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EYE FATIGUE IN VIDEO DISPLAY TERMINAL USERS AND ITS RELATION TO SLEEP DISORDERS

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SUMMARY: Visual display terminal (VDT) work has become a major part of operation in majority of workplace. This study aimed to eye fatigue in video display terminal users and its relation to sleep disorders. This cross-sectional study was done on 209 computer users who work more than one year in this field. All participants completed a questionnaire about their age, sex, BMI, years of experience, and hours of daily computer use. A standardized visual fatigue questionnaire was used for detection presence and severity of eye strain. Sleep quality was used to assess Pittsburg Sleep Quality Questionnaire (PSQI), and the Epworth Sleepiness Questionnaire (ESS) to assess daytime sleepiness in participants. Insomnia was assessed by Insomnia Severity Index (ISI). The most common eye symptoms including eye fatigue (65.5%), eyelid heaviness sensation (69.4%), eye irritation (67.2%), dry eye (67.8%), blurred vision (68.5%), and tearing (68.1%) were significantly higher in participants who were working more than 8 hours with DVT in day. There was a significant correlation between scores of eye fatigue and insomnia severity (Rho=0.32, P<0.05). According to results, the prevalence of eye symptoms particularly eyelid heaviness sensation and blurred vision was high. However, eye fatigue was more affected insomnia severity in VDT users. Therefore, it is needed to protect computer users from the adverse effects of VDT. Implementing proper ergonomic programs to the workplace are important for achievement to good physical and mental health among VDT users.

Key words: *eye fatigue, VDT users, sleep disorders*

INTRODUCTION

The modern industrial life has brought great achievement for communities, but in many ways also had a wide range of side effects on human health. One of the most important effects of industrial life is that people are exposed to high level of stress in their personal and social life *(Ninaus et al., 2015, Petrie et al., 2011)*.

Over the last decades, a major lifestyle change has occurred due to the incorporation of digital media device use into daily life. Previous studies have demonstrated that conventional electronic devices such as televisions and computers negatively impact sleep *(Cain et al., 2010, Hale et al., 2015)*. There was a strong association between media device use and poor sleep quality and excessive daytime sleepiness *(Carter et al., 2016)*. Increased use of media led to shorter sleep time and more sleep disturbances *(Cain et al., 2010)*.

One of the problems can be stressful for employees in the working environment is long term work with the visual display terminals (VDTs) *(Cole, 2013)*. More than twenty years have passed since the presence of computers in people's

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lives, and today has become an integral part of life. More than a third of all jobs use VDTs on a daily basis. Accordingly, the number of computer users in 2013 was estimated to be approximately one billion worldwide *(Ninaus et al., 2015, Ye et al., 2007, Nakazawa et al., 2002)*.

Due to the widespread use of computers, many studies have been done to determine the safety and health guidelines for computer users. An important part of these studies assessed adverse health effects of computer monitors' radiation *(Ninaus et al., 2015, Ye et al., 2007, Nakazawa et al., 2002, Molina-Torres et al., 2016)*.

According to studies, a large percentage of computer users have complained of eye-related discomforts and visual symptoms. Eye strain is the most common vision problems including accommodative disorders, eye dryness, and eye tiredness. Also, the feeling of eye irritation, loss of visual acuity and accuracy are other common side effects in VDTs users *(Rosenfield, 2011, Blehm et al., 2005, Courtin et al., 2016)*.

Some studies have been conducted in this field have reported that eye problems are the most common complaints among VDT users *(Neeraj et al., 2014, Yan et al., 2008)*. In another study of Dehghani that was conducted on the bank's employees, more than half of them complained from eye fatigue *(Dehghani et al., 2008)*. In a survey on 105 VDT users in Yazd university, the prevalence of eye fatigue, eye irritation, eye redness, and tearing were 79%, 33%, 30%, and 7.5%, respectively *(Manaviat et al., 2011)*.

Also, previous studies showed that eye disorders such as eye fatigue and dry eye can be associated with health and mental problems including mood disorders. A study conducted in Turkey found significant association between dry eye disease and presence of stress *(Yilmaz et al., 2015)*.

Other adverse health effects of VDT users are poor quality of sleep and insomnia that has been mentioned in recent studies *(Nakazawa et al., 2002, Ye et al., 2007)*. In another study conducted by Labbafinejad and his colleagues, three hundred and sixty-two clerks of national statistics were assessed in terms of association between duration of their daily performance with VDT and sleep disorders. Their results showed that there were more symptoms of insomnia in the subjects with increasing the hours of working with computer so that computer working longer than 6 hours per days was associated significantly with sleep disturbances and daytime sleepiness *(Labbafinejad et al., 2010)*.

This study aimed to investigate the prevalence of eye fatigue symptoms in VDT users of Qazvin University of medical sciences. Also, we assessed association between eye fatigue symptoms with sleep disorders.

METHODOLOGY

Participants

This cross-sectional study was conducted on computer users employed in Qazvin University of medical sciences. Ethical approval was obtained from the Research Ethics Committee of the university. Users were enrolled had worked at least one year in Qazvin university and usually work six hours per day with the computer.

People who used the computer in the afternoon and night or were employed at a second job were excluded. Moreover, those who had a history of eye injuries or were treated for eye disease were excluded from the study. An active drug use, and history of sleep disorders, chronic musculoskeletal pain, and depression were additional exclusion criteria. All exclusion criteria were controlled by an educated general practitioner. Participants were assured that were enrolled in the study with the personal decision and their personal information will be safe and secure. All participants signed written informed consent for study enrollment.

Measures and Procedure

Participants in the study were divided into two groups based on the number of hours working with VDTs: less than 8 hours (group 1) and equal or more than 8 hours with VDT per day (group 2).

The questionnaire used in this study consisted of three parts. The first part included questions about demographic and occupational characteristics of participants. This information included

age, sex, height, weight, marital status, educational level, years of work experiences, hours of using computer during the day, and a history of refractive eye disorders.

Visual fatigue questionnaire

In the second part of the questionnaire, visual fatigue questionnaire was used. This questionnaire includes 15 questions that will assess visual fatigue in four domains. All items of questionnaire are listed in table 2. The first domains with the name of eye strain consists of four questions (items 1, 3, 5, 12). The second to fourth domains with the names of impaired vision, impaired eye surface, and out-eyes problems consist 5 (items 8, 9, 13, 14, 15), 3 (2, 4, 6), and 3 questions (7, 10, 11), respectively. Participants using 10-point Likert scale from zero to ten for responding to the questionnaire. According the questionnaire's instruction, higher scores indicate more eye fatigue and lower scores indicate lower eye fatigue *(Rajabi et al., 2014)*. In a study by Rajabi-Vardanjani et al. *(2014)* in Iran, this questionnaire had good validity and the reliability co efficiency were equal to 0.75.

Epworth Sleepiness Questionnaire (ESS)

The next questions include the Epworth Sleepiness Questionnaire (ESS) to assess daytime sleepiness in participants. This questionnaire consists of eight questions and measure individual sleepiness in different situations such as driving and watching TV. Score of each question will be between zero and three point, and total questionnaire scores greater than 10 indicates excessive daytime sleepiness *(Sadeghniiat et al., 2014)*. In study by Sadeghniiat et al *(2014)*, it has acceptable validity and reliability.

Insomnia Severity Questionnaire (ISI)

The Insomnia Severity Questionnaire (ISI) was used to assess severity of insomnia in respondents. This questionnaire using seven questions to detect the type and severity of insomnia and its effects on daily performance of respondents *(Yazdi et al., 2012)*. All items are rated on a 5-point Likert scale ranging from zero (no problem) to 4 (very severe problem). All responses are summed up to obtain a total score ranging from (0-28) with 5 subscores: 0-7 (absence of insomnia), 8-14 (sub-threshold insomnia), 15-21 (moderate insomnia), and 22-28 (severe insomnia). The ISI has been translated into several languages including Persian. In a study by Yazdi et al *(2012)*, the internal consistency demonstrated by Cronbach's alpha coefficient was reported as 0.87.

Pittsburg Sleep Quality Questionnaire (PSQI)

Participants' sleep quality was assessed using Pittsburg Sleep Quality Questionnaire (PSQI) *(Farrahi et al., 2009)*. The PSQI questionnaire was used to survey the sleep quality of the previous month of the participants. It is a 19-item self-report questionnaire. These 19 items assess seven components: Subjective Sleep Quality (SSQ), Sleep Latency (SL), Sleep Duration (SDu), Habitual Sleep Efficiency (HSE), Sleep Disturbances (SD), Use of Sleeping Medication (USM), and Daytime Dysfunction (DD). Each component is rated on a 0-3 scale, where 0 and 3 indicate no difficulty and severe difficulty, respectively. The scores of seven components are then summed up to yield a total score which has a range of 0-21; A score above six, indicates a poor sleep quality *(Buysse et al., 1989)*. Validity and reliability of this questionnaire have been investigated in Iran Cronbach-alpha of 0.83 *(Ahmadi et al., 2010)*.

Statistical analysis

Data from the questionnaires were analyzed by SPSS software version 19. Descriptive and analytical statistical methods were used to analyze the data. P-value less than 0.05 was considered statistically significant.

RESULTS

A total of 209 VDT users participated in this study, and the majority of participants were female (180 of the participants, 86.1%). Mean age of participants was 31.6±7.03 years, ranging between 22 to 54 years. Mean BMI of participants was 23.1±3.3. Mean years of work experiences for VDT using of participants was 6.2±8.1, ranging between 1 to 25 years. Mean hours of

working with computer per day in the participants was 8±1.93, ranging between 4 to 14 hours.

Participants were divided into two groups based on hours of working with computer less than and more than 8 hours. Accordingly, 97 (46.4%) participants were working less than 8 hours and 112 (53.6%) participants were working equal or more than 8 hours with the computer per day.

Table 1 shows and compares demographic data and information about sleep habits between the two groups of participants with less and more than 8 hours of computer working per day.

Table 1. Comparison demographic data and information about sleep habits between the two groups

Tablica 1. Usporedni demografski podatci i informacije o navikama spavanja između dvije skupine

	VDT user			P-value
Subscales	**Less than 8 hours N=97**	**Equal or more than 8 hours N=112**	**Total 209=N**	
Age	31.4±7.06	31.8±7.03	31.6±7.04	0.651
Gender male Female	9 (4.3%) 88 (42.1%)	20 (9.6%) 92 (44%)	29 (13.9%) 180 (86.1%)	0.741
Years of experiences	7.9±6.5	8.3±6.05	8.1±3.05	0.712
BMI	23.3±3.1	23.03±3.4	23.3±2.5	0.592
Marital status single Married	34 (16.3%) 62 (29.8%)	36 (17.3%) 76 (36.5%)	70 (33.5%) 138 (66%)	0.612
Smoking yes No	22 (22.7%) 75 (77.3%)	35 (31.2%) 77 (68.7%)	57 (27.3%) 152 (72.7%)	0.034
Total hours of sleep during night	7.3±1.3	6.8±1.4	7.05±1.3	0.042
Hours tend to sleep at night	8.1±1.5	8.5±1.1	8.3±1.03	0.062
Delay to sleep at night	19.06±16.3	23.5±17.6	21.3±16.9	0.581
Hour of awakening in the morning	7.3±1.4	7.5±1.4	7.4±1.4	0.532
Number of awakening during night	1.2±1.3	1.4±1.4	1.3±1.3	0.413
Total time of awakening at night	13.7±22.7	19.6±23.8	16.6±23.2	0.681
Sleep quality during past month good Poor	52 (24.9%) 45 (21.5%)	40 (19.1%) 72 (34.4%)	92 (44.1%) 117 (55.9%)	0.009

Table 2 compares information about eye fatigue questionnaire between two groups. As the table shows frequency of eye discomfort symptoms in the group with computer working more than 8 hours is significantly higher than group with computer working less than 8 hours per day.

Table 2. Comparison the individual items of eye fatigue questionnaire between two groups

Tablica 2. Usporedba pojedinačnih stavki upitnika o umoru očiju između dvije skupine

		VDT user		Chis-statistic	P-value
	Subscales	Less than 8 hours per day N=97	Equal or more than 8 hours per day N=112		
1	Feeling of the pressure around the eyes Frequency Severity of symptom	40 (30.5%) 1.02±1.8	91 (69.5%) 3.7±3.1	35.6	<0.001
2	Feeing of the dry eye and need to rubbing the eyes Frequency Severity of symptom	39 (32.2%) 1.1±1.9	82 (67.8%) 3.3±3.03	23.2	<0.001
3	Feeling of tiredness in the eyes (eye fatigue) Frequency Severity of symptom	53 (34.6%) 1.6±2.2	100 (65.4%) 4.4±2.8	31.8	<0.001
4	Eye irritation Frequency Severity of symptom	42 (32.8%) 1.3±1.9	86 (67.2%) 2.9±2.5	24.5	<0.001
5	Feeling of heaviness of the eyelids Frequency Severity of symptom	37 (30.6%) 1.03±1.7	84 (69.4%) 3.06±2.9	28.9	<0.001
6	Tearing of the eyes during work Frequency Severity of symptom	36 (31.9%) 0.8±1.4	77 (68.1%) 2.2±2.4	26.8	<0.001
7	Dizziness during work Frequency Severity of symptom	58 (36.3%) 2.2±2.4	102 (63.8%) 4.8±2.8	28.3	<0.001
8	Blurred vision Frequency Severity of symptom	29 (31.5%) 0.8±1.8	63 (68.5%) 1.5±2.1	14.6	<0.001
9	Double vision during work Frequency Severity of symptom	53 (34.6%) 1.9±2.7	100 (65.4%) 4.8±3.1	31.8	<0.001
10	Headache during work Frequency Severity of symptom	28 (27.2%) 0.8±1.9	75 (72.8%) 2.3±2.5	61.2	<0.001
11	Feeling sleepy during work Frequency Severity of symptom	52 (37.4%) 1.4±1.9	87 (62.6%) 3.6±2.9	13.5	<0.001
12	Eye pain Frequency Severity of symptom	55 (36.9%) 1.8±2.3	94 (63.1%) 3.7±3.1	12.4	<0.001
13	Inability to clearly see the near objects Frequency Severity of symptom	55 (39.3%) 2.1±2.4	85 (60.7%) 4.2±3.05	15.8	0.003
14	Inability to clearly see the far objects Frequency Severity of symptom	54 (41.9%) 1.1±1.6	75 (58.1%) 1.6±2.1	2.8	0.094
15	Inability to see words and rows Frequency Severity of symptom	37 (40.2%) 1.3±1.4	55 (59.8%) 1.9±1.7	2.5	0.12

The mean of eye fatigue questionnaire was 2.27±0.79 totally. The mean of it in subjects who were working with computer less than 8h was 1.35±0.47, and in those with more than 8h was 3.2±1.1.

The mean of Insomnia severity index (ISI) was 9.8±4.3. Of the participants, 74 (35.4%) subjects had no clinically significant insomnia. A total of 98 (46.9%) and 37 (17.7%) subjects had suffered from sub threshold insomnia and clinical insomnia, respectively.

The mean of daytime sleepiness (ESS) was 8.9±3.8, so that 139 subjects (66.5%) had not daytime sleepiness and 70 (33.5%) cases complaint from daytime sleepiness.

Based on PSQI score, about 68% of participant (142 cases) had poor sleep quality (score above six). Majority of them were working equal or more than 8 hours with the computer per day (66%, 74 cases of 112 cases).

Table 3 shows correlation between results from eye fatigue questionnaire with age and BMI of participants. Also, shows correlation between eye fatigue with insomnia, daytime sleepiness and sleep quality of participants.

Table 3. Correlation between eye fatigue questionnaire with participants' information

Tablica 3. Korelacija između upitnika o umoru očiju i informacija sudionika

	Eye fatigue questionnaire	
	p-value	Pearson correlation
Age	0.92	-0.006
BMI	0.51	-0.45
Years of experience	0.37	0.063
Insomnia severity index (ISI)	0.034	0.16
Excessive daytime sleepiness	0.007	0.18
PSQI	0.005	0.195

As can be seen in the table, high eye fatigue was related to the high severity of insomnia, daytime sleepiness, and poor quality of sleep significantly (P<0.05). There was no significant correlation between eye fatigue and age, BMI, and years of experience of participants (P>0.05). Also, there was significant correlation between dry eye (one of the components of eye fatigue questionnaire) and severity of insomnia measured by ISI questionnaire (Rho=0.21, P=0.002). However, obtained correlations were very small.

Other results showed that there was a significant difference between two groups in terms of eye fatigue questionnaire in four domains (P<0.05).

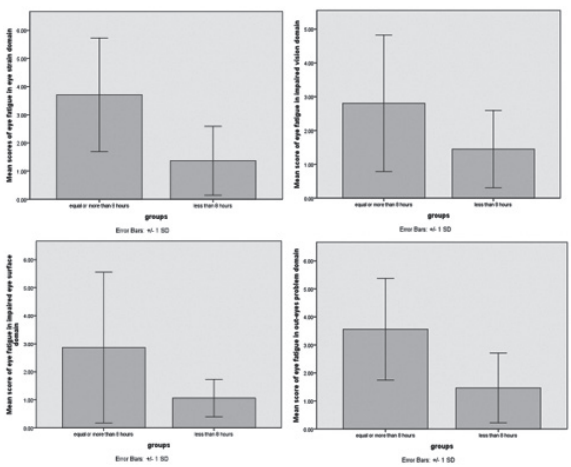

Figure 1. Comparison of eye fatigue questionnaire between two groups (less than 8 hours and equal or more than 8 hours with VDT per day) in four domains

Slika 1. Usporedba upitnika o umoru očiju između dvije skupine (manje od 8 sati i jednako ili više od 8 sati s VDT-om dnevno) u četiri područja

DISCUSSION

The most common complaints among computer users in this study was eye fatigue, feeling of heaviness of the eyelids, eye irritation, and feeling sleepy and headaches during working with computer. Also, other complaints such as needs to rub their eyes, feeling of pressure around the eyes, blurred vision of monitor, eye pain, blurred vision of distant objects, eye tearing, skip words or lines during reading, and feeling of dizziness had high frequency.

In a study conducted by Biswas and et al. *(2003)* the prevalence of eye fatigue was reported 68% and 47% in two groups of computer users and control group, respectively. In another study conducted on the computer users of Yazd university of medical sciences, the prevalence of different eye complaints was as follow: eye fatigue 79%, eye irritation 57.7%, tearing 34.4%, and red eye 30% *(Manaviat et al., 2011)*. Another case-control study conducted by Dehghani et al. *(2008)* on bank staffs. Employees who worked continuously with the computer was considered as case group, and employees who did not work with computer was considered as control group. The prevalence of eye irritation and tearing in the case and control groups were 79% and 45% respectively. The prevalence of feeling of dry eye in the case and control groups were 66% and 32% respectively. These numbers were about 64% and 40% for eye fatigue in case and control groups, respectively. The authors concluded that eye complaints are significantly higher in the computer users than control group *(Dehghani et al., 2008)*.

The findings show that most severe symptoms of eye fatigue in VDT users is related to the impaired vision sub domain. This disorder is the most important factor in the occurrence and development of human errors. Other symptoms of eye fatigue that had high severity in this study can also act as prognostic factors and early warning symptoms of eye fatigue for VDT users. With sufficient attention to these symptoms, VDT users have been informed from their deterioration in accuracy and efficiency over the time and take the necessary steps to remove or control their eye fatigue.

Based on the results of this study, the longer hours of computer working, the higher severity of eye complaints in all sub domains significantly. Other study conducted by Manaviat et al. *(2011)* a significant correlation was seen between the severity of eye fatigue symptoms with duration of using computer during the day. In this study, significant association has not been found between age, and gender of VDT users and type of monitor with eye complaints.

In elderly people, the lens of the eye becomes less flexible and less able to match with the incoming light. Therefore, older people need to try more to read the content of the monitors. Also, increasing the years of experiences in VDT users as well as increased pressure on the eyes induces more eye fatigue in users. Although in this study did not find any correlation between these variables and the severity of eye complaints. All monitors used in Qazvin University were LCD type. This monitor increase image clarity and eliminate glare during computer working and can be effective in reducing eye complaints. The difference in the brightness of the work environment and other causes of eye fatigue may also be other reasons for the different results in this study.

Previous studies concluded that both the time working with VDT screen and total number of hours of working with computer per day related to subjective eye fatigue disorders. A study conducted by Stella concluded that eye symptom complaints are more prevalent in employees with more than 8 hours using VDT per day *(Chiemeke et al., 2007)*. Out of eyes symptoms such as arthralgia, low back pain, general fatigue, and stiff shoulder were also reported higher in this group. These results are consistent with present study.

With long hours of working with computer during the day, will not be created enough time to relax the eyes and relieve from stresses. This factor is important among users of all ages and is probably the main cause of visual fatigue in computer users. Long-term looking at the monitor in close proximity cause disorder in eye accommodation and impaired visual performance *(Ninaus et al., 2015, Petrie et al. 2011, Cole, 2013, Ye et al., 2007, Nakazawa et al., 2002)*.

Also in this study, we investigated the relationship between different sleep disorders such as insomnia, daytime sleepiness, and poor quality of sleep with eye fatigue due to computer working. Our results showed that employees who worked with VDTs more than 8 hours per days have less sleeping during the night and lower quality of sleep. Also, there was a positive correlation between severity of eye fatigue and severity of insomnia, daytime sleepiness, and low quality of sleep. According to our knowledge, few studies have been done in this area.

Labbafinejad et al. *(2010)* reported a significant association between the duration of working with VDTs and different insomnia symptoms such as

difficulty in initiation asleep and early awakening during morning. In their study, insomnia assessed by Athens Insomnia Scale *(Labbafinejad et al., 2010)*. Another study conducted by Tachibana et al *(1996)* showed a significant relationship between working overload with VDTs and sleep related complaints. They did not use standard questionnaire for detecting insomnia *(Tachibana et al., 1996)*. There are few studies that investigated association between VDTs use and sleep disorders. Study conducted by Nakazawa et al. *(2002)* reported that sleep related symptoms became more prevalent with increasing daily duration of VDT use. Tachibana et al. *(1998)* performed a cross sectional study of 271 workers and found that the odds ratios of different sleep disorders such as initiating sleep, frequent sleep interruption, and early morning waking were significantly higher in VDT workers than non-VDT workers. A systematic review reported that increased use of media led to shorter sleep time, longer sleep onset, and more sleep disturbances. According to a systematic review in 2016, there was a strong and consistent association between media device use and inadequate sleep quantity (OR =2.17; 95%CI 1.42-3.32); poor sleep quality (OR=1.46; 95%CI 1.14-1.88); and excessive daytime sleepiness (OR=2.72; 95%CI 1.32-5.61) *(Carter et al., 2016)*.

One of the common symptoms in computer users in our study was dry eye. There was significant correlation between dry eye and insomnia symptoms in our study. Previous studies showed that dry eye decrease the quality of life by affecting mental health and physical function of people *(Galor et al., 2016, Pouyeh et al., 2012)*. Consistent with the results of this study, study conducted by Galor found that both dry eye symptoms and ocular pain positively correlated with insomnia measured by ISI questionnaire. Also, these results confirmed by other studies *(Ayaki et al., 2016, Ayaki et al., 2015, Pallesen et al., 2014)*. It is necessary to mention that the relationship between the above items can be explained from both sides. Nocturnal eye discomfort created by insomnia understood more stressful and prominent among insomniac people than among normal sleepers. On the other hand, eye symptoms induced by VDT use and its associated mood disorders may interfere with normal initiation in sleep *(Galor et al., 2016, Pouyeh et al., 2012, Ayaki et al., 2016)*.

Majority of participants reported clinically relevant symptoms of insomnia in present study. This prevalence is much higher than the prevalence of insomnia in previous studies carried out in this field. The reported prevalence of insomnia among different population varied from 20 to 40 percent in different studies *(Labbafinejad et al., 2010, Pallesen et al., 2014, Calhoun et al., 2014)*. Our study showed a higher prevalence of insomnia in our participants compared to previous studies. One of the reasons for the high prevalence of insomnia in this study can be working long hours with the computer.

The high prevalence of poor quality of sleep in VDT users more than 8 hours than those with less than 8 hours is similarly justified. Also, the prevalence of poor quality of sleep in all participants in present study (55.9% of total sample) is more than general population assessed in another studies *(Labbafinejad et al., 2010, Tachibana et al., 1996, Pallesen et al., 2014)*.

There was not control group in this study, which was a limitation for this study. Another limitation of this study was detecting of eye problems and sleep disorders with subjective questionnaires. Using objective methods will help to diagnose both of these problems accurately.

CONCLUSION

Our study showed that employers who work longer duration with VDTs tend to have more difficulties with their sleep including insomnia, daytime sleepiness, and poor quality of sleep. The relationship between sleep problems with the incidence of different systemic disease, increasing human errors, and low productivity in the workplace has been well established in previous studies. Therefore, it is necessary that computer user screen periodically in terms of eye fatigue symptoms and sleep disorders. Further clinical trial studies suggested to clarify whether appropriate management of working with VDTs reduce eye fatigue and insomnia.

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Conflict of interests

The authors declare no conflict of interest.

Informed consent

Informed consent was obtained from all the participants included in the study.

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UMOR OČIJU KORISNIKA TERMINALA ZA VIDEOPRIKAZ I NJEGOV ODNOS S POREMEĆAJIMA SPAVANJA

SAŽETAK: Rad terminala za vizualni prikaz (VDT) postao je glavni dio pogona na većini radnih mjesta. Ova studija presjeka provedena je na 209 korisnika računala koji rade više od jedne godine u ovom području. Svi sudionici ispunili su upitnik o svojoj dobi, spolu, indeksu tjelesne mase, godinama iskustva i satima svakodnevnog korištenja računala. Standardizirani upitnik korišten je kako bi se detektirala prisutnost i ozbiljnost naprezanja oka. Upitnik sadrži 15 pitanja o problemima s očima. Nesanica je ocijenjena indeksom ozbiljnosti nesanice. Najčešći očni simptomi uključujući umor očiju (65,5 %), osjećaj težine kapaka (69,4 %), iritacija oka (67,2 %), suho oko (67,8 %), zamagljen vid (68,5 %) i suzenje oka (68,1 %) bili su značajno viši u sudionika koji su radili više od osam sati s VDT-om na dan. Postojala je značajna korelacija između rezultata umora očiju i ozbiljnosti nesanice (Rho=0,32, P<0,05). Prema ovim rezultatima, prevalencija očnih simptoma bila je visoka i povezana s ozbiljnošću nesanice u naših VDT korisnika. Dakle, potrebno je zaštititi korisnike računala od štetnih VDT učinaka. Implementacija ispravnih ergonomskih programa na radnom mjestu važna je kako bi se postiglo dobro fizičko i mentalno zdravlje među VDT korisnicima.

Ključne riječi: *umor očiju, VDT korisnici, poremećaji spavanja*

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