The iTrack for Pediatric Trabeculotomy

Improved visualization and the ability to inject an OVD may augment the success of this procedure.

BY PETER W. DEBRY, MD

My recent experiences with ophthalmic microcatheters have opened new surgical approaches for the management of both pediatric and adult glaucoma. This article focuses on the use of a new 250-µm microcatheter for pediatric glaucoma surgery associated with 360º trabeculotomy.

SURGICAL APPROACH

The initial treatment of congenital glaucoma is typically surgical, with the approach based on the clarity of the cornea and the glaucoma surgeon's training. The goal is to cut or break through the abnormally developed angle and establish aqueous flow from the anterior chamber to Schlemm's canal. Goniotomy and trabeculotomy are the two main surgical techniques performed in the US today for the treatment of congenital glaucoma. Successfully controlling the IOP after trabeculotomy requires a functional canal and other downstream outflow pathways.

The standard 360º suture trabeculotomy consists of a superior conjunctival peritomy, deep lamellar scleral dissection through a scleral flap, and identification of Schlemm's canal. The surgeon heats a 6–0 Prolene suture (Ethicon Inc., Somerville, NJ) to smooth and round the tip and then places it into the cut end of the canal. The suture is then fed through the canal until it appears at the cut end of the canal adjacent to the entry site. The surgeon injects an ophthalmic viscosurgical device (OVD) into the anterior chamber and pulls the suture ends until they are sufficiently taut to cut through the inner wall of the canal and the trabecular meshwork. He then removes the suture, tightly sutures the scleral incisions, and closes the conjunctiva at the limbus.

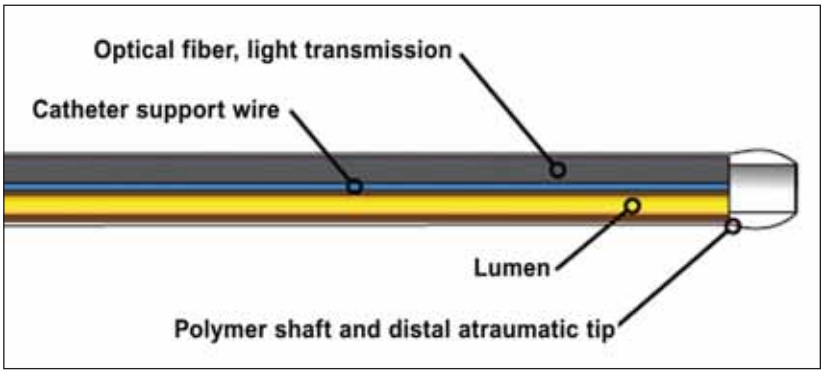
THE iTRACK

The iTrack 250 microcatheter (iScience Interventional, Menlo Park, CA) allows the circumferential cannulation of structures such as Schlemm's canal. Unlike the sutures utilized in traditional trabeculotomies, the microcatheter allows the surgeon to inject an OVD during cannulation, provides a small-gauge wire for greater control during the advancement of the microcatheter, and has an illuminated tip for transscleral visualization during the device's advancement (Figures 1 and 2).

OBSTACLES TO SUCCESS AND SOLUTIONS

Scleral Dissection

The potential obstacles to a successful trabeculotomy involve the scleral dissection and the passage of the suture through the canal. Identifying the cut end of the canal requires a clean dissection at the correct depth of the sclera. This step can be tricky in a pediatric eye, even for a seasoned glaucoma surgeon who regularly performs nonpenetrating glaucoma surgery. Because a child's sclera is much more pliable and elastic than an adult's, assessing the incision's depth can be difficult. Moreover, intraoperative drying of the tissue can thin the sclera. In addition, a



(All images courtesy of iScience Interventional.)

Figure 1. The iTrack ophthalmic microcatheter combines a fiber optic light source with a lumen for the controlled delivery of a viscoelastic.

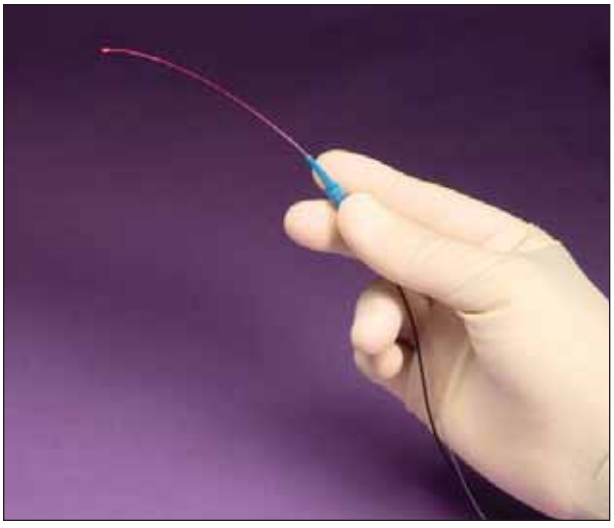


Figure 2. The iTrack ophthalmic microcatheter.

buphthalmic eye from elevated IOP has thinner stretched sclera and abnormal dimensions at the limbus that can make identifying normal anatomical landmarks (particularly the change in color that signals the surgical limbus and the location of the canal) difficult. Finally, in an eye with congenital glaucoma, the outflow pathways may be so underdeveloped that there is no Schlemm's canal to identify.

New ultrasound technology can image Schlemm's canal. High-resolution ultrasound such as the iUltrasound 80-MHz-frequency system (iScience Interventional) can help reveal key outflow structures and their location during trabeculotomy (Figure 3). Before starting a procedure, the surgeon can use the iUltrasound device to measure the scleral thickness and the location and patency of Schlemm's canal. If intraoperative ultrasound fails to identify a patent Schlemm's canal, the chance of a successful trabeculotomy is zero, and the surgeon can abort the procedure in favor of a glaucoma drainage device. If the outflow system is patent, he can note the depth and position of the canal and use this information to guide the dissection. Should visually identifying the canal during the dissection prove difficult, a repeat assessment with ultrasound will permit a comparison of the depth and position of the dissection to that of the canal and help the surgeon to make the necessary adjustments to access the canal more easily.

The Passage of the Suture

With traditional suture trabeculotomy, after identifying the cut end of the canal, the surgeon blindly passes the suture around the circumference of the angle for 360º. Because the canal is often incompletely developed in pediatric eyes, the suture often (1) stops advancing, (2) advances but does not come out the other end of Schlemm's canal, or (3) breaks through the canal into the anterior chamber. In these situations, a common approach is to remove the suture and attempt its passage in the opposite direction. If that maneuver is unsuccessful, the surgeon can create a second dissection inferiorly, either to find the partially advanced suture or to attempt to identify the canal and pass the suture from a different area.

The iTrack has significantly improved my ability to successfully cannulate Schlemm's canal for 360º. The end of the device has a specially designed tip with a smooth round edge that allows the device to glide through the canal. In contrast, even a well-prepared suture is likely to have some roughness at its tip or edges, which could drag and prevent the suture's successful passage. I also find that my ability to inject an OVD can facilitate the iTrack's passage, because the viscoelastic dilates a small, partially developed area of the canal that would prevent the passage of a suture alone. Moreover, an OVD may provide some lubrication to the microcatheter as it is fed through the canal.

Most importantly, the fiber-optic cable allows me to visualize the probe's tip directly, as I advance the microcatheter through the canal. I immediately recognize when the tip alters course and starts to move away from the limbus, either into the suprachoroidal space or a large collector channel. I can then back up and inject an OVD in an attempt to dilate the canal and allow the iTrack's continued circumferential movement, or I can remove the tip and attempt the microcatheter's passage in the opposite direction. If the tip cannot be advanced in either direction past a certain location, I can easily create a cut-down, because I can quickly identify the tip's position. By pulling the microcatheter to create tension, I can create a partial trabeculotomy as the microcatheter cuts through the angle in that section where it was passed.

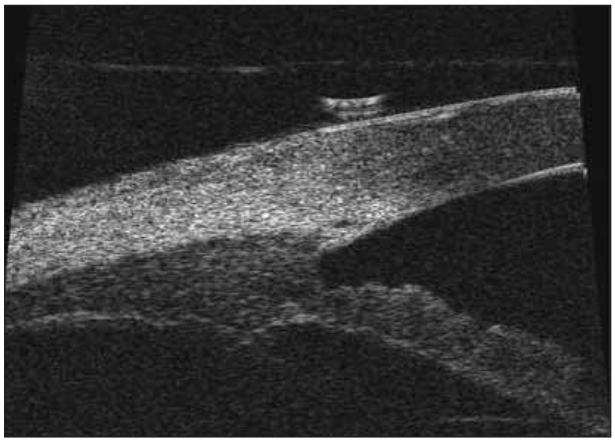


Figure 3. An image of Schlemm's canal as seen with the iUltrasound 80-MHz-frequency system.

PERSONAL EXPERIENCE

I recently performed microcatheter-based trabeculotomies in both eyes of two patients with bilateral congenital glaucoma. In one eye, I easily identified the cut end of the canal and passed the cannula 360º. By firmly grasping the ends of the microcatheter and placing tension on the catheter, I enabled the iTrack to break through the abnormal angle into the anterior chamber to complete the trabeculotomy in a similar fashion as with a Prolene suture. In two cases, after multiple attempts, the microcatheter advanced approximately 270º before turning away from the limbus. In both instances, I easily performed a cut-down at the position of the tip and completed the trabeculotomy by pulling the catheter to open 270º of the angle. In the fourth case, I could not identify Schlemm's canal or the outflow passages, so I placed a glaucoma implant.

The full pressure-lowering effectiveness of my procedures is still to be determined. At present, it appears that the IOPs will be less than the preoperative values, although not low enough to avoid some use of medications by the patients.

CONCLUSION

The safety and effectiveness of a new procedure can only be confirmed through a prospective trial comparing two techniques. From a purely anatomical standpoint, the iTrack and iUltrasound will make trabeculotomy surgery quicker and easier, especially for a less-experienced pediatric glaucoma surgeon. The main question that needs to be answered is whether cutting though the angle structures with the larger-diameter catheter lowers IOP similarly to cutting through the angle with a Prolene suture. Thus far, I find microcatheters promising and use them in both adults and children. I am hopeful that future data will support the iTrack's utility for glaucoma surgery. ❑

Peter W. DeBry, MD, is in private practice in Las Vegas. He acknowledged no financial interest in the products or companies mentioned herein. Dr. DeBry may be reached at (702) 219-8770; pwdebry@yahoo.com.

Further Reading:

Beck AD, Lynch MG. 360 degrees trabeculotomy for primary congenital glaucoma. Arch Ophthalmol. *1995;113:1200-1202.*

Lewis RA, von Wolff K, Tetz M, et al. Canaloplasty: circumferential viscodilation and tensioning of Schlemm's canal using a flexible microcatheter for the treatment of open-angle glaucoma in adults: interim clinical study analysis. J Cataract Refract Surg. *2007;33:1217-1226.*