Wound Gape: Two Closure Techniques

A radial or horizontal stitch can produce watertight closure after thermal injury.

BY ROBERT H. OSHER, MD, AND JAMES M. OSHER, MD

Thermal injuries during phacoemulsification range from subtle shrinkage of collagen to dramatic gape of a whitened incision. The former is far more common than appreciated and may appear as a thin curvilinear lucency in the incisional tunnel, representing contraction of collagen where a focal thermal event has occurred. For example, if the sleeve surrounding the phaco needle is compressed against any part of the tunnel, there may be focal interruption of irrigation and increased friction between the needle and the sleeve, causing the temperature to rise high enough for the adjacent collagen to contract. Clinically, this resembles the shape of a shark fin, and it may be seen as the examiner sweeps a thin slit beam across the incision, observing subtle curvilinear luceny.[1]

At the other end of the clinical spectrum, complete interruption of either aspiration flow or infusion can cause a rapid and sustained rise in the temperature of the phaco needle. Within seconds, transparency of the adjacent cornea is lost, and the surrounding tissue whitens and coagulates, causing the lips of the incision to gape. The incision can no longer self-seal, and frank leakage with an inability to maintain the chamber occurs. In severe burns, the iris and cornea may be irreparably damaged.[2]

ULTRASOUND DELIVERY

During the past several years, manufacturers have added thermal protective safeguards.[3] All contemporary machines allow the surgeon to modulate ultrasound energy. Because friction is the dominant variable for generating heat, continuous ultrasound is the least safe option; rather, delivering pulses or bursts of ultrasound energy can reduce total energy.

Increasing off time by lowering duty cycle, an innovation introduced with Whitestar technology (Abbott Medical Optics Inc., Santa Ana, CA), is another extremely effective method for reducing heat within the incision. Dramatic reductions in friction and temperature have been measured with torsional ultrasound (Alcon Laboratories, Inc., Fort Worth, TX). Additionally, different tips have been designed to maintain some flow, including the Mackool tip (Alcon Laboratories, Inc.), with its rigid outer sleeve and the Barrett tip (Bausch + Lomb, Rochester, NY), with a series of longitudinal grooves that ensure infusion even if the sleeve is compressed. The Aspiration Bypass System tip (ABS; Alcon Laboratories, Inc.) allows fluid to bypass an obstruction until rising vacuum can clear the occlusion. Audible tones can warn the surgeon when occlusion occurs or the amount of fluid in the bottle is low. One of us (RHO) developed an internal flare to the cataract incision that reduces friction and improves maneuverability of the tip (data submitted for publication, 2010).

THERMAL INJURY

The universal warning sign of thermal injury is visible lens particles (ie, lens milk) that represent the stagnant emulsion. The surgeon may also notice a lack of cutting activity or lens movement when the tip is obstructed. In this instance, one should immediately abort emulsification by decelerating the foot pedal into I/A or irrigation-only mode to avoid a rapid temperature rise. Warning beeps or audible tones will alert the surgeon to an interruption of flow that can be verified by the nurse, who can quickly confirm the absence of activity in the drip chamber. The surgeon may feel a temperature rise in the handpiece itself; however, the damage is usually done at this point, as it occurs in several seconds.

If the thermal injury is minimal, the procedure may be completed without much fanfare. Hydration will probably fail to produce a watertight incision, in which case suture closure will likely be necessary. If the injury is more severe and a gape is present, injection of an air bubble or an ophthalmic viscosurgical device may be required to prevent chamber collapse while the surgeon attempts to suture the incision. Unfortunately, a standard closure is ineffective because the incision's lips are separated as if tissue has been lost. Standard suturing techniques may result in a leaking wound with extreme astigmatism.

TWO SUTURE OPTIONS

We have published two suturing options, a radial and a horizontal gape stitch, for this purpose. A video depic-

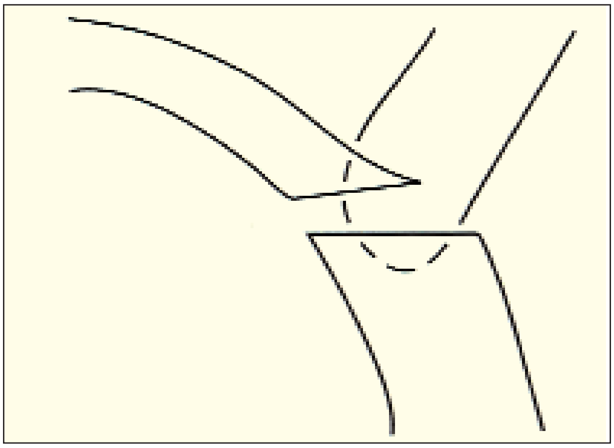

Figure 1. Side view of a radial suture.

tion of these techniques is available at www.eyetube.net/v.asp?vetero.

Radial suture. This stitch begins with the needle's entering the proximal lip of the incision. Then, the needle catches a bite of the floor before exiting without passing through the distal lip (Figure 1).[4] This method approximates the anterior portion of the incision, permitting a watertight closure.

Horizontal gape suture. This stitch is a trapezoidal mattress suture that begins by passing the needle of a 10–0 nylon suture radially through the posterior roof and then exiting within the incisional tunnel (Figure 2).[5] The needle is reloaded and passed parallel to the incision through the anterior floor, exiting within the tunnel. This needle is reloaded a third time, passing a radial bite from within the tunnel up through the posterior roof. The bites through the posterior roof are slightly closer together than the bites through the anterior floor, resulting in a trapezoidal configuration. The sutures are cinched and tied, bringing the anterior floor to the posterior roof and giving back tissue for a watertight enclosure. ■

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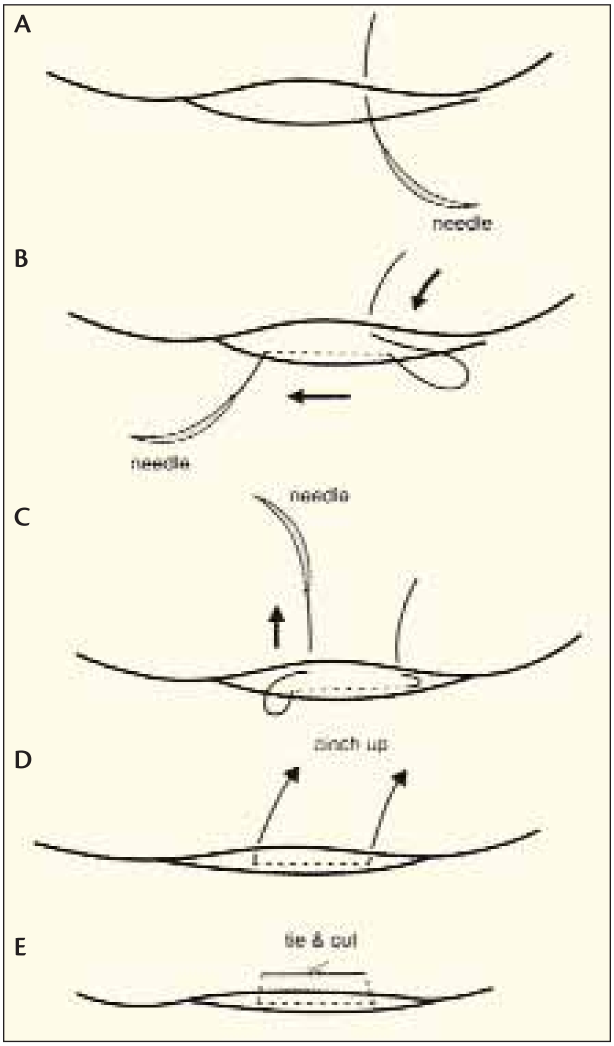

Figure 2. Step-by-step configuration of a horizontal suture.

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1. Osher RH. Shark fin: a new sign of thermal injury. *J Cataract Refract Surg*. 2005;31(3):640-642.
2. Sugar A, Schertzer RM. Clinical course of phacoemulsification wound burns. *J Cataract Refract Surg*. 1999;25:688-692.
3. Osher RH, Injev V. Thermal study of bare tips with various system parameters and incision sizes. *J Cataract Refract Surg*. 2006;32:867-872.
4. Osher RH. Gape stitch. *Video Journal of Cataract and Refractive Surgery*. 1990;VI(3).
5. Osher RH. Thermal burns. *Video Journal of Cataract and Refractive Surgery*. 1993;IX(3).