Torsional phaco demonstrates power of attraction

Sonia H Yoo

Reduced BSS consumption and overall as cavitation, turbulence and repulsion. Our undesirable aspects of traditional phaco such as caviation, turbulence and repulsion. O ur research findings help to explain the clinical observation of improved followability, reduced BSS consumption and overall improved surgical outcomes of torsional phacoemulsification,” Jaime Zacharias of the Clínica Oftalmológica Pasteur, Santiago, Chile.

As a new cataract removal modality on the Infiniti Vision System (Alcon), O Zil incorporates a combination of handpiece, hardware and software enhancements. By using ultrasonic oscillations of an angulated or curved needle, torsional phacoemulsification alters both the energy profile of the tip and the reaction of the lens material contacted by the vibrating needle. Unlike traditional ultrasound, there is no forward and backward movement of the tip with torsional ultrasound. In the torsional mode, the handpiece oscillates from side to side at approximately 32,000 times per second. These oscillations are much faster and because they happen at a lower frequency than longitudinal phaco, there provide approximately 20 per cent energy savings and less risk of thermal burn, according to surgeons who are familiar with the technology.

Dr Zacharias’ study used in vitro recording of turbulence, repulsion and cavitation characteristics for both torsional and standard phacoemulsification systems using mixed experimental set-ups with real human cataract fragments.

Defining cavitation “as expanding and imploding bubbles during cycles of ultrasonic oscillation”, Dr Zacharias noted its potentially undesirable effects in phacoemulsification surgery.

“Cavitation may lead to free radical formation, loss of efficiency and turbulence induction. It can also cause random displacement of lens fragments and the possibility of direct and indirect damage to the endothelium, which is obviously something we would prefer to avoid,” he said.

Using O Zil, turbulence patterns using a density gradient detection method showed significant turbulence reduction, said Dr Zacharias. Also, any kind of repulsion phenomenon cannot be perceived using torsional phaco, he said.

Reduced turbulence in the anterior chamber

Dr Zacharias noted that even with dense nuclei, the low energy released into the eye with O Zil enables the surgeon to maintain minimal turbulence in the anterior chamber.

“The repulsion caused by dislodgment of the lens fragments by mechanical forces at the phaco tip was was an unsolved problem.

Tips on getting the most from O Zil

Dr Akahoshi noted that all the tips were bent toward the bevel in order to enable them to make a complete occlusion to the nuclear surface.

“I bend the tip in the opposite direction to a Kelman tip. This allows me to easily make a complete occlusion and the tip shaft is almost parallel to the incision. So there is no stress on the incision or no mechanical or thermal damage at the incision site using this approach,” he said.

For the standard tip, the original round tip port was modified to be oval or square to evaluate the ultrasound (U/S) time and average power as well as the aspiration time.

Discussing the results, Dr Akahoshi said that the tapered tip could not maintain a stable anterior chamber at the designated high settings, while the flared tips experienced no difficulty in this regard. Furthermore, the U/S time and aspiration time were shorter using a standard tip compared to a micro tip. The oval tip was also more efficient in the U/S time than the round tip. The square tip was found to be efficient both in the U/S time and aspiration time. It is also easier to introduce through a small sub-2mm incision.

Dr Akahoshi also offered advice on the best phaco settings to use with the O Zil handpiece. Torsional phaco alone using 100 per cent continuous fixed mode is usually sufficient to emulsify most of the nucleus. Linear mode using a foot pedal is also possible with less dense cataracts but is more prone to cause a thermal damage of sub-2mm incision in dense cataracts, said Dr Akahoshi.

To prevent clogging, Dr Akahoshi suggested combining the torsional and longitudinal phacoemulsification. For soft and medium cataract, he uses 100 per cent fixed longitudinal phaco with 15msec O N time followed by 100 per cent fixed torsional phaco with 100msec O N time and 100msec linearly decreased O F F time. For denser cataract, he uses 30msec fixed longitudinal and 300msec fixed torsional power with 150msec linearly decreased O F F time.

For cataract removal, Dr Akahoshi also advised approaching from the peripheral side rather than the centre.

“This is effective for harder cataracts. If I approach from the periphery, I can bury the tip deep into the nucleus using a longitudinal movement and the torsional movement will then destroy the nucleus. If I approach from the core of the nucleus, however, I cannot bury the tip deep into the nucleus so it will require more energy to emulsify the cataract,” he said.

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with longitudinal phaco, leading to a loss of efficiency and endothelial damage. With torsional phaco, however, the nuclear fragments keep on the tip and come towards you at all times, rather than going away from you, so followability is greatly enhanced with this system compared to traditional phaco,” he said.

The risk of thermal injury is also considerably reduced with OZiL, according to Khiun Tjia MD.

“Torsional ultrasound is significantly more efficient compared to longitudinal ultrasound. Torsional ultrasound, on the other hand, generates two to three times less heat at the same power level and there is no risk of wound burn. Torsional ultrasound has a greatly reduced repulsion and nuclear quadrants appear to be ‘glued’ at the tip. Sculpting through very hard nuclei is markedly easier, faster and more efficient with torsional ultrasound, added Dr Tjia. To illustrate the point, he presented the results of a recent trial in which 32 dense cataracts were randomised for either a torsional or longitudinal ultrasound phaco procedure.

Fluid dynamics parameters were the same for all the procedures (bottle height 90cm, aspiration flow 35 ml/min and vacuum 350 mmHg) and the same tapered Kelman 45-degree tip was used with the Infiniti machine. Torsional ultrasound was used in 100 per cent continuous mode and longitudinal in pulse mode with a 50 per cent duty cycle and 30 pulses/sec. All surgeries were performed by the same surgeon with a fast crack divide and conquer technique.

The results showed that torsional phaco required significantly less fluid use than longitudinal phaco during both sculpting and quadrant removal, concluded Dr Tjia.

Less fluid, more control

“Less total fluid consumption indicates that torsional ultrasound is significantly more efficient compared to longitudinal ultrasound. Corneal endothelial cell loss could be reduced and patient outcomes improved with this new ultrasound delivery modality,” he said.

Another study, carried out at the Bascom Palmer Eye Institute in Miami, Florida, also concluded that torsional phacoemulsification surgery is an effective alternative to conventional phacoemulsification due to improved surgical efficiency and comparable visual outcomes.

In a series of 25 eyes that underwent cataract extraction with torsional ultrasound between November 2005 and February 2006, Sonia H Yoo MD said that total case time and fluid usage were lower for torsional phacoemulsification compared to conventional ultrasound.

The total OR time was 17 minutes on average and the total volume of BSS used intraoperatively was 270ml, which is less than with conventional ultrasound, noted Dr Yoo. Visual acuity results were excellent, with 100 per cent of patients recording uncorrected visual acuity of 20/40 or better at one month and 100 per cent with best-corrected visual acuity of 20/25 or better at one month. Postoperative endothelial cell counts ranged from 2790 to 2670 cells after one month and remained stable out to six months.

Dr Yoo said that torsional phaco was found to be a safe and effective alternative to conventional phacoemulsification. “Visual acuity results and endothelial cell counts were excellent and commensurate with other phaco modalities recorded in the literature. The total fluid use during surgery also proved to be less than what was seen with conventional ultrasound,” she said.

Hard cases

Dr Yoo’s findings were also confirmed by the results of a clinical trial comparing torsional and conventional phacoemulsification carried out by Abhay Vasavada, MBBS, MS, FRC S, of the Ilaidevi Cataract & IOL Research Centre, Ahmedabad, India.

In a randomised prospective study of 120 consecutive patients divided into three groups, Dr Vasavada used either Alcon Legacy 20000 or Infiniti vision system with one of three configurations: OZiL torsional phaco, Infiniti vision ultrasound and Everest Upgraded Legacy 20000.

Dr Vasavada said that the torsional technology performed better than the conventional phaco in terms of total phacoemulsification time, average percentage of maximum power expenditure, fluid volume use, integrity of incision and corneal clarity.

He also noted that the cutting efficiency of OZiL enables him to use this modality on all grades of cataract.

“In India, I often have to remove many rock-hard, brunescent cataracts. For these cases, many surgeons often feel compelled to use high parameters. With torsional technology, however, we can maintain low parameters and better safety and you do not have to worry about posterior capsule rupture or other complications,” he said.