Original Research Article

Comparison of the OSDI questionnaire, the tear film break-up time and Schirmer tests for the evaluation of tear film in computer users and contact lenses without dry eye symptoms

ABSTRACT

Aims: To compare the diagnostic values of the OSDI, the Schirmer's and tear film breakup time test to check for dry eye in healthy adult students using computers and contact lenses.
Methodology: Our sample consisted of hundred (100) eyes from fifty (50) healthy adults aged 18-24 years students at the University of West Attica (25 participants were contact lens wearers, while the remaining 25 were not). All participants were exposed to a computer screen or a mobile screen. Qualitative tear measurement was performed with Tear Break-Up Time Test (TBUT), quantitative measurement of tears with Schirmer Test and use of the Ocular Surface Disease Index (OSDI).
Results: During the analysis of the results, it was found that OSDI was inversely proportional to the TBUT test and the Schirmer test. 60% did not have dry eye, 34% had a low dry eye, 4% had moderate dry eye and 2% had high dry eye. A statistically significant relationship existed between OSDI and the other variables as well as the TBUT test with Schimer test (p-value <0.05). A statistically significant relationship existed between OSDI and TBUT test and Schimer test (p-value <0.05). A statistically significant relationship existed in the Schimer test between those who used drops and those who did not.

Conclusion: The OSDI questionnaire, used in conjunction with the TBUT test, was easy to perform and could be helpful in supporting the diagnosis of dry eye syndrome.

Comment [V1]: Use mild and severe, instead of low and high

Comment [V2]: Schirmer

Comment [V3]: repitition

Keywords: OSDI, TBUT, Schirmer test, dry eye

1. INTRODUCTION

Dry eye is a multifactorial disease that affects the tears and the ocular surface and results in symptoms of discomfort, blurred vision and instability of the tear film with possible damage to the ocular surface.

Dry eye syndrome (DES) affects a significant proportion of the population. It can affect any gender, is more common in women and is one of the most common reasons for seeking eye care.[1] Extensive use of contact lenses and use of screens (mobile or computer) in everyday life seems to be an important factor contributing to the presence of dry eye.

Different studies have reported different prevalence rates of DES ranging from 5.5% to 37.7%. [1,2] Limitations in comparing these studies to different populations include different age divisions of the population, different dry eye definitions and different methodologies. Studies of tear function tests, including the Schirmer test and the Tear Break-Up Time Test (TBUT) test with fluorescein staining, have generally found lower prevalence rates than questionnaire-based studies.[1]

The Ocular Surface Disease Index (OSDI) questionnaire consists of twelve questions that provide a rapid assessment of the symptoms of ocular irritation according to the DES and their impact on vision-related function.[3]

In this study, we investigated the prevalence of DES in healthy adult students at University of West Attica, who were all computer users and half of them were contact lens users and compared the diagnostic values of the TBUT test, the Schirmer test and the OSDI.

2. MATERIAL AND METHODS

The study was conducted between October 2021 and February 2022 among students of the University of West Attica who were exposed to screens (computer or mobile) in their daily lives. Half of the participants are contact lens wearers and the other half are not.

The study protocol was explained to all participants.
The study included 50 young people (100 eyes from healthy adults aged 18-24 years students. Twenty-five participants were contact lens wearers, while the remaining twenty-five were not). All participants were exposed to a computer screen or a mobile screen. Qualitative tear measurement was performed with TBUT, quantitative measurement of tears with Schirmer Test and use of the OSDI.
Individuals previously diagnosed with DES were excluded from the study. We also excluded individuals who had a history of ocular or intraocular disorders, who used topical ophthalmic drugs and / or systemic medications.
The measurement conditions remained the same for all individuals. The study was according to the Helsinki Declaration.

2.1 TBUT test

TBUT test was the first test. The purpose of the test was to determine the possible instability of the tear film.[4] Fluoroscein was applied to the test eye using fluoroscein impregnated strips and the tear film is observed by biomicroscopy and illumination with cobalt blue light.[5,6]
The subject was asked to blink three times and then look straight forward, without blinking.
The time between the last blink and the appearance of the first discontinuity or dry spot of the tear film was recorded with a stopwatch. This procedure was repeated three times in both eyes.
The normal value of the TBUT test was greater than 10 sec, values of 5 to 10 sec were considered marginal while values less than 5 sec were indicative of dry eye.[7] The TBUT test showed 75% sensitivity and 60% specificity for categorizing the symptoms of dry eye. [8]
Mean TBUT test scores of the right and left eye were used for statistical analysis.

2.2 Schirmer test [9]

Five minutes after the TBUT test, the Schirmer test was performed without anesthesia, where it evaluated the basic and reflex secretion of tears.
The Schirmer test evaluated the amount of tears produced. The examination is done with the Schirmer Strips where they are placed folded inside the lower eyelid, where the patient should look slightly upwards.
If the Schirmer Strips were soaked with tears over 10mm in 5 minutes then there is normal production of tears, at 5-10mm there was a suspicion of dry eye and below 5mm there was severe dry eye.
During the test, the patient may continue to blink normally or keep his eyes closed.

2.3 OSDI

OSDI is a twelve-item questionnaire that aims to assess the symptoms of DES-related eye irritation and their impact on vision-related functions, focusing on the last 7 days.[3,10]
OSDI calibration is based on a 5-point Likert scale and consists of 3 sets of questions.[11]

The first group is related to the frequency of ocular symptoms, the second group is concerned with questions about the difficulty of vision-related functions and the last group is concerned with the discomfort caused by environmental factors.[12]
OSDI can take values from 0 to 100. The higher the score one has the more intense dry eye.[3] Normal values are 0 to 12, values 13 to 22 express mild DES, and values 23 to 32 express moderate DES and values above 33 express severe DES.[13]
The OSDI, therefore, consists of an overall score derived from the 3 score subsections, which deal with ocular symptoms, vision function and environmental factors.[12] In the questionnaire sections, their score was calculated by the same formula as the total questionnaire but taking into account only the questions of each section.[3]
OSDI association with the use of artificial tears is moderate.[13] The use of the clinical trial questionnaire has been approved by the FDA (Food and Drug Administration, USA) after first undergoing psychometric testing as suitable for use in clinical trials.[11]
The limitations of OSDI were that it did not include all the symptoms of dry eye such as tearing while it did include some of the symptoms of dry eye such as photosensitivity and pain. In addition, OSDI has focused only on some of the effects of DES on visual function, failing to capture the full effect of DES on the patient's daily life. In addition, it targeted responses to the frequency of symptoms while ignoring their severity.[13]
Some other limitations of OSDI arised from the non-linear correlation of the results in relation to the severity of the symptoms, the difference in difficulty between the categories and more general issues of analysis from the use of the regular ranking. This led to an artificially increased final score when some difficult questions were not answered and were considered not valid by the patient.[11]

Comment [V4]: arose

3. RESULTS AND DISCUSSION

The STATA statistical package was used for data analysis. Due to the nature of the data, the inductive controls used were Spearman's Rho and Mann–Whitney U test. During the analysis of the results, it was found that OSDI was inversely proportional to the TBUT test and the Schirmer test. 60% did not have dry eye, 34% had a low dry eye, 4% had moderate dry eye and 2% had high dry eye (Table 1).

Table 1. **Mean TBUT and Schirmer by OSDI categories**

Comment [V5]: Please check, this is showing directly proportional. How can lower Schirmer and TBUT be associated with low (mild) DES.
High (severe) DES should have lower TBUT and Schirmer

OSDI	% of N	TBUT	Schirmer
Normal	60.0	12.9	25.5
Low DES	34.0	13.5	22.5
Medium DES	4.0	10.5	35
High DES	2.0	16	25

People who use contact lenses:

Existence of a statistically significant relationship between OSDI and the other variables as well as the TBUT test with Schirmer test (p-value <0.05). In particular, OSDI showed a negative correlation with the examined variables with the largest being recorded by the Schirmer test (-0.69) (Table 2).

Table 2. Correlation matrix. People who use contact lenses

	No use of contact lenses				**Use of contact lenses**			
	OSDI	**TBUT**	**Schirmer**	**Screen**	**OSDI**	**TBUT**	**Schirmer**	**Screen**
OSDI	1.0	-	-	-	1.0	-	-	-
TBUT	-0.05	1.0	-	-	-0.49*	1.0	-	-
Schirmer	0.28	-0.29	1.0	-	-0.69*	0.65*	1.0	-
Screen	0.01	-0.24	0.24	1.0	-0.40*	-0.09	0.09	1.0

* p-value<0.05

People who use eye drops:
Existence of a statistically significant relationship between OSDI and TBUT test and Schimer test (p-value <0.05). In particular, OSDI showed a negative relationship with the examined variables with the largest being recorded with the Schirmer test (-0.94) (Table 3).

Table 3.Correlation matrix. People who use drops

Comment [V6]: What eye drops – specify lubricating/artificial tears

	No eyedrops				**Eyedrops**			
	OSDI	TBUT	Schirmer	Screen	OSDI	TBUT	Schirmer	Screen
OSDI	1.0	-	-	-	1.0	-	-	-
TBUT	0.03	1.0	-	-	-0.68*	1.0	-	-
Schirmer	0.15	-0.17	1.0	-	-0.94*	0.56	1.0	-
Screen	-0.06	-0.29	-0.007	1.0	-0.40	0.09	0.30	1.0

* p-value<0.05

It was then checked whether the use of drops created a significant difference in the values of the parameters under consideration. The results indicate a statistically significant difference in the Schirmer test between those who used drops and those who did not.
The value distribution of the Schirmer index appeared to differ between those participants who used drops and those who did not. In the first case, the distribution was characterized by a large concentration in the left part of the distribution. In contrast, the values of the index increase significantly as the distribution shifts to the right with the main volume being recorded in the value range from 25 to 35 mm (Table 4).

Table 4. Mean value test controlling for Eyedrops

	Yes	No	p-value
OSDI	10.3	10.7	n.s
TBUT	11.5	13.5	n.s
Schirmer	17.5	26.9	<0.05
Screen exp	6	5.9	n.s

**Moisture content on oven dry weight basis*

Comment [V7]: Use of eyedrops (yes) is lowering Schirmer and TBUT? Please check

4. CONCLUSION

In our research we did not observe a statistically significant relationship between TBUT test and the use of contact lenses, in contrast to the Schirmer test which had lower values in people who used contact lenses. Finally, another limitation that we have, apart from the small sample, is that we did not exclude people who have undergone refractive surgery. According to Gialelis et al. 2021, people who have undergone refractive surgery report that they may have the conversion of biomechanics of the cornea and dry eye, which we do not know what results with OSDI, TBUT and Schirmer test.[14] Traditional diagnostic tests for DES, such as the TBUT test and the Schirmer test, were often associated with low reproducibility and reliability, making it difficult to diagnose and manage the disease. Advances in ocular imaging technology enable the objective and reproducible measurement of changes in ocular surface, tear film, and visual quality associated with DES. The OSDI together with the TBUT test can be easily performed and used for the existence or not of DES. Further studies may be needed to improve the understanding and diagnosis of DES.

Comment [V8]: Put in discussion. Create a discussion section after results, and impact of gadget screen use on dry eye.

CONSENT

All authors declare that 'written informed consent was obtained from the patient. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

The study is according to the Helsinki Declaration.

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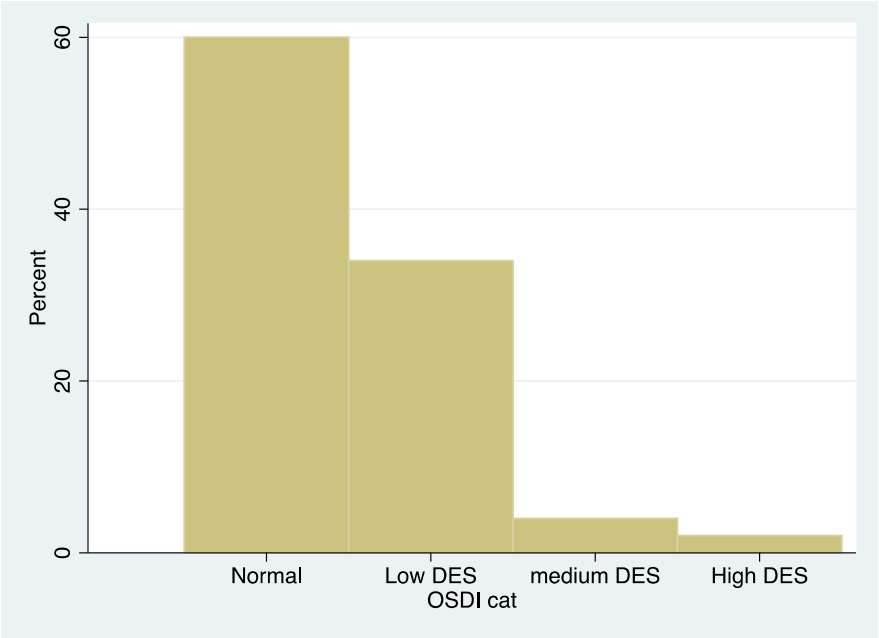
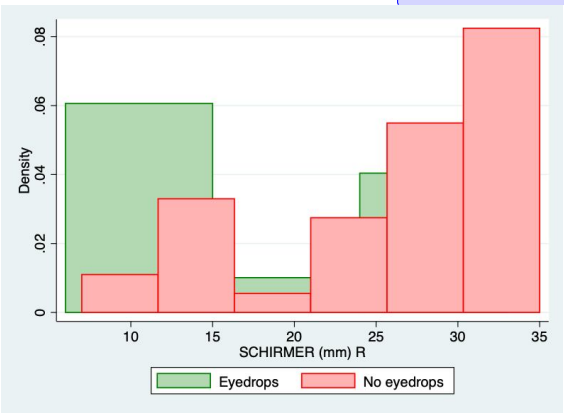
APPENDIX

HISTOGRAM: DISTRIBUTION OF OSDI CATEGORIES



HISTOGRAM : TOTAL SCHIRMER BY EYEDROPS USAGE



Comment [V9]: Eyedrop usage showed low Schirmer? Please check. Specify what eyedrops