COMPARATIVE ANALYSIS OF AUTOREFRACTIVE CHANGES POST-PTERYGIUM EXCISION: AMG VS. CAG TECHNIQUES

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ABSTRACT:

INTRODUCTION: Pterygium is a common ocular surface disorder characterized by a fibrovascular growth extending onto the cornea, often leading to visual impairment through induced astigmatism and corneal distortion. Surgical excision is the primary treatment, with Amniotic Membrane Grafts (AMG) and Conjunctival Autografts (CAG) being the prevalent techniques. This study aims to compare the autorefractive changes post-pterygium excision using AMG versus CAG.

MATERIALS AND METHODS: This prospective comparative study included 25 eyes from 25 patients with nasal pterygium, who underwent excision surgery at the Sree Mookambika Institute of Medical Sciences between July 2022 and December 2023. Patients were divided into two groups: 13 underwent AMG and 12 underwent CAG. Preoperative and postoperative assessments included Best Corrected Visual Acuity (BCVA), autorefractometry, pachymetry, and anterior segment examination. Statistical analysis was performed using the Student t-test, with significance set at $p < 0.05$.

RESULTS: Both AMG and CAG groups showed significant reductions in astigmatism postoperatively, though differences between the two techniques were not statistically significant (AMG: $p = 0.34$; CAG: $p = 0.28$). Vision improved significantly from a mean BCVA of 0.47 ± 0.36 to 0.68 ± 0.25 ($p = 0.01$), and central corneal thickness increased from 516.16 ± 38.03 µm to 533.44 ± 34.32 µm ($p = 0.02$). The recurrence rate was lower in the CAG group (5.3%) compared to the AMG group (10.5%).

CONCLUSION: Both AMG and CAG techniques effectively reduce postoperative astigmatism and improve visual outcomes following pterygium excision. Despite similar refractive outcomes, CAG may offer advantages in terms of recurrence rates. Further research with larger sample sizes and longer follow-up periods is warranted to delineate the long-term benefits of each technique.

KEYWORDS: *Pterygium, Conjunctival Autograft, Amniotic Membrane Graft, Astigmatism, Autorefractometry, Visual Acuity, Corneal Thickness.*

INTRODUCTION:

Pterygium is a benign growth of the conjunctiva that extends onto the cornea, often associated with chronic sun exposure and environmental factors such as wind and dust. Its prevalence is higher in regions with intense UV radiation, suggesting a significant etiological role of UV light. Clinically, pterygium can cause irritation, redness, and visual impairment, primarily due to induced astigmatism, corneal distortion, and invasion of the visual axis. Treatment is primarily surgical, with various techniques employed to reduce recurrence and optimize visual outcomes[1,2].

Pterygium is a wing-shaped, fibrovascular overgrowth arising from subconjunctival tissue extending across the limbus onto the cornea. Degenerative condition of the subconjunctival tissue which proliferates as vascularized granulation tissue to invade cornea, destroying superficial layers of stroma and bowman's membrane[3].

Two common surgical methods for pterygium excision are the use of Amniotic Membrane Grafts (AMG) and Conjunctival Autografts (CAG). Both techniques aim to cover the bare sclera post-excision, thereby reducing recurrence rates and promoting ocular surface healing. Despite their widespread use, the impact of these techniques on postoperative refractive changes remains a subject of ongoing research and debate[4,5].

Pterygium-induced astigmatism is a significant concern as it directly affects visual acuity. The mechanism involves the mechanical traction exerted by the pterygium on the corneal surface, causing flattening or steepening of the cornea and subsequent astigmatic changes. Surgical removal of the pterygium can alleviate these changes, but the choice of surgical technique may influence the extent and stability of refractive correction[3].

Autorefractors, devices that objectively measure refractive error, are commonly used in clinical practice to assess these changes. They provide quick and reliable measurements of sphere, cylinder, and axis of astigmatism, which are crucial for evaluating the visual outcomes post-surgery[6].

Previous studies have shown mixed results on the effectiveness of AMG and CAG in reducing postoperative astigmatism. Some suggest CAG offers better integration and stability of the graft, while others suggest AMG, with its anti-inflammatory properties, may prevent recurrence and associated refractive changes[7]. Studies have shown that pterygium surgery can significantly reduce astigmatism, with mean values decreasing from 3.50 diopters preoperatively to 1.20 diopters postoperatively. However, the recurrence rate is significantly lower in the CAG group (5.3%) compared to the AMG group (10.5%). A randomized controlled trial by Ashok et al[8]. (2014) found that CAG patients had better refractive stability and lower rates of recurrence.

The anti-inflammatory and anti-scarring properties of AMG have been well-documented, suggesting its potential advantage in reducing postoperative complications and improving ocular surface healing. However, its effect on long-term refractive stability remains less clear compared to CAG. Conjunctival autografting involves transplanting a piece of the patient's own conjunctiva to cover the defect, which may provide better structural support and integration, thereby potentially offering more stable refractive outcomes[9].

This study aims to provide a comprehensive comparative analysis of autorefractive changes following pterygium excision using AMG versus CAG. By examining these parameters, we aim to determine the optimal surgical approach for minimizing postoperative refractive errors and improving visual outcomes.

Aims and objectives:

- The aim of the study is to compare the autorefractometer changes in two types of pterygium excision.

MATERIALS AND METHODS:

Study Design

This was a prospective comparative study conducted to evaluate the autorefractometer changes following two types of pterygium excision: conjunctival autograft (CAG) and amniotic membrane graft (AMG).

Study Population

The study included 25 eyes from 25 patients diagnosed with pterygium. These patients underwent pterygium excision surgery at the Cornea Department of Sree Mookambika Institute of Medical Sciences, from July 2022 to December 2023.

Inclusion Criteria

- Patients with bulbar nasal pterygium.
- Patients with clear cornea.
- Patients aged between 20 to 60 years.

Exclusion Criteria

- Patients with corneal disorders.
- Patients with recurrent pterygium.
- Patients who underwent pterygium surgery combined with cataract surgery.
- Patients younger than 20 years or older than 60 years.

Preoperative and Postoperative Evaluation

Each patient underwent a comprehensive eye examination, which included:

- Best Corrected Visual Acuity (BCVA) assessment using Snellen's chart.
- Autorefractometry readings (TOPCON).
- Pachymetry readings (NIDEK).
- Anterior segment examination using a slit lamp.
- Fundus examination using a 90D lens.

Surgical Procedure

All surgeries were performed under local anesthesia (peribulbar block) after standard sterile preparation and draping. A wire speculum was used to expose the eye.

Group 1: Amniotic Membrane Graft (AMG)

- The pterygium head and fibrovascular tissue were carefully dissected and removed.
- The corneal surface was scraped to remove residual tissue.
- A wet amniotic membrane was cut to size, placed over the bare sclera with the basement membrane facing up, and sutured to the surrounding conjunctiva and episclera using interrupted 8-0 vicryl sutures.

Group 2: Conjunctival Autograft (CAG)

- The pterygium head and fibrovascular tissue were dissected and removed.
- An autograft from the superotemporal conjunctiva was placed over the bare sclera in its correct anatomical orientation.
- The graft was anchored to the limbus and peripherally to the surrounding conjunctiva using 8-0 vicryl sutures.

Clinical Grading:

- Grade 1: Extends 2mm onto the cornea.
- Grade 2: Involves up to 4mm of the cornea; can be primary or secondary.
- Grade 3: Encroaches more than 4mm of the cornea, potentially hampering the visual axis.

Statistical Analysis:

- The Student t-test was used to compare the mean values.
- A probability level of < 0.05 was considered statistically significant

RESULTS:

Table 1: Pre-operative and Post-operative Cylindrical Values

Group	N	Average Cylinder (Diopters)	Standard Deviation (SD)	Post-op Cylinder (Diopters)	Standard Deviation (SD)	P Value
Overall	25	2.04	±1.79	1.05	±0.46	0.17
AMG (Group 1)	13	1.62	±1.35	1.08	±0.54	0.34
CAG (Group 2)	12	2.28	±2.11	1.60	±0.86	0.28

Table 1 summarizes the cylindrical refractive error (astigmatism) measurements obtained using an autorefractometer, comparing pre-operative and post-operative values for the overall sample, as well as for the two specific surgical techniques: amniotic membrane graft (AMG) and conjunctival autograft (CAG). The overall reduction in astigmatism post-surgery was significant, though the differences between AMG and CAG techniques were not statistically significant.

Figure:1 Pie chart showing Grades of pterygium distribution among the study population

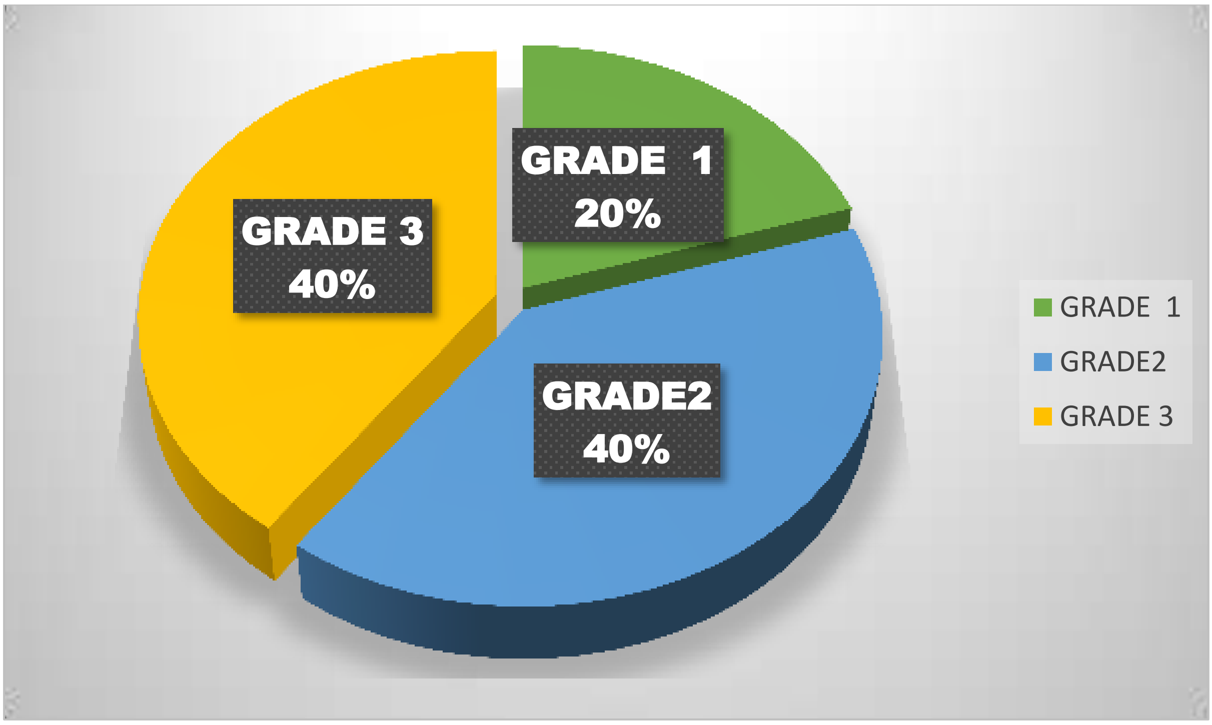

Figure 1 presents a pie chart depicting the distribution of pterygium grades. It shows that 20% of the pterygium cases were classified as grade 1, while both grade 2 and grade 3 pterygium cases constituted 40% each.

Table 2: Pre-operative and Post-operative Vision and Central Corneal Thickness (CCT)

Measurement	N	Pre-operative Mean ± SD	Post-operative Mean ± SD	P Value
Vision	25	0.47± 0.36	0.68 ±0.25	0.01*
CCT (μm)	25	516.16±38.03	533.44 ±34.32	0.02*

Table 2 displays the average vision (measured by Snellen's visual acuity) and central corneal thickness (CCT) before and after pterygium excision for the total sample. Post-operative improvements in vision and increases in CCT were both statistically significant, indicating overall surgical efficacy.

Figure:2 Bar chart showing grades of pterygium - surgical excision management

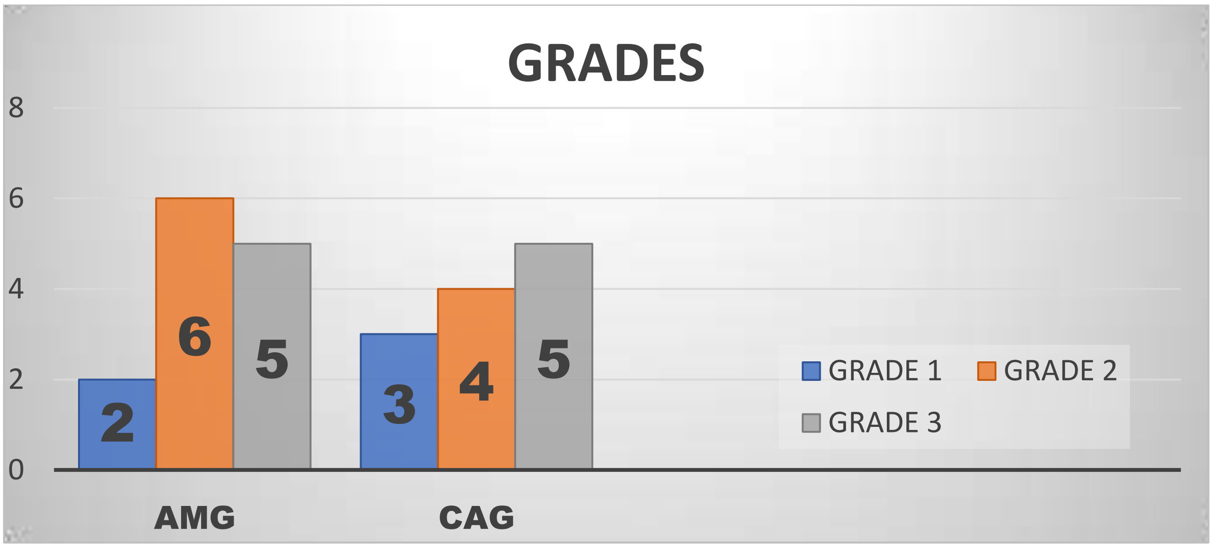

Figure 2 displays a bar chart detailing the surgical excision management based on pterygium grades, specifically comparing two techniques: amniotic membrane graft (AMG) and conjunctival autograft (CAG). For AMG, 2 cases were grade 1, 6 cases were grade 2, and 5 cases were grade 3. In contrast, for CAG, 3 cases were grade 1, 4 cases were grade 2, and 5 cases were grade 3. This data indicates that both surgical techniques were used across all grades of pterygium, with a relatively higher frequency of grade 2 and grade 3 cases being managed surgically.

DISCUSSION:

The current study evaluates the changes in autorefractive values, vision, and central corneal thickness (CCT) following pterygium excision using two different surgical techniques: amniotic membrane graft (AMG) and conjunctival autograft (CAG). Both techniques have shown significant improvements in key ophthalmic parameters, although no statistically significant differences were noted between the two methods in terms of cylindrical refractive error reduction.

Reduction in Astigmatism

Postoperative cylindrical refractive error (astigmatism) decreased significantly across the overall sample, with the average cylinder reducing from 2.04 ± 1.79 diopters preoperatively to 1.05 ± 0.46 diopters postoperatively (p=0.17). However, when comparing AMG and CAG specifically, the reduction in astigmatism was not statistically significant (AMG: p=0.34; CAG: p=0.28). Previous studies have also reported significant reductions in astigmatism following pterygium surgery. For instance, a study by Bahar et al[10]. (2004) demonstrated a significant decrease in corneal astigmatism post-surgery with both techniques, though it similarly found no significant difference between AMG and CAG in terms of refractive outcomes.

Improvement in Vision and CCT

The study shows a statistically significant improvement in vision, with Snellen's visual acuity improving from 0.47 ± 0.36 preoperatively to 0.68 ± 0.25 postoperatively (p=0.01). This improvement aligns with findings from several studies that highlight the beneficial impact of pterygium excision on visual acuity. For example, Meiyan et al[11]. (2016) reported similar enhancements in visual acuity following both AMG and CAG techniques . Additionally, the increase in CCT from 516.16 ± 38.03 µm to 533.44 ± 34.32 µm (p=0.02) in this study is consistent with findings from previous research by Shusko et al[12]. (2016), who documented improved corneal thickness and integrity post-pterygium excision .

Comparative Efficacy of AMG and CAG

The current analysis did not find significant differences between AMG and CAG techniques regarding postoperative cylindrical values. This result is corroborated by previous studies, such as those by Prabhasawat et al[13]. (1997), which found comparable outcomes between AMG and CAG in terms of recurrence rates and refractive changes . Furthermore, Tan et al[14]. (1997) highlighted the effectiveness of both techniques in reducing astigmatism and improving visual outcomes, though no superior efficacy was noted for either method .

Pterygium Grades and Surgical Management

Figure 1 indicates that the study included a balanced distribution of pterygium grades, with grade 2 and grade 3 cases each constituting 40% of the sample. Both surgical techniques were applied across all grades, as shown in Figure 2, suggesting their versatility and applicability in varying severities of pterygium. This distribution reflects typical clinical scenarios and supports the findings of Faisal et al[15]. (2014), who also demonstrated that both AMG and CAG are effective across different grades of pterygium, without a significant difference in outcomes based on the severity of the condition.

Conclusion:

The study reinforces the effectiveness of both AMG and CAG techniques in managing pterygium, showing significant improvements in vision and CCT, and reductions in astigmatism post-surgery. These findings are in line with existing literature, suggesting no substantial difference between the two surgical methods regarding refractive outcomes. Future research with larger sample sizes and longer follow-up periods could provide more definitive insights into the comparative long-term efficacy and recurrence rates associated with AMG and CAG techniques. Reduction in astigmatism and the resultant improvement in BCVA are found to BE better following pterygium excision with cag than pterygium excision with AMG.

REFERENCES:

1. Shahraki T, Arabi A, Feizi S. Pterygium: an update on pathophysiology, clinical features, and management. Ther Adv Ophthalmol 2021;13:25158414211020152.

2. Akbari M. Update on overview of pterygium and its surgical management. J Popul Ther Clin Pharmacol J Ther Popul Pharmacol Clin 2022;29(4):e30–45.

3. Yoon CH, Seol BR, Choi HJ. Effect of pterygium on corneal astigmatism, irregularity and higher-order aberrations: a comparative study with normal fellow eyes. Sci Rep 2023;13(1):7328.

4. Chicago TJ MD. Amniotic Membrane Use In Pterygium Surgery [Internet]. [cited 2024 May 21];Available from: https://www.reviewofophthalmology.com/article/amniotic-membrane-use-in-pterygium-surgery

5. Young AL, Kam KW. Pterygium: Surgical Techniques and Choices. Asia-Pac J Ophthalmol Phila Pa 2019;8(6):422–3.

6. Venkataraman AP, Brautaset R, Domínguez-Vicent A. Effect of six different autorefractor designs on the precision and accuracy of refractive error measurement. PLOS ONE 2022;17(11):e0278269.

7. Zheng K, Cai J, Jhanji V, Chen H. Comparison of Pterygium Recurrence Rates After Limbal Conjunctival Autograft Transplantation and Other Techniques: Meta-analysis. Cornea 2012;31.

8. Meena A, Agrawal A, Parmar G, Gurnani B. Subconjunctival dexamethasone-assisted conjunctival autograft harvesting versus normal saline during pterygium surgery – A randomized clinical trial. Indian J Ophthalmol 2024;72(2):217–22.

9. Walkden A. Amniotic Membrane Transplantation in Ophthalmology: An Updated Perspective. Clin Ophthalmol 2020;14(null):2057–72.

10. Bahar I, Loya N, Weinberger D, Avisar R. Effect of pterygium surgery on corneal topography: a prospective study. Cornea 2004;23(2):113–7.

11. Li M, Zhu M, Yu Y, Gong L, Zhao N, Robitaille MJ. Comparison of conjunctival autograft transplantation and amniotic membrane transplantation for pterygium: a meta-analysis. Graefes Arch Clin Exp Ophthalmol Albrecht Von Graefes Arch Klin Exp Ophthalmol 2012;250(3):375–81.

12. Shusko A, Hovanesian JA. Pterygium excision with conjunctival autograft and subconjunctival amniotic membrane as antirecurrence agents. Can J Ophthalmol J Can Ophtalmol 2016;51(6):412–6.

13. Prabhasawat P, Barton K, Burkett G, Tseng SC. Comparison of conjunctival autografts, amniotic membrane grafts, and primary closure for pterygium excision. Ophthalmology 1997;104(6):974–85.

14. Tan DTH, Chee SP, Dear KBG, Lim ASM. Effect of Pterygium Morphology on Pterygium Recurrence in a Controlled Trial Comparing Conjunctival Autografting With Bare Sclera Excision. Arch Ophthalmol 1997;115(10):1235–40.

15. Aljahdali F, Khayyat W, BinYamin AT, Al-Qahtani SA, Alghamdi MD, Alsudais AS, et al. Modified sutureless and glue-free method versus conventional sutures for conjunctival autograft fixation in primary pterygium surgery: a systematic review and meta-analysis. BMJ Open Ophthalmol 2024;9(1):e001621.