Supplement to

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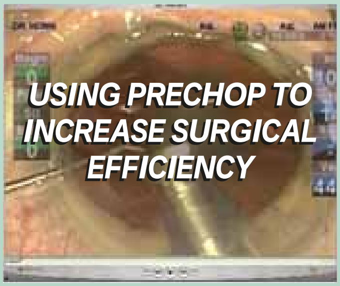
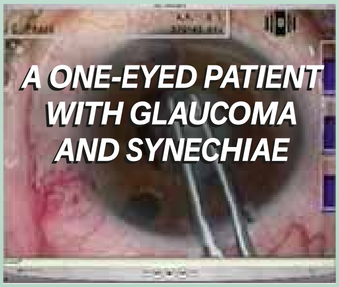
Cataract & Refractive Surgery TODAY

April 2005

Managing the Challenges of Cataract Surgery

An instructional print and audiovisual presentation on successful surgical strategies.





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Managing the Challenges of Cataract Surgery

For cataract surgeons, watching experienced colleagues successfully manage a difficult case or a complication is among the most valuable kind of instruction. To that end, Cataract & Refractive Surgery Today *and Alcon Laboratories, Inc., are pleased to present this collection of challenging cataract cases performed by noted ophthalmologists. The accompanying CD-ROM contains narrated videos on a variety of surgical techniques and strategies for challenging cases or complications. We hope you find this supplement informative, and we urge you to share it with your fellows and residents.*

—David F. Chang, MD

Mixing a Viscoelastic and a Capsular Dye

One surgeon's soft shell staining technique.

BY TAKAYUKI AKAHOSHI, MD

In the conventional method of staining the capsule with indocyanine green (ICG), the powdered dye is diluted in BSS PLUS intraocular irrigating solution (Alcon Laboratories, Inc., Fort Worth, TX) and provides only a faint stain. Dissolving ICG into a cohesive viscoelastic agent (a solution called visco-ICG) achieves deeper, more uniform staining. If ICG dissolved in BSS PLUS resembles an ink, then visco-ICG is like paint. To apply visco-ICG most effectively and safely, the corneal endothelium should be protected by the modified soft shell technique called *soft shell stain*. The lens capsule stained by this method will never become fragile.

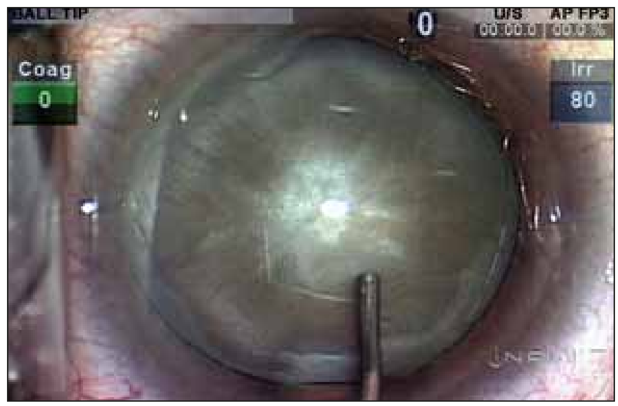

Figure 2. Enough PROVISC is injected under the VISCOAT so that the former flows out of the incision.

HOW TO MAKE VISCO-ICG

One milliliter of sterile distilled water is injected into a bottle of ICG, which contains 25mg of ICG powder (Diagnogreen; Daiichi Pharmaceutical Co. Ltd., Tokyo, Japan). Shaking the bottle for a few minutes dissolves the powder completely. After aspirating all of the solution into a 5-mL syringe, I add one vial (0.7mL) of PROVISC ophthalmic viscosurgical device (Alcon Laboratories, Inc.) into the syringe and shake it vigorously for another few minutes. A small amount of air in the syringe will facilitate the mixing of the ICG solution with the viscoelastic. Once aspirated into a sterile 2.5-mL syringe, the mixture may be prepared for use with a visco-ICG cannula (AE-7272; American Surgical Instruments Corporation, Westmont, IL). One vial of visco-ICG solution can be used for several cases.

SOFT SHELL STAIN

After injecting a small amount of VISCOAT ophthalmic viscosurgical device (Alcon Laboratories, Inc.) into the front of the anterior chamber (Figure 1), I inject PROVISC under the VISCOAT so that the latter may spread uniformly on the corneal endothelial surface. To completely coat the

Figure 1. The author injects VISCOAT into the front of the anterior chamber.

Figure 3. An I/A tip aspirates the PROVISC.

endothelium with VISCOAT, the amount of PROVISC must be sufficient to flow out of the incision (Figure 2). I then remove the PROVISC with I/A to make a space for the visco-ICG (Figure 3). The dispersive VISCOAT will remain on the cornea and iris, where it will form a transparent, soft shell. I apply the visco-ICG to the capsular surface by means of the visco-ICG cannula (Figure 4). Because this instrument has an oval port on the inferior side of its curved tip, I can paint a small amount of the visco-ICG on the lens' surface. With VISCOAT protecting the cornea, I am able to fill the anterior chamber with visco-ICG and then immediately wash the chamber with I/A (Figure 5). If any part of the capsule is unstained, I can apply additional visco-ICG focally using the procedure just described. It is important not to inject too much visco-ICG under the iris blindly, or the vitreous body may be stained for a few days. Next, I fill the anterior chamber with VISCOAT (Figure 6) and perform the capsulorhexis (Figure 7).

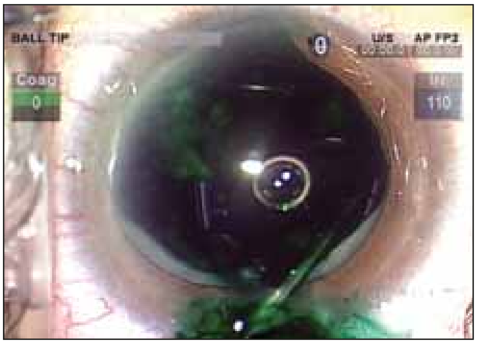

Figure 4. The author uses a special cannula to paint the capsular surface with visco-ICG.

Figure 5. The author washes out the visco-ICG with the I/A tip.

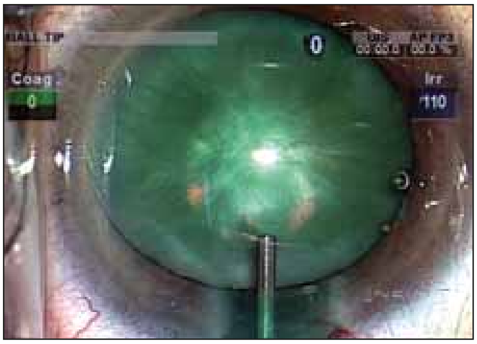

Figure 6. The anterior chamber is filled with VISCOAT.

Figure 7. The author carefully performs the capsulorhexis.

TIPS FOR A SUCCESSFUL CAPSULORHEXIS

Despite the advantage of a deeply stained capsule, successfully executing the capsulorhexis requires a careful approach. In cases of white, intumescent cataract in which the lenticular cortex has liquefied, it is important to reduce the intralenticular and vitreous pressures by intravenously administering a hyperosmotic agent such as mannitol or glycerin 1 hour before surgery. One should also fill the anterior chamber sufficiently with VISCOAT before starting the capsulorhexis so that the lens' surface is pushed flat or concave. This viscoelastic is unlikely to flow out of the incision during the procedure.

Positive pressure in the anterior chamber will augment control of the capsulorhexis' edge. Before starting the capsulorhexis, I puncture the capsule and wait for a moment until liquefied cortex leaks through the hole. Reducing the intralenticular pressure makes it easier to perform the capsulorhexis. I strongly advise against making a large capsulorhexis initially, because its edge will often tear to the equator. If the initial capsulorhexis was too small, it will be easy to enlarge after removing the liquefied cortex. The ideal capsulorhexis is a little smaller than the size of the IOL's optic and is located centrally so that the optical edge is uniformly covered by the capsulorhexis.

CONCLUSION

I have used this technique for more than 5 years in nearly 1,000 cases. My success rate of a complete capsulorhexis in cases of white, mature cataracts is greater than 99%. I have never experienced any complications.

Capsular staining is helpful not only for a white, mature cataract but also for a dense nucleus with a poor retroreflex of the microscope illumination. The use of visco-ICG can also be beneficial in cases of corneal opacity. ■

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Traumatic Injury With Thorn

DUOVISC and cyanoacrylate glue help preserve visual function in this challenging case.

BY LISA BROTHERS ARBISSER, MD

While on a camping and hunting trip, a 17-year-old white male was struck in his left eye by a thorn bush 10 days prior to presenting to me with hand-motion vision. He complained of minimal discomfort but reported that his vision had slowly worsened over the few days before he came to see me. He had accurate light projection in all quadrants and no evidence of an afferent pupillary defect. The anterior chamber was formed but filled with fluffy white cortex from an obvious tear in the anterior capsule. His IOP was 30mmHg. Despite minimal injection of the conjunctiva, the pupil was slightly out of round in association with a pinpoint prolapse of iris visible under the conjunctiva temporally, just peripheral to the limbus at the 4-o'clock position. This area was Seidel negative. B-scanning showed no evidence of significant posterior segment pathology. There was no cell or flare in his right eye, which had 20/20 UCVA.

The patient was scheduled for next-day surgery under general anesthesia, after extensive informed-consent counseling that included the highly unlikely possibility of sympathetic ophthalmia. Because there was no apparent sign of endophthalmitis and so much time had elapsed since the penetrating injury, I preoperatively prescribed only a topical antibiotic. I also started the patient on ocular hypotensive topical medications. Because I saw no evidence of a retained foreign body and the patient reported having seen the thorn upon extracting it from his eye, I ordered no radiological studies.

The next morning, the surgery center received a call from the patient's father, who asked if his son's surgery had to be postponed because he had discovered that his son had used marijuana to "help the glaucoma." Our center's kind anesthesiologist replied that it would not affect the surgery, and he induced endotracheal anesthesia uneventfully.

SURGICAL APPROACH

Evaluating the Tear

I planned to rely on a "dry technique" under viscoelastic to manually remove the hydrated cortical material so that I could identify the extent of the capsular break without extending the tear. I sent an initial aspirate from the anterior chamber for Gram staining and culturing, particularly to rule out evidence of fungus. Once I had aspirated the bulk of the escaped cortex with a cannula and syringe under a soft shell of DUOVISC viscoelastic system (Alcon Laboratories, Inc., Fort Worth, TX), I used an Osher cannula (Duckworth & Kent Ltd., Hertfordshire, England) to paint Vision Blue dye (DORC International BV, Zuidland, The Netherlands) over the edges of the anterior capsule in order to identify the extent and shape of the tear. After applying Vision Blue to the capsule's surface, I cleared excess dye with viscoelastic. This maneuver revealed that the tear extended from equator to equator in a horizontal, linear fashion just below the visual axis. A sweep demonstrated no evidence of vitreous around the zonules in the area of perforation, which had only 1 or 2mm of zonulolysis.

Capsulorhexis and IOL Insertion

I could not place a capsular tension ring because the anterior capsule was torn, so it was fortunate that the

Figure 1. Cortex escaped from a tear in the anterior capsule 10 days after a penetrating injury from a thorn bush.

Figure 2. At 9 months postoperatively, the eye showed no signs of inflammation.

zonular defect was trivial. I used a manual technique to clear the lenticular material without using irrigation. Meanwhile, I maintained the extent of the capsular tear with a dispersive viscoelastic injected over the crux of the tears, which I had compartmentalized with a cohesive viscoelastic that packed in the dispersive. I then used a Vannas scissors to initiate a cut in the superior flap of the anterior capsule, and I completed a semicircular capsulorhexis with a Utrata forceps and thereby cleared the visual axis. I performed the same maneuver on the inferior half of the capsule. The resultant curvilinear capsulorhexis had two tears that were 180º apart. I inserted a one-piece, acrylic, blue-light–filtering IOL (SN60AT; Alcon Laboratories, Inc.) into the capsular bag. Because of the lens' gentle unfolding, well-distributed forces, and tacky material that rapidly adheres to the capsular bag, I considered this IOL to be the best choice in this case. I oriented the haptics 90º away from the tears to ensure that they would be covered by the flaps of the residual capsule.

Iris Management

I irrigated and aspirated the viscoelastic from the anterior chamber and ascertained that the incisions were watertight. I then turned my attention to the incarcerated iris. I irrigated Miochol-E (Novartis Ophthalmics, Inc., Duluth, GA) into the anterior chamber. I initiated a limbal-based flap superior to the site of the perforation and exposed the area of penetration under the partially healed conjunctiva. I instilled VISCOAT (Alcon Laboratories, Inc.) to push the incarcerated iris back into the anterior chamber. A bit more Miochol-E rounded the pupil and revealed a small, slit-like iridotomy that did not require repair.

Sealing the Wound

I tried to close the defect from the thorn's penetration at the limbus. After several attempts at suturing that failed to form a watertight chamber, I ceased this effort in order to preserve the integrity of the tissue. Because of the hole's roundness, its conical shape that was wider on the outside than the inside, and the cross-linked fibers at the limbus, I felt that I had to find another way to seal the wound. I found that the conjunctival tissue was too friable and too easily buttonholed over the defect for me to rely on a trebeculectomy-style closure.

A quick telephone consultation with my partner, who is a corneal specialist, resulted in my using cyanoacrylate glue to seal the leak. I left one 8–0 Vicryl suture (Ethicon Inc., Somerville, NJ) in the defect to promote inflammation, reduce the gap, and provide a matrix for the glue. After several tries, I managed to dry the area sufficiently and apply just the right dab of glue to form the chamber without leakage. I amputated the flimsy limbal-based flap, mobilized a fornix-based flap, and sewed this into place over the mound of glue. I then placed a bandage contact lens for the patient's comfort. The surgery had lasted 3 hours. I hoped that the glue would hold long enough to avoid a recurrence of leakage and that healing would occur without the formation of a fistula.

FOLLOW-UP

On the first postoperative day, the patient reported that his eye felt surprisingly comfortable. The chamber was formed, the lens was centered, and the flap was Seidel negative. His visual acuity was 20/50, and his IOP was 19mmHg. By 1 week postoperatively, the conjunctival flap had retracted, exposing the glued area (Figure 1). The chamber was almost clear of cells, and the patient's vision improved to 20/25. At 10 days, the glue fell out, and the chamber remained formed with a stable IOP and no recurring leak. Over time, the conjunctiva advanced to the limbus, and its appearance resembled a pterygium with vessels only to the limbus. At 9 months postoperatively, the patient showed no sign of inflammation in either eye (Figure 2), and he remains 20/20 uncorrected and unmedicated. He has an IOP of 16mmHg in his fellow eye and 14mmHg in the operative eye. "Glue Boy," as our staff fondly calls him, is now a happy camper. ■

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Using AQUALASE With Salvitti Akahoshi Prechop

A prechopping technique makes an AQUALASE solution predictably efficient.

BY ROBERT J. ARLEO, MD

The AQUALASE liquefaction device (Alcon Laboratories Inc., Fort Worth, TX) is an exciting phaco technology whose adoption rate has suffered because traditional phaco techniques perform inefficiently with it. The prechopping technique I describe herein and show in the corresponding video makes AQUALASE as efficient and predictable a procedure as traditional phacoemulsification and expands the range of nuclear densities it can efficiently remove without phaco energy.

INITIAL STEPS

I begin by making a 0.7-mm paracentesis incision that is just large enough to accommodate the instrumentation. A longer incision will create an exit for fluid and lens material when the only avenue of egress should be through the AQUALASE handpiece. I then insert a No. 75 blade (Alcon Laboratories, Inc.) through the paracentesis and introduce 0.3mL of 1% intracameral nonpreserved lidocaine followed by VISCOAT ophthalmic viscosurgical device (Alcon Laboratories, Inc.) into the anterior chamber. Injecting VISCOAT across the eye avoids creating any bubbles. One purpose of using VISCOAT is to protect the endothelium from the fluid flow of the AQUALASE procedure (it involves no phaco energy) and from any lens material that may bump against the cornea. In the absence of phaco energy, these are the only mechanical processes that can cause endothelial cell loss. VISCOAT coats the endothelium so effectively throughout the procedure that I will have to manually remove it at the completion of the surgery. A second function of VISCOAT is to maintain adequate space in the anterior chamber when I begin the capsulorhexis, especially if I prechop the nucleus. Prechopping will force a more cohesive viscoelastic out of the eye and thereby cause the chamber to collapse, complicating the surgery.

CAPSULORHEXIS CREATION

I make a 3-mm incision using a dual bevel blade (Alcon Laboratories, Inc.). I consider this size of incision ideal. Although an IOL will pass through a 2.75-mm incision, I find that an incision of this length compromises the AQUALASE technique. It is critical to maintain efficiency with the AQUALASE handpiece when using relatively high vacuum and flow rates, and I use a high-infusion sleeve to deliver fluid into the eye (more fluid in the eye equals greater chamber stability). When I first worked with the high-infusion sleeves, a 2.75-mm incision negated some of their benefits by reducing the flow through them.

To begin the capsulorhexis, I nick the capsule with a cystotome. The capsulorhexis should be slightly smaller than the optic of the lens, and I made this one approximately 5.5mm. I grabbed at the capsule multiple times, because the patient was under topical anesthesia and I did not want his eye to move while I grasped the capsule, which could have caused the capsulorhexis to migrate peripherally. Maintaining a continuous capsulorhexis is critical with prechopping, because the forces involved could cause a radial extension of any tear in the anterior capsule.

Performing the capsulorhexis slowly is important with the AQUALASE technique. VISCOAT maintains the chamber very well. It is also important to hydrodissect just beneath the capsule in order to avoid creating an epinuclear plate that will require attention later. Hydrodissecting under the capsule ensures that the epinucleus will adhere to the lens and will be much easier to remove. I also prefer this

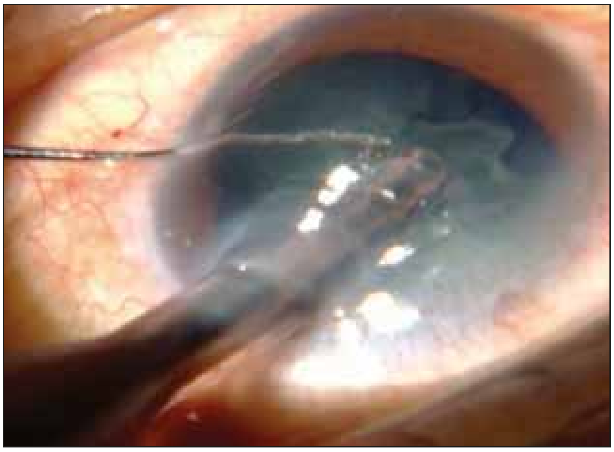

Figure 1. AQUALASE efficiently removes nuclear fragments.

approach because it does not to stir up any material that will block my visualization. Also, I have had some capsular bags break from fluid pressure (especially with dense lenses).

One way to avoid overfilling the bag during hydrodissection is to only push the fluid wave halfway across the posterior capsule and then inject fluid across the other half from 180º away, simultaneously burping out any excess fluid. I use the cannula to spin the lens to make sure it is fairly mobile.

NUCLEAR FRAGMENTATION AND REMOVAL

I prechop the nucleus using a Salvitti Akahoshi Combo Pre-Chop Forceps (Duckworth & Kent Ltd., Hertfordshire, England). It uses a cross-action and has wide blades and pointed tips that maximize surface area for splitting the len. It also gently manipulates the lens' rotation. The pointed tips impale the lens easily, and the wide blades achieve adequate purchase to split the lens rather effortlessly. I place the tip of the chopper in the center of the lens, tilt it downward, and lift up the handle of the instrument so that the rest of the blade follows the pointed tip in a fashion similar to using a can opener. Then, I gently compress the handle to open the blades and use the tip to rotate the blade. During this maneuver, I appreciate how VISCOAT, unlike other viscoelastics, remains in the eye and maintains the space.

The first crack travels across the lens. I usually split the far hemisection next, then the near one (VISCOAT is more likely to be expressed when splitting the near hemisection). Before I extract the instrument, I rotate it to avoid catching the anterior capsulorhexis. I introduce a Kansas manipulator (Storz Medical, St. Louis, MO) through the paracentesis. It has a wide, dull blade that I sometimes use again for purchase if I need to manipulate the lens fragments. When necessary, I may even use the manipulator to hold dense fragments against the AQUALASE tip to facilitate emulsification. I expose approximately the same amount of the AQUALASE tip (bevel up) as with the phaco needle.

My settings are a magnitude of 50%, a pulse rate of 40 per second, and a burst width of 65ms. Having chopped the nucleus, I can lower the magnitude. If I am performing divide and conquer to carve the nucleus, I increase the magnitude to approximately 100. In this case, using linear control, I set the maximal magnitude at 50, because the system provides enough followability to reduce the magnitude necessary to emulsify the lens fragments. I raise the bottle to 110cm and use a high flow rate with linear control at 60mL/min, a rapid rise time of 4 that will peak the flow at approximately 100mL/min, and a vacuum of 525mmHg with linear control. This dual linear control allows me to manage both the flow and vacuum rates and therefore the cadence of the surgery. Using burst mode with linear control prevents me from blasting through the nuclear material, because it does not deliver a burst of energy. Instead, I can start with a lesser amount of power and increase it if needed.

The AQUALASE needle delivers more surge after occlusion than a flared ABS phaco tip needle, which is why I use a much lower vacuum level than my normal setting of 650mmHg or more. I lower the vacuum with AQUALASE to preserve the anterior chamber's stability. Furthermore, the AQUALASE tip is quite capsule-friendly and lets me work deep in the bag with relative safety. Any contact between the tip and the capsule will not damage the latter if the vacuum is below 300mmHg. Also, working deeper in the bag keeps the fluid flow away from the corneal endothelium.

When I begin extracting the nuclear quadrants, I slightly twist the AQUALASE handpiece like a pencil to enhance followability. This step is important with AQUALASE, because the tip's flat face must rest against the flat face of the nucleus in order to get enough vacuum power to pull in the fragment. The tip is too blunt to dig into the nucleus. Constantly changing the position of the front of the AQUALASE tip on the nucleus keeps the two in contact (Figure 1). The vacuum level on the video shows that I maintain occlusion a high percentage of the time during this maneuver.

I/A AND IOL IMPLANTATION

I usually begin I/A with the subincisional cortex and roll the AQUALASE tip underneath the area where I am working. Moving counterclockwise, I try to aspirate as much cortex as possible in one bite and then pull the residual pieces to the center of the capsular bag. Then, I fill the capsular bag with PROVISC ophthalmic viscosurgical device (Alcon Laboratories, Inc.), which is highly cohesive. I only need to maintain enough space in the bag to implant the lens, and then I remove the Provisc. I partially fill the lens cartridge with VISCOAT to ease the implant's deployment, and I use the tip of the plunger to position the lens. I insert a SN60WF natural aspheric lens (Alcon Laboratories, Inc.), which in my experience has improved the IOL's optical performance. My patients no longer complain about bright blue light after cataract surgery or night-vision symptoms. Clinically, I have not seen any contrast-sensitivity issues with the SN60WF.

I usually begin I/A before the haptics of the implant have fully unfolded. When I begin extracting the VISCOAT, I first direct the AQUALASE tip around the periphery of the capsular bag to remove the viscoelasatic from the angle. In this case, I could see the VISCOAT coming off in pieces from the endothelium. I aspirate it in the center last so that I may concentrate on the fluid traveling around inside the eye. Last, I hydrate the stroma with BSS and close the wound. ■

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How to Prepare for Cataract Complications

Ten anterior-vitrectomy pearls for the cataract surgeon.

BY DAVID F. CHANG, MD

There are many reasons to feel demoralized when we must reluctantly ask the scrub nurse to open up the vitrectomy pack. An otherwise calm morning is suddenly interrupted by a storm of emotions—the surprise of an unexpected complication, the stress of how to remove the remaining nucleus, the letdown of the staff's realization that you have lost vitreous, the impatience of waiting for seldom-used instruments to be located, the worry over telling the patient that there was a problem, and the time pressure of the subsequent cases that are falling further behind schedule with each passing minute.

It is little wonder, then, that surgeons faced with capsular rupture often resort to hurried maneuvers and tactics that they might later regret, whether chasing a descending nucleus with the phaco tip, implanting an inappropriate IOL in the sulcus, or leaving vitreous incarcerated in the incision. It is during stressful times like these that you must demonstrate the judicious decision making that results from proper preparation. Such preparedness means mentally rehearsing how these challenging scenarios should be handled. This article presents 10 pearls for managing vitreous loss (Figures 1 through 5).

"It is during stressful times that you must demonstrate the judicious decision making that results from proper preparation."

PEARL NO. 1

Upon recognizing a posterior capsular rent, do not immediately withdraw the phaco tip. Withdrawing the instrument is as natural a reflex as retract-

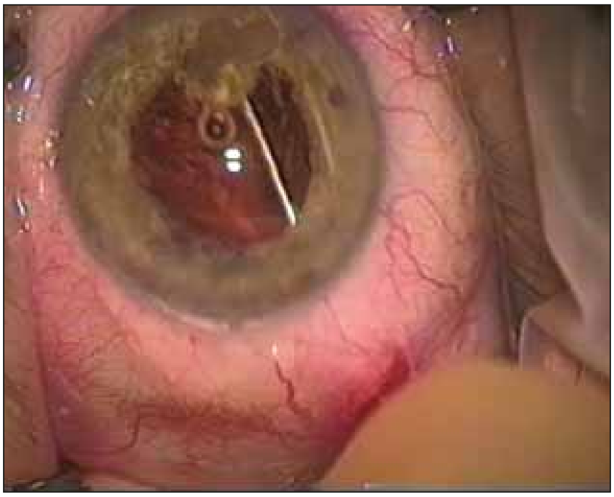

Figure 1. In the VISCOAT PAL technique, the author injects VISCOAT behind the partially descended nuclear fragment after posterior capsular rupture. He uses the cannula via a pars plana sclerotomy to levitate the fragment into the anterior chamber.

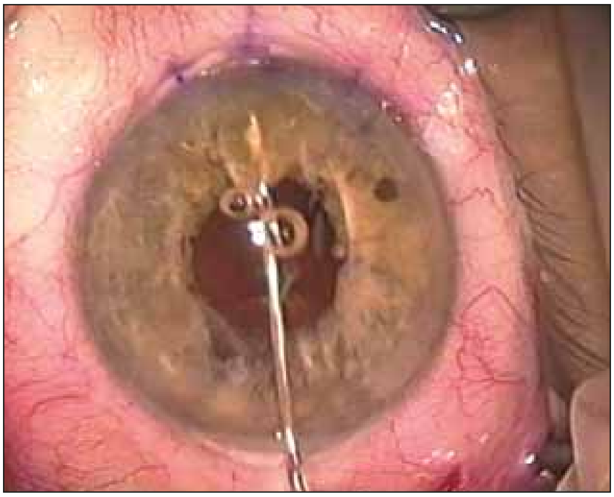

Figure 2. In the VISCOAT Trap technique, the author elevates the nuclear fragment as anteriorly as possible prior to initiating the anterior vitrectomy. Filling the anterior chamber with VISCOAT traps the fragment.

ing our hands from a hot stove. However, abruptly unplugging the incision will empty the anterior chamber and create a sudden posterior pressure gradient that will cause the intact hyaloid face to rupture. Vitreous will then expand the capsular rent as it prolapses through the incision. Instead, remain in foot pedal position one and use your nondominant hand to inject viscoelastic through the sideport incision. After switching to foot pedal position zero, fill the anterior chamber with viscoelastic in order to prevent vitreous herniation as you withdraw the phaco tip.

> *"Consider inserting a trimmed Sheet's glide through the phaco incision to act as an artificial posterior capsule, as described by Marc Michelson, MD."*

PEARL NO. 2

Create an artificial posterior capsule. Assess the amount and location of any residual nucleus. If the remaining fragments can be elevated into the anterior chamber with a dispersive viscoelastic, then consider inserting a trimmed Sheet's glide through the phaco incision to act as an artificial posterior capsule, as described by Marc Michelson, MD.[1] The glide can keep lenticular material from dropping posteriorly and prevent vitreous from being drawn forward to the aspirating port. Widen the incision slightly to accommodate the phaco tip's insertion over the glide. Alternatively, use bimanual microincisional phaco instrumentation through separate 1.2-mm sideport incisions if you are comfortable with this technique (Figure 4). The lower inflow/outflow rates minimize fluidic turbulence that might flush small fragments posteriorly.

PEARL NO. 3

Consider the VISCOAT Posterior Assisted Levitation (PAL) Technique. If the nucleus has already partially descended through the posterior capsular rent, do not chase it with the phaco tip. The posteriorly directed flow of coaxial irrigation will widen the rent, hydrate the vitreous, and propel the fragment away from the approaching phaco tip. The aspiration and incarceration of vitreous in the 1-mm–wide opening of the phaco tip can cause a giant retinal tear. Instead, consider a PAL technique using VISCOAT (Alcon Laboratories, Inc., Fort Worth, TX), as long as the sinking fragment is anterior enough to be visualized through the microscope. Charles Kelman, MD, popularized the use of a metal spatula through a pars plana sclerotomy. Richard Packard, MD, and I subsequently published our results using the VISCOAT PAL method to support and levitate the nucleus.[2]

After opening the conjunctiva and applying light cautery, use a No. 19 or 20 microvitreoretinal blade to create a pars plana sclerotomy 3.5mm behind the limbus. Avoid the cardinal positions directly in front of the rectus muscle insertions. This maneuver is surprisingly well tolerated under topical anesthesia. Aim the VISCOAT injection behind the nucleus to immediately provide supplemental support. This approach is more difficult to perform through a limbal incision and capsulorhexis because the angle of approach is too steep. Next, use the cannula's tip to elevate the nuclear fragment(s) into the anterior chamber (Figure 1). During this maneuver, injecting small amounts of VISCOAT can help to better orient the fragment. Avoid injecting excessive viscoelastic that could cause vitreous expulsion through the sclerotomy. Once the nucleus is in the anterior chamber, remove it manually through a standard-sized extracapsular cataract extraction incision or by resuming phacoemulsification above a Sheet's glide as described previously.

PEARL NO. 4

If vitreous is unintentionally aspirated during any lens-removal step, employ the VISCOAT Trap tech-

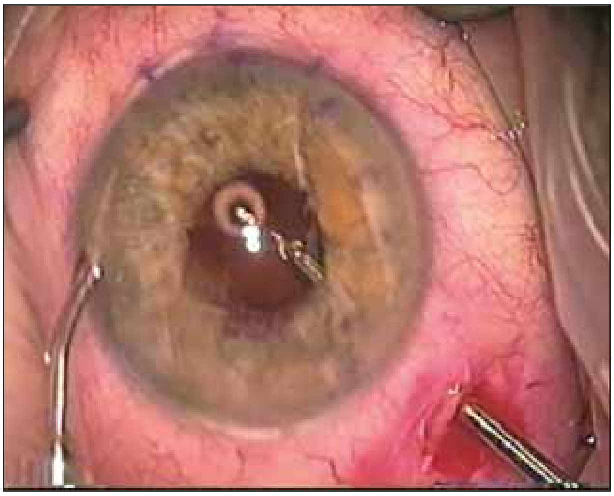

Figure 3. When performing bimanual pars plana vitrectomy, the author places a self-retaining No. 22 irrigating cannula through a limbal paracentesis. He introduces the sleeveless vitrectomy cutter through the pars plana incision and keeps it posterior to the iris. This approach excises the prolapsing strands without removing the layer of VISCOAT.

nique before initiating the vitrectomy. Following posterior capsular rupture, the formed vitreous supports the remaining nucleus. The latter will descend into the posterior segment as more and more vitreous is either excised or prolapses out of the eye. To prevent this sequence, I devised a technique that I call the VISCOAT Trap.[3,4] I first elevate any loose lens fragments as anteriorly as possible, and then I fill the anterior chamber with a dispersive viscoelastic such as VISCOAT (Figure 2). Because it is highly retentive and resists aspiration, a dispersive viscoelastic will continue to support any loose lenticular material as the vitreous is excised using the techniques described in pearls 5 and 6.

"Employing a separate, self-retaining, limbal infusion cannula allows you to dissociate the I/A currents so that the irrigation stream is kept as anterior as possible."

PEARL NO. 5

Separate the infusion cannula from the vitrectomy cutter. A coaxial infusion sleeve creates fluid countercurrents that undermine the vitrectomy's objectives. First, the irrigation inflow hydrostatically propels away vitreous and lens particles that are being drawn to the tip. In addition, posteriorly directed coaxial irrigation will hydrate the vitreous and induce further prolapse. Finally, such fluid currents may hydrostatically enlarge a small capsular rent. Employing a separate, self-retaining, limbal infusion cannula allows you to dissociate the I/A currents so that the irrigation stream is kept as anterior as possible (Figure 3). Use a maximally high cutting rate to minimize vitreous traction.

PEARL NO. 6

Introduce the vitrectomy cutter through a pars plana sclerotomy. Although the phaco incision is more convenient, it is much too large for the sleeveless vitrectomy cutter. A leaking incision not only causes chamber instability, but it also allows vitreous to prolapse and exit alongside the instrument shaft. As more and more vitreous is excised or prolapses, the unsupported lens fragments will start to descend into the posterior segment. In contrast, a pars plana sclerotomy is relatively watertight and provides better fluidic stability. This incision aids in keeping the vitrectomy tip posterior to the pupil, where it can still transect the transpupillary bands of vitreous without evacuating the overlying layer of VISCOAT or inadvertently cutting the capsulorhexis (Figure 3). The sclerotomy can eventually be closed with an interrupted 8–0 Vicryl suture (Ethicon Inc., Somerville, NJ).

PEARL NO. 7

Use bimanual I/A instrumentation. For cortical removal in the presence of an open posterior capsule, the advantages of dissociating the I/A currents are the same as for bimanual vitrectomy. Using snug paracentesis incisions avoids excessive fluid leak and optimizes chamber stability. The ability to exchange entry ports enhances your access to the subincisional (phaco) area. Finally, without a silicone irrigation sleeve, the aspirating tip can more easily reach the most peripheral areas.

PEARL NO. 8

Select the proper IOL size, design, and power for the sulcus. The only 13.5-mm–long foldable IOL is the Staar silicone AQ2010 lens (Staar Surgical Company, Monrovia, CA). All other foldable IOLs are 13mm or less in length and will be too short for the ciliary sulcus in many eyes. Although there is no precise or reliable way to gauge the sulcus diameter, it is generally larger if the horizontal white-to-white corneal diameter is >12mm. I prefer the Staar AQ2010 as a backup foldable IOL for these eyes. The single-piece Acrysof IOL (Alcon Laboratories, Inc.) is contraindicated for sulcus implantation. Not only is its overall length

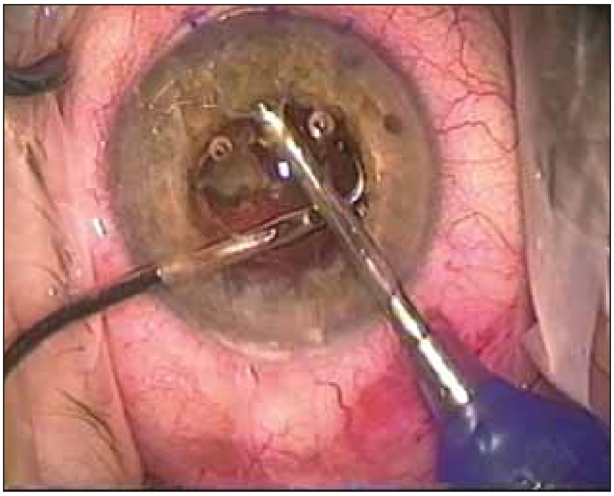

Figure 4. Following the vitrectomy, the author uses bimanual microphaco instrumentation to remove the residual nuclear fragments. He has inserted a trimmed Sheet's glide across the pupil via the phaco incision to act as an artificial posterior capsule.

insufficient, but also its thicker, sharp-edged haptics can cause posterior iris chafing and pigmentary dispersion.[5] For surgeons preferring to place an acrylic IOL in the sulcus, the MA50BM IOL (Alcon Laboratoreis, Inc.) has a 6.5-mm optic. Finally, because the effective lens position will be more anterior in the ciliary sulcus, decrease the IOL's power by 0.50 to1.00D from that intended for in-the-bag implantation.[6]

PEARL NO. 9

Stain the vitreous with Kenalog (Bristol-Myers Squibb Company, New York, NY) if an IOL is present. As described by Scott Burk, MD,[7] Kenalog staining provides excellent visualization of the vitreous. Although generally not necessary for performing a total anterior vitrectomy and capsulectomy in an aphakic eye, this technique is invaluable when trying to visualize and excise prolapsed vitreous after the IOL is already in place (Figure 5). The reason is that vitreous strands are more easily trapped or entangled around the IOL and may not be detected until the postoperative slit-lamp examination.

PEARL NO. 10

Prepare a contingency instrument kit. Posterior capsular rupture with vitreous loss necessitates a stressful departure from the surgical routine for both surgeons and their OR staff. By anticipating these difficulties, you can prepare for this contingency in several ways. First, program "emergency" parameters into a memory setting on your phaco machine. These parameters should include a

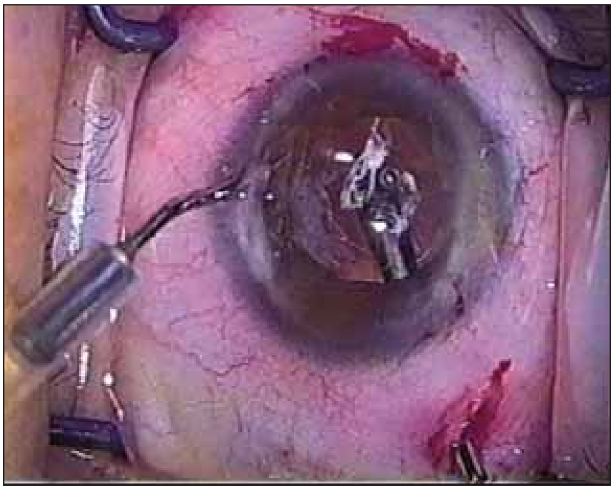

Figure 5. Following an IOL exchange, vitreous has herniated through a capsular defect into the anterior chamber. Kenalog staining allows the surgeon to visualize when the connecting posterior bands have been excised by the pars plana vitrectomy.

"The OR staff can prepackage special instruments in a contingency kit that is kept sterile in a separate, autoclavable container."

decreased aspiration flow rate (20 to 22mL/min), vacuum limit (100 to125mmHg), and bottle height. This precaution avoids the need for nursing personnel to urgently and manually reprogram settings.

Second, as Louis "Skip" D. Nichamin, MD, and I have advocated, the OR staff can prepackage special instruments in a contingency kit that is kept sterile in a separate, autoclavable container.[4] This kit eliminates panicked searches for seldom-used instruments.

Anticipating the need to convert to an extracapsular cataract extraction or perform a vitrectomy, I pack my contingency kit with a sub-Tenon's cannula (for supplemental anesthesia); corneal scissors; an irrigating lens loop; a 22-gauge, self-retaining, limbal infusion cannula; and a bimanual I/A handpiece set. Such a kit is commercially available (Chang Contingency Kit; Katena Products, Inc., Denville, NJ). Vitrectomy instrumentation, disposable microvietreoretinal blades, Sheet's glides, a dispersive viscoelastic such as VISCOAT, and backup IOLs for sulcus implantation should also be readily available. ■

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Viscoelastic Strategies to Save the Capsule

Steps to ensure a trouble-free surgery.

BY GARRY P. CONDON, MD

Cataract surgeons generally do not aspire to become authorities on vitreous loss through increasing their own personal experience in that area. In responding to a posterior capsular tear, however, the surgeon who is best able to apply a knowledge of fluidics, viscoelastics, and IOL characteristics will consistently produce optimal results. When posterior capsular rupture occurs, it is critical to have the ability to respond readily, rationally, and in a relaxed manner in order to achieve the best possible outcome for the patient.

Posterior capsular rupture requires the surgeon to (1) minimize vitreous prolapse and subsequent vitreous loss, (2) safely extract residual nuclear material, and (3) preserve capsular support for a PCIOL. With respect to the first of these goals, it is important to understand that creating a posterior capsular tear does not necessarily induce vitreous loss. The surgeon's initial response to recognizing a tear is to create a closed system with vitreous tamponade. I suggest leaving the phaco tip in the eye, immediately going to foot position one, and lowering the infusion bottle. Keep the phaco tip in the anterior chamber and, via the sideport incision, replace the anterior segment and intracapsular fluid with a highly retentive dispersive viscoelastic such as VISCOAT ophthalmic viscosurgical device (Alcon Laboratories, Inc, Fort Worth, TX). Unlike a cohesive agent, VISCOAT tends to remain in place during ongoing infusion. Use this approach to tamponade any prolapsing vitreous, stabilize any remaining nuclear fragments, and create a positively pressurized closed system. Try to compartmentalize residual nuclear material anteriorly by infusing viscoelastic behind any lenticular material and directly along the plane of the posterior capsule to create a barrier across this space. At this point, any vitreous prolapse is less likely to extend to

> *"Unlike a cohesive agent, VISCOAT tends to remain in place during ongoing infusion."*

Figure 1. A cohesive viscoelastic fills the capsular bag and facilitates a posterior capsulorhexis.

Figure 2. The author completes the continuous curvilinear posterior capsulorhexis.

Figure 3. The author aspirates the subincisional cortex present within a cohesive viscoelastic.

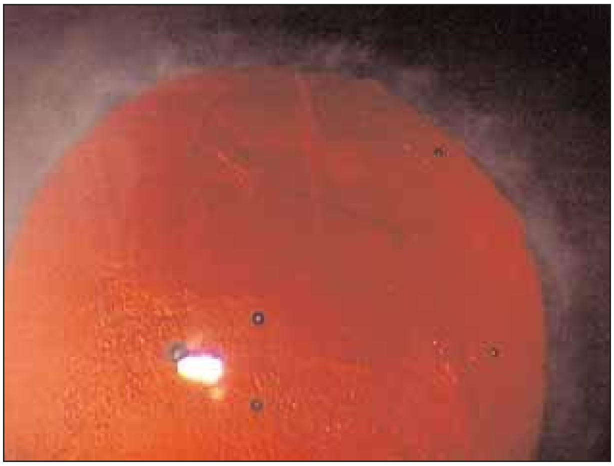

Figure 4. A limited, irregular posterior capsular tear is evident prior to IOL insertion.

the wound when you extract the phaco tip. Take a breath, try to relax, and assess the situation fully before proceeding.

ADDRESSING THE TEAR

If possible, turn the tear into a continuous posterior capsulorhexis to prevent it from extending, as well as to allow the safer placement of an IOL in the capsular bag. I like to add a cohesive viscoelastic such as PROVISC ophthalmic viscosurgical device (Alcon Laboratories, Inc.) at this point to promote a crisp view of the capsular tear and keep a posterior layer of the VISCOAT solidly placed against the remaining capsule. Instilling PROVISC will also push some of the VISCOAT posteriorly through the opening to maximally sequester any prolapsing vitreous. A microcapsulorhexis forceps greatly facilitates the creation of the posterior capsulorhexis by not distorting the cornea and thus maintaining an optimal view. Add enough cohesive viscoelastic to keep the bag well distended; otherwise, it will be very difficult to create the capsulorhexis (a loose bag will simply move with you). Again, gently pushing some viscoelastic through the opening helps to stabilize the bag and may reduce your tendency to grasp vitreous along with the capsule (Figures 1 and 2).

PHACOEMULSIFICATION

How best to extract residual nuclear fragments depends primarily on their size relative to the size of the capsular rent and how adequately separated they are from any vitreous. It is reasonable to proceed with phacoemulsification if the lenticular fragments are not admixed with vitreous and can be buoyed up to the iris plane with viscoelastic. Use a low flow rate, a low bottle height, and moderate vacuum. Keep the tip fully occluded with lenticular material during I/A to help to selectively remove nuclear fragments rather than viscoelastic and vitreous. Use a second instrument through the sideport incision to press hard material into the phaco tip; use reduced phaco power and duration to avoid a wound burn. Take your time and add dispersive viscoelastic as you go so as to maintain the segregation of vitreous and lenticular fragments. Although I have not tried it, some surgeons use a phaco glide placed behind the fragments for added security.[1]

It is important to resist any temptation to use aspiration or forceps to retrieve nuclear fragments that drop into the vitreous cavity. Those maneuvers greatly risk serious retinal complications. Rather, cut your losses and keep to your objective of cleaning up the anterior segment and implanting a stable IOL. Letting the vitreoretinal surgeon address any large or small posteriorly dislocated nuclear pieces in the following days is likely to produce an excellent result if you do not promote retinal detachment.

VITRECTOMY

If vitreous prolapse is minimal, a “dry” vitrectomy performed under viscoelastic without simultaneous irrigation can be very effective in preventing further infusion-related prolapse and will allow the placement of an IOL in the capsular bag.[2] For a more effective vitrectomy, remove the infusion sleeve from the vitrectomy handpiece and connect the irrigation line to an anterior-chamber–maintaining cannula placed through a corneal paracentesis. Placing the cutter through a pars plana incision to bring prolapsed vitreous posteriorly more effectively cleans up the anterior segment. A small subconjunctival injection of lidocaine is usually adequate at the incision site. Alternatively, a small corneal incision will also accommodate the cutter. Clear any external vitreous at the primary wound site to make it watertight during the vitrectomy. Use a cutting rate of at least 400 cuts/min.

CORTICAL REMOVAL

After refilling the chamber with viscoelastic, residual cortex is best removed using dry aspiration with a 23- or 25-gauge cannula. Withholding irrigation entirely will virtually eliminate shearing or fragmentation of these viscoelastics. The so-called pseudoplasticity of the working space allows you to selectively aspirate cortex while the capsular bag remains locked in position. A J-shaped cannula is ideal for removing subincisional cortex (Figure 3). Using a cohesive viscoelastic at this point to refill the chamber as needed has a tremendous advantage in that it is easy to remove at the conclusion of the procedure. A machine that has an I/A-cut mode as well as an adjustable cutting port size on the vitrectomy handpiece offers automated cortical removal; however, do not risk compromising capsular support in an effort to get every cortical strand.

IOL IMPLANTATION

It is imperative to preserve as much of the anterior capsular leaflet as possible for sulcus support of the IOL if the posterior capsule is inadequate for the lens' placement in the capsular bag. An intact anterior capsulorhexis often allows posterior capture of the optic with better stability of any sulcus-supported IOL.

Prior to the availability of the single-piece acrylic IOL, placing the lens entirely in the capsular bag was recommended only if a posterior capsulorhexis had been achieved. With their gentle haptic-compression forces, these lenses may in some cases be safely placed in the capsular bag over small, discontinuous capsular tears (Figures 4 and 5). Once the IOL is in position, use a reduced bottle height and flow rate to gently remove the anteriorly located viscoelastic. This approach is safe and easy if you have used a cohesive agent such as PROVISC during cortical removal.

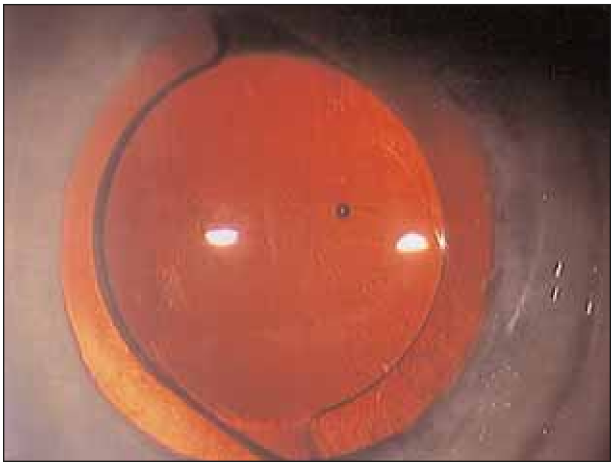

Figure 5. With in-the-bag placement of a single-piece ACRYSOF acrylic IOL (Alcon Laboratories, Inc.), the tear remains stable.

"Once the IOL is in position, use a reduced bottle height and flow rate to gently remove the anteriorly located viscoelastic."

WRAP-UP

Intracameral, long-acting miotics (Miostat intraocular soluation [carbachol]; Alcon Laboratories, Inc.) are the most effective agents to prevent postoperative IOP spikes.[3] I use topical dexamethasone and a nonsteroidal agent in cases of capsular tears to minimize the increased risk of cystoid macular edema. The risk of endophthalmitis warrants prophylactic broad-spectrum antibiotic coverage with a fourth-generation fluoroquinolone.

When addressing the challenge of a torn capsule, strategies that take advantage of specific viscoelastic properties, available instrumentation, and single-piece acrylic IOLs will greatly enhance the outcomes for our patients. ■

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Hard Cataract and Medium Pupil in a Hyperopic Eye

VISCOAT and PROVISC aid in this challenging surgery.

BY JAMES A. DAVISON, MD, FACS

One of the more common challenges that an anterior segment surgeon encounters is a hyperopic eye that contains a hard cataract. In the following case, the nuclear hardness measured NC 4.5 in the LOCS III scale.

PUPILLARY EXPANSION

I believe that success with removing a cataractous lens and implanting an IOL is aided by using Grieshaber flexible iris retractors (Alcon Laboratories, Inc., Fort Worth, TX) to dilate the pupil and by re-injecting Viscoat (Alcon Laboratories, Inc.) at certain times during phacoemulsification. Although the pupil in this case was approximately 5mm to start, I knew it would become progressively smaller as the surgery proceeded. Pupillary expansion is not needed with a soft cataract, but I appreciated the additional dilation in the later phases of this particular surgery.

I find that the Alcon 22.5º ClearCut HP steel blade makes a suitable incision to accommodate the iris hooks without entering the anterior chamber too far. I also use this blade to make the accessory incision to my immediate left (the dilating hook incisions are created in the center of each quadrant). The blade is sharp enough that I do not have to inject viscoelastic into the anterior chamber in preparation for inserting the blade. Making the incisions prior to injecting viscoelastic is especially convenient and effective for anterior capsular staining under air, if necessary.

THE VISCOELASTIC SANDWICH TECHNIQUE

I easily created the 2.8-mm metal keratome incision using subtle countertraction and stabilization with the blunt edges of the 22.5º blade. Then, I injected lidocaine followed by VISCOAT and PROVISC ophthalmic viscosurgical devices (Alcon Laboratories, Inc.) into the anterior chamber. I was careful to use just enough VISCOAT to coat the corneal endothelium, and then the PROVISC pushed the VISCOAT forward according to the VISCOAT sandwich technique.

I placed the iris retractors with a tying forceps and a 0.12-mm forceps (Figure 1). Placing the instruments was harder to perform with this 5-mm pupil than with a smaller one. I tightened the traction on the iris retractors after they were in place.

CAPSULORHEXIS AND HYDRODISSECTION

I created the capsulorhexis using a cystotome. I recommend this device because forceps present greater bulk and are more likely to cause iris prolapse, especially in eyes of small dimensions. Next, I injected minimal but effective amounts of BSS intraocular solution in a slow and controlled fashion through a Chang cannula (Katena Products, Inc., Denville, NJ) to complete cortical cleaving hydrodissection.

In order to allow the iris to fall backward, I relaxed the iris retractors that trampoline the pupil underneath the phaco tip. This maneuver helps prevent trauma to the iris from the vibrating phaco needle. I introduced the phaco tip into the tight anterior chamber. To prevent phaco burns, I withdrew some viscoelastic (this can be done with no or very little ultrasound energy to facilitate aspiration prior to engaging phaco energy). I used this approach to aspirate viscoelastic prior to engaging phacoemulsification power with each viscoelastic re-injection. I make the first injection prior to creating the capsulorhexis, the second before beginning to

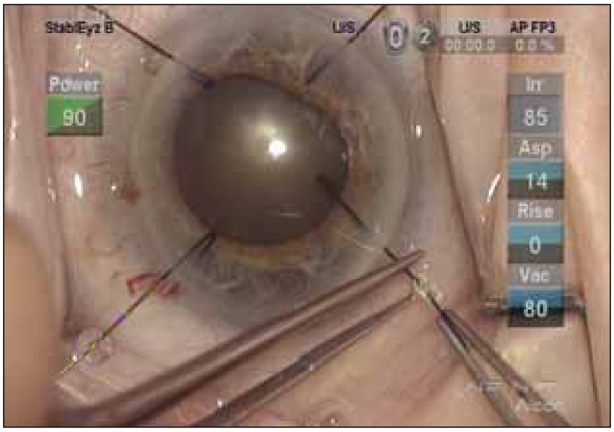

Figure 1. The author has inserted four microiris retractors through the incisions. He engages the first retractor to the edge of the iris of the 4.5-mm–diameter pupil.

Figure 2. Before he begins phacoemulsification, the author slightly relaxes the proximal microiris retractors so that the iris will fall back and not make strong contact with the phaco tip. Also, he re-injects VISCOAT into the anterior chamber prior to aspirating the four quadrants. The edge of the wave of viscoelastic can be seen over the infusion sleeve as it spreads from right to left. The author has removed the internal corners of the quadrants by using a shaving action with the 45º phaco tip while the quadrants were in situ within the capsular bag. This maneuver removes as much of the hard central bulk as possible in this deep location.

aspirate nuclear quadrants, and the third prior to aspirating the fourth quadrant.

NUCLEAR REMOVAL

After I finished grooving the nucleus, I worked behind the iris to perform posterior nuclear cracking and debulk the nuclear fragments into relatively two-dimensional nuclear plates (Figure 2). Next, I re-injected VISCOAT into the anterior chamber. The quadrant-removal portion of cataract surgery involves drawing nuclear fragments into the iris plane for emulsification, and VISCOAT protects the cornea from the abrasive contact of larger fragments and their impact during the turbulence of BSS.

I carefully aspirated each fragment using minimal hyperpulsed phacoemulsification energy with the INFINITI vision system (Alcon Laboratories, Inc.). I always try to keep the nuclear fragments away from the corneal endothelium. Rotating the fragments clockwise produced a remaining fragment that comprised the floor on which I had placed the fragment I was aspirating. Such a floor supports the fragment away from the posterior capsular surface and also insulates the capsule from inadvertent aspiration. The fragments were relatively two-dimensional and less hard than they would have been had I not debulked them as they lay in the capsular bag.

I re-injected VISCOAT into the anterior chamber prior to aspirating the last fragment. The viscoelastic helped float the fragment into the iris plane and protected the posterior capsule from aspiration. In general, VISCOAT also prevents the damage that can occur within the last few seconds of phacoemulsification when nuclear material gathers over the phaco tip and accumulates anteriorly, where it can be trapped by the corneal endothelium.

IOL INSERTION

Prior to inserting the IOL (ACRYSOF SN60WF IOL; Alcon Laboratories, Inc.), I filled the MONARCH IOL delivery system (Alcon Laboratories, Inc.) with VISCOAT while I injected PROVISC into the anterior chamber. Sometimes in hyperopic eyes with small anterior-chamber dimensions, iris trauma may occur from cartridge insertion. The surgeon may push back the iris by injecting a minimal amount of PROVISC or VISCOAT underneath the incision. Surgeons using this technique must take care to not overfill the entire anterior chamber, because the iris will be more prone to prolapse if the incision is opened. They must also use sufficient PROVISC to make the posterior capsule smooth and concave; flaccidity will allow the leading haptic to catch, gather, and tear the capsule.

I inserted the IOL just under the iris plane without regard to its final position. Trying to inject it too close to the posterior capsule can create friction between the IOL's haptic and the capsule and cause a capsular tear. The IOL is easy to dial into the capsular bag with a Lester hook (Katena Products, Inc.).

SURGICAL COMPLETION

I removed the iris hooks without difficulty and extracted the VISCOAT from in front of and behind the IOL. It is not necessary to remove all of the viscoelastic from either chamber, but I recommend removing as much as possible anteriorly. I always inflate the anterior chamber with BSS and make sure there are no nuclear fragments hiding in the angle or behind the iris, because VISCOAT can sometimes trap fragments in those areas. Exercising caution, I used high-vacuum flow to aspirate the easily accessible viscoelastic from the small space behind the IOL optic. I inspected the incision and stroma and hydrated them as needed while I inflated the anterior chamber. Finally, I gently applied a Weck cell sponge to the incision to let out just enough BSS to return the eye to its normal internal tension, and I checked that the incision was watertight. ■

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Using Prechop to Increase Surgical Efficiency

Two cases highlight the strong points of the AQUALASE liquifaction device.

BY JEFFREY D. HORN, MD

I typically perform cataract removal with the AQUALASE liquifaction device (Alcon Laboratories, Inc., Fort Worth, TX) on patients under the age of 70 (an arbitrary cutoff) who have cataracts that are usually of no more than 2+ to 3+ nuclear sclerosis. I have used the AQUALASE surgical handpiece on harder cataracts, but the NEOSONIX and ultrasonic capabilities on the INFINITI Vision System (Alcon Laboratories, Inc.) are exceptionally efficient at removing dense cataracts. For moderately dense cataracts, however, I use AQUALASE quite often, because the soft tip on its handpiece is very gentle on the capsule.

PROCEDURAL POINTERS

When I perform an AQUALASE procedure, I usually first protect the endothelium by coating it with a viscoelastic such as VISCOAT ophthalmic viscosurgical device (Alcon Laboratories, Inc.). Although AQUALASE uses no ultrasonic energy, it does produce some fluid in the eye, and I think that a degree of endothelial cell loss is related to turbulent fluid flow within the anterior chamber.

Figure 1. The author prechops the nucleus in preparation for performing the AQUALASE procedure.

"I feel that prechopping the lens prior to performing AQUALASE is the most efficient use of this technology."

In my hands, AQUALASE really shines when I prechop the nucleus into three or four pieces before extracting them. Unlike traditional ultrasonic phacoemulsification, AQUALASE's soft tip does not groove very well; it will not burrow into the nucleus in order to gain enough purchase to chop it. Thus, I feel that prechopping the lens prior to performing AQUALASE is the most efficient use of this technology.

CASE NO. 1

The first surgery represents the removal of a typical, moderately dense cataract. It involved a 2+ to 3+ nuclear sclerotic cataract in the right eye of a white male patient who was younger than 70 years old. I performed the surgery after placing the patient under topical anesthesia combined with 0.25mL of preservative-free 1% lidocaine. Using a steel disposable blade, I made a 3-mm limbal incision temporally after making a 300-µm groove.

I made a paracentesis at the 11-o'clock position and used a combination cystotome/forceps (Rhein Medical Inc., Tampa, FL) to make the capsulorhexis. I next performed cortical cleaving hydrodissection and prechopped the nucleus using an Akahoshi Combo Prechopper (ASICO, Westmont, IL) (Figure 1). I also removed some of the peripheral cortex from around the nucleus. Often, the first piece of nucleus is the hardest to extract, and eliminating some cortex helps to mobilize the nuclear quadrants by reducing the lenticular volume in the capsular bag. I call this approach *pre-phacoemulsification cortical cleanup.* Then, simply repositioning the fragments on the handpiece allows the system to phacoemulsify them quite rapidly.

The rest of the case continued smoothly. I removed residual cortical material with the silicone sleeve I/A tip. I implanted the ACRYSOF Natural IOL (SN60AT; Alcon Laboratories, Inc.) using the Monarch II delivery system (Alcon Laboratories, Inc.) through the unenlarged incision. I then extracted the viscoelastic and hydrated the wound. The patient had a UCVA of 20/20 on the first postoperative day.

CASE NO. 2

The second case is of a white female in her early-to-mid-50s who had undergone frequent changes in her eyeglasses prescription over the previous 6 months to 1 year. This was her first visit with me, and her previous provider had repeatedly changed her prescription to treat her progressing myopia. She had a significant, 6.00D myopic shift in her left eye. When I examined her, she had a very small, rock-hard cataract in the middle of her lens.

When I entered the eye, the cataract was harder than I expected. Because of her age and the relatively small size of her nuclear cataract, I decided to perform an AQUALASE procedure. The smallness of the cataract prompted me to forgo prechopping. In this case, I performed cortical cleaving hydrodissection and then I hydrodelineated the nucleus. I thought I would be able to lift it up in one piece, like lifting a manhole cover up from the street. I applied more AQUALASE pulses to facilitate the hydrodelineation. I lifted up the nucleus with the AQUALASE handpiece, and the system emulsified the hard cataract fairly quickly (Figure 2). What remained was essentially clear epinuclear material. As a result, after extracting the hard nucleus, I removed a fairly substantial amount of lens in much the same manner as a refractive lensectomy. I proceeded with I/A and then implanted the new SN60WF higher-order aberration IOL (Alcon Laboratories, Inc.).

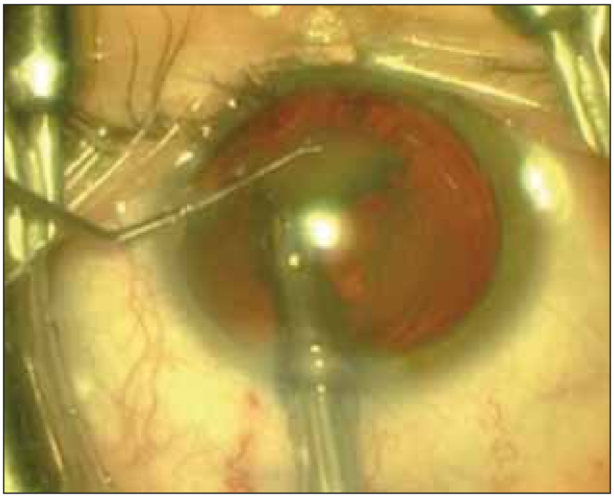

Figure 2. The AQUALASE system emulsifies the hard cataract efficiently.

The patient achieved approximately 20/20 UCVA on the first postoperative day. She was a little surprised to learn that a cataract was the cause of her problems, but she was pleased postoperatively.

I think this case clearly shows why AQUALASE is an appropriate means of removing the moderately dense to dense nuclei as well as for removing softer lenses in younger patients. The technology is especially effective in the age of accommodative IOLs, because surgeons will remove relatively soft, clear lenses and cannot afford to make a mistake. AQUALASE does not introduce a sharp needle into the eye, and I only use it on such cataracts for that reason.

CONSIDERATIONS

Company representatives for the AQUALASE liquefaction device have told me that surgeons who were using it with cataract extraction techniques similar to the ones they used with ultrasound averaged approximately 3,000 AQUALASE pulses. By prechopping the lens prior to emulsification, the highest number of pulses I have needed is approximately 1,000 on the hardest nuclei. On average, I use between 200 and 300 pulses. I find this approach with AQUALASE to be effective and efficient. It reduces the amount of necessary pulses and is safe, especially when used in conjunction with a viscoelastic such as VISCOAT to protect the endothelium.

The AQUALASE procedure is so similar in approach and speed to traditional phacoemulsification with ultrasound that one could easily mistake it for the latter. Moreover, AQUALASE can eliminate residual lens epithelial cells on the capsule and thus may help reduce posterior capsular opacification. Similar to Alcon's silicone sleeve I/A tip (which I consider to be one of the most significant improvements in cataract surgery since I began practicing), the AQUALASE handpiece's soft tip is unlikely to rupture the capsule if contact occurs. ■

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Cataract Surgery in a One-Eyed Patient With Glaucoma and Synechiae

Using VISCOAT and PROVISC in a case that demanded a careful approach.

BY SATISH MODI, MD, FRCS(C)

Today, it is rare to see patients using pilocarpine drops to control their glaucoma. The patient in the video presented a unique surgical challenge. She was a 62-year-old with one working eye; her left eye had been enucleated some years ago. She had undergone two previous peripheral iridotomies in her right glaucomatous eye and was using 2% pilocarpine and 0.5% timolol drops, which kept her IOP in the range of 20mmHg. The patient had 360º posterior synechiae, a 2-mm pupil, and decreasing vision as a result of progressive axial cortical cataract formation. Her acuity was 20/70, which decreased to 20/400 upon glare testing. She had occasional corneal guttata. Using a 90.00D lens with direct ophthalmoscopy, the view of the optic nerve, although hazy, was normal. A direct-contact A-scan revealed a normal axial length.

This patient's unique situation required me to make careful surgical decisions regarding the medications, materials, and surgical techniques I selected.

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ANESTHESIA

Two factors to consider when choosing the type of anesthesia to use in cataract surgery are (1) patient compliance and (2) one's comfort with a given procedure. I often tell my ophthalmic residents that the amount of anesthesia one uses is directly proportional to one's level of anxiety about a particular surgery. I have been using topical anesthesia (0.5% tetracaine; Alcon Laboratories, Inc., Fort Worth, TX) with intracameral supplementation (methylparaben-free 1% lidocaine [Zylocaine; Amphastar Pharmaceuticals, Inc., Rancho Cucamonga, CA]) for more than a decade. Alternatively, one could use a peribulbar block with 1% Xylocaine (Astrazeneca Pharmaceuticals LP, Wilmington, DE), and hyaluronidase, but then the patient would have to remain in the ambulatory surgery center for approximately 2 hours until her eye opened and she could function. Happily, this patient was compliant and able to handle the minimal discomfort of the surgery under topical anesthesia.

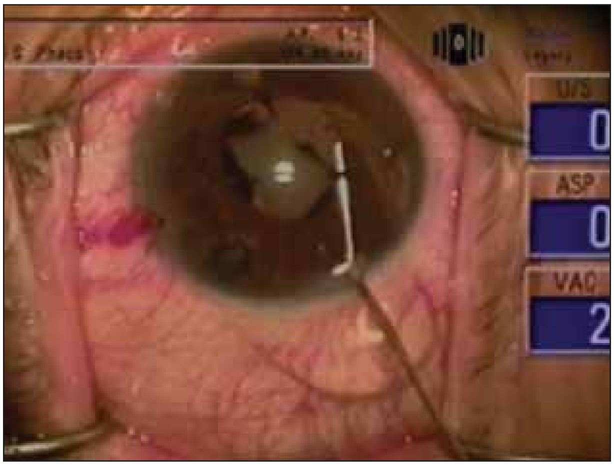

Figure 1. The author lyses the remaining posterior synechiae before initiating the capsulorhexis.

SURGICAL CONSIDERATIONS

My most important considerations with this case were (1) protecting the endothelium, (2) minimizing iris manipulation, and (3) controlling inflammation and pressure spikes.

Obviously, the 360º posterior synechiae required a significant amount of iris manipulation. Although I had Kuglen hooks as well as Grieshaber flexible iris retractors (Grieshaber, Schaffhausen, Switzerland) (which I have used with topical anesthesia), I wanted to handle the iris as little as possible, because I have personally had a higher incidence of cystoid macular edema in cases involving a lot of iris manipulation. I decided to premedicate the patient with Voltaren drops (Novartis AG, Duluth, GA) for 48 hours, and she continued this course postoperatively for 2 weeks. The patient also received VIGAMOX solution (Alcon Laboratories, Inc.) drops beginning on the first preoperative day.

INCISION

The iris was atonic, and I expected it to prolapse easily. Although a scleral incision would have been logical, I reserve using these for patients with severely compromised endothelia. Instead, I used a near-clear hinged corneal incision and made the first part of the incision vertically with a 300-µm guarded diamond knife. The diamond keratome was "dimpled down" to make the incision 3.0- by 1.3mm and aqueous-proof.

In my opinion, VISCOAT (Alcon Laboratories, Inc.) is the best viscoelastic for endothelial protection. I use high-flow phacoemulsification (40mL/min) that flushes out 160 times the volume of the anterior chamber every minute, and VISCOAT is the only viscoelastic that can withstand the enormous shearing forces that this kind of high flow entails. I feel that VISCOAT's ability to compartmentalize and manage space intraocularly is undervalued. Some may argue that a supercohesive viscoelastic such as Healon5 (Advanced Medical Optics, Inc., Santa Ana, CA) manages space better than VISCOAT, but I was concerned about a postoperative IOP spike in this eye, something that is more likely to occur with Healon5.

After I instilled lidocaine through the sideport incision, the VISCOAT effectively lysed almost 180º of the synechiae adhesions. Once I completed the phaco incision, I safely lysed the other 180º of adhesions (Figure 1) and used a bolus of VISCOAT to dilate the pupil. It is important not to overfill the anterior chamber with VISCOAT and raise the IOP, because doing so could alter the phaco wound's construction.

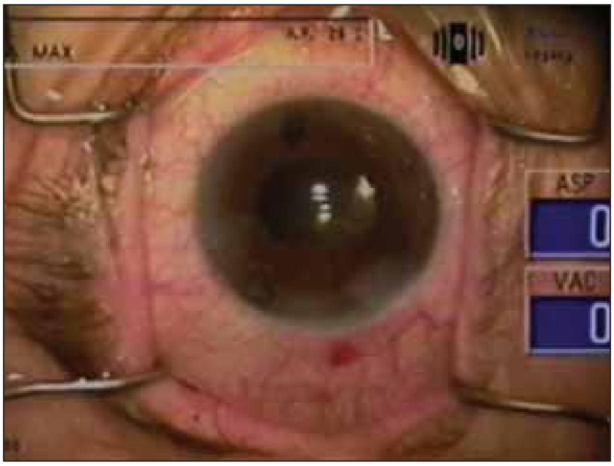

Figure 2. Upon completion of the surgery, the eye appeared clear and quiet.

One criticism of my surgical approach could be that I did not use a soft shell technique, where I would have placed a cohesive viscoelastic (PROVISC; Alcon Laboratories, Inc.) on the iris and capsule and then covered them with VISCOAT for endothelial protection. Although theoretically this approach can prevent iris prolapse through the incision, in my hands, this has not always been the case.

CAPSULORHEXIS

The capsulorhexis is the single most important step in phacoemulsification and can make or break the case. In the days before trypan blue (Vision Blue; DORC International BV, Zuidland, The Netherlands), I knew that the edge of the torn capsule would remain upright in VISCOAT, thereby enabling me to regrab it, even if its visibility were not optimal. In this case, the angle of the leading torn capsular flap allowed me to "see" the outer edge of the capsulorhexis and effectively make an optimally sized opening.

After hydrodissection and delineation, nuclear disassembly was routine.

LENS INSERTION

Because I was concerned about postoperative IOP spikes in this patient's eye, I completely filled the capsular bag with PROVISC and thus facilitated easy lens implantation. I was able to remove the PROVISC quickly, almost in one bolus, with little risk of IOP spikes.

A loss of iris sphincter tone can prompt the formation of adhesions to the IOL implant with attendant amoeboid deposits on the lenticular surface. I therefore used a hydrophobic acrylic implant for its high level of biocompatibility (Figure 2). Today, I would use an ACRYSOF IOL (Alcon Laboratories, Inc.), for its blue-light filtration capability that mimics the light transmission of a 25- to 30-year-old eye.

FOLLOW-UP

This patient saw 20/25 uncorrected on the first postoperative day. She had a clear cornea and a quiet anterior chamber within 1 week. Her pressure stabilized in the midteens with timolol 0.5% drops b.i.d. The patient was immensely pleased with the ease of the procedure and her final outcome. ■

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