Coaxial microphaco technique “revolutionary”

**Coaxial microphacoemulsification with IOL implantation through a 2.2-mm incision is a revolutionary advance in cataract surgery offering all of the advantages of standard coaxial surgery and modern, large optic IOL technology with the added benefit of a smaller incision size, according to Robert H. Osher MD, Professor of Ophthalmology, University of Cincinnati College of Medicine, Ohio, US.

The procedure utilizes a new 2.2 mm ultrasound sleeve (Ultrasleeve) that is used with the Infiniti Vision System (Alcon) and a 1.1 mm Infiniti Flared tip. Dr Osher first undertook extensive laboratory testing comparing its performance characteristics against sleeveless bimanual microincision phaco. The results of those studies demonstrated that coaxial microphaco was superior with respect to fluidics, heat generation, and incision competency, Dr Osher told the XVIII Congress of the ESCRS.

Encouraged by those findings and after developing a technique that allowed implantation of a full-size, 6.0 mm, one-piece acrylic IOL through an unenlarged 2.2 mm incision, Dr Osher took the new procedure into the clinic.

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Results of a study enrolling 100 consecutive cataract surgery patients demonstrated that coaxial microphacoemulsification had a very favourable intraoperative performance profile, allowing safe and efficient cataract removal, and yielded postoperative outcomes matching those achieved with standard coaxial surgery.

Robert H Osher

In his clinical study, Dr Osher assessed anterior chamber stability, incision competency, and ease of IOL delivery, as well as postoperative UCVA, IO P incision appearance, and corneal appearance. The results from his 100 cases were extremely solid, he commented.

“We have all been eager to take the next step forward in the evolution of cataract surgery and further reduce our incision size. However, because of its many limitations, I believe sleeveless bimanual microincision surgery has not fulfilled its initial promise for making that change. Considering the positive findings from my laboratory and clinical studies, and that coaxial microphaco is a technique that can easily be transitioned to by any phacoemulsification surgeon, I consider it a major step forward in the evolution of cataract surgery and expect that it will be rapidly adopted into widespread use,” he said.

Although he had been performing sleeveless bimanual phaco for several years with satisfactory results, Dr Osher said he was never completely happy with the technique because of its inferior fluidics profile and problems with incision competency. Furthermore, sleeveless bimanual phaco requires a new set of specialised instruments and has a steep learning curve that makes it difficult to teach to younger surgeons. Additionally, in the US where ultra-small incision IOLs are not available, IO I implantation necessitated incision enlargement or creation of a separate, larger incision.

New torsional ultrasound increases phaco safety

To resolve these issues, Dr Osher developed the protocol for their procedure to overcome those limitations of sleeveless bimanual surgery, Dr Osher and colleagues developed the protocol for their laboratory studies.

In one experiment, they measured infusion flow into the eye when operating with 19, 20, and 21 gauge irrigation choppers through a 1.2 mm incision and compared it with the Ultrasleeve through a 2.2 mm incision. The infusion bottle height was kept constant at 100 cm. The flow rates using the various irrigating choppers ranged from 20 to 60 cc/min and were significantly less than the 85 cc/min rate achieved using the Ultrasleeve.

Dr Osher and colleagues addressed these limitations by performing standard coaxial phaco, reduced duty cycles with built-in pauses are necessary to minimise heat production and compensate for chatter and repulsion. The pauses help to reduce heat build-up at the incision and allow the repelled nuclear material to return to the tip. In contrast, 100% power can be used with the torsional technology.

Another benefit of torsional phaco is that it eliminates difficulty with footswitch power control.

With footswitch control of power during longitudinal phaco, it could be challenging at times to achieve the correct, delicate balance between efficacy and repulsion. The torsional technique takes repulsion out of the picture to make footswitch control very easy, even for heavily-footed surgeons.”

**Reduced heat**

As a result of the minimal tip movement with torsional ultrasound, heat production at the incision site is only about one-third of that occurring with traditional longitudinal ultrasound. In addition, since there is no intrinsic repulsion of the nuclear material as there is with longitudinal ultrasound, the effectiveness of emulsification is greatly improved with the torsional technique.

“With this technology, I believe it is possible to use 100% continuous ultrasound without risk of wound burn, and there is also better followability and holding force that can compensate for the reduced irrigation flow occurring with smaller phaco sleeves. Those features add up to a safer, more self-contained procedure,” said Dr Tjia.

He demonstrated its performance by showing videos from a series of cases with dense cataracts, including some where he began the procedure using conventional longitudinal ultrasound in linear burst mode and then switched to 100% torsional ultrasound with the new handpiece.

“The difference in speed is striking, and continues to amaze me even after working with this technology for a year. Although we were satisfied with traditional ultrasound when it was all that was available, with access to new technology, it is easy in retrospect to see the difference and appreciate the benefits,” said Dr Tjia.

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**Better fluids with coaxial**

Intrigued by what he saw as the potential of the coaxial microphaco procedure to overcome those limitations of sleeveless bimanual surgery, Dr Osher and colleagues developed the protocol for their laboratory studies.

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These data confirm the coaxial technique affords much better fluidics and that translates into safer, more stable chambers,” Dr Osher said.

Less heat
The study also included an assessment of heat generation when operating in cadaver eyes and using a thermal camera to measure the temperature at the phaco tip. While both systems remained cool, Dr Osher acknowledged being somewhat surprised to find the tip temperature was relatively lower using the coaxial technique. In retrospect, however, the results made sense.

“Aspiration bypass and an insulated sleeve act in concert to help cool the tip when performing coaxial surgery but play no role when working with a sleeveless tip,” Dr Osher said.

The researchers also evaluated the competency of the 1.2 mm and 2.2 mm incisions through fluorescein testing. After one minute of phaco time with constant settings, the incisions in cadaver eyes operated on with the coaxial microphaco technique consistently demonstrated greater competency than the sleeveless bimanual group when tested for sealability immediately after phaco handpiece withdrawal.

New implantation technique for unenlarged incision
To maintain the benefit of the 2.2 mm incision at the end of the case, Dr Osher worked in human cadaver and porcine eyes to develop a method for implanting a 6.0 mm, single piece, foldable IOL through an unenlarged incision. The approach he designed uses a C cartridge (Alcon) plus a plunger style inserter (Asico Royale or Duckworth & Kent) with a counter-traction technique and achieves reliable delivery of single-piece acrylic IOLs (SN 60AT, SA 60AT, ReStor (Alcon) with a final incision size usually no greater than 2.3 mm.

In testing various modifications to the implantation approach, Dr Osher found it was important that the IOL be loaded in a manner identical to that depicted in the directions-for-use which is also indicated by the etching on the cartridge. After creating a firm eye by filling it with a cohesive viscoelastic, he then places the inserter bevel down through the incision, and introduces a second instrument through the stab incision to provide counter-traction. Application of firm and steady pressure to depress the plunger at a relatively rapid pace is also important to deliver the IOL efficiently and freely through the 2.2 mm incision.

“Working simultaneously but independently, Takayuki Akahoshi MD, also devised the same method for effectively implanting a full-size IOL without having to enlarge the incision or make a separate one. Therefore, using coaxial microphaco, surgeons can provide patients the benefits of smaller incision surgery together with all of the attributes of current IOL technology, including low PCO rates, optimal centration, macular protection, aberration reduction, toxicity, and multifocality,” Dr Osher said.

“And the future? Now I’m combining 2.2 mm ultrasleeve technique with torsional ultrasound. Times are really exciting!” he added.

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