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# Visual Acuity Improvement After Conjunctival Autograft Versus Mitomycin-C in Primary Pterygium Surgery

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**Abstract** **Original Research Article**

***Background:*** Pterygium is a common ocular surface disease that can impair vision through induced astigmatism and corneal encroachment. Among the various surgical options, conjunctival autograft and intraoperative Mitomycin-C (MMC) are widely used, but their comparative impact on postoperative visual outcomes and complications remains inadequately explored. ***Methods:*** This prospective study included patients undergoing primary pterygium surgery in two groups: Group A (conjunctival autograft) and Group B (MMC). Visual acuity, pterygium grading, postoperative symptoms and complications were assessed preoperatively and at multiple follow-up intervals from the first postoperative day to the sixth postoperative month. Statistical significance was set at $p < 0.05$. ***Results:*** The mean age was significantly lower in Group A than Group B (36.77 ± 10.05 vs. 42.66 ± 10.31 years, p=0.018). Preoperative pterygium grading showed no significant difference between the groups (p=0.606). Visual acuity improved progressively in both groups, with 37.1% of Group A and 28.6% of Group B achieving 6/6 vision by the sixth postoperative month (p=0.102). Mean visual acuity scores showed a consistent downward trend (improvement) over time in both groups. Symptom scores for congestion and photophobia decreased markedly postoperatively, though a slight rise at the sixth month was more pronounced in the MMC group. Postoperative complications were significantly higher in Group B (54.3%) than Group A (11.5%), with itching and delayed wound healing being most common. ***Conclusion:*** Both procedures improved visual outcomes, but conjunctival autograft demonstrated superior safety with markedly fewer complications.

**Keywords:** Pterygium, Conjunctival autograft, Mitomycin-C, Visual acuity, Postoperative complications.



## INTRODUCTION

Pterygium is a common ocular surface disorder characterized by a wing-shaped fibrovascular proliferation of conjunctival tissue extending onto the cornea [1]. Although its exact etiology remains multifactorial, chronic ultraviolet light exposure, environmental irritants, wind and dust are widely recognized as major contributing factors [2]. The condition is particularly prevalent in populations living in regions with intense sunlight and outdoor occupational exposure. Progressive pterygium may lead to significant visual disturbances through induced astigmatism, alteration of the ocular surface, tear film instability and direct encroachment onto the visual axis [3]. In addition to functional impairment, many patients seek treatment due to cosmetic concerns, recurrent irritation, redness and foreign-body sensation.

Surgical excision remains the mainstay of management for primary progressive pterygium, as medical therapy offers only symptomatic relief without halting disease progression [4]. Over the years, several surgical techniques have been introduced to minimize recurrence, a major challenge in pterygium management [5]. The traditional bare sclera technique, although simple, is associated with high recurrence rates. To improve outcomes, adjunctive measures such as conjunctival autografting and antimitotic agents, particularly Mitomycin-C (MMC), have been widely adopted [6].

Conjunctival autografting involves transplantation of a free conjunctival graft from the superior bulbar conjunctiva to the excision site [7]. This technique not only reduces recurrence but also restores the ocular surface more physiologically, resulting in favorable cosmetic and functional outcomes [8].

However, it is technically more demanding, requires longer surgical time and may lead to complications such as graft edema or retraction.

In contrast, MMC, an alkylating antineoplastic agent, is used intraoperatively to suppress fibroblast proliferation at the surgical site [9]. Its application has been shown to significantly reduce recurrence rates when compared with simple excision. Nevertheless, MMC carries potential risks, including delayed epithelial healing, scleral thinning, necrosis and secondary infections, particularly when used in higher concentrations or with prolonged exposure [10].

While numerous studies have evaluated recurrence and complication rates between conjunctival autograft and MMC-assisted excision, less emphasis has been placed on comparing visual acuity outcomes, especially in primary progressive pterygium [11]. Visual acuity improvement after surgery depends not only on successful removal of the fibrovascular tissue but also on the restoration of corneal curvature, reduction of inflammatory symptoms and prevention of postoperative complications [12]. Understanding how these two techniques differ in terms of vision-related outcomes is essential for optimizing patient care.

This study was designed to compare visual acuity improvement and related postoperative changes between patients treated with conjunctival autograft and those treated with intraoperative MMC following primary pterygium excision. By evaluating both functional and symptomatic outcomes over a structured follow-up period, the study aims to provide a more comprehensive understanding of which technique offers superior visual rehabilitation and overall patient benefit.

## METHODOLOGY & MATERIALS

This prospective study was conducted in the Department of Ophthalmology, Mymensingh Medical College Hospital and BNSB Eye Hospital, Mymensingh, from January 2008 to June 2009. A total of 80 eyes of 80 patients with primary progressive pterygium were selected on a random basis, with each patient considered as a single case. Due to the lack of sustained follow-up, we excluded 10 participants from the study cohort. The patients were divided into two equal groups: Group A included 35 patients treated with conjunctival autograft and Group B included 35 patients treated with intraoperative mitomycin-C. Allocation was initially done by lottery on the first day, followed by alternate assignment to the two groups on subsequent days. Eligible patients were between 20 and 65 years of age, included both sexes and represented various socioeconomic and educational backgrounds from rural and urban areas. Only healthy patients without local or systemic diseases were included. Patients with other ocular diseases, previous ocular surgery, recurrent pterygium, trauma, prior antimitotic therapy, cataract, glaucoma, systemic comorbidities, or those failing to complete follow-up were excluded.

A detailed history was recorded, including demographic information, ocular complaints, prior illnesses and drug history. Comprehensive ophthalmic examination was performed using Snellen's chart, torchlight, slit-lamp biomicroscopy, applanation tonometry, ophthalmoscopy and retinoscopy. Baseline clinical parameters included visual acuity, ocular adnexal condition, conjunctiva, cornea, anterior chamber, iris, pupil, lens, intraocular pressure and fundus. Routine investigations included complete blood count, ESR, bleeding and clotting time, fasting blood sugar, urine R/M/E, conjunctival swab for culture and ECG.

All surgeries were performed under topical 0.4% oxybuprocaine and local 2% lignocaine with adrenaline. In Group A, the pterygium head was dissected and excised, followed by placement of a conjunctival autograft secured with 10-0 nylon sutures. In Group B, after excision, sponges soaked in 0.02 mg/ml Mitomycin-C were applied to the bare sclera for 150 seconds, followed by copious saline irrigation. Postoperative assessments were performed at Day 1, Week 1, Week 3, Month 3 and Month 6, evaluating visual acuity, ocular symptoms, signs, intraocular pressure, recurrence and graded symptom scores. Data were analyzed using SPSS with appropriate statistical tests. Ethical approval was obtained and written informed consent was taken from all participants.

## RESULTS

**Table 1: Distribution of the patients age by the type of operation**

| **Age (in years)** | **Group A (n=35)** | **Group B (n=35)** | **p value** |
|---|---|---|---|
| 21–30 | 11 (31.4) | 6 (17.1) | |
| 31–40 | 14 (40.0) | 12 (34.3) | |
| 41–50 | 8 (22.9) | 7 (20.0) | |
| 51–60 | 2 (5.7) | 10 (28.6) | **0.018** |
| 61–65 | 0 (0.0) | 0 (0.0) | |
| Total | 35 (100.0) | 35 (100.0) | |
| **Mean ± SD** | **36.77 ± 10.05** | **42.66 ± 10.31** | |

 

Table 1 shows the distribution of patients' age by type of operation, revealing that most participants in Group A were 31–40 years old (40.0%), while Group B had a higher proportion in the 51–60 age range (28.6%). The mean age was lower in Group A (36.77 ± 10.05) compared to Group B (42.66 ± 10.31) and this difference was statistically significant (p=0.018).

**Table 2: Grading of pterygium in pre-operative two study group**

| Grading | Group A (n=35) | Group B (n=35) | p value |
|---|---|---|---|
| 1. Invasion <2 mm on the cornea | 2 (5.7) | 1 (2.9) | 0.606 |
| 2. Invasion 2.1–3 mm on the cornea | 12 (34.3) | 14 (40.0) | |
| 3. Invasion 3.1–4 mm on the cornea | 14 (40.0) | 12 (34.3) | |
| 4. Invasion 4.1–5 mm on the cornea | 7 (20.0) | 6 (17.1) | |
| 5. Invasion >5 mm on the cornea | 0 (0.0) | 2 (5.7) | |
| **Total** | **35 (100.0)** | **35 (100.0)** | |

Table 2 shows the grading of pterygium in the two pre-operative study groups, where most patients in both groups had invasion between 3.1–4 mm on the cornea (40.0% in Group A and 34.3% in Group B). Mild invasion <2 mm was uncommon, seen in only 5.7% of Group A and 2.9% of Group B. No statistically significant difference was observed between the groups (p = 0.606).

**Table 3: Distribution of the patients by visual acuity and type of operation by pre and post-operative follow up**

| Visual Acuity | Type of Operation | | Mean ± SD | p value |
|---|---|---|---|---|
| | Group A (n=35) | Group B (n=35) | Group A + Group B | |
| **Preoperative** | | | 2.34 ± 0.94 | 0.193 |
| 6/6 | 5 (14.3) | 5 (14.3) | 2.71 ± 1.38 | |
| 6/9 | 17 (48.6) | 16 (45.7) | | |
| 6/12 | 11 (31.4) | 6 (17.1) | | |
| 6/24 | 2 (5.7) | 8 (22.9) | | |
| **1st post operative day** | | | | |
| 6/6 | 5 (14.3) | 7 (20.0) | 2.31 ± 0.87 | 0.395 |
| 6/9 | 17 (48.6) | 16 (45.7) | 2.57 ± 1.40 | |
| 6/12 | 11 (31.4) | 4 (11.4) | | |
| 6/18 | 1 (2.9) | 1 (2.9) | | |
| 6/24 | 1 (2.9) | 7 (20.0) | | |
| **7th post operative day** | | | | |
| 6/6 | 12 (34.3) | 13 (37.1) | 2.23 ± 1.24 | 0.854 |
| 6/9 | 11 (31.4) | 10 (28.6) | 2.29 ± 1.34 | |
| 6/12 | 7 (20.0) | 4 (11.4) | | |
| 6/18 | 2 (5.7) | 5 (14.3) | | |
| 6/24 | 3 (8.6) | 3 (8.6) | | |
| **3rd Post Operative Week** | | | | |
| 6/6 | 15 (42.9) | 16 (45.7) | 1.74 ± 0.78 | 0.513 |
| 6/9 | 15 (42.9) | 11 (31.4) | 1.89 ± 1.02 | |
| 6/12 | 4 (11.4) | 4 (11.4) | | |
| 6/18 | 1 (2.9) | 4 (11.4) | | |
| **3rd Post Operative Month** | | | | |
| 6/6 | 12 (34.3) | 9 (25.7) | 2.26 ± 1.29 | 0.095 |
| 6/9 | 12 (34.3) | 6 (17.1) | 2.80 ± 1.39 | |
| 6/12 | 4 (11.4) | 7 (20.0) | | |
| 6/18 | 4 (11.4) | 9 (25.7) | | |
| 6/24 | 3 (8.6) | 4 (11.4) | | |
| **6th Post Operative Month** | | | | |
| 6/6 | 13 (37.1) | 10 (28.6) | 2.06 ± 1.14 | 0.102 |
| 6/9 | 13 (37.1) | 11 (31.4) | 2.57 ± 1.44 | |
| 6/12 | 5 (14.3) | 3 (8.6) | | |
| 6/18 | 2 (5.7) | 6 (17.1) | | |
| 6/24 | 2 (5.7) | 5 (14.3) | | |

Table 3 shows the comparison of visual acuity outcomes between Group A and Group B at different postoperative intervals. Preoperatively, 48.6% of patients in Group A and 45.7% in Group B had a visual acuity of 6/9 (p = 0.193). On the first postoperative day, 14.3% of Group A and 20% of Group B achieved 6/6 vision (p = 0.395). By the 3rd postoperative month, 34.3% in Group A and 25.7% in Group B reached 6/6 vision, with mean visual acuity scores of 2.26 ± 1.29 and 2.80 ± 1.39, respectively (p = 0.095). At the 6th postoperative month, visual acuity continued to improve, with 37.1% in Group A and 28.6% in Group B achieving 6/6 vision (p = 0.102). Overall, both groups demonstrated progressive visual recovery over time, though the differences were not statistically significant.

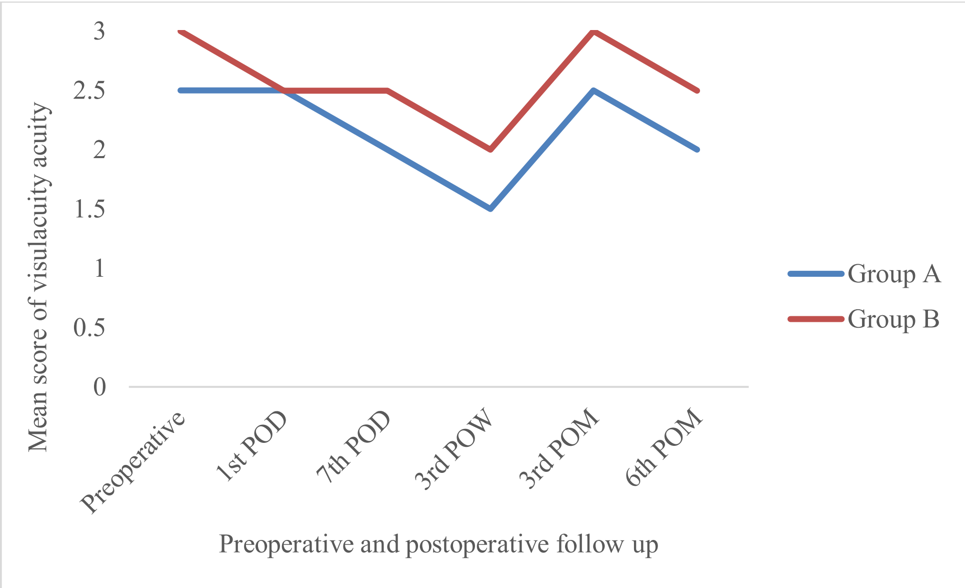


**Figure 1: Line graph shows distribution of the patients by visual acuity and type of operation by pre and post-operative follow up**

Figure 1 shows the mean visual acuity scores of the two groups across the preoperative and postoperative follow-up period. Preoperatively, Group A and Group B had scores of 2.5 and 3.0, respectively. The values remained similar at the 1st POD (2.5 in both groups), then declined by the 7th POD to 2.0 in Group A and 2.5 in Group B. The lowest scores were observed at the 3rd POW, with 1.5 in Group A and 2.0 in Group B. Improvement was seen again at the 3rd POM, reaching 2.5 and 3.0, followed by a slight decrease at the 6th POM to 2.0 in Group A and 2.5 in Group B.

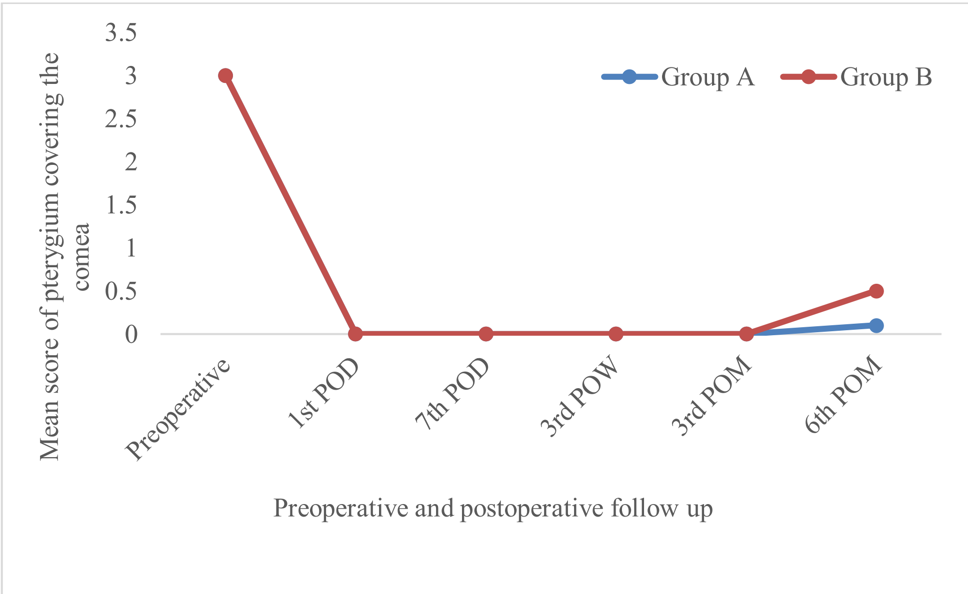

**Figure 2: Line graph shows distribution of the patient grading of pterygium by the type of operation by pre and post-operative follow up**

Figure 2 shows the mean score of pterygium congestion in both groups across the preoperative and postoperative follow-up period. Preoperatively, both Group A and Group B had a score of 3. From the 1st POD to the 3rd POM, the congestion score remained 0 in both groups. By the 6th POM, a slight increase was observed, with Group A reaching 0.1 and Group B reaching 0.5.

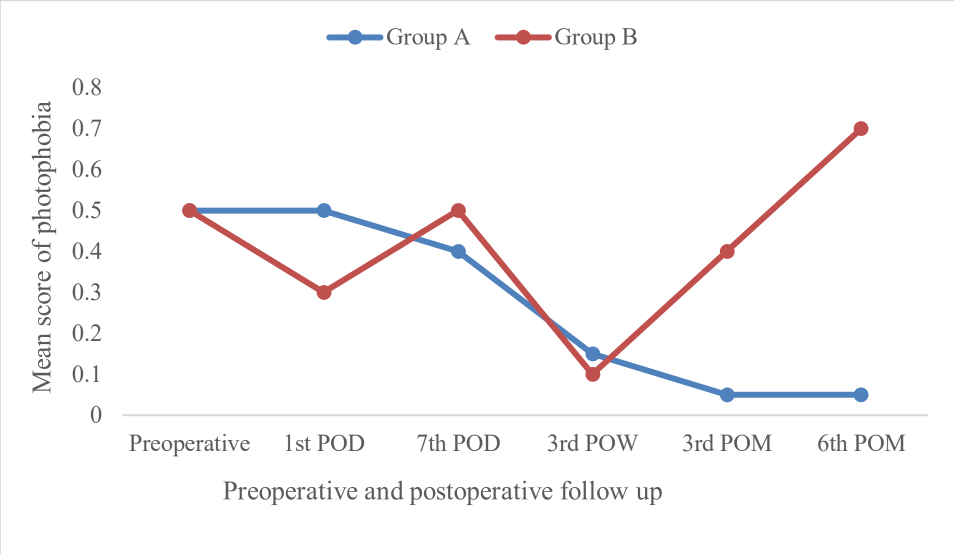


**Figure 3: Line graph shows distribution of the patients' symptoms (Photophobia) by the type of operation preoperative & post-operative follow up**

Figure 3 presents the mean photophobia scores in both groups across the preoperative and postoperative follow-up period. At baseline, Group A and Group B both had a score of 0.5. By the 1st POD, scores remained 0.5 in Group A but decreased to 0.3 in Group B. On the 7th POD, the values were 0.4 in Group A and 0.5 in Group B. The lowest scores were seen at the 3rd POW, with 0.15 in Group A and 0.1 in Group B. A slight rise occurred at the 3rd POM, reaching 0.05 in Group A and 0.4 in Group B, followed by a further increase at the 6th POM to 0.05 in Group A and 0.7 in Group B.

**Table 4: Distribution of the patients' post-operative complications by the type of operation**

| **Complication** | **Group A (n = 35)** | **Group B (n = 35)** |
|---|---|---|
| Superficial punctate keratitis | 0 (0%) | 3 (8.6%) |
| Conjunctival granuloma | 0 (0%) | 2 (5.7%) |
| Delayed wound healing | 1 (2.9%) | 4 (11.4%) |
| Itching | 2 (5.7%) | 9 (25.7%) |
| Anterior chamber reaction | 1 (2.9%) | 0 (0%) |
| Limbal avascularity | 0 (0%) | 1 (2.9%) |
| **Total** | **4 (11.5%)** | **19 (54.3%)** |

Table 4 shows the postoperative complications observed in both groups. Complications were more frequent in Group B (54.3%) compared to Group A (11.5%). The most common issue in Group B was itching (25.7%), followed by delayed wound healing (11.4%) and superficial punctate keratitis (8.6%). In contrast, Group A showed minimal complications, with only isolated cases of delayed wound healing (2.9%), itching (5.7%) and anterior chamber reaction (2.9%).

## Discussion

This study compared visual acuity improvement, postoperative symptoms and complications between conjunctival autograft and intraoperative Mitomycin-C (MMC) in primary pterygium surgery. Although both techniques resulted in progressive visual recovery over the six-month follow-up period, the pattern and magnitude of improvement differed, with the conjunctival autograft group demonstrating more favorable clinical outcomes in several domains.

Visual recovery was evident in both groups, with 37.1% of patients in the autograft group and 28.6% in the MMC group achieving 6/6 vision by the sixth postoperative month. Although this difference was not statistically significant, the trend favored the autograft procedure. The early postoperative visual patterns observed in this study initial decline followed by gradual improvement are consistent with reports by Yilmaz *et al*., who demonstrated that postoperative corneal remodeling and reduction of induced astigmatism contribute to improved acuity over time [13]. The slightly better functional outcomes in the autograft group may reflect more physiological ocular surface restoration compared to antimitotic therapy.

Regarding symptom resolution, congestion scores dropped sharply in both groups immediately after surgery and remained stable, although the MMC group showed a slight rise at the sixth month. Photophobia followed a similar pattern, but with a greater late increase in the MMC group (0.7 vs. 0.05), suggesting a more prolonged surface irritation. This is supported by findings from Kheirkhah *et al*., who reported higher rates of postoperative conjunctival inflammation after MMC-based procedures compared with tissue-based reconstruction [14].

Complications were significantly more common in the MMC group (54.3%) compared to the autograft group (11.5%). Itching, delayed wound healing and superficial punctate keratitis predominated among MMC-treated patients. These findings align with earlier reports showing that MMC, despite its efficacy in reducing recurrence, carries risks of epithelial toxicity and impaired wound healing. Hayasaka *et al*., described delayed complications such as scleral thinning and chronic irritation following MMC exposure [15]. Similarly, Abraham *et al*., highlighted that MMC disrupts fibroblast proliferation and may destabilize the ocular surface if not carefully dosed [16].

Conversely, conjunctival autografting produced fewer complications and maintained a stable ocular surface throughout follow-up. The safety advantage of autografts has been reported widely in the literature. Al Fayez found significantly lower complication rates and better ocular comfort in autograft-treated patients compared to MMC [17]. Kawano *et al*., also showed that conjunctival grafting promotes healthy epithelialization and provides long-lasting stability of the limbal microenvironment [18].

While MMC remains valuable in reducing recurrence, especially in complex or recurrent cases, its routine use in primary pterygium particularly at low to moderate grades remains debated [19, 20]. Nabawi *et al*. and Uçakhan & Kanpolat observed satisfactory outcomes with MMC in selected patients but emphasized the need for cautious application due to potential toxicity [21, 22]. Moreover, comparative studies such as Sodhi *et al*. and Amano *et al*., showed that while MMC effectively reduces recurrence, it does not consistently improve functional outcomes such as vision or symptoms when compared with tissue-based techniques [23, 24].

The findings of this study indicate that conjunctival autografting offers superior safety and comparable, if not better, visual rehabilitation relative to intraoperative MMC for primary pterygium. Although the differences in visual acuity did not reach statistical significance, the consistently lower complication profile and more favorable symptom recovery suggest that autografting remains the preferred technique for most primary cases.

**Limitations of the study**

This study has several limitations that should be considered when interpreting the findings. The sample size was modest, which may have limited the ability to detect statistically significant differences in visual outcomes between the conjunctival autograft and MMC groups. Follow-up was restricted to six months; although adequate for assessing early healing and symptom resolution, it may not fully capture long-term complications or recurrence patterns, which are crucial in pterygium research. The study also did not include objective corneal topographic measurements, which could have provided deeper insights into the mechanisms underlying visual acuity changes.

## CONCLUSION

Both conjunctival autograft and intraoperative MMC were effective in improving visual acuity and reducing postoperative symptoms in primary pterygium surgery. However, the conjunctival autograft demonstrated a more favorable safety profile, with substantially fewer complications and more stable symptom resolution over time. Although visual outcomes were similar between the two groups, the overall pattern of healing and comfort supports the autograft technique as the more reliable option for routine primary cases. MMC remains a valuable adjunct in selected situations, particularly where recurrence risk is high, but its potential for surface toxicity underscores the need for cautious use. The findings of this study reinforce the clinical value of autologous tissue-based reconstruction and highlight the importance of individualized surgical decision-making to optimize both safety and long-term visual rehabilitation.

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## REFERENCES

1. Sharma A, Gupta A, Ram J, Gupta A. Low-dose intraoperative mitomycin-C versus conjunctival autograft in primary pterygium surgery: long term follow-up. Ophthalmic Surgery, Lasers and Imaging Retina. 2000 Jul 1;31(4):301-7.
2. Ma DH, See LC, Liau SB, Tsai RJ. Amniotic membrane graft for primary pterygium: comparison with conjunctival autograft and topical mitomycin C

treatment. British journal of ophthalmology. 2000 Sep 1;84(9):973-8.
3. Frucht-Pery J, Raiskup F, Ilsar M, Landau D, Orucov F, Solomon A. Conjunctival autografting combined with low-dose mitomycin C for prevention of primary pterygium recurrence. American journal of ophthalmology. 2006 Jun 1;141(6):1044-50.
4. Segev F, Jaeger-Roshu S, Gefen-Carmi N, Assia EI. Combined mitomycin C application and free flap conjunctival autograft in pterygium surgery. Cornea. 2003 Oct 1;22(7):598-603.
5. Kim M, Chung SH, Lee JH, Lee HK, Seo KY. Comparison of mini-flap technique and conjunctival autograft transplantation without mitomycin C in primary and recurrent pterygium. Ophthalmologica. 2008 Aug 1;222(4):265-71.
6. Young AL, Leung GY, Wong AK, Cheng LL, Lam DS. A randomised trial comparing 0.02% mitomycin C and limbal conjunctival autograft after excision of primary pterygium. British journal of ophthalmology. 2004 Aug 1;88(8):995-7.
7. Narsani AK, Jatoi SM, Gul S, Dabir SA. Treatment of primary pterygium with conjunctival autograft and mitomycin CA comparative study. J Liaquat Uni Med Health Sci. 2008 Sep;7(4):184-7.
8. Mandour SS, Farahat HG, Mohamed HM. Preoperative subpterygial mitomycin C injection versus limbal conjunctival autograft transplantation for prevention of pterygium recurrence. Journal of ocular pharmacology and therapeutics. 2011 Oct 1;27(5):481-5.
9. Young AL, Tam PM, Leung GY, Cheng LL, Lam PT, Lam DS. Prospective study on the safety and efficacy of combined conjunctival rotational autograft with intraoperative 0.02% mitomycin C in primary pterygium excision. Cornea.
10. Narsani AK, Jatoi SM, Khanzada MA, Dabir SA, Gul S. Recurrence of pterygium with conjunctival autograft versus mitomycin C. Pakistan Journal of Ophthalmology. 2008 Mar 31;24(01).
11. Saleem MI, Channar MS, Saleem MF. Comparison of recurrence rate of Pterygium, Conjunctivalautograft versus Mitomycin-C adjuvant in pterygium surgery. Pakistan Journal of Medical Sciences. 2011 Apr 1;27(3).
12. Akinci A, Zilelioglu O. Comparison of limbal-conjunctival autograft and intraoperative 0.02% mitomycin-C for treatment of primary pterygium. International ophthalmology. 2007 Oct;27(5):281-5.
13. Yilmaz S, Yuksel T, Maden A. Corneal topographic changes after four types of pterygium surgery. Journal of Refractive Surgery. 2008 Feb 1;24(2):160-5.
14. Kheirkhah A, Nazari R, Nikdel M, Ghassemi H, Hashemi H, Behrouz MJ. Postoperative conjunctival inflammation after pterygium surgery with amniotic membrane transplantation versus conjunctival autograft. American journal of ophthalmology. 2011 Nov 1;152(5):733-8.
15. Hayasaka S, Iwasa Y, Nagaki Y, Kadoi C, Matsumoto M, Hayasaka Y. Late complications after pterygium excision with high dose mitomycin C instillation. The British Journal of Ophthalmology. 2000 Sep;84(9):1075.
16. Abraham LM, Selva D, Casson R, Leibovitch I. Mitomycin: clinical applications in ophthalmic practice. Drugs. 2006 Feb;66(3):321-40.
17. Al Fayez MF. Limbal versus conjunctival autograft transplantation for advanced and recurrent pterygium. Ophthalmology. 2002 Sep 1;109(9):1752-5.
18. Kawano H, Kawano K, Sakamoto T. Separate limbal-conjunctival autograft transplantation using the inferior conjunctiva for primary pterygium. Oman journal of ophthalmology. 2011 Sep 1;4(3):120-4.
19. Ma DH, See LC, Hwang YS, Wang SF. Comparison of amniotic membrane graft alone or combined with intraoperative mitomycin C to prevent recurrence after excision of recurrent pterygia. Cornea. 2005 Mar 1;24(2):141-50.
20. Tseng SC, Di Pascuale MA, Liu DT, Gao YY, Baradaran-Rafii A. Intraoperative mitomycin C and amniotic membrane transplantation for fornix reconstruction in severe cicatricial ocular surface diseases. Ophthalmology. 2005 May 1;112(5):896-903.
21. Nabawi KS, Ghonim MA, Ali MH. Evaluation of limbal conjunctival autograft and low-dose mitomycin C in the treatment of recurrent pterygium. Ophthalmic Surgery, Lasers and Imaging Retina. 2003 May 1;34(3):193-6.
22. Uçakhan ÖÖ, Kanpolat A. Combined 'symmetrical conjunctival flap transposition'and intraoperative low-dose mitomycin C in the treatment of primary pterygium. Clinical & experimental ophthalmology. 2006 Apr;34(3):219-25.
23. Sodhi PK, Verma L, Pandey RM, Ratan S. Comparison between the role of intraoperative mitomycin C and doxorubicin in preventing the recurrence of primary pterygium. Ophthalmic Research. 2005 Apr 22;37(1):1-6.
24. Amano S, Motoyama Y, Oshika T, Eguchi S, Eguchi K. Comparative study of intraoperative mitomycin C and β irradiation in pterygium surgery. British Journal of Ophthalmology. 2000 Jun 1;84(6):618-21.