IOL Implantation:
Changes in Technique Over the Past 35 Years

Improved IOL and cataract removal technologies help to boost patient satisfaction.

BY LUCIO BURATTO, MD

I began performing phacoemulsification in the spring of 1978, and by that fall I was implanting IOLs. At the time, there were a handful of lens designs to choose from, and I opted for the Shearing IOL (Iolab), placed in the posterior chamber. A lot has changed since the early days of lens implantation, and we now have available to us hundreds of IOL models, a wide range of phacoemulsification systems, and countless other gadgets that make cataract surgery easier than ever before.

MY TECHNIQUE IN 1978

The Shearing lens was the first three-piece IOL designed for insertion in the posterior chamber following extracapsular cataract extraction (ECCE) or phacoemulsification; it was a 6.0-mm plano-convex disc with two polypropylene loops that extended from the PMMA optic. I performed phacoemulsification in the posterior chamber, using a method that I learned from Richard Kratz, MD (Figure 1). More than any other colleague, Dr. Kratz gave me the greatest understanding of phacoemulsification.

At the time, phacoemulsification was performed under parabulbar or general anesthesia, and the patient was admitted to the hospital for 3 days. Following creation of a conjunctival incision, I prepared the main incision at the 12-o’clock position: a sclerocorneal flap with a width slightly less than 2.0 mm, a length of 7.0 mm, and a depth of approximately half the scleral thickness. I used a can-opener technique to create a wide capsulotomy with a disposable 24-gauge insulin needle. The needle, with a bent tip, was connected to an irrigation handpiece, and irrigation fluid flowed from a bottle of saline solution. With the needle inserted into the anterior chamber through the scleral flap, I performed the capsulotomy under continuous irrigation.

I then created a small sideport incision (1.0 mm)
approximately 80° from the main incision, widened the main incision to 3.2 mm, and removed the anterior capsule using smooth forceps with fine arms. No ophthalmic viscosurgical device (OVD) substances were available at the time.

The phaco procedure began with shaving of the epinucleus and the nucleus to form a central groove. While introducing a spatula through the sideport incision and depressing the nucleus in the 6-o’clock position, I withdrew the tip of the ultrasound probe toward the incision and interrupted the irrigation; the superior portion of the nucleus would rise, and I could catch the nucleus at the equator with the ultrasound tip. Then I fragmented the nuclear material, followed by coaxial irrigation and aspiration of the semi-hard cortex.

The posterior capsule was cleaned using a Kratz rough irrigating cannula, the corneal incision was widened to 7.0 mm, and the IOL was implanted in the sulcus. With lens-holding forceps, I would catch the optic zone close to the superior loop and introduce the lower loop and the remaining portion of the optic into the anterior chamber, which was previously filled with air.

After I inserted the inferior haptic loop into the sulcus by introducing it underneath the iris at the 6-o’clock position, I would place the superior loop with the assistance of two iris hooks. One hook, inserted through the sideport incision, was used to retract the iris and another to catch the hole on the lens in a position close to the superior loop; this hook was then used to push the lens toward the 6-o’clock position and rotate it slowly toward the retracted portion of the iris. In this way, the superior loop was passed underneath the iris.

The lens was rotated clockwise until the two loops were in a horizontal position and the optic disc was centered on the pupil. Then, I would perform a peripheral iridectomy, close the incision with five or six single nylon 10-0 sutures, suture the conjunctiva, and inject betamethasone and an antibiotic under the conjunctiva.

**POSSIBLE COMPLICATIONS**

Phacoemulsification was a lengthy procedure in the late 1970s and early 1980s, mainly because patients were referred to surgery only when their cataracts had become hard. Consequently, endothelial damage could be considerable, and, occasionally, corneal edema persisted permanently. During IOL insertion, the loops or the optic of the lens could come into contact with the endothelium, and corneal edema could persist for several days. During IOL implantation and rotation, laceration of the posterior capsule could occur, and there was also a risk that the inferior zonula would tear if the haptic loop was pushed excessively toward the 6-o’clock position.

Postoperative complications, in particular pupil capture (Figure 2A and 2B) and insufficient centering of the lens in the pupillary field (known as sunset syndrome; Figure 3A and 3B), were relatively frequent. On rare occasions iritis and, more infrequently, vitritis, were observed when the posterior capsule remained intact; these complications occurred more frequently when the posterior capsule was cut. Episodes of cystoid macular edema were also relatively frequent, and irregularities of the IOL were common (Figure 4).

**MY TECHNIQUE IN 2014**

Today, my cataract surgery technique consists of two phases: a femtosecond laser phase and a surgical phase.

**Laser phase.** The patient is positioned underneath the LenSx Femtosecond Laser (Alcon), the laser is programmed, and the eye is docked to the patient interface. I then attempt to obtain a perfectly centered and circular capsulotomy with a diameter of 5.4 mm using about 6.0 mJ of energy. With a setting of 6.0 to 11.0 mJ of energy, the laser then splits the central nucleus into four quadrants. The ablation begins approximately 500 µm from the posterior capsule and terminates 800 µm from the anterior capsule.

Next, the laser creates three incisions: the main three-plane incision (1.8 mm) and two sideport incisions (1.4 mm) located 70° to the right and left of the main incision and entering the chamber at an angle of 30°.

**Surgical phase.** The eye is then prepped with a sterile sheet, and the eyelid speculum is placed. I open the sideport incisions first, followed by the main incision. I then inject 4% lidocaine and DisCoVisc (Alcon) into the anterior chamber. These injections are performed from the
distal position, allowing any gas created by the laser to escape from the anterior chamber. I remove the laser-cut anterior capsule with Buratto forceps (Janach) and perform hydrodissection with a Buratto cannula (Janach), taking care to rotate the nucleus by at least 90°.

After injecting additional DisCoVisc, I split the nucleus into four well-defined quadrants with a Buratto chopper (Janach) and remove them with the Infiniti phacoemulsifier (Alcon) using the following settings: flow rate, 25 cc/min; Ozil (Alcon) amplitude 70%; ultrasound, 0; and bottle height, 120 cm. Quadrant removal is simple and rapid, as the laser has already softened and fragmented the pieces.

Bimanual I/A follows. I use Buratto cannulas to remove the residual cortex, and I then fill the capsular bag and anterior chamber with ProVisc (Alcon) and implant an AcrySof SN60WF one-piece IOL (Alcon) into the capsular bag with the Monarch III injector (model 7086661; Alcon). Next, I inject additional ProVisc to deepen the anterior chamber and fill the capsular bag and then position the second haptic loop in the bag. Any remaining OVD is carefully removed from behind the lens and from the anterior chamber. At the end of the procedure, I hydrate the three incisions and inject cefturoxime antibiotic (Aprokam; Thea) into the anterior chamber.

CHANGES OVER TIME

What has changed over the past 35 years? In my opinion, nothing yet everything has changed.

In 1978, I was removing cataracts using ultrasound through a small incision, and I inserted a 6.0-mm IOL into the posterior chamber. Today, I also perform lens removal through a small incision and insert a 6.0-mm IOL in the posterior chamber. But today I can also precisely program the diameter and the position of the capsulotomy using a femtosecond laser, and I can perform the capsulotomy and split the nucleus even before I begin the surgical procedure.

I also still create a small incision and use ultrasound to remove the nucleus, but to a lesser degree. I can protect the intraocular structures with OVD, and I insert the lens inside the capsular bag, where it is isolated from the eye’s delicate structures. I inject the foldable IOL through the same incision I used for phaco, without the need to widen it. The lens is perfectly centered because it lies inside the capsular bag, and the procedure is completed with no need for sutures. And the procedure is completed on an outpatient basis with topical anesthesia, quite a change from the routine 3-day hospital stay in 1978.

Most important, today my patients are happy and satisfied; however, I have to admit that they are much more demanding than my patients back in 1978.

As technologies and techniques in routine cataract surgery have improved, incisions have gotten smaller. Even with the trend of reducing incision sizes, we are not yet able to create a truly astigmatically neutral cataract incision. Several studies have shown a measurable difference in surgically induced astigmatism with a temporal 2.2-mm microcoaxial incision compared with a traditional 3.0-mm clear corneal incision.1 Furthermore, use of a motorized versus a standard manual injector can lead to significantly less incision enlargement, especially on a high-speed setting (4.4 mm/sec).2

CONCLUSION

The next step in cataract surgery is to further reduce the variability of our surgical techniques and increase focus on the surgical procedure itself. In this respect, I look forward to devices that continue on the sub–2-mm incision pathway, including hydrophobic acrylic aspheric IOLs that ensure wound integrity with a convenient pre-loaded delivery system. This will be crucial for establishing a minimally invasive procedure capable of maintaining the integrity of wound architecture.

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