ORIGINAL ARTICLE

Comparison of Videokeratographic Changes Before And After Pterygium Surgery

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Abstract:

Objective: To compare the contrast sensitivity and videokeratographic changes of corneal surface topography before and after surgery in patients with pterygium.

Methods: This Quasi-experimental study was carried out at Department of Ophthalmology, Armed Forces Institute of Ophthalmology (AFIO), Rawalpindi from January to December 2024. A total of 130 patients with varying grades of pterygium were sampled using simple random sampling via lottery method. Values for best corrected visual acuity, astigmatism, corneal irregularity, refractive power and contrast sensitivity were assessed. Pterygium removal and conjunctival autograft were done. All values were re-assessed at 4 weeks after surgical removal and conjunctival autograft in all patients. Data were analyzed using SPSS version 26.

Results: Best corrected visual acuity (BCVA) reported to be 0.16±0.02 LogMAR units versus 0.12±0.07 LogMAR units ($p<0.001$). Mean overall SIM-K (simulated keratometry) Astigmatism was 3.67±0.42 diopters versus 1.49±0.24 diopters before and after surgery ($p<0.001$). Contrast sensitivity values assessed at 1.5,03,06,12 and 18 cycles per degree in LogCS units before and after surgery at 4 weeks were 1.16±0.009 versus 1.17±0.005 ($p<0.001$), 1.14±0.100 versus 1.13±0.005 ($p<0.001$), 1.50±0.331 versus 1.69±0.024 ($p<0.001$), 0.91±0.134 versus 1.21±0.025 ($p<0.001$), 0.29±0.156 versus 0.63±0.25 respectively.

Conclusion: We concluded that pterygium surgery is associated with a statistically significant improvement in corneal topography including astigmatism, corneal irregularity, refractive power as well as improvement of corneal sensitivity. *Al-Shifa Journal of Ophthalmology 2025; 21(4): 227-233. Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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Introduction:

Pterygium is the commonest ocular pathology presenting in the outpatient clinics worldwide. [1] It is a fibrovascular growth caused by the underlying degeneration of the bulbar conjunctiva and presents clinically as a fleshy growth overlying the cornea. [2] Even if it does not involve the complete cornea, it is associated with decrease in visual acuity and considerable astigmatism caused by corneal traction and accumulation of the tear film in the affected area. [3] Literature reports that the disorder in more common in countries with warm climates, dust pollution and ultraviolet exposure. [4] In Pakistan, literature reports that prevalence of pterygium among ocular disorders is around 12% in the population. [5] This staggering number places

is only after cataract and refractive errors in our demographic population.

Ocular parameters are subjected to diverse variation depending on demographics, area and environmental factors. [6] There is a gap in local literature in results of post-surgical improvement in corneal topographic parameters along with improvement in visual acuity as well as contrast sensitivity. Even in international literature, post-surgical improvement in corneal topographic parameters and visual acuity is well documented but contrast sensitivity before and after removal requires more diverse studies for more conclusive results. [7] While previous surgical options only relied on removal of the conjunctival abnormal tissue, other techniques including conjunctival autograft in patients are reported to result in better improvement of visual parameters and drastically reduce the recurrence. [8] Since recurrence rates for pterygium are reported to be 10-15% within 2 years of removal, we aim to study ocular parameters after pterygium removal and autograft application. [9] The rationale of our study is to compare corneal topographical improvement as well as improvement in corneal sensitivity after pterygium surgery and conjunctival autograft in our demographic population.

Methodology:

This quasi-experimental study was carried out at the Department of Ophthalmology, Armed Forces Institute of Ophthalmology, Rawalpindi from January to December 2024 after approval from the ethical review board vide letter no.311/ERC/AFIO. Sample size was calculated keeping the confidence interval at 95%, power of test at 80% with anticipated population prevalence for pterygium at 7.4%.[10] Minimum sample size came out to be 106 patients according to WHO calculator. We included 130 patients using simple random sampling via lottery method in our final study protocol as per the inclusion criteria furnished keeping margin for lost to follow-up.

Patients of both genders, aged between 18-65 years presenting with pterygium (Grade II-IV) induced astigmatism and visual disturbances including blurring, distortion, ghosting, halos, squinting and eye strain for more than 4 weeks were included in the study. Patients with pseudo-pterygium, previous corneal ulceration or scarring, ocular trauma, patients wearing contact lenses for more than 2 years, patients lost to follow-up and non-consent were excluded from the study.

The study method included all patients according to the inclusion criteria provided. All patients were thoroughly counselled about the study protocol before induction in the study group. All participants agreed to and ensured regular follow-up in the OPD (outpatient department) as per the study design. All patients presenting to the eye OPD with complaints and findings of pterygium were subjected to detailed history and clinical examination. Demographic data was collected on a proforma provided by the study team by a resident ophthalmologist along with follow-up variables at the end of the study protocol. Grade of pterygium (Grade I-IV) was assessed in all patient depending on the vascular tissue encroaching on the globe. Grade-I: approaching the corneoscleral margin, Grade-II: approaching between the corneoscleral margin and pupil, Grade-III: encroaching on the pupil margin, Grade-IV: mass reaching the corneal center resulting in blocked vision. Diagnosis of pterygium induced astigmatism was made using keratomertric reading and a value of 0.75 diopters astigmatism was diagnosed as pterygium induced astigmatism. After being planned for surgery, examinations for astigmatism, corneal topography and contrast sensitivity were done one week before the operative date and were repeated four weeks after to see the difference in change of study variables. Visual acuity was assessed as the best corrected visual acuity (BCVA) and expressed in the LogMAR scale. Keratometric values for astigmatism were repeated and endorsed

including refractive irregularities assessed with refractive power in the central zones at 3 mm and 5 mm. Contrast sensitivity was done under mesopic room conditions. Testing distance was defined as 3 meters for all patients. Sensitivity was tested at spatial frequencies of 1.5, 3,6,12 and 18 cycles per degree (CPD). The data output was expressed as log contrast sensitivity values. All these measurements were repeated on follow-up visits in all patients at 4 weeks after the procedure.

Surgical removal of pterygium was done by a consultant ophthalmologist under local anesthesia under antibiotic cover. The growth was scraped off, body of the pterygium tissue was resected and removed, and the remnants left were shaved off the cornea. Conjunctival autograft was taken from the superior conjunctiva and secured on the shaved off surface using 10-0 sutures of nylon. A therapeutic contact lens was placed till corneal re-epithelization. Post-operatively, all patients were given anti-biotic drops for two weeks with autologous serum to be applied 2 hourly for two weeks prepared using patient's own blood in the lab and given to each patient on discharge to be stored in a domestic fridge to prevent infection. Primary variables studied were change in BCVA, Sim-K astigmatism assessed for irregularity at 3 mm and 5 mm and mean refractive power at 3 mm and 5 mm for all patients.

Demographic data were statistically described in terms of mean and SD, frequencies, and percentages when appropriate. Paired samples t-test was used to compare statistically significant means before and after treatment in the study group. A p value of ≤0.05 was considered statistically significant. All statistical calculations were performed using Statistical Package for Social Sciences version 26.0.

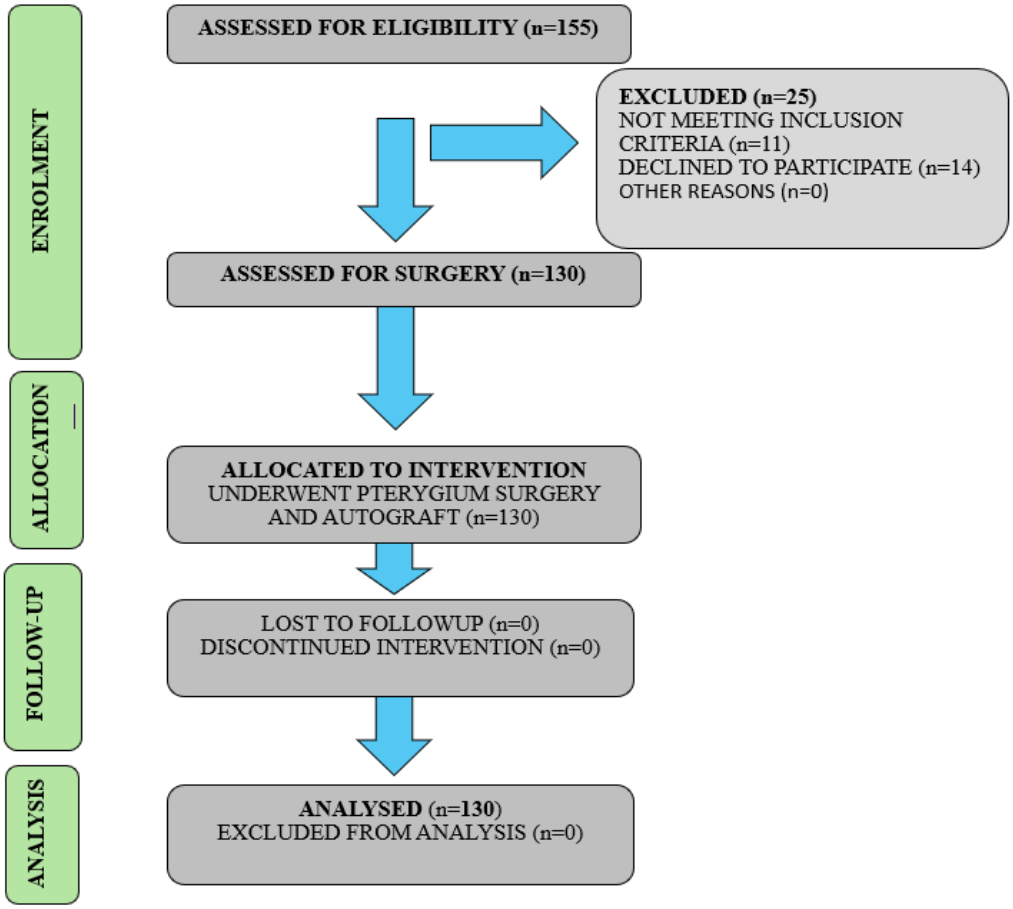

Fig 1. Phases of the study

Results:

A total of 130 patients were analyzed in the final assessment protocol. Mean age of the study group was 42.24±7.45 years and mean weight was 72.70±4.45 years. Gender distribution showed 94 (72.3%) males and 36 (27.7%) females. Grade of pterygium in the study group showed 38 (29.2%) patients with Grade-II, 73 (56.2%) patients with Grade-III and 19 (14.6%) patients with Grade-IV (Table 1).

Clinical outcomes for ocular parameters before and after pterygium surgery and autograft showed change in best corrected visual acuity (BCVA) reported to be 0.16±0.02 LogMAR units versus 0.12±0.07 LogMAR units ($p<0.001$) using the paired sample t-test. Mean overall SIM-K (simulated keratometry) Astigmatism was 3.67±0.42 diopters versus 1.49±0.24 diopters before and after surgery ($p<0.001$) using the paired sample t-test. Astigmatic irregularity assessed at the 3 mm zone was 3.69±0.44 diopters versus 1.50±0.24 diopters and at the 5 mm zone was 5.09±0.36 diopters versus 1.54±0.25 diopters before and after surgery ($p<0.001$) using the paired sample t-test. Mean refractive power assessed at the 3 mm and 5 mm zone before and after surgery was 45.17±1.67 diopters versus 42.93±2.84 diopters ($p<0.001$) and 45.13±1.72 diopters versus 42.37±3.01 diopters ($p<0.001$) using the paired sample t-test. (Table 2).

Table 1. Demographic and clinical characteristics

VARIABLE	STUDY GROUP (n=130)
	(Mean±SD)
Age (years)	42.24±7.45
Mean weight (kg)	72.70±4.45
Gender	N (%)
Male	94 (72.3%)
Female	36 (27.7%)
Pterygium grade	N (%)
Grade-II	38 (29.2%)
Grade-III	73 (56.2%)
Grade-IV	19 (14.6%)

Table 2. Clinical variables compared before and after treatment

Variable	Before surgery (n=130)	After surgery (n=130)	P value
Change in bcva (logmar units)	0.16±0.02	0.12±0.07	<0.001
Mean overall sim-k astigmatism (diopters)	3.67±0.42	1.49±0.24	<0.001
Irregularity (at 3 mm zone) (diopters)	3.69±0.44	1.50±0.24	<0.001
Irregularity (at 5 mm zone) (diopters)	5.09±0.36	1.54±0.25	<0.001
Mean topographic changes (k1 and k2) (diopters)	3.85±0.31	2.60±0.33	<0.001
Mean power of refraction (at 3 mm zone) (diopters)	45.17±1.67	42.93±2.84	<0.001
Mean power of refraction (at 5 mm zone) (diopters)	45.13±1.72	42.37±3.01	<0.001
Contrast sensitivity changes (logcs units)			
At 1.5 cycles per degree (cpd)	1.16±0.009	1.17±0.005	<0.001
At 03 cycles per degree (cpd)	1.14±0.100	1.13±0.005	<0.001
At 06 cycles per degree (cpd)	1.50±0.331	1.69±0.024	<0.001
At 12 cycles per degree (cpd)	0.91±0.134	1.21±0.025	<0.001
At 18 cycles per degree (cpd)	0.29±0.156	0.63±0.025	<0.001

Discussion:

The study concluded that surgical removal of pterygium and subsequent autograft application improved not only the topographic parameters including astigmatism, irregularity and refractive power but also improved the contrast sensitivity especially in the 6,12 and 18 cycles per degree in the study group. While values for contrast sensitivity were statistically significant for the 1.5 and 3 cycles per degree range, they were not clinically significant after surgery.

Comparing our study to the available national and international literature on the subject, a study done by Natesh et al concluded that early surgery of pterygium when the tissue has not encroached more than 2mm results in excellent correction of astigmatism with improvements reported as high as 1.5 D (diopters) assessed 4 weeks after surgery. [11] This is in line with results of our study where astigmatism improved in the range of more than 2 D when assessed 4 weeks after the surgery. Another study comparing the topographic changes before and after surgery by Rad et al concluded that early correction results in excellent post-operative improvement in astigmatism as well as improvement in irregularity of the cornea which can be further improved by conjunctival autograft. [12] This supports our findings where not only astigmatism but irregularity of the cornea was improved both at the 3mm and 5mm ranges. A local study done by Israr et al at Hayatabad Medical Complex in Peshawar showed that with improvement of astigmatism, there was also a statistically significant improvement in the BCVA in all patients in their study group which is in line with our results where the BCVA was improved by a factor of more than two when assessed on the LogMAR scale. [13]

Another study done by Dogan et al in Iran also assessed for change in intra ocular lens

power and found that power was slightly reduced following pterygium surgery and there was a positive co-relation between pterygium size and the severity of loss of power. The Sim-K astigmatism was improved in all patients as with results of our study and there was an improvement in the refractive power as well owing to improvement in the corneal curvature which was more pronounced in patients with lower grade of pterygium than those with higher grades. [14] Regarding timing for surgery with best possible optimized outcomes, Grade-II and Grade-III horizontal rather than vertical pterygium is associated with a better outcome when the surgery is done with a history of presentation within 6 months.

When talking about improvement in contrast sensitivity, in a study carried out by Ucar et al, the authors found that the mean deviation and cycles per degree improved significantly after the surgery when assessed at 4 weeks and 3 months. [15] This is in line with our study where there was a statistically significant and clinically prominent improvement especially at 6,12 and 18 cycles per degree on assessment at 4 weeks. In another study by Xu et al, the authors found improvement in astigmatism and corneal aberration at the 3mm, 5mm and 7 mm ranges in line with values of our study where there was statistically significant improvement at the 3mm and 5mm ranges. [16]

In local studies carried out by Yousaf et al at Armed Forces Institute of Ophthalmology in 2021, the authors concluded that pterygium surgery is associated with a significant improvement in best corrected visual acuity along with improvement in astigmatism parameters. [10] The same was reported by Khan et al conducted at Jinnah Hospital Karachi in 2021. [17] Bano et al carried out a multi-center study in Rawalpindi in 2021 and found that corneal curvature was improvement by more than 1.5 D in patients assessed 4 weeks after pterygium surgery and transplant. [18]

These findings strongly recommend early recognition and surgical correction of pterygium in patients with higher grades of the disorder resulting in improvement in both astigmatism issues as well as corneal sensitivity. Literature also recommends early surgical correction and autograft for preventing long term complications and best possible patient outcome.

The limitation of the study is that it was a single-centred study only. Long-term follow-up is needed to see the continued improvement effects at 6 and 12 months after the surgical correction which was not done in our study.

Conclusion:

We concluded that pterygium surgery is associated with a statistically significant improvement in corneal topography including astigmatism, corneal irregularity, refractive power as well as improvement of corneal sensitivity

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