Radial Rhexis Tear or Sulcus Implantation

Which IOL to use?

BY LISA BROTHERS ARBISSER, MD

The goal of cataract surgery is to achieve 100% capsular bag placement of the IOL in the setting of an intact continuous curvilinear capsulorhexis (CCC) and posterior capsule. Although a laudable aim, cataract surgeons sometimes fall short. Knowing how to compensate for complications related to suboptimal surgical anatomy is essential to providing our patients with optimal outcomes.

CCC TEARS

My lens of choice for routine cataract surgery is a one-piece, acrylic, truncated-edge, blue-blocking implant (SN60 AT; Alcon Laboratories, Inc., Fort Worth, TX). This lens' attributes include maximum capsular biocompatibility, acceptable uveal biocompatibility, maximum refractive stability and predictability of effective lens position (ELP), reduced capsular opacification, ease of insertion, and theoretically maximized macular protection. Many of these traits make this lens ideal for cases in which the anterior CCC tears.

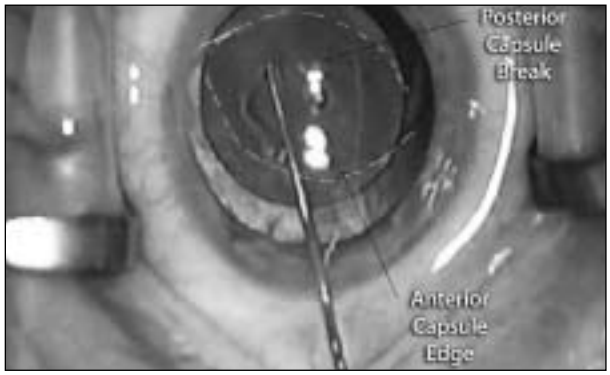

Figure 1. A three-piece acrylic lens with its haptics in the sulcus and its optic captured through the CCC in the bag tamponades the posterior capsular break and ensures lens centration.

> "Many ... traits make [the SN60 AT] lens ideal for cases in which the anterior CCC tears."

In the complicated setting of a CCC tear, one salient reason to use a one-piece acrylic IOL in the bag is the lack of pent-up energy the lens disperses as it unfolds within the eye, thus allowing a controlled placement during insertion. Silicone IOLs generally release more energy during folder ejection than do acrylic implants. The force of an explosively unfolding lens extends to the capsule's edge and can result in a radial tear that often extends through the equator. Three-piece lenses are tricky to place without applying some pressure on the capsule. A two-handed technique that uses a "Y" hook through the paracentesis incision to support the trailing haptic near the haptic-optic junction reduces these insertion forces compared with dialing or one-handed pronation of PMMA haptics. Surgeons should never consider inserting a plate-haptic lens without an intact capsule.

To place the AcrySof one-piece IOL, the surgeon folds the acrylic haptics onto the optic, inserts the implant

into the loading cartridge, implants the entire body of the lens into the viscoelastic-expanded bag, and gently floats the implant into position. As long as the trailing optic-haptic junction clears the rhexis' edge, no force is transmitted to the capsule's edge upon lens insertion or unfolding, and the tear does not extend.

The second reason to choose a one-piece acrylic IOL is its immediate and long-term force distribution. Hydrophobic acrylic causes the least capsular fibrosis, and, because of its tackiness, firmly bonds to the capsule. Third-generation silicone is quite biocompatible with the uvea but less so with the capsule. When unbalanced, due to fibrosis in the presence of a tear, the shrinking capsule can cause postoperative movement of the three-piece lens as it applies asymmetric forces to the bag. In a small eye, PMMA haptics may have a sufficient diameter to cause a Maddox rod effect on the posterior capsule with axial striae. These same forces translate to the anterior capsular edge. In the presence of CCC discontinuity, asymmetric forces may increase over time and lead to lens decentration. If the surgeon must place a three-piece lens inside a capsular bag that has a single radial tear, Howard Gimbel, MD, of Loma Linda, California, has recommended intentionally creating a small radial incision 180º away from the tear,[1] a technique that may help distribute the forces over time. I find this maneuver unnecessary for one-piece acrylic IOLs, because the haptics distribute forces evenly to the bag and do not lose their memory; this IOL design produces predictable centration even in this compromised situation.

TORN POSTERIOR CAPSULE

Although some physicians advocate using a one-piece acrylic lens in the capsular bag in the case of a torn posterior capsule, I limit in-the-bag implantation to eyes in which the posterior capsular tear is converted to a true posterior CCC. Even limited or round posterior tears are undependable intraoperatively and postoperatively. For an unconverted posterior capsular tear with an intact anterior capsulorhexis, I choose any three-piece IOL for sulcus implantation with optic capture, as first described by Neuhann.[2] The diameter of the CCC must be at least 1 mm smaller than the optic's diameter and centered (my goal in every case).

For a torn posterior capsule with an intact CCC, I implant the lens initially in the sulcus. Then, I apply gentle posterior pressure to the surface of the optic, 90º away from the optic-haptic junctions. I use a sweep or lens manipulator, first near the distal edge and then the proximal edge, to push the optic under the CCC edge. Thus, the optic sinks into the bag, thus causing the CCC to ovalize (Figure 1). This maneuver firmly fixates the optic-haptic junctions at the apex of the oval, a situation that provides ideal stability. Because the implantation does not depend on the relationship between the haptic diameter and the sulcus length for centration, any three-piece foldable lens is acceptable. If the CCC is centered, the optic will remain centered forever. Because the optic is drawn backward toward the plane of the anterior capsule, it minimally changes the ELP so that the lens power need not be modified for lower IOL powers. For IOLs exceeding 23.00 D, the altered lens position warrants a 0.50-D decrease in the power of the lens implanted. Pigment dispersion, sometimes seen in pure sulcus implantation, is absent because the optic is drawn back and the edges are covered by the anterior capsule. Optic capture also prevents an undesirable fusion of the anterior and posterior capsules' leaves, a situation that can lead to early capsular opacity that requires a capsulotomy.

> "One-piece acrylic lenses do not belong in the sulcus; they are too short, thick, and tacky, and they lack angulation."

In an eye for which in-the-bag or optic-capture options are impossible, the surgeon must plan the sulcus location of both the haptic and the optic. We know that the diameter of the sulcus is roughly the white-to-white measurement plus 2 mm. There must be capsular support 180º apart on opposite sides of the sulcus for haptic placement as well as reasonable zonular stability in order for lens placement to depend solely on the sulcus for fixation. The main concerns with this approach are centration and uveal biocompatibility. One-piece acrylic lenses do not belong in the sulcus; they are too short, thick, and tacky, and they lack angulation. Most three-piece IOLs measure 13 mm or less from haptic to haptic and are too small for some eyes. The ideal lens features angulated haptics with excellent memory, a large haptic diameter of 13.5 to 14.0 mm, a third-generation silicone composition, a 6.5-mm optic for optimal uveal biocompatibility and greater coverage in case of minor decentration, and round edges to reduce chaffing of the iris pigment epithelium. The IOL's profile must be slim, especially in the case of a secondary piggyback lens, where one IOL is already in the bag. No lens precisely fits this description.

My lens of choice for the sulcus component of a piggyback strategy is the AQ series three-piece silicone lens (STAAR Surgical Company, Monrovia, CA) with large, stiff elastimide haptics and a thin profile. I consider an MA50 three-piece acrylic lens (Alcon Laboratories, Inc.) with its

larger 6.5-mm optic as my backup for primary sulcus use when neither capsular leaf is intact. It is worth remembering that sulcus fixation results in a more anterior ELP than bag fixation, which is assumed by our current power calculation formulas. Therefore, I reduce the anterior chamber depth and surgeon's factor components of the formula by 0.30 mm and the A-constant by approximately 0.50 D. In practical use, the higher the lens power is, the more effect the positional change will exert.

CALCULATING LENS POWER

When the calculated lens power is between 15.00 and 23.00 D, I reduce the power of the sulcus lens by 1.00 D. A lens of under 15.00 D I reduce by 0.50 D, and one greater than 23.00 D I reduce by 1.50 D to approximate the equivalency of my refractive aim.

When in doubt about the security of sulcus fixation, I prefer iris fixation with a 10–0 PROLENE (Ethicon, Inc., Somerville, NJ) suture to avoid IOL subluxation or dislocation in the future. The growing number of reports on excellent long-term results with modern, open-looped, four-point–fixation anterior chamber lenses make this alternative extremely viable as well.[3] ■

Lisa Brothers Arbisser, MD, is in private practice in Davenport, Iowa, and is the immediate past President of the American College of Eye Surgeons. She holds no direct financial interest in any product or company mentioned herein. Dr. Arbisser may be reached at (563) 323-8888; drlisa@arbisser.com.

1. Gimbel HV, DeBroth BM. Intaocular lens optic capture. *J Cataract Refract Surg*. 2004;30:200-206.
2. Petternel V, Menapace, R, Findl O, et al. Effect of optic edge design and haptic angulation on postoperative intraocular lens position change. *J Cataract Refract Surg*. 2004;30:52-57.
3. Holladay JT. International intraocular lens and implant registry 2004. *J Cataract Refract Surg*. 2004;30:207-229.