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Original Research Article

Association of Pterygium with Dry Eye Disease: A Cross-Sectional Study from Northeast India

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ABSTRACT

Background: Pterygium is a degenerative ocular surface disorder strongly influenced by ultraviolet exposure, environmental irritants, and limbal stem cell dysfunction. Dry eye disease (DED) is a complex condition that causes tear-film instability and has been linked to pterygium development.
Aim: This study was designed to investigate and compare the association between pterygium and dry eye.
Methods: A total of 158 patients with clinically diagnosed pterygium were enrolled. Demographic, occupational, and environmental data were collected. Dry eye was assessed using Schirmer's test and tear film break-up time (TBUT). Statistical analysis was conducted using SPSS, employing Fisher's exact test or t-test to assess the relationships.
Results: Of the 158 participants, 56.7% were women. The average age was 47.2 years, with a standard deviation of 12.2 years. Most participants lived in rural areas (70.9%) and were either unemployed (34.8%) or farmers (31.6%). The most common symptoms were a foreign-body sensation, blurred vision, cosmetic intolerance, and a gritty sensation. Dry eye was present in 60.8% of patients, with prevalence increasing significantly with age ($p < 0.05$). No significant differences were observed by sex or affected eye. Schirmer's test values were much lower in patients with dry eye (9.95 ± 3.58 mm) than in those without dry eye (22.98 ± 5.49 mm; $p < 0.001$). TBUT was also significantly shorter in dry eye cases (6.45 ± 2.99 seconds) compared to controls (15.27 ± 3.93 seconds; $p < 0.001$).
Conclusion: This study highlights a strong association between pterygium and dry eye disease, influenced by age, occupation, and environmental exposure. Tear film dysfunction is central to disease development, underscoring the need for routine dry eye screening and preventive measures, especially in rural and outdoor-working populations. Longitudinal studies are needed to assess postoperative outcomes and recurrence, clarifying the long-term impact of dry eye on pterygium progression.

Keywords: Pterygium, Dry eye, Schirmer's test, Tear film break-up time, North East India

INTRODUCTION

Pterygium is a fibrovascular growth that starts under the conjunctiva and spreads onto the cornea. It disrupts Bowman's membrane and the top layer of the cornea but stays covered by the conjunctival epithelium. The exact cause is not known. However, long-term exposure to ultraviolet light, dust, and tear-film problems is an important risk factor. Other risks include being older, male, or living in rural areas.[1] Genetic influences, including alterations in the tumour suppressor gene p53 and other associated genes, are thought to play a role in pterygium development.[2] Current understanding highlights that a deficiency of limbal stem cells contributes significantly to the pathogenesis of pterygium.[3]

This condition usually does not cause symptoms, but it can sometimes lead to redness, watery eyes, sensitivity to light, a feeling that something is in the eye, and astigmatism. As it worsens, the lesion can spread into the area of the pupil, reducing vision.[4] Pterygium is most common and severe in tropical regions near the equator, while it is less frequent and milder in cooler climates. The prevalence varies widely, reaching up to 29% in some equatorial populations. Worldwide, rates range from 0.3% to 37.46%, and studies in India show a prevalence of 5.2%.[5]

Dry eye disease is a multifactorial disorder of the ocular surface, defined by a disruption in tear film homeostasis and accompanied by characteristic symptoms. Its pathophysiology involves tear-film instability, hyperosmolarity, ocular-surface damage, and neurosensory dysfunction. For diagnostic purposes, a Schirmer's test value of less than 10 mm is considered indicative of dry eye, while a tear film break-up time of under 10 seconds signifies tear film instability consistent with the condition.[4] Abnormalities in tear function have been implicated in the pathogenesis of pterygium, as its progression is often aggravated by elevation of the pterygium head, ocular surface dryness, and the development of dellen. Reported global prevalence ranges from 6% to 34%. The disorder occurs more frequently in individuals over the age of 50 and shows a higher incidence among women.[6]

The fact that not all people exposed to similar environmental conditions develop pterygium suggests that multiple factors contribute to its pathogenesis. Research has found a possible connection between pterygium and DED. While there are standard ways to measure dry eye, the links between pterygium, tear film behaviour, and the health of the eye's surface are complicated. Some studies suggest that tear film problems may precede and contribute to pterygium. In contrast, others suggest that the ocular surface changes caused by pterygium itself contribute to dry eye symptoms by disrupting the stability of the tear film. Overall, growing clinical and research evidence supports an association between pterygium and DED.[7]

Dry eye syndrome leads to alterations of the ocular surface and is linked to instability of the tear film.[8] Gupta and colleagues reported that eyes affected by unilateral pterygium showed a significant reduction in tear film break-up time (TBUT) and Schirmer's test (ST) values compared to the contralateral healthy eyes.[1]

Although numerous studies have emphasised that, beyond geophysical influences, socioeconomic, lifestyle, and systemic factors may contribute directly or indirectly to the pathogenesis of pterygium, research from Northeast India remains scarce. Given the variations in socioeconomic conditions and lifestyle practices across different regions, the present study was designed to investigate and compare the association between pterygium and dry eye among populations residing in geographically diverse areas of Northeast India.

MATERIALS AND METHODS

Study design

The investigation was conducted as a hospital-based, observational cross-sectional study.

Study setting

The research was conducted in the Department of Ophthalmology at Agartala

Government Medical College & GBP Hospital (AGMC & GBPH).

Study period

Data were collected over 1.5 years.

Study population

The study population comprised all patients who attended the Department of Ophthalmology at AGMC & GBPH during the study period.

Selection criteria

Inclusion criteria

Patients with a clinical diagnosis of pterygium, with informed consent.

Exclusion criteria

- Patients with disorders of the lacrimal drainage system (e.g., dacryocystitis, eyelid malformations).
- Those with ocular inflammatory conditions such as uveitis, glaucoma, lagophthalmos, or proptosis.
- Patients with a prior history of contact lens use.
- Patients with previous ocular surgery, trauma, or the presence of corneo-limbal scarring.
- Cases presenting pseudo-pterygium or clinical features suggestive of malignancy within the pterygium.
- Patients who have used topical ophthalmic preparations or systemic medications—including antihistamines, phenothiazines, diazepam, lubricating agents, or other drugs known to influence tear film stability—within the three months preceding enrolment.

Sample size and sampling

This study enrolled 158 participants selected using convenience sampling.

Study tools

1. Structured case record proforma
2. External ocular examination with torch light
3. Snellen chart for visual acuity assessment
4. Schirmer's test strips
5. Tear film break-up time using fluorescein-impregnated strips
6. Slit-lamp examination with +90 D lens
7. Autorefractometer

Data collection method

Written informed consent was obtained from all participants before enrolment. A comprehensive history was recorded, including demographic details such as age, occupation, and presenting complaints. Data collection was carried out using a pre-validated questionnaire. Each patient underwent general, systemic, and ocular examinations. Visual acuity and refractive status were measured and documented. Slit-lamp evaluation was performed for all patients, and specific diagnostic tests for dry eye—namely Schirmer's test and tear film break-up time—were administered.

Tests for dry eye

1. Schirmer's test

This test provides a quantitative measure of aqueous tear secretion. It was conducted using Schirmer's strip (No. 41 Whatman filter paper, 5 mm in width and 35 mm in length). The strip was folded 5 mm from one end and carefully placed at the junction of the medial two-thirds and lateral one-third of the lower eyelid without touching the cornea or eyelashes. After 5 minutes, the strip was removed, and the length of the wetted area from the fold was recorded. A wetting length of less than 10–15 mm on the Schirmer strip without anaesthesia is indicative of dry eye. The interpretation of Schirmer's Test I results was as follows:

- 0–5 mm: severe dry eye
- 5–10 mm: mild to moderate dry eye
- 10–15 mm: possible dry eye
- More than 15 mm: normal tear production

2. Tear film break-up time (TBUT)

This test is employed for the qualitative evaluation of tear film stability. A fluorescein-impregnated strip moistened with preservative-free lubricating eye drops was used to stain the tear film. The strip was gently placed in the lower fornix at the lateral one-third of the eyelid and then removed. After the dye was evenly distributed across

the tear film through blinking, participants were instructed to look straight ahead without blinking. Using a slit lamp equipped with a cobalt blue filter, the interval between the last blink and the appearance of the first discontinuity (randomly located dry spot) in the precorneal fluorescent tear film was recorded. The occurrence of a dry spot within 10 seconds was considered indicative of dry eye.

Data collection and analysis

We used a semi-structured pro forma to collect data. For each patient, we recorded sociodemographic details and results from ophthalmic exams, including Schirmer's test and tear film break-up time. The data were entered into Microsoft Excel and analysed using SPSS version 26.0. For categorical variables, we reported proportions and percentages, while for continuous variables, we provided means and standard deviations. We used Fisher's exact test or t-test to assess associations between variables, considering results significant if $p < 0.05$.

Ethical considerations

Before initiation, the study protocol was approved by the Institutional Ethics Committee of AGMC. No invasive or non-invasive diagnostic procedures were required, and no treatment interventions were withheld during the study.

Informed consent

The study objectives were explained to all patients, and both verbal and written informed consent were obtained. Measures were taken to safeguard privacy and confidentiality, with identifiers and variables coded during data presentation. All patients received care in accordance with established clinical guidelines.

RESULT

The study enrolled 158 patients clinically diagnosed with pterygium who attended the Department of Ophthalmology at AGMC and GBP Hospital during the study period. A greater proportion of participants were female (56.7%) compared to male (43.7%). The mean age was 47.2 years (±12.2), with the majority falling within the 31–45 year age group. Most of the patients (70.9%) were residents of rural areas. Most of the participants identified as Hindu (83%).

Figure 1 shows that the largest group was unemployed (34.8%, n = 55), followed by farmers (31.6%, n = 50). Those in formal employment accounted for 17.7% (n = 28), while 14.6% (n = 23) were self-employed. Business professionals represented the smallest category, comprising 1.3% (n=2).

The majority of patients reported foreign-body sensation as the most common symptom, followed by blurred vision, cosmetic intolerance, and a gritty sensation. Redness and irritation were less frequently noted (Figure 2).

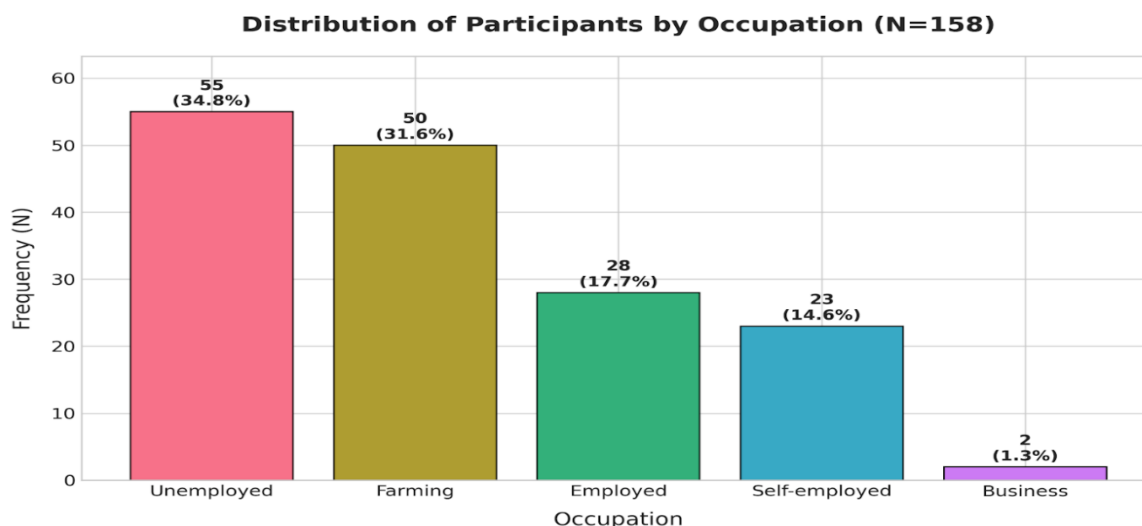


Figure 1: Occupational Distribution of Participants

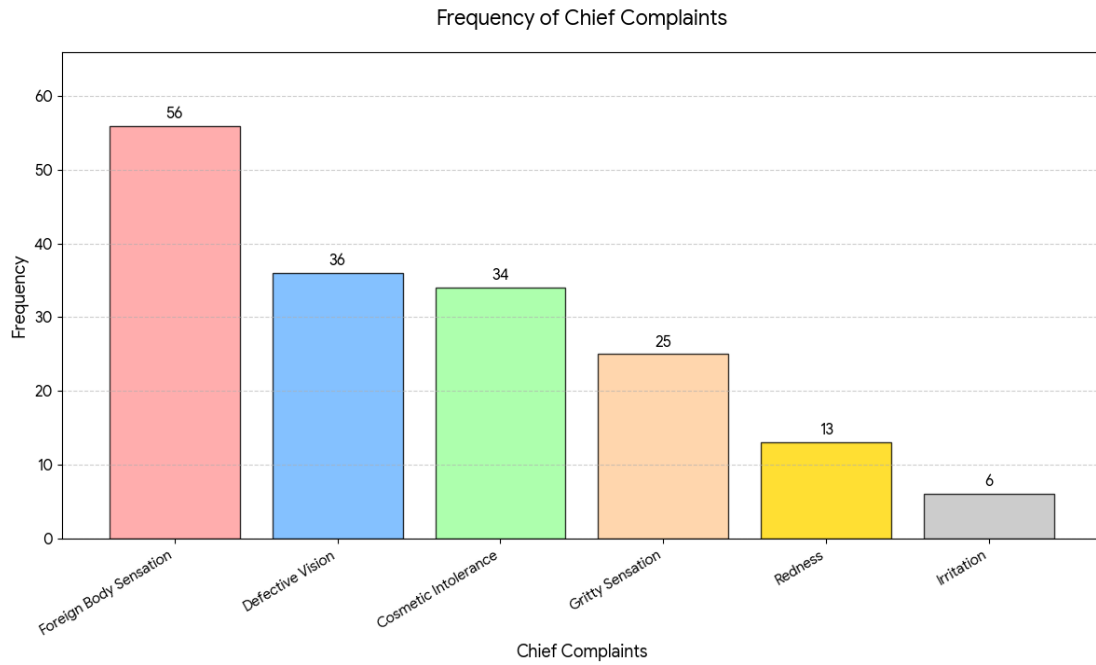


Figure 2: Analysis of Chief Complaints in Clinical Presentation

A positive family history of pterygium was present in only 13.3% of cases. In most patients, the right eye was affected. Dry eye was observed in 60.8% of participants based on the defined criteria (Figure 3), with half of them classified as having mild to moderate dry eye, followed by those categorised as possible dry eye (Figure 4).

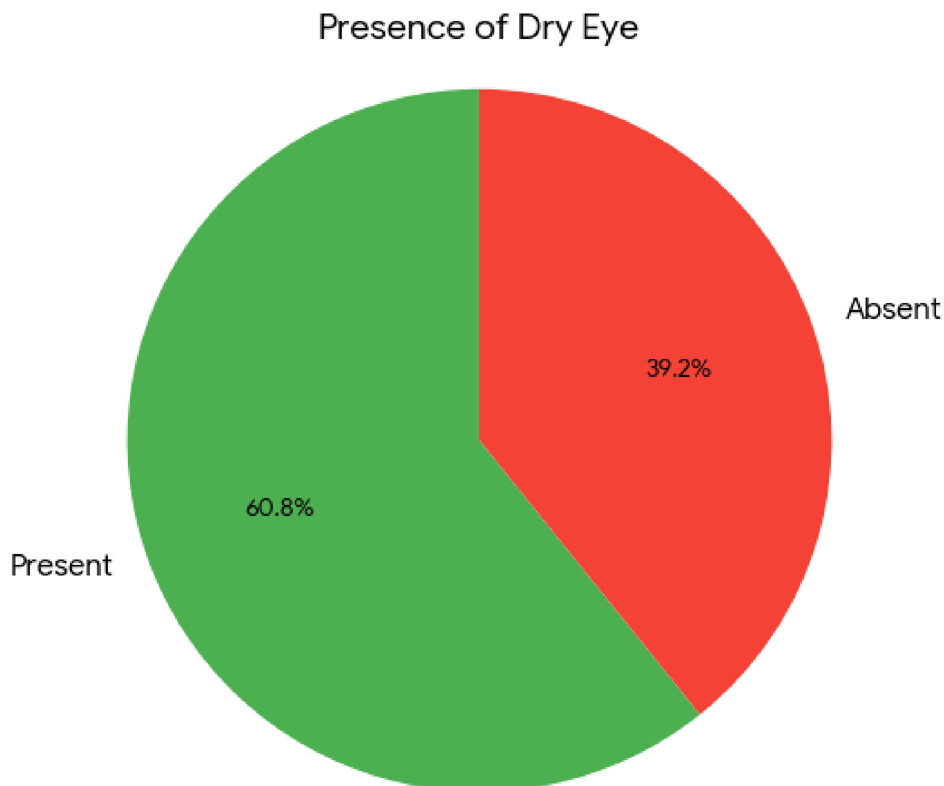


Figure 3: Prevalence of Dry Eye Condition among Participants

The prevalence of dry eye increased with age, and this association was statistically significant by Fisher's exact test ($p = 0.002$). Among male participants, 53 (59.55%) had dry eye, while 43 (62.32%) of the female participants were affected. The comparison between sexes did not reveal any statistically significant difference. Analysis of laterality showed that dry eye was present in 53 of 79 right eyes (67.09%) and in 43 of 71 left eyes (60.56%). However, the difference between the right and left eyes was not statistically significant.

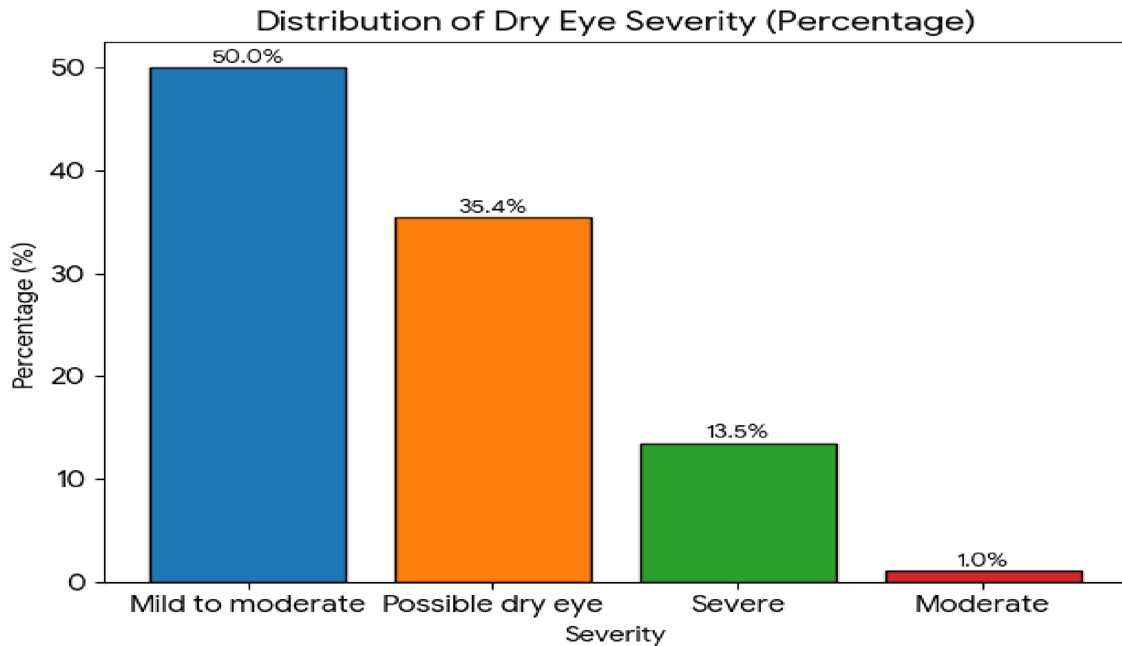
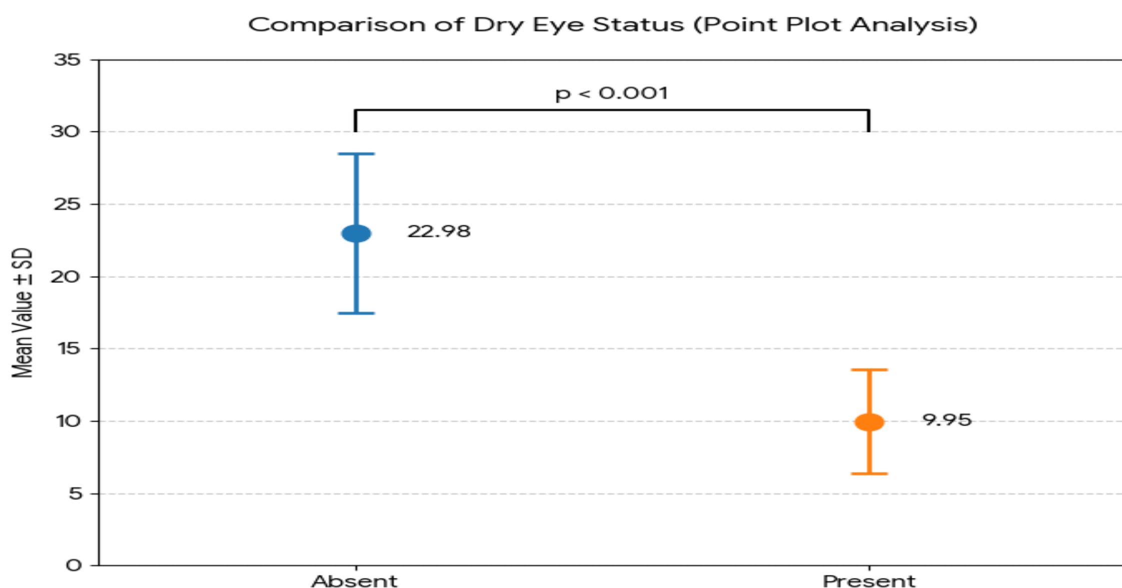


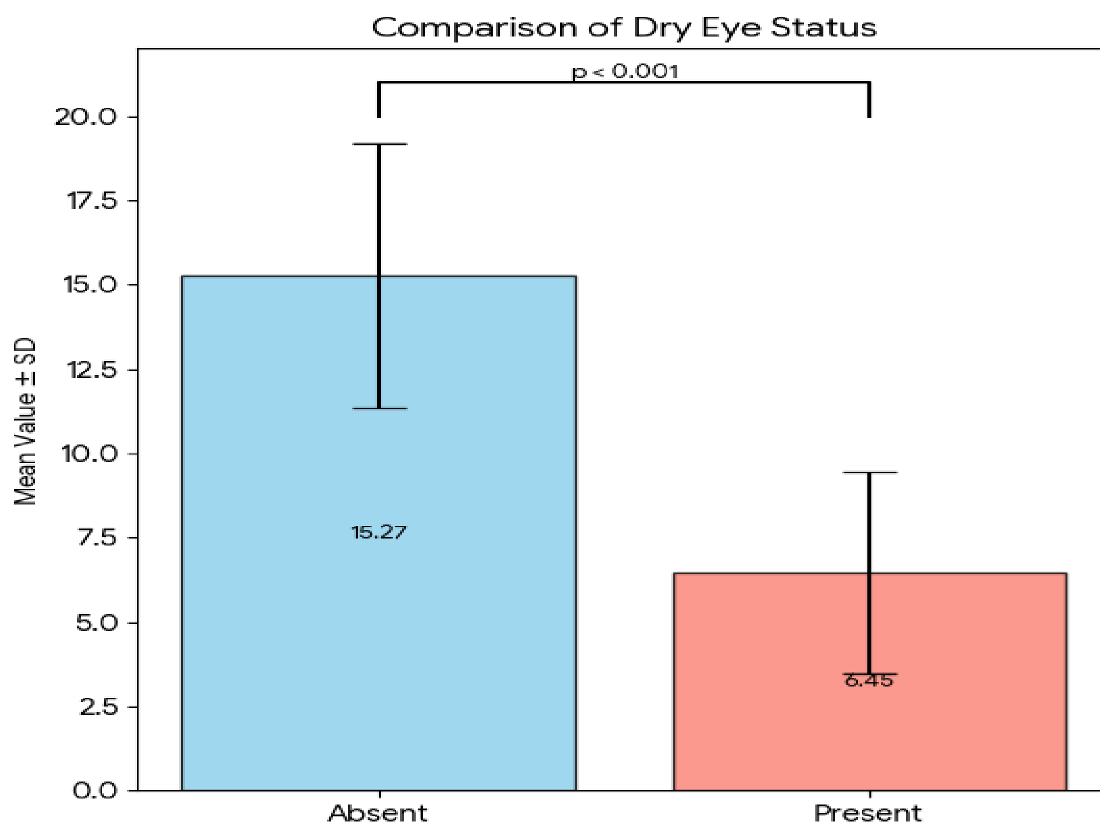
Figure 4: Clinical Classification: Severity of Dry Eye Condition

Figure 5 revealed that Participants without dry eye had a mean Schirmer test score of 22.98 ± 5.49 mm, while those with dry eye had a significantly lower mean of 9.95 ± 3.58 mm ($p < 0.001$).



t-test, *Statistically significant
Figure 5: Advanced Comparative Analysis: Dry Eye Clinical Data

Comparison of TBUT results demonstrated a statistically significant difference between individuals with and without dry eye ($p < 0.001$). Participants without dry eye had a mean TBUT of 15.27 ± 3.93 seconds, whereas those with dry eye had a significantly lower mean of 6.45 ± 2.99 seconds (Figure 6).



t-test, *Statistically significant

Figure 6: Dry Eye Statistical Analysis

DISCUSSION

The present study provides valuable insights into the demographic and clinical characteristics of patients with pterygium, with particular emphasis on its association with dry eye disease. Our findings revealed that the majority of participants were middle-aged adults, predominantly female, and residing in rural areas. This demographic distribution is consistent with previous reports from India and other tropical regions, where environmental exposure plays a pivotal role in disease development.[9,10] Ultraviolet radiation, dust, and wind are well-established risk factors, and rural populations are particularly vulnerable due to limited access to protective measures such as sunglasses or hats.[11]

Occupational analysis demonstrated that unemployed individuals and farmers constituted the largest groups. Farming has long been associated with pterygium due to prolonged outdoor exposure, a finding corroborated by systematic reviews on occupational solar radiation exposure.[12] The predominance of Hindu participants in our cohort reflects regional demographics rather than disease-specific susceptibility. These results highlight the importance of occupational and environmental risk mitigation strategies, particularly in rural communities.

In clinical practice, the most common symptoms were a foreign-body sensation, blurred vision, and concerns about appearance. This aligns with the literature, which finds that mechanical irritation and

tear-film instability are the main causes of eye discomfort.[13] Redness and irritation were less common but still important secondary complaints. Many patients choose to treat pterygium mainly because of its appearance, even if it does not affect their vision.

More than 60% of participants had dry eye disease, and the prevalence increased with age. Several studies have shown that this increase is linked to reduced tear film stability and lacrimal gland function with age.[14,15] Although females showed a slightly higher prevalence, the difference was not statistically significant. Some studies suggest hormonal influences, particularly estrogen deficiency in postmenopausal women, as a contributing factor.[16] However, in our cohort, environmental exposure may outweigh hormonal effects, explaining the lack of significant sex-related differences.

Laterality analysis revealed no significant difference between right and left eyes, though the right eye was marginally more affected. While this may be incidental, previous reports have speculated that asymmetric sun exposure and habitual head positioning could explain laterality patterns.[17] Further multicentric studies are warranted to clarify this association.

Objective assessments demonstrated significant tear film dysfunction in patients with pterygium. Schirmer's test and TBUT values were substantially lower in individuals with dry eye, providing evidence that tear film instability plays a role in the development and progression of pterygium. Meibomian gland dysfunction has also been implicated as a cofactor, further linking it to pterygium pathogenesis.[18] These findings emphasise the need for comprehensive ocular surface evaluation in all patients presenting with pterygium.

From a clinical perspective, our results underscore the importance of integrating dry eye management into pterygium treatment protocols. Tear film instability not only exacerbates symptoms but may also increase the risk of recurrence following surgical excision.[19] Preventive strategies such as UV protection, lubrication, and early detection should be prioritised, especially in rural and outdoor-working populations. Furthermore, postoperative care should include dry eye management to enhance patient satisfaction and reduce long-term morbidity.[20]

Study Limitations:

1. **Single-centre design:** This study took place in one tertiary care hospital, so the results may not apply to other regions or groups with different environmental exposures.
2. **Cross-sectional nature**: Because of its cross-sectional design, a definitive causal link between pterygium and dry eye disease cannot be established.
3. **Sample size constraints:** Although 158 patients were included in the study, this sample size might not be large enough to identify rare risk factors or subtle demographic differences.
4. **Potential recall bias:** Family history and occupational exposure data were obtained from patient self-reports, which may introduce recall bias.
5. **Lack of longitudinal follow-up:** The investigation excluded postoperative outcomes and recurrence rates, which are essential for understanding the long-term effects of dry eye on pterygium.
6. **Limited diagnostic tools:** The study utilised Schirmer's test and TBUT but did not incorporate advanced assessments such as tear osmolarity or meibography. The inclusion of these advanced tests would have offered a more comprehensive evaluation of ocular surface disorders.

CONCLUSION

The findings demonstrate a strong association between pterygium and dry eye disease, emphasising the impact of demographic, occupational, and environmental factors on prevalence. Middle-aged adults in rural areas and outdoor occupations, especially farming, were most frequently affected. This trend points to the important role of ultraviolet radiation and environmental exposure in the pathogenesis

of pterygium. Most patients reported feeling as if something was in their eye and had cosmetic concerns, indicating that the condition has both practical and emotional effects.

Objective tests like Schirmer's test and TBUT showed that people with pterygium often have significant tear-film problems. This supports the idea that instability on the eye's surface helps cause and worsen pterygium. While differences between eyes were not statistically significant, earlier studies highlight that uneven sun exposure and the way people hold their heads might be risk factors.

These findings highlight the importance of regularly checking for dry eye in patients with pterygium. Preventive steps like using UV protection, keeping eyes lubricated, and detecting problems early should be a priority, especially for people in rural areas or those who work outdoors. Adding dry eye care to surgical and post-surgical routines may help improve patient outcomes and reduce the risk of the condition returning. In the long term, multi-centre studies are needed to better understand the causes and assess how well targeted treatments reduce the impact of the disease.

Declaration by Authors

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REFERENCES

1. Gupta AKR, Nathwani Y. Correlation between pterygium and dry eye. Kerala J Ophthalmol. 2019;31(3):217-220.
2. Sharma S, Pal PP, Sengupta P, Sarkar P. A study of meibomian gland and tear film changes in patients with pterygium in a tertiary care centre. Panacea J Med Sci. 2021;11(2):336-340.
3. Kotecha MR, Paranjpe RR, Manade VV, Gotecha SS. A clinical study of correlation between pterygium and dry eye. Indian J Clin Exp Ophthalmol. 2021;7(4):736-740.
4. Khurana AK, Comprehensive Ophthalmology. 8th Ed New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2022.p 367-80.
5. Omran O, Bukhatwa S. Association between Pterygium and Dry Eye among Patients in Benghazi, Libya. Libyan Journal of Medical Sciences. 2020;4(2):80-83.
6. Ha DH, Kim KW. Impact of pterygium morphological profiles on dry eye parameters. Sci Rep. 2025;15(1):9661.
7. Kucuk E, Yilmaz U, Zor KR. Tear Film Functions and Dry Eye Symptoms in Young Patients with Pterygium. Beyoglu Eye J. 2020;5(1):26-31.
8. Ramakrishnan H, John J. A Clinical Study on Severity of Dry Eye in Individuals with Pterygium at a Tertiary Hospital in South Kerala. Middle East Afr J Ophthalmol. 2024;30(3):149-155.
9. Tandon R, Vashist P, Gupta N, Gupta V, Yadav S, Deka D, et al. The association of sun exposure, ultraviolet radiation effects and other risk factors for pterygium (the SURE RISK for pterygium study) in geographically diverse adult (≥40 years) rural populations of India -3rd report of the ICMR-EYE SEE study group. PLoS One. 2022;17(7):e0270065.
10. Shah N, Patel M. Pterygium: A study of its demography and correlation with dry eye. Int J Sci Res. 2017;6(5):409-411.
11. Modenese A, Gobba F. Occupational Exposure to Solar Radiation at Different Latitudes and Pterygium: A Systematic Review of the Last 10 Years of Scientific Literature. Int J Environ Res Public Health. 2017;15(1):37.
12. Detorakis ET, Spandidos DA. Pathogenetic mechanisms and treatment options for ophthalmic pterygium: trends and perspectives (Review). Int J Mol Med. 2009;23(4):439-447.
13. Baig M, Munir R. Dry Eye Disease and Pterygium. Pak J Ophthalmol. 2019;35(3): 198-202.
14. Padmavathi CG, Indira Y, Malathi Y. Dry eye in patients with pterygium at a tertiary care centre. Int J Pharm Clin Res. 2024;16(1):438-443.
15. Gupta C, Gupta L, Rizvi Y, Thakur A, Bajwa BS, Goyal P. Pterygium and Its Correlation with Dry Eye Disease: Comparing Patients from Different Geographical Locations

Attending Sub-Himalayan Tertiary Institute. Int J Pharm Clin Res. 2024;16(5):482-488.
16. Matos LL, Freitas LZ, Souza PA, Weber SLP. The Influence of Estrogen on Dry Eye Prevalence in Women. J Clin Ophthalmol Eye Disord. 2021;5(1):1035.
17. Mackenzie FD, Hirst LW, Battistutta D, Green A. Risk analysis in the development of pterygia. Ophthalmology. 1992;99(7):1056-1061.
18. Sharma N, Jain S, Sharma S, Gupta CP. Tear film dysfunction and meibomian gland abnormalities in patients with pterygium: A comparative study. Int J Acad Med Pharm. 2025;7(5):796-799.
19. Ghiasian L, Samavat B, Hadi Y, Arbab M, Abolfathzadeh N. Recurrent Pterygium: A Review. J Curr Ophthalmol. 2022;33(4):367-378.
20. Gathinavar SS. Tear film instability and meibomian gland dysfunction in pterygium patients: A rural eye health study. Paripex Indian J Res. 2025;14(12):45-46.

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