

Improving Centration With OCT-Guided Laser Capsulotomy

A capsulorhexis should be an exact circle of a specific size in a precise position.

BY WILLIAM F. WILEY, MD

Femtosecond laser capsulotomy is the latest development in the ongoing evolution of cataract surgery. Laser creation of the capsulorhexis, the laser increases the precision of the opening's size, shape, and position, which has a significant impact on capsulotomy centration outcomes.

MACHINE OVER MAN

Although all physicians like to consider themselves to be highly skilled, every surgery is vulnerable to human error. Automating a process increases its precision.

The main goal of a manual capsulorhexis or a laser capsulotomy is to create an exact circle of a specific size in a precise position to ensure the proper amount of optic-capsule overlap, thereby facilitating the IOL's

placement. Daniel Palanker, MD, and colleagues have shown that performing anterior capsulotomy, lens segmentation, and corneal incisions with a laser that is guided by diagnostic imaging produces continuous incisions in the ante-

rior capsule that are twice as strong as and the size and shape of which are more than five times as precise than a manual capsulorhexis.¹ Zolton Z. Nagy, MD and colleagues reported that the laser's use resulted in fewer patients with incomplete capsule-IOL overlap.² The investigators found incomplete overlap of capsulotomies in 28% of eyes (n = 57) that received manual continuous curvilinear capsulorhexes, whereas only 11%

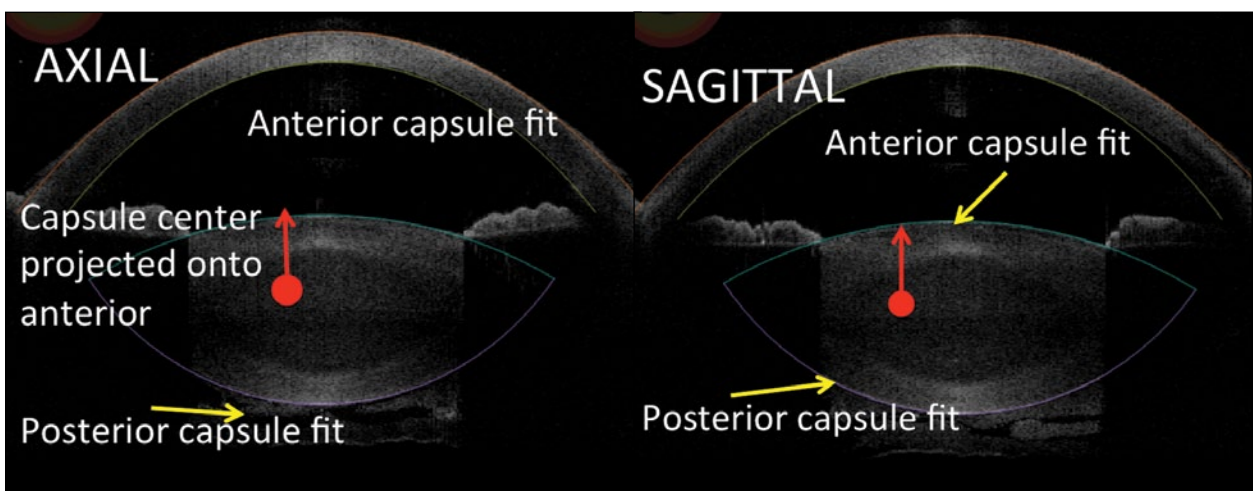


Figure. The Catalys maps three-dimensional biometry using customized high-resolution high-speed anterior segment optical coherence tomography (OCT) imaging of the anterior and posterior capsules (turquoise and purple lines, respectively). Based on these fits, the center of the capsule is identified and then projected onto the anterior capsular surface and can be used to align the center of the IOL.

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of eyes (n = 54) that received an anterior capsulotomy created with a laser had incomplete overlap. The researchers also found that improved overlap parameters help maintain proper positioning of the IOL.³

WHAT IS THE CENTER?

Establishing centration of the capsulotomy is not always straightforward. There are myriad approaches. Pupillary centration is a common method, but opinions vary regarding whether or not the pupil should be dilated. I have found flaws with both. A pharmacologically dilated pupil can be asymmetrical, leaving me with an incorrect reference point. Similarly, although an undilated pupil may better represent the visual axis, it may also be decentered relative to the capsular bag.

It is important to understand that the IOL is naturally going to migrate toward the center of the capsular bag based on the haptics' orientation. Although, theoretically, a lens can be intentionally decentered, lenses tend to find their natural resting position inside the capsular bag. Thus, the capsulotomy should be positioned on top of the theoretically centered lens within the bag.

The Catalys Precision Laser System (Abbott Medical Optics) offers full-volume OCT, which allows the capsulotomy to be centered over the scanned capsule, the pupil, the limbus, or other options (Figure). My colleagues and I conducted a retrospective analysis of 50 consecutive eyes, randomly assigned to either pupillary centration or scanned capsular centration with the Catalys.⁴ All eyes received a 5.1-mm capsulotomy and were subsequently analyzed for relative position versus IOL optic position and optic coverage. One hundred percent of the eyes centered with a scanned capsule had complete optic coverage, whereas 75% of the eyes with pupil-centered capsulotomies had complete optic coverage.

OUTLIERS

In certain instances, surgeons may not want to center the capsulotomy on the capsular bag. For example, if a particular pathology results in an irregular bag or if an optical situation prevents a clear image of the bag, it would be reasonable to rely on pupillary centration

as the landmark for the placement of the capsulotomy. In addition, certain surgeons, particularly in Europe, have access to capsulotomy-fixed lenses or bag-in-lens implants are designed to fit inside the capsulotomy and thus are best centered on the visual axis, which may correlate better to the undilated pupil.

THE LENS' INFLUENCE

I find it beneficial to use the scanned-capsule centration technique for all IOLs, but it is particularly relevant for aspheric, multifocal, and toric IOLs. With some lenses, slight decentration may cause visual aberrations or decrease the patient's quality of vision. A decentered toric lens may lose its ability to correct astigmatism. This is important, because overall, I find that well-centered aspheric optics are somewhat forgiving in regard to the postoperative unaided visual acuity. In my experience, I observe more patients with 20/20 visual acuity even when the final refraction is slightly off target. Anecdotally, I have seen patients whose outcomes are 0.50 to 0.75 D off target but who are very satisfied. This is in contrast to IOLs with nonaspheric optics, which seem to be less forgiving to off-target refractive outcomes.

LONG-TERM RESULTS

Patients who choose premium services have high expectations. Although a lens may be perfectly centered after surgery, incomplete overlap by the capsular bag may allow the lens to shift or tilt as the capsulotomy starts to heal, changing the surgical result and decreasing the quality of vision at 3 or 6 months postoperatively. Three-dimensional intraoperative OCT imaging makes it possible to align the capsulotomy with the natural resting place of the optic in the capsular bag, enhancing the benefits of laser cataract surgery. ■

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