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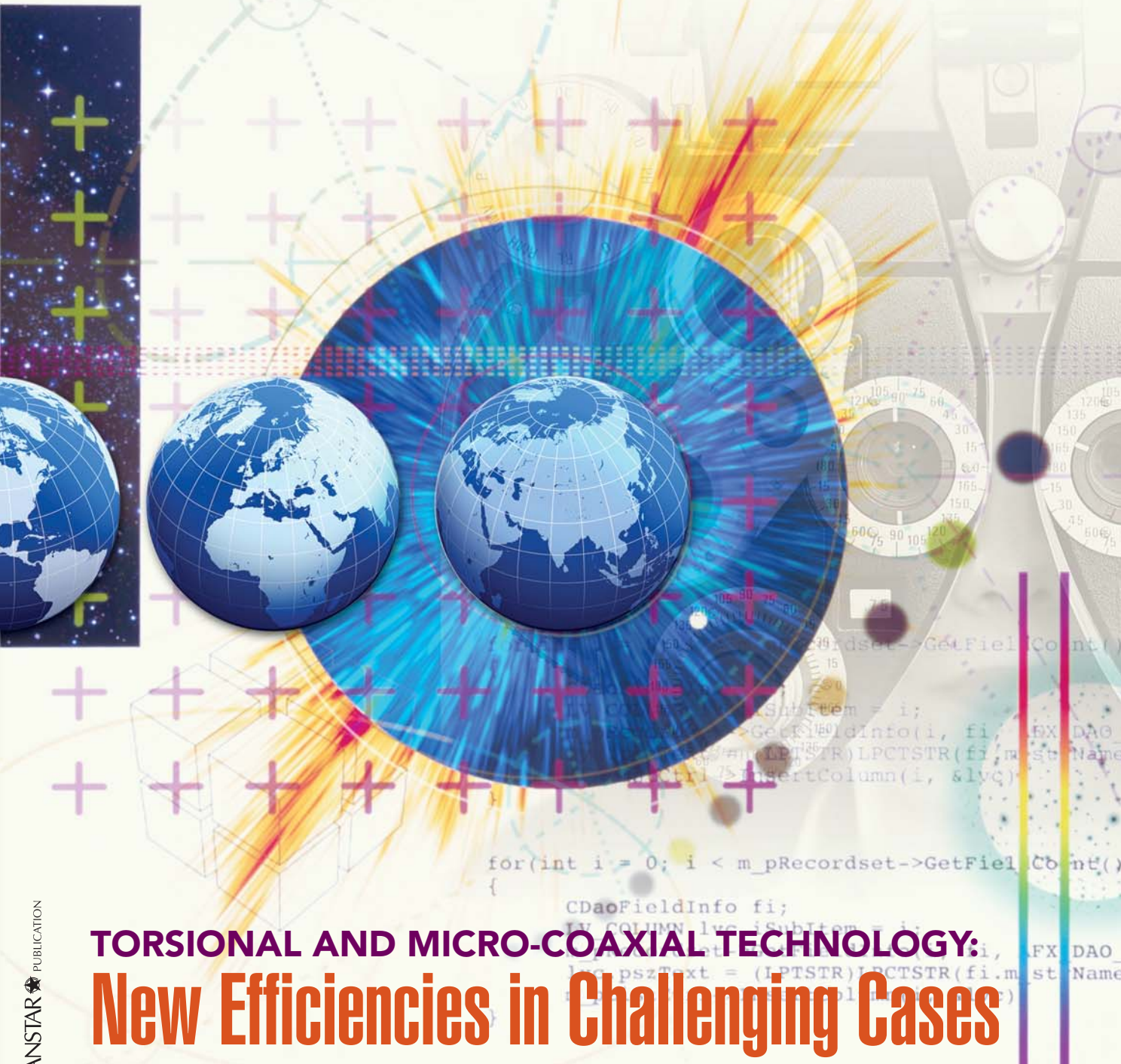


AN ADVANSTAR PUBLICATION

TORSIONAL AND MICRO-COAXIAL TECHNOLOGY:

New Efficiencies in Challenging Cases

Highlights from a CME symposium held during the 2007 XXV ESCRS Congress in Stockholm, Sweden

This supplement has been made possible by funding from Alcon®

Torsional ultrasound virtually eliminates repulsive forces and increases followability to provide phenomenal cutting efficacy.

Khiun F. Tjia, MD

Torsional and Micro-Coaxial Technology: New Efficiencies in Challenging Cases

Introduction

Khiun F. Tjia, MD
Zwolle, The Netherlands

Torsional ultrasound performed with the INFINITI Vision System® (Alcon Laboratories) using the OZil® Torsional Handpiece (Alcon Laboratories) became commercially available in July, 2006.

Torsional ultrasound offers many advantages compared with traditional longitudinal ultrasound and is considered a revolution in ultrasound technology. Torsional ultrasound virtually eliminates repulsive forces and increases followability to provide phenomenal cutting efficacy and rapid nucleus evacuation. These benefits are achieved with lower fluidics settings and minimal heat generation so that the safety of the lens removal procedure is enhanced. Moreover, torsional ultrasound is a perfect partner with a micro-coaxial approach in all eyes and particularly in challenging cases where the advantages of each combine to enable controlled, safe, and efficient surgery.

At a symposium held during the XXV Congress of the ESCRS in Stockholm, a distinguished faculty of renowned cataract surgeons presented their experiences with micro-coaxial phacoemulsification using torsional ultrasound. Using impressive videos recorded intraoperatively and including some particularly challenging cases with very advanced cataracts, they demonstrated the features of the micro-coaxial approach and torsional ultrasound and contrasted the benefits of these techniques with the drawbacks of bi-manual micro-incisional phacoemulsification and traditional longitudinal ultrasound. The information they presented is summarized in this supplement and has relevance to all surgeons as we continually strive to deliver higher quality surgery and better outcomes for our patients.

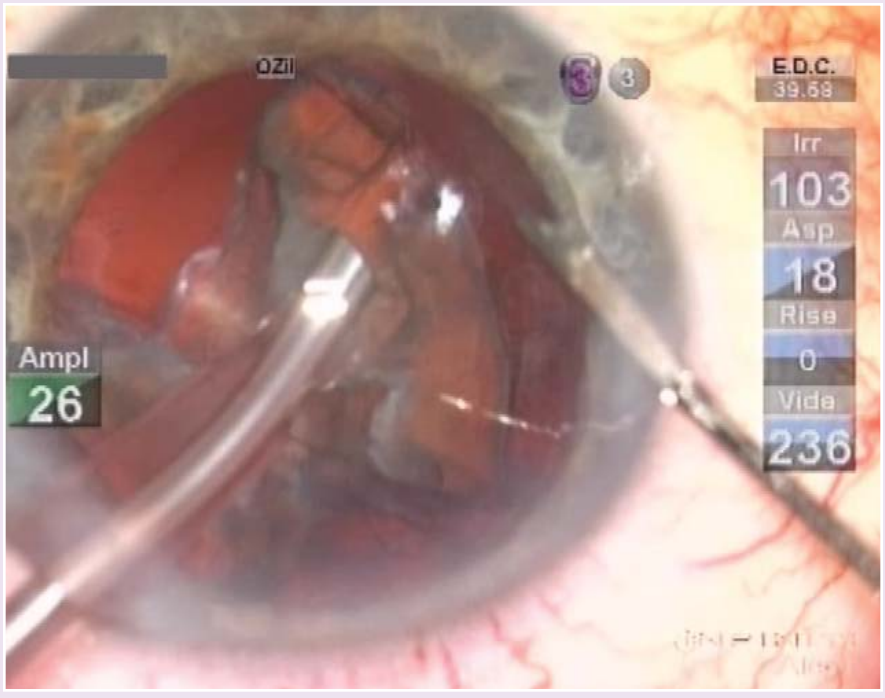
Experience with Torsional Technology

Marc Weiser, MD
Paris, France

I would like to present our experiences with torsional and micro-coaxial technology on behalf of our French research group. My goal is to demonstrate to surgeons the transition from performing phacoemulsification with traditional longitudinal ultrasound to a micro-coaxial procedure using torsional technology.

The impetus for the development of micro-incisional phacoemulsification was to provide a lens removal technique that is less traumatic and truly affords astigmatically neutral cataract surgery. Compared with 1.0- to 1.5-mm bi-manual micro-incisional phacoemulsification, the micro-coaxial approach offers several advantages. Whereas bi-manual micro-incisional phacoemulsification requires use of an ultra-thin capsulorhexis forceps or a cystome for capsulorhexis creation, 2.2- to 2.4-mm micro-coaxial surgery allows the surgeon to create the anterior capsular opening without any special instrumentation. In addition, the infusion rate is preserved with micro-coaxial phacoemulsification so that fluidic balance is more naturally achieved using lower bottle heights than with bi-manual tech-

FIGURE 1.



"anterior chamber stability is well-maintained… without a need for… changing settings… used in traditional coaxial surgery…"
Marc Weiser, MD

niques. Consequently, anterior chamber stability is well-maintained during the procedure without a need for substantially changing biomechanical settings relative to those used in traditional coaxial surgery through a larger incision or for using any ancillary device to enhance infusion (Figure 1).

Another positive feature of micro-coaxial phacoemulsification is that it allows the pre-chop approach to be easily performed whereas it is impossible to use this technique in bi-manual phacoemulsification. Introduced by Takayuki Akahoshi, MD, the pre-chop technique eliminates sculpting in most cases and decreases the duration and intensity of ultrasound use so that the total energy delivered during the case is decreased by approximately 50%. This benefit further enhances the atraumatic nature of micro-coaxial surgery.

The micro-coaxial technique also has a very important advantage in allowing implantation of a high quality thin profile aspheric acrylic intraocular lens (IOL) without any need to enlarge the incision. That benefit is not possible when performing bi-manual micro-incisional surgery. However, there is a learning curve for developing skill in delivering the implant through the 2.2-mm incision when you are using the Monarch II "C" Cartridge.

For implantation, the IOL is grasped by toothless forceps and a drop of an ophthalmic viscosurgical device (OVD) is placed on the optic. With the two haptics positioned above the optic, the implant is inserted into the injection tunnel. The cartridge tip is placed under the anterior edge of the incision and positioned at less than 45 degrees. The lens is then passed through the incision by advancing the plunger in a single continuous motion without any stopping or slowing.

All implants can be safely and effectively delivered in the same fashion with this technique, including multifocal IOLs and lenses with a high dioptric power. In fact, the micro-coaxial technique represents an important advance in the success of multifocal IOL implantation because of its benefit for enabling precise control of corneal astigmatism. In eyes without preexisting astigmatism, the neutrality of the

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Marc Weiser, MD

Once the torsional tip is positioned… the nucleus material is… very efficiently sheared and emulsified.

Marc Weiser, MD

surgery performed guarantees stability of the corneal curvature. In the case of eyes with significant preoperative astigmatism, the micro-coaxial technique allows the surgeon to achieve a predictable refractive outcome and provide the patient with the best uncorrected visual result whether astigmatism is being managed by performing limbal relaxing incisions or implanting a toric IOL.

Torsional ultrasound is a major advance in lens removal technology that partners well with the micro-coaxial technique. With traditional longitudinal ultrasound, the axial or jackhammer vibrations of the phaco tip create a repulsion phenomenon that limits the efficacy of phacoemulsification and generates frictional heat. This feature is almost completely absent with use of torsional energy where there is side-to-side oscillatory motion with decreased movement and resultant friction within the incision.

During sculpting where ultrasound fragmentation of the lens occurs upon contact of the tip, cutting efficacy is dramatically improved with torsional ultrasound compared with longitudinal ultrasound. In addition, operating with torsional technology affords more precise visual control. Whereas penetration cannot be seen until after the tip is retracted when using traditional longitudinal ultrasound, the torsional technique allows the surgeon to directly and precisely monitor the nuclear fragmentation as it occurs in front of the tip. Once the torsional tip is positioned in the central zone of the capsulorhexis, the nucleus material is continually drawn to the vibrating tip and is very efficiently sheared and emulsified.

Using torsional ultrasound, lens material removal is also achieved very efficiently without any need for the surgeon to stop and reposition the probe or the use of any second instrument or micromanipulator. The elimination of any repulsion phenomena together with reduced turbulence in the anterior chamber provides maximum protection of the corneal endothelium.

New mini-flared micro tips for the OZil® Torsional handpiece provide a particularly effective holding force for nuclear material that optimizes energy use and particularly the use of torsional energy. Moreover, torsional ultrasound is particularly safe and effective for emulsifying any type of nuclear material. Because of the lack of repulsive forces and the minimal heat generation associated with torsional ultrasound, efficient nuclear removal can be best achieved using the continuous linear torsional mode.

In summary, the micro-coaxial technique using torsional ultrasound with the INFINITI Vision System and OZil Torsional handpiece allows safe and efficient lens removal surgery. Phacoemulsification is accomplished with minimal use of ultrasound energy, and the 2.2-mm incision allows reproducible implantation of a high quality and proven IOL through an unenlarged incision. The benefits of these features are demonstrated by surgical outcomes. Clinical observations made on the first day after surgery and with the use of optical coherence tomography to image the cornea show that the incision edges exhibit little to no distortion whereas after bi-manual phacoemulsification, it is not unusual to observe moderate edema around the incision. Even very hard nuclei can be removed with low amounts of energy using the micro-coaxial technique with torsional ultrasound so that only very mild signs of corneal edema are evident after surgery in these more challenging cases as well.

Performing phacoemulsification through a standard 3.0- to 3.2-mm is neither wrong nor outdated. However, the experience of the members of the French research OZil group indicate micro-coaxial surgery using torsional ultrasound has many advantages that make it clearly superior. To our knowledge, surgeons who have attempted this new method rapidly convert to it as their technique of choice, and we believe that others who decide in the future to try micro-coaxial phaceomulsification with torsional ultrasound will quickly embrace it as well.

DISCUSSION

Dr. Tjia: Dr. Weiser, you mentioned that IOL implantation represents the only step of the micro-coaxial technique that involves a learning curve. Have you had any experience using the new, smaller D-cartridge (Alcon Laboratories) developed for injection of the AcrySof® acrylic single piece IOLs?

Dr. Weiser: Although the D-cartidge is not widely available, we have had the opportunity to try it, and we believe use of this new cartridge with the MONARCH®

III Delivery System (Alcon Laboratories) will definitely facilitate IOL delivery through the 2.2-mm incision for all surgeons and eliminate the learning curve for the implantation procedure.

Dr. Tjia: I fully agree with your assessments. I have also had the opportunity to use the D-cartridge and expect that it will significantly reduce problems surgeons may have encountered trying to implant an AcrySof lens through a 2.2-mm incision with the C-cartridge. The tip of the D-cartridge is significantly smaller than its predecessor and so it fits very well in the incision. Using a wound-assisted injection technique, implantation is easily accomplished without any need to exert excessive pressure at the incision. This D-cartridge is a perfect complement to 2.2-mm surgery, but I believe that surgeons who pursue the use of a smaller incision size will find there is some stretching of the incision, even with use of the D-cartridge. Therefore, I think it is best to continue using a 2.2-mm incision, which will result in induction of no more than 0.1 D of astigmatism. ■

Intra-operative Performance of Emerging Phaco Standards

Abhay R. Vasavada, MS, FRCS
Ahmedabad, India

The majority of patients who present for cataract surgery in India have very advanced cataracts. Experience at our institution with these very dense lenses provides testament to how the micro-coaxial approach partnered with torsional ultrasound using the OZil® Torsional Handpiece (Alcon Laboratories) and INFINITI® Vision System (Alcon Laboratories) represents a new standard in efficiency and safety for phacoemulsification of difficult cataracts.

Compared with a bi-manual approach to phacoemulsification, the micro-coaxial technique has significant benefits for both the surgeon and the patient. Micro-coaxial surgery is performed with a sleeve over the phaco tip and so derives the advantages of the sleeve, which include both enhanced incision and thermal protection with increased irrigation flow versus bare needle bi-manual techniques. The learning curve for micro-coaxial phacoemulsification is minimal, if present at all, whereas the bi-manual technique presents a steep learning curve for even experienced surgeons. Furthermore, the micro-coaxial technique allows surgeons to use high quality acrylic, 6.0-mm optic IOLs and provide patients with all of the benefits accompanying this implant technology, including excellent vision outcomes, intraocular stability, low rates of posterior capsule opacification, and features such as toricity, asphericity, and multifocality.

The combination of the micro-coaxial technique with torsional ultrasound results in outstanding cutting efficiency that allows surgeons to readily handle even more challenging cases of lens removal, including extremely dense cataracts or eyes with a small pupil or pseudoexfoliation. With longitudinal ultrasound, the tip acts in a jackhammer effect and emulsification only occurs 50% of the time upon forward motion of the tip. In contrast, the left-to-right-to-left oscillation of the torsional phaco tip cuts continuously in both directions and smoothly shears through the nucleus, just like a knife through soft cheese or butter. As a result, it is possible to rapidly sculpt a groove through even the bulkiest and densest of cataracts without stressing the sub-incision zonules or distorting the capsular bag.

Another difference between longitudinal and torsional ultrasound relates to the dynamics of aspiration. In longitudinal ultrasound, there is a conflict between aspiration and energy as removal of lens material by aspiration requires overcoming the repulsive energy at the phaco tip. During micro-coaxial surgery with torsional ultrasound, aspiration and micro-fragmentation work in harmony to afford excellent followability. As a result, dramatically effective lens removal is achieved with use of lower fluidic parameters that further enhance surgical safety (Figure 2). Across

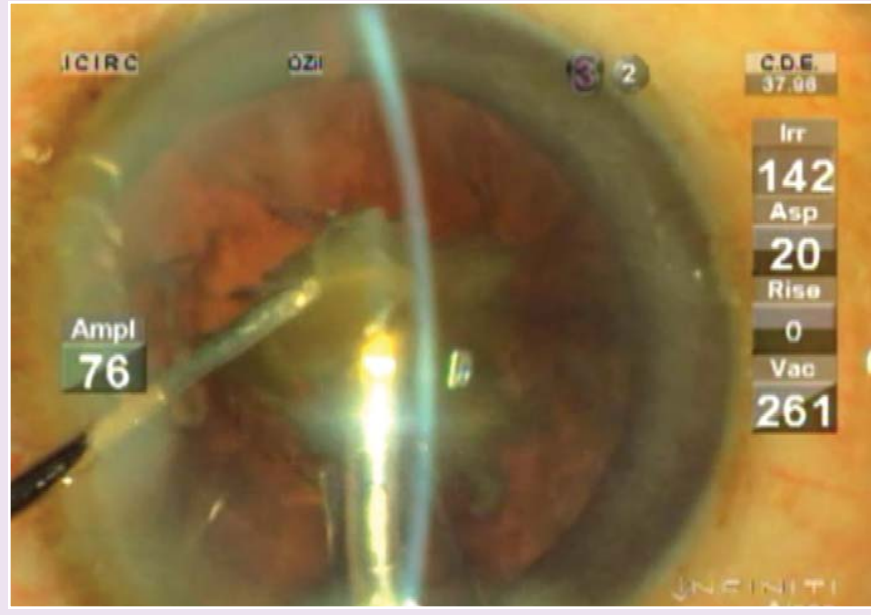
The combination of the micro-coaxial technique with torsional ultrasound results in outstanding cutting efficiency… including extremely dense cataracts or eyes with a small pupil or pseudo-exfoliation.

Abhay R. Vasavada, MS, FRCS

The combination of micro-coaxial technique with torsional ultrasound… allows surgeons to readily handle more challenging cases of lens removal.

Abhay R. Vasavada, MS, FRCS

FIGURE 2.



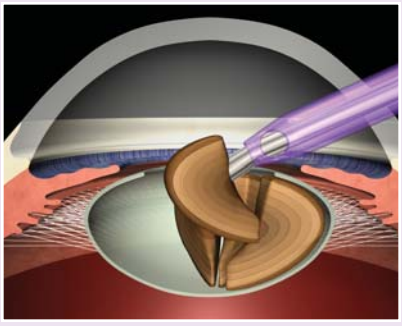
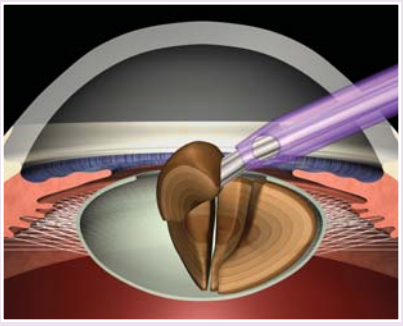
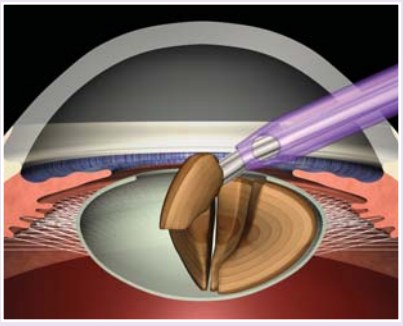
"During micro-coaxial surgery with torsional ultrasound, aspiration and micro-fragmentation work in harmony to afford excellent followability."
Abhay R. Vasavada, MS, FRCS

the spectrum of cases, emulsification can be achieved predictably in the posterior plane at a safer distance away from the endothelium when using torsional ultrasound. This is especially important in eyes with a very dense cataract where there is an increased risk of hard fragments approaching or tumbling into the endothelium. However, with the micro-coaxial technique and torsional ultrasound, removal of fragments of a black cataract is achieved rapidly and well away from the endothelium using an aspiration flow rate of only 20 mL/min.

CarOziling represents a new method of lens removal that optimizes the benefits of torsional technology for surgeons by allowing them to take full advantage of its surface shearing action (See sidebar, page 7). With CarOziling, the lens substance continuously presents itself to the phaco tip, rotating and moving around the phaco tip like a carousel. Coring of the lens substance, which is associated with wasted energy and some loss of control, is not necessary with this technique as it is when using traditional longitudinal ultrasound. In addition, we have found that CarOziling offers the best method for using torsional ultrasound when operating on leathery, hard cataracts. In that setting, with the use of a moderate flow rate and low vacuum, the nuclear fragments are consumed quickly and in a controlled fashion at a posterior plane without ever having to bring the phaco tip near the endothelium. The favorable postoperative appearance of the incision, which exhibits minimal signs of surgical stress, provides further illustration of the safety and atraumatic nature of this technique for operating on difficult cataracts.

For more than a decade, I have been advocating a step-by-step approach to nuclear disassembly of hard cataracts that combines the techniques of chop in situ and cracking.[1] The principles of this approach involve dividing the lens into multiple small fragments that can be safely removed in a central trench that I create initially within the lens. Now, with the superior cutting efficiency of torsional, I can impale the tip into the nucleus with a rapid rise time, quickly achieving the vacuum seal needed to effectively hold the nucleus. Then, after I have proceeded to divide the lens in a stepwise fashion, working strictly in the center, I use CarOziling to effectively remove the fragments.

CarOZiling

CarOZiling represents a technique that utilizes the surface shearing action of torsional ultrasound to enhance its benefits, and it represents the best method for achieving fragment removal with torsional technology.

In CarOZiling, the phaco tip is held stationary with the bevel facing sideways. The oscillatory motion along the long axis of the phaco tip removes the lens fragment by surface shearing that in turn causes the fragment to tumble and present a new surface to the phaco tip at all times. Since there is minimal to no repulsion with torsional ultrasound, the phaco tip acts as a pivot around which the fragment continuously rotates.

Using torsional ultrasound, emulsification can be performed away from the endothelium, fragment removal is rapid and well-controlled, and fluid usage is significantly reduced. Based on its benefits, torsional technology has proved invaluable in emulsification of dense cataracts as well as when operating in eyes with a weak endothelium, weak zonules, or a shallow anterior chamber. With over a year of experience with torsional ultrasound, I have found no contraindications to its use.

Abhay R. Vasavada, MS, FRCS

We compared micro-coaxial phacoemulsification using torsional ultrasound against traditional longitudinal ultrasound in a prospective double-masked randomized study.[2] As reported at this meeting, we found that the intraoperative outcomes with respect to surgical clock time and volume of balanced salt solution usage during the surgery were superior for the torsional approach compared with traditional longitudinal ultrasound when operating on grades 1 to 3 lenses as well as on denser cataracts. (Table 1) Especially exciting were our postoperative clinical outcomes. We achieved clear corneas on the first day after surgery in 100% of eyes in the torsional group along with a minimal and lesser increase in corneal thickness compared to the longitudinal ultrasound group.

Micro-coaxial phacoemulsification encompasses procedures performed across incision sizes ranging from 2.4-mm to below 2-mm. Surgeons who are still performing standard coaxial surgery through a 2.8-mm or larger incision can work toward reducing their incision size to reach a width within this range that is compatible with their comfort level. Maximal enjoyment of the benefits of micro-coaxial phacoemulsification with torsional ultrasound can be achieved without necessarily having to go down to a 2.2-mm incision.

In conclusion, torsional ultrasound with a micro-coaxial approach and the CarOziling technique provide exquisite surgical control for cataract removal. This combination of technique and technology has established new standards for intraoperative performance and achieving predictably excellent clinical outcomes, including clear corneas on the first postoperative day. The partnering of

TABLE 1. Intraoperative Results

	Nuclear sclerosis	Group 1 Torsional (n=120 eyes)	Group 2 INFINITI Micro-burst (n=120 eyes)	Group 3 Legacy Micro-burst (n= 120 eyes)	P-Value (Kruskal-Wallis test)
Clock Time (in minutes)	Grades 1 to 3	3.8 ± 0.4	5 ± 1.2	5 ± 2.3	<0.001
	Grades 4, 5	5.01 ± 1.9	8.3 ± 3.3	9.1 ± 4.2	<0.001
Fluid used (in ml)	Grades 1 to 3	72 ± 34	90 ± 33	100 ± 51	0.002
	Grades 4, 5	130 ± 46	160 ± 42	170 ± 90	0.001

My… approach… is based on three major principles. The first is to minimize the total amount of ultrasound energy delivered into the eye in order to protect the incision and perform the safest procedure.

Yuri Takhtaev, MD

torsional ultrasound with a micro-coaxial approach yields synergistic benefits and represents a revolutionary advance for the cataract surgeon and, more importantly, for our patients.

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1. Vasavada A, Singh R. Step-by-step chop in situ and separation of very dense cataracts. J Cataract Refract Surg 1998;24:156-9.

2. Vasavada AR, Raj SM, Patel U, et al. Evaluating intra-operative performance and post-operative outcome of torsional versus longitudinal phacoemulsification: a prospective randomized masked clinical trial. Presented at the XXV Congress of the ESCRS, September 8, 2007; Stockholm, Sweden.

DISCUSSION

Audience member: What tip do you use for torsional ultrasound for these hard cataracts?

Dr. Vasavada: I've used a 45-degree Kelman tip for a number of years and now have a 45-degree Kelman 0.9-mm Mini-Flared ABS tip that I use for torsional ultrasound in all cases regardless of nuclear density. While I originally would use a little bit of longitudinal ultrasound in combination with torsional to help clear any clogging, I have found it is not necessary if I reduce the foot pedal treadle in foot position 3 to 10% in order to increase the torsional energy.

Dr. Tjia: Tip selection is very important when using torsional ultrasound. A Kelman or angled tip is most optimal because those tips, with their angled design, amplify the benefits of the oscillatory movement of torsional technology. With regard to CarOziling, that technique is done most effectively with use of a 45 degree bevel Kelman tip that allows the continuous repositioning of the nuclei to happen automatically. There have been reports of clogging with the use of 30 degree mini-flared tip, and these problems are more likely to happen when using low torsional power settings. As Dr. Vasavada explained, he has been able to avoid this through the use of continuous application of higher power that he achieves by stepping down to low treadle in foot position 3. An alternate solution, is to use a taper tip or micro-tip, either of which have a larger shaft than the mini-flared tips. The only modification surgeons need to make with use of a taper tip or micro-tip is to lower the aspiration rate to compensate for the lower irrigation flow they provide. ■

Considerations in Implementing Micro-Coaxial Technology

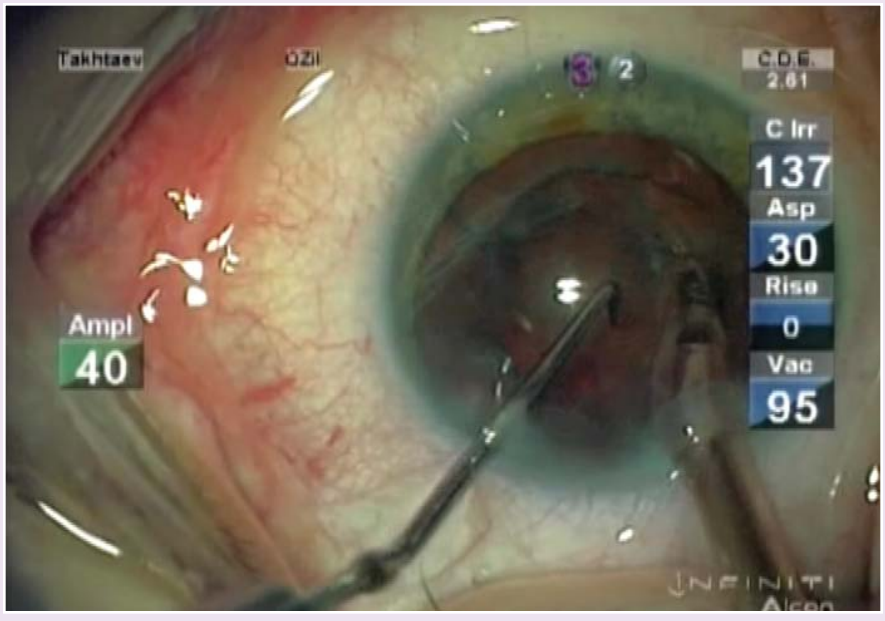
Yuri Takhtaev, MD
St. Petersburg, Russia

Micro-coaxial phacoemulsification encompasses surgery performed through an incision size of 2.4-mm or smaller. There are a few new technical elements necessary for this approach. Surgeons will need a special knife for creating the micro-incision and a new micro phaco tip with a smaller irrigation sleeve. Otherwise, there is no need to deviate from one's routine technique or to overcome a learning curve before implementing micro-coaxial phacoemulsification in clinical practice. I have found a new steel blade (INTREPID™ ClearCut™) a good choice for creating a 2.2-mm incision. Surgeons can use their preferred method for creating the capsulorhexis using whatever instrumentation they prefer as well as their favored approach for nuclear fracture. I believe cross-action forceps represents the best instrument choice for performing the capsulorhexis through a sub-2-mm incision, whereas traditional forceps are preferred when working through a 2.2- or 2.4-mm incision.

My personal approach to surgery is based on three major principles. The first is to minimize the total amount of ultrasound energy delivered into the eye in order to protect the incision and perform the safest procedure. An important factor in achieving that goal is to use a mechanical nuclear fracture technique to disassemble the nucleus. My method of choice is the quick chop technique, and I use traditional longitudinal ultrasound in burst mode to bury into and hold the nucleus while dividing it. Then I use the continuous torsional mode for quadrant removal as this power modulation better protects the incision and yet is very effective for all kinds of cataracts (Figure 3).

As a second principle, appropriate use

FIGURE 3.



"…I use the continuous torsional mode for quadrant removal as this power modulation better protects the incision and yet is very effective for all kinds of cataracts."
Yuri Takhtaev, MD

of ophthalmic viscosurgical devices (OVDs) is critical to assure optimal protection of the ocular tissues and the incision. I use the dispersive agent Viscoat® (Alcon Laboratories) in every case for corneal protection. Importantly, there is less of a tendency for Viscoat to be aspirated during phacoemulsification when using torsional ultrasound. I also fill the anterior chamber with DisCoVisc® (Alcon Laboratories), a viscous-dispersive viscoelastic for implantation of the IOL.

Instilling an OVD to create and maintain a firm eye during implantation through the 2.2-mm incision is also critical. Comparisons of available OVDs show there are important differences in the performance of cohesive and dispersive agents during IOL implantation. Although ProVisc is well-suited for expanding the capsular bag for IOL implantation, it may be lost from the side port when pressure is exerted during IOL implantation. Viscoat remains in the eye better than ProVisc, but is more difficult to aspirate at the end of the surgery. DisCoVisc offers the benefits of both types of OVDs as it expands the bag, maintains a full chamber during the implantation, and allows for easy OVD removal at the end of the case.

A counter-traction technique is needed for the IOL implantation when using a C cartridge and is performed by using the left hand to introduce a second instrument through the side port incision while applying firm and steady pressure on the injector. For this approach I prefer using the Royale spring injector (ASICO).

DISCUSSION

Dr. Vasavada: I would like to comment on the suggestion Dr. Takhtaev made to use DisCoVisc. We evaluated intraoperative performance in a number of cases of difficult cataracts and found that while the soft shell technique combining two viscoelastics, the dispersive agent Viscoat and the cohesive OVD ProVisc, worked well, it is also possible to perform the entire surgical procedure using DisCoVisc alone. Taking our observations one step further, we conducted a prospective, randomized study comparing DisCoVisc against the soft shell technique using Viscoat and ProVisc. The results showed there were similar protective effects in our surgical groups. ■

There is no need to deviate from one's routine technique or to overcome a learning curve before implementing micro-coaxial phaco-emulsification in clinical practice.

Yuri Takhtaev, MD

Using torsional, I notice that there is no surge, no chatter, and almost no repulsion of nuclear material.

Robert Osher, MD

Micro-Coaxial and Torsional Phaco: Challenging Cases

Robert Osher, MD
Cincinnati, Ohio, USA

Since the inception of cataract surgery, we have witnessed an evolution toward smaller and smaller incisions. Three years ago, I predicted surgeons would become convinced that micro-coaxial phacoemulsification performed through a 2.2-mm incision using a new ultra sleeve was a superior operation and that the majority would switch to this new technique for lens removal. However, a year later I realized my assessment was incomplete because I was using a less-efficient longitudinal ultrasound (Figure 4). I now believe that micro-coaxial phacoemulsification through a 2.2-mm incision using torsional technology represents the safest operation for lens removal, and with its advantages, it will be rapidly adopted and become the most widely performed surgical technique.

One case that I performed last week provides an exceptional example for demonstrating the safety and efficiency of cataract surgery with torsional and micro-coaxial technology. The case involved a white cataract in a patient who presented with hand motion vision. The procedure was performed through a 2.2-mm, 3-plane incision. After instilling the ophthalmic viscosurgical device (OVD), I stained the capsule with trypan blue (Vision Blue, DORC International BV) and created a safety capsulorhexis with a bent 22-gauge needle. I then loosened the lens with hydrodelamination and hydrodissection and refilled the chamber with the OVD. With this modified flare phaco tip placed bevel down and a vacuum of 250 mm Hg, a divot was created in the lens to allow space for safe fluid movement beneath the OVD. Then I turned the bevel up and began shaving the nucleus to create a trough with a very low vacuum setting at 40 mm Hg because occlusion never occurs during sculpting. Then the nucleus is divided into hemispheres and the vacuum is increased to 190 mm Hg. Using torsional ultrasound, I imbedded the phaco tip into the hemisphere and proceeded to chop. With torsional ultrasound, lens removal is completed with extreme efficiency and minimal turbulence or lens chatter. Finally, the cortex is removed using a silicone I/A tip.

An important advantage of the micro-coaxial technique is that it affords the thermal protection benefit of having a sleeve over the phaco tip. That feature is especially relevant when operating on hard cataracts where thermal injury can be a significant concern. While results of multiple studies demonstrate that the presence of a sleeve over the phaco tip helps to protect against thermal injury, use of torsional ultrasound provides an added benefit. A study presented by Richard Mackool, MD, showed that use of torsional ultrasound was associated with a decrease in temperature rise of about 60% compared with longitudinal ultrasound.[1]

There has been significant discussion about tip profiles. My own preference is for a less curved tip than the present 20 degree angled Kelman tip.

A straight phaco tip is favored by cataract surgeons worldwide. However, maximal enjoyment of the benefits of torsional requires that the tip have some slope or curvature (Figure 5). After switching to an angled tip, I found the slope was an asset for achieving improved torsional efficiency but also provided this extra thermal protective benefit.

The micro-coaxial technique consistently results in excellent self-sealing incisions, and independent studies from several leading surgeons, including Dr. Abhay Vasavada, Dr. Doug Koch, and Dr. Terry Kim, have all demonstrated the superiority of these incisions compared to the incisions created for bi-manual micro-incisional surgery. This feature of incision integrity combined with the stable chambers, minimal turbulence, and high efficiency of lens removal associated with micro-coaxial phacoemulsification using torsional ultrasound convince me that it is absolutely the best operation available for my patients. Its benefits are confirmed by the appearance of this eye on the first postoperative day with a clear cornea and the uncorrected visual acuity of 20/20.

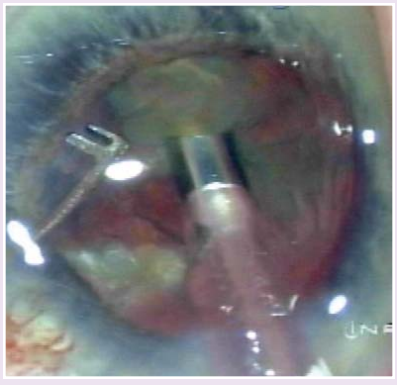
Another surgical case that I recently performed was very interesting because it involved a patient with a relatively hard cataract who was referred for surgery with a coexisting iris dysgenesis. The iris pathology was segmental and characterized by an area where there was only pigment epithelium without overlying stroma. This case afforded a unique setting to appreciate the gentleness of the micro-coaxial technique with torsional ultrasound because any turbulence created in the anterior chamber during the procedure would certainly liberate pigment.

I used the same approach as in the prior case, beginning by creating a space in the lens with the phaco tip placed bevel down and using a vacuum of 250 mm Hg. Once a divot in the lens was made, I turned the bevel up and sculpted deep into the nucleus. The hemispheres were divided, chopped into quadrants at 190 mm Hg vacuum, and emulsified using a new proprietary torsional program. Using torsional I notice that there is no surge, no chatter, and almost no repulsion of nuclear material. As a result, the iris is undisturbed. On the day after surgery, I was pleased to find no evidence of pigment on the endothelium, a finding I attribute to the unsurpassed chamber stability and gentleness of surgery using the micro-coaxial technique with torsional ultrasound.

These two challenging cases showcase the benefits of micro-coaxial phacoemulsification using torsional ultrasound. At the 2007 ASCRS Symposium, I presented the results of a study conducted by Dr. Fabio Vaz, a past fellow. He reviewed 100 consecutive cataract surgery patients who underwent 2.2-mm micro-coaxial phacoemulsification using the INFINITI platform with torsional ultrasound. On the first day after surgery, 98% of eyes attained uncorrected visual acuity of 20/40 or better and 62% achieved 20/25 or better unaided visual acuity. These superb results provide convincing evidence confirming the gentleness of this procedure that combines a revolutionary new surgical technique with the most advanced lens removal technology.

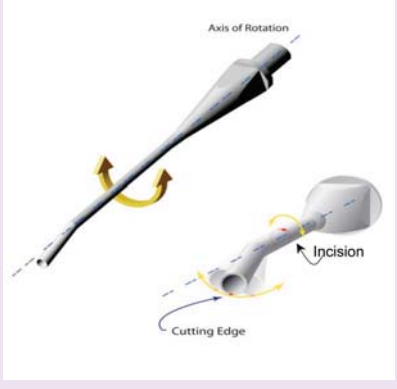
Regardless of a surgeon's preferences for settings and lens removal technique, the INFINITI with torsional ultrasound represents an outstanding platform because it permits adjustment of every parameter. With its opportunity for customization, surgeons can create the operating conditions in which they are most comfortable. This feature makes the INFINITI an excellent choice for multiple surgeons sharing a single unit or for an individual who needs to perform a spectrum of cases presenting different clinical findings and surgical demands. ■

FIGURE 4.



"Micro-coaxial phacoemulsification through a 2.2-mm incision using torsional technology represents the safest operation for lens removal."
Robert Osher, MD

FIGURE 5.



"After switching to an angled tip, I found the slope was an asset for achieving improved torsional efficiency but also provided this extra thermal protective benefit."
Robert Osher, MD

REFERENCE:
1. Mackool RJ. Lens removal/torsional phacoemulsification: advantages of nonlinear ultrasound. Presented at: Annual ASCRS Symposium on Cataract, IOL and Refractive Surgery, March 17-22, 2006; San Francisco, CA

An important advantage of the micro-coaxial technique is that it affords the thermal protection benefit of having a sleeve over the phaco tip.

Robert Osher, MD

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