

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.¹⁻³ Eye conditions associated with weak zonules include pseudoexfoliation, advanced age, trauma, retinopathy of prematurity, and prior intraocular surgery (particularly vitrectomies and trabeculectomies). 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 trampolineing 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. 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.

PMMA CTRs (Morcher GmbH and OPHTEC BV, Groningen, the Netherlands) partially compensate for a weakened zonular apparatus in several ways.⁴⁻¹⁰ 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. In the presence of a focal zonular dehiscence or weakness, the ring redistributes capsular forces to areas of stronger zonular support. However, uniform weakness throughout the entire circumference of the zonu-

lar ring will partially negate this advantage.

Another benefit of the CTR is that the centrifugal pressure it applies makes the flaccid capsular bag more taut. This effect reduces redundant capsular folds, forward trampolining of the posterior capsule, and inward collapsing of the capsular fornices toward the aspirating instrument's tip. In the absence of a CTR, the stiff PMMA haptics of a three-piece foldable IOL can provide some of the same benefits during cortical aspiration. In addition, the IOL optic can block a floppy posterior capsule from vaulting toward the I/A tip in the subincisional area.

The final benefit of a CTR becomes evident postoperatively, as the permanently implanted ring counters progressive contractile forces. Centrifugal zonular tension normally resists capsulorhexis shrinkage as the capsular bag contracts. Thus, severe capsulophimosis is always the result of deficient zonular countertraction (although deficient countertraction does not always cause capsulophimosis). Extreme capsular contracture can decenter the IOL and further weaken the remaining zonules.¹¹ This is likely a factor in pseudoexfoliation cases in which the entire capsular bag dislocates years following the initial surgery.^{12,13} There is some evidence that CTRs may also retard posterior capsule opacification by mechanically blocking lens epithelial cell migration.¹⁴

There are two potential drawbacks to using CTRs. First, if

PREFERRED PHACO TECHNIQUE

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.¹

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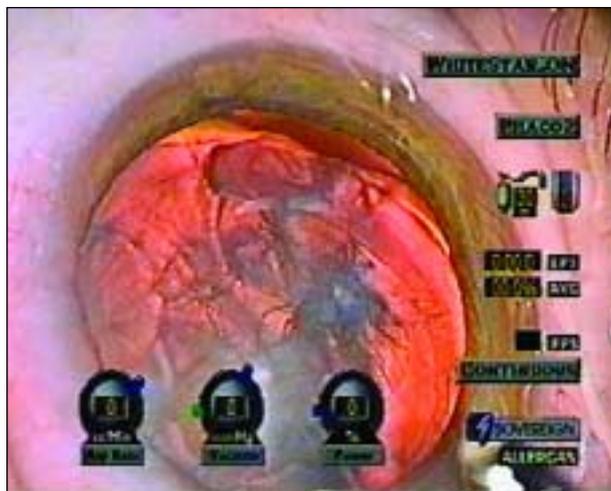


Figure 1. A nasal zonular defect is shown.

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 cap-

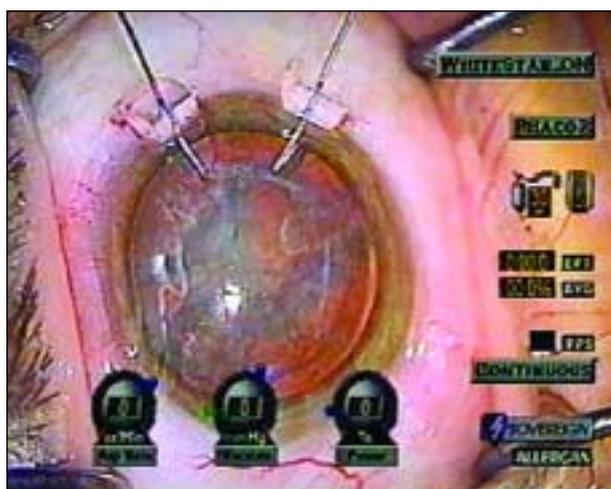


Figure 2. Two Mackool capsule retractors support the nasal quadrant and recenter the bag.

sulorhexis.^{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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