DOI: 10.7860/JCDR/2013/5150.2760

Original Article

Ophthalmology Section

Evaluation of the Factors which Contribute to the Ocular Complaints in Computer Users

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ABSTRACT

Context: Use of information technology hardware given new heights to professional success rate and saves time but on the other hand its harmful effect has introduced an array of health related complaints causing hazards for our human health. Increased use of computers has led to an increase in the number of patients with ocular complaints which are being grouped together as computer vision syndrome (CVS). In view of that, this study was undertaken to find out the ocular complaints and the factors contributing to occurrence of such problems in computer users.

Aims: To evaluate the factors contributing to Ocular complaints in computer users in Teerthanker Mahaveer University, Moradabad, U.P. India.

Settings and Design: Community-based cross-sectional study of 150 subjects who work on computer for varying period of time in Teerthanker Mahaveer University, Moradabad, Uttar Pradesh.

Materials and Methods: Two hundred computer operators working in different institutes offices and bank of were selected randomly in Teerthanker Mahaveer University, Moradabad, and Uttar Pradesh. 16 were non responders 18 did not come for assessment and 16 were excluded due to complaints prior to computer use making no response rate Twenty-one did not participate in the study, making the no response rate 25%. Rest of the subjects (n = 150) were asked to fill a pre-tested questionnaire, after obtaining their verbal consent Depending on the average hours of usage in a day, they were categorized into three categories viz. <2 hrs, 2-6 hrs, >6 hrs of usage. All the responders were asked to come to the Ophthalmic OPD for further interview and assessment.

Statistical Analysis Used: Simple proportions and Chi-square test.

Results: Among the 150 subjects studied major ocular complaint reported in descending order were eyestrain. (53%). Occurrence of eye strain, (53.8%), itching (47.6%) and burning (66.7%) in subjects using computer for more than 6 hours. distance from computer screen with respect to eyes, use of antiglare screen, taking frequent breaks, use of LCD monitor and adjustment of brightness of monitor screen bear a significant association with these ocular complaints in computer users.

Conclusions: Eye strain is the most common ocular complaints among computer users working for more than 6 hours a day. We also found that maintaining ideal distance from screen, keeping level of eyes above the top of screen, taking frequent breaks, using LCD monitors and using antiglare screen and adjusting brightness levels according to workplace reduced these ocular complaints to a significant level.

Key Words: Eyestrain, Ocular complaints, Asthenopia, Computer vision syndrome

INTRODUCTION

The use of computers in the era of information technology has given new heights to the professional success rate and it saves time, but on the other hand, it has led to an increase in the number of patients with ocular complaints, which are being grouped together as the Computer Vision Syndrome (CVS).

CVS is characterized by itching, redness, burning, tearing of the eyes, headache, double vision, eye strain and blurred vision [1, 2].

Though the asthenopic symptoms have been studied previously in computer users, only few studies have been done on the factors which contribute to these complaints and this necessitates further research.

AIM

To study the factors which contributed to the ocular complaints in computer users at the Teerthanker Mahaveer University, Moradabad.

OBJECTIVES

1. To prepare the profile of the ocular complaints among the computer users.

2. To evaluate the factors and their impact on the ocular complaints among computer users

3. To put forth recommendations if necessary, regarding the preventive measures at different levels, that can be taken to improve the ocular health of the people who are engaged in computer work.

MATERIALS AND METHODS

This study was carried out at the Teerthanker Mahaveer University (TMU), Moradabad, Uttar Pradesh, India from Jan 2012 to July 2012. A cross sectional study was carried out in all the colleges of TMU (where the students use computers as a part of their curriculum) as well as at all the offices and the bank of the university campus, where the use of computers was required. The study

design was approved by the human research ethical committee of TMU, Moradabad. The establishments and the institutes where computers were extensively used, were enlisted in the study. These included the IT section, accounts offices, digital libraries and banks and also personal computer users. The study design was explained to the heads of the various institutions and their due consent was taken to carry out the study in their respective departments, following which, those, who were using computers at least for the past 1 year and were of the ages between 18 to 39 years, were enlisted. The verbal consents of the 200 such subjects were taken and they were asked to respond to a predefined questionnaire in terms of their demographic details, occupation, daily working hours on a computer, their refractive status, whether they were using glasses or not, their distance from the computer screen, the type of monitor, the brightness and resolution adjustment, the use of an antiglare screen, the level of the eyes and the top of the monitor and the habit of taking breaks. The ocular complaints like diminution of vision for distance and near sight, ocular strain, headache, redness, itching, watering and double vision were sought, along with the duration of their complaints.

Out of the total subjects, 16 were non responders or they provided incomplete responses. Depending on the average hours of computer usage in a day, they were categorized into three categories viz. <2 hrs, 2-6 hrs and >6 hrs of usage. All the responders were asked to come to the Ophthalmic OPD for a further interview and their assessment on the scheduled days. 18 people did not come for the assessment despite sending repeated reminders. 16 subjects who reported one or more complaint like eye strain, headache, redness, itching, watering and double vision prior to the computer usage, were excluded. A total of 150 subjects completed the study and the observations and the data were analyzed by using the SPSS software, version 19. Depending on the type of data, the appropriate statistical tests were applied.

Statistical analysis which was used: Simple proportions and the Chi-square test.

RESULTS

Mean age of subject who participated in this study was 24.13 years, with range of 18 to 39 years. Out of these 150 subjects who responded, 102 (68%) were males and 48 (32%) were females. Out of 150 subjects, 52 (34.6%) were having refractive error and all were using glasses.

Most subjects (44.66%) were using computer for more than 6 hrs [Table/Fig-1]. Most females were using computer for less than 2 hrs (41%) while most male subjects were using computer for more than 6 hours (79.1%). This was found to be statistically significant with p value of 0.032 [Table/Fig-1]. 73 (48.66%) subjects kept an ideal distance of 20-24 inches from the computer and males are maintaining more ideal distance (57.5%) as compared to female subjects (42.5%) and this was statistically significant with p value of 0.007. Similarly, a significant p value of 0.007 was found in 79 subjects (52.66%) using LCD monitor and it was found that more number of male subjects (58.2%) used LCD monitor.

[Table/Fig-2] depicts that out of all ocular complaints reported by subjects only redness had a significant association with 82.8% of male subjects suffering from it and p value was found to be 0.05.

Factors		Female	Male
Duration of use	Less than 2 hours	41.0%	59.0%
	2 hours to 6 hours	40.9%	59.1%
	More than 6 hours	20.9%	79.1%
	P=0.032 Significant		
Glass users	Glass users	44.2%	55.8%
	Glass nonusers	25.5%	74.5%
	P=0.0019 Significant		
Distance from computer	20-24 inches from screen	42.5%	57.5%
	Either more or less	22.1%	77.9%
	P=0.007 Significant		
Level of the top of screen	Below the level of eyes	28.9%	71.1%
	At or above the level of eyes	33.3%	66.7%
	P=0.593 Not Significant		
Use of antiglare screen	Using screen	38.1%	61.9%
	Not using screen	29.6%	70.4%
	P=0.318 Not Significant		
Brightness adjustment	Adjustment	36.1%	63.9%
	No adjustment	29.2%	70.8%
	P=0.377 Not Significant		
Breaks during computer use	Took breaks	29.5%	70.5%
	No breaks	37.8%	62.2%
	P=0.321 Not Significant		
Type of monitor	Lcd monitor	41.8%	58.2%
	Crt monitor	21.1%	78.2%
	P=0.007 significant		

[Table/Fig-1]: Showing the gender distribution of various factors reported by the subjects

Ocular complaints		Female	Male
Eye strain	Present	31.3%	68.8%
	Absent	32.9%	67.1%
P=0.833 Not Significant			
Headache	Present	34.4%	65.6%
	Absent	30.2%	69.8%
P=0.591 Not Significant			
Watering	Present	29.2%	70.8%
	Absent	33.3%	66.7%
P=0.610 Not Significant			
Redness	Present	17.2%	82.8%
	Absent	35.5%	64.5%
P=0.05 Significant			
Itching	Present	28.6%	71.4%
	Absent	32.6%	67.4%
P=0.716 Not Significant			
Burning	Present	33.3%	66.7%
	Absent	31.7%	68.3%
P=0.879 Not Significant			
Double vision	Present	37.5%	62.5%
	Absent	31.7%	68.3%
P=0.732 Not Significant			

[Table/Fig-2]: Showing the gender distribution of various complaints reported by the subjects

Ocular complaints		Duration of use			Glass users		Distance f rom screen		Level of screen		Antiglare screen		Brightness adjustment		Habit of breaks		Type of monitor	
		Less than 2 hours	2 to 6 hours	More than 6 hours	User	Nonuser	20-24 inches from screen	Either more or less	Below the level of eyes	At or above the level of eyes	User	Nonuser	Adjustment	No adjustment	Took breaks	No breaks	Lcd	Crt
Eye strain	Present	25.0%	21.3%	53.8%	40.0%	60.0%	36.3%	63.8%	20.0%	80.0%	21.3%	78.8%	30.0%	62.5%	40.0%	60.0%	46.3%	46.3%
	Absent	27.1%	38.6%	34.3%	28.6%	71.4	62.9%	37.1%	41.4%	58.6%	35.7%	64.3%	52.9%	57.0%	81.4%	18.6%	60.0%	40.0%
P=0.029 Significant P =.001, Significant P=0.004, Significant P=0.049, Significant P=0.004, Significant P=0.004, Significant P=0.042 Significant																		
Headache	Present	23.4%	25.0%	51.6%	37.5%	62.5%	39.1%	60.9%	21.9%	78.1%	23.4%	76.6%	37.5%	62.5%	64.1%	35.9%	50.0%	50.0%
	Absent	27.9%	32.6%	39.5%	32.6%	67.4%	55.8%	44.2%	36.0%	64.0%	31.4%	68.6%	43.0%	57.0%	74.4%	25.6%	54.7%	45.3%
P=0.042 Significant																		
Watering	Present	22.9%	27.1%	50.0%	27.1%	72.9%	45.8%	54.2%	22.9%	77.1%	25.0%	75.0%	29.2%	70.8%	66.7%	33.3%	56.3%	43.8%
	Absent	27.5%	30.4%	42.2%	38.2%	61.8%	50.0%	50.0%	33.3%	66.7%	29.4%	70.6%	46.1%	53.9%	71.6%	28.4%	51.0%	49.0%
P=0.049 Significant																		
Redness	Present	17.2%	24.1%	58.6%	13.8%	86.2%	34.5%	65.5%	37.9%	62.1%	17.2%	82.8%	34.5%	65.5%	72.4%	27.6%	44.8%	55.2%
	Absent	28.1%	30.6%	41.3%	39.7%	60.2%	52.1%	42.9%	28.1%	71.9%	30.6%	69.4%	42.1%	57.0%	69.4%	30.6%	54.5%	45.5%
P=0.009 Significant																		
Itching	Present	4.8%	47.6%	47.6%	13.8%	86.2%	33.3%	66.7%	19.0%	81%	14.3%	85.7%	42.9%	57.1%	52.4%	47.6%	38.2%	61.9%
	Absent	29.5%	26.4%	44.2%	39.7%	60.2%	51.2%	48.8%	31.8%	68.2%	30.2%	69.8%	40.3%	59.7%	72.9%	27.1%	55.0%	45.0%
P=0.029 Significant																		
Burning	Present	8.3%	25.0%	66.7%	38.1%	61.9%	33.3%	66.7%	33.3%	66.7%	25.0%	75.0%	29.2%	70.8%	50.0%	50.0%	37.5%	62.5%
	Absent	29.4%	30.2%	40.5%	34.1%	65.9%	51.6%	48.4%	29.4%	70.6%	28.6%	71.4%	42.9%	57.1%	73.8%	26.2%	55.6%	44.4%
P=0.035 Significant P=0.020 Significant																		
Double vision	Present	25%	12.5%	62.5%	33.3%	66.7%	62.5%	37.5%	12.5%	87.5%	12.5%	87.5%	12.5%	87.5%	50.0%	50.0%	37.5%	62.5%
	Absent	26.1%	30.3%	43.7%	34.9%	65.1%	47.9%	52.1%	31.0%	69.0%	28.9%	71.1%	42.3%	57.7%	71.1%	28.9%	53.5%	46.5%

[Table/Fig-3]: Showing the association of different factors with various ocular complaints reported by the subjects

[Table/Fig-3] shows the association of various factors with ocular complaints reported by the subjects. It was found that all the ocular complaints were reported more by subjects using computer for more than 6 hours and out of this, only eye strain (p value=0.029), itching (p value=0.029) and burning (p value=0.035) had a significant association. Redness was more frequent with glass nonusers and had a significant association with p value of 0.009 as depicted in [Table/Fig-3].

It was also found that eyestrain (p value=0.001), headache (p value=0.042), had a significant association in subjects not maintaining proper distance from the computer. [Table/Fig-3] also depicts that eyestrain was less and had a significant association (p value=0.004) when subjects maintained top of the screen level below the eyes. Similarly eyestrain was reported significantly by more number of subjects who do not use antiglare screen (p value 0.004) [Table/Fig-3].

It was also observed from the [Table/Fig-3] that eyestrain (p value=0.004), and watering (p value= 0.049) were significantly reported by more number of subjects who work with computers without adjusting the brightness of the screen. [Table/Fig-3] also showed that eyestrain (p value=0.004) and burning (p value=0.020) of eyes was found to be significantly associated with subjects not taking breaks during computer use It was also found that eyestrain was less when subjects used LCD monitor instead of CRT monitor and had a significant association with p value of 0.042 [Table/Fig-3].

DISCUSSION

The computer and video display terminal usage have caused major changes in the professional habitual manners of millions of people. Our study found a high prevalence of eyestrain (53%), headache (42.66%),diminution of vision for distance (34%) and watering (32%) among the asthenopic complaints in the computer workers of our university. A high prevalence of asthenopic complaints (46.3%) in the computer operators was also reported in a similar study [3]. A study which was performed on 385 bank workers of Italy reported the prevalence of such ocular complaints to be 31.9% [4]. Another study which was done in Spain found this prevalence to be as high as 68.5% [5]. In our study, the major ocular complaints which were reported in the descending order were eyestrain, headache, diminution of vision for distance, watering, redness, itching, burning and double vision. In our study, the female subjects used computers for lesser time periods than the males, as well as, most of them maintained a proper viewing distance from the computer screen, but we did not find any significant association with the age and gender of the subjects with these complaints.Such ocular complaints were correlated with the age and gender of the subjects in one such study [4]. The visual symptoms scores in the visual display terminal operators were found to be higher among the females than among the males in a Japanese study. However, they did not find any difference with respect to the age [6]. While considering the duration of the computer use, the review of literature revealed mixed pictures as far as the occurrence of the ocular complaints was concerned. One of the studies found a significant difference in such complaints and in the daily hours of the visual display terminal work between the workers who worked less than 6 hrs daily and those who worked more than 6 hours daily [7].

Another study reported that the prevalence of the visual symptoms was significantly higher in the individuals who spent more than 4 hours daily, working on video display terminals [8]. Similar results were reported by 2 such studies which also showed that

the duration of the computer work was directly related to the eye symptoms, and that a longer duration tended to result in long-lasting complaints which persisted even after the Visual Display Terminal (VDT) work was finished [6,9]. Our study also revealed that the ocular complaints were reported more by the subjects who used computers for more than 6 hours a day, of which eye strain (53.8%) ,itching (47.6%) and burning (66.7%) were statistically significant in these subjects. Although more number of males used computers for more than 6 hours, we did not find any significant association with the ocular complaints. A similar study which was done in Italy did not find any association with the duration of the computer use and the ocular complaints [4].

Our study also found that the ocular complaints were more frequent in the subjects who did not use glasses and redness had a significant association. On the contrary, two other studies reported a significant association of asthenopia in the presence of refractive errors [10,11].

The viewing distance of the computer is also an important risk factor for the development of ocular complaints. The closer the VDT is to the eyes, the harder the eyes have to work to accommodate with it. These problems can be explained as that close distance causes an excess accommodation, thus leading to overworking of the ciliary muscles of the eye, therefore inducing the symptoms of CVS as eye fatigue and headache. Working with monitors that make the users concentrate on the VDT, decreases the speed of blinking and the eye exposure to the free air increases, thereby causing redness burning, tiredness and eyestrain.

One of the researches recommended a viewing distance of 50-70cm [12]. It was found in a study that the change from a greater to a lesser viewing distance produced a larger increase in the eyestrain when the VDTs were at eye level [13]. Another study showed that the asthenopia was less in the subjects whose viewing distance was more than 30 cm (12 inches) and that it was the highest when the viewing distance was less than 30 cm (12 inches), which was statistically significant [3].

Similarly, our study also found a significant association of asthenopia in the subjects who did not maintain a proper distance of 20-24 inches from the computer and eye strain and headache had a significant association.

The height and the inclination of the monitor have influence on the visual discomfort. In a study which was done in 1990, it was shown that the visual discomfort has a high correlation with the height and the inclination of the computer monitor. Therefore, it highly suggested the use of an ergonomic position of the computer monitor and the chair. The video display terminal is usually located higher than the users' watching level, which makes the palpebral fissure more open, which results in dryness of the eyes. Therefore, it is recommended that the location of middle point of the video display terminal should be 5-6 inches below the straight line of the users' vision, which decreases not only the dry eye, but also the degrees of the spasm and pain in the neck muscles [14]. As another important term of the viewing distance, the United States Occupational Safety and Health Administration (OSHA) has recommended that the centre of the computer monitor should normally be located 15–20 below the horizontal eye level and that the entire visual area of the display screen should be located, so that the downward viewing angle is >60 [15].

In our study, it was found that the complaints were less when the subjects maintained the top of the screen level below the eyes, but a significant association was found only for eyestrain. Similar results were found in two such studies and therefore a downward gaze was recommended so as to work comfortably on a VDT [12,16]. Studies have reported increased odds ratios for certain eye discomfort symptoms when the computer operators kept the terminal at about the eye level rather than below the eye level [10]. Studies have found that high screens result in greater eyestrain than the low screens [13].

The glare and the reflections on the computer screens can also cause eye strain. Glare is an issue with all the monitors. The CRT monitors cause more glare and potential strain issues due to the screen dynamics and due to the screen being constantly "re-drawn". The best way to minimize the glare is to use an antiglare cover over the screen and the use of flat screens whenever possible. Studies have found that proper lighting, using non reflective coatings and the elimination of glare are the important factors for an optimal visual display design. The conditions of high illumination and sensitivity to the glare due to computer use were shown to increase the reading time and to decrease the attention to the task. The brightness has to be adjusted so that it is about the same as the surroundings and the contrast has to be adjusted to as high as possible to eliminate the discomfort. Dust may also impair one's vision when viewing a computer screen by affecting the glare, so it has to be ensured all the monitors or screens are clean and free of dust [17].Our study showed that eyestrain was reported significantly by more number of subjects who do not use antiglare screens. Eyestrain, headache and watering were significantly reported more by the subjects who worked with computers without adjusting the brightness of the screens.

Research has shown that taking frequent breaks while using the computer increases the efficiency and that it relaxes the accommodative system [18]. Frequent work breaks (at least once per hour) have to be taken in order to prevent the eye strain which is associated by prolonged eye work, as was recommended in one of the studies [19]. It also helps the muscles of the eye to relax, thus decreasing the eye fatigue and headache. In our study, eyestrain and burning of the eyes were found to be significantly associated with the subjects who did not take breaks during the computer use [Table/Fig-3].

It was also observed that the eyestrain, redness, itching, burning and double vision were less when the subjects used LCD monitors instead of CRT monitors, but a significant association was found only with eye strain [Table/Fig-3]. The CRT monitors have to be replaced with flat-panel LCD screens. The LCD screens are easier on the eyes and they usually have an anti-reflective surface. The images on the CRT monitors can "flicker", which can cause eye strain [19].

CONCLUSIONS

Our study suggested that eyestrain, itching and burning were the common ocular complaints among the computer users who worked for more than 6 hours a day. We also found that maintaining an ideal distance from the screen would reduce the eyestrain and headache, while maintaining a downward gaze during the computer work would also contribute in reducing the eyestrain to a significant level.

Adjustment of the brightness level according to the workplace reduces the eyestrain and watering, while the use of flat panel LCD monitors with antiglare screens and taking frequent breaks during the work also reduce these ocular complaints dramatically.

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FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date of Submission: **Oct 07, 2012**
Date of Peer Review: **Nov 11, 2012**
Date of Acceptance: **Nov 25, 2012**
Date of Online Ahead of Print: **Dec 24, 2012**
Date of Publishing: **Feb 01, 2013**