

# Safe Cortical Removal

This step is essential to a successful cataract procedure.

BY ROBERT H. OSHER, MD

Removal of the cortex may be one of the less glamorous steps in today's elegant cataract procedure, but underestimating its importance can result in a frustrating or even a disastrous experience. I first became aware of the potential for complications in the early 1980s when evaluating a retrospective series of torn posterior capsules. To my surprise, the capsular rupture occurred more often during the cortical removal than during the phacoemulsification. Granted, that was in the days of can-opener capsulotomy when edges were easier to snag, but complete and atraumatic cortical removal remains a fundamental ingredient in the successful operation.

To begin with, the surgeon must recognize that there are various types of cortex and that each may behave differently. The cortex of the soft lens may be almost indistinguishable from the nucleus, whereas the compact cortex of the hard lens may behave like leather. The stubborn nature of dense, white, corticocapsular adhesions can challenge the equanimity of even the most patient surgeon.

## BASIC PRINCIPLES

In my experience, it is always best to engage the cortex at the proximal end of the anterior reflection. Engaging the cortex anywhere else, especially posteriorly, may result in incomplete removal with ribbons and wispy shreds. After grasping this portion of the cortex, the surgeon should allow the vacuum to build before initiating a radial excursion. As the vacuum increases, he or she should depress the I/A tip slightly away from the anterior capsular edge, which will prevent the application of excessive force to the capsule. In my opinion,

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snagging the anterior capsule is the most frequent cause of iatrogenic zonular dialysis. By releasing the footswitch as soon as the cortex disappears into the port, the surgeon minimizes shallowing of the chamber from an occlusion break as the port, which is always directed anteriorly, moves toward the next cortical target.

## SUBINCISIONAL CORTEX

Few would disagree that the subincisional cortex is the most challenging to remove. For decades, I have championed my belief that the coaxial surgeon should remove the subincisional cortex first. If he or she begins by removing the easiest cortex opposite the incision and works back toward the subincisional cortex, access to the capsular bag may be more difficult. In contrast, if the surgeon attempts to place the I/A port at the edge of the subincisional capsulorhexis at the beginning of the cortical removal, it will be surprisingly easy to engage the cortex, because the capsular bag is held wide open by the cortical bowl. Richard Mackool, MD, has a different explanation for this phenomenon. He believes that, by removing distal cortex first, the infusion pressure and the force of gravity allow balanced salt solution to flow between zonules into Berger's space, causing a progressive closure of the capsular bag.



**Figure.** Dr. Osher strongly recommends the use of a soft I/A tip to protect the posterior capsule during cortical removal.

Theory aside, we both strongly recommend that the coaxial surgeon address the subincisional cortex first.

The biaxial surgeon has an easier time removing subincisional cortex. Regardless of his or her preference, a soft I/A tip is safer than a metal one. In a study by William Gates, MD, contact between a metal I/A tip and the posterior capsule resulted in rupture at a vacuum of 15 mm Hg.<sup>1</sup> A silicone tip did not rupture the capsule at any vacuum level, even up to 600 mm Hg. Using scanning electron microscopy, I have evaluated the inside of the I/A port that comes into contact with the capsule, and I have found frightening shards and roughened edges with metal tips in contrast to the smooth, polished finish of silicone (RHO, unpublished data, 2002). Because every surgeon will eventually snag the posterior capsule during cortical removal, a soft I/A tip offers an additional margin of safety (Figure).

If the subincisional cortex cannot be removed easily with the I/A tip, the surgeon should clean up the remaining cortex and then fill three-quarters of the capsular bag with an ophthalmic viscosurgical device (OVD). I designed a J-shaped cannula with a special angulation (Bausch + Lomb and Crestpoint Management Ltd.) to easily access the subincisional cortex. Using a push-pull technique with a 3-mL syringe filled with 1 mL of balanced salt solution, I find it easy to engage the edge of the proximal cortex and cleanly strip it from the eye. Other angled I/A tips or handheld instruments will also safely accomplish this task. Some surgeons even advocate placing the IOL in the bag and allowing one of the haptics to dislodge the remaining cortex, but I have not found this technique to be necessary.

### SPECIAL CIRCUMSTANCES

Cortical capsular adhesions may occur as pasty white or glue-like adhesions to the capsule. They may require

additional hydrodissection or even blunt dissection to be dislodged from the capsule. Leathery cortex may not be easily aspirated into a small I/A port. The greater surface area of the phaco tip may prove helpful in such cases. The same is true for the thick bowl-like cortex with which epinucleus seems to have fused.

Harry Grabow, MD, and I independently first described viscodissection of cortex in the early 1980s. An OVD may be useful in cleaving adherent cortex off the equatorial or posterior capsule. Dr. Mackool and Vaishali Vasavada, MS, have independently studied and supported the safety of using viscodissection in both routine and complex cataract surgery.

Rarely, the entire posterior cortex will behave like a sheet and lift away from the posterior capsule, prolapsing forward and interfering with routine cortical removal. In this case, creating a small opening in the posterior cortical layer will allow pooled fluid to escape and permit the posterior cortex to settle back, eliminating this annoying behavior.

In the face of severe positive pressure, it may be necessary to inflate the capsular bag with an OVD and remove the cortex by means of a dry technique. The surgeon should have access to a straight and a curved 27- or 25-gauge cannula to accomplish this exercise through either the main incision or a separate stab incision.

When a zonular dialysis is present, cortex should not be stripped in the usual radial direction perpendicular to the dialysis. It is better for the surgeon to tease cortex away from the capsule by stripping it parallel to the dialysis, which will reduce stress on the remaining intact zonules. If a capsular tension ring is acting as a belt to restrict cortical cleanup, any of the aforementioned techniques may be helpful in removing cortex. The surgeon's key attributes in these situations are patience and perseverance. With its sinusoidal configuration, the Henderson Capsular Tension Ring or the Ahmed Capsular Tension Segment (both from Morcher GmbH; distributed in the

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Direct link to Dr. Osher's video:  
<http://eyetube.net/?v=teegg>



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United States by FCI Ophthalmics, Inc.) make the removal of the cortex a bit easier when zonules are loose.

If an anterior capsular tear has extended toward the equator, I find it best to remove the cortex elsewhere before tackling the cortex adjacent to the tear. In this situation, the surgeon might even consider taking a moment to fill the bag with an OVD and to place a single-piece lens within the bag. The cortex seems to reinforce the tear and can then be gently teased free after the IOL is rotated and supported by the intact capsular fornices 90° away.

Removing the cortex when the posterior capsule is torn requires the surgeon’s dexterity and familiarity with an array of more advanced maneuvers. I personally prefer to stabilize the capsule with an OVD and then to remove the cortex utilizing a dry technique. If the surgeon cannot convert a linear tear to a posterior capsulorhexis, cortical stripping should exert a vector of force toward, rather than away from, the tear. Vitreous presentation may require a minimal anterior vitrectomy, followed by the reinjection of an OVD before continuation of cortical removal. By patiently removing as much cortex as possible, the surgeon may reduce the inflammatory burden, thereby minimizing the risk of both anterior and posterior segment consequences.

## SUMMARY

Cortical removal may not constitute the most exciting step in the contemporary cataract procedure, but the surgeon’s attention to detail and meticulous technique are essential to achieving a successful outcome. ■

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1. Gates W. Silicone I/A tip. *Video Journal of Cataract and Refractive Surgery*. 2002;18(1).