Blending the Old and the New in Glaucoma Surgical Innovation

BY NATHAN M. RADCLIFFE, MD

On Eyetube.net, we have seen an evolution of techniques that enhance our understanding of surgical approaches to glaucoma. Regardless of which techniques ultimately prevail, some approaches seem to have endless applications. For example, the creation of a scleral flap has applications for time-tested trabeculectomy as well as for the treatment of “bubble trouble” after Descemet stripping endothelial keratoplasty (DSEK) and for the placement of a suprachoroidal shunt. Additionally, ab interno gonioscopic procedures are becoming more common, such as with the placement of a standard iStent Trabecular Micro-Bypass Stent or perhaps even the iStent Supra (both from Glaukos Corporation, the latter not available in the United States). This edition of “Inside Eyetube.net” highlights the blend of traditional and novel surgical approaches to managing glaucoma.

BUBBLE TROUBLE

In clinical practice, glaucoma and corneal disease often coexist. Many secondary glaucomas such as iridocorneal endothelial syndrome or acute angle-closure glaucoma can cause corneal decompensation and thus require corneal transplantation. Complications from cataract surgery can result in both corneal disease and glaucoma, complicating the management of both conditions. Trabeculectomy and tube shunt implantation may lead to corneal endothelial loss, so it is not surprising that DSEK is an increasingly common procedure performed on glaucoma patients.

In his video titled, “Acute Bubble Trouble: Glaucoma Post DSEK,” Ronald L. Fellman, MD, notes that pupillary block induced by an air bubble after DSEK can cause a unique case of acute angle-closure glaucoma (Figure 1). According to Dr. Fellman, these cases can be challenging because the iris and air bubble can adhere to the endothelial button, limiting the standard treatment options available in the office.

Dr. Fellman presents a surgical technique with which to remove the air bubble, free the iris from the endothelial button, and re-form the anterior chamber. He begins by converting the scleral tunnel used for the endothelial keratoplasty placement into a scleral flap. Next, he performs an iridectomy and removes the air bubble, as he simultaneously re-forms the anterior chamber with balanced salt solution. Due to the underlying corneal disease and immature DSEK procedure, the view of the angle is limited during goniosynechiolysis. Given the patient’s history of IOP problems and Dr. Fellman’s inability to confirm an anatomically restored angle, he converts the scleral flap to a trabeculectomy by removing a portion of the cornea on the posterior lip of the scleral tunnel. He closes the conjunctiva without the use of an antimetabolite.

At the end of the video, Dr. Fellman leaves the viewer with an interesting thought: “If the angle recovers, the trabeculectomy will fail.” This video is an example of how...
surgical paradigms in glaucoma management evolve, as we apply traditional pathophysiological understanding and treatment techniques to unconventional and novel situations.

**A SHUNT MADE OF GOLD**

Of the many surgical techniques I have observed throughout my career, the implantation of the Solx Gold Shunt (Solx, Inc.) seemed especially daunting. Specifically, I recall being taught as a second-year resident learning strabismus surgery that the suprachoroidal space was to be avoided, not intentionally entered. For this reason, I was particularly pleased to see that Marlene Moster, MD, posted her technique for the implantation of this novel suprachoroidal shunt on Eyetube.net. The implant, which is biocompatible and made of pure gold (due to its inert nature for intraocular tissues), uses the eye’s natural pressure differential to reduce IOP. The shunt is 5.2 mm long and measures 2.4 mm wide anteriorly and 3.2 mm wide posteriorly. It weighs 6.2 mg and has a thickness of 60 μm, concealing nine microchannels (25 × 44 μm) that drain aqueous humor from the anterior chamber into the suprachoroidal space.

Dr. Moster presents the implantation of a Solx Gold Shunt to lower the IOP from 28 mm Hg in a failed trabeculectomy case. The surgery begins with a corneal traction suture (note the clever two-pass technique that allows her fine control over the direction of indentation). She makes a corneal paracentesis and performs a subconjunctival posterior injection of lidocaine to facilitate an 8-mm-wide, fornix-based conjunctival dissection. Dr. Moster creates a 4- × 4-mm scleral flap of approximately 70% thickness and brings the dissection into clear cornea. Next, she incises the scleral bed 2.8 mm posterior to the limbus and injects viscoelastic to increase the suprachoroidal space. She then incises the scleral bed at the grey line and uses a keratome to enter the anterior chamber, which is also filled with viscoelastic. Before implanting the shunt, Dr. Moster ensures that the shunt is freely mobile on the insertion device, the hook of which facilitates the placement of the shunt’s tip into the anterior chamber (Figure 2) while the tail is placed into the choroidal space through the more posterior incision. After suturing the corners of the scleral flap into place, Dr. Moster gently nudges the device ab interno into the angle, removes the viscoelastic, and closes the conjunctiva. The surgery employs a blend of traditional techniques (scleral flap and conjunctival dissection) with some elegant maneuvers specific to the procedure (sliding a thin gold plate into the suprachoroidal space).

**A LESSON IN ANGLE SURGERY**

For those of us not facile with angle surgery, Eric Donnenfeld, MD, provides a step-by-step video on how to implant the iStent. He recommends that, after a cataract is removed, we consider the use of acetylcholine (Miochol-E; Bausch + Lomb) and then fill the anterior chamber with viscoelastic. It is important that we become comfortable using a goniolens to visualize the angle, and Dr. Donnenfeld recommends that the microscope be tilted 30° toward the surgeon and the patient be tilted 30° away from the surgeon. He also suggests that we employ blood reflux to visualize the angle, as low IOP in the anterior chamber will allow nature’s contrast to enter Schlemm canal, making the target visible.

In terms of timing and coordination, Dr. Donnenfeld...
recommends that the gonio lens be placed on the cornea once the iStent is close to the trabecular meshwork in the distal angle. A little hyphema, he says, is a good sign that the surgeon has hit the target. Dr. Donnenfeld explains that, compared with cataract surgery, there is no additional management. Finally, acknowledging that it is an off-label protocol, he notes that, for patients on two glaucoma medications, he implants two stents, and for patients on one glaucoma medication, he implants one stent. Because the iStent was recently approved by the FDA, I suspect that many of us will appreciate the advice of an experienced cataract surgeon who has extensive experience implanting this device.

If you feel that brevity is the sole of wit, you will likely enjoy a short video by Jason Bacharach, MD, on the iStent Supra. Dr. Bacharach demonstrates the ab interno implantation of Glaukos’ next-generation device into the suprachoroidal space (Figure 3). The video is 10 seconds long, highlighting the streamlined nature of this procedure. After watching the video, the viewer will likely be interested in seeing data regarding the efficacy of this device and technique, because the briefness cannot be topped.

CONCLUSION
As our glaucoma surgical techniques evolve, we will likely blend the old and the new to enhance glaucoma care for our patients, and Eyetube.net will chronicle the adventure.

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