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Original Research Article

A study on corneal astigmatism before and after pterygium excision

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ABSTRACT

Introduction: The prevalence of pterygium shows a substantial increase for increasing age and UV irradiation. There is paucity of available literature regarding the total area of pterygium, percentage of extension of pterygium on to the cornea and its effects on corneal astigmatism. Hence this study was undertaken to evaluate the pre and post-surgical effect of the size of the pterygium on corneal astigmatism.
Materials and Methods: 100 out patients aged between 22 to 50 years diagnosed with pterygium were included in the study. Slit lamp bio microscope was used to measure the length and width of pterygium in millimetres. Slit beam was used to measure the diameter of cornea. Corneal astigmatism was measured pre and postoperatively on day 1 and 1 month follow up using keratometery.
Results: In this study 2.13±1.39 was the mean preoperative astigmatism, 1.36±1.03 was the mean post-operative astigmatism on day 1 and on 1 month follow up 0.86±0.91 was the mean post-operative astigmatism which was statistically significant($p<0.001$)). The corneal astigmatism was directly proportional to pterygium area. As the area of pterygium increased the post-operative astigmatism significantly decreased. There was increase in corneal astigmatism with the increase in the percentage of pterygium extension onto cornea. In post-operative period the corneal astigmatism decreased with the increase in the percentage of pterygium extension onto cornea ($p<0.001$).
Conclusion: As per our findings we draw a conclusion that surgical removal of pterygium significantly reduces pterygium induced astigmatism and also there is an improvement in visual acuity.

1. Introduction

The active hyperplastic proliferative tissue which is actively growing from the conjunctival-limbal area onto the cornea is known as pterygium.[1] The pterygium is commonly found in Indian population its reported prevalence is 22%.[2] When the pattern of pterygium prevalence in aborigines is treated against UV zones a significant positive correlation emerged. The highest prevalence is for old age group in the highest UV zone and conversely the prevalence is lowest in lowest age group in the lowest UV intensity zone. The prevalence shows a substantial increase for increasing age and UV irradiation.[3] Patients with pterygium can have redness, itching, ocular motility defect a blurred vision and cosmetic defect. There will be decreased vision in these patients due to pterygium induced astigmatism. These include; pooling of tear film over the apex of pterygium; mechanical traction of the pterygium on the cornea.[4,5] There are numerous studies available on the impact of different sizes of pterygium and of pterygium surgery on corneal refractive status including keratometry and corneal topography. However, there is paucity of available literature regarding the total area of pterygium and percentage of pterygium extension on to the cornea and its effects on

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corneal astigmatism. Hence this study was undertaken to evaluate the pre and post-operative effect of the size of the pterygium on corneal astigmatism.

2. Materials and Methods

The study was conducted in the Department of Ophthalmology, Basaveshwar Teaching and General Hospital(BTGH) attached to Mahadevappa Rampure Medical College, Kalaburagi After obtaining informed consent, 100 out patients aged between 22 to 50 years who had visited the Department of Ophthalmology, BTGH, Kalaburagi were included in the study.

2.1. Inclusion criteria

Patients with > 1D astigmatism as per measurement by keratometry and Pterygium encroachment >2mm on the cornea.

2.2. Exclusion criteria

Recurrent pterygium, Double pterygium, Pseudo-pterygium, Corneal abnormalities like scarring, degenerations and dystrophies.

First informed consent was obtained from the patient later detailed history and clinical examination was done related to patients existing illness. The findings were recorded on proforma.

2.3. Ocular examination

Using Snellen's chart best corrected visual acuity was recorded. Using slit lamp bio microscope in diffuse and oblique illumination detailed anterior segment examination was done. The size of the pterygium was measured using slit lamp bio microscope. The width of pterygium was measured using thin slit beam of light (in millimeters). Horizontal corneal diameter was measured using a thin slit beam of light (in millimeters).

The total area of pterygium was calculated as follows: $\frac{1}{2}$ X width of the pterygium (in millimeters) X horizontal length of the pterygium (in millimeters).

The following formula was used to calculate the percentage extension of the pterygium on to the cornea.

2.4. Distance between the pterygium advancing edge and the limbusX 100%.

2.4.1. Horizontal diameter of the cornea

Automated kerato-refractometer was used to obtain keratometric values. Corneal astigmatism was calculated after obtaining the difference between K1 and K2. To rule out the dry eye on the subjects, tear break up time and Schirmer test 2 will be done. To rule out corneal pathology fluorescein staining of cornea was done on study participants.

2.4.2. Surgical technique

Prior to surgical procedure peribulbar or facial anaesthesia was given. Eye was painted using betadine solution under aseptic condition and eye was draped. Lid speculum was placed and superior rectus bridle suture was inserted and clipped to the eye drape. After marking the body of pterygium, the head and body of pterygium was separated from cornea. Total pterygium (body and head) including underlying tenons was excised. After achieving haemostasis the residual fibrous tissue on the cornea was removed by sharp dissection. Castroviejo calliper was used to measure the conjunctival defect. After measurement the obtained dimensions were marked on supero-temporal conjunctiva. The graft was excised beginning at the forniceal end with Pierse Hoskins forceps and Westcott scissors. Thin graft was taken without button holing. After flipping the graft over onto the cornea and tenons attachments at the limbus it was carefully dissected. Using Vannas scissors the flap was excised with inclusion of limbal tissue. The excised graft was slid onto the cornea and it was rotated and moved to scleral bed. The placement of graft was done with stomal side facing down and to limbus to limbus orientation. The graft was ironed out and edges were opposed. To maintain the position of graft, two anchoring interrupted sutures using 10-0 nylon were placed at the limbus with episclearal bites. To attach and place the graft in its position multiple interrupted sutures were placed. A sub conjunctival injection using an antibiotic steroid combination was injected after the completion of the procedure. Overnight patching of eyes was done. After surgical procedure an antibiotics steroid combination eye drop was prescribed 4 times/day for 7 days which was followed by tapering dose. 24 hour and 1 month follow up was done for the patients.

During each follow-up the following was assessed: visual acuity, examination of anterior segment, automated keratometry readings and corneal astigmatism was calculated after obtaining the difference between k1 and k2.

The Data was collected and was analysed according to appropriate statistical tests.

3. Results

In the current study, total 100 study subjects participated in that mean age group was 41.13 years

Table 1: Age distribution of study subjects

Mean age group	41.13
SD	11.86
Range	23-48

Out of 100 patients the mean age was 41.13 years, and age ranged from 23-48

Table 2: Gender distribution of study participants

	No	%
Males	57	57%
Females	43	43%
Total	100	100%

In our total sample of 100, 57% males participated and 43% of females participated in the current study.Table 2

Table 3: Right and left eye distribution

Eye	Number	Percent
Right	63	63%
Left	37	37%
Total	100	100%

63% of patients had pterygium on right side and 37% had on left side.Table 3

Table 4: Pterygium size, width,and area and percentage extension

Pterygium	Mean	SD(±)	Min-max
Size	3.28	1.24	2.3-5.6mm
Width in mm	5.21	1.07	3.6-7.4
Cornea diameter	10.23	1.03	9.4-11.8
Area extension (mm^2)	10.64	3.5	5-22
Percentage extension Into cornea	29.76	7.9	18.20-52.12

Pterygium size varied from 2.3 to 5.6mm with a mean of 3.28±1.24mm.
Width of pterygium varied from 3.6mm to 7.4mm with mean of 5.21±1.07.
Diameter of cornea varied from 9.4 to 11.8 with a mean of 10.23±1.03.
Area of extension varied from 5 to 22mm^2 with a mean of 10.64±3.6.
Pterygium percentage extension onto cornea ranged from 18.20% to 52.12% with a mean of 29.76±7.9.Table 4

Table 5: Pre and post-operative comparison of k1 value

	Mean	SD(±)	Range	P-value
Preoperative	41.86	1.26	38.45-44.67	
1 day post-operative	40.79	1.18	37.86-43.13	<0.001
1month post-operative	39.95	1.24	36.54-42.18	<0.001

Mean k1 value in our observation was 41.86±1.26which was significantly reduced to 40.79±1.18 (p<0.001) during 1^{st} postoperative day and further the mean k1 value was very significantly reduced to 39.95±1.24 D (p<0.001).Table 5

Preoperative mean k2 value was 43.16±2.38 D, which was increased to 43 .86±1.82 D (p<0.00) on 1^{st} post-operative day and it was increased to 44.11±1.71D on one month post-operative period.Table 6

Table 6: Pre and postoperative comparisonof astigmatism

	Mean	SD(±)	Range	P-value
Pre-operative	43.16	2.38	39.25-46.11	
1 day post-operative	43.86	1.82	40.18-47.68	<0.001
1month post-operative	44.11	1.71	40.31-48.56	<0.001

Table 7: Pre and post-operative comparison of astigmatism

	Mean	SD(±)	Range	P value
Pre-operative	2.13	1.39	0.91-5.89	
1 day post-operative	1.36	1.03	0.71-4.91	<0.001
1 month post-operative	0.86	0.91	0.44-4.12	<0.001

Mean preoperative astigmatism was 2.13±1.39 d which was significantly reduced to 1.36±1.03D (p<0.001) on 1^{st} day of post-operative period and it was very significantly reduced to 0.86±0.91D (p<0.001) on 1 month post-operative period.Table 7

Table 8: Correlation between area of pterygium and corneal astigmatism

	Correlation	P value
Pterygium area with astigmatism	0.816	0.001

There was positive correlation between pterygium area and astigmatism (r=0.816 p<0.001).Table 8

Table 9: Correlation between percent extension of pterygium and corneal astigmatism

	Correlation	P value
Percentage extension of Pterygium Onto the cornea with preoperative astigmatism	0.766	0.001

There was positive correlation between pterygium percentage extension onto cornea and pterygium induced corneal astigmatism (r=0.766 p<0.001).Table 9

With increased area of pterygium onto cornea there was significant greater reduction of Post-operative astigmatism.Table 10

3.1. < 8 mm pterygium area on to cornea

Mean preoperative astigmatism was which was reduced to during 1^{st} day post-operative period and it was very significantly reduced to during 1month post-operative period.

Table 10: Relationship between pterygium area and corneal astigmatism

Pterygium area	Pre-operative Astigmatism (mean+SD)	1day post- operative astigmatism	1month post -operative astigmatism	P value
<8	1.68±0.56	0.95±0.43	0.59±0.26	
8-12	3.12±0.77	1.45±0.53	1.05±0.42	0.001
>12	5.91±1.32	3.56±1.39	2.63±1.45	0.001

Table 11: Relationship between percentage extension of pterygium onto cornea and corneal astigmatism

Percentage extension of Pterygium onto cornea	Pre-operative Astigmatism (mean±SD)	1day post -operative astigmatism	1month post- operative astigmatism	P value
<30	2.23±0.93	1.39±0.69	0.86±0.48	
30-40	3.31±0.83	1.56±0.56	0.92±0.38	0.001
>40	5.62±1.07	3.11±0.86	2.69±1.21	0.001

3.2. 8-12 pterygium area on to cornea

Mean preoperative astigmatism was which was reduced to during 1^{st} day post-operative period and it was very significantly reduced to during 1month post-operative period.

3.3. >12mm pterygium area on to cornea

Mean preoperative astigmatism was which was reduced to during 1^{st} day post-operative period and it was very significantly reduced to during 1month post-operative period

With increased percentage extension of pterygium there was significant greater reduction of post-operative astigmatism.Table 11

< 30% extension of percentage pterygium on to cornea: Mean preoperative astigmatism was 2.23±0.93 which was reduced to 1.39±0.69 during 1^{st} day post-operative period and it was very significantly reduced to 0.86±0.48 during 1month post-operative period

30% -40 % extension of percentage pterygium on to cornea: Mean preoperative astigmatism was 3.31±0.83 which was reduced to 1.56±0.56 during 1^{st} day post-operative period and it was very significantly reduced to 0.92±0.38 during 1month post-operative period

>40 % extension of percentage pterygium on to cornea: Mean preoperative astigmatism was 5.62±1.07 which were reduced to 3.11±0.86 during 1^{st} day post-operative period and it was very significantly reduced to 2.69±1.21during 1month post-operative period

4. Discussion

In our study, K1 value was reduced significantly in 24 hours and again it was reduced very significantly in month, (Table 5) and K2 value increased post operatively on day 1 and there was greater increase on 1 month post-operative period. (Table 6) This observation is in accordance with the studies of Saleem et al.[5] in 2011 determined the difference in mean corneal curvatures before and after pterygium excision by using automated refraction and keratometry. The quasi experimental study was conducted at eye unit-1, Bahawal victoria hospital Pakistan. 30 patients with primary pterygium were analysed before and after pterygium surgery for corneal curvature changes. Automated refraction and automated keratometry were used to calculate the cylindrical error and the corneal surface power respectively. They concluded that pterygium excision brings a statistically significant change in corneal curvatures which lead to decrease in cylindrical correction needed. This causes an improvement in subjective visual acuity in patients who have undergone pterygium surgery. Chourasia et al.[4] in 2014 carried out study 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 1, 3, 6 months post operatively. They observed that preoperative mean astigmatism was a maximum in horizontal meridian than in oblique and vertical meridian. Mean size of the pterygium was 2.59 mm. the magnitude of pre -operative mean astigmatism was 1.38D, which was seen to be increasing with increasing in size of pterygium. Mean pre-operative refractive astigmatism of 1.38D decreased to 0.22 D, 0.16D after 1, 3 and 6 month post operatively which were statistically significant. They concluded that pterygium excision induces a reversal of pterygium related corneal flattening. In our investigation, pre-operative astigmatism (2.131±1.39D) was reduced to 1.36±1.03D and it was greater reduction on 1month post-operative period (Table 7), our finding are in accordance with the findings of Maheshwari[6] studied the effect of pterygium on corneal topography in 151 eyes with primary pterygium and found that corneal astigmatism reduced from 4.40 ±3.64D to 1.55±1.63D following surgery. In our research, pterygium area and astigmatism was positively correlated(r=0.816 p<0.001) (Table 8) and there was also positive correlation

between pterygium percentage extension onto cornea and pterygium induced corneal astigmatism (Table 9). Our findings are in agreement with that of Mohammad-Salih et al.[7] who have studied the relationship between pterygium size (extension, width, total area) and corneal astigmatism and they found that pterygium extension and total area have stronger correlation with corneal astigmatism than the width. With increased area of pterygium (from <8mm to > 12mm) on to cornea there was significant greater reduction of post-operative astigmatism (Table 10) Bajantri et al.[8] did conducted study on 70 patients of 70 eyes with pterygium. Post operatively visual acuity and keratometry were evaluated on 1 day, 4th week and 9th week, they found that as the increase area of pterygium there was greater reduction in astigmatism in post-operative period. With increased percent extension of pterygium (from <30 percent to >40 percent) there was significant greater reduction of post-operative astigmatism (Table 11). These findings are in accordance with the study of Mohite et al.[9]

5. Conclusion

In our observations, we draw a conclusion that surgical removal of pterygium significantly reduces pterygium induced astigmatism and also there is an improvement in visual acuity. Proper diagnosis and early management of pterygium reduces the adverse effects of pterygium on cornea and other ocular regions.

6. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

7. Source of Funding

None.

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