393 school going children were analysed during the study period from 2020 to 2022. Prevalence of refractive errors among school going children in the year 2020, 2021 and 2022

was 1278(29.2%), 1463(33.3%) and 1652(37.6%) respectively. Alvarez-Peregrina C et al investigated the impact of home confinement during the COVID-19 pandemic in the school-aged children. A cross-sectional study in children between 5 and 7 years old that completed a visual screening and a questionnaire about their lifestyles at opticians was conducted. Statistical analysis to compare lifestyles pre and post confinement, and vision in 2020 versus a similar cohort examined at the same opticians in 2019, was conducted. Children spent less time outdoors and more time doing near work in 2020 than in 2019 ( $p \leq 0.001$ ). There was a significant decrease of the spherical equivalent. Lifestyles of Spanish children changed during the home confinement at the beginning of 2020. Together with changes in their lifestyles, spherical equivalents have decreased, which implies higher figures of myopia for children aged between 5 and 7.<sup>10</sup>

Wang J et al assessed 194904 photoscreening tests conducted in 123 535 children, a substantial myopic shift (−0.3 diopters) was noted after home confinement due to coronavirus disease 2019 for children aged 6 to 8 years. The findings of our study are contrary to Wang J et al which showed that prevalence of myopia increased 1.4 to 3 times in 2020 compared with the previous 5 years. Our study however showed no increase of myopia in the subsequent years. However there was significant increase in the number of cases of astigmatism. Home confinement due to coronavirus disease 2019 appeared to be associated with a substantial myopic shift in children; younger (aged 6-8 years) children's refractive status may be more sensitive to environmental changes than older children, given that they are in an important period for the development of myopia.<sup>11</sup> Bahkir FA et al assessed the impact of the lockdown on digital device usage, and consequently, the ocular surface health implications and circadian rhythm abnormalities related to digital eye strain. An open online survey was sent through various social media platforms and was open for a period of 2 weeks. A total of 407 usable responses were obtained; the average age of respondents was 27.4 years. Typically, 93.6% of respondents reported an increase in their screen time since the lockdown was declared. The average increase in digital device usage was calculated at about  $4.8 \pm 2.8$  h per day. The total usage per day was found to be  $8.65 \pm 3.74$  hours. Sleep disturbances have been reported by 62.4% of people. Typically, 95.8% of respondents had experienced at least one symptom related to digital device usage, and 56.5% said that the frequency and intensity of these symptoms increased since the lockdown was declared. The study highlighted the drastic increase in use of digital devices after the initiation of the COVID-19 lockdown, and along with it, the slow deterioration of ocular health across all age groups.<sup>12</sup>

## CONCLUSION

From the above results, the authors concluded that there has been an increase in use of digital devices during the era of COVID-19 pandemic, and has resulted in deterioration of ocular health among school going children.

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