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Original Research Article

# To study the effects of online teaching on eyes of school going children during COVID pandemic

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ABSTRACT

**Background and Objectives:** During COVID pandemic, with schools being closed, digital platforms are being extensively used for online teaching and learning. Children are being exposed to video display units (VDU) for prolonged durations making them susceptible to ocular problems and development of the Computer Vision Syndrome. Through this study, we attempted to study the effect of this added use of VDUs through online teaching on eyes of school going children.

**Materials and Methods:** A Google survey of 18 questions was prepared assessing the pattern of online teaching sessions, type of devices used, use of protective accessories and presence of ocular symptoms. The form was floated on social platforms for parents of school going children. Data was collected and analysed using Microsoft Excel and percentage and p value calculated using chi square test.

**Results:** Out of 982 children, 494 (50.3%) had one or more ocular symptoms. Headache was found in 205(41.49%), excessive rubbing of eyes in 178 (36.03%), pain in 155 (31.37%), redness in 135 (27.32%), watering in 132 (26.72%), blurring of vision in 67 (13.56%) and changes in glass prescription in 42 (8.50%) children. We found total duration of online class and continuous use of VDUs to be statistically significant influencing factors.

**Interpretation and Conclusion:** Online teaching learning should be cautiously conducted as the use of VDUs can affect the ocular health of the children.



## 1. Introduction

In late 2019, multiple cases of pneumonia of unknown etiology were observed in the city of Wuhan caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2); also known as 2019 novel Coronavirus (2019-nCoV) and World Health Organization then declared it a pandemic.[1–3] In an effort to restrict the spread of this disease, many governments across the world enforced 'lockdowns'. In India, the lockdown came into force at midnight on 24th March 2020 and was enforced for 21 days. Subsequently, on April 14th, 2020, this lockdown was extended up to 31st May 2020, taking the total number of days under lockdown to beyond 50 days.[4] After that India declared Unlock 1 and further gradual unlocks to normalize the economy and human life but considering the risk to children, the re-opening of schools was withheld till September. Since schools remained closed from March 24 onwards, classroom teaching was not possible for almost 3 months.

To ensure that there was no hiatus in the education and students got full access to classes; schools opted for digital learning platforms and online teaching. These online classes are being regularly conducted as per the routine school schedules and syllabus requirements. These sessions benefit students as they can have access to study material

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and can interact with teachers and peers like in physical classrooms but they also expose them to the video display devices for many hours at a stretch. Further, left with no choice of going out or playing, children are left with very few options for indoor activities; most of them killing their time watching television or playing games on smartphones or tablets. Constant and repeated exposure to video display units (VDU) can lead to various eye problems like dryness, redness, watering, change in refraction and many others also known as Computer Vision Syndrome (CVS).[5] Through this study we want to assess the effects of online education on eyes of children during COVID 19 era.

## 2. Materials and Methods

Ours was an ethically approved cross sectional survey conducted on parents of school going children who were attending online classes. A Google questionnaire was prepared of 18 questions assessing the pattern of online teaching sessions, types of VDU used for learning and otherwise, use of protective accessories, presence of pre existing refractive error or other eye diseases and presence of ocular symptom after the initiation of online learning. After validation, the questionnaire was shared on social platforms like Whatsapp, Facebook, Telegram, Twitter, Instagram and through bulk emails. Parents were advised to fill individual forms for each of their children. Responding to the survey was taken as an implied consent for participation and the same was mentioned in the questionnaire. The survey was kept open from August to September 2020. The data was collected and analyzed using Microsoft Excel and percentage and p value were calculated using chi square test. The questionnaire is attached as annexure 1.

Annexure 1:

1. Currently in which class is your child studying?
   (a) Pre-primary
   (b) Primary
   (c) Secondary
   (d) Higher secondary
2. Does your child wear glasses?
   (a) Yes
   (b) No
3. Does your child have any eye disease other than glasses?
   (a) Yes
   (b) No
   If yes, mention it
4. For how many hours does your child attend online classes?
   (a) 0-2 hours
   (b) 3-5 hours
   (c) 6-8 hours
5. During which time of the day are the online classes conducted?
   (a) Morning (before 12pm)
   (b) Afternoon (12-5pm)
   (c) Evening (after 5pm)
6. On which VDU (Video Display Unit) does your child attend online classes?
   (a) Smartphone
   (b) Laptop
   (c) Desktop
   (d) Tablet
7. At what distance does your child look at the screen?
   (a) <40 centimetres
   (b) >40 centimetres
   (c) Not sure
   (d) Variable
8. In which posture does your child attend online classes?
   (a) Sitting
   (b) Sleeping
   (c) Variable
9. Are you using any screen filters over your VDU (Video Display Units)?
   (a) Yes
   (b) No
10. What is the duration of one continuous session in the online class?
    (a) 0-20 minutes
    (b) 21-40 minutes
    (c) 41-60 minutes
    (d) >1 hour
11. What is the duration of break between two sessions of an online class?
    (a) None
    (b) 5-10 minutes
    (c) 11-20 minutes
    (d) 21-30 minutes
    (e) >30 minutes
12. Apart from online class, for how much time in a day does your child use a VDU ( Video Display Unit)?
    (a) 0-2 hours
    (b) 3-5 hours
    (c) 6-8 hours
13. Regarding the above question, is the use continuous or intermittent?

(a) Continuous
(b) Intermittent

14. For purpose other than online classes, which device does your child use?

(a) Television
(b) Smartphone
(c) Laptop
(d) Desktop
(e) Tablet

15. Have you noticed any of the following eye problems in your child?

(a) Excessive rubbing of eyes
(b) Pain in eyes
(c) Redness of eyes
(d) Watering from eyes
(e) Blurring of vision
(f) Headache
(g) Change in glass prescription
(h) None
(i) Other_____

16. Do you feel that the above mentioned eye problem(s) started after beginning of online classes?

(a) Yes
(b) No
(c) May be

17. Did you have to visit an eye specialist for these eye problems?

(a) Yes
(b) No
(c) Not applicable

18. Any other comments from your side regarding the effect of online classes on your child's ocular health?

## 3. Results

Nine hundred eighty two responses were received for each child being exposed to online school education. Out of 982 children, 179(18.2%) were studying in pre-primary section, 399(40.6%) in primary, 195(19.9%) in secondary and 209(21.3%) in higher secondary section. Seven hundred children (71.3%) were not having any refractive error and majority, 931 (94.8%) were not having any pre existing eye disease.

The total duration of online classes was 0-2 hours for 429 (43.7%) children, 3-5 hours for 452(46%) and 6-8 hours for 101(10.3%) children. Regarding timing of online classes, majority of them 804(81.9%) had classes in morning hours, 243(24.7%) in afternoon and 153(15.6%) in evening hours with overlapping of time in few children. To attend online classes, most of the children 579 (59%) used smartphones while 393 (40%) used laptops, 128(13%) used tablets and 67 (6.8%) used desktop. The viewing distance was <40 centimeters in 248 (25.3%) children, > 40 cm in 265 (27%), variable in 145 (14.6%) children whereas 324 (33%) parents were not sure about the viewing distance of their children. Majority children, 771(78.5%) were attending online classes in sitting position, few 28 (2.9%) were attending in sleeping position and the rest in varying positions. Most children, 892 (90.8%) did not using any filter or protective accessories over the screen.

Outdoor activities being unsafe during Covid era, children are compelled to remain indoors and spend their leisure time significantly on VDU. Apart from online classes, 664 (67.6%) children were using some form of a VDU for 0-2 hours, 266(27.1%) children for 3-5 hours and 52(5.3%) children for 6-8 hours. Further, 346(36.8%) children were watching VDU continuously, without any interruptions. Apart from the use for online sessions, 555(56.5%) children were exposed to television, 637(64.9%) to smartphone, 150(15.3%) to laptop, 36(3.7%) to desktop and 135(13.7%) to tablet indicating that children spent most of their waking hours on VDUs, smartphone being the commonest of all.

Out of 982, 488(49.69%) children did not have any ocular problems after starting online classes but almost half of the children, 494(50.3%) had one or more ocular symptoms. Out of the symptomatic 494 children, 64(12.95%) were in pre-primary class, 193(39.06%) in primary, 97(19.63%) in secondary and 140(28.34%) were in higher secondary class. Among the symptoms, headache was the most common, in 205(41.49%) children, followed by excessive rubbing of eyes, pain, red eye, watering, blurring of vision and changes in glass prescription. (Figure 1) For these eye problems, 85(17.20%) children needed to an eye specialist.

Two hundred and ten (42.51%) responses indicated that the ocular problems occurred after beginning of online classes, 181(36.69%) expressed uncertainty and the remaining responses stated that cause effect relationship could not be established.

Presence of refractive errors and other eye disease were found to be statistically significant related to development of symptoms ($p<0.01$). Increased duration of classes, longer duration of a single continuous online session and total duration of use of VDU apart from online classes were also found to be statistically significant ($p<0.01$) influencing factors. (Table 1)

Among the open ended responses received, 128(13.03%) responses stated that online classes caused harm to their children's health and should be stopped, 72(7.33%) responses mentioned that they could be continued in the same pattern while 58(5.90%) responses suggested that online teaching could be continued with some modifications in pattern and timings. Seven responses requested a long term study to reach to a definitive conclusion.

**Table 1:** Statistical analysis of various parameters in symptomatic and asymptomatic group

| | | Symptomatic (N-494) | Asymptomatic (N-488) | P Value |
|---|---|---|---|---|
| Use of spectacles | Yes (n = 282) | 174 | 108 | <0.0001* |
| | No (n = 700) | 320 | 380 | |
| Presence of pre existing eye disease | Yes (n = 51) | 39 | 12 | 0.000124* |
| | No (n = 931) | 455 | 476 | |
| Total duration of online class in a day | 0-2 hours | 165 | 264 | <0.00001* |
| | 3-5 hours | 260 | 192 | |
| | 6-8 hours | 69 | 32 | |
| Duration of one continuous session | 0-20 minutes | 42 | 57 | 0.01779* |
| | 21-40 minutes | 250 | 283 | |
| | 41-60 minutes | 127 | 105 | |
| | >1 hour | 75 | 43 | |
| Duration of break between two sessions | None | 66 | 92 | 0.16 |
| | 5-10 minutes | 237 | 233 | |
| | 11-20 minutes | 116 | 100 | |
| | 21-30 minutes | 32 | 26 | |
| | >30 minutes | 43 | 37 | |
| Duration of VDU*use apart from online class | 0-2 hours | 300 | 364 | <0.00001 |
| | 3-5 hours | 155 | 111 | |
| | 6-8 hours | 39 | 13 | |

*Video Display Units

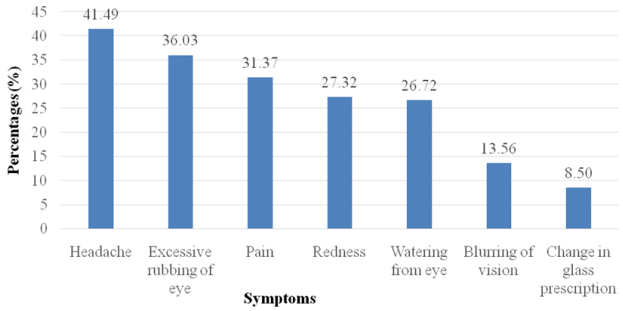


**Fig. 1:** Ocular symptoms in children attending online classes:

## 4. Discussion

Our use of VDU has increased over the past few decades. Reports have suggested that 72% of children (<8 years) used digital tools in 2013 compared to 38% in 2011.[6] Though VDUs can be portable, easy-to-use and provide extensive amounts of information at the tip of a finger, the extent to which an average child uses screens has raised red flags. During the current pandemic, with schools being closed, the resulting use of alternative methods of teaching has further increased the screen time of kids. In addition, social distancing has put restrictions on outdoor activities, resulting in even more screen time indoors. In light of all these changes, it becomes important to take into account the screen effect on eyes of children.

Ocular symptoms were reported in 50.3% children out of which headache was the most common followed by excessive rubbing of eyes, pain, redness, watering and blurring of vision. This finding correlates with the study done by Rabab et al wherein they noticed headache (47.3%) as the most common complaint followed by eye pain in or around the eyes (33.0%).[7] In another study by Ichhpujani et al, out of 576 students, 103 (17.9%) students experienced eyestrain at the end of the day after working on digital devices.[8]

In our study, the total duration of online class and duration of use of VDU apart from online class was found to be statistically significant for development of symptoms. In a study by Logaraj M et al. in college going students, those who used computer for 4-6 hours were at significantly higher risk of developing ocular symptoms compared to those who used computer for less than 4 hours.[9] In a study by Reddy SC, students who used computers for more than 8 hours per day experienced symptoms of computer vision syndrome significantly more often than those who used them up to 2 hours (p=0.0001).[10] These findings indicate that longer exposure to VDU can definitely be a risk factor for development of ocular symptoms.

In our study, students who were wearing spectacles experienced symptoms significantly more often than those who were not wearing spectacles (p<0.0001). Similar significance was seen in the study by Logaraj et al.[9] In a study by Reddy et al, out of 176 students wearing either spectacle or contact lens, 72.2% (127/176) had ocular symptoms.[10] Similarly, ocular symptoms were also higher in those children who had pre-existing ocular pathology. These indicates that VDUs should be used cautiously in children having refractive errors or any other ocular disease.

In our study, we could not find any influence of viewing distance which is contradictory to another study where

increased incidence of headache in VDU users was noted when the device was being viewed at a distance of less than 50 cm.[5] In our study, the duration of break between two sessions was also not statistically significant which is contradictory to other studies. Reddy et al have reported that taking breaks during extended computer use was the most common preventive measure taken for relief of symptoms of Computer Vision Syndrome; the mean duration of rest being 15 minutes (range 5 – 60 minutes). However, they did not find any statistically significant association between taking breaks and relief of symptoms (p=0.3238).[10] Logaraj et al did find significant correlation between taking fewer breaks and symptoms ($P< 0.01$) .[9] This could be due to differences in study population.

In our study, we found that majority children were not using any radiation reducing screen filter which was similar to the study done by Reddy et al.[10] In our study, we found that majority children studied on smartphone followed by laptop use. In the study by Ichhpujani et al also, 336 students (58.3%) used a smartphone while 215(37.3%) used a tablet/ phablet/ iPad, 206 (35.8%) used a laptop, 137(23.8%) used a desktop computer and rest used an eBook Reader device.[8]

As ours was a self reported online survey, we could not assess the objectivity of the ocular symptoms. Also since it was conducted within a short time after starting of online classes, long term effects of the same remain to be evaluated. Further, a similar survey done in all parts of the country with maximum number of participants could help to gather actual data.

## 5. Conclusion

Among the children exposed to online educational sessions, about 50% developed some form of an ocular symptom, headache being the commonest one. Pre existing refractive glasses or eye disease, total duration of screen exposure and continuous use of a VDU were found to be significant risk factors in relation to development of ocular symptoms. Since the use of VDUs has increased amongst children over years, especially now during COVID era, because of online teaching and avoidance of outdoor activities, effects of these on ocular health of children should be borne in mind. The total duration of VDU exposure should be restricted and appropriate planning of screen time sessions needs to be done. Public awareness needs to be created regarding the effects of VDU on ocular health.

## 6. Conflict of Interest

There are no conflicts of interest in this article.

## 7. Source of Funding

None.

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