How Do I Extend a Tube?

Five approaches to the surgical revision of a glaucoma drainage device.

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HERBERT P. FECHTER, MD

The retraction and exposure of a tube are two common complications that require the tube's extension. During the initial glaucoma implant surgery, I typically direct the tube toward the 6- or 12-o'clock limbus using an S-shaped routing (Figure 1). I secure the tube to the sclera with a 7–0 coated 910 polyglactin suture (Vicryl; Ethicon Inc., Somerville, NJ) in a horizontal mattress fashion. This positioning keeps the tube covered by the eyelid, helps to prevent conjunctival erosion, and provides extra slack in the tube in the event of its retraction from the anterior chamber. I usually treat retraction by rerouting the tube closer to the plate. The repair requires a peritomy with relaxing incisions, dissection beneath the patch graft, pulling the tube from the eye, creating a new 23-gauge needle tract into the anterior chamber, and repositioning the tube by using up the extra slack. The tube can even be directed into the vitreous cavity following a thorough vitrectomy. I resuture the prior patch graft and conjunctiva to the limbus using a 7–0 coated 910 polyglactin suture. The capsule surrounding the plate remains intact and prevents postoperative hypotony.

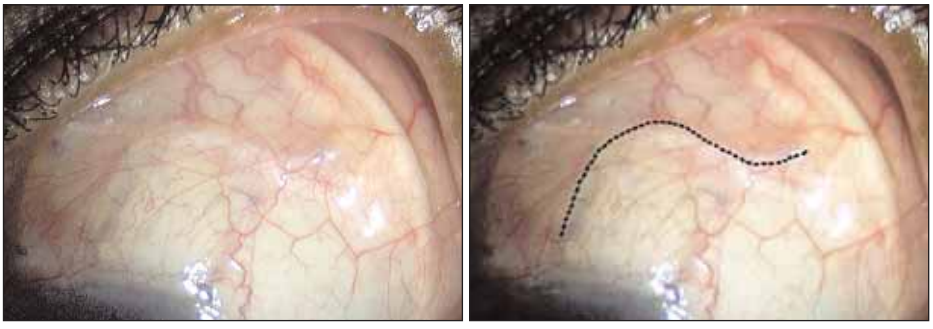
On rare occasions, a tube must be rerouted to another quadrant due to its exposure, infection, or conjunctival scarring. The commercially available Tube Extender (New World Medical, Inc., Rancho Cucamonga, CA) can be used to reroute the glaucoma drainage device's tube to an area with healthier conjunctiva. The older technique using a 4-mm section of 22-gauge angiocatheter and Crawford tubing works equally well and is a little less bulky (Figure 2). I use a 10–0 polypropylene suture (Prolene; Ethicon Inc.) to secure the angiocatheter around the glaucoma tube and the Crawford tube extension. The Tube Extender or the modified angiocatheter should be positioned as far from the limbus as possible, and they should be covered with a patch graft to prevent conjunctival erosion. The extended tube's distal end is cut with a bevel and inserted through a new 23-gauge needle tract.

STEVEN R. SARKISIAN, JR, MD

The Tube Extender has proven invaluable to me, especially in cases of retracted tubes. The extender could also be helpful in cases in which a tube is inadvertently cut. In the largest published case series with the device, Peter Netland, MD, PhD, and I demonstrated that it can also be used to revise an exposed tube or to relocate a malpositioned tube.[1]

Because of its design, using the Tube Extender is rather straightforward. It is 1.14 mm high and 3.05 mm wide. The device is composed of a 24-mm-long piece of silicone tubing attached to a silicone plate with two positioning holes for scleral fixation (Figure 3). The opposite end of the plate has a junction with a slightly larger bore that can be connected to the tube from the drainage device. The surgeon may cut the new tubing to whatever length necessary. Because the Tube Extender has a lower profile than most device plates, its minimal bulk is not prohibitive.

Finally, the advantage of the extender is that it is on the shelf. It is readily available when I need to create a secure junction with any glaucoma drainage implant. I need not wait for the OR staff to find the device. Nor must my staff



(Courtesy of Herbert P. Fechter, MD.)

Figure 1. The surgeon routes the tube toward the 12-o'clock limbus.

(Courtesy of Herbert P. Fechter, MD.)

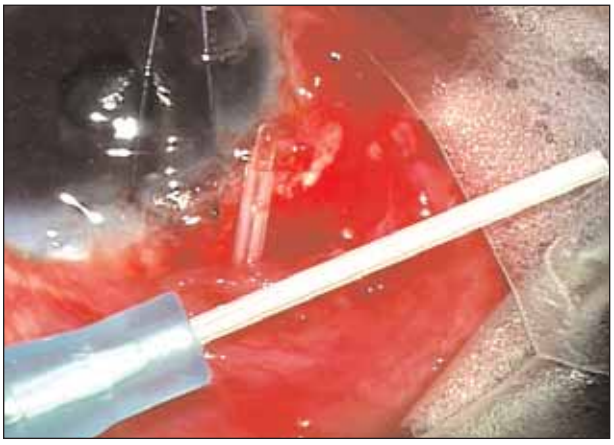


Figure 2. The surgeon creates an improvised tube extender using a 22-gauge angiocatheter.

special order tubing material for me to manipulate for an unintended purpose. I find the Tube Extender offers an efficient way to revise a tube that needs lengthening.

DONALD L. BUDENZ, MD, MPH

A number of surgical options address the problem of a tube that has retracted out of the anterior chamber or a tube that was trimmed too short during the original insertion. Normally, I use the commercially available Tube Extender.[1] If this device is unavailable for some reason, I extend the tube by splicing in the sleeve from a 22-gauge angiocatheter according to a technique described by Smith and Doyle.[2]

When I revise a tube using the Tube Extender, I start by creating a large fornix-based conjunctival flap to expose the limbal portion of the tube. The old patch graft is removed. Posterior dissection should be limited to avoid disruption of the capsule around the plate of the implant. If the capsule is inadvertently violated, I religate the tube to avoid postoperative hypotony if the implant has no valve. The Tube Extender has a receptacle for the original tube. I trim the original tube back but leave 2 to 4 mm extending from the capsule to allow me room to slide the Tube Extender's receptacle over the cut end of the original tube (Figure 4). There is no need to suture the end of the old tube into the receptacle; rather, surgeons simply must be careful not to pull it out as they proceed with the rest of the case. The plate is fixated to the sclera with nonabsorbable sutures through the two fixation holes. The new tube is trimmed to an appropriate length and reinserted through the original hole into the anterior chamber or through a new 23-gauge needle track, if needed.

Next, I put a new patch graft over the tube and the receptacle. There may be adequate Tenon's layer over the receptacle to prohibit erosion, but I place the patch graft to be safe. I then close the conjunctiva.

OMAR PIOVANETTI, MD, AND ROBERT M. FELDMAN, MD

Surgeons have a variety of methods for revising a short, dislocated, or malpositioned tube in a glaucoma drainage device. Often, replacing a tube is an effective, easier alternative to extending it.

Used for canalicular repair, Crawford tubes are made from the same type of material and have the same dimensions as the tubes that are a part of most commonly available glaucoma drainage devices. Crawford tubes are therefore an effective device for extending a tube shunt. The first step is to cut the original tube of the glaucoma drainage device close to the plate. Next, the surgeon should make a small opening in the anterior aspect of the fibrous capsule around the plate, insert the new Crawford tube extension over the plate, and tightly close the capsule around the new tube. After placing the new tube into the anterior chamber or vitreous cavity, the surgeon secures it to the sclera with interrupted 8–0 nylon sutures. With adequate tension on these sutures, the new tube should not move or migrate. Finally, the surgeon covers the entry site with a corneal or scleral patch graft.

In addition to the technical advantages, one Crawford tube can be cut, sterilized, and packaged so that it can be used for multiple patients. In short, using a Crawford tube is an easy and cost-effective way to replace rather than extend a tube in a glaucoma drainage device.

MICHAEL B. HORSLEY AND MALIK Y. KAHOOK, MD

Early retraction of a glaucoma drainage device tube is an uncommon phenomenon often linked to the improper securing of the plate to the sclera (Figure 5). Our approach for repairing a retracted tube involves creating a fornix-based conjunctival flap and carefully dissecting the scleral patch graft off the sclera with 0.12 forceps and blunt Westcott scissors. The scissors should pass parallel to the path of the tube to avoid cutting it unnecessarily. Once the tube's path has been completely exposed, we engage and

Figure 3. The Tube Extender (model TE).

(Courtesy of Steven J. Gedde, MD.)

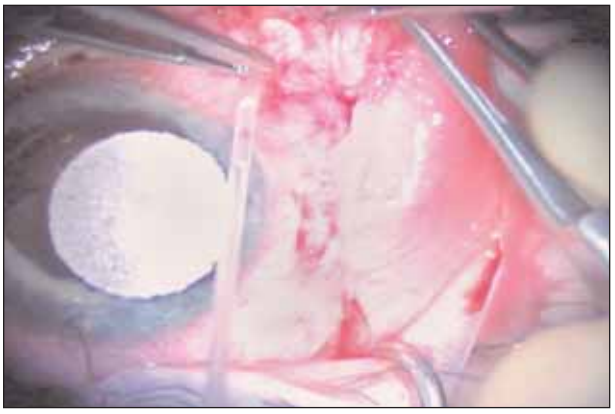


Figure 4. The surgeon attaches the Tube Extender to the end of a glaucoma drainage implant tube.

(Courtesy of Michael B. Horsley and Malik Y. Kahook, MD.)

Figure 5. A silicone tube has retracted and is now abutting the cornea after the posterior migration of the plate.

trim the tube 2 to 3 mm away from the plate while allowing for enough length to engage the Tube Extender. We then dispose of the distal edge of the tube and suture closed the original scleral tunnel.

We favor the Tube Extender for its ease of attachment to the existing tube and the presence of two islets that help secure the extender to the sclera. The proximal edge of the existing tube is threaded into the extender, which is then sutured in place with a 7–0 Vicryl suture. Once secured, the extender tube is trimmed and threaded through a new scleral tunnel created with a 23-gauge needle 3 mm posterior to the limbus and adjacent to the old scleral tunnel. Using a new tunnel decreases the risk of early leakage around the tube. We secure a new scleral patch graft over the tube and reapproximate the conjunctiva with a 7–0 Vicryl suture or Tisseel glue (Baxter Healthcare Corporation, Glendale, CA).

The bleb and plate should be avoided if possible during tube extension procedures unless the plate has migrated posteriorly and is at risk of contacting the optic nerve, leading to mechanical injury.[3,4] In that case, the plate can be exposed, brought forward, and sutured approximately 8 mm posterior to the limbus prior to completing the tube extension procedure. ❑

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