

Ninety degree conjunctival rotation autograft versus zero and 180 degree rotation autograft for pterygium surgery

Talal A. Haider, MSc, PhD, Louay M. Al-Amin, DO, MD, Mahfouth A. Bamashmus, FRCS (Ed.), FRC Ophth,
Shatha F. Ali, MBBS, DO.

ABSTRACT

الأهداف: تقييم مدى احتمالية عودة الظفرة العينية عند زراعة الملتحمة (من ذات العين) باستدارة 90° مقارنة باستدارة 0° و 180° في معالجة الظفرة الأولية.

الطريقة: أجريت دراسة مرصدية مستقبلية مقارنة شملت 74 مريضاً مصاباً بظفرة عينية متقدمة، منهم (47 ذكر – 27 أنثى) بمتوسط عمر 47.5 عاماً تراوحت ما بين (19–79 عاماً)، في مستشفى الكويت الجامعي – صنعاء – اليمن، خلال الفترة ما بين فبراير 2004م وحتى مارس 2006م. باستخدام المجهر الجراحي وتحت التخدير الموضعي وبعد استئصال الظفرة تم اقتطاع الملتحمة الررعوية من الجزء الصدغي العلوي ونقلها إلى منطقة الصلبة العارية، أرضية الظفرة المستئصلة ويوافق 38 عيناً باستدارة الملتحمة الررعوية، 15 عيناً بدون استدارة و 21 عيناً باستدارة 180°.

النتائج: باعتبار الظفرة العائدية هي ما زاد عن 1mm عبر القرنية وبعد متابعة الحالات لمدة عام بعد العملية الجراحية كانت نسبة الظفرة العائدية هي 3% في استدارة 90°، 28.6% في استدارة 0°، 15.8% في استدارة 180° ($p=0.033$). كان واقع إجمالي نسبة الظفرة العائدية 10.8%.

خاتمة: زراعة الملتحمة بالاستدارات الثلاث تعد جراحة ذات نتائج فعالة وآمنة، يضاف إلى ذلك إن الزراعة باستدارة 90° تعتبر عملية سهلة وأعطت نسبة أقل للظفرة العائدية مقارنة مع الاستدارتين 0° و 180° ($p=0.033$)، كذلك فإن مكان وضع الخلايا الجذعية للنسيج الطلائي القرني أو وجود هذه الخلايا من عدم وجودها ليس ذو صلة بنتائج عمليات الظفرة.

Objectives: To evaluate the safety, efficacy, and recurrence of pterygium following 90° versus zero degrees and 180° rotation autograft for treating primary pterygium.

Methods: We included in this observational, prospective, and comparative study, 74 patients

(47 males, 27 females) with advanced primary pterygium, with a mean age of 47.5 years (range 19–79 years). This study was conducted in Kuwait University Hospital between February 2004 to March 2006. The excision was under local anesthesia using an operating microscope with rotation autograft taken from upper temporal bulbar conjunctiva by total excision, and free transposition to the bare sclera. We treated 38 eyes by 90° rotation, 15 eyes by 0° rotation, and 21 eyes by 180° rotation.

Results: With a one-year follow-up, the recurrence rates (regrowth of the pterygium more than 1 mm over the cornea) were 3% in 90° rotation, 28.6% in 0° rotation, and 15.8% in 180° rotation ($p=0.033$). The overall recurrence rate for all rotation autograft surgeries was 10.8%.

Conclusion: In this study, all techniques were effective, and 90° rotation autograft is safe and an easy procedure to perform for management of pterygium, with a lower recurrence rate compared with the 0° and 180° rotation autograft ($p=0.033$). The position or the presence of stem cells of the corneal epithelium is not important in the outcome of the pterygium surgery.

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From the Department of Ophthalmology (Haider, Bamashmus), Faculty of Medicine and Health Sciences, Sana'a University, and the Department of Ophthalmology (Haider, Al-Amin, Bamashmus, Ali) Kuwait University Hospital, Sana'a, Yemen.

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Address correspondence and reprint request to: Associate Professor Mahfouth A. Bamashmus, Faculty of Medicine and Health Sciences, Sana'a University, PO Box 19576, Sana'a, Yemen. Tel/Fax: +967 1210020. E-mail: bamashmus@y.net.ye

Pterygium is a wedge of abnormal (fibrovascular) conjunctival tissue that invades the cornea from the canthal region of the bulbar conjunctiva. Pterygium is still not well understood, but it is thought to be associated with chronic ultraviolet (UV) exposure leading to fibrosis, angiogenesis, and inflammatory process.¹ There is a worldwide distribution of pterygium, but it is more common in warm and dry climates.² There is a strong association between UV light exposure (both UV-A and UV-B) and the formation of pterygium.² Di Girolamo et al,² in their recent study provided the first direct experimental evidence that implicates UV in the pathogenesis of pterygia. Reducing UV exposure might decrease the incidence and recurrence of pterygium. Local dryness of the cornea and conjunctiva in the interpalpebral fissure from tear film abnormalities may lead to new fibroblastic growth according to one theory.³ The increased incidence of pterygium in windy, dry climates is consistent with this hypothesis. Chui et al's⁴ study showed the presence of neurokinin 1 receptor in pterygia, and that substance P (an undecapeptide that functions as a neurotransmitter and as a neuromodulator which alters the excitability of the dorsal horn ganglion [pain responsive neurons]) is a potent chemoattractant for pterygium fibroblasts and vascular endothelial cells, implying that substance P may contribute to the shape of pterygia through its profibrogenic and angiogenic action.⁴ There are various surgical procedures for treatment of pterygium, but recurrence remains a significant problem after surgical excision. Simple excision with the bare sclera technique without additional surgical measures, demonstrates high recurrence rates ranging from 14-89%.^{5,6} Conjunctival autograft has proven to be an effective and safe technique to decrease the recurrence rate from 5.3-8%.⁵ Pterygium excision combined with sliding conjunctival graft also decreases the recurrence rate to 18.5%.⁷ Conjunctival autografts alone, or combined with mitomycin-C (MMC) are effective in preventing recurrence in the treatment of recurrent pterygium.⁸ Topical MMC lowers the recurrence rate to 3.7%, but has its own complications.⁹ In using amniotic membrane graft, the recurrence rate decrease to 3.8%, but it is a difficult procedure (in obtaining and preparation of the amniotic membrane graft) in comparison with conjunctival autograft.^{8,10} The use of radiation has lowered the recurrence rate to 12%, but it is difficult to perform as it needs a radiotherapist, and it has some complications.¹¹ It was suggested that healthy limbal corneal epithelial stem cells acts as a junctional barrier to conjunctival migration onto the corneal surface. The aim of this study is to evaluate the safety, efficacy, and recurrence of pterygium following 90° versus 0° and 180° rotation autograft for treating primary pterygium.

Methods. The ethical committee of Kuwait University Hospital (affiliated to Sana'a University) approved this study. We obtained written consent from administrators and patients to participate in this study. We conducted this prospective unicenter randomized study, from February 2004 to March 2006. Seventy-four eyes of 74 consecutive patients (47 [63.5%] were males, and 27 [36.5%] were females) with primary pterygium were referred for management at the Eye Department in Kuwait University Hospital in Sana'a, Yemen. Patients age ranged from 19-79 years old (mean age 47.5 years). Criteria for eligibility were: a pterygium extending at least 2 mm beyond the limbus, no other ocular surface pathologic features or infection, and no collagen vascular diseases. Follow up of patients who came from far areas was difficult, since patients could not return to us in most cases, therefore such patients were excluded from the study a few months after they were included. Each patient had complete eye exam including visual acuity, slit lamp examination, and evaluation of the type and size of pterygium, and its extension over the cornea. Surgeries were carried out in the last week of every month (4-6 cases per month).

Surgical technique. All operations were carried out under the operating microscope as day cases. The operations were performed under peribulbar anesthesia with lidocaine hydrochloride 2%. A solid lid speculum was used to expose the surgical field. A wire speculum was used to separate the lids. A superior rectus bridle suture was inserted using 4-0 black silk. The suture was used to abduct the eye maximally, by clipping it to the drapes adjacent to the lateral canthus, after passing it under the arm of the wire speculum. A small incision was made in the conjunctiva just medial to the head of the pterygium, avoiding the obviously altered conjunctiva on the head of the pterygium. Beginning here, the conjunctiva was progressively dissected from the body of the pterygium towards the caruncle using Westcott scissors. Care was taken to release only the conjunctiva, and this was achieved by tenting up the dissected conjunctiva and snipping the taut adhesions to the subconjunctival tissue. The process was completed towards the upper fornix, caruncle, and lower fornix in the shape of a triangle with its apex at the limbus, avoiding any conjunctival buttonholing. The head of the pterygium was left attached to the cornea and served as a third hand for the surgeon, enabling easier dissection of the conjunctiva. The corneal epithelium 2 mm in front of the head of the pterygium was scraped off with a hockey-stick knife. This exposed the altered epithelium just adjacent to the head of the pterygium, which was thickened and more firmly attached to the underlying cornea. The hockey-stick knife was used to elevate this thickened

epithelium off the underlying cornea. Once this plane was defined, the pterygium head was easily avulsed using a combination of blunt dissection and traction. Residual fibrous tissue on the cornea was removed by sharp dissection with a no. 15 Bard-Parker blade. The body of the pterygium with the involved Tenon's capsule was then excised. The abnormal tissue at the limbal end of the pterygium was aggressively resected, often extending approximately 2-3 mm beyond the visible extent of the pterygium to avoid leaving behind any scaffold for a later recurrence, and to have a good bed for placement of the graft. The size of the conjunctival graft required to resurface the exposed scleral surface was determined using Castroviejo calipers in 3 directions - extent across the limbus, maximum circumferential extent of the bed, and maximum distance from the limbus. This enabled the harvested graft to fit precisely in the bed. Careful hemostasis of the exposed scleral surface was carried out using wet-field cautery. The bridle suture was used to rotate the globe downwards exposing the superior limbus and conjunctival surface. The measured dimensions were marked onto the superotemporal conjunctiva using several cautery spots. Using Westcott scissors, the graft was excised starting at the fornecal end. Care was taken to obtain as thin a graft as possible without button-holing. Once the limbus was reached, the graft was flipped over onto the cornea and the subtenson's tissue attachments at the corneal limbus were meticulously dissected. After excision, the conjunctival-limbal graft was slid onto the cornea. Without lifting the tissue off the cornea, it was rotated and moved onto its scleral bed with fine non-toothed forceps. A limbus-limbus orientation was maintained. **Figure 1** shows the conjunctival autograft has been moved from the superior temporal bulbar area to the region of the excised pterygium. The graft was smoothed out in its bed, taking care to avoid any folding of the edges. At this stage, using a random number table with blocked randomization, patients were randomly assigned to undergo autograft, which was rotated 90° (group A), 0° degrees (group B), and 180° degrees (group C). **Figure 2** shows the yellow color representing the limbal area of the conjunctival autograft. The eye was again abducted and the position of the graft was secured using interrupted 8-0 vicryl sutures. The 4 corners of the graft were anchored with episcleral bites to maintain position. The medial edge of the graft was sutured with 2-4 additional sutures. No sutures were placed on the limbal side of the graft. After surgery, a pressure patch was used for the first 48 hours, and patients were treated with topical prednisolone 1% and tobramycin on a tapered regimen. Patients were followed up and photographed on postoperative days 1, 7, 14, and 30, then every 3 months for at least one year.

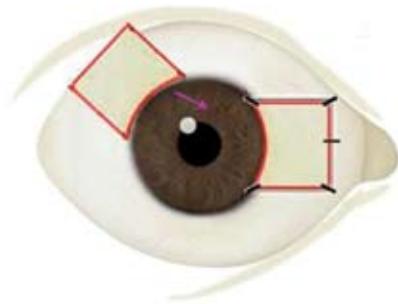


Figure 1 - Conjunctival rotation autograft moved from the superior temporal bulbar area to the region of the excised pterygium.

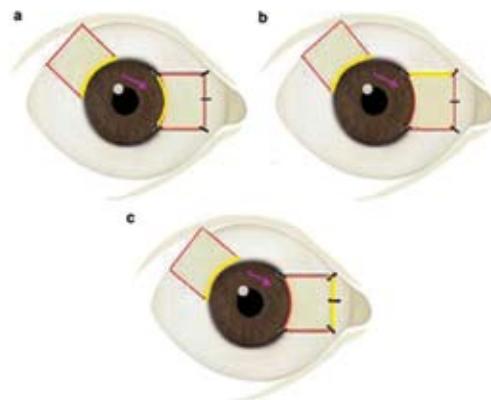


Figure 2 - The yellow color represents the limbal area of the conjunctival autograft. In a) 0° degree rotation, b) 90° degree rotation and c) 180° degree rotation.

Stitches were removed around 2 weeks postoperatively. Recurrence of pterygia was defined as any fibrovascular proliferation encroaching more than 1 mm onto the cornea from the original pterygium site.

Using Epi Info 6™, Fisher's exact test was used to analyze recurrence rates, and a *p*-value less than 0.05 was considered significant.

Results. The total number of eyes operated on was 74, 63.5% males, and 36.5% females (Table 1). Patients were from different areas in Yemen. The right eye was affected in 30 (40.5%) patients, and in 44 (59.5%) patients the left eye was affected (Table 1). The follow-up period was one year. Group A comprised 38 patients, group B includes 15 patients, and group C includes 21 patients (Figure 2). Corneal epithelial defects healed within 5 days and graft sites within 12 days in all groups. The most common intraoperative complications were sub-graft hemorrhage. All grafts showed mild transient edema and sub-graft hematoma

Table 1 - Characteristics of patients with pterygium study in Yemen (N=74).

Variants	n	(%)
<i>Gender</i>		
Male	47	(63.5)
Female	27	(36.5)
<i>Age group, years</i>		
19-33	17	(23.0)
34-48	21	(28.4)
49-63	24	(32.4)
64-79	12	(16.2)
<i>Eye Operated</i>		
Right	30	(40.5)
Left	44	(59.5)
<i>Occupation</i>		
Farmer	19	(25.7)
Housewives	17	(23.0)
Governmental staff	9	(12.2)
Unemployed	6	(8.1)
Student	4	(5.4)
Driver	4	(5.4)
Soldier	4	(5.4)
Teacher	3	(4.1)
Others	8	(10.8)
<i>Pterygium grade</i>		
Grade 1	3	(4.1)
Grade 2	47	(63.5)
Grade 3	24	(32.4)

postoperatively, which usually cleared out within a few weeks. One or more stitches slipped out in 3 patients and were noticed within a few days of the operation, and in most cases were re-sutured. Other less common complications, such as dellen, associated with localized dry area, that occurred in 4 cases (1 in group A, 1 in group B, and 2 in group C), and treated with frequent artificial teardrops and gel. Postoperative retraction of the graft occurred in 5 cases (1 in group A, 2 in group B, and 2 in group C) within 3 weeks, retention cyst under the graft occurred in 2 cases (2 in group B) within 4 weeks, granuloma were noticed in 2 cases (1 in group B, and 1 in group C), and were treated by excision. One case of scleral thinning at a previous pterygium bed (in group B) was reported 3 weeks postoperatively. Recurrence was defined as fibro-vascular tissue of more than 1 mm over the cornea in the area of previous pterygium excision. The overall end result recurrence rate in all different rotation autograft techniques was 10.8% (8 eyes); and in each group, the recurrence was: group A - 1 eye (3%), group B - 4 eyes (28.6%), and group C - 3 eyes (15.8%). The patients that showed recurrences of pterygium mostly were housewives (3), farmers (2), governmental staff (2), and unemployed (1).

Fisher's exact test to compare recurrence rates between the 3 groups regardless of the type of pterygium, showed a statistical difference, with $p=0.033$.

Discussion. Different surgical procedures have been described for the treatment of pterygium. The recurrence rates in all procedures described indicate that there is still no single definitive treatment. The ideal surgical technique should be one that effectively prevents recurrences without development of complications. Of the procedures used most often to treat recurrent or advanced pterygium, the one that comes closest to achieving this goal is probably, the conjunctival autograft.^{5,7} This procedure reduces recurrence with minimal complications when compared with the use of β -radiation or MMC.^{8,9} However, recurrences were not completely eliminated, especially in patients who live in areas with high levels of UV light.² A study of the prevalence and risk factors of pterygium in Hodeidah governorate in Yemen was carried out,¹² and found a prevalence of 3.8% among the population, and among the risk factors were sunlight, high temperature, wind, and dust. A study carried out in Indonesia¹³ to determine prevalence rates, severity, and risk factors for pterygium in adults, found a prevalence of 4.1%, which is almost similar to the Yemeni study. Regarding gender distribution, it was noticed that it was higher in males than females as males are more liable to sunlight, dust, and wind due to outdoor work. The same was observed in certain occupations, such as farmers and village housewives. There was a significant association between outdoor work, sunlight exposure, and pterygium formation in a study carried out by Al-Bdour et al¹⁴ in Jordan. Public education should focus on avoidance of unnecessary sunlight exposure and education of outdoor workers to wear sunglasses and brimmed hats.¹⁴ In our study, we found that the most affected age group were 34-63 years, working as farmer or village housewives with outdoor work.

The conjunctival autograft was proven to be an effective and safe technique to decrease the recurrence rate to 8%.^{7,8} The overall recurrence rate of pterygium with rotation autograft in our study was 10.8%, with the least recurrence rate in group A (90° rotation), which also excludes the importance of the presence and position of stem cells of the corneal epithelium in the graft. In the 90° rotation graft, we noticed that the direction of blood vessels was vertical, away from the cornea, and this could work as an additional factor, which might explain the lower recurrence rate.

The use of topical mitomycin-C and beta radiation lowers the recurrence rate from 3.7-12%, but it is difficult to perform, and needs a radiotherapist, and it has some complications, some of which might be serious.^{9,11,15,16} Using an amniotic membrane graft, the recurrence rate decreases to 3.8%, but it is not easy to get the supply of the amniotic membranes in every

hospital.^{8,10} Moreover the procedure is more difficult in comparison with conjunctival autograft. The 90° conjunctival rotation autograft is safe, and an easy procedure to perform for management of pterygium, it also has a clinically significant low recurrence rate.

The limitation of this study is that the number in each group was not equal, and patients need to be followed-up for a longer period to exclude long-term recurrences.

We conclude that despite the fact that conjunctival autograft transplantation is a time consuming procedure, it is a safe and effective technique for the treatment of different grades of pterygium. It is very useful in prevention of pterygium recurrence, which is a major problem in pterygium surgery.^{8,10} While studies with larger numbers and longer follow up are required, we feel that this report provides encouraging results regarding the safety and efficacy of 90° rotation for pterygium. The total recurrence rate for our study was 10.8%. In this study, all patients had a follow up of one year, and since 97% of recurrences after pterygium surgery are reported to occur within one year,¹⁷ we feel that the recurrence rate in this study is unlikely to increase with longer follow up. In our study, we noticed that the presence and position of stem cells of the corneal epithelium was not important in the outcome of the surgery with conjunctival autograft. We recommend, during excision of the pterygium with graft, using 90° rotation of the graft, which gives the best results.

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References

- Chui J, Di Girolamo N, Wakefield D, Coroneo MT. The pathogenesis of pterygium: current concepts and their therapeutic implications. *Ocul Surf* 2008; 6: 24-43.
- Di Girolamo N, Kumar RK, Coroneo MT, Wakefield D. UVB-mediated induction of interleukin-6 and -8 in pterygia and cultured human pterygium epithelial cells. *Invest Ophthalmol Vis Sci* 2002; 43: 3430-3437.
- Taylor HR, West SK, Rosenthal FS, Munoz B, Newland HS, Emmett EA. Corneal changes associated with chronic UV irradiation. *Arch Ophthalmology* 1989; 107: 1481-1484.
- Chui J, Di Girolamo N, Coroneo MT, Wakefield D. The role of substance P in the pathogenesis of pterygia. *Invest Ophthalmol Vis Sci* 2007; 48: 4482-4489.
- Ang LP, Chua JL, Tan DT. Current concepts and techniques in pterygium treatment. *Curr Opin Ophthalmol* 2007; 18: 308-313.
- Jaros PA, DeLuise VP. Pingueculae and pterygia. *Surv Ophthalmol* 1988; 33: 41-49.
- Müller S, Stahn J, Schmitz K, Behrens-Baumann W. Recurrence rates after pterygium excision with sliding conjunctival flap versus free conjunctival autograft. *Ophthalmologe* 2007; 104: 480-483.
- Katircioglu YA, Altiparmak UE, Duman S. Comparison of three methods for the treatment of pterygium: amniotic membrane graft, conjunctival autograft and conjunctival autograft plus mitomycin C. *Orbit* 2007; 26: 5-13.
- Mikaniki E, Rasolinejad SA. Simple excision alone versus simple excision plus mitomycin C in the treatment of pterygium. *Ann Saudi Med* 2007; 27: 158-160.
- Ma DH, See LC, Liau SB, Tsai RJ. Amniotic membrane graft for primary pterygium: comparison with conjunctival autograft and topical mitomycin C treatment. *Br J Ophthalmol* 2000; 84: 973-978.
- Isohashi F, Inoue T, Xing S, Eren CB, Ozeki S, Inoue T. Postoperative irradiation for pterygium: retrospective analysis of 1253 patients from the Osaka University Hospital. *Strablenther Onkol* 2006; 182: 437-442.
- Muath I, Haider T, Hassan M. Pterygium in Hodeidah Governorate [Thesis]. Khartoum (Sudan): Khartoum University; 2005.
- Gazzard G, Saw SM, Farook M, Koh D, Widjaja D, Chia SE, Hong CY, Tan DT. Pterygium in Indonesia: prevalence, severity and risk factors. *Br J Ophthalmol* 2002; 86: 1341-1346.
- Al-Bdour M, Al-Latayef MM. Risk factors for pterygium in an adult Jordanian population. *Acta Ophthalmol Scand* 2004; 82: 64-67.
- 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* 2009; 28: 166-169.
- Assaad NN, Coroneo MT. Conjunctival autograft failure in eyes previously exposed to beta-radiation or mitomycin. *Arch Ophthalmol* 2008; 126: 1460-1461
- Hirst CW, Sebban A, Chart D. Pterygium recurrence time. *Ophthalmology* 1994; 101: 755-758.