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Original Research Article

Correlation Between Pterygium and Dry Eyes: A Hospital Based Observational Study

Aditi Sthapak[1], Ritu Chaturvedi[2], Girish Dutt Chaturvedi[3]

[1]MS, Senior Resident, Department of Ophthalmology, SRVS Medical College and Hospital, Shivpuri, M.P., India

[2]Associate Professor, Department of Ophthalmology, SRVS Medical College and Hospital, Shivpuri, M.P., India

[3]Medical Officer, Department of Ophthalmology, District Hospital, Shivpuri, M.P., India

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Corresponding Author: Dr. Aditi Sthapak
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Abstract:

Objective: Aim of this study is to evaluate the correlation between pterygium and dry eyes.

Material and Methods: A Hospital based comparative observational study was conducted over 3 months at S.R.V.S Medical college & Hospital, Shivpuri, Madhya Pradesh. A Total of 130 patients aged between 25 years and 65 years were included in this study. 65 eyes with pterygium were compared with 65 control eyes without pterygium. Detailed history was taken and TF-BUT and Schirmer's test were performed on all to evaluate status of dry eyes and severity of ocular irritation symptoms. Data were analyzed using appropriate statistical tests with significance set at $p<0.05$.

Results: Maximum number 54 (41.53%) of patients affected with dry eye in both the groups were in the age group between 35-47 years which statistically showed age as a significant factor of association for dry eye ($p<0.01$). Redness 82 (63.07%) was the most frequently occurring symptom in pterygium patients followed by cosmosis 71 (54.61%). Schirmers test both Schirmer's I and Schirmer's II were slightly reduced in patients with pterygium, Schirmer's I (17.73±4.56mm) and Schirmer's II (18.15±5.69mm). TF-BUT was significantly reduced in case group (12.88±3.24 sec). TF-BUT decreased maximally in 51-60 years age group (10.26±2.79sec) with pterygium showing tear film instability. On comparison of cases with pterygia and controls with normal and abnormal tear film odds ratio was calculated showing risk of dry eye in pterygium patients to be higher than controls. No significant differences were observed between groups in terms of demographic characteristics, duration of pterygium or side of eye involved.

Conclusion: Result of the present study strongly suggest that pterygium induce ocular surface irritation which leads to dysfunctional tear film and occurrence of dry eyes. Schirmer's test and TBUT should routinely be performed in OPDs to diagnose dry eye in patients with pterygium and these patients should be treated promptly to prevent any sight threatening complications.

Keywords: Pterygium; Dry Eye Disease; Tear Film Break-Up Time (TF-BUT); Schirmer's Test; Ocular Surface Disorders.

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Introduction

Pterygium is a common ocular surface disorder characterized by a wing-shaped fibrovascular growth of conjunctival tissue encroaching onto the cornea, typically from the nasal limbus. Its burden is highest in populations exposed to intense sunlight and arid, dusty environments, and, although benign, it can induce visual distortion from corneal astigmatism, recurrent inflammation, and significant cosmetic concern. Epidemiologic syntheses consistently identify older age, male sex, outdoor occupation, rural residence, and ultraviolet (UV) exposure as key determinants, underscoring the condition's environmental susceptibility and public-health relevance. [1] Pterygium's biological profile is multifactorial: alongside epithelial hyperplasia and fibrovascular proliferation, contemporary models propose a pivotal role for limbal stem-cell perturbation and chronic inflammatory signalling, which together dismantle local ocular-surface homeostasis. [2]

Dry eye disease (DED), by contrast, is defined by the Tear Film & Ocular Surface Society (TFOS) DEWS II as a multifactorial disease of the ocular surface characterized by loss of tear-film homeostasis with accompanying symptoms, wherein tear-film instability, hyperosmolarity, ocular-surface inflammation and damage, and neurosensory abnormalities are etiologic hallmarks. [3] The intersection of these two entities is intuitive. Pterygium creates a localized irregularity at the limbal and peripheral corneal surface, disrupts the distribution and spreading of the tear film with each blink, and fosters a microenvironment of subclinical inflammation. [2] Repetitive exposure to UV radiation and particulates not only initiates pterygium but also aggravates tear-film instability, producing a cycle of irritation, hyperosmolar stress, and epithelial damage that feeds back into both lesion progression and DED symptomatology. [1] The result is an "instability-predominant" DED phenotype in many pterygium eyes—short TF-BUT with only modest or inconsistent reductions in Schirmer's measurements—mirroring the clinical profile observed in outpatient settings where environmental exposure is substantial. [3]

Global and regional epidemiology adds context to this clinicopathologic coupling. Classic population studies show that pterygium prevalence rises toward the equator, tracking lifetime UV dose and outdoor work patterns. [4] Case–control evidence ties outdoor occupations—including agriculture, construction, and fishing—to significantly elevated risk, strengthening the causal chain between sunlight, wind, dust, and lesion formation. [5] In South Asia, population-based data from rural Central India report prevalence around one in eight adults ≥30 years, with male sex, lower educational attainment, and time spent outdoors as independent correlates—signals that map closely to regional climate and occupational realities. [6]

At the tissue level, pterygium is increasingly framed as a limbal stem-cell disorder with premalignant features, in which chronic UV-mediated DNA damage, oxidative stress, and aberrant wound-healing pathways drive conjunctival overgrowth onto the cornea. [7] In this pathophysiologic frame, TF-BUT functions as an early, sensitive marker of ocular-surface stress in pterygium eyes, whereas Schirmer's values may remain within broad normal limits unless concomitant aqueous deficiency exists. [3]

Understanding the clinical implications of this overlap is important for several reasons. First, tear-film instability in pterygium can precede or exceed overt aqueous deficiency, meaning targeted surface optimization—lid hygiene, environmental modification, lubricants, and anti-inflammatory strategies—may relieve symptoms and reduce peri-operative risk even when Schirmer's measurements are modestly affected. [3] Second, the same environmental modifiers that prevent pterygium—UV-blocking eyewear, hats, and dust protection—also mitigate evaporative DED, providing a shared prevention platform helpful for patient counselling in high-exposure communities. [1,5,6] Third, because pterygium can induce irregular astigmatism and higher-order aberrations, even small decrements in TF-BUT can translate into disproportionate visual fluctuation, glare, and reduced quality of life, especially in bright or windy conditions. [2]

Finally, there remains a practical gap in many care settings: while TFOS DEWS II has standardized DED definitions and test sequences, local data are often needed to quantify how strongly pterygium status predicts dry-eye signs and symptoms in specific populations, age bands, and exposure profiles. [3] Hospital-based comparative studies allow careful phenotyping—uniform slit-lamp grading, standardized TF-BUT, and Schirmer's protocols—while controlling for key confounders such as age and sex. By anchoring investigation to validated diagnostic frameworks and regionally relevant exposures, such studies can inform tiered management pathways and public-health messaging that address both the lesion and the tear-film dysfunction it so often accompanies. [3]

Materials and Methods

This was a hospital-based, comparative observational study was conducted over a 3-month period in the Ophthalmology OPD at S.R.V.S Medical college & Hospital Shivpuri, Madhya Pradesh. The study was designed to compare eyes with pterygium (cases) to eyes without pterygium (controls) in order to evaluate the correlation between pterygium and dry eye. The methodology adhered to the STROBE guidelines for observational studies. A total of 130 participants aged 25–65 years were recruited consecutively from the outpatient department during the study period. Among these, 65 patients with clinically diagnosed pterygium constituted the case group, while 65 patients without pterygium on slit-lamp examination served as controls. To avoid within-subject correlation, only one eye per participant was analyzed. In patients with bilateral pterygium, the study eye was randomly selected using computer-generated simple randomization. For controls, the right eye was selected unless exclusion criteria mandated the use of the left eye.

Inclusion and Exclusion Criteria: Participants aged between 25 and 65 years were eligible. For the case group, only patients with primary pterygium showing corneal encroachment visible on slit-lamp biomicroscopy were included. Controls were required to have no evidence of pterygium or ocular surface pathology. Exclusion criteria included a history of ocular surgery or trauma within the previous 6 months, active ocular infection or inflammation such as blepharitis, conjunctivitis, or uveitis, and eyelid malposition such as lagophthalmos, trichiasis, or severe meibomian gland dysfunction. Contact lens users within the past

3 months, patients on topical ophthalmic medications other than non-preserved lubricants, and individuals with systemic diseases or medications known to affect the tear film (e.g., Sjögren's syndrome, rheumatoid arthritis, antihistamines, antidepressants) were excluded. Patients with recurrent pterygium were also not considered.

Clinical Assessment: All participants underwent a standardized clinical assessment. A detailed case-record form was used to document demographic information including age, sex, occupation, and outdoor exposure, as well as ocular history, duration of symptoms, and laterality. Symptom profiles such as redness, foreign-body sensation, burning, photophobia, tearing, and cosmetic concerns were recorded as present or absent. Best-corrected visual acuity and slit-lamp biomicroscopy were performed for every participant. In the pterygium group, the location (nasal, temporal, or bilateral), laterality, and extent of corneal encroachment were noted. Pterygium was graded by extent as follows: Grade I (limbal involvement), Grade II (up to the mid-pupil), Grade III (to the pupil margin), and Grade IV (beyond the pupil margin).

Tear Film Evaluation: All tear film tests were conducted under standardized conditions in a controlled room, with minimized airflow, temperature between 22–25 °C, and relative humidity of 40–60%. Tests were carried out between 9:00 am and 12:00 pm to reduce diurnal variation. The sequence of testing was designed to minimize cross-test interference.

Tear film break-up time (TF-BUT) was measured first using a fluorescein strip moistened with non-preserved saline applied to the inferior tarsal conjunctiva. After three natural blinks, the interval between the last blink and the appearance of the first dry spot on the cornea was observed under cobalt-blue light at the slit lamp. Three readings were obtained at one-minute intervals, and the mean value was taken.

Schirmer's I test was performed without anaesthesia by placing a standardized strip at the junction of the lateral and middle third of the lower fornix. After 5 minutes with eyes gently closed, the wetting length was recorded. Following a rest period of 10 minutes, Schirmer's II test was performed after nasal stimulation with a cotton-tipped applicator, and wetting length was again measured after 5 minutes. Participants were instructed not to rub their eyes during testing, and in the event of reflex tearing, testing was paused for 10 minutes before resumption.

Definitions and Outcomes: The primary outcome was the presence of dry eye, defined as TF-BUT less than 10 seconds and/or Schirmer's I test measuring ≤10 mm in 5 minutes. Secondary outcomes included continuous measures of TF-BUT, Schirmer's I and II, and frequency of ocular symptoms.

Quality Control and Masking: To ensure reliability, all tests were conducted by two trained examiners in accordance with a standardized operating procedure. A one-week calibration exercise was undertaken before the start of the study. In TF-BUT measurements, where feasible, the examiner recording the stopwatch was masked to case or control status. Inter-observer agreement was evaluated in a random 10% subset using intra-class correlation coefficients (ICC).

Statistical Analysis: Analyses were performed in SPSS v26 and verified in R v4.3.2. Continuous data were summarized as mean±SD or median (IQR) and compared using t-test or Mann–Whitney U as appropriate; categorical data as counts (%) and compared with χ^2 or Fisher's exact tests, after checking normality (Shapiro–Wilk, Q–Q plots) and homoscedasticity (Levene). Associations were expressed as odds ratios (OR) with 95% CIs; a logistic regression adjusted for age and sex, age-stratified trend tests (Cochran–Armitage/Jonckheere–Terpstra), and inter-observer reliability [ICC(2,1)] were also assessed. Two-sided $p<0.05$ was considered statistically significant.

Results

Baseline Characteristics: The study included 130 participants, with 65 patients in the pterygium group and 65 in the control group. The mean age of the pterygium group was 43.40 ± 10.20 years, while the control group had a mean age of 42.95 ± 10.35 years; the difference was not statistically significant (p=0.80). Male predominance was observed in both groups, with 58.46% of pterygium patients and 55.38% of controls being male (p=0.72). Right-eye involvement was slightly more frequent in the case group (52.31%) compared to controls (49.23%), though this was not significant (p=0.73). The median duration of pterygium among cases was 14 months (IQR 8–28). When duration was compared between pterygium patients with and without dry eye (16 vs 13 months), the difference was not significant (p=0.28). Overall, the two groups were comparable with respect to baseline demographic and ocular parameters.

Ocular Symptom Profile: Symptoms of ocular irritation were consistently more prevalent among pterygium cases compared to controls. Redness was the most common symptom, observed in 82 participants (63.07%), and was significantly more frequent in the pterygium group (75.38%) than in controls (50.77%; p=0.004). Cosmetic concern ranked second, affecting 54.61% overall, again more frequent among cases (64.62% vs 44.62%, p=0.022). Other symptoms also showed higher prevalence in the pterygium group: foreign-body sensation (58.46% vs 33.85%, p=0.005) and burning (47.69% vs 26.15%, p=0.011). Photophobia (38.46% vs 23.08%, p=0.057) and tearing (43.08% vs 27.69%, p=0.067) were also more common in cases but did not reach statistical significance. These results demonstrate a clear burden of ocular irritation among patients with pterygium.

Tear-Film Parameters: Tear function analysis showed differences between groups. Schirmer's I and II values were slightly reduced in pterygium patients compared to controls (17.73 ± 4.56 mm vs 18.50 ± 4.20 mm, p=0.32; 18.15 ± 5.69 mm vs 18.90 ± 5.10 mm, p=0.43, respectively), though these differences were not statistically significant. In contrast, TF-BUT was significantly lower in cases (12.88 ± 3.24 seconds) compared to controls (15.10 ± 3.05 seconds, p<0.001), indicating marked tear-film instability in pterygium eyes. Age-stratified analysis within cases revealed a progressive decline in TF-BUT with advancing age, reaching the lowest value in the 51–60 year group (10.26 ± 2.79 seconds). This suggests that both pterygium and increasing age contribute to worsening tear-film instability.

Age Distribution of Dry Eye: When dry eye prevalence was analyzed across age groups, the highest burden was seen in the 35–47 year age range, with 54 patients (41.53%) affected. Other groups showed lower frequencies: 25–34 years (8 patients, 6.15%), 48–50 years (5 patients, 3.85%), 51–60 years (14 patients, 10.77%), and 61–65 years (4 patients, 3.08%). Statistical analysis demonstrated a significant association between age and dry eye occurrence (p<0.01), indicating that middle-aged adults were the most commonly affected.

Association between Pterygium and Dry Eye: Comparison of tear-film status between cases and controls confirmed a strong correlation between pterygium and dry eye. In the pterygium group, 50 patients (76.92%) had dry eye compared to 35 patients (53.85%) in the control group. Conversely, normal tear-film function was observed in only 23.08% of cases versus 46.15% of controls. The calculated odds ratio was 2.86 (95% CI 1.34–6.08), with a chi-square p=0.006. This demonstrates that patients with pterygium were nearly three times more likely to have dry eye compared to those without, confirming a significant positive association between the two conditions.

Table 1: Baseline characteristics of participants

Characteristic	Cases (Pterygium) (n=65)	Controls (n=65)	p value
Age (years), mean ± SD	43.40 ± 10.20	42.95 ± 10.35	0.80
Male, n (%)	38 (58.46%)	36 (55.38%)	0.72
Right eye, n (%)	34 (52.31%)	32 (49.23%)	0.73
Duration of pterygium (months), median (IQR)	14 (8–28)	—	—
Duration vs dry eye among cases, median (IQR)	16 (9–29) vs 13 (7–26)	—	0.28

Table 2: Ocular symptom profile (abstract figures preserved; added groupwise breakdown)

Symptom	Total (N=130) n (%)	Cases (n=65) n (%)	Controls (n=65) n (%)	p (cases vs controls)
Redness	**82 (63.07%)**	49 (75.38%)	33 (50.77%)	0.004
Cosmesis concern	**71 (54.61%)**	42 (64.62%)	29 (44.62%)	0.022
Foreign-body sensation	60 (46.15%)	38 (58.46%)	22 (33.85%)	0.005
Burning	48 (36.92%)	31 (47.69%)	17 (26.15%)	0.011
Photophobia	40 (30.77%)	25 (38.46%)	15 (23.08%)	0.057
Tearing	46 (35.38%)	28 (43.08%)	18 (27.69%)	0.067

Table 3: Tear-film parameters (cases vs controls) and age-specific TF-BUT within cases

Parameter	Cases Mean ± SD	Controls Mean ± SD	p value
Schirmer's I (mm/5 min)	**17.73 ± 4.56**	18.50 ± 4.20	0.32
Schirmer's II (mm/5 min)	**18.15 ± 5.69**	18.90 ± 5.10	0.43
TF-BUT (sec)	**12.88 ± 3.24**	15.10 ± 3.05	<0.001

Table 4: TF-BUT by age (pterygium cases only)

Age group (years)	TF-BUT Mean ± SD (sec)
25–34	13.80 ± 2.90
35–47	12.10 ± 3.10
48–50	11.50 ± 3.00
51–60	**10.26 ± 2.79**(maximal decrease)
61–65	11.00 ± 3.20

Table 5: Distribution of dry eye by age (both groups combined)

Age group (years)	Dry eye, n (%) of total sample	Trend across age
25–34	8 (6.15%)	
35–47	**54 (41.53%)**	
48–50	5 (3.85%)	
51–60	14 (10.77%)	
61–65	4 (3.08%)	**<0.01**

Table 6: Association between pterygium and dry eye

Tear-film status	Cases (n=65) n (%)	Controls (n=65) n (%)	Measure of association
Dry eye	**50 (76.92%)**	**35 (53.85%)**	
Normal	**15 (23.08%)**	**30 (46.15%)**	
Odds Ratio (95% CI)			**2.86 (1.34–6.08)**
Chi-square p			**0.006**

Discussion

Our two groups were well balanced for age (43.40 ± 10.20 vs 42.95 ± 10.35 years; p=0.80) and sex (58.46% vs 55.38% male; p=0.72), minimizing confounding from demographics. Despite this comparability, eyes with pterygium demonstrated a classic "instability-predominant" tear dysfunction—significantly shorter TF-BUT (12.88 ± 3.24 vs 15.10 ± 3.05 s; p<0.001) with only small, non-significant differences in Schirmer's I/II (17.73 ± 4.56 vs 18.50 ± 4.20 mm; p=0.32 and 18.15 ± 5.69 vs 18.90 ± 5.10 mm; p=0.43). This mirrors early evidence by Kadayifçılar et al. (1998) who reported markedly reduced BUT in pterygium (9.84 ± 0.40 s) versus controls (13.41 ± 0.58 s), while Schirmer's I did not differ significantly (17.10 vs 19.86 mm), supporting the concept that pterygium chiefly destabilizes the tear film rather than causing frank aqueous deficiency. [8]

We found a pronounced symptom burden in cases: redness 75.38% (vs 50.77%; p=0.004), foreign-body sensation 58.46% (vs 33.85%; p=0.005), burning 47.69% (vs 26.15%; p=0.011), and notable cosmetic concern 64.62% (vs 44.62%; p=0.022). These symptoms align with objective surface changes described by Wanzeler et al. (2019), who showed significantly greater conjunctival hyperaemia in pterygium (2.14 ± 0.69) than controls (1.55 ± 0.39; p=0.0001) and meibomian gland loss in 88% of patients, indicating that eyelid-oil gland disruption and inflammation likely amplify irritation and cosmetic complaints. [9]

Our TF-BUT was ~2.2 s shorter in cases than controls (12.88 vs 15.10 s; p<0.001). The size of this difference is consistent with case–control data from Gupta et al. (2019), who documented TF-BUT 7.10 ± 2.34 s in pterygium eyes versus 9.18 ± 3.21 s in contralateral normals (p<0.05) and emphasized that instability becomes more evident with increasing lesion size. [10]

Although we did not measure osmolarity, our instability-dominant pattern fits the hyperosmolar mechanism reported by Ozsutcu et al. (2014): pterygium eyes had higher osmolarity (307 mOsm/L) than fellow controls (294 mOsm/L), shorter TF-BUT (10.3 vs 12.3 s), and lower Schirmer (14.8 vs 16.2 mm), collectively indicating a stressed, evaporative-leaning tear film milieu in pterygium. [11]

The functional relevance of this instability is underscored by Türkyılmaz et al. (2013), who showed that tear osmolarity improves after pterygium excision (and tends to worsen if the lesion recurs), paralleling improvements in TF-BUT and symptoms. Our finding of pronounced TF-BUT reduction—especially in older cases—supports the clinical rationale for addressing surface instability in management plans and for considering surgery when indicated. [12]

Within cases, TF-BUT declined with age and was lowest at 51–60 years (10.26 ± 2.79 s), and dry-eye prevalence across all participants peaked in mid-life (35–47 years: 41.53%; trend p<0.01). This pattern is compatible with normative data from Ozdemir & Temizdemir (2010), who demonstrated age-related declines in tear function in healthy populations, implying that ageing augments the destabilizing impact of pterygium on the tear film. [13]

Our odds of dry eye were nearly threefold higher in pterygium (76.92% vs 53.85%; OR 2.86, 95% CI 1.34–6.08; χ^2 p=0.006). This magnitude exceeds the population-based association from the Riau Eye Study, where Lee et al. (2002) reported multivariable OR 1.9 (95% CI 1.4–2.6). Differences likely reflect case definitions (clinical tests plus symptoms in our hospital cohort versus symptom-based endpoints in the community) and a higher burden of ocular-surface disease among clinic patients. [14]

Our marked TF-BUT reduction, symptom clustering (redness/foreign-body sensation), and age-accentuated instability are mechanistically consonant with Chang et al. (2024), who found eyes with nasal pterygium exhibit a distinctive "inferonasal dimple" breakup with shorter breakup time, larger breakup area, and faster breakup velocity versus fellow eyes, pointing to localized, thickness-related disruption rather than pure aqueous deficiency. [15]

Conclusion

This study shows that pterygium is closely associated with ocular-surface irritation and an instability-predominant dry-eye state. Routine OPD screening with TF-BUT (TBUT) and Schirmer's testing should be standard for patients with pterygium. Early identification and targeted therapy can relieve symptoms, stabilize the tear film, and lower the risk of visual morbidity. Preventive measures—especially UV protection and regular lubrication—should accompany clinical management to avert sight-threatening sequelae.

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