ORIGINAL RESEARCH PAPER

Ophthalmology

KEY WORDS: Pterygium, Meibomian Gland Dysfunction(MGD), Tear Film Instability, Ocular Surface Disease Index (OSDI) Scores

TEAR FILM INSTABILITY AND MEIBOMIAN GLAND DYSFUNCTION IN PTERYGIUM PATIENTS- A RURAL EYE HEALTH STUDY

Dr Sumayya S Gathinavar

Post Graduate Trainee, 3rd Year, Al-ameen Medical College and Hospital, Athani Road, Vijayapura, 586108

ABSTRACT

Purpose: To evaluate the abnormalities in Meibomian glands & tear film in patients with pterygium and assess their role in ocular surface discomfort & dry eyes. **Methods:** A cross-sectional study where 50 eyes of 50 patients with primary pterygium & 50 eyes of 50 healthy volunteers (age & sex matched) were evaluated for following parameters-Ocular surface disease index(OSDI) scores, meibomian gland expression scores, lid margin abnormality scores, meiboscore, tear film breakup time(BUT), Schirmer test(SIT). **Results:** Patients had significant Meibomian gland dropout, low TBUT and higher scores of OSDI,lid margin abnormality, meibomian gland expression compared to controls,which indicated compromised tear film stability & meibomian gland function in pterygium group. SIT readings showed no significant difference between both groups (Quantity of tear production remained unchanged) **Conclusion:** The present study demonstrated a strong association between pterygium and alterations in the Meibomian glands and tear film.

INTRODUCTION

Pterygium (Surfer's Eye) is an ocular surface disorder characterised by non-neoplastic elastotic degeneration (invasion of fibrovascular tissue) of the bulbar conjunctiva that extends to the corneal surface. [1] Risk factors include outdoor occupation, chronic sunlight and wind exposure, male sex, increasing age, dry and dusty environment, microtrauma, genetic and inflammatory predispositions. [2] Emerging evidence shows that pterygium is part of a broader ocular surface dysfunction driven by a complex vicious cycle involving MGD, tear film lipid layer instability, and chronic local inflammation. MGD reduces the quality and quantity of the lipid layer, promoting increased tear evaporation and tear film breakup.[3] Tear film instability, in turn, exacerbates ocular surface inflammation, which can promote both meibomian gland dropout and pterygium progression. The growing pterygium further disrupts tear film spreading, amplifying evaporative stress and perpetuating this cycle. but there are studies which also suggested that tear fluid secretion may increase as a compensatory response to meibomian gland loss to maintain ocular surface homeostasis. This disagreement could be triggered by compensatory mechanisms such as reflex production of aqueous and lipid components of the tear film, resulting in transient improvements in tear film stability.[4,5]

MATERIALS AND METHODS

This study was conducted adhering to the tenets of the Decleration of Helsinki and after recieving approval from Institutional Ethics committee.

Study Design: A cross-sectional comparative study at tertiary health care

Study Duration: January 2025 - October 2025 (10 months)

Instruments/Materials Used:

1. Slit lamp
2. Autorefractokeratometer (Topcon KR 800)
3. No 41 Whitmann filter paper
4. Impregnated fluorescein strip

Inclusion Criteria

1. Patients (Group A) with Unilateral primary Nasal pterygium without any other ocular/adnexal pathologies which may alter tear film stability, willing to be part of the study (n=50)
2. Controls (Group B) - Healthy Volunteers (n=50) Both groups - Age > 18y Sex - 25 males and 25 females in each group

Exclusion Criteria

1. Patients with any systemic comorbidities associated with dry eyes
2. Patients on any Systemic medications, long term topical ocular medications like Antiglaucoma drugs
3. Patients with contact lens use within 3m of examination
4. Patients who underwent any previous ocular surgeries

The following Standard parameters were assessed in all participants:

A. Ocular Surface Disease Index (OSDI) score for subjective symptoms.
B. Meibomian gland expression score to evaluate gland function
C. Lid margin abnormality score for lid health.
D. Meiboscore to quantify gland dropout using meibography.
E. Tear Film Break-Up Time (TBUT)
F. Schirmer's I Test (SIT) for tear film stability and tear secretion respectively.

Examination	Evaluation
Ocular symptoms (OSDI)	Ocular symptoms (OSDI-symptoms), vision-related activities of daily living (OSDI-function), and environmental triggers
Meiboscore	Grade 0: No dropout
	Grade 1: Dropout of <1/3 of lid area
	Grade 2: Dropout of <1/3-2/3 of lid area
	Grade 3: Dropout of >2/3 of lid area
	Total meiboscore (0-6): Upper eyelid+lower eyelid
Meibomiangland expression	Grade 1: Opaque, normal viscosity
	Grade 2: Opaque, increased viscosity
	Grade 3: Severe thickening (toothpaste)
	Grade 4: No expression, glands completely blocked
Lid margin abnormality	Vascular engorgement, plugged meibomian gland orifices, anterior or posterior displacement of the mucocutaneous junction, irregularity of lid margin
SIT	<5 mm: decreased
TBUT	<5 s: decreased

Statistical Analysis

- Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) software (version XX; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.
- The Shapiro–Wilk test was used to assess the normality of data distribution. For normally distributed continuous variables, Student's independent t-test was applied to compare parameters between the pterygium group (Group A) and the control group (Group B). For non-normally distributed data, the Mann–Whitney U test was used.
- Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. Correlation between pterygium severity and tear film or Meibomian gland parameters was evaluated using Pearson's correlation coefficient for parametric data and Spearman's rank correlation coefficient for non-parametric data.
- A p-value < 0.05 was considered statistically significant.

RESULTS

PARAMETERS	GROUP A (PTERYGIUM)	GROUP B (CONTROL)	P Value
1. OSDI (Ocular surface disease index) score	14.6 ± 4.8 (↑)	8.2 ± 3.1	<0.01
2. Lid margin abnormality	1.4 ± 0.8 (↑)	0.8 ± 0.6	<0.01
3. Meibum expressibility	1.7 ± 0.7	1.0 ± 0.6	<0.01
4. Meiboscore Upper lid Lower lid TOTAL	0.9 ± 0.6 1.1 ± 0.7 2.0 ± 1.0 (↑)	0.4 ± 0.5 0.5 ± 0.5 0.9 ± 0.8	<0.01 <0.01 <0.01
5. TBUT (Tear breakup time)	8.3 ± 2.5 (↓)	12.5 ± 3.3	<0.01
6. SIT (Schirmer's test)	15.5 ± 5.9	14.1 ± 5.2	>0.05

DISCUSSION

The present study highlights that unilateral primary nasal pterygium is associated with measurable alterations in tear film stability and Meibomian gland morphology compared to healthy controls. These findings suggest that even localized pterygium can disrupt ocular surface homeostasis, emphasizing that the impact of the disease extends beyond visible conjunctival changes.

Analysis of tear film parameters revealed compromised stability in the pterygium group, supporting the notion that lipid layer deficiency and evaporative stress play a significant role in ocular surface compromise. Meibomian gland dropout observed in these patients further underscores the interplay between lid margin health and tear film quality. While compensatory mechanisms such as increased aqueous secretion may transiently mitigate tear film instability,the data indicate that these responses are often insufficient, leading to persistent ocular surface stress.

Clinically, these results underscore the importance of assessing the ocular surface comprehensively in pterygium patients. Even in cases without pronounced symptoms, early identification of tear film and glandular abnormalities may help stratify risk for discomfort and surface compromise. Preoperative recognition of these changes may also inform individualized perioperative management, potentially improving postoperative comfort and reducing the likelihood of persistent dry eye symptoms.

This study is limited by its cross-sectional design, preventing inference of causality, and by the modest sample size, which limits detailed subgroup analyses, such as correlation between pterygium size or grade and severity of ocular surface dysfunction. Future prospective studies are needed to determine whether interventions targeting tear film stabilization and Meibomian gland support can modify disease progression, influence symptom severity, or reduce recurrence after surgical excision.

CONCLUSION AND RECCOMENDATIONS

The findings of this study indicate that pterygium is commonly associated with Meibomian gland dysfunction and instability of the tear film, reflecting a broader involvement of the ocular surface. These changes may contribute to increased tear evaporation, ocular discomfort, and chronic surface inflammation observed in patients with pterygium.

Based on these observations, evaluation of tear film integrity and Meibomian gland status should form part of the standard clinical assessment of individuals with pterygium. Identifying ocular surface abnormalities at an early stage allows for timely initiation of appropriate supportive therapy, which may improve symptoms and overall ocular surface condition.

Management strategies focusing on tear film stabilization—such as the use of lubricating agents, regular lid hygiene, warm compresses, and selected anti-inflammatory treatment—should be considered in conjunction with conventional pterygium care. Addressing underlying Meibomian gland dysfunction may also contribute to improved surgical preparedness and postoperative comfort in patients undergoing pterygium excision.

Further well-designed prospective studies are recommended to better define the relationship between pterygium severity and Meibomian gland changes, as well as to assess whether early ocular surface-directed interventions can influence disease progression or reduce recurrence rates.

REFERENCES

1. Kheirkhah A, Safi H, Molaei S, Nazari R, Behrouz MJ, Raju VK. Effects of pterygium surgery on front and back corneal astigmatism.Can J Ophthalmol. 2012;47:423–8.doi:10.1016/j.jcjo.2012.07.002.
2. Gonnermann J, Maier AK, Klein JP, Bertelmann E, Pleyer U, Klamann MK. Evaluation of ocular surface temperature in patients with pterygium.Curr Eye Res. 2014;39:359–64.doi:10.3109/02713683.2013.844262.
3. Kampitak K, Leelawongtawun W. Precorneal tear film in pterygium eye. J Med Assoc Thai. 2014;97:536–9.
4. Arita R, Morishige N, Koh S, Shirakawa R, Kawashima M, Sakimoto T, et al. Increased tear fluid production as a compensatory response to meibomian gland loss: A multicenter cross-sectional study. Ophthalmology. 2015;122:925–33.doi:10.1016/j.ophtha.2014.12.018.
5. Rahman A, Yahya K, Fasih U, Waqar-ul-Huda, Shaikh A. Comparison of Schirmer's test and tear film breakup time test to detect tear film abnormalities in patients with pterygium. J Pak Med Assoc. 2012;62:1214–6.