The term microincisional cataract surgery (MICS) was coined and registered by me in 2001 to define cataract surgery performed through incisions of 1.8 mm or less. Those who truly understand this concept realize that MICS is not only about a smaller incision size; rather, it implies a global transformation toward minimally aggressive cataract surgery.

Separated fluidics for irrigation and aspiration and high vacuum with pressurized inflow of fluid are necessary for MICS. Especially in the case of soft cataracts (grades 2 or 3), the use of ultrasound can be decreased or practically eliminated, as high vacuum and infusion permit lens material to be smashed and aspirated without ultrasound power. Removal of harder cataracts must be supported with minimal doses of ultrasound energy; however, these smaller doses reduce the risk of overheating at the phaco tip and prevent thermal injury to the cornea compared with the level of energy used during conventional cataract surgery.

THE TRANSITION TO MICS

Because complications can occur during the learning curve, transition to MICS must begin with an understanding of its basic principles, including incision creation, fluidics, power modulation, and instrumentation. A grasp of these concepts will increase the surgeon’s chances of maintaining anterior chamber stability and wound integrity.

Incision. The smaller incision sizes used in MICS decrease the dimensions of the wound, create less trauma, and promote faster healing, the last of which reduces the risk of bacterial infection. Moreover, watertight wound construction decreases the likelihood of iris prolapse, and the absence of surgically induced astigmatism allows better control of the refractive outcome. Among the requirements for use of MICS are special surgical instruments and foldable IOLs, both of which are discussed in detail below.

Fluidics. Fluid management is essential in MICS, and the proper phaco pump set-up is one that helps the surgeon implement the stages of surgery without complications. Fluid inflow should be balanced by outflow; this can be maintained by controlled pressurized infusion. Some MICS platforms, such as the Stellaris (Bausch + Lomb, Rochester, New York), are supported by an internal pump that creates pressurized infusion. The goal should be to maintain an infusion of fluid greater than the outflow, thereby preserving the anatomy of the anterior segment and allowing the infusion to act as a tool to break up the cataract. During occlusion, high pressure in the aspiration tip can fracture the masses without the need for ultrasound power. Pressure dysregulation can lead to anterior chamber collapse and intraoperative hypotony, as are seen with standard coaxial phacoemulsification.

Postocclusion surge can occur when the occluded mass is
aspirated suddenly, causing the pressure in the anterior chamber to drop quickly. Some of today’s phaco machines include software that prevents surge, such as the Sovereign (Abbott Medical Optics Inc., Santa Ana, California), which uses a virtual anterior chamber to decrease vacuum at the precise moment of occlusion. Another strategy is to use a flow restrictor, which is connected to the aspiration tube to control inflow, such as the Cruise Control System (STAAR Surgical, Monrovia, California; Figure 1A) or the StableChamber Fluidics System (Bausch + Lomb; Figure 1B). These small filters restrict the flow so that surge does not exceed the limit values.

Power modulation. Varying the power modulation during phacoemulsification improves the efficacy of cataract surgery. Strategies include pulsing ultrasound, which can dramatically diminish energy delivery into the eye, and varying on-off times and shortening pulse duration, which help achieve emulsification while protecting the corneal wound and endothelial cells. Very short power modulation techniques such as hyper pulse and ultra pulse dramatically decrease the potential for wound burn during MICS because heat penetrates the cornea during the on-time cycle but decreases during the off-time cycle, cooling the phaco tip and cornea. Additionally, short pulse energy may be more effective because it produces more cavitation energy than continuous power.

MICS INSTRUMENTATION

In my hands, MICS is performed with a bimanual technique. For a video demonstration of my technique, visit http://eyetube.net/?v=newev. I create two incisions of equal length, allowing me to use the same instruments in either wound and providing me with complete access to the anterior chamber. Having two microincisions is helpful during anterior and posterior capsular polishing and cortical and nuclear fragment removal. Instrumentation is available for
standard bimanual MICS (19 gauge) and bimanual micro-
MICS (22 gauge).

**MICS 19-gauge.** Instrumentation for 19-gauge MICS
must fit through a 1.5-mm incision. The first necessity is the
appropriate calibrated knife, and I prefer the trapezoidal
Alió MICS Knife (Katena Inc., Denville, New Jersey; Figure 2).
An alternative instrument is a diamond knife with the same
proportions (Figure 3).

Regardless of the phaco technique used, a continu-
ous curvilinear capsulorrhexis (CCC) is essential. When
targeting CCC creation through a 1.25-mm incision,
the use of microforceps is obligatory. I use the pointed
catch of the 23-gauge Alió MICS Capsulorrhexis
Forceps (Katena Inc.; Figure 4) to create the tear in the
anterior capsule. Following the CCC and hydrodissec-
tion and hydrodelineation, I perform prechopping
with either the Alió-Rosen MICS Phaco PreChopper
(Katena Inc.; Figure 5A) or the Alió-Scimitar
Prechopper Micro Incision Cataract Surgery (Katena
Inc.; Figure 5B). The shape of the Scimitar Prechopper,
with its curved tip, blunt end, and sharp inferior edge,
is designed to facilitate 700-µm surgery. The choppers
are crossed by situating each one symmetrically oppo-
site to the other, and cutting movements are made
from the perimeter to the center of the nucleus. After
creating two hemispheres, I rotate the nucleus approx-
imately 90° and repeat the process. In the near future,
femtosecond laser technology for cataract surgery will
facilitate the prechopping process.

Bimanual phacoemulsification is performed with the
irrigating chopper in one incision and the sleeveless
phaco tip in the other, depending on the location of
corneal astigmatism, surgeon preferences, and intraopera-
tive conditions. For standard bimanual MICS in softer
cataracts, I use the Alió MICS Irrigating Stinger (19-gauge
manufactured by Katena Inc., Figure 6; 25-gauge manufac-
tured by MicroSurgical Technologies, Redmond,
Washington, Figure 7). The 1-mm irrigation hole is locat-
ed on the bottom lower side of the tool. The very thin
walls of the instrument increase the internal diameter and
achieve an infusion rate of 72 cc/min. Infusion is directed
toward the bottom of the device to assure excellent flow
and to chill the phaco tip. When infusion is used to direct
the liquid toward the lens masses at the back of the bag,
anterior chamber stability is maintained independent of
high vacuum settings. The strength of the stream keeps
the capsular bag at a safe distance from the phaco tip and
eases the manipulation of tools and lens masses. The
remaining cortical cells are removed with the Alió MICS
Aspiration Handpiece (Katena Inc.; Figure 8).

**MICS 22-gauge.** The 22-gauge (0.7-mm) Alió Stinger irri-
gating chopper Duet System (MicroSurgical Technologies;
Figure 9) has one hole on the inferior side of the cannula
that focuses the infusion stream posteriorly, forcing cataract
fragments to levitate toward the phaco tip. This design
helps to keep the anterior chamber deep and to keep the
capsule far from the phaco tip. When using 0.7-mm instru-
ments, 100 mm Hg pressurized infusion is mandatory. The
pointed tip of the Stinger is angled downward.

**IMPROVED SURGICAL OUTCOMES**

MICS improves postoperative refractive results, as surgically
induced astigmatism and optical aberrations are bet-
ter controlled with a smaller incision size.1-4 Additionally,
MICS techniques decrease effective phaco time and mean

**TAKE-HOME MESSAGE**

- MICS is part of a global transformation toward minimally
  aggressive cataract surgery.
- A thorough transition to MICS requires understanding
  incision creation, fluidics, power modulation, and
  instrumentation.
- With bimanual MICS using two equal-sized incisions, all
  instruments can be used in either wound to provide
  complete access to the anterior chamber.
phaco power use across all cataract grades.

Today’s biggest limitation to widespread use of MICS is the small selection of IOLs that fit through microincisions; however, recent availability of select microincision premium IOLs has stimulated the popularity of MICS. This technique is essential for premium lenses because it allows precise control and correction of astigmatism as well as accurate manipulation of total eye aberrations.3,6-8

MICS, whether biaxial or coaxial, is the best surgical option today for cataract removal. Micro-MICS (through incisions of less than 1 mm) may be feasible in the future, but for this to happen IOL technology must be further developed. To watch micro-MICS, visit http://eyetube.net/?v=gobez. The continued evolution of laser cataract surgery and IOL technology will make MICS the gold standard of cataract surgery in the immediate future.

Jorge L. Alió, MD, PhD, is a Professor and the Chairman of Ophthalmology at the Miguel Hernandez University, Alicante, Spain, and the Medical Director of Vissum Corp., Spain. Professor Alió states that he is a paid consultant to Topcon, Oculentis, and Carl Zeiss Meditec and has a royalty agreement with Hanita. He may be reached at tel: +34 96 515 00 25; e-mail: jialio@vissum.com.