Ilam University of Medical Sciences

Plant Biotechnology Persa

Online ISSN: 2676-7414

Homepage: https://pbp.medilam.ac.ir

A comparative study on surgical outcomes in primary pterygium excision using argon laser therapy versus bare sclera technique: A randomized prospective trial

Qader Motarjemizadeh[1], Naser Samadi Aidenloo [1]✉, Nazanin Khadem[1]

[1]Department of Ophthalmology, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran. Email: gmotarjemizadeh@gmail.com
[2]Department of Ophthalmology, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran. Email: dr.nasersamadi@yahoo.com
[3]Department of Ophthalmology, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran. Email:khadem.n@gmail.com
*Corresponding Author, [2]Department of Ophthalmology, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran. Email: dr.nasersamadi@yahoo.com

Article Info

Article type:
Original Article

Article History:
Received: 21 Jan 2023
Received in revised form: 07 March 2023
Accepted: 20 December 2023
Published online: 1 July 2024

Keywords:
Pterygium, Sclera, Laser therapy, Recurrence

Abstract

Objective: The frequency of recurrence is a critical factor in the utilization of different treatments for pterygium. The present study was undertaken to compare the pterygium recurrence rates after bare sclera excision with that of argon laser therapy.

Methods: Sixty eyes of 53 patients with primary pterygium were included in this prospective, interventional case series. The participants were randomly categorized into 2 groups each consisting of 30 subjects. In the first group, pterygium excision was performed using bare sclera technique whereas the second group received argon laser therapy alone. The patients were examined for pterygium recurrence and complications at postoperative 1 and 7 days as well as in months 1, 3, and 6 after the operation. All analyses were performed using SPSS software (version 17.0) and P-values less than 0.05 were considered significant.

Results: Pterygia recurred in 7 eyes (23.3 %) in the first group (*i.e.* bare sclera group) and in 4 eyes (13.3 %) in the second group (*i.e.* argon laser therapy group). The recurrence rate was not significantly different between the two groups. No ocular or systemic complication developed till the end of follow-up.

Conclusion: Argon laser photocoagulation of pterygium may be more favorable for patients with coagulopathy or a history of conjunctival surgery. The coagulation effect of the argon laser may prevent severe conjunctival bleeding, which may occur after surgical excision in patients with coagulopathy.

Introduction

Pterygium (Surfer's eye) is a benign ocular lesion characterized by a triangular fibrovascular growth from the bulbar conjunctiva on to the cornea [1-5]. It is a common pathology, especially in tropical and subtropical regions. Prevalence has been reported as 0.7% to 31% across different populations [6-8]. Pterygium usually causes visual impairment, astigmatism and cosmetic problems [9]. Risk factors strongly associated with the development of pterygium is exposure to ultraviolet light (UVB), wind, dust and heat, dryness, oncogenes, and viruses. Destruction of

© The Author(s).
Publisher: Ilam University of Medical Sciences
How to cite: Motarjemizadeh Q, Samadi Aidenloo N, Khadem N. A comparative study on surgical outcomes in primary pterygium excision using argon laser therapy versus bare sclera technique: A randomized prospective trial. Plant Biotechnology Persa 2024; 6(1): 20-27.

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]
[DOI: 10.61186/pbp.6.1.20]

the Bowman's layer by fibrovascular growth revealed mild inflammatory changes in the cornea and conjunctiva [10–16].

Generally, pterygium excision surgery is indicated in any of the following situations: when the lesion threatens visual acuity, has dysplastic characteristics or causes significant astigmatism, when it restricts ocular movements, causes discomfort or contact lens intolerance, or for cosmetic purposes [17, 18].

In the past, excision of pterygium with no added therapy was widely accepted. However, it became apparent that the recurrence rates were unacceptably high (30%–82%) [19-20]. Various adaptations to the surgical technique, such as amniotic membrane transplantation, anterior lamellar keratoplasty, conjunctival and/or limbal autograft, and the application of anti-metabolites including mitomycin C, have been introduced to avoid recurrence [21,22]. However, it is still impossible to completely prevent recurrence, which still remains a great challenge [23, 24].

Various surgical techniques and application methods before and after surgery, such as pharmacotherapy and radiotherapy, have been used to get the best outcome and prevent a recurrence. The high cost of some of these methods and lack of access or unavailability affects their use in the treatment, especially in low-and middle-income countries [25]. Argon laser is a safe and inexpensive method that may be effective in the treatment of pterygium. This prospective, interventional study was performed to compare the recurrence rate and the complications between the bare sclera surgery and argon laser therapy in patients with pterygium.

Materials and Methods

Patients

The current investigation was performed at Imam Khomeini hospital affiliated with Urmia University hospital, a principal referral center in Northwest of Iran, from April 2019 to June 2020. It included 60 eyes of 53 patients with pterygia indicated for surgical removal. The study followed the tenets of the Declaration of Helsinki. Informed consents were obtained from all participants after a thorough explanation of the nature and the potential complications of the surgical technique, as well as the alternative treatment options. One surgeon (N. SA) performed all surgeries. Best corrected visual acuity and intraocular pressure measurement were measured in all patients before surgery and in all follow-up sessions. Recurrent pterygium cases were excluded from the study. A specialist determined all pterygia' horizontal lengths by measuring the distance from the limbus to the apex of the lesion on the cornea by slit lamp technique. Symptoms of pterygium were considered as the presence of any of following conditions: persistent redness, inflammation, foreign body sensation, tearing, dry, and itchy eyes.

Surgery

Patients were randomly assigned 1:1 to two groups: The first group underwent simple excision of the pterygium (*i.e.* bare sclera), whereas the second group received argon laser therapy. Treatment allocation was determined by picking an envelope containing a pre-prepared randomization label generated by a biostatistician with block size 4. Bare sclera surgery was performed under anesthesia with lidocaine hydrochloride 2%. The injection of lidocaine hydrochloride 2% was performed under the conjunctiva in the body of the pterygium. Before the injection, all patients received topical anesthesia with two drops of tetracaine instilled into the eye. Then, the body of the pterygium was dissected and excised by Westcott scissors and crescent knife after complete and meticulous resection of the pterygium from the cornea. The abnormal scarring tissue on the corneal surface was polished. Minimal, if any, cautery was used to control bleeding. Eyes were patched for one day with tetracycline 1% ointment. Ciprofloxacin drops were prescribed 4 times a day for 7 days, whereas corticosteroid (Betamethasone) drops were administered 8 times daily, for 7 days and then 4 times daily for two weeks.

Laser therapy

Argon laser therapy was applied on the second group of patients. Argon laser applications ranged from 1 to 4 sessions (mean, 2.5 sessions), with a mean of 95 spots in each session (range: 46 to 150). An argon green laser (wavelength, 514 nm; VISULAS 532; Carl Zeiss, Jena, Germany) was used for photocoagulation. The laser spot size was 500 micrometer (μm), the duration was 0.1 second, and the power was set between 200 and 500 mW. Lower power was used for superficial vessels (laser spot size = 300

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

mm) in which the wattage had to be increased to 0.5 second. The shots were arranged in 3 to 4 rows parallel to the limbus with approximately 1.5 mm distance between each row. Immediate post-operative treatment was similar to the first group.

Patients were invited for postoperative clinical evaluation for recurrence and complications on Days 2 and 7 as well as on Months 1, 3, and 6 after the operation. The recurrence was defined as the postoperative regrowth of fibrovascular tissue invading the cornea ≥1 mm at the area of previous pterygium excision.

Statistical analyses

All analyses were performed using SPSS software (version 17.0, SPSS Inc., Chicago, USA). Mann-Whitney U test and Fisher's exact test were utilized for comparing quantitative and qualitative variables, respectively. Changes relative to baseline in visual acuity, intraocular pressure, and recurrent pterygium length were evaluated by paired t-test within the investigated groups. P values less than 0.05 were considered as statistically significant. The statistician who performed the analysis was masked to the details of the investigation.

Results

Sixty eyes of 53 patients were initially enrolled in the current investigation. 30 cases were assigned to each of the groups. Altogether, 37 men and 23 women were included to the study all of who underwent surgery to have their pterygia removed. The clinical and demographic characteristics of the participants are shown in Table 1. No statistically significant differences were observed between the 2 groups in terms of sex, age, laterality, anatomical position of pterygium (temporal vs. nasal), pterygium symptoms, intraocular pressure, and pterygium length.

Table 1. *Pre-operative demographic characteristics of participants*

	Group 1 (n=30) (bare sclera)	Group 2 (n=30) (argon laser therapy)	P value
Age (years), mean [range]	37 [20-64]	34 [22-60]	0.812
Sex, n (Male/Female)	19/11	18/12	1.000
Eye, n (Right/Left)	14/16	18/12	0.438
Temporal/Nasal, n	0/30	0/30	1.000
Pterygium symptoms* (n) (%)	30 (100)	30 (100)	1.000
Intraocular pressure (mmHg), mean ± SD	15.05±3.00	14.07±3.20	0.776
Best collected visual acuity	10/10	10/10	1.000
Pterygium Length, mean ± SD	2.60±0.18	2.40±0.25	0.817

*: Considered as the presence of any of following conditions: persistent redness, inflammation, foreign body sensation, tearing, dry, and itchy eyes.

Table 2 compares demographic and clinical data between two groups of patients six months after the surgery. The length of recurrent pterygia was the only variable which showed significant difference between two groups, albeit at a borderline-significant level (Mann–Whitney U test, P = 0.039). Postoperative lengths of recurrent pterygia were 1.43±0.22 mm and 0.87±0.20 mm in the first (i.e. bare sclera group) and second group (i.e. argon laser therapy group), respectively (Table 2). Pterygium symptoms were observed in 26.8% (8 of 30 eyes) of eyes in the first group and 6.7% (2 of 30 eyes) in the second group (Fisher's exact test, P = 0.078). Recurrence rates were found to be 23.3% (7 out of 30 eyes) in the first group and 13.3% (4 out of 30 eyes) in the second group (Fisher's exact test, P = 0.506). No significant differences were observed between the 2 groups in terms of best corrected visual acuity and intraocular pressure (Table 2).

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

Table 2. *Demographic and clinical data of patients 6 months after surgery*

	Group 1 (n=30) (bare sclera)	Group 2 (n=30) (argon laser therapy)	P value
Pterygium symptoms (n) (%)	8 (26.8)	2 (6.7)	0.078
Intraocular pressure (mmHg), mean ± SD	16.01±3.03	15.50±3.10	0.869
Best collected visual acuity	10/10	10/10	1.000
Pterygium Length, mean ± SD	1.43±0.22	0.87±0.20	**0.039**

Table 3 compares postoperative clinical variables with baseline values in each group. There was a statistically significant reduction in the length of the recurrent pterygia at the end of the 6-month follow-up session compared to baseline values in both groups of patients (Table 3).

Table 3. *Pre- and post-operative clinical variables*

	Group 1 (n=30) (bare sclera)	P value	Group 2 (n=30) (argon laser therapy)	P value
Intraocular pressure (mmHg), mean ± SD	15.05±3.00	0.848	14.07±3.20	0.909
Baseline	16.01±3.03		15.50±3.10	
6-month follow-up session				
Pterygium Length, mean ± SD				
Baseline	2.60±0.18	**0.027**	2.40±0.25	**0.005**
6-month follow-up session	1.43±0.22		0.87±0.20	

Discussion

Pterygium is an ocular surface disease of humans attributed to chronic UV-B exposure. Clinically, the condition involves invasive centripetal growth with associated inflammation and neo-vascularization [26]. Prior clinical studies focused primarily on the clinical characteristics and surgical management of pterygia and, due to this fact, the pathogenesis of pterygia remains incompletely understood. However, considerable progress in this area has been achieved, providing additional insight into this complex disease. This recent evidence implicates anti-apoptotic mechanisms, immunological mechanisms, cytokines, growth factors, extracellular matrix modulators, genetic factors, viral infections, and other possible causative factors [26, 27].

Pterygium removal has always been associated with a variable recurrence rate with most scientific reports describing existing or new techniques that purport to reduce the rate at which the pterygium returns [28]. There seems to be a consensus that simply excising the pterygium and leaving bare sclera or simply closing the resultant conjunctival defect results in a recurrence rate of up to 82% [29, 30]. If these findings are replicated by other surgeons, then it would be reasonable to suggest that this method should no longer be used. The advantage of these outdated methods was simplicity and speed, which are also the principal advantages of the methods that have generally replaced these, namely, bare sclera technique with adjunctive radiotherapy [31, 32] or cytotoxic agents [33], both of which reduce the unacceptable recurrence rate of bare scleral closure, to <15%. However, adjunctive radiotherapy has been demonstrated to result in a high rate of scleral thinning or necrosis, which is usually seen only after 10–20 years of postoperative follow-up [34]. This

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

complication leaves the eye at risk of endophthalmitis, which has been reported in the literature [35]. Complications of mitomycin have also been reported in the literature, with not only late-onset scleral necrosis [36], similar to that seen after the administration of radiotherapy, but also acute scleritis [37], both of which may result in loss of all vision. It is difficult to rationalize the use of these agents for a disease that can be successfully treated with extremely low complication rates with a conjunctival autograft, when the reason for their use is speed and simplicity only.

The other commonly used method is amniotic grafting, which results in a wide range of recurrence rates, from 5% to 64% [38]. Researchers who promote this method have found it necessary to combine the amniotic membrane graft with mitomycin, extensive tenonectomy, and a variable number of postoperative injections of steroids to achieve the lowest recurrence rate reported for amniotic membrane [39]. It would seem reasonable to postulate that the lowered recurrence rate may be because of the mitomycin or the tenonectomy and not the amniotic membrane. The same researchers have been unable to provide consistent cosmetic results and report a very high rate of granuloma formation [40].

Photocoagulation of those vascular structures with argon laser therapy could prevent inflammatory response and cause regression of pterygia. Argon laser application could evolve as a safe and simple therapy that avoids excision and potential subsequent complications such as infectious scleritis etc [41]. In fact, argon laser photocoagulation has already been described for treating pterygium [42]. However, it has not achieved uniform acceptance because of vessel recanalization, thermal damage to adjacent tissue, and possible worsening of pterygium.

Some limitations of our study require consideration. First, a small number of patients does not necessarily allow for a definitive conclusion regarding the effects of laser therapy. Second, bias can be introduced by including both eyes of a study patient. The short duration of follow up is another noteworthy limitation of our study. Moreover, parameters like environmental risk factors (*e.g.* sunlight, wind and dust) were not considered in this study because they were not well referenced in clinical histories.

Conclusion

In conclusion, laser therapy showed better outcome when compared with the simple excision surgery in terms of recurrence rate. In the first group (i.e. bare sclera group), the success rate was 76.7%, while in the second group (i.e. argon laser therapy group) the success rate was about 86.7%. Therefore, more studies with higher population size and with a much longer follow-up period is advised because; it is rational to imagine that recurrence rate may elevate with time. Argon laser photocoagulation of pterygium may be more favorable for patients with coagulopathy or a history of conjunctival surgery. The coagulation effect of the argon laser may prevent severe conjunctival bleeding, which may occur after surgical excision in patients with coagulopathy. Previous conjunctival surgery might cause adhesions between the conjunctiva and underlying tissues, making surgical excision of the pterygium more difficult.

Statements and Declarations

Funding support:

The authors did not receive support from any organization for the submitted work

Competing interests:

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval:

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Urmia University of Medical sciences (No. IR.UMSU.REC.1398.234).

Consent to participate:

Informed consent was obtained from all individual participants included in the study.

Author contributions:

N S A: Conceptualization, the original draft writing, investigation, writing including reviewing and editing and investigation and formal analysis; G. M. : Conceptualization, supervision, and project administration; N KH.:

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

Conceptualization, the original draft writing, investigation, writing including reviewing and editing

Acknowledgments

The authors would like to express their gratitude to the clinical research development unit of Imam Khomeini Hospital, Urmia University of Medical Sciences, for English editing and nursing staff of the Imam Khomeini Hospital for their helping with data collection.

References

1. Kurna SA, Altun A, Aksu B, Kurna R, Sengor T. Comparing treatment options of pterygium: limbal sliding flap transplantation, primary closing, and amniotic membrane grafting. Eur J Ophthalmol. 2013;23(4):480–487. doi: 10.5301/ejo.5000263.
2. Mahar PS, Manzar N. Pterygium recurrence related to its size and corneal involvement. J Coll Physicians Surg Pak. 2013;23:120–123. PMID: 23374515.
3. Huerva V, March A, Martinez-Alonso M, Muniesa MJ, Sanchez C. Pterygium surgery by means of conjunctival autograft: long term follow-up. Arq Bras Oftalmol. 2012;75(4):251–255. doi: 10.1590/s0004-27492012000400006.
4. Kareem AA, Farhood QK, Alhammami HA. The use of antimetabolites as adjunctive therapy in the surgical treatment of pterygium. Clin Ophthalmol. 2012;6:1849–1854. Kareem AA, Farhood QK, Alhammami HA. The use of antimetabolites as adjunctive therapy in the surgical treatment of pterygium. Clin Ophthalmol. 2012;6:1849-54. doi: 10.2147/OPTH.S38388.
5. Kaufman SC, Jacobs DS, Lee WB, Deng SX, Rosenblatt MI, Shtein RM. Options and adjuvants in surgery for pterygium: a report by the American Academy of Ophthalmology. Ophthalmology. 2013;120(1):201–208. doi: 10.1016/j.ophtha.2012.06.066.
6. Norn MS. Prevalence of pinguecula in Greenland and in Copenhagen, and its relation to pterygium and spheroid degeneration. Acta Ophthalmol (Copenh). 1979;57:96–105. doi: 10.1111/j.1755-3768.1979.tb06664.x.
7. Hashemi H, Khabazkhoob M, Yekta A, Jafarzadehpour E, Ostadimoghaddam H, Kangari H. The prevalence and determinants of pterygium in rural areas. J Curr Ophthalmol. 2016;29(3):194-198. doi: 10.1016/j.joco.2016.09.002.
8. Furuya-Kanamori L, Dulanto-Reinoso CM, Stone JC, Marroquín L, Dulanto-Reinoso VCh, Roca JA, et al. Neoplasia escamosa de la superficie ocular en pacientes con pterigión en Perú [Squamous neoplasia of the ocular surface in patients with pterygium in Peru]. Rev Peru Med Exp Salud Publica. 2014;31(4):689-94. Spanish. PMID: 25597719.
9. Lan A, Xiao F, Wang Y, Luo Z, Cao Q. Efficacy of fibrin glue versus sutures for attaching conjunctival autografts in pterygium surgery: a systematic review with meta-analysis and trial sequential analysis of evidence. Oncotarget. 2017 Jun 6;8(25):41487. doi: 10.18632/oncotarget.17195.
10. Urbinati F, Borroni D, Rodríguez-Calvo-de-Mora M, Sánchez-González JM, García-Lorente M, Zamorano-Martín F, et al. Pseudopterygium: An Algorithm Approach Based on the Current Evidence. Diagnostics (Basel). 2022 Jul 30;12(8):1843. doi: 10.3390/diagnostics12081843.
11. Kocamis O, Bilgec M. Evaluation of the recurrence rate for pterygium treated with conjunctival autograft. Graefe's Archive for Clinical and Experimental Ophthalmology. 2014;252:817-20. doi: 10.1007/s00417-014-2581-y.
12. Kumar S, Singh R. Pterygium excision and conjunctival autograft: A comparative study of techniques. Oman J Ophthalmol. 2018;11(2):124-128. doi: 10.4103/ojo.OJO_6_2017.
13. Qin XJ, Chen HM, Guo L, Guo YY. Low-dose strontium-90 irradiation is effective in preventing the recurrence of pterygia: a ten-year study. PLoS ONE 7(8): e43500. https://doi.org/10.1371/journal.pone.0043500.
14. Sharma B, Bajoria SK, Mishra M, Iqubal N. Refractive Outcomes of Simultaneous Pterygium

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

and Cataract Surgery With Fibrin Glue. Cureus. 2021;13(11):e19857. doi: 10.7759/cureus.19857.

15. Ghiasian L, Samavat B, Hadi Y, Arbab M, Abolfathzadeh N. Recurrent Pterygium: A Review. J Curr Ophthalmol. 2022 Jan 6;33(4):367-378. doi: 10.4103/joco.joco_153_20.
16. Zhang X, Jiang Y, Fu Q, Zhang X, Chen Y. Efficacy of bevacizumab in the treatment of pterygium: An updated meta-analysis of randomized controlled trials. Int Immunopharmacol. 2021 Sep;98:107921. doi: 10.1016/j.intimp.2021.107921.
17. Doğan E, Çakır B, Aksoy N, Köse E, Alagöz G. Does pterygium morphology affect corneal astigmatism? Ther Adv Ophthalmol. 2021;13:25158414211030423. doi: 10.1177/25158414211030423.
18. Zhou WP, Zhu YF, Zhang B, Qiu WY, Yao YF. The role of ultraviolet radiation in the pathogenesis of pterygia (Review). Mol Med Rep. 2016;14(1):3-15. doi: 10.3892/mmr.2016.5223.
19. Martins TG, Costa AL, Alves MR, Chammas R, Schor P. Mitomycin C in pterygium treatment. Int J Ophthalmol. 2016;9(3):465-8. doi: 10.18240/ijo.2016.03.25.
20. Al-Salem KM, Saif AT, Saif PS. Comparing adjuvant beta radiation, mitomycin C, and conjunctival autograft in primary pterygium treatment, a three-year follow-up study. Open J. Ophthalmol. 2020;14(1). DOI: 10.2174/1874364102014010082
21. Han SB, Yang HK, Hyon JY, Wee WR. Conjunctival metaplasia after pterygium excision and limbal autograft. Optom Vis Sci. 2015;92(3):324-8. doi: 10.1097/OPX.0000000000000517.
22. Oguz H, Kilitcioglu A, Yasar M. Limbal conjunctival mini-autografting for preventing recurrence after pterygium surgery. Eur J Ophthalmol. 2006;16(2):209-13. doi: 10.1177/112067210601600203.
23. Torres-Gimeno A, Martínez-Costa L, Ayala G. Preoperative factors influencing success in pterygium surgery. BMC Ophthalmol. 2012;12:38. doi: 10.1186/1471-2415-12-38.
24. Ozer A, Yildirim N, Erol N, Yurdakul S. Long-term results of bare sclera, limbal-conjunctival autograft and amniotic membrane graft techniques in primary pterygium excisions. Ophthalmologica. 2009;223(4):269-73. doi: 10.1159/000210444.
25. Phathanthurarux S, Chantaren P. A Survey of Surgical Techniques in Pterygium, Thailand 2016. Asia Pac J Ophthalmol (Phila). 2019;8(6):476-480. doi: 10.1097/01.APO.0000605100.25659.f7.
26. Zhou WP, Zhu YF, Zhang B, Qiu WY, Yao YF. The role of ultraviolet radiation in the pathogenesis of pterygia. Mol. Med. Rep.2016;14(1):3-15. doi.org/10.3892/mmr.2016.5223
27. Shahraki T, Arabi A, Feizi S. Pterygium: an update on pathophysiology, clinical features, and management. Ther Adv Ophthalmol. 2021;13:25158414211020152. doi: 10.1177/25158414211020152.
28. Khan FA, Niazi SP. Effect of pterygium morphology on recurrence with preoperative subconjunctival injection of mitomycin-C in primary pterygium surgery. J Coll Physicians Surg Pak. 2019;29(7):639-43. doi: 10.29271/jcpsp.2019.07.639.
29. Ghiasian L, Samavat B, Hadi Y, Arbab M, Abolfathzadeh N. Recurrent Pterygium: A Review. J Curr Ophthalmol. 2022;33(4):367-378. doi: 10.4103/joco.joco_153_20.
30. Nuzzi R, Tridico F. How to minimize pterygium recurrence rates: clinical perspectives. Clinical Ophthalmology. 2018:2347-62. doi.org/10.2147/OPTH.S186543
31. Palewski M, Budnik A, Konopińska J. Evaluating the Efficacy and Safety of Different Pterygium Surgeries: A Review of the Literature. Int J Environ Res Public Health. 2022;19(18):11357. doi: 10.3390/ijerph191811357.
32. Martins TG, Costa AL, Alves MR, Chammas R, Schor P. Mitomycin C in pterygium treatment. Int J Ophthalmol. 2016;9(3):465-8. doi: 10.18240/ijo.2016.03.25.
33. Mohammed I. Pre- and intraoperative mitomycin C for recurrent pterygium associated with

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]

symblepharon. Clin Ophthalmol. 2013;7:199-202. doi: 10.2147/OPTH.S40472.

34. Alizadeh Y, Akbari M, Moghadam RS, Dourandeesh M, Moravej Z. Comparison of Pterygium Recurrence with and without Using Postsurgical Topical Cyclosporin A 0.05%: A Randomized Clinical Trial. J Curr Ophthalmol. 2022;34(2):208-215. doi: 10.4103/joco.joco_285_21.
35. Young AL, Ho M, Jhanji V, Cheng LL. Ten-year results of a randomized controlled trial comparing 0.02% mitomycin C and limbal conjunctival autograft in pterygium surgery. Ophthalmology. 2013;120(12):2390-2395. doi: 10.1016/j.ophtha.2013.05.033.
36. Vassallo J, Pirotta ST, Sciriha GM, De Bono Agius M, Vella M. Can pterygium excision with mitomycin C leaving bare sclera be salvaged?. Malta Medical J. 2017;1(3):1-7.
37. Bamdad S, Kooshki AS, Yasemi M. Surgical outcome of conjunctival rotational autograft-mitomycin C (MMC) versus free conjunctival autograft-MMC for pterygium removal: A randomized clinical trial. Electron Physician. 2017;9(12):5877-5884. doi: 10.19082/5877.
38. Dehghani A, Ashtari A, Ghatreh Samani H. Pterygium Recurrence in Amniotic Membrane Graft and Mitomycin C Me-thods. J. Isfahan Med. Sch. 2011;28(122):1808-13.[In Persian].
39. Eslami F, Alizadeh M, Seifrabiei MA, Mohebi Emam N. Comparison of Amniotic Membrane Transplantation and Conjunctival Autograft Transplantation for the Treatment of Pterygium. Avicenna J Clin Med. 2019;25(4):215-21. doi:10.21859/ajcm.25.4.215
40. Kucukerdonmez C, Karalezli A, Akova YA, Borazan M. Amniotic membrane transplantation using fibrin glue in pterygium surgery: a comparative randomised clinical trial. Eye. 2010;24(4):558-66. doi.org/10.1038/eye.2009.136.
41. Taher NO, Alnabihi AN, Hersi RM, Alrajhi RK, Alzahrani RA, Batais WT, et al. Amniotic membrane transplantation and conjunctival autograft combined with mitomycin C for the management of primary pterygium: A systematic review and meta-analysis. Front Med (Lausanne). 2022;9:981663. doi: 10.3389/fmed.2022.981663.
42. 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. 2012;250(3):375-81. doi: 10.1007/s00417-011-1820-8.

[Downloaded from pbp.medilam.ac.ir on 2026-11-25]

[DOI: 10.61186/pbp.6.1.20]