SJ Ophthalmology Africa
Vol. 3 No. 3 (2026): July 2026 Issue
https://doi.org/10.51168/x6pgwh95
Original Article

Tear film stability in patients with pterygium and normal healthy subjects: A cross-sectional comparative study.

Dr. Mohammed Haris[1], Dr. Boddupally Soujanya[2*]
[1]Senior Resident, Department of Ophthalmology, Government Medical College, Karimnagar, Telangana, India
[2]Senior Resident, Department of Ophthalmology, Government Medical College, Nalgonda, Telangana, India

Abstract

Background

Pterygium is a fibrovascular ocular surface disorder that can disturb tear distribution and produce symptoms of dry eye. Tear film instability is clinically important because it affects ocular comfort, visual quality and surface protection.

Objectives

To assess tear film stability in patients with pterygium, evaluate the same parameters in normal healthy subjects and compare the two groups.

Methods

This cross-sectional comparative study included 104 participants aged 18-60 years, with 52 patients having unilateral or bilateral pterygium and 52 normal healthy subjects. Tear film break-up time, Ocular Surface Disease Index score and Schirmer test values were recorded after slit-lamp evaluation. Group differences were analysed using appropriate statistical tests.

Results

The pterygium group had lower mean tear film break-up time than controls (8.12 ± 3.48 vs 11.38 ± 2.69 seconds; $p<0.001$). Mean Ocular Surface Disease Index score was higher in the pterygium group (30.44 ± 17.95 vs 16.96 ± 11.21; $p<0.001$). Mean Schirmer value was also lower among pterygium patients (13.37 ± 3.75 vs 15.77 ± 3.87 mm; $p=0.002$). Abnormal tear film break-up time and moderate-to-severe symptom burden were more frequent in the pterygium group.

Conclusion

Pterygium was associated with reduced tear film stability, greater dry eye symptom severity and lower tear secretion. Routine dry eye assessment in pterygium patients can support timely ocular surface management and improve clinical decision-making.

Recommendation

Patients with pterygium should undergo routine dry eye screening, early ocular surface treatment and follow-up to improve comfort and outcomes.

Keywords: *Dry eye disease; Ocular Surface Disease Index; Pterygium; Schirmer test; Tear film break-up time; Tear film stability*
Submitted: February 19, 2026 Accepted: March 20, 2026 Published: April 30, 2026

Corresponding Author: *Dr. Boddupally Soujanya*
Email: ***soujsouji33@gmail.com***
Senior Resident, Department of Ophthalmology, Government Medical College, Nalgonda, Telangana, India

Introduction

Pterygium is a common ocular surface lesion characterized by triangular fibrovascular growth of conjunctival tissue across the limbus toward the cornea. Although benign, it is clinically relevant because it can produce redness, foreign body sensation, irritation, dryness, watering, induced astigmatism and visual disturbance when the lesion approaches the pupillary area [1,2]. The disease is strongly linked with environmental exposure, especially ultraviolet radiation, wind, dust and outdoor work. A systematic review has shown that pterygium prevalence varies widely across populations and is influenced by age, sex, latitude and sunlight exposure, which explains its higher burden in tropical and subtropical regions [3].

The tear film forms the first refractive and protective interface of the eye. Its lipid, aqueous and mucin components preserve optical smoothness, epithelial hydration, lubrication, antimicrobial defence and inflammatory balance [8]. Disturbance of this integrated system produces tear instability, hyperosmolarity, ocular surface inflammation and neurosensory symptoms. The TFOS DEWS II report defines dry eye disease as a multifactorial disorder with loss of tear film homeostasis, where tear instability and hyperosmolarity play central roles [4]. Epidemiological data indicate that dry eye disease is frequent worldwide, with prevalence estimates influenced by diagnostic criteria, population structure and environmental exposure [5].

Pterygium can disturb tear film physiology through several mechanisms. The raised fibrovascular tissue changes the regularity of the ocular surface, interferes with even tear spreading after blinking and creates localized areas of surface drying. Associated inflammation and conjunctival remodeling can affect goblet cell function, mucin distribution and meibomian gland activity. Pathophysiological models of dry eye describe evaporative water loss, surface inflammation and epithelial damage as interacting processes that perpetuate ocular surface disease [6]. Therefore, even before major corneal encroachment occurs, patients with pterygium can experience tear instability and dry eye symptoms.

Several clinical studies have reported lower tear film break-up time, altered tear secretion, higher tear osmolarity and increased dry eye symptom scores among patients with pterygium [10-14]. The Ocular Surface Disease Index is a validated questionnaire for quantifying dry eye-related symptoms and functional limitation [9], while tear film break-up time and Schirmer testing remain practical clinical tools for evaluating tear stability and aqueous tear secretion [7]. However, regional data from Telangana are limited, and local evidence is useful because environmental exposure, occupation and health-seeking patterns differ across settings.

The present study was conducted to assess tear film stability in patients with pterygium and in normal healthy subjects attending a tertiary care ophthalmology setting. The objectives were to evaluate tear film break-up time, Ocular Surface Disease Index score and Schirmer test values in patients with pterygium; to evaluate the same parameters in normal healthy subjects; and to compare tear film stability and symptom burden between the two groups.

Materials and Methods

Study design and setting: This cross-sectional comparative study was conducted in the Department of Ophthalmology, Government Medical College/Government General Hospital, Siddipet, Telangana, India. Data were collected over 18 consecutive months, from January 2024 to June 2025. The study compared patients with pterygium and normal healthy subjects without ocular surface disease.

Study population and sample size

A total of 104 participants were enrolled in the study, including 52 patients with unilateral or bilateral pterygium and 52 age-matched healthy controls. The sample size was estimated based on proportions reported in a previous comparative study assessing tear parameters in pterygium, in which the factor of interest was observed in 54% of patients with pterygium and 26% of controls [10].

Using the two-proportion sample size formula,

$$n = [(Z\alpha/2\sqrt{2P(1-P)} + Z\beta\sqrt{p1(1-p1)+p2(1-p2)})^2]/(p1-p2)^2,$$

where p1=0.54, p2=0.26, and P=(p1+p2)/2,

the required sample size was calculated as 52 participants per group.

Eligibility criteria

Participants aged 18-60 years of either sex who were willing to provide written informed consent were eligible. Cases included patients with unilateral or bilateral pterygium and dry eye symptoms. Controls were normal healthy subjects without ocular surface disorders. Participants below 18 years or above 60 years, contact lens users, patients with Sjogren syndrome or other relevant systemic illness, users of systemic or topical medications affecting tear film, patients with other adnexal diseases and those with recent ocular surgery were excluded.

Participant recruitment and flow

Consecutive patients with clinically diagnosed pterygium who attended the ophthalmology outpatient department were screened until 52 eligible cases were enrolled. Age-matched healthy subjects without ocular surface disease were recruited as controls from attendants and individuals presenting for routine ophthalmic evaluation. Eligibility was verified before written informed consent and tear-film testing. All 104 individuals screened fulfilled the selection criteria, completed the assessments and were included in the final analysis; no participant was excluded after screening, and no outcome data were missing.

Data collection and clinical assessment

All participants underwent detailed history taking, symptom assessment and slit-lamp biomicroscopic examination. Tear film break-up time was measured after instillation of fluorescein; the interval between the last complete blink and first appearance of a randomly distributed dry spot was recorded in seconds [7]. Ocular Surface Disease Index scoring was used to assess subjective symptom severity, with scores classified as normal, mild, moderate or severe [9]. Schirmer test values were recorded in millimeters to assess tear secretion.

Bias control

Selection criteria were applied uniformly to both groups. Patients using contact lenses, ocular medications or systemic medications known to disturb tear film were excluded. The same clinical setting and assessment protocol were used for both groups to reduce measurement variability. Data were entered using predefined variables before statistical analysis.

SJ Ophthalmology Africa
Vol. 3 No. 3 (2026): July 2026 Issue
https://doi.org/10.51168/x6pgwh95
Original Article

Statistical analysis

Data were coded in Microsoft Excel and analysed using IBM SPSS. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequency and percentage. Independent-samples t-test was used for comparison of continuous variables between groups. Pearson chi-square test was used for categorical variables with more than two categories, whereas Yates continuity-corrected chi-square test was used for 2 × 2 tables. Chi-square values, degrees of freedom and p values were reported for categorical comparisons. A p value below 0.05 was considered statistically significant.

Ethical considerations

Approval was obtained from the Institutional Ethics Committee, Government Medical College, Siddipet, before study initiation. Written informed consent was obtained from all participants. Confidentiality was maintained by removing personal identifiers, and collected data were used only for research analysis.

Results

Participant flow

A total of 104 individuals were assessed for eligibility: 52 patients with clinically diagnosed pterygium and 52 potential healthy controls. All 104 fulfilled the eligibility criteria, provided written informed consent and completed TBUT, OSDI and Schirmer testing. No participant was excluded after screening, and all enrolled participants were included in the final analysis (Figure 1).

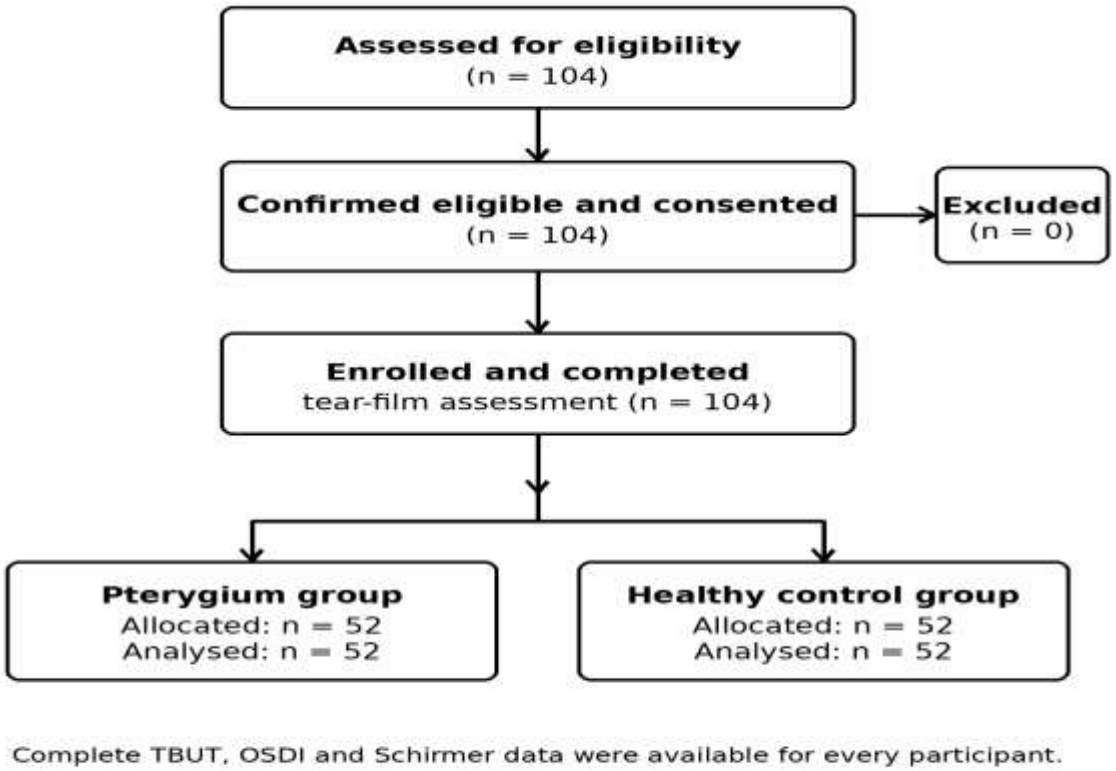

Figure 1. Participant recruitment and analysis flow.

A total of 104 participants were analysed, including 52 patients with pterygium and 52 normal healthy controls. The mean age was 44.0 ± 10.1 years in the pterygium group and 39.7 ± 12.9 years in the control group, with no statistically significant difference between groups. Females constituted 63.5% of the pterygium group and 51.9% of controls. The right and left eye distribution was identical in both groups. The demographic and eye-side distribution is shown in Table 1.

Table 1: *Demographic and eye-side distribution of the study groups*

Characteristic	Category	Pterygium group (n=52)	Control group (n=52)	Test statistic	p value
Age, years	Mean ± SD	44.0 ± 10.1	39.7 ± 12.9	t = 1.87	0.064
Age group, years	20-30	7 (13.5)	17 (32.7)	χ^2 = 6.699 (df=3)	0.082
	31-40	15 (28.8)	10 (19.2)	—	—
	41-50	15 (28.8)	9 (17.3)	—	—
	51-60	15 (28.8)	16 (30.8)	—	—
Sex	Male	19 (36.5)	25 (48.1)	χ^2 = 0.985 (df=1)	0.321
	Female	33 (63.5)	27 (51.9)	—	—
Eye side	Right	24 (46.2)	24 (46.2)	χ^2 = 0.000 (df=1)	1.000
	Left	28 (53.8)	28 (53.8)	—	—

Note. Values are mean ± SD or n (%). Mean age was compared using the independent-samples t-test. Age-group distribution was assessed using Pearson chi-square test; sex and eye-side comparisons used Yates continuity-corrected chi-square test. The statistic and p value shown on the first category row apply to the complete variable.

The pterygium group demonstrated significantly poorer tear film parameters than controls. Mean tear film break-up time was 8.12 ± 3.48 seconds in the pterygium group and 11.38 ± 2.69 seconds in controls. The mean Ocular Surface Disease Index score was substantially higher in patients with pterygium, indicating greater symptom burden. Schirmer test values were also lower in the pterygium group. The between-group comparison of primary clinical parameters is presented in Table 2.

Table 2: *Comparison of tear film and symptom parameters between study groups*

Parameter	Pterygium group (n=52)	Control group (n=52)	Mean difference	95% CI	p value
TBUT, seconds	8.12 ± 3.48	11.38 ± 2.69	-3.27	-4.48 to -2.06	<0.001
OSDI score	30.44 ± 17.95	16.96 ± 11.21	13.48	7.65 to 19.32	<0.001
Schirmer test, mm	13.37 ± 3.75	15.77 ± 3.87	-2.40	-3.89 to -0.92	0.002

Note. Data are mean ± SD. All three parameters were compared using independent-samples t-tests; the p value for each variable is presented in the final column. CI, confidence interval; OSDI, Ocular Surface Disease Index; TBUT, tear film break-up time.

Based on Ocular Surface Disease Index severity categories, normal scores were more frequent among controls, whereas moderate and severe symptom categories were more frequent among patients with pterygium. Severe symptoms were present in 38.5% of pterygium patients compared with 9.6% of controls. The distribution of Ocular Surface Disease Index severity is shown in Table 3. The reported p value represents the overall comparison across all four OSDI categories and does not apply only to the normal category.

Table 3: *Distribution of Ocular Surface Disease Index severity categories*

OSDI category	Pterygium group (n=52)	Control group (n=52)	χ^2 (df)	p value
Normal (0-12)	10 (19.2)	22 (42.3)	15.313 (3)	0.002
Mild (13-22)	10 (19.2)	16 (30.8)	—	—
Moderate (23-32)	12 (23.1)	9 (17.3)	—	—
Severe (>32)	20 (38.5)	5 (9.6)	—	—

Note. Pearson chi-square test was applied to the complete 4 × 2 contingency table. Therefore, $\chi^2=15.313$ (df=3) and p=0.002 represent the overall difference in OSDI severity distribution and do not refer only to the normal category.

When clinically abnormal results were analysed categorically, tear film break-up time below 10 seconds was observed in 69.2% of pterygium patients and 25.0% of controls. Moderate-to-severe Ocular Surface Disease Index scores were also more frequent in the pterygium group. Although reduced Schirmer values were numerically higher among patients with pterygium, the categorical difference did not reach statistical significance. These findings are summarized in Table 4.

Table 4: *Comparison of clinically abnormal tear-film and symptom findings*

Clinical variable	Pterygium group (n=52)	Control group (n=52)	χ^2 (df=1)	p value
TBUT <10 seconds	36 (69.2)	13 (25.0)	18.678	<0.001
OSDI >22	32 (61.5)	14 (26.9)	11.265	0.001
Schirmer test ≤10 mm	12 (23.1)	6 (11.5)	1.680	0.195

Note. Values are n (%). Each comparison was assessed using Yates continuity-corrected chi-square test. OSDI, Ocular Surface Disease Index; TBUT, tear film break-up time.

Discussion

This cross-sectional comparative study demonstrated that patients with pterygium had significantly altered tear film parameters compared with normal healthy subjects. The pterygium group showed lower tear film break-up time, higher Ocular Surface Disease Index scores and lower Schirmer test values. The demographic profile of the two groups was broadly comparable, and eye-side distribution was identical, supporting that the observed differences were related primarily to ocular surface status rather than major baseline imbalance.

Reduced tear film break-up time was the most prominent finding. The mean value in the pterygium group was nearly three seconds lower than that of controls, and more than two-thirds of pterygium patients had a value

below 10 seconds. This agrees with Kadayifcilar et al., who reported significantly reduced tear film break-up time among patients with pterygium [11]. Roka et al. also observed altered tear secretion and tear film instability in pterygium compared with normal subjects [10]. A raised fibrovascular lesion disrupts the smooth ocular surface, alters the spread of tears after blinking and creates localized tear thinning. These changes reduce short-term tear film stability and contribute to ocular irritation.

The higher Ocular Surface Disease Index scores in the pterygium group indicate that objective tear film changes were accompanied by clinically meaningful symptoms. Kucuk et al. similarly reported lower tear film break-up time and higher symptom scores in young patients with pterygium [14]. The present study also found that severe symptom scores were markedly more common in the pterygium group. These findings are important because pterygium is often judged mainly by size or corneal encroachment, while symptom burden reflects additional ocular surface compromise.

The lower Schirmer test values suggest that aqueous tear secretion was also affected, although the categorical

difference in low Schirmer values was not statistically significant. This pattern indicates that tear instability and symptom severity were stronger discriminators than frank aqueous deficiency. Mechanistically, pterygium-related inflammation, surface irregularity and meibomian gland alterations can destabilize the lipid and mucin-aqueous interface [6,8]. Ye et al. showed altered meibomian gland function and tear film parameters in pterygium, while Ozsutcu et al. reported tear hyperosmolarity and abnormal tear function in unilateral pterygium [12,13].

Clinically, the study supports routine assessment of dry eye symptoms and tear film stability in patients with pterygium. Early use of ocular lubricants, environmental protection and counselling regarding ultraviolet exposure are relevant conservative measures. In symptomatic or progressive cases, ocular surface findings can assist surgical planning and postoperative care. The results add regional evidence from a tertiary care setting in Telangana and emphasize that pterygium should be considered not only a fibrovascular growth but also an ocular surface disorder associated with tear film dysfunction.

Generalizability

These findings may be applicable to similar tertiary care ophthalmology settings where pterygium and dry eye symptoms are commonly encountered. However, generalization to community populations should be cautious because environmental exposure, occupation, lesion severity and diagnostic protocols may differ regionally.

Conclusion

Pterygium was associated with significant impairment of tear film stability compared with normal healthy eyes. Patients with pterygium had reduced tear film break-up time, higher Ocular Surface Disease Index scores and lower Schirmer test values, indicating combined instability of the preocular tear film and greater dry eye symptom burden. The findings support routine evaluation of tear film parameters in patients presenting with pterygium, even when the lesion is not visually advanced. Early recognition of ocular surface disturbance can guide lubricant therapy, environmental protection advice and timely surgical decision-making. Larger multicentre studies with tear osmolarity, meibography and postoperative follow-up will strengthen understanding of this association in different populations and clinical practice locally.

Limitations

This study was limited by its single-centre design, convenience sampling and modest sample size. Tear osmolarity, meibography, conjunctival staining and inflammatory markers were not assessed, so mechanistic interpretation remains restricted. Exposure history to ultraviolet light, dust and outdoor work was not quantitatively measured. Longitudinal follow-up after pterygium treatment was also unavailable, reducing causal and postoperative interpretation. These factors restrict external validity.

Recommendations

Patients with pterygium should undergo routine dry eye screening using tear film break-up time, Ocular Surface Disease Index scoring and Schirmer testing, especially when they present with irritation, watering, foreign body sensation or visual discomfort. Early ocular surface management with lubricants, environmental protection advice and counselling regarding ultraviolet light, dust and outdoor exposure may reduce symptom burden. Future studies should include larger multicentre samples, grading of pterygium severity, quantitative assessment of occupational and environmental exposure, tear osmolarity, ocular surface staining, meibography and postoperative follow-up. Longitudinal studies are needed to determine whether pterygium treatment improves tear film stability and dry eye symptoms.

Acknowledgement

The authors acknowledge the patients and healthy volunteers who participated in the study. The authors also thank the ophthalmology outpatient staff, optometry personnel, nursing team and institutional administration for their support during patient evaluation, data collection and conduct of the study. The authors are grateful to the Department of Ophthalmology for facilitating clinical assessment and manuscript preparation.

Abbreviations

CI: Confidence interval
IEC: Institutional Ethics Committee
mm: Millimetre
OSDI: Ocular Surface Disease Index
SD: Standard deviation
SPSS: Statistical Package for the Social Sciences
TBUT: Tear film break-up time.

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

MH-Concept and design of the study, clinical evaluation, data collection, results interpretation, review of literature and preparation of the first draft of the manuscript. **BS**-Concept and design of the study, clinical evaluation, data collection, statistical interpretation, manuscript revision and corresponding author responsibilities**.**

Data availability

Data available on request.

Author Biography

Dr. Mohammed Haris is a Senior Resident in the Department of Ophthalmology at Government Medical College, Karimnagar, Telangana, India. He is actively involved in clinical ophthalmic care, patient evaluation, and academic activities within the department. His areas of professional interest include comprehensive ophthalmology, neuro-ophthalmic disorders, anterior segment diseases, and clinical research. He contributes to undergraduate teaching, departmental case discussions, and patient-centered ophthalmic practice. Dr. Haris is committed to improving visual health through evidence-based clinical care, continued academic learning, and research-oriented medical practice.

Dr. Boddupally Soujanya is a Senior Resident in the Department of Ophthalmology at Government Medical College, Nalgonda, Telangana, India. She is involved in clinical ophthalmology practice, patient evaluation, ophthalmic diagnostics and academic work. Her areas of interest include ocular surface disease, tear film assessment, anterior segment disorders, pterygium and

dry eye-related clinical research. **ORCID iD**: https://orcid.org/0009-0004-4677-2556

References

1. Solomon AS. Pterygium. Br J Ophthalmol. 2006;90(6):665-666. doi:10.1136/bjo.2006.091413. PMID:16714259. https://doi.org/10.1136/bjo.2006.091413
2. Chu WK, Choi HL, Bhat AK, Jhanji V. Pterygium: new insights. Eye (Lond). 2020;34(6):1047-1050. doi:10.1038/s41433-020-0786-3. PMID:32029918. https://doi.org/10.1038/s41433-020-0786-3
3. Liu L, Wu J, Geng J, Yuan Z, Huang D. Geographical prevalence and risk factors for pterygium: a systematic review and meta-analysis. BMJ Open. 2013;3(11):e003787. doi:10.1136/bmjopen-2013-003787. PMID:24253031. https://doi.org/10.1136/bmjopen-2013-003787
4. Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS, Joo CK, et al. TFOS DEWS II Definition and Classification Report. Ocul Surf. 2017;15(3):276-283. doi:10.1016/j.jtos.2017.05.008. PMID:28736335. https://doi.org/10.1016/j.jtos.2017.05.008
5. Stapleton F, Alves M, Bunya VY, Jalbert I, Lekhanont K, Malet F, et al. TFOS DEWS II Epidemiology Report. Ocul Surf. 2017;15(3):334-365. doi:10.1016/j.jtos.2017.05.003. PMID:28736337. https://doi.org/10.1016/j.jtos.2017.05.003
6. Bron AJ, de Paiva CS, Chauhan SK, Bonini S, Gabison EE, Jain S, et al. TFOS DEWS II Pathophysiology Report. Ocul Surf. 2017;15(3):438-510. doi:10.1016/j.jtos.2017.05.011. PMID:28736340. https://doi.org/10.1016/j.jtos.2017.05.011
7. Wolffsohn JS, Arita R, Chalmers R, Djalilian A, Dogru M, Dumbleton K, et al. TFOS DEWS II Diagnostic Methodology report. Ocul Surf. 2017;15(3):539-574. doi:10.1016/j.jtos.2017.05.001. PMID:28736342. https://doi.org/10.1016/j.jtos.2017.05.001
8. Pflugfelder SC, Stern ME. Biological functions of tear film. Exp Eye Res. 2020;197:108115. doi:10.1016/j.exer.2020.108115. PMID:32561483. https://doi.org/10.1016/j.exer.2020.108115
9. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and validity of the Ocular Surface Disease Index. Arch Ophthalmol. 2000;118(5):615-621. doi:10.1001/archopht.118.5.615. PMID:10815152. https://doi.org/10.1001/archopht.118.5.615
10. Roka N, Shrestha SP, Joshi ND. Assessment of tear secretion and tear film instability in cases with pterygium and normal subjects. Nepal J Ophthalmol. 2013;5(1):16-23. doi:10.3126/nepjoph.v5i1.7816. PMID:23584641. https://doi.org/10.3126/nepjoph.v5i1.7816
11. Kadayifçilar SC, Orhan M, Irkeç M. Tear functions in patients with pterygium. Acta Ophthalmol Scand. 1998;76(2):176-179. doi:10.1034/j.1600-0420.1998.760210.x. PMID:9591948. https://doi.org/10.1034/j.1600-0420.1998.760210.x
12. Ye F, Zhou F, Xia Y, Zhu X, Wu Y, Huang Z. Evaluation of meibomian gland and tear film changes in patients with pterygium. Indian J Ophthalmol. 2017;65(3):233-237. doi:10.4103/ijo.IJO_743_16. PMID:28440253. https://doi.org/10.4103/ijo.IJO_743_16
13. Ozsutcu M, Arslan B, Erdur SK, Gulkilik G, Kocabora MS, Muftuoglu O. Tear osmolarity and tear film parameters in patients with unilateral pterygium. Cornea. 2014;33(11):1174-1178. doi:10.1097/ICO.0000000000000235. PMID:25255132. https://doi.org/10.1097/ICO.0000000000000235
14. 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. doi:10.14744/bej.2019.18853. PMID:35098058. https://doi.org/10.14744/bej.2019.18853

SJ Ophthalmology Africa
Vol. 3 No. 3 (2026): July 2026 Issue
https://doi.org/10.51168/x6pgwh95
Original Article

PUBLISHER DETAILS

SJC PUBLISHERS COMPANY LIMITED

SJC Publishers Company Limited
TODAY AND TOMORROW

Catergory: Non Government & Non profit Organisation
Contact: +256 775 434 261 (WhatsApp)
Email: info@sjpublisher.org or studentsjournal2020@gmail.com
Website: https://sjpublisher.org
Location: Scholar's Summit Nakigalala, P. O. Box 701432,Entebbe Uganda, East Africa