


Prevalence of Computer Vision Syndrome and Its Associated Risk Factors Among Computer Science Students at The University of Sargodha, Pakistan: A Cross-Sectional Study

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ABSTRACT

Background: Computer Vision Syndrome (CVS) or Digital Eye Strain is a widely-known ailment that is the result of excessive use of digital displays and causes ocular and musculoskeletal discomfort. Technology based programs, especially to university students are highly vulnerable. The purpose of the study was to identify the prevalence and the risk factors of CVS among computer science students in the University of Sargodha.

Methods: The study was descriptive and cross-sectional with a study period of four months among 177 students who were selected using the convenience sampling technique. The self-administered questionnaire was a structured questionnaire that was self-administered and it included questions that evaluated the following: demographics, screen usage patterns, ergonomic practices and CVS symptoms. The severity of symptoms was measured as mild, moderate or severe symptoms.

Results: The prevalence of CVS was 71.2% (n = 126). The mean age was 21.51 ± 1.92 years, with 57.6% males. The most prevalent symptoms were dry eyes (35.6%), headache (31.6%), and neck and shoulder pain (25.4%), with severe symptoms being most frequently reported on neck and shoulder pain (22.0%). Almost half of the participants (49.7) were using a 20-20-20 rule (66.7). Significant relationships were found between daily screen time and CVS severity ($\chi^2 = 325.843, 15, 0.001$).

Conclusion: CVS is very common among the students. Such modifiable factors like long screen time, poor ergonomics and low awareness play a significant role. Educating on eye health, ergonomics training and regular screening should be incorporated.

Keywords: Computers, Eyestrain, Ocular, Vision

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INTRODUCTION

Computer Vision Syndrome (CVS) or Digital Eye Strain (DES) can be defined as the complex of eye and vision symptoms in relation to near-vision tasks that are experienced during or in relation to computer use and the use of other digital devices, including desktop computers, laptops, tablets, and smartphones¹. The resulting screen time has placed a student population at a higher risk to CVS in recent years, especially during and after the COVID-19 pandemic, when academic instruction shifted to online platforms²⁻³.

Among computer users, CVS is estimated to affect about 60 million people, with nearly one million new cases reported each year⁴. It has been noted that its prevalence among computer users ranges between 63% and 89%, establishing it as one of the leading occupational health hazards of the twenty-first century⁵. The prevalence rates among university students have been found to be particularly high: 94% of medical students in Saudi Arabia have reported at least one of the CVS symptoms⁶, and 77% of students surveyed in China have reported similar complaints⁷. Among Thai university students who study online during COVID-19, self-reported CVS has been found to be significantly high³. The



most common ocular symptoms are dry eyes, eye strain, burning, redness, blurred vision, and diplopia, whereas the most common systemic complaints include headache, neck and shoulder pain, and musculoskeletal discomfort.^{8,9} Headache and dry eyes have always been the most common reported symptoms with diverse study populations^{6,10}. Also, CVS has been demonstrated to lower work and academic productivity rates by up to 40%, indicating its substantial socioeconomic cost¹¹. A number of risk factors have been determined to be related to the development of CVS. They include a long period of computer use, low ambient light, incorrect viewing distance and angle, uncorrected refractive errors, reduced blink rate, and improper workstation ergonomics^{5,12}. Gender of females, lack of break time and pre-existing ocular conditions have also been linked to increased predisposition to CVS.^{10,13} Physiologically, the decrease in blink rate between a normal 16-18 blinks/minute to an approximate of 6-8 blinks/minute in prolonged screen time results in incomplete tear film replacement, corneal drying and resultant ocular discomfort¹⁴. With prolonged accommodative effort, ciliary muscle fatigue also increases, thereby leading to asthenopia and blurred vision. Although there is significant literature on CVS in Western and East Asian student populations, the literature on South Asian academic settings is limited. In Pakistan and within the specific population of Pakistani university students, there has been an increased dependence on digital devices as a means of academic learning and research, as well as for socializing, but the burden of CVS in this population has not been sufficiently quantified¹⁵. The University of Sargodha is a large state-run institution in Punjab, which harbors thousands of students of all kinds, with various degrees of screen exposure, which makes it a perfect place to conduct such an investigation. The local prevalence and related risk factors of CVS should be understood to help develop context-specific preventive methods and evidence-based guidelines to screen use among students. Hence, the current study was carried out, so as to estimate the prevalence rate and the risk factors of Computer Vision Syndrome among the University of Sargodha students.

METHODOLOGY

Design and Setting

It was a descriptive cross sectional observational study which was conducted on computer science students at university of Sargodha, Punjab, Pakistan. The university was chosen as the study site because of the large number of students enrolled in the university at various disciplines having significant and diverse computer use. The study was conducted for four months and the ethical approval was obtained from the University of Sargodha under Ethics Code: 3152024.

Sample Size

The sample size was determined according to the standard formula for proportion-based cross-sectional studies:

$$n = z^2 \times P(1 - P) / d^2$$

Based on a similar study done among computer science students of an engineering college in Bengaluru, India with a reference prevalence of 86.67%, the calculated sample size for a 95% confidence level ($z = 1.96$) and margin of error ($d = 0.05$) was a total of 177 students were thus involved in the study.

Sampling Technique

The non-probability sampling method of convenience sampling technique was used to recruit those participants who were eligible for the study from the Department of Computer Science, University of Sargodha. Students who were on site during data collection and met the selection criteria were approached for enrollment.

Inclusion Criteria

The age of the students was between 18 to 30 years and they were the students of computer science program in University of Sargodha. The participants had to use a computer or digital screen at least five hours a day and to have used a computer or digital screen on a regular basis for four months prior to data collection¹⁶.

Exclusion Criteria

Students were excluded if they had known ocular disease, history of cervical head injury or history of neck, back or shoulder injury. In addition, those students who refused to give informed consent and those who did not volunteer to participate were excluded from the study¹⁶.

Data Collection Tool

The questionnaire was divided into two parts and based on previously validated questionnaires in

similar CVS studies¹⁷. The first part included demographic and screen use data including age, gender, hours per day of screen use, frequency of computer use, average break length, distance between eyes and screen, sitting position, ambient light level in the room, screen brightness, and knowledge of the 20-20-20 rule. Other data recorded included corrective eyewear (spectacles, contact lenses), topical eye drops (dry eye) and history of ocular disease or head injury.

The second section evaluated the four cardinal CVS symptoms of headache, dry eyes, blurred vision and neck and shoulder pain. The severity of the symptoms was rated as follows: Mild (transient, lasting only a few minutes); Moderate (lasting a few hours, but subsiding on rest or sleep); and Severe (persistent, requiring medical attention).

Data Collection Procedure

Ethical approval was obtained from the Institutional Review Board (IRB) prior to commencement of the study. Written informed consent was obtained from each participant after the study purpose, procedures, and confidentiality measures had been clearly explained. Participation was entirely voluntary, and participants were permitted to withdraw at any point without consequence. Questionnaires were distributed in-person during class hours and collected on the same day to ensure a high response rate. Anonymity of responses was maintained throughout the data collection process.

Statistical Analysis

All data were entered and analyzed using IBM SPSS Statistics, Version 22.0 for Windows (IBM Corp., Armonk, NY, USA). Categorical variables, including demographic characteristics, screen-use habits, and CVS symptom frequencies, were summarized using frequencies and percentages. The association between CVS symptoms and potential risk factors was evaluated using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic Description

A total of 177 computer science students at the University of Sargodha were enrolled in this cross-sectional study. Data were collected via a self-administered questionnaire and analyzed using SPSS version 22. The mean age of

participants was 21.51 ± 1.92 years. The majority were male (n = 102, 57.6%), with 75 females (42.4%). Demographic characteristics, device usage patterns, and clinical history are summarized in Table 1.

Table 1. Demographic Characteristics, Device Usage, and Clinical History of Participants (n = 177)

Variable	Category	n (%)
Gender	Male	102 (57.6%)
	Female	75 (42.4%)
Age (years) Mean ± SD: 21.51 ± 1.92	18–20	64 (36.2%)
	21–22	54 (30.5%)
	23–25	59 (33.3%)
Device Used Most Frequently	Laptop	83 (46.9%)
	Android Mobile	68 (38.4%)
	Tablet/iPad	22 (12.4%)
	Desktop PC	4 (2.3%)
Daily Screen Time	1–2 hours	11 (6.2%)
	3–4 hours	44 (24.9%)
	4–5 hours	73 (41.2%)
	>6 hours	49 (27.7%)
Pre-existing Ocular Disease	Yes	51 (28.8%)
	No	126 (71.2%)
Use of Glasses/Contact Lenses	Yes	85 (48.0%)
	No	92 (52.0%)
Use of Topical Eye Drops	Yes	67 (37.9%)
	No	110 (62.1%)

SD = Standard deviation.

Screen Use Habits and Ergonomic Risk Factors

Regarding device usage, the laptop was the most frequently used screen (46.9%), followed by android mobile (38.4%). The majority of students (41.2%) spent 4–5 hours daily on screens, while 27.7% spent more than 6 hours. Nearly half of participants (49.7%) reported a bent-back posture during screen use, and only 24.9% maintained an upright posture. Viewing distance was suboptimal in 24.9% of students who sat closer than 45 cm, while 27.1% were unaware of their screen distance. Most participants (52.0%) worked in a bright room, while 40.1% used a bright screen setting. Even though 72.3% said that they took breaks, only 11.3% did it every 15 minutes as they should have done. More importantly, two-thirds of students (66.7%) were not aware of the 20-20-20 rule. Table 2 outlines these ergonomic risks factors.

Table 2. Ergonomic and Screen Use Risk Factors Among Study Participants (n = 177)

Risk Factor	Category	n (%)	
Sitting Posture	Upright / Straight back	44 (24.9%)	
	Bent back	88 (49.7%)	
	Lying down	45 (25.4%)	
Eye-to-Screen Distance	<45 cm	44 (24.9%)	
	40–76 cm (optimal)	69 (39.0%)	
	>76 cm	16 (9.0%)	
	Don't know	48 (27.1%)	
Screen Brightness	Very bright	22 (12.4%)	
	Bright	71 (40.1%)	
	Dull	69 (39.0%)	
Room Illumination	Very dull	15 (8.5%)	
	Bright	92 (52.0%)	
	Dull	54 (30.5%)	
Takes Break During Screen Use	Dark	16 (9.0%)	
	Yes	128 (72.3%)	
Break Frequency	No	49 (27.7%)	
	Every 15 min	20 (11.3%)	
	Every 30 min	79 (44.6%)	
	After 1 hour	27 (15.3%)	
Awareness of 20-20-20 Rule	No break	51 (28.8%)	
	Aware	59 (33.3%)	
		Not aware	118 (66.7%)

20-20-20 rule: every 20 minutes, look at something 20 feet away for 20 seconds

CVS Symptom Profile and Severity

Table 3 shows the severity of each CVS symptom in each of the four grades (no symptom, mild, moderate, severe). The most clinically severe symptom was a neck and shoulder pain, with 22.0% of the participants reporting severe grades. The severity of headache was mostly mild (40.7%), and moderate (38.4%). The moderate severity reported by 34.5% of students on dry eyes is moderate. The most prevalent mild symptom was burning of the eyes (49.7%), and the highest proportion of participants who were asymptomatic had eye redness (38.4%).

Table 3. Severity Distribution of Computer Vision Syndrome Symptoms among Study Participants (n = 177)

Symptom	No Symptom n (%)	Mild n (%)	Moderate n (%)	Severe n (%)
Headache	32 (18.1%)	72 (40.7%)	68 (38.4%)	5 (2.8%)
Burning Eye Sensation	48 (27.1%)	88 (49.7%)	36 (20.3%)	5 (2.8%)

Eye Redness	68 (38.4%)	68 (38.4%)	40 (22.6%)	1 (0.6%)
Blurred Vision	51 (28.8%)	73 (41.2%)	50 (28.2%)	3 (1.7%)
Dry Eyes	44 (24.9%)	70 (39.5%)	61 (34.5%)	2 (1.1%)
Neck & Shoulder Pain	17 (9.6%)	48 (27.1%)	73 (41.2%)	39 (22.0%)

Severity grading: Mild = transient, lasting minutes; Moderate = lasting hours, resolves with rest; Severe = requires medical attention.

Prevalence of CVS and Association with Screen Time

The overall prevalence of CVS in this study was 71.2% (n = 126). The only most frequently reported dominant symptom (35.6%), was the dry eyes, and in turn, headache (31.6%), neck and shoulder pain (25.4%). The relationship between daily hours of screen time and the prevalent symptoms experienced in CVS were statistically significant (Pearson $\chi^2 = 325.843$, $df = 15$, $p < 0.001$), which implies that an increase in the hours spent on screens was strongly correlated with an increase in the number of symptoms experienced in CVS. All these findings are summarized in Table 4.

Table 4. Prevalence of CVS, Most Common Symptoms, and Association with Daily Screen Time

VARIABLE	Category / Finding	n (%)	χ^2 / p -value
Prevalence of CVS	CVS Present	126 (71.2%)	–
	No CVS	51 (28.8%)	–
Most Common Symptom	Dry Eyes	63 (35.6%)	–
	Headache	56 (31.6%)	–
	Neck & Shoulder Pain	45 (25.4%)	–
	Burning Eye Sensation	8 (4.5%)	–
	Blurred Vision	4 (2.3%)	–
	Eye Redness	1 (0.6%)	–
	Association: Daily Screen Time × CVS Symptoms	Pearson Chi-Square	325.843 (df=15)

CVS = Computer Vision Syndrome; $\chi^2 =$ Pearson Chi-Square; $df =$ degrees of freedom. $p < 0.05$ considered statistically significant.

DISCUSSION

The present study established a high prevalence (71.2%) of digital eye strain among computer science students in the University of Sargodha, which confirmed a high level of digital eye strain

in this academic group. This statistic is generally standard with the previous estimates observed in university students across the world, which are between 63% and 89% depending on the population being studied and the diagnostic criteria used⁵. Our study revealed a prevalence similar to that of 71.6% reported in the medical students of Kathmandu, Nepal¹⁸, and comparable to that of Saudi Arabian undergraduate students where 94% reported at least one CVS symptom². It is, though, less than the 86.67% prevalence of the same, recorded amongst engineering students in Bengaluru, India¹², that was used as the reference in calculating the sample size in the present study. This peripheral difference can capture a difference in the daily patterns of exposure to the digital device, the intensity of academic workload, and the type of digital devices that is used in the majority of cases between the two groups.

In our study, male students constituted the majority (57.6%), with a mean age of 21.51 ± 1.92 years. No statistically significant association was identified between gender and CVS occurrence, which is consistent with findings reported in a Karachi-based study among undergraduate medical students¹⁵. However, this contrasts with some studies that have reported a higher susceptibility among females, possibly attributable to hormonal influences on tear film stability and greater symptom reporting tendencies⁵. The young age of our study participants is noteworthy, as early-onset CVS in this cohort may carry significant long-term implications for academic performance and ocular health if preventive measures are not adopted.

Dry eyes emerged as the most prevalent dominant symptom in this study (35.6%), followed by headache (31.6%) and neck and shoulder pain (25.4%). The predominance of dry eye symptoms is physiologically explained by the well-documented reduction in blink rate during sustained screen use — declining from a normal 16–18 blinks per minute to approximately 6–8 blinks per minute — which leads to incomplete tear film replenishment, corneal surface desiccation, and resultant ocular discomfort¹⁴. These findings are consistent with those reported among Sri Lankan office workers, where dry eyes (31.1%) and headache (45.7%) were the leading complaints⁵, and with a study among Thai university students during COVID-19 online learning, which similarly identified dry eyes and

headache as the most frequently reported symptoms³. The moderate-to-severe grading of dry eyes observed in 35.6% of our participants underscores the clinical significance of this symptom and the need for targeted intervention.

Headache was the second most dominant CVS symptom (31.6%), reported as mild by 40.7% and moderate by 38.4% of participants. This trend is in line with results of other related studies. The cause of headache related to prolonged computer use is the repeated accommodative and vergence demands being placed on the visual system, where constant refocusing between the screen and other near objects places stress on the ciliary muscles and extraocular musculature which eventually results in frontal or periorbital headache⁹. A survey conducted among medical students in Riyadh also found headache as the most reported CVS complaint². The overall implications of these findings are that more structured eye rest periods should be implemented in schools.

The most severe symptom in the current study was neck and shoulder pain with 22.0% of students reporting severe grades which is a burden of severe symptoms than the current study found any other CVS symptom. This observation is comparable to reports in several studies that reported musculoskeletal complaints as a major non-ocular aspect of CVS.^{10,19} Sitting posture was very popular in our cohort with 49.7% of the students assuming a bent back position when they were using the screen and only 24.9% maintaining an upright posture. The sustained forward-leaning, and bent postures during a prolonged screen use are well known causes of cervical strain, excessive load on upper trapezius muscles, and musculoskeletal pain²⁰. These ergonomic shortcomings in a young learner population should be subjected to corrective interventions.

A statistically significant association was identified between daily screen time and CVS symptom burden ($\chi^2 = 325.843$, $df = 15$, $p < 0.001$), with greater screen exposure correlating with increased symptom frequency and severity. This is in line with the wider literature: Al Tawil and colleagues have found that students who spend over four hours a day at screens are much more likely to develop CVS,¹⁰ and dose-response relations between screen exposure and CVS symptoms have been reported in Ethiopian and Indian student populations^{4,21}. In our research,

41.2 % of students spent 4-5 hours per day on screens, and 27.7 % of students spent more than 6 hours per day on screens, a trend that places the majority of the sample in the high-risk exposure category.

A number of adjustable ergonomic risk factors were common in this study population. It was found that sub-optimal viewing distances existed in 24.9% of participants who sat within 45 cm of their screen and in 27.1% of participants who were completely unaware of what they were watching. This is because 52.5% of students rated the brightness of the screen as very bright or bright. These environmental factors have been repeatedly discovered to play a role in CVS among similar populations^{12,22}. Importantly, 66.7% of students were unaware of the 20-20-20 rule which is one of the widely recommended preventive measures which advises one to look at an object that is 20 feet away 20 seconds every 20 minutes of screen use. This observation is similar to the low levels of preventive knowledge of a study published by the Sohag University²³, and outlines a great deficiency in health education in the university context which needs to be filled by systematic creation of awareness²⁴⁻²⁵.

Although nearly half of the participants (48.0%) were wearing corrective eyewear (spectacles or contact lenses), the prevalence of CVS still remained high at 71.2% indicating that the symptom load in this population may not be fully attributed to refractive errors that are uncorrected or incorrectly corrected. This aligns with other studies it was discovered that that university students realized high levels of CVS despite relatively high levels of visual correction¹². About 37.9% of students were self-administering topical eye drops to dry eyes, which is a significant proportion of students already experiencing symptomatic ocular discomfort severe enough to justify self-treatment, but without being formally clinically assessed. This further highlights the significance of regular optometric screening in university health care. This research has a number of limitations which must be noted. The CVS symptoms were completely self-reported through a structured questionnaire and no objective clinical ocular examination was conducted. The actual screen-use behavior of the participants, such as the accuracy of viewing distance and posture was not directly observed.

The research was confined to a single department at one university with the use of convenience sampling, which limits the application and generalization of the results to the general student population in Pakistan. In addition, the cross-sectional study design does not allow any causal relationship between the risk factors identified and the development of CVS. It is suggested to enhance the evidence base by future studies that will utilize larger multi-institutional samples and objective clinical measures and longitudinal follow-up.

CONCLUSION

The prevalence of Computer Vision Syndrome is very high among the computer science students of the University of Sargodha with a prevalence of about three quarters of the study population (71.2%). The most burdensome symptoms were dry eyes, headache, and pain in the neck and shoulders, although all of them proved to be the same in severity. Long-term daily screen time was considerably linked with CVS symptom burden. Bad ergonomic habits such as bent-back posture, less than optimum viewing distances and near universal ignorance of the 20-20-20 rule are critical and modifiable risk factors in the population. These results suggest the need to incorporate structured ergonomic education, periodic optometric screening and evidence-based screen-use policies in university health and academic policies. It is advisable to conduct larger multi-center studies so that the generalizability of these findings to the population of students in Pakistan can be made.

Ethical Approval

The research protocol was approved by the ethical review committee of University of Sargodha under Ethics Code: 3152024

Author Contributions

MA: Conception & Design, Data Collection, and Critical Revision

MS: Conception & Design, Data Analysis & Interpretation, Manuscript Writing, and Final approval

MM: Conception & Design, Data Analysis & Interpretation, Manuscript Writing, Critical Revision and Final approval

SFZR: Data Collection, Data Analysis & Interpretation, and Manuscript Writing.

AA: Conception & Design, Critical Revision and Final approval

Conflict of Interests

No conflict of interest.

Data Availability

Data will be available upon request.

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No sources

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