

## Paris 2004

# New Trends in Cataract Surgery

## MICS proponents discuss its advantages and how they are achieved

**Cheryl Guttman**  
in New Orleans

INTRODUCED just a few years ago, bimanual microincision cataract surgery (MICS), a term created by Jorge Alio MD, has generated significant interest. Some surgeons have become strong advocates, others have tried it and discarded it, and others are still waiting as controversy about its benefits and drawbacks continues.

In a symposium focusing on “New Trends in Cataract Surgery” during the XXII Congress of the European Society of Cataract & Refractive Surgeons, speakers reviewed evidence supporting the use of bimanual MICS and the advances in technique and technology that they said make it a safe, effective, and efficient procedure.

Looking at MICS from a scientific perspective, Randall J. Olson MD, professor, chair, and director, John A. Moran Eye Institute, University of Utah School of Medicine, Salt Lake City, noted that well-conducted studies are needed to address the potential barriers of all procedures before they can be comfortably adopted into clinical practice.

Reviewing the literature, Dr Olson concluded there is ample scientific information to demonstrate bimanual MICS is at least as safe and effective in many respects compared with coaxial phacoemulsification. He also presented data that are accumulating to support the conclusion that MICS may have a number of advantages, although he acknowledged further study is needed to establish those benefits conclusively.

Three main concerns have been raised about bimanual MICS, but have all been adequately addressed. Those concerns relate to the potential of MICS to increase the risk of incisional burns, be inapplicable in difficult cases and hard cataracts, and be less efficient compared with conventional coaxial phaco.

Dr Olson noted corneal burns have occurred with MICS as they have with coaxial phaco. However, based on the results of four published studies, including three in vitro experiments and one in vivo trial, the risk with MICS appears to be no greater than with coaxial surgery, and it may even be less.

“The fact that microincisions always leak, the thermal advantages of pulse and ultrapulse technology, and experience from the field further indicate that wound burn is not a concern differentiating MICS from conventional coaxial surgery,” Dr Olson said.

### Suitable for nearly all cataracts

With respect to applicability across the wide spectrum of cataract cases, Dr Olson cited his own recently published paper and two other larger, earlier series showing that good results can be achieved in eyes with very hard cataracts. He further proposed that MICS might be preferred in certain challenging cases.

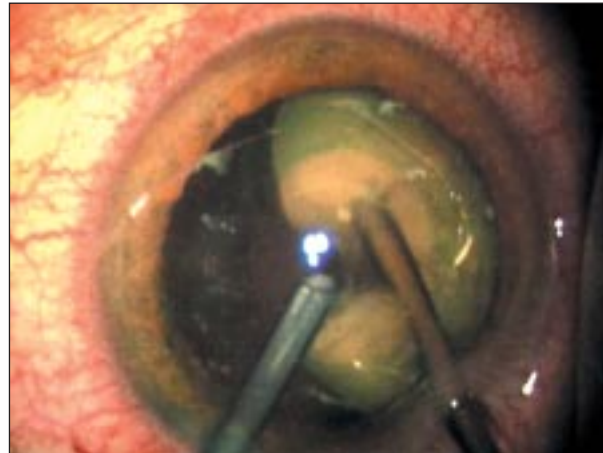
“MICS offers increased control of the anterior capsule during capsulorhexis, which may be beneficial in eyes where there is concern about stability of the capsule, chamber or iris. In addition, by providing the opportunity to switch instruments in the incisions, MICS eliminates the issue of residual sub-incisional cortex and facilitates surgery in eyes with sectoral zonular loss or iris damage,” Dr Olson said.

**“There are a number of confounding variables that can affect the outcome of endothelial cell loss so that a study demonstrating a definite benefit of MICS may be difficult to do”**

*Randall Olson MD*

He acknowledged that early in its evolution, MICS was slower and less efficient than coaxial surgery. However, advances in technology and technique, particularly developments in irrigation instrumentation and use of pressurised infusion systems, have narrowed the gap such that if there is any difference in length between the two procedures, it is probably less than one minute.

“Inappropriate instrumentation led some surgeons performing MICS to abandon the technique early on. However, I am pleased to say issues relating to irrigation are rapidly disappearing, and I believe that



*Hypermature cataract undergoing MICS with 21 ga technology. The patient had no complications with a clear cornea the next day.*

*Courtesy of Randall Olson MD*

future developments will further equalise the playing field,” Dr Olson said.

### Safety benefits controversial

While the major objections against bimanual MICS have been resolved, studies are also beginning to emerge suggesting the procedure affords a number of safety advantages. Dr Olson noted that Jorge Alio MD has reported a benefit of MICS for reducing the capsular rupture rate, and he mentioned there are two studies documenting reduced endothelial cell loss with MICS.

However, there are some conflicting data as well, with some other studies reporting greater endothelial cell loss rates in eyes undergoing MICS compared with coaxial surgery.

“There are a number of confounding variables that can affect the outcome of endothelial cell loss so that a study demonstrating a definite benefit of MICS may be difficult to do. Furthermore, our ability to demonstrate improvement may be limited by our already excellent results. However, my own experience is that the corneas look the same in eyes operated on with MICS and coaxial phaco,” Dr Olson said.

Similarly, while there is a sound rationale to predict reduction in surgically induced astigmatism with MICS when it is performed with implantation of microincision IOLs, the good astigmatism results with current sub 3-mm incision procedures also leave little room for measurably better outcomes.

### May reduce risk of retinal detachment

A reduced risk of retinal detachment is one of the most intriguing potential benefits of MICS. That concept is based on a

hypothesis put forth by I. Howard Fine, MD, who suggests retinal detachment after lens removal procedures is related to anterior chamber collapse and hyperdeepening – events that can be avoided with MICS.

“It would be difficult to conduct a definitive study of that issue, but it is certainly an important consideration, especially for younger patients undergoing refractive lens exchange to treat high myopia,” Dr Olson said.

Other speakers concurred with Dr Olson that developments in instrumentation designed specifically for bimanual MICS have been critical for improving its safety, efficacy, and efficiency.

### Tools for the job

Richard Packard MD, Prince Charles Eye Unit, Windsor, UK, told attendees that in his opinion, there is no ideal keratome for creating the MICS wound. His own preference is for a 15-degree steel knife (Alcon) that creates the correct size incision for his phaco tip and which he enlarges marginally for introducing the irrigating chopper. The incisions should be trapezoidal so as to minimise the entry point into the anterior chamber while being larger externally to facilitate instrument manipulation.



*Phaco instruments for bimanual with Alcon Infinity*

*Courtesy of Richard Packard FRCS*

“It has become obvious to all of us that having instrumentation to match the microincision wounds is one of the most important elements for the success of MICS. Differences in instruments used can account for much of the variation in surgeon experience and outcomes with this technique,” he said.

While bimanual MICS offers an advantage for greater control in capsulorhexis creation, the capsule opening needs to be done with a needle or a microsurgical capsulorhexis forceps. Surgeons who purchase the latter need to be aware that maintaining optimal performance depends



Randall Olson

Randall Olson MD  
Moran Eye Center  
Salt Lake City, Utah  
randall.olson@hsc.utah.edu



Richard Packard

Richard Packard MD  
The Prince Charles Eye Unit  
King Edward VII Hospital  
Windsor, UK  
eyequack@vossnet.co.uk



Graham Barrett

Graham Barrett FRACO, FRACS  
University of Western Australia  
Perth, Australia  
barrett@uniwa.edu.au  
barrett@cyllene.uwa.edu.au



Kari Krootila

Kari Krootila MD  
Helsinki University Eye Hospital,  
Helsinki, Finland  
kari.krootila@hus.fi



Jorge L Alio

Jorge L Alio, MD PhD  
Professor and Chairman of  
Ophthalmology,  
Universidad Miguel Hernandez,  
Alicante, Spain  
jalio@oftalio.com



I Howard Fine

I Howard Fine MD  
Clinical Professor of Ophthalmology  
Casey Eye Institute  
Oregon Health & Science University  
Oregon, US  
hfine@finemd.com

on careful handling and meticulous rinsing of viscoelastic at the end of the case. To enable precise placement of the forceps for starting the capsulorhexis, Dr Packard also recommended novices consider using a capsular dye, even in eyes with a good red reflex.

Multiple irrigating choppers are now available for use in MICS, but Dr Packard cautioned that not all have adequate flow that is necessary to maintain good chamber stability. To address that limitation, Dr Packard has designed an irrigating chopper (Duckworth and Kent) that is 18-gauge and allows a flow rate of 82 cc/min.

He noted that it is even more vital in MICS than in coaxial surgery to ensure there is adequate movement of the nucleus within the capsular bag before attempting removal. However, MICS does present challenges for performing hydrodissection, and before it is attempted, viscoelastic must be removed from the eye.

According to Dr Packard, surgeons should find no reason to change their cataract removal technique. In addition, they can use any of the multiple available phaco machines that offer micropulsing modes and

may use similar settings to those they are used to, varying the power according to the density of the nucleus.

However, he recommended an angled Kelman style as the preferred phaco tip configuration, noting that it improves cutting and tissue manipulation, and sculpts with less energy than a conventional straight tip. Dr Packard added that flared tips are not suitable for MICS.

“Advances in microincision IOL technology may be the driver that draws more cataract surgeons to bimanual MICS. However, we now have the tools for performing true MICS, and I am happy to use this technique because it works well,” Dr Packard concluded.

#### Techniques and technology

Graham Barrett MD, Perth, Australia, also spoke as an advocate for bimanual MICS and presented his perspective on optimal technique and technology for performing that procedure.

“The potential to achieve a truly astigmatism-neutral incision with improved visual outcomes has driven the latest trend to MICS. Pursuing that target is worthwhile if the better visual outcomes can be achieved without compromising safety and efficacy, and so careful attention must be directed to a number of parameters,” he said.

Dr Barrett reported that a suitable high flow irrigation chopper is the most important instrument for MICS as the fluid infusion into the eye via the chopper must equal or exceed fluid lost secondary to aspiration and wound leakage. His preference is an open-ended 19-gauge instrument from Duckworth and Kent that he said provides excellent infusion capacity with less resistance to inflow compared with instruments having a side port opening. In addition, its tip facilitates division of the nucleus.

He also emphasised the importance of correct incision construction to create a well-sealed incision that will not leak excessively around the cannula. After trying several knives, he now uses a 1.6-mm keratome that creates a wound to match a 19-gauge cannula and makes a pre-cut groove to allow easier insertion of the instrument.

Dr Barrett also cautioned that the microincisions generally do not seal as effectively as the larger coaxial incisions.

“In particular, if the incision is being enlarged for implantation of a standard IOL, extra stromal hydration may be needed to enable sealing and obtain a secure wound,” he advised.

## “The potential to achieve a truly astigmatism-neutral incision with improved visual outcomes has driven the latest trend to MICS”

Graham Barrett MD

Dr Barrett recommended raising the bottle height to more than 110 cm to increase infusion, but cautioned that raising the bottle too high can further increase wound leakage. For his machine settings, he prefers using a 50% duty cycle with 120 pulses per second.

While flow-limiting devices, such as cruise control have been reported to be helpful when performing MICS, he prefers the concept of “surgeon control”, i.e., dual linear control with surgeon control of vacuum and allowance for ultrasound to be engaged at whatever level of vacuum.

“That technique avoids inappropriate levels of vacuum that may compromise chamber stability,” Dr Barrett said.

Regarding the technique for cataract removal, he noted that some are better suited than others. His preference is for the phaco-axe technique that produces a quick vertical crack of the nucleus. Relative to techniques relying on sculpting, phaco-axe affords greater energy efficiency, requires use of only modest vacuum levels, and allows for greater safety since vertical manoeuvring is done in the centre of the pupil.

#### Less Phaco time and power

Kari Krootila MD noted that comparative studies indicate that the bimanual MICS

procedure uses less power and less phaco time than conventional coaxial surgery.

In addition, MICS offers better fluid dynamics, a more controlled surgical situation with better anterior chamber stability, and more effective removal of cortex and proliferating lens epithelial cells. Those features translate into use of less fluid and may result in less postoperative inflammation with reduced development of posterior capsule opacification and minimisation of the risk for IOL tilt or decentration, Dr Krootila said, adding:

“MICS provides a number of benefits and has a favourable effect on the postoperative outcome in normal eyes that might be even more meaningful in compromised eyes that are prone to inflammatory changes after surgery,” he said.

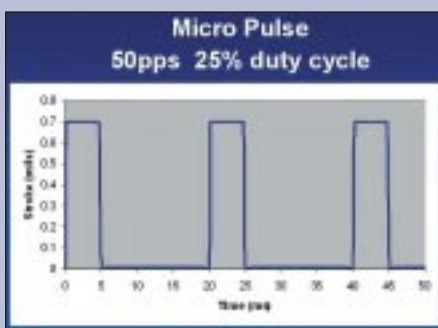
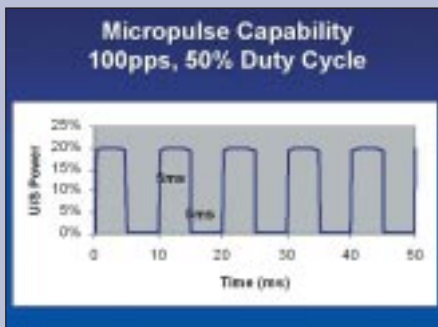
He reported the results from a study that involved 318 eyes that underwent either bimanual MICS using the Sovereign Whitestar™ (AMO) or coaxial phacoemulsification using either Whitestar micropulse or conventional ultrasound technology.

The results showed bimanual MICS with Whitestar™ was associated with significant reductions in average phaco power relative to both comparators, and also significantly reduced effective phaco time compared with the conventional procedure. When eyes were divided into groups by nuclear hardness, the benefits of bimanual MICS persisted regardless of nuclear density, but were most pronounced in eyes with hard cataracts.

## “Postoperative inflammation may cause discomfort, corneal oedema, IOP spikes, and increase the PCO rate.”

Kari Krootila MD

He also reported preliminary data from a randomised study that so far includes about 50 eyes suggesting that bimanual MICS is associated with faster visual recovery. On the first postoperative day, best-corrected



Although various attempts had been made to do bare needle phaco, wound cooling was needed. Micropulse phaco changed all that. First on the Sovereign and now on the Alcon Infiniti, B&L Millenium and machines from Oertli and Geuder.

acuity of 0.5 or better ranged from 75% to 90% in all groups. However, 42% of bimanual MICS eyes achieved best-corrected acuity of at least 1.0 compared with only 18% of eyes in the conventional group and none of the Whitestar coaxial eyes.

By the first postoperative week, 100% of eyes in the conventional surgery and bimanual MICS groups had best corrected acuities of at least 0.5, compared with only 90% of eye in the Whitestar coaxial group. Best-corrected acuity was at least 1.0 in nearly two-thirds of eyes that had bimanual MICS versus half of the eyes in the other two groups.

Inflammation was also reduced by bimanual MICS as measured by the maximum increase in flare. The difference between groups showed a numerical advantage of bimanual MICS at one day, and a statistically significant difference at one week.

“Postoperative inflammation may cause discomfort, corneal oedema, IOP spikes, and increase the PCO rate, and it is a particular risk in patients with uveitis, pseudoexfoliation, diabetes, and perhaps retinitis pigmentosa,” Dr Krootila said.

Rates of endothelial cell loss were similar in the three groups after three months, ranging from 7.1% to 7.4%. After six months, eyes undergoing surgery with micropulse technology had lower rates of endothelial cell loss – 8.8% for Whitestar, 9.7% for MICS – compared with conventional coaxial surgery (12.6%).

Differences were also seen in analyses of the acute IOP response. At the one-day visit, the mean increase from baseline IOP was lower in eyes that underwent bimanual MICS compared to the coaxial Whitestar and conventional groups, 0.6 mm Hg versus 2.5 mm Hg and 3.1 mm Hg, respectively. In addition, none of the eyes in the bimanual MICS experienced an increase in IOP of more than 30 mm Hg compared with 10% of eyes in the conventional phaco group and 13% of eyes operated on with coaxial Whitestar micropulse.

Dr Alio presented results from his own studies of eyes implanted with the Acri.Smart 48S (Acritec) and the Ultrachoice Thinlens (ThinOptx). Both lens types provided good refractive predictability, minimised induced astigmatism, and resulted in excellent distance uncorrected and best-corrected visual acuity. However, pseudoaccommodation appeared superior for the Acri.Smart IOL and this was associated with better near vision.

## “Bimanual MICS has improved outcomes of cataract surgery, and with adequate IOL technology at hand, microincision surgery has now come of age.”

Jorge Alio MD

The Acri.Smart 48S is a standard design, hydrophobic acrylate IOL featuring a 5.5 mm optic. Dr Alio implanted the lens in 45 eyes using the Acri.Glide hydraulic injector system through a mean incision size of 1.49 mm. No complications were encountered and MTF studies indicated that the IOL suffered no damage resulting in optical changes and offered similar optical performance compared with a standard IOL.

Data collected during a mean follow-up of 11 months showed excellent visual and refractive results. The mean sphere and cylinder values were -0.6 D and -1.1 D, respectively, while vector analysis of astigmatism showed a mean change of only 0.38 D

Mean distance uncorrected and best-corrected acuities were 0.7 and 0.9, respectively, while mean values for near vision were 0.6 without correction and 0.9 with optimal correction. The mean near vision add to best-corrected distance vision was 1.2 D, which Dr Alio described as better than expected. Most patients benefited with a gain in near vision, and the IOL was found to have a mean pseudoaccommodative effect of 1.88 D.

The Ultrachoice IOL is an ultra-thin lens with 100 micron thick haptics and an optic that is 50 microns thick at its edges. The optic is 5.5 mm in diameter and has a diffractive-refractive design. It can be placed through incisions of 1.8 mm or less by being scrolled up and inserted with an injector.

Dr Alio analysed data from 50 eyes of 25 patients followed for a mean of 12 months. The results were similar to those achieved with the Acri.Smart 48S with respect to mean incision size (1.56 mm), residual sphere (-0.4 D), residual cylinder (-1.2 D), and change in vector analysis (0.4 D). However, Dr Alio noted that implantation through a 1 mm incision is possible with this IOL with the new Ultrachoice IOL injector.

Mean distance uncorrected and best-corrected acuities were 0.6 and 0.9, respectively. Mean near uncorrected acuity was 0.4, the near vision add to best-corrected distance vision was 2.6 D, and the pseudoaccommodative effect ranged from 0.5 to 1.25 D.

MTF studies showed similarities in optical performance compared with a standard IOL (AcrySof). However, because of its thin lens optics, this lens does not induce spherical aberrations, Dr Alio said.

In contrast to the experience with the Acri.Smart, a few complications were encountered with the Ultrachoice IOL, including one ruptured posterior capsule that led to macular oedema. In addition four lenses tilted or decentred and led to lens exchange in two eyes. PCO requiring YAG laser capsulotomy became necessary in two eyes, but the IOL remained stable after the procedure.

“There is a risk of a high PCO rate if this IOL is not properly implanted, although unpublished data from experiments by Dr Nishi show there is an opportunity for PCO prevention with proper technique. Adequate training is needed to minimise the risk of complications with this IOL, but when acquired, the complication rate should be no higher than with the Acri.Smart IOL,” Dr Alio said.

Special considerations for implanting the Ultrachoice IOL include creation of a capsulorhexis of at least 6 mm. In addition, the bag needs to be opened wide with viscoelastic, and then adequate positioning is achieved by visual control using the haptic tear hole. The IOL should never be rotated and the lens optic needs to be stabilised against the posterior capsule with avoidance of residual viscoelastic behind the lens.



Courtesy of Howard Fine MD

### Expanding the envelope for MICS

Howard Fine MD told symposium attendees that refractive lens exchange (REFLEX) is an important modality for treating presbyopes and that bimanual MICS offers a new measure of safety and efficacy for performing that procedure.

“With contemporary techniques and technology, cataract or lens extraction has become incredibly safe and efficacious and provides excellent refractive outcomes. As a result, cataract surgery has continued to evolve into refractive surgery. We believe removal of the crystalline lens and replacement with a pseudophakic lens will become the dominant refractive surgery procedure in the future, as it can address all components of refractive error, including presbyopia. Bimanual MICS brings added advantages as it affords excellent control and maximises safety because the procedure is always performed at the level of the capsulorhexis, equidistant from the posterior capsule and corneal endothelium,” he said.

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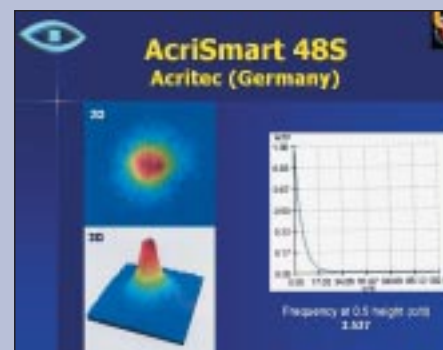
Howard Fine MD

In various patient series, Dr Fine and colleagues have achieved high rates of spectacle-free vision with binocular implantation of either the refractive multifocal IOL (Array) or the accommodative IOL (CrystaLens, Eyeonics). In his most recent analysis of 124 patients implanted with the CrystaLens, 73% achieved acuity of 20/25 or better at near, intermediate, and distance.

“However, quality of life is the most important measure of effectiveness, and those data document that the same percentage of patients – 74% – consider themselves completely or almost completely spectacle independent,” Dr Fine said. ■



Courtesy of Jorge Alio MD



### IOL advances

IOLs that can be placed through incisions 1.5 mm and smaller and fulfilling the desired criteria for a pseudophakic implant are now on the market. The availability of these lenses, combined with the benefits of MICS, support use of that procedure as the standard approach for cataract removal, said Jorge F Alio MD PhD.

“Bimanual MICS has improved outcomes of cataract surgery, and with adequate IOL technology at hand, microincision surgery has now come of age,” he commented.