Today, with the use of small incisions and foldable IOLs, cataract extraction has become a safer and more effective surgery than ever. However, despite many advances over the years, the current state of cataract surgery nevertheless involves safety concerns and refractive limitations. Complications such as endophthalmitis, posterior capsular rupture, and cystoid macular edema still arise. Refractive accuracy remains suboptimal, and true accommodating IOLs are in their first generation with much advancement yet to come.

Most important, we continue to be challenged by complex eyes, such as those with weak zonules, partially dislocated crystalline lenses, low endothelial cell counts, shallow anterior chambers, and mature lenses. The use of the femtosecond laser can significantly simplify and reduce complications in these challenging cases. Additionally, the femtosecond laser can perform surgical maneuvers that are simply impossible to perform manually. The true test of the femtosecond laser for cataract surgery is its ability to improve outcomes in the most difficult cases that all cataract surgeons deal with on a routine basis.

A major advantage of femtosecond laser technology is the imaging capability incorporated into these systems. Femtosecond laser systems include built-in OCT or Scheimpflug imaging that allows us to measure the relevant dimensions of the anterior segment, namely the cornea, the anterior and posterior lens capsules, and the nucleus (Figure 1). Based on these measurements, the laser-assisted cataract surgery (LACS) treatment can be planned and performed. This imaging ability allows surgeons to visualize lens tilt, vitreous presentation, anterior chamber depth, and lens thickness—information that can be invaluable in complex cataract surgery cases.

Preoperative knowledge of the crystalline lens dimensions provides the surgeon with useful information in cataract surgery planning.

This article examines some specific complex issues in cataract surgery in which femtosecond technology represents an improvement over manual surgery.
COVER FOCUS

MATURE LENSES
Although the laser will not penetrate through a white intumescent lens (Figure 1), its ability to create a capsulotomy in these lenses with reduced risk of a radial tear is a significant advantage.

TIGHT SPACES
The laser allows capsulotomy creation in patients with shallow anterior chambers, which may be difficult to perform manually (Figure 2).

LOOSE LENSES
In patients with poor zonular support, capsulotomy may not only be challenging but may also cause additional zonular damage. In eyes with an acquired or congenital lens dislocation, the femtosecond laser can penetrate through vitreous in the anterior chamber to perform a successful capsulotomy.

Figure 1. Femtosecond laser technology allows safer capsulotomy creation in a white intumescent cataract.

Figure 2. Shallow anterior chamber in a patient with a dense cataract after trabeculectomy. Femtosecond capsulotomy is safer than manual capsulorrhexis in such patients.
The femtosecond laser is also helpful in reducing EPT and endothelial cell loss in challenging dense cataracts. In a study by Hatch et al, femtosecond laser pretreatment of brunescent cataracts allowed significant reduction in EPT compared with conventional phacoemulsification techniques.

**CONCLUSION**

Although still in its infancy, LACS has already been shown to produce more reliable and accurate capsulotomies while reducing phaco energy and phaco time. Reducing intraocular application of energy reduces the risk of endothelial cell loss, which should make the cataract surgical procedure safer for all patients—but particularly for patients with compromised endothelium such as in Fuchs dystrophy. Additionally, with femtosecond laser, less stress is placed on the patient’s zonules, which is ideal for patients with compromised zonular support, such as those with pseudoxfoliation or a history of accidental or surgical trauma.

We have witnessed the natural progression of cataract surgery from intracapsular, to extracapsular, to phacoemulsification, and now to the femtosecond laser. The future of cataract surgery will lie in our ability to correct the limitations we currently have and produce a more optimized cataract extraction procedure. Atraumatic capsulotomies and lens disruption can now be performed even in eyes after trauma, despite zonular dehiscence and vitreous in the anterior chamber.

Less energy applied inside the eye will increase the safety of the procedure, reduce endothelial cell loss, and reduce the risk of lens dislocation in patients with compromised zonules. This technology currently improves safety in complex cases and will improve it further in the near future. LACS is a novel technique that provides the precision of image-guided laser technology. It will dramatically elevate the level of cataract surgery for all surgeons and improve safety and efficacy in the most challenging cases we perform.

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**AT A GLANCE**

- The use of the femtosecond laser can simplify cataract surgery and reduce complications in challenging cases and can also offer the surgeon a way to perform surgical maneuvers that are impossible to perform manually.
- The imaging capabilities of the femtosecond laser allow surgeons to visualize lens tilt, vitreous presentation, anterior chamber depth, and lens thickness—information that can be invaluable in complex cataract surgery cases.
- With LACS, traumatic capsulotomies and lens disruption can now be performed even in eyes after trauma, despite zonular dehiscence and vitreous in the anterior chamber.

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