Fibrin glue assisted amniotic membrane graft reconstruction of conjunctival fornix and canthus following excision of conjunctival tumours

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Conjunctival tumors involving non-limbal locations, such as the fornix and canthus, are typically excised using a “non-touch” technique, often with a wide surgical margin. Reconstruction of these large defects can be difficult due to the contour of the ocular surface and are often complicated by shortening of the fornix, symblepharon formation, and restriction of eye movements. In our experience, the use of amniotic membrane grafts combined with the sealant properties of fibrin glue such as Tisseel® has improved our surgical outcomes during the reconstruction phase. We would like to highlight and describe our surgical technique using fibrin glue and squint hooks to aid amniotic membrane graft reconstruction for surgically challenging locations in the fornix and canthus following excision of conjunctival lesions, with excellent surgical outcomes.

Key words: Amniotic membrane graft, canthus, excision, fibrin glue, fornix, reconstruction

Conjunctival tumors are typically excised using a “non-touch” technique with a wide surgical margin.[6,7] Non-limbal locations of tumors such as those involving the fornices, plica, and caruncle carry a high risk of local recurrence and systemic spread.[3,4] Thus, meticulous care must be taken during the excision, and it is important to take a wide surgical margin to prevent recurrence. After excising the tumor, the reconstruction of non-limbal locations can be difficult due to the contour of the ocular surface. Additionally, the reconstruction is often complicated by shortening of the fornix, symblepharon formation, and restriction of eye movements.

Tisseel glue (TISSEEL®, Baxter Healthcare Corporation, USA) is a fibrinogen and thrombin sealant used for its hemostatic or sealing properties. Its use as a sealant has been well established in ophthalmic surgery,[5] especially in pterygium surgery,[6] vitreoretinal surgery,[7] and glaucoma surgery.[8] However, the use of Tisseel glue in the reconstruction stage following tumor excision is often underutilized.

In our experience, the use of amniotic membrane graft (AMG) for reconstruction after excision of large conjunctival lesions has improved local surgical outcomes.[9] Additionally, introducing the use of fibrin glue such as Tisseel® and squint hooks during the reconstruction with AMG has provided us with excellent surgical results.

We would like to highlight and present our surgical technique of the excision of conjunctival tumors and the use of fibrin glue and squint hooks to aid AMG reconstruction of surgically challenging non-limbal locations, such as the superior and inferior fornices and medial and lateral canthus.

Surgical Technique

The surgical technique is described in two stages: surgical excision and reconstruction [Figs. 1 and 2]. See the video for an example of inferior fornix tumor removal and reconstruction. Example cases demonstrating pre and post reconstructions of superior fornix, inferior fornix, lateral canthal, and medial canthal conjunctival lesions by using this technique are described and shown in Figs. 3 and 4.

Surgical excision

The authors prefer the surgery to be undertaken under general anesthesia. To gain access to tumors involving the superior or inferior fornix, a Desmarre eyelid retractor along with 5.0 prolene on the lid margin is used to double evert the lid to expose the required fornix [Fig. 1b and c]. A limbal stay suture with 6.0 silk is used to move the globe away to gain exposure to the surgical site, Fig. 1f.

For tumors involving the medial or lateral canthus, a large Clarke’s speculum and limbal stay suture with 6.0 silk are
adequate in providing exposure of the surgical site; 3.0 silk traction suture to eyelids may be required in tumors extending into the fornices, though care must be taken not to pass the suture through the conjunctiva involved by the tumor.

Excision of the tumor: the tumor area along with a margin of 2–4 mm is marked [Fig. 1d]. A subconjunctival injection of 0.5% marcaine with adrenaline is injected to balloon the surgical site. (f) A limbal stay suture with 6.0 silk is used to move the globe away to gain exposure to the surgical site. (g) A “non-touch” technique used to excise the tumor. (h) The excised tumor is orientated with a suture to be sent for histopathological analysis.

Reconstruction
Hemostasis is achieved, and then double freeze-thaw cryotherapy is applied to the conjunctival edges and to the base if there is any suspicion of deeper involvement [Fig. 2a]. The AMG is thawed, and a fresh set of instruments is used for the reconstruction of the surgical site. The AMG is laid on the area to be reconstructed (2 cm × 2 cm graft is usually adequate but using a 3 cm × 3 cm is better for wider tumors) [Fig. 2b and c]. Cardinal 8.0 vicryl sutures are placed to secure and anchor the graft to the conjunctiva [Fig. 2d]. The graft is then sutured to the bulbar conjunctival edge with an interrupted 8.0 vicryl suture. The AMG is draped over the contour of the fornix or canthus onto the reconstruction site with ample laxity. Excess AMG is cut if required, and the AMG is sutured to the palpebral conjunctival edge. Further 8.0 vicryl sutures are placed as required along the edges of the graft. A small amount of fibrin glue is applied under the AMG by inserting the cannula up to the fornix and gently withdrawing it back outside the graft site from two different directions to allow uniform adhesion of the AMG [Fig. 2e]. The curved edge of one or two squint hooks is used to quickly smoothen over the AMG into the fornix or canthus to optimize the graft position [Fig. 2f]. The squint hooks are kept in position for 2 min until the glue seals to allow adhesion of the AMG in the desired contours. Any excess glue which oozes out of the graft site is stripped off when solidified.

Figure 1: Surgical technique: excision. (a) Preoperative photo of inferior fornix conjunctival melanoma. Intraoperative photos: (b) and (c) a Desmarre eyelid retractor along with 5.0 prolene on the lid margin is used to double evert the lid to expose the required fornix. (d) The tumor area along with a margin of 2–4 mm is marked. (e) A subconjunctival injection of 0.5% marcaine with adrenaline is injected to balloon the surgical site. (f) A limbal stay suture with 6.0 silk is used to move the globe away to gain exposure to the surgical site. (g) A “non-touch” technique used to excise the tumor. (h) The excised tumor is orientated with a suture to be sent for histopathological analysis.

Figure 2: Surgical technique: reconstruction. Intraoperative photos (a) Double freeze-thaw cryotherapy applied to the conjunctival edges and base. (b) and (c) AMG is removed from the filter paper and is laid onto the inferior fornix. (d) Cardinal 8.0 vicryl sutures are placed to secure and anchor the graft to the conjunctiva. (e) Fibrin glue cannula is inserted under the AMG. (f) Two squint hooks are used to smoothen over the AMG into the fornix. (g) Inferior fornix following reconstruction. Ten months post-surgery, this patient has no restriction of eye movement and symblepharon formation.
Surgical excision of the lesion was performed with a wide margin including the lateral canthal conjunctiva caruncle highly suspicious of conjunctival squamous cell carcinoma [Fig. 3a]. Excision of the lesion was performed with a wide margin including the lateral canthal conjunctiva caruncle, 6 months post-op. (c) Preoperative photograph of conjunctival melanoma involving left inferior fornix. (d) Postoperative photograph demonstrating a well-formed inferior fornix with no symblepharon or restriction of eye movement, 3 months later.

Fornix deepening sutures or ring conformers are not required as the squint hooks help form a permanent fornix by causing adhesion of the AMG to the underlying tissue.

 Cases

Superior fornix reconstruction
A 37-year-old female patient presented with a large mass in the superior fornix, which was clinically diagnosed as a conjunctival malignant melanoma [Fig. 3a]. Surgical excision and fibrin glue and squint hook-assisted AMG reconstruction of superior fornix was done successfully, with full range of movement post-operatively and no symblepharon formation noted at follow-up 5 years post-surgery [Fig. 3b]. This was the first reported case of conjunctival melanoma in pregnancy.[30]

Inferior fornix reconstruction
A 45-year-old female patient presented with a localized, well-demarcated mass in the inferior fornix, which was clinically diagnosed as a conjunctival malignant melanoma [Fig. 3c]. Surgical excision and fibrin glue and squint hook-assisted AMG reconstruction of inferior fornix was done successfully with no significant symblepharon and restriction of eye movements postoperatively at 4 years follow-up [Fig. 3d]. In other similar cases, we have noted an occasional small band in the inferior fornix on pulling the lower eyelid down and asking the patient to look up, but none that were significant enough to cause restriction of eye movements or fornix shortening.

Lateral canthal reconstruction
An 86-year-old female patient presented with a lesion on her temporal bulbar conjunctiva extending into the lateral canthus highly suspicious of a conjunctival squamous cell carcinoma [Fig. 4a]. Excision of the lesion was performed with a wide margin including the lateral canthal conjunctiva up to the skin edge. Fibrin glue and squint hook-assisted AMG reconstruction allowed reconstruction of the canthal anatomy [Fig. 4b]. Histopathology interestingly demonstrated this lesion to be a conjunctival granuloma as a response to an old prolene suture that had eroded through into the lateral canthus from a previous lateral tarsal strip surgery from ectropion repair. No recurrence was noted at the 1 year follow-up period when the patient was discharged.

Medial canthal reconstruction
A 68-year-old male patient had developed severe symblepharon following the previous excision of a medial limbal squamous cell carcinoma [Fig. 4c]. He had restricted eye movements, and the eye was in a fixed inward position with the upper eyelid and lower eyelid also adherent to the limbus medially. There was suspicion of recurrence of his underlying ocular surface squamous neoplasia (OSSN) causing the symblepharon. The adhesions were divided meticulously up to the medial canthal area, as well as into the superior and inferior fornix medially and from the underlying medial rectus muscle. Fibrin glue and squint hook-assisted AMG reconstruction was done of the entire bare medial area successfully with the reformation of medial canthus [Fig. 4d]. The excess glue was meticulously removed to prevent adhesion, and a large bandage contact lens was applied. In the first week, the fornix and canthus were swiped with a cotton bud if any mucous strand or adhesions were present. The patient was advised regular eye and lid movements with an intensive postoperative topical steroid regimen. Despite all the measures, this patient had a partial recurrence of the medial canthal shortening a year post-surgery. This was possibly related to the medial canthal location and underlying OSSN related scarring process. However, the patient was comfortable with reasonable eye movements and no further intervention was required.
We have also used our technique for the surgical treatment of old symblepharon formation, though we use adjuvant wound modulation by applying intraoperative mitomycin C to the surgical site with postoperative topical steroids and 5-fluorouracil injections to the surgical site in cases of early recurrence.

**Discussion**

The surgical management of conjunctival tumors involving the fornix or canthus can be particularly challenging. Achieving a complete excision of the lesion with tumor-free margins is the most fundamental element of surgical intervention, usually involving wide excisions. However, the reconstruction can be complicated by shortening of the fornix or dragging of the canthus, symblepharon formation, and scarring, causing discomfort and restriction of eye movements.

The use of fibrin glue to fix the AMG allows reconstruction of the natural anatomy of the anterior ocular surface, including the fornix and canthus, as well as the conjunctival surface of the eyelids.

We believe this is the first comprehensive paper describing this surgical technique and should assist surgeons involved in the management of such complex cases. This technique of using fibrin glue and squint hooks allows effective adherence of the amniotic membrane graft to the fornix or canthus, allowing excellent surgical reconstruction and outcomes. The use of the squint hooks is novel as the authors have found that the curvature of the squint hooks helps to maintain the contour of the ocular surface and recreate the fornix or canthal space. In the authors’ experience, the squint hooks provide a better contour for reconstruction and favor this over other instruments or fornix deepening sutures. We have found good surgical results using this technique with minimal formation of symblepharon, shortening of fornices, and scarring over a long-term follow-up period. We thus recommend the use of this surgical technique in the reconstruction phase following removal of tumors of the ocular surface involving the fornix or canthus to reduce postoperative complications.

**Conclusion**

Our surgical technique of using fibrin glue and squint hooks to aid amniotic membrane graft reconstruction for surgically challenging locations in the fornix and canthus following excision of conjunctival lesions provides excellent surgical outcomes.

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**Conflicts of interest**

There are no conflicts of interest.

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