Capsular Tension Rings Versus Capsule Retractors

Stabilizing the weakened capsular bag during phacoemulsification.

BY DAVID F. CHANG, MD

Loose zonules complicate every step of the cataract procedure. Eye conditions associated with weak zonules include pseudoexfoliation, advanced age, trauma, retinopathy of prematurity, and prior intraocular surgery (particularly vitrectomies and trabeculotomies). During nuclear emulsification, poor stability of the capsular bag heightens the risk of capsular rupture. Also, sculpting or rotating the nucleus too forcefully may shear the zonules in the oppositely located quadrants. Fortunately, the intraoperative use of devices such as capsular tension rings (CTRs) and capsule retractors can stabilize the capsular bag during phacoemulsification.

CTRs

Deficient centrifugal zonular tension permits excessive trampolining of the flaccid posterior capsule, either during removal of the last nuclear fragment or during epinuclear and cortical cleanup. The surgeon may accidentally aspirate redundant folds of a lax posterior capsule during I/A or snag them with a capsule polisher. Because the nuclear bulk will mask this situation initially, surgeons must remain vigilant as more nucleus is removed. With the FDA's recent approval of the Morcher GmbH (Stuttgart, Germany) CTR, US surgeons now have an important new strategy at their disposal for operating in the presence of loose zonules.

PMMA CTRs (Morcher GmbH and OPHTEC BV, Groningen, the Netherlands) partially compensate for a weakened zonular apparatus in several ways. Using forceps or a specially designed injector (such as those made by Geuder, AG, Heidelberg, Germany; and OPHTEC BV), a surgeon can insert the ring at any point following completion of the capsulorhexis. For preventing capsular rupture during phacoemulsification, the questions now are whether to use the CTR in conjunction with other devices and techniques, and at what point in the procedure to insert it.

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Phaco chop significantly reduces the stress that nuclear emulsification places on the zonules and capsule by replacing sculpting and cracking motions with the manual forces of one instrument pushing inward against the other. Because horizontal chopping is particularly effective at avoiding nuclear tilt or displacement, it is my preferred emulsification technique in cases of weak zonules.

the posterior capsule ruptures, then retrieving the ring may become impossible because it will no longer be safely confined to the bag. Therefore, CTRs should never be inserted if the capsulorhexis or posterior capsule is torn. Second, the CTR traps cortex in the capsular fornix and impedes I/A. For this reason, surgeons should instead consider using capsule retractors to stabilize the bag during phacoemulsification. This approach may allow the surgeon to delay CTR insertion until after cortex removal.

**CAPSULE RETRACTORS**

In addition to enlarging a small pupil, flexible iris retractors can also be used to support the capsular bag in the presence of extremely loose zonules. John Merriam, MD, of New York first described using these self-retaining retractors through paracentesis openings to hook and fixate the capsulorhexis.15,16 However, because their hooked ends are short and flexible, iris retractors tend to slip off fairly easily.

Richard Mackool, MD, of Astoria, New York, has designed titanium capsule retractors with hooked ends, which are elongated enough to support the peripheral capsular fornix as well as the capsulorhexis (Figures 1 and 2).17 In this way, the retractors function like artificial zonules to stabilize the entire bag during phacoemulsification and cortical cleanup. Unlike CTRs, the capsule retractors provide excellent support in the anterior-posterior direction and do not trap the cortex (each retractor applies only point pressure to the capsular fornix without ensnaring the cortex). Called the capsule support system, these hooks are available in a reusable (Duckworth and Kent Ltd., Hertfordshire, England) or a single-use design (Impex, Staten Island, NY).

Capsular dye can facilitate proper placement of the retractors. They may be inserted at any surgical stage, including midway through the capsulorhexis step. They stabilize the capsular bag against rotational forces and thereby can aid the completion of the capsulorhexis, hydrodissection, and nuclear rotation. The self-retaining titanium retractors are also strong enough to center and immobilize a capsular bag that is subluxated due to a severe zonular dialysis. As a single strategy for severe zonular deficiency, I believe that capsule retractors are more effective than CTRs at preventing posterior capsular rupture. Because CTRs can only redistribute capsular forces to the remaining intact zonules, the larger the zonular defect is, the less stability CTRs can provide.

Although the tip of the retractor is dull, it is possible for the hooks to tear the capsulorhexis margin during surgery. This is another reason to delay CTR insertion, if possible. Finally, capsule retractors do not solve the problem of permanent capsular bag support for the IOL, and this is when the CTR or the Cionni Modified Tension Ring (Morcher GmbH) is advantageous.18-20 Ike Ahmed, MD, of Toronto has designed the capsular tension segment (CTS; Morcher GmbH) that merges the concept of a Cionni ring and a capsule retractor. The Ahmed CTS is a partial ring with a hole for temporary or permanent fixation. By hooking this hole, a single iris retractor can support the segment during surgery. Lacking a pointed tip, these broad, segmental retractors will not tear the capsulorhexis during surgery. Postoperatively, the surgeon may either remove them or suture them to the sclera for permanent support.

In conclusion, CTRs provide numerous benefits to surgeons managing challenging cataracts with weakened zonules. However, physicians should consider using capsule retractors to stabilize the capsular bag during surgery in order to delay CTR insertion until after the cortex has been removed.
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