Recognizing and Pushing the Limits on Eyetube.net

BY NATHAN M. RADCLIFFE, MD

Ophthalmic videos can tell great stories. This edition of "Inside Eyetube.net" examines three examples of evolution in the areas of glaucoma diagnosis and surgery. Although the topics of optical coherence tomography (OCT), therapeutic ultrasound for glaucoma (TUG), and surgical adhesives seem somewhat disparate, when viewed together, they tell an account of evolution in our specialty. In some cases, we must recognize the limitations of our current favorite technologies, as we do today with OCT. In other cases, we must push our existing technology from diagnostics into the treatment realm, as with TUG. Sometimes, we must prepare to say goodbye to the old in favor of the new, as we may someday do with the ophthalmic suture. When we review a series of videos on Eyetube.net, the story that emerges can be as telling as the individual videos themselves.

OCT PITFALLS

For my colleagues who use OCT on a daily basis, I highly encourage you to view a fantastic video by Sanjay G. Asrani, MD. Dr. Asrani systematically reviews the pitfalls that can occur when interpreting images and data from spectral-domain OCT scans.

In his video, Dr. Asrani categorizes OCT artifacts into separate categories. Operator-dependent artifacts occur when the OCT image quality is low or when the OCT signal is truncated, usually because the patient is positioned too close or too far from the OCT machine. Misinterpretation of OCT signals or "red disease" occurs when a normative database is applied to patients who should not be considered normal (eg, high myopes). "Green disease" occurs in patients who have globally normal values such as an average thickness of the retinal nerve fiber layer (RNFL) but have small focal defects that are missed because the reviewer does not carefully inspect the retinal nerve fiber layer for 360°.

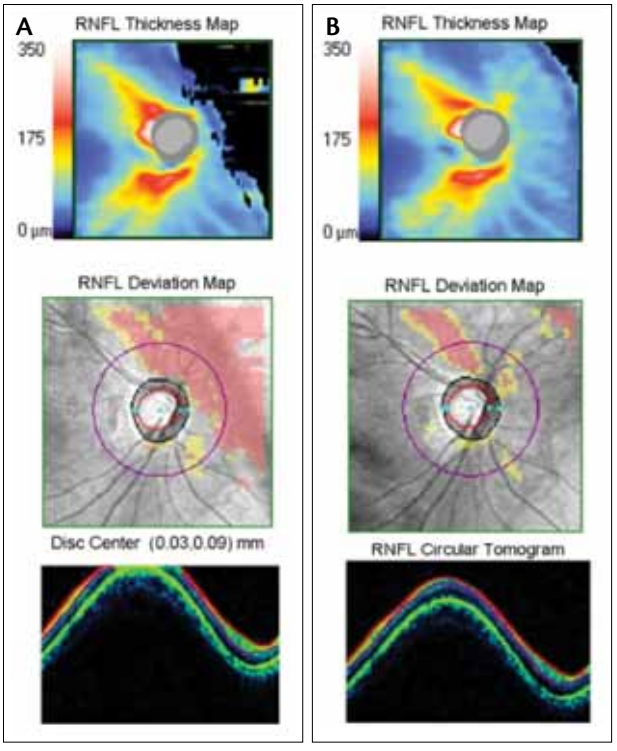

Figure 1. An example of two OCT images collected seconds apart. The first image is not entirely acquired due to optic nerve tilting and misalignment of the capture window, resulting in an abnormal RNFL thickness and deviation map (A). In the second, after proper acquisition with the appropriate alignment, the abnormalities are corrected (B).

According to Dr. Asrani, artifacts caused by pathology are very common. He points out that epiretinal membranes and posterior vitreous detachment can cause artifactitious increased RNFL values. In my practice, many patients with glaucoma and diffuse diabetic macular edema will have normal RNFL values, despite having known glaucoma optic

Figure 2. Dr. Schwartz performs the TUG procedure by applying the ultrasound transducer just posteriorly to the limbus.

atrophy. Artifacts can also occur due to the way that the OCT software acquires data (Figure 1). For example, if compensation is not made, microsaccades or inconsistent head tilt can result in test-retest variation. Finally, the algorithms that automatically split the OCT data can fail, causing segmentation errors. Dr. Asrani reminds us that OCT is here to stay, but that we must look carefully at the raw images and specifically rule out artifacts before we act upon the information the scans provide.

ULTRASOUND ENERGY

Over the years, ultrasound has become trusted by patients and doctors as a noninvasive and safe diagnostic therapy. Could ultrasound also have minimally invasive therapeutic capabilities for glaucoma? In his video, Donald Schwartz, MD, demonstrates TUG (Eye Sonix), a low-power, low-frequency ultrasound technique that is thought to incite biochemical activity at the angle to facilitate aqueous outflow. According to the patent awarded to Dr. Schwartz, the device "emits ultrasonic energy, holding the ultrasonic instrument at a location external to the trabecular meshwork, transmitting the ultrasonic energy at a frequency to a desired location for a predetermined time, dislodging material built up in the trabecular meshwork, and generating heat that initiates biochemical changes in the eye."[1]

As the video demonstrates, for the TUG procedure, Dr. Schwartz's patient is seated in the supine position, and an eyelid speculum is placed. The custom ultrasound transducer looks somewhat like a B-scan probe but with a more pointed tip, and it is applied just posteriorly to the limbus (Figure 2). Each application lasts approximately 40 seconds, and Dr. Schwartz indicates that about 12 treatments are delivered per patient. Although efficacy and safety data have yet to be published, TUG appears to be an interesting and promising new treatment modality for glaucoma.

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ALTERNATIVES TO SUTURES

Although becoming facile with suture material is a fundamental part of performing a glaucoma suture, are sutures always the best tool for the job? An Eyetube.net interview with Robert J. Noecker, MD, MBA, at the Annual Meeting of the American Academy of Ophthalmology in Chicago has made me reconsider the ideal method of wound closure. Dr. Noecker speaks about the use of cyanoacrylate, fibrin-based, and other new adhesive materials in corneal wounds, cataract incisions, pterygia, glaucoma surgery, and more. In his video, Dr. Noecker notes that, although suturing tissue is common in ophthalmic surgery, placing stitches in the eye has several drawbacks. In addition to being time consuming and inducing some ocular trauma, the use of sutures in the eye increases OR expenses and may cause discomfort for the patient. Ocular Therapeutix, Inc. recently developed a tissue sealant for the closure of a clear corneal cataract surgery incision. The ReSure Bandage is an ocular hydrogel bandage, and this material has historically been used by neurosurgeons to seal leaks in the dura mater. This material may allow glaucoma surgeons to secure the conjunctiva and patch graft materials more easily in the future.

CONCLUSION

The diagnostic and therapeutic landscape continues to evolve in glaucoma. Keeping up with Eyetube.net can be a great way to hear stories of ophthalmic innovation, as our specialty recognizes and pushes its own limits. ■

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1. United States Patent and Trademark Office. Ultrasonic treatment of glaucoma. http://patft.uspto.gov/netacgi/nph-Parser?Sect2=PTO1&Sect2=HITOFF&p=1&u=/netahtml/PTO/search-bool.html&r=1&f=G&l=50&d=PALL&RefSrch=yes&Query=PN/7909781. Posted March 22, 2011. Accessed December 7, 2012.