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ORIGINAL RESEARCH

Comparison of ocular-surface disease index questionnaire, tearfilm break-up time, and Schirmer tests for the evaluation of the tearfilm in computer users with and without dry-eye symptomatology

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Objective: To compare the diagnostic values of the Schirmer's and tearfilm breakup time (TBUT) tests and the Ocular Surface Disease Index (OSDI) in dry-eye syndrome.

Subjects and methods: Thirty-five employees of Ümraniye Training and Research Hospital who used computers in their daily work participated in this prospective study. All participants completed the OSDI. Following routine ophthalmologic examination, the TBUT and Schirmer's test were undertaken and outcomes were compared.

Results: The mean age was 29.09 ± 6.73 (range 20–46) years. Mean OSDI questionnaire, TBUT, and Schirmer's test scores were detected as 37.12 ± 19.05 (range 4–75), 11.37 ± 3.69 seconds (range 4–18 seconds), and 25.80 ± 8.43 mm (range 6–35 mm), respectively. There was a significant inverse correlation between the OSDI and TBUT scores ($r = -0.385$, $P = 0.022$). No significant correlation existed between the OSDI and Schirmer's test scores.

Conclusion: Dry eye is a common problem among computer users. The OSDI questionnaire, used together with the TBUT, is easily performed and may be of benefit in supporting the diagnosis of dry-eye syndrome.

Keywords: computer use, dry eye, ocular-surface disease

Introduction

Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tearfilm instability with potential damage to the ocular surface. It is accompanied with increased osmolarity of the tearfilm and inflammation of the ocular surface.[1] Dry-eye syndrome (DES) affects a significant percentage of the population, especially those aged >40 years old. It can affect any race, is more common in women, and is one of the most frequent reasons for seeking eye care.[2] Extensive use of computers in daily life seems to be an important contributing factor.[3]

Different studies have reported various prevalence rates of DES ranging from 5.5% to 37.7%.[4,5] Limitations in comparisons of studies in different populations include different age distributions of the population, definitions of dry eye, and methodologies. Studies on the tests of tear function, including Schirmer's test, tear breakup time test (TBUT), fluorescein staining, and/or rose bengal staining, have generally found lower prevalence rates than questionnaire-based studies.[4,6] The Ocular Surface Disease Index (OSDI) is the best validated questionnaire in Turkey.[7] It is composed of twelve questions that provide a rapid assessment of the symptoms of ocular irritation consistent with DES and their impact on vision-related functioning.

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In this study, we investigated the prevalence of DES in computer users and compared the diagnostic values of two tests (Schirmer's and the TBUT) and the Ocular Surface Disease Index.

Subjects and methods

The study was performed between July 2010 and October 2010 among employees of Ümraniye Training and Research Hospital who used computers in their daily work. The study was approved by the Ümraniye Training and Research Hospital Ethics Committee. The study protocol was explained to all participants and verbal informed consent was received.

Subjects

Employees aged ≥20 years old were included in the study. Subjects previously diagnosed with DES were excluded from the study. We also excluded subjects who had had any previous ocular-surface disorders or intraocular surgery, who had nasolacrimal duct obstruction, or who were using topical ophthalmic drugs and/or systemic medications.

Ophthalmologic examination and measurements

Subjects underwent a detailed ophthalmic examination, including best-corrected visual acuity, intraocular pressure measurement with noncontact tonometer, anterior segment, and fundus examination with a slit-lamp biomicroscope. The tests were administered at the end of the work day and measurement conditions remained the same for all subjects.

The OSDI was administered to subjects before ophthalmic examination using a computer program provided by Allergan Inc (Goleta, CA), which was validated for use in Turkey.[7] The test included twelve questions in three groups. The first group contained questions about the ocular symptoms of DES, the second group about the ocular symptoms while watching television or reading a book, and the third group about ocular symptoms induced by environmental factors. The OSDI is assessed on a scale of 0 to 100, with higher scores representing greater disability. The cutoff OSDI score for diagnosis of DES was accepted as ≥35. Following the OSDI questionnaire and ophthalmic examination, subjects underwent the TBUT and the Schirmer's test.

To measure tear breakup time, a sterile strip of fluorescein was applied in the lower eyelid fornix and then removed. The subject was asked to blink three times and then look straight forward, without blinking. The tearfilm was observed under the cobalt blue filtered light of the slit lamp microscope and the time that elapsed between the last blink and appearance of the first break in the tearfilm was recorded with a stopwatch. This procedure was repeated three times on both eyes. A tear breakup time of <10 seconds was considered consistent with DES. The mean TBUT scores of the right and left eyes were used for the statistical analysis.

Five minutes after the TBUT, a Schirmer I test (without anesthesia) was performed to evaluate basal and reflex tear secretion. In the Schirmer I test, a filter paper strip (35 × 5 mm) was used to measure the amount of tears produced over 5 minutes. The strip was placed at the junction of the middle and the lateral thirds of the lower eyelid. The test was performed under ambient light. The patients were directed to look forward and to blink normally during the course of the test (5 minutes), then wetting of the filter paper in 5 minutes was recorded. Wetting ≤ 6 mm was considered consistent with DES. The mean Schirmer's test scores of the right and left eyes were used for the statistical analysis.

Study protocol

The OSDI questionnaire was administered to subjects by the physician (CÜ) and the OSDI scores were calculated. Following routine ophthalmologic examination, the TBUT and Schirmer's test were performed and measurements noted. Tear substitutes were prescribed to subjects who were diagnosed as having dry-eye disease.

Statistical analysis

Statistical analyses were performed with NCSS 2007 and PASS 2008 (NCSS, LLC, Kaysville, UT). Descriptive statistics of the study population were noted. Correlation analysis was performed between the OSDI, TBUT and Schirmer's test scores using Pearson's correlation coefficient. A P value of <0.05 was considered significant.

Results

A total of 35 subjects participated in the study; 29 (82.9%) were female and six (17.1%) were male. The mean age was 29.09 ± 6.73 years old (range 20–46 years).

The mean OSDI, TBUT, and Schirmer's test scores were calculated to be 37.12 ± 19.05 (range 4–75), 11.37 ± 3.69 seconds (range 4–18 seconds), and 25.80 ± 8.43 mm (range 6–35 mm), respectively. There was a statistically significant inverse correlation between the OSDI and TBUT scores ($r = -0.385$, $P = 0.022$), whereas no significant correlation existed between the OSDI and Schirmer's test scores (Table 1). According to the TBUT results, 42% of the

Table 1 Correlation analyses between Ocular Surface Disease Index (OSDI), tearfilm breakup time (TBUT), and Schirmer's test scores

	OSDI	
	r value	***P* value**
TBUT	–0.385*	0.022
Schirmer's test	–0.133	0.445

Note: *Statistically significant ($P < 0.05$).

subjects were diagnosed as having dry eye, while, when the cutoff OSDI score was accepted as ≥35, 35% of the subjects were diagnosed as having dry eye. The mean time taken for performing each test was as follows: OSDI, 74.11 ± 28.61 seconds (range 15–138 seconds); TBUT, 215.14 ± 65.27 seconds (range 120–480 seconds); Schirmer's test, 334.29 ± 70.22 seconds (range 120–480 seconds). The mean time taken to undertake the OSDI questionnaire was significantly lower than for the TBUT and Schirmer's test ($P < 0.05$) and the mean time taken for the TBUT was significantly lower than for Schirmer's test ($P < 0.05$).

Mean daily computer usage time was 7.97 ± 2.57 hours (range 1–12 hours), with 37% of the subjects spending more than 8 hours in front of computers. There was no statistically significant correlation between time spent using computers each day and the mean OSDI, TBUT, and Schirmer's test scores.

Discussion

The popularity of personal computers has increased in recent years with the greater involvement of the Internet in our daily lives. In 1994, it was estimated that 75% of all jobs would involve computer usage by the year 2000.[8] Many people have begun to spend more time in front of computers at work and at home. The ever-increasing use of computers in various fields of life has led to an increase in eye-related symptoms.[9] Dry-eye disease is frequently encountered among computer users.[9] This study was undertaken to evaluate DES in computer users and to compare the OSDI, which is a quick and noninvasive test, with two partly invasive tests, the TBUT and Schirmer's, in diagnosis of dry eye.

DES is a common public health problem encountered by ophthalmologists; however, diagnosis is not straightforward. The symptoms – which include eye redness, grittiness, burning, itching, blurred vision, sensation of presence of foreign body, and eye tiredness – may also be encountered in other eye diseases. Further, the symptoms and signs do not correlate well. Ocular symptoms may not occur despite reduction of tear production. Nichols et al reported that there was a poor relationship between the symptoms and results of diagnostic tests in patients with DES.[10] A subject may have no symptoms besides eye tiredness even though the result of a Schirmer's test is below 5 mm or even zero. Because of the challenges in diagnosis and grading of DES, clinicians should evaluate ocular history, symptoms and signs, and test results together. In this study, we performed three tests for confirmation of the diagnosis. The OSDI results were well correlated with those of the TBUT: 35% of the subjects were diagnosed as having DES according to the results of the OSDI and 42% of the subjects according to results of the TBUT. The mean time required to undertake OSDI test was 74.11 ± 28.61 seconds and 215.14 ± 65.27 seconds for the TBUT. The mean time spent in taking both tests was significantly lower than that required for Schirmer's test. Thus, we consider that diagnosis might be strengthened if the OSDI and TBUT are both performed; these together would be less time consuming than a Schirmer's test alone.

Schirmer's test alone does not seem to be a good test for diagnosis of DES because reflex epiphora might result in the misdiagnosis of dry-eye patients as being normal. In our study, only two subjects (5%) had a Schirmer's test result of <10 mm. Singh Bhinder and Singh Bhinder reported that Schirmer's test results changed according to reflex epiphora, therefore, there was no correlation with symptoms in DES.[11] Reflex epiphora that developed during the Schirmer's test may be the underlying cause of the absence of correlation between the OSDI and Schirmer's test scores in our study.

DES has been reported to increase with age in many population-based studies.[4,12] However, there has been a dramatic increase in the amount of work undertaken using visual display terminals (VDTs) such as computer screens and this has resulted in an increase in DES in the younger population. In our study group composed of computer users, the mean age was 29.1 years old and the prevalence of DES was 42%, which is higher than in the normal population.[13] Dry-eye disease in VDT users can result from a decreased rate of blinking and consequent increase in the rate of tear evaporation.[14] Longer duration of VDT work has been observed to be associated with a significant trend toward higher prevalence of DES in VDT workers.[9]

Conclusion

It seems that the prevalence of DES is increasing in the era of the Internet. Thus, as ophthalmologists will probably encounter an increasing number of dry-eye patients in their daily practice, they should be familiar with quick, reliable, and less invasive diagnostic tests to manage the disease successfully. The OSDI together with the TBUT can be performed easily and used to support the diagnosis of DES. Further studies

may be necessary to increase our understanding and diagnosis of DES.

Disclosure

The authors report no conflicts of interest in this work.

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