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PREVALENCE OF OCULAR SYMPTOMS AMONG COMPUTER PROFESSIONALS IN A UNIVERSITY SETTING IN SOUTH INDIA

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ABSTRACT: BACKGROUND: It has been estimated that computer use is increasing exponentially worldwide and so have resultant health problems, especially ocular problems. These reduce quality of life and productivity of computer users leading to financial losses. There is an urgent need to reduce this emerging epidemic. **AIMS:** To evaluate the prevalence of ocular symptoms among computer professionals in a University setting in South India and to establish associated variables. **METHODS:** A cross sectional study was conducted among 385 non-teaching faculty members using computers in different offices of Manipal University. The ocular symptoms were evaluated by a modified pre-tested, structured questionnaire which included age, gender, amount of computer work, years of computer use, type of computer used, eye or systemic diseases, medications used, work-environment, breaks, optical correction, ocular symptoms, musculoskeletal symptoms, general symptoms and ergonomics of computer work station. Chi square test was used to find out association between ocular symptoms and variables under study. **RESULTS:** Among computer professionals, ocular symptoms had a prevalence of 76%. The most prevalent symptom was eye strain (62%). Chi square test showed association between ocular symptoms, musculoskeletal symptoms ($p < 0.0001$) and general symptoms ($p < 0.0001$). No statistical significance was observed between age, gender, duration of computer use, eye level and distance from the computer monitor and ocular symptoms. **CONCLUSION:** Self-reported ocular symptoms were highly prevalent among professionals using computers in a University setting. There is need of further studies performing clinical assessment of the subjects and find out the reason for symptoms and manage them effectively.

KEYWORDS: computer professional, ergonomics, musculoskeletal symptoms, ocular symptoms.

INTRODUCTION: There has been a great advancement in the information technology in the past two decades. The use of computer has made life easier and has increased the work productivity tremendously.¹

There is an array of health related problems associated with computer usage, of which the most frequently reported are eye problems. The main visual symptoms reported by Visual Display Terminal (VDT) users include eye strain, tired eyes, irritation and burning sensation, redness, blurred vision and double vision thus termed the phrase "Computer Vision Syndrome" (CVS).² These symptoms are usually temporary and disappear at the end of the working day although a minority of workers may have long lasting symptoms. If intervention is not initiated, many symptoms may become persistent and worsen in the future. The American Optometric Association defines CVS as a complex of eye and vision related problems related to the activities which stress the near vision and which are experienced in relation or during the use of computer.¹ Those who spend more than four hours per day working on computer tasks experience much higher incidence, severity and duration of computer related symptoms.³

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The number of computer users is rapidly growing worldwide and is estimated to exceed 2 billion by 2015 primarily operated by developing nations. Therefore CVS may take on an epidemic form in the near future.⁴ The causes of CVS are a combination of individual visual problems and poor visual ergonomics. The most important approach in the management of CVS is eliminating the causative factor leading to the symptoms. The challenge of the practitioner is to identify the possible causes of symptoms and design an appropriate management plan. Modification in the ergonomics of the work environment, patient education and proper eye care are important strategies in preventing CVS.⁵ Financial and industrial losses and the quality of life of the users is a matter of concern. More understanding about the CVS will help us prevent the proposed epidemic of the 21st century.²

There is paucity of studies on ocular problems of computer users in a University setting in India. Hence this study will be beneficial in knowing the extent of the problem in this setting and locality. It will also serve to increase the awareness among users regarding the eye problems that can occur with the use of VDT and they will be more concerned about eye health.

METHODS: This cross sectional study was conducted among non-teaching staff members of different institutions of Manipal University who regularly use computers. It was approved by the Institutional Review Board for Research Proposal, School of Allied Health Sciences, Manipal and was performed according to the guidelines of the Declaration of Helsinki. A pilot study was conducted among 20 computer users in one the offices of the University and the prevalence of ocular symptoms was found to be 20%. Moreover we observed a non-response rate of 10% for filling the questionnaire. The formula used for sample size calculation was $n = z^2pq/d^2$ ($z=1.96$, $p=20\%$, $q=(100-p)$, $d=20\%$) and was estimated to be 384. Expecting a nonresponse rate of 10% as it is a questionnaire based study, final sample size of 427 was decided upon.

Inclusion criteria were computer users who were working on computer for ≥ 4 hours per day on six days a week for at least six months prior to the study. Subjects with any redness of the eye at the time of the study were excluded.

The permission for conducting the study was obtained from the Institutional Research Committee and subsequently, the University Officials and Heads of the included institutions and Departments.

A modified pre-tested structured questionnaire was used to enquire about computer use, work environment and physical symptoms. It addressed the following areas –demographic variables like age and gender, amount of computer work, years of computer use, type of computer used, eye or systemic diseases, medications used, work-environment, breaks, optical correction, eye symptoms, musculoskeletal symptoms, general symptoms and ergonomics of computer work station.

The office of each institution was visited by the investigator and the purpose and the procedure of the study was explained to each participant. Once consent to participate had been given, the questionnaire was distributed and any ambiguities were clarified. The participants were asked to record scores (0=none, 1=mild, 2=moderate, 3=severe) according to the severity of ocular symptoms experienced at the end of a typical working day with computers. Symptoms enquired about included blurred vision, difficulty in refocusing, double vision, irritated or burning eyes, dryness, redness, contact lens discomfort, eyestrain, headache, eye fatigue and sensitivity to light. The questionnaire was collected one day after distribution. If questionnaires could not be collected after one day, three more attempts for collection were made.

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STATISTICAL ANALYSIS: Data was analysed and tabulated using SPSS software version 15 for Windows. Data entry was done by JGP and analysis by TJ. Descriptive statistics was used. Findings were described in terms of proportions.

Chi square test was used to find the association between self-reported ocular symptoms and age, gender, duration of computer use, eye level, and distance from the computer monitor, musculoskeletal and general symptoms. A p value < 0.05 was considered to be statistically significant.

RESULTS: A total of 500 questionnaires were distributed and 400 (80%) questionnaires were returned. Fifteen questionnaires were excluded as the participants failed to meet the inclusion criteria. So the total number of questionnaires analyzed for the study was 385.

Mean age of the study subjects was 36 ± 10.2 years. 43.6% were males and 56.4% were females. Mean duration of computer use 6.6 ± 1.3 hours. The mean distance from the computer monitor was 60 ± 15.3 centimetres. The eye level was same as the centre of the computer monitor for 66.8% of the study population.

44.9% of study subjects worked in air conditioned environment. Mean working years of the computer users were 9.34 ± 6.2 years. 107 (28.2%) used CRT displays, 252 (66.5%) used L.C.D and 18 (4.7%) used laptops for their work. 301 (78%) of them took breaks in between computer work. Only 103 (26.8%) had some form of refractive correction among which 6 (5.8%) wore contact lenses. Among the study subjects, 9 (2.3%) had diabetes, 18 (4.7%) had hypertension, 4 (1%) had history of eye surgery done among which 1 was a refractive surgery. 2 (0.5%) of them were aware of their eye disease. One of them had squint and another had optic nerve problem in one of the eyes.

Musculoskeletal symptoms and general symptoms were observed in 74% of the study population.

No statistical significance was observed between ocular symptoms and age ($\chi^2=3.12$, $p=0.57$).

Similarly, no association was found between ocular symptoms and gender ($\chi^2=3.45$, $p=0.32$).

There was no increasing trend observed in ocular symptoms with the increase in duration of computer use among study subjects ($\chi^2_{\text{trend}}=3.1$, $p=0.575$). There was no statistical significance observed (Fischer's exact test, $p=0.172$) in ocular symptoms with increase in eye level from the centre of the computer monitor in study subjects.

Association between ocular symptoms and the distance from the computer monitor was not statistically significant ($\chi^2_{\text{trend}}=0.339$, $p=0.560$) among the subjects.

Statistical significance was observed between ocular and musculoskeletal symptoms in the study population. ($\chi^2=129.82$, $p<0.0001$). There was association between ocular symptoms and general symptoms ($\chi^2=168.62$, $p<0.0001$)

DISCUSSION: Computer technology has transformed the workplace, and has introduced an array of health complaints, mostly involving visual and musculoskeletal systems.¹ Eye strain was the most commonly reported complaints among computer users.^{1-3,5,8,10,18,23,24} In our study, 76% of the study subjects reported ocular symptoms at the end of a typical working day on computer. The results obtained were consistent with the studies done by Suparna et al⁶ and Talwar et al⁷ who reported the prevalence of visual problems in IT professionals to be 76% in both the studies. The prevalence of visual problems was found to be 70.6%, 59.5%, 40% and 26% in studies conducted by National Institute of Occupational Health and Safety,¹ Kesavachandran et al⁸ and Rao et al⁹ and Broudmant et

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al¹⁰ respectively. The prevalence of ocular symptoms among computer users ranges from 25% to 93% as reported by various investigators.¹ This wide range is because of the variability in the methods of measuring symptoms, wide range of jobs under study and the differences in the availability of eye care.

Eyestrain was the most prevalent reported ocular symptom (62%) in our study, followed by eye fatigue (43%), irritating and burning eyes (39%), blurred vision (36%), dryness of eyes (27%) and redness of eyes (23%). Consistent results were obtained by other studies. (See Table 2)

Schatz et al¹⁵ observed that subjective signs of visual fatigue with on screen work were significantly more frequent in the exposed group than the control group.

No association was found between age and ocular symptoms in this study. Our study results were consistent with that of Bhandari et al⁴ and Collins et al¹⁶ where no relation was observed between subjects' age and ocular symptoms. However, Cole et al¹⁷ had found significance of age in older VDT users who used spectacles and association between sensitivity to glare and increasing age in the same group.

There was no statistical significance observed between ocular symptoms and gender in our study. Similar results were obtained in the study conducted by Broumand et al¹⁰ and Bhandari et al.⁴ However Suparna et al⁶ observed more visual problems in females compared to males. But the female to male ratio in the study was 7:3.

The results of this study are consistent with the observations made by Bhandari et al⁴, Mocci et al¹⁴ who found out that there was no correlation between ocular problems, duration of computer use per day and work at VDT. However Hanne et al⁽¹⁹⁾ Kanitkar et al²⁴, Sanchez- Roman et al²⁰ Suparna et al⁶ and Rao et al⁹ found a positive correlation between duration of computer use daily with ocular symptoms. Bhandari et al⁴ observed statistical significance between asthenopia and the level of top of computer screen from the eye level. Angle of gaze at the computer monitor was associated with ocular symptoms according to Izquierdo et al²⁷ and Bergquist et al⁽²⁸⁾ who reported increased odds ratios for eye symptoms when computer operator keeps terminal above the eye level. Our findings were not consistent with other study results. Suparna et al⁶ and Bhandari et al⁽⁴⁾ reported statistical significance between ocular symptoms and distance of the monitor from the eye which is also not consistent with our study results. This may be because of other variables that could not be controlled during the study.

Significant association was found between musculoskeletal and general symptoms with the ocular symptoms in the study population. Similar results were obtained by Talwar et al,⁷ Haynes et al,³ Palm et al²¹ and Wiholm²² who reported a significant positive association between eye strain and neck shoulder symptoms. Rocha et al²⁵ and Mocci et al.²⁶ reported an association between eye symptoms and psychological factors which supports our study findings. A possible causative effect is suggested by Sheedy et al.⁵ who reports that eye leads the body. Ocular symptoms can change the work posture of the individuals and lead to increased tension during work as time taken to complete a task might be more for them compared to someone without symptoms.

The limitation of the study was that objective assessment of symptoms and work station ergonomics could not be done as it was a questionnaire based study. The symptoms recorded by the participants may depend on their mood and personality also. Different patients may under or over-report problems, therefore we can only obtain directly comparable objective data by performing clinical tests.

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Given the high prevalence of self-reported ocular symptoms following a day using a computer, the value of prevention is clearly the most important strategy in management of computer vision syndrome. Health education to computer users, screening programmes and more ergonomically designed workstations are vital in reducing this sprouting epidemic.

The administration of questionnaire can be an effective tool in the identification of ocular symptoms among computers professionals which is the first step towards management of this emerging problem.

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Sl. No	Variable	Number	Percent
1	Age in years (n =382)*		
	20-29	126	33.0
	30-39	104	27.2
	40-49	112	29.3
	≥ 50	40	10.5
2	Gender (n = 385)*		
	Male	168	43.6
	Female	217	56.4
3	Duration of computer use in hours per day (n = 385)*		
	4.0 - 5.9	90	23.4
	6.0 – 7.9	191	49.6
	8.0 - 9.9	99	25.7
	≥ 10	5	1.3

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4	Distance from the computer monitor in centimetres (n =378)*		
	20-39	24	6.3
	40-59	105	27.8
	60-79	213	56.3
	80-99	27	7.1
	≥ 100	9	2.4
5	Level of eye from the centre the screen (n = 377)*		
	Lower	12	3.2
	Same	252	66.8
	Higher	113	30.0

Table 1: Base line characteristics of the study subjects

*the study population varies because of missing data.

Studies	Ocular Symptoms	Percentage
Dehgani et al ¹¹	Burning eyes, tearing	79
	Dry eyes	66
	Asthenopia	65
Onyekonwu et al ¹²	Asthenopia	71.6
	Tearing	27.1
	Ocular discomfort	26.6
Sanchez Roman et al ¹³	Asthenopia	68.5
Banderi et al ⁴	Asthenopia	46.3
Mocci et al ¹³	Asthenopia	31.9
Broumand et al ¹⁰	Blurred vision	5.1
	Ocular pain	41
	Lacrimation	18
	Burning and itching	15.4

Table 2: Prevalence of different ocular symptoms as reported in previous studies

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Figure 1: shows the prevalence of self-reported ocular symptoms in the study population. 76% reported ocular symptoms at the end of working day on computer

Figure 2: shows the distribution of reported ocular symptoms that were specifically investigated. Eye strain was the most prevalent ocular symptom (62%), followed by eye fatigue (43%), irritating and burning eyes (39%), blurred vision (36%), dryness (27%) and redness of eyes (23%).

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Figure 3: shows the severity of ocular symptoms in the study population. 62.4% had mild symptoms, 31.7% had moderate symptoms and 5.9% had severe symptoms.

Figure 4: shows the age group of the study population. Maximum number (24.3%) belonged to the age group 20-39 years and minimum number (7.3%) to the age group ≥ 50 years.

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