Original Article

Computer Use and Vision-Related Problems Among University Students In Ajman, United Arab Emirate

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Abstract

Background: The extensive use of computers as medium of teaching and learning in universities necessitates introspection into the extent of computer related health disorders among student population. **Aim**; This study was undertaken to assess the pattern of computer usage and related visual problems, among University students in Ajman, United Arab Emirates. **Materials and Methods** A total of 500 Students studying in Gulf Medical University, Ajman and Ajman University of Science and Technology were recruited into this study. Demographic characteristics, pattern of usage of computers and associated visual symptoms were recorded in a validated self-administered questionnaire. Chi-square test was used to determine the significance of the observed differences between the variables. The level of statistical significance was at $P < 0.05$. The crude odds ratio (OR) was determined using simple binary logistic regression and adjusted OR was calculated using the multiple logistic regression. **Results:** The mean age of participants was 20.4 (3.2) years. The analysis of racial data reveals that 50% (236/471) students were from Middle East, 32% (151/471) from other parts of Asia, 11% (52/471) from Africa, 4% (19/471) from America and 3% (14/471) from Europe. The most common visual problems reported among computer users were headache - 53.3% (251/471), burning sensation in the eyes - 54.8% (258/471) and tired eyes - 48% (226/471). Female students were found to be at a higher risk. Nearly 72% of students reported frequent interruption of computer work. Headache caused interruption of work in 43.85% (110/168) of the students while tired eyes caused interruption of work in 43.5% (98/168) of the students. When the screen was viewed at distance more than 50 cm, the prevalence of headaches decreased by 38% (50-100 cm – OR: 0.62, 95% of the confidence interval [CI]: 0.42-0.92). Prevalence of tired eyes increased by 89% when screen filters were not used (OR: 1.894, 95% CI: 1.065-3.368). **Conclusion:** High prevalence of vision related problems was noted among university students. Sustained periods of close screen work without screen filters were found to be associated with occurrence of the symptoms and increased interruptions of work of the students. There is a need to increase the ergonomic awareness among students and corrective measures need to be implemented to reduce the impact of computer related vision problems.

Keywords: Computer vision syndrome, Dry eyes, Headache, University students

Introduction

Early 20th century has seen increasing use of computers world-wide for both professional and personal use. This has also resulted in a drastic change in the educational sector, resulting in advert use of this technology for instruction in schools and universities.[1] In the present era of excessive and rampant computer usage, there has been an upsurge of computer related health problems.

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Ocular complaints of computer users have been grouped together and collectively termed as computer vision syndrome (CVS).[2] It is defined by the American Optometric Association as "a complex of eye and vision problems related to activities, which stress the near vision and which are experienced in relation or during the use of computer."[3] Blurred vision, dry eyes, burning sensation, redness of eyes and headache are the main symptoms resulting from improper use of computers.[4]

Apart from the duration of usage, factors such as poor lighting, glare, screen brightness, vision problems and improper workstation setup also account for eye and visual problems associated with computer usage.[5] Sustained periods of close screen work results in visual fatigue symptoms such as sore eyes and increased glare sensitivity.[6] McCollough effect, a transient visual aberration resulting in black and white objects visualized with colored tinge, is also documented with long duration usage of visual display terminals.[7] Dry eyes and related symptoms are associated with reduced blink rate and horizontal gaze causing wider opening of the palpebral fissure that lead to increased evaporation through exposed area.[8]

The discomfort associated with computer usage has not yet been proven to result in permanent damage, but may cause a reduction in work accuracy. This can reduce productivity by as much as 40%.[9]

The extensive use of computers as a tool in teaching and learning in universities necessitates introspection into the extent of the disorder's effect on the population of students tested. The aim of this study therefore is to evaluate the pattern of computer usage and related visual problems, among University students in Ajman, United Arab Emirates (UAE). This study will hopefully enlighten public health professionals, physical therapists and orthopedicians on the need of spreading awareness regarding health hazards of computers and implementing corrective measures right from school level itself to ease the additional stress on the students.

Subjects and Methods

Study settings and population

A total of 500 university students studying in Ajman, UAE, irrespective of their age, gender, Nationality and course or discipline were recruited into this cross sectional study. Based on the previous studies we expected a prevalence of 13%. With the mean error of 3%, the sample size was calculated to be 500. We adopted convenient sampling procedure (non-probability sampling) recruiting 250 students from Gulf Medical University and 250 from Ajman University of Science and technology, the two of the three universities in Ajman. The exclusion criterion was students who have been diagnosed with any form of eye disease in the past 1 year. Students with refractive errors were however included in the study.

Study tool

A questionnaire was designed by the investigators for data collection. The questionnaire has three sub-sections dealing on participants' demographics, variables associated with computer use and the visual symptoms associated with computer use. It was sent to subject experts for content validity. The modifications suggested were incorporated and was pilot tested in 10 students. Suitable modifications were incorporated and the final questionnaire was prepared.

Data collection

Participants were briefed about the purpose and objectives of the study before taking consent from them. The pre-designed questionnaires were distributed among the study population and collected back on the same day.

Data analysis

Data was fed into Excel spread sheet and transferred to predictive analytics software 19 version software for statistical analysis (IBM, SPSS Inc, United states). The prevalence of computer related disorders was expressed as percentage. Chi-square test was used to determine the association between the variables. The crude odds ratio (OR) was determined using simple binary logistic regression and adjusted OR was calculated using multiple logistic regression. The significance level was considered as $P < 0.05$.

Ethical approval

The study was approved by the Ethics committee of the University and therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

Results

A total of 500 questionnaires were administered to students across two universities in Ajman. Four hundred and seventy one were returned; giving a 94.2% (471/500) response rate. Majority of the respondents were females accounting for a total of 66% (311/471) [Figure 1]. The age of the participants ranged from 17 to 31 years with a mean of 20.40 (3.2) years. Nearly 76% (358/471) were students of Health professional and Allied health science courses, followed by 17% (80/471) engineering students and 7% (33/471) (pursuing degrees in law, business, advertising or general education [Figure 2]. The racial data of the students is presented in [Figure 3].

Table 1 shows the percentage distribution of visual problems among different genders and nationality. With regards to the gender, females had significantly higher incidence of headaches and blurred distant vision than males, 58.2% (181/311) vs 43.9% (70/160). There was a preponderance of most of the visual complaints among students of Middle Eastern origin.

Pattern of computer usage and symptoms

The most common visual problems reported were headache, burning sensation in eyes and dry/tires/sore eyes with 53.3% (251/471), 54.8% (258/471) and 48% (226/471) of students reporting the same respectively [Table 1].

Dry/tired/sore eyes was more in students viewing the screen at a distance less than 50 cm not using screen filters and working for longer duration on computer and the complaints decreased as the viewing distance increased.

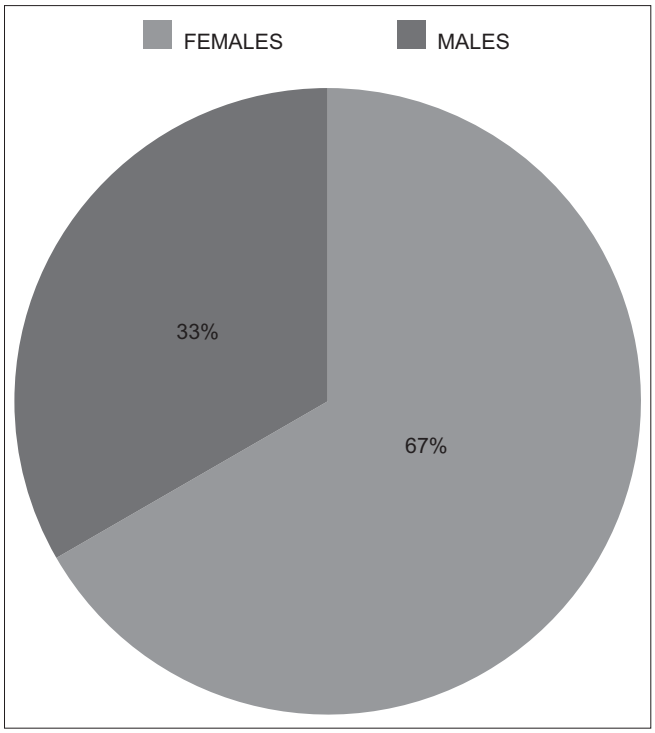

Figure 1: Gender description of participants

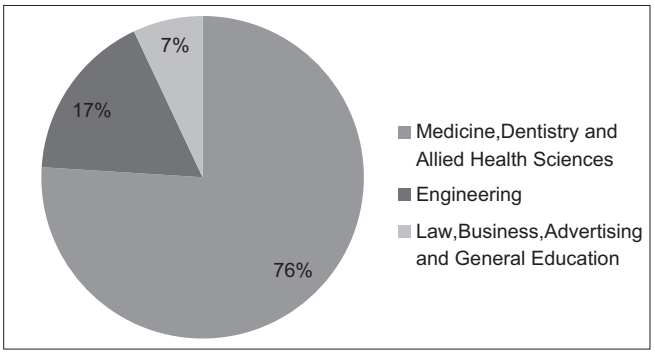

Figure 2: Educational background of participants

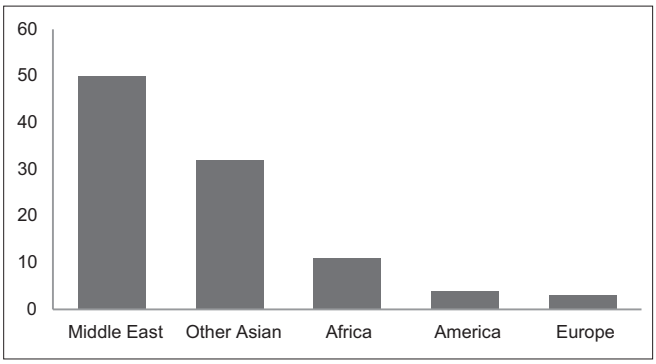

Figure 3: Nationality of participants

Chi-square tests did not reveal significant correlations of burning sensation with any of the variables. Hence only headache and dry eyes were analyzed further. The details of pattern of computer usage and symptoms are given in Table 2.

Pattern of computer usage and headache

Table 3 shows the pattern of computer usage and headache. Simple binary logistic regression showed significant association of headache with the gender and the distance at which the user views the screen. With regards to gender, females are 78% more at risk of developing headache than males. The risk of developing headache was 38% significantly less in students viewing the computer at a distance of 50-100 cm, compared with students who were using a viewing distance of less than 50 cm. There was no confounding effect of gender or distance from the screen, as evident from the multiple logistic regressions.

Pattern of computer usage and dry/tired/sore eyes

Usage of computers without screen filters was significantly associated with dry eyes when simple binary logistic regression was applied. The risk of developing dry eyes increases by 89% when no screen filters are used. Binary logistic regression however showed no significant association between taking breaks and developing dry eyes details are given in Table 4.

Frequent interruption of work caused by symptoms

Table 5 shows that nearly 72% (339/471) of students reported frequent interruption of computer work, a significant 43.8% (110/168) of them complained of headache. This finding was in parallel with the complaint of dry/tired/sore eyes, which caused interruption of work in 43.5% (98/168) of the students.

Discussion

Computer eyestrain is identified to occur due to frequent, long saccadic movements, continuous accommodation changes and continuous changes in alignment (vergence). The visual fatigue results when the stress caused by these movements on the musculature of the eye exceeds the visual performance ability.[10]

The results of this study point to possible differences in gender for headache where female students are at an increased risk. This is in accordance with studies finding higher scores for somatic or discomfort complaints in females.[11-13] Accommodative and vergence dysfunction are found to be more prevalent in females thus increasing their risk of having moderate to high visual discomfort.[14,15]

Increased incidence of headache has been noted in the present study in when computer is viewed at a distance less than 50 cm. This is in accordance with some studies that highlighted the fact that with shorter distance the visual fatigue increases especially in individuals with a disparity between the (shorter) viewing distance and the individual's (longer) dark convergence.[16,17] Changes of tonic vergence are more specifically related to subjective feelings of visual fatigue or eyestrain. The ideal

Table 1: Percentage distribution of visual problems among different genders and ethnic groups

Symptoms	Gender			Nationality					Net percentage of users
	Male	Female	*P*	Middle east	Other Asian	African	American	Others	
Headache	43.9	58.2*	0.03	52.6	53.1	53.6	52.9	57.1	53.3
Dry, tired, or sore eyes	49.7	46.9	0.57	51.3	42.9	46.4	41.2	57.1	48.0
Burning sensation	52.9	55.6	0.58	56.5	54.4	51.8	47.1	50	54.8
Double vision	12.9	10.9	0.60	12.6	10.9	5.4	11.8	14.3	11.5
"Halos" around objects on the screen	17.4	19.4	0.53	23	14.3	10.7	11.8	14.3	18.3
Need to interrupt work	32.3	37.3	0.61	39.1	33.3	30.4	29.4	35.7	35.7
Blurred distant vision	16.1	29.6*	0.02	26.5	23.9	25.0	17.6	21.4	24.8

Table 2: Pattern of computer usage and occurrence of headache and dry/sore eyes

Variable	Groups	Headaches		Dry eyes		Burning sensation	
		Number (%)	*P*	Number (%)	*P*	Number (%)	*P*
Distance from screen	<50 cm	132(60)*	0.03	110 (50)	0.76	123 (55.9)	0.68
	50-100 cm	23 (47.9)		91 (45.5)		111 (55.5)	
	>100 cm	25 (52.1)		15 (46.5)		23 (51.7)	
Hours of computer use	<4 h	120 (58.2)	0.59	75 (42.6)	0.08	96 (54.5)	0.99
	4-6 h	101 (58.4)		83 (48.0)		95 (54.9)	
	6 h	70 (57.4)		68 (55.7)		67 (54.9)	
Taking breaks	Yes	208 (53.1)	0.32	186 (47.7)*	0.01	209 (53.6)	0.59
	No	43 (53.3)		40 (49.4)		49 (60.5)	
Use of screen filter	Yes	30 (51.7)	0.84	20 (34.5)*	0.02	26 (44.8)	0.10
	No	216 (53.1)		203 (49.9)		229 (56.3)	
Illumination of the room	Very bright	27 (54)	0.98	27 (54.0)	0.59	25 (50)	0.42
	Bright	179 (52.8)		156 (46.0)		183 (54.0)	
	Dull	32 (54.2)		31 (52.5)		38 (64.4)	
	Dark	13 (56.5)		12 (52.2)		12 (52.2)	
Brightness of computer screen	Very bright	56 (62.9)	0.17	45 (50.6)	0.12	61 (58.5)	0.12
	Bright	170 (51.8)		151 (46.0)		164 (50)	
	Dull	22 (47.8)		23 (50.0)		25 (54.3)	
	Dark	3 (37.5)		7 (87.5)		8 (60)	

Table 3: Pattern of computer usage and headache

Variable	Group	Crude OR	CI	Adjusted OR	CI
Gender	Male	1	-	1	-
	Female	1.78	1.21-2.63	1.8	1.22-2.68
Distance from screen	<50 cm	1	-	1	-
	50-100 cm	0.62	0.42-0.90	0.62	0.42-0.92
	>100 cm	0.61	0.33-1.15	0.62	0.33-1.16

OR: Odds ratio, CI: Confidence interval

Table 4: Pattern of computer usage and tired eyes

Variable	Group	Crude OR	CI	Adjusted OR	CI
Screen filter	Yes	1	-	1	-
	No	1.891	1.06-3.36	1.894	1.065-3.368
Taking breaks	Yes	1	-	1	-
	No	1.070	0.67-1.73	1.083	0.665-1.763

OR: Odds ratio, CI: Confidence interval *P* values should be in two decimal places, but when $P \leq 0.001$, it should be left in 3 decimal places

viewing distance from the screen has been suggested to be about 50-70 cm, when the accommodation and vergence are at physiological resting state.[18]

The study results are in accordance with a majority of the studies that have shown that the prevalence of asthenopia is associated with increase in the time spent on computers, although this increase was not significant.[19-22]

Table 5: Frequent interruptions of work caused by symptoms

Symptom	Group	Frequent interruption of work		
		Number	Percentage	*P*
Headache	No	58	26.4	0.001
	Yes	110	43.8*	
Dry eyes	No	70	28.6	<0.001
	Yes	98	43.4*	

In the present study, visual complaints were more among students did not take frequent breaks from the computer. This can be explained by the fact that accommodation is an active process and stationary position of the eyes can lead to fatigue of accommodation. Relief can be obtained from continual visual accommodative spasm and glare from monitor by varying the focal point of the user.[23] It has been recommended that the user looks at a distant object away from the screen at least once every ½ to 1 h.[24]

The results of this study show fewer incidences of dry eyes and headaches in users of screen filters. The blink rate reduces from a normal of 16-12 blinks/min to about 6-8 blinks/min while working on a computer, resulting in dry eyes.[6] Screen filters are known to reduce reflection and glare from the computer screen. It has also been proven to prevent reduction in blink rates, usually associated with computer usage as the user focuses intently for visual processing of the image.[3] This results in fewer asthenopic symptoms.[25]

Imbalance of light between the computer screen and the surrounding is another important factor to be considered. Bright illumination from surrounding can wash out screen character images. It can also be reflected and cause a glare which can reduce the reading time.[8] In this study, we found that students using computer in a very bright or dark room were more prone to visual fatigue symptoms. The incidence of headache was more when the computer screen was very bright and complaints of dry eyes were more among students using darker screen. It has been suggested that screen brightness and contrast should be adjusted to provide balance with room lighting and maximum visibility.[26]

Visual problems have been known to lead to 4-8% slower performance on occupational tasks.[27] The interruptions in the computer work of the students posed by the headaches and dry eyes, as seen in the study could prove to decrease their productivity and hence needs to be addressed.

Conclusion

Nearly more than half of the students included in the study had mentioned to have some computer-related eye problems. Headache, burning sensation in eyes and dry/tires/sore eyes were the most common visual related problems associated with usage of computers. Female preponderance was observed for developing the problems. Improper viewing distances from computer screen, filters not being placed on the screens and using computer without taking frequent breaks were found significantly contribute to the symptoms. As universities are adopting this technology to enhance the educational instructional methods, students in universities use computers increasingly for their course work and social networking. Hence more attention needs to be given in an attempt to reduce the impact of computer related vision problems and the interruptions in computer work caused by them.

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