

Complications of Laser Cataract Surgery

A group practice's experience improving the safety and outcomes of both complex and routine cataract procedures performed with the femtosecond laser.

BY MICHAEL A. LAWLESS, MBBS, FRANZCO, FRACS

Cataract surgery is the world's most commonly performed eye operation. Femtosecond laser technology aims to improve the safety and accuracy of the procedure for patients, including those with an advanced cataract or who need a refractive lensectomy.

The key steps of manual phacoemulsification can have an impact on the surgery's safety. In particular, the quality of the anterior capsulotomy influences the rate of complications and is one of the most difficult steps for trainees and inexperienced surgeons to master.¹ In contrast, when combined with high-resolution anterior segment imaging, laser technology can improve the safety profile of cataract surgery by creating more consistent main and sideport incisions and a more reproducible capsulorhexis with less chance of an anterior capsular tear. The laser can also fragment or soften the nucleus² and has the ability to precisely place intrastromal corneal incisions to treat astigmatism, and these incisions may be left intrastromally or opened in the OR or postoperatively to augment their effect, if needed.

Since the first report of laser cataract surgery in 2009, considerable progress has been made in terms of software development. These advancements, combined with more surgical experience with laser cataract surgery, have led to reduced phacoemulsification time, better wound architecture, greater precision and accuracy of the anterior capsulotomy, and more stable and predictable positioning of the IOL.³⁻⁷

RESULTS OF A GROUP PRACTICE STUDY

Our group at Vision Eye Institute in Sydney, Australia, reported a short learning curve with laser cataract sur-

gery.⁸⁻¹⁰ In a subsequent single-center, consecutive cohort study, we examined the rate of complications in a large prospective series of cases performed by six surgeons who had experience with laser cataract procedures. We analyzed the complication rates and compared them to the initial learning curve.¹¹ All procedures were performed with the LenSx Laser (Alcon Laboratories, Inc.) under topical anesthesia. Patients with corneal opacities or poorly dilating pupils (< 5 mm), advanced glaucoma, hypotony or narrow palpebral fissures, and nystagmus or hemifacial spasm, which prevented the docking rings' placement, were excluded.

In group one (the first 200 eyes) 74.5% of eyes underwent a complete laser cataract procedure that included a laser capsulotomy, lens fragmentation, and corneal incisions. Five eyes (2.5%) had suction breaks during the laser procedure, and 21 eyes (10.5%) had anterior capsular tags. The incidence of capsular complications (anterior and posterior tears) was 7.5% (15/200), and the incidence of posterior lens dislocation was 2% (4/200). The mean number of docking attempts was 1.5 per eye.

In group two (the next consecutive 1,300 eyes), an anterior capsulotomy, lens segmentation, and main and sideport corneal incisions were successfully completed in 1,280 eyes (98.5%). In addition to routine preoperative dilating drops, all eyes received one drop of 10% phenylephrine immediately after the laser procedure. Eyes are mildly inflamed after the laser cataract surgery, and phenylephrine drops maintain good pupillary dila-

FIVE TIPS FOR PERFORMING A SAFE LASER CATARACT SURGERY

- 1. Use minimal topical anesthesia.** Only one drop of anesthesia is needed to perform the laser portion of the procedure. Any more than this may cause the epithelium to be hazy and your surgical view less than ideal.
- 2. Well-centered docking is critical.** A well-centered dock allows the temporal corneal incision to be performed, minimizes time and laser energy, and lessens the likelihood of a cascading set of problems. Do not be afraid to re-dock if the first attempt is not ideal, and make use of Bell's phenomenon when attempting to dock.
- 3. Do not assume that the capsulorhexis is perfect.** In the rare instance where there is a tag or an adhesion, it is better to use capsulorhexis forceps so that it does not become a problem.
- 4. Less is more at every step.** I recommend using less viscoelastic and performing less hydrodissection than manual cataract surgery. During hydrodissection, use minimal fluid in a decompressed eye.
- 5. Recognize gas patterns.** Learn to recognize the different intracapsular gas patterns, and modify your technique accordingly.

tation while patients are transferred to the OR. With this technique, only 16 eyes (1.23%) had constricted pupils after the laser procedure. Twenty-five eyes (1.92%) required manually created corneal incisions with a keratome, either due to suction breaks, an air meniscus, or because the incisions made with the laser could not be easily opened. The mean number of docking attempts was 1.05 per eye. We learned that docking is crucial for the case to go smoothly. The increase in IOP is minimal, and the procedural time is short; therefore, it is worthwhile to re-dock if the original attempt is not ideal.

On a scale of 1 to 10, with 1 indicating great difficulty and 10 indicating a free-floating capsulotomy, the ease with which the anterior capsule was removed was rated at least 8 in 100% of cases. A free-floating capsulotomy or postage stamp configuration (small areas of nonperforation not affecting the complete removal of the capsular button) was present in 96% of cases.

OTHER COMPLICATIONS

The anterior capsulotomy button was incomplete in 52 cases (4%), and in these cases, a manual capsulorhexis was required to complete the capsulotomy. Anterior capsular tags were seen in 21 eyes (1.62%) after the

capsulotomy button was removed. In four eyes (0.31%), capsular tags led to extension and formation of radial anterior capsular tears. These tears extended to the posterior capsule in two eyes, with one eye requiring an anterior vitrectomy. The overall incidence of posterior capsular tears was 0.31% (4/1,300), with two cases occurring during phacoemulsification. Three cases of vitreous loss were successfully managed with a bimanual anterior vitrectomy and the implantation of an IOL in the sulcus. There were no cases of posterior lens dislocation or capsular block syndrome.

Not surprisingly, a significantly lower rate of complications occurred after the first 200 eyes when the surgeons became familiar with the technology. The rate of major capsular complications (anterior and posterior tears) decreased from 7.5% in group 1 to 0.62% in group 2. Surgeons' experience, the addition of one drop of 10% phenylephrine immediately after the procedure, and technical improvements made to the LenSx Laser System contributed to an overall decrease in complication rates.

LESSONS LEARNED

During the course of this study, we became proficient at managing the different operative environments by releasing gas and decompressing the capsular bag before commencing phacoemulsification as well as mobilizing the nuclear segments and modifying the I/A technique for the removal of the lens cortex. Each surgeon developed a slightly different technique. For example, some performed hydrodissection before releasing intracapsular gas, while others completed this step afterward. In some cases, hydrodissection was eliminated, and the nuclear segments were mobilized by using the laser-generated gas cleavage plane between the nucleus and the cortex (pneumodissection).

There is some evidence that a laser-created capsulotomy may be stronger than a continuous tear capsulorhexis created manually.⁶ If there is a microtag, it can be stretched and torn during intracapsular manipulation. We recommend inspecting the edge of the laser cut capsulotomy for a capsular tag under higher magnification before phacoemulsification. If there is any doubt, assume that the anterior capsule has not been uniformly cut and use forceps to mobilize the capsule. It is tempting to assume that all capsules are free floating and perfect, and that simply inserting the phaco tip and aspirating the capsule will be sufficient. In most cases, this is true, but occasionally, this approach could lead to problems that could have been prevented by a more careful removal of the capsule with forceps.

It is helpful to inspect the gas pattern as well. Sometimes, the gas will escape anteriorly into the anterior chamber, and there will be little or no gas within the

nucleus itself. At other times, particularly in hard grade 4 nuclei, gas will become trapped behind the nucleus, and care needs to be taken to avoid capsular block syndrome, which occurs because of increased pressure within the capsular bag. Any additional pressure within the capsular bag can cause the posterior capsule to blow out. If the surgeon is suspicious of gas trapped behind the nucleus, a few simple maneuvers such as decompressing the anterior chamber prior to gentle hydrodissection with minimal fluid or splitting the hemispheres or mobilizing the nuclear fragments to allow gas to escape before hydrodissection will prevent capsular block syndrome.

CONCLUSION

These data reflect that of a group practice's experience, which tends to better mirror the real world compared with a single surgeon's best case series. We used the same selection for all 1,500 eyes. Only a few small pupil cases were excluded. Eyes with intraoperative floppy iris syndrome, pseudoexfoliation, traumatic zonulopathies, white cataract, and mild to moderate corneal opacities were included. Eyes that underwent previous trabeculectomy or penetrating keratoplasty were also included in the study.

If we consider that the community rate for posterior capsular tear is 2%,¹² then we now have a procedure that allows a group of surgeons to perform cataract surgery more safely than the community rate and is comparable or better than the best single-surgery studies reported in the literature. ■

Michael A. Lawless, MBBS, FRANZCO, FRACS,
is medical director of the Vision Eye Institute in
Chatswood, New South Wales, Australia.
Dr. Lawless may be reached at +61 2 9424 9999;
michael.lawless@visioneyeinstitute.com.au.



1. Dooley JJ, O'Brien PD. Subjective difficulty of each stage of phacoemulsification cataract surgery performed by basic surgical trainees. *J Cataract Refract Surg*. 2006;32:604-608.
2. Nagy Z, Takacs A, Filkorn T, Sarayba M. Initial clinical evaluation of an intraocular femtosecond laser in cataract surgery. *J Refract Surg*. 2009;25:1053-1060.
3. Kranitz K, Mihaltz K, Sandor GL, et al. Intraocular lens tilt and decentration measured by Scheimpflug camera following manual or femtosecond laser-created continuous circular capsulotomy. *J Refract Surg*. 2012;28:259-263.
4. Mihaltz K, Knorz MC, Alio JL, et al. Internal aberrations and optical quality after femtosecond laser anterior capsulotomy in cataract surgery. *J Refract Surg*. 2011;27:711-716.
5. Kranitz K, Takacs A, Mihaltz K, et al. Femtosecond laser capsulotomy and manual continuous curvilinear capsulorhexis parameters and their effects on intraocular lens centration. *J Refract Surg*. 2011;27:558-563.
6. Palanker DV, Blumenkranz MS, Andersen D, et al. Femtosecond laser-assisted cataract surgery with integrated optical coherence tomography. *Sci Transl Med*. 2010;2:58ra85.
7. Friedman NJ, Palanker DV, Schuele G, et al. Femtosecond laser capsulotomy. *J Cataract Refract Surg*. 2011;37:1189-1198.
8. Roberts TV, Lawless M, Chan CC, et al. Femtosecond laser cataract surgery: technology in clinical practice [published online ahead of print July 12, 2012]. *Clin Experiment Ophthalmol*. doi: 10.1111/j.1442-9071.2012.02851.x.
9. Bali SJ, Hodge C, Lawless M, et al. Early experience with the femtosecond laser for cataract surgery. *Ophthalmology*. 2012;119(5):891-899.
10. Roberts TV, Sutton G, Lawless MA, et al. Capsular block syndrome associated with femtosecond laser assisted cataract surgery. *J Cataract Refract Surg*. 2011;37:2068-2070.
11. Roberts TV, Lawless M, Bali SJ, et al. Surgical outcomes and safety of femtosecond laser cataract surgery: a prospective study of 1,500 consecutive cases. *Ophthalmology*. 2013;120(2):227-33.
12. Lundström M, Behndig A, Kugelberg M, et al. Decreasing rate of capsule complications in cataract surgery: eight-year study of incidence, risk factors, and data validity by the Swedish National Cataract Register. *J Cataract Refract Surg*. 2011;37:1762-1767.