

Original Article**Prevalence of ocular symptoms and signs among professional computer users in Isfahan, Iran**

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Abstract

BACKGROUND: This study was undertaken to detect the prevalence of ocular symptoms and signs in professional video display users (VDUs) and non-users in Isfahan.

METHODS: This is a cross-sectional descriptive case-control study. The VDUs group was selected from among employees working with computer and the control group was selected from among employees not working with computer. Fifty seven VDUs (34 male & 23 female with mean age of 30.7 ± 6.8) and 56 employees in the control group (25 male & 31 female, mean age of 27.6 ± 7.2) were evaluated. Complete ocular examination was done for both groups.

RESULTS: Among VDUs, 45 cases (79%) had burning eyes and tearing, 38 cases (66%) had dry eye, 37 cases (65%) had asthenopia, and 47 cases (82.5%) had musculoskeletal pain but these values for the control group were 24 (42.8%), 18 (32.2%), 22(39.3%) and 15 (26.8%) respectively and the difference was statistically significant ($p = 0.037$, $p = 0.023$, $p = 0.044$, $p = 0.013$). Schirmer's test was positive in 22 VDUs (38.5%) vs. 6 (10.7%) of control group ($p = 0.012$). There was heterophoria in 19 VDUs (33.3%) vs. 3 controls (5.4%) ($p = 0.032$).

CONCLUSION: Eye burning and tearing, dry eye, asthenopia and musculoskeletal problems were obviously more common in VDUs. Considering the extensive use of computers at home and work, a plan is required to detect dangers and provide appropriate solutions.

KEY WORDS: Video Display Terminal, Video Display Users, Computer Vision Syndrome, Dry Eye, Schirmer test, Asthenopia.

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In the past decade, computers have turned to an integral part of modern life. It is estimated that, since 2000, about 75% of daily activities of all jobs involve computer use.¹ Because of the high volume and increasing use of computers, many studies have tried to assess its safety and a major part of these researches are allocated to the effects of computer video display terminals. In the beginning, studies were mostly focused on radiation and its hazards but gradually ophthalmic complaints due to exposure to video display terminals (VDT) became the main focus and the term "com-

puter vision syndrome" was born to refer to these complaints. Among complaints reported by video display users (VDUs) red eye, blurred vision, diplopia, burning and irritation, and asthenopia (i.e. weakness or easy fatigue of the eyes) are more common.^{2,3} These complaints can be divided into different groups including asthenopia (complaint of fatigue, pain, and pressure on eye), eye surface disorders (dry eye sensation, tearing, irritation and redness), vision disturbances (blurred vision and diplopia) and extra ocular complaints

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(musculoskeletal pain in neck, shoulder and back).¹

Increasing use of computers in Iranian administrative and social structure may cause ocular and bodily signs and symptoms. This can turn to an important general health issue for the society while the employees health problem and its consequences on financial and industrial loss are major concerns. Data extracted in this study provides some statistical information about ocular problems among a group of computer users in Isfahan province and can be a primary pattern for more extensive studies in the future as well as a preface for presenting appropriate solutions and directions to prevent and treat health problems caused by technology.

Methods

This is a cross-sectional descriptive case-control study. The target society was Bank employees because of their severe exposure to VDT and highly computer-related work load. Inclusive criterion was direct work with computers for at least 6 past months in a way that accomplishing their tasks was impossible without computers. Exclusive criteria included age above 55 years old, chronic eyes or systemic diseases, using topical eye drops, systemic drugs or contact lenses which can cause similar ocular signs. These criteria were extracted from the first check list and rechecked by a physician examining the subjects. The control group included employees with administrative jobs whose daily duties were absolutely without computer working in the same environmental condition as VDUs group. Exclusive criteria was the same for both groups. Sampling was simple method. Both groups filled a check list including questions on the time spent at a computer per day both at work and outside, the time spent watching TV per day, history of ocular disease and ocular surgery, using drugs and cosmetics, the presence and severity of ocular complaints such as burning and tearing, dry eye, diplopia, disturbances of vision at night and also muscular pain in the neck, shoulder and back. The check list completion

was supervised by a project executor who would provide explanations in the case of ambiguity. All the participants had a thorough ocular examination by an ophthalmologist who was unaware of their group.

Refraction was done by Topcon 2000 apparatus. Complete slit lamp exam to detect such problems as tear film deficiency and keratitis was done and also examination for detection of phoria, tropia and convergence insufficiency was performed. Measuring dry eye was performed by schirmer's test. A standard schirmer's paper was placed in the lower fornix for 5 minutes without any anesthetic drops. Wetness of paper was measured and recorded by millimeter and dry eye was defined by less than 10 mm wetness after 5 minutes of insertion.⁴ Tear break up time test was performed for all subjects to determine tear film deficiency and tear break up time less than 10 seconds considered as tear film deficiency.

Student t test was used to compare the two groups. Frequency data were compared using Chi Square test. A p value less than 0.05 was considered as statistically significant. Statistical analysis was performed on a computer using SPSS 11.0 software.

Results

Fifty seven VDUs (34 male and 23 female, age 30.7 ± 6.8) and 56 controls (25 male and 31 female, age 27.6 ± 7.2) were evaluated. There was no statistically significant difference between the mean ages and gender distribution between the two groups ($p = 0.63$ for age and $p = 0.53$ for gender). Table 1 shows distribution of ocular complaints frequency among VDUs and controls. The two groups were significantly different in the rate of burning and tearing, dry eye sensation, strain feeling and asthenopia on working and also musculoskeletal complaints, but proportions of diplopia and difficult night vision were not significantly different between the two groups. Proportions of dry eyes and tear film disorders, using Schirmer's test together with tear break up

Table 1. Frequency distribution of ocular complaints among users and control group.

		Having difficulty most of the time n (%)	Having difficulty occasionally n (%)	No difficulty n (%)	p-value
Burning and tearing	VDU	10(17.5)	35(61.5)	12(21)	0.037
	Control	5(8.9)	19(33.9)	32(57.2)	
Dry eye sensation	VDU	15(26.3)	23(40.3)	19(33.4)	0.023
	Control	7(12.5)	11(19.7)	38(67.8)	
Diplopia	VDU	4(7.1)	10(17.5)	43(75.4)	0.84
	Control	4(7.1)	5(8.9)	47(84)	
Night vision difficulty or difficult driving at night	VDU	5(8.7)	10(17.5)	42(73.6)	0.62
	Control	12(21.4)	8(14.2)	37(66)	
Eye strain and asthenopia	VDU	15(26.4)	22(38.6)	20(35)	0.044
	Control	8(14.3)	14(25)	34(60.7)	
Muscular pain or spasm in neck, shoulder and back	VDU	18(31.6)	29(50.9)	10(17.5)	0.013
	Control	5(8.9)	10(17.9)	41(73.2)	

time are summarized in table 2. Punctate corneal epithelial erosion existed in 18 (11.1%) VDUs whereas no one in the control group had this problem and Exact Fisher test showed a significant difference ($p = 0.032$). There was not any case of corneal thinning, vascularization, and marginal infiltration in the two groups.

Relative frequency of refractive errors studied showed that despite higher frequency of myopia and hyperopia in VDUs, there was no

significant difference between the two groups ($p = 0.09$). Table 3 shows the relative frequency of refractive errors in the VDUs and control group. The two groups were significantly different with respect to heterophoria ($p = 0.032$) but their difference in tropia and convergence insufficiency were not significant ($p = 0.146$ and $p = 0.783$ respectively). Table 4 compares relative frequency of heterophoria, tropia and convergence insufficiency of the two groups.

Table 2. Schirmer's test and tear break up time in video display users and control group.

	TBUT		Schirmer's test	
	Tear film deficiency n (%)	Normal n (%)	Absence of dry eye n (%)	Dry eye n (%)
VDU group	25(43.8%)	32(56.2%)	35(61.5%)	22(38.5%)
Control group	5(8.9%)	56(91.1%)	50(89.35%)	6(10.7%)
P	0.041		0.012	

Table 3. Relative frequency of refractive errors in VDUs and control group.

	Hyperopia n (%)	Myopia n (%)	Emmetropia n (%)
VDUs	7(12.3)	31(57.4)	19(33.3)
Control group	3(5.3)	21(37.6)	32(55.1)

Table 4. comparison between relative frequency of heterophoria, tropia and convergence insufficiency in users and control group.

	Heterophoria n (%)		Tropia n (%)		Convergence Insufficiency n (%)	
	Yes	NO	Yes	No	Yes	NO
VDUs	19(33.3)	38(66.7)	10(17.5)	47(82.4)	17(29.8)	40(70.1)
control group	3(5.4)	53(94.6)	6(10.6)	51(89.4)	10(17.8)	46(82.2)

Discussion

Computer and video display terminal usage have caused major changes in professional habitual manners of millions of people. Although computer causes no unique organic ocular disease by itself, users' complaints of such problems as asthenopia, burning, dry eye etc. are very common. In one study, 10-15% of patients visited for routine ocular examination suffered from headache and asthenopia when using a computer.² In addition to ocular problems such as accommodative and refractive problems in far and near distances, working environmental conditions such as luminosity of milieu, video display terminal quality, and also detailed statements such as chair comfort have roles in diminishing or establishment of signs and symptoms.⁵ As seen in table 1 about 82.5% of users occasionally or often complain from musculoskeletal pains at work which seems to be a very high value. In Faucet et al study about 52% of users complained of musculoskeletal pains.⁶ It seem that in manufacturing and using administrative equipments, little attention is paid to body and skeletal system safety and most people have no information about correct use of these equipments and it is proper to plan a comprehensive study in this field. In our study, about 79% of VDUs complained of burning and tearing and about 66 % complained of dry eye. Also, burning and feeling of heaviness in eyes were frequent complaints of users. Complaint of tearing means that there is an effort to establish chemical balance, lubricate and moisturize the anterior surface of the eyes.⁵

In Apostol et al study, computer use is one of the reasons for dry eye sensation.⁷ In Biswas et al study in 2003 the rate of dry eye sen-

sation was 68.5% in users and 47.7% in control group, which is close to our findings.⁸ The result of schirmer's test was positive in about %40 of users and the tear break up time more than 10 seconds was almost the same percentage among users, which was significantly more than control group. Other studies found the same results. For example, in Nakaishi et al study quantitative criteria of dry eye was seen in more than 30% of computer users.⁹ This problem is explained as a cause of close distance work with monitors that makes users concentrate on video display terminal and the speed of blinking decreases and eyes exposure to free air increases. Moreover, the video display terminal is usually located upper than users' watching level, which makes palpebral fissure more open and as a result dries the eyes¹. Therefore it is recommended that the location of middle point of video display terminal should be 5-6 inches below the straight line of users vision, which decreases not only dry eye, but also degrees of spasm and pain in neck muscles.^{10, 11}

Another important complaint that 65% of VDUs in this study suffered from was asthenopic symptoms such as tiring and strain on eyes. In evaluation of these patients usually uncorrected refractive errors, accommodative disorders and occult deviations are found.¹² In our study, the prevalence of heterophoria was significantly higher in users (Table 4) but in the refractive errors and convergence insufficiency there was no significant difference between the two groups. In Gur et al study in 1997, fusional convergence, heterophoria, convergence insufficiency and refractive errors had more prevalence among users compared to the control group, which explained eye exhaustion accord-

ing to Gur's belief.¹² However, more recent studies such as Futima et al in 2002 suggest that long time work with monitor causes no changes in visual functions such as accommodation, convergence, stereopsis and visual acuity for near and far distances and that reported changes in previous studies were mostly due to tiring work at near distance rather than direct effect of video display terminal.¹³ Iribaren et al in their study found similar results.¹⁴ About relation between myopia and the use of VDTs, although some investigators reported temporary myopia among the users,¹⁵ it

doesn't seem that using monitor is an independent risk factor for myopia.^{1,16}

Let it not remain unsaid that computer use safety is a new wide area for researchers. This study for the first time in Isfahan province estimated the ocular signs and symptoms in a large society of computer users. Further studies are necessary to find the detailed statements and effective factors in this issue of health concern. It is better if studies follow computer users in longer period. Also, more investigations and studies should target prevention and treatments of ocular disorders caused by using computers.

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