



Original Research Article

## Comparison of Astigmatism Before and After Pterygium Surgery

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### ABSTRACT

**Aims and objectives:** To evaluate prospectively the corneal refractive status before and after pterygium surgery and its relationship with pre operative pterygium size.

**Design:** Prospective, non randomized study.

**Materials and Methods:** This study was carried out on 50 eyes of 46 patients with primary pterygium in one or both eyes. Objective refraction, subjective refraction, Keratometry and BCVA were assessed pre operatively, and at 1, 3, 6 months post operatively.

**Results:** Pre operative mean astigmatism was maximum in horizontal meridian than in oblique and vertical meridian. Mean size of pterygium was 2.59mm. The magnitude of pre operative mean astigmatism was 1.38D, which was seen to be increasing with increase in size of pterygium. Mean pre operative refractive astigmatism of 1.13D decreased to 0.22D, 0.16D and 0.13D after 1, 3 and 6 month post operatively which were statistically significant.

**Conclusion:** This study confirms that pterygium excision induces a reversal of pterygium-related corneal flattening. A significant decrease in astigmatism and improvement in visual acuity is observed post-operatively.

**Key words:** Astigmatism, Pterygium Surgery.

### INTRODUCTION

Pterygium is a Greek word for 'wing' and was described by Hippocrates, Gallen and others (Duke-Elder S1965). It is a wing-shaped over growth of fibrovascular connective tissue of bulbar conjunctiva towards and onto the cornea causing significant astigmatism. It is located in interpalpebral fissure horizontally, commonly on the nasal side, but and/or temporally also. As pterygia are commonly seen in tropical climates, implicates sunlight and/or UV radiation as probable cause.

Other than causing irritative symptoms and having cosmetic

implications, pterygium can cause decreased vision as it encroaches on the visual axis or induces astigmatism.

Several mechanisms have been suggested to explain the induced astigmatism. These include (a) pooling of tear film at the leading edge of the pterygium, and (b) mechanical traction exerted by the pterygium on the cornea. (Oldenburg J B et al, 1990)

Astigmatism and surface phenomena in pterygium was studied by (Hansen A, Norn M et al 1980) and they found increased astigmatism with the rule (greater than 0.5 D IN 46%, greater than or equal to 4 D in

13%) without associated impairment of vision.

Pterygium excision is indicated if it is progressive, visual axis is threatened; diplopia is induced due to extreme fibrosis, prior to LASIK. Though pterygium excision is a simple procedure, the main problem is recurrence after excision.

This study was carried out to evaluate prospectively the corneal refractive status before and after pterygium surgery and its relationship with pre operative pterygium size.

## MATERIALS AND METHODS

A prospective randomized study, to compare refractive astigmatism before and after pterygium excision, was carried out on 50 eyes of 46 patients who were having primary pterygium in one or both eyes.

Only those patients with primary pterygium in one or both eyes were included in the study. Patients with recurrent pterygium, pseudo pterygium, patients with keratoconus, lenticonus, corneal dystrophy were not included in this study. Patients with cataract and retinal diseases where pterygium excision would not help in visual acuity improvement were not included in this study.

Pterygium was graded as follows:

Grade 1 - Apex crossing limbus

Grade 2 - Apex midway between limbus and pupil

Grade 3 - Apex reaching upto papillary margin

Grade 4 - Apex crossing papillary margin

Pre operative assessment of astigmatism was done by objective refraction, subjective refraction and Keratometry. Objective refraction was done by retinoscopy at ½m distance with Streak retinoscope after cycloplegic dilatation of pupil BCVA and subjectively tolerated cylinder in which patient is comfortable was noted. Keratometry was done using auto keratometer. Corneal astigmatism was calculated taking the difference of K1 and K2 with regard to axis of K1. Concave cylinder lens at  $180^0 \pm 20^0$  was taken as astigmatism at horizontal meridian; Concave cylindrical lens at  $90^0 \pm 20^0$  was taken as astigmatism at vertical meridian.

## RESULTS AND OBSERVATIONS

This study was conducted on 50 eyes of 46 patients. Two patients had recurrence after 8 weeks of pterygium excision, they were included from the study, and new patients were included.

### *Age and Sex distribution:*

Mean age of patients was  $32.54 \pm 8.03$  years (range 20-64 years). Total number of male and female patients were 26 and 20 respectively, but one female patient having grade 2 pterygium in one eye and grade 3 pterygium in the other eye. (Table 1)

Nasal pterygium was present in all the eyes. 4 (8%) eyes had grade 1 pterygia; 36 (72%) eyes had grade 2 pterygia; 6 (12%) eyes had grade 3 pterygia and grade 4 pterygia was present in 4 (8%) eyes.

Table 1. Age and Sex distribution of patients having Pterygium.

Grade of the Pterygium	Total number of Eyes	Age in years Mean age ±	Mean age ±SD	Male (%)	Female
1	4	25-31	28.50±2.60	2 (4.35%)	2 (4.35%)
2	36	20-64	31.92±8.00	18 (39.13%)	16 (34.78%)
3	6	20-40	36.00±9.43	3 (6.52%)	2 (4.35%)
4	4	28-42	37.00±5.52	4 (8.70%)	
Mean age of patients			32.54±8.03 (Range 20-64 yrs.)		

**Amount of astigmatism:**

The magnitude of pre operative mean astigmatism as measured by keratometer was  $1.38\pm 1.39D$ , which was seen to be increasing with increase in the size of pterygia and had a statistically significant value with  $p=0.0012$  (Table 2).

The amount of preoperative astigmatism was seen to increase with the grade of pterygium (Table 2; Fig 3). Pre operative mean astigmatism in grade 1 was  $0.53\pm 0.05D$  and in grade 2 was  $0.94\pm 0.64D$ . Grade 3 and grade 4 pterygia were having  $2.36\pm 1.28D$  and  $4.73\pm 1.44D$  respectively.

In grade 1 pterygium, out of 4 eyes, 1 eye showed astigmatism in oblique meridian with mean astigmatism of  $0.62D$  and 3 eyes showed mean astigmatism of  $0.50D$  in vertical meridian.

In grade 2 pterygium, out of 36 eyes, 14 eyes showed mean astigmatism of  $1.37\pm 0.87D$  in horizontal meridian, 14 eyes were having mean astigmatism of  $0.64\pm 0.23D$  in oblique meridian and in vertical meridian 8 eyes were having mean astigmatism of  $0.75\pm 0.22D$ .

Grade 3 pterygium present in 6 eyes, involved 3 eyes in horizontal meridian with mean astigmatism of  $2.54\pm 1.57D$  and 3 eyes in oblique meridian with mean astigmatism of  $2.18\pm 0.87D$ .

Out of 4 eyes having grade 4 pterygium, 2 eyes were having mean astigmatism of  $5.95\pm 0.95D$  in horizontal meridian and 2 eyes in oblique meridian

were having a mean astigmatism of  $3.50\pm 0.50D$ .

A significant decrease in astigmatism was noted after pterygium excision. After 1 month of pterygium excision, in grade 1 pterygium mean pre operative astigmatism of  $0.53\pm 0.05D$  decreased to  $0.28\pm 0.11D$  post operatively. In grade 2 pterygium, it decreased from  $0.94\pm 0.18D$  to  $0.45\pm 0.15D$ . Grade 3 pterygium showed significant decrease in pre operative astigmatism from  $2.36\pm 0.70D$  to  $0.88\pm 0.23D$  post operatively. In grade 4 pterygium, mean pre operative astigmatism  $4.73\pm 1.44D$ , decreased to  $0.65\pm 0.18D$  after pterygium excision, which was statistically significant.

No much difference was noted in between the mean post operative astigmatism measured at 1 month, 3 month and 6 month of pterygium excision.

**Post operative effect of meridian of astigmatism:**

A change in the meridian of astigmatism was noted post operatively. Maximum amount of pre operative astigmatism was present in horizontal meridian, which reduced significantly after pterygium excision, but the number of eyes showing horizontal meridian of astigmatism post operatively increased. This increase in number was associated with decrease in post operative numbers of eyes in oblique meridian. Number of eyes in vertical meridian pre operatively remained same post operatively.

Table 2. Grade of Pterygium and Astigmatism.

Grade of pterygium	Pre op. Mean Astigmatism± SD	Post op. Mean Astigmatism ±SD		
		1 month	3 month	6 month
1	$0.53\pm 0.05 D$	$0.28\pm 0.11 D$	$0.21\pm 0.15 D$	$0.19\pm 0.15 D$
2	$0.94\pm 0.18 D$	$0.45\pm 0.15 D$	$0.43\pm 0.16 D$	$0.39\pm 0.20 D$
3	$2.36\pm 0.70 D$	$0.88\pm 0.23 D$	$0.84\pm 0.28 D$	$0.80\pm 0.32 D$
4	$4.73\pm 1.44 D$	$0.65\pm 0.18 D$	$0.56\pm 0.16 D$	$0.48\pm 0.18 D$

Table 3. Meridians of astigmatism in grade 1 pterygium.

Meridian of Astigmatism	Pre op	Post op 1 month	Post op 3 month	Post op 6 month
Horizontal	0	2	2	1
Oblique	1	0	0	3
Vertical	3	2	2	0

Table 4. Meridians of astigmatism in grade 2 pterygium.

Meridians of Astigmatism	Pre op	Post op 1 month	Post op 3 month	Post op 6 month
Horizontal	14	14	16	18
Oblique	14	13	12	8
Vertical	8	9	8	10

Table 5 Meridians of astigmatism in grade 3 pterygium.

Meridians of Astigmatism	Pre op	Post op 1 month	Post op 3 month	Post op 6 month
Horizontal	3	3	4	5
Oblique	3	3	2	1
Vertical	0	0	0	0

Table 6. Meridians of astigmatism in grade 4 pterygium.

Meridians of Astigmatism	Pre op	Post op 1 month	Post op 3 month	Post op 6 month
Horizontal	2	4	4	2
Oblique	2	0	0	1
Vertical	0	0	0	1

Table 7. Keratometric astigmatism, Refractive astigmatism and subjectively tolerated cylinder seen pre operatively.

GRADE	Keratometric astigmatism	Refractive astigmatism	Subjectively tolerated astigmatism
1	0.53±0.04 D	0.50±0.18 D	0.44±0.21 D
2	0.94±0.65 D	0.63±0.35 D	0.56±0.31 D
3	2.36±1.28 D	2.29±0.68 D	2.00±0.84 D
4	4.73±1.44 D	4.44±0.72 D	4.13±0.74 D

Table 8. Keratometric astigmatism, Refractive astigmatism and Subjectively tolerated cylinder at 2 month follow up.

GRADE	Keratometric astigmatism	Refractive astigmatism	Subjectively tolerated astigmatism
1	0.38±0.21 D	0.06±0.11 D	0.06±0.11 D
2	0.45±0.30 D	0.11±0.24 D	0.10±0.22 D
3	0.88±0.88 D	0.67±0.51 D	0.46±0.17 D
4	0.65±0.18 D	0.69±0.37 D	0.50±0.31 D

Table 9. Keratometric astigmatism, Refractive astigmatism and subjectively tolerated cylinder at 3 month follow up.

Grade	Keratometric astigmatism	Refractive astigmatism	Subjectively corrected astigmatism
1	0.21±0.05 D	0.00±0.00 D	0.00 0.00 D
2	0.43±0.28 D	0.10 0.24 D	0.08 0.21 D
3	0.84±0.50 D	0.46 0.28 D	0.38 0.19 D
4	0.56±0.16 D	0.38 0.41 D	0.31 0.32 D

Table 10. Keratometric astigmatism, Refractive astigmatism and subjectively tolerated cylinder at 3 month follow up.

Grade	Keratometric astigmatism	Refractive astigmatism	Subjectively corrected astigmatism
1	0.19 0.07 D	0.00 0.00 D	0.00 0.00 D
2	0.39 0.24 D	0.07 0.20 D	0.06 0.20 D
3	0.80 0.52 D	0.42 0.24 D	0.33 0.19 D
4	0.48 0.17 D	0.31 0.32 D	0.25 0.25 D

## DISCUSSION

Pterygia may be classified as stationary and progressive. A stationary pterygium shows little or no evidence of progression over a long period. A progressive pterygium behaves in more aggressive fashion with an advancing margin of grayish opacification and hyperemia within the tissue. The pterygium may invade the superficial peripheral cornea (with the apex of the lesion towards the cornea), eventually causing corneal distortion and visual loss (Kanski J, 1999; Poirier RH, 1984)

There is a significant correlation between the extension of the pterygium onto the cornea and the amount of induced astigmatism. Pterygia appear to have a minimal effect on the central cornea until they exceed 45% of the corneal radius. Once this critical size is reached, increasing degrees of astigmatism are induced (Lin A, 1998). It has been observed that the length of pterygium on the cornea has a statistically significant relationship with the amount of astigmatism; more the length more was the astigmatism (Ashaye AO, 2002). Such an observation was made in the present study also. The magnitude of pre operative mean astigmatism was 1.38D ( $p=0.0012$ ), which was seen to be increasing with the increase in the grade of the pterygium, the maximum degree of mean astigmatism was noted in eyes with grade 4 pterygium and least was noted in eyes with grade 1 pterygium.

The development of a pterygium can lead to significant corneal distortion and astigmatism. A pterygium generally causes localized flattening central to the apex of the pterygium (Pavilack MA, 1995). As this flattening is along the horizontal meridian, it usually causes with-the-rule corneal astigmatism (Buratto L, 1996). Distinct from the symmetry of most forms of corneal astigmatism, that induced by a pterygium is usually hemimeridional on the side of

pterygium (Stern GA, 1998). In one study, it was found pterygium induces a significant amount of regular and irregular astigmatism in proportion to its size, which can be removed after surgery, but corneal distortion does not normalize completely in eyes with advanced pterygium.(Tomidokoro et al, 1999)

In the present study, pterygium induced astigmatism was observed in all the meridians. The axis or meridian of corneal astigmatism in horizontal meridian was 51%, in oblique meridian 29.4% (20 eyes) and in vertical meridian it was observed as 19.5% (11 eyes). One study observed that the extension of pterygium is significantly correlated with the degree of corneal astigmatism in the positive direction, with the highest percentage of with-the-rule astigmatism (Kampitak K, 2003). In this study also maximum amount of mean astigmatism was observed in the horizontal meridian and thereby causing with-the-rule astigmatism.

Fong et al, 1998 observed that pterygium excision usually induces a reversal of pterygium-related corneal flattening. Consequently, successful pterygium surgery should reduce pterygium induced refractive astigmatism and improve visual acuity (Pavilack MA 1995)

Mean pre operative astigmatism in grade4 pterygium decreased from 4.73D to 0.65D one month post operatively. In grade 2 pterygia pre operative mean astigmatism decreased from 2.36D to 0.88D one month post operatively. Grade 2 pterygia showed a decrease in astigmatism from 0.94D to 0.45D and in grade 1 pterygia a decrease from 0.53D to 0.28D in astigmatism was seen one month post operatively. These findings are, very much correlating with findings of (Maheshwari S, 2003).

The higher the pre operative astigmatism, the higher the difference between pre and post-operative astigmatism

was noted in this study, which was similar to findings of the (Soriano JM et al, 1993).

In grade 1 and grade 2 pterygium visual acuity improved to near normal after pterygium excision but some amount of diminution in vision remained there in grade 3 and grade 4 as some amount of corneal distortion remains there in higher grades of pterygia. These observations are very similar to the findings of (Tomikodoro A. et al).

As regards keratometric readings (K1, K2) before and after 1 month, 3 months and 6 months of pterygium excision, no significant difference was seen. This finding that pterygium excision had no effect on the keratometric readings, are very much consistent with findings of another study. (Avisar R et al, 2000)

## CONCLUSION

This study concludes that pterygium excision induces a reversal of pterygium-related corneal flattening. A significant decrease in astigmatism and improvement in visual acuity is observed post-operatively.

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