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Determining the frequency of dry eye in computer users and comparing with control group

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计算机用户中干眼的发生情况

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摘要

目的:明确计算机用户中干眼的发生情况,并将其与非使用者进行比较。

方法:这是一项病例对照研究,于 2015 年在 Birjand 进行。研究的样本量确定为 304 例(计算机用户组和对照组每组 152 例)。两组都使用非随机抽样方法。泪液分泌试验用于评价研究对象的干眼情况。研究对象填写问卷,所用问卷通过回顾文献基于客观情况发展来。使用 SPSS 进行卡方检验和 Fisher 检验,显著性水平为 0.05。

结果:干眼发生率:对照组为 3.3%(5 例),计算机用户组为 61.8%(94 例)。两组差异具有统计学意义(P<0.01)。眼部不适症状发生率:对照组为 7.9%(12 例),计算机用户组为 34.2%(52 例),两组之间的差异具有统计学意义(P<0.01)。计算机用户组,不同性别、不同年龄之间干眼发生率无统计学差异(P=0.8)。干眼患者平均每天使用计算机时间为 6.65±3.52h,对照组为 1.62±2.54 h(T=13.25, P<0.001)。

结论:这一研究显示了使用计算机和干眼、眼部症状发生具有显著相关性。因此,管理人员需要对员工使用计算机工作的时间予以特别的关注。

关键词:干眼;计算机用户;生理影响

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Abstract

• AIM: To determine the frequency of dry eye in computer users and to compare them with control group.

• METHODS: This study was a case control research conducted in 2015 in the city of Birjand. Sample size of study was estimated to be 304 subjects (152 subjects in each group, computer user group and control group). Non-randomized method of sampling was used in both groups. Schirmer test was used to evaluate dry eye of subjects. Then, subjects completed questionnaire. This questionnaire was developed based on objectives and reviewing the literature. After collecting the data, they were entered to SPSS Software and they were analyzed using Chi-square test or Fisher's test at the alpha level of 0.05.

• RESULTS: In total, 304 subjects (152 subjects in each group) were included in the study. Frequency of dry eyes in the control group was 3.3% (5 subjects) and it was 61.8% in computer users group (94 subjects). Significant difference was observed between two groups in this regard (P<0.001). The frequency of eye symptoms in the control group was 7.9% (n=12), and it was 34.2% in computer users group (n=52), which significant difference was observed between two groups in this regard (P<0.001). Frequency of dry eye syndrome in computer users by gender and age groups showed no significant correlation in this regard (P=0.8). The mean working hour with computer per day in patients with dry eye was 6.65±3.52h, while it was 1.62±2.54h in healthy group (T=13.25, P<0.001).

• CONCLUSION: This study showed a significant relationship between using computer and dry eye and ocular symptoms. Thus, it is necessary that officials need to pay particular attention to working hours with computer by employees. They should also develop appropriate plans to divide the working hours with computer among computer users. However, due to various confounding factors, it is recommended that these factors to be controlled in future studies.

• KEYWORDS: dry eye; computer users; physical effects
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INTRODUCTION

The increasing use of computers in the last decade has become an integral part of modern life. It is estimated that more than 75% of the daily activities of all jobs need to use the computer since 2000[1]. Due to the increasing use of computer, major part of studies initially focused on the radiation effects of screens, but due to eye problems resulting from using computer, studied were extended to this area gradually.

The eye complaints can be classified in several groups: 1) asthenopia (fatigue and pain in or around the eyes, blurred vision, headache, and occasional double vision.); 2) eye surface disorders (feeling dry eye-tearing-irritation and redness of the eye); 3) vision disturbances (blurred vision-double vision) and 4) extra ocular complaints (muscle pains in the neck-shoulder-back).

In this regard, red eye, blurred vision, double vision, and eye irritation are more common[1-2]. Nowadays, in medical papers around the world, eye problems resulting from the use of computers are known as computer vision syndrome (CVS)[3].

Department of American Occupational Safety and Health defines computer vision syndrome as a "series of ocular and visual problems that are created by using a computer and these problems are iterative and progressive". One study found that about 90% of the 70 million computer users in America work with computer more than 3h a day so that they have symptoms of CVS[4].

One of the major problems occurring after the use of computer is dry eye. Dry eye refers to reduced quantity or quality of tear. The National Eye Institute has defined it as "a disorder of the tear film, resulting in reduced tear or increased tear evaporation, which causes damage to inside-eyelash surface of eyes, followed by eye injuries[5]. The dry eye can result from many different causes, such as pollution, smoking and drugs, low humidity and high temperature, sunlight, computer and TV screens, *etc.*[6]. The increasing use of computers in administrative and social structure of Iran has led to the growing prevalence of CVS. Health damages, reduced efficiency of employees and subsequently financial losses to the economy of country are only a small part of these problems[7].

The findings of this study provide a basic model for better use of computer. Along with other studies, it can also provide appropriate solutions and guidelines for prevention and treatment of health and social problems created by this technology. The area where the study was conducted has so dry weather and placed near desert with long sunshine and dry weather which led to easy evaporation of tears. Since UV radiation plays an important role in appearance of dry eye problem. Therefore, the aim of this study was to determine the amount of dry eye among computer users and to compare them with the control group in Birjand city, east of Iran.

METHOD

This control case study was conducted on computer users who have used computer daily more than 6mo. The inclusion criteria of study included being at least 18 years old and 55 years old at most and non-existence of any external eye disease as well as consent of subjects to participate in the study. In the control group, people who have used computer less than 6mo daily were included in the study if they met the criteria of inclusion criteria of being at least 18 years old and 55 years old at most, non-existence of any external eye disease, and consent of subjects to participate in the study. Exclusion criteria of study included a history of previous disease or surgery on the eye, users with a history of using eye drops and medications, users with a history of using contact lens, users with a history of smoking and users under the age of 18 years and more than 55 years.

According to a study conducted by Dehghani *et al*[7] in Isfahan, sample size of study was determined using the following formula:

$$n=\frac{(z_{1-\frac{\alpha}{2}}\sqrt{2p(1-p)}+z(1-\beta)\sqrt{p_1(1-p_1)+p_2(1-p_2)})^2}{(p_1-p_2)^2}$$

Considering $z_{(1-\alpha/2)}=1.96$, $z_{(1-\beta)}=0.84$, P1 (percentage of dry eye in the computer user group) = 23%, and P2 (percentage of dry eyes in the control group) = 11%, sample size was determined to be 304 (152 subjects for each group). In case control group, non-randomized (convenient) sampling method was used. Employers who are working in university and bank as well as non-employed people who are using computer for their personal and administrative tasks were selected as sample of study, if they met the inclusion criteria. In the control group, sample was selected among bank and university employees as well as non-employed people who do not use computer by using non-randomized (convenient) method, if they met the inclusion criteria of study.

Ethical standards were observed in this study. One of the ethical considerations of this study included observing the patients' rights. Accordingly, after passing this project in Research Committee of the Faculty of Medicine, the protocol was sent to Research Council of university to be approved. After obtaining oral and tacit consent of the subjects to participant in the study, written informed consent was obtained from the subjects. All processes of sampling were performed in sterile conditions by observing all safety precautions by an experienced person. Schirmer test was used in this regard. Schirmer paper was placed in lower fornix for 5min without applying eye drops. After removing it, the moisture content of the paper was measured in millimeters. Dry eye refers to moisture content of the paper less than 10 mm after 5min. Tear film break up time (TBUT) test will be used to determine the tear film defects. In TBUT, fluorescein dye is used in eye. The user does not blink and tear film can be seen by Slit Lamp. If its green color turns to blue in less than 10s, it is concluded that tear film has defect.

Table 1 Demographic characteristics in computer users and control group %(*n*)

Parameters	Computer users	Control group	Sum	χ^2	*P*
Gender					
M	39.5(60)	36.8(56)	38.2(116)	0.223	0.7
F	60.5(92)	63.2(96)	61.8(188)		
Age					
≤25y	25.7(39)	21.1(32)	23.4(71)	4.15	0.5
26-35y	53.9(82)	67.8(103)	60.9(185)		
≥36y	20.4(31)	11.2(17)	15.8(48)		
Living place					
Village	11.2(17)	13.2(20)	12.2(37)	0.277	0.7
City	88.8(135)	86.8(132)	87.8(267)		
Occupation					
Employed	64.5(98)	51.4(78)	57.9(176)	3.2	0.3
Non-employed	35.5(54)	48.6(74)	42.1(128)		

Then, subject completed the questionnaire. The questionnaire was developed based on objectives and review of the literature. It included demographic information such name (optional), mobile phone number (optional), age, occupation, gender (male/female), living place (city/village), glassed or not, previous disease (Yes/No), history of previous symptoms in eye (double vision, blurred vision, etc), and the history of previous medical disease (Yes/No). It also included the questions of how many hours do you watch TV in average (h), how many hours do you work with your computer in average (h), and Schirmer test result (if the patient has dry eyes). After collecting the data, they were entered to SPSS Software and they were analyzed using Chi-square or Fisher tests. *P*-values less than or equal to 0.05 was considered significant.

RESULTS

In total, 304 patients (152 per group) were included in the study. Mean age was 30.2±7.15y in the users group, and it was 29.61±5.00y in control group ($t=0.846$ and $P=0.4$). Table 1 compares the demographic characteristics of subjects of two groups. Frequency of dry eyes in the control group was 3.3% (5 subjects) and it was 61.8% in computer users group (94 subjects), which significant difference was observed between two groups in this regard ($P<0.001$). The frequency of eye symptoms in the control group was 7.9% ($n=12$), and it was 34.2% in computer users group ($n=52$), which significant difference was observed between two groups in this regard ($P<0.001$) (Table 2). Frequency of dry eye syndrome in computer users group in terms of age showed that there is no significant relationship in this regard ($P=0.1$) (Table 3). Frequency of dry eye syndrome in computer users group in terms of gender showed that there is no significant relationship in this regard ($P=0.8$) (Table 4).

The mean working hours with computer per day among people dry eye was 6.65±3.52h, and it was 1.62±2.45h in healthy people ($t=13.25$, $P<0.001$) (Table 5).

DISCUSSION

This study was conducted to determine the frequency of dry eye on computer users and control groups. Frequency distribution of gender, age, place of living was not significantly different in computer users and control groups. Frequency of dry eye in the control and computer users groups as well as frequency of eye symptoms in these groups showed significant difference, and these cases were significantly high in computer users group.

These results are in line with results of study conducted by in New York City in which most of participants complained eye dry following 3h of computer use, since both studies indicated that dry eye is positively correlated with using computer.

In addition, in line with the results of this study, it was found that by increasing use of computer, ocular complaints such as feeling the external object, and/or blurred vision increase[8]. In a study published in 2005, results revealed that most of users suffered from eyestrain, headache, irritation and dry eyes, tearing, and redness of the eyes[9]. In a study conducted in the Iran and published in 2008, symptoms such as burning and tearing, dry eyes, double vision, impaired night vision, impaired vision during driving, eyestrain, and asthenopia were also reported higher in computer users group compared to control group[7]. In line with results of this study, other study showed that operators working in computer units had complaints such as eyestrain, increased intraocular pressure, and eye itching, irritation and dryness. Ocular problems in users who used computer more than 6h were more evident. In this regard, it was comparable with results of this study in which subjects with dry eye used computer 6h daily in average[10].

The results of similar studies conducted abroad and Iran also indicate significantly higher prevalence of dry eye among computer users[7,11-12]. In a study published in 2012, eye dryness and associated symptoms were significantly higher among computer users[13]. Case control study conducted in 1999 showed that eye dryness was highly correlated with using computer (compared with refractive errors)[14]. In line with this study, a qualitative study conducted on computer users by using Schirmer test showed that significant coordination between TBUT and Ocular Surface Disease Index(OSDI) and

Table 2 Distribution of dry eye (based on Schirmer test) in computer users and control group %(n)

Parameters	Computer users	Control group	Sum	χ^2	P
Eye dryness					
Yes	61.8(94)	3.3(5)	32.6(99)	118	0.001
No	38.2(58)	96.7(147)	67.4(205)		
Sum of symptoms					
Yes	34.2(52)	7.9(12)	21.1(64)	31	0.001
No	65.8(100)	92.1(140)	78.9(240)		
Tearing					
Yes	89.4(42)	10.6(5)	15.4(47)	34	0.001
No	42.8(110)	57.2(147)	84.6(257)		
Redness					
Yes	87.8(36)	12.2(5)	13.4(41)	27	0.001
No	44.1(100)	55.9(140)	86.6(263)		
Eye pain					
Yes	93.9(31)	6.1(2)	10.8(33)	28	0.001
No	44.6(121)	55.4(150)	89.2(271)		
Blurred vision					
Yes	90.3(28)	90.7(3)	10.1(31)	22	0.001
No	45.4(124)	54.6(149)	89.8(273)		
Double vision					
Yes	82.4(14)	17.6(3)	5.5(17)	7	0.006
No	48.1(138)	61.9(149)	94.5(287)		
Dry eye					
Yes	96.9(31)	3.1(1)	10.5(32)	31	0.001
No	44.5(121)	55.5(151)	89.5(272)		
Muscle pain					
Yes	96.9(31)	3.1(1)	10.5(32)	31	0.001
No	44.5(121)	55.5(151)	89.5(272)		

Table 3 Distribution of dry eye in computer users in terms of age groups %(n)

Dry eye	Under 25 years old	26–35 years old	Over 36 years old	Sum	χ^2	P
Yes	56.4(22)	61.0(50)	71.0(22)	61.8(94)	4.6	0.1
No	43.6(17)	39.0(32)	29.0(9)	38.2(58)		

lack of coordination between Schirmer and OSDI scores, resulting from eye dryness[15]. In addition, the results of this study showed that dry eye is common problem in computer users and its results are easily approved by TBUT test and OSDI questionnaire. Some of the most important causes of dry eye in computer users is computer screen brightness and impaired blinking during computer work with ocular problems[16]. In addition, factors such as distance form screen are also involved in this regard[9].

This study showed significant correlation between the use of the computer and eye dryness as well as other ocular symptoms. Therefore, it seems obvious that the officials would have to pay special attention to the working hours with the computer by their employees and to divide working hours with computer appropriately by proper planning. It is recommended that patients with artificial tear to be used during or after long-term use of computer since it would have a significant role in reducing ocular injuries. Additionally, providing trainings such as distance from screen, using screen saver, adjusting its brightness rate, and using LED screens are protecting factors against ocular injuries, which can play role in reducing these complaints.

Table 4 Distribution of dry eye in computer users in terms of gender %(n)

Dry eye	Male	Female	Sum	χ^2	P
Yes	60(36)	63(58)	61.8(94)	0.020	0.8
No	40(24)	37(34)	38.2(58)		

Table 5 Distribution of working hours with computer control and computer users groups

Group hour	Computer users	Control group	Sum	χ^2	P
1 to 3	22.4(34)	100(152)	61.2(186)	192	0.001
4 to 6	38.8(59)	0(0)	19.4(59)		
Over 7	38.8(59)	0(0)	19.4(59)		

Considering the great impact of using computer on eye dryness and causing ocular symptoms, it is recommended that educational programs to be developed for this group of users in the form of written pamphlets or videos and the effect of this process to be evaluated. On the other hand, considering excessive use of electronic tools, especially computer and

laptop, among lower age groups and schools, it is recommended that similar study to be conducted in this age group. Additionally, due to weather impact in creation of eye dryness, it is recommended that further studies to be conducted in geographically different populations.

Factors such as high age, female gender, smoking, intense heat or cold weather, low moisture, using tools such as TV, refractive surgeries of eye, using lens and other drugs have been also considered as risk factors involved in dry eye. In this study, researcher tried to match two groups in terms of some cases, while some factors such as weather of the area might be independently effective in dry eye.

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