

## Study of Post-Operative Changes in Corneal Astigmatism Post Pterygium Excision Using Various Methods

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### Abstract:

Aim of the study is to investigate post-operative changes in corneal astigmatism following pterygium removal using various surgical methods using conjunctival autograft (CLAG), and amniotic membrane graft (AMG). This is randomized, prospective, comparative study conducted at department of ophthalmology for period two years. The study population included 100 patients who had surgery for primary pterygium. Each group is randomly assigned 50 AMG techniques and 50 CLAG techniques. Preoperatively, all patients were evaluated for visual acuity, anterior and posterior segments, autorefractometry, and auto keratometry. The patients' visual acuity, autorefractometry, and auto keratometry were assessed on day 5, one month, and three months after surgery, and the results were analysed.

The mean age of the study population was  $46.88 \pm 11.35$  years. Majority of the patients including in this study are giving history of chronic exposure to sunlight and dust. Pterygium is predominantly found nasally of about 84% and temporal 16%. Patients underwent surgery with Grade 1 (0%), 104 in grade 2(74%) and 36 in grade 3 (26%). Pterygia of grades II, III, and IV were present in 53%, 27%, and 20% of the patients. Eighty percent of patients in the conjunctival autograft group had 'with the rule astigmatism' prior to surgery. In the AMG group, 68% of patients had 'with the rule astigmatism'. After 3 months of surgery, the preoperative corneal astigmatism of  $3.52 \pm 1.665$  D was reduced to  $1.174 \pm 0.26$  D ( $P < 0.0001$ ). The groups CLAG and AMG had preoperative mean corneal astigmatism of  $3.63 \pm 1.50$  D and  $3.41 \pm 1.83$  D, respectively, which were reduced to a 3-month postoperative corneal astigmatism of  $1.33 \pm 0.30$  D ( $p < 0.0001$ ) and  $0.99 \pm 0.23$  D ( $p < 0.0001$ ), respectively. The preoperative mean astigmatism in eyes with grade II, III, and IV pterygia was  $2.26 \pm 0.14$  D,  $3.69 \pm 0.09$  D, and  $6.57 \pm 0.113$  D, respectively. At three months, the postoperative mean astigmatism in eyes with grade II, III, and IV pterygia was  $1.17 \pm 0.26$  D ( $P < 0.0001$ ),  $1.105 \pm 0.26$  D ( $P < 0.0001$ ), and  $1.196 \pm 0.27$  D ( $P < 0.0001$ ). All three grades of pterygium showed a significant reduction in corneal astigmatism three months after surgery. BCVA changes 3 months postoperatively were statistically significant. Primary complication among two groups following pterygium excision with conjunctival limbal autograft and amniotic membrane graft is recurrence in 5 cases. AMG has an 8% recurrence rate, while CLAG has a 2% recurrence rate. These patients are providing a history of UV exposure and dust exposure because of their outside work. These patients are outdoor workers. The most common site of recurrent pterygium is the nasal side, and the average duration of recurrence is 3 months. All cases are managed with CLAG. In CLAG group 1 recurrence was seen with age of 58 years male. All these patients have history of dust exposure and UV radiation site of recurrent pterygium is nasal side. Mean duration of recurrence is 3 months. All the 3 cases underwent CLAG + topical mitomycin C (MMC). Epithelial inclusion cyst seen in 1 case of AMG which may be due to embedded conjunctiva epithelium and cyst was excised and regrafting done. 2 cases in AMG and 3 cases in CLAG which may be due to faulty technique in excessive scraping on cornea and managed by decreasing steroid dose, increasing lubrication and observation. Graft infection was identified in one case of AMG and is being treated with topical antibiotics and lubricants. Graft retraction seen in 2 cases of CLAG and 1 case of AMG. One case adjusted by sutured with 8.0 vicryl and in other case, replaced with AMG. Surgical excision can significantly reduce pterygium-induced astigmatism. Hence, visual acuity improves as well. Amniotic membrane graft, and conjunctival autograft resulted in significant reductions in corneal astigmatism. Study proves that amniotic membrane graft and conjunctival autograft are superior surgical techniques.

**Keywords:** Pterygium excision, conjunctival autograft, amniotic membrane graft.

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## Introduction

The term pterygium comes from the Greek word pterygion, which means "wing. It was introduced into the English language in 1875 by Walton. Clinically it appears as a fleshy vascular mass that occurs in the interpalpebral fissure.[1,2] Its incidence varies across geographical locations.[3] Pterygium is found in the world's sunniest, hottest, and dustiest regions, primarily between the latitudes of 370 North and South of the Equator.[4] It is more commonly located nasally rather than temporally.

Pterygium is triangular and divided into 4 parts:

1. On the head, the apical part of a pterygium on the cornea.
2. Neck: lies between the head and the body, on the limbus.
3. Body: extending from the canthal side of the bulbar conjunctiva and lying over the sclera.
4. Cap: is located directly in front of the head. It can be of two types: Fuch's spots and "Stocker's line."

According to the progression, pterygium divided into:

1. Progressive: is a thick, fleshy and vascular pterygium with fuch's spot.
2. Regressive or Atrophic: is thin, atrophic, attenuated pterygium with little vascularity.

The long-term impact of environmental factors such as sun exposure, dry heat, high winds, and an abundance of dust. Pterygium is more common in men due to long periods of outdoor work. Pterygium is the most common cause of "with the rule astigmatism," which means that the vertical meridian is steeper than the horizontal meridian because pterygium generally encroaches the cornea from the nasal side in a horizontal direction at first, causing the H meridian to flatten, but as the pterygium progresses, it leads to irregular astigmatism. Grades of pterygium;

- invades < 1.5 mm of cornea,
- invades < half of radius of cornea,
- invades > half of radius of cornea,
- Pterygium almost or reaching cornea center.

The cause of pterygium is unknown, but it is more likely to develop in people who work outside in the sun and wind, causing conjunctival irritation.[5] Pterygium is currently thought to be a growth disorder characterised by conjunctivalisation of the cornea as a result of limbal stem cell damage from local ultraviolet rays. Surgery is indicated for reduced vision due to encroachment on the visual axis, recurrent inflammation and chronic irritation, ocular motility restriction, and cosmesis.[7] The first description on surgical removal of a pterygium

was by Susruta.[8] Different surgical options for pterygium are:

1. Bare sclera excision (d'ombrain)
2. Mitomycin (mmc)
3. Pterygium excision with amniotic membrane transplant [9]
4. Pterygium excision with conjunctivolimbal autograft transplantation by fibrin glue.
5. Pterygium excision surgery with conjunctivolimbal autograft transplantation using sutures.
6. Pterygium removal followed by conjunctivolimbal autograft transplantation from the patient's own blood.
7. Lamellar keratoplasty and excimer laser phototherapeutic keratectomy

Pterygium is very common in India, which is part of the "pterygium belt." [11] With a thin ozone layer failing to block UV sunlight, this entity has a relatively high incidence, making it a significant public-health problem.[11] Astigmatism is caused by the pooling of the tear film, mechanical traction on the cornea, and the double headed pterygium. Keratometry, corneal topography, and refraction will be used to determine this. Pterygium excision surgery can be used to reduce corneal astigmatism using a variety of techniques. The current study compared postoperative changes in corneal astigmatism following pterygium excision using techniques such as conjunctival autograft and amniotic membrane.

## Materials and Methods

### Place of study

The research is being carried out at department of ophthalmology, Nimra Institute of Medical Sciences (NIMS), Nimra Nagar, Jupudi (V), Ibrahimpatnam (M), Vijayawada, Andhra Pradesh.

### Study population

Patients with primary pterygium undergoing graft procedures at tertiary care center for 2 years (December 2020 to November 2022) of duration.

### Study design

Prospective, Interventional and Randomized clinical study.

### Sample size

Sample size =  $(z\text{-score})^2 \times \text{std deviation} \times (1\text{-std deviation}) / (\text{margin of error})^2$  90% -z score =1.645.

Standard deviation = 0.5 Margin of error =10%

Sample size =50 eyes considered for each group - AMG and CLAG. Total Patients included in the study: 100 eyes.

**Study duration**

2 years duration from December 2020 to November 2022. Follow up of cases for recurrence is maximum period of 6 months till November 2022.

**Inclusion Criteria**

- a) Patients with primary pterygium who are undergoing pterygium excision with graft.
- b) Age between 18-75yrs.
- c) Pterygium that extends 3 mm or more from the limbus to the cornea.

**Exclusion Criteria**

- a) Patients who had a history of allergy to steroid eye drops.
- b) Cases of recurrent pterygium
- c) Cases of double headed pterygium pseudo pterygium
- d) history of ocular morbidity
- e) History of glaucoma
- f) Severe ocular surface diseases or any lid abnormalities
- g) History of any chemical or mechanical injury

**Procedure and Method of measurement of outcome**

After explaining the prognosis for recurrence of the pterygium and changes in astigmatism, all patients provided written informed consent.

A thorough medical history was taken prior to surgery. Diabetes Mellitus, Hypertension, Collagen Vascular Disease, and any other major illness were investigated in the past and present. A history of any ocular surgery and pterygium surgery was obtained, as well as a history of any chemical and mechanical trauma. An occupational history, particularly one involving outdoor activities, was obtained. A thorough general physical examination was performed. To make a clinical diagnosis, a complete ocular clinical examination was performed, including assessments of visual acuity, refraction, ocular movements, anterior segment, posterior segment evaluation under slit-lamp bio microscopy, and intraocular pressure.

**Clinical grading of pterygium**

- Grade 1: pterygium not extending beyond limbus  
 Grade 2: extending on to cornea till less than halfway from limbus to Centre of pupil  
 Grade 3: extending in between halfway from limbus to center of pupil  
 Grade 4: at center of pupil or crossing it.

The encroachment of the conjunctiva onto the cornea, as defined by Kanski et al., has been used to grade pterygium. Grade 1: < 2 mm of conjunctiva encroaching onto the cornea. Grade 2: 2-4 mm of conjunctiva encroaching onto the cornea. Grade 3: > 4 mm of conjunctiva encroaching onto the cornea.

**Study groups**

All the patients were assigned to one of three groups at random: Amniotic membrane graft (AMG) technique is used in Group 1.

Group 2- Conjunctival autograft (CLAG) technique

**Randomization**

Cases reporting for pterygium surgery to our hospital meeting exclusion and inclusion criteria are assigned with numbers. Every 5th, 10th, 15th...case is selected to include in study. Every 5th, 15th, 25th are allotted in AMG group and every other 10th, 20th, 30th are allotted in CLAG group.

To reduce interobserver bias, all preoperative investigations and postoperative evaluations were performed by a single ophthalmologist and all surgical procedures were performed by a single surgeon.

**Surgical Procedure**

In all cases, local anesthesia (a mixture of 2% lignocaine and hyaluronidase plus 0.5 percent bupivacaine-peribulbar block) is administered. Betadine is applied to the surgical field, which is then draped with sterile drapes. To separate the lids and expose the surgical field, a wire speculum is used. The pterygium's head is grasped with fine-toothed forceps and dissected off from the cornea with a crescent blade up to the limbus. The dissected corneal area is smoothed out by scraping with a crescent blade. The pterygium's body, including the involved Tenon's capsule, is then dissected and excised with Westcott scissors, taking care to protect the underlying horizontal rectus muscle and the overlying conjunctiva. Castroviejo callipers are used to determine the size of the graft needed to resurface the exposed scleral surface.

**Conjunctival Limbal Autograft**

The supertemporal conjunctiva is marked with the measured dimensions. To separate the Tenon's capsule, 0.5 ml of normal saline is injected beneath the supertemporal conjunctiva. The graft is excised starting at the forniceal end with Pierre-Hoskins forceps and Westcott scissors. It is important to obtain a graft that is as thin as possible without buttonholing.

When the limbus is reached, the graft is flipped over onto the cornea and the Tenon's attachments at the limbus are dissected meticulously. The graft is dissected a little deeper and 0.5 mm into clear cornea at the limbus. The flap is then excised using a Westcott scissors, taking care to include the limbal tissue.

The conjunctival-limbal graft is slid onto the cornea after excision. Glue is applied to the surface.

With fine non-toothed forceps, the tissue is rotated and moved onto its scleral bed without being lifted off the cornea. The limbus-limbus orientation is preserved. This helps to avoid inadvertent graft scrolling, which results in surface inversion. The graft is smoothed out in its bed while being careful not to fold the edges, and the eye is closed.

### Amniotic Membrane Graft

Prior to surgery, a preserved amniotic membrane graft is obtained and dipped in sterile normal saline for 15 minutes at room temperature. The amniotic membrane graft is trimmed to fit the defect. It is detached from its nitrocellulose paper attachment. Over the bed, glue is applied. The epithelial side of an amniotic membrane graft is placed over the surface. The presence of vitreous-like strands distinguishes the stromal side. To avoid folds, the graft is secured and smoothed out. The eye is padded and closed.

Post operatives follow up done for recurrence.

The following schedule is followed for post-operative evaluations: post-operative day 5, one month, and three months. Post-operative evaluation includes the following components:

- a) uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA) in logarithm of the minimum angle of resolution (Log MAR).
- b) Evaluation of the fundus anterior segment using a slit lamp and a 90 D lens.
- c) refraction and keratometry using Auto Refractometer
- d) Corneal astigmatism was derived from values obtained through keratometry.
- e) At each follow up, the graft is examined for:

Whether the graft is in place or if there is any displacement. The graft's margins are examined for any retraction. The graft is examined for the development of graft oedema, any hemorrhage under the graft, any graft necrosis, and any graft infection. At each follow-up, any recurrence of pterygium is monitored. Recurrence is defined as fibrovascular growth across the limbus onto the cornea. The timing of the recurrence is recorded.

Other complications likely to occur are monitored at each follow up. The timing of occurrence of these complications is noted.

### Statistical methods and analysis study variables

SPSS for Windows was used for statistical analysis (Version 20.0; SPSS Inc, Chicago, IL, USA).

**Independent variables:** Demographics – Age, gender and UV exposure.

**Dependent variables:** Recurrence and post-operative complications.

### Mode of data collection

Descriptive statistical measures like Mean, median, mode, standard deviation, etc. Data presentation tools: Charts (bars, pie), tables (simple frequency tables, cross tables), etc. Hypothesis formulation and testing for significance using Chi Square tests-tests of proportion and tests of means is done. The qualitative data was analysed using appropriate significance tests such as the Unpaired T test and the Paired T test. To compare the variables, paired and unpaired t tests were used. The statistical significance was set at a probability level of 0.05.

### Results

The mean age of the participants in the study was 46.8 years, with a standard deviation of 11.35 years. The total study population ranged in age from 25 to 70 years.

Whereas the mean age was 46.3yrs  $\pm$  10.93 yrs (range: 28-70 yrs) in AMG group, and 47.46  $\pm$  11.78 yrs, (25-70 yrs) in CLAG group.

According to the data presented above, 42% of patients who underwent conjunctival autograft surgery were between the ages of 41 and 50yrs. In AMG, 40% of patients were between the ages of 41 and 50yrs. The difference was not statistically significant ( $p=0.117$ ).

64% of the patients in the conjunctival autograft group were males, while 36% were females. Out of a total of 50 patients in the Simple closure group, 62% were males and 38% were females. The percentage of females and males included in the current study is 37% and 63%, indicating a male dominance.

Among the 100 patients, predominantly engaged in outdoor work which includes labourers (60), fieldwork (5), farmers (21), police (2) and business (4). Patients engaged in indoor work constitutes of housewives (15) retired employees (3) teachers (7) student (1) and indoor employee (8).

Majority of the patients including in the present study have given history of chronic exposure to sunlight and dust.

The eyes included in the present study are 45 in right eye (45%) and 55 in left eye (55%). Site of Pterygium included in this study is 84 nasal (84%) and 16 temporal (16%) cases. Majority 84% are nasal side.

### Distribution Based on Pterygium Grade

According to Kanski et al. grading, patients included are with Grade-1 (5%), 70 in grade-2 (70%), and 25 in grade-3 (25%). People who visit our medical Centre are predominantly agricultural laborers, mostly are not concerned about cosmetic

so we advise grade-I pterygium for observation and lubrication.

### Clinical grading of Pterygium

Grade II, III, and IV pterygia were present in 53 (53%) of the 100 patients, 27 (27%) of the patients, and 20 (20%) of the patients, respectively, with the latter two grades pterygia covering the visual axis of the eyes. The main complaint is a mass over the eye (95 %), foreign body sensation (60%) and redness (50%) were the next most common Symptoms.

### Type of astigmatism distribution

In conjunctival autograft, 74% of patients had "with the rule astigmatism," 8% had "against the rule astigmatism," and 18% had "oblique astigmatism." In CLAG, 80 percent of patients had 'with the rule astigmatism,' 8% had oblique astigmatism, and 12% had against the rule astigmatism. In AMG, 68% of patients had 'with the rule astigmatism, 28% had oblique astigmatism and 4% had against the rule astigmatism. There was a very high statistical difference observed between them.

**Table 1: Association between Mean K1 value, Mean K2 value in both groups**

	Conjunctival Autograft	AMG	P value
Mean K1 value			
pre op	42.158 ± 1.94	44.867 ± 2.74	< 0.0001*
5 Days post-surgery	44.098 ± 1.6	44.602 ± 2.05	0.1699(not sig)
1 month post-surgery	44.416 ± 1.41	44.55±2.07	0.7060(not sig)
Mean K2 value			
pre op	45.554 ± 1.62	47.149 ± 2.91	0.0363*
5 Days post-surgery	46.328 ± 1.82	46.32 ± 1.52	1.0000(not sig)
1 month post-surgery	46.43 ± 1.809	46.05 ± 2.40	0.3726 (not sig)

### Conjunctival autograft K1 Reading

The t value is 4.320 (p 000) between pre-operative K1 D and first post-operative day K1 D. The t value between preoperative K1 D and 1-month postoperative K1D is 5.065 (p.000), and the t value between first postoperative K1 D and 1-month postoperative K1D is 1.216 (p=0.237). This demonstrates a statistically significant steepening of the horizontal meridian following conjunctival autograft.

### AMG K1 reading

The t value between preoperative KI D to first post-operative day K1D is 0.437 (p = .637). The t value between preoperative K1 D to post-operative 1-month K1D is 0.590 (p=0 .562). The t value between first post-operative day K1 D to post-

operative 1month K1D is 0.117 (p=0.908). In Conjunctival autograft K2 reading, the t value between pre-operative K2 D to first post-operative day K2 D is 0.2.65 (p< 0.015).

The t value between preoperative K2 D to post-operative 1 month K2 D is 2.52 (p<0.019). There is very minimal change between first post-operative K2 D to post-operative 1 month K2 D.

This states that there is statistically significant steepening of vertical curvature after conjunctival autograft. In AMG group, the t value between preoperative K2 D to first post-operative day K2 D is 1.51(p=0 .144) the t value between preoperative K2 D to post operative I month K2 D is 2.22 (p= 0.034).the t value between post-operative K2 D to post-operative I month K2 D is 1.317 (p= 0.202).

**Table 2: Association between Grading and astigmatism at admission, at postop 5 days, postop 1 month, at postop 3 months**

Grading of pterygium	CLAG		AMG		P value
	Mean astigmatism in diopter	SD	Mean astigmatism in diopter	SD	
at admission					
II	2.50	0.12	2.029	0.172	< 0.0001*
III	3.759	0.09	3.63	0.10029	
IV	6.402	0.113	6.744	0.113	
at postop 5 days					
II	2.38	0.49	0.822	0.61	< 0.0001*
III	2.82	0.61	2.73	0.56	
IV	4.9	1.14	5.33	0.51	
postop 1 month					
II	1.9	0.32	1.60	0.31	< 0.0001*
III	2.75	0.74	2.038	0.490	
IV	2.014	0.465	2.97	0.69	

at postop 3 months					
II	1.34	0.28	1.01	0.24	< 0.0001*
III	1.30	0.29	0.91	0.23	
IV	1.44	0.36	1.05	0.18	

**Table 3: Pre and Post-Operative Corneal Astigmatism (in Diopters) vs. Pterygium Grade**

Grade of pterygium	No of patients	Preoperative Astigmatism (D)		Postoperative Astigmatism (D) (at 3months)		P value
		Mean	SD	Mean	SD	
II	53	2.2645	0.146	1.175	0.26	0.001
III	27	3.6945	0.095	1.105	0.26	
IV	20	6.573	0.113	1.965	0.27	

The degree of astigmatism varied according to the grade of Pterygium. The preoperative mean astigmatism in eyes with grade II, III, and IV pterygiums was 2.26 ±0.14 D, 3.69± 0.09 D, and 6.57 ±0.113 D, respectively. The amount of corneal astigmatism caused by pterygium increased with pterygium grade.

At 3 months, the postoperative mean astigmatism in eyes with grade II, III, and IV pterygiums was 1.17 ±0.26 D (P 0.0001), 1.105± 0.26 D (P 0.0001), and 1.196± 0.27 D (P 0.0001).

However, the greatest change in astigmatism was observed in Grade IV >Grade II.

**Table 4: Astigmatism pre-operative and post-operative follow-up in the entire study population**

	CLAG		AMG	
	Mean astigmatism in diopter	SD	Mean astigmatism in dioptre	SD
Pre-op	3.63	1.50	3.41	1.83
Day 5 post op	2.98	1.20	2.766	1.46
1 month post op	2.102	0.567	1.99	0.69
3 months post op	1.354	0.303	0.994	0.234

**Table 4: Comparison of Preoperative and Postoperative Corneal Astigmatism (in Diopter [D])**

Group	Preoperative Astigmatism		Postoperative Astigmatism		95% CI	P value
	Mean	SD	Mean	SD		
CLRA	3.63	1.50	1.3354	0.303	-2.7241 to -1.8651	< 0.0001
AMG	3.41	1.83	0.994	0.234	-2.9338 to -1.8982	< 0.0001

**Table 5: Comparison of Preoperative and Postoperative Corneal Astigmatism (in Diopter [D])**

	No. of patients	Mean	SD	St. Error	P value
Preop.	100	3.52	1.665	0.19	-
Postop Day 5	100	2.873	1.33	0.13	0.0001
Postop 1 month	100	2.046	0.6285	0.06	0.006
Postop 3 months	100	1.174	0.2685	0.05	0.001

#### Comparison of Postoperative Change in Corneal Astigmatism at 3 months

There was no significant difference in outcomes between CLAG and AMG groups (P = 0.751). We concluded that when pterygium excision surgery was performed using both the amniotic membrane graft and conjunctival autograft techniques, astigmatism was reduced more effectively.

**Table 6: Preoperative and Postoperative Uncorrected Visual Acuity (UCVA) Comparison (in Log MAR)**

	Mean	SD	St. Error	P value
Preop.	0.57	0.48	0.06	-
Postop Day5	0.45	0.43	0.057	0.001*
Postop 1 month	0.35	0.28	0.036	0.0004*
Postop 3 months	0.35	0.28	0.036	0.0009*

On day 5, one month, and three months after surgery, the pre and postoperative mean UCVA (in Log MAR)

were compared. On day 5, one month, and three months after surgery, the preoperative mean UCVA of  $0.57 \pm 0.48$  was significantly reduced to  $0.45 \pm 0.43$  ( $P < 0.001$ ),  $0.35 \pm 0.28$  ( $P < 0.0001$ ), and  $0.35 \pm 0.28$  ( $P < 0.0001$ ), respectively.

**Table 7: Frequency of complications by first month, 3 months follow up**

Complication	AMG (n=50)		CLAG (n=50)	
	Number	Percentage	Number	Percentage
1 <sup>st</sup> month follow-up				
Recurrence	0	0%	0	0%
Pyogenic granuloma	1	2%	1	2%
Corneal scar in visual axis	15	30%	10	20%
Infection	1	2%	0	0%
graft retraction	1	2%	1	2%
Dellen	1	2%	1	2%
3 <sup>rd</sup> month follow-up				
Recurrence	4	8%	1	2%
Pyogenic granuloma	1	2%	1	2%
Corneal scar in visualaxis	15	30%	12	24%
Infection	1	2%	0	0%
graft retraction	1	2%	2	4%
Dellen	1	2%	2	4%

**Table 8: Comparison of Complications between the Two Groups**

Complication	AMG	CLAG	Intervention
Recurrence	4(8%)	1(2%)	Regraft
Granuloma	1(2%)	1(2%)	Excision+Regraft
Dellen	1(2%)	2(4%)	Observation
Retarcted Graft	1(2%)	2(4%)	Sutured + Regraft
Infection	1(2%)	0	Antibiotics+ Lubricitation
Epithelial Inclusion Cyst	1(2%)	0	Excision +Regraft

#### AMG recurrences

4 recurrences are seen in AMG with mean age of 44.8 years. Among these 4 patient's maximum patients were doing outdoor work and 1 patients is housewife. Site of pterygium 2 in nasal and 2 in temporal. Mean duration of recurrence is 3 months in AMG group. All these 4 cases underwent surgery for recurrent pterygium with CLAG.

#### CLAG Recurrences

ONE recurrences was seen in CLAG group with age of 58 years. This patient has chronic exposure to dust and sunlight. Site of pterygium is nasal. Mean grade of pterygium is 3. The duration of recurrence in months is 3 months.

#### Comparison of recurrence rates between AMG and CLAG

AMG has an 8% recurrence rate, while CLAG has a 2% recurrence rate.

There was no significant difference in postoperative astigmatism between the amniotic membrane graft and conjunctival autograft techniques in this study.

There was total 14 post-operative complications observed among study population, in which 9 complications in AMG group and 5 complications

in CLAG group. Maximum complications recorded in grade III at nasal site.

#### Discussion

This study is based on a study of 100 eyes from 100 patients. A total of 100 patients were chosen at random and split into two groups of 50. The patients in this study were divided into two groups of 50 each. Group I received conjunctival autograft (CLAG) treatment, while Group II received amniotic membrane graft (AMG) treatment.

Age distribution in CLAG group is found to be less than 40 years is 13, and more than 40 years is 37. The mean age was  $46.3 \pm 10.93$  years (28-70 years) in AMG group, and 47.46 years (25-70 years) in CLAG group. According to Garg et al., the mean age of study participants was 39.69 years.[12]

#### Grading of pterygium

Most of the patients in the current study had a Grade 2 pterygium at the time of presentation, the pterygium encroaching 2-4mm onto the cornea 104 in number (AMG 49 and CLAG 55). Patients who presented with grade 1 pterygium, the pterygium encroaching <2 mm onto the cornea, came for cosmetic purpose. They are not considered for surgery and are advised for observation. Grade 3 pterygium is seen in 36 cases

(AMG 21 and CLAG 15), the pterygium encroaching >4 mm onto the cornea. At the time of presentation, it touched the pupillary margin or crossed the visual axis causing significant impairment of vision.

In other study conducted by Toker et al [13], grade 1 included are 8 (n=78), grade 2 included 39 and grade 3 include 26 in number which is correlating with present study.

#### **Clinical grading:**

In the current study, grade II, III, and IV pterygia were present in 53 (53 %), 27 (27 %), and 20 (20 %) of the total 100 patients, respectively, with the latter two grades pterygia covering the visual axis of the eyes.

According to Garg et al., study reported grade II, III, and IV pterygia were present in 38 (53.52 %), 19 (26.76 %), and 14 (19.72 %) of the 71 total patients, respectively, with the latter two grade pterygia covering the visual axis of the eyes.

#### **Astigmatism**

In the current study, 80 percent of patients in the conjunctival autograft group had 'with the rule astigmatism' prior to surgery. In the AMG group, 68 percent of patients had 'with the rule astigmatism'. The findings of this study back up previous reports that pterygium is a common cause of 'with the rule astigmatism'. This has positive correlation with the following studies:

Richard G. Lindsay study [14], Sejah maheswari study [15], and Hetal kumar yagnik et al. study.[16]

This supports the claim that pterygia presses against the cornea, flattens it, and thus increases the horizontal diameter of the corneal curvature.

In this study, the amount of astigmatism increases with pterygium grading ( $p < 0.000$ ).

This implies that pterygium surgery significantly improves astigmatism.

In the current study, there was a significant difference in the outcomes of the CLAG and AMG groups ( $P < 0.01$ ). As a result, this study concluded that astigmatism was reduced more effectively when pterygium excision surgery was performed using the amniotic membrane graft and conjunctival autograft techniques.

#### **BCVA changes**

In the present study, BCVA changes 3 months postoperatively were statistically significant, while Spherical and Cylindrical error changes were statistically insignificant in both groups. We discovered that pterygium excision surgery significantly improved visual acuity. Maheswari et al. discovered significant improvements in visual acuity following pterygium excision surgery in all

grades of pterygium. ( $P < 0.05$ ).

#### **UCVA**

On day 5, one month, and three months after surgery, the preoperative mean UCVA of  $0.57 \pm 0.48$  was significantly reduced to  $0.45 \pm 0.43$  ( $P < 0.001$ ),  $0.35 \pm 0.28$  ( $P < 0.0001$ ), and  $0.35 \pm 0.28$  ( $P < 0.0001$ ), respectively.

In contrast, Garg et al [12] found that the preoperative mean UCVA of  $0.56 \pm 0.49$  was significantly reduced to  $0.47 \pm 0.44$  ( $P < 0.001$ ),  $0.32 \pm 0.29$  ( $P < 0.0001$ ), and  $0.32 \pm 0.29$  ( $P < 0.0001$ ) on day 5, one month, and three months after surgery.

#### **Corneal Curvature Changes**

Postoperatively, there was a significant steepening of horizontal curvature in the conjunctival autograft group ( $p < 0.000$ ). There was no post-operative steepening of horizontal curvature in the AMG group ( $p > 0.05$ ). Post-operatively, there was a significant steepening of vertical curvature in the conjunctival autograft group ( $p < 0.015$ ). Post-operatively, there is a significant flattening of vertical curvature in the AMG group ( $p > 0.05$ ). When compared to the following studies, the conjunctival autograft group has a positive correlation.

#### **Comparison between two techniques**

In addition, we compared the change in corneal astigmatism after two pterygium surgery techniques: conjunctival autograft and amniotic membrane graft. Both techniques were found to have no significant effect on astigmatism ( $P = 0.751$ ). The postoperative astigmatism changes of the conjunctival autograft and amniotic membrane graft techniques were  $2.55 \pm 1.26$  D and  $2.67 \pm 1.44$  D, respectively, at 3 months. The astigmatic changes caused by the conjunctival autograft technique and the amniotic membrane graft technique differed significantly. However, the difference between conjunctival autograft and amniotic membrane graft techniques was not statistically significant.

We prefer amniotic membrane grafting because it can be used in cases with very large conjunctival defects after pterygium excision and where bulbar conjunctiva is required for future glaucoma filtration surgery. However, the amniotic membrane technique's widespread use in pterygium surgery is hampered by its high cost.

#### **Post-operative complications**

Patients are followed up on at post-operative day 5, one month, and three months. In postoperative day 1, patients complained mainly of foreign body sensation, watering, redness and mild pain which is more complained in CLAG group than in AMG



group. These complaints subsided with topical steroid and antibiotic combination which is advised for 1 month duration.

On follow up visit in 1 month most of these complaints subsided and improvement of vision is observed in some cases. In some of the other cases where there is significant cataract present no visual improvement is seen with pterygium excision. For 1 month follow-up, corneal scar in visual axis occurred in 15 cases in AMG, and 10 cases in CLAG group respectively. On infection in AMG group, graft retraction in both groups each, dellen in both groups each. Recurrence is not observed by 1<sup>st</sup> month.

### Graft related complications

#### Graft Retraction

Graft retraction is seen in 2 cases of CLAG and 1 case of AMG. Graft retraction is observed in all cases on the first post-operative day. This may be due to bare area not corresponding in size to graft size which can be avoided if graft slightly oversized to bare area is used. Displacement of graft during removal of lid speculum without firm adhesion between graft and glue can result in graft retraction. Premature removal of eye patch and frequent rubbing can also result in this. This is reduced in our study by removing patch till next day and advising patient to avoid rubbing or any trial trauma. In already retracted graft which is seen in 2 cases in CLAG in our study if it is partial, it is adjusted and sutured with 8.0 vicryl and in other case it is replaced with AMG. 1 case is seen in AMG for which redrafting is done.

In a study by Nazulla Khan et al [17], graft retraction is seen in 3 cases of conjunctival auto grafting (10%).

#### Graft infection

This is observed in 1 case of AMG in our study as graft melting, which is treated with topical antibiotic and lubricants. In study by Fernandes et al [18] infection is seen in 0.3% cases. Other graft related complications like graft necrosis, graft rejection and surgically induced necrotizing scleritis is not observed in our study this may be due not using sutures and electro cautery.

#### Graft Inflammation

Inflammation is more intense following pterygium excision observed more after CLAG with glue to AMG with glue. It could be due to the anti-angiogenic and anti-inflammatory properties of the amniotic membrane. Topical steroid in tapered dose is advised to reduce inflammation. Prashbasawat et al.[19] reported that sublesional triamcinolone and 5 fluor-uracil are effective in halting inflammation.

#### Graft oedema

This is seen in CLAG cases in the early post-operative period due to graft handling. However, with the use of topical antibiotic-steroid drops, this was resolved within three weeks. However, graft edema in the AMG group is mild and usually resolved within a week. This could be attributed to more extensive handling of the donor conjunctival tissue in CLAG leading to more surgical trauma to the tissue and more inflammation. At 8-10 days postoperatively, graft edema resolved without intervention.

#### Subconjunctival Hemorrhage

It is defined as bleeding underneath conjunctival graft. It is assumed that it causes inflammation, which contributes to the recurrence of the condition. This is most commonly associated with CLAG group than in AMG. This could be due to excessive manipulation of tissue, systemic diseases like hypertension and any bleeding diathesis which are predisposing factors. In our study electro cautery is not used as it results in other complications like scleral necrosis, perforation instead epinephrine is used intraoperatively. This is self-limiting condition which is managed with steroids.

#### Host and donor site complications

##### Lid Oedema

This is observed in 5 cases which may be due to peribulbar block complication. Patients are advised for observation and lubrication.

##### Pyogenic Granuloma

By 1 month postoperatively, this is seen in two cases, one in the AMG group and one in the CLAG group.

This may be due to retained subconjunctival tissue and inadvertent removal of tenon's tissue along with graft. These cases underwent excision of granuloma and regrafting with AMG followed with intense steroids in tapering dose.

Similar findings reported by Sangeeta *et al* [20], with 2 cases each of pyogenic granuloma (8%) in both the groups are observed. Similar findings of pyogenic granuloma are reported by Pramod et al [21] following CLAG (8%), this may be due to graft suturing only with adjacent conjunctiva and not with underlying episclera.

##### Dellen

This is observed in 2 cases in AMG and 3 cases in CLAG which may be due to faulty technique in excessive scraping on cornea. These cases are managed by decreasing steroid dose, increasing lubrication and observation.

### Epithelial inclusion cyst

This is seen in one case of AMG and could be caused by embedded conjunctiva epithelium. The cyst was removed, and re-grafting was performed.

### Recurrence

Secondary fibrovascular growth across the cornea onto the limbus following primary pterygium excision is referred to as recurrence.

In the present study, Recurrence is seen in 1 case following pterygium excision with CLAG and in 4 cases following pterygium excision with AMG. The recurrence rate of amniotic membrane grafting was higher than that of conjunctival limbal auto grafting, but the difference was not statistically significant. ( $p=0.189$ ).

In AMG group recurrence seen in with mean age is 44.85 years, in occupation involving outside work. Mean duration of recurrence noted is about 3. Re-surgery is done with CLAG.

In CLAG group recurrence is seen in 1 case with age of 58 years. This case has exposure to dust and UV radiation. Mean age of recurrence is found to be 3 months. Re surgery is done in these cases with CLAG and MMC.

In a study conducted by Toker E et al.[13], two eyes (5.4%) in the CAG group experienced corneal recurrence, while five eyes (13.8%) in the amniotic membrane graft group experienced recurrence; one limbal (2.7%), four corneal recurrences were observed (11.1 percent).

CLAG may contain limbal stem cells, which restore the limbal barrier and thus prevent recurrence, in addition to the contact inhibition effect on residual abnormal tissue.

AMG has the advantage of no pain, inflammation, or risk in the donor site, easier to handle and suture (AMG is thicker and more elastic), larger sizes of graft available for larger primary or two headed pterygium, quicker patient recovery without going through the chemosis phase, save the donor site for glaucoma or other uses, especially in young patients.

There was no significant difference in postoperative astigmatism between the amniotic membrane graft and conjunctival autograft techniques in this study. However, amniotic membrane grafting is the preferred technique because it can be used in cases with very large conjunctival defects following pterygium excision and where bulbar conjunctiva is required for future glaucoma filtration surgery. However, the amniotic membrane technique's widespread use in pterygium surgery is hampered by its high cost.

### Conclusions

Pterygium excision surgeries utilizing amniotic membrane graft and conjunctival autograft techniques were found to be more effective in reducing astigmatism.

There was a significant difference in the astigmatic changes between the conjunctival autograft and amniotic membrane graft techniques.

Higher association of UV and dust exposure with risk of pterygium is observed.

Recurrence of pterygium is found to be in relation to younger/middle age and outside work.

Both AMG and CLAG are considered to be safe procedures for primary pterygium excision without any sight threatening complications

CLAG is relatively difficult procedure with time consuming, but it is found to be more effective in decreasing recurrence than AMG.

Surgical excision can significantly reduce pterygium-induced astigmatism. Hence, visual acuity improves as well. The different types of pterygium surgeries such as amniotic membrane graft and conjunctival autograft resulted in significant reductions in corneal astigmatism. Study shows that amniotic membrane graft and conjunctival autograft are superior surgical techniques.

### References

1. Michael R, Craig A Skolnick Management of pterygium. Krachmer JH, Mannis MJ, Holland EJ. Cornea. 2<sup>nd</sup> ed. Mosby Elsevier, volume 2 :1749-1761.
2. Walton HH. A practical treatise on the diseases of the eye. 3rd ed. J and A Church- ill. London.1875:435-7
3. Hirst LW. Distribution, risk factors, and epidemiology of pterygium. Pterygium, Ku-gler Publications, The Hague, The Netherlands. 2000:15-27.
4. Cameron ME: Pterygium throughout the world. Springfield, Ill: Charles C. Thomas, 1965;141:171.
5. Saleem M, Muhammad L. Pterygium and Dry Eye-A clinical study. Journal of Post-graduate Medical Institute (Peshawar-Pakistan). 2004; 18:558-562.
6. Dushku N, Reid TW. Immunohistochemical evidence that human pterygia originate from an invasion of vimentin-expressing altered limbal epithelial basal cells. Curr Eye Res. 1994 Jul;13(7):473-81.
7. Oldenburg JB, Garbus J, McDonnell JM, McDonnell PJ. Conjunctival pterygia. Mechanism of corneal topographic changes. Cornea. 1990 Jul;9(3):200-4.
8. Rosenthal JW. Chronology of pterygium

- therapy. *Am J ophthalmol.* 1953 Nov; 36(11):1601-16.
9. Hirst LW. The treatment of pterygium. *Surv ophthalmol.* 2003 Mar-Apr ;48(2):145-80.
  10. Demartini DR, Vastine DW. Pterygium. Surgical intervention in corneal and external diseases. ed Abbott RL (Grune and Stratton, Orlando, USA). 1987:141-53.
  11. Tseng SC, Chen JJ, Huang AJ, Kruse FE, Maskin SL, Tsai RJ. Classification of conjunctival surgeries for corneal diseases based on stem cell concept. *Ophthalmol Clin North Am.* 1990;3(4):595-610.
  12. Garg P, Sahai A, Shamshad MA, Tyagi L, Singhal Y, Gupta S. A comparative study of preoperative and postoperative changes in corneal astigmatism after pterygium excision by different techniques. *Indian J Ophthalmol* 2019; 67:1036-9
  13. Toker E, Eraslan M. Recurrence after primary pterygium excision: amniotic membrane transplantation with fibrin glue versus conjunctival autograft with fibrin glue. *Current eye research.* 2016 Jan 2;41(1):1-8.
  14. Lindsay R G, Sullivan L. Pterygium induced corneal astigmatism, case report. *Clinical and Experimental Optometry* 2001; 84; 4: 200-03
  15. Maheswari S, Pterygium-induced corneal refractive changes. *Indian Journal of Ophthalmology* September-October 2007; 55(5): 383-86.
  16. Yagnik H K, Billore O P, Das S, et al. Corneal Topographical Changes after Pterygium Excision Surgery: A Reason to Smile. *All India Ophthalmic Conference Proceedings* 2008:27-29.
  17. Khan N, Ahmed M, Baseer A. To compare the recurrence rate of pterygium excision with bare sclera, free conjunctival autograft and amniotic membrane grafts. *Pak J Ophthalmol.* 2010;26(3):138-42.
  18. Fernandes M, Sangwan VS, Bansal AK, Gangopadhyay N, Sridhar MS, Garg P, Aasuri MK, Nutheti R, Rao GN. Outcome of pterygium surgery: analysis over 14 years. *Eye.* 2005 Nov 1;19(11):1182-90.
  19. Prabhasawat P, Barton K, Burkett G, Tseng SC. Comparison of conjunctival autografts, amniotic membrane grafts, and primary closure for pterygium excision. *Ophthalmology.* 1997 Jun 30;104(6):974-85.
  20. Adnan Alam, Mubashir Rehman, Bilal Khan, Khurshid Alam, Adnan Ahmad Comparison of Pterygium Resection with Conjunctival Auto Graft Versus Amniotic Membrane Graft *Pakistan Journal of Ophthalmology.* 2015 Oct;31(4):183.
  21. Pramod Kumar Chhawania, Prashant Raj Pipariya. A Comparative Study of Conjunctival Limbal Autograft and Amniotic Membrane Transplantation in Management of Pterygium. *Journal of Evolution of Medical and Dental Sciences* April 2014;3(15):3908-3918.