North Clin Istanb 2018;5(4):319–322
doi: 10.14744/nci.2017.54036

ORIGINAL ARTICLE OPHTHALMOLOGY

Effects of long-term computer use on eye dryness

Sezen Akkaya, Tugba Atakan, Banu Acikalin, Sibel Aksoy, Yelda Ozkurt

Department of Eye Diseases, University of Health Sciences Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Turkey

ABSTRACT

OBJECTIVE: To evaluate the effects of long-term computer use on tear production and evaporation.

METHODS: In this study, 30 eyes of 30 people using computer for 8 hours a day were taken as the study group. In the control group, 30 eyes of 30 healthy individuals who did not spend 1 hour using computer on a daily basis were evaluated. The cases were examined at 8 am and 5 pm. The Schirmer test, tear break-up time (TBUT), and ocular surface disease index (OSDI) were evaluated.

RESULTS: There was no significant difference between the groups in terms of age and gender. The Schirmer test results, which measure the parameters of tear production, were 16.80±2.04 and 15.50±2.06 mm ($p>0.05$) in the study group, and 17.28±1.52 and 17.16±2.53 in the control group. The TBUT measurements were 9.15±2.93 and 6.80±1.11 sec in the study group. It was observed that the evening TBUT decreased ($p<0.05$). The TBUT measurements were 15.80±3.15 sec and 15.20±1.92 sec ($p>0.05$) in the control group. The OSDI scores were 26.7±3.36 and 28.3±1.19 in the study group, and 25.0±4.48 and 27.3±2.27 in the control group.

CONCLUSION: As a result, it was found that a long-term computer use did not change the Schirmer test results significantly, but there were statistically significant changes in the tear break-up time (TBUT) results of the evaporative type eye dryness. According the our study results, long-term computer usage may cause an evaporative-type dry eye disease.

Keywords: Dry eye disease; Schirmer test; TBUT; use of computer.

Cite this article as: *Akkaya S, Atakan T, Acikalin B, Aksoy S, Ozkurt Y. Effects of long-term computer use on eye dryness. North Clin Istanb 2018;5(4):319–322.*

Dry eye disease is a multifactorial condition. Eye dryness is more common in elderly postmenopausal women, and it is becoming more frequent as the life span of people increases [1, 2]. In addition, the number of individuals using computer and display devices with a screen is increasing every day [3, 4]. Use of computers and display devices with a screen decreases the number of eye blinks, leading to incomplete blinking, evaporation of tears, and subsequently to dry eye disease. The most common type of dry eye disease is an evaporative type, and the use of computers is especially important in this group [5].

Computer vision syndrome, also referred to as digital eye fatigue, has been described by the American Optometry Association as an eye and vision problem seen in long-term computer, tablet, and cell phone users [6]. The most frequent symptoms are eye fatigue, headache, blurred vision, and dry eyes. Double vision and head and neck pain can also be added [7]. Eye dryness is a very common eye disease nowadays, and it affects daily activities by decreasing the quality of life due to its symptoms. In addition, it has also become an important public health problem because of the increased treatment costs [1, 8].

In this study, we wanted to determine the points to be noted with regard to use of devices with screen display important for this public health problem by evaluating the results of the Schirmer test and tear break-up time,

Received: September 14, 2017 *Accepted:* December 22, 2017 *Online:* August 08, 2018

Correspondence: Dr. Sezen AKKAYA. Saglik Bilimleri Universitesi, Fatih Sultan Mehmet Egitim ve Arastirma Hastanesi, Goz Hastaliklari Klinigi, Istanbul, Turkey.
Tel: +90 216 578 30 00 e-mail: drsezenakkaya@gmail.com

© Copyright 2018 by Istanbul Provincial Directorate of Health - Available online at www.northclinist.com

which are the parametres of dry eye disease related to a long-term computer use.

MATERIALS AND METHODS

In this study, 30 eyes of 30 persons using computer long-term for work were taken as the study group, and 30 eyes of 30 healthy individuals who did not work with devices with display screen were evaluated as the control group. The study was conducted in accordance with the Helsinki Declaration, and informed consent forms were obtained from patients.

The study group consisted of staff working as secretary and information-processing officers in our hospital. Persons with systemic diseases other than eye diseases, or eye diseases that could not be corrected by using eyeglasses, individuals who experienced open or laser surgery for their eyes, and cases using ophthalmic medications, artificial tear drops, or contact lenses were excluded from the study. During the study, the right eye of the individuals was evaluated.

Individuals included in the study were examined twice before starting work at 8 am and at 5 pm in the evening after at least 8 hours of computer use. The morning and evening tear break-up time (TBUT), results of the Schirmer test (with topical anesthesia), and ocular surface disease index (OSDI) scores were recorded.

Dry eye symptoms of the cases were assessed using the OSDI questionnaire, which is a 12-item questionnaire that assesses dry-eye-related ocular symptoms and their visual functions. Questions cover the ocular symptoms, environmental stimuli, and visual functions.

The Schirmer test was performed after applying topical anesthesia with proparacaine drops (proparacaine HCI, Alcaine 0.5%, Alcon) and after drying the excess tear drops. In this test, the Schirmer strip was placed on the-one third of the lateral part of the lower eyelid of the patient. The patient waited for 5 minutes and then was asked to look across and blink normally. Five minutes later, Schirmer strips were taken, and the the quantity of tears was recorded. To determine TUBT, fluorescein solution was dropped into patients' eyes, and they were asked to blink three times and then look across with their eyes open. During the biomicroscopic examination, the integrity of the tears is lost under cobalt blue light, and the time to the formation of the dry spot on the cornea was recorded and evaluated.

The obtained data were recorded in SPSS 16.0 (Statistical Package for the Social Sciences, IBM). The chi-squared test, Mann–Whitney U test, and Wilcoxon test were used for comparisons. The evaluations were made within the 95% confidence interval, and the p-value less than 0.05 was regarded as a statistically significant difference.

RESULTS

The average age of the study participants (17 women and 13 men) using computers for a long time was 29.92±4.25 years. The control group consisted of 30 healthy individuals (18 women and 12 men) with a mean age of 28.42±4.56 years. There was no difference in terms of age and gender between the two groups who were using or not using computers for a long time on a daily basis ($p>0.05$).

Duration of daily computer use was 7.70±0.86 hours in the computer group and 0.72±0.68 hours in the control group ($p<0.001$) (Table 1).

The Schirmer average value in the group using the computer for a long period of time per day was 16.80±2.04 mm at 8 am and at 15.00±2.06 mm at 5 pm at the end of the workday ($p>0.05$). In the control group, the Schirmer value was 17.28±1.52 in the morning, and the evening measurement was 17.16±2.53 mm ($p>0.05$) (Table 2). The study group had 9.15±2.93 seconds in the morning examination of TBUT measurements. At the end of the

Table 1. Daily computer use of the groups

Daily duration of computer use (hours)		p
Study group	7.70±0.86	<0.001*
Control group	0.72±0.68	

*: Statistically significant.

Table 2. Morning and evening values of Schirmer test with anesthesia

	Morning (mm)	Evening (mm)	p
Study group	16.80±2.04	15.50±2.06	>0.05
Control group	17.28±1.52	17.16±2.53	>0.05

TABLE 3. Morning and evening tear break-up time values of the groups

	Morning TBUT value	Evening TBUT value	p
Study group	9.15±2.93	6.80±1.11	(<0.05)*
Control group	15.80±3.15	15.20±1.92	(>0.05)
	(<0.05)*	(<0.05)*	

TBUT: Tear break-up time; p<0.05, level of statistical significance.

TABLE 4. Morning, and evening OSDI values of the groups

	Morning OSDI value	Evening OSDI value	p
Study group	26.7±3.36	28.3±1.19	(>0.05)
Control group	25.0±4.48	27.3±2.27	(>0.05)
	(>0.05)	(>0.05)	

OSDI: Ocular surface disease index; p<0.05 level of statistical significance.

day, the TBUT value was determined as 6.80±1.11 sec. There was a statistically significant difference between these two values in the study group. A decrease in the evening TBUT value was observed (p<0.05). In the control group, the TBUT value was recorded as 15.80±3.15 sec in the morning and 15.20±1.92 sec in the evening (p>0.05). There was no statistically significant difference between these two values in the control group (Table 3).

The OSDI score of the group using computers for a long time every day was 26.7±3.36 in the morning and 28.3±1.19 at the end of the workday (p>0.05). In the control group, it was 25.0±4.48 in the morning and 27.3±2.27 in the evening (p>0.05). There was no statistically significant difference between the two groups or OSDI scores, and between the evening and morning values (Table 4).

There was no significant intergroup difference between the Schirmer test results and OSDI values measured in the morning and evening (Tables 2, 4), but the TBUT values were significantly different, and the TBUT values in the study group were significantly lower (Table 3). In addition, the evening TBUT values were significantly lower in the group using computer (Table 3).

DISCUSSION

It has been shown in our study that a long-term use of the computer caused instability in the distribution of tears on the ocular surface, leading to easy evaporation of the tear drops. The TBUT showing tear stability was found to be significantly lower in the group using computer compared to the control group. In addition, when the evening TBUT measurements were compared with the morning measurements, there was a significant decrease in the computer users group. Previous studies have shown that the use of computers causes tear evaporation, which is attributed to a reduction in the number of blinks and an incomplete blinking. Portello et al. found a positive correlation between the number of incomplete blinks and eye dyness symptoms of individuals. They found a negative correlation between the number of blinks and relevant symptoms [5, 9].

When we evaluated the results of the Schirmer test performed with topical anesthesia, which demonstrates the basal tear release in our study, we did not find any significant difference between the two groups and between the morning and evening values. This suggests that the mechanism of evaporation is more prevalent than the reduction of tear release in the dry eyes due to computer use. We did not find any statistically significant difference between the study and control groups in terms of OSDI scores in our study. Bayhan et al. previously reported that OSDI scores were significantly higher in the group using computers for a long time [10]. In our study, there was no statistically significant difference between morning and evening OSDI values. We think that the lack of any difference between OSDI scores among the study participants due to the fact that they had not complaints of eye dryness, and all of them were healthy individuals.

A long-term computer use also affects the functions of accommodation and vergence functions, other than dry eye functions [11]. It has been reported that those who use computer for 4 hours or longer show convergence insufficiency, exosphoria, lower fusional convergence, and decrease in accommodation width [12].

An increasing use of devices with display screens at all ages is beginning to make computer vision syndrome an important public health problem. This problem affects both the eye health and job performance.

There are environmental and personal precautions that can be taken to protect individuals from the com-

puter vision syndrome and to reduce the eye fatigue. Some of them are 20–20–20 rules. A person who uses a computer for a long time should look at an object from 20 feet (6 m) away for 20 seconds every 20 minutes. Employees should be advised to blink their eyes frequently so as to prevent the evaporation of tear drops and to protect moisture. If the problem of refraction develops, it should be absolutely corrected [13].

The American Optometry Association recommends that the center of the computer monitor should be 15–20 degrees (approximately 10–12.5 cm) below the eye level, and it should be 50–70 cm away from the eyes. Appropriate lighting should be provided in the environment, and the daylight should be received from one side if possible. Screen filtering can help reduce glare. In addition, 15 minutes of rest after 2 hours of work will both improve the work performance and provide protection from computer vision syndrome [6].

In addition, in a large-scale study by Buhargava et al., a total of 456 individuals with computer vision syndrome were divided into two groups: One group received an oral Omega-3 treatment, and the other group received placebo. The authors demonstrated the beneficial effects of Omega-3, which is used for the treatment of dry eyes due to computer vision syndrome. In the group that received oral Omega-3 preparations, the dry eye symptoms were alleviated, and the tear evaporation rate was decreased [14]. As a result, a prolonged computer use increases the eye evaporation rate and causes eye strain. Employees and employers should be warned in this regard and take necessary precautions and measures that will be effective in solving this public health problem.

Conflict of Interest: The authors declare no conflict of interest.

Financial Disclosure: The authors declared that this study has received no financial support.

Authorship Contributions: Concept – S.A, S.Ak., Y.O.; Design – S.A., S.Ak., Y.O.; Supervision – B.A., Y.O.; Materials – S.A., S.Ak.; Data collection &/or processing – S.A., S.Ak.; Analysis and/or interpretation – T.A.; Writing – T.A.; Critical review – B.A., Y.O.

REFERENCES

1. The definition and classification of dry eye disease: report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop (2007). Ocul Surf 2007;5:75–92.
2. Peck T, Olsakovsky L, Aggarwal S. Dry Eye Syndrome in Menopause and Perimenopausal Age Group. J Midlife Health 2017;8:51–54.
3. Nakamura S, Kinoshita S, Yokoi N, Ogawa Y, Shibuya M, Nakashima H, et al. Lacrimal hypofunction as a new mechanism of dry eye in visual display terminal users. PLoS One 2010;5:e11119.
4. van Tilborg MM, Murphy PJ, Evans KS. Impact of Dry Eye Symptoms and Daily Activities in a Modern Office. Optom Vis Sci 2017;94:688–93.
5. Portello JK, Rosenfield M, Chu CA. Blink rate, incomplete blinks and computer vision syndrome. Optom Vis Sci 2013;90:482–7.
6. Randolph SA. Computer Vision Syndrome. Workplace Health Saf 2017;65:328.
7. Munshi S, Varghese A, Dhar-Munshi S. Computer vision syndrome-A common cause of unexplained visual symptoms in the modern era. Int J Clin Pract 2017;71.
8. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, et al. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. BMC Res Notes 2016;9:150.
9. Hirota M, Uozato H, Kawamorita T, Shibata Y, Yamamoto S. Effect of incomplete blinking on tear film stability. Optom Vis Sci 2013;90:650–7.
10. Bayhan HA, Bayhan SA,Muhafız E, Gürdal C. Evaluation of the Dry Eye Parameters and Tear Osmolarity in Computer Users.Turkiye Klinikleri J Ophthalmol 2014;23:167–71.
11. Rosenfield M. Computer vision syndrome: a review of ocular causes and potential treatments. Ophthalmic Physiol Opt 2011;31:502–15.
12. Gur S, Ron S, Heicklen-Klein A. Objective evaluation of visual fatigue in VDU workers. Occup Med (Lond) 1994;44:201–4.
13. Tribley J, McClain S, Karbasi A, Kaldenberg J. Tips for computer vision syndrome relief and prevention. Work 2011;39:85–7.
14. Bhargava R, Kumar P, Phogat H, Kaur A, Kumar M. Oral omega-3 fatty acids treatment in computer vision syndrome related dry eye. Cont Lens Anterior Eye 2015;38:206–10.