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Original Research Article

Computer vision syndrome among Al-Rayan Medical Colleges students, Madinah, Saudi Arabia

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ABSTRACT

Background: Digital devices now become a part of university student's life, and with prolonged use, they may experience some ocular problems like dryness, headache, eye strain, and pain. These symptoms and others constitute computer vision syndrome (CVS). Our study aimed to assess CVS among Al-Rayan medical college students and to evaluate students' behaviors related to preventing CVS.
Methods: A cross-sectional, questionnaire-based study was performed among the students of Alrayan Medical College from the period from November to December 2022, with a sample size of 270 cases. Data were collected using (CVS-Q) questionnaire.
Results: Near half of the participants (53.7%) were suffering from CVS. The most reported symptoms included headache (43.3%), tearing (42.9%), burning (39.3%), and blurred vision (35.1%). The most significant measures applied to minimize the impact of electronic devices were putting the digital device at enough distance (p value=0.001) and adjusting the screen brightness of the digital device (p value=0.004).
Conclusions: This study disclosed that CVS is a common problem among medical students. The manifestation of CVS was affected by the frequency and duration of electronic device use.

Keywords: Computer vision syndrome, Electronic devices

INTRODUCTION

The use of digital devices as an educational tool among students has increased substantially in recent years and has become a necessity in everyday life and therefore impacted the visual health of many university students.[1]

Computer vision syndrome (CVS), also referred to as digital eye strain, encompasses a range of ocular and visual symptoms that result from prolonged computer, tablet, e-reader, and cell phone use.[2,3]

The ocular complaints experienced by computer users typically include eyestrain, eye fatigue, burning sensations, irritation, redness, blurred vision, and dry eyes, among others.[4,5]

The pathophysiology of CVS is still unclear. Blinking of the eyes contributes to maintaining of the normal ocular surface by secretion, dispersal, evaporation, and drainage of tears. The use of the computer contributes to the disruption of this mechanism leading to a decrease in the blinking rate and increased evaporation of tears which lead finally to dryness.[6]

Inappropriate accommodation response is the probable cause of blurred vision, presbyopia, myopia, and slowness of focus change.[7] Additionally, excessive near work usually exaggerates phoria (latent squint) symptoms which lead to eye strain and headache.[8]

CVS is a common problem among medical students. The commonest reported symptoms include headache, feeling of affected eyesight (short- or long-sightedness), eye itchiness, burning sensation, excessive tearing, dry eyes, eye redness, neck and shoulder pain, and other symptoms.[9,10] Many factors contribute to symptom development and severity, such as posture, room illumination, use of screen filters, screen brightness, distance from the screen, and duration and frequency of digital device use.[10,11]

CVS is considered a common problem all around the world.[12] Therefore, there is an increasing interest to focus on CVS because of the increasing use of digital devices and subsequent symptoms development that affect the quality of life of the population. So, we decided to study the CVS in Madinah with a special focus on medical students at Al-Rayan Medical Colleges and conducted the study to determine visual symptoms related to digital device use among universal students, the proportion of these symptoms among them and to evaluate students' behaviors related to preventing symptoms of CVS.

METHODS

A cross-sectional study was conducted at Al-Rayan medical colleges in Al-Madinah, KSA. The colleges are as follows: College of Medicine and College of Health Sciences which are subdivided into 3 departments (pharmacy, nursing and anesthesia). Colleges are divided into male and female sections. The study was conducted in the period from November to December 2022.

Participants who consented and accepted to participate were offered to answer the pre-designed online questionnaires to explore their frequency of using digital devices, the occurrence of CVS symptoms, and their current practice to mitigate the overuse of electronic devices. Data were collected using (the CVS-Q) questionnaire which is a validated questionnaire with Cronbach's alpha score was 0.78.[13]

The questionnaire assessed CVS based on 16 symptoms and measured the frequency of occurrence and the intensity of each symptom.

To measure the frequency of occurrence, that is, how often the symptoms occur, a 0-3-point rating scale was used in the following categories: never, sometimes=1, often=2, always=3 The three levels of intensity, or severity of the symptom, was similarly evaluated, on a scale of 1 to 3 points, where moderate=1, intense=2, and very intense=3. In the analysis, a symptom rated as never occurring was treated as 0 (none) on the intensity scale. Finally, the following expression was proposed to calculate the total score on the questionnaire.

$$\text{Total score} = \sum(\text{frequency of symptoms occurrence}) \times (\text{Intensity of symptoms})$$

If the total score is six points or more, the student is considered to have CVS.[13]

The sample was a convenience sample selected from the population of Al-Rayan college students to participate by answering the online survey. The included participants were students of Al-Rayan Medical College above 18 years old. The excluded participants were those students with known eye diseases that affect the symptomatology of CVS (blepharitis, corneal disease, amblyopia, squint, any previous eye surgery, pterygium, pinguecula, allergic conjunctivitis, cataract, diabetic retinopathy, glaucoma, uveitis, on chronic eyedrops).

The sample size was calculated by using OpenEpi program to be 270 participants, based on the following assumptions: prevalence of CVS among students as 69.8% based on results of a previous study done in King Saud bin Abdulaziz University, Riyadh, KSA, confidence level was 95%, margin of error was 5%, and total of students in colleges as 1595.[14,15]

The data was analyzed using the statistical package for the social sciences (SPSS) program (version 29). Categorical data was presented as numbers and percentages; Chi-square test was used for the comparison of qualitative variables.

P value <0.05 was considered significant.

Regarding ethical considerations, questionnaires were anonymous and and the data confidentiality was protected. The consent was taken on the same questionnaire for every applicant after reading the research objectives and participant rights. the ethical approval was secured from the ethical committee at Alrayan Medical Colleges [HA-03-M-122-014].

RESULTS

A total of 270 medical students who always rely on digital devices for studying were invited to participate in the study. Only students who never had any eye problems previously were included in the study, 74.4% were females; the age ranged between 18 and 27 years, with a mean of 21.65 years. 65.9% of the students preferred to use an iPad/tablet when studying 66% of them used it more than 6 hours a day, and 63.3% used it all week long.

CVS symptoms were highly prevalent among the participants where 53.7% of participating students had suffered from CVS (Figure 1).

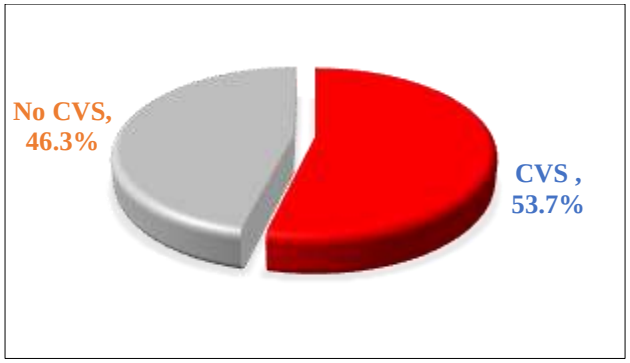

Figure 1: Computer vision syndrome among the participating students.

Headache was the most frequent symptom where 28.5% always had it and 43.3% of participants occasionally suffered from it, followed by tearing eyes (42.9%) and burning eyes (39.3%). The least reported symptom was double vision as 76.6% of participating students never complained of it, followed by heavy eyelids and difficulty focusing for near vision (Figure 2).

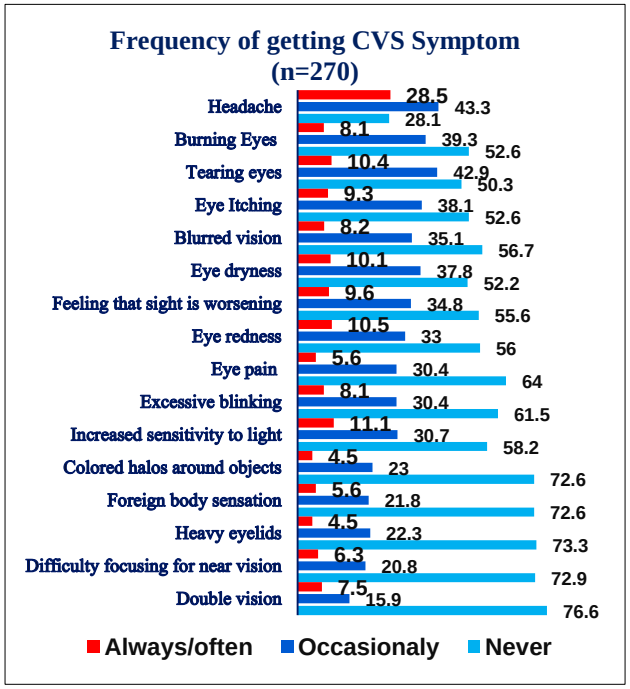

Figure 2: The frequency of getting the symptoms among the participants.

The following table shows that adjusting the device brightness is the preferable protection technique among students as 33% always practiced it, followed by taking breaks when using digital devices (18.5%), and putting the digital device at a enough distance (13.3%). Using eye drops when using digital devices was the least used technique where only 5.6% practiced it followed by anti-glare and anti-reflective glasses or lenses respectively (Table 1).

Table 1: Eye protection techniques used by the participants.

Eye protection techniques	%
I use eye drops when using digital devices	
Always	5.6
Often	6.7
Sometimes	19.3
Rarely	14.4
Never	54.1
I use anti-glare glasses/lenses when using digital devices	
Always	9.3
Often	5.9
Sometimes	8.5
Rarely	8.1
Never	68.1
I use Anti-reflective glasses/lenses when using digital devices	
Always	9.6
Often	4.8
Sometimes	10.4
Rarely	8.9
Never	66.3
I take breaks when using digital devices	
Always	18.5
Often	17.8
Sometimes	36.7
Rarely	13.7
Never	13.3
I put the digital device on an enough distance	
Always	13.3
Often	10.0
Sometimes	36.3
Rarely	22.2
Never	18.1
I put the digital device on correct angle while using	
Always	13.0
Often	13.7
Sometimes	34.8
Rarely	20.0
Never	18.5
I set in a correct posture when using digital devices	
Always	8.5
Often	14.4
Sometimes	38.5
Rarely	19.6
Never	18.9
I adjust the screen brightness of the digital device when using	
Always	33.0
Often	19.6
Sometimes	27.0
Rarely	10.4
Never	10.0

Adjusting the screen brightness of the digital device had a highly significant effect on reducing CVS occurrence (p value=0.004) where 87.2% of students who use it complain of no symptoms of CVS. Putting the digital device at enough distance also appeared to have a significant association with reducing the chances of getting CVS (p value=0.001) where 70.4% of students with no CVS confirmed using it as a protection technique while 49.7% reported no or rare use of this technique and suffered from CVS symptoms. Other protective techniques had no significant effect on the occurrence of CVS among the participating students in the current study (Table 2). In terms of the relationship between time spent on electronic devices and the chances of suffering from CVS, the length of time spent on electronic devices was significantly associated with the chance of getting CVS (p value=0.025) where 31.7% of participants with CVS spent more than 8 hours a day on their devices compared to 42.4% of those who suffered of no symptoms and reported the digital devices use for less than 5 hours a day, Therefore the longer the duration of sitting in front of devices, the greater the chance of getting CVS. Additionally, the more frequent the use of digital devices per week the higher the risk of suffering from CVS (p value=0.039) (Table 3).

Table 2: Relation between CVS and eye protection techniques application among the studied participants.

Eye protection techniques application on digital devices use.	CVS (N=145) N (%)	No CVS (N=125) N (%)	P value
Anti-glare glasses/lenses			
Yes	39 (26.9)	25 (20)	0.184
No/rarely	106 (73.1)	100 (80)	
Anti-reflective glasses/lenses			
Yes	36 (24.8)	31 (75.2)	0.996
No/rarely	109 (75.2)	94 (23.2)	
Taking breaks			
Yes	101 (69.7)	96 (76.8)	0.188
No/rarely	44 (30.3)	29 (23.2)	
Putting the digital device on an enough distance			
Yes	73 (50.3)	88 (70.4)	0.001
No/rarely	72 (49.7)	37 (29.6)	
Putting the digital device on correct angle			
Yes	85 (58.6)	81 (64.8)	0.298
No/rarely	60 (41.4)	44 (35.2)	
Setting in a correct posture			
Yes	83 (57.2)	83 (66.4)	0.123
No/rarely	62 (42.8)	42 (33.6)	
Adjusting the screen brightness of the digital device			
Yes	106 (73.1)	109 (87.2)	0.004
No/rarely	39 (26.9)	16 (12.8)	

Table 3: Relation between CVS and duration of digital device use among the studied participants.

Digital devices use pattern.	CVS (N=145) N (%)	No CVS (N=125) N (%)	P value
How often do you use digital devices in a week?			
2 days a week	10 (6.9)	8 (6.4)	0.039
3-5 days a week	34 (23.4)	47 (37.6)	
All week long	101 (69.7)	70 (56)	
How many hours do you spend using digital devices during the day?			
<3	6 (4.1)	15 (12)	0.025
3-5	33 (22.8)	38 (30.4)	
6-8	60 (41.4)	39 (31.2)	
>8	46 (31.7)	33 (26.4)	

DISCUSSION

The current study aimed to assess the CVS here in Madinah with a special focus on medical students at Al-Rayan Medical Colleges and was conducted to determine visual symptoms related to digital device use among university students, the proportion of those suffering from

CVS among them and to evaluate student's behaviors related to preventing symptoms of CVS.

More than half (53.7%) of a total of 270 participants were suffering from CVS during studying using computers, the most frequent symptoms experienced by participants were headache (71.8%), tearing eyes (53.3%), burning eyes (47.4%), and itching eye (47.4%). These findings are lower than the findings of a study done in the Indian city of Chennai by Logaraj et al among medical students that found 78.6% of participants suffering from CVS, and the study conducted in a private university in Paraguay (82.5%), and near the finding of the study conducted among medical students at the University of Illinois at Chicago (69.1%), and 60.8% among medical students in Riyadh by Abdulrahman et al.[16-19]

Headache was the most frequent symptom experienced by participants in our study, with 71.8% reported suffering from CVS, which is in line with a number of other studies, such as the study done among health sciences students by Altalhi et al that found headache was reported by 68% of participants, and 66.5% among university students in the study Tawil, 81.6% in Islam Medical College and Dental College Sialkot in Pakistan, and 78.3% at the University of Illinois in Chicago.[9,10,18,20] Headache can be triggered by many factors, excessive work usually exaggerates phoria (latent squint) symptoms which lead to eye strain and headache,[8] inappropriate accommodation response and impairment in convergence can contribute to headache. Digital devices have certain streaks and flickers that can induce the headache and also while using digital devices the muscles around the orbit will spasm leading to headaches.[21]

Other studies reported a high prevalence of other symptoms comparable to our study, like the study done by Logaraj et al where neck and shoulder pain were the most reported symptoms by 60.7% of participants followed by headache (43.3%), and in Sohag university hospital in Egypt, the blurred vision was the most frequent symptom experienced by participants (31%).[11,16] Another study conducted by Abudawood et al reported that the most frequently reported extraocular symptoms were neck, shoulder, or back pain (39.7%) and the most frequent ocular symptom was excessive tearing (20.6%).[22]

The least reported symptoms of our study were double vision (23.4%) and heavy eyelids (26.8%). These findings are in line with the study done by Almousa et al who reported that the least symptoms were double vision (18.3%) and watery eyes (35.7%).[23] Additionally, in a study conducted by Gammoh in Jorden, double vision (18.3%) and heavy eyelids (28.7%) were the least symptoms.[24] Double vision (1%) and difficulty in refocusing the eye (8%) were the least symptoms reported by Iqball.[11] Another similar study done by Cheema et al reported that change of colon vision (2.4%), sore eye (2.4%), and double vision (6%) were the least symptoms.[20] Based on our results and with the results of other studies double vision was the least frequent symptom experienced by those suffering from CVS.

The present study demonstrated that increased duration of daily computer usage was significantly associated with an increased risk of developing CVS, and the risk is higher among frequent computer users with long duration than among infrequent computer users, where 31.7% of students reported the use of electronic devices for more than 8 hours suffered from CVS.

And this is in agreement with the finding of the study conducted by Akinbinu et al who reported that 48.9% of participants spend 6 to 8 hours daily on the computer daily and suffer from CVS symptoms.[25] Additionally, a previous study by Stella showed that the majority of the respondents who spent above 8 hours on the computer daily complained of visual symptoms, and those who spent less than 1 hour on the computer daily recorded the lowest visual symptoms complaints.[26] Rahman and Sanip in their study documented that more than 7 hours per day of work on computer usage is significantly associated with CVS symptoms.[27] In contrast, the study by Reddy et al reported more than 2 hours per day of continuous use of a computer was significantly associated with the occurrence of CVS symptoms.[28]

The current study showed that adjusting the device brightness was the preferable protection technique among the participants where 87.2% who used this technique complained of no symptoms of CVS.

The study was conducted by Almudhaiyan et al also reported that altering display brightness according to the surrounding light brightness was reported by 82% of participants.[29] Additionally, the study by Altalhi et al reported that adjusting brightness based on the surrounding lighting was reported by 82% of participants.[9] Additionally, the study conducted by Stella et al also reported that the visual symptom complaints were less for respondents employing a dark background VDU screen, and the color of computer characters and background also influenced the severity of visual symptoms.[26] In contrast, a study conducted by Ranasinghe et al showed that adjusting the brightness of the screen and angle of gaze were not significantly associated with CVS.[30]

According to the findings of the current study, putting digital devices at enough distance had a significant association with reducing the risk of developing CVS where 70.4% of participants with no CVS confirmed using it as a protection technique while 49.7% who never/rarely used it suffered from the CVS. This is in agreement with the study conducted by Logaraj et al reported those students who used a digital device at a distance of less than 50 cm were at a higher risk of developing CVS.[16] Another study conducted by Alhibshi et al showed that the distance from a computer screen of less than 40 cm is considered a predictive factor for developing CVS symptoms.[33]

The majority of the current study participants who reported taking breaks when using digital devices (76.8%) did not suffer from CVS. Logaraj et al reported a similar finding where nearly 75.7% of participants reported taking frequent breaks rather than students who did not take frequent breaks were at a higher risk of getting symptoms of CVS.[16] The study conducted by Akinbinu et al supported this finding by reporting that taking regular breaks decreases the developing CVS,[25] and Reddy SC et al. reported, that taking breaks in between the use of a computer was the most common preventive measure taken for relief of symptoms of CVS.[28] In contrast the study conducted by Ranasinghe et al, taking a break was not significantly associated with the prevalence of CVS.[30] Additionally, another study was conducted by Khola et al revealed a significant association between the frequency of breaks and relief of symptoms.[31]

The current study showed that using anti-glare or anti-reflective glasses and lenses was the least used technique. Compared to Akinbinu et al who showed that the participants used the glare screen on the computer as the most commonly used preventive measure.[25] Shrivastava et al reported in their study that the participants who used the antiglare screen had a much lower risk of visual complaints (53.4%) when compared with those who were not using it (72.5%).[32]

Additionally, the study conducted by Reddy et al showed that the use of filters did not help in reducing the symptoms of CVS.[28] Moreover, the study of Reddy et al showed that university students who were wearing spectacles developed symptoms of CVS significantly more than those who were not wearing spectacles.[28] Moreover, the study conducted by Logaraj et al also revealed that medical students wearing corrective lenses showed a significantly higher risk of developing CVS symptoms.[16] The explanation for the increased risk of CVS among those using correction spectacles or lenses is because the computer is considered as a near work where the letters on the screen are formed by tiny dots, rather than a solid image, it causes the eyes which have a corrective problem to work a bit harder to keep the images in focus.[27]

CONCLUSION

In conclusion, the current study highlighted the size of the problem of CVS among Al-Rayan medical students as 53.7% of the participants were suffering from CVS and the symptoms were more frequent among female students. There was a significant relationship between time spent on electronic devices and the occurrence of CVS, the longer the time spent on computer devices, the greater the chance of getting CVS, as 31.7% of students used electronic devices for more than 8 hours were suffering from CVS.

Based on the findings of the current study, it is recommended that efforts should be made to optimize computer exposure time. It is also important to provide health education for the students focusing on significant protective measures such as proper sitting position, putting the electronic devices at a enough distance, and adjusting the screen brightness of the electronic device. It is also recommended that students should take caution while acquiring eyeglasses without a physician's prescription. Furthermore, it is critical to raise community awareness of the safety precautions that can be taken to reduce CVS.

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