Performing Seamless Hydrodissection

A small but effective step in cataract surgery.

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JORGE L. ALIÓ, MD, PhD

I perform a simple hydrodissection with a flat cannula (Pearce Nucleus Hydrodissector; Beaver-Visitec International) and rotate the nucleus with two Alió Prechoppers (Katena Products). Afterward, prechopping is performed in three or four areas, depending on the hardness of the cataract.

ROBERTO BELLUCCI, MD

I always use the Buratto cannula (Janach; Figure 1) for hydrodissection. This cannula has several helpful design features: (1) it reduces zonular stress by directing fluid downward, (2) it can come in direct contact with the lens equator, thus avoiding leaving any seam, (3) it produces a flat stream of fluid, (4) it can be moved or retracted, even abruptly, without causing any damage, (5) it can be used to rotate the nucleus to confirm hydrodissection, and (6) it is suitable for direct translenticular hydrodissection during laser-assisted cataract surgery.

In my technique, the cannula is first advanced beneath the anterior capsular rim out to the lens equator. Next, the cannula is tilted to lift its edge and press the body onto the scleral lip of the corneal incision. This allows fluid egress. When irrigation commences, the fluid wave progression beneath the lens can be observed through the microscope. Nucleus rotation follows, with additional irrigation if required.

Caution: This maneuver will fail in laser-assisted cataract surgery, as fluid will follow the already present lens fragmentation lines. Seamless hydrodissection is impossible at the moment with laser technologies.

BJÖRN JOHANSSON, MD, PhD

Any cannula used for hydrodissection should allow fluid injection at various angles and easy movement within the anterior chamber, and it should be suitable for rotating the nucleus after hydrodissection and hydrodelineation.

I favor a design with a 45° tip bent about 2 mm from the end of the cannula (Figure 2); this design provides optimal maneuverability in every angle of the anterior chamber, for hydrodissection and hydrodelineation and

Figure 1. The Buratto hydrodissection cannula.

Figure 2. The hydrodelineation cannula.
for other purposes. Single-use cannulas with similar configurations are also available. I described my preferred technique for hydrodissection and hydrodelineation in the December 2013 issue of *CRST Europe*.1 There are seven key steps for successful hydrodissection:

**Step No. 1.** Introduce the cannula exactly under the anterior capsule by slightly lifting the capsulorrhexis edge upward. This should be done before the cannula is advanced at least 2 mm toward the lens equator.

**Step No. 2.** Use firm but gentle injection of balanced saline solution in small portions until a fluid wave can be seen traversing the pupil inside the posterior capsule. In eyes with dense cataracts, this wave may not be visible; however, the lens should be pushed slightly forward, signaling that a bolus of balanced saline solution has collected between the lens and the posterior capsule.

**Step No. 3.** Using the tip of the cannula, gently depress the pole of the lens at the site of the injection.

**Step No. 4.** When needed, repeat steps 1 through 3 opposite from the initial injection.

**Step No. 5.** Direct the cannula tip downward and sink it into the cortical and epinuclear layers. Continue with hydrodelineation using small, stepwise injections. Note that this injection of balanced saline solution may meet much greater resistance than the initial hydrodissection; take care to avoid injecting too much saline once the resistance is overcome.

**Step No. 6.** Rotate the nucleus using the cannula tip as a lever.

**Step No. 7.** Repeat steps 5 and 6 in one to three more angles when needed (eyetube.net/?v=dahil).

In cases with exfoliation and suspected or obvious zonular weakness, it is extremely important to achieve a good separation of the lens from the capsule. Fortunately, when the zonulas and capsule are a bit loose, it is often easier to achieve good hydrodissection. I do not hesitate to rotate the mobilized nucleus even in these cases, but some colleagues advise against it. As long as the hydrodissection has been sufficient, it is better to free the nucleus from corticocapsular adhesions as much as possible. This is preferable to starting phacoemulsification and then discovering that the nucleus is not mobile.


**SIMONETTA MORSELLI, MD**

Hydrodissection is one of the most important components of a perfect phaco technique. A dedicated cannula should be used for hydrodissection. I use a curved cannula with a flat end, going underneath the anterior capsule—close to the external border of the crystalline lens—to lift it. With the cannula in position, balanced saline solution is injected under the anterior capsule to achieve a hydrodissection wave (Figure 3). If the wave does not appear, hydrodissection is repeated in another position.

**THOMAS F. NEUHANN, MD**

I first hydrodissect the corticocapsular plane and follow it with hydrodelineation of the corticonuclear plane. I like to do both because the extra work is minimal but the extra benefit is that, whatever phaco technique is chosen, the decisive two dissection planes are clearly and visibly defined. The margin of the lens that requires phacoemulsification is particularly demarcated.

I administer lidocaine for hydrodissection and hydrodelineation, as it provides further intraocular anesthesia without adding a step.

**TOBIAS H. NEUHANN, MD**

Hydrodissection is a small but effective step in achieving successful phacoemulsification. Ideally, once it is performed, the entire lens cortex is separated from the lens capsule.
by balanced saline solution. We use a 27-gauge disposable bent cannula (Hurricane Medical), screwed onto a bacterial filter. The filter, which is attached to a 5-mL Luer-lock syringe and has a pore size of just 0.2 μm, permits only a small, controlled volume of fluid into the lens (Figure 4). Perfect, seamless hydrodissection can be achieved in this way.

KHIUN F. TJIA, MD

I have noticed that many colleagues intentionally do not separate the lens from the anterior capsule. If this connection is not adequately separated, however, the lens will be unable to rotate.

A video demonstration of my hydrodissection technique can be viewed at eyetube.net/v?=defipe. After a complete posterior fluid wave crosses the entire posterior lens surface (Figure 5), I depress the nucleus, which will subsequently separate from the anterior capsule at approximately the 4- or 5-o’clock position (Figure 6). Pressing on the nucleus causes the fluid underneath it to shift to the opposite side. I then depress the nucleus on the opposite side (Figure 7).

The nucleus may move slightly posteriorly into the accumulated fluid pool, separating itself further from the anterior capsule. If the anterior capsule remains in position

Figure 4. A 27-gauge hydrodissection cannula is connected to a 0.2-μm fluid filter and to a 5-mL syringe loaded with balanced saline solution.

Figure 5. A posterior wave (blue area).

Hydrodissection 2nd step

Depress the nucleus immediately to separate a part of the nucleus from the anterior capsule

Figure 6. The second step of Dr. Tjia’s hydrodissection technique (A, B).

Hydrodissection 3rd step

Depress the nucleus approx. 180° away to separate the opposite part of the nucleus from the anterior capsule

Figure 7. The third step of Dr. Tjia’s hydrodissection technique (A, B).
when the nucleus is pressed downward close to the anterior capsulorrhexis edge (Figure 6), the anterior capsule and lens have separated. If one observes this separation at opposite sides of the lens, the anterior connections should be sufficiently dissected to allow easy rotation.

**ABHAY R. VASAVADA, MS, FRCS**

Cortical cleaving hydrodissection has become an integral part of cataract surgery. Creating a cleavage plane between the capsule and the peripheral cortex not only makes subsequent maneuvers easier but also plays an important role in reducing the formation of posterior capsular opacification.

My preferred technique is to use a 45º bent cannula instead of a straight tip; this is a modification of Akahoshi’s hydrodissection cannula (Figure 8). I insert the tip underneath the capsulorrhexis margin, but, unlike what is described conventionally, I do not tent the anterior capsule—I press the cannula against the peripheral lens surface. I inject balanced saline solution rapidly until I see a fluid wave pass across the posterior capsule.

A fairly rapid injection is essential to ensure adequate hydraulic pressure buildup and, thus, good corticocapsular cleavage. Often, the wave is visible, but it passes so slowly that it fails to produce a cleaving effect. The bent cannula that I use directs the fluid along the peripheral curve of the lens matter, helping to ensure fluid passage in the desired plane.

Successful hydrodissection is confirmed by the prominence of the capsulorrhexis margin and a slight forward bulge of the lens. Having recognized a successful hydrodissection, I do a gentle decompression by pressing the lens downward in order to vent the fluid out.

I do not rotate the lens at this point, but rather proceed directly to phacoemulsification. Rotating the nucleus at this stage requires placing a spatula onto the peripheral lens surface and applying a gentle posterior and sideways force. In this maneuver, the force is applied to a single point, but it is transmitted to a broader horizontal surface; this can lead to greater zonular stress.

To avoid this stress, I rotate the nucleus only once I have created a trench and initiated the first chop or crack. The vertical element of the chopper is placed in the crack as peripheral as visibility allows. In this way, the force is applied to a larger vertical area within the lens matter. This is likely to transmit less stress to the zonules.

**Special considerations.** There are four special considerations worth mentioning: multiquadrant focal hydrodissection, repeat hydrodissection, capsular block syndrome, and when to avoid hydrodissection.

**Multiquadrant focal hydrodissection.** A single-point fluid injection is often not enough to produce corticocapsular cleavage. This is particularly seen in the entity known as corticocapsular adhesions, which we first described in 2003, and is different from a cortical cataract in that actual adhesions are found between the capsule and underlying cortex. Here, a single wave of hydrodissection may be insufficient to cleave the adhesions (Figure 9). The adhesions act as a snag to nucleus rotation, and any forceful attempt at rotation may lead to zonular dehiscence.

It is important to identify corticocapsular adhesions preoperatively. When they are found, the surgeon should immediately attempt multiple-quadrant hydrodissection. I use two specially designed 90º bent cannulas, one for each hand (Figure 10), injecting small quantities of fluid focally in...
different quadrants. Multiquadrant focal hydrodissection cleaves the corticocapsular adhesions and ensures nucleus rotation without stressing the zonules.

**Repeat hydrodissection.** At times during the initial hydrodissection, the surgeon is unsure whether an adequate fluid layer has passed through. At other times, the wave may have failed to create enough hydraulic pressure to dissect the capsule and cortex or may have been injected into the lens substance. This can lead to nonrotation or stressful rotation of the nucleus during subsequent phacoemulsification.

It is important to remember that, at any stage when rotating the nucleus is difficult, hydrodissection can be repeated. Take the phaco probe out of the eye, fill the anterior chamber with a dispersive ophthalmic viscosurgical device (OVD), and repeat hydrodissection. Alternatively, performing multiquadrant focal hydrodissection can ensure cleavage in multiple areas and simplify surgery.

In an eye with a small pupil, shallow anterior chamber, or the potential for intraoperative floppy iris syndrome, injecting too much fluid can increase pressure behind the iris and contribute to constriction and floppiness of the pupil. Therefore, a single fluid wave should be passed first, making sure not to inject more than 0.1 to 0.2 mL of fluid. If the nucleus does not rotate, subsequent hydrodissection can always be performed.

**Capsular block syndrome.** Overzealous fluid injection can cause excessive forward lens bulge that blocks the anterior capsular opening and traps fluid in the capsular bag. In extreme cases it can lead posterior capsular blowout (ie, capsular block syndrome), but milder forms of capsular block may go unnoticed by the surgeon.

Intraoperative anterior capsular block can be recognized by the following signs: forward bulge of the lens, prominence of the capsulorrhexis margin, and shallowing of the anterior chamber that are not relieved by attempted lens decompression (Figure 11). The blockage at the anterior capsule does not allow fluid to egress; attempted rotation could damage the zonular integrity. Surgeons must be vigilant to notice these signs.

When anterior capsular block occurs, the surgeon must directly proceed to phacoemulsification. A central trench is created and a crack or chop is initiated to allow fluid egress and relieve the capsular block. The surgeon will immediately notice deepening of the chamber and backward movement of the lens. At this point, the surgeon can proceed as normal.

To avoid capsular block syndrome, the amount of fluid injection must be titrated and the anterior chamber not overfilled with OVD. In dense, bulky nuclei, having too much space in the capsular bag must be avoided; therefore, gentle hydrodissection is preferred.

**When to avoid hydrodissection.** It is well recognized that, in cases of suspected or actual posterior capsular dehiscence or weakness, such as with a posterior polar cataract, it is best to avoid hydrodissection altogether. In these eyes, buildup of hydraulic pressure in the capsular bag must be avoided in order to prevent posterior capsular blowout. Here, several techniques can be performed to protect the posterior capsule, such as conventional hydrodelineation, inside-out delineation, and viscodissection.

Another condition in which hydrodissection should be avoided is a total cataract, when the patient has not been examined previously. A masked underlying posterior polar cataract can sometimes be present, and immediate nucleus drop can occur if hydrodissection is performed.

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