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Digital Eye Strain in Medical Undergraduate Students during COVID-19 Pandemic

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ABSTRACT

Background: Digital devices have been an integral part of our daily lives. With the emergence of COVID-19 pandemic we have gone through strict lockdowns. Most educational institutions conducted classes virtually. This increased the symptoms of digital eye strain. This study aims to assess the prevalence, symptoms, and level of awareness regarding digital eye strain in medical undergraduate students following the COVID-19 pandemic.

Methods: Our study was a questionnaire-based cross-sectional study with a duration of 3 months. All the undergraduate medical students studying at Kathmandu Medical College Teaching Hospital were included in the study. A self-administered questionnaire was sent to each student electronically via google forms. Descriptive statistics, frequency tables, and percentages were calculated.

Results: A total of 208 students were included in the study. The mean age of participants was 22.7±1.6 years (Mean ± SD) with a mean duration of online classes being11.39 ± 5.2 months (Mean ± SD) . The average screen time of students before the start of online classes was 4.14 (SD=2.13) hours. The average screen time after the start of online classes was 7.93 (SD=2.44) hours, an increase of 91.54%. The overall prevalence of digital eye strain among the respondents was 90.8% (n=189).

Conclusions: The prevalence of digital eye strain in our study was high. The average screen time increased significantly following COVID-19. Therefore, it is important to create awareness regarding digital eye strain and practices that decrease the symptoms of digital eye strain.

Keywords: COVID- 19; eye strain; medical students.

INTRODUCTION

Digital devices have been an integral part of our daily lives. Digital devices include smartphones, laptops, desktops, and tablets. From work to entertainment and from kids to adults, everyone use gadgets for various purposes. Even though these devices have made our life easier, the excessive use of these devices is not without side effects. The adverse effects due to their excessive use is termed Digital Eye Strain or Computer Vision Syndrome. Digital eye strain includes all the ocular and non-ocular symptoms following prolonged use of digital devices. Digital eye strain consists of eye strain, blurring of vision, burning sensation, redness, ocular fatigue, double vision neck/shoulder pain injury to fingers and wrist due to repetitive movements, headache, and psychosocial stress also leading to occupational overuse syndrome. [1,2] COVID- 19 pandemic led to many changes in our lifestyle including excessive use of digital devices. People started to work from home and schools started online classes. Similarly, medical colleges also started e-learning which led to the prolonged use of digital devices. Nationwide lockdowns restricted outdoor activities and digital gadgets were used not only for work and studies but also for entertainment purposes. COVID-19 has led to an increase in the number of people complaining of digital eye strain following excessive and prolonged use of computers. Many studies have been conducted on digital eye strain but very few studies

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have been conducted on the undergraduate medical students, especially during the pandemic. This study aims to study the effect of increased screen time and digital eye strain in undergraduate medical students during the COVID pandemic.

METHOD

Our study was a questionnaire-based cross-sectional study. The duration of our study was 3 months from October 2021 to December 2021. All the undergraduate medical students studying at Kathmandu Medical College Teaching Hospital and who attended online classes for a minimum of 3 months were included in the study. A self-administered online questionnaire was sent to each student electronically via Google forms. A digital consent was taken from each of the students before filling up the questionnaire. Ethical clearance was taken from the institutional review committee of Kathmandu Medical College Teaching Hospital (Ref No 0609202104). The sample size was calculated using the formula $N=z^2 X p (1-p) / e^2$ with a confidence interval of 95%, margin of error 5%, non response rate 10% and an estimate based on the prevalence of digital eye strain of 90%[3]. The calculated sample size was 152 however, all the responses that were attained and fulfilled the inclusion criteria were included in the study. The response rate was 100%. Samples were collected proportionately from first, second, third, and fourth year Bachelor of Medicine and Bachelor of Surgery (MBBS) students. A structured questionnaire was prepared following a thorough literature review and consultation with experts.

The questionnaire included three parts. The first part included the demographic details like the age, gender, years of study, use of prescription glasses, preexisting ocular disease/systemic disease, and use of any medications. The second part included questions regarding the duration of online classes attended, time spent in digital devices and lighting conditions, and ergonomic principles followed during digital device use. The last part assessed the knowledge, attitude, and practice regarding digital device use.

The presence of any one or more ocular or non ocular symptom following prolonged digital device use was considered as digital eye strain.

The data was entered and analyzed by Statistical Package for the Social Sciences (IBM SPSS Statistics, Version 20). Descriptive statistics, frequency tables, and percentages were used.

RESULTS

A total of 208 students were included in the study. The age of the participants ranged from 18-29 years and the mean age of participants was 22.7±1.6 (Mean ± SD). The total number of female participants was 80 (38.5%) and male participants were 128 (61.5%). The number of students from first year MBBS was 38 (18.3%), second year was 46 (22.1%), third year was 72 (34.6%) and fourth year was 52(25%). Prescription glasses were used by 116 (55.8%) and 92 (44.2%) did not have any prescription glasses. Among the 116 participants with prescription glasses, 93 (80.1%) had myopia, 13 (11.2%) had astigmatism, 5 (4.3%) had hypermetropia and the rest 5, (4.3%) were not aware of the type of refractive error.

The mean duration of online classes attended by the students was 11.39 months (SD = 5.2 months, Range 3-30 months). The average screen time of students before the start of online classes was 4.14 hours (SD= 2.13 hours, Range 1-13 hours) compared to the average screen time after the start of online classes which was 7.93 hours (SD= 2.44 hours, Range 3-16 hours), an increase of 91.54%. There has been a statistically significant increase in screen time after the start of online classes. ($p<0.001$).

Most of the participants used smartphones for their online classes. The distribution of the type of gadgets used by the participants for online classes is given in Table 1.

Table 1. Distribution of different digital devices used by the participants for online classes.

Device used	Number	Percentage
Smartphones	181	87 %
Ipad and tablets	58	27.8%
Laptop	50	24%
Desktop	3	1.44%

The overall prevalence of digital eye strain among respondents who had at least one ocular or non-ocular symptom was 90.8% (n=189). Among the respondents with digital eye strain, 41.3% (n=78) were female and 58.7% (n= 111) were males. The distribution of symptoms among the participants is given in Table 2.

While using gadgets, 57.2% (n=119) alternate between sitting and lying position, 13.5% (n=28) used it in lying position and 29.3% (n=61) sat most of the time. Among the participants with neck pain (n=104), 62.5% (n=65)

alternated between sitting and lying positions while using digital devices, 9.6% (n=10) lay down while using digital devices and 27.8 (n=29) were sitting while using digital devices. However, the relation between the neck pain and position while using digital devices was not statistically significant.

Table 2. Distribution of symptoms among the Participants (n= 208).

Symptoms	Number	Percentage
Neckpain	104	50
Headache	102	49
Ocular fatigue	100	48
Back pain	83	39.9
Sleep disturbances	82	39.4
Dryness of eyes	80	38.4
Shoulder pain	72	34.6
Burning sensation	55	26.4
Anxiety	50	24
Blurring of vision	49	23.5
Redness of eyes	28	13.4
Foreign body sensation	19	9.1

Among the 189 participants who had digital eye strain 58.2% (n=110) participants had refractive error among whom , 83.6% (n=92) had myopia followed by 11.8% (n=13) had astigmatism and hyperopia in 4.5% (n=5). Among the participants with headaches, 59.8% (n=61) had refractive error however the association was not statistically significant.

Sixty six percent of the participants placed their digital device(n=138) below the level of the eyes, 30.8% (n=64) placed it at the level of the eyes, and 2.9% (n=6) placed it above the level of the eyes. Sixty-four percent (n=133) of the participants place the screen at a distance of 25-40 centimeters (cm), 32.7 % (n=68) placed it at a distance of less than 25 cm and 3.4% (n=7) placed it at a distance of more than 40 cm. Ninety-nine participants (47.6%) were using blue ray-filtering lenses in their glasses while using digital devices. One hundred and sixty-five (79.3%) subjects were using night mode in the evening while using their gadgets.

Regarding awareness of digital eye strain, participants were asked whether they had heard about the condition or not. The results regarding the awareness of digital eye strain and the 20-20-20 rule are given in Table 3:

Table 3. Distribution of patients regarding awareness of Digital eye strain and 20-20-20 rule.

	Yes (%, n)	No (%,n)
Aware about Digital Eye Strain or Computer Vision Syndrome	58.2 (121)	41.8 (87)
Aware about 20-20-20 rule	40.9 (85)	59.1 (123)

The details regarding the various practices adopted by the participants to reduce the symptoms of digital eye strain are given in Table 3.

Table 4. Distribution of participants based on different practices adopted to reduce the symptoms of digital eye strain.

Practice	Most of the time n (%)	Sometimes n (%)	Do not practice n (%)
Follow 20-20-20 rule (n=85)	6 (7)	40 (47)	162 (45.8)
Frequent breaks	48 (23)	144 (69.2)	16 (7.6)
Think and blink	33(15.8)	56(26.9)	119 (57.2)
Use of eye drops	9 (4.3)	24 (11.5)	175 (84.1)

After the start of online classes, 33.1% (n=69) of the participants felt the need for glasses or change of glasses. However, only 16.3% (n=34) had visited the ophthalmologist for problems related to digital eye strain.

Seventy-two percent of the subjects (n=105) had symptoms during digital device use before the start of online classes. Among the participants who had symptoms before start of online classes, about 50.4% (n=53) felt that the symptoms had increased after the start of online classes. Among the participants who did not have any symptoms before start of online classes 25.9 % (n=28) developed symptoms after the start of online classes. Also, in 13.9%(n=29) there has been a change in refractive error after the start of online classes.

DISCUSSION

COVID- 19 pandemic caused major changes in our lifestyles. Classes, meetings, and various other human interactions were done virtually through online

meetings, audio and video conferencing, and social networking. For online classes, various platforms like Zoom, Microsoft teams, and google classrooms were used by most educational institutions. This prolonged use of the digital device has led to increased digital eye strain. [4]

Digital eye strain can be managed by pharmacological and non-pharmacological methods. Simple actions like good ergonomics practices, think and blink practice, appropriate lighting, adjusting the image parameters like resolution, text size, contrast and luminance of digital devices, correction of refractive error and presbyopia, correction of vergence and accommodative problems and taking frequent breaks can significantly decrease symptoms of digital eye strain. It can also be managed pharmacologically using topical artificial tears. [5,6]

In our study, it has been seen that there has been a significant increase in the duration of computer use following online classes due to COVID -19. The overall prevalence of digital eye strain among undergraduate medical students was 90.8% which was comparable to other studies done among medical students. [3,7,8] However, more males had symptoms of digital eye strain as compared to females unlike in a study by Babu et al where the occurrence of symptoms was more in females than males.[9] There was a 91.54 % increase in the screen time after the onset of online classes and the increase in screen time was statistically significant , the results of which were comparable to other studies which also showed an increase in screen time following COVID-19 pandemic. [4,10]

Among our participants, 87% were using smartphones for their online classes. The reason for a large number of participants using the smartphone could be because of the ease and convenience of handling. The results were comparable to other studies where a large proportion of students were using mobile phones for online classes. [1,4]

The most common refractive error among the subjects with symptoms of digital eye strain was myopia (83.6 %). The results are similar to that in a study done by Kinnari etal where the most common type of refractive error was myopia. [11]

Ergonomics has a very important role in preventing and decreasing the symptoms of digital eye strain. Following certain rules decreases the frequency of symptoms of digital eye strain. With the new emerging strains of COVID-19, we do not know how many times we may have to go through nationwide lockdowns, and work from home and online classes have become the new norm. Therefore, it is important to raise awareness regarding digital eye strain and spread knowledge regarding good ergonomic practices and visual hygiene practices to reduce the incidence of digital eye strain.

The most common symptom following prolonged digital use was neck pain followed by headache. It was seen that among the subjects with neck pain, 62.5% did not maintain good posture while using digital devices. Among the participants with headaches, 59.8% had refractive errors. So it is very important to have our eyes checked and refractive error corrected to prevent digital eye strain. Uncorrected refractive errors are an important cause of digital eye strain.

Regarding the awareness of digital eye strain, 58.2% of the participants were aware of the condition. The awareness of digital eye strain in our medical students was higher as compared to other studies.[12,13] For alleviating the symptoms of digital eye strain, the American Optometric Association advocates taking a 20 seconds break by looking at a distance of 20 feet after 20 minutes of digital device use.[14] In our study , 40.9% (n=85) were aware of the 20-20-20 rule Among the 85 participants who were aware of the 20-20-20 rule, only 54%(n=46) were following the rule during digital device use. This showed that only awareness of it does not necessarily result in the partice of rule the findings of which were similar to that in the study by Alabdulkader.[13] The most common practice to prevent or relieve the symptoms of digital eye strain was taking frequent breaks during gadget use which was practiced by 23% of the participants most of the time. The above findings were comparable to the findings of another study done among medical students in Nepal.[12]

It is recommended to place the computer screen at a distance of more than 40 cm, to use anti-reflective coating in glasses, and also to use gadgets in night mode in the evening to reduce the symptoms of digital eye strain.[10] In our study 64% of our subjects were placing their gadgets at a distance of less than 40 cm however, this could be the most preferred distance as a majority of subjects were using smart phones for online classes, and only 47.6% were using antireflective coating in their glasses. A greater portion of subjects (79.3%) in our study were using night mode in digital devices while using them in the evening.

The limitation of our study was that it was an online questionnaire study done in medical undergraduated

students with a small number of sample size which may not be a representation of the general population.

CONCLUSIONS

This study has shown a high prevalence of digital eye strain in medical students following increased digital device use during COVID -19 pandemic in Nepal. It is also seen that many students did not follow good ergonomic practices during digital device use. A majority of the subjects were unaware of digital eye strain and the various methods to prevent it. Among those who were aware of the condition and the practices a majority of them did not follow them. As the risk of new waves of COVID-19 persists, we may again need to go back to online classes. Therefore it is important to create awareness regarding digital eye strain , the various ways to minimize the side effects of prolonged digital device use , encourage digital device users to adopt the various preventive and ergonomic practices and if required seek medical help for the treatment of digital eye strain.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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