ARTICLE TYPE

Computer vision syndrome and ergonomic practices among university office workers

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Abstract:

Introduction: Computer vision syndrome is prevalent among computer users, particularly office workers. Proper workstation design and good posture are essential preventive measures of computer vision syndrome among office workers to increase their work productivity and quality of life. A cross-sectional study was done to determine the symptoms of computer vision syndrome experienced by office workers in UiTM Selangor Puncak Alam Campus and their ergonomic practices and posture. Material and Methods: A self-administered questionnaire was distributed to 140 administrative staffs from 8 faculties. Results: The most common symptoms experienced by the office workers were shoulder pain (90%), followed by neck pain (88.6%), and headache (82.9%). Neck pain (p=0.004) and shoulder pain (p=0.027) was significantly related to using a laptop on the thigh. Headache was significantly associated with viewing computer screen at a distance lesser than 30 inches (p=0.038). Conclusion: High prevalence of CVS among the office workers is preventable by implementing strategies focusing on awareness of the visual ergonomics and adjustment to the workstation.

1. INTRODUCTION

Prolong use of the computer has been found to cause Computer Vision Syndrome (CVS), a condition describes a group of eye and vision-related problems [1]. Ocular symptoms that characterise the CVS include eyestrain, irritation, burning sensation, redness, blurred vision, and double vision. Symptoms such as shoulders pain, neck, or back pain are non-ocular symptoms known to be associated with CVS [2]. People who spend more than 4 hours a day on the computer have been found to have more visual problems than those who do not [3]. Besides than duration of exposure, improper workstation design, and poor posture are additional risk factors known to have caused CVS [4]. Computer users who maintain a prolong uncomfortable position, and static body movements acquire musculoskeletal disorders, eye fatigue, and headaches [5]. One study in Malaysia recorded 33% prevalence of upper limb musculoskeletal disorder among clerical office workers [6].

One method for reducing the prevalence of musculoskeletal and visual symptoms is to provide specialised ergonomics training and workstation changes [7]. Appropriate height of the seat and armrest, backrest, straight alignment of the wrist and the elbow, and correct positioning of the keyboard are among the proper strategies for an ergonomic workstation [4]. An ergonomically designed workplace will not only reduce the risk of CVS but consequently improve the productivity of work [8].

Failure to implement the ergonomic principles at the workplaces could lead to physical exhaustion, impaired productivity, and declines products quality [9]. Avid computer users like office workers are prone to have a loss of work productivity and compromised quality of life due to prolong and persistent CVS. The knowledge and attitude of ergonomics are essential in preventing the onset and progress of musculoskeletal and ocular injuries [10]. In one of the public universities in Malaysia, administrative staffs reportedly had a high prevalence of CVS (63%) despite that the majority has good knowledge of visual ergonomic [11]. Although the majority have good knowledge, half of them had poor attitudes on visual ergonomics. Khan et al. similarly reported that even for those who knew were not able to carefully and entirely apply the ergonomic practices for prevention from health hazards [4]. In light of those findings, investigation on the practice of ergonomics among office workers to identify the factors that could have caused or increased the risk of CVS is necessary before the planning of the preventive strategies. Thus, this study aims to determine the prevalence of CVS symptoms among office workers in UiTM Selangor Puncak Alam Campus and additionally assess the ergonomic practices among the office workers.

2. METHODOLOGY

The CVS symptoms and ergonomic practices among office workers of eight faculties in UiTM Selangor Puncak

Alam Campus were evaluated using a questionnaire in cross-sectional study design. The questionnaire was adapted from the previous study by Mowatt et al. surveyed the prevalence of computer vision syndrome (CVS) and ergonomic practices among university students in Jamaica [12]. The original set of questionnaires was in English. The questions were translated into the Malay language to suit the targeted participants. The draft version of the survey was pretested on five individuals to ensure ease of understanding and clarity, and then accordingly revised. All questions were closed-ended. The final questionnaire has 6 sections; (A) general demographic, (B) method of use of computer, (C) symptoms while working on the computer, (D) ergonomic principles while looking at the computer screen, (E) body posture and placement of the computer and (F) awareness of CVS and ergonomic principle.

The bilingual pretested, self-administered questionnaire were distributed to administrative staffs of eight faculties (Faculty of Architecture, Planning, and Surveying, Faculty of Art and Design, Faculty of Business and Management, Faculty of Health Science, Faculty of Hotel and Tourism Management, Faculty of Pharmacy, Faculty of Accountancy and Faculty of Education) in UiTM Puncak Alam, a public university located in Selangor. The questionnaires were collected within a week of distribution date. Ethics approval was obtained from the UiTM Research Ethics Committee. Completion of the survey indicates voluntary participation.

The data obtained were presented in descriptive analysis. Statistical analysis with Chi-square tests was done at the 0.05 significance level to assess the significance of associations between CVS symptoms and ergonomic practices using SPSS version 21.0.

3. RESULT AND DISCUSSION

One hundred forty office workers took the survey. Of the 140 office workers, 44 were males, and 96 were females with a mean age of 36.73 years. Majority of the office workers have myopia (46.4%) and wear glasses (67.1%) Table 1 summarised the sample demographic data.

Table 1: Demographic characteristics

Characteristic	Frequency, n (%)
Gender	
Male	44 (31.4)
Female	96 (68.6)
Age (years)	
Mean (SD)	36.73 ±7.762
Wear Glasses	
Yes	94 (67.1)
No	46 (32.9)
Type of refractive error	
Myopia	65 (46.4)
Hyperopia	16 (11.4)
Presbyopia	11 (7.9)
Don't know	2 (1.4)

Information on the subjects' daily computer usage is

summarized in Table 2. Most of the office workers wear glasses when using a computer (50.7%). Regarding the duration of usage, most of the subjects use the computer for more than 6 hours (45%), followed by 4 to 6 hours (38.6%) and 2 to 4 hours (16.4%). The main reason for using the computer was for word processing (59.3%) followed by data entry (33.6%). Checking emails (3.6%) and social media (3.6%) are the least frequent activity done using the computer. Majority of the office workers reported they use desktop (76.4%) and position their device on the desk (83.6%). A majority of the office workers use a computer at a distance of more than 20 inches (70.7%) at their eye level (84.3%).

Table 2: Information on computer usage

Characteristic	Frequency, n (%)
Visual aid wear for computer use	
Glasses/Contact lens	82 (58.5)
None	58 (41.5)
Duration of computer use/day	
2 to < 4 hours	23 (16.4)
4 to < 6 hours	54 (38.6)
>6 hours	63 (45.0)
Main reason for using computer	
Checking emails	5 (3.6)
Social media	5 (3.6)
Data entry	47 (33.6)
Word processing	83 (59.3)
Most frequent device	
Smartphone/Tablet	20 (14.3)
Laptop	13 (9.3)
Desktop	107 (76.4)
Position of device	
Handheld	22 (15.7)
On lap	1 (0.7)
On desk	117 (83.6)
Distance from the computer screen (inches)	
<30	91 (65)
>30	49 (35)
Level of viewing (eye level)	
Same level	118 (84.3)
Looking Upwards	3 (2.1)
Looking Downwards	19 (13.6)

3.1. Distribution of CVS symptoms

Figure 1 showed the most reported symptoms by the office workers according to severity while working on a computer. The most common symptoms experienced by the office workers were shoulder pain (90%), followed by neck pain (88.6%), and headache (82.9%). Taking into account the severity of symptoms, blurred vision (7.1%), neck pain (5.7%),

and shoulder pain (5.7%) were the most commonly reported severe symptoms. In this study, blurred vision, neck pain, and shoulder pain were the most severe symptoms widely reported.
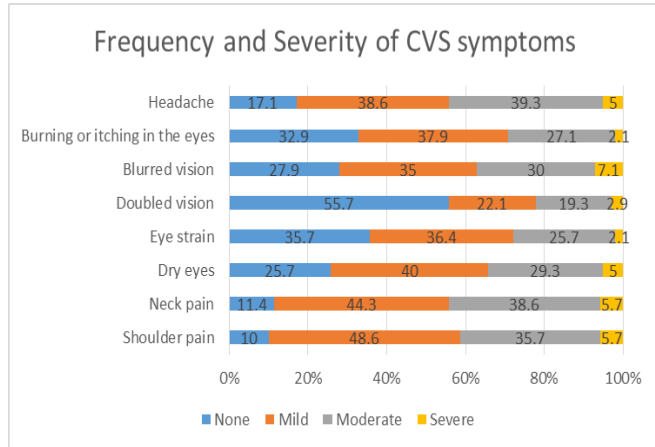

Figure 1: Distribution of CVS symptoms according to the severity

3.2. Awareness of CVS and ergonomic principles

In response to a question about awareness of CVS and ergonomic principle, more than half (55%) of those surveyed indicated that they are aware of CVS, but less than half (40%) aware of the ergonomic principles when using a computer. Half of the office workers (50.7%) reported that they are not aware of the 20-20-20 rule, which indicates a computer user to take a break every 20 minutes by looking about 20 feet away from the computer for 20 seconds.

3.3. The pattern of computer usage and ergonomic practice

The ergonomic practices of the office workers were self-reported (Table 3). The majority of office workers were found to have never used anti-glare screen (55.7%) or document holder (45.7%) when using the computer. Adjustable chairs were always used (37.9%) but most did not use an adjustable keyboard (29.3%). Most of the office workers took a break every hour (29.3%) for about 10 to 20 minutes (48.6%). When the office workers were asked about their usual posture while working on the computer, only a few practices good postures placing their feet on the floor or footrest (18.6%), arms and forearms at a right angle (12.9%), and lower legs kept vertically (9.3%). More than half of them (59.3%) have never rested their laptop over the thigh or use a computer on the bed (53.6%).

3.4. Factors related to CVS symptoms

The association of visual and musculoskeletal problems with the ergonomic condition of the worker's working environment was evaluated (Table 4). Neck pain (p=0.044) was found to be significantly related to laptop usage, while shoulder pain was found to be significantly associated with both laptop (p=0.027) and desktop usage (p=0.022). There

was a significant association between the symptom of headache and viewing distance of lesser than 30 inches (p=0.038) but no association between the viewing angle with any of the CVS symptoms (p > 0.05). Those who used a laptop on thighs were likely to get symptoms of burning or itching in the eyes (p=0.036) and doubled vision (p=0.002). The symptoms of headache (p=0.049) and eye strain (p=0.013) were significantly related to the increasing curvature of the back while working on a computer. Other ocular symptoms such as blurred vision, double vision, and dry eyes were not significantly related to the ergonomic practices during computer use. The present study was conducted among university administrative staffs whose majority used desktop mainly for data entry and word processing following the current nature of office works that are mostly computer dependence. Our finding revealed that the non-ocular symptoms of shoulder pain (90%), and neck pain (88.6%) were most commonly experienced, followed by ocular symptoms of headache (82.9%). Talwar et al. similarly found neck pain as the most disturbing non-ocular symptom among professional computer users in Delhi while Akinbinu and Mashalla also found headache as most disturbing ocular complaint among office workers in Nigeria [13], [14].

Table 3: Ergonomic practices during computer use

	Frequency, n (%)			
	Never	**Occasionally**	**Frequently**	**Always**
Computer practices				
Anti-glare screen	78 (55.7)	24 (17.1)	22 (15.7)	16 (11.4)
Adjustable chair	14 (10.0)	34 (24.3)	39 (27.9)	53 (37.9)
Document holder	64 (45.7)	41 (29.3)	24 (17.1)	11 (7.9)
Adjustable keyboard	41 (29.3)	36 (25.7)	37 (26.4)	26 (18.6)
Regular breaks	3 (2.1)	65 (46.4)	48 (34.3)	24 (17.1)
Breaks				
Frequency of breaks	Every ½ hour	Every hour	Every 2 hours	Every 3 hours
	39 (27.9)	41 (29.3)	37 (26.4)	20 (14.3)
Length of breaks	<5 mins	10-20 mins	>20-30 mins	>30 mins
Posture				
Wrist support	28 (20.0)	67 (47.9)	33 (23.6)	12 (8.6)
Arm at right angle	8 (5.7)	69 (49.3)	45 (32.1)	18 (12.9)
Thigh horizontal	29 (20.7)	66 (47.1)	37 (26.4)	8 (5.7)
Leg kept vertically	11 (7.9)	64 (45.7)	52 (37.1)	13 (9.3)
Feet on floor	14 (10.0)	49 (35.0)	51 (36.4)	26 (18.6)
Hunch shoulder	27 (19.3)	77 (55.0)	31 (22.1)	5 (3.6)
Increase curvature of back	36 (25.7)	71 (50.7)	29 (20.7)	4 (2.9)
Laptop on thigh	83 (59.3)	53 (37.9)	2 (1.4)	2 (1.4)

Computer-related problems, especially musculoskeletal, can be prevented by proper workstation strategies such as seating posture, appropriate viewing distances, and viewing angle, and computer screen. A study by Moffet et al. investigates the

impact of two work situations using laptop and desktop on muscle activity and neck postures [15]. They found that people bend their head forward, had more back trunk inclination and wrist extension resulting in more symptoms in the back, wrist, and neck when using the laptop. In the present study, the office workers adopted correct positions of the arm and leg, with wrist support. However, some workers have been found to place their laptop on the thigh (59.3%). Those who placed their laptop on the thigh was found to suffer from both shoulder pain (p=0.027) and neck pain (p=0.004). The improper posture of sitting in front of the laptop for an extended period among the office workers in this study may have lead to neck pain and shoulder pain among the workers. High frequency of hunch shoulder (80.7%) and increased curvature of the back (74.3%) when using the computer was also observed in this study as a majority tend to view the computer screen at a distance less than 30 inches (65%).

Table 4: Association of CVS symptoms and computer use

Computer use		CVS Symptoms n (%)		p-value
Laptop		Neck pain		
		Present	Absent	
	Yes	9 (6.4)	4 (2.9)	0.004
	No	115 (82.1)	12 (8.6)	
		Shoulder pain		
		Present	Absent	
	Yes	9 (6.4)	4 (2.9)	0.027
	No	117 (83.6)	10 (7.1)	
Distance from computer screen less than 30 inches		Headache		
		Present	Absent	
	Yes	37 (26.4)	13(9.3)	0.038
	No	79 (56.4)	11 (7.9)	
Increasing curvature of the back		Headache		
		Present	Absent	
	Yes	90 (64.3)	14 (10.0)	0.049
	No	26 (18.6)	10 (7.1)	
		Eyestrain		
		Present	Absent	
	Yes	73 (52.1)	31 (22.1)	0.013
	No	17 (12.1)	19 (13.6)	
Usage of laptop on the thigh		Burning or itching in the eyes		
		Present	Absent	
	Yes	44 (31.4)	13 (9.3)	0.036
	No	50 (35.7)	33 (23.6)	
		Doubled vision		
		Present	Absent	
	Yes	34 (24.3)	23 (16.4)	0.002
	No	28 (20.0)	55 (39.3)	

Additionally, the ocular symptom of headache was also reported by those who viewed the computer at a distance of lesser than 30 inches (p=0.038). Keeping a proper viewing distance about 35 to 40 inches from the screen and screen position at an angle of 10-20 degrees below eye level are recommended to allow the eyes to relax and reduce eyestrain [16]. Lower frequency of CVS symptoms was reportedly observed among students who viewed the computer screen below eye level than those who viewed the screen at eye level or above the eye level [17]. The present study found no significant association between the viewing angle and any of the symptoms even though a majority of the office workers in this study viewed the computer screen at eye level rather than in downwards position.

Although half of the workers (50.7%) were not aware of the 20-20-20 rule, most of them practice ergonomic principles, which include taking regular breaks for a duration of at least 20 to 30 minutes (48.6%). Among other practice adopted were using document holder, adjustable chair, and the adjustable keyboard was also observed among the office workers. Talwar et al. and Venkatesh et al. reported that the use of the anti-glare screen on a computer protects against visual problems [13], [18]. However, a significant association between visual symptoms and the use of the anti-glare screen was not evident among those who did not use the anti-glare screen (55.7%) in the present study. Limitation of this study was that the exclusion of subjects with musculoskeletal disorders was self-reported. Therefore, symptoms of CVS may not be an accurate representation of that arise from the incorrect practice of ergonomic.

4. CONCLUSIONS

The most common symptoms experienced by the administrative staffs were shoulder pain, neck pain, and headache. Preventive strategies emphasising on awareness of the ergonomic principles when using a computer and the correct posture at a workstation should be implemented in the future to reduce the prevalence of CVS among the staffs.

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