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CO-MICS: the future is small

Highlights from an expert roundtable meeting discussion on coaxial microincision cataract surgery

Part 2 of a two-part series

CO-MICS: the future is small

Highlights from a roundtable discussion on coaxial microincision cataract surgery

Introduction

On 24 February 2007, a roundtable meeting was convened at the Sacher Hotel in Vienna, Austria, to discuss microincision cataract surgery (MICS) and its place in a cataract surgeon's practice, both today and in the future.

Specifically, a panel of experts was assembled to discuss coaxial microincision cataract surgery (CO-MICS) — coaxial cataract surgery through incisions of between 1.6 and 1.8 mm using specific instruments designed by the Swiss firm Oertli Instruments.

Speaking frankly of their experiences with CO-MICS — its advantages, limitations, how it compares with other forms of surgery, ease of implementation, surgical technique and learning curve — the panel provided an honest account of what it is like to work with CO-MICS in everyday practice.

In June 2007, the first supplement to emerge from this roundtable discussion was published.[1] To reiterate the key findings of the first installment; overall the panel felt that there was little, if any, future for bimanual microincision cataract surgery, owing largely to its association with an increased risk of incision leaking and chamber instability. CO-MICS, on the other hand, was found to be associated with good deformation stability, astigmatism-neutral incisions and wound tightness.

Although only recommended so far for use in special indications, widespread adoption of the procedure is anticipated in the future. In particular, with firms such as Bausch & Lomb, *Acri.Tec, Carl Zeiss/Ioltech, ThinOptX, Lenstec, Acrimed, W20 Medizintechnik and Rayner producing foldable lenses designed to be implanted through microincisions, other intraocular lens (IOL) manufacturers are sure to follow suit. This combination of new surgical techniques, instruments and lenses will undoubtedly change the way surgeons perform cataract surgery in the future.

The panel also pointed out that a slightly longer surgical time was required to perform CO-MICS, in comparison to standard cataract surgery but, on the whole, the benefits were found to outweigh any limitations of the procedure.

This second supplement of the series will focus, in more detail, on the surgical technique required to perform CO-MICS, from beginning to end; the aim being to demonstrate exactly how CO-MICS can be integrated into a practice and what outcomes one can expect from this new form of surgery.

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OTE: Let's begin by discussing anaesthesia. Do you adopt any different methods of anaesthesia when performing CO-MICS in comparison to other cataract surgery techniques?

All: No.

Dr Prünte: Topical anaesthesia is still used in the same way with CO-MICS as with all other techniques.

OTE: Okay, and incisions? What incision would you make with CO-MICS? What issues are critical in making the incisions?

Dr Menapace: With the incision sizes required for current phaco and IOL surgery, I use a temporally located posterior limbal incision because it provides for greater deformation stability of the wound and topographical stability of the cornea compared with a clear corneal incision (CCI), and allows for quick wound healing. However, the transconjunctival approach sometimes results in bleeding, which is cosmetically undesirable, and may cause foreign body sensation, which may jeopardize the wound by triggering eye-rubbing. Reducing the incision width to less than 2 mm dramatically improves the resistance of a CCI to deformation and its impact on corneal topography, making CCI the preferred blood- and irritation-free option.

With regards to the instrumentation for creating the wound, this has not changed with CO-MICS; I still use a bevel-up metal blade rather than a diamond blade to create a non-stepped single-plain incision. What has changed, however, is that, already for the phacoemulsification procedure, I now slightly widen the inner aspect of the corneal tunnel to make it funnel-shaped in order to reduce the stress to the corneal lip and the adjacent endothelium caused by instrument manipulation.

OTE: What incision size do you make?

Dr Menapace: 1.6 mm with CO-MICS. Of course, this has to be widened for implantation depending on the IOL being used.

OTE: And the rest of the panel?

Dr Breyer: I start with a 1.6 mm incision with CO-MICS, which I widen to 1.8 mm for lens implantation (*Acri.Smart; *Acri.Tec).

Dr Marcon: For CO-MICS, I use a 1.7 mm metal blade. Usually I enlarge the incision to 2.2 or 2.3 mm to insert the IOL; a surgeon has many choices of lens when implanting through an incision of this size. I also still use the three-plane incision for standard 19-gauge phaco — I perform a pre-incision, a vertical pre-incision and then I go inside the eye. I employ this method with every incision size I make, whether it is 1.7 mm or 3.2 mm.

Dr Dosso: I am doing the same. I currently use disposable knives to make a three-plane incision; I haven't changed my method of incision since I began performing microincision surgery.

Dr Prünte: I do a straightforward clear corneal incision, also preferably 1.7 mm in size.

OTE: Are you still concerned about inducing astigmatism when making smaller incisions and do you still take necessary precautions to prevent this?

Dr Menapace: According to previous studies using topographical batch-analysis, CO-MICS through a 1.6 mm CCI will not induce any astigmatism within the 5 mm optical zone.

OTE: Would you all agree?

All: Yes.

Dr Marcon: Regarding astigmatism, in my experience, the tightness of the wound must always be checked after the operation. IOLs, implanted through a very small incision, can stretch the wound and the result can sometimes be a wound that is not very tight. Although I am not concerned about inducing astigmatism with CO-MICS, I would recommend that the wound is checked immediately postoperatively.

Problems, however, do arise when you are treating patients with congenital astigmatism. In these patients, you have to either alter the incision or use other techniques to correct it. Certainly, astigmatism correction during cataract surgery will not yield an accurate correction, however, if a cataract surgeon is able to reduce a congenital astigmatism to an extent, the patient will always appreciate this.

OTE: What advice would you give to a budding CO-MICS surgeon regarding these small incisions? Is it easier or more difficult to make a smaller incision?

Dr Menapace: Smaller incisions are easier to create than large ones and are more forgiving. However, attention to the details mentioned above optimizes wound sealing, and minimizes tissue trauma when paired with delicate instrument manipulation during phaco and IOL insertion.

Dr Prünte: I think it is easier to make a small incision than it is to make a large incision. I would advise the CO-MICS beginner not to start with a 1.5 mm incision, because this will add stress to the cornea, but they should gradually reduce their incision sizes as their experience with the technique grows.

Dr Menapace: The beginner may start out with a 20-gauge tip and then move on to CO-MICS once he or she has become accustomed to it.

Chamber stability is much better now with CO-MICS

Dr Dosso

The fact that there is less post-occlusional surge, coupled with the fact that the tunnel or incision preparation is easier with CO-MICS, makes learning the overall technique easier for the beginner

Dr Breyer

OTE: Let's move on to the next surgical step — making the capsulorhexis. Did you have to change your approach to this stage of surgery?
Dr Breyer: No. I still prepare two paracentheses for I/A and perform the capsulorhexis with a bent needle through one of those incisions.
Dr Marcon: I simply changed the forceps.
Dr Dosso: I did find it difficult to use the forceps when I began performing CO-MICS, simply because you have a smaller range of motion for manoeuvring the instruments. After a few cases, however, this does become easier and there is a learning curve with this technique.
Dr Marcon: The particular forceps required for this procedure are more expensive than normal so this would pose a problem, for example, for public hospitals.

OTE: But the learning curve for CO-MICS, I understand, is not too great?
Dr Dosso: No, no, the learning curve is fairly gentle.

OTE: Now we should discuss the next stage of the surgery — phacoemulsification. First of all, I would like to ask about the pump system that you use and how you changed your pump settings for CO-MICS?
Dr Dosso: I didn't change my pump system when I began performing CO-MICS but I did change the vacuum. In the past, I worked with 170 mmHg of aspiration but now I use 300 mmHg.

OTE: So you are still using the peristaltic pump?
Dr Dosso: Yes.

OTE: And you didn't change the flow rate at all?
Dr Dosso: No.

OTE: What are your impressions of the followability and holdability with the new settings now?
Dr Dosso: I find it very stable; I have not experienced any problems.

OTE: What is the experience of other peristaltic pump users around the table?
Dr Menapace: I mainly use the peristaltic pump but I also use the venturi pump. Since I introduced CO-MICS into my practice, I have increased the vacuum significantly; with 19-gauge surgery, I used a vacuum setting of 150 mmHg for nucleus fragment conquering. With CO-MICS, I increased it to 300 to 400 mmHg.

OTE: So the changes you made to the vacuum are comparable to those Dr Dosso mentioned earlier; an approximately 150 mmHg increase in vacuum?
Dr Menapace: Yes
Dr Marcon: I have always used the peristaltic pump; this is something that I haven't changed. I have, however, increased my vacuum rate settings from 280 to 300 mmHg (with 19-gauge surgery) to 400 mmHg with CO-MICS, in order to increase the holdability of the fragment. Another parameter that I change is phaco power, which I increase by 30 to 35% when performing CO-MICS. In certain cases, I increase the phaco power by 40 to 45% from the standard, when presented with a hard nucleus. Flow rate has remained the same at 30 cc/minute.

OTE: Do you use the pulse powers?
Dr Menapace: Yes, I have also been using a pulse mode, specifically that with 40 pulses per second. This is the same whether I am performing standard phaco or CO-MICS.

OTE: So to summarise, all of the peristaltic users around the table increase their vacuum limit by about 150 mmHg. What about chamber stability, how does it compare with 19- or 20-gauge?
Dr Dosso: Chamber stability is much better now with CO-MICS [agreement from all others] (**Figure 1**).

OTE: Let's ask our more experienced users, what did you change and what are your experiences?
Dr Prünte: I have doubled my vacuum settings from 150 mmHg, which I used for 20-gauge surgery, to 300 mmHg for CO-MICS. I admit that it did take around three to four procedures before I felt comfortable doing this, because I was concerned about chamber stability. However, stability is not a problem even at 300 mmHg.
Dr Menapace: I would urge anyone considering using CO-MICS technology to consult the chart provided by Oertli (**Figure 2**) in order to understand the fluidics. There is a critical amount of vacuum preset for any flow rate, which must be exceeded if a constant flow at the rate set on the panel is to be guaranteed. If the vacuum preset is lower than that, the pressure sensor will stop the pump prematurely before the desired flow is reached. As a rule of thumb, the vacuum must be increased by at least 150 mmHg compared with standard phaco. One is reluctant to do this at the beginning. However, one will readily adopt it once having experienced the outstanding chamber stability that comes along with CO-MICS.
Dr Dosso: It is not your first inclination to increase the vacuum settings when you first try it. I started very low.
Dr Prünte: Same with me.

OTE: Dr Breyer?
Dr Breyer: I generally prefer very high vacuum settings and continue to use them to perform CO-MICS. I work with vacuum settings of 600 mmHg; it's the way I like to perform surgery. In my opinion, problems relating to chamber stability cannot be

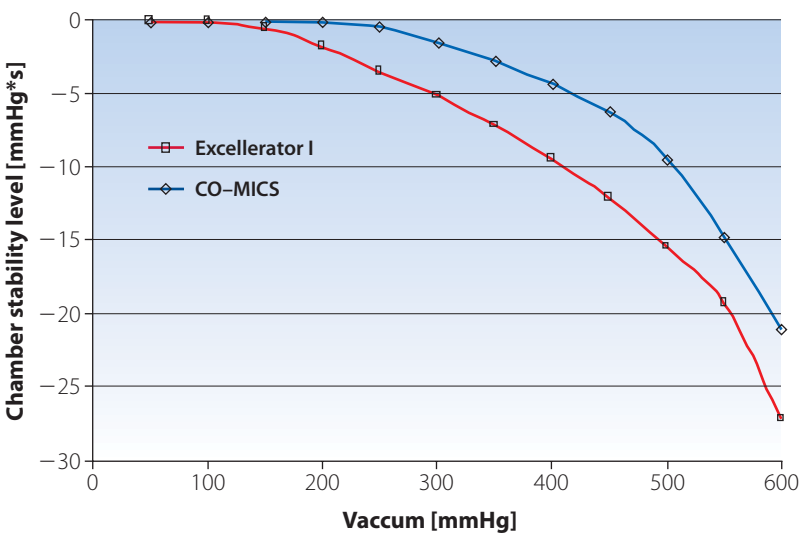

Figure 1: *Relationship between chamber stability and vacuum settings during cataract surgery with the Excellerator I tip (2.8 to 3.0 mm tip; Oertli Instruments) and the CO-MICS tip.*

Lessons learned

The experts that attended the roundtable discussion on 24 February, 2007, came to the overall conclusion that CO-MICS is a state-of-the-art technique and that it is an excellent procedure for performing smallest incision cataract surgery.

It was evident, however, that two technical fields still required improvement: a) emulsification efficiency and b) holdability. During the time since the roundtable discussion earlier this year, Oertli has launched a second generation of CO-MICS phaco tips, which overcomes these two drawbacks.

First, the outer diameter of the distal end of the phaco tip is slightly larger than that of the first generation. This increase in the outer diameter results in enhanced emulsification power, because the larger tip more than doubles the acoustic power generated by the tip, using the same machine settings. Therefore the emulsification properties of the latest Oertli CO-MICS tip are well improved. The increase of the distal end of the phaco tip does not affect the incision size of 1.6 mm: the tip geometry, which during the surgery, lies in the incision, remains the same. Second, with the latest generation CO-MICS tip, the bevel angle has increased from 30° to 53°. This results in much higher holdability. Chopping techniques are now as feasible as any other technique to remove the nucleus.

attributed to high vacuum settings but to surgical experience. Instead I feel these problems can improve with CO-MICS because of the smaller diameter of the tip, as we have already experienced with 23-gauge surgery. I think it will be interesting to investigate the optimum relationship between vacuum setting, phaco power, incision diameter and hardness of nuclei in the near future.

OTE: That's a good point and certainly a subject for future discussion. Right now, however, it would be interesting to discuss fluidics. What are your experiences with surge after occlusion breaks? Are there any differences between CO-MICS and 19- or 20-gauge surgery when the occlusion breaks?

Dr Menapace: We do certainly witness some surge, however, its inception is prolonged and the dip significantly shallower because of the reduced diameter of the tip (**Figure 3**). It is because of this small diameter that we can emulsify so efficiently and safely at significantly higher vacuum settings with CO-MICS.

OTE: Which parameter of the surge is less with CO-MICS — depth of surge or the total relaxation type?

Dr Menapace: Both of them.

Dr Breyer: I think that this is an important point to stress. The fact that there is less post-occlusional surge, coupled with the fact that the tunnel or incision preparation is easier with CO-MICS, makes learning the overall technique easier for the beginner. When I began learning classical 19-gauge cataract surgery, the majority of my cases of capsular rupture or capsular break were caused by the surge phenomenon, so by reducing the incidence and intensity of surge, the CO-MICS beginner should be safer.

Dr Menapace: I think one point needs to be made here: much technological effort has been invested in the development of systems that compensate for surge at the level of the pump. However, with CO-MICS surge is inherently reduced at the level of the tip, which essentially serves as a "surge break". Therefore, a surgeon performing CO-MICS is much less dependent on complicated technical systems with sophisticated pressure sensors, software, and pumps designed to compensate for surge, which in themselves reduce direct control by the surgeon.

OTE: Do all the participants agree that surge is less aggressive with CO-MICS?

All: Yes.

Dr Prünte: It is less of a problem, definitely.

OTE: How do the fluidics compare with larger phaco tips, such as 19-gauge tips?

Dr Marcon: I personally haven't noticed any particular changes in fluidics when comparing 20- and 19-gauge surgery with CO-MICS. Apart from the fact that you have less fluid inside the eye with CO-MICS, I didn't notice any great difference.

OTE: Do you think the fluid dynamics are about the same inside the anterior chamber?

Dr Marcon: Yes, this is my view.

Dr Menapace: I think the fluid dynamics are improved when using a small tip, because the tip does not consume much space; the less space the tip consumes, the less it induces fluid turbulence during the phaco procedure. The small tip diameter speeds up flow, which reduces the area of turbulences while targeted nuclear fragments are attracted very avidly.

Dr Prünte: I would agree. In my experience, the fluidics are better directed, and you can see this if you are aiming for the small remnants of the nucleus, or if you are dealing with smaller pupils; the iris is not in as much danger as it might be with a larger diameter, so I think it is better directed.

Dr Menapace: This is a good example; small pupils are a good indicator of fluid dynamics. If you have a small tip, everything stays very calm; there is no trampolining or other movements of the iris plane.

Dr Dosso: This is especially important in floppy iris syndrome.

OTE: If you compare 19-gauge surgery to 20-gauge surgery, or even smaller, what would be a surgeon's main motivation for performing 19-gauge surgery today, i.e. through a 2.8 to 3 mm incision? Are there any viable reasons?

Dr Breyer: I think there are still reasons for performing 19-gauge surgery, primarily, the larger tip opening associated with this kind of surgery, means that surgical time is less than it is with 20-gauge or smaller surgery.

Secondly, the biomechanics associated with a larger tip opening to create the vacuum are better with a larger diameter than with a smaller diameter. If, for example, you are trying to grip and pull a nuclear fragment with a small tip, it is more difficult to do this than if you are performing the same task with a larger tip, particularly in the case of softer nuclei. From a biomechanical aspect, I do think that it is generally easier to perform surgery through larger tip openings.

Dr Marcon: It must be reiterated that the CO-MICS technique must be learned. For example, I use a

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Dr Menapace

chopping technique, in all of my cataract cases, however, to chop a nucleus with a CO-MICS needle is more difficult than with a standard 19- or even 20-gauge needle, particularly in the early stages of practicing the technique. This factor can be eliminated with time and experience, but there is a learning curve, albeit a small one, with CO-MICS.

OTE: It is worth discussing the optimum emulsification technique for CO-MICS. Is it preferable to use the divide-and-conquer or the chop technique for CO-MICS? Is there one technique which you prefer or which might have advantages for CO-MICS?

Dr Menapace: The holdability required for the chopping technique is certainly reduced with a CO-MICS tip because of the smaller opening; on the other hand, the divide-and-conquer technique is rendered much easier because the troughs are narrower; you don't have to make full grooves, you just drill a hole or create a short trough deep into the centre of the central nucleus which then allows easy bimanual cracking of the whole lens. I found this method to be much faster and more controlled when using a smaller tip. This was one of my main reasons for switching to CO-MICS phaco.

Dr Prünte: I totally agree with you [Dr Menapace]. I also use the divide-and-conquer technique; the divide part is much easier with a smaller tip, however, holdability is definitely not as good as it is when using larger diameter instruments, thus creating more of a problem when employing the chopping technique with a smaller instrument. The divide-and-conquer technique works very nicely with smaller diameter tips.

Dr Dosso: I've had a similar experience. In normal circumstances, I would use the chop technique, but with CO-MICS I change to the divide-and-conquer method but not in the conventional way. I perform a very nice chop, but only a little, this then allows me to divide easily when performing CO-MICS. So I do not really use the divide-and-conquer technique, rather it is a little bit of chop, divide and chop.

Dr Menapace: One may call it internal cracking. You drill a hole and then you crack.

OTE: Why is chopping difficult in CO-MICS?

Dr Marcon: Chopping is more difficult because we have two thin instruments. In my experience, you do encounter difficulties in separating the nucleus when using the standard chop technique in CO-MICS. Even if you chop the nucleus in three or four pieces, you are at risk of creating more smaller pieces around the anterior chamber, simply because the small tip tends to create some small pieces when used to perform the chop technique.

Dr Prünte: So in conclusion, maybe if somebody generally uses the chop technique but has difficulties using this method with CO-MICS, it is fine to go with the divide-and-conquer technique.

Dr Marcon: Maybe.

Dr Prünte: They should at least try it.

Dr Breyer: I think the problem comes from the fact that a smaller diameter tip means that you create less holding power, which is essential for chopping the nucleus.

Dr Marcon: Yes, what happens is, when you try to emulsify, you don't hold the nucleus but you perforate it and so this is the problem with the chop technique.

OTE: Let's now discuss the next stage of surgery — irrigation aspiration (I/A). Have you made any changes to this part of your surgical routine when performing CO-MICS?

All: Nothing.

Dr Marcon: Some surgeons may have changed the way they perform I/A. As Dr Dosso discussed earlier, many surgeons perform three incisions in total; two incisions for I/A and one incision for phacoemulsification. With CO-MICS, you only need to make two incisions; a third incision is not necessary.

Dr Prünte: Is this what you do?

Dr Marcon: Yes. However, I do admit that, if you require a very tight anterior chamber, you do need three incisions, so by that rationale, I agree with Dr Dosso. In general though, the less incisions you make the better, in my opinion.

Dr Prünte: I can perform I/A at 350 mmHg with a venturi pump, however, leakage can sometimes be a problem, so I do tend to go for two paracenteses also.

Dr Breyer: At first, I didn't change my I/A technique, but now I perform 180° cortical aspiration opposite the incision with the phaco tip and then I use the bimanual I/A system to perform irrigation and aspiration of the remaining 180°.

OTE: And regarding lens implantation, who has experience of implanting small lenses through 1.6 or 1.8 mm incisions?

Dr Dosso: I have tried although I have found it to be too difficult at present and not very tidy, so I tend to enlarge the incision to 2 mm.

OTE: What about the lenses; are there small incision lenses already available or will they be available soon?

Dr Menapace: I am still waiting for reliable three-year follow-up data from a study of microincision lens implantation in cataract patients, however, at present we do not have any long-term data available for these lenses.

OTE: Have any of you encountered wound leakage during CO-MICS surgery, owing to excessive outflow?

All: No.

I appreciate the benefits of CO-MICS and, as such, have begun the process of shifting from a 20- or 19-gauge standard phaco practice to a CO-MICS practice

Dr Marcon

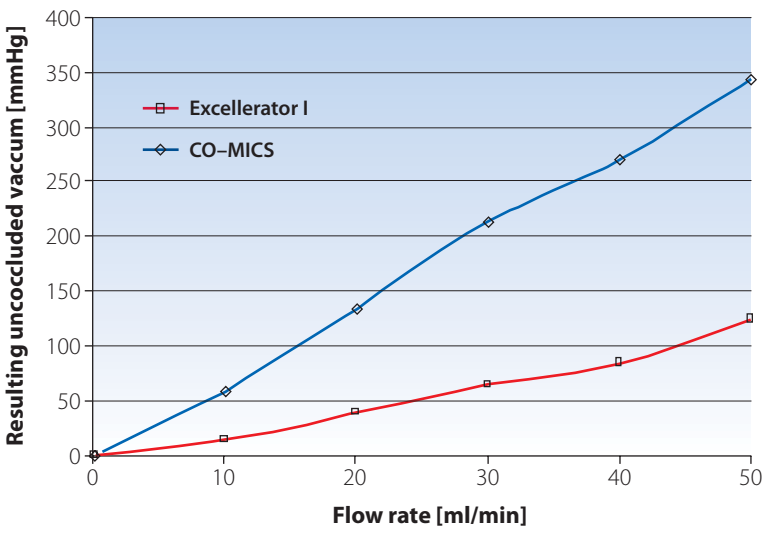

Figure 2: *Relationship between flow rate and the unoccluded vacuum during cataract surgery with the Excellerator I tip (2.8 to 3.0 mm tip; Oertli Instruments) and the CO-MICS tip.*

OTE: How about postoperatively and have you had to deal with issues relating to wound tightness?

Dr Marcon: I have come across one or two cases where, at the end of the operation, I had to add a stitch to the wound, maybe because I had stretched the incision while implanting the lens and not during the phaco phase of the operation. I have always been concerned, however, by the fact that we are introducing a round instrument into a linear incision. I do feel that this can sometimes induce stress in certain types of cornea, even during phacoemulsification. I don't know if you [Dr Menapace] have felt this during an operation.

Dr Menapace: I think that problems with wound tightness at the end of surgery result from the lens implantation procedure. The advantage of the coaxial instrument is that you have a relatively small round tube and a flexible sleeve around it, which fills out and tamponades the slit-like wound. So there is no reason why this wound should suffer, if it is of adequate size and the phaco instrument is properly manipulated. Of course, if the incision is too small, also a sleeved phaco tip does have the ability to damage the wound by friction or oarlocking, especially if the inner aspect of the tunnel is not funnel-shaped as I recommended earlier. Otherwise there is no reason why this should happen.

Dr Prünte: I have not experienced issues relating to wound tightness with CO-MICS but I think this would certainly prove to be problematic in very young children, not because of the technique, but because of problems with the young cornea. We can definitely phase these problems out though.

OTE: What is your overall impression of CO-MICS and what is your vision for the future of this procedure?

Dr Menapace: Because we don't have the appropriate lenses available as yet, CO-MICS will not readily expand into routine application for the time being. It is only for this reason that I do feel that 20-gauge surgery is currently the best option for routine cataract surgery at the moment.

Dr Marcon: I agree with Dr Menapace. I appreciate the benefits of CO-MICS and, as such, have begun the process of shifting from a 20- or 19-gauge standard phaco practice to a CO-MICS practice, simply because I think this technique offers great advantages without the disadvantages offered by bimanual phaco. I truly believe that CO-MICS can completely replace standard phaco in the future once the appropriate lenses are available. Now, I practice CO-MICS in 50% of my patients and I expect its uptake to be more widespread once microincision lenses are made available to us.

Dr Prünte: Based on my experience so far, CO-MICS will be my standard cataract surgery for all of my cases as soon as intraocular lenses are available that can prove to perform as well as our routine IOLs. The technique has become routine for me personally and I think it provides the best results for my patients.

OTE: That concludes our discussion on CO-MICS. *Ophthalmology Times Europe* would like to thank the esteemed members of the panel for a very interesting and informative discussion on this promising and exciting area of cataract surgery and for speaking honestly of their personal experiences.

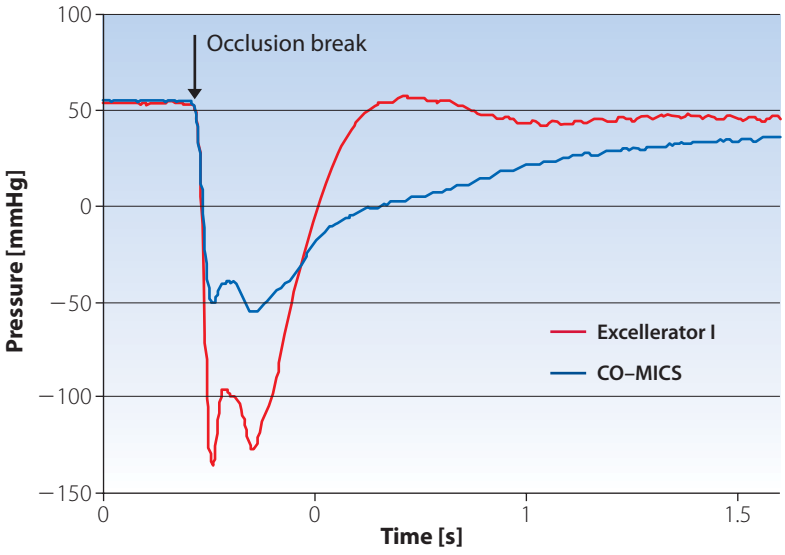

Figure 3: *Relationship between fluid dynamics and time during cataract surgery with the Excellerator I tip (2.8 to 3.0 mm tip; Oertli Instruments) and the CO-MICS tip.*

The main points to take home from this, and the first supplement of the series, are as follows:

- **CO-MICS works well.**
- **It is already recommended for special indications.**
- **It is safe.**
- **It has a short learning curve.**
- **The divide-and-conquer technique is the recommended phaco procedure.**
- **Vacuum settings must be increased to perform CO-MICS.**
- **It is associated with extremely low post-occlusion surge.**
- **The future availability of microincision lenses should lead to widespread uptake of the technique.**

We hope that this roundtable discussion has armed you with sufficient information to allow you to make a more informed decision on whether you feel your patients and your practice would benefit from this procedure. It is true to say that its potential will not be fully realized until the several investigational microincision IOLs that are currently undergoing clinical testing make their way to the market. So far, CO-MICS has been shown to have many advantages over standard coaxial cataract surgery and bimanual MICS. Furthermore, according to those who have embraced this new technique, it has the potential to become the gold standard in cataract surgery once IOL technology development advances closer to this new method of surgery.

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1. A. Dosso, D. Breyer, R. Menapace, C. Prünte, G.B. Marcon. *CO-MICS: the future is small*. Highlights from an expert roundtable meeting on coaxial microincision cataract surgery. February 2007, Vienna, Austria. June 2007.

Further information

If you would like to receive a copy of the first supplement from this roundtable discussion, or if you would like further information on CO-MICS, please contact the Editor of *Ophthalmology Times Europe*, Fedra Pavlou; fpavlou@advanstar.com

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