# Early Adopters' Experiences With Laser Cataract Surgery

## Incorporating laser cataract surgery into my practice was a very difficult—yet correct—decision.

**By A. James Khodabakhsh, MD**

My colleagues' and my surgery center was one of the first in the United States to purchase and use a femtosecond laser unit, and the process was one of the most difficult with which I have been involved. I am one of the managing partners of a large eye surgery center in Los Angeles. My colleagues and I have prided ourselves in always being on the cutting edge of technology, due in no small part to our Beverly Hills location.

In this article, I would like to discuss our process of obtaining a femtosecond laser cataract surgery unit and how we overcame the difficulties.

### DIFFICULT DECISION

The first problem was that a few of my partners had no interest at all in investing in laser cataract surgery—a hurdle that all groups are likely to face. The talented cataract surgeons operating at our center already achieve excellent results with premium and monofocal lenses. The dilemma was why should we risk learning a whole new way to perform cataract surgery that requires an investment of a few hundred thousand dollars? Some of my partners made the real argument that we were not even sure of the outcomes yet. I myself was skeptical at first, but as a group, we decided that we needed to make a commitment to laser technology. Now that I have performed many cases using a femtosecond laser, I am happy we did.

### WHICH MACHINE?

The next decision we faced was the choice of machine. We have consultants to/speakers for every major ophthalmic device and drug company as partners. Two physicians are on the medical advisory boards of competing femtosecond laser companies. After an arduous period of vetting the companies and technologies—and a few minor arguments among us—we purchased the LenSx Laser (Alcon Laboratories, Inc.).

**Figure 1. The author removes the femtosecond laser-created capsulorhexis.**

### WHERE TO PUT IT

We have three ORs in our suite, and we decided to keep the laser in a separate room. This setup allows multiple surgeons to use the laser consecutively. The laser room is located a few meters away from the main ORs. The surgeon completes the laser portion of the cataract procedure, and then the patient is wheeled to the OR on the same bed and prepped for surgery. Then, the next surgeon starts his or her case.

As efficient as this process was for us, it still added about 15 to 20 minutes to each case's duration. I am confident that procedural time will decrease as we gain more experience with the laser. Ophthalmologists planning to incorporate a laser into their practice must factor in the extra time, however, or they will quickly fall behind in their surgical schedule. At first, I would suggest counting the femtosecond laser portion of cataract surgery as a second case altogether. This mindset keeps me from rushing and does not keep my patients waiting.

## LEARNING CURVE

The use of any femtosecond laser platform requires at least a slight alteration in surgical technique. Our LenSx laser performs the main and sideport incisions, the capsulorhexis (Figure 1), limbal relaxing incisions, and nuclear softening (Figure 2). We can program the laser to perform all of these steps or customize its use for each case. For example, I do not make my main/sideport incisions using the femtosecond laser. This is because I would then have to adjust my hand position and chair for the utmost level of comfort. I still use my diamond knife for incisions because it gives me maximum comfort in their placement. I always use the laser to perform the other three steps mentioned.

One of my other partners uses the laser for incisions, the capsulorhexis, and limbal relaxing incisions. He does not use it for nuclear softening. Most others use the device for all four steps.

## MY SURGICAL TECHNIQUE

After the femtosecond laser portion is completed, the patient is taken to the OR. I first make a sideport incision and instill intracameral lidocaine. I use an ophthalmic viscosurgical device to fill the chamber while making sure not to overinflate the eye. Although the capsulorhexis (5.1 mm for standard, toric, and multifocal lenses and 6.1 mm for accommodating lenses) is usually free-floating, I always make sure that it is free for 360º. Rarely, tags can remain between the button and the anterior capsule. During one of my first cases, I had an anterior capsular tear, because I did not see a small tag. Now, I always use a cystotome to fully open these tags. I use a rotating motion while pushing the button's edge toward the middle in any quadrant that has adhesions. This vector tears the capsule without allowing it to extend outward. My partners use other techniques, such as employing capsulorhexis forceps to tear any tags or adhesions "along the dotted line."

Next, I use the hydrodissecting cannula just below the anterior capsule and above the cortex to separate these two layers for 360º. This step creates an outlet for the fluid wave and decreases the chance of a capsular block. I then perform gentle hydrodissection in two quadrants. Subsequent viscodissection usually pushes anteriorly any bubbles that may be trapped behind the nucleus, and it gives me an extra layer of protection in front of the posterior capsule.

After making sure the nucleus rotates well, I introduce the phaco unit and remove the central blocks made by the femtosecond laser in the nucleus. I then use my chopper and phaco tip to separate the quadrants created by the laser. They usually come right up to the tip and are easily removed. Depending on the density of the nucleus, however, I may chop each quadrant in half. After aspirating the cortex, I fill the capsular bag with an ophthalmic viscosurgical device and polish the underside of the anterior capsule and the posterior capsule. I then implant my IOL of choice.

**Figure 2. The author removes the nuclear segments after the lens is conditioned by the laser.**

## CONCLUSION

Although I have only performed a few cases, my results have been tremendous, especially in eyes receiving a premium IOL. Most important to me, my limbal relaxing incisions are now far more predictable. I have heard other surgeons around the country express the same sentiment.

My colleagues and I are in the process of pooling our data to see the true results of laser versus manual cataract surgery. I believe that laser technology will enhance outcomes and help surgeons achieve more precise results with cataract surgery.

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## Surgeons trained to use phacoemulsification will adopt laser cataract surgery, and the next generation of residents will start training using it.

**By Michael C. Knorz, MD**

Has laser cataract surgery opened the door to a new era of lens and cataract surgery? I am totally convinced it has! When I observed laser cataract surgery for the first time, performed by Zoltan Nagy, MD,[1] in Budapest in 2009, I was completely awed. This laser actually created a capsulorhexis,

**Figure 1. The LenSx Laser (left) and the patient placed under the laser.**

**Figure 2. After the laser procedure, the bed is swiveled to the right, and the patient is placed under the operating microscope.**

chopped the nucleus, and finished by creating the main and sideport incisions. It was like the first time I saw LASIK performed in 1993 in Bogotá, Colombia: I immediately knew it was the way to go, and I started performing LASIK as soon as I got home. Time has proven me right.

My experience in Budapest felt just the same. Here was this wonderful procedure, which actually performed all the critical steps of cataract surgery with incredible ease and unbelievable precision. I knew I had to be involved, and I performed my first cases in Budapest between 2009 and 2010 and received my own laser in Mannheim, Germany, in July 2011.

## PERFORMING LASIK

As a cataract surgeon initially, I became involved in LASIK surgery in 1993 and focused most of my research on LASIK and laser refractive surgery. During all these years, I continued to work within the complete spectrum of refractive surgery by performing LASIK, surface ablation, phakic IOL implantation, refractive lens exchange, and cataract surgery. I also started implanting multifocal IOLs as early as 1989,[2,3] and I use these lenses in about 60% to 70% of my cataract and refractive lens exchange patients today.

With my background and my refractive approach to lens-based surgery, a new tool like the LenSx Laser (Alcon Laboratories, Inc.) is very attractive to me. Multifocal IOLs require perfect centration to perform optimally, which in turn necessitates a precisely sized and centered capsulorhexis. They also demand postoperative emmetropia to achieve the best results, which in turn necessitates a perfect capsulorhexis to avoid variations in effective lens position and relaxing incisions to minimize corneal astigmatism. Laser cataract surgery can fulfill all these requirements[4-6] and more. It was therefore a natural choice for me to immediately incorporate this technology into my practice.

## PRACTICE INTEGRATION

### Patients

My clinical practice is mainly refractive, as explained previously. I use premium IOLs, mainly multifocal lenses, for the majority of my patients. Most of my patients are therefore used to the idea of paying for a premium technology. Because I feel laser cataract surgery is superior to manual phacoemulsification, I offer the former as my standard procedure. Of course, I explain to every patient that there is another option, namely manual phacoemulsification, but I outline the reasons why I believe laser cataract surgery is better. I typically will not ask the patient to decide between the procedures, however, just as I do not offer a choice of LASIK with the microkeratome versus a femtosecond laser; I simply use a femtosecond laser to create the flap for LASIK. My initial experience with this approach to cataract surgery has been positive: patients have readily embraced the new technology.

### Setup

I prefer to have the laser and operating microscope together in the operating suite. Another option would be to place the laser in the cataract surgery suite. Because LASIK must be performed in a full OR in Germany, the legal requirements for intraocular surgery were no problem. I perform both the laser and phaco portions of the cataract procedure myself, so patients need not move from one room to another during the operation. All of my patients receive premium surgery, and I prefer the procedure to be as easy on them as possible.

I installed an operating microscope right next to the laser, and I use a pivoting bed (Akrus GmbH) much like the one used with most excimer lasers (Figure 1). It can be operated with a joystick (Figures 1 and 2) and has two

locking positions. The patient remains on the bed for the laser and the I/A and/or phaco portion of the procedure.

**Procedure**

Once the patient is on the bed, I irrigate the conjunctival sac with diluted Betadine (Purdue Products) (1:10) and disinfect the lids and the skin around the lids with undiluted Betadine solution. A sterile plastic drape (Tegaderm; 3M) over the eye also tapes the lashes. I wear a mask, a gown, and powder-free gloves. After performing the laser part of the procedure, I lower the bed once suction is off and swivel it to the right, placing the patient under the surgical microscope (Figure 2). Next, I change gloves, because I had to touch the nonsterile laser controls with one hand during the laser procedure. I perform standard phacoemulsification and/or I/A, and then implant an IOL.

**Time**

The total time for laser cataract surgery is about 3 minutes longer than for my traditional technique. It takes about a minute to position the laser and start suction, another minute to set or confirm all the steps of the procedure (capsulorhexis, fragmentation, incisions), and 40 to 60 seconds for the actual laser procedure. The time required to enter the treatment parameters (position and size of the incisions, position and size of the astigmatism-correcting incisions, fragmentation pattern, capsulorhexis, etc.) is additional, whether completed by the surgeon or the laser technician.

## CONCLUSION

I believe the potential of laser cataract surgery is similar to the potential phacoemulsification had over extracapsular cataract extraction (ECCE). Lens surgery will change in the next few years, as all of the demanding and affluent baby boomers become presbyopic and seek early cataract/lens surgery. Cataract surgeons' refractive results have to improve considerably over today's standard of care. That will drive demand. The availability of laser cataract surgery addresses in large part the missing pieces of today's lens surgery.

Yes, the technology will make the cataract procedure more expensive, but price has never been a limiting factor if the outcomes are better. I believe a new era has begun that will be remembered much like the transition from ECCE to phacoemulsification in the 1980s and 1990s. Surgeons trained to use phacoemulsification will adopt laser cataract surgery, and the next generation of residents will start to train to perform this procedure first, not phacoemulsification—much like today's generation started with phacoemulsification rather than ECCE. It is an exciting time to be a cataract surgeon.

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# My first 6 months of laser cataract surgery.

**By Vance Thompson, MD**

My reasons for starting the laser refractive cataract surgery journey as soon as I could get the technology (April 2011) were the same ones that caused me to become an early adopter of the femtosecond laser for creating the flap in LASIK: I wanted to maximize precision for my patients. As evidenced by the high adoption rate of laser cataract surgery in my colleagues' and my practice, patients also feel great confidence in this technology. As expected, the majority of patients who desire a premium IOL also want laser cataract surgery. It is surprising to us, however, the number of patients choosing traditional monofocal IOLs who also opt for laser cataract surgery. Still, many patients are completely satisfied with the traditional approach to their cataract removal, and I believe both procedures have a robust future.

## A REASONABLE SWITCH

Because I had been performing docking and optical coherence tomography (OCT)-guided femtosecond laser corneal surgery for almost a decade, the switch to docking and OCT-guided laser cataract surgery was very reasonable. Nonetheless, there are many things to observe simultaneously during OCT-guided laser procedures, such as the meniscus, cutting and bubble patterns, suction, and any potential movement by the patient. It was comforting for me to realize that there is no point in this procedure when I cannot stop (for instance, if I am losing suction) and complete surgery in the OR with my traditional manual technique.

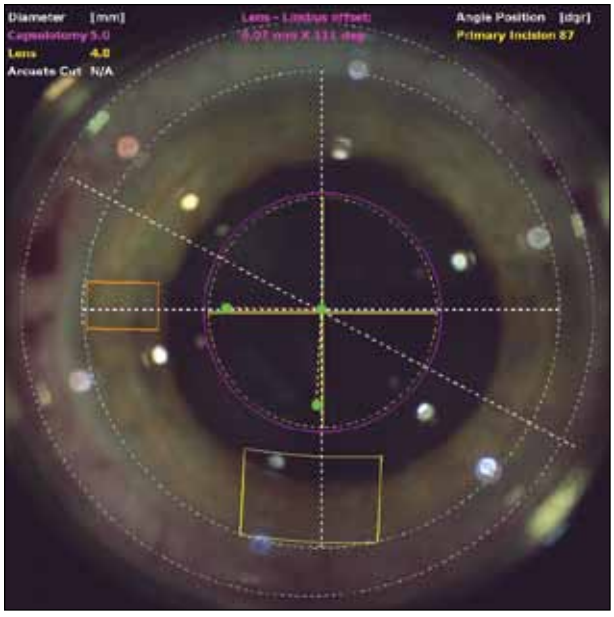


**Figure 1. Note the purple ring where the capsulorhexis will be performed. The surgeon can make this whatever size he or she wants and center it wherever best.**

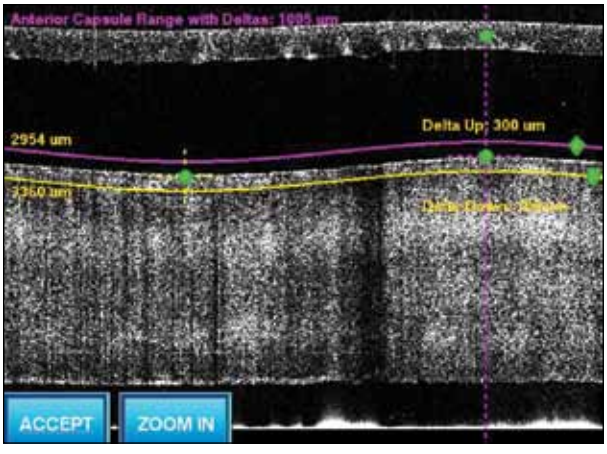


**Figure 2. The capsule surgery anterior limit (purple) and posterior limit (yellow) are lined up by the surgeon to create a 360º free-floating capsulorhexis.**

## INCREASED PRECISION

The increased precision achieved with femtosecond lasers in the capsular component of cataract surgery has been a true joy. In traditional cataract surgery, I always mark the cornea with a 6-mm optical zone marker to help guide my manual creation of a 5.5-mm capsulorhexis. Still, it is rare for me to achieve the centration and consistent size that I can with the laser (Figures 1 and 2). With this technology, many more of my procedures have consistent IOL edge overlap of the capsule to minimize long-term tilt.

I needed to add a new dimension to my initial entry into the anterior chamber with laser cataract surgery and that was not to let the anterior chamber shallow. If the chamber is allowed to shallow when a tag of the capsule has not been cut, an unwanted extension can occur. I have performed more than 200 laser cataract surgeries now and have avoided any extension by paying close attention to the chamber's depth.

The first step I perform, after slightly opening the main or sideport incision, is to fill the anterior chamber with viscoelastic. Only then do I fully open the incisions. I have also found it important to ensure that the capsule is free for 360º. If it is not, I use the same circumferential motions as in a routine manual capsulorhexis to complete the tear of any small "postage stamp" adhesions. One of the most comforting aspects of this procedure is the consistently round and centered capsulotomy.

## CORNEAL INCISIONS

In traditional cataract surgery, I enjoy operating on the steep axis of astigmatism. It has been a joy to be able to orient the incisions at any location around the limbus with ease (Figure 1). It has also been great to be able to construct the inner details of the primary incision to maximize its strength and self-sealing abilities (Figure 3). I have had to be cognizant of the fact that the femtosecond laser does not cut through limbal tissue. It is always a clear corneal incision. Occasionally, I will make a decision during the preoperative setup that, because I cannot make limbal incision through any opaque tissue, I have to create the incision manually in the OR. In this case, I can still complete my capsule, lens, and astigmatic work.

I have enjoyed performing astigmatic keratotomy (AK) for many years, as I was trained in a refractive surgery fellowship. What has amazed me about laser-created AK incisions is the consistency of their arc length and depth (Figures 4 and 5). I have also noticed that, for surgeons who have not had significant training in AK, the laser provides the same high level of precision. These improvements in both capsular and astigmatic surgery contribute to the accuracy of the refractive outcome in laser cataract surgery and reduce the need for excimer laser enhancements postoperatively.

Our practice has a busy refractive surgery component, so in terms of flow, it works best for us to keep the refractive and cataract surgery areas somewhat separate. Of concern was the patient bed we initially used. We found that, even when we achieved quality coupling of the patient's cornea to the laser lens through the docking process, the bed was gradually drifting down, which interrupted a couple of procedures. Now, we have a bed that does not drift. It is important to consider this detail when starting to perform laser cataract procedures.

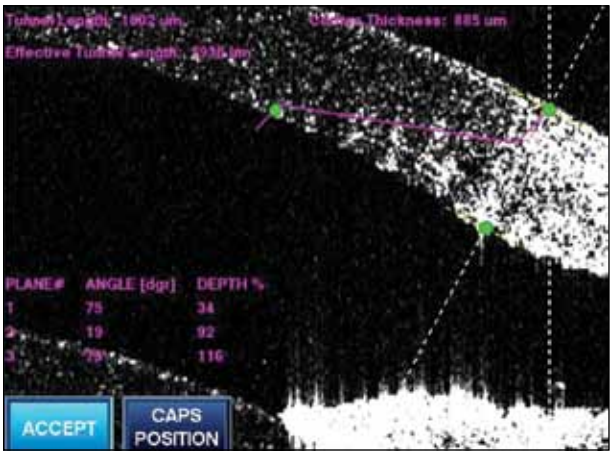


**Figure 3. The details of the incisional architecture are determined by the surgeon on the computer and finalized on the OCT image.**

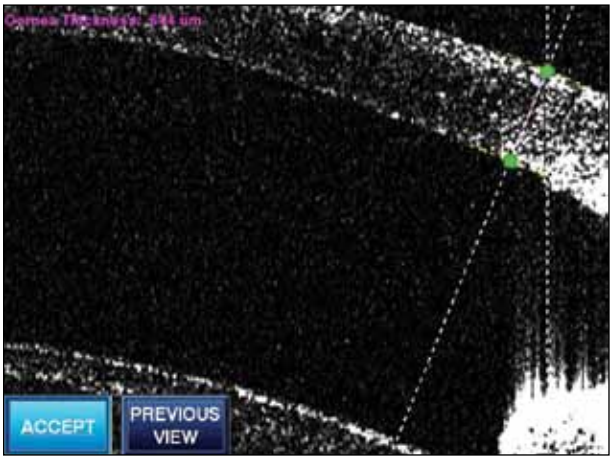


**Figure 5. The surgeons finalizes the incisional AK depth on the OCT image by moving the internal green dot for maximum accuracy. Of note, we set our AK depth at 90% in the laser computer so that, when the green dot looks to have 100% thickness, the AK is going to be consistently at 90% thickness.**

## VARIABLES AT THE BEGINNING

### Computer Work

There are many variables associated with using a technology for the first time, and the femtosecond laser is no different. One aspect of laser cataract surgery that surprised us was how much computer work the surgeon does to plan the procedure, engage the docking process, assess the OCT images, set up a customized treatment for the patient, and deliver the laser energy while constantly monitoring everything. It was also amazing how quickly we became comfortable performing the procedure efficiently. The learning curve was quite short compared with other techniques I have adopted. In actuality, we now consider laser cataract surgery routine in our practice.

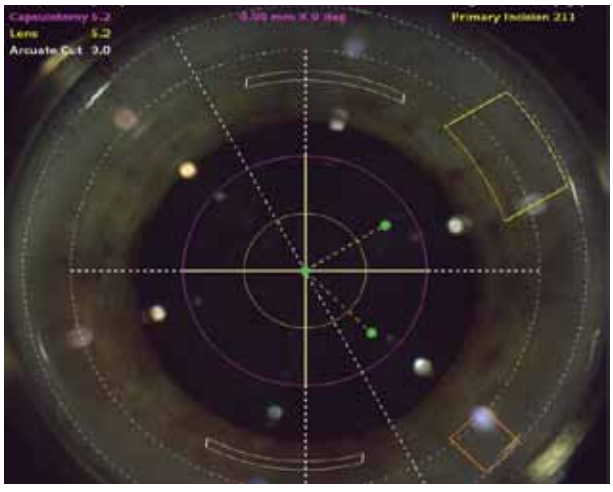


**Figure 4. The details of the AKs (number, axis, arc length, depth) are entered into the laser's computer and show up on the screen exactly where they will be placed.**

### Tilt

Some specific advice for the new user is to watch for any tilting upon docking. Traditional cataract surgery is highly refined, and each step builds upon the previous one; it is the same with laser cataract surgery. The entire procedure is easier and more accurate if docking occurs with quality centration while the patient is fixating well. It is important to realize that, if the patient has a Bell phenomenon, however, and tilt is a part of the procedure, that the surgeon can still do a very complete and quality capsulotomy. The only thing he or she will not be able to do is go as deep into the lens for the caspsular portion of the procedure (Figures 6 and 7).

### Lens Component

As far as the lens component of laser cataract surgery, it has been a true joy to have deep, accurate quadrant incisions. A cylindrical pattern can be used to soften the lens, although I have not needed that much. A combination of quadrant and cylindrical patterns can also be used. The entire optimizing journey is one of the beauties of this procedure, with all the variables that can be precisely addressed. We have also found that less phaco energy is needed to remove the cataract, which produces quieter eyes with clearer corneas on the first postoperative day compared with traditional phacoemulsification.

### Discussions With Patients

Laser technology has affected our clinical flow and discussions with patients. Premium technology requires premium (ie, longer) conversations. Whether it is a comparison of traditional versus premium implant technology or a discussion

*(Continued on page 77)*

# Why We Are Waiting to Adopt Laser Cataract Surgery

We will be watching from the sidelines for a few more months.

BY WILLIAM B. TRATTLER, MD, AND RICHARD M. AWDEH, MD

Laser technology has a tremendous potential to affect the safety and efficacy of cataract surgery. Early studies have demonstrated that cataract procedures performed with a femtosecond laser use less phaco energy across all grades of nuclear density[1] and that they increase refractive accuracy.[2] Dozens of practices across the country have already incorporated this technology. Why are surgeons such as ourselves waiting to adopt laser cataract surgery at their centers?

## COST

An obvious issue is cost. The femtosecond laser platform is a major capital investment, and therefore, much care should be put into the decision of when to purchase the technology and which of the current or soon-to-be available options should be chosen. The LenSx Laser (Alcon Laboratories, Inc.), the first commercially available unit, has provided enhanced surgical outcomes during cataract surgery by ensuring a centered and round capsulorhexis[2] as well as a reduced energy requirement for nuclear removal.[1] Surgeons have also reported that the LenSx Laser can assist with reducing astigmatism owing to its ability to place precise astigmatic keratectomy incisions in the peripheral cornea.[3] Enhancements that would provide improved imaging and beam delivery could further help enhance the effectiveness of this laser.

LensAR Inc., OptiMedica Corporation, and Technolas Perfect Vision GmbH demonstrated their platforms' excellent imaging capabilities at the AAO Annual Meeting in Orlando, Florida. Without clinical results to review, we would not say that one unit is better than another, although they appear to provide advantages over current technology. The platforms from LensAR Inc., OptiMedica Corporation, and Technolas Perfect Vision GmbH employ a curved patient interface filled with liquid for their patient docking system, which avoids compression of the cornea. This allows for improved visualization of the internal structures of the eye, with the potential for improved precision of the femtosecond laser application.

"An obvious issue is cost. The femtosecond laser platform is a major capital investment, and therefore, much care should be put into the decision of when to purchase the technology."

## IMAGING TECHNOLOGY

The LensAR Laser System uses proprietary technology called 3D-CSI (Confocal Structured Illumination) to image the entire anterior segment of the eye. Because the unit uses a Scheimpflug imaging technique to enhance the depth of field of the image capture, it provides a high-resolution image from the anterior portion of the cornea to the posterior capsule in a single image. The excellent contrast of the image allows the software

to automatically detect the edges of all of the important structures of the eye and then plan the treatment.

OptiMedica's Catalys Laser Precision System uses optical coherence tomography similar to that employed by the LenSx platform, and it appears to provide a very high-resolution image. Additionally, OptiMedica's patient interface attempts to minimize distortion of the cornea through a proprietary technology and a graphic user interface. The Victus, formally unveiled by Technolas Perfect Vision at the 2011 ESCRS meeting in Vienna, Austria, builds on the previously mentioned technologies. It offers high-resolution, active image acquisition of the eye's anterior segment. This device is particularly interesting because it has been designed to perform laser cataract surgery as well as to create the corneal flap in LASIK/refractive surgery.

## WHEN WILL IT BE TIME?

Surgeons who adopt laser cataract surgery will achieve improved visual outcomes as well as increased safety, based on a variety of reported studies.[4,5] Additional research is underway and should further elucidate the impact that this technology will have on patients' care. With this in mind, the challenge facing surgeons is when to adopt this technology. Is it better to wait and let it mature? For now, we are excited to watch from the sidelines while the various manufacturers battle it out during their respective commercial launches. ■

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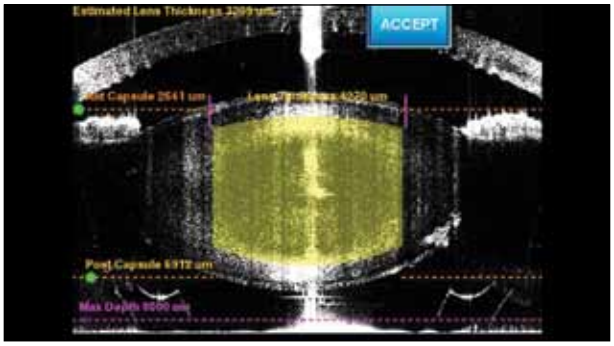


**Figure 6. With proper centration and minimal tilt, deeper lens surgery can help the surgeon break the lens into its quadrants with more ease compared with a tilted case.**

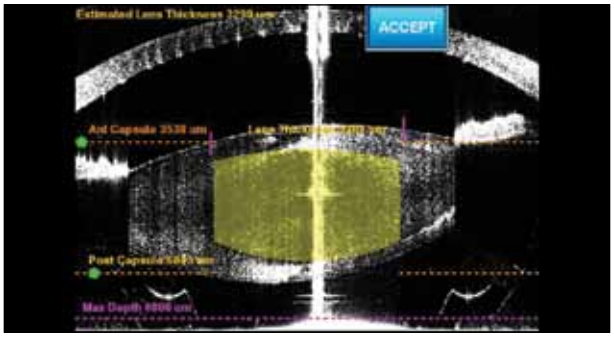


**Figure 7. With tilt, the procedure can still be performed in all aspects, except the lens portion of the procedure will not be as deep as it could have been.**

of traditional phacoemulsification versus a laser procedure, patients deserve to know their options and our opinions (pros and cons) of those options. We allow extra time for these discussions in all of our cataract consultations, and we have found even those who do not choose advanced technology feel at peace with their decisions.

## CONCLUSION

In my opinion, the femtosecond laser represents a paradigm shift in cataract surgery that will go down in history alongside the developments of lens implants and phacoemulsification. In our practice, patients are adopting laser technology with ease. Optimization will continue to improve our procedure as we learn more, but the technology already represents what we consider to be the most advanced method with which we can perform cataract surgery. ■

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