

Evaluation of Dry Eye Parameters in Relation to Pterygium Grading in a Tertiary Care Setting

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Abstract:

Background: Pterygium is a common ocular surface disorder characterized by fibrovascular proliferation extending from conjunctiva onto the cornea. Tear film instability and dry eye disease are frequently associated with this condition; however, their relationship with disease severity remains insufficiently explored. **Objective:** To evaluate the association between pterygium grading and dry eye parameters in patients presenting to a tertiary care centre. **Methods:** This cross-sectional observational study included 30 patients aged ≥ 18 years with primary unilateral pterygium attending a tertiary care ophthalmology outpatient department between April 2025 and September 2025. Pterygium severity was graded according to corneal involvement. Dry eye evaluation included Tear Film Break-Up Time (TBUT), Schirmer's test. Statistical analysis was performed using the chi-square test with significance set at $p < 0.05$. **Results:** Dry eye prevalence increased progressively with advancing pterygium grade, rising from 25% in Grade 1 to 100% in Grade 4. Abnormal TBUT was present in all Grade 3 and Grade 4 cases. Increasing age demonstrated significant association with advanced disease ($p < 0.01$). **Conclusion** Pterygium severity correlates strongly with tear film instability and ocular surface damage. Routine dry eye assessment should be incorporated into clinical evaluation of all pterygium patients.

Keywords: Pterygium; Dry Eye Disease; Tear Film Break-Up Time; Schirmer Test; Ocular Surface

Introduction

Pterygium is a degenerative and proliferative disorder of the ocular surface characterized by fibrovascular tissue extending from the conjunctiva onto the cornea. The condition is strongly associated with chronic ultraviolet radiation exposure, environmental irritation, and oxidative stress affecting limbal stem cells [1]. The prevalence of pterygium is higher in populations living in equatorial regions and areas with increased sunlight exposure, suggesting a significant environmental component in disease pathogenesis [2].

Dry eye disease is a multifactorial disorder characterized by tear film instability, hyperosmolarity, inflammation, and neurosensory abnormalities leading to ocular surface damage [3]. Structural alterations caused by pterygium can disrupt tear film distribution, reduce goblet cell density, and alter ocular surface homeostasis [4]. Previous studies have demonstrated reduced tear film break-up time and abnormal Schirmer test values in patients with pterygium, indicating a strong association between pterygium and dry eye disease [5,6]. However, the relationship between increasing pterygium severity and progressive tear film dysfunction remains insufficiently evaluated. Therefore, the present study aims to assess the association between pterygium grading and dry eye parameters in patients attending a tertiary care centre.

II. Materials and Methods

III. Study Design and Setting

A hospital-based cross-sectional observational study conducted at the Department of Ophthalmology, Chirayu Medical College and Hospital, Bhopal.

Study Duration

April 2025 – September 2025.

Study Population

Thirty patients with primary unilateral pterygium were included.

Inclusion Criteria

- Age ≥ 18 years
 - Primary unilateral pterygium
 - Patient giving consent
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Exclusion Criteria

- Previous ocular surgery or trauma
- Contact lens usage
- Topical medications affecting tear film

Pterygium Grade	Dry Eye Present	%	Dry Eye Absent	%
Grade 1	2	25.0%	6	75.0%
Grade 2	3	42.9%	4	57.1%
Grade 3	6	85.7%	1	14.3%
Grade 4	8	100%	0	0.0%

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- Systemic diseases affecting tear secretion

Clinical Examination

All patients underwent:

- Detailed ocular history
- Visual acuity assessment
- Slit-lamp biomicroscopy

Pterygium Grading

- Grade 1: <2 mm corneal involvement
- Grade 2: 2–4 mm involvement
- Grade 3: >4 mm involvement
- Grade 4: Crossing pupillary margin

Dry Eye Evaluation

- TBUT <10 seconds considered abnormal
- Schirmer’s test (1) <10 mm considered dry eye

Statistical Analysis

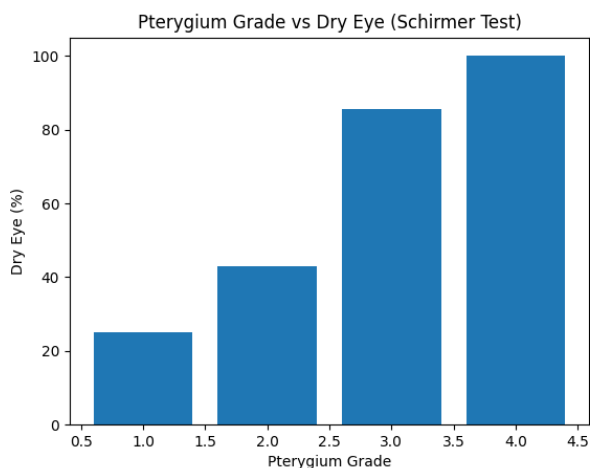
Data were analyzed using SPSS software. Chi-square test was applied. A p-value <0.05 was considered statistically significant.

Results

Association Between Pterygium Grade and Schirmer Test:

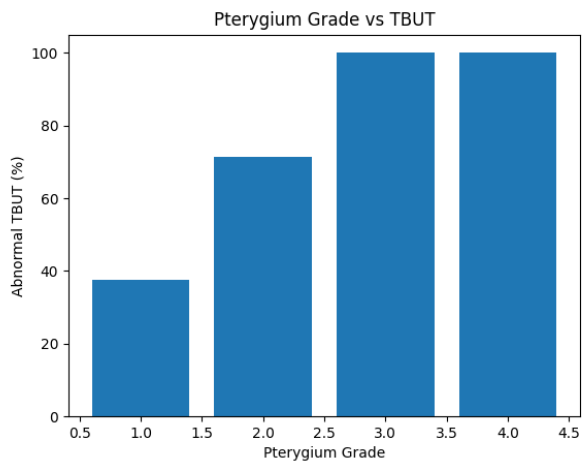
(Cut-off: ≤10 mm = Dry Eye)

Dry eye prevalence increased with advancing disease severity.



TBUT Findings

Pterygium Grade	Abnormal TBUT	%	Normal TBUT	%
Grade 1	3	37.5%	5	62.5%
Grade 2	5	71.4%	2	28.6%
Grade 3	7	100%	0	0.0%
Grade 4	8	100%	0	0.0%



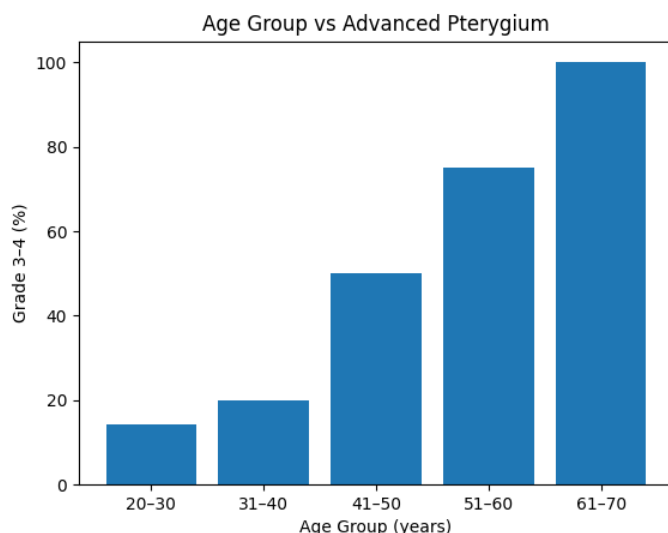
(Cut-off: <10 sec = Abnormal)

Abnormal TBUT increased progressively and was present in all advanced grades.

Age Distribution and Disease Severity

Older age groups showed increased prevalence of advanced pterygium.

Age Group	Grade 1–2	%	Grade 3–4	%
20–30	6	85.7%	1	14.3%
31–40	4	80.0%	1	20.0%
41–50	3	50.0%	3	50.0%
51–60	2	25.0%	6	75.0%
61–70	0	0.0%	4	100%



Chi-square test: $p < 0.01$

Interpretation:

Higher age groups are significantly associated with advanced grades of pterygium.: Chi-square test was applied to assess the association between pterygium grading and categorical dry eye parameters. A statistically significant association was observed between increasing pterygium grade and presence of dry eye (Schirmer test), abnormal TBUT scores ($p < 0.001$). Additionally, age was significantly associated with disease severity ($p < 0.01$), with advanced grades being more common in older individuals.

Discussion

The present study demonstrates a statistically significant association between increasing pterygium grade and worsening dry eye parameters, particularly tear film instability and reduced tear secretion.

Pterygium is now recognized as a complex ocular surface disorder rather than a simple degenerative condition. Ultraviolet (UV) radiation plays a central role in its pathogenesis by inducing oxidative stress and inflammatory changes in the limbal stem cell region, leading to fibrovascular proliferation and corneal invasion [1,2]. These structural alterations disrupt the normal ocular surface architecture and contribute to tear film dysfunction.

Tear film instability, as reflected by reduced Tear Film Break-Up Time (TBUT) in this study, is likely due to both mechanical and inflammatory factors. The advancing pterygium causes irregularity of the corneal surface, leading to uneven distribution of the tear film and early tear breakup. In addition, inflammatory changes associated with pterygium result in decreased goblet cell density and altered mucin production, further compromising tear film stability [4,8]. Similar findings have been reported in previous studies demonstrating reduced TBUT in patients with pterygium [8,9].

In the present study, Schirmer test values showed a progressive decline with increasing pterygium grade, indicating worsening tear secretion. This may be attributed to chronic ocular surface inflammation affecting the lacrimal functional unit, leading to decreased aqueous tear production. Previous studies have also reported reduced Schirmer values in pterygium patients, supporting the association between pterygium and aqueous-deficient dry eye [5–7].

The significant association between increasing age and higher grades of pterygium observed in this study is consistent with previous epidemiological evidence. Cumulative exposure to ultraviolet radiation over time is a major contributing factor in disease progression, explaining the higher prevalence of advanced pterygium in older individuals [2]. Additionally, age-related decline in tear film function may further exacerbate ocular surface instability.

The findings of this study support the concept that pterygium and dry eye disease are closely interrelated conditions. According to the TFOS DEWS II definition, dry eye disease involves tear film instability and ocular surface inflammation, both of which are evident in patients with advanced pterygium [3,11]. The presence of pterygium contributes to tear film dysfunction, while pre-existing dry eye may further aggravate ocular surface inflammation, creating a self-perpetuating cycle.

From a clinical perspective, these findings highlight the importance of routine dry eye evaluation in all patients with pterygium. Early detection and management of tear film abnormalities can improve patient symptoms and may help prevent progression of ocular surface damage. Furthermore, preoperative assessment and management of dry eye are essential in patients undergoing pterygium surgery, as tear film instability may affect postoperative healing and surgical outcomes.

Conclusions

The present analysis demonstrates a strong and clinically significant association between pterygium severity and ocular surface dysfunction, particularly dry eye disease. Assessment using the Schirmer test (cut-off ≤ 10 mm) revealed a progressive increase in dry eye prevalence with advancing pterygium grade. While only 25.0% of patients with Grade 1 pterygium exhibited dry eye, this proportion rose sharply to 42.9% in Grade 2, 85.7% in Grade 3, and reached 100% in Grade 4. These findings indicate that tear secretion is increasingly compromised as the disease advances. Similarly, Tear Break-Up Time (TBUT) findings (cut-off < 10 seconds) showed a parallel trend. Abnormal TBUT was observed in 37.5% of Grade 1 cases and increased to 71.4% in Grade 2. Notably, all patients with Grade 3 and Grade 4 pterygium demonstrated abnormal TBUT (100%), suggesting severe tear film instability in advanced stages. This reinforces the concept that both quantitative (Schirmer) and qualitative (TBUT) tear film abnormalities worsen with disease progression.

Age-wise distribution further supports the progressive nature of the condition. Younger individuals (20–40 years) predominantly presented with early-stage pterygium (Grade 1–2), whereas older age groups showed a markedly higher prevalence of advanced disease (Grade 3–4). In particular, 75.0% of patients aged 51–60 years and 100% of those aged 61–70 years had advanced grades. This trend was statistically significant (Chi-square test, $p < 0.01$), confirming a strong association between increasing age and disease severity. Overall, the findings suggest that pterygium is not merely a localized degenerative condition but is closely linked with progressive tear film dysfunction. The increasing severity of both aqueous deficiency and tear film instability with higher grades highlights the importance of early detection and management. In conclusion, advancing pterygium grade is significantly associated with increased prevalence and severity of dry eye disease, along with worsening tear film stability. Additionally, older age is a significant risk factor for more severe disease. These insights emphasize the need for comprehensive ocular surface evaluation in patients with pterygium, especially in advanced stages, to guide timely therapeutic intervention and prevent further complications.

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Ethical Permission: CMCH/IEC/2024/74

Conflict of Interest: None

References

1. Coroneo MT. Pterygium as an early indicator of ultraviolet insolation: a hypothesis. *Br J Ophthalmol.* 1993;77(11):734-739.
2. Moran DJ, Hollands FC. Pterygium and ultraviolet radiation: a positive correlation. *Br J Ophthalmol.* 1984;68(5):343-346.
3. Craig JP, Nichols KK, Akpek EK, et al. TFOS DEWS II definition and classification report. *Ocul Surf.* 2017;15(3):276-283.
4. Li M, Zhang M, Lin Y, et al. Tear function and goblet cell density after pterygium excision. *Eye (Lond).* 2007;21(2):224-228.
5. Kampitak K. The effect of pterygium on tear film function. *J Med Assoc Thai.* 2003;86(7):615-619.
6. Rajiv MS, Sethi S, Sethi MJ. Tear film abnormalities in pterygium patients. *J Coll Physicians Surg Pak.* 2012;22(4):236-239.
7. Kadayifcilar SC, Orhan M, Irkec M. Tear function in patients with pterygium. *Acta Ophthalmol Scand.* 1998;76(2):176-179.
8. Tomidokoro A, Miyata K, Sakaguchi Y, Samejima T, Oshika T. Effects of pterygium on tear film stability. *Ophthalmology.* 2005;112(4):703-707.
9. Ishioka M, Shimmura S, Yagi Y, Tsubota K. Pterygium and dry eye. *Ophthalmologica.* 2001;215(3):209-211.
10. Lemp MA. Report of the National Eye Institute/Industry workshop on clinical trials in dry eyes. *CLAO J.* 1995;21(4):221-232.
11. Stapleton F, Alves M, Bunya VY, et al. TFOS DEWS II epidemiology report. *Ocul Surf.* 2017;15(3):334-365.