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CORNEAL ASTIGMATISM BEFORE AND AFTER SURGICAL EXCISION FOR PTERYGIUM

Original Research

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ABSTRACT

Background: Pterygium, a fibrovascular growth extending onto the corneal surface, is a prevalent ocular condition that disrupts corneal morphology and induces astigmatism, resulting in visual impairment. The etiology is multifactorial, involving ultraviolet radiation, chronic irritation, and genetic predisposition. Surgical excision, particularly with conjunctival autografting, is a widely accepted treatment, aiming to correct induced corneal astigmatism and enhance visual acuity while minimizing recurrence and complications.

Objective: To evaluate the impact of pterygium excision with conjunctival autografting on corneal astigmatism and visual acuity by comparing preoperative and postoperative outcomes.

Methods: A quasi-experimental study was conducted at the Clinical Ophthalmology Unit, Hayatabad Medical Complex, Peshawar, between May 2023 and April 2024. Sixty-eight patients with primary pterygium underwent excision surgery under topical anesthesia, followed by conjunctival autografting. Corneal astigmatism was measured preoperatively and one month postoperatively using automated keratometry. Data collected included demographic details, pre- and postoperative best-corrected visual acuity (BCVA), and postoperative complications. Statistical analysis was performed using SPSS 23.0, with significance set at $p \leq 0.05$.

Results: The mean age of participants was 48.6 ± 14.3 years, with a majority being male (90%). Preoperative mean corneal astigmatism was 2.71 ± 1.02 diopters (D), which significantly reduced to 1.25 ± 0.73 D postoperatively ($p < 0.001$). Postoperative improvement in BCVA was observed in 88.2% of patients, with 64.7% improving by one line and 23.5% by two lines or more. Minimal complications were reported, including mild conjunctival inflammation in three cases, and no recurrences were documented during the one-month follow-up.

Conclusion: Pterygium excision with conjunctival autografting effectively reduces corneal astigmatism, enhances visual acuity, and poses minimal risk of postoperative complications or recurrence. This technique remains a reliable and safe option for the management of primary pterygium.

Keywords: Astigmatism, Conjunctival Autograft, Corneal Surgery, Ophthalmology, Pterygium, Pterygium Excision, Visual Acuity.

INTRODUCTION

Pterygium, a fibrovascular growth originating from the conjunctiva and encroaching onto the corneal surface, is a prevalent ocular condition commonly observed in regions with high exposure to ultraviolet (UV) radiation. Its etiology is multifactorial, involving the interplay of UV radiation, chronic irritation, and genetic predisposition, making it a significant concern in ophthalmic practice (1, 2). The condition disrupts corneal morphology, often leading to visual disturbances, with one of the most notable being induced astigmatism. This refractive error, resulting from irregularities in the curvature of the cornea, manifests as blurred or distorted vision and is primarily attributed to the tractional forces exerted by the pterygium's fibrovascular tissue, creating an uneven corneal surface (3, 4). The magnitude of this induced astigmatism has been closely linked to the size and progression of the pterygium, emphasizing the clinical importance of early detection and management (5, 6).

Surgical excision remains the cornerstone of pterygium management, aimed at alleviating both the mechanical and visual impairments associated with this condition. Several techniques, including bare sclera excision, conjunctival autografting, and amniotic membrane transplantation, have been refined to optimize outcomes and minimize recurrence, which is a notable postoperative challenge (7). The impact of such interventions extends beyond mere removal of the fibrovascular growth, as they significantly alter corneal topography, often resulting in a substantial reduction in corneal astigmatism. Improved corneal regularity post-surgery has been consistently correlated with enhancements in visual acuity and overall quality of life for affected individuals, underscoring the functional benefits of surgical treatment (8, 9).

This study seeks to deepen the understanding of the relationship between pterygium and corneal astigmatism by evaluating changes in astigmatic parameters pre- and post-surgery. Through a comprehensive analysis of these changes, the research aims to provide evidence-based insights into the efficacy of surgical interventions, thereby rationalizing their role in the restoration of optimal visual function and contributing to improved clinical practices for managing pterygium-induced astigmatism.

METHODS

After obtaining approval from the Institutional Review Board, this quasi-experimental study was conducted at the Ophthalmology Unit, Hayatabad Medical Complex, Peshawar, over a period spanning May 2023 to April 2024. A total of 68 patients were enrolled, with the primary aim of comparing corneal astigmatism before and after pterygium excision. Inclusion criteria encompassed individuals aged 18 years or older, diagnosed with primary pterygium extending onto the corneal surface, possessing a best-corrected visual acuity (BCVA) of 20/40 or better, and willing to provide informed consent and comply with follow-up visits. Exclusion criteria included patients with recurrent pterygium, ocular surface disorders, prior ocular surgeries, systemic diseases impacting the ocular surface, such as rheumatoid arthritis or Sjögren’s syndrome, and those using medications such as corticosteroids that could interfere with corneal healing.

The surgical procedure involved meticulous steps to ensure consistency and optimal outcomes. Topical anesthesia was administered using 0.5% proparacaine eye drops. The pterygium was carefully dissected from the corneal surface, and the fibrovascular tissue was excised. A conjunctival autograft, harvested from the superior bulbar conjunctiva, was sutured to the scleral bed using 8-0 vicryl sutures, with graft dimensions matching the area of excised pterygium. Postoperative care included the application of moxifloxacin 0.5% and dexamethasone 0.1% eye drops, administered four times daily for two weeks. Patients were advised to avoid eye rubbing and wear sunglasses to mitigate UV exposure.

The primary outcome was the change in corneal astigmatism, assessed preoperatively and one month postoperatively using automated keratometry (Topcon KR-800, Topcon Corporation, Japan). Preoperative and postoperative evaluations included demographic data, detailed ocular examinations with slit-lamp biomicroscopy, BCVA assessments, and automated keratometric measurements of corneal astigmatism. Statistical analyses were conducted using SPSS 23.0, with the level of significance set at $p \leq 0.05$. Follow-up visits at one month postoperatively were conducted to document any complications, including recurrence of pterygium.

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RESULTS

A total of 68 patients were included in the study to assess changes in corneal astigmatism following pterygium excision. The mean age of participants was 47.6 ± 12.8 years, with the largest age group being 41–50 years (26.5%), followed by 51–60 years (23.5%). The majority of the participants were male (90%), with females comprising only 10% of the study population. The size of the pterygium ranged from 2.0 to 4.0 mm, with 35.3% of cases measuring 2.6–3.0 mm and 29.4% between 3.1–3.5 mm. This demographic distribution highlights the predominance of middle-aged males with moderate pterygium in this cohort.

The primary outcome, corneal astigmatism, showed a significant reduction postoperatively. The mean preoperative corneal astigmatism was 2.71 ± 1.02 diopters (D), which reduced to 1.25 ± 0.73 D at one month postoperatively, demonstrating a statistically significant improvement ($p < 0.001$). This reduction underscores the impact of surgical excision on restoring corneal regularity and improving refractive outcomes. Visual representation of the reduction in astigmatism values among patients reinforced these findings. Additionally, postoperative complications were minimal, with only three patients reporting mild conjunctival inflammation, all of which resolved with extended anti-inflammatory treatment. No intraoperative complications or cases of recurrence were observed within the one-month follow-up period.

Improvements in best-corrected visual acuity (BCVA) were also notable, with 88.2% of patients experiencing enhanced visual outcomes. Specifically, 64.7% improved by one line on the Snellen chart, and 23.5% achieved an improvement of two lines or more. Only 11.8% showed no change in BCVA, suggesting that pterygium excision positively affected functional visual outcomes in the majority of cases. These findings demonstrate the efficacy of surgical intervention in addressing both structural and visual abnormalities caused by pterygium.

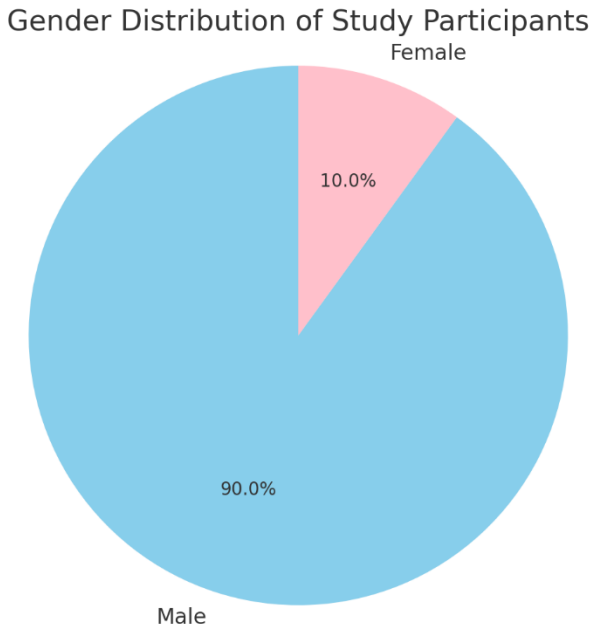

Figure 1 Gender Distribution of Study Participants

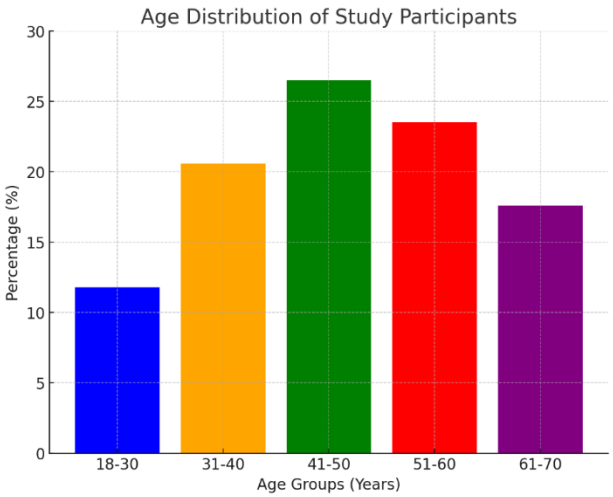

Figure 2 Age Distribution of Study Participants

The bar chart illustrates the age distribution of the study participants, showing that the largest proportion (26.5%) were aged 41–50 years, followed by 23.5% in the 51–60 years category. Participants aged 31–40 years accounted for 20.6%, while 18–30 years and 61–70 years comprised 11.8% and 17.6%, respectively. This distribution highlights a predominance of middle-aged individuals in the study population.

Table 1 Pterygium Size and Astigmatism Outcomes

Pterygium size (mm)		
Characteristics	Frequency	Percentage
2.0 - 2.5	16	23.5%
2.6 - 3.0	24	35.3%
3.1 - 3.5	20	29.4%
3.6 - 4.0	8	11.8%
Astigmatism (D)		
Characteristics	Mean ± SD	p-value
Preoperative	2.71 ± 1.02	< 0.001
Postoperative	1.25 ± 0.73	

The table summarizes the pterygium size and its impact on corneal astigmatism. The most common pterygium size was 2.6–3.0 mm (35.3%), followed by 3.1–3.5 mm (29.4%), 2.0–2.5 mm (23.5%), and 3.6–4.0 mm (11.8%). Preoperative astigmatism averaged 2.71 ± 1.02 diopters, which significantly reduced to 1.25 ± 0.73 diopters postoperatively ($p < 0.001$), highlighting the effectiveness of pterygium excision in improving corneal regularity.

The primary outcome measure was the change in corneal astigmatism from preoperative to one month postoperative. The preoperative mean corneal astigmatism preoperatively was 2.71 ± 1.02 diopters (D). One month postoperatively, the mean corneal astigmatism was significantly reduced to 1.25 ± 0.73 D ($p < 0.001$). The reduction in astigmatism is presented in Table 1 and Figure 3.

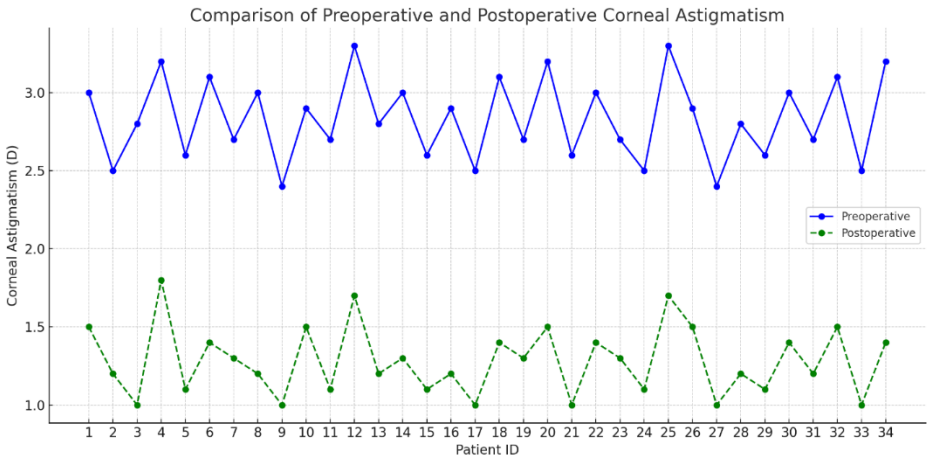

Figure 3 Comparison of Preoperative and Postoperative Corneal Astigmatism

in majority of patients 60 (88.2%). Detailed BCVA changes are presented in Table 3.

The figure above shows the comparison of corneal astigmatism values preoperatively and postoperatively for each patient, which clearly illustrates the significant reduction in astigmatism following pterygium excision surgery.

No significant intraoperative complications were reported. Postoperative complications were minimal and included mild conjunctival inflammation in 3 patients, which resolved with extended anti-inflammatory treatment. There were no cases of pterygium recurrence within the one-month follow-up period. Postoperatively improvement in best-corrected visual acuity (BCVA) was observed

Table 2 Improvement of BCVA postoperatively

BCVA Improvement	Frequency	Percentage
Improved by 1 line	44	64.7%
Improved by 2 lines or more	16	23.5%
No change	8	11.8%

The table highlights the postoperative improvement in best-corrected visual acuity (BCVA) among participants. A significant majority (64.7%) experienced an improvement of one line on the Snellen chart, while 23.5% improved by two or more lines. Only 11.8% showed no change in BCVA, demonstrating the positive visual outcomes achieved following pterygium excision.

DISCUSSION

The findings of this study reinforce the clinical benefits of pterygium excision surgery, particularly in reducing corneal astigmatism and enhancing visual acuity. Pterygium, as a fibrovascular growth, has long been implicated in significant visual disturbances, primarily due to its impact on corneal regularity and the resultant astigmatism. This study demonstrated a marked reduction in mean preoperative corneal astigmatism from 2.71 ± 1.02 diopters to 1.25 ± 0.73 diopters one month after surgery, a statistically significant improvement consistent with previous research (12, 13). Comparable findings by Aidentoo NS highlighted the efficacy of conjunctival autografting in astigmatism correction, further validating the results of this study (14). Additionally, prior observations by Mohammad-Salih emphasized the size-dependent nature of induced astigmatism, supporting the notion that surgical intervention effectively mitigates this refractive error (15).

The mechanism underlying this improvement likely stems from the removal of fibrovascular tissue exerting tractional forces on the cornea, which disrupts its regular curvature. Surgical excision alleviates this distortion, restoring a smoother corneal surface and reducing astigmatic aberrations (16). Beyond astigmatism correction, the improvement in best-corrected visual acuity was substantial, with 88.2% of patients experiencing a postoperative enhancement. These outcomes align with those reported by Long T et al., further establishing the role of pterygium excision in functional visual rehabilitation (17).

Postoperative outcomes were favorable, with minimal complications. Mild conjunctival inflammation in three patients resolved with extended anti-inflammatory treatment, and no recurrences were observed during the one-month follow-up. The conjunctival autograft technique appeared instrumental in minimizing recurrence risk, consistent with findings by Campagna G and Mohite US, who reported superior outcomes with this method compared to bare sclera excision (18, 19, 20).

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A recent comparative study conducted by Garg et al. (2019) evaluated the effectiveness of different surgical techniques for pterygium excision, specifically the bare sclera, conjunctival autograft, and amniotic membrane graft techniques. The study included 71 patients with primary pterygium, and outcomes such as corneal astigmatism and visual acuity were assessed preoperatively and at 1 month and 3 months postoperatively. The results indicated a significant reduction in mean preoperative astigmatism from 3.47 ± 1.74 diopters (D) to 1.10 ± 0.78 D three months after surgery ($p < 0.0001$). Among the surgical techniques, conjunctival autografting demonstrated the greatest reduction in astigmatism (2.55 ± 1.26 D), followed closely by amniotic membrane grafting (2.67 ± 1.44 D), with the bare sclera method showing the least improvement (1.85 ± 0.88 D). The findings underscore the superior efficacy of conjunctival autografting and amniotic membrane grafting compared to bare sclera excision, particularly in reducing astigmatism and enhancing visual acuity (21).

While the results are promising, the study is limited by a short follow-up period, restricting the assessment of long-term recurrence and stability of outcomes. Extending the follow-up duration would provide deeper insights into the durability of astigmatism correction and recurrence rates. Moreover, the reliance on automated keratometry, though effective, could be supplemented with advanced tools like corneal topography for a more nuanced evaluation of corneal morphology. Despite these limitations, the study underscores the efficacy of pterygium excision with conjunctival autografting, affirming its value in managing pterygium-induced visual disturbances.

CONCLUSION

Pterygium excision with conjunctival autografting is an effective and safe surgical intervention for reducing corneal astigmatism and improving visual outcomes. The procedure restores corneal regularity, significantly enhances best-corrected visual acuity, and is associated with minimal postoperative complications. The absence of recurrence within the follow-up period further supports the reliability of this approach in managing pterygium-induced visual disturbances, aligning with its role as a standard treatment modality to improve ocular health and patient quality of life.

AUTHOR CONTRIBUTIONS

Author	Contribution
Mohammad Israr	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Naz Ullah	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Asna Tahir	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Samina Karim	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Nuzhat	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Romaisa	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Shehzada	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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