



Original Research Article

Keratometric Changes and Visual Outcomes Following Pterygium Excision with Sutureless Glueless Conjunctival Autograft: A Prospective Comparative Interventional Study

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ABSTRACT

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Pterygium refers to a fibrillary bulge of the conjunctiva onto the cornea which is likely to result in astigmatism and visual disturbance. This is a prospective interventional study that compared the changes in keratometric values (K1, K2) and visual acuity in pterygium excision using the sutureless, glueless conjunctival autograft. 96 eyes of 91 patients were evaluated preoperatively and on day 1, one month, and three months after the operation. Paired t-test and RMANOVA were used to perform statistical analysis with significance, p, being 0.05. The findings demonstrated the substantial improvement in K1 of all grades ($p < 0.001$), which indicates the reversal of corneal flattening. K2 showed great improvement in Grade 1 and 3, which indicates return to normalcy of the corneal curvature. Three months later, Keratometric stability was attained. All grades had better visual scores and higher scores on advanced ones. The research draws the conclusion that conjunctival autograft is an effective method in the process of restoring corneal curvature and improving vision and that keratometry was an effective measure of surgical outcome.

Keywords: Pterygium, Pterygium Excision, Conjunctival Autograft, Sutureless Glueless Technique, Keratometry, Keratometric Changes.

INTRODUCTION

Pterygium is a fibrovascular degenerative growth arising from the bulbar conjunctiva and extending onto the corneal epithelium, stroma, and Bowman's membrane, predominantly affecting the nasal limbus [1]. It affects approximately 12% of the global population (13.2% in India), with higher prevalence in regions of sustained UV exposure [2]. The primary pathogenic driver is ultraviolet B (UVB) radiation, with additional risk factors including male gender, dry eye disease, p53 mutation, microsatellite instability, and VEGF overexpression [3–6]. Clinically, pterygium may induce with-the-rule

astigmatism or obstruct the visual axis, with corneal curvature changes quantifiable via keratometric measurements of the flat (K1) and steep (K2) meridians [7]. Graded by Youngson's criteria (Grade 1: <2 mm, Grade 2: 2–4 mm, Grade 3: >4 mm corneal involvement), surgical excision with conjunctival autograft has become the standard of care, offering lower recurrence rates and improved keratometric outcomes; the sutureless, glueless technique using autologous blood further reduces complications while maintaining efficacy [8,9].

AIMS AND OBJECTIVES

This was mainly because the main objective of the study was to compare the pre and post-surgical keratometric values (K1 and K2) of sutureless and glueless conjunctival autograft in comparison to various grades of pterygium. The secondary aim was to test the extent of visual acuity improvement after surgery and to test the temporal changes of the stabilisation of the keratometry in the three-month period of the post-surgical follow-up.

MATERIALS AND METHODS

This prospective, comparative, interventional study was conducted over one year at the Department of Ophthalmology, SDM College of Medical Sciences and Hospital, India, following institutional Ethics Committee approval and written informed consent from all participants. A total of 96 eyes of 91 patients (ages 18–60 years) with primary nasal or temporal pterygium of any grade were enrolled; eyes with bilateral pterygium, corneal pathology (dystrophy, degeneration, or keratoconus), or prior/planned ocular surgery were excluded. Preoperative evaluation included slit-lamp examination, non-contact tonometry, indirect ophthalmoscopy, and Youngson's grading of pterygium. Keratometric values (K1: flat meridian; K2: steep meridian) were recorded preoperatively and at postoperative day 1, month 1, and month 3 using a calibrated autokeratorefractometer by the same trained observer. All patients underwent sutureless, glueless pterygium excision under peribulbar block; the pterygium was excised, haemostasis achieved by cauterisation, and a limbus-oriented conjunctival autograft from the same eye was secured over the bare sclera using autologous blood as biological adhesive. Postoperatively, topical antibiotic ointment was applied for 24 hours, followed by a tapering regimen of steroid-antibiotic combination drops. Data were analysed using SPSS 21.0; categorical variables are presented as frequencies and percentages, and continuous variables as mean $\pm$ SD or median (range). Paired t-test and repeated measures ANOVA (RMANOVA) were used for normally distributed data; the non-parametric Friedman test was applied otherwise. Statistical significance was set at $p \leq 0.05$.

RESULTS

Demographic Profile

Data were collected from 96 eyes of 91 patients. The cohort comprised 50 female (52.1%) and 46 male (47.9%) patients. The mean age was 42.5 ± 11.17 years, with a median age of 41 years (range: 21–67 years). The age group 31–40 years was most frequently represented (34.3%), followed by 41–50 years (30.2%). The right eye was slightly more frequently affected (51%) than the left eye (49%). Grade 1 pterygium was the most prevalent (82.3%), followed by Grade 2 (10.4%) and Grade 3 (7.3%). Corneal encroachment of 1 mm was the most common measurement (40.6%), while encroachment of 4 mm was observed in 7.3% of eyes (Table 1).

Table 1: Distribution of subjects according to demographic details

Variable	Subcategory	Number of Subjects (%)
Gender	Female	50 (52.1%)
	Male	46 (47.9%)
Age (years)	21–30	11 (11.5%)
	31–40	33 (34.3%)
	41–50	29 (30.2%)
	51–60	17 (17.7%)
	61–67	6 (6.3%)
	Mean $\pm$ SD	42.5 ± 11.17
Eye	Right	49 (51%)
	Left	47 (49%)

Grade	Grade 1	79 (82.3%)
	Grade 2	10 (10.4%)
	Grade 3	7 (7.3%)
Corneal Encroachment (mm)	0.5	8 (8.3%)
	1.0	39 (40.6%)
	1.5	4 (4.2%)
	2.0	28 (29.2%)
	2.5	2 (2.1%)
	3.0	8 (8.3%)
	4.0	7 (7.3%)

K1 (Flat Meridian) Keratometric Changes

The results of the paired t-test of K1 values of preoperative readings against each time point after the operations are provided in Table 2 in all three grades. The average preoperative K1 of Grade 1 patients (n=79) was 43.36 ± 1.25 D. This became much higher on postoperative day 1 of 43.97 ± 1.13 D ($p < 0.001$), one month of 44.00 ± 1.11 D ($p < 0.001$) and three months of 44.01 ± 1.10 D ($p < 0.001$).

Grade 2 patients (n=10) had a mean preoperative K1 of 41.32 ± 2.74 D that rose to 43.90 ± 1.10 D on the first postoperative day ($p=0.007$), 44.12 ± 1.15 D at one month ($p=0.005$) and 44.12 ± 1.15 D at three months ($p=0.005$). Grade 3 cases (n=7) showed that the mean preoperative K1 was 40.60 ± 1.62 D which rose to 43.78 ± 2.57 D at day 1 ($p=0.009$), 44.39 ± 2.03 D at one month ($p=0.002$) and 44.39 ± 2.03 D at three months ($p < 0.001$). The statistical significant difference in the changes of K1 during all postoperative periods was supported by RMANOVA ($p < 0.001$) irrespective of the grades.

Table 2: Paired t-test of K1 at pre-surgery over different time intervals

Grade	Variable 1 (V1)	Variable 2 (V2)	Mean $\pm$ SD / Median (Min, Max) – V1	Mean $\pm$ SD / Median (Min, Max) – V2	p-value
1	Pre-surgery	PO Day 1	43.36 ± 1.25 ; 43.5 (40.25, 46.75)	43.97 ± 1.13 ; 44 (40.75, 47)	<0.001
	Pre-surgery	PO 1 Month	43.36 ± 1.25 ; 43.5 (40.25, 46.75)	44.00 ± 1.11 ; 44 (40.75, 46.5)	<0.001
	Pre-surgery	PO 3 Months	43.36 ± 1.25 ; 43.5 (40.25, 46.75)	44.01 ± 1.10 ; 44 (41, 46.5)	<0.001
2	Pre-surgery	PO Day 1	41.32 ± 2.74 ; 42 (35, 44.5)	43.90 ± 1.10 ; 43.37 (42.75, 46)	0.007
	Pre-surgery	PO 1 Month	41.32 ± 2.74 ; 42 (35, 44.5)	44.12 ± 1.15 ; 43.5 (43, 46.5)	0.005
	Pre-surgery	PO 3 Months	41.32 ± 2.74 ; 42 (35, 44.5)	44.12 ± 1.15 ; 43.5 (43, 46.5)	0.005
3	Pre-surgery	PO Day 1	40.60 ± 1.62 ; 41.25 (38, 42.5)	43.78 ± 2.57 ; 44.25 (39.75, 48)	0.009

	Pre-surgery	PO 1 Month	40.60 ± 1.62; 41.25 (38, 42.5)	44.28 ± 2.04; 44.25 (42, 48.25)	0.002
	Pre-surgery	PO 3 Months	40.60 ± 1.62; 41.25 (38, 42.5)	44.39 ± 2.03; 44.25 (42, 48.25)	<0.001

K2 (Steep Meridian) Keratometric Changes

The heterogeneity of results was observed in grades (Table 3) with K2. Grade 1 patients did not exhibit any significant change of K2 on postoperative day 1 ($p=0.059$) but there was statistically significant change of -2.9 at one month ($p < 0.001$) and three months ($p < 0.001$) with a mean value of 45.04 -1.33 D before surgery reducing to 44.66 -1.17 D. The Grade 2 ($n=10$) patients did not exhibit statistically significant change in K2 at any of the post operative time points ($p=0.614, 0.222, 0.149$ at day 1, one month and 3 months respectively) probably because of the small sample size.

Grade 3 patients had extremely significant decreases in K2 at all time points: a preoperative mean of 47.21 +1.37 D reduced to 45.67 +1.87 D on day 1 ($p=0.002$), 45.21 +1.97 D on one month ($p=0.002$), and 45.21 +1.94 on day 3 ($p=0.001$). RMANOVA ensured that statistically significant difference between all postoperative time points of all grades was observed ($p < 0.001$ all grades).

Table 3: Paired t-test of K2 at pre-surgery over different time intervals

Grade	Variable 1 (V1)	Variable 2 (V2)	Mean ± SD / Median – V1	Mean ± SD / Median – V2	p-value
1	Pre-surgery	PO Day 1	45.04 ± 1.33; 44.75 (41.75, 47.75)	44.87 ± 1.33; 44.75 (41.75, 50.75)	0.059
	Pre-surgery	PO 1 Month	45.04 ± 1.33; 44.75 (41.75, 47.75)	44.69 ± 1.20; 44.5 (41.5, 47.5)	<0.001
	Pre-surgery	PO 3 Months	45.04 ± 1.33; 44.75 (41.75, 47.75)	44.66 ± 1.17; 44.5 (41.5, 47.5)	<0.001
2	Pre-surgery	PO Day 1	45.80 ± 1.51; 46 (43.75, 48.25)	45.50 ± 1.92; 45.12 (43.5, 50.25)	0.614
	Pre-surgery	PO 1 Month	45.80 ± 1.51; 46 (43.75, 48.25)	45.25 ± 1.46; 45 (43.5, 48.5)	0.222
	Pre-surgery	PO 3 Months	45.80 ± 1.51; 46 (43.75, 48.25)	45.20 ± 1.34; 45 (43.5, 48)	0.149
3	Pre-surgery	PO Day 1	47.21 ± 1.37; 46.75 (45.5, 49.75)	45.67 ± 1.87; 45.25 (44, 49.5)	0.002
	Pre-surgery	PO 1 Month	47.21 ± 1.37; 46.75 (45.5, 49.75)	45.42 ± 1.97; 45.25 (43.5, 49.5)	0.002
	Pre-surgery	PO 3 Months	47.21 ± 1.37; 46.75 (45.5, 49.75)	45.21 ± 1.94; 45 (42.75, 49)	0.001

DISCUSSION

This perspective intervention study shows that pterygium excision using a sutureless and glueless conjunctival autograft will result in substantial changes in the parameters of keratometry and visual acuity. The younger average age of the patients also indicates an earlier onset of the disease and prompt referral within the study population. High prevalence of grade 1 pterygium is an indication of good early diagnosis and treatment. In the postoperative period, there is a steady rise in K1 values in all grades, which shows reversal of corneal flattening by traction of pterygium, and higher grades improve more because of more pronounced pretreatment distortion. Variability of K2 changes was observed with great normalization in Grades 1, 3, and Grade 2 results were statistically non-significant, which could be explained by the smaller sample size.

The presence of early postoperative asymmetry between K1 and K2 recovery is a sign of the difference in the remodelling of the cornea. The visual acuity improved in all grades, especially in higher grades in which the impairment was higher at baseline, which favors the functional advantage of surgery. The benefits of the sutureless, glueless method of autologous blood include the fact that it is less expensive, less likely to cause complications, and more comfortable than the alternatives. Yet, such drawbacks as unequal grade distribution, absence of advanced corneal imaging, and limited follow-up period may be outlined. In general, three months is the time when the process of keratometric stabilization is reached, which is why refractive assessments should not be done before this time.

CONCLUSION

This prospective study shows that pterygium removal using sutureless and glueless conjunctival autograft have statistically significant and long-term effects on corneal keratometric measurements and visual acuity regardless of pterygium grade. K1 values were found to improve greatly in all grades and in all postoperative time points, indicating consistent reversal of corneal flattening induced by pterygium. There was a significant decrease in K2 values in Grade 1 and Grade 3 pterygium, and three months after surgery the keratometric stabilisation was established. All grades showed improvements in visual acuity and higher grades of pterygium showed higher improvements.

The extent of keratometric change is associated with the extent of pterygium, which indicates the clinical benefit of early surgical treatment before the cornea becomes distorted to the point of irreversibility. Keratometric measurement is a valid, noninvasive, and objective method of measuring the outcome of surgery and as part of planning postoperative refractive corrections. These results confirm existing evidence that pterygium excision using conjunctival autograft to perform surgical excision is the surgical method of choice, and that surgical excision is important to help achieve maximum corneal and visual recovery in patients with pterygium.

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