RESEARCH PAPER

KERATOMETRIC CHANGES AND VISUAL OUTCOME FOLLOWING PTERYGIUM EXCISION: A PROSPECTIVE INTERVENTIONAL STUDY

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ABSTRACT

Background

Pterygium produces progressive corneal distortion leading to induced astigmatism and visual impairment. Surgical excision restores corneal curvature and improves visual acuity.

Aim

To evaluate keratometric changes following pterygium excision and analyze the association between pterygium size, surgical technique, and postoperative visual outcome.

Materials and Methods

A prospective interventional study was conducted on 100 eyes with primary pterygium undergoing surgical excision. Preoperative and postoperative keratometric readings were recorded using autokeratometry. Follow-up was done up to 45 days. Statistical comparison of pre- and postoperative astigmatism was performed.

Results

Mean corneal astigmatism reduced significantly after surgery, stabilizing by postoperative day 45. Larger pterygium size was associated with greater preoperative astigmatism and greater postoperative reduction. Conjunctival autograft technique demonstrated better refractive outcomes compared with bare sclera excision.

Conclusion

Pterygium excision significantly improves corneal curvature and visual acuity. Lesion size is an important determinant of induced astigmatism and postoperative recovery.

Keywords: Pterygium, Keratometry, Astigmatism, Conjunctival autograft, Visual outcome.

How to cite this article: Sheth H, Popat K. Keratometric Changes and Visual Outcome Following Pterygium Excision: A Prospective Interventional Study. Int J Drug Deliv Technol. 2026;16(54s): 1297-1302. DOI: 10.25258/ijddt.16.54s.114

Source of support: Nil.

Conflict of interest: None

INTRODUCTION:

Pterygium is a common degenerative ocular surface disorder characterized by a triangular fibrovascular growth of conjunctival tissue extending onto the cornea, typically within the interpalpebral fissure. The condition is particularly prevalent in tropical and subtropical regions where exposure to ultraviolet (UV) radiation, dust, and dry environmental conditions is high [1,2]. These environmental factors contribute to chronic inflammation, oxidative stress, and degeneration of conjunctival connective tissue, ultimately resulting in fibrovascular proliferation across the limbus [2,3].

The prevalence of pterygium is higher among individuals engaged in outdoor occupations such as agriculture, fishing, and construction work due to prolonged exposure to sunlight and environmental irritants [1]. Ultraviolet radiation is believed to induce limbal stem-cell damage and promote elastotic degeneration of subconjunctival tissue, leading to conjunctivalization of the corneal surface [3].

Although pterygium is often considered a benign condition, it can produce significant visual impairment. Visual disturbance occurs primarily due to induced corneal astigmatism, tear-film instability, and progressive encroachment onto the visual axis in advanced cases [4]. Mechanical traction exerted by fibrovascular tissue causes flattening of the horizontal corneal meridian, resulting in with-the-rule astigmatism. In addition, pooling of tears at the apex of the pterygium contributes to irregular corneal optics and refractive distortion [4,5].

Keratometry provides an objective and reliable method for evaluating changes in corneal curvature associated with pterygium. Previous studies have demonstrated that the degree of corneal astigmatism increases with the size and extent of corneal involvement [4,6]. Larger pterygia produce greater corneal distortion and more pronounced visual symptoms compared to smaller lesions.

Surgical excision remains the definitive treatment for progressive or visually significant pterygium. The goals of surgery include restoration of corneal curvature, reduction of induced astigmatism, prevention of recurrence, and improvement in visual acuity [7]. Various surgical techniques have been described, including bare sclera excision, conjunctival autograft transplantation, and amniotic

membrane grafting. Among these, conjunctival autograft has become the preferred technique due to lower recurrence rates and improved postoperative ocular surface stability [7,8].

Several clinical studies have reported significant reduction in keratometric astigmatism following pterygium excision, with improvement in visual acuity observed within weeks after surgery [6,9]. Corneal curvature typically stabilizes within four to eight weeks postoperatively, reflecting corneal remodeling after removal of fibrovascular traction [6].

Despite well-documented refractive changes associated with pterygium, postoperative keratometric outcomes may vary depending on lesion size, surgical technique, and healing response. Quantitative evaluation of keratometric changes following surgery is therefore important for understanding corneal recovery and planning refractive correction.

The present prospective clinical study was undertaken to evaluate keratometric changes following pterygium excision and to analyze the relationship between pterygium size, surgical technique, and postoperative visual outcome in patients undergoing surgical management of primary pterygium at a tertiary care center.

MATERIALS AND METHODS:

This prospective interventional clinical study was conducted in the Department of Ophthalmology at P. D. U. Govt. Medical College, Rajkot, Gujarat over a period from October 2011 to April 2013. The study was designed to evaluate keratometric changes following surgical excision of primary pterygium and to assess the improvement in visual acuity after surgery. Institutional ethical committee approval was obtained prior to commencement of the study, and the study adhered to the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all patients participating in the study.

A total of 100 eyes of 95 patients diagnosed with primary pterygium and scheduled for surgical excision were included in the study. Patients presenting with progressive pterygium associated with visual disturbance, significant induced astigmatism, cosmetic concern, or recurrent ocular irritation were considered eligible for inclusion. Patients with recurrent pterygium, pseudopterygium, corneal scarring, previous ocular surgery, coexisting corneal pathology, or any other ocular condition that could influence corneal curvature were excluded from the study. Patients with systemic diseases affecting wound healing were also excluded.

All patients underwent a detailed ophthalmic evaluation at the time of presentation. A thorough history regarding symptoms, duration of pterygium, occupational exposure to sunlight, and ocular complaints such as redness, irritation, watering, and diminution of vision was obtained. Each patient then underwent comprehensive ocular examination including measurement of visual acuity using Snellen's chart, slit-lamp biomicroscopy of the anterior segment, and fundus examination whenever indicated.

The size and extent of pterygium were carefully assessed during slit-lamp examination. The horizontal extension of the pterygium onto the cornea was measured from the limbus to the apex of the lesion using the slit-lamp scale. Pterygium was graded according to the extent of corneal involvement. Keratometric readings were obtained using a Bausch and Lomb keratometer to determine the corneal curvature in the horizontal and vertical meridians. The amount of corneal astigmatism was calculated from the difference between the two principal meridians.

All patients subsequently underwent surgical excision of the pterygium under local anesthesia. After aseptic preparation and draping, the head of the pterygium was carefully dissected from the corneal surface using a surgical blade. The body of the pterygium was then separated from the underlying sclera by blunt dissection and excised. The fibrovascular tissue was completely removed, and the corneal surface was gently polished to remove residual tissue. Hemostasis was achieved by gentle cauterization when necessary.

Following excision of the pterygium, a conjunctival autograft was harvested from the superior bulbar conjunctiva of the same eye. The graft was carefully dissected, maintaining an adequate thickness without inclusion of Tenon's capsule. The conjunctival graft was then placed over the bare scleral area and secured in position using interrupted 10-0 nylon sutures. Care was taken to maintain proper orientation of the graft and to ensure complete coverage of the scleral defect.

Postoperatively, all patients were treated with topical antibiotic and steroid eye drops along with lubricating eye drops. Patients were examined on the first postoperative day and subsequently at regular follow-up visits. Follow-up evaluations were conducted at one week, four weeks, and six weeks after surgery.

During each follow-up visit, patients underwent assessment of visual acuity, slit-lamp examination of the surgical site, and keratometric measurements. Particular attention was paid to graft integrity, postoperative inflammation, recurrence, and any surgical complications. Keratometric readings obtained during postoperative visits were compared with preoperative values in order to assess changes in corneal curvature and reduction in pterygium-induced astigmatism.

The collected data were compiled and analyzed to evaluate the effect of pterygium excision on corneal astigmatism and visual acuity. Descriptive statistical methods using MS Excel were used to summarize

the findings, and the preoperative and postoperative keratometric values were compared to determine the significance of surgical intervention in improving corneal curvature.

RESULTS AND ANALYSIS:

A total of **100 eyes of 95 patients** with primary pterygium were included in the study. Five patients had bilateral involvement. All patients completed the scheduled follow-up period and were included in the final analysis.

The age of the patients ranged from **25 to 79 years**, with the majority of cases observed in the **fifth and sixth decades of life**. This finding reflects the cumulative effect of environmental exposure in the pathogenesis of pterygium. There was a slight female predominance in the study population (Table 1).

Table 1: Age distribution of patients (n = 95)

Age group (years)	Number of patients	Percentage (%)
20–30	8	8.4
31–40	15	15.8
41–50	20	21.1
51–60	30	31.6
>60	22	23.1
Total	**95**	**100**

Regarding laterality, **right eye involvement was marginally more common** than left eye involvement; however, the difference was not statistically significant. Bilateral pterygium was observed in a small subset of patients (5 patients).

Based on morphological classification, **Type 2 pterygium (2–4 mm corneal extension)** was the most frequently observed, accounting for the majority of cases. Type 1(<2 mm corneal extension) lesions were less common, while **Type 3 pterygium (>4 mm corneal extension)** constituted the smallest proportion. This distribution suggests that most patients presented with moderate disease rather than early-stage lesions (Table 2).

Table 2: Distribution of pterygium according to grade

Grade	Description	Number of eyes	Percentage (%)
Type 1	<2 mm	20	20
Type 2	2–4 mm	60	60
Type 3	>4 mm	20	20
Total	—	**100**	**100**

Preoperative keratometric evaluation revealed a clear association between the size of the pterygium and the degree of induced corneal astigmatism. Patients with **larger lesions demonstrated significantly higher astigmatism**, indicating greater corneal distortion. Type 3 pterygium showed the highest mean astigmatism, whereas Type 1 lesions were associated with comparatively lower values (Table 3).

Table 3: Preoperative astigmatism according to pterygium grade

Grade	Mean astigmatism (D)	Standard deviation
Type 1	2.10	± 0.80
Type 2	5.80	± 1.90
Type 3	8.90	± 2.40
Overall mean	**6.20**	**± 3.50**

Following surgical excision, a **progressive reduction in corneal astigmatism** was observed during the follow-up period. At the first postoperative week, a noticeable decrease in astigmatism was evident; however, the values had not yet stabilized. By the **sixth postoperative week (approximately 45 days)**, keratometric readings showed significant stabilization, indicating restoration of corneal curvature.

The **mean preoperative corneal astigmatism was approximately 6.2 ± 3.5 diopters**, which reduced markedly to **around 1.2 ± 1.3 diopters at six weeks postoperatively**. This reduction was statistically significant and demonstrates the effectiveness of pterygium excision in reversing corneal distortion (Table 4).

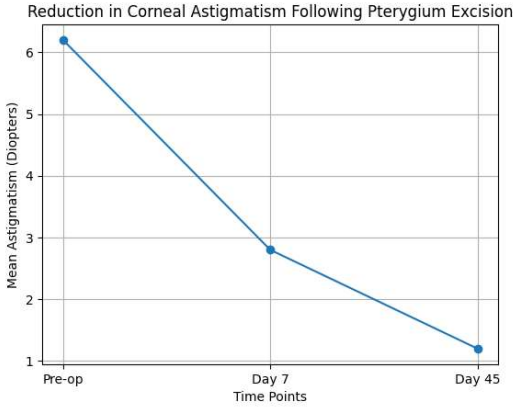
Table 4: Comparison of preoperative and postoperative astigmatism

Time point	Mean astigmatism (D)	Standard deviation
Preoperative	6.20	± 3.50
Post-op Day 7	2.80	± 1.90
Post-op Day 45	1.20	± 1.30

Changes in corneal astigmatism over multiple follow-up visits were analyzed using repeated measures analysis of variance (ANOVA). Post-hoc pairwise comparisons were performed using paired t-test with Bonferroni correction. A p-value of <0.05 was considered statistically significant. Repeated measures ANOVA showed a **statistically significant reduction in astigmatism across follow-up visits ($F = 152.4$, $p < 0.001$).** Post-hoc analysis with Bonferroni correction revealed that the reduction in astigmatism from preoperative values to both postoperative Day 7 and Day 45 was highly significant ($p < 0.001$). Additionally, a further significant reduction was observed between Day 7 and Day 45 ($p < 0.01$), indicating continued corneal remodelling during the postoperative period.

Below is the line graph showing progressive reduction in mean corneal astigmatism following pterygium excision, with maximum stabilization observed at 45 days postoperatively. (Figure 1)

Figure 1: Reduction in Corneal Astigmatism Following Pterygium Excision:



These findings suggest that although substantial improvement occurs within the first postoperative week, maximum stabilization of corneal curvature is achieved by approximately six weeks after surgery.

Visual acuity improved significantly following surgery in the majority (75%) of patients. A substantial proportion of eyes showed improvement of one or more Snellen lines postoperatively. The improvement in visual acuity closely correlated with the reduction in corneal astigmatism and improvement in corneal surface regularity.

When outcomes were analyzed based on surgical technique, eyes treated with **conjunctival autograft** demonstrated better keratometric stability and greater reduction in astigmatism compared to those managed with the bare sclera technique (Table 5). Additionally, the conjunctival autograft group showed improved ocular surface healing and fewer postoperative complications.

Table 5: Comparison of surgical techniques

Parameter	**Bare sclera (n ≈ 40)**	**Conjunctival autograft (n ≈ 60)**
Pre-op astigmatism (D)	6.10 ± 3.40	6.30 ± 3.60
Post-op astigmatism (D)	1.80 ± 1.40	0.90 ± 1.10
Mean reduction	4.30 D	5.40 D
Outcome	Good	Better

No significant intraoperative complications were encountered. Postoperative complications were minimal and included mild graft edema, transient irritation, and subconjunctival hemorrhage in a few cases, all of which resolved with conservative management. No clinically significant recurrence was observed during the follow-up period.

Overall, the results of the present study indicate that **pterygium excision leads to a significant reduction in corneal astigmatism and improvement in visual acuity**, with superior outcomes observed in patients undergoing conjunctival autograft surgery.

DISCUSSION:

The present study evaluated keratometric changes following pterygium excision and demonstrated a significant reduction in corneal astigmatism along with improvement in visual acuity. The findings confirm that pterygium-induced corneal distortion is largely reversible following surgical removal of the fibrovascular tissue.

In this study, the highest incidence of pterygium was observed in the fifth and sixth decades of life, which is consistent with the degenerative nature of the condition and cumulative exposure to environmental factors such as ultraviolet radiation. Similar age distribution patterns have been reported by Moran et al. [(1)] and Bradley et al. [(2)].

A slight female predominance was observed in the present study. Although many epidemiological studies report a higher prevalence among males due to greater outdoor exposure, regional variations and occupational patterns may influence gender distribution.

The present study demonstrated a clear relationship between the size of the pterygium and the degree of induced corneal astigmatism. Larger lesions (Type 3) were associated with significantly higher astigmatism compared to smaller lesions. This finding is consistent with observations by Tomidokoro et al. [(4)] and Mohammad-Salih et al. [(9)], who reported progressive corneal distortion with increasing pterygium size.

The mean preoperative astigmatism in the present study was 6.2 ± 3.5 diopters, which decreased significantly to 1.2 ± 1.3 diopters at six weeks postoperatively. This substantial reduction highlights the effectiveness of pterygium excision in restoring corneal curvature. Similar observations have been reported by Maheshwari et al. [(6)], who demonstrated significant reduction in pterygium-induced astigmatism following surgical excision.

Repeated measures ANOVA in the present study demonstrated a statistically significant reduction in astigmatism across follow-up visits, with continued improvement observed between the first postoperative week and six weeks. This indicates that corneal remodeling continues beyond the immediate postoperative period. Similar findings have been reported in recent studies by Gupta et al. [(10)] and Khan et al. [(11)], who observed progressive stabilization of keratometric values within 4–8 weeks following surgery.

Visual acuity improved in 75% of cases in the present study, correlating with the reduction in corneal astigmatism. Improvement in visual function following pterygium excision has been widely reported and is primarily attributed to restoration of corneal surface regularity and reduction of refractive error, as described by Hsu et al. [(12)].

Comparison of surgical techniques revealed that conjunctival autograft provided better outcomes in terms of astigmatism reduction and ocular surface

stability compared to the bare sclera technique. These findings are consistent with studies by Clearfield et al. [8] and Tan et al. [13], which demonstrated superior outcomes with conjunctival autografting.

An important aspect of the present study is the use of keratometry for assessment of corneal curvature changes. While corneal topography provides a more detailed and comprehensive analysis of corneal surface irregularities, it is not readily available in many peripheral and resource-limited ophthalmic setups. In contrast, a manual keratometer is a simple, cost-effective, and widely available instrument in routine ophthalmic practice. The present study highlights that even with this basic instrument, clinically significant and reliable assessment of pterygium-induced astigmatism and its postoperative changes can be achieved. This makes the findings of the study more applicable to a broader spectrum of ophthalmologists, especially in settings where advanced diagnostic modalities are not accessible.

The mechanism of astigmatism reduction following pterygium excision is multifactorial. Removal of fibrovascular tissue relieves tractional forces on the cornea, while restoration of a smooth ocular surface improves tear film dynamics, leading to normalization of corneal curvature.

The strengths of the present study include its prospective design, adequate sample size, and use of repeated measures ANOVA for statistical analysis, which provides a robust assessment of changes over time. Additionally, the use of a widely available diagnostic tool enhances the practical applicability of the study findings.

However, certain limitations should be acknowledged. The follow-up period was relatively short, and long-term outcomes such as recurrence and refractive stability beyond six weeks were not assessed. Corneal topography and higher-order aberration analysis were not performed, which could have provided more detailed insight into corneal surface changes.

Despite these limitations, the study highlights the significant refractive benefits of pterygium excision. Early surgical intervention in progressive cases may help prevent permanent corneal distortion and improve visual outcomes.

ADDITIVE VALUE OF THIS PAPER:

The present study reinforces the significant reduction in corneal astigmatism following pterygium excision and its positive impact on visual acuity. It further establishes a clear correlation between the size of the pterygium and the degree of induced astigmatism.

Importantly, this study emphasizes the utility of simple keratometry as a reliable tool for assessing corneal curvature changes in pterygium. While advanced modalities such as corneal topography provide detailed analysis, they are not universally available, particularly in peripheral or resource-limited settings. The findings of this study demonstrate that a standard keratometer, which is widely available in routine ophthalmic practice, can effectively be used to evaluate and monitor keratometric changes.

Thus, the study provides clinically relevant evidence that can be readily applied by the majority of ophthalmologists, making it especially valuable in settings where access to advanced diagnostic technology is limited.

CONCLUSION:

Pterygium induces significant corneal astigmatism that correlates directly with the size of the lesion. Surgical excision results in a marked reduction in astigmatism and significant improvement in visual acuity. Maximum stabilization of corneal curvature is achieved within six weeks postoperatively.

Conjunctival autograft technique provides superior refractive outcomes and better ocular surface stability compared to the bare sclera method.

The study also highlights that **simple keratometry is an effective and practical tool for evaluating corneal changes**, making the findings widely applicable across diverse ophthalmic practice settings.

REFERENCES:

1. Moran DJ, Hollows FC. Pterygium and ultraviolet radiation: a positive correlation. *Br J Ophthalmol.* 1984;68(5):343–346.
2. Bradley JC, Yang W, Bradley RH, Reid TW, Schwab IR. The science of pterygia. *Br J Ophthalmol.* 2010;94(7):815–820.
3. Detorakis ET, Spandidos DA. Pathogenetic mechanisms and treatment options for ophthalmic pterygium. *Int J Mol Med.* 2009;23(4):439–447.
4. Tomidokoro A, Miyata K, Sakaguchi Y, Samejima T, Oshika T. Effects of pterygium on corneal spherical power and astigmatism. *Ophthalmology.* 2000;107(8):1568–1571.
5. Avisar R, Loya N, Yassur Y, Weinberger D. Pterygium-induced corneal astigmatism. *Isr Med Assoc J.* 2000;2(1):14–15.
6. Maheshwari S. Effect of pterygium excision on pterygium-induced astigmatism. *Indian J Ophthalmol.* 2003;51(2):187–188.
7. Ang LP, Chua JL, Tan DT. Current concepts and techniques in pterygium treatment. *Curr Opin Ophthalmol.* 2007;18(4):308–313.
8. Clearfield E, Muthappan V, Wang X, Kuo IC. Conjunctival autograft for pterygium. *Cochrane Database Syst Rev.* 2016;2:CD011349.
9. Mohammad-Salih PA, Sharif AF. Analysis of pterygium size and induced corneal

astigmatism. *Clin Ophthalmol.* 2008;2(4):869–872.
10. Gupta VP, Saxena T. Evaluation of corneal astigmatism following pterygium surgery. J Clin Diagn Res. 2017;11(3):NC09–NC12.
11. Khan FA, Khan N, Khan A. Corneal astigmatism before and after pterygium excision. Pak J Ophthalmol. 2018;34(2):87–91.
12. Hsu MY, Lee YC, Shieh SJ. Visual outcome and corneal changes after pterygium excision. Clin Ophthalmol. 2019;13:1563–1569.
13. Tan DT, Chee SP, Dear KB, Lim AS. Effect of pterygium morphology on recurrence and surgical outcome. Am J Ophthalmol. 1997;123(5):621–628.