Original Research Article

Eyestrain and associated problems among undergraduate medical students undergoing e-learning/teaching methods during Covid-19 pandemic

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ABSTRACT

Background: Increase in usage of digital devices and mandatory e-learning imposed during the Covid 19 pandemic curfew may have given rise to an emerging public health threat of digital eyestrain among undergraduate medical students in the state. The study aimed to assess the distribution of digital eyestrain among undergraduate medical students and to determine the association between digital eyestrain and screen time spent on different digital devices for e-learning and social media use.

Materials and Methods: A cross sectional, questionnaire based online study was done on undergraduate medical students of a teaching hospital in Central Kerala during the month of October, 2020. Survey form included CVS-Q questionnaire, OSDI questionnaire and questions regarding screen time spent on different digital devices for e-learning and social media use.

Result: Around three -fourth of the 113 participants experienced at least one symptom of digital eyestrain. Headache (76.1%) was the most common symptom followed by neck/shoulder/back pain (67.3%), tearing(49.6%), itching(48.7%), eye pain (41.6%) and increased sensitivity to light (38.1%).OSDI score revealed that 67.7% of the students had dry eye disease. Screen time of more than 6 hours spent on mobile/tablet was significantly associated with feeling of foreign body sensation, excessive blinking and itching. Lens /spectacle use was significantly associated with a feeling that eyesight is worsening and difficulty focusing for near vision. No association was seen between screen time spent for e- learning and digital eyestrain.

Conclusion: Steps towards awareness and prevention of digital eyestrain should be taken to promote ocular health and to avoid this occupational hazard.

1. Introduction

Digital eyestrain is a group of eye- and vision-related problems that result from prolonged computer, tablet, e-reader and cell phone use.[1] Medical institutions in Kerala closed in March, 2020 after the Covid-19 pandemic hit the state. Online classes started soon afterwards and all students were required to attend classes through various e-platforms and submit their assignments digitally.[2]

In view of Covid 19 pandemic, the National Medical Commission approved the conduct of online classes for medical course.[3] Mandatory e-learning may have given rise to an emerging public health threat of digital eye strain or computer vision syndrome among medical students.[4] The pandemic forced students indoors and this has led to an increase in usage of various electronic devices.

This study aimed to assess the distribution of frequency and intensity of different symptoms of digital eyestrain among undergraduate medical students attending online classes during the Covid 19 pandemic and to estimate their screen time on different screen based media (e.g. television,

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mobile, computer, etc). The study also aimed to determine the association between digital eyestrain and screen time spent on different digital devices for e-learning and social media use.

2. Materials and Methods

A cross-sectional, questionnaire based online study on undergraduate medical students during the month of October, 2020.

Based on prevalence of Computer Vision Syndrome observed in an earlier publication," by Logaraj et al.[5] with 95% confidence level and 10% relative allowable error, minimum sample size was calculated as 108.

After obtaining approval from the Institutional Ethics Committee, a pre-designed semi structured questionnaire was distributed digitally as Google Forms. It was used to collect data on age, gender, eyecare history, screen time spent on different devices, time spent for e-learning and on social media, computer vision syndrome symptoms (based on CVS-Q questionnaire[6] and Ocular Surface Disease Index (based on OSDI questionnaire[7] CVS-Q questionnaire assesses the frequency and intensity of 16 symptoms of eyestrain, namely, burning, itching, feeling of a foreign body, tearing, excessive blinking, eye redness, eye pain, heavy eyelids, dryness, blurred vision, double vision, difficulty focusing for near vision, increased sensitivity to light, coloured halos around objects, feeling that eyesight is worsening and headache.[6]

The OSDI is a 12-item questionnaire designed to assess symptoms seen in Dry Eye Disease (DED). The OSDI questionnaire has 3 subdomains: ocular symptoms, vision-related function, and environmental triggers.[7]

Consent was taken and participants were asked to fill the questionnaire. A total of 127 responses were received out of which 113 responses were taken for the study. Non-consenting study participants were excluded.

The data was entered in Excel sheet and analysed using IBM SPSS v20. Descriptive analysis was carried out in the form of frequency, percentage, mean and standard deviations. Chi square test was used for doing comparisons and all analyses were done at 5% significance.

3. Results

The study included 113 undergraduate medical students (29(25.7%) males and 84(74.3%) females). Age ranged from 20 years to 27 years.38(33.6%) were 23 years old, 36(31.9%) were 22 years old, 29(25.7%) were 21 years old, 5(4.4%) were 24 years old, 3(2.7%) were 27 years old and 2(1.8%) were 20 years old. Mean age was 22.27 ± 1.2.

84(74%) of the students have had previous visual examination and 55(51%) used spectacles/contact lens. Significant association was observed between lens/spectacle use and feeling that eyesight is worsening (p-value=0.000).

Lens/spectacle use was also significantly associated with difficulty focusing for near vision (p-value=0.004).

Table 1 shows the distribution of frequency of different eyestrain symptoms. Prevalence of eyestrain symptoms ranged from 76.6% for headache to 3.5% for double vision. Most common symptom seen among the students was headache. 86 (76.1%) of the students complained of headache. 65(57.5%) had occasional headache and 21(18.6%) experienced headache often or always. Next most common eyestrain symptom was neck/shoulder/back pain seen in 76(67.3%) students followed by tearing in 56(49.6%) students, itching in 55(48.7%) students, eye pain in 47(41.6%) students, increased sensitivity to light in 43(38.1%) of students and feeling that eyesight is worsening in 41(36.3%) of students. 40(35.4%) students complained of feeling of foreign body in eye, heavy eye and dryness and 35(31.0%) students complained of burning and red eye. Blurred vision was reported by 30(26.5%) students, 27(23.9%) had excessive blinking and 26 (23%) had difficulty focusing for near vision. Least common eyestrain symptoms were coloured halos around objects which was reported by 11(9.7%) students and double vision reported by 4(3.5%) students.

Table 2 shows distribution of intensity of eyestrain symptoms. Very severe headache and very severe neck/shoulder/back pain was experienced by 4 students each.22 students had severe headache and 13 students had severe neck/shoulder/back pain.7 students had a severe feeling that their eysight was worsening. Severe sensitivity to light and severe eye pain was experienced by 6 students each. 5 students experienced severe itching and 4 students experienced severe dryness of eyes. Severe redness and severe tearing was reported by 3 students respectively.

Table 3 shows distribution of computer vision syndrome. Computer vision syndrome(CVS) score was calculated using the formula; CVS Score= (frequency of symptom occurrence) x (intensity of symptom). If the total score is ≥6 points, student is considered to suffer from Computer Vision Syndrome.Table 3 shows distribution of students with CVS. 46(40.7%) of the students had CVS. Most common CVS symptom was headache which was seen in 13(11.5%) of students followed by increased sensitivity to light seen in 6(5.3%) of students, feeling that eyesight is worsening experienced by 5(4.4%) of students, itching felt by 4(3.5%) students and eye pain in 3(2.7%) students.CVS was not seen for symptoms like coloured halos around objects and feeling of foreign body in eye.

Table 4 shows distribution of students according to screen time spent on different devices. 72(63.7%) of students watched TV for <=1 hour, 20(17.7%) watched TV for >1 hour and <=2 hrs and 15(13.3%) students watched TV for >2 hours and <=4 hours. 5(75.2%) of students used desktop/laptop for <=1 hour and 9(8%) used desktop/laptop for >1 hour and <=2 hr.29(25.7%) of students spent time

Table 1: Distribution of frequency of eyestrain symptoms among students

Eyestrain symptoms	Number & percentage of students		
	never	occasionally	often/always
Burning	78(69.0%)	31(27.4%)	4(3.5%)
Itching	58(51.3%)	49(43.4%)	6(5.3%)
Feeling of a foreign body	73(64.6%)	37(32.7%)	3(2.7%)
Tearing	57(56.4%)	50(44.2%)	6(5.3%)
Excessive blinking	86(76.1%)	26(23.0%)	1(0.9%)
Eye redness	78(69.0%)	32(28.3%)	3(2.7%)
Eye pain	66(58.4%)	40(35.4%)	7(6.2%)
Heavy eyelids	73(64.6%)	33(29.2%)	7(6.2%)
Dryness	73(64.6%)	34(30.1%)	6(5.3%)
Blurred vision	83(73.5%)	28(24.8%)	2(1.8%)
Double vision	109(96.5%)	2(1.8%)	2(1.8%)
Difficulty focusing for near vision	87(77.0%)	21(18.6%)	5(4.4%)
Increased sensitivity to light	70(61.9%)	35(31.0%)	8(7.1%)
Coloured halos around objects	102(90.3%)	10(8.8%)	1(0.9%)
Feeling that eyesight is worsening	72(63.7%)	33(29.2%)	8(7.1%)
Headache	27(23.9%)	65(57.5%)	21(18.6%)
Neck/Shoulder/Back pain	37(32.7%)	58(51.3%)	18(15.9%)

Table 2: Distribution of intensity of eyestrain symptoms among students

Eyestrain symptoms	Number and percentage of students			
	Mild	Moderate	Severe	Very severe
Burning	38(73.1%)	13(25.0%)	1(1.9%)	0
Itching	41(62.1%)	19(28.8%)	5(7.6%)	1(1.5%)
Feeling of a foreign body	33(67.3%)	15(30.6%)	1(2.0%)	0
Tearing	44(64.7%)	21(30.9%)	3(4.4%)	0
Excessive blinking	36(81.8%)	6(13.6%)	2(4.5%)	0
Eye redness	40(75.5%)	9(17.0%)	3(5.7%)	1(1.9%)
Eye pain	39(60.9%)	19(29.7%)	6(9.4%)	0
Heavy eyelids	36(66.7%)	15(27.8%)	2(3.7%)	1(1.9%)
Dryness	36(69.2%)	12(23.1%)	4(7.7%)	0
Blurred vision	32(68.1%)	13(27.7%)	1(2.1%)	1(2.1%)
Double vision	28(90.3%)	0	2(6.5%)	1(3.25)
Difficulty focusing for near vision	31(67.45)	12(26.1%)	2(4.3%)	1(2.2%)
Increased sensitivity to light	35(60.3%)	16(27.6%)	6(10.3%)	1(1.7%)
Coloured halos around objects	32(86.5%)	4(10.8%)	1(2.7%)	0
Feeling that eyesight is worsening	37(62.7%)	14(23.7%)	7(11.9%)	1(1.7%)
Headache	38(40.9%)	29(31.2%)	22(23.7%)	4(4.3%)
Neck/Shoulder/Back pain	37(43.5%)	31(36.5%)	13(15.3%)	4(4.7%)

on mobile/tablet for >4 hours and <=6 hours, 25(22.1%) used mobile/tablet for >4 hour and <=6 hrs and 22(19.5%) students watched TV for >6 hours and <=8 hours. Screen time of more than 6 hours spent on mobile/tablet was found be significantly associated with eyestrain symptoms like feeling of foreign body(p-value=0.008), excessive blinking(p-value=0.036) and itching(p-value=0.025).

Table 5 shows distribution of students according to screen time spent for e-learning and on social media. 37(32.7%) of students had undergone e-learning for >2 hours and <=4 hours, 29(25.7%) of students used e-learning methods for <=1 hours, 20 (17.7%) of students used e-learning for >1 hours and <=2 hours and 19(16.8%) of students spent >4 hours and <=6 hours for e-learning. There was no significant association observed between time spent for e-learning methods and symptoms of eyestrain. Table 1.8 and Fig 1.8 shows distribution of students according to screen time spent on social media platforms.38(33.6%) of students used social media for>2 hours and <=4 hours, 31(27.4%) students spent >1 hour and <=2 hours on social media and 25(22.1%) students used different social media platforms for <=1 hour.

44(38.9%) of students spent <=1 hour for reading/writing (not on screen based media), 32(28.3%) spent >1 hour and <=2 hours and 21(18.6%) spent >2 hours and <=4 hours for reading/writing. 82(72.6%) of students reported sleep

Table 3: Distribution of symptoms of CVS among students

| CVS Computer Vision Syndrome(CVS) symptoms	Number and percentage of students with CVS
Burning	1(0.9%)
Itching	4(3.5%)
Feeling of a foreign body	0
Tearing	2(1.8%)
Excessive blinking	1(0.9%)
Eye redness	2(1.8%)
Eye pain	3(2.7%)
Heavy eyelids	2(1.8%)
Dryness	2(1.8%)
Blurred vision	1(0.9%)
Double vision	2(1.8%)
Difficulty focusing for near vision	2(1.8%)
Increased sensitivity to light	6(5.3%)
Coloured halos around objects	0
Feeling that eyesight is worsening	5(4.4%)
Headache	13(11.5%)

Table 4: Distribution of students according to screentime spent on different devices

Screen time spent on different devices	Number & Percentage of students
Television	
<=1 hr	72(63.7%)
>1 hr& <=2 hr	20(17.7%)
>2& <=4 hr	15(13.3%)
>4 & <=6 hr	2(1.8%)
>6 & <=8 hr	2(1.8%)
>8 & <=10 hr	1(0.9%)
>10 & <=12 hr	1(0.9%)
Desktop/Laptop	
<=1 hr	85(75.2%)
>1 & <=2 hr	9(8.0%)
>2 & <=4 hr	11(9.7%)
>4 & <=6 hr	2(1.8%)
>6 & <=8 hr	3(2.7%)
>8 & <=10 hr	3(2.7%)
Mobile/tablet	
<=1 hr	4(3.5%)
>1 & <=2 hr	3(2.7%)
>2& <=4 hr	25(22.1%)
>4 & <=6 hr	29(25.7%)
>6 & <=8 hr	22(19.5%)
>8 & <=10 hr	19(16.8%)
>10 hr & <=12 hr	7(6.2%)
>12 & <=14 hr	1(0.9%)
>14 & <=16 hr	3(2.7%)

Table 5: Distribution of students according to screen time spent for e-learning and on social media

Screen time spent for e-learning & on social media	Number & Percentage of students
E-learning	
<=1 hr	29(25.7%)
>1 & <=2 hr	20(17.7%)
>2& <=4 hr	37(32.7%)
>4 & <=6 hr	19(16.8%)
>6 & <=8 hr	2(1.8%)
>8 & <=10 hr	4(3.5%)
>10 & <=12 hr	2(1.8%)
Social media	
<=1 hr	25(22.1%)
>1 & <=2 hr	31(27.4%)
>2& <=4 hr	38(33.6%)
>4 & <=6 hr	12(10.6%)
>6 & <=8 hr	3(2.7%)
>8 & <=10 hr	2(1.8%)
>10 & <=12 hr	2(1.8%)

duration of >6 hours and <=8 hours,18(15.9%) of students reported sleep duration of >4 hours and <=6 hours and 13(11.5%) students had sleep duration of >8 hours and <=10 hours. Among 113 students, 17(15%) of them felt tired often or always, 87(77%) of them felt tired occasionally and 9(8%) never felt tired.
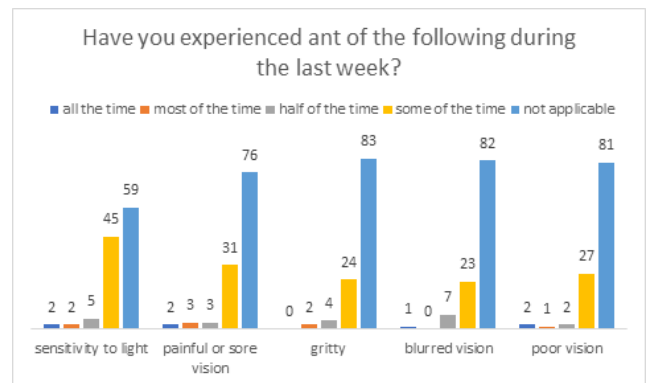

Fig. 1: Distribution of ocular symptoms among students according to OSDI questionnaire

Table 6: Distribution of DED (based on OSDI score) among students

Severity of dry eye disease	Number & percentage of students
normal	34(32.4%)
mild	25(23.8%)
moderate	24(22.9%)
severe	22(21.0%)

Figure 1 shows distribution of ocular symptoms, Figure 2 shows distribution of vision related triggers and Figure 3
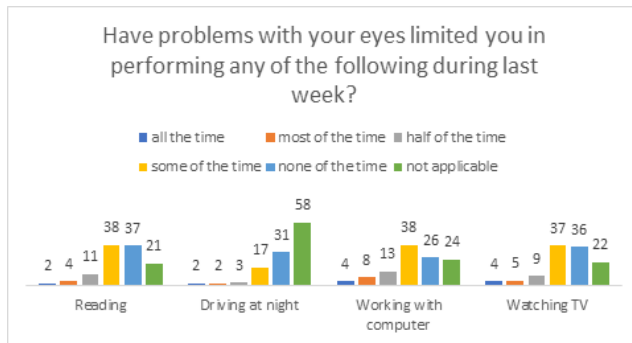
Fig. 2: Distribution of vision related triggers among students according to OSDI questionnaire
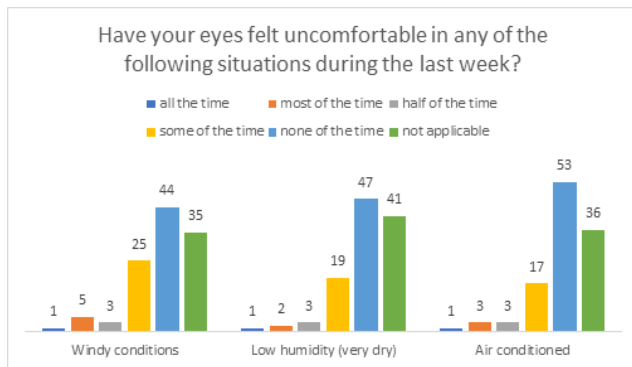
Fig. 3: Distribution of environment related triggers among students according to OSDI questionnaire

shows distribution of environment related triggers in the study population according to OSDI questionnaire. Participants had to rate their responses on a 0 to 4 scale, where 0 indicates "none of the time" and 4, "all of the time". The total OSDI score was calculated based on the formula: ([sum of scores for all answered questions] $\times$ 25)/ ([total number of answered questions]). Participants were then classified into four categories based on their total score: normal (scores: 0–12), mild (13–22), moderate (23–32), and severe dry eye (33–100). Table 6 shows distribution of students according to severity of dry eye disease (DED) based on OSDI score. 25(23.8%) students had mild DED, 24(22.9%) of students had moderate DED and 22(21.0%) of students had severe DED.

4. Discussion

Headache was the most common symptom associated with digital eyestrain according to American Optometric Association.[1] The present study shows 76.1% prevalence of headache and was the most common symptom in the student population under study. This was comparable with a study done by Kan AA et al in Karnataka[8] on undergraduate medical students where headache was the most common symptom with a prevalence of 73.3%. A study by Bahkir FA

et al in Chengalpet[9] done during the Covid 19 lockdown and a study on UG medical students by Logaraj et al[5] showed a lower prevalence of 43.3%. Headache was reported as the most common eyestrain symptom by other studies also.[10]

Neck/shoulder/back pain was the second most common symptom of eyestrain with a prevalence of 67.3% in the student population in this study. Logaraj et al[5] reported this as the most common symptom with a prevalence of 61%. In a study from Tamil Nadu done on medical students during the Covid 19 pandemic curfew,[11] neck/shoulder/back pain was the most common extra ocular symptom with a prevalence of 35.2%.

31% of students reported dry eye and heavy eyelids but OSDI score revealed that 67.7% of the students had dry eye disease (mild, moderate and severe combined). This was comparable with a study done in Karnataka[8] where they reported a prevalence rate of 63.3%. Althahi et al.[10] reported a lower prevalence of 48.3% and even lower prevalence of 21% was reported among a student population in Tamil Nadu by Niveditha KP, Dheepak Sundar M[11] during the Covid 19 lockdown.

Blurred vision which is one of the most common symptoms of eyestrain as per the American Optometric Association[1] had a prevalence of only 26.5% in this study population. Logaraj et al[5] reported a lower prevalence of 16.4%.

Burning sensation was reported by 31% of students which was similar to a prevalence of 32.3% among medical students reported by Logaraj et al.[5] Red eye was also seen in 31% students but it had a lower prevalence of 13.9% was reported as the least common eyestrain symptom among medical students by Logaraj et al.[5] In this study the least common eyestrain symptoms were double vision(3.5%) and coloured halos around objects(9.7%).

Tearing was seen in 49.6% of students and itching in 48.7% of students. Altalhi et al.[10] reported a higher prevalence of 58% and 63% respectively.

Eye pain was experienced by 41.6% of students. A lower prevalence of 29% was seen in a study done by Bahkir FA et al.[9] Lower prevalence may be due to exclusion of contact lens wearers and people who had undergone LASIK.

Significant association between lens/spectacle use and eyestrain symptoms was seen in different studies.[5,8,12,13] In this study, we found significant association with lens/spectacle use and feeling of worsening eyesight and difficulty focusing for near vision. Duration of digital screen time was also significantly associated with eyestrain symptoms in several studies.[5,14,15] Although significant association was seen between more than 6 hours of mobile/tablet use and certain symptoms of digital eyestrain like excessive blinking, feeling of foreign body in eye and itching, there was no significant association between increased screen time spent for e-learning and eyestrain.

81% of students reported feeling tired during the day and this may be a cause or consequence of the high prevalence of eyestrain seen in this population.11.5% of the students had a sleep duration of less than 6 hours which may have contributed to tiredness/fatigue.

5. Conclusion

This was a cross sectional study on 113 undergraduate medical students conducted in a single medical college. Another limitation of this study was that digital eyestrain was assessed based on self reported symptoms and not by ophthalmic examination. This study revealed that around three -fourth of the student population experienced at least one symptom of eyestrain. Computer vision syndrome was seen in 40.7% of students and headache was the most common symptom reported. Significant association was seen between more than 6 hours of screen time spent on mobile/tablet with eyestrain symptoms like feeling of foreign body sensation, excessive blinking and itching. Lens /spectacle use was significantly associated with a feeling that eyesight is worsening and difficulty focusing for near vision. No significant association was seen between screen time spent for e- learning and symptoms of eyestrain. Steps towards awareness and prevention of digital eyestrain should be taken to promote ocular health and to avoid this occupational hazard.

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