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ORIGINAL RESERCH ARTICLE

Effect of Pterygium Surgery on Precorneal Tear Film

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ABSTRACT

INTRODUCTION
Pterygium is a common disease of the ocular surface characterized by the invasion of fibrovascular tissue from the bulbar conjunctiva onto the cornea. It can cause chronic ocular irritation, tear film disturbances, induced astigmatism, and decreased vision secondary to growth over the visual axis.

OBJECTIVES
To assess precorneal Tear film before and after pterygium surgery.

METHOD
This prospective observational study was done on all consecutive patients with pterygium came to ophthalmology OPD at R L Jalappa hospital in kolar from August 2022 to December 2023. A total of 39 eyes were included in each group of which 12 were males and 27 females. All the patients subjected for detail visual acuity (VA) assessment, slit lamp examination, intraocular pressure (IOP) estimation, tear film function tests and underwent Pterygium excision with conjunctival limbal autograft. They were followed post- operatively 1 week, 4 weeks and 6weeks.

RESULTS
Majority of the patients were females (69.2%), while 30.8% were males with average age (in years) as 51.33 years. Majority had Type 2 (51.3%), followed by Type 3 (26.6%) and Type 1 (23.1%). Schimers test 1 was significantly decreased in the affected eye compared to control eye at pre-op and 1 week following post-op. There was no significant difference in the ST1 at 4 weeks and 6 weeks between the affected and control eyes. Schimers test 2 was significantly decreased in the affected eye compared to control eye at pre-op, one week and four weeks following post-op. There was no significant difference in the ST-2 at 6 weeks between the affected and control eyes. TBUT was significantly decreased in the affected eye compared to control eye at pre-op, and 4 weeks following post-op. There was no significant difference in the TBUT at 1 week and 6 weeks between the affected and control eyes. TMH was significantly lower in the affected eye than the control eye at pre-op, and 1 week following post-op. No significant difference in the TMH at 4 weeks and 6 weeks between the affected and control eyes was noticed. Comparision of schirmers test 1, schirmers 2, TBUT and TMH at 1week,4week & 6 weeks between preop and post op in type 1 pterygium**,** among the affected eye, the tear film function significantly improved.

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CONCLUSION
Our research found that after the pterygium was removed, the measurements, such as Schirmers and Tear Break-up Time (TBUT), showed improvement over time. After a month after the operation in the affected eye, the Schirmers and Tear Break-up Time were almost as close to the control eye's values. This suggests that the dry eye symptoms related to the pterygium got better after the surgery. Nonetheless, our research did not include a long-term check-up to explore if the pterygium would come back and how it might affect the tear film's function.

KEYWORDS
Pterygium, Tear Film, Dry Eye Disease, Tear Film Function Tests, Ocular Surface

INTRODUCTION

A key feature of pterygium, also known as surfer's eye, is the growth of limbal and conjunctival tissue on the edge of the cornea, creating a wing-like structure. The main elements of pterygium consists of the growth of limbal stem cells (LSCs), changes in the cornea's epithelial cells, the presence of active fibrovascular tissue, inflammation, and rupture of Bowman's layer at the edge of the pterygium. These changes occur due to alterations in the balance of the eye's surface environment.[1]

Pterygium development is hypothesized to be more susceptible to certain environmental conditions. The chance of acquiring these disorders is believed to be increased by over exposure to sunshine and ultraviolet (UV) radiation, with pterygium showing a higher correlation.2 One theory is that UV radiation induces a mutation in the p53 tumor suppressor gene, which activates transcription factors that support the development of pterygium, including “activator protein 1 (AP-1)” and “nuclear factor kappa B (nF-kB)”. Additionally, pterygium has been linked to various eye conditions.3 For instance, data suggests that individuals with dry eye disease (DED) have a higher prevalence of pterygium. According to a research, the likelihood of dry eye in a person with a pterygium was three times higher than in a patient without one.4

The effects of pterygium excision on epithelium of the eye surface and refraction were explored in great detail; however, little is known about the relationships between pterygium characteristics and excision prognosis. Pterygium has several symptoms with meibomian gland dysfunction (MGD) and dry eye, such as irritation and dryness.[5] As per the past studies, pterygium may directly cause localized rise of conjunctiva and unequal tear distribution, which may result in aberrant tear dynamics and dry eyes.[6]

Various studies have explored the relationship of pterygium with the stability of the tear film, using tests like the “Schirmer's test (ST)” or “Tear Break-up Time (TBUT)”. These tests suggest that pterygium-related eyes tend to have lower ST and TBUT, pointing to a relationship of tear instability with issues of the eye's surface. The TBUT, which evaluates tear production qualitatively, indicates that a shorter TBUT is linked to tear film instability. This test is relatively easy and fast for assessing tear film health. The only therapy for pterygium is surgery. Options include the bare sclera method, conjunctival autografting, and additional treatments like MMC.[7]

Yet the studies assessing the impact of pterygium surgeries on the dry eye parameters are limited in Indian settings. Hence, the present study has been undertaken.

MATERIALS AND METHODS

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Study Design
Observational study.

Source of Data
Patients with unilateral pterygium who visit Ophthalmology OPD at R. L Jalappa Hospital, Kolar attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Study Duration
September 2022-December 2023

Inclusion Criteria
- All patients of either sex above 18 years of age
- Patients with unilateral pterygium

Exclusion Criteria
- Allergic conjunctivitis
- Corneal ulcer
- Type 2 diabetes mellitus
- Bronchial asthma
- Previous history of eye surgeries
- Sjojren ‘s syndrome
- Medications (anti histamines, beta blockers, antispasmodics, diuretics)
- Contact lens users
- Vitamin A deficiency

Method of Data Collection
- This study was done on the patients coming to R.L.Jalappa Hospital, Tamaka, Kolar.
- All the consecutive patients underwent detail visual acuity assessment, slit lamp examination, intraocular pressure estimation and tear film function tests.
- Tear film function test includes (TBUT), Schirmer’s test (1&2), Tear meniscus height (TMH) were measured.
- All the patients underwent Pterygium excision with conjunctival limbal autograft and were followed post-operatively at 1 week, 4 weeks and 6weeks.
- TBUT, schirmer’s test and TMH were performed post-operatively.

RESULTS
Majority of the patients were females (69.2%), and 30.8% were males.

		Frequency	Percent (%)
Gender	Males	12	31 %
	Females	27	69 %
	Total	39	100%

Table 1: Distribution of subjects according to gender

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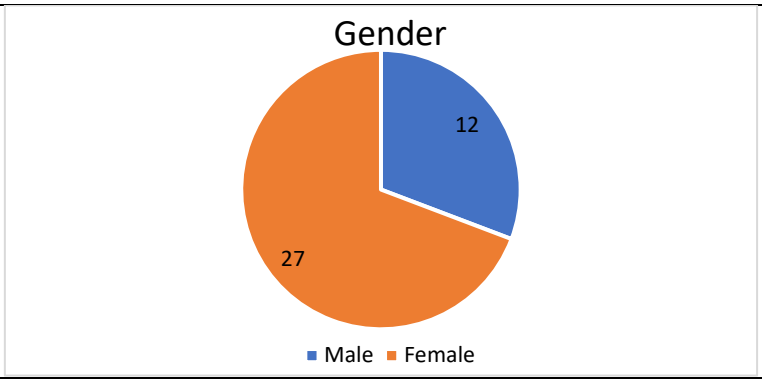


Graph 1: Distribution of subjects according to gender

The patients had an average of 51.33 years.

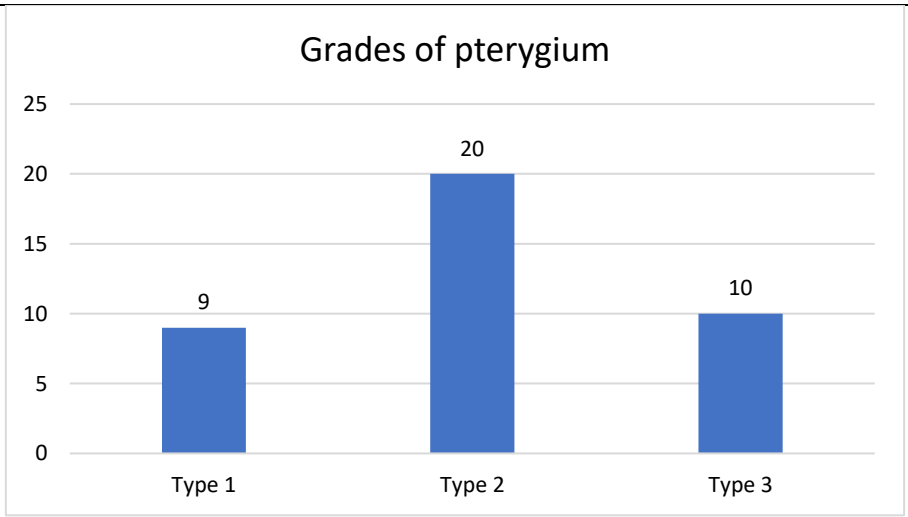
Mean	51.33
Median	52
SD	13.36
IQR	40,60

Table 2: Patient Characteristics

Majority of the patients had Type 1 (51.3%), followed by Type 3 (26.6%) and Type 1 (23.1%).

Grades of Pterygium		Frequency	Percent (%)
Diagnosis	Type 1	9	23.1%
	Type 2	20	51.3%
	Type 3	10	26.6%
	Total	39	100.0%

Table 3: Distribution of grades of pterygium



Graph 2: Distribution of grades of pterygium

Most of the patients had their left eye affected (59%)

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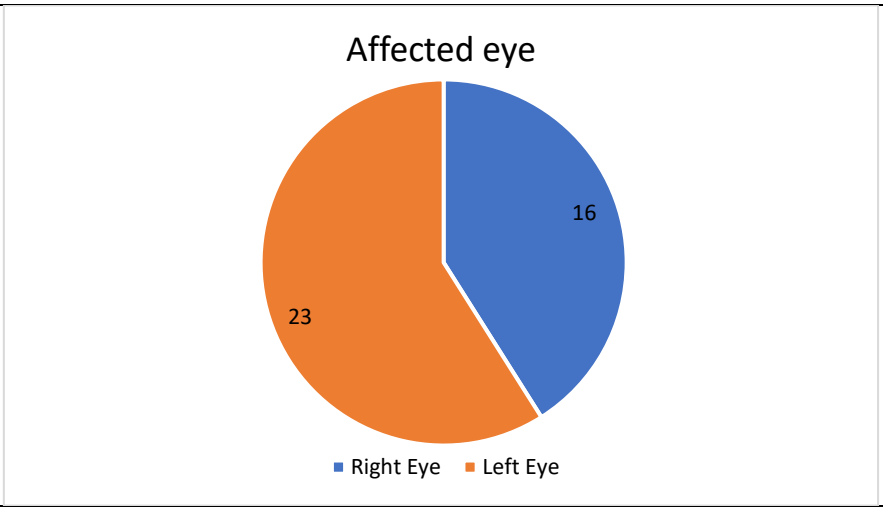
Laterality of pterygium			
Laterality of pterygium		**Frequency**	**Percent (%)**
	Right Eye	16	41.0%
	Left Eye	23	59.0%
	Total	39	100.0%

Table 4: Laterality of pterygium



Graph 3: Laterality of pterygium

The mean Schirmers test 1 pre-op values of affected and control eyes were 8.38 and 22.62, respectively.

The mean Schirmers test 1 one week post-op values of affected and control eyes were 19.79 and 22.92, respectively.

The mean Schirmers test 1 four weeks post-op values of affected and control eyes were 22.05 and 22.67, respectively.

The mean Schirmers test 1 six weeks post-op values of affected and control eyes were 24.21 and 24.21, respectively.

The mean Schirmers test 2 pre-op values of affected and control eyes were 10.54 and 26.15, respectively.

The mean Schirmers test 2 one week post-op values of affected and control eyes were 22.31 and 25.18, respectively.

The mean Schirmers test 2 four weeks post-op values of affected and control eyes were 25.03 and 25.74, respectively.

The mean Schirmers test 2 six weeks post-op values of affected and control eyes were 25.69 and 25.79, respectively.

The mean TBUT pre-op values of affected and control eyes were 8.44 and 15.9, respectively.

The mean TBUT one week post-op values of affected and control eyes were 15.82 and 16.69, respectively.

The mean TBUT four weeks post-op values of affected and control eyes were 16.46 and 18, respectively.

The mean TBUT six weeks post-op values of affected and control eyes were 17.1 and 17.46, respectively.

The mean TMH pre-op values of affected and control eyes were 0.22 and 0.29, respectively.

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The mean TMH one week post-op values of affected and control eyes were 0.28 and 0.29, respectively.

The mean TMH four weeks post-op values of affected and control eyes were 0.29 and 0.29, respectively.

The mean TMH six weeks post-op values of affected and control eyes were 0.29 and 0.29, respectively.

	Eye with pterygium (affected eye)				**Eye without pterygium (control eye)**			
	Mean	**Median**	**Std. Deviation**	**IQR**	**Mean**	**Median**	**Std. Deviation**	**IQR**
Schirmers test 1 pre-op	8.38	5.00	6.44	5,6	22.62	24.00	1.73	22,24
Schirmers test 1 1 week post-op	19.79	20.00	2.71	20,22	22.92	22.00	1.44	22,24
Schirmers test 1 4 weeks post-op	22.05	22.00	1.69	22,22	22.67	22.00	1.85	22,24
Schirmers test 1 6 weeks post-op	24.21	24.00	1.44	24,26	24.21	24.00	1.44	24,26
Schirmers test 2 pre-op	10.54	7.00	7.03	6,8	26.15	26.00	1.41	26,28
Schirmers test 2 1 week post-op	22.31	22.00	1.42	22,24	25.18	26.00	1.27	24,26
Schirmers test 2 4 weeks post-op	25.03	24.00	1.29	24,26	25.74	26.00	1.31	24,26
Schirmers test 2 6 weeks post-op	25.69	26.00	1.69	24,28	25.79	26.00	1.76	24,28
TBUT pre op	8.44	7.00	4.00	5,9	15.90	16.00	1.50	15,18
TBUT 1 week post-op	15.82	16.00	2.17	14,16	16.69	16.00	2.40	15,18
TBUT 4 weeks post-op	16.46	16.00	2.22	14,18	18.00	18.00	2.05	16,20
TBUT 6 weeks post-op	17.10	17.00	1.79	16,18	17.46	18.00	1.83	16,18
TMH pre op	0.22	0.19	0.06	0.16,0.28	0.29	0.28	0.02	0.28,0.3
TMH 1 week post-op	0.28	0.28	0.02	0.26,0.29	0.29	0.30	0.01	0.29,0.3
TMH 4 weeks post-op	0.29	0.29	0.01	0.28,0.3	0.29	0.29	0.01	0.28,0.3
TMH 6 weeks post-op	0.29	0.29	0.01	0.28,0.3	0.29	0.29	0.02	0.28,0.3

Table 5: Comparison of Tear Film Parameters Between Affected and Control Eyes

DISCUSSION

This research assessed the enhancement of dry eye symptoms through established evaluations like Schimers tests (ST) 1 and 2, TBUT and TMH. The participants were monitored and contrasted before and after surgery, as well as at one, four, and six weeks following the procedure.

Demographic Characteristics

In the research conducted by Li et al., to assess the immediate impact of pterygium removal on the tear film, half of the participants were women, with an average age of 54 years ± 15. In the current investigation, 70% of the participants were women, averaging 51.3 years ± 13.3.59

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Patkar et al. conducted a study at a hospital examining how pterygium and its removal surgery, using the conjunctival autograft technique, impacts tear films. The average age of the participants in this research was 52.84±11.99 years, with 53% being women.

In the study by Sharma et al., two techniques for surgical removal (Bare sclera and autograft) were evaluated, involving a combined group of 68 individuals, with a median age of 53.32 years for the female participants and 48.4 years for the males.[7] The average age across both groups was found to be similar.

Study	Mean Age
Our study	51.3 years
Li et al	54 years
Patkar et al	52.84 years
Sharma et al	53.32 years (females) 48.4 years (males)
Li et al	54±15 years
Patkar et al	52.84±11.99 years

Table 6: Comparison of age of our study with other studies

ST and TBUT

The results of ST and the TBUT were assessed both before and after the pterygium surgery by Kampitak et al. Interestingly, there was no substantial change in ST and TBUT measurements between the two-time points.[8] The Schirmer's test results indicated an average ± standard deviation of 9.2 ± 4.3 and 10.0 ± 6.3 millimeters one month after the surgery, compared to before the surgery. In this study, ST was performed at four different time intervals. The test demonstrated an improvement from 8.3 ± 6.4 to 22 ± 1.6 millimeters one month after the surgery. The TBUT measurements revealed times of 7.5 ± 3.0 and 7.9 ± 3.1 seconds, respectively. Although the Kampitak et al. research did not observe any changes in TBUT,[8] our findings indicated a notable increase in the average TBUT from 8.4 ± 4 to 16.4 ± 2.2 seconds one month after the surgery. The variation in the results could be attributed to the fact that the Kampitak et al. study utilized a wet amniotic membrane graft on the scleral bed following the pterygium removal, whereas our study employed a conjunctival limbal autograft.[8]

Sharma et al. looked into how tear film characteristics changed when comparing patients with pterygium surgery to the traditional bare sclera method or the newer conjunctival autograft technique.[7] Before the surgery, the average ST-I score was 9.333 millimetre, that rose to 12.203 millimetre following the pterygium removal. In the group that received the conjunctival autograft, the average times for TBUT and Schirmer's I scores before and after the surgery were 7.253 secs and 14.0 secs, with scores of 9.178 mm and 12.678 mm. The patients who had surgery with the traditional bare sclera method also saw improvements in their Schirmer's I and TBUT scores, with scores increasing from 9.500 mm to 11.692 mm for Schirmer's I and from 7.169 seconds to 12.046 seconds for TBUT. In a similar manner, the Schirmer's I score rose from 8.3±6.4 to 22±1.6 over the course of one month after the surgery. Schirmers' second test before surgery had a range of 19±7, but it improved to 22.3±1.4 one week after the operation, 25±1.1 one month later, and 25.6±1.7 six weeks later. Sharma et al.' research indicated that the total time spent under anesthesia (TBUT) before surgery was 7.212 seconds.[7] Following the removal of the pterygium, this value rose to 13.059 seconds. In a similar way, the average TBUT increased from 8.4±4 in the days before the operation to 16.4±2.2 seconds one month after the procedure. Regardless of the specific method used, both Schirmers' test scores and TBUT values showed an upward trend over time after the surgical intervention.[7]

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Li et al. evaluated the immediate effects of removing a pterygium on the goblet cells count in the conjunctiva and the function of the tear glands. They found that the time it took for the tear glands to recover, as estimated by the TBUT, was significantly longer after the surgery compared to before (9.74±3.43" vs. 11.49±3.76"). However, the Schirmer test showed no notable difference in tear production before and after the procedure. The removal of a pterygium seemed to enhance tear function in people with a primary pterygium, indicating a strong connection between the pterygium and dry eye. In a similar way, the tear breakup time increased from 8.4±4 to 15.8±2.1 in the first week, 16.4±2.2 in the second month, and 17.1±1.8 in the sixth week after surgery. The Schirmer I Test remained the same in both groups from Li et al.'s research, which mirrored our findings, showing no difference in tear production across the affected and control eyes at 4 weeks and 6 weeks.[9]

Study	ST-I value Changes
Our study	8.3 ± 6.4 (Baseline) and 22 ± 1.6 (1 months after surgery)
Kampitak et al	9.2 ± 4.3 (baseline) and 10.0 ± 6.3 (1 month after)
Sharma et al	Overall: 9.333 mm (baseline), 12.203 mm (1 month) Conjunctival autograft group: 9.178 mm and 12.678 mm Bare sclera group: 9.500 mm and 11.692 mm
Patkar et al	Baseline: 13±2.47 mm, 22±1.6 one month
Singh et al	Non-recurrence vs recurrence Baseline 10.68 (3.18) vs 10.67 (3.74) 1 month 10.96 (3.30) vs 11.56 (3.05) 3 months 11.18 (3.14) vs 11.67 (2.78) 6 months 11.51 (2.96) vs 11.56 (2.79)
Manhas et al	Cases:13.17±4.57 mm Controls: 16.40±5.21 mm

Table 7: Comparison of Schirmer's test I with other studies

Patkar et al. examined the impact of pterygium surgery, specifically the conjunctival autograft method, on the tear film. They selected one eye with pterygium as the case eye and another, unaffected eye was considered to be the control. Before and after the surgery, tests for TBUT, ST-I &II, were conducted on the eyes on days 10, 30, and 60. Before the operation, the case eye's tear breakup time was 9.71±1.35 secs, while the control eye's was 10.64±1.32 seconds. Before the operation, the case eye's Schirmer's I test showed an average of 13±2.47 mm, compared to 14.54±2.45 mm in the normal eye. Similarly, the case eye's ST-II test was 9.85±2.33 mm in the affected, and the control eye's had 10.44±2.54 mm. This showed that the eye with the pterygium removed eventually had a tear film of higher stability than the eye without surgery, which was the same as the comparison eye. In a similar way, the TBUT in our research went up from 8.4±4 in the time before surgery to 15.8±2.1 in one week, 16.4±2.2 in one month after surgery, and 17.1±1.8 in six weeks after surgery. Likewise, the Schirmer's test showed an increase from 8.3±6.4 before surgery to 22±1.6 one month after surgery. The Schirmer's test II before surgery was 19±7, but it improved to 22.3±1.4 one week after surgery, 25±1.1 one month after surgery, and 25.6±1.7 six weeks after surgery. The similarity in the results of the study could be attributed to the similar number of participants, the design of the study, and the method used, including the procedure of pterygium removal with conjunctival limbal autograft.[10]

Study	ST-II value Changes
Our study	Before surgery: 19±7, 22.3±1.4 one week after surgery 25±1.1 one month after surgery

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	25.6±1.7 six weeks after surgery
Patkar et al	Baseline: 9.85±2.33 mm, 22.3±1.4 one week after surgery, 25±1.1 one month after surgery, and 25.6±1.7 six weeks
Singh et al	Non-recurrence vs recurrence Baseline 9.50 ((3.02)vs 9.33 (2.78) 1 month 9.80 (2.63) vs 10.00 (2.24) 3 months 10.22 (2.33) vs 10.33 (2.18) 6 months 10.57 (2.59) vs 10.33 (2.12)
Table 8: Comparison of Schirmer's test II	

Singh et al. evaluate the changes in the eye's tear layer before and after surgery for pterygium removal (conjunctival autograft). Out of 75 patients who underwent conjunctival autografting and pterygium removal, 9 (12%) experienced a recurrence within three to six months. Following the pterygium removal surgery with conjunctival autograft, among those who did not experience a recurrence, the TBUT increased from 8.26 ± 2.37 seconds to 10.06 ± 2.36 seconds one month after the procedure. The TBUT increased from 8.33 ± 2.12 seconds before the surgery to 10.44 ± 2.0 seconds one month after the surgery in patients who later experienced a recurrence. There was a significant difference in these measurements. Following the surgery for pterygium, the Schirmer-1 and Schirmer-2 tests showed a slight enhancement in all patients, though these changes were not deemed statistically meaningful. Nonetheless, in the current research, the Schirmer-1 test was notably reduced in the eye where surgery was performed compared to the non-operated eye both before and one week after the operation, and there was no notable disparity in the ST-1 results between the operated and non-operated eyes at four and six weeks post-surgery. A similar trend was noted in the Schirmer-2 test. Singh et al. explored and analyzed the composition or quality of the tear fluid in relation to the TBUT, a factor not examined in the current study.[11]

The average of tear TBUT before surgery in eyes affected by pterygium was 8.26 seconds, among those who did not experience any recurrence following the procedure. A research study by Manhas A et al found that the average TBUT of the tear film in eyes affected by pterygium before surgery was 9.9 seconds. Other research on pterygium also reported an average TBUT of 10.4 seconds in eyes without pterygium, in comparison with 5.6 seconds in eyes affected by pterygium. The average TBUT before surgery was similar in the current study, with a TBUT time of 8.4 ± 4.4 seconds.[11,12]

Singh et al. found that, when compared to the average tear break-up time (TBUT) one month after surgery (10.44 seconds), the average TBUT three months after surgery decreased to 8.56 seconds, indicating a disruption in the tear film stability, once again. This could be due to the fact that the recurrence began to affect the normal spread of the tear film at three months. Nonetheless, the current research only looked at TBUT up to 45 days, so the impact of the recurrence on tear film stability beyond this period was not investigated.[11]

Manhas et al. carried out a study comparing patients with pterygium to those without, aiming to explore how common dry eye is among these groups and to determine if there's a link between the two conditions. They found that the average time it took for the TBUT was 9.88 seconds in those with pterygium and 14.22 seconds in the comparison eyes. This difference was found to be statistically significant. The average gap in TBUT was 4.34 seconds. The average difference in TBUT before surgery was more than 6 seconds. In this study, TBUT was assessed to be significantly lower in the affected eye compared to the control eye both before and after surgery. However, there was no notable difference in TBUT between the affected and control eyes at 1 week and 6 weeks after surgery.[12]

	Tear Break-up Time (TBUT)

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Our study	8.4 ± 4 to 16.4 ± 2.2 (1month after surgery)
Sharma et al	Overall: 7.212 seconds (baseline) and 13.059 seconds (1 month) Conjunctival autograft group: 7.253 seconds and 14.0 seconds Bare sclera group: 7.169 seconds and 12.046 seconds
Kampitak et al	7.5 ± 3.0 (baseline), 7.9 ± 3.1 (post surgery)
Li et al	9.74±3.43 (baseline) vs. 11.49±3.76 (1month)
Patkar et al	Baseline: 9.71±1.35 seconds, 15.8±2.1 in one week, 16.4±2.2 in one month after surgery, 17.1±1.8 in six weeks after surgery.
Singh et al	Non recurrence group: 8.26 ±2.37 (baseline) 10.06 ±2.36 (1 month) 10.27 ±2.24 (3 month) 10.77 ±2.23 (6 month) Recurrence group: 8.33 ±2.12 (base) 10.44 ±2.01 (1mon) 8.56 ±2.01 (3mon) 8.89 ±1.83 (6mon)
Manhas et al	Cases: 9.88±3.39 Controls: 14.22±3.99

Table 9: Tear Break-up Time (TBUT) in our study with other studies

Tear Meniscus Height (TMH)

In the research conducted by Li et al., the Tear meniscal Height (TMH) showed no significant change, with an average difference of approximately 0.23±0.10 observed one to six months after surgery, in comparison with the control eyes. Similarly, there was no notable disparity across the groups. Our research found that the TMH was noticeably lower in the operated eye compared to the non-operated eye both before and one week after surgery. However, there was no significant variation in TMH between the operated and non-operated eyes at four and six weeks post-surgery. The comparison of TMH between the two groups of eyes (surgery done and surgery not done), in the post-surgery period remained consistent throughout the study.[9]

Study	TMH
Our study	0.22 pre op to 0.29 6 weeks after surgery
Li et al	Difference of 0.23 at 6 months after surgery

Table 10: Comparison of Tear Meniscus Height (TMH) Changes

CONCLUSION

Our research found that after the pterygium was removed, the measurements, such as ST and TBUT, showed improvement over time. After a month after the operation in the affected eye, the ST and TBUT were almost as close to the control eye's values. This suggests that the dry eye symptoms related to the pterygium got better after the surgery. Nonetheless, our research did not include a long-term check-up to explore if the pterygium would come back and how it might affect the tear film's function.

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Conflicts of interest

There are no conflicts of interest.

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