The trabeculectomy has been the so-called gold standard of glaucoma filtration surgery. When one trabeculectomy failed, surgeons would often perform a second or even third, followed by some form of cycloablation when these filters failed as well. In the latter part of the 20th century, glaucoma drainage implants, starting with the Molteno (Katena Products), became a viable option. Currently, drainage devices are more often used as the next surgery in the glaucoma treatment algorithm when one filter fails. This practice is supported by the results of the Tube Versus Trabeculectomy (TVT) Study, which demonstrated that tube shunts may hold an advantage in terms of efficacy and fewer complications when performed in cases of refractory glaucoma where previous surgery has failed.\(^1\)

Glaucoma drainage devices are not without unique complications, however, such as diplopia, tube/plate exposure, retinal breaks/scarring from deep scleral fixation sutures, plate encapsulation, and failure.\(^2\) Consequently, new technology is being developed to minimize the complications from both tubes and trabeculectomy. Among the devices in development—and the focus of this article—are the Xen Gel Stent from AqueSys and the InnFocus MicroShunt from InnFocus. Both manufacturers are trying to control flow and minimize hypotony by applying Poiseuille’s law of laminar flow to create a tube that is sufficiently long and narrow to restrict and control outflow while allowing for minimal biofouling, scarring, and inflammation.

**THE XEN GEL STENT**

The Xen is a soft, collagen-based gelatin implant. Because it is injected into the subconjunctival space via an ab interno route through a clear corneal incision (Figure 1), the technology is categorized as microinvasive glaucoma surgery (MIGS). The Xen is the only MIGS procedure, however, that uses a space typically accessed in an ab externo fashion with the goal of an external, subconjunctival fistula. It is therefore an interesting and unique “hybrid” that could conceivably be performed as a primary procedure in the early stages of glaucoma without eliminating the option of standard filtration surgery in the future. Nor would the device preclude future treatment with ab interno MIGS procedures such as the iStent Trabecular Micro-Bypass Stent (Glaukos),
cause scarring and become encapsulated (Figure 2). Another difference between the device and a conventional tube shunt is that, with the InnFocus Microshunt, mitomycin C (MMC) is used to modulate wound healing. Research has shown MMC not to be effective at lowering IOP with conventional glaucoma drainage implants. The InnFocus Microshunt is placed in the anterior chamber through an ab externo scleral needle track tunneled posteriorly to the limbus. The implantation of the device is not technically MIGS, because it must be implanted with a fornix-based conjunctival incision.

No data on this device have been published, but the implant is under investigation in the United States. A multicenter, randomized, prospective clinical trial comparing the InnFocus Microshunt with MMC to standard trabeculectomy with MMC is currently recruiting patients. Like the Xen implant, the InnFocus Microshunt does not preclude the use of future ab interno MIGS procedures. Unlike the Xen implant, implantation of the InnFocus Microshunt requires significant conjunctival dissection, making future filtration surgery more difficult.

THE FUTURE

A continuing shift of filtration surgeries to smaller-incision “stenting” procedures is likely. Since the release of the Ex-Press Glaucoma Filtration Device (Alcon) over 10 years ago, surgeons have sought different ways to restrict outflow by standardizing wound size and slowing flow by channeling it through a cylindrical implant. The Xen and InnFocus implants as well as the many new MIGS devices being studied make this an exciting time in the fight against glaucoma-related blindness.

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