ORIGINAL ARTICLE

Prevalence of Computer Vision Syndrome (CVS) Among Undergraduate Students of a Health-related Faculty in a Public University

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ABSTRACT

Introduction: Electronic devices such as smartphones, laptops, and tablets are integral part of university learning. Digital display devices not only have their advantages, but it also eliminates gaps in systematic education. Currently, very little research has been undertaken on health and safety issues related to computer use among students. Therefore, this study aimed to investigate the association between the prevalence of computer vision syndrome among undergraduate students and the practices of ergonomic principles while working on computers. **Methods:** A cross-sectional study was conducted involving full-time bachelor's degree students from the eight undergraduate programs in a health-related faculty. A self- administered questionnaire was used and students with chronic illness related to the eyes were excluded. **Results:** Out of 206 respondents, the most common symptoms were shoulder pain (96.7%), neck pain (96.1%), eye strain (90.8%), and eye burn (87.9%) were the most common symptoms. Dry eyes (76.7%), blurred vision (33.5%) and double vision (24.3%) were less commonly reported. The results also revealed that the majority of the students did not practice correct ergonomic principles. Shoulder pain was significantly related to level of viewing (p=0.005, $\chi 2$ =18.75) while neck pain was associated with the lack of use of adjustable chairs (p=0.004, $\chi 2$ =24.1). Eye strain was significantly related to use of antiglare screens (p=0.003, $\chi 2$ =24.77), use of adjustable chairs (p=0.049, $\chi 2$ =16.99), and regular breaks (p=0.020, $\chi 2$ =19.72). **Conclusion:** There was a high prevalence of CVS amongst undergraduate university students, thus improvement of ergonomic practices are required.
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Keywords: Computer vision syndrome, Computer use, Ergonomic principles, Undergraduate students

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INTRODUCTION

Electronic devices such as smartphones, laptops, and tablets are an integral part of university learning. Nearly every institution, university, college, and home are using computers. However, the use of technology in education rapidly increased due to the COVID-19 pandemic announced by the World Health Organization (WHO). This is because the pandemic spread too fast, prompting the Malaysian government to declare a state of emergency by imposing movement restrictions and physical distance (1, 2). This resulted in the abrupt closure of schools and other educational institutions, causing students to undergo an instant shift from face-to-face education to an online learning environment.
The abrupt increase in the use of computers in education requires exploring, particularly, the safety and ergonomics issues related to the usage of computer devices. Ergonomics in this context primarily deal with designing and arranging the space that students regularly use when using the computer. Although technologies purportedly make students' lives and studies easier, unfortunately, individuals who use computers for three hours or more everyday may acquire several health-related medical issues such as migraine, back pain, neck pain or stiffness, shoulder pain, computer vision disorder, postural discomfort, and psycho-social stress. These can be caused by the combination of poor ergonomic practices, poor workplace settings, individual visual complications, and inadequate work routines (3).

Computer vision syndrome (CVS) as the outcome of interest in this study is an example of an ophthalmic problem that results from computer use. It is a complex eye and vision issue associated with activities that stress the near vision resulting from prolonged computer, tablet, or phone use (4). It is estimated that almost 60

million persons worldwide are experiencing vision complications due to computer use. Additionally, 90% of individuals who use computer three to four hours daily can develop CVS and it can be characterized by symptoms of blurred or double vision, head pain, irritation, dry and tired eyes, eye soreness, burning sensation, redness, tiredness, and dizziness (5,6).

Currently, very little research has been undertaken on health and safety issues related to computer use among students, and the fact that the world is moving on to a more digitally oriented workspace means that carrying out a CVS study among students is even more important. They are not only a vulnerable population but understanding this issue can help with management of future online education. Therefore, the study aimed to investigate the association between the prevalence of CVS symptoms and the practices of ergonomic principles while working on computers among undergraduate students.

MATERIALS AND METHODS

Study design and data collection

A cross-sectional study was conducted involving full-time bachelor's degree students from eight undergraduate programs in a health-related faculty. A non-probability convenience sampling procedure was used to select the potential respondents from the sampling population, where questionnaires were personally distributed to students who were present during data collection. The inclusion criterion was those students who were using any digital devices (desktop, laptop, tablet) for their coursework. Students who had suffered from any chronic illness related to the eyes were excluded from this study.

Questionnaire

A questionnaire was used as the main instrument, adopted from a tested questionnaire by Mowatt et. al (7). It was transformed into Google Forms and distributed by sending the link via WhatsApp platform. It is divided into several parts. The first part aims to obtain demographic information from respondents. This includes questions about the respondents' gender, age, course currently attending, the type of computer used, use of contact lenses or glasses and duration. The second part assesses computer use (position), CVS symptoms and its severity (eyestrain, blurred vision, headache, burning and itchy eyes), as well as posture (wrist support, body posture, viewing level and distance from the computer screen). The final section of the questionnaire explored issues on other ergonomic practices such as taking regular breaks, use of an adjustable keyboard, chair, and anti-glare screen. Questions about CVS symptoms are rated on a scale of "none" to "severe," while ergonomic practices are rated on a scale of "never" to "always."

Statistical analysis

SPSS software version 20.0 was used to analyse the data gathered from the survey with a significant level set at $\alpha<0.05$ and the confidence interval set at 95%. The first and second objectives, which determine the prevalence of Computer Vision Syndrome (CVS) and ergonomic practices among undergraduate students, are presented descriptively. For the third objective, Chi-square test was used to identify whether Computer Vision Syndrome (CVS) and ergonomic practices are associated. Ethical approval has been granted by the UiTM Research Ethics Committee [REC/11/2021 (UG/MR/932)].

Limitations

While care is taken to ensure the validity and reliability of the data, the results of this research rely largely on self-reported data and therefore may have potential bias. The authors cannot entirely capture the observation of their practices while they were actually working, hence data on variables such as viewing distance, the posture of the subjects and the symptoms of CVS relies entirely on the respondents. The results of this study also cannot be generalized to the larger student population, due the convenient sampling method employed.

RESULT

Demographic Characteristics of the Respondents

Table I presents the distribution of demographic characteristics (gender, age, and course). Among the surveyed respondents, only 38 (18.4%) of the 206 were male. Apart from that, the majority of respondents were between the age range of 22 and 24 (69.3%). Additionally, there's almost equal distribution of respondents from all courses in the Faculty of Health Sciences (between 9% and 11%), with the exception of respondents from Environmental Health and Safety (27.2%).

Table I: Demographic characteristics of respondents (n=206)

Variables	Categories	Frequency	Percent (%)
Sex	Male	38	18.4
	Female	168	81.6
Age	19-21	63	30.6
	22-24	143	69.3
Course	Physiotherapy	20	9.7
	Occupational Therapy	21	10.2
	Medical Imaging	20	9.7
	Nursing	23	11.2
	Medical Lab Technology	22	10.7
	Optometry	22	10.7
	Environmental Health and Safety	56	27.2
	Nutrition and Dietetics	22	10.7

Computer usage

All data from Section 2 of the questionnaire, which covers issues such as computer use and awareness of CVS, the 20-20-20 rule and ergonomic principles are presented in Table II. To clarify, the 20-20-20 rule refers to eye exercise aimed towards preventing strains, which basically means "every 20 minutes, look about 20 feet away from the computer for 20 seconds" (20). From the data, most of the respondents (88.3%) indicated that they used laptops for their coursework. Additionally, of the 206, only 55 used spectacles, eight are wearing both spectacles and contact lenses while only one respondent claims that he/she used only contact lens. This means that close to 70% of the respondents are not wearing any form of optical aids at the time of data collection. Apart from that, 50% of the respondents claim that they are using the computer for >6 hours per day; followed by 38.8% who use between 4 and 6 hours and only five respondents are using less <2 hours per day. Not only that, over 60% of the respondents have never heard of the term CVS. Additionally, only 22.3% of the respondents are aware of the 20-20-20 rule, while 54.4% of them claimed to be aware of the principles of ergonomics.

Table II: Computer use and awareness (n=206)

Computer usage and awareness	Frequency	Percent %)
Types of computer used		
Desktop	17	8.3
Laptop	182	88.3
Tablet	7	3.4
Visual aids used for computer		
Glasses	55	26.7
contact lenses	1	0.5
Both	8	3.9
None	142	68.9
Duration of continuous computer use (h)		
<2	5	2.4
2 to <4	18	8.7
4 to <6	80	38.8
>6	103	50
Awareness of CVS		
Yes	51	24.8
No	132	64.1
Not sure	23	11.2
Awareness of 20-20-20 rule		
Yes	46	22.3
No	122	59.2
Not sure	38	18.4
Awareness of ergonomic principles for computer use		
Yes	112	54.4
No	55	26.7
Not sure	39	18.9

Table III: Prevalence and severity of computer vision syndrome (CVS) symptoms (n=206)

Symptoms	Severity, n (%)			
	None	Mild	Moderate	Severe
Headache	32 (15.5)	105 (51.0)	56 (27.2)	13 (6.3)
Burning eyes	25 (12.1)	64 (31.1)	103 (50.0)	14 (6.8)
Blurred vision	137 (66.5)	45 (21.8)	22 (10.7)	2 (1.0)
Double vision	156 (75.7)	34 (16.5)	14 (6.8)	2 (1.0)
Eyestrain	19 (19.2)	55 (26.7)	117 (56.8)	15 (7.3)
Dry eyes	48 (23.3)	96 (46.6)	51 (24.8)	11 (5.3)
Neck pain	8 (3.9)	40 (19.4)	91 (44.2)	67 (32.5)
Shoulder pain	7 (3.4)	28 (13.6)	72 (35.0)	99 (48.1)

CVS Symptoms

Table III presents the prevalence and severity of CVS symptoms among respondents. This study found shoulder pain (96.7%), neck pain (96.1%), eye strain (90.8%), and burning eyes (87.9%) were among the most common symptoms. Meanwhile, dry eyes (76.7%), blurred vision (33.5%) and double vision (24.3%) are the least common symptoms. In terms of severity, neck pain and shoulder pain have the highest severe percentage at 32.5% and 48.1% respectively.

Ergonomic practices while working on computer

Information on ergonomic practices and posture during computer use is shown in Table IV. Based on the questionnaire, the majority of respondents had never used adjustable keyboards (83.5%), antiglare screens (82.5%), nor adjustable chairs (70.9%). Meanwhile, half of the respondents (50.0%) reported taking regular breaks frequently with most of them (49.5%) takes 10-20 minutes breaks from the devices and at every 1- 2 hours interval (84%). The majority of them also never used wrist support on their keyboard or mouse (73.8%). In terms of posture, almost all respondents reportedly kept their feet resting on the floor (96.5%) and their thighs horizontal (96.1%) working on the computer. However, among poor habits reported include shoulder hunching posture (95.1%) putting a laptop on the thigh (1.5%) and on a bed (4.4%). Further breakdown of the frequency of computer practices and habits is presented in Table IV.

Association of CVS symptoms and ergonomic practices

In the analysis, eight CVS symptoms (headache, burning eyes, blurred vision, double vision, eye strain, dry eyes, neck pain and shoulder pain) were analysed with a variation of ergonomic practices which includes; [1] distance from the screen, [2] taking regular breaks, [3]

Table IV: Frequency of ergonomic practices and posture during computer use (n=206)

	Frequency, n (%)			
	Never	**Occasionally**	**Frequently**	**Always**
Computer practices				
Antiglare screen	170 (82.5)	23 (11.2)	4 (1.9)	9 (4.4)
Adjustable chair	146 (70.9)	42 (20.4)	9 (4.4)	9 (4.4)
Adjustable keyboard	172 (83.5)	17 (8.3)	11 (5.3)	6 (2.9)
Laptop holder	106 (51.5)	49 (23.8)	35 (17.0)	16 (7.8)
Regular breaks	1 (0.5)	67 (32.5)	103 (50.0)	35 (17.0)
Breaks				
Length of breaks	>30 min	20-30 min	10-20 min	<5min
	34 (16.5)	66 (32.0)	102 (49.5)	4 (1.9)
Frequency of breaks	Every 3 h	Every 2 h	Every hour	Every half hour
	18 (8.7)	63 (30.6)	110 (53.4)	15 (7.3)
Posture				
Wrist support	152 (73.8)	37 (18.0)	8 (3.9)	9 (4.4)
Back support	37 (18.0)	121 (58.7)	26 (12.6)	22 (10.7)
Thigh horizontal	8 (3.9)	39 (18.9)	83 (40.3)	76 (36.9)
Leg vertical	12 (5.8)	36 (17.5)	92 (44.7)	66 (32.0)
Feet on floor	7 (3.4)	66 (32.0)	80 (38.8)	53 (25.7)
Hunch shoulders	10 (4.9)	59 (28.6)	85 (41.3)	52 (25.2)
Laptop on lap	46 (22.3)	147 (71.4)	10 (4.9)	3 (1.5)
Laptop on bed	32 (15.5)	86 (41.7)	79 (38.3)	9 (4.4)

frequency of breaks, [4] adjustable chair, [4] adjustable keyboard, [5] antiglare screen, and [6] level of computer screen (see Table V for details). From the results presented in Table V, all analysed variables showed a p-value of < 0.05, indicating significant associations between CVS symptoms and all forms of ergonomic practices and postures. In fact, there was a strong association between headache and the distance from the computer screen ($p<0.001$, $\chi^2 = 29.3$)

DISCUSSION

The present study showed that knowledge of CVS was uncommon among undergraduate students in the Faculty of Health Sciences, which manifested in the high prevalence of shoulder pain, neck pain, eye strain and eye burn (Table III). Additionally, all the respondents had developed at least one of the CVS symptoms since using their devices full time as a result of lockdowns. These results, which found similarities with pre-COVID studies carried out among students (7,8,9,) indicated that the issue of CVS is a prevalent one, and needs to be addressed, regardless of current situation.

The descriptive results of the CVS symptoms (Table III) showed a small percentage of severe symptoms. However, all respondents reported at least one symptom and a significant portion of the symptoms experienced are moderate in terms of severity, indicating a potential health burden for students as they get older. These long-term health issues can manifest in various forms and could also be unrelated to CVS. This includes musculoskeletal disorders (MSDs), tendonitis, and even carpal tunnel syndrome, all of which are associated with poor ergonomics (21).

Fortunately, addressing these issues require very simple preventive measures that can be applied. Computer viewing distance, for instance, should be adjusted to a range between 50 cm and 70 cm (10). In fact. the closer you are to the screen the more you are at risk of eye strain (11). Another example of preventive measures is poor posture. Hunched shoulders, for instance, not only negatively impact our appearance and body language, but they create stress and pain in the neck, shoulders, and upper back (12). In addition, incorrect posture can also cause muscle strain and soreness in the neck, shoulders, and lower back (13). This can simply be corrected using adjustable chairs that always allow individuals complete control of their workspaces and maximum comfort.

Apart from that, changes to the workspaces such as computer viewing angles may also help with ergonomic and CVS issues experienced by the respondents. In fact, uncomfortable postures caused by a bad viewing angle of the screen and the position of the chair and table might shorten the soft tissues, resulting in muscle tension, fatigue and weakness (14), all of which could lead to long-term health problems beyond education. Additionally, the 20-20-20 rule could also be used to provide eye relief (15), as eye strain and eye burning were significantly linked with those who did not take breaks when using the computer (16). This 20-20-20 rule refers to the guideline that states for every 20 minutes of computer use, take a 20-seconds break by looking at an object 20 feet away rather than the screen in front of you. This is one of the measures that students can take to restore and relax the accommodative system (17), thereby reducing ocular symptoms and improving work rate and efficiency.

Additionally, evidence from the study indicates that there needs to be more exposure to preventive technologies

Table V: Association of CVS symptoms and ergonomic practices

	Category	Frequency, n (%)				χ^2 (df)	*p*-value
		None	Mild	Moderate	Severe		
Headache							
Distance from computer screen	Less than from tip of finger to elbow	0 (0.0)	7 (29.2)	15 (62.5)	2 (8.3)	29.323 (6)	<0.001
	From tip of finger to elbow	22 (15.7)	82 (58.6)	31 (22.1)	5 (3.6)		
	More than from tip of finger to elbow	10 (23.8)	16 (38.1)	10 (23.8)	6 (14.3)		
Regular breaks	Never	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	18.794 (9)	0.027
	Occasionally	15 (22.4)	39 (58.2)	8 (11.9)	5 (7.5)		
	Frequently	12 (11.7)	50 (48.5)	35 (34.0)	6 (5.8)		
	Always	4 (11.4)	16 (45.7)	13 (37.1)	2 (5.7)		
Burning eyes							
Frequency of breaks	Every 3 hours	6 (33.3)	5 (27.8)	6 (33.3)	1 (5.6)	22.121 (9)	0.009
	Every 2 hours	13 (20.6)	15 (23.8)	30 (47.6)	5 (7.9)		
	Every hours	6 (5.5)	36 (32.7)	61 (55.5)	7 (6.4)		
	Every half hours	0 (0.0)	8 (53.3)	6 (40.0)	1 (6.7)		
Blurred vision							
Adjustable chair	Never	99 (67.8)	33 (22.6)	13 (8.9)	1 (0.7)	23.452 (9)	0.005
	Occasionally	31 (73.8)	8 (19.0)	3 (7.1)	0 (0.0)		
	Frequently	4 (44.4)	1 (11.1)	3 (33.3)	1 (11.1)		
	Always	3 (33.3)	3 (33.3)	3 (33.3)	0 (0.0)		
Double vision							
Distance from computer screen	Less than from tip of finger to elbow	17 (70.8)	4 (16.7)	3 (12.5)	0 (0.0)	21.325 (6)	0.002
	From tip of finger to elbow	109 (77.9)	27 (19.3(	4 (2.9)	0 (0.0)		
	More than from tip of finger to elbow	30 (71.4)	3 (7.1)	7 (16.7)	2 (4.8)		
Adjustable chair	Never	110 (75.3)	26 (17.8)	8 (5.5)	2 (1.4)	17.624 (9)	0.04
	Occasionally	37 (88.1)	3 (7.1)	2 (4.8)	0 (0.0)		
	Frequently	4 (44.4)	2 (22.2)	3 (33.3)	0 (0.0)		
	Always	5 (55.6)	3 (33.3)	1 (11.1)	0 (0.0)		
Adjustable keyboard	Never	136 (79.1)	27 (15.7)	7 (4.1)	2 (1.2)	21.387 (9)	0.011
	Occasionally	12 (70.6)	3 (17.6)	2 (11.8)	0 (0.0)		
	Frequently	4 (36.4)	3 (27.3)	4 (36.4)	0 (0.0)		
	Always	4 (66.7)	1 (16.7)	1 (16.7)	0 (0.0)		
Eyestrain							
Antiglare screen	Never	12 (7.1)	41 (24.1)	105 (61.8)	12 (7.1)	24.772 (9)	0.003
	Occasionally	3 (13.0)	9 (39.1)	8 (34.8)	3 (13.0)		
	Frequently	0 (0.0)	1 (25.0)	3 (75.0)	0 (0.0)		
	Always	4 (44.4)	4 (44.4)	1 (11.1)	0 (0.0)		
Adjustable chair	Never	11 (7.5)	32 (21.9)	90 (61.6)	13 (8.9)	16.986 (9)	0.049
	Occasionally	6 (14.3)	19 (45.2)	16 (38.1)	1 (2.4)		
	Frequently	0 (0.0)	2 (22.2)	6 (66.7)	1 (11.1)		
	Always	2 (22.2)	2 (22.2)	5 (55.6)	0 (0.0)		
Regular breaks	Never	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	19.722 (9)	0.02
	Occasionally	7 (10.4)	16 (23.9)	38 (56.7)	6 (9.0)		
	Frequently	4 (3.9)	30 (29.1)	63 (61.2)	6 (5.8)		
	Always	7 (20.0)	9 (25.7)	16 (45.7)	3 (8.6)		
Dry eyes							
Adjustable keyboard	Never	37 (21.5)	88 (51.2)	39 (22.7)	8 (4.7)	21.088 (9)	0.012
	Occasionally	8 (47.1)	4 (23.5)	5 (29.4)	0 (0.0)		
	Frequently	2 (18.2)	1 (9.1)	6 (54.5)	2 (18.2)		
	Always	1 (16.7)	3 (50.0)	1 (16.7)	1 (16.7)		
Neck pain							
Adjustable chair	Never	7 (4.8)	19 (13.0)	69 (47.3)	51 (34.9)	24.099 (9)	0.004
	Occasionally	0 (0.0)	12 (28.6)	16 (38.1)	14 (33.3)		
	Frequently	1 (11.1)	3 (33.3)	4 (44.4)	1 (11.1)		
	Always	0 (0.0)	6 (66.7)	2 (22.2)	1 (11.1)		
Shoulder pain							
Level of viewing computer screen	Above eye level	5 (3.5)	13 (9.2)	56 (39.4)	68 (47.9)	18.749 (6)	0.005
	At the eye level	1 (25.0)	2 (50.0)	0 (0.0)	1(25.0)		
	Below eye level	1 (1.7)	13 (21.7)	16 (26.7)	30 (50.0)		

in order to help students cope with the strain of using devices from long periods of time. One example is the use of anti-glare screens, a technology that has been around for a number of years. The results from the survey indicate that the majority of the students are not using anti-glare screens at all, but the use of anti-glare filters over digital screens have been linked to fewer, less frequent, and less severe eye problems (18). In fact, anti-glare screen users had a significantly decreased rate of visual problems (19).

CONCLUSION

The results of this study indicates an underlying issue that could worsen in the coming years if left untreated. While this study focuses on CVS as a result of prolonged and poor ergonomics related to computer use, the consequences of this problem does not stop with the eyes. Poor posture can cause issues in the later years of one's life, leading to a reduced quality of life, apart from putting more burden on health care. However, all of this issue can be prevented by adopting a few simple preventive measures such as changes to workspaces and taking breaks. The education system should also play a part in informing and reminding both students and academicians alike of the possible ways to minimise and even prevent CVS and other ergonomics related issues. In fact, we believe that since the use of computers has grown universal at higher education institutions and will only continue when the students graduate and start to work, the prevention of CVS, ergonomic issues and its associated pain should be included in the curriculum.

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REFERENCES

1. The Jakarta Post. Malaysia's declaration of emergency keeps Muhyiddin's window open [Internet]. The Jakarta Post. Available from: https://www.thejakartapost.com/academia/2021/01/22/malaysias-declaration-of-emergency-keeps-muhyiddins-window-open.html
2. CDC. Communities, Schools, Workplaces, & Events [Internet]. Centers for Disease Control and Prevention. 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/community/community-mitigation.html
3. Mahalingam. (2015). Computer Vision Syndrome Among Nurses. Jnep, 1(1), 1–5.
4. American Optometric Association. Computer Vision Syndrome [Internet]. American Optometric Association. Available from: https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/computer-vision-syndrome?sso=y
5. Muhammad, H., Hassan, J., Ehsan, S., & Arshad, H. S. 1. Frequency of Computer Vision Syndrome & Ergonomic Practices among Computer Engineering Students. International Journal of Science and Research (IJSR). 2016 May 5;5(5):121–5.
6. Akinbinu R. Knowledge of computer vision syndrome among computer users in the workplace in Abuja, Nigeria. Journal of Physiology and Pathophysiology. 2013 Sep 30;4(4):58–63.
7. Mowatt L, Gordon C, Santosh ABR, Jones T. Computer vision syndrome and ergonomic practices among undergraduate university students. International Journal of Clinical Practice. 2017 Oct 5;72(1):e13035.
8. Logaraj M, Madhupriya V, Hegde S. Computer vision syndrome and associated factors among medical and engineering students in Chennai. Annals of Medical and Health Sciences Research. 2014;4(2):179.
9. Sa EC, Ferreira Junior M, Rocha LE. Risk factors for computer visual syndrome (CVS) among operators of two call centers in Sro Paulo, Brazil. Work. 2012;41:3568–74.
10. Taptagaporn S, Sotoyama M, Saito S, Suzuki T. Visual comfort in VDT workstation design. Journal of human ergology. 1995 Jun 1;24(1):84-8.
11. Jaschinski, W., & Heuer, H. (2010). Preferred position of visual displays relative to the eyes: a field study of visual strain and individual differences. October 2014, 37–41.
12. Roland, J. (2018). How to Fix Hunched Shoulders. Healthline; Healthline Media. https://www.healthline.com/health/hunched-shoulders
13. Hakala PT, Rimpelᐞ AH, Saarni LA, Salminen JJ. Frequent computer-related activities increase the risk of neck–shoulder and low back pain in adolescents. The European Journal of Public Health. 2006 Oct 1;16(5):536-41.
14. Ming Z, Nᐞrhi M, Siivola J. Neck and shoulder pain related to computer use. Pathophysiology. 2004 Jul 1;11(1):51-6.
15. Turgut B. Ocular ergonomics for the computer vision syndrome. Journal of Eye and Vision. 2018;1(1):1-2.
16. Agarwal S, Goel D, Sharma A. Evaluation of the factors which contribute to the ocular complaints in computer users. Journal of clinical and diagnostic research: JCDR. 2013 Feb;7(2):331..
17. Fenety A, Walker JM. Short-term effects of workstation exercises on musculoskeletal discomfort and postural changes in seated video display unit workers. Physical therapy. 2002 Jun 1;82(6):578-89.
18. Kanitkar K, Carlson AN, Richard Y. Ocular problems associated with computer use: The ever-increasing hours spent in front of video display terminals have led to a corresponding increase in visual and physical ills. Review of Ophthalmology E-Newsletter. 2005;12(04).
19. Shrivastava SR, Bobhate PS. Computer related health problems among software professionals in Mumbai: A cross-sectional study. International Journal of Health & Allied Sciences. 2012 Apr 1;1(2):74.
20. Alrasheed SH, Alghamdi WM. Impact of an educational intervention using the 20/20/20 rule on Computer Vision Syndrome. African Vision and Eye Health. 2020 Jan 1;79(1):1-6
21. Boro WL, Andanje M, Onywera V. Work-related

musculoskeletal injuries and conditions suffered by computer-user employees in the banking institutions in Nairobi, Kenya: biokinetics practice and sport injuries. African Journal for Physical Health Education, Recreation and Dance. 2012 Jun 1;18(2):344-52.