Cataract Surgery in an Eye With Blunt Trauma, Glaucoma, and Zonular Weakness

BY JOHN BERDAHL, MD; ROBERT J. CIONNI, MD; GARY FOSTER, MD; HOWARD V. GIMBEL, MD; AND MARK PACKER, MD, CPI

A 50-year-old black man was struck in his right eye by a fly swatter at the age of 5. His level of vision after this injury is unclear. He developed a retinal detachment in 2009 in his right eye and is presently using latanoprost for chronic glaucoma in that eye. The patient's vision has declined during the past few years due to the progression of a nuclear sclerotic cataract.

On examination, the patient's BCVA is 20/200, achieving 20/70 by potential acuity meter. He has a moderate afferent pupillary defect, and the IOP measures 12 mm Hg OD and 13 mm Hg OS. Gonioscopy confirms angle recession inferonasally in the right eye. A slit-lamp examination identifies a nuclear sclerotic cataract with approximately 3 clock hours of zonular absence in the region of angle recession (Figures 1 and 2). The lens capsule has contracted in that area and resembles a colobomatous lens defect. The anterior hyaloid face is intact. The retina is attached, and the cup-to-disc ratio is 0.9 OD and 0.5 OS. The patient's IOP is adequately controlled medically, and he desires elective cataract surgery.

How would you approach cataract surgery in this patient with 3 to 4 clock hours of zonular absence while also preserving the anterior hyaloid face and achieving adequate centration and support of the IOL? Would you offer additional surgery to control the patient's IOP considering the optic nerve atrophy?

—Case prepared by Alan N. Carlson, MD.

Figure 1. A pharmacologically dilated pupil with a brunescent nuclear sclerotic cataract revealing zonular dialysis and capsular contraction inferonasally in the right eye.

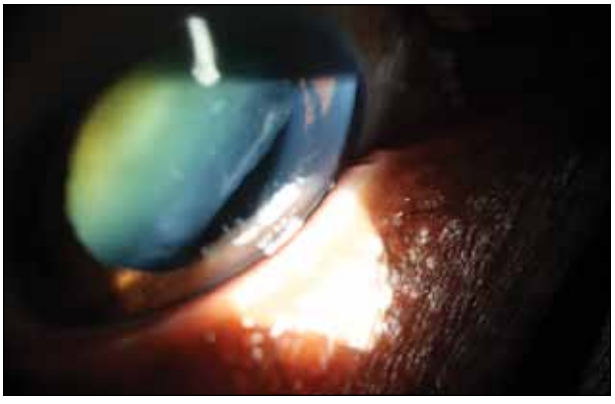

Figure 2. Asking the patient to look down and to his left reveals the absence of zonular support that extends for 3 clock hours.

JOHN BERDAHL, MD

This patient could benefit from cataract surgery, although his visual potential would not truly be known until after the procedure. The patient is missing 3 clock hours of zonules,

so phacodonesis must be assumed even if it is not visible on slit-lamp examination. A good preoperative plan is critical to making this surgery as atraumatic as possible for both the patient and the surgeon. I would use a capsular tension ring (CTR), and the timing of its placement would depend upon how much phacodonesis is present and if there is potential for vitreous prolapse around the inferior nasal colobomatous lens defect. If the lens capsule has a tendency to collapse centrally in that area, I would place the CTR sooner in order to tamponade the vitreous face posteriorly. I would also be ready with capsular hooks to stabilize the capsular bag and prevent prolapse of the vitreous face.

I would use the femtosecond laser to perform the capsulotomy and lens chop. This approach would allow me to center the capsulotomy exactly where I want it without putting tension on the zonules. The lens could be chopped into numerous pieces prior to putting unnecessary force on the zonules, and the necessary phaco energy could be decreased.

In eyes that have concomitant cataract and glaucoma, I generally prefer to perform microinvasive glaucoma surgery with the iStent Trabecular Micro-Bypass Stent (Glaukos Corporation). Because this patient has a history of angle recession inferior nasally, I would place an iStent superior nasally in hopes of eliminating the use of latanoprost in his right eye. A number of benefits are afforded with this approach. First, compliance would no longer be an issue. Second, prostaglandins can induce eyelash growth, changes in the color of the iris, and prostaglandin-associated periorbitopathy. None of these side effects is overly worrisome when a prostaglandin is used bilaterally. With unilateral use, however, patients can develop an unwanted asymmetric appearance to the eyes and orbits.

ROBERT J. CIONNI, MD

In a case like this, I prefer to perform the capsulotomy with the LenSx Laser (Alcon Laboratories, Inc.) to ensure a perfectly sized, shaped, and centered capsulotomy (Figure 3). Lens fragmentation with the laser simplifies surgery in challenging eyes. Whether the capsulotomy is performed with the laser or manually, it should be centered on the center of the fetal nucleus. This means decentering the capsulotomy relative to the dilated pupil and away from the area of dialysis. The LenSx laser's integrated optical coherence tomography can help the surgeon easily identify the center of the fetal nucleus. When a CTR is placed, the capsulotomy will become centered as the remaining strong zonules help support the compromised zonules.

Whether or not the capsulotomy is made manually or with a laser, I would begin the case by administering generous amounts of a dispersive ophthalmic viscosurgical device (OVD) through a sideport incision to protect the anterior hyaloid face and prevent the chamber from collapsing,

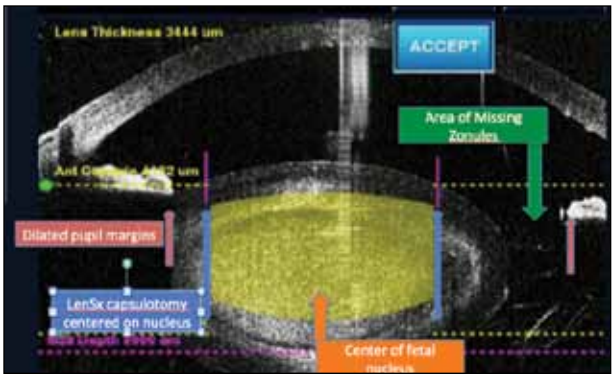

Figure 3. A high-definition optical coherence tomography scan from the femtosecond laser shows the capsulotomy and lens-chop parameters set to the center of the subluxated cataractous lens and off-centered from the pupil's margins.

which would encourage the vitreous to prolapse. Next, I would complete the capsulotomy, or if I used the laser, I would remove the central button with a capsulotomy forceps. For hydrodissection, I would place a dispersive OVD into the capsular bag at the site of the zonular compromise to expand and maintain expansion of the bag in that region.

With only 3 clock hours of zonular compromise, capsular retention hooks will not likely be required. I would use a divide and conquer technique if I did not use the femtosecond laser to fragment the lens, and I would be careful not to stress the weakened area. An OVD could be used to help manipulate nuclear quadrants. Before aspirating the cortex, I would use a dispersive OVD to viscodissect cortex from the bag's periphery in the area of zonular weakness so that cortical aspiration does not further compromise the zonules. Once the cortex had been aspirated, I would fill the bag with a cohesive OVD and place a standard CTR. More recently, I have preferred the preloaded CTRs from FCI Ophthalmics, Inc., and generally use the largest size available for maximal support and expansion of the capsular bag. Once the CTR was in place, I would insert a one-piece hydrophobic acrylic IOL into the bag and rotate it until it was well centered. I would then aspirate the OVD from behind the implant.

I do not believe a trabeculectomy or tube shunt is needed, as this patient's IOP is well controlled on one medication. I would, however, consider placing an iStent if the procedure went well. Precious conjunctiva would be spared for later use if needed.

GARY FOSTER, MD

The industrial-strength fly swatter appears to have caused only blunt and not penetrating damage to the anterior segment. The capsule is most likely intact, but I would still approach this eye with an abundance of caution. I would

use a soft-shell OVD technique over the area of missing zonules and would replenish the OVD throughout the case. A well-centered and carefully sized capsulorhexis would important; it would need to be large enough to easily remove the lens but small enough for optic capture if needed. According to the figures, the lens looks most dense centrally with a softer cortical shell, so I would hydrodelineate the lens and avoid hydrodissection. I would remove this core of nucleus, leaving the epinucleus as a barrier. I would then remove the epinucleus and cortex. The inferonasal capsule has contracted centrally, so it would then be visible for direct inspection. If the capsule were intact, then I would place a one-piece acrylic IOL in the bag. It is not likely that a CTR would effectively stretch the contracted capsule. If the actual amount of zonular loss observed during surgery made me fear for the stability of the bag complex, or if I worried that the bag would further contract and decenter the IOL over time, I would suture an Ahmed Capsular Tension Segment (Morcher GmbH, distributed in the United States by FCI Ophthalmics, Inc.) to the sclera inferonasally.

The patient's glaucoma is considered well controlled with medical therapy. I would perform cataract surgery alone, which would tend to lower his already acceptable IOP. I would place an iStent if the patient's consistent compliance were in question. I would also check the patient's pressure 4 hours after surgery to detect and treat an IOP spike if present.

HOWARD V. GIMBEL, MD

I would use a dispersive OVD, because it would protect the intact vitreous face better then a cohesive one. The continuous curvilinear capsulorhexis would be eccentric superiorly to be centered on the lens rather than on the pupil. I would apply a little OVD under the edge of the anterior capsule inferiorly and place a CTR before performing hydrodissection so that the CTR would be next to the capsule as much as possible rather than trapping the cortex against the capsule.

To avoid rupturing the area of the capsule near the end of the CTR, I would insert a Sinskey hook through the paracentesis and place it in the eyelet of the CTR as it exited the injector. The hook would guide the tip around at about the diameter of the pupil as more and more of the ring was ejected. This would create a large bend in the CTR before releasing the tip, so that the initial force against the bag would be distributed over a few clock hours of the equator of the capsule.

If the capsular bag were unstable during the removal of cortical material, I would fill the bag with a dispersive OVD,

most of which would stay in place for this portion of the procedure. At this point, I would judge whether the bag were centered well enough to ensure that the IOL would be centered. If not, I would anchor a Cionni Ring (Morcher GmbH, distributed in the United States by FCI Ophthalmics, Inc.) to the sclera with a 9–0 Prolene suture (Ethicon, Inc.) in a Hoffman tunnel and adjust the tension of the suture after the IOL was in place to center the lens.

MARK PACKER, MD, CPI

Based on the patient's history and examination, the following diagnoses can be made for his right eye: (1) severe angle-recession glaucoma, (2) repaired rhegmatogenous retinal detachmen, (3) traumatic zonulopathy, and (4) nuclear sclerosis.

The first two diagnoses limit the prognosis for visual rehabilitation after cataract surgery and represent an important component of informed consent. The IOP appears to be well controlled on a single medication, and I do not feel that a trabeculectomy is indicated. Although cataract surgery alone reduces IOP in patients with primary open-angle glaucoma, its effect on traumatic glaucoma is less certain. The effectiveness of a trabecular microbypass device may also be limited in this case. The iStent's safety profile is excellent, however, and it may reduce the patient's medication burden in the future. Because a higher risk of an errant capsulorhexis exists due to the local absence of zonular support, a laser capsulotomy may have an advantage in this case.

To ensure that the hyaloid face remained intact, I would place a viscoelastic tamponade in the area of missing zonular fibers. Usually, a simple CTR will suffice to maintain capsular integrity with 3 to 4 clock hours of zonular dialysis. I would introduce the CTR after gentle hydrodissection by first placing a small amount of a dispersive OVD beneath the capsular edge. The CTR would protect the capsule during phacoemulsification. Circumferential cortical stripping would facilitate cleanup, while pulling cortex centrally should be avoided as it meets with resistance from the CTR. Implanting a hydrophobic acrylic IOL with controlled unfolding and superior resistance to capsular contraction would help maintain stability in the long term.

This case is typical for blunt trauma at a young age, after which the child grows up with a lens that is not markedly subluxated but is misshapen with a flattened equator in the area where the zonules were compromised. Fortunately, the remaining zonules are nearly universally quite strong, allowing for a nicely centered and stable IOL with the placement of a standard CTR without scleral suturing.

A few general principles are important for all cases of compromised zonules: (1) never let the anterior chamber shallow; (2) work toward the area of the zonular weakness or, if needed, tangential to it, but never away from it; and (3) place the CTR as late in the procedure as possible, but as soon as you feel that support is truly needed. ■

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