

## Comparison of Schirmer's test and tear film breakup time test to detect tear film abnormalities in patients with Pterygium

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### Abstract

**Objective:** To compare tear film breakup time test with Schirmer's test in patients with pterygium.

**Methods:** The case-control study, involving 86 patients with unilateral primary pterygium aged between 30 and 70 years, was conducted at the Department of Ophthalmology, Karachi Medical and Dental College, Abbasi Shaheed Hospital, from May 2009 to December 2010. The eye with pterygium was taken as the case, and was compared with the other eye without pterygium which was taken as the control in these patients. All patients underwent routine ophthalmic examination. Tear film tests such as Schirmer's test and tear film breakup time test were performed on all these eyes. Results of tear function test between the eyes with pterygium (cases) and the eye without pterygium (control) were compared. SPSS 17 was used for statistical analysis. Chi square test was used for comparing the results of the cases and the controls.

**Results:** Of the 86 patients, 63 (73.3%) were men, while 23 (26.7%) were women. The median age was 41 years. There were 62 (72.1%) patients with pterygium in the right eye, while 24 (27.9%) had it in the left. Among the involved eyes, decreased tear breakup time (<10 seconds) was observed in 65 (75.6%) eyes, while 21 (24.4%) eyes did not show decreased tear breakup time i.e. >10 seconds. On the other hand, 8 (9.3 %) eyes with pterygium had Schirmer's test positive and 78 (90.7 %) eyes had it negative.

**Conclusion:** Tear film breakup time test has better diagnostic value compared to Schirmer's test in detecting tear film abnormality in patients with pterygium.

**Keywords:** Pterygium, Schirmer's test, Tear film breakup time test, Eye. (JPMA 62: 1214; 2012)

### Introduction

Pterygium is a fibro-vascular growth of conjunctiva that extends across the limbus and invades the cornea. It is more common in tropical and sub-tropical countries.<sup>1,2</sup> Pterygium is most likely related to ultraviolet radiation (240-400nm) which causes mutation in limbal basal stem cells and alters expression of p-53 protein, tissue growth factor  $\beta$  and matrix metalloproteinases.<sup>3,4</sup>

Tear instability is a disorder of tear film that is associated with pterygium.<sup>5</sup> Tear film consists of three layers. The most superficial layer of the tear film is lipid layer, which is 0.11  $\mu$ m thick and is produced by the meibomian glands. The middle layer is the aqueous layer produced by the main lacrimal gland as well as accessory lacrimal glands of Krause and Wolfring and is 7.0  $\mu$ m in thickness. Aqueous tear deficiency is the most common cause of dry eyes. Aqueous layer constitutes over 90% of the tear film. The layer closest to the cornea is the mucin layer 0.02-0.05  $\mu$ m thick, produced by conjunctival goblet cells.<sup>6</sup> The tear film instability causes dry eye syndrome which can lead to vision-threatening complications and, therefore, early diagnosis is important.<sup>7</sup>

Symptom assessment, medical history, slit lamp examination for tear meniscus height, Rose Bengal and fluorescein staining of conjunctiva and cornea, tear breakup time test (TBUT) and Schirmer's test are among the preferred diagnostic tools to detect the tear film instability.<sup>8</sup>

Tear breakup time test is the standard clinical procedure that was introduced by Norn and its high sensitivity suggests a strong connection to the dry eye.<sup>9</sup> A study has shown that the most frequently used diagnostic test to determine tear film abnormality was the tear breakup time test which was done by 93% of the participants, followed by conjunctival and corneal staining done by 74-85%. Schirmer's test was performed by 41% of the participants, which was more likely because of the irritative nature and time needed for this test.<sup>10</sup> Another study has reported that the most common diagnostic test performed for tear film abnormality by 53% of the participants was the tear breakup time test, while the Schirmer's test was done by 44%.<sup>8</sup>

The objective of the present study was to compare Schirmer's test and the tear break up time test diagnostic utility to detect tear film abnormalities in patients with pterygium.

## Patients and Methods

The case-control study included 86 patients selected from the out patient department of Ophthalmology, Karachi Medical and Dental College, Abbasi Shaheed Hospital, between May 2009 and December 2010. The study was approved by the Hospital Review Committee and informed consent was obtained from the participants. Patients with unilateral primary pterygium aged between 30 and 70 years were included in the study.

Sample size was calculated by the reported data of 16.4% in patients with pterygium having a dry eye.<sup>5</sup> Keeping the confidence interval  $(1-\alpha) = 95\%$  and absolute precision (d) of 0.08, the calculated sample size was 83.

Among our patients, the eye with pterygium was taken as the case and was compared with the other eye without pterygium which was taken as the control in these patients.

All patients were examined to rule out any ocular disease such as blephritis, disorders of the lacrimal system, ocular surface abnormality and history of diabetes mellitus, hypertension, collagenous diseases and use of topical or systemic drugs and ocular surgeries.

Tear function tests such as Schirmer's test and the TBUT test were performed by the same examiner. Schirmer's test was performed, following instillation of one drop of proparacaine hydrochloride 0.5% (Alcaine - Alcone Couvreur Belgium) by placing sterile Schirmer test paper (Whatman filter paper strips by Clement Clarke) which was 5mm x 35mm. The strips were placed in the lower fornix near the lateral canthus, away from cornea and left in place for 5 minutes with eyes closed. The strip was removed after 5 minutes, the wet portion of the strip was measured in millimeters with the scale.<sup>11</sup> Both eyes were tested simultaneously. The test results were considered positive if the length of wetting obtained was less than 6mm in 5 minutes.<sup>12</sup>

The TBUT test was performed using fluorescein strips (Fluorets strips by Chauvin Pharmaceuticals Ltd), which were introduced to the conjunctival sac with minimal stimulation. The patient was asked to blink several times and then to keep the eyes open. Cornea was examined under cobalt blue filter on the slit lamp. The dry area was indicated by the presence of black spot. The time between the last blink and the appearance of a random dry spot was recorded in seconds as the tear film breakup time. The test was repeated three times and the average value was recorded. The test was considered positive if the average tear film breakup time was less than 10 seconds.<sup>13</sup>

Statistical analysis was done by SPSS version 17. The frequency of positivity detected by the tear break up time test and the Schirmer's test in case group were compared using chi square test with significance set at  $\leq 0.05$ . All possible

confounders were restricted in the eligibility criteria.

## Results

Out of the 86 patients in the study, 63 (73.3%) were men, while 23 (26.7%) were women. The median age was 41 years (Interquartile range [IQR] 36-55 years). There were 62 (72.1%) patients who had pterygium in the right eye, while 24 (27.9%) had it in the left.

**Table-1: Tear breakup time in involved and uninvolved eyes.**

|                                     | Eyes with Pterygium | Eyes without Pterygium |
|-------------------------------------|---------------------|------------------------|
| Tear Breakup Time +VE (<10 Seconds) | 65 (75.6%)          | 08 (9.3%)              |
| Tear Breakup Time -VE (>10 Seconds) | 21 (24.4%)          | 78 (90.7%)             |

**Table-2: Schirmer's test in involved an uninvolved eyes.**

|                              | Eyes with Pterygium | Eyes without Pterygium |
|------------------------------|---------------------|------------------------|
| Schirmer's Test +VE (< 6 MM) | 08 (9.3%)           | 03 (3.5%)              |
| Schirmer's Test -VE (> 6 MM) | 78 (90.7%)          | 83 (96.5%)             |

**Table-3: Comparison between Schirmer's test and tear break up time test in eyes with Pterygium.**

| TBUT value   | Schirmer's Test |        | *p           |
|--------------|-----------------|--------|--------------|
|              | < 6 mm          | > 6 mm |              |
| < 10 seconds | 8               | 57     | $\leq 0.001$ |
| > 10 seconds | 2               | 19     |              |
| Total        | 10              | 76     |              |

\*Pearson Chi - square  
TBUT = Tear Break Up Time.

Among the involved eyes, decreased tear breakup time (<10 seconds) was observed in 65 (75.6%) eyes, while 21 (24.4%) eyes had it >10 sec (Table-1). On the other hand, 8 (9.3%) eyes with pterygium had Schirmer's test positive (<6mm) and 78 (90.7%) eyes had it negative (Table-2).

Taking Schirmer's test as the gold standard, sensitivity of the TBUT test was found to be 88.88% and specificity 25.97%, while sensitivity of Schirmer's test was 75% and specificity 91.46% (Table-3).

Statistically, significant difference was observed in the comparison between the two tests ( $p > 0.001$ ).

## Discussion

We correlated and found that the tear film abnormalities occur in patients with pterygium and we performed clinical diagnostic TBUT and Schirmer's tests with anaesthesia.

Schirmer's test values with anaesthesia are reduced in eyes with unilateral pterygium. As shown in a study, it is the most popular test as it is easy to perform without any additional equipment and it indicates the instability of the aqueous phase of the tear film.<sup>14,15</sup> The TBUT test is an excellent diagnostic test for detecting the mucin and lipid layer deficiency of the tear film.<sup>11,16</sup>

According to a study, tear film instability is reported in patients having pterygium, as values of both the tests were significantly reduced in these patients.<sup>17</sup>

TBUT of < 10 seconds and in the Schirmer's test, wetting of Whatman filter paper of less than 6mm after 5 minutes were considered abnormal,<sup>12</sup> in a study, and we took the same values for the two tests.

Our study found that in patients with pterygium, TBUT test was abnormal in 75.6% of eyes and in 9.3% of eyes in the control group. One study has reported TBUT test to be positive in 30.35% eyes with pterygium, and 21.91% eyes in the control group.<sup>18</sup> Unstable TBUT test in 39.7% eyes with pterygium, and 23% eyes in the control group has also been reported.<sup>5</sup> Among our patients with pterygium, the value of TBUT test was more compared to other studies which may be due to exposure to dust and hot climate leading to excessive evaporation of tears, as most of our patients were involved in outdoor work.

Among our patients, the Schirmer test was positive in 9.3% of eyes with pterygium, and 3.5% of eyes in the control group. A study has shown positive Schirmer's test in 31.2% eyes with pterygium and 30.82% in the control group.<sup>5</sup> Another study has reported no patient with pterygium and in the control group with abnormal value of Schirmer's test.<sup>12</sup>

Also in literature, reduced TBUT test in patients with pterygium has been reported, whereas no significant difference was seen with regard to the Schirmer's test.<sup>19</sup> A close relationship between tear instability and ocular surface abnormality has been reported as Schirmer's test and TBUT test were found to be lower in these eyes.<sup>13</sup>

Our study showed that statistically, sensitivity of Schirmer's test was found to be 75% whereas specificity was 91.46%. The sensitivity of the TBUT test was 88.88% and specificity was 25.97% in eyes with pterygium, showing that it had good sensitivity compared to the Schirmer's test and was an important diagnostic tool for detecting tear deficiency in eyes with pterygium. Both tests were performed by a single examiner. As such, observer bias was excluded.

## Conclusion

The study demonstrated high sensitivity of the TBUT

test compared to the Schirmer's test. Thus, it could be used as an initial screening tool in out-patient departments to detect tear film instability in patients with pterygium. Tear film abnormality causes dry eye syndrome, which make early diagnosis and prompt treatment as key steps in preventing vision-threatening complications.

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