Creating the Capsulorhexis Through Microincisions

Our technique offers enhanced intraoperative control and increased flexibility.

BY MARK PACKER, MD; I. HOWARD FINE, MD; AND RICHARD S. HOFFMAN, MD

During bimanual or biaxial microincisional phacoemulsification, we prefer to initiate and complete the capsulorhexis through a 1.4-mm trapezoidal clear corneal incision. We describe this technique herein.

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BENEFITS OF BIMANUAL MICROINCISIONAL PHACOEMULSIFICATION

To begin our microincisional capsulorhexis technique, we construct radial paracenteses in the superior and inferior temporal quadrants with a trapezoidal diamond blade (eg, Packer Bimanual Phaco Diamond Knife; ASICO, Westmont IL). These symmetric incisions measure 1.4 mm internally, precisely the size required for the insertion of the 20-gauge instrumentation we use for bimanual microincisional phacoemulsification. The incisions' trapezoidal shape permits a wider range of motion inside the eye without stretching corneal tissue and preserves a clear view of the capsule by preventing wrinkling or folding of the cornea.

We believe the advantages of learning bimanual microincisional phacoemulsification outweigh any increased difficulty surgeons may encounter during their early experience with the technique. These advantages include enhanced chamber stability (due to a more perfectly closed system), better followability (due to the separation of infusion and aspiration), and access to 360º of the anterior segment with either infusion or aspiration (made possible by switching instruments from one hand to the other). Bimanual microincisional phacoemulsification also allows us to use the flow of irrigation fluid to move material within the capsular bag or anterior chamber (particularly from an open-ended irrigating chopper or manipulator), and because it maintains a pressurized stream of irrigation from above, it significantly decreases the risk of vitreous prolapse in cases of posterior capsular tear or rupture.

CREATING THE INCISION

To benefit from the advantages offered by bimanual microincisional phacoemulsification, surgeons must pay strict attention to detail. The first technique to master is construction of the incision and the second is the formation of the capsulorhexis.

Surgeons who perform bimanual microincisional phacoemulsification create incisions of varying size to accommodate differently sized (19- to 23-gauge) instruments. We prefer to use 20-gauge instruments, because we feel they offer the right balance between control and efficiency.

We size our incisions (1.4 mm) based on the 20-gauge instruments' tips' outer diameter (approximately 0.9 mm) and circumference (2.8 mm [$2\pi r$ = 2 X 3.14 X 0.45]). An incision smaller than 1.4 mm in width will stretch or tear during bimanual microincisional phacoemulsification with 20-gauge instruments and affect the wound's ability to seal itself. The microincisions are converted from a line to a circle upon the introduction of the phaco tip and irrigating chopper,

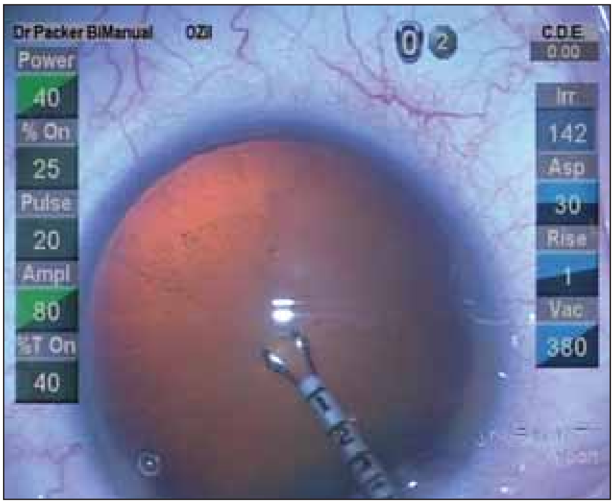

Figure 1. To initiate the capsulorhexis' formation with microincisional forceps, touch the anterior capsule's surface with just enough pressure to cause slight dimpling. Squeezing the forceps' tines pinches the capsule and initiates the tear.

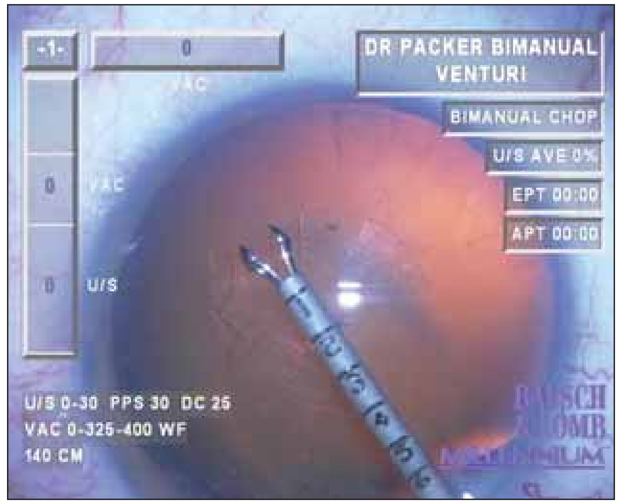

Figure 2. The Seibel Rhexis Ruler helps the surgeon control the capsulorhexis' size in this large myopic eye (axial length = 30.24 mm, horizontal white-to-white = 12.50 mm, anterior chamber depth = 4 mm) with a widely dilated pupil.

and we want them to resume the configuration of a line when the tip is withdrawn. If the corneal collagen is stretched or torn, the incision is less likely to resume its native architecture at the end of the case.

A variety of manufacturers offer diamond and metal knives specially designed for the construction of these incisions for bimanual microincisional phacoemulsification. It behooves the surgeon to purchase and learn to use these instruments whether they are constructed of steel, diamond, or other materials.

MANAGING THE CAPSULORHEXIS

The capsulorhexis' construction represents the greatest hurdle in the learning curve for bimanual microincisional phacoemulsification. Although we initially used a bent-needle cystotome to create the capsulorhexis during this surgical technique and believe this approach is still viable, we have found that microforceps such as the 23-gauge curved Fine-Hoffman capsulorhexis forceps (Microsurgical Technology, Redmond, WA) provides a greater degree of precision and control. Pinching the anterior capsule to initiate the tear is particularly valuable in eyes with compromised zonules, because the equal and opposite forces exerted by this action minimize stress on any one area of zonular fibers.

Even if a capsule is severely wrinkled due to traumatic zonular dialysis or pseudoexfoliation, the extraordinarily delicate microforceps provide exquisite control over the capsulorhexis' formation.

Following the incision's construction and the instillation of nonpreserved intracameral lidocaine, we fill the anterior chamber with a dispersive ophthalmic viscosurgical device (OVD) that will remain in the eye while we perform high-flow, high-vacuum chopping techniques. The capsulorhexis is initiated centrally with a pinch, and the flap is pulled in a counterclockwise motion. Because the fellow symmetric paracentesis is always available if we encounter trouble and need to switch hands, our surgical flexibility is greatly increased. Unlike standard Utrata forceps, (ie, Lehner-Utrata forceps; Bausch & Lomb Storz, St. Louis, MO) that are handled with a wrist motion, the microforceps is manipulated with the fingers and thumb like a pencil. Holding the forceps in this position enables us to control the instrument with greater precision.

Other factors that provide excellent control for the capsulorhexis' formation include the microincisional forceps' firm grasp and the small corneal incisions, which prevent the egress of OVD from the eye during our intraocular maneuvers. The prevention of OVD efflux helps maintain the chamber's stability and exerts pressure on the anterior capsule. It is well known that loss of stability in the chamber will cause the capsulorhexis to run out toward the periphery. An advantage of bimanual microincisional phacoemulsification is its ability to give us better control over the size, diameter, and position of the capsulorhexis.

CHALLENGING CASES

The proper function of newer-technology IOLs that prevent posterior capsular opacification with a square

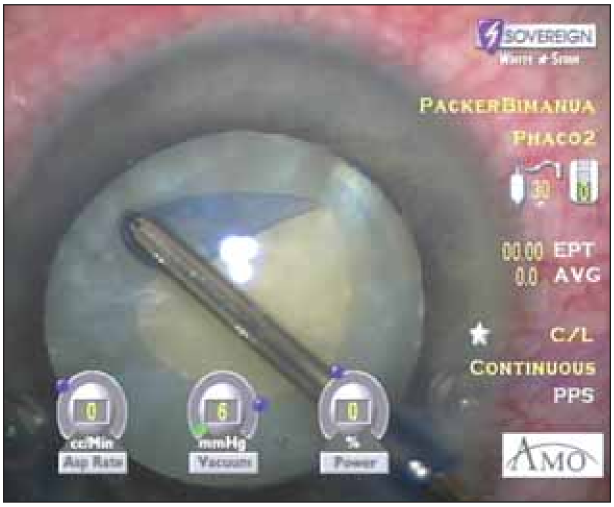

Figure 3. The combination of capsular staining with trypan blue and the microforceps technique facilitated exquisite control over the capsulorhexis' construction in this eye with an opaque cataract.

edge or facilitate accommodation with axial or translational movement depends on the accurate sizing and positioning of the capsulorhexis. In general, we desire a capsulorhexis that is smaller in diameter than the lens' optic (4.5 mm for a 5-mm accommodative IOL or 5 mm for a standard 6-mm multifocal or single-vision lens).

> "The proper function of newer-technology IOLs depends on the accurate sizing and positioning of the capsulorhexis."

The Seibel Rhexis Ruler (Microsurgical Technology) offers a good alternative for controlling the capsulorhexis' size in large, myopic eyes that have thin, friable capsules (Figure 2). Dilating the patient's pupils to their maximum size removes the key customary landmark for sizing the capsulorhexis. In addition, the outsized anterior chamber defies adequate filling with OVD, and constructing the capsulorhexis through a standard 2.5-mm incision with Utrata forceps will allow the chamber to become shallow due to efflux of OVD. Without a solid chamber or any clear boundary, the capsulorhexis will tend to run to the periphery before surgeons can react. This complication can be avoided, however, by employing the Rhexis Ruler, plenty of OVD, and the microincisional forceps technique described herein.

The microincisional capsulorhexis technique does not foreclose the option of standard coaxial phaco. In fact, this procedure can enhance any surgical strategy and can be particularly advantageous for removing opaque, mature, or intumescent cataracts. The use of a capsular stain also facilitates the capsulorhexis' formation with these types of cataracts. The combination of maintaining pressure in the anterior chamber (to prevent egress of OVD through the microincisions) and the delicate, finely controlled application of the microincisional forceps improves visibility and control and prevents a tear-out of the capsulorhexis (Figure 3).

CONCLUSION

We believe that surgeons can benefit from learning to create capsulorhexes with microincisional forceps, because the technique gives them an advantage for approaching difficult and challenging cases. Increasing surgical skill and learning new techniques always involves risk; the reward follows if the new approach provides increased flexibility and enhanced outcomes. As surgeons have found with other advances in phacoemulsification such as clear corneal incisions, cortical cleaving hydrodissection, and chopping techniques, once they switch from standard coaxial to bimanual microincisional cataract surgery, they are not likely to go back. ■

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