



Original Research Article

CLINICAL CORRELATION BETWEEN UNILATERAL PTERYGIUM AND DRY EYE

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ABSTRACT

Background: The aim is to study dry eye in cases of unilateral pterygium. The objective is to study the incidence of dry eye among the patients of unilateral pterygium. To find the clinical correlation between dry eye and unilateral pterygium.

Results: This study demonstrates a significant association between pterygium and dry eye disease, as evidenced by measurable impairments in tear film stability and production. Using objective clinical parameters—Tear Break-Up Time (TBUT), Tear Meniscus Height (TMH), and Schirmer's Tests I and II—we found that patients with pterygium consistently exhibited reduced values across all indicators when compared to controls. Among these, TBUT showed the strongest correlation with both the presence and severity of pterygium, underscoring the progressive nature of tear film instability as pterygium advances in grade. While TMH and Schirmer's test values were also significantly lower in pterygium patients, their association with pterygium severity was less pronounced, likely due to sample size limitations and variability in tear secretion patterns. Nevertheless, these findings align with existing literature suggesting that pterygium contributes to both aqueous tear deficiency and tear film instability—key factors in the pathogenesis of dry eye disease.

Conclusion: The present study highlights the clinical importance of routine screening for dry eye symptoms in patients with pterygium, particularly in moderate to severe cases. Early identification and management of tear film dysfunction may alleviate symptoms, enhance visual quality, and potentially reduce postoperative recurrence following pterygium excision. Future studies with larger cohorts and standardized diagnostic criteria are recommended to further validate and refine the association between pterygium and dry eye disease.

Keywords: Pterygium, Dry eye, TBUT, TMH, Schirmer's test.

INTRODUCTION

Pterygium is the most common triangular fibrovascular proliferative disease characterized by a wing-shaped growth from the conjunctiva over the ocular surface. This refers to the term “pterygion” or “pterygos” or “pteron”, which means a little wing in Greek.^[1] Pterygium (also known as surfer's eye) is an ocular surface disease characterized mainly by a wing-shaped growth of limbal and conjunctival tissue over the adjacent cornea. As a result of alterations in local ocular surface homeostasis, the main

components of pterygium include proliferative clusters of limbal stem cells (LSCs), epithelial metaplasia, active fibrovascular tissue, inflammation, and disruption of Bowman's layer along the invading apex of the pterygium.^[2]

The growth of pterygium often causes unsatisfactory cosmetic appearance among its sufferers. Although rare, pterygium can also cause visual disturbances by interfering with the tear film stability, obscuring the visual axis, and inducing astigmatism.^[3]

Epidemiology: Depending on the population studies, the prevalence of pterygium lies within the range of 1% to more than 30%.^[4-8] The prevalence of

pterygium is reported to be 3% in Australians, 23% in blacks in United States, 15% in Tibetans in China, 18% in Mongolians in China, 30% in Japanese and 7% in Singaporean Chinese and Indians.^[9-14]

Pterygium is the most common in geographic latitude 40° around the equator.^[15] The prevalence rate of pterygium within this area is reported to be more than 10 times higher than that outside it, which strongly supports the role of ultraviolet (UV) irradiation in the pathogenesis of pterygium.^[16]

Histopathology: The main histologic findings in a pterygium specimen from surface to depth include invading pterygium epithelial cells with proliferative features, squamous metaplasia, hyperplasia of goblet cells, underlying disrupted Bowman's layer, stromal fibroblasts and vessels, altered extracellular matrix (ECM) with accumulation of collagen and elastin fibers, and inflammatory infiltration.

Indication for surgery: The main indication for pterygium surgery is visual disturbance secondary to encroachment over the pupillary area or induced astigmatism. Other indications which can be considered are, restriction in eye movements, chronic redness and foreign body sensation, and cosmetic concerns.

Surgery: The first reported surgical approach to pterygium management was described by Celsus, in which a needle and thread were passed under the pterygium. The thread was then elevated, the pterygium was completely lifted from the cornea to the canthus using a sawing motion, and the pterygium was excised. Unfortunately, this approach was often associated with pain, as well as blindness.

Dry eyes, also known as dry eye syndrome (DES), dry eye disease (DED), ocular surface disease (OSD), dysfunctional tear syndrome (DTS), and keratoconjunctivitis sicca (KCS). The definition of a dry eye according to the Tear Film and Ocular Surface Society (TFOS) Dry Eye Workshop II (DEWS II) is, "Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiologic roles.

Aim

To study dry eye in cases of unilateral pterygium.

Objectives

To study the incidence of dry eye among the patients of unilateral pterygium. To find the clinical correlation between dry eye and unilateral pterygium.

MATERIALS AND METHODS

Study site: Bhaskar General Hospital, Yenkapally

Study population: This study is being conducted among the patients who visit Bhaskar general hospital

Sample size: A sample of 100 eyes of 50 patients

Study duration: June 2023 – Dec 2024

Study design: Case control study

Inclusion criteria

Cases: All Patients of > 18 yrs and <45yrs of age presenting with unilateral pterygium

Controls: The normal eye of the same patients without any signs and symptoms of dry eye.

Exclusion criteria

1. Patients with systemic diseases/syndromes associated with dry eye (e.g. Sjogren's syndrome, hyper/hypo thyroid, RA)
2. Patients on systemic medication (e.g. diuretics, psychotropic, that leads to ocular drying)
3. Contact lens users
4. Patients having other adnexal disease, anterior or posterior segment disease which alters tear secretion and stability
5. Patients having recent ocular surgery (e.g. cataract surgery)
6. Patients on topical anti glaucoma medications (beta blockers) that leads to ocular drying
7. Post menopausal women.
8. Recurrent pterygium.
9. Those who did not give consent

Clinical Evaluation: After obtaining informed consent, patients meeting the inclusion criteria were enrolled in the study. A thorough demographic profile was recorded, including age, gender, occupation, and lifestyle factors. A detailed history was elicited to document the onset, duration, and aggravating or relieving factors associated with ocular symptoms, such as dryness, irritation, foreign body sensation, burning, and photophobia.

Clinical Examination

Each patient underwent a systematic clinical assessment that included:

General Physical Examination: A routine examination was conducted to assess overall health status and identify any systemic conditions (e.g., autoimmune diseases, diabetes) that may influence ocular surface health.

Detailed Ophthalmic Examination

A comprehensive eye examination was performed as follows:

- **External Eye Examination:** Assessment of eyelids, conjunctiva, cornea, iris, pupil, and lens was done to rule out any gross abnormalities or pathologies.
- **Visual Acuity Testing:** Measurement of distance and near vision using standard Snellen charts, with and without correction.
- **Slit Lamp Biomicroscopy:** A detailed anterior segment examination using a slit lamp microscope was performed to observe the conjunctiva, corneal surface, tear film quality, and to detect any signs of inflammation, meibomian gland dysfunction, or other structural abnormalities.

Specialized Tests for Tear Film and Ocular Surface Evaluation

The following diagnostic tests were employed to assess the quantity and quality of the tear film:

Tear Film Break-Up Time (TBUT):

- **Purpose:** Assesses the stability of the tear film.
- **Method:** A fluorescein dye is instilled into the conjunctival sac. The patient is asked to blink several times, then keep the eyes open while observing the tear film under cobalt blue light using a slit lamp.
- **Interpretation:** The time interval between the last blink and the first appearance of a dry spot (break) on the cornea is recorded. A TBUT of less than 10 seconds is typically considered abnormal.

Tear Meniscus Height (TMH):

- **Purpose:** Measures tear volume present in the lower tear meniscus.
- **Method:** Observed at the junction of the lower eyelid and globe using a slit lamp.
- **Interpretation:** A TMH of less than 0.2 mm suggests aqueous tear deficiency.

Schirmer's Test I and II:

- **Purpose:** Quantifies tear production.
- Schirmer's Test I:
- Performed without anesthesia.

- Assesses both reflex and basal tear secretion.
- Filter paper strips are placed in the lower fornix for 5 minutes, and the wetting length is measured.

Schirmer's Test II:

- Performed with topical anesthesia to inhibit reflex tearing.
 - Measures basal tear secretion only.
- All the data is tabulated and statistical software was used to assess the significance.

RESULTS

After careful evaluation of the patients in this study we have observed the following findings:

Age distribution:

Among the 50 patients examined the following age distribution was observed:

The age distribution of participants reveals that the majority of patients were within the age group 21-40 (56%), followed by >40 age group accounting for 40% and only 4% under 20.

Table 1: Age Distribution

Age group	Frequency	Percent
<20	2	4.0
21-40	28	56.0
>40	20	40.0
Total	50	100.0

[Table 1] Age distribution of the study population.

Gender distribution: Among the study population 62% of participants were female, while 38% were

male, indicating a female predominance among individuals presenting with unilateral pterygium.

Table 2: Gender

Gender	Count	Percent
Female	31	62.0
Male	19	38.0
Total	50	100.0

[Table 2] Gender distribution of the study population

Grade of pterygium: Among the 50 patients examined, the majority of patients (58%) presented

with Grade 2 pterygium, followed by 24% with Grade 1, and 18% with Grade 3.

Table 3: Grade of pterygium:

GRADE	Frequency	Percent
1	12	24.0
2	29	58.0
3	9	18.0
Total	50	100.0

[Table 3] Distribution of Pterygium Grades Among study population

1. TBUT (Tear film Break-Up Time)

All the patients were subjected to TBUT after staining with Fluorescein dye and the breakup time of the tear film was recorded using the cobalt-blue filter of the slit lamp

- TBUT values recorded were as follows Case Group Mean: 8.20 Control Group Mean: 9.94

Standard Deviations: Case: 3.136, Control: 3.377
SEM: The standard error for the case group is 0.444, while the control group has a SEM of 0.478. On paired sample t-test, the p-value for TBUT was (P = 0.001), indicating a statistically significant difference between case and control eyes. This shows a reduction in tear film stability in eyes affected by unilateral pterygium.

Table 4: TBUT

	Case eye	Control eye

	P-value	Mean	SD	Mean	SD
TBUT	8.20	3.136	9.94	3.377	0.001
TMH	0.182	0.0825	0.240	0.1107	0.001
SCHIRMER'S 1	14.30	8.546	18.86	8.783	0.001
SCHIRMER'S 2	11.50	6.982	15.62	7.312	0.001

[Table 4] Comparison of Tear Film Parameters Between Case and Control Eyes

2. TMH (Tear Meniscus Height)

TMH for all the patients was calculated on Slit-lamp after staining with Fluorescein dye and the beam width was set to 0.1mm under cobalt-blue filter and the values were recorded. The values recorded were as follows:

Case Group Mean: 0.182 Control Group Mean: 0.240 Standard Deviations: Case: 0.0825, Control: 0.1107.

SEM: The standard error for the case group is 0.0117 and the control group is 0.0156.

The p-value for TMH was (P = 0.001), which is also statistically significant and reflects a decrease in tear volume in the case group

3. Schirmer's Test I

The patients were subjected to Schirmer's test by placing the test strip in the lower fornix of both eyes and the values were recorded after 5 minutes.

Case Group Mean: 14.30 Control Group Mean: 18.86 Standard Deviations:

Case: 8.546

Control: 8.783

For Schirmer's Test I, the p-value was (P = 0.001), indicating a significant reduction in tear secretion in eyes with pterygium, further supporting a link between pterygium and dry eye disease.

4. Schirmer's Test II

The patients were subjected to Schirmer's test II with anaesthesia by placing the test strip in the lower fornix of both eyes and the values were recorded after 5 minutes.

Case Group Mean: 11.50 Control Group Mean: 15.62 Standard Deviations:

case group :6.982

control group: 7.312

Similarly, the p-value for Schirmer's Test II was (P = 0.001), which also shows a statistically significant difference.

Association Between TBUT and Pterygium Grade

Among patients with normal TBUT, the majority were in Grade 1 (52.4%) and Grade 2 (47.6%), and notably, none were in Grade 3, indicating preserved tear film stability in the early stages of pterygium.

In the mild-to-moderate TBUT group, most patients (81%) were in Grade 2, with a small portion in Grade 3 (14.3%) and only one case in Grade 1 (4.8%). The severe TBUT group was dominated by Grade 3 pterygium (75%), with the remaining 25% in Grade 2 and none in Grade 1, highlighting a clear progression toward more severe dry eye symptoms with advancing pterygium.

The Pearson Chi-square test yielded a significant value ($\chi^2 = 34.387$, df = 4, P = 0.001), confirming a statistically significant association between TBUT category and pterygium grade.

Table 5. TBUT GROUP * Grade

TBUT GROUP	Grade 1	Grade 2	Grade 3	Total
NORMAL	11	10	0	21
MILD-MODERATE	1	17	3	21
SEVERE	0	2	6	8
Total	12	29	9	50

Chi square = 34.387, P value = 0.001 (S).

[Table 5] Distribution of Pterygium Grades Across TBUT Severity groups (Normal->10 sec, Mild-Moderate - 5-10 sec, severe- <5sec)

Association Between TMH and Pterygium Grade

The relationship between Tear Meniscus Height (TMH) and pterygium grade was assessed using a chi-square test.

Abnormal TMH (AN) was more commonly observed in higher grades: 28.6% of these cases were in Grade 3, compared to only 10.3% in the normal TMH group.

Table 6. TMH GROUP * Grade

TMH GROUP	Grade			Total
	Grade 1	Grade 2	Grade 3	
ABNORMAL	3	12	6	21
NORMAL	9	17	3	29
Total	12	29	9	50

Chi square = 3.676, P value = 0.159 (NS)

In contrast, normal TMH (N) values were more prevalent in Grade 1 cases (31%), compared to only 14.3% among those with abnormal TMH.

Despite these differences, the Pearson Chi-square value was 3.676 with a p-value of 0.159, which exceeds the standard threshold for significance (P < 0.05). Therefore, the association between TMH and pterygium grade is not statistically significant in this sample.

[Table 6] Distribution of Pterygium Grades in TMH groups (>0.2 Normal, < 0.2 - abnormal)

Association Between Schirmer's I and Pterygium Grade

The cross-tabulation between Schirmer's I test categories and pterygium grades reveals variable tear secretion levels across different stages of pterygium, though the association was not statistically significant.

In the "Normal" Schirmer's I group, patients were spread across all grades: 29.4% in Grade 1, 58.8% in Grade 2, and 11.8% in Grade 3.

The "Mild dry eye" group showed no cases in Grade 3, with most in Grades 1 (50.0%) and 2 (50.50%).

The "Moderate" group showed a stronger concentration in Grade 2 (61.9%) and a notable

presence in Grade 3 (28.6%). The "Severe" dry eye group had only two cases, evenly split between Grades 2 and 3.

This pattern suggests a trend where tear deficiency, as measured by Schirmer's I, may worsen with increasing pterygium grade—particularly notable in the moderate and extreme dry eye categories.

Statistical Results: A Chi-square test was performed to assess the association between dry eye severity (SCHIRMERS 1 GROUP) and pterygium grade. The analysis yielded a Chi-square value of 10.136 with a corresponding P-value of 0.119. Although the cross-tabulation suggested a potential trend where higher levels of dry eye were associated with more severe pterygium grades, the result was not statistically significant.

Table 7: Pearson Chi-square shows that the p-value is not statistically significant. SCHIRMER'S 1 GROUP * Grade

SCHIRMER'S 1	Grade			
	Grade 1	Grade 2	Grade 3	Total
NORMAL	5	10	2	17
MILD	5	5	0	10
MODERATE	2	13	6	21
SEVERE	0	1	1	2
Total	12	29	9	50

Chi square = 10.136, P value = 0.119 (NS)

[Table 7] Distribution of pterygium grade across Schirmer's I test severity groups (Normal - >15mm, Mild -11-15mm, Moderate -5-10mm, Severe <5mm)

DISCUSSION

The results of the study reveal a significant association between pterygium and dry eye, as measured through various ocular tests, including Tear Break-Up Time (TBUT), Tear Meniscus Height (TMH), and Schirmer's tests I and II.

Tear Break-Up Time (TBUT)

The TBUT results from this study show that the case group (pterygium patients) had significantly lower TBUT values compared to the control group. The mean difference of - 1.740 seconds was highly significant ($p = 0.001$), indicating reduced tear film stability in the pterygium-affected eyes. This finding is consistent with previous research suggesting that pterygium contributes to the instability of the tear film, leading to symptoms of dry eye (Kotecha et al., 2013; Karole et al., 2015). Specifically, the study by Karole et al.^[17] demonstrated that tear break-up time was significantly reduced in pterygium patients, with a greater reduction observed in higher pterygium grades, thus suggesting a relationship between pterygium severity and tear film instability. Similarly, our findings show a significant correlation between TBUT and pterygium grade (Chi-square = 34.387, $p = 0.001$), highlighting that more advanced stages of pterygium are associated with greater tear film dysfunction.

Tear Meniscus Height (TMH): Regarding TMH, the case group showed a significantly lower mean compared to the control group (mean difference = -

0.0580, $p = 0.001$), which suggests a reduced tear volume in eyes with pterygium. Reduced TMH is indicative of insufficient tear production, a hallmark of aqueous-deficient dry eye. This aligns with findings from studies such as Thatte et al. (2015),^[18] where a reduction in tear volume was observed in patients with pterygium, although the correlation between pterygium size and TMH was not statistically significant in our study. Interestingly, our results show that the case group exhibited less variability in TMH compared to the control group (smaller standard deviation and SEM), suggesting that tear volume deficiency may be a more consistent feature in pterygium patients.

While TMH was reduced in the pterygium group, the association between TMH and pterygium grade was not statistically significant (Chi-square = 3.676, $p = 0.159$). This lack of statistical significance could be attributed to the sample size and distribution of TMH values, as discussed in the study by Kotecha et al.^[19] (2013), which also found variability in the relationship between TMH and pterygium severity.

Schirmer's Test I and II

Schirmer's test results further support the hypothesis that pterygium is associated with tear film instability. Both Schirmer's I and II scores were significantly lower in the case group compared to the control group, indicating reduced basal and reflex tear secretion in pterygium patients. Schirmer's I, had a mean difference of -4.100 mm ($p = 0.001$), while Schirmer's II, had a mean difference of -1.960 mm ($p = 0.001$). These findings are in agreement with those of Padmavathi et al.^[20] (2018), who found a reduction in Schirmer's test values in pterygium patients,

although the association between pterygium size and dry eye was not statistically significant in their study. The reduction in Schirmer's test scores observed in our study highlights the potential contribution of pterygium to both basal and reflex tear secretion deficiencies. Notably, these impairments were most pronounced in the moderate to severe stages of pterygium, which corroborates the findings of studies by Thatte et al. (2015) [18] and Gupta et al. (2016),^[21] where increased pterygium size and grade were associated with greater tear film dysfunction and dry eye severity. While our study did not find a significant association between Schirmer's test and pterygium grade, this trend was reflected in the distribution of results, particularly with higher-grade pterygium patients showing greater reduction in tear secretion.

Comparison with Previous Studies

The results of our study align with those of previous research, confirming that pterygium is associated with tear film dysfunction and dry eye symptoms. Several studies (Padmavathi et al, 2018,^[20] Kotecha et al,^[19] 2013; Gupta et al, 2016,^[18]) have also reported a reduction in TBUT, Schirmer's test scores, and TMH in pterygium patients. For instance, Gupta et al,^[21] (2016) reported that pterygium patients had a higher prevalence of dry eye (58.89%) and a significantly lower TBUT, which is consistent with our findings of reduced tear film stability in the case group. Similarly, Karole et al,^[19] (2015) demonstrated that higher pterygium grades were associated with significant decreases in tear meniscus height, further supporting our results.

However, studies, such as those by Padmavathi et al,^[20] (2018), did not find a significant correlation between pterygium and dry eye, which may be due to differences in methodology or sample size. In their study, the authors did not observe a direct link between the size of pterygium and dry eye symptoms, whereas our study found that increasing pterygium grade was significantly associated with decreased TBUT. This discrepancy could also be influenced by differences in the criteria used to diagnose dry eye, as Padmavathi et al,^[20] relied on a single Schirmer's test cutoff (<10mm) to define dry eye, whereas our study incorporated a range of objective tests.

This study investigated the relationship between pterygium and dry eye disease using objective clinical parameters, including Tear Break-Up Time (TBUT), Tear Meniscus Height (TMH), Schirmer's Test I, and Schirmer's Test II. The analysis revealed that patients with pterygium consistently exhibited significantly reduced values across all dry eye parameters when compared to control eyes. These findings indicate that pterygium has a measurable impact on tear film stability and production, thereby contributing to the development or exacerbation of dry eye symptoms.

Among the parameters assessed, TBUT showed the strongest and most statistically significant association with both the presence and severity of

pterygium. A clear linear relationship was observed between declining TBUT and increasing pterygium grade, suggesting that tear film instability progresses with disease severity. Schirmer's Tests I and II further confirmed reduced basal and reflex tear production in pterygium eyes, though their association with pterygium grade was less significant statistically, possibly due to sample size limitations. TMH was significantly lower in pterygium eyes, but no strong association was found between TMH and disease grade.

When compared with existing literature, the results of our study align with previous findings that highlight a strong correlation between pterygium and dry eye. Studies by Karole et al,^[17] Manhas et al,^[22] and Gupta et al,^[21] similarly demonstrated significant tear film dysfunction in pterygium patients. Conversely, studies such as that by Padmavathi et al,^[20] found no significant association, emphasizing the need for standardized assessment tools and larger sample sizes to validate findings.

CONCLUSION

Given the consistency of these findings, this study highlights the clinical importance of routine screening for dry eye symptoms in patients with pterygium, particularly in moderate to severe cases. Early identification and management of tear film dysfunction may alleviate symptoms, enhance visual quality, and potentially reduce postoperative recurrence following pterygium excision. Future studies with larger cohorts and standardized diagnostic criteria are recommended to further validate and refine the association between pterygium and dry eye disease.

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