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Comparative study of changes in corneal astigmatism after pterygium excision with conjunctival auto graft and effect of demographics on the incidence and surgical outcome

Sujithra H[1], **Kannisha Nainesh Shah**[1,*], **Amina Thansi**[1]

[1] *Dept. of Ophthalmology, Amrita Institute of Medical Sciences and Research, Kochi, Kerala, India*

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ABSTRACT

Purpose: Aim of this article was to study the role of demographics in the incidence of pterygium and its surgical outcome and also to study the change in astigmatism in patients undergoing pterygium excision with conjunctival auto graft in the southern Indian state of Kerala.

Materials and Methods: 46 eyes of 43 patients with pterygium were studied over a period of 2 years. A complete ophthalmological examination was done. Patient data like age, sex, residing area and occupation were collected. All the patients underwent pterygium excision with auto conjunctival graft under local anaesthesia. Outcome variables like best corrected visual acuity (BCVA), keratometry, subjective refraction and extent of pterygium were recorded preoperatively as well as postoperatively at 1 month and analysed for the change in astigmatism.

Results: Incidence of pterygium was more among patients of the age group 50-70 years, fishermen (28.3%), housewives (21.7%) and among residents of coastal area (71.7%). There was no significant difference between male and female. Majority of the patients were found to have with the rule astigmatism (56%) preoperatively with a mean of 0.88. There was a significant reduction in astigmatism postoperatively in 39 eyes with only 15.4% having clinically significant astigmatism.

Conclusion: There is a significant role for patient demographics in the incidence of astigmatism along the coastal areas with fishing being the most common occupation. Pterygium excision with auto conjunctival graft results in significant reduction in astigmatism which leads to improvement in visual acuity.

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1. Introduction

Pterygium is a benign degenerative disorder of the conjunctiva, presenting as a wing-shaped subepithelial fibrovascular tissue proliferation of the bulbar conjunctiva, which occasionally encroaches onto the cornea. It is commonly located, horizontally, in interpalpebral fissure, more commonly seen on the nasal side than temporally. Ultraviolet radiation has been suggested to be a major environmental factor in pterygium formation.[1] Pterygium can lead to a variety of signs and symptoms such as ocular surface irritation, inflammation, foreign body sensation, cosmetic problems and corneal scarring. Visual disturbances may occur as it encroaches onto the visual axis or induces refractive astigmatism. Various mechanisms have been suggested regarding the induced astigmatism.[2,3] Excision of pterygium may reduce the pterygium induced corneal astigmatism, thus improving visual acuity.[4] The present study assessed the effect of pterygium excision on the change in astigmatism. Since the Kerala is a coastal state of south India, the incidence of pterygium is greater when compared to others. This further pushed us to study

* *Corresponding author*.
E-mail address: kanisha_shah94@yahoo.in (K. N. Shah).

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the specific demographics and their association with the severity of astigmatism preoperatively as well as residual astigmatism post-operatively. This detection of "at risk" individuals is important so as to ascertain preventive measures to this population.

2. Materials and Methods

This was a hospital based prospective comparative study was carried out from 2018 – 2020 which included 46 eyes of 43 patients, diagnosed clinically with primary pterygium. Patients with recurrent pterygium, incomplete data and those lost to follow up were excluded from the study. A detailed ophthalmic evaluation was carried out for all the patients included in the study pre and post-operatively at 1 month. The data collected included the age, sex, residing area and occupation of the patients. All the patients were preoperatively and postoperatively assessed for visual acuity by Snellen's visual acuity chart with a standard illumination box at a distance of 6 meters, keratometry reading was done by auto-keratorefractometer. Type and amount of astigmatism and subjective refraction were documented. Anterior segment examination was done with slit lamp biomicroscopy and the extent of pterygium was determined.

In our study, we divided the examined eyes into two groups, depending on the size of pterygium: Grade I for pterygium size of less than 2 mm and Grade II for pterygium size equal to or greater than 2mm.

All the patients underwent pterygium excision with conjunctivo-limbal autograft under local anesthesia.

Statistical analysis was carried out using SPSS (statistical package for social sciences) statistics V 26.0 Software. Data were compiled, checked edited properly before analysis. An appropriate test of significance was used for the statistical analysis.

3. Results

Prevalence of pterygium was highest among the age group of 51-60 (17 eyes), 15 eyes belong to the age group 61-70, two eyes in 10-40 age group and 6 eyes in the age group of both 41-50 and more than 70. (Table 1). Pterygium was seen to occur more commonly in females [24(52.20%)] than in males [22(47.80%)].

Fishermen were more likely to develop pterygium when compared to other occupations followed by housewives (Table 1), and out of 43 patients (46 eyes), 33 (71.73%) patients lived in coastal areas and 13 (28.26%) patients in non-coastal areas (Table 1) suggesting that factors such as sunlight, dry, dusty and windy climate may lead to and accelerate pterygium formation.

Out of 46 eyes, nasal pterygium was most seen in 40(87%), followed by 5(10.9%) which were bi-headed and 1(2.2%) was temporal. (Table 2). Out of 46 eyes, 44 (95.6%) were grade II and only 2 (4.3%) were grade 1. (Table 2)

Table 1: Demographics of the subjects

Subject characteristics	Percentage (%)	Frequency
Age (in years)		
10- 40	43.4	2
41- 50	13	6
51- 60	36.9	17
61-70	32.6	15
>70	13.04	6
Sex		
Female	52.20	24
Male	47.80	22
Occupation		
Accountant	2.2	1
Daily wage worker	6.5	3
Driving	2.2	1
Electrician	2.2	1
Farmer	6.5	3
Fishing	28.3	13
Government service	6.5	3
Housewife	21.7	10
Maison	4.3	2
Police	2.2	1
Railway	2.2	1
Security	2.2	1
Student	2.2	1
Teacher	4.3	2
Welding	6.5	3
Area of Living		
Coastal	71.7	33
Non-coastal	28.3	13

With the rule (WTR) astigmatism was the most common type of astigmatism associated with pterygium formation in our study [26 eyes (56.5%)], followed by 13 eyes having against the rule (ATR) astigmatism (28.3%) and 7 eyes having oblique astigmatism (15.2%). (Table 2)

Table 2: Clinical characteristics of the subjects

Site	Frequency (n)	%
Nasal	40	87
Bi- headed	5	10.9
Temporal	1	2.2
Size of Pterygium	**Number of patients**	**%**
Grade I	2	4.3%
Grade II	44	95.6%
Distribution of astigmatism pre-operatively	**Number of patients**	**%**
With the rule	26	56.5
Against the rule	13	28.3
Oblique	7	15.2

Out of 43 patients (46 eyes), vision has increased postoperatively in 40 eyes (86.95%), and decreased in 6

eyes (13%) which was found to be due to the occurrence of cataract. P: value 0.04 (Table 3, Figure 1).

Table 3: Distribution of visual acuity pre and post–operatively

Vision	Number of patients pre-operatively	Number of patients post-operatively
<6/60	9	4
6/36	3	4
6/24	4	0
6/18	9	5
6/12	6	9
6/9	4	13
6/6	11	11

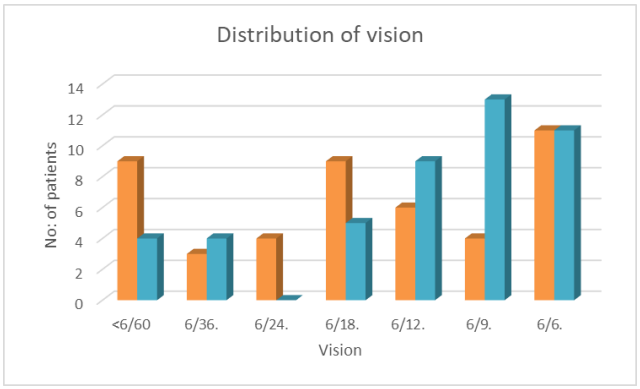

Fig. 1: Distribution of visual acuity pre and post-operatively

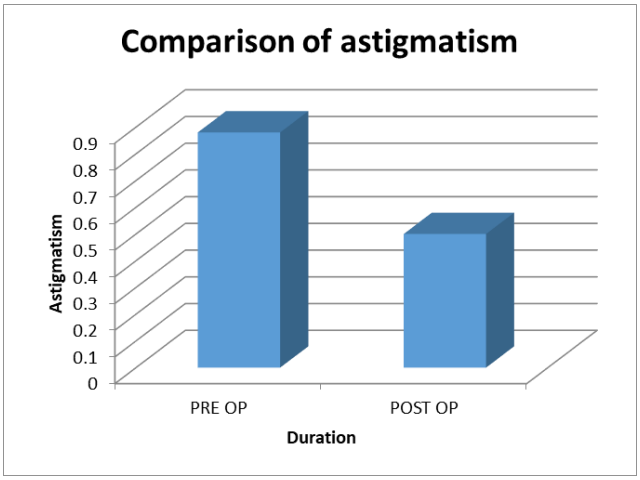

Fig. 2: Comparison of corneal astigmatism pre and post-operatively

Post-operatively there was an overall reduction in the corneal astigmatism from 0.88 pre-operatively to 0.5 post-operatively (p: value: <0.002)(Figure 2). The number of patients having WTR astigmatism reduced to 21(45.7%), with ATR astigmatism increased to 16(34.8%) suggesting the possible reversal of the previous WTR astigmatism in patients with pterygium. Oblique astigmatism post-op was found in 8 patients (17.4%) and 1(2.2%) patient had nil astigmatism post-op. (Table 4, Figure 3)

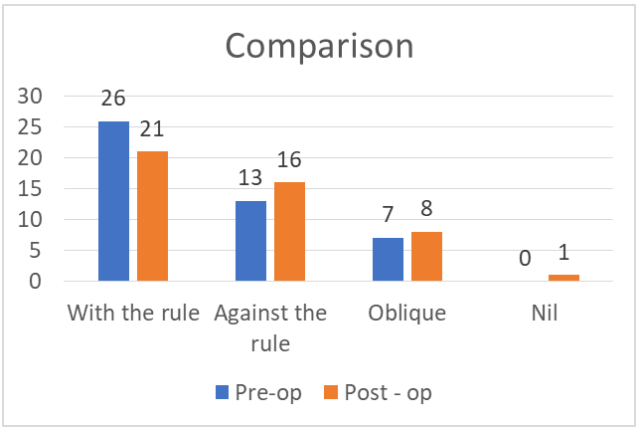

Fig. 3: Comparison of type of astigmatism pre and post-operatively

Table 4: Distribution of type of corneal astigmatism post-operatively

Astigmatism	No: of patients	Percentage
With the rule	21	45.7
Against the rule	16	34.8
Oblique	8	17.4
Nil	1	2.2

On comparing post-operative astigmatism with pre-operative astigmatism, an improvement was seen in a significant number of patients as seen by the decrease from 30.4% (n=14) to 6.5% (n=3) in patients with a pre-operative astigmatism of > 2.00dc. Mean reduction in astigmatism post-op: 1.543 ± 1.54 to 0.962 ± 0.966 ($p < 0.001$).

Based on demographics we studied the severity of astigmatism pre and post-operatively and found that patients having an outdoor occupation or living in the coastal areas were found to have higher pterygium related astigmatism when compared to the other group. This difference was found to be statistically significant with a p: value of < 0.05. This further cements the theories of the cumulative effect of environmental factors on the development and severity of pterygium.

4. Discussion

Pterygium induced astigmatism is a common reversible cause for diminution of vision with appropriate surgical management. Patients at a higher risk of pterygium formation should be aptly identified so that suitable preventive measures can be taken accordingly of these modifiable risk factors. Our study was designed to identify the population at risk of developing pterygium, since the state of Kerala, a tropical region, lying within the

Table 5: Effect of occupation and area of residence on visual outcome

Occupation	Astigmatism (n)			
	< 1 dc		> 1dc	
	Pre-op	Post-op	Pre-op	Post-op
Outdoors	13 (28.30%)	17(36.95%)	17(36.95%)	13 (28.30%)
Indoors	10(21.73%)	12(26.08%)	6(13.04%)	4(8.70%)
Area of Residence				
Non- Coastal	7(15.21%)	5(10.9%)	6(13.04%)	8(17.4%)
Coastal	16(34.8%)	24(52.2%)	17(36.95%)	9(19.6%)

"pterygium belt" as described by Cameron. Amongst our study group of 43 patients (46 eyes), 24 were females (52.20%) and 22 are males (47.80%) suggesting that females were the more commonly affected gender. These findings were in accordance with studies by Kshama B Popat et al,[5] who showed similar results with 44% patients being males and 56% were females. However, the study conducted by G Gazzard, S-M Saw, M Farook,[6] Moran D J[1] and Coroneo M T[7] the presence of pterygium was more frequently found in men than in women, while the studies conducted by Luthra R[8] and Forsius H[9] showed no gender bias. This increased prevalence of female population in our study may be due to fishing, being a common outdoor occupation to both men and women in this part of the country.

Studies done previously were suggestive of pterygium occurrence showing an increasing trend with an increased age. Our study showed that the most common affected age group the 6^{th} decade of life (51-60 years). These findings were in accordance with studies by Kshama B Popat et al.,[5] who showed similar results with an incidence of 35% between the age of 50-60 years. Studies conducted by A Goyal, Chetanya Prakash Gupta[10] shows pterygium was found to be most common between 31-40 years of age group (34%). The increased incidence in these age groups was probably because they were more exposed to sun, dust and hot climate due to their more outdoor nature of work. These factors may cause ocular surface inflammation, tear film disturbances and damage of limbal stem cell, which may further lead to or accelerate pterygium formation. These age-specific findings were also reported by the Blue Mountain Eye Study,[11] in which the prevalence of pterygium was 7.3% for participants aged 49 years or older.

Study conducted by Tan, Lim T, Koh W et al.[12] found that most patients with pterygium had little formal education and began working outdoors in fishing-related occupations. Similar results were obtained in the present study, out of 46 eyes most of them spent time working outdoors exposed to the sun (65.2%), with fishing being the most common occupation (28.3%), this may be the reason why most of the population, developing pterygium, in our study group were found to have resided in the coastal region [33 eyes (71.73%)]. Studies other than ours have found that pterygium occurs commonly in people with occupations involving the outdoors as suggested by a review conducted by Liu L, Wu J, et al.,[13] a case-control study of 278 patients by Mackenzie FD et al.,[14] showed people working outdoors were 4 to 11 times more likely to have pterygium than those working indoors. This maybe be due to repeated and longer periods of exposure to sunlight and UV radiation making them more prone for pterygium formation. UV light has been found to cause hyperplastic growth and thickening of the conjunctiva.

In our study, out of 46 eyes 40 (87%) were nasal, 5 (10.2%) were nasal and temporal and 1 (2.2%) was temporal. This finding was also found in a study conducted by Maloof A J.[15] This common occurrence of pterygium nasally is attributed to the light coming to the temporal cornea and being focused on the nasal cornea.

Tan, Lim T, Koh W et al.[12] divided the examined eyes into two groups, depending on the size (corneal involvement) of the pterygium: grade I for pterygium size of less than 2 mm and grade II for pterygium size equal to or greater than 2 mm. In their study, 12 eyes (32.4%) had grade I pterygia and 25 eyes (67.6%) had grade II pterygia. In the present study only 2 eyes (4.3%) had grade I and 44 eyes (95.6%) had grade II pterygium, suggesting more severity of the pterygium in this population or a later presentation.

Maximum patients had with-the-rule astigmatism (56.5%) preoperatively which is caused due to flattening of the central cornea by mechanical traction or pooling of tears at the apex of the pterygium. This was similar to studies by Sudheer Verma et al[16] (76%), Mohammed Salih PA, Sharif AF[17] (49.4%).

Post- operatively we found that the number of patients having WTR reduced by 10.80% and ATR increased by 6.5% due to reversal of the flattening caused post-surgery as reported by Youn J., Ryang W.[18] Based on our study there was a significant reduction in keratometric astigmatism (84.7%) after pterygium surgery. This reduction in astigmatism or clearing of the pupillary axis was directly related to the significant improvement in visual acuity post-surgery ($p = 0.041$). This finding was similar to studies by Cinal et al.,[19] Kshama B Popat et al,[5] Maheswari et al.[4]

Our study further showed that along with a common occurrence of pterygium in the coastal population, the severity of astigmatism was more in this population as well as those with an outdoor occupation pre-operatively

when compared to those living in non-coastal areas and with an indoor occupation. Also, post-operatively, a residual astigmatism of more than 1 dioptre cylinder was seen in these patients with a coastal residence (19.6%) and an outdoor occupation (28.30%) when compared to those residing in non-coastal areas (17.4%) or working indoors (8.70%).

Ours being a tropical population with a more coastal population and outdoors occupation, these patients are at a constant exposure of ultraviolet radiation which is a common risk factor for both pterygium formation as well as cataract.[20] This along with an increasing demand of cataract surgery, it is of utmost importance that the surgeon address the pre-operative astigmatism. This requires us to find the type and degree of the corneal astigmatism caused by pterygium. This may help us surgeons improve the visual quality of the patients and provide satisfactory results.

5. Conclusion

There is a significant role of patient demographics in the incidence of pterygium along the coastal areas. Pterygium excision with auto conjunctival graft results in significant reduction in astigmatism which leads to improvement in visual acuity. All patients constantly exposed to environmental factors such as sunlight, dry, dusty and windy climate especially people in coastal areas are at constant risk of pterygium development such individuals should be counselled regarding the use of protective eye wear, sun-protective gear like caps and use of lubricants.

6. Source of Funding

None.

7. Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Moran DJ, Hollows FC. Pterygium and ultraviolet radiation: a positive correlation. *Br J Ophthalmol*. 1984;68(5):343–6.
2. Oldenburg JB, Garbus J, Mcdonnell JM. Conjunctival Pterygia: Mechanism of corneal topographic changes. *Cornea*. 1990;9(3):200–4.
3. Gupta A, Maurya RP, Manisha, Kadir SMU, Patel A, Devi A, et al. Recent update on pterygium. *IP Int J Ocul Oncol Oculoplasty*. 2017;8(2):95.
4. Maheshwari S. Effect of pterygium excision on pterygium induced astigmatism. *Indian J Ophthalmol*. 2003;51(2):187–8.
5. Popat KB, Sheth HK, Vyas VJ, Rangoonwala MM, Sheth RK, Shah JC. A study on changes in keratometry readings and astigmatism induced by pterygium before and after pterygium excision surgery. *J Res Med Den Sci*. 2014;2(3):37–42.
6. Gazzard G, Saw S, Farook M. Pterygium in Indonesia: prevalence, severity and risk factors. *Br J Ophthalmol*. 2002;86(12):1341–6.
7. DiGirolamo N, Chui J, Coroneo MT, Wakefield D. Pathogenesis of pterygia: role of cytokines, growth factors, and matrix metalloproteinases. *Prog Retin Eye Res*. 2004;23:195–228.
8. Luthra R, Nemesure BB, Wu SY, Xie SH, Leske MC. Frequency and risk factors for pterygium in the Barbados Eye Study. *Arch Ophthalmol*. 2001;119(12):1827–32.
9. Forsius H, Maertens K, Fellman J. Changes of the eye caused by the climate in Rwanda, Africa. *Ophthalmic Epidemiol*. 1995;2(2):107–13.
10. Goyal A, Gupta CP, Gupta DC. Comparison of Preoperative and postoperative astigmatism following pterygium excision with conjunctival graft. *J Evol Med Dent Sci*. 2018;7(29):3321.
11. Panchapakesan J, Hourihan F, Mitchell P. Prevalence of pterygium and pinguecula: the Blue Mountains Eye Study. *Aust N Z J Ophthalmol*. 1998;26(Suppl 1):2–5.
12. Tan C, Lim T, Koh W. Epidemiology of pterygium on a tropical island in the Riau Archipelago. *Eye (Lond)*. 2006;20(8):908–12.
13. Liu L, Wu J, Geng J, Yuan Z, Huang D. Geographical prevalence and risk factors for pterygium: a systematic review and meta-analysis. *BMJ Open*. 2013;3(11):e003787.
14. Mackenzie FD, Hirst LW, Battistutta D, Green A. Risk analysis in the development of pterygia. *Ophthalmology*. 1992;99(7):1056–61.
15. Maloof AJ, Ho A, Coroneo MT. Influence of corneal shape on limbal light focusing. *Invest Ophthalmol Vis Sci*. 1994;35(5):2592–8.
16. Verma S, Bhatkoti B, Chauhan R. Evaluation of corneal topographic changes following pterygium surgery and correlation with size of pterygium. 2020;6(3):31–9.
17. Mohammad-Salih PA, Sharif AF. Analysis of pterygium size and induced corneal astigmatism. *Cornea*. 2008;27(4):434–8.
18. Youn J, Ryang W. The effect of pterygium surgery on contrast sensitivity and corneal topographic changes. *Clin Ophthalmol*. 2010;4:315–9.
19. Cinal A, Yasar T, Demirok A, Topuz H. The effect of pterygium surgery on corneal topography. *Ophthalmic Surg Lasers*. 2001;32(1):35–40.
20. Pham TQ, Wang JJ, Rochtchina E, Mitchell P. Pterygium, pinguecula, and 5-year incidence of cataract. *Am J Ophthalmol*. 2005;139(6):1126–8.

Author biography

Sujithra H, Professor https://orcid.org/0000-0002-3894-0589

Kannisha Nainesh Shah, Masters in Surgery (Ophthalmology) https://orcid.org/0000-0002-7388-4316

Amina Thansi, Bsc Optometry https://orcid.org/0000-0002-2022-2167

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