



## MEAN CHANGE IN KERATOMETRY, KERATOMETRIC ASTIGMATISM AND BCVA IN PATIENTS UNDERGOING PTERYGIUM EXCISION WITH CONJUNCTIVAL AUTOGRAFT

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**ABSTRACT** **Introduction:** Pterygium is a common surface disorder of the eye that may cause change in visual acuity of patients by inducing astigmatic refractive error. Surgical excision with grafting is considered the most effective recommended treatment for pterygium. The objective of this study was to evaluate the outcomes of pterygium excision with autologous graft surgery on keratometric astigmatism and visual acuity. **Materials and methods:** In this study total 64 eyes of 64 patients were enrolled having the diagnosis of pterygium. Prior to the pterygium excision surgery all the enrolled patients in addition to other parameters were studied for keratometric values and best corrected visual acuity (BCVA). Postoperatively, BCVA and keratometric readings were recorded at one week, one month, two months and four months intervals. **Results:** Mean age of study participants was  $44.16 \pm 8.24$  years in the age group of 20-60 years. Preoperative median and quartiles (25% -75%) horizontal and vertical keratometric values were 43.00 (42.50-44.00) D and 44.25 (43.75-44.50) D, respectively and both reduced significantly to 42.50 (42.50-42.94) D and 42.50 (42.50- 43.00) D, respectively after four months postoperatively. Median keratometric astigmatism before surgery was 1.37 (1.25-1.93) D which reduced significantly to 0.50 (0.32-0.75) D after four months of pterygium excision. Similarly, BCVA improved significantly [0.20(0.16-0.25) vs 0.53 (0.50-0.80)] when assessed postoperatively after four months. **Conclusion:** Excision of pterygium with conjunctival autograft reduced pterygium-induced keratometric astigmatism and improved BCVA significantly.

**KEYWORDS :** Astigmatism, BCVA, Cornea, Keratometry ,Pterygium

### Introduction

Pterygium is a triangular wing shaped superficial ocular surface disorder characterized by fibroelastic degeneration of the conjunctiva and subconjunctival tissue, wherein overgrowth of bulbar conjunctiva encroaches on the cornea and may disturb topography of cornea (Popat et al, 2014).<sup>1</sup> Several previous studies have stated that the pterygium induced changes of corneal curvature are significant astigmatism and visual disturbances (Khan et al, 2014; Shelke et al, 2014).<sup>2,3</sup> Studies indicate that in the majority of pterygium patients, localized flattening of the corneal curvature usually occurs at horizontal meridian, which results in with- the- rule astigmatism (Radadia, 2014; Vadodaria et al, 2019).<sup>4,5</sup> However, other studies suggested that in some cases against-the-rule or oblique astigmatism can also be induced by the pterygium (Chourasia et al, 2014; Popat et al, 2014).<sup>6,1</sup> Alteration in the curvature of cornea in pterygium is mainly supposed to occur due to pooling of tear film over the edge of the fibrovascular growth as well as tractional force applied on the cornea due to pterygium, leading to pulling of the cornea (Altan-Yaycioglu et al, 2013; Meitei et al, 2016; Mohite et al, 2017).<sup>7,8,9</sup> Astigmatism developed due to pterygium as well as invasion of the visual axis and restriction of medial rectus muscle due to pterygium, might affect the visual acuity significantly and cause blurring of vision (Maheshwari 2003; Mohite et al, 2017).<sup>10,9</sup> Grading of pterygium also affects the amount of corneal astigmatism. It has been shown in many previous studies that the higher grades of pterygium correspondingly increase the amount of corneal astigmatism (Bhargava et al, 2015; Deepankar & Jain, 2016).<sup>11,12</sup> Although early grades of pterygium can be managed by conservative treatment however, the surgical excision is considered the only effective approach for the treatment of pterygium (Makkar et al, 2015; Zheleva & Voynov, 2018).<sup>13,14</sup> Various indications for surgical excision of pterygium include diplopia due to restriction of ocular motility, impingement of overgrowth onto the visual axis, prior to laser eye surgery and cosmetic reasons (Chourasia et al, 2014; Shelke et al, 2014).<sup>6,3</sup>

Various surgical excision techniques can be used to reduce pterygium induced corneal astigmatism and to improve the visual acuity of patients (Altan-Yaycioglu et al, 2013; Chourasia et al, 2014; Garg et al, 2019).<sup>7,6,15</sup> Several studies done in the past concluded that effect of surgical excisions techniques on pterygium - induced corneal astigmatism can be measured by various methods including refraction, keratometry and corneal topography (Popat et al, 2014; Devika et al, 2015; Manhas et al, 2018).<sup>1,16,17</sup> However, some studies proposed that

keratometry is not a very useful tool to evaluate the corneal surface changes in pterygium because flattening of peripheral cornea is more than central cornea; hence the keratometry which measures only the central cornea can give rise to imprecise results. (Maheshwari, 2007; Radadia, 2014; Parajuli & Bajracharya, 2019)<sup>18,4,19</sup> Excision of pterygium with autologous conjunctival graft is considered the gold standard and most preferable choice of treatment for the management of pterygium (Gahlot et al, 2015; Parajuli & Bajracharya 2019)<sup>20,19</sup>

### Materials and methods

This hospital based interventional prospective study was accomplished at the tertiary care hospital of Kashmir in the department of ophthalmology. Using a simple random sampling method 32 patients (32 eyes) attending the Ophthalmology OPD with the diagnosis of pterygium fulfilling the inclusion criteria were enrolled. Depending on the extent of pterygium over the cornea pterygium was divided into Grade I: crossing limbus, Grade II: halfway between limbus and pupil, Grade III: approaching the pupil edge and Grade IV: central pupillary portion. Only those patients who were willing to give written informed consent for surgical excision of pterygium were recruited for study. Patients having no astigmatic error or less than 1 dioptre error with pterygium, patients unfit for pterygium excision due to other ocular or systemic conditions and were not fit for keratometry because of severe corneal pathologies were not included in the study. Ethical clearance to conduct study was obtained from the Institutional Ethical Committee.

Pre-operative best corrected visual acuity (BCVA) of the affected eye of the patients was recorded as decimal values by using modified Early Treatment Diabetic Retinopathy Study ( ETDRS ) chart (6/6 equals 1.0 and 6/60 equals 0.1). Slit lamp examination was carried out to record the type and grade of pterygium. Subsequently, the keratometric readings of horizontal (K1) and vertical (K2) meridia for the same eyes were recorded in all patients using automated keratometer. Under aseptic precautions using local anesthesia all the pterygium excision surgeries with autologous conjunctival grafting were performed. About 3-4 mm conjunctival incision was made above the pterygium head and dissection of subconjunctival tissue was done to separate the tissue. Pterygium head was avulsed by blunt dissection and traction technique. To clear the tissue about 1-2 mm corneal epithelium was scrapped using a Bard Parker blade. Body of pterygium was excised using scissors and the bare scleral area was covered using thin conjunctival free flap taken from the superior-temporal region of the

same eye. Eye dressing was done after subconjunctival injection of gentamicin and dexamethasone.

**Post operative regimen:** Next day dressing was removed and an eye drop of antibiotic with steroid combination and oral antibiotics along with anti-inflammatory drugs were prescribed for one week duration. Topical drops were gradually tapered over a period of one month. Post-operatively during the follow up visits BCVA and keratometric readings of the operated eye were documented after one week, one month, two months and four months durations.

**Statistical analysis:** Statistical analysis was done using descriptive statistics. Values are expressed as actual numbers, percentage and median and quartiles (25% -75%). Wilcoxon signed rank test and Kruskal-Wallis test followed by Dunn's multiple comparisons test were used to analyze data before and after surgical excision of pterygium. P value <0.05 was considered as significant

**Results:** In this study total 32 eyes of 32 patients with diagnosis of pterygium were included. Out of total 32 patients, 20 (62.50%) were male and 12 (37.50 %) were female. Mean ±SD age of all patients was 44.16±8.24 years. The overall age group of patients was 20-60 years where maximum numbers of patients were in the age group of 26-35 years.

**Table 1: Outcomes of pterygium surgery on keratometric values (D) following pterygium excision with autograft**

	Preoperative keratometric value (D)	Post operative keratometric value (D)			
		1 week	1 month	2 months	4 months
K1 (horizontal)	43.00 (42.50-44.00)	43.25(42.25-43.75)	42.50 (42.25-43.50) *	43.00(42.00-43.25) \$	42.50 (42.50-42.94)\$
K2 (vertical)	44.25 (43.75-44.50)	44.00(43.25-44.25)	44.00(43.00-44.00) *	43.38(43.00-44.00) \$	42.50 (42.50-43.00) \$

Values are represented as median and quartiles (25% -75%). D= dioptres; Kruskal-Wallis test followed by Dunn's multiple comparisons test. \*p<0.05, \$p<0.001 when compared with preoperative keratometric value.

Table 1 shows keratometric reading before surgical excision and one week, one month, two month and four months post pterygium surgery. Median (25th–75th percentile) K1 (horizontal) and K2 (vertical) readings before surgical excision were 43.00 (42.50-44.00) D and 44.25 (43.75-44.50) D, respectively. Postoperatively, mean K1 subsequently changed to 43.25(42.25- 43.75) 43.10±0.89 at one week, 42.50 (42.25- 43.50) at one month, 43.00(42.00-43.25) at two months and 42.50 (42.50-42.94) at four months. Similarly, K2 reading after surgical excision decreased progressively in follow up period (44.00(43.25-44.25) at one week; 44.00(43.00- 44.00) (p<0.001)

**Table 2: Preoperative and postoperative (4 months) visual acuity according to grading of pterygium**

Pterygium grade	Number of patients	Preoperative BCVA (decimals)	Postoperative (4 months) BCVA (decimals)	p-value
II	21	0.20 (0.16-0.32)	0.80 (0.52-1.00)	<0.0001
III	8	0.20 (0.16-0.25)	0.50 (0.34-0.52)	<0.0001
IV	3	0.11 (0.10-0.13)	0.32 (0.20-0.40)	0.031

Values are represented as median and quartiles (25% -75%).; BCVA = Best Corrected Visual Acuity Pre and post- operative BCVA [median and quartiles (25% -75%)] in grade II pterygium cases were 0.20 (0.16-0.32) and 0.80 (0.52- 1.00) decimals, respectively. In patients of grade III median pre and post-operative BCVA values were 0.20 (0.16-0.25) and 0.50 (0.34- 0.52) while in grade IV pterygium values were 0.11 (0.10-0.13) and 0.32 (0.20-0.40), respectively. (Table 2)

**Table 3: Preoperative and postoperative (4 months) astigmatism according to grading of pterygium**

Pterygium Grade	Number of patients	Preoperative keratometric astigmatism (D)	Postoperative (4 months) keratometric astigmatism (D)	p-value
II	21	1.25(0.75-2.06)	0.50 (0.25-0.56)	<0.0001
III	8	1.75 (1.56-1.75)	0.75 (0.50-0.75)	<0.0001
IV	3	2.75 (1.50-3.00)	0.87(0.00-1.75)	0.0625

Values are represented as median and quartiles (25% -75%). D= dioptres Values of preoperative and postoperative keratometric astigmatism in cases who presented with different grades of pterygium are tabulated in Table 3. Pre and post operative keratometric astigmatism values at 4 month were 1.25(0.75-2.06) D and 0.50 (0.25-0.56) D, respectively in patients having grade II pterygium. However, in patients having grade III (16 cases) and grade IV (6 cases) the preoperative keratometric astigmatism values were 1.75 (1.56-1.75) and 2.75 (1.50-3.00) D, respectively while postoperative keratometric astigmatism values were 0.75 (0.50-0.75) and 0.87(0.00-1.75) D, respectively

**Table 4: Keratometric astigmatism (K1 – K2) and BCVA before and after pterygium excision**

Parameter	Keratometric astigmatism (D)	Mean BCVA (decimal)
Before excision (Preoperative)	1.37 (1.25-1.93)	0.20 (0.16-0.25)
After 4 months of excision (Postoperative)	0.50 (0.32-0.75)	0.53 (0.50-0.80)
P value	p<0.0001	p<0.0001

Values are represented as median and quartiles (25% -75%) D= dioptres, BCVA = Best Corrected Visual Acuity

Preoperative median and quartiles (25% -75%) difference in keratometric astigmatism (K1-K2) was 1.37 (1.25-1.93) D whereas, postoperative keratometric astigmatism was 0.50 (0.32- 0.75) D. Median and quartiles (25% -75%) BCVA in all subjects was 0.20 (0.16-0.25) (preoperatively) and 0.53 (0.50-0.80) decimal (post-operatively at 4 months). (Table 4)

**Discussion**

The exact cause of change in topography of cornea due to pterygium is not clearly recognised however, different theories suggest that alteration in tear film and pulling of cornea due to pterygium tissue lead to distortion of cornea (Makkar et al, 2015; Meitei et al, 2016).<sup>13,8</sup> As the pterygium encroaches towards the cornea, formation of tear meniscus takes place between apex of the cornea and pterygium tissue that cause apparent flattening of corneal meridian (Yousuf, 2005; Vadodaria et al, 2019).<sup>21,5</sup> Thus, pterygium can induce astigmatism by involving the corneal meridia which in turn will lead to refractive changes. Alteration in refractive status of cornea due to pterygium can be calculated using keratometric values, corneal topographical analysis and refractive status (Popat et al, 2014; Devika et al, 2015; Garg et al, 2019).<sup>1,16,15</sup> Results of present study showed that median keratometric astigmatism in grade II and grade III pterygium patients before surgical excision was 1.25(0.75-2.06) D and 1.75 (1.56-1.75) D, respectively which reduced significantly (p < 0.0001) to 0.50 (0.25-0.56) D and 0.75 (0.50- 0.75) D, respectively after 4 months period. However, in grade IV pterygium patients reduction in keratometric astigmatism was found non-significant after pterygium excision. These results indicate that quantum of astigmatism varied with the grades of pterygium i.e. with increase in grade, the value of astigmatism increases proportionately. These results were similar to the studies done by Maheshwari, 2007; Gahlot et al, 2016; Mohite et al, 2017; Manhas et al, 2018; Parajuli & Bajracharya, 2019.<sup>10,20,9,17,19</sup> Moreover, after surgical excision reduction of astigmatism in grade II and grade III patients was more significant as compared to grade IV pterygium patients. This shows that chances of reversal of corneal curvatures after excision of pterygium are more with early grades of pterygium. These observations were similar to the studies performed by Yousuf, 2005; Saleem et al, 2011; Shelke et al, 2014; Garg et al, 2019.<sup>21,22,3,15</sup> BCVA in all grades of pterygium significantly improved following surgical excision at four months which are in correlation with previous studies (Mohite et al, 2017; Shastry et al, 2019).<sup>9,23</sup> However, some studies reported improvement in BCVA only in 50-60% cases (Bhargava et al, 2015; Gahlot et al, 2015) or no

improvement (Malik et al, 2012).11,20,24 In our study the preoperative keratometric values in horizontal (K1) and vertical meridian (K2) were 43.00 (42.50-44.00) D and 44.25 (43.75-44.50) D, respectively indicating that the vertical meridian is comparatively steeper. Similar findings were observed by Vadodaria et al, 2019 in their study.5 Postoperatively at 4 months the pre and post-operative difference in mean K1 and K2 values were 1.00 (0.50- 1.18) D and 1.50 (1.25-2.25) D respectively; the change of corneal curvature occurs more significantly in vertical meridian (K2). Median astigmatism before excision of pterygium was 1.37 (1.25-1.93) which reduced significantly ( $p < 0.001$ ) to 0.50 (0.32-0.75) D at 4 months after excision. This shows that excision of pterygium caused a significant flattening of vertical meridian along with reduction in values of keratometric astigmatism postoperatively. Similar observations have been reported in by Yousuf, 2005; Maheshwari, 2007; Sipai & Shukla, 2016.<sup>21,10,25</sup> In contrast, another study found significant flattening in horizontal meridian

## CONCLUSION

The observations of this study prove that surgical excision of pterygium using autologous conjunctival graft is an effective technique to treat pterygium induced keratometric astigmatism and hence the improvement in the visual acuity.

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