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Minimally Invasive Pterygium Surgery: Sutureless Excision with Amniotic Membrane and Hydrogel Sealant

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Key Words
Pterygium · Sutureless surgery · ReSure® glue · Conjunctiva · Cornea

Abstract
Purpose: To describe a novel technique for sutureless pterygium surgery using ReSure® tissue sealant. ***Methods:*** In this retrospective observational case series, we describe a modified procedure for pterygium excision followed by amniotic membrane transplant (AMT) adhered to the corneal and conjunctival defects using ReSure tissue sealant. ***Results:*** Nine eyes of seven patients (age range: 28–80 years, 4 females and 3 males) underwent pterygium removal with AMT followed by adherence of tissue to the conjunctival edges with ReSure. No issues with transplant dislocation or failure and no intra- or postoperative complications were noted. No recurrences were noted during the follow-up period. ***Conclusion:*** ReSure may be considered as a potential sealant to adhere AMT to defective corneal and conjunctival tissues in sutureless pterygium surgery.

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Introduction

Pterygium is a fibrovascular hyperplastic growth of the conjunctiva at the limbus of the eye. It has the potential to compromise vision and distress a patient cosmetically, functionally, and symptomatically. Although various treatments have been advocated for this condition, inflammation and recurrences are consistently troublesome for patients as well as surgeons.

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Surgical procedures employed for management of pterygium include bare scleral closure, simple conjunctival closure, and use of sliding conjunctival flaps, conjunctival autograft, and cryopreserved or lyophilized amniotic membrane graft. The major postoperative complications of pterygium surgery are recurrence and infection.

The recurrence rate after surgical excision has been reported to be as high as 88% with bare scleral excision, 39% with conjunctival autograft, and 33% with conjunctival flap [1, 2]. To reduce recurrence rates, surgery has been supplemented with numerous adjuvant therapies, including intraoperative and postoperative mitomycin C, thiotepa, and postoperative beta irradiation [1, 3–5]. Recurrence is usually a consequence of either undertreated or untreated inflammation.

Postoperative conjunctival inflammation and pyogenic granuloma, which can lead to poor surgical outcome, are relatively common with the use of sutures [4]. Persistent inflammation can play a pathogenic role and lead to recurrence of pterygium despite adjuvant therapies [4].

The introduction of fibrin glue in pterygium surgery significantly reduced surgery time, precluded the need for additional visits for loose or broken sutures, improved postoperative patient comfort, and resulted in lower recurrence rates compared with suturing [6–8]. The intensity of postoperative complaints including pain, foreign body sensation, irritation, and epiphora were significantly lower in patients treated with fibrin tissue sealant compared with those treated with sutures [7].

The use of fibrin glue may incur a risk of viral transmission (such as parvovirus B19, hepatitis, and HIV) despite viral inactivation techniques. Use is also limited by the complexity of preparation and application to the surgical site [9]. Kurian et al. [10] demonstrated the use of autologous blood for adherence of tissues; they reported a 3.13% rate of total graft dislodgement with autologous blood, compared with 2.04% with fibrin tissue sealant, and recurrence rates of 6.25% and 8.16%, respectively.

In search of an effective sealant to avoid use of sutures and to further reduce inflammation and pain, ReSure® tissue sealant (Ocular Therapeutix) was used in a series of nine eyes of seven patients (4 women and 3 men, age range 28–80 years) at the Moran Eye Center. ReSure was previously used in Australia for pterygium surgery using conjunctival autograft, which resulted in prolonged inflammation and conjunctival scarring [11]. In this case series, pterygium excision was performed followed by amniotic membrane transplant (AMT), which was affixed to the corneal and conjunctival defects using ReSure sealant.

Eight eyes with nasal pterygia and one eye with temporal pterygium were operated (table 1). Mean follow-up time (excluding case No. 4) was 32.3 weeks. There were no intraoperative or postoperative complications requiring further management, and no transplant dislocations, failures, or pterygium recurrences were noted during the follow-up period. Visual acuity before and after the pterygium surgery was not tabulated because none of the pterygia in this case series encroached on to the visual axis affecting the acuity of the patients.

Surgical Technique

The borders of the pterygium were marked to 2.5 mm behind the limbus. Then, Cohan forceps and an iridodialysis spatula were used to remove the pterygium from the cornea. Westcott scissors were then used to remove the pterygium and underlying diseased Tenon's capsule. Cauterization to control bleeding and mitomycin C pledgets (0.04%) were applied to the corneal surface for 30–90 s, depending on patient age, race, and comorbidities. Super-

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ficial keratectomy of the underlying corneal scar was performed using a crescent blade (fig. 1).

A marking pen tracing on a Tegaderm (3M) dressing was used to delineate the size and shape of the conjunctival defect, and this tracing was then used to trim the amniotic membrane to fit. The amniotic membrane was brought to the cornea and fastened stromal-side down onto the corneal and conjunctival defect using ReSure sealant. Edges were tucked under the conjunctiva. Subconjunctival cefazolin and triamcinolone injections were administered (including a bleb of triamcinolone underneath the amniotic membrane, sealed by ReSure at the edges). The lid speculum was removed, Pred Forte (prednisolone acetate ophthalmic suspension; Allergan) and Zymar (gatifloxacin ophthalmic solution; Allergan) drops were instilled in the eye, a bandage contact lens was placed, and the eye was covered with a shield for protection.

At the 6-week follow-up, cosmesis was excellent in all cases and patients were symptom free (fig. 2). No recurrence was noted in any case, with the longest follow-up at 41 weeks.

Discussion

Pterygia are common ocular surface lesions traditionally regarded as a degenerative condition with propensity to invade normal tissue and coexist as premalignant lesions. Due to possible evolution into precursors of malignant ocular melanoma and squamous cell carcinoma, early and complete treatment is ideal to prevent unexpected disease progression [12]. Similarly, minimally invasive techniques are in need to prevent inflammation and further recurrence.

ReSure tissue sealant is made of a polyethylene glycol hydrogel and has been FDA approved for sealing corneal incisions in cataract surgery. It comes as two separate materials, a polyethylene glycol solution and a trilysine amine solution, that form a sealant when mixed together. The mixture is easy to directly apply at the edges of the transplant membrane, cornea, and conjunctiva using a spear sponge. ReSure is 90% water after polymerization and hence sloughs off in the tears during re-epithelialization. After ReSure application, the seal is monitored for a few seconds to ensure adhesion. Postoperative care with steroids and antibiotic drops routinely follows.

ReSure appears to be an effective sealant with enhanced comfort for the patient and convenience for the physician. In the cases described herein, the sealant appeared to be easier to use, less time-consuming, and also improved patients' symptoms postoperatively compared to either sutures or fibrin glue. In contrast, Hirst [11] noted prolonged inflammation replaced by conjunctival scarring after ReSure application to adhere conjunctival autograft to the lesion. This could be due to direct application of ReSure to cover the area of Tenon from where the donor graft was retrieved and/or using sutures to place the graft in place. With ReSure, there was no risk of viral transmission as there would have been with fibrin tissue sealant, no risk of transplant dislocation as there would have been with autologous blood, and lower risk of inflammation than there would have been with sutures. This compares favorably with surgeon's experience and with published literature on surgery using sutures.

The study had a small series of patients with short follow-ups. Larger studies with longer follow-up are needed to better understand the impact of ReSure on recurrence of pterygium. Based on our experience, ReSure tissue sealant is safe and effective to fasten amniotic membrane to defective corneal and conjunctival tissues in sutureless pterygium surgery.

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Statement of Ethics

The study conformed to the tenets of the Declaration of Helsinki.

Disclosure Statement

This report has no potential financial conflicts of interest.

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Table 1. Demographics of the patients with characteristics of pterygium and details with follow-up and complications

Case No.	Sex	Age, years	Eye	Location	Size (base × extension), mm	Follow-up, weeks	Complications/ recurrences
1	Female	45	Right	Nasal	3.5×1.4	40	No
2	Female	71	Right	Temporal	3.6×2.4	41	No
			Left	Nasal	2.2×1.3	37	No
3	Female	66	Right	Nasal	3.2×0.7	28	No
4*	Female	47	Left	Nasal	4.0×2.5	6	No
5	Male	28	Right	Nasal	4.7×2.2	30	No
			Left	Nasal	4.2×2.4	28	No
6	Male	66	Left	Nasal	6.5×3.6	28	No
7	Male	80	Right	Nasal	3.5×5.5	27	No

* This patient was treated at a medical camp in rural Utah; hence, follow-up was verbal through telephone at 6 weeks.

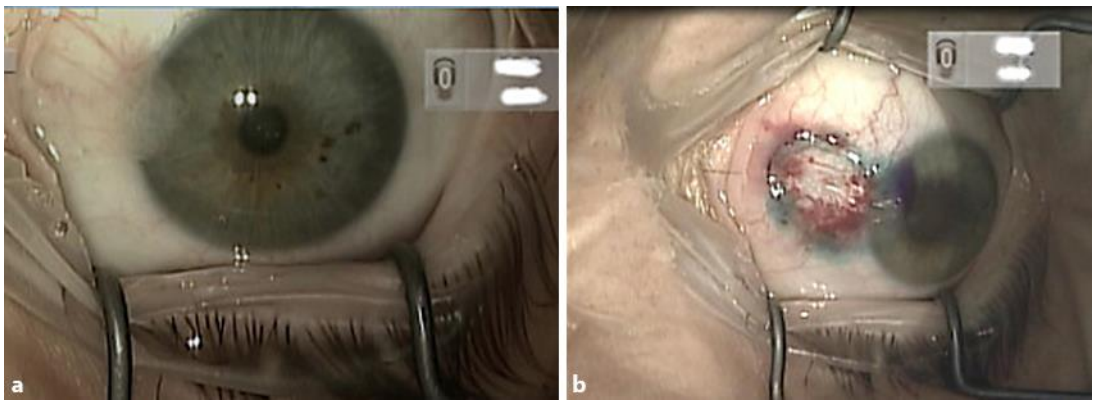

Fig. 1. **a** Nasal pterygium of the right eye from 9:00 to 10:00 o'clock before surgery. **b** The same eye after application of ReSure glue to fasten amniotic membrane graft to the defective conjunctiva.

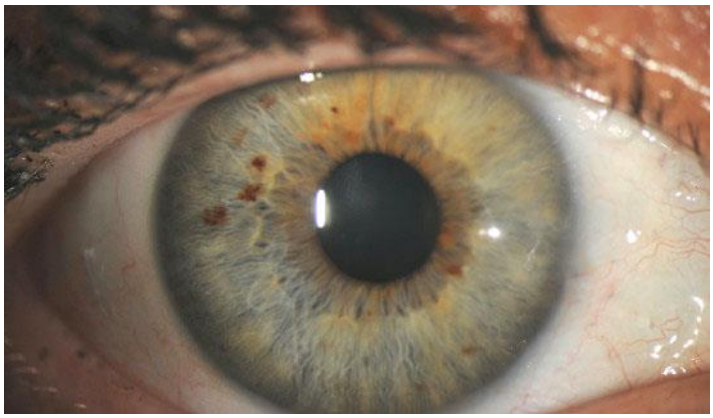

Fig. 2. Nasal pterygium of the right eye (same patient as in fig. 1) is well healed at the 6-week follow-up.