Original Article

Computer Vision Syndrome and Associated Factors Among Medical and Engineering Students in Chennai

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Abstract

Background: Almost all institutions, colleges, universities and homes today were using computer regularly. Very little research has been carried out on Indian users especially among college students the effects of computer use on the eye and vision related problems. **Aim:** The aim of this study was to assess the prevalence of computer vision syndrome (CVS) among medical and engineering students and the factors associated with the same. **Subjects and Methods:** A cross-sectional study was conducted among medical and engineering college students of a University situated in the suburban area of Chennai. Students who used computer in the month preceding the date of study were included in the study. The participants were surveyed using pre-tested structured questionnaire. **Results:** Among engineering students, the prevalence of CVS was found to be 81.9% (176/215) while among medical students; it was found to be 78.6% (158/201). A significantly higher proportion of engineering students 40.9% (88/215) used computers for 4-6 h/day as compared to medical students 10% (20/201) ($P < 0.001$). The reported symptoms of CVS were higher among engineering students compared with medical students. Students who used computer for 4-6 h were at significantly higher risk of developing redness (OR = 1.2, 95% CI = 1.0-3.1, $P = 0.04$), burning sensation (OR = 2.1,95% CI = 1.3-3.1, $P < 0.01$) and dry eyes (OR = 1.8, 95% CI = 1.1-2.9, $P = 0.02$) compared to those who used computer for less than 4 h. Significant correlation was found between increased hours of computer use and the symptoms redness, burning sensation, blurred vision and dry eyes. **Conclusion:** The present study revealed that more than three-fourth of the students complained of any one of the symptoms of CVS while working on the computer.

Keywords: Associated factors, Computer use, Computer vision syndrome, Engineering students, Medical students

Introduction

Globally, personal computers were one of the commonest office tools. Almost all institutions, colleges, universities and homes today were using computer regularly. Using computers had become a 21st century necessity.[1] However, their usage, even for 3 h/day, led to a health risk of developing computer vision syndrome (CVS), low back pain, tension headaches and psychosocial stress.[2] CVS was defined as the combination of eye and vision problems associated with the use of computers.[3] Common symptoms of CVS include eye strain, headache, blurred vision and neck or shoulder pain that generally increase in severity with the amount of video display terminal (VDT) use.[4] Prevalence of CVS ranges from 64% to 90% among computer users.[5] Nearly 60 million people suffer from CVS globally: A million new cases of CVS occur each year.[2] Although many studies have reported the association between prolonged computer use, poor postures at workstations and various musculoskeletal discomforts, most of them were focused on western adult subjects.[3,6,7] Very little research has been performed to document the effects of computer use on the physical health of Indian users especially among college students.

Hence, this study was designed to assess the prevalence of CVS among medical and engineering students and factors associated with the same.

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Subjects and Methods

A cross-sectional study was conducted among final year medical and engineering (Computer science and Information technology streams) college students of a University situated in the suburban area of Chennai. All those students who used computer in 1 month preceding the date of the study were included in the study. Those who were absent on the day of the study and those who did not consent to participate in the study were excluded. The institutional ethical review board approved the study. The participants were surveyed using a pre-tested structured questionnaire, which included the basic demographic profile, hours of computer use per day, frequency of break while working on computers. The outcome variable in this study was CVS. CVS is defined as ''the complex of eye and vision problems related to near work, which are experienced during or related to computer use has been termed "CVS".[4] The eye symptoms were redness, burning sensation of eye, headache, blurred vision, dry eyes and neck and shoulder pain.[2,4,8] The study subjects were asked to report any eye symptoms experienced while on continuous computer work either at college or home within the past 1 month duration. They were asked to mark whether they had experienced none, mild (transient symptoms persist for few minutes to hours), moderate (persist for few hours and subsides after rest or sleep) or severe (needs medical consultation) visual problems during or after computer use. Those students with existing eye diseases were excluded from the study. Data were analyzed using the standard statistical software packages. Descriptive data were presented as percentages and unadjusted odds ratios (OR) to measure the strength of association and 95% confidence intervals (CI) were calculated. Chi-square test was used to lend statistical support to prove associations between categorical variables. A correlation analysis (Kendall) was done between the increase in hours of computer use and presence of the various symptoms of CVS and the frequency of taking a rest break while on the computer and symptoms of CVS. Kendall correlation coefficient and corresponding *P* values were estimated.

Results

A total of 416 final year students were included in the study based on the inclusion criteria, of which 48.3% (201/416) belonged to medical stream while 51.3% (215/416) belonged to the engineering stream. In the population studied, 47.6% (198/416) were females while 52.4% (218/416) were males. About 42.3% (176/416) students were wearing spectacle or contact lens, among them 72.2% (127/176) of them were wearing only spectacle, 24.4% (43/176) were wearing both contact lens and spectacle and 3.4% (6/176) were wearing only contact lens. A total of 334 students reported a history of one or more of the symptoms of CVS. Hence, the prevalence of CVS was found to be 80.3% (334/416). Among engineering students the prevalence of CVS was found to be 81.9% (176/215) while among medical students it was found to be 78.6% (158/201). A significantly higher proportion of medical students 85% (171/201) were using computers for less than 4 h/day as compared with engineering students 46% (99/215) ($P < 0.001$).

Figure 1 shows the reported symptoms of CVS among medical and engineering students. The prevalence of symptoms ranged from 13.9% for redness to 60.7% for neck and shoulder pain among medical students. Similarly, the prevalence ranged from 23.3% for redness to 61.9% for neck and shoulder pain among engineering students. The reported symptoms of CVS were higher for engineering students compared to medical students.

Figure 2 shows the reported symptoms of CVS among males and females. The redness, burning sensation, blurred vision and dry eyes were comparatively more in males than in females. However, headache and neck and shoulder pain were relatively more in females. Males had a higher risk of developing dry eyes (OR = 1.8, 95% CI = 1.2-2.9, $P = 0$. $P < 0.01$) and it was statistically significant. On the other hand, males were at lower risk of developing headache (OR = 0.6, 95% CI = 0.4-0.9, $P < 0.01$) and neck and shoulder pain (OR = 0.6, 95% CI = 0.4-1, $P = <0.01$) compared to females, which was statistically significant.

Table 1 shows that engineering students were at higher risk of developing redness (OR = 1.9, 95% CI = 1.2-3.1, $P = 0.01$), blurred vision (OR = 2.4, 95% CI = 1.5-3.8, $P < 0.001$) and dry eyes (OR = 2.1, 95% CI = 1.3-3.4, $P < 0.01$) compared to medical students and they were statistically significant.

Table 2 shows that students who were using computer for 4-6 h were at significantly higher risk of developing redness, burning sensation and dry eyes compared to those who use computer for less than 4 h. A statistically significant difference was not noted for the symptoms of CVS between those who used computer for more than 6 h and less than 4 h. Significant correlation was found between increased hours of computer use and the symptoms redness ($r = 0.13$, $P < 0.01$), burning sensation $r = 0.12$, $P = 0.01$), blurred vision ($r = 0.01$, $P = 0.02$) and dry eyes ($r = 0.09$, $P = 0.04$).

Table 3 shows that students who took a break after every 2 h of continuous use of computer had a higher risk of developing blurred vision, dry eyes and neck and shoulder pain as compared to those who took a break every hour and it was statistically significant. Even though, those who took a break after 3 h of continuous use of the computer were at higher risk compared to those who took breaks every hour, but it was not statistically significant. Significant correlation was found between taking less frequent breaks while working on computers and the symptoms blurred vision ($r = 0.13$, $P < 0.01$) and dry eyes ($r = 0.14$, $P < 0.01$).

Table 1: Association between courses of study CVS

Symptoms	Course	CVS present	CVS absent	OR	95% CI	*P* value
Redness	Medical (*n*=201)	28	173	1.872	1.249-3.116	0.01
	Engineering (*n*=215)	50	165			
Burning Sensation	Medical (*n*=201)	65	136	1.565	1.048-2.335	0.03
	Engineering (*n*=215)	92	123			
Headache	Medical (*n*=201)	87	114	1.077	0.731-1.586	0.70
	Engineering (*n*=215)	97	118			
Blurred vision	Medical (*n*=201)	33	168	2.355	1.470-3.772	<0.001
	Engineering (*n*=215)	68	147			
Dry eye	Medical (*n*=201)	35	166	2.147	1.348-3.418	0.001
	Engineering (*n*=215)	67	148			
Neck and and shoulder pain	Medical (*n*=201)	122	79	1.050	0.707-1.558	0.08
	Engineering (*n*=215)	133	82			

CVS: Computer vision syndrome, OR: Odds ratio, CI: Confidence interval. Mild, moderate and severe cases amalgamated

Table 2: Association between hours of computer use per day and CVS

Symptoms	Hours	CVS present	CVS absent	OR	95% CI	*P* value	Kendalls *r*
Redness	<4 h (*n*=270)	41	229	1	-	-	0.125**
	4-6 h (*n*=108)	26	82	1.171	1.019-3.076	0.04	
	>6 h (*n*=38)	11	27	2.275	1.047-4.943	0.04	
Burning sensation	<4 h (*n*=270)	89	181	1	-	-	0.118*
	4-6 h (*n*=108)	55	53	2.110	1.339-3.325	0.001	
	>6 h (*n*=38)	15	23	1.32	0.659-2.666	0.43	
Headache	<4 h (*n*=270)	114	156	1	-	-	0.048
	4-6 h (*n*=108)	53	55	1.318	0.842-2.063	0.23	
	>6 h (*n*=38)	17	21	1.07	0.559-2.194	0.77	
Blurred vision	<4 h (*n*=270)	56	204	1	-	-	0.111*
	4-6 h (*n*=108)	32	76	1.533	0.922-2.549	0.10	
	>6 h (*n*=38)	13	25	1.894	0.910-3.940	0.09	
Dry eye	<4 h (*n*=270)	57	213	1	-	-	0.096*
	4-6 h (*n*=108)	35	73	1.791	1.089-2.947	0.02	
	>6 h (*n*=38)	10	28	1.334	0.612-2.908	0.47	
Neck and and shoulder pain	<4 h (*n*=270)	159	111	1	-	-	0.05
	4-6 h (*n*=108)	74	34	1.519	0.946-2.438	0.08	
	>6 h (*n*=38)	22	16	0.959	0.482-1.910	0.91	

Mild, moderate and severe cases amalgamated. **Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed). CVS: Computer vision syndrome, OR: Odds ratio, CI: Confidence interval

Spectacle/contact lens wearer and CVS

Out of 176 students wearing either spectacle or contact lens, 72.2% (127/176) of them had ocular symptoms of CVS. Students wearing corrective lens either spectacle or contact lens (n = 176) showed a higher risk of developing headache (OR = 1.8, 95% CI = 1.2-2.6, $P < 0.01$) and blurred vision (OR = 2.1, 95% CI = 1.4-3.4, $P < 0.001$) and it was statistically significant. Students who were wearing contact lens (n = 49) were at higher risk of developing headache (OR = 2.2, 95% CI = 1.2-4.0, P = 0.01), blurred vision (OR = 2.0, 95% CI = 1.1-3.7, P = 0.03) and (dry eyes-OR = 2.4, 95% CI = 1.3-4.5, $P < 0.01$) compared with non-contact lens users.

Discussion

The present study was conducted among 416 medical and engineering college students and the prevalence of CVS in the study population was found to be 80.3%. The prevalence was almost similar between the medical 78.6% and engineering 81.9% students. Rahman and Sanip, reported 68.1% prevalence of CVS among university staff in Malaysia.[9] In contrast, Subratty and Korumtolee, reported 59.5% prevalence of CVS among keyboard users.[10] Iwakiri *et al*., reported that 72.1% among office workers reported having eye strain and/or pain.[11] Sen and Richardson, in their study reported a higher prevalence of 46% to 87% for the various eye symptoms.[2]

Males were at a higher risk of developing symptoms of redness, burning sensation, blurred vision and dry eyes. Females were at a significantly higher risk of developing headache and neck and shoulder pain as compared to males. Toama *et al*., in their study reported that the proportion of females with CVS was more compared to males.[12] Similar findings were reported by other investigators.[2,13,14]

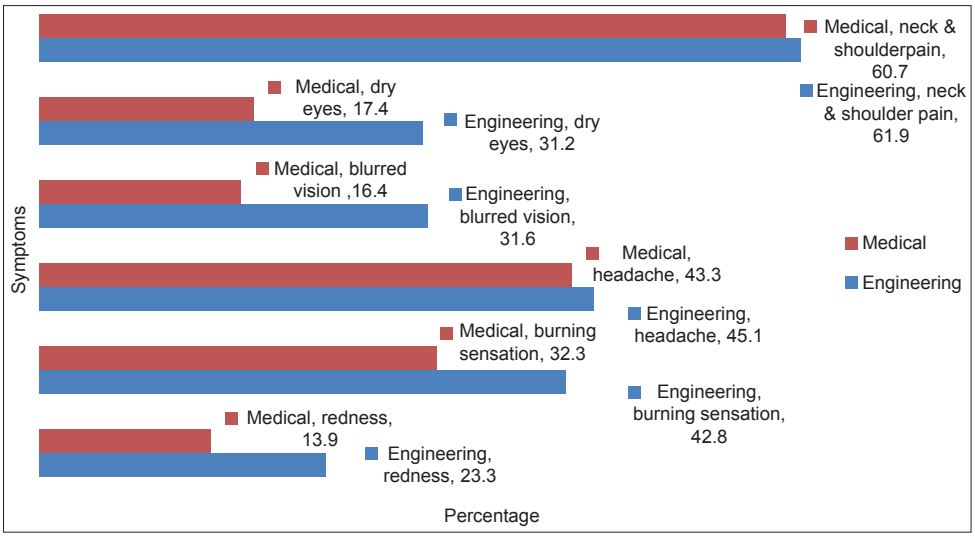

Figure 1: Percentage of medical and engineering students reported computer vision syndrome. (Mild, moderate and severe cases amalgamated)

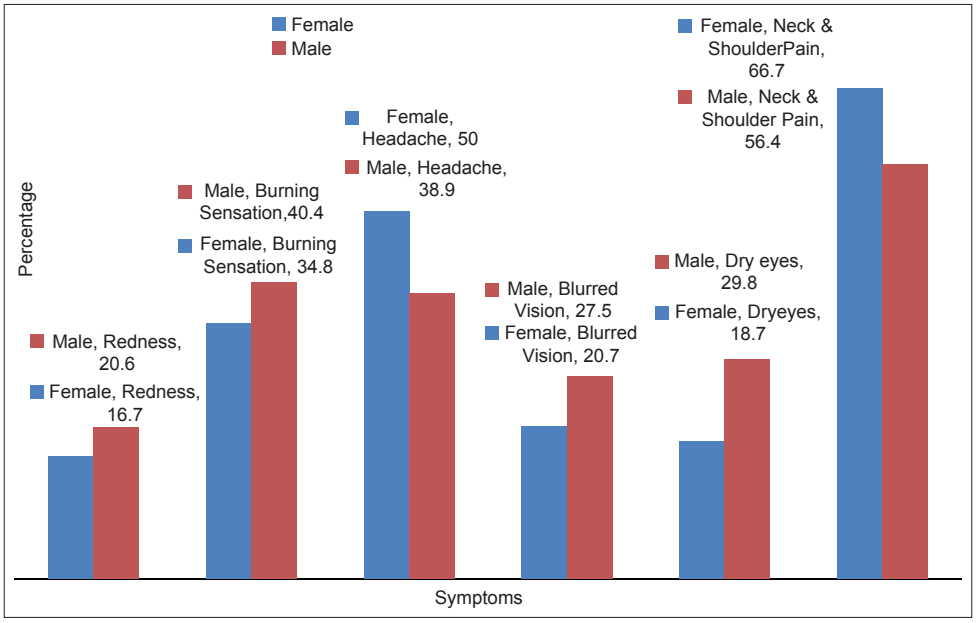

Figure 2: Percentage of female and male students reported computer vision syndrome. (Mild, moderate and severe cases amalgamated)

Redness

About 13.9% of the medical and 23.3% (50/215) of engineering students reported redness. In contrast, higher prevalence of 40.2% and 40.7% symptom of redness was reported by Shrivastava and Bobhate, and Talwar *et al.,* among computer professional respectively.[15,16]

Burning sensation

Nearly 32.3% of medical students and 42.8% engineering students reported burning sensation. Lower prevalence of 28.9% was reported by Talwar *et al*., while Sen and Richardson, reported 55% among undergraduates.[2,16] Similar finding of 54.6% of prevalence of burning sensation was reported by Costa *et al*., among call center workers in Brazil.[17]

Headache

About 43.3% medical and 45% of engineering students reported headache. Lower prevalence of 29.9% was reported by Talwar *et al.,* while Sen and Richardson, reported 61% among undergraduates.[2,16] Kesavachandran *et al*., reported 17% of the employees at information technology suffered from headache.[18]

Blurred vision

The engineering students were at 2.4 times at higher risk of developing blurred vision compared to medical students and it

Table 3: Association between frequency of break and CVS

Symptoms	Frequency of break	CVS present	CVS absent	OR	95% CI	*P* value	Kendalls *r*
Redness	Every 1 h (*n*=290)	52	238	1	-	-	0.036
	Every 2 h (*n*=84)	17	67	1.161	0.630-2.139	0.63	
	Every 3 h (*n*=42)	9	33	1.248	0.563-2.766	0.58	
Burning sensation	Every 1 h (*n*=290)	105	185	1	-	-	0.035
	Every 2 h (*n*=84)	38	46	1.455	0.850-2.380	0.13	
	Every 3 h (*n*=42)	14	28	0.881	0.444-1.747	0.72	
Headache	Every 1 h (*n*=290)	124	166	1	-	-	0.046
	Every 2 h (*n*=84)	39	45	1.160	0.712-1.889	0.55	
	Every 3 h (*n*=42)	21	21	1.338	0.700-2.559	0.38	
Blurred vision	Every 1 h (*n*=290)	59	231	1	-	-	0.125**
	Every 2 h (*n*=84)	30	54	2.175	1.280-3.695	<0.01	
	Every 3 h (*n*=42)	12	30	1.600	0.772-3.315	0.23	
Dry eye	Every 1 h (*n*=290)	58	232	1	-	-	0.143**
	Every 2 h (*n*=84)	32	52	2.519	1.436-4.418	<0.001	
	Every 3 h (*n*=42)	12	30	1.600	0.772-3.315	0.21	
Neck and and shoulder pain	Every 1 h (*n*=290)	167	123	1	-	-	0.091
	Every 2 h (*n*=84)	65	19	2.519	1.436-4.418	<0.001	
	Every 3 h (*n*=42)	23	19	0.891	0.465-1.709	0.73	

Mild, moderate and severe cases amalgamated. **Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed). CVS: Computer vision syndrome, OR: Odds ratio, CI: Confidence interval

was statistically significant. Nearly 16.4% of medical students and 31.6% of engineering students reported blurring of vision while it was 13.2% as reported by Talwar *et al*.,[16] Other studies also supports the association of blurred vision with computer use.[1,19,20] Rosenfield had reported in his study, a significant difference in the median score with regard to blurred vision during the computer task compared to with a hard copy printout of the material.[3]

Dry eyes

Nearly 18.6% of the females and 30% of the males reported dry eyes following computer use. In contrast, Uchino *et al*., observed symptoms of dry eyes in 10.1% of male and 21.5% of female Japanese office workers using VDTs.[21] Xu *et al*., Schaumberg *et al*., and Gayton, have also observed higher prevalence in women than men.[22-24] Dry eyes is more commonly encountered in women, elderly and contact lens wearers and not common in the younger age group and non-contact lens users.[25-27] Our study showed that there was a statistically significant difference in prevalence of dry eyes between engineering and medical students indicating that the engineering students were at greater risk of developing dry eyes compared to the medical students. When seated in front of a computer for an extended period of time, blinking may drop by 60%. The reduced blink rates while sitting at a computer monitor contributes to poor tear production and temporarily stresses the cornea, resulting in dry eyes.[28] To substantiate the finding our study results also showed nearly 53.9% (116/215) the engineering students were viewing computer for more than 4 h/day compare to medical students where only 14.9% (30/201) were viewing computer for more than 4 h. In our study, contact lens users were at higher risk of developing dry eyes 40.8% (20/49) compared to non-users 22.3% (82/367) (OR = 2.4). Nichols *et al*., have reported contact lens wearers were 12 times more likely than emmetropes and 5 times more likely than spectacle wearers to report dry eye symptoms.[29]

Neck and shoulder pain

Nearly 61% of the students had reported neck and shoulder pain. Similar findings were reported by Wahlstrom, in their study.[30] Students who were using computer for 4-6 h were at higher risk of developing neck and shoulder pain (OR = 1.5) compared to students who were using less than 4 h, but it was not statistically significant. Jacobs and Baker, have reported in their study a significant association between the number of hours on the computer and overall musculoskeletal discomfort. The prevalence of neck, shoulder and arm symptoms in computer workers were as high as 62%.[31] In contrast, Diepenmaat *et al*., have reported a low prevalence of neck/shoulder pain (11.5%) among adolescents.[32]

In our study, males had lesser risk of developing symptoms of headache and neck and shoulder pain compared to females and it was statistically significant. A similar finding was reported by Diepenmaat *et al*., the prevalence of neck/shoulder pain higher among girls compared to boys.[32]

Hours of usage of computer and CVS

The present study found that an increase in the number of hours spent on computer increases the risk of CVS significantly. Statistical significance was seen for redness, burning sensation and dry eyes, but not for other symptoms. Respondents who spend less than 1 h on computer daily reported the lowest visual symptoms.[4] Shrivastava and Bobhate report found that visual symptoms increased with the increase in working hours on the

computer.[15] Rahman and Sanip, in their study reported that those respondents who used computer for more than 5 h/day were at higher risk of developing CVS.[9] Previous studies have also shown that computer users are at increased risk of having such visual symptoms.[19,33]

Contact lens users and CVS

Contact lens users were at higher risk of developing all the symptoms of CVS and it was statistically significant for headache, blurred vision and dry eyes. Many studies have reported the significant association of wearing of contact lens with dry eyes.[9,34] Subratty and Korumtolee, reported symptoms of CVS were more in spectacle-wearers, compared to non-spectacle users.[10]

Taking frequent breaks and CVS

Students who took frequent break were at lower risk of developing symptoms of CVS compared those who did not take. An Australian study among 1000 computer workers showed a reduction in the symptoms of asthenopia by optimizing ergonomic desk and frequent work breaks.[35] Taking short breaks of 5 min for every hour has been shown to decrease discomfort (eye and musculoskeletal) while not impeding productivity.[36] Many studies recommend frequent breaks to avoid CVS.[8,37,38] Brewer *et al*., in their systemic review concluded that the evidence was insufficient to conclude that rest breaks have an effect on visual outcomes with only one study examining this association and finding both positive and no effects.[39]

The main limitation includes, the study was cross-sectional and it was purposive sampling involving students of a single university. The study did not include ophthalmic examination and the symptoms reported were self-reported.

Conclusions

The present study revealed more than three-fourth of the students complained of any one of the symptoms of CVS while working on computers. Engineering students (computer science and information technology) were at higher risk of developing CVS compared With medical students. Those students who were using computer continuously for more hours were at higher risk developing CVS syndrome compared to students who spend less hours and took frequent breaks. Even though, use of computer had not yet proven to cause any permanent damage to eyes, but studies have proven that temporary discomfort reduces the efficiency of work and thereby productivity. Health and Education professionals have suggested the need for teachers and students to be ergonomically conscious when using computers.[12,40-43] As the use of computer had become universal in higher education institutions, the subject of the prevention of CVS and associated discomfort should be made part of the curriculum in higher institutions.

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