

2013-9-11 20:09:35

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Date published online: September 2012

NEWS &
OPINION**Tools & techniques**
Cortical cleaving hydrodissection

by I. Howard Fine, M.D.



Howard Fine, M.D., has confided in me that one of his biggest disappointments in ophthalmology has been his difficulty in adequately teaching cortical cleaving hydrodissection. This technique is one of the simplest but most powerful methods of adding safety to routine cases and especially challenging eyes with compromised zonules. The first time you successfully perform cortical cleaving hydrodissection and look down at a pristine capsular bag devoid of cortex—without having used an I/A handpiece—it

Following the completion of a capsulorhexis through a side-port incision, we perform gentle cortical cleaving hydrodissection.¹ Hydrodissection of the nucleus in cataract surgery has traditionally been perceived as the injection of fluid into the cortical layer of the lens under the lens capsule to separate the lens endonucleus and epinucleus from the cortex and capsule.² With increased use of continuous curvilinear capsulorhexis and phacoemulsification in cataract surgery, hydrodissection became a very important step to mobilize the nucleus within the capsule for disassembly and removal.³⁻⁶ Following nuclear removal, cortical cleanup proceeded as a separate step, using an irrigation and aspiration handpiece.

I first described cortical cleaving hydrodissection, which is a hydrodissection technique designed to cleave the cortex from the lens capsule and thus leave the cortex attached to the epinucleus.¹ If cortical cleaving hydrodissection is performed correctly, it lyses the connections between the cortex and the equator of the lens capsule resulting in greater ability to rotate the cataract and dramatically facilitates cortical clean-up. In fact, cortical cleaving hydrodissection frequently eliminates the need for cortical clean-up as a separate step in cataract surgery thereby eliminating the risk of capsular rupture during cortical clean-up. In a large percentage of cases with 19 gauge tips, less frequently with 20 gauge tips, cortical clean-up is not necessary as a separate step in that during the mobilization of the epinucleus, the cortex is mobilized at the same time. We generally hydrodissect in

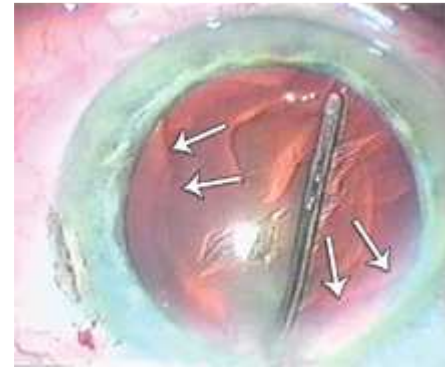


Figure 1. Anterior capsule is tented up by the cannula, fluid wave is moving posteriorly, and capsulorhexis is enlarged (arrows fluid wave)

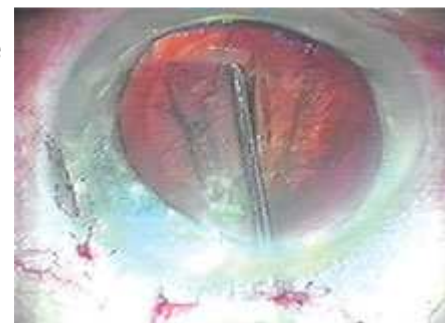


Figure 2. Capsulorhexis is enlarged by the posterior loculated fluid pushing the lens forward



Figure 3. Return of the capsulorhexis to its previous size after decompression of

will be difficult to suppress a big smile.

In this month's column, we have the honor of having Dr. Fine describe his cortical cleaving hydrodissection technique in a detailed step-by-step approach that should be clear to any surgeon. His description of the anatomy of cortical capsular connections and the mechanical explanation of how the method works should give us all a better understanding of the complexity of cortical capsular structure and the ingenious simplicity of his technique.

I encourage all cataract surgeons who do not perform cortical cleaving hydrodissection to give it a try.

Richard Hoffman, M.D.,

Tools & techniques editor

two aliquots: one through each of two side-port incisions with decompression following the injection of each aliquot.

We then try to rotate the lens within the capsular bag.

A small capsulorhexis, 5-5.5 mm, optimizes the procedure. The large anterior capsular flap makes this type of hydrodissection easier to perform. The anterior capsular flap is elevated away from the cortical material with a 26-gauge blunt cannula (e.g., Katena, K7-5150) prior to hydrodissection. The cannula maintains the anterior capsule in a tented-up position at the injection site near the lens equator. Irrigation prior to elevation of the anterior capsule should be avoided because it will result in transmission of a fluid wave circumferentially within the cortical layer, hydrating the cortex and creating a path of least resistance that may disallow later cortical cleaving hydrodissection. Once the cannula is properly placed and the anterior capsule is elevated, gentle, continuous irrigation results in a fluid wave that passes circumferentially in the zone just under the

capsule, cleaving the cortex from the posterior capsule in most locations (Figure 1). When the fluid wave has passed around the posterior aspect of the lens, the entire lens bulges forward because the fluid is trapped by the firm equatorial cortical-capsular connections. The procedure creates, in effect, a temporary intraoperative version of capsular block syndrome as seen by enlargement of the diameter of the capsulorhexis (Figure 2). At this point, if fluid injection is continued, a portion of the lens prolapses through the capsulorhexis. However, if prior to prolapse the capsule is decompressed by depressing the central portion of the lens with the long arm of the cannula in a way that forces fluid to come around the lens equator from behind, the cortical-capsular connections in the capsular fornix and under the anterior capsular flap are cleaved. The cleavage of cortex from the capsule equatorially and anteriorly allows fluid to exit from the capsular bag via the capsulorhexis, which constricts to its original size (Figure 3), and mobilizes the lens in such a way that it can spin freely within the capsular bag. Repeating the hydrodissection and capsular decompression starting in the opposite distal quadrant may be helpful.

Adequate hydrodissection at this point is demonstrable by the ease with which the nuclear-cortical complex can be rotated by the cannula.

Following at least two cortical cleaving hydrodissection injections and rotation of the lens, we then perform hydrodelineation.^{1,7}

Hydrodelineation circumferentially separates the endonucleus from the epinucleus and facilitates mobilization of the endonucleus separate from the epinucleus. The epinucleus remains in the capsule and keeps the bag stretched throughout the procedure, thereby making it much more unlikely that a knuckle of capsule will vault anteriorly, occlude the phaco tip, and rupture. In addition, hydrodelineation reduces the size of the nucleus that has to be mobilized through disassembly and emulsification, thereby reducing the amount of energy into the eye. Circumferential division reduces the volume of the central portion of nucleus removed by phacoemulsification by up to 50 percent. This allows less deep and less peripheral grooving and smaller, more easily mobilized quadrants after cracking or chopping. Hydrodelineation thus creates additional safety and reduces the invasiveness of the procedure.

Once all of the endonucleus has been mobilized we address the epinucleus. The bevel of the phaco tip is now turned up and

the capsule

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the epinuclear rim and roof are purchased distally, in foot position two, pulled centrally and then swept with the phaco needle at a low power, in foot position three, to trim the roof and rim of the epinucleus. This is associated with mini-occlusion breaks and mini-surges, more pronounced with 19 gauge tips, which allow the cortex in that quadrant to flow over the rim of the epinucleus and into the phaco needle. The epinucleus is allowed to settle back and then is rotated twice more, and two additional quadrants of peripheral epinuclear roof and rim are mobilized along with the cortex under them. The final quadrant of epinuclear rim is rotated distally, purchased with the phaco tip in foot position 2, and pulled centrally, while the second handpiece is used to push the floor of the epinucleus, distally, thereby creating anti-parallel forces that flip the residual floor and last quadrant of the epinuclear rim upside down within the confines of the anterior chamber, removing it from its proximity to the posterior capsule, as it is mobilized mostly by vacuum with low power bursts of ultrasound energy.

If there is residual cortex, more common with smaller gauge phaco tips, we simply sweep the cortical aspirator circumferentially around the capsulorhexis, port facing the fornix of the capsule, and easily bring the remaining fragments out. Because the connections to the capsule have previously been lysed by cortical cleaving hydrodissection, we rarely need to strip cortex centrally. If there are some fine strands of cortex still attached to the capsule, we find it efficacious to use a 0.2 mm aspiration port, compared to a 0.3 mm port, as it will occlude more easily. Prior to cortical cleaning hydrodissection, the majority of capsule ruptures during phacoemulsification surgery occurred during aspiration of the cortex.

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Editors' note: *This is a modification of Chapter 9 (pages 197-216), "Minimally Invasive Cataract Surgery," in the book Minimally Invasive Ophthalmic Surgery published by Springer-Verlag Berlin Heidelberg, 2010.*

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