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EFFECT OF ONLINE LEARNING AND RECREATIONAL SCREEN TIME ON SCHOOL-GOING CHILDREN'S VISION DURING THE COVID-19 PANDEMIC: A REVIEW

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ABSTRACT

Mankind has faced a tremendous impact of the Covid-19 pandemic which has left us shattered, with many of us lost our near and dear ones. Among the numerous impacts felt, effect on vision of numerous school going children due to online classes and leisure screen time was an important one. In the present review it observed that usage of mobile phones was maximum with 44.57% followed by computers 26.85%, tablets 24.44% and televisions 4.14% during the pandemic. They spend 4.9hrd-1 during Covid-19 while it was 2.05hrd-1 before Covid-19, leading to increase incidence of Myopia in the age group of 6 -12 years and development of Computer Vision Syndrome in the >12 years old age group.

Keywords: Digital Eye Syndrome, Incidence, Mobile Phones, Myopia

1. INTRODUCTION

The World Health Organization declared Corona virus-2019 (Covid-19) as a pandemic on March 11, 2020. More than 633 million people were infected and 7.05 million deaths have been reported globally due to Covid-19 till May, 2024 (WHO 2024). After declaration of Covid-19 as a pandemic several countries took up measures to control spread of the pandemic. Closure of educational institutions and recreational facilities, ban on travel, quarantine measures, lockdowns at local, state and national level were major tasks taken up by different countries. Owing to all these different kinds of measures the whole world was impacted to a great extent in all sectors, and the impact on children going to school was one of them. By September, 2020 more than 180 countries closed their educational institutions affecting one billion students which was 80% of the student population (UNESCO 2020). The lives of schoolchildren have been profoundly disrupted for months in many countries, with outdoor activities prohibited and daily routines being

restricted to indoor activities (Zhang et al. 2021).In order to continue teaching, online classes were initiated for all grades in every educational institution. However, conducting of online classes was not so successful in rural areas of less developed countries due to unavailability of internet facilities.

Online teaching led to utilization of different electronic gadgets by the students in order to attend their classes. Prolonged use of electronic gadgets such as computers, laptops, mobile phones, tablets and televisions has a profound impact on overall health of a person and in particular on vision. The use of digital devices are directly linked to vision problems as these devices emit more high energy waves that can penetrate eyes and can eventually contribute to photochemical damage to the retinal cells, making the exposed individual vulnerable to a variety of eye problems (Sarkar et al. 2020). Blehm et al. (2005) categorized the symptoms of Computer Vision Syndrome (CVS) which is also known as Digital Eye Strain (DES) into 4 categories namely: asthenopia, ocular disorders, visual disorders and extraocular symptoms. Asthenopia is associated with symptoms such as eyestrain and eye fatigue; ocular disorder includes dryness, tearing, eye redness, itching, excessive blinking, feeling of a foreign body; visual disorders refers to blur vision, double vision, difficulty focusing for near vision, increased sensitivity to light and extraocular symptoms include neck and shoulder pain, back discomfort, headache and fatigue. Myopia or Nearsightedness is also a common vision related ailment occurring mostly in children. It is an abnormal condition of vision in which all the objects nearer appears clear, but the objects farther away looks blur. This occurs when light rays gets bended or refracted not allowing it to focus correctly on the retina, doctors called it as Refractive Error. It can occur due to genetic as well as environmental factors (Morgan et al. 2005). Among the environmental factors prolonged exposure to electronic gadgets and reduction in outdoor activities are the dominant factors.

The present study was undertaken to evaluate change in screen exposure time and their impacts on vision especially in young children during Covid-19 pandemic. Information was collected from published literatures using the platforms: Researchgate, Google Scholar and Scopus.

2. FINDINGS AND DISCUSSION

2.1. USE OF ELECTRONIC GADGETS

In a study conducted in West Bengal in eastern India among 240 students belonging to class 1-12 during the year 2020, it was recorded that 80.4% of the students used small screens of mobile phones to avail their online classes during the covid-19 pandemic (Sarkar et al. 2020). In Indonesia for online learning activities more than 50% of students use mobile phones, 38.89% used laptops, tablets 6.67% and computer 3.89% (Rifai et al. 2021). In Kerala (southern India) a study conducted on 496 students age 5 - 15 years revealed that use of tablets was 42.5%, laptops 29.2%, mobile phones 20.2% and television 7.9% for attending online classes during the pandemic (Neena et al. 2021). Aldukhayel et al. (2022) in Saudi Arabia recorded tablets was the most commonly used device with 51.2 % followed by laptops with 35.3% for attending online classes in the age group of 8-12 years in a cohort of 547 children. Wang et al.(Wang et al. 2021a) in a study of 1733 children in China observed use of mobile phones was maximum with 57.2%, followed by tablets 17.9%, computers 22.6%, televisions 2.1% and projectors 0.2% for attending online classes. In a survey of 217 parents and guardians of an average of age of 13 years a record of maximum use of mobile phones with 61.7% from India was reported (Mohan et al. 2021).

In order to find out a proportionate use of the different types of electronic gadgets the laptops and computers were grouped together under the category of computer, televisions and projectors were grouped under televisions based upon the size of the screen. Therefore, four groups were made mobile phone, tablet, computer and television. Overall, average utilization of the four groups of electronic gadgets for attending online classes was found to be 44.57%, 24.44%, 26.85% and 4.14% respectively (Fig.1). Mobile phone was the most common device used for attending online classes as they are cheaper and easily available in the local shops during the pandemic. Use of bigger screens of projectors and televisions was found in developed countries as the costly inbuilt facilities can be availed by the children for attending online classes.

Figure 1

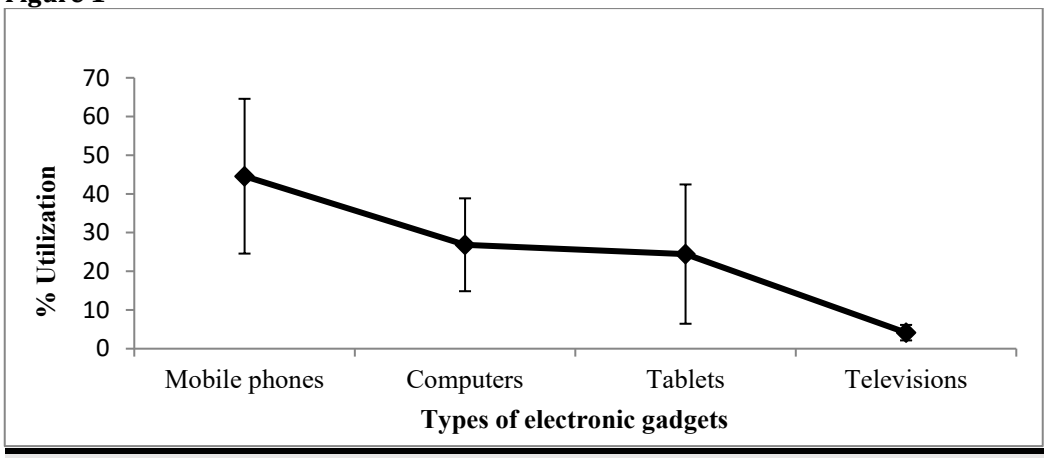

Figure 1 Average use of electronic gadgets during covid-19 pandemic (±standard error).

2.2. CHANGE IN SCREEN TIME

In a study on a cohort of 709 children during covid-19 pandemic and pre-covid cohort of 1084 children within age range of 6 - 8 years in Hong Kong, it was observed that children's outdoor time decreased from 1.27 to 0.41 hrd^{-1} while their screen time increased from 2.45 hrd^{-1} to 6.89hrd^{-1} (Zhang et al. 2021) showing a reduction of 67% in outdoor time and a 64% increase in screen time during the pandemic. Pietrobelli et al. (2020) reported a decrease in sports activities by 2.3 $hrweek^{-1}$, increase in sleep time by 0.65 hrd^{-1} and increase in screen time by 4.85hrd^{-1} among children during covid-19 lockdown in Italy. When children are out of school they become less active physically and spend more time in screen, whereas an increase in outdoor time gives a protection against development of myopia (Xiong et al. 2017). Trott et al. (2022) in a meta-analysis found that primary aged- children belonging to 6 - 10 years reported largest increase in total screen time with 1.0hrd^{-1} compared to young children (0 to 5 years), adolescents (11 to 17 years) and adults (>18 years) during the covid-19 pandemic. Among children studying in grade 6 - 8 it was observed that there was an increase of upto 3.9 hrd^{-1} during covid compared to 1.9 hrd^{-1} during pre-covid time (Mohan et al. 2021). Sarkar et al. (2020) observed a mean duration of 4.54 hrd^{-1} in screen time among the school children during covid-19 and Gupta et al.(2022) also recorded an average duration of 5.2hrd^{-1} screen time in 654 children having average age of 12 years during the pandemic.

Ma et al. (2021a) observed 0.67 hrd^{-1} of screen time in pre-covid and it increased to 5.24hrd^{-1} during covid-19, outdoor time also decreased to 0.49hrd^{-1} from 1.11hrd^{-1} in 7 - 12 year old students in China. Ekemiri et al. (Ekemiri et al.

2022) in Trinidad and Tobago observed 91% of the 435 school children belonging to 12 - 19 years exceeded the daily recommended hours of <2 hours, 59% reported 4 to 6 hours spending on digital devices while learning during covid-19. Yum et al.(2021) recorded an average reduction in outdoor activities to 4.1hrweek^{-1} from 11.0hrweek^{-1}, while an increase in spending time on screen to 3.9 hrd^{-1} from 1.7 hrd^{-1} in 5 - 15 years old children in South Korea during covid-19.

The range of screen time spent by school children was found to be 3.9 - 6.9 hrd^{-1} with an overall average of 4.9 hrd^{-1} during covid whereas, the pre-covid range was 1.7 - 2.4hrd^{-1} (average = 2.05hrd^{-1}). Overall the screen time was doubled during covid while attending online class and spending leisure time.

2.3. EFFECT ON VISION

An incidence of myopia was recorded with 16.76%, 15.42% and 14.66% before covid and it increased to 27.64%, 26.47% and 25.81% for 6, 7 and 8 years old children respectively during covid. The overall increase in incidence of myopia was 11.03% in the 6 - 8 years old during covid (Zhang et al. 2021). Wang et al.(2021a) observed myopia incidence to be 3 times higher in 6 years old, 2 times higher in 7 years old and 1.4 times higher in 8 years old children during covid. Such a substantial increase in the incidence of myopia was not seen in the older age groups of 9-13 years, despite the fact that they were offered more intense daily online learning classes. Yum et al.(2021) also observed increase in myopia progression more pronounced in 5 - 7 years old although the exposure to screen time was lesser compared to 8 - 15 year old children during covid. A rapid myopia progression of 10.5% before covid to 45.9% during covid was reported in a sample of 133 school student (Mohan et al. 2022). Chang et al. (2022) also recorded myopia incidence of 48% before covid and 73.7% during covid.

Wang et al. (2021b) recorded an overall percentage of myopia among teenagers in the year 2020 during covid to be 55.02% which was increased by 10.4% compared to pre-covid (44.62%). Home confinement due to covid-19 substantially increased the incidence of myopia among school children and children aged 9-12 were the most affected (Battabliola et al. 2022). Ma et al. (2021b) observed myopia progression was 3 times greater during covid compared to the pre-covid and older age was found to be a protective factor whereas, more digital screen time was a risk factor. Younger children aged 6 to 8 years are more sensitive to the environmental change than older children and within this age window, the plasticity of myopia is high and myopia control may be easier. Beyond this age window, the plasticity of myopia is low and myopia is harder to control during environmental changes (Wang et al. 2021a). Myopia progression in students using projectors and television was found to be slower than those using mobile phones and tablets. Myopia is the leading cause of distance vision impairment globally and if uncorrected it can lead to vision loss.

The increase in incidence of Myopia among schoolchildren during covid ranged from 11.03% to 73.7% with an average of 42.5%, which is very high as already the incidence of Myopia was high due to hereditary and environmental factors.

The CVS during pre-covid and covid was recorded for 180 students in Indonesia by Rifai et al.(2021) and there was an increase of 28.61% in asthenopia, 24.71% extraocular, 17.31% ocular disorders and 11.53% visual disorder. Sarkar et al.(2020) surveyed 240 students from class 1 - 12 aged 6 - 18 years and found 15% needed spectacles due to blurred vision after attending online classes during covid, 2.33% recorded change in power of spectacles who wore spectacle prior to

lockdown. The prolonged screen time exposure showed a high correlation with new spectacle use or change of spectacle lens power during online class (r=0.60). Mohan et al. (2021) observed common CVS of eye itching 53.9%, headache 53.9%, double vision 11.1%, seeing halos around objects 20.27% while attending online classes in grade 6 - 8 students during covid. Smartphone preference over other digital devices was found to be an independent risk factor for CVS among the children. Before covid-19 reports have also been made on association of smart phone use with 71% of dry eye diseases compared to other digital devices among school going children (Moon et al. 2014). Neena et al.(2021) revealed duration of online class was the single most independent factor associated with development of eye complaints with more than 2 hours of online classes leading to 2.55 times increased likelihood of eye complaints and this increased to 3.28 times with more than 4 hours of online class during covid. Ekemiri et al. (2022) reported 77.2% of a total of 435 school children complaining at least one of the vision related symptoms of headache 75%, 65.1% blurred vision after attending online classes during covid. Aldukhayel et al. (2022) also observed using digital device for more than 5 hours were independently associated with CVS in 8 - 12 years old children during the pandemic. Similar report was also made by Beyoglu and Beyoglu (2021).

The infusion of online learning and spending leisure time on screen during covid-19 pandemic led to an increase of CVS in the range of 2.33% to 53.9% leading to an average of 27.10% especially in school going children.

2.4. TEACHER'S PERSPECTIVE OF ONLINE CLASS

In the context of conducting online classes the authors as teachers want to share the experience which we assume must be felt by the teachers especially from less developed countries. During conducting of online classes a feeling in lack of the presence of students and speaking alone was observed, sometimes the students log in and do some other work, and bad connectivity due to network problem are the major issues. All these factors can lead to lowering in quality of education while conducting online classes.

2.5. PARENT'S PERSPECTIVE OF ONLINE CLASS

The parents generally had negative beliefs about the values and benefits of online learning and preferred traditional learning especially in early childhood settings (Dong et al. 2020). Even the authors again switching the role as a parent have the same concept and prefer traditional learning system. Exposure to screen mainly of mobile phones for more than 3 hrd^{-1} in the age group of 9 - 18 years was personally observed in our children and the hesitancy of what will be the impact on their vision occurred.

2.6. TO CONTROL IMPACT ON VISION

The use of electronic gadgets for learning and entertainment has become a part of the lives of the students in the present generation, therefore measures should be taken up by parents to reduce the screen exposure as the children belonging to the age group 6 - 12 years are found to be more vulnerable to development of myopia and the age group beyond 12 years are more vulnerable to development of CVS. Remedial measures provided by Kaur and Gurnani (2021) can also be look into as they are simple steps that needs to be followed: A: Adjust screen position according to eye location and reduce brightness, B: Blink frequently, C: Change habits and

follow the 20-20-20 rule while using digital devices, after every 20 minutes every person should take 20 seconds break and relax eyes by looking at something 20 feet away, D: Drink adequate amount of water, E: Exercise, F: Fruits and fresh vegetables should be sufficiently taken and G: Glasses should be worn regularly.

The recommended distance between projector and television screens and the eyes is usually greater than 1 m, but the distance is always less than 50cm when using mobile phones or tablets because of the small font size (Long et al. 2017). Therefore, children should minimize exposure to screen particularly mobile phones in order to prevent development of CVS and reduced risk of myopia incidence. Online learning is preferred using larger screens of projectors and televisions however, these facilities may not be affordable by the parents of poor families.

The children should be engaged more in outdoor activities, if facilities for such activities are not available due to certain circumstances the children should be encouraged to play different kinds indoor games and to have hobbies.

CONFLICT OF INTERESTS

None.

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