



Computer Vision Syndrome in Medical Students: Awareness, Prevalence and Risk Factors

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Abstract

Background: Computer Vision Syndrome (CVS) is a common problem among students, with very little conducted research about it on Saudi users. The aim of this study was to determine the awareness, prevalence and risk factors of CVS among medical students at the University of Bisha, Saudi Arabia.

Methods: A cross-sectional study was conducted on the students registered in the faculty of medicine at the University of Bisha, Saudi Arabia. Two hundred thirty-four students were asked to fill out a predesigned online questionnaire covering sociodemographic characters, frequency of using computers, the associated symptoms and the relieving strategies.

Results: The participation rate was 87.5% (n=196), of which males formed 78.1% (n=153) and females 21.9% (n=43). The age ranged from 18 to 27 years, with a mean $\pm$ SD of 21.3 ± 2.1 . Participants spent variable hours using their computers with a mean $\pm$ SD of 5.1 ± 1.37 . Most respondents experienced diverse symptoms (92.1%), including neck pain, headache, eye strain,

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redness of the eyes, dry eyes, backache and shoulder pain. Significant relationships were confirmed between the average time spent on computers daily, the onset of symptoms, the awareness of bad effects and the different symptoms encountered.

Conclusion: Symptoms of computer vision syndrome are widely distributed among medical students at the University of Bisha, especially headaches which might be misinterpreted. Students' awareness is acceptable but needs more persuasion to relieve eye stress by taking short, frequent breaks.

Keywords

Awareness; Computer Vision Syndrome; College of Medicine; University of Bisha; Saudi Arabia

Introduction

Information technology has advanced at an exponential rate during the last few decades. Modern technology has made it necessary for people to use computers and other gadgets daily. It has been documented that 75% of all daily activities involve using a computer [1]. These devices have made life more accessible and their use is now essential in companies, educational institutions, public spaces and private residences [2]. Long-term use of computers has been linked to several health issues, including eye issues, musculoskeletal ailments like tingling and numb fingers, cervical stiffness and backaches [3]. Also, the decrease in the utilization of paper-based reading materials and the use of online resources lead to several ocular symptoms such as eye strain, headache, blurry vision, dry eyes and pain in the shoulders or neck [4]. The resulting group of eye and vision difficulties encountered during computer activities and stressed close vision are known as Computer Vision Syndrome (CVS) [5]. Musculoskeletal issues like neck stiffness, headaches, backaches and shoulder pain are closely related to inappropriate computer screen placement, which causes muscle sprain [6]. CVS is a widely prevalent health problem as most people who frequently use computers suffer from such symptoms [7]. In CVS, there are four main categories of symptoms: eye pain and strain; ocular surface symptoms such as dry eyes, discomfort and eye tearing; visual symptoms such as double vision, blurred vision and sluggish changes in focus; and the accompanying side effects such as back pain, neck pain and shoulder pain [8]. Eye strain, irritation, burning, redness and double vision are the most common eye symptoms in students and employees [9]. Although some people have had permanent visual difficulties, it was agreed that CVS symptoms are temporary and do not cause permanent visual damage and that regular, short breaks can rejuvenate and relax the accommodative system of the eyes and reduce eye pressure and visual tiredness [10]. According to estimates, there are roughly 60 million CVS patients worldwide and a million new cases are reported yearly [7]. Workers with computer vision syndrome symptoms frequently are recommended to receive a thorough eye exam and assessment from

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an optometrist [11]. Many studies were conducted to measure the prevalence of CVS in the workers of a single institution in different populations, as in final year medical and engineering university students in Chennai, India, medical sector students in King Saud Bin Abdul-Aziz University, Saudi Arabia, staff members of an institution in Abuja, Nigeria, workers of Alawkaf markets in Khartoum, Sudan, University students in Ajman, United Arab Emirate, public higher learning institution in Malaysia, institutional office workers in New York city, USA and civil servants in Spain [3,4,6,8,12,13-15]. Based on this, the current study was designed to assess CVS prevalence and risk factors among university students in Bisha, Saudi Arabia.

Methods

This is a cross-sectional study designed to determine the pattern of CVS among students at the college of medicine, university of Bisha, KSA. Ethical consideration was obtained from the ethical committee of the University of Bisha. College of Medicine (UBCOM) under the reference number UBCOM/H-06-BH-087(06/18). Also, the participants received informed consent by filling out the provided document. The study adopted a previously structured and validated questionnaire [16]. The online administered questionnaire was sent to all students (234 male and female students at all levels) at the college of medicine, the University of Bisha, along with the consent form. The questionnaire was delivered through google documents and marked as anonymous, with optional participation and the ability to review their responses before submission. At the beginning of the survey, all participants were given an easy-to-understand information statement describing the researchers, the study's aim, the number of items, the length of time required for completion and full details about confidentiality and data storage. They asked to give their consent before proceeding. The questionnaire started with some questions addressing the participants' sociodemographic characteristics and their experience in using computers. The second section identified the students' awareness of the harmful effects of prolonged exposure to computer screens and the best position for the computer screen in front of the eye. After that, the survey discussed different symptoms such as eye strain, red eye, dry eye, headache, neck pain, shoulder pain and backache and the timing of their occurrence. Finally, the survey asked about the measures to overcome the symptoms encountered. The data were collected, revised and replies with missing data were excluded from the analysis. The refined data were statistically analyzed using Statistical Package for Social Science (SPSS) version 25. A univariate analysis was performed and data were presented as frequencies. Pearson's correlation was performed to determine the relationship between different variables. To confirm the identified relations, linear regression was conducted. Associations were considered significant when the P value was less than 0.05.

Results

A previously validated online questionnaire was distributed among the student in the college of medicine, university of Bisha, KSA, to assess the prevalence and the associated risk factors of CVS. 196 out of 234 students filled out the provided survey with a response rate of 87.5% after excluding the replies with missed data. About two-thirds of respondents were males forming 78.1% (n=153) and the remaining were females 21.9% (n=43). The age of participants ranged from 18 to 27 years with a mean $\pm$ SD of 21.3 ± 2.1 . Diverse participation levels from all educational grades were noted. 18.4% of responses were derived from the students in the first year and 25.5% were related to students in the second year. Moreover, 14.3%, 16.8%, 14.8% and 10.2% of responses corresponded to the third, fourth, fifth and sixth years respectively. The years of experience in using the computers varied greatly among participants, with a mean $\pm$ SD of 8.03 ± 4.3 . More than two-thirds of the students (72.9%) admit to using computers for less than ten years. However, the remaining 27.1% of participants had more than ten years of experience in using their computers. On questioning the average duration spent using a computer daily, a wide range was elaborated from responses. 17.9% of students spend less than 2 hours using their computers daily. As well as 25.5% use computers for an average of 3 to 4 hours/per day. Moreover, the computers were used for 5 to 6 hours/day by 23.5% and for 7 to 8 hours/day by 13.3% of participants. The highest duration spent using computers was more than 8 hours per day, expressed in 19.9% of responses. Similarly, the mean number of hours spent on the computer varies according to the level of study. Students' awareness regarding CVS was evaluated within the questionnaire. Most respondents (85.2%) declared that the prolonged use of computers has some harmful effects on the eye and the remaining 14.8% were unaware of any detrimental effects of prolonged use. Moreover, 51% of respondents agreed that the ideal place for the computer during work is at eye level. The remaining participants revealed that it is more suitable to put the computers below eye level and above eye level (40.3% and 8.7%, respectively). Various symptoms were experienced by 92.86% (n = 182) of the students after using their computers as dry eyes, redness of the eyes, headache, shoulder or neck pains and backache. In comparison, only 7.14% (n = 14) faced no problems with the prolonged use of computers. Diverse combinations of symptoms were elaborated and showed marked overlapping. The distribution of different symptoms among participants is presented in Fig. 1. The results showed that headache, eye strain and redness of the eye are the most common visual symptoms among students (47%, 44% and 41%, respectively). Also, neck pain represented the highest symptom encountered by more than half of students, with a distribution percentage of 54%. In addition, the onset of symptoms varied greatly among students and ranged from less than 2 hours to more than 8 hours per day. As well as the students adopted numerous maneuvers to relieve the experienced symptoms, like taking a break, looking at distant objects, massaging their eyes, using eye drops and using radiation filters. Frequencies of variable onsets of symptoms and the followed procedures are presented in Fig. 1.

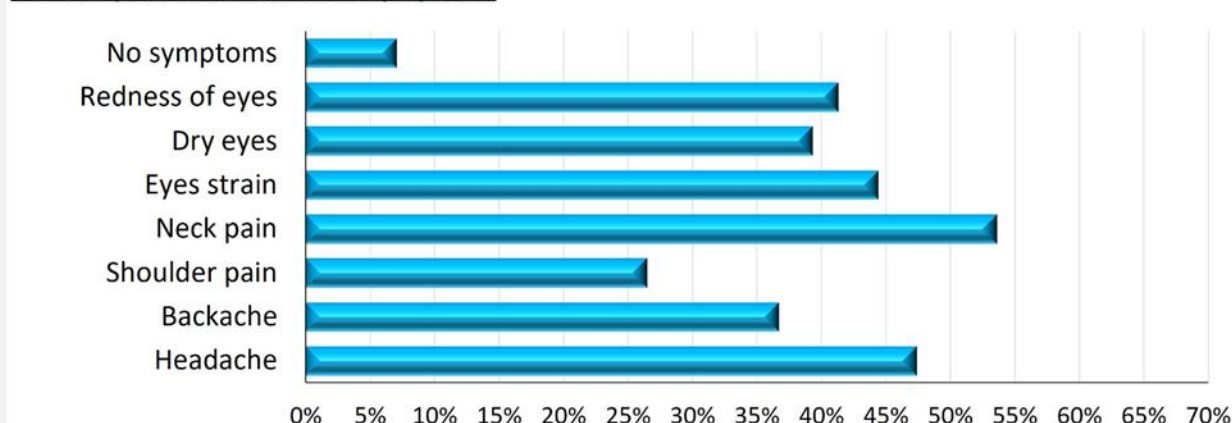
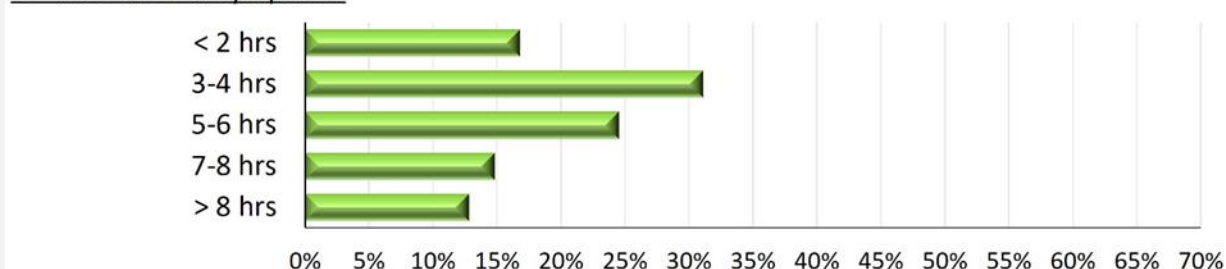
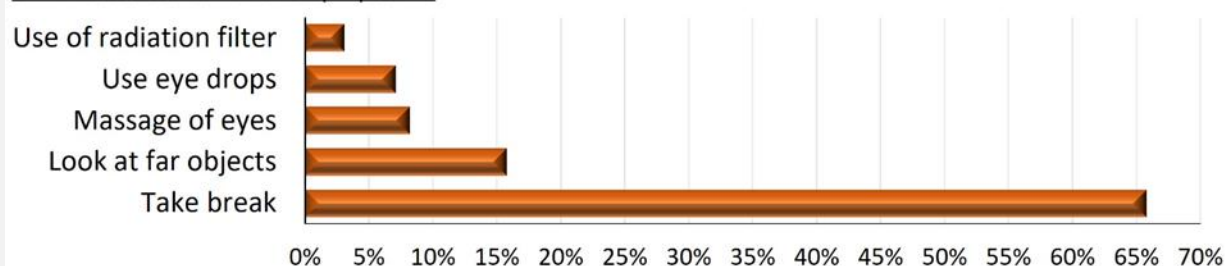
A: Frequencies of different symptoms**B: The onset of symptoms****C: Measures to relieve symptoms**

Figure 1: A: Representation of the distribution of different encountered symptoms among medical students. B: Participants' distribution depending on the onset of symptoms. C: The distribution of the respondents according to the measures adopted to relieve symptoms. Values are presented as percentages.

Multiple significant relations were elaborated by conducting spearman's correlation, as shown in Table 1. Of the most critical ties is the medium positive significant correlation between the average hours spent on the computer per day and gender ($p < 0.001$). Also, the medium positive significant correlation between the onset of symptoms on one side and the gender and the average hours spent on the computer per day on the other side ($p = 0.001$ and < 0.001 respectively). As well as the negative correlation between the onset of symptoms and awareness ($p = 0.001$). In addition, several significant relations were noticed between different encountered symptoms with each other, with the average duration of using computers and the

awareness of harmful effects on the eye, especially the red eye. Linear regression was conducted to confirm and assess the nature of the relations. It showed significant variable ties between the average time spent on the computer daily, the onset of symptoms, the awareness of harmful effects and different symptoms, as presented in Table 1.

	Gender	Year of Education	Duration Spent on Computer Per Day	Shoulder Pain	Backache	Headache	Dry Eye	Red Eye
Age	- 0.472 < 0.001 (- 0.109)	0.889 < 0.001 (0.425)	- 0.196 0.006 -					
Gender		- 0.503 < 0.001 (- 0.27)	0.336 < 0.001 (0.454)					
Year of Education	- - (- 0.089)		- 0.154 0.031 -	- - (- 0.282)				
Duration Spent on Computer Per Day	- - (0.096)							0.141 0.05 -
Awareness of Bad Effects on the Eye					- - (- 0.143)			- 0.162 0.023 -
The Onset of Symptoms	0.240 0.001 (0.498)		0.260 < 0.001 (0.126)					
Eye Strain				- - (- 0.166)	0.233 0.001 -	0.176 0.014 -	0.288 < 0.001 (0.186)	0.248 < 0.001 (0.194)
Neck Pain			- - (7.174)	0.326 < 0.001 (0.234)	0.325 < 0.001 (0.182)	0.184 0.01 -	0.243 0.001 -	0.196 0.006 -
Shoulder Pain					0.260 < 0.001 (0.163)		0.225 0.002 -	0.151 0.036 -
Backache						0.354 < 0.001 (0.211)	0.338 < 0.001 -	0.282 < 0.001 -
Headache							0.342 < 0.001 (0.223)	0.341 < 0.001 (0.291)
Dry Eye								0.171 0.017 -

Data are presented as r value (top), p value (middle) and β value (bottom)

Table 1: Significant correlation matrix and linear regressions.

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Discussion

Technology development and continuous internet use made work easier and more productive. Also, children can complete their schoolwork and play video games, making life more interesting. However, all these behaviors need prolonged exposure to electronic devices with visual displays, such as computers, laptops, smartphones and tablets, increasing the prevalence of visual problems like Computer Visual Syndrome (CVS) [17]. The American Optometric Association (AOA) described this digital eye strain as a group of activity-related visual and eye problems experienced during computer use due to stress on the near vision [10]. A quantitative, descriptive cross-sectional study was conducted to evaluate the prevalence of CVS among the students in the college of medicine, University of Bisha, KSA. Also, identifying different risk factors among these medical students will help in improving awareness of the medical students about this challenging problem. It was found that the prevalence of symptomatic students after prolonged use of computers in the college of medicine, University of Bisha was 92.86%. Previous studies reported different percentages of symptomatic participants according to the sample size tested and the nature of the population. Ranasinghe, et al. and Chennai performed their studies on a larger sample size of students drawn from all colleges in their universities and showed the prevalence of symptoms 67,4% and 78,6%, respectively [1,7]. Also, a prevalence of 89,9% and 74% were reported in the studies that were carried out on all Malaysian staff (both academic and administrative) in a university at the center of Peninsular Malaysia and all the staff members of the Securities and Exchange Commission in Abuja, Nigeria [6,13]. In the current study, the students experienced various symptoms with marked overlap. The most frequent visual symptom encountered was headache (47.7%), then eye strain (44.4%). Similarly, it was reported that headache is the most common visual problem among university students in Ajman, the United Arab Emirates, with a prevalence of (53.3%) followed by eye strain (48%) [12]. In addition, a previous study was implemented at King Saud bin Abdul-Aziz University for Health Sciences in Jeddah, KSA and revealed that 68% of students encountered headaches, 51% and 48.3% suffered from redness and dryness of the eyes after prolonged use of computers [4]. Reddy, et al., declared that headache was the most common symptom presented by the participants, who showed a symptomatic prevalence of 89.9% [16]. Redness was experienced in the eyes of 41.3% of participants and dry eye was described as the least prevalent symptom in this study (39.3%). Computer users registered a much higher prevalence of dry eye (49.5%) than the general population (19%) [18]. Also, extraocular symptoms were recorded as neck pain, showing the highest prevalence (54%) among medical students in the current study. This might be one of the underlying causes of the reported high prevalence of CVS in this study due to several factors. The first was that neck pain is usually associated with headache, which is reported as the highest prevalent ocular symptom after prolonged use of computers. Also, it was difficult for the participants to identify a selective encountered symptom as all symptoms usually overlap each other. This occurred in the study in Chennai and showed a high prevalence of 80.3% due to the involvement of neck and shoulder pains recorded by 60.7% of medical students [3]. In addition, a recent study reported 41.5% and 38.2% prevalence of mild and

severe neck and shoulder pain, respectively [19]. Another factor that might affect the prevalence of neck and shoulder pain is the awareness and commitment to the suitable position of the screen near the eye. More than 50% of the current study respondents revealed that it is suitable to put the screen at or above eye level. However, placing the screen 10-20 degrees below the eye level was recommended to decrease the strain on the neck muscles [20]. Correlation and linear regression were conducted to identify the potential risk factors underlying CVS. It was found that the average duration spent on the computer per day correlates mildly with the onset of symptoms ($r = 0.260$, $\beta = 0.126$). This follows multiple authors who mentioned that the duration spent by the students using their computers is considered the most significant risk factor for developing CVS [8,21,22]. Gender-dependent variances were detected in the current study in the form of significant differences between the males and the females in the mean hours spent using computers per day and the mean timing of the onset of symptoms. Although the females spend more hours per day using their computers than males ($r = 0.336$, $\beta = 0.454$), the onset of symptoms delays in them more than in males ($r = 0.240$, $\beta = 0.498$). Unlike other studies, there was no significant relationship between gender, prevalence or encountered symptoms. This might be explained by the dominance of males in the studied sample in this work (78.1%) as the female section in the college is newly established and different educational grades are not yet available (confirmed by the negative correlation between the gender and the year of education). Previously, it was reported that females are at higher risk for developing CVS than males [4,19,22]. On the other hand, it was declared that males are more susceptible to CVS than females [3]. Also, certain symptoms were correlated with gender, such as headache, which was described as the most prevalent visual symptom in the current work and more dominant in females as well [7,21]. While blurred vision, redness and dryness of eyes were reported to be more encountered in males [4,7]. In addition, several risk factors for CVS were described in the literature, such as the distance between the eyes and the screen and the population's awareness regarding CVS [4,7,10]. To find that 85.2% of the participants in this work declaring their awareness about the bad effects of prolonged use of computers on the eyes is considered a double-edged sword, as well as the case reported by Reddy, et al., (87% awareness) [16]. Such cases give a good impression of the population's awareness while also giving an alarming sign about the noticed negligence among these students, highlighting the importance of persuasion and motivation rather than orientation [7]. From another point of view, headache is the most prevalent presentation of CVS, which might be misinterpreted in most of the population as a general symptom that can be induced by many other causes, such as psychological or physical stresses. On the other hand, poor awareness levels regarding the problem of CVS were recorded among students in certain areas and of different backgrounds [19,21,23]. Although the acceptable percentage of awareness in the current study, 65.8% of the participants take a break to relax their eyes and only 3.1% use protective screen filters. The respondents described other relieving methods, such as looking at far objects, massaging eyes and using eye drops. It was agreed that viewing the screen at a distance of more than 50 cm decreased the prevalence of headaches and the prevalence of eye strain increased markedly when using screen filters was neglected [12]. Logaraj, et al., disagreed with this and found that screen radiation filters did not reduce the

CVS symptoms [3]. The most important ergonomic practice to decrease CVS symptoms was adjusting the display brightness according to the surrounding light brightness [4]. It was advised to take frequent, frequent breaks while using computers, which is more beneficial in relaxing the eye's accommodative system than taking a long break every 2-3 hours [10]. Usually, symptoms of CVS do not occur strenuously and it drives the person to the physician's office [13]. Ranasinghe, et al., confirmed that good knowledge and implementation of ergonomics practices were associated with significant improvement in CVS symptoms as well as, reduced discomfort and improved performance [20].

Conclusion

Computer vision syndrome is one of the current problems on the scene that face medical students at the University of Bisha. Also, headache is the most common presentation, which might be misdiagnosed by any other type of stress and can lead to an apparent increase in the prevalence. Sometimes, awareness is not enough for commitment, while persuasion and motivation are highly recommended. Finally, relieving eye stress by taking frequent breaks is crucial for computer users.

Limitations of the Study

It was not feasible to examine the eyes of the participants and the study depended on students' declarations through the survey. The second limitation was represented in the decrease in the number of females in the college, which was reflected in the sample as the female section was recently added to the college and most of the levels were not available yet.

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Conflict of Interest

The author did not report any potential conflicts of interest in research, authorship and/or publication of this article.

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Supplementary Files

Hi everyone. We are a group of researchers from the college of medicine at the University of Bisha. The purpose of this questionnaire is to identify the awareness, prevalence and risk factors for computer vision syndrome in medical students at the University of Bisha. I am hoping you can help me by completing this very brief questionnaire. Your responses are anonymous and will not be identified with you in any way.
Please submit it after completing the questionnaire.
Age:
Gender:
☐ Male
☐ Female
Grade of education:
☐ 1 st
☐ 2 nd
☐ 3 rd
☐ 4 th
☐ 5 th
☐ 6 th
Do you use the computer daily?
☐ Yes
☐ No
If yes, how long have you been using the computer?
..... Years
..... Months
What is the average duration of computer use in a day?
☐ 1-2 hours
☐ 3-4 hours
☐ 5-6 hours
☐ 7-8 hours
☐ More than 8 hours
Are you aware that prolonged computer use has bad effects on the eyes?
☐ Yes
☐ No
At what level is your computer screen during work?
☐ above the eye level
☐ at the eye level
☐ below the eye level

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Have you experienced any one of the following symptoms while using/ after finishing the work on computer? You can circle more than one answer.
☐ Eye Strain (Irritation, Heaviness)
☐ Tiredness of Eyes
☐ Watering of Eyes
☐ Redness of Eyes
☐ Dry Eye
☐ Headache
☐ Backache
☐ Neck Pain
☐ Shoulder Pain
☐ No Symptoms.
After how many hours of computer use, do you experience the above symptoms?
☐ 1-2 hours
☐ 3-4 hours
☐ 4-5 hours
☐ 6-7 hours
☐ More 8 hours
Do you practice the following measures to prevent/ relieve the above symptoms? You can circle more than one answer.
☐ Taking breaks in between use
☐ Looking at far objects in between uses
☐ Massage of eyes
☐ Use of eye drops
☐ Use of radiation filter on the screen