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DRY EYE: THE RELATION BETWEEN SYMPTOMS AND DIAGNOSTIC TESTS

Case Study

Keywords
OSDI;
Dry eye;
Schirmer test;
Contrast sensitivity;
Oxford staining schema;
Tear breakup time;
Symptoms

Abstract

The aim of our study is to identify the relation between ocular symptoms and clinical diagnostic tests in dry eye disease with a view to finding an optimal combination of diagnostic tests. Spearmen's correlation coefficient was used to describe the correlation between symptoms (OSDI) and clinical signs (Schirmer test I, contrast sensitivity, Tear breakup time (TBUT) and Oxford staining schema). The results were compared with the findings in current literature.

INTRODUCTION

Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface (Craig et al., 2017). It is often accompanied by ocular symptoms such as: tearing, foreign body sensation, grittiness, dryness, redness, transient blurring of vision or burning sensation (Asiedu et al. 2016; Asiedu et al., 2019; Kanski et al., 2011).

According to the TFOS DEWS II Report, the prevalence of dry eye disease, with and without symptoms, ranged from 5% to 50%. Dry eye disease prevalence based on signs alone was generally higher and more variable (Craig et al., 2017).

The risk factors in dry eye disease include: environmental factors (such as exposure to screens, driving or reading, windy settings, air-conditioned rooms), comorbidities (rheumatoid arthritis, sarcoidosis, Sjögren syndrome, diabetes, rosacea, thyroid disease and allergies) and personal risk factors: female gender, advanced age and contact lens use (Rouen et al., 2018; Stapleton et al., 2017).

The neuropathic pain in dry eye patients is described as discomfort, itching, burning, allodynia, hyperalgesia etc. The ocular disease index (OSDI) was used to evaluate ocular pain. OSDI plays an important role in highlighting the impact of dry eye on the quality of life in these patients (Galor et al., 2018).

Dry eye tests are meant to make a qualitative and quantitative appreciation of dry eye syndrome: symptoms, visual disturbance, tear volume, tear film stability, ocular surface damage, etc. The selection principles are: diagnostic ability, minimal-invasiveness, objectivity and clinical applicability (Craig et al., 2017).

Some studies found a poor relation between dry eye symptoms and clinical tests (Nichols et al., 2004) and others found low and inconsistent association between clinical examinations and dry eye symptoms (Kyei et.al 2018).

This study aims to evaluate the relation between dry eye symptoms and clinical tests among a European clinical sample.

MATERIALS AND METHODS

This clinic-based study comprises 64 eyes of 32 patients with dry eye. All patients gave their consent, based on the Declaration of Helsinki to participate in the study after the type of the study had been explained.

The study was carried out on patients who visited the Ophthalmology Clinic of Emergency Hospital of Sibiu, Romania.

All patients had a complete ophthalmic evaluation to exclude any condition that can mimic dry eye. Dry eye diagnosis was based on the methodologies of the TFOS DEWS Report of 2017. The diagnostic tests were selected according to: objectivity, minimal-invasiveness, diagnostic ability and clinical applicability (Craig et al., 2017).

The Ocular Surface Disease Index (OSDI) was performed in order to assess the severity of dry eye-associated symptoms. The twelve questions were quantified on a scale of 0 to 4 as folows: 4-all of the time, 3-most of the time, 2-half of the time, 1-some of the time, 0-none of the time.

The total OSDI score was calculated for each subject using the formula: the sum of scores of all answered items multiplied by twenty-five divided by the total number of answered items (Schiffman et al., 2000).

Contrast sensitivity was determined for each eye by using the LCD CHART PROJECTOR (CC-100 Series 2015). The test was conducted at a distance of 4 m from the screen and takes about 4 minutes per eye. All patients were evaluated monocularly under best spectacle correction. The contrast sensitivity measurement was made at 4 contrast levels, 100%, 30%, 10% and 3% using grading frequencies: 1.50cpd, 2.12cpd, 3.00cpd, 4.24cpd, 6.00cpd, 8.49cpd, 12.00cpd, 16.97cpd, 24.00cpd. The background luminance was 200 candelas per square meter (Craig et al., 2017).

The Schirmer I Test was performed with the help of filter paper strips (Visual Med, Tear Touch Schirmer Strips) placed at the temporal third of the lower eyelid. The wetted length was measured after 5 minutes (Craig et al., 2017).

Tear breakup time (TBUT) was measured using a fluorescein-impregnated strip wetted with a single drop of normal saline. The patients were made to blink for a few times then the time from normal blinking to the first appearance of a dry eye spot in the tear film was measured. The mean value of the tree measurements was used (Craig et al., 2017).

Ocular surface staining was graded using the Oxford staining schema: 0-absent, 1-minimal (staining per sector up to 10 dot), 2-mild (dot count per sector up to 32), 3-moderate (dot per sector up to 100), 4-marked (dot per sector up to 316) and 5-severe (count per sector greater than 316). The examination was made under cobalt blue filter (Craig et al., 2017).

Ocular surface examinations were performed by the same investigator (C.R) in the following order: visual acuity, contrast sensitivity, OSDI questionnaire, Schirmer test I (with no anesthesia), tear break up time (TBUT) and Oxford staining scale.

The inclusion criteria are: subjects between 20-70 years old, OSDI more than 13 points, Schirmer I Test values less than/equal to 10 mm, Tear breakup time (TBUT) less than/equal to 5 seconds, visual

acuity AO=1 (corrected or uncorrected), spherical equivalent less than/equal +/-4 D, no other ocular disease (except dry eye). All patients were new cases without a history of dry eye medication.
All analyses were performed using the SPSS 21 statistical package. Shapiro-Wilk test was used to analyse the normality of the clinical tests, and Spearman's correlations coefficient (rs) was used for the correlations between the clinical test results and dry eye symptoms. A $p<0.05$ was considered statistically significant (Mocan, 2005; Maniu, 2014).

RESULTS

The OSDI questionnaire was completed by all patients. The symptoms of the studied patients we evaluated with the help of this questionnaire. The following procedures were used to obiectively evaluate the dry eye patients: to tear break up time, Schirmer test I, Oxford staining schema. Out of 32 patients 27 (84.4%) were women and 5 (15.%) were men. The mean age of females and males was 53.59 (SD 11.56) and 44.80 (SD 12.49), respectively. The OSDI scores were compared with the objective tests. The OSDI mean score was 47.03 (SD 19.87) indicating, on average, a mild dry eye disease of the subjects.
The mean values of tear film parameters, including tear film BUT, Schirmer test, Oxford staining, contrast sensitivity were 3.86 seconds (SD 1.43), 4.47 mm(SD 3.25), 0.88 (SD 0.87) and 87.18 (SD 19.20), respectively.
The association between signs (Schirmer test I, tear brek up time, Oxford staining) and symptoms (OSDI) in the case of DED was described by using the Spearmen's correlation coefficient. A significant negative correlation ($rs = -0.501$, $p = 0.003$) was observed between OSDI and TBUT (Figure no. 1) respectively and between OSDI and contrast sensitivity values ($rs = -0.517$, $p = 0.002$) (Figure no. 4). Increased OSDI scores (dry eye symptomatology) are associated with tear film instability (decreased TBUT values) with low quality of vision (decreased contrast sensitivity values).
Analyzing the contrast sensitivity at the level of 9 frequencies, negative correlations were observed between OSDI and those frequencies as follows: V2.12 ($rs = -0.415$, $p = 0.018$), V3 ($rs = -0.477$, $p = 0.006$), V.6 ($rs = -0.480$, $p = 0.005$), V.12 ($rs = -0.424$, $p = 0.016$) and V.24 ($rs = -0.447$, $p = 0.010$), for the left eye. In the case of the right eye significant correlation was for V2.12 ($rs = -0.364$, $p = 0.041$) and V.24 ($rs = -0,387$, $p = 0.029$).
Also a negative correlation ($rs = -0.271$, $p = 0.134$) was identified between OSDI scores and Schirmer test I (Figure no. 2). Increased OSDI scores (greater disability) were associated with decreased Schirmer I test values (low amount of tears).
Positive correlation ($rs = 0.317$, $p = 0.077$) was observed between OSDI and Oxford staining scale; increased OSDI score was associated with increased Oxford grades (Figure no. 3).
Only TBUT and contrast sensitivity were statistically significant, out of the four clinical tests performed.

CONCLUSION AND DISCUSSION

The relationship between signs and symptoms in dry eye syndrome is very important for both diagnosis and treatment. In current practice, we need to use the set of clinical tests which enables a quick and accurate diagnosis of dry eye syndrome. The ideal clinical tests to diagnose dry eye syndrome are those tests that correlate with the symptoms of the patients. Jimmy D Bartlett et al have not found any associations between signs and symptoms in a systematic review of 33 studies. (Bartlett et al., 2015)
Our study shows a significant correlation between patient symptoms (assessed by OSDI) and tear film instability (assessed by TBUT). Factors such as the respective designs of the studies may have influenced statistical results which led to differences in results.
Pult et al. and Ozcura et al. also found a significant correlation between OSDI and TBUT. These findings suggest that tear film instability is associated with the ocular discomfort in dry eye patients. (Pult et al., 2011, Ozcura et al., 2007)
In dry eye, the disruption of the lacrimal film and central superficial punctate keratitis can lead to alteration in contrast sensitivity. (Kyei et al., 2018)
The qualitative visual acuity may be difficult to identify by using conventional visual acuity methods and contrast sensitivity tests can give substantial information. The current study revealed that the correlation between contrast sensitivity score of the patients and the OSDI scores was significant. A decreased contrast sensitivity function in dry eye patients was noticed. Previous reports also identified a low contrast sensitivity in dry eye patients, with or without superficial punctate keratopathy (Rolando et al., 1998; Huang et al., 2002). Contrast sensitivity can give information about the quality of vision in dry eye patients.
Being minimally invasive and well tolerated, the Schirmer test is commonly used to diagnose and evaluate dry eye. (Schirmer 1903, Machado et al., 2009) Some studies suggest that there is a poor correlation between dry eye symptoms and Schirmer test (Nichols et al., 2004, Onwubiko et al., 2016). In contrast, OSDI did correlated with Schirmer tear test in our study. The patients with a greater disability presented a low amount of tears.
Our study showed a correlation between corneal and conjunctival staining and OSDI. Kyung-Chul Yoon

et al also found correlation between conjunctival staining and symptoms in dry eye patients. (Yoon et al., 2011)

It is statistically significant to highlight that correlation coefficients, in our study, ranged between -0.5 and 0.3, indicating low-to-moderate correlation, which is still significant taking into account the small size of the dataset. The clinical significance can be supported by our study design (patient selection criteria).

There is no agreement as to which tests should be combined to evaluate dry eye. Using a combination of tests that correlate with symptoms in dry eye can help us to diagnose and to evaluate the disease progression. Contrast sensitivity is not a routine investigation in dry eye syndrome, but it seems to bring additional information about the impact of lacrimal film disruption on the quality of vision in dry eye patients.

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FIGURES

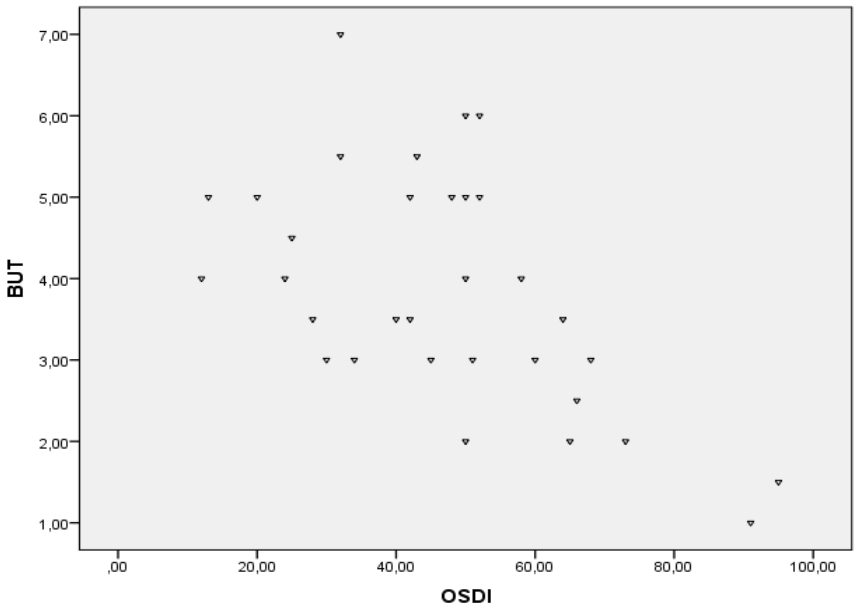

Figure No. 1
Association between OSDI scores and TBUT scale

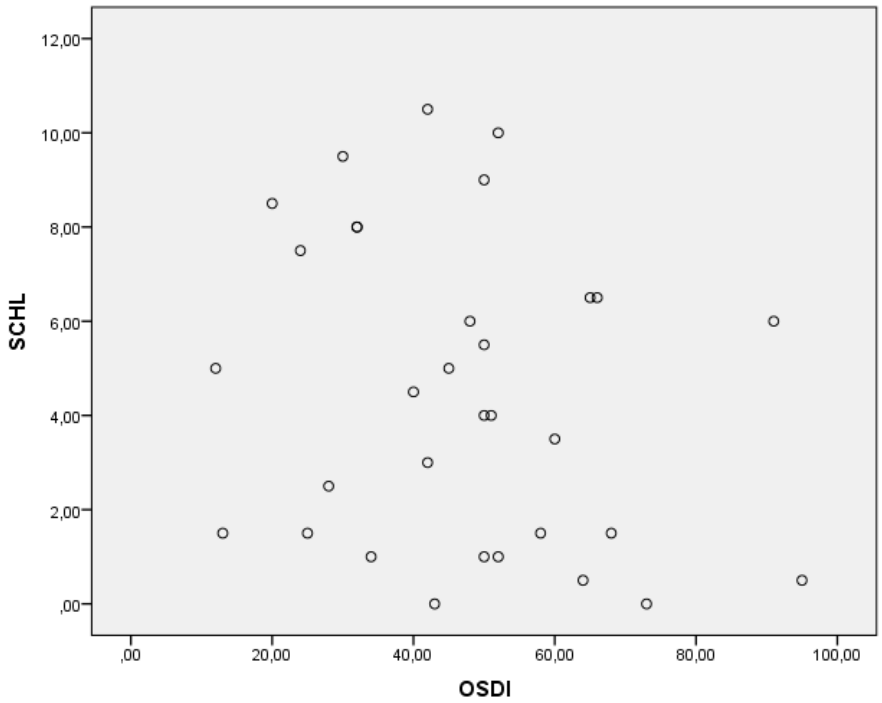

Figure No.2
Association between OSDI scores and Schirmer test values

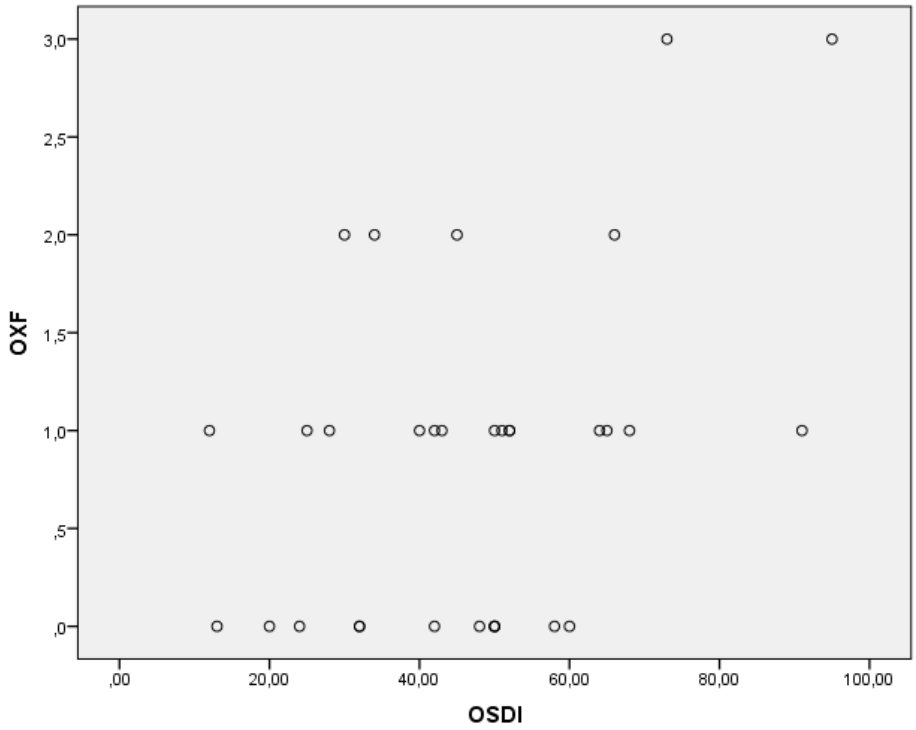

Figure No. 3
Association between OSDI scores and Oxford grades

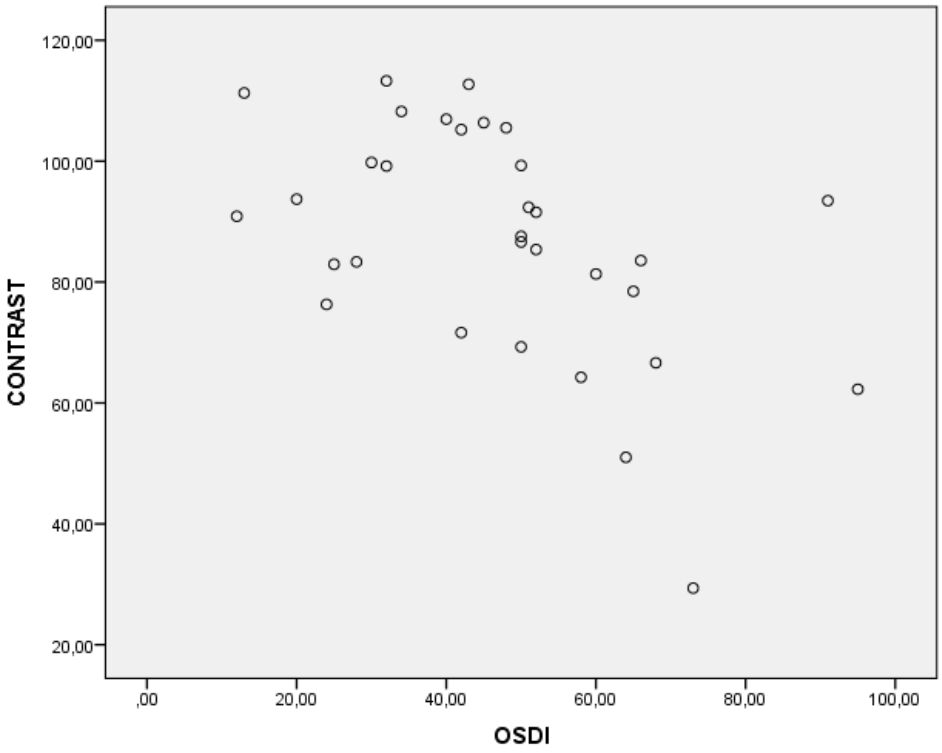

Figure No. 4
Association between OSDI scores and contrast sensitivity