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Prevalence of Computer Vision Syndrome and Ergonomic Practices among Adults in an Urban Setting

Naufal Nordin, Norlaila Mat Daud, Hana Salwani and Muhammad Redzuan Ahmad

Faculty of Health Sciences, Centre for Community Health Studies (ReaCH), Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

Corresponding Author Email: naufalnordin@ukm.edu.my

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Abstract

Computer Vision Syndrome (CVS) prevalence has risen with increased digital device use, yet knowledge about its occurrence and ergonomic practices among young adults remains limited. This study aims to assess the prevalence of CVS and the adoption of ergonomic practices in an urban setting. A cross-sectional study involving 406 students and working adults (mean age: 25.97 ± 5.30 years) was conducted using an electronic self-administered questionnaire. Data on CVS symptoms, computer usage habits, and ergonomic practices were collected and analyzed using descriptive statistics and chi-square tests. CVS prevalence was high, with burning or itching in the eyes (82.5%), neck pain (76.6%), and headaches (75.1%) as the most reported symptoms. Females experienced more burning eyes, dry eyes, neck pain, and shoulder pain, while males reported more headaches and blurred vision. Working adults had a higher incidence of headaches, blurred vision, and eye strain, whereas students experienced more burning eyes, dry eyes, neck pain, and shoulder pain. Despite high practice of ergonomic principles, over 80% of participants exhibited poor postural habits, such as hunching their shoulders. The findings reveal a high prevalence of CVS and significant association with the ergonomic practices among young adults, emphasizing the need for increased awareness and intervention strategies to reduce CVS symptoms and promote healthier computer usage habits.

Keywords: Computer Vision Syndrome, Ergonomic Practices, Visual Symptoms

Introduction

Eye health concerns arise with the widespread use of computers, affecting the general population (Ellahi et al., 2011; Hassan et al., 2016). However, technology has made studying more accessible, presenting information easier, increased work efficiency, and facilitated communication. In todays modern age, people use computer for many tasks which involves 75% of their daily activity (Logaraj et al., 2013). With the increasing reliance on computer, one

eye health-related concern arise which is computer vision syndrome (CVS), a condition defined by a collective set of signs and symptoms. CVS is defined by the American Optometric Association as "a complex of eye and vision problems related to near work experienced during computer use" (American Optometric Association 1997). These visual disturbances can be caused by extended usage of video display terminals (VDTs) which includes computers, tablets, e-readers, and smartphones. CVS can also be known as digital eye strain or visual fatigue (Rosenfield, 2016) which are all symptoms associated with different digital devices. There are many symptoms of CVS and it can be differentiated as extraocular, ocular, and visual (Ahmed et al., 2018). These symptoms include blurred vision, visual fatigue, discomfort, diplopia (double vision), dry eyes, redness, eye strain, irritation, headaches, and pain in the shoulders, neck, and back (Akkaya et al., 2018; Association, 1995; Chawla et al., 2019; Iqbal et al., 2021; Klamm & Tarnow, 2015; Munshi et al., 2017; Vaz et al., 2019).

CVS occur globally and has affected around 60 million people (Sen & Richardson, 2007). This is primarily due to the increasing use of VDTs worldwide, with nearly 45 million workers spending hours staring at screens continuously (Gangamma & Rajagopala, 2010). One study conducted a meta-analysis regarding the prevalence of CVS and was reported to be 66% (95% CI: 59, 74) (Anbesu & Lema, 2023). The impact of CVS is not limited to a specific region. The prevalence varies significantly depending on the country, with the highest reported in Pakistan at 97% (Noreen et al., 2021) and the lowest in Japan at 12% (Uchino et al., 2013). Globally reported data on the prevalence of CVS ranges from 35.2% to 97.3% in the adult population and from 12.1% to 94.8% in the pediatric population, indicating high variability (Altalhi et al., 2020; Lavin et al., 2018; Li et al., 2021; Selvaraj et al., 2021). The evaluated demographic data reveal variability in prevalence. Differences in the operational definition of CVS, the population studied, and the instruments used to measure CVS may impact the reported prevalence. Risk factors include addiction to technology, use of multiple VDTs, previous ocular disorder, stress, and contact lens use (Alabdulkader, 2021; Tangmonkongvoragul et al., 2022). During the COVID-19 pandemic, the prevalence of CVS was likely increased due to more frequent VDT use during isolation (Bhattacharya et al., 2020; Wang et al., 2021) and limited access to eye care (Vargas-Peirano et al., 2020).

Adopting ergonomic practices is important for enhancing individuals' work experiences. Several ergonomic factors have been documented to play a role in CVS among computer users (Assefa et al., 2017; Boadi-Kusi et al., 2022). Proper ergonomics, such as using a computer with the correct display angle, can help reduce the incidence of CVS and musculoskeletal symptoms (Szeto & Sham, 2008). However, no studies have been conducted on the role of ergonomic practices in CVS among adults in urban settings in Malaysia. With the widespread use of computers for various purposes, CVS has become increasingly common among Malaysians (Yaacob et al., 2022). This study aims to investigate the prevalence of CVS and the adoption of ergonomic practices among Malaysian young adults in an urban setting.

Methodology

This cross-sectional study was conducted among Malaysian adults in Kuala Lumpur using non-probability convenience sampling. The inclusion criteria were working with computers for more than three hours daily. Those who had a history of ocular injury, used reading glasses, had abnormal body postures such as arthritis, and had previous neck, back and shoulder injuries were excluded. Data were collected using an electronic, self-administered

questionnaire adapted from a past study (Mowatt et al., 2018). The questionnaire included demographic information, ocular history, computer use habits, and primary reason for use (e.g. studying, video games, social media). Regarding the question about CVS symptoms (e.g. headache, double vision, blurred vision, eye strain, dry eye, neck pain, shoulder pain), the severity (none, mild, moderate and severe) and ergonomic practices (e.g. body posture and distance from the computer screen) were also included. This study was ethically approved by the National University of Malaysia (JEP-2023-B95) and was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants. The data were analyzed using the SPSS 26th version, with descriptive statistics and chi-square tests. The Fisher's exact test was used when required and a p-value of <0.05 was considered statistically significant.

Finding

Demographic Characteristic

A total of 406 subjects with a mean age of 25.97 ± 5.30 years, participated in the study by completing the questionnaire. The sample consisted of 140 males (34.5%) and a larger proportion of 266 females (65.5%). The majority of the subjects were Malay (72.3%), Chinese (24.5%), and Indian (3.3%). Among them, 236 individuals (58.1%) were working adults, and 170 (41.9%) were students. Refractive errors were found in 92.1% of subjects, with 71.5% being myopic and 12.8% hyperopic. Among them, 52.7% used glasses, while just 1% wore contact lenses, and 32% of the overall group experienced dry eyes.

Computer Usage

The ergonomic factors related to computer usage revealed that 18.5% of subjects used a computer for less than 4 hours per day, 40% for 4 to 6 hours, and 42% for more than 6 hours daily. Regarding viewing posture, 40.4% reported looking downward, while 53.7% maintained eye level with the screen. Additionally, 66.7% of subjects were aware of CVS, whereas 17.5% were unfamiliar. Awareness of the 20-20-20 rule was reported by 60.6% of subjects, while 24.6% were unfamiliar with this guideline. These findings are summarized in Table 1.

Table 1
Computer use and awareness of ergonomic principles

Computer usage and awareness	N	%
Visual aid used for computer		
Glasses	214	56.5
Contact lens	3	0.8
Either	8	2.1
None	154	40.6
Duration of continuous computer use (h)		
<2 hours	14	3.4
2 to <4 hours	61	15
4 to <6 hours	162	39.9
>6 hours	169	41.6

Reason for using computer		
Games/movies	28	6.9
E-mail	168	41.4
Social media	71	17.5
Studying	139	34.2
Awareness of CVS		
Yes	271	66.7
Uncertain	64	15.8
No, never heard of it	71	17.5
Awarenss of 20-20-20 rule		
Yes	246	60.6
No	100	24.6
Uncertain	60	14.8
Awareness of ergonomic principles for computer/ tablet/ smart phone use		
Yes	247	60.8
No	85	20.9
Uncertain	74	18.2

CVS *Symptoms*

Burning or itching in the eyes (82.5%) was the most commonly reported CVS symptom (82.5%). This was followed by neck pain (76.6%) and headaches (75.1%). The least prevalent reported symptoms were dry eyes (55.7%) and double vision (24.1%). Table 2 reports the summary of prevalence for all the symptoms.

Table 2
Frequency and severity of computer vision syndrome (CVS) symptoms

	Severity, n (%)			
Symptoms	None	Mild	Moderate	Severe
Headache	101 (24.9)	193 (47.5)	106 (26.1)	6 (1.5)
Eye burn	71 (17.5)	222 (54.7)	84 (20.7)	29 (7.1)
Blurred vision	147 (36.2)	224 (55.2)	31 (7.6)	4 (1.0)
Double vision	308 (75.9)	88 (21.7)	9 (2.2)	1 (0.2)
Eye strain	103 (25.4)	162 (39.9)	133 (32.8)	8 (2.0)
Dry eyes	180 (44.3)	165 (40.6)	54 (13.3)	7 (1.7)
Neck pain	95 (23.4)	205 (50.5)	86 (4.9)	20 (4.9)
Shoulder pain	111 (27.3)	203 (50.0)	70 (17.2)	22 (5.4)

Association between CVS and Gender

Significant differences were found in the prevalence of CVS between genders. Males were found to experience a higher prevalence of headaches (82.1%) and blurred vision (66.4%), while females reported higher rates of burning or itching in the eyes (88%), dry eyes (60.2%), neck pain (78.9%), and shoulder pain (75.2%). However, no significant gender differences were found for double vision (p=0.605) and eye strain (p=0.262). Table 3 summarizes all the analyses.

Table 3
CVS symptoms and Gender

	Gender				
	Male		Female		
CVS symptoms	N	%	N	%	p-value
Blurred vision					
None	47	33.60	100	37.6	0.016
Mild	88	62.90	136	51.1	
Moderate	4	2.9	27	10.2	
Severe	1	0.7	3	1.1	
Double vision					
None	103	73.6	205	77.1	0.605
Mild	35	25	53	19.9	
Moderate	2	1.4	7	2.6	
Severe	0	0	1	0.4	
Eye burn					
None	39	27.9	32	12	< 0.001
Mild	86	61.4	136	51.1	
Moderate	9	6.4	75	28.2	
Severe	6	4.3	23	8.6	
Headache					
None	25	17.9	76	28.6	0.019
Mild	76	54.3	117	44	
Moderate	39	27.9	67	25.2	
Severe	0	0	6	2.3	
Dry eyes					
None	74	52.9	106	39.8	0.046
Mild	52	37.1	113	42.5	
Moderate	12	8.6	42	15.8	

Severe	2	1.4	5	1.9	
Eye strain					
None	28	20	75	28.2	0.0262
Mild	63	45	99	37.2	
Moderate	46	32.9	87	32.7	
Severe	3	2.1	5	1.9	
Neck pain					
None	39	27.9	56	21.1	0.001
Mild	81	57.9	124	46.6	
Moderate	19	13.6	67	25.2	
Severe	1	0.7	19	7.1	
Shoulder pain					
None	45	32.1	66	24.8	0.006
Mild	77	55	126	47.4	
Moderate	15	10.7	55	20.7	
Severe	3	2.1	19	7.1	

Association between CVS and Occupational Status

Significant differences in the prevalence of symptoms were found between occupational status. The working group experienced a higher prevalence of headaches, blurred vision, and eye strain. At the same time, students reported more frequent burning or itching in the eyes, dry eyes, neck pain, and shoulder pain. However, no significant difference was observed between the two groups for double vision (p=0.056). Detailed results are provided in Table 4.

Table 4
CVS symptoms and occupational status

	Occupational status				
	Working		Student		
CVS symptoms	N	%	N	%	p-value
Blurred vision					
None	67	28.4	80	47.1	< 0.01
Mild	163	69.1	61	35.9	
Moderate	5	2.1	26	15.3	
Severe	1	0.4	3	1.8	
Double vision					
None	179	75.8	129	75.9	0.056
Mild	55	23.3	33	19.4	

Moderate	2	0.8	7	4.1	
Severe	0	0	1	0.6	
Eye burn					
None	71	30.1	0	0	< 0.01
Mild	152	64.4	70	41.2	
Moderate	12	5.1	72	42.4	
Severe	1	0.4	28	16.5	
Headache					
None	35	14.8	66	38.8	< 0.01
Mild	117	49.6	76	44.7	
Moderate	83	35.2	23	13.5	
Severe	1	0.4	5	2.9	
Dry eyes					
None	119	50.4	61	35.9	< 0.01
Mild	98	41.5	67	39.4	
Moderate	17	7.2	37	21.8	
Severe	2	0.8	5	2.9	
Eye strain					
None	47	19.9	56	32.9	= 0.013
Mild	97	41.1	65	38.2	
Moderate	88	37.3	45	26.5	
Severe	4	1.7	4	2.4	
Neck pain					
None	65	27.5	30	17.6	< 0.01
Mild	137	58.1	68	40	
Moderate	30	12.7	56	32.9	
Severe	4	1.7	16	9.4	
Shoulder pain					
None	71	30.1	40	23.5	< 0.01
Mild	135	57.2	68	40	
Moderate	24	10.2	46	27.1	
Severe	6	2.5	16	9.4	

Regularity of Ergonomic Practice Adoption among Adults in an Urban Setting

The majority of subjects reported positive habits. 90.6% took regular breaks, 89.2% used adjustable chairs, 79.7% used document holders, and 60.8% employed anti-glare screens. Additionally, 95.6% ensured proper arm positioning, while 96.6% kept their legs vertical with their feet supported. However, 82.5% admitted to hunching their shoulders, and 84.7% rested devices on their thighs. Detailed results for all the ergonomic practices are provided in Table 5.

Table 5
Ergonomic practices during computer use

	Frequency, n (%)			
	Never	Occasionally	Frequently	Always
Computer practices				
Antiglare screen	159 (39.2)	134 (33.0)	89 (21.9)	24 (5.9)
Adjustable screen				
Adjustable keyboard	162 (39.9)	120 (29.6)	113 (27.8)	11 (2.7)
Regular breaks	38 (9.4)	179 (44.1)	137 (33.7)	52 (12.8)
Breaks				
Length of breaks	>30 min	20-30 min	10-20 min	< 5 min
Frequency of breaks	Every 3 h	Every 2 h	Every hour	Every half
	Never	Occasionally	Frequently	Always
Wrist support	40 (9.9)	184 (45.3)	143 (35.2)	39 (9.6)
Right angle	18 (4.5)	190 (47.1)	169 (41.9)	26 (6.5)
Leg vertical	14 (3.5)	235 (58.0)	135 (33.3)	21 (5.2)
Feet on floor	14 (3.5)	193 (47.7)	166 (41.0)	32 (7.9)
Hunch	71 (17.5)	197 (48.6)	121 (29.9)	16 (4.0)
Curvature of back	63 (15.6)	195 (48.1)	121 (29.9)	26 (6.4)
Laptop on thigh	62 (15.3)	192 (47.3)	142 (35.0)	10 (2.5)
Computer on bed	47 (11.6)	158 (38.9)	164 (40.4)	37 (9.1)

Association between Regularity of Ergonomic Practice Adoption and the Occurrence of CVS Symptoms

Significant associations were found between ergonomic practices and CVS symptoms. Headache was associated with anti-glare screens ($p < 0.01$), document holders ($p < 0.01$), and adjustable keyboards ($p < 0.01$). Burning or itching in the eyes was linked to anti-glare screens ($p = 0.02$), adjustable chairs ($p < 0.01$), and document holders ($p < 0.01$). Blurred vision was strongly associated with anti-glare screens ($p < 0.01$) and adjustable keyboards ($p < 0.01$). Dry eyes, neck pain, and shoulder pain were significantly associated with nearly all practices ($p <$

0.01). No significant associations were found between adjustable chairs and headaches (p = 0.15), regular breaks and several symptoms, or adjustable keyboards with double vision (p = 0.34).

Association between CVS and Ergnomic Factors Related to Computer Use

Only burning or itching in the eyes, double vision and shoulder pain were not significantly linked to the duration of computer use. At the same time, the rest of the symptoms showed significant associations. Regarding the viewing level, only blurred vision (p = 0.045) showed a significant association, while other symptoms were insignificant.

Discussion

The prevalence of CVS among the subjects in this study was relatively high, with the most commonly reported symptom being burning or itching in the eyes. This exceeds the recently reported global prevalence of CVS, which was 66% (Anbesu & Lema, 2023). Our data was categorized into four choices of symptoms, which were none, mild, moderate and severe. Most subjects reported mild symptoms, indicating the presence of CVS. Other highly reported symptoms were neck pain and headache, which was similar to past studies reporting neck pain and headache as common symptoms among university students (Al Tawil et al., 2020). The least reported symptoms were dry eyes and double vision, contrasting with other studies reporting a high prevalence of dry eyes (Al Tawil et al., 2020; Alamro et al., 2020; Mowatt et al., 2018).

The study revealed differences of CVS prevalence between gender with male subjects experiencing more headaches and blurred vision, while females reported more burning eyes, dry eyes, and neck and shoulder pain. Overall, female subjects experience more CVS symptoms compared to male. This aligns with past study reporting that CVS were more commonly affected by females compared to male (Alamri et al., 2022; Alamro et al., 2020). For example, our study showed that females experienced dry eyes more than males, and the difference is significant. The differences may be caused by physiological factors like hormonal fluctuations, which can significantly impact eye health (Gorimanipalli et al., 2023), particularly during pregnancy, menopause, or the use of contraceptives. Androgens affect the maintainence of meibomian gland function whereby any decrease of the hormone can cause evaporative dry eye due to gland dysfunction (Schirra et al., 2005; Sullivan et al., 2002). Furthermore, because female have smaller body frame, female experience more musculoskeletal discomfort, particularly in the neck, shoulders, and upper back, during identical computer tasks (Arvidsson et al., 2006). The differences can be explained by the ergonomic setup's design. Usually, it is designed with a male body frame in mind. This causes females to have less optimal postures with the setup, which may explain why musculoskeletal symptoms were reported to be more pronounced among female computer users compared to males (Jensen et al., 1998).

There was a difference in the prevalence of CVS between the two groups of subjects. The working group reported higher rates of headaches, blurred vision, and eye strain. At the same time, students experienced more frequent burning or itching in the eyes, dry eyes, neck pain, and shoulder pain. The duration and intensity of computer usage may be a significant factor in the prevalence of symptoms, as reported by Gupta et al. (2016). Since both groups use computers frequently, the type of task may contribute to the differences and the

environment in which they are engaged. The workers may have higher headaches and eye strain symptoms due to working in structured environments with prolonged computer usage and potentially more ergonomic challenges. This has been supported by a recent study that found that employees reported a higher prevalence of CVS than students, although the difference was not statistically significant (Qolami et al., 2020). Additionally, the nature of repetitive tasks and the need to take fewer breaks during work worsen the symptoms. In contrast, the student group showed more musculoskeletal-related symptoms, such as neck and shoulder pain. This could be explained by varying postures and working position for most students in a less structured working environment.

The majority of our subjects practice ergonomic principles regularly, such as taking regular breaks, using adjustable chairs, using document holders, proper arm positioning, and keeping legs vertical. This suggests that most adults in the city are aware of ergonomic principles. This was consistent with a past study that found that 70% of their subjects had a fair practice of ergonomic principles (Elias, 2016). However, a decade ago, a study showed different findings, which reported that 70.1% of their subjects were unaware of ergonomic principles, and few knew how to implement them (Ranasinghe et al., 2011). This study's more significant adoption of ergonomic practices reflects increased awareness due to the growing reliance on digital devices. Over the past decade, more frequent device use has raised awareness of the risks and the importance of proper ergonomics. However, our study also revealed that more than 80% of the subjects hunch their shoulders and rest devices on their thighs, which can contribute to musculoskeletal strain. Poor postures, such as bent or twisted backs, are significant contributors to work-related musculoskeletal disorders (Dagne et al., 2020), which may explain the high rate of CVS among our subjects.

The results indicate a strong association between the regularity of adoption of ergonomic practice and CVS symptoms. Headaches were significantly linked to ergonomic factors such as anti-glare screens, document holders, and adjustable keyboards. This aligns with past findings that improper screen brightness and positioning can contribute to visual discomfort and strain (Gerr et al., 2006). Prolonged screen exposure can lead to screen-induced foveal dysfunction, negatively affecting visual performance. Additionally, by reducing daily screen time to one hour, significant improvements can be observed in the foveal responses and visual performance of the subjects with CVS (Iqbal et al., 2021). Symptoms such as neck and shoulder pain were significantly associated with nearly all ergonomic practices, indicating that inadequate ergonomic setups can contribute to musculoskeletal issues. This supports previous studies that found neck pain is exacerbated by prolonged neck flexion and lack of forearm support, both common in suboptimal ergonomic environments (Johnston et al., 2008). Prolonged computer use without ergonomic support can lead to musculoskeletal problems (Jensen, 2003), supporting the associations between ergonomic practices and CVS symptoms in this study.

Awareness of the 20-20-20 rule and ergonomic principles for computer use was relatively high (60%), yet a significant prevalence of CVS was still observed among the subjects. This suggests that while many individuals are aware of the guidelines, consistent application remains a challenge, as supported by past studies showing awareness but a reluctance to change among adults (Iqbal et al., 2018; Reddy et al., 2013). Therefore, there's

a clear need for finding strategies that can effectively increase ergonomic practices that can help reduce CVS associated with computer use.

Conclusion and Future Work

This study reveals a high prevalence of CVS among students and working adults in an urban setting, with burning or itching in the eyes, neck pain, and headaches being the most common symptoms. Although awareness of ergonomic practices was relatively high, poor posture remains prevalent, contributing to CVS symptoms. Majority of ergonomic practices have an association with the CVS symptom presented. Future work should focus on the effectiveness of the consistent ergonomic practices, raising awareness, and implementing preventive strategies to reduce the CVS occurrence among computer users.

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