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ORIGINAL ARTICLE

Surgical result of pterygium extended removal followed by fibrin glue-assisted amniotic membrane transplantation

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KEYWORDS
amniotic membrane transplantation;
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pterygium;
recurrence

Background/Purpose: To report the recurrence rate and cosmetic results of conjunctival wound edge and caruncle, and complications after pterygium extended removal followed by fibrin glue-assisted amniotic membrane transplantation.

Methods: A prospective interventional cohort study enrolled 57 (58 eyes) patients undergoing pterygium extended removal followed by fibrin glue-assisted amniotic membrane transplantation. All patients received postoperative follow-up for at least 12 months. Recurrence rate was graded from 1 to 4, and cosmetic results of conjunctival edge and caruncle were graded from 1 to 5.

Results: The cohort included 48 eyes with nasal pterygium, 5 eyes with temporal pterygium, and 5 eyes with double pterygium. There were 81.0% ($n = 47$), 0% ($n = 0$), 12% ($n = 7$), and 7% ($n = 4$) of eyes with Grades 1–4 recurrence, respectively. The cosmetic results of conjunctival wound edge and caruncle in cases with nasal pterygium showed 59.3% ($n = 32$), 14.8% ($n = 8$), 9.3% ($n = 5$), 16.6% ($n = 9$), and 0% ($n = 0$) of eyes with Grades 1–5 morphology, respectively. Overall, 5.1% ($n = 3$), 3.4% ($n = 2$), 3.4% ($n = 2$), 3.4% ($n = 2$), 1.7% ($n = 1$), 6.9% ($n = 4$), and 1.7% ($n = 1$) of patients suffered from postoperative pyogenic granuloma, transient diplopia, permanent motility restriction, steroid glaucoma, fat prolapse, subamniotic membrane hemorrhage, and early detachment of amniotic membrane, respectively.

Conflicts of interest: The authors have no commercial proprietary interest in the products or companies mentioned in the article.

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Conclusion: Pterygium extended removal followed by fibrin glue-assisted amniotic membrane transplantation results in low recurrence, satisfactory cosmetic results and a low incidence of additional complications.

Introduction

Pterygium is a common ocular disorder with a tendency for recurrence after surgical removal. In addition to the simple pterygium removal leading to bare sclera, several adjunctive procedures have been developed with the goal of preventing pterygium recurrence after surgery.[1] Among these strategies, mitomycin C application, β-irradiation, amniotic membrane transplantation, and conjunctival transplantation are well-accepted procedures.[2] However, these techniques are associated with their own complications. In addition to these adjunctive therapies, other surgical factors can also affect the postoperative recurrence rate.[2] The extent of Tenon's layer removal underneath the conjunctival edge after pterygium removal is an issue under debate.[3,4] Extended removal of Tenon's layer has been proposed in the pterygium extended removal followed by extended conjunctival transplantation (P.E.R.F.E.C.T.) method, developed by Hirst.[5,6] The P.E.R.F.E.C.T. method consists of extended pterygium and Tenon's layer removal followed by extended autologous conjunctival transplantation obtained from the superior bulbar conjunctiva, demonstrated low recurrence, and satisfactory cosmetic results for both primary and recurrent pterygia. Although the results with this technique provide a promising way to treat pterygium, this procedure has drawbacks such as lengthier operative time, more complex procedures, and additional damage to the healthy superior conjunctiva.[7] Finding a way to preserve the advantages of P.E.R.F.E.C.T. and reduce its drawbacks is clinically important.

Herein, we report the results of a prospective study in which the Tenon's layer was extensively removed, while fibrin glue-assisted amniotic membrane transplantation instead of conjunctival autograft was performed to cover the bare sclera after removal of pterygium and Tenon's layer. Patients were followed-up for at least 12 months, and the recurrence rate, cosmetic results of conjunctival wound edge and caruncle, and additional complications were analyzed.

Methods

A prospective study in 57 consecutive patients who sought treatment in the clinic of the author (W.L.C.) was performed. All patients warranted excision of their pterygium for either corneal invasion more than 3 mm and/or strong request for cosmesis. Surgery was performed by a single surgeon (W.L.C.) in the Department of Ophthalmology, National Taiwan University Hospital, Taipei, Taiwan between July 2011 and January 2013. This study was conducted in accordance with the Declaration of Helsinki and approved by an Institutional Review Board of the National Taiwan University Hospital (protocol approval number: 200910010M). Complete ophthalmologic examinations, including slit-lamp examination, intraocular pressure measurement, and dilated fundus examination were performed before the surgery. External eye photography was taken before and after the operation for record purposes. Each patient was followed-up for at least 12 months.

Surgical technique

The technique included extended removal of the pteyrgium by the method of Hirst[5,6], but followed by amniotic membrane transplantation instead of conjunctival autograft. Anesthesia was initiated with 0.5% proparacaine hydrochloride (Alcaine, Alcon-Couvreur, Puurs, Belgium) topically followed by peribulbar anesthesia with 2% lidocaine hydrochloride (Xylocaine, Recipharm, Monts, France). Lamellar keratectomy was performed meticulously using a No. 64 crescent knife to remove the pterygium head on the corneal surface. The body of the pterygium which included the conjunctiva and underlying Tenon's layer was excised. The recipient bed previously covered by pterygium was then prepared for subsequent amniotic membrane transplantation. The Tenon's layer, near the superior and inferior recti and back to the caruncle, was isolated by undermining the two surgical planes: one between Tenon's layer and sclera, and the other between the conjunctiva and Tenon's layer. After identifying and securing the medial rectus insertions with a muscle hook, Tenon's layer was carefully excised using Westcott Tenotomy Scissors (without damage to the rectus muscles). The semilunar fold was excised leaving a bare sclera, approximately 14 mm × 14 mm, measuring from the limbus to the paracaruncular edge of conjunctiva. A surgical sponge soaked with mitomycin C (2 mg/10 mL) was placed on the exposed sclera for 2 minutes followed by vigorous irrigation with normal saline. Amniotic membrane was obtained from the tissue bank of the National Taiwan University Hospital. The prepared amniotic membrane was then applied on the bare sclera with the assistance of fibrin glue (Tissueco Duo Quick, Baxter, IL, USA) between the amniotic membrane and bare sclera for fixation. The amniotic membrane attached firmly to the bare sclera within 15 seconds. To prevent graft detachment in a relatively large size of amniotic membrane, three stitches of 10-0 nylon suture were anchored to the limbus for strengthening the amniotic membrane attachment, and two stitches of 8-0 polyglactin 910 sutures were used to anchor the superior/inferior conjunctival wound edge, episcleral tissue, and the edge of

the amniotic membrane 3 mm from the limbus. A therapeutic contact lens was applied at the end of the surgery.

Postoperative follow-up

All patients wore therapeutic contact lenses for 1 week after surgery. Acetaminophen 500 mg, as needed (maximal daily dose 2g), was administered as oral analgesia for the first 7 days and topical 0.1% betamethasone sodium phosphate (Betame, AI Medicine, Taoyuan, Taiwan) was used four times daily for 1 month, tapered to two times a day for 1 month, once a day until the postoperative 3rd month. Patients were followed-up at the 1st postoperative day, 1–2 weeks later, 1 month later, and three more times over the 1st year after surgery. These visits were supplemented if the clinical course suggested any acute problems. All sutures were removed within 2 weeks after surgery. During each visit, external eye photography, intraocular pressure, slit-lamp biomicroscopy, and routine visual acuity testing were performed.

Grading of recurrence, and cosmetic classification of conjunctival edge and caruncle

The grading of postoperative recurrence was performed by a single investigator (H.Y.L.) on the basis of a grading system (on a scale of 1–4) as previously described by Prabhasawat et al,[8] with some modifications (Table 1). Grade 4 was defined as a true recurrence in this study with fibrovascular tissue across the limbus. In addition, we set up a new classification system ranging from Grade 1 to Grade 5 to describe the postoperative cosmetic results of the conjunctival wound edge and caruncle for patients with nasal pterygium (Table 2 and Figure 1). Grades 1–3 were defined as acceptable cosmetic outcomes in this study.

Additional complications

In addition to recurrence and cosmetic results on conjunctival edge and caruncle, other complications such as pyogenic granuloma, transient diplopia, permanent motility restriction, steroid-induced glaucoma, fat prolapse, subamniotic hematoma, and detachment of the amniotic membrane were regarded as additional complications in this study (Figure 2). Transient diplopia was defined as postoperative diplopia which recovered spontaneously within 3 months, while permanent motility restriction indicates diplopia which persists 3 months after surgery.

Table 1 The grading system of postoperative recurrence of pterygium.

Grade 1	A normal appearance of the operated site.
Grade 2	The presence of fine episcleral vessels in the excised area extending to the limbus but without any fibrous tissue.
Grade 3	Fibrovascular tissue in the excised area reaching to the limbus but not invading the cornea.
Grade 4	A true corneal recurrence, with fibrovascular tissue invading the cornea & across the limbus.

Table 2 The grading system of postoperative conjunctival wound edge/caruncular morphology in nasal pterygium.

Grade 1	A normal appearance.
Grade 2	Focal synechia of conjunctival wound edge to the amniotic membrane covered area without thickening of conjunctival wound edge or change of caruncle location.
Grade 3	Thickened conjunctival wound edge without obvious adhesion or change of caruncular morphology.
Grade 4	Diffuse synechia of conjunctival wound edge to the amniotic membrane covered area with anterior advancement of caruncle location < 3 mm.
Grade 5	Diffuse synechia of conjunctival wound edge to the amniotic membrane covered area with anterior advancement of caruncle location > 3 mm.

Statistical analysis

Continuous variables were presented as mean $\pm$ standard deviation. To identify the risk factors associated with the additional complications mentioned above, χ^2 test or Fisher's exact test were performed as appropriate. A multiple lineal regression analysis was performed to factors related to the recurrence of pterygium after the surgery: age, sex, laterality, and primary or recurrent pterygium. All of the statistical analyses were performed using STATA 8.2 software (StataCorp LP, College Station, TX, USA). A p value < 0.05 was considered statistically significant.

Results

The basic profile of patients in the study is shown in Table 3. Fifty-eight eyes in 57 patients were included in this study. A great majority of patients belonged to the intermediate or fleshy type of pterygium. Pterygium was diagnosed in 27 (47%) right eyes and 31 (53%) left eyes. The male-to-female ratio was 28:29, with a mean age of 61.6 ± 12.0 years (range, 33–88 years). Forty eyes had primary pterygium and 18 eyes had recurrent pterygium. All the patients in our study had pterygium extending onto the cornea more than 3 mm. In cases that had pterygium surgeries previously, the interval between the two operations was > 1 year. The mean follow-up was 26.2 ± 11.9 months (range, 12.1–51.2 months).

The postoperative course was associated with mild pain for 1–3 days requiring oral analgesia for the first 24 hours. The therapeutic contact lenses were all removed 2 weeks postoperatively, and no corneal epithelial defects remained at that time. Total epithelialization on the amniotic membrane was found within the first 3 weeks after the surgery. Three weeks following the operation, the majority of patients felt no pain and the operated eyes

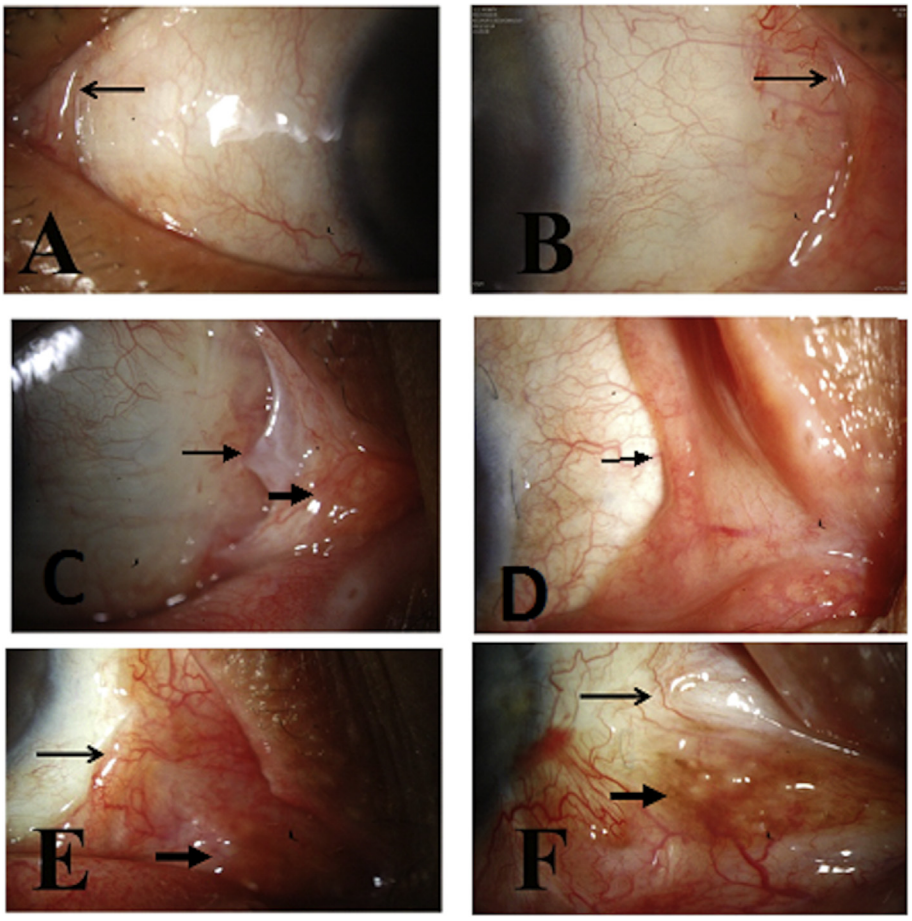

Figure 1 The normal temporal conjunctival wound edge after the operation, and the grading of nasal wound edge and caruncular morphology after operation, (A) The normal temporal conjunctival wound edge after operation; (B) Grade 1 conjunctival wound edge (arrow) and normal caruncular morphology at nasal canthus; (C) Grade 2 shows obvious focal adhesion of the conjunctival edge (thin arrow) to the underlying tissue without obvious change of morphology and location of caruncle (thick arrow); (D) Grade 3 shows thickening of conjunctival wound edge (arrow) without obvious change of morphology and location of caruncle; (E) Grade 4 shows diffuse synechia of conjunctival wound edge (thin arrow) to the amniotic membrane covered area with anterior advancement of caruncle location $<$ 3 mm (thick arrow); and (F) Grade 5 shows diffuse synechia of conjunctival wound edge (thin arrow) to the amniotic membrane covered area with anterior advancement of caruncle location $>$ 3 mm (thick arrow).

were quiet. Figure 3 shows representative photos at 6 months after surgery.

The postoperative recurrence rates evaluated at the last visit are shown in Table 4. 81.0% ($n = 47$), 0% ($n = 0$), 13.8% ($n = 7$), and 6.9% ($n = 4$) of patients were found to have Grades 1—4 recurrence, respectively. Regarding the cosmetic results of nasal conjunctival wound edge and caruncle, 59.3% ($n = 32$), 14.8% ($n = 8$), 9.3% ($n = 5$), 16.6% ($n = 9$), and 0% ($n = 0$) of patients were found to have Grades 1—5 morphology, respectively. Overall, 5.1% ($n = 3$), 3.4% ($n = 2$), 3.4% ($n = 2$), 3.4% ($n = 2$), 1.7% ($n = 1$), 6.9% ($n = 4$), and 1.7% ($n = 1$) of patients suffered from postoperative pyogenic granuloma, transient diplopia, permanent motility restriction, steroid-induced glaucoma, fat prolapse, subamniotic membrane hemorrhage, and early detachment of amniotic membrane, respectively, as shown in Table 4.

Those cases with pyogenic granuloma and subamniotic membrane hematoma improved under a topical corticosteroid course within 2 months. Both patients with transient diplopia recovered without sequels within 3 months. Two cases had permanent motility restriction after the operation and both had Grade 4 conjunctival wound edge and caruncle pattern. One case had detachment of the amniotic membrane at postoperative Day 3 due to eye rubbing and received surgery to reattach the graft without further complications.

Statistical results

The prognostic factors for recurrence and cosmetic results on conjunctival edge and caruncle by univariate and multiple analyses are listed in Tables 5 and 6, respectively. Despite that older persons achieved significantly better cosmetic results regarding the conjunctival edge and caruncle, older age is not associated with reduced recurrence. Moreover, there were no statistical associations of sex, primary or recurrent pterygium, or laterality with postoperative pterygium recurrence (all $p > 0.05$). Only

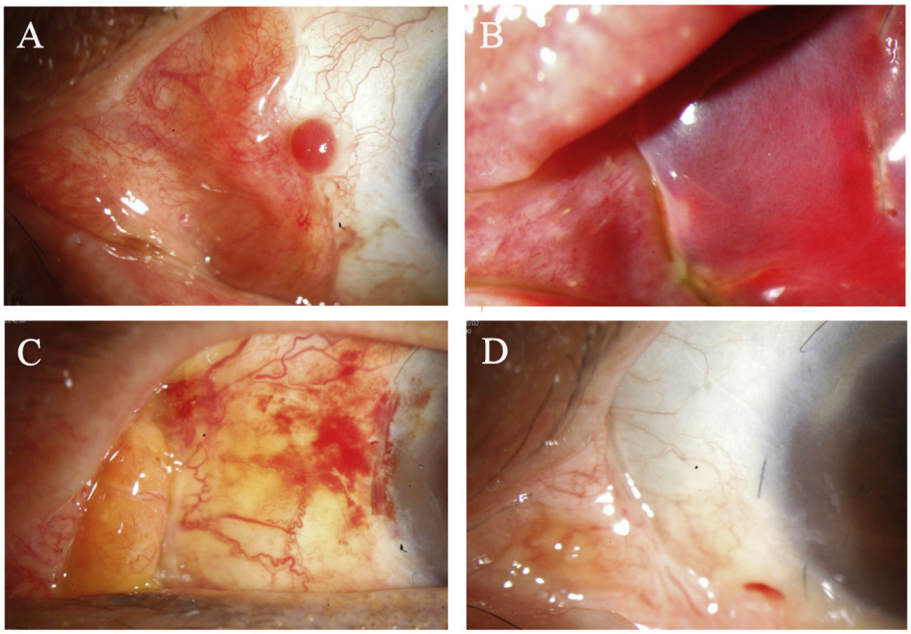

Figure 2 (A) Pyogenic granuloma in a Grade 4 caruncle; (B) subamniotic membrane hemorrhage; (C) fat prolapse at the caruncle; and (D) synechia of the caruncluar area with limitation of ocular motility limitation.

patients with recurrent pterygium had a trend of rerecurrence in our multiple linear regression analysis model ($p = 0.07$). There were no significant risk factors found associated with the additional complications (all $p > 0.05$).

Discussion

Recurrence after pterygium removal remains a major challenge for ophthalmologists, as evidenced by the numerous surgical methods that have been developed to treat this condition over the years.[9–11] Among which, the P.E.R.F.E.C.T. method demonstrated a high success rate, which was claimed to be due to the extended removal of the pterygium and Tenon's layer.[5,6] However, the technically challenging procedure that sacrifices a large area of healthy superior conjunctiva remains a major drawback of this procedure. In this study we developed a method named as pterygium extended removal followed by amniotic membrane transplantation (P.E.R.F.A.M.T.), which contains the benefit of extended pterygium and Tenon's layer removal as P.E.R.F.E.C.T., but avoids the disadvantage of damaging large areas of healthy conjunctiva as the source of donor graft. With the aid of fibrin glue-assisted amniotic membrane transplantation to cover the large area of bare sclera, the procedure was simple, less traumatic, and more surgeon/patient friendly.

Tracing back the history of pterygium surgery, simple bare scleral surgery has been used for more than half of the 20th century as the basic component of pterygium surgery.[12] The area of bare sclera created during surgery may play an important role in pterygium recurrence.[2] The reason we adopted extended pterygium and Tenon's layer removal was based on the hypothesis that Tenon's layer remained a major source of recurrent pterygium. Kamel[13] proposed that removal of Tenon's layer may be important in reducing recurrence after pterygium removal. This strategy has also been emphasized by Solomon et al,[14] who combined this technique with mitomycin C and amniotic membrane to achieve low recurrence rate. The extensive removal of

Table 3 Biographical details of the population.

	Total	Primary	Recurrent
No. of eyes	58 eyes	40 eyes in 40 pts (3 with double pterygium; 3 with temporal pterygium)	18 eyes in 18 pts (2 with double pterygium; 1 with temporal pterygium)
OD/OS	27/31	20/20	7/11
Laterality* (N/T)	54/9	37/6	17/3
Sex (M/F)	28/29	22/18	7/11
Age (y)	61.6 ± 12.0 (33–88)	60.2 ± 12.3 (33–88)	64.9 ± 10.4 (43–84)
Follow-up (mo)	26.2 ± 11.9 (12.1–51.2)	27.3 ± 10.4 (12.07–51.16)	23.8 ± 12.4 (12.33–51.16)

Data are presented as mean ± standard deviation (range) unless otherwise indicated.
F = female; M = male; N = nasal; OD = right eye; OS = left eye; pts = patients; T = temporal.
* Eyes with double pterygium are excluded.

Table 4 Postoperative recurrence, conjunctival wound edge/caruncle morphology in nasal pterygium, and additional complications.

Grading of postoperative recurrence, *n*/*N* (%)	
Grade 1	47/58 (81)
Grade 2	0
Grade 3	7/58 (12)
Grade 4	4/58 (7)
Grading of postoperative conjunctival wound edge/caruncular morphology	
Grade 1	32/54 (59.3)
Grade 2	8/54 (14.8)
Grade 3	5/54 (9.3)
Grade 4	9/54 (16.6)
Grade 5	0
Additional complications	
Pyogenic granuloma	3/58 (5.1)
Transient diplopia	2/58 (3.4)
Permanent motility restriction	2/58 (3.4)
Steroid-induced glaucoma	2/58 (3.4)
Fat prolapsed	1/58 (1.7)
Subamniotic membrane hematoma	4/58 (6.9)
Early detachment of amniotic membrane	1/58 (1.7)

Tenon's capsule, at least 10 mm beyond the area of conjunctival defect, may well be the reason for the zero recurrence rate reported using the P.E.R.F.E.C.T. method.[5,6] However, the application of intra-operative mitomycin C and topical steroid postoperatively may also play a part in reducing recurrence. Studies by Kheirkhah et al[15,16] demonstrated that amniotic membrane combined with mitomycin C use has similar outcomes and complication rates to conjunctival autograft with mitomycin C in patients with recurrent pterygium. In addition, the antiproliferative and anti-inflammatory actions of mitomycin C may reduce the scarring of conjunctiva and thus allow better cosmesis.[17]

One important procedure to be combined with bare scleral pterygium removal involved covering the bare scleral area with conjunctival autograft or amniotic membrane. The superior or inferior bulbar conjunctiva can both be used as the donor grafts.[10,18] Although the postoperative recurrence rate and cosmetic results after conjunctival transplantation are promising, both superior or inferior bulbar conjunctiva transplantation have common drawbacks such as being a lengthy and complex procedure due to graft harvest and graft attachment by suture.[19,20] Furthermore, the damage of the superior conjunctiva may make further glaucoma filtering surgery impossible.[21] In the techniques of extended pterygium and Tenon's layer removal, even larger areas of unexposed sclera will inevitably be created. Conjunctival grafts with such large areas can exacerbate the situation. Amniotic membrane graft has been used as an effective alternative to conjunctival autograft in pterygium surgery due to its anti-inflammatory and antifibrotic properties, as well as its ability to promote the differentiation and migration of epithelial cells.[11] In addition, amniotic membrane graft is safely and abundantly supplied by the tissue bank. Although not yet fully proven, the texture of amniotic membrane, its anti-inflammatory property,[22,23] and the tissue availability may make amniotic membrane graft an alternative and noninferior to conjunctival autograft, since the latter might be limited by the lack of remaining healthy tissue and usually has Tenon's

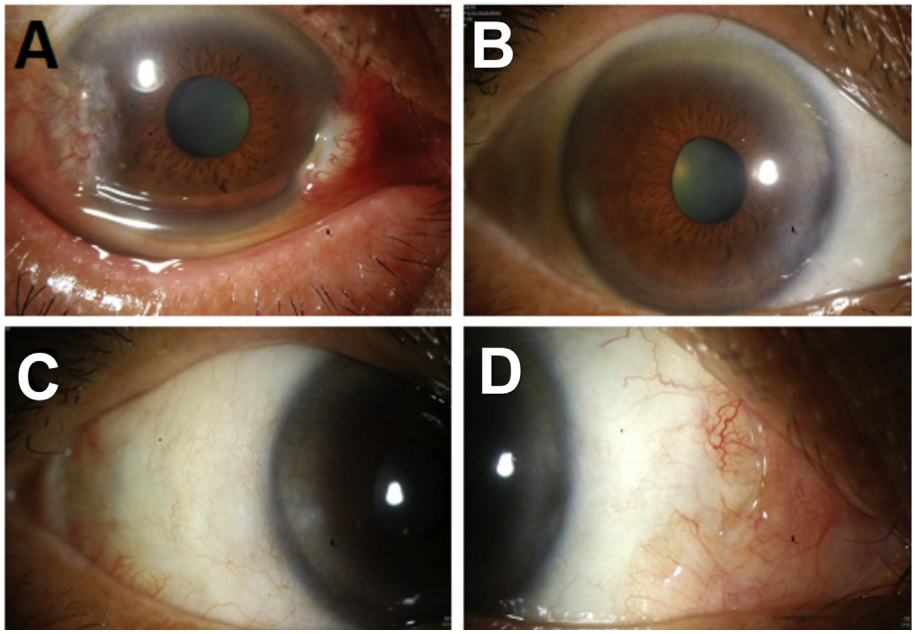

Figure 3 The representative photos at 6-months after the pterygium extended removal followed by extended conjunctival transplantation procedure from a 67 year-old man with double pterygium: (A) preoperative picture shows double pterygium, both extending across the limbus; (B) postoperative 6-month picture shows a silent ocular surface with Grade 1 postoperative appearance of pterygium; (C) the postoperative 6-month photograph demonstrates a satisfactory appearance of the temporal conjunctiva; and (D) the postoperative 6-month photograph demonstrates a Grade 1 caruncular appearance.

Table 5 Lineal regression analyses of risk factors associated with pterygium recurrence.

Analysis ($n = 58$)	Coefficient (95% CI)	p^*
Univariate logistic regression		
Age (per y)	−0.01(−0.04−0.01)	0.17
Sex (M vs. F)	−0.14(−0.65−0.37)	0.59
Primary or recurrent	−0.49 (−1.02−0.05)	0.07
Laterality (nasal vs. temporal vs. bilateral)	0.17(−0.74−1.07)	0.72
Stepwise multivariate regression		
Laterality (nasal vs. temporal vs. bilateral)	−0.50 (−1.04−0.03)	0.07

*$p < 0.05$ was considered to be statistically significant.
CI = confidential interval; F = female; M = male.

layer which can be difficult to remove completely. The application of fibrin glue that assisted P.E.R.F.A.M.T. in this study may provide a quick, nontraumatic, and even safer way than P.E.R.F.EC.T. for treating pterygium. P.E.R.F.A.M.T. may allow for a decreased number of sutures or no sutures, and avoid complicated manipulation around the caruncular area. Reviewing the literature, the conjunctival grafting method has a recurrence rate between 5% and 15% while the amniotic grafting method results in a wide range of recurrence rates, from 5% to 64%.[8,24,25] However, the varying severity of pterygium, extent of Tenon's tissue removal, observation period, and the usage of adjuvant medication may all affect the surgical results, and make comparisons difficult. Unlike the zero recurrence rate in P.E.R.F.E.C.T. surgery published by Hirst,[5,6] our results showed a true recurrence rate of 6.6%, which was less than, or at least comparable, to the previous studies.[8,24,25] Whether this was caused by the different transplanted tissue or other factors, remains to be evaluated.

Successful pterygium surgery is based on a low recurrence rate and good cosmetic outcome. Most studies have only focused on the recurrence of pterygium, which may not truly reflect the patients' satisfaction after the surgery. Trying to improve cosmetic dissatisfaction is still important. In the technique of pterygium extended removal, which involved the manipulation of rectus muscle, caruncle, and semilunar fold, the cosmetic morphology of conjunctival edge and caruncle are especially important. In this study, we designed a classification system for the conjunctival edge and caruncle morphological characteristics. Nine eyes suffered from Grade 4 patterns of conjunctival edge and caruncular morphology. It has been known that multiple factors contribute to recurrence.[26] Although we found age is associated with cosmetic outcome (Table 5), other factors may prevail over age in terms of recurrence. Older patients had better cosmetic patterns of the nasal conjunctival edge and caruncle after surgery (Table 6). We considered age-related alternations in wound healing process and mitomycin C use may partly explain the finding. The four phases of wound healing (hemostasis, inflammation, proliferation, and resolution) have been studied and exhibit characteristic changes with aging.[27] Decreased levels of growth factors, diminished cell proliferation and migration, and diminished extracellular matrix secretion have been demonstrated during aging process.[28] Since inflammation and fibroblast proliferation both play a role in wound scarring, the decreased response with aging and the anti-inflammatory and antiproliferative effects of mitomycin C may reduce the chance of scar formation.

Table 6 Lineal regression analyses of risk factors associated with cosmetic results on conjunctival edge and caruncle.

Analysis ($n = 54$)	Coefficient (95% CI)	p^*
Univariate logistic regression		
Age (per y)	−0.03(−0.64−−0.01)	0.007
Sex (M vs. F)	−0.14(−0.75−0.47)	0.65
Primary or recurrent	−0.32 (−1.05−0.30)	0.30
Laterality (nasal vs. temporal vs. bilateral)	−0.43(−1.51−0.65)	0.43
Stepwise multivariate regression		
Age (per y)	−0.03 (−0.06−−0.01)	0.007

* $p < 0.05$ was considered to be statistically significant.
CI = confidential interval; F = female; M = male.

Additional complications in this study included pyogenic granuloma, transient diplopia, permanent motility restriction, steroid-induced glaucoma, fat prolapse, subamniotic membrane hemorrhage, and early detachment of the amniotic membrane. Most of the complications were mild and transient, except two cases of permanent motility restriction. Both cases with permanent motility restriction had mild motility restriction before the operation. The severity of motility restriction before and after the surgery was comparable to each other. A Grade 4 conjunctival wound edge/caruncular morphology was noted in the two cases and conjunctival adhesion was considered as the major cause for motility restriction rather than damage to the medial rectus. Although rare, extensive damage to the caruncular area may lead to cicatricial motility restriction, which is difficult to manage.[29] The possibility of iatrogenic orbital fat prolapse should be avoided.[30] Carefully handling the tissue around the caruncle and conjunctival edge combined with long-term and adequate steroids should be emphasized in extended pterygium and conjunctival resection, such as P.E.R.F.E.C.T. and P.E.R.F.A.M.T.

In conclusion, we developed a surgical method called P.E.R.F.A.M.T., and demonstrated its advantage for the surgical treatment of pterygium. The low recurrence rate, high cosmetic satisfaction, and low additional complication rate demonstrate that P.E.R.F.A.M.T. is a reliable procedure.

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