

CATARACT

Phaco Update: Tip Motion, Power and Fluidics

BY LORI BAKER SCHENA, CONTRIBUTING WRITER

It has been more than four decades since Charles D. Kelman, MD, ushered in the modern age of cataract surgery with the introduction of phacoemulsification. Yet the world has radically changed since 1967. And phaco is no exception: In 2010, ophthalmologists find themselves weighing the benefits of newer technologies—including torsional and transversal phaco machines—over their traditional longitudinal devices.

“In longitudinal phaco, the needle tip uses an in-and-out motion to break up the lens material,” noted Steven I. Rosenfeld, MD, voluntary associate professor of ophthalmology at the Bascom Palmer Eye Institute in Miami, and in practice with the Delray Eye Associates in Delray Beach, Fla.

“While this was wonderful technology at the time, the jackhammer effect sometimes works against you. The material is only broken up when the tip goes forward. When it moves backward, it is not cutting anything, just generating more energy—and more heat,” he said.

In contrast to repulsing the lens material in a back-and-forth fashion, newer transversal technology cuts the material in an elliptical lateral motion, and torsional technology cuts the lens material through circular oscillations.

“The logic is that when the needle is going side to side, it is not repulsing the lens material and is actually maintaining longer contact with it. This makes these technologies faster and

more efficient because they require less phaco energy,” Dr. Rosenfeld said.

In Pursuit of Safety

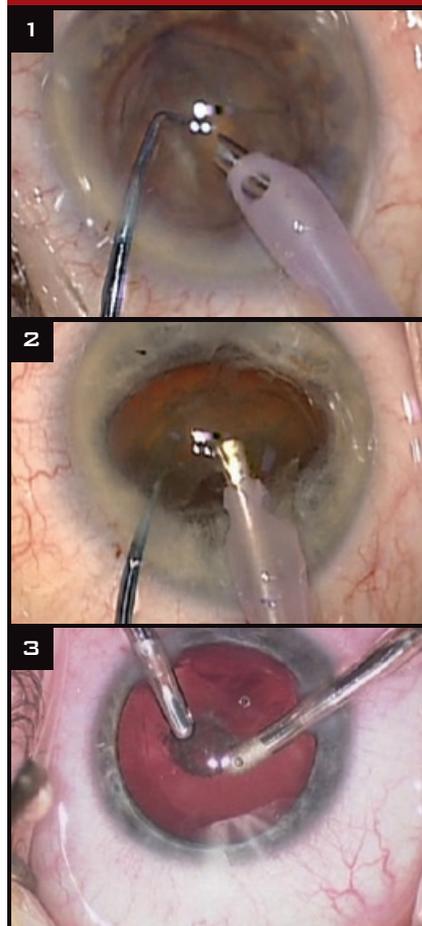
The case for greater efficiency and faster surgical time is especially critical when confronted with a hard lens. “Successful cataract surgery is like a chess game, where every move is critically dependent on the move before it,” Dr. Rosenfeld said. “When you start the case, you need a good capsulorhexis. If you don’t have a smooth intact anterior capsular rim, then the next steps are more difficult. And some would consider the phaco phase to be the most dangerous, especially the longer it takes.”

Potential problems include tearing the posterior capsule, thus causing vitreous loss; using too much phaco energy, which in turn can cause a wound burn or endothelial cell loss; and excessive fluid irrigation in the eye, resulting in more turbulence that can lead to endothelial cell loss. “The longer you do phaco, and the higher the power, the greater chance you can lose endothelial cells and contribute to postoperative corneal edema,” Dr. Rosenfeld said. “This is why the newer technologies are so attractive. You can remove a cataract at a faster rate using less power and with balanced fluidics.”

Tech Update

All three of the newer phaco devices employ sophisticated technology. Here’s a brief overview of their platforms.

Efficient Trio



The needle used here on Alcon’s In-finiti with OZiL is squared and bent for better cutting ability in dense cataracts (1). A straight needle used on B&L’s Stellaris in a small pupil case (2). A bimanual technique of lens cortex removal using AMO’s WhiteStar system in a pediatric case with posterior lenticonus (3).

Stellaris (Bausch & Lomb). This is a longitudinal device that uses a straight or Kelman bent needle. Power modulation and pulse shaping are used to optimize longitudinal ultrasound delivery.

Infiniti (Alcon). This features both longitudinal and torsional (OZiL) ultrasound delivery using a Kelman bent needle. The torsional movement of the OZiL is similar to that of turning a doorknob. The company recently introduced new software for the OZiL called Intelligent Phaco, which it describes as “adaptive software that continuously monitors and responds to” conditions during surgery.

WhiteStar Signature (AMO). This features both longitudinal and transversal (Ellips) ultrasound delivery using a straight or Kelman bent needle. Transversal motion is elliptical in nature.

Interestingly, Dr. Rosenfeld pointed out, the motion of the phaco tip is only part of the story in terms of safety and efficacy. Other key factors that give all these devices an advantage over traditional phacoemulsification technology is that they generate less heat and require lower vacuum settings.

“Indeed, of equal importance in any discussion about these technologies is being knowledgeable about fluidics and using the right amount of vacuum to maintain an optimal irrigation flow rate,” Dr. Rosenfeld said.

Power Plus Fluidics

The need for more information on this topic was obvious at October’s Academy Joint Meeting in San Francisco, where physicians packed a talk given by Uday Devgan, MD, titled Using Phaco Power Modulations and Improving Fluidics for Better and Safer Phaco Surgery.

“The bottom line for all three machines is that they are very effective in delivering safe, efficient and minimally traumatic phacoemulsification,” said Dr. Devgan, who is in private practice at the Devgan Eye Center in Los Angeles and chief of ophthalmology at Olive View UCLA Medical Center. “The key for physicians is learning—with each

machine—how to deliver just enough phaco energy to break down the lens material but not damage the corneal endothelium. And they need to learn to move less fluid through the eye and keep the anterior chamber very stable so there isn’t a lot of surge or bounce.”

Power. The three different types of basic phaco power modulation (phaco continuous, phaco pulse and phaco burst) can be controlled with foot pedals. Dr. Devgan noted that high pulse rates give the feeling of continuous phaco with half the energy expended. “This micro amount of energy does not heat up the phaco needle, and all three devices can deliver this type of energy,” he said.

The AMO WhiteStar Signature, with the transversal tip, is the originator of the phaco power modulations, said Dr. Devgan. “AMO originally called it cold phaco because it wouldn’t build up heat. It can deliver 100 bursts of energy in one second.” By having the phaco power turn off and on multiple times per second, the total amount of energy utilized is drastically reduced, he said. The Alcon Infiniti also offers pulse, burst and continuous modes with a handpiece that delivers both longitudinal and torsional ultrasound. Dr. Devgan added that Bausch & Lomb’s Stellaris, with its longitudinal tip, has also improved the ways it modulates power with methods of pulse shaping.

Fluidics. Another key aspect of successful phacoemulsification is fluidics. Balanced fluidics keeps the eye inflated, thus preventing collapse; creates currents that bring cataract pieces to the phaco probe and remove the cataract pieces; and helps prevent thermal injury to the eye by keeping the phaco needle cool.

The right amount of vacuum is important to maintaining this balance. The three devices use two types of pumps: peristaltic, which is flow-based, and venturi, which is vacuum-based. With the peristaltic, vacuum is created on occlusion of the phaco tip and flow is constant until occlusion. With the venturi, vacuum is created instantly via the pump and the flow

varies with the vacuum level. Alcon uses a peristaltic fluid pump; AMO has a pump that can function as both peristaltic and venturi in the same surgery; and B&L has a system that is either peristaltic or venturi but cannot be switched in the same surgery.

Flow is also related to tubing size. Small tubing requires more vacuum, while larger tubing requires less vacuum. “While microincisions have several advantages in cataract surgery and phacoemulsification, they require smaller tubing, which in turn leads to the need for more vacuum,” said Dr. Devgan.

A fluid surge occurs when the outflow of fluid is greater than the inflow, leading to possible anterior chamber instability and collapse, and a risk of capsule rupture. To prevent surge, each company has developed a special fluid system: Alcon has the Intrepid Fluid Management System, AMO has Fusion Fluidics and B&L has EQ Fluidics. The engineers behind these platforms have done their homework and it shows, with fluidics that are markedly better than those of the machines of yesteryear, Dr. Devgan added.

Which Machine to Use?

With these three technologies vying for a place in a surgeon’s practice, the question naturally arises as to which is the best one to use. Dr. Devgan—who uses all three in his private practice—noted that there is “still no perfect machine and ultimately the success of the surgery is up to the surgeon.”

Dr. Devgan added, “Each of these machines is a tremendous improvement from the earlier technologies. I use the analogy of luxury cars. When you look at an Audi, a Mercedes and a BMW, they are all great cars with many similarities. The ‘best’ car depends on how it will be driven and the personal preference of the driver. These phaco platforms are similar, and physicians should choose the device that best fits their technique.”

Dr. Rosenfeld, after much personal research, chose to use Alcon’s OZiL model. “I had one patient where I used my traditional longitudinal Alcon

model and then a few weeks later used the new Alcon Infiniti with OZiL,” he said. “These were cataracts of equal density, and I found that using the OZiL model resulted in a much easier and quicker operation. The patient’s cornea was much clearer on the first postoperative day.”

In Europe, Roberto Pinelli, MD, scientific director at the Istituto Laser Microchirurgia Oculare in Brescia, Italy, focuses on what he terms “anti-aging” procedures. He and his colleagues treat patients who seek clear lens exchange procedures to treat presbyopia before they develop cataracts. Consequently, he rarely treats patients with age-related cataracts.

“We use [Alcon’s] torsional phaco with the Intelligent Phaco option,” said Dr. Pinelli. “The advantages are low temperature in the anterior chamber and incision area. In addition, we do not have any repulsion of the captured piece of lens we are working on. This increases the ‘followability.’

“I like the torsional very much,” he continued, “because I don’t like to be aggressive when I am performing clear lens exchange for presbyopia. The patient’s lenses are usually very soft. The most important thing for me is that if you put too much energy in the eye, you can have some complications. So a minimum of energy in a human eye and controlled timing of surgery are our goals.”

All About Settings

Dr. Devgan concluded that whichever device an ophthalmologist selects, it is important to understand how to determine the optimum settings on the machine to perform a safe and effective surgery. “Ophthalmologists are aware that these machines are excellent upgrades from previous technology. They now need to understand how to customize their settings in terms of power modulation and fluidics to optimize their surgical performance.”

Dr. Devgan is a consultant to AMO and Bausch & Lomb and is a stockholder in Alcon. Drs. Pinelli and Rosenfeld have no related financial interests.



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