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Surgical Pearls for Pterygium Surgery

Randall Ulate, MD

Introduction

Pterygium, a common ocular surface disorder, manifests as a wing-shaped degenerative fibrovascular benign growth characterized by the fibrovascular proliferation of conjunctival tissue onto the cornea **(Figure 1)**. This condition often results from prolonged exposure to ultraviolet light, dry eye conditions, or chronic irritation. On histopathology, there is classically elastotic degeneration of the conjunctival stroma with overgrowth of blood vessels and fibrous tissue, i.e., a fibro-proliferative reaction.[1,2] While small and asymptomatic lesions may be managed conservatively, surgical excision becomes necessary when the lesion threatens vision, causes significant discomfort, or results in cosmetic concerns. A pterygium with documented growth that extends toward the visual axis should be removed before it reaches the central cornea. However, due to its high recurrence rate and variability in presentation, surgical management of pterygium requires attention to detail and a thorough understanding of optimal techniques.

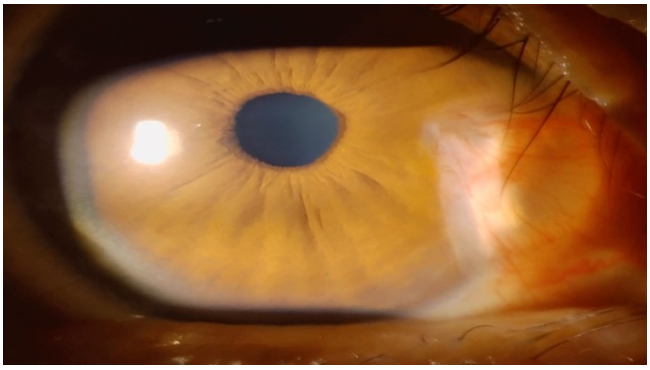

Figure 1. Pterygium. Wing shaped fibrovascular tissue at the nasal limbus and cornea; *courtesy of Randall Ulate, MD*

Pterygium Surgical Techniques

Over the decades, pterygium surgery has seen significant advancements, with multiple techniques being developed to reduce recurrence and improve outcomes. Each technique offers its own set of benefits and risks, and the selection often depends on the size and type of the pterygium, the surgeon's preference, and the available resources. The goal of pterygium surgery is to obtain good visual acuity and cosmetic

appearance, avoid complications, and achieve a low recurrence rate.[3,4]

Bare Sclera Technique

The pterygium is excised, leaving the underlying sclera exposed without any tissue graft or coverage. This technique has the advantage of being simple and quick to perform and requires minimal instrumentation.[5] However, it comes with several disadvantages. The recurrence rate is high, ranging from 30–80%, and the exposed sclera may scar or become inflamed, leading to poor cosmetic results. Therefore, this technique should not be used as a standalone technique due to its high recurrence rate.

Beta Irradiation (Beta Therapy)

Beta radiation (typically using strontium-90) was applied postoperatively to inhibit fibroblast proliferation and reduce recurrence. This technique has several advantages including significantly reducing recurrence when used adjunctively and being effective in cases of aggressive or recurrent pterygium. However, there are disadvantages associated with beta radiation. It carries the potential for serious complications, such as scleral thinning, necrosis, delayed healing, and cataract formation. In addition, this technique requires access to specialized radiation equipment and adherence to safety precautions. Given these risks and lack of availability, the use of beta radiation is not routinely performed nor recommended.

Mitomycin C

Mitomycin C (MMC) is an antimetabolite commonly used intraoperatively (typically at a concentration of 0.02% for 1–2 minutes) to inhibit fibroblast activity and prevent recurrence. It is particularly advantageous as an adjunct treatment to reduce recurrence rates, especially in high-risk or recurrent cases. However, the use of MMC carries certain risks, including the potential for sight-threatening complications if not used properly, scleral melt, delayed epithelial healing, and secondary infections.[6] Therefore, MMC treatment requires careful dosing and technique.

MMC is widely used as an adjunct with both bare sclera and graft techniques, especially in recurrent pterygium surgery.[7] The bare sclera technique, where the pterygium is excised and the scleral bed is left uncovered, is a simple and quick procedure. When combined with MMC, it reduces recurrence rates compared to bare sclera alone. However, it remains inferior to techniques involving tissue grafting.

Conjunctival Autograft

After pterygium excision, a conjunctival graft (typically from the superior bulbar conjunctiva) is transplanted to cover the bare sclera. This technique is considered the gold standard for primary pterygium due to its numerous advantages.[8] It has low recurrence rates (2–15%), provides good cosmetic outcomes, and can be performed using either sutures or fibrin glue.

However, there are some disadvantages to this method. It is technically more demanding and takes longer to perform compared to the bare sclera technique. Additionally, in cases of bilateral or recurrent pterygium, the availability of conjunctiva may be limited. Despite these challenges, the conjunctival graft remains the most commonly used and preferred method for primary pterygium surgery.[9,10,11]

The following pearls can enhance surgical outcomes and reduce complications.

Preoperative Evaluation and Planning

A thorough preoperative assessment is vital. This evaluation should include an assessment of tear film stability, ocular surface inflammation, and the extent of corneal involvement. Corneal topography is an important preoperative tool in the evaluation and planning of pterygium surgery. It provides detailed information about the corneal curvature and surface irregularities that may not be evident on a slit-lamp exam alone.

The benefits of preoperative topography are numerous. Firstly, it allows for the assessment of corneal distortion. Pterygium can induce with-the-rule astigmatism, typically flattening the horizontal meridian. The larger and more advanced the pterygium, the more likely it is to cause irregular astigmatism and decreased visual acuity.

Secondly, topography helps determine surgical indication. Significant topographic distortion or steepening/flattening may indicate the need for surgery, even if the lesion is not visually encroaching on the visual axis.

Thirdly, it guides surgical planning by documenting the preoperative status, which is essential for assessing the visual and refractive impact of surgery postoperatively. It is also useful for identifying irregular astigmatism that may improve after surgery.

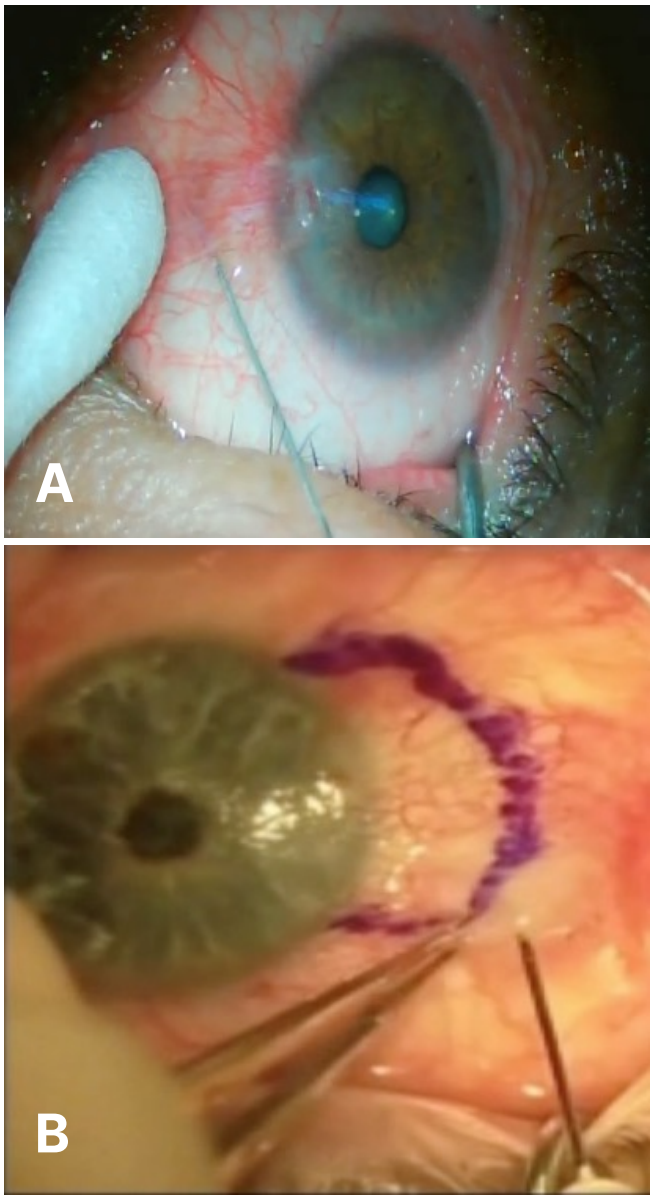

Figure 2. A: Subconjunctival anesthesia injection. **A.** 30G needle pinching under the pterygium. **B.** Injection placed after marking the area of excision; *courtesy of Randall Ulate, MD*

Lastly, topographic images are valuable for patient counselling. They can help explain the potential visual benefits to patients beyond just cosmetic improvements. This is particularly helpful for setting realistic expectations, especially in cases of longstanding or recurrent pterygium where some corneal distortion may be permanent.

Surgical Technique

Marking the Area to Excise

Proper preoperative marking of the area to be excised is crucial for achieving a complete removal, optimizing the graft size, and ensuring a clean surgical field.

It is important to identify the extent of the pterygium, which involves several steps. Begin by examining both the head (corneal extension) and the body (conjunctival portion) of the pterygium. Note the vascularized fibrovascular tissue, which can often extend deeper than it appears. Next, determine the limbal involvement and any associated Tenon's capsule thickening.

Using a Gentian violet marker, caliper, or surgical marking pen is recommended for precision. A corneal ruler or dot marking can help guide the dissection margins. When marking the conjunctival incision, place it 1.0-2.0 mm posterior to the limbus, around the body of the pterygium. Include a margin of normal-looking conjunctiva to ensure complete removal of fibrovascular tissue. Avoid excessive excision of healthy conjunctiva, especially in recurrent cases where the conjunctiva may be limited.

Anesthesia

Topical anesthesia with a supplemental subconjunctival injection ensures patient comfort. Careful administration minimizes chemosis and provides a clearer surgical field. Lidocaine plus epinephrine is recommended **(Figure 2)**.

Gentle and Complete Excision

Meticulous removal of the pterygium head and body is essential. Begin by dissecting the fibrovascular tissue cleanly off the cornea, preserving as much normal conjunctiva as possible. It is generally recommended to begin the excision on the conjunctival side, rather than directly at the cornea **(Figure 3)**. This approach allows for a more controlled dissection, better tissue plane identification, and more complete removal of the pathological tissue.

For the conjunctival incision, make an incision posterior to the body of the pterygium (~1-3 mm from the limbus). Elevate the conjunctiva to expose the underlying fibrovascular tissue and Tenon's capsule **(Figure 4)**.

When dissecting the fibrovascular tissue, carefully remove it en bloc, including the associated Tenon's capsule. Use blunt Westcott scissors to separate the tissue from the underlying

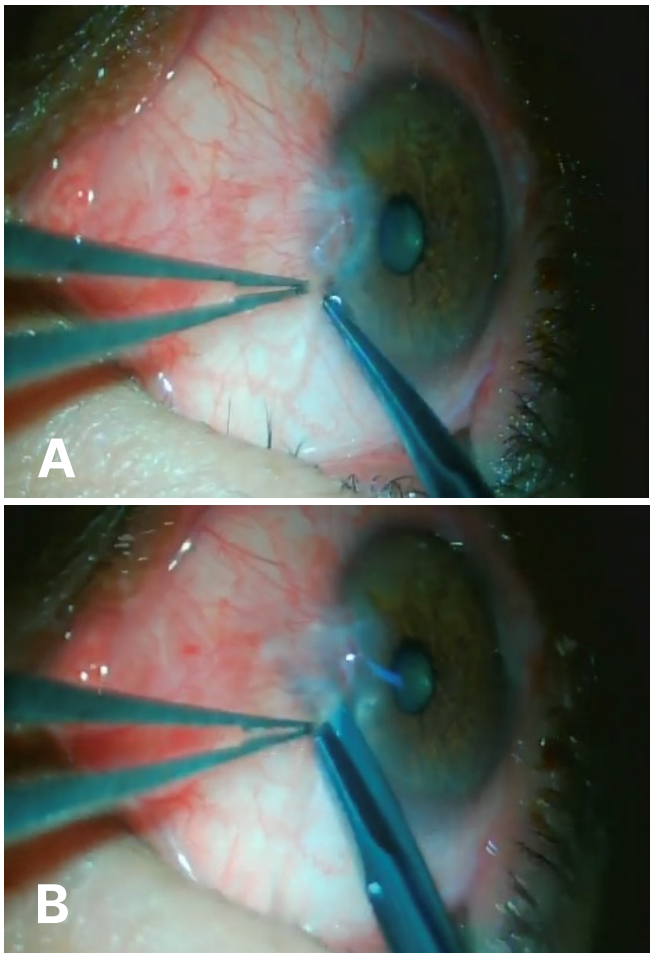

Figure 3. A. Conjunctival incision using Wescott scissors. **B.** Subconjunctival blunt dissection; *courtesy of Randall Ulate, MD*

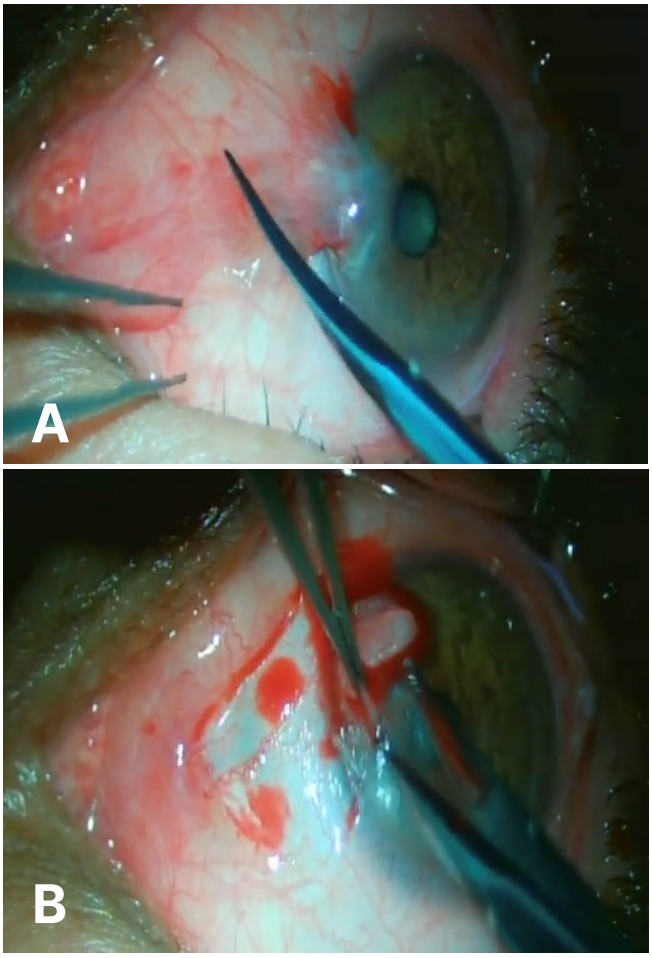

Figure 4. A. Conjunctiva is cut posterior to the body of pterygium. **B.** Pterygium separated from sclera; *courtesy of Randall Ulate, MD*

sclera. Ensure the dissection is in the correct plane (between Tenon's and sclera) to minimize bleeding and trauma.

Once the posterior dissection is complete, proceed anteriorly toward the limbus. At the limbus, sharply cut across the insertion of the fibrovascular tissue. After mobilizing the body, gently peel the pterygium head off the corneal surface. Use a crescent blade, 15 blade scalpel or Beaver blade to shave the remaining fibrous tissue off Bowman's layer. Smooth the corneal surface as needed with the blade or diamond burr (rarely necessary if the superficial keratectomy was made in the correct plane) **(Figure 5)**.

Why Start on the Conjunctival Side?

Starting on the conjunctival side results in better visualization and tissue handling. It also reduces the risk of buttonholing the conjunctiva, allows for complete removal of Tenon's tissue, reducing recurrence, and helps maintain anatomical planes and minimizes trauma.

Surgical Pearl

"If you remove only what you see, you'll leave behind what causes recurrence." That is why dissecting from the conjunctival side and ensuring Tenon's capsule is included is key to long-term success.

Scleral Bed Smoothing

After excision, the scleral bed should be smooth and free of Tenon's remnants. This can be achieved with light scraping with the same blade previously used for the superficial keratectomy. An uneven bed can lead to graft irregularities and poor healing. Avoid excessive cautery, as it may promote scarring and recurrence.

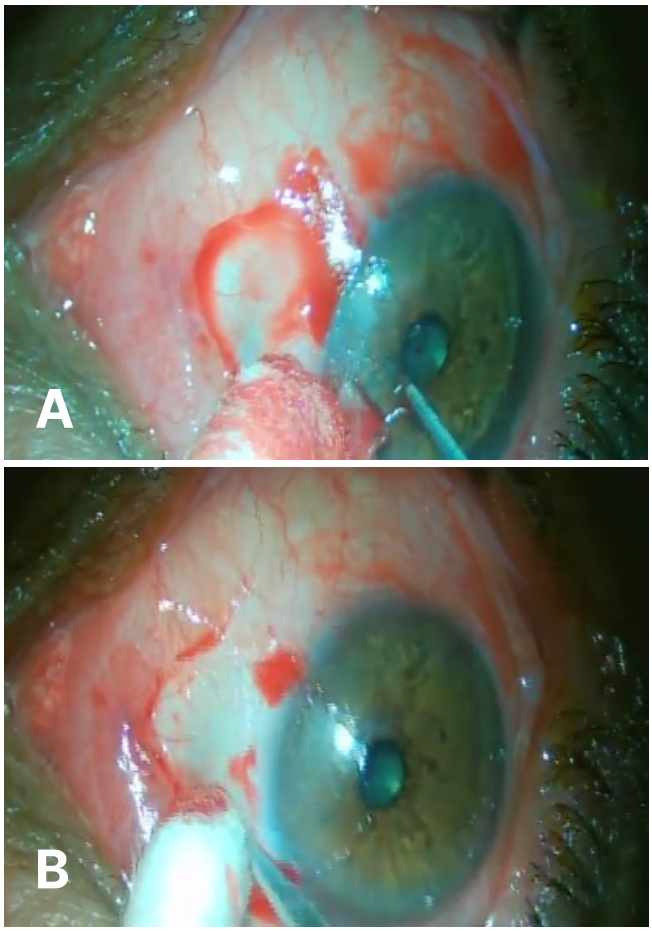

Figure 5. A. Superficial keratectomy. **B.** Smooth corneal and scleral surface; *courtesy of Randall Ulate, MD*

Conjunctival Autografting

A conjunctival autograft, preferably sourced from the superior bulbar conjunctiva, is widely regarded as the gold standard for reducing recurrence. Key techniques involve sizing the graft slightly larger than the bare scleral defect. This begins by measuring the defect size after excising the pterygium and exposing the bare sclera **(Figure 6)**. Subsequently, mark the donor graft to match or slightly exceed the size of the excised area **(Figure 7)**.

If using fibrin glue, slightly oversize the graft for better edge apposition. In recurrent pterygium removal surgery, a graft containing some limbal stem cells can reduce recurrence rates. However, for primary pterygium surgery, a conjunctival autograft without stem cells will suffice and surgical trauma to the superior limbus can be avoided. Include minimal Tenon's tissue to prevent bulkiness. Ensure the graft is oriented correctly (epithelium side up).

Figure 6. Measurement of bare sclera; *courtesy of Randall Ulate, MD*

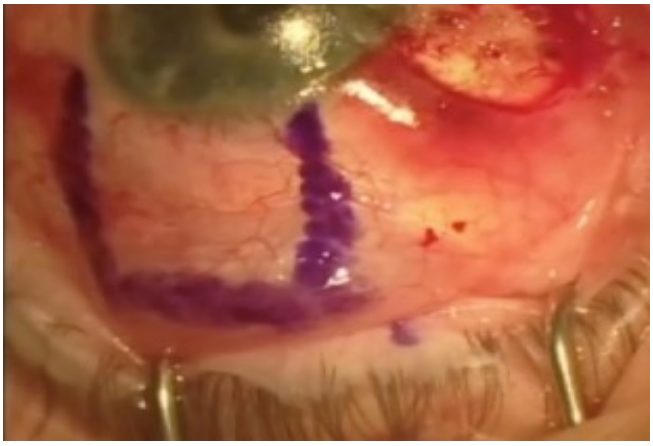

Figure 7. Marking conjunctival graft; *courtesy of Randall Ulate, MD*

You can secure the graft with fibrin glue or sutures. Fibrin glue offers shorter surgery time and better patient comfort, while sutures may be preferred in certain settings. Conjunctival grafts secured with fibrin glue during pterygium surgery are as stable as those secured with sutures and produce significantly less inflammation. Tissue adhesives have revolutionized conjunctival autograft fixation in pterygium surgery by offering faster, sutureless techniques with excellent cosmetic and functional outcomes **(Figure 8)**.[12]

Fixation of the Graft with Fibrin Glue

First, prepare the bed, ensuring that the scleral bed is clean and dry. Achieve meticulous hemostasis (any bleeding can prevent adhesion). Apply small drops of fibrin glue.

Next, gently position the conjunctival autograft over the glued area. Carefully align the limbal edge with the limbus **(Figure 9)**. Using a forceps, gently press the edges of the graft against the host conjunctiva for 1–2 minutes to

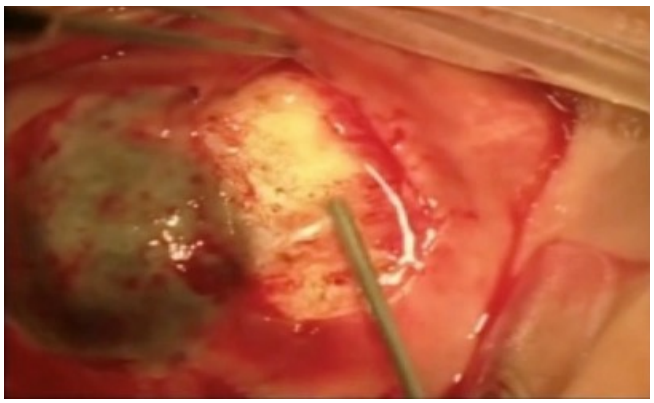

Figure 8. Fibrin glue is placed on the bare sclera previous to position the conjunctival graft; *courtesy of Randall Ulate, MD*

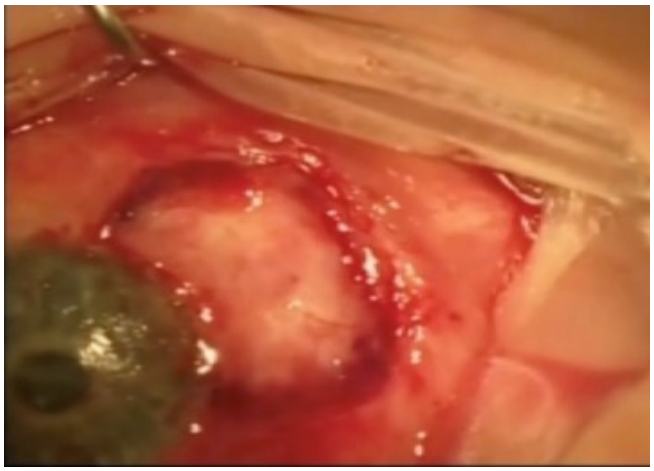

Figure 9. Conjunctival graft holding in position; *courtesy of Randall Ulate, MD*

ensure adhesion. Allow time for polymerization, as fibrin glue typically sets in 10–60 seconds, depending on the brand used.[13] Once the graft is in place, avoid manipulating it after placement.

Fixating the Conjunctival Autograft with Sutures in Pterygium Surgery

Although tissue glue is gaining popularity, suture fixation remains a widely used and effective method for securing conjunctival autografts, especially in settings where glue is unavailable. A commonly used suture material for conjunctival graft fixation is 10-0 Nylon, which is favoured for its tensile strength, low tissue reactivity, and fine calibre that minimizes tissue trauma. While alternative options such as 9-0 or 10-0 vicryl are available, nylon is preferred when longer graft stability and minimal inflammation are desired.

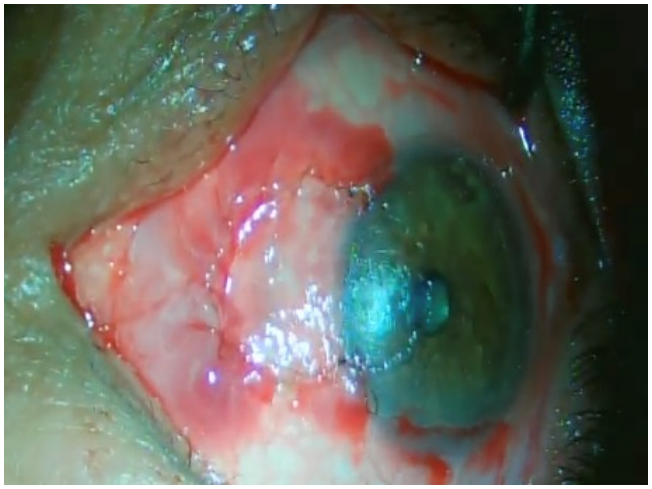

Figure 10. Conjunctival autograft fixated with 10-0 Nylon suture; *courtesy of Randall Ulate, MD*

Suturing Techniques

For interrupted sutures, place four to six interrupted 10-0 nylon sutures at the edges and corners of the graft. This technique ensures edge-to-edge apposition without causing tension or redundancy.

Running (continuous) sutures, while faster, are slightly more technically demanding. They are typically used for the limbal edge or to anchor one side of the graft. However, there is a risk of cheese-wiring if the sutures are placed under tension.

A combination technique can be used, where interrupted sutures are placed at the corners, and a running suture is used along the limbal edge. Additionally, optional limbal anchoring can be employed. Placing a suture at the limbus helps maintain orientation and ensure an anatomical match (especially if a limbal stem cell barrier is being restored) **(Figure 10)**.

Minimize Recurrence with Adjunctive Therapies

MMC at a 0.02% concentration applied intraoperatively under the rim of retracted conjunctiva for 1–2 minutes has shown efficacy in reducing recurrence, especially in cases of aggressive or recurrent pterygium.[14,15] However, care must be taken to avoid complications such as scleral thinning. We recommend using MMC for recurrent pterygium, and only rarely for primary cases.

Postoperative Care

Post-surgical care includes several steps. Patients are usually prescribed topical antibiotics and corticosteroids which are tapered over a period of 4–6 weeks. Lubricants are recommended to support ocular surface healing. Wearing sunglasses is recommended to protect the eyes from UV light. Close follow-up during the early weeks is necessary to monitor for graft displacement, infection, or recurrence signs.

Complications

Common complications following surgery include graft edema, graft displacement or loss, Dellen formation, infection, pyogenic granuloma, recurrence, symblepharon, scleral thinning or necrosis. However, most of these are preventable with careful surgical technique and early intervention.

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Financial Disclosures

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