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Comparison of Dry Eye Parameters between Keratoconus Patients and Control Subjects in Gaza Strip, Palestine

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Abstract

The study aimed to compare the dry eye symptoms and signs between keratoconus patients and control subjects.

In a prosepctive analysis, tear break up time (TBUT), Shirmer test I (ST) and symptoms were assessed for 23 keratoconus (KC) patients and 22 control subjects from the Eye Hospital in Gaza. At least one dry eye (DE) symptoms, TBUT or ST was used in assigning patients into either DE or non-DE group. A "yes" or "no" response was further used for the discriminant analysis and tear abnormality (TBUT<10 seconds; ST< 5 mm). The prevalence of DE symptoms was significantly higher in KC patients (39.1%) than control subjects (31.8%). Red eye was the most common symptom of dry eye among control subjects (57.1%) and KC patients (55.5%). There was no significant associations between ST and DE (*p=0.073).* However, the TBUT was significantly different between KC patients and control subjects (p=0.031).

In the current study, the number of patients of dry eye symptoms was higher in KC patients than control subjects. Red eye was the main symptom of dry eye among control and KC cases. In addition, TBUT was significantly different between KC patients and control subjects.

Keywords:
Tear break up time test,
Keratoconus,
Shirmer test,
Dry eye,
Red eye.

1. Introduction:

Keratoconus is defined as a non-inflammatory disease that can alter the shape of the cornea (Romero-Jiménez et al., 2010). According to Sugar and Macsa (2012), KC is a specifically characterized by a progressive conical shape with a bulge of the thinned stoma area. The disease is usually bilateral, although asymmetrical which typically lead to mild or severe functional visual acuity impairment due to irregular astigmatism, progressive myopia and by clinicians and researchers to evaluate and diagnose KC (Rohit et al., 2017). A higher incidence of the disorder has been reported among the Asian frequently corneal scarring (Vazirani and Basu, 2013). Subjects with moderate or severe KC experience great discomfort; hence often become frustrated because KC limits their lifestyle activities, as well as occupational productivities (Kymes et al., 2008). Its prevalence was reported to be around 8.8 to 54.4 per 100,000 across the globe. Reported seemingly prevalence wide variation is in part due to different clinical tests and diagnostic criteria used populations compared to Caucasians, suggesting a possible genetic factors (Georgiou et al., 2004). However, the cause of the condition remains

unclear. On the same note KC was reported to be significantly related to dry eye symptoms, as confirmed with the TBUT assessment. However, significance difference was not detected for ST values between three stages of KC (Mohd-Ali et al., 2011). Another study, which investigated the percentage of dry eye symptoms in KC patients was found to be 81.5% (Dogru et al., 2003). Hence, it is important for practitioners to know about alterations in tear functions in KC patients in order to initiate a proper management for dry eye which may affect their quality of life. To the best of our knowledge, there is no available data in the literature about the tear functions of KC patients in Palestine. The results of this investigation may enhance the understanding of the relationship between KC and tear functions. The current study aimed to compare tear functions between KC patients and normal subjects in Gaza strip, Palestine.

2. Materials and methods:

As the prevalence of keratoconus is very low (1 in 4,000), we use similar sample size as quoted in earlier works on keratoconus patients in Asia (Moon et al., 2006; Mohd-Ali et al., 2011). A prospective analysis was performed using a case-controlled study based on the examination of patients attending the Eye Hospital in Gaza. The study protocol has been approved by local committee from Ministry of health. A total number of 23 Keratoconus patients (13 males, 10 females) as well as 22 control subjects (10 males, 12 females) were included in this study. Each age was matched to the similar age within a range of ±2 years. The clinical signs of dry eye disease were examined at 2 to 3 months for data collection by clinical practitioners with strict adherence to the guidelines. The exclusion criteria were included patients who had ocular surgeries or laser treatment, vitamin A deficiency, cigarette smoking, contact lens wear, oral contraceptives and rheumatoid arthritis. Dry eye in the current study was diagnosed based on one or more symptom or positive clinical signs which include ‘‘dry sensation,’’ ‘‘eye itching,’’ ‘‘red eye,’’ ‘‘blurred vision,’’ ‘‘foreign body sensation,’’ ‘‘excess tearing,’’ ‘‘sensitivity to bright light,’’ ‘‘eye pain,’’ and ‘‘eye discharge’’. The responses ‘‘yes’’ or ‘‘no’’ were used for the discriminant analysis.

Shirmer test is an invasive method of assessing change in the flow of the tears in the tear pool (Cho and Yap, 1993). This test uses non-toxic filter strips to measure aqueous tear secretion. Schirmer I is performed without corneal anesthesia while measuring total tear production which include examining reflex, and basic tear flow within a 5-minute period. Values of the ST were obtained prospectively in the present research.

For TBUT, dye that readily mixes with the tear fluid was used. The tear film takes on a uniform fluorescent green appearance. The chin and forehead were rested on a chin and forehead rests of slit lamp biomicroscopy respectively. The period from the last blink to the appearance of random dark spots and streaks in the tears was recorded as TBUT. The dark spots are caused by the migration of superficial lipids towards the ocular surface, rendering the surface dry (Dry Eye Work Shop, 2007c). Average of three consecutive readings was recorded for each measurement. Slit lamp biomicroscopy magnification was fixed at ×10. Results of the invasive TBUT were examined prospectively and patient with less than 10 seconds was diagnosed as having a dry eye in this present research.

3. Statistical analysis:

Statistical analysis was conducted using IBM SPSS (Version 20.0, SPSS Inc, Chicago, Illinois, USA). In this study, McNemar’s test was used to compare the frequency of dry eye symptoms between KC patients and control subjects. In addition, non-parametric (Wilcoxon signed rank test) was used to compare the scores of the clinical signs between KC patients and control subjects. A value of $p<0.05$ was considered significant at 95% confidence interval.

4. Results:

Table 1 shows that the percentage of patients with dry eye symptoms was higher in KC patients 39.1% than control subjects 81.8%. Additionally, the presence of dry eye symptoms were significantly different with KC patients (p=0.023).

Table 1 *Comparison of dry eye symptoms percentage between KC patients (n=23) and control subjects (n=22)*

Variable	KC patients N(%)	Control subjects N(%)	*p*-value
One or more dry eye symptom	(9) 39.1	7 (31.8)	0.023

KC: keratoconus; N: number; %: percentage; McNemar's test

Red eye and blurred vision were the two most commonly reported symptoms of KC patients and represented 55.5% and 44.4%, respectively (Table 2).

Table 2 *Frequency of dry eye symptoms in KC patients and control subjects*

Symptoms	KC patients (n=9) N(%)	Control subjects (n=7) N(%)
F.B sensation	3 (33.3%)	1 (14.3%)
Red eye	5 (55.5%)	4 (57.1%)
Eye pain	1 (11.1%)	2 (28.6%)
Blurred vision	4 (44.4%)	1 (14.3%)
Others	5 (55.5%)	2 (28.6%)

N: number; %: percentage; KC: keratoconus; F.B: foreign body; Others include: scratchiness, soreness, grittiness, burning sensation, eye discharge

TBUT was used for measuring tear film volume. The median (interquartile range) of TBUT was 8 (5) seconds in patients with KC versus 12 (9) seconds control subjects (p =0.031; Table 3).
The median (interquartile range) of Shirmer test was 14 (7) mm in patients with KC versus 16 (10) mm in control subjects. However, no correlation was observed in the Shirmer test between KC and control subjects (p=0.073; Table 3).

Table 3 *Comparison of clinical signs scores between KC patients (n=23) and control subjects (n=22)*

Variable	KC patients (median(IOR))	Control subjects (median(IOR))	*p*-value
TBUT	8 (5)	12 (9)	0.031
(sec)	14 (7)	16 (10)	0.073
ST (mm)			

KC: keratoconus; TBUT: tear break up time test; ST: Shirmer test; Sec: second; mm: millimeters; IQR: Interquartile Range; Wilcoxon Signed Rank Test

5. Discussion:

In our study, KC patients had a significantly higher frequency of dry eye symptoms than control subjects. This conforms to a study by Gonzalo et al. (2015) who found a significant correlation between dry eye symptoms and KC. According to Dogru et al. (2003), 81.5% of patients with either KC had self-reported clinically relevant dry eye. Acera et al. (2011) stated that there is a correlation between KC and dry eye disease. Results from the current study showed a significant difference in TBUT values between KC and control subjects. The present findings are comparable to Mohd-Ali et al. (2011) who evaluated tear functions in KC patients in Malaysia. Their results showed an average value of 3.99 (1.69) seconds in patients with KC versus 7.03 (3.48) seconds in control subjects, with a significant difference of TBUT between them. The authors also reported no significant difference was noted between the Schirmer test values of both groups. On the other hand, Gonzalo et al. (2015) found neither a significant decrease of aqueous tear flow nor an impaired tear break up time test among KC patients.
It can be concluded that our findings support the suggestion that KC patients have an elevated frequency of dry eye symptoms. In addition, TBUT was significantly less in KC patients with dry eye disease at the Eye Hospital in Gaza. We suggest a further prospective investigation to identify the relationship between KC and dry eye.

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مقارنة معايير جفاف العين ما بين مرضى القرنية المخروطية والأشخاص الطبيعيين في قطاع غزة فلسطين

كلمات مفتاحية:
جفاف العين
القرنية المخروطية
اختبار شيرمر
احمرار العين
مستشفى العيون

تهدف الدراسة إلى مقارنة أعراض وعلامات جفاف العين ما بين مرضى القرنية المخروطية والأشخاص الطبيعيين.
ولقد تم تقييم ثلاثة وعشرون مريض قرنية مخروطية وأثنان وعشرون شخص طبيعي في مستشفى العيون بغزة باستخدام كل من اختبار شيرمر وأيضا ثبات الفلورسين في القرنية للكشف عن جفاف العين. تم تقسيم المرضى الى مجموعتين منهم من يعاني من أعراض وعلامات جفاف العين وأخرين ليس لديهم جفاف في العين.
وأظهرت الدراسة أن نسبة أعراض جفاف العين زادت في مرضى القرنية المخروطية مقارنة بالأشخاص الطبيعيين. احمرار العين هو أكثر أعراض جفاف العين انتشارا في مرضى القرنية المخروطية والأشخاص الطبيعيين. حسب النتائج لا يوجد علاقة ما بين اختبار شيرمر وجفاف العين ولكن يوجد علاقة ما بين جفاف العين وثبات الفلورسين في القرنية. ٢٦ بالمئة من مرضى القرنية المخروطية يعانون من جفاف العين المتوسط بينما ١٨ بالمئة من الأشخاص الطبيعيين لديهم جفاف في العين بسيط.
بينت هذه الدراسة إن مرضى القرنية المخروطية الذين يعانون من أعراض جفاف العين أعلى من الأشخاص الطبيعيين. وأن احمرار العين هو العرض الرئيسي لجفاف العين في مرضى القرنية المخروطية والأشخاص الطبيعيين. ويتناسب ثبات الفلورسين في القرنية طرديا مع مرضى القرنية المخروطية والطبيعيين أيضا.