The Future of Phaco and MIGS Surgeries

Highlights from Oertli Instrumente AG's Satellite Symposium, "The Future Way of Phaco and MIGS Surgeries," held September 2015, Barcelona, Spain.

The need for fast, effective surgical equipment

By Rupert Menapace, Chief Surgeon and Medical Director of Day Surgery Unit, University of Vienna Medical School, Vienna, Austria.

As the world's population ages, we see ever-increasing numbers of patients presenting to ophthalmology clinics – many of whom need surgery for age-related eye disease. Ophthalmologists find themselves today in need of surgical technology that can keep up with this rise in demand. To do this, the surgical equipment needs to not only produce the best possible outcomes, but also do it in a speedy and economical manner.

I have had the pleasure of three decades of experience using Oertli's Swiss-made machines, as well as many years of working with the company – helping to develop the latest *easy*Phaco®, SPEEP® and CortexMode™ technology. Oertli is an independently owned family business based in Berneck, Switzerland; the company is a 60-year inventor of ophthalmic surgical platforms and instruments designed and built to meet those aforementioned criteria for use in cataract, vitreoretinal and glaucoma surgery. Oertli invited five leading ophthalmic surgeons with no financial interests in the products to share their experiences with their OS4 platform, the CataRhex 3® surgical system, and their *easy*Phaco® and HFDS® MIGS technology.

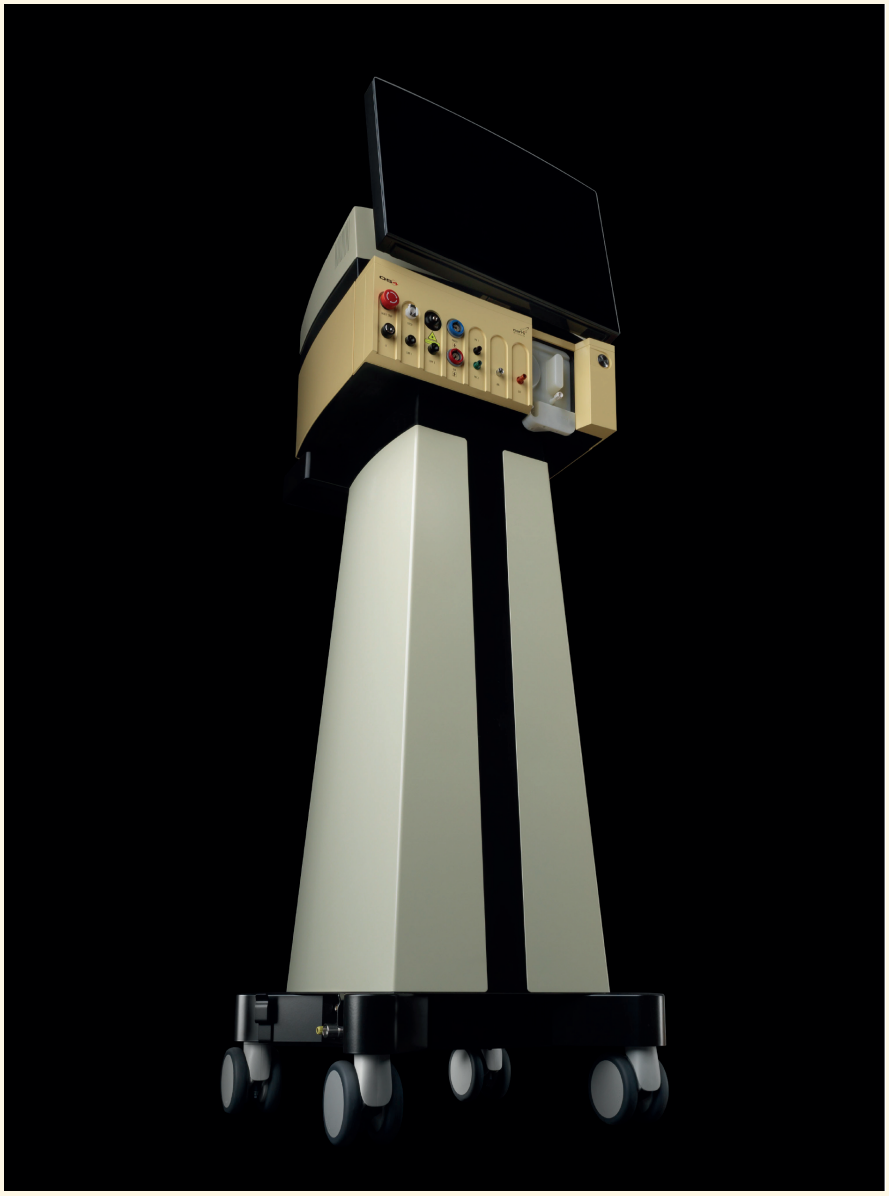
Why I like the OS4's design: the cream color of the base unit reminds me of a 1958 Mercedes Benz 300 SL, the yellow color of the box reminds me of a 1952 Fender Telecaster, and the high-quality touchscreen reminds me of an iPad.

Firsthand experiences with the OS4® surgery platform

By Liem Trinh, Cataract and refractive surgeon at Pôle Vision Val d'Ouest in Lyon, France

I was fortunate enough to be able to try out an Oertli OS4 in my operating room, and I'd like to share my experiences with you.

First, the design. I can see the influence of a number of design classics in there (above), and I think that it looks Swiss, sober and compact. That last point is important – you can see that the OS4 is smaller, thinner, and requires only one foot pedal even when using the integrated endo-laser. I also think that the OS4 is thoughtfully designed. All of the connectors are located at the front of the machine, at a comfortable height for operating, and the cassette itself is self-retracting, automatically



The OS4 is available in three platforms: anterior; anterior and posterior; and anterior and posterior including endo-laser.

installing itself into the device without breaching the sterile field. It's all very efficient – **I am able to commission the OS4 and have it ready for surgery under a minute!** Finally, there's a 15-inch glass touchscreen that has a simple, uncluttered interface, something you appreciate during surgery, when there's so much else going on that competes for your attention.

Second, the features. It does everything you could ask of a machine sold today, combining phacoemulsification, continuous flow vitrectomy (more information on page 11), and you can even specify an endo-laser for cyclophotocoagulation. The surgical platform has a tri-pump system, meaning that both pure Venturi and real peristaltic are available during surgery – giving you extremely fine control over suction throughout the procedure. The third is the impressive SPEEP® mode (Speed and Precision). The single, wireless foot pedal controls the three main functions: phaco, vitrectomy and the laser, with either linear or dual linear steering modes, as required. It accomplishes this by registering foot movements in every direction. There's also some state-of-the-art illumination built in: two LED light sources with user-controllable color and intensity variation.

What is it like to use during cataract surgery? I feel very safe performing phacoemulsification with the OS4. The fluidics of the OS4 and tulip-shaped *easy*Tip® mean that I can easily perform phaco with active or gravity infusion. I work in occlusion, and I use the Venturi pump to provide high vacuum. Along with the high fluidics that are provided with this platform and made possible with the *easy*Tip®, this means that I get efficient and precise phaco control. That, combined with the maximal phaco power efficiency provided by the *easy*Phaco® technology, keeps the phaco time to an absolute minimum.

The fact that the foot pedal is wireless is a bonus, as I can easily place it in the most comfortable position for me when I'm operating. The irrigation/aspiration (I/A) cannula I use is curved, making it very easy to aspirate the cortex and tissue, particularly in SPEEP® mode.

My overall impression is that the OS4 is safe and efficient in phaco and vitrectomy as well, and it has everything you need in a modern machine. It combines a state-of-the-art technology in vintage, elegant case, making the OS4's stylish appearance as unique and specialized as its surgical capabilities.

See the video online at:
http://top.txp.to/liemtrinh

Eligibility of CO-MICS in state-of-the-art cataract surgery

By John Bolger, Chief Surgeon, My iClinic, London, UK.

I was one of the first to adopt microincisional cataract surgery in the United Kingdom, and I have now performed over 5,000 sub-2 mm procedures to date.

I use a Zeiss plate haptic lens because it passes easily through an incision of less than 2 mm. Patients with a reasonable degree of cylinder receive toric lenses included in the basic price, and there are no exclusions to the procedure. Furthermore, most of my patients are bilateral simultaneous, meaning that I do both eyes on the same day. To perform the procedure, I first mark the steep axis of the cornea, and then enter the eye via a scleral tunnel. The machine can be used with clear and "near clear" corneal approaches just as easily, but the reason I personally use the scleral tunnel is that I find it more secure. I also find that there's no possibility of inducing astigmatism, and a reduced risk of endophthalmitis in the postoperative period.

To open the capsule, I prefer a needle rhexis – but if you're going for forceps and want to go sub-2 mm, you will need to buy specialist forceps, as conventional forceps will not open wide enough in such a small incision. One bonus of the CataRhex 3® is that it supports capsulorhexis via Oertli's Klöti capsulotomy probe, which can be used in patients with white or dense black cataracts. Radio waves heat the probe enough to melt the capsule; the probe is then used to trace a circle for capsulotomy in instances where a needle or forceps may not be used safely. When a cataract is too dense for me to do a needle rhexis, I use the Oertli capsulotomy probe. It's very simple, and the radiofrequency probe melts the capsule in any reference size you want, in whatever shape you want. It's important that you go very slowly, so that the probe has enough time to melt the capsule in a 360° continuous curve. Once the capsule is opened, I move the free capsule into the center of the anterior chamber to ensure that it's completely free, and then I use Howard Fine's cortical cleaving hydrodissection technique to mobilize the nucleus (http://top.txp.to/sub-two/vid and http://top.txp.to/bolger-kloti).

The ability to use the Oertli capsulotomy probe is one of my favorite aspects of the CataRhex 3®. I find that it's essential for my practice, because I have a lot of patients with white or dense black cataracts. I don't use dyes to visualize the capsule anymore, I just go straight to the capsulotomy probe. A common concern is that a capsulorhexis created in this manner might not be as strong as one created manually or by femtosecond laser – but I disagree. The capsule behaves pretty much like a conventional torn or femto rhexis, and in my hands, it's quite secure and withstands all the normal manipulations.

When using the CataRhex 3®, I start with some conservative settings (very low flow and no occlusion), and I shave off the anterior cortex so that there's more space to work on the lens. For lens removal, I first make a 100 percent depth groove – so that the posterior capsule is visible at the bottom of the groove – and then I unlock and chop the lens. The fragmented material is then removed by switching to very high flow and vacuum to maintain the stability of the anterior chamber. To clean the capsule of cortical remnants, I perform turbo polishing – a technique where any remnants are dislodged by irrigation with a hydrodissector. Another great advantage of the CataRhex 3® is a

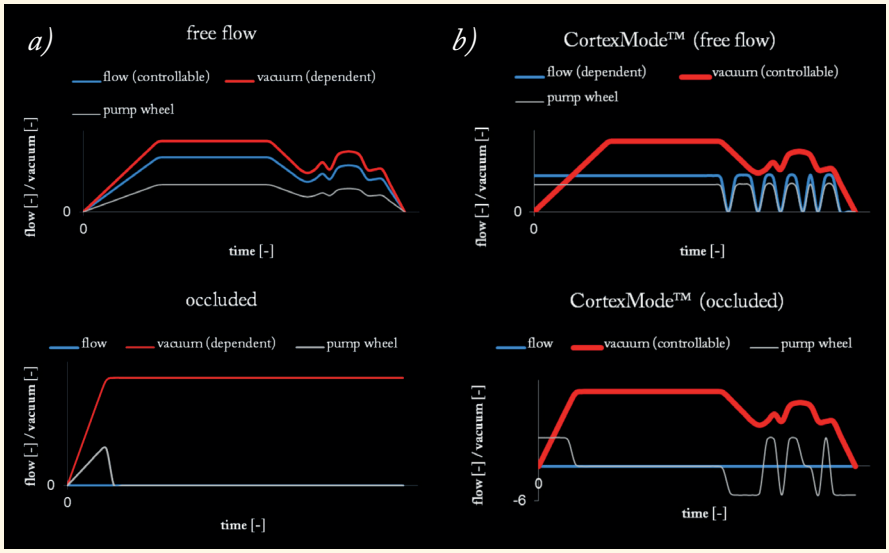


Figure 1. a) Flow and vacuum performance over time using a standard peristaltic pump mode for ophthalmic surgery. b) Flow and vacuum performance over time using Oertli's CortexMode™.

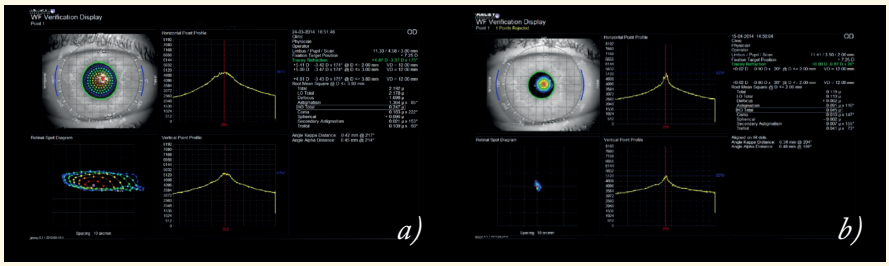
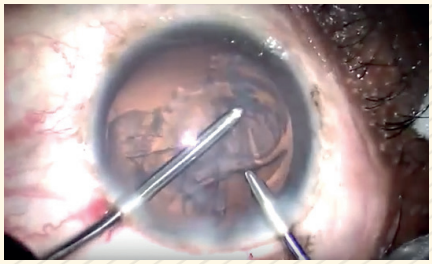


Figure 2. a) Preoperative wavefront aberrometry data: patient has +5.5 D of hyperopia and -3.5 D cylinder. b) Postoperative data: almost no hyperopia and less than 1 D cylinder.

function called the CortexMode™, which changes the way the pump system works. Instead of a conventional peristaltic pump that increases the flow rate as you press the foot pedal, it increases the vacuum. Additionally, a constant flow rate can be set on the machine. **In my cases, the ability to directly control vacuum with the foot pedal makes a significant difference.**

After peeling off any plaques that may have formed, I finish by placing the intraocular lens into the capsular bag, positioning it appropriately, and then performing irrigation and aspiration to remove viscoelastic. There's a little bit of work involved in my technique, but it's handy, and the anterior chamber stays nicely stable.

Let's highlight the extent of what the CataRhex 3® can do by looking at some wavefront aberrometry data from a patient with about +5.5 D of hyperopia and -3.5 D cylinder (see Figure 2a). After receiving a toric lens through a sub-2 mm incision, in an operation conducted using the Oertli *easy*Phaco® technology, the same patient showed almost no hyperopia and less than 1 D cylinder (see Figure 2b). The wound itself was painless and almost invisible. The patient is absolutely ecstatic. Even though you do need some special equipment for sub-2 mm surgery, and there is a learning curve – which is easy if you're prepared – I think Oertli's CataRhex 3® is a very good system.



Performing sub-2 mm cataract surgery

1. Using a scleral tunnel to enter via a 1.8 mm incision. It's important to get the architecture of the wound correct, because even with a small wound, it's possible to get leaking or even iris prolapse, and there are times when I'll have to suture. So the architecture is important even when the wound is small.

2. Vitrectomy-style forceps were used to manage the capsulorhexis, because conventional forceps don't open wide enough in the wound.

3. The CataRhex 3® system provides efficient nucleus fragment removal using a high aspiration rate (about 35 mL/min) and high vacuum (about 400 mmHg). I think it's far more efficient than conventional phaco. You can see the way the pieces just jump into the mouth of the tip, and are then emulsified and aspirated very readily.

4. Vacuum control is simple and precise with the CataRhex 3® system, meaning that the anterior chamber is stable and cortexremoval is easy, particularly when using CortexMode™.

5. Finally, to close the wound created by the use of a scleral tunnel, I use cautery to "spot-weld" the conjunctiva back into place and end the procedure.

See the videos online at:
http://top.txp.to/sub-two/vid
http://top.txp.to/bolger-kloti

Minimizing Phaco Times with CataRhex 3® and *easy*Phaco®

By Detlef Holland, Cataract and refractive surgeon at nordBLICK Augenklinik Bellevue in Kiel, Germany

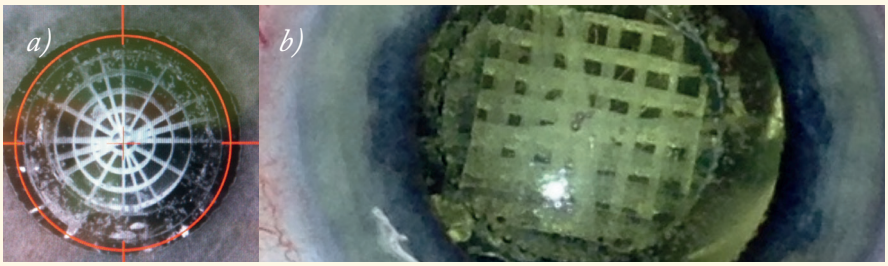


Figure 1. Pie-shaped a) and dice b) femtosecond laser lens fragmentation patterns.

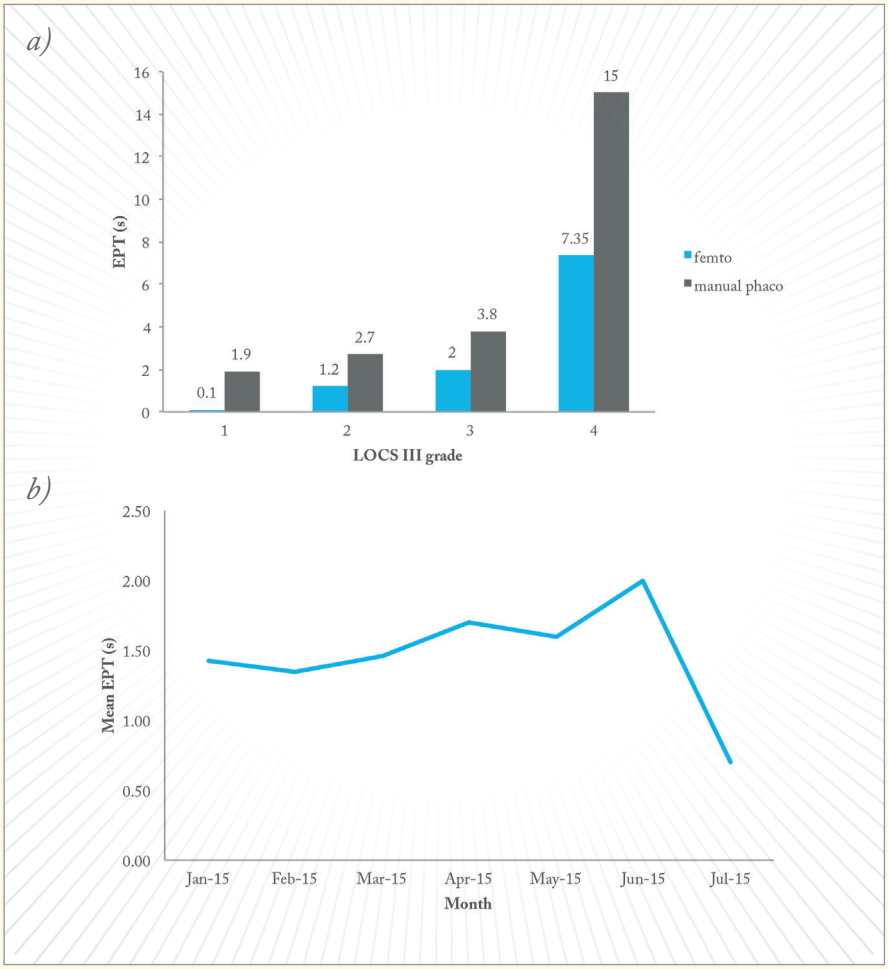


Figure 2. a) Femtosecond laser-assisted *vs.* manual phacoemulsification – effective phacoemulsification time (EPT) comparison, according to LOCS III grading; b) Mean EPT after femtosecond laser lens fragmentation is typically under 1.5 seconds.

The introduction of femtosecond lasers to cataract surgery has been a further step forward in the ophthalmic field. They can plan and perform incisions like the paracentesis, perform the capsulotomy, and fragment the lens. But what a femtosecond laser cannot do is completely liquefy nor aspirate the lens. The laser alone, therefore, doesn't eradicate the need for phacoemulsification.

Let me share my experience of femtosecond laser-assisted lens fragmentation, followed by phacoemulsification/ lens aspiration with the Oertli CataRhex 3® system. I started off using a pie-shaped lens fragmentation pattern (Figure 1a), which I found to be very good, requiring only short phaco times with low phaco energy to liquefy and aspirate the lens. However, more recently, I've moved over to using a dice pattern (Figure 1b) which has enabled me to reduce phaco time and energy even further – aiming for an average of less than 1.0 seconds and often zero phaco time. The reduction in phaco times with laser-assisted lens fragmentation starts to get noticeable with harder lenses (Figure 2a), but overall, my mean effective phacoemulsification times in laser cataract surgery are normally less than 1.5 seconds – and never more than 2.0 seconds (Figure 2b).

To give you an idea of the difference femto-phaco makes to traditional phaco in terms of lens aspiration times, I can perform the former in around 50 to 60 seconds (http://top.txp.to/femto-phaco), whereas lens aspiration with conventional phacoemulsification takes me around 85 seconds (http://top.txp.to/lens-aspiration).

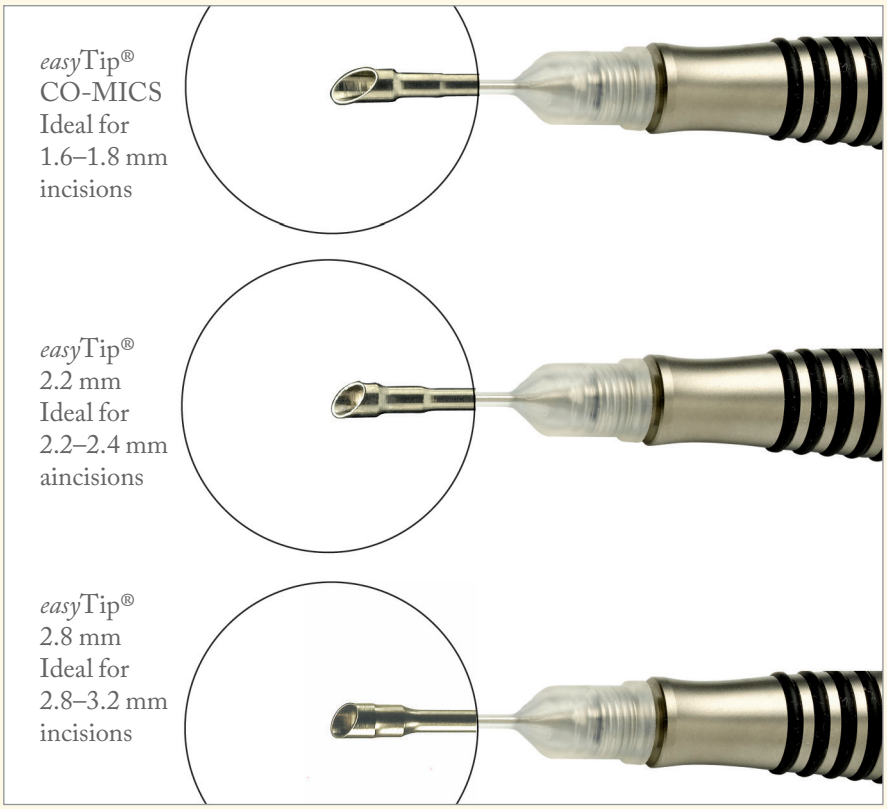
However, the basic requirements for safe and efficient phacoemulsification and lens aspiration have not changed with the rise of femtosecond laser-assisted cataract surgery. Most importantly, you still require a stable anterior chamber – but efficient aspiration, gentle processing of the

nucleus and its fragments, and controlled emission of ultrasound are all central to the procedure. And all of these requirements, in my opinion, are fulfilled in a very small machine – the CataRhex 3®.

Part of the reason the CataRhex 3® works well for me is the *easy*Phaco® technology with its *easy*Tips®. They come in incision sizes ranging from 1.6 to 3.2 mm and have a wide infusion coat (see Figure 3) that allows inflow (from irrigation) to be seven times greater than outflow (from aspiration) – virtually guaranteeing a stable anterior chamber, even at maximum flow and vacuum settings (50 mL/min flow and 600 mmHg vacuum). High vacuum settings offer a benefit of their own: namely, they provide very good traction for effective ultrasound energy transmission. With the Oertli peristaltic pump system, high flow and vacuum settings are produced extremely quickly, and the tip can be occluded without problem. The clever tulip design of the *easy*Tip® (which exponentially increases the cross-sectional area of the tip relative to other designs) makes for not only a quick (followability) but also a strong occlusion (holdability). This is particularly useful when ultrasound energy is needed to break up the occlusion: the energy is transmitted directly into the firmly held nucleus material, meaning that breaking up the occlusion requires very little energy, and almost all of that energy is absorbed into the nucleus fragment itself, rather than into other ocular tissues. Even after occlusion break, there's no clogging of the aspiration canal, because the ultrasound breaks the material up into very fine pieces that can be aspirated very quickly and smoothly.

For phacoemulsification with the Oertli OS3, I work in dual linear mode with three foot pedal positions – one for irrigation (which uses 10 percent of the possible pedal movement); one for aspiration (which uses 90 percent of the pedal movement); and one sidewards to produce a burst of ultrasound energy. Because it takes a fair distance of pedal movement to make reasonably small adjustments to the outflow, it means that flow is under very fine, precise control. It's only on the rare occasions when the occlusion can't be broken up any further by aspiration alone that I use the horizontal rightwards motion of the pedal to produce an extremely short ultrasound impulse, which almost instantly breaks up tenacious material from the nucleus and frees the tip.

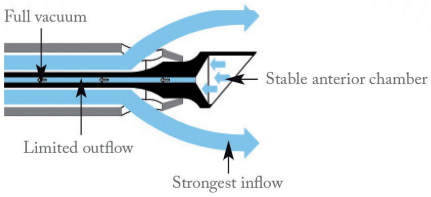
The end result of this delicate control of irrigation, aspiration and ultrasound energy is an overall reduction in phaco times – regardless of whether the lens was fragmented by a laser or not. Clearly, I aim to get my phaco times as close to zero as possible with femtosecond laser-assisted cataract surgery; and for traditional surgery, my aim is to reduce phaco times to less than two seconds. The difference in ultrasound energy when using Oertli's newest tools



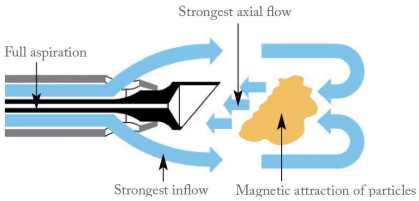
The portable CataRhex 3® weighs only 5.2 kg.

Detlef Holland's personal machine settings:
Vacuum: 600 mmHg
Vent. Eff.: 100%
Modulation: Pulse
Power: 30%
Cooling: 70%
Frequency: 40 Hz

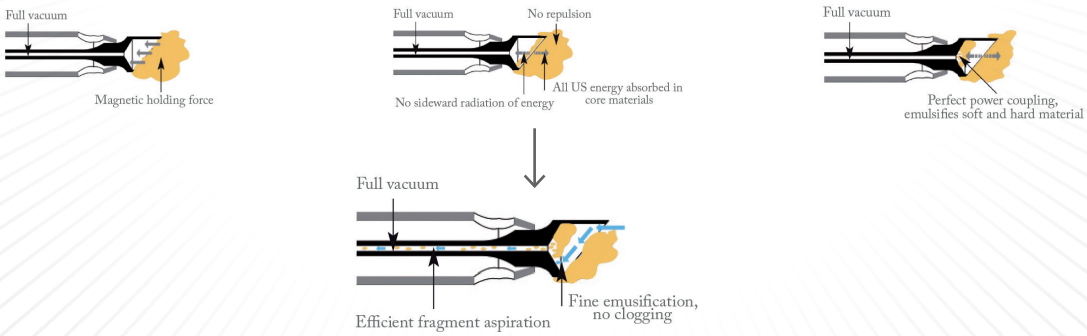
The wide infusion coat allows inflow (from irrigation) to be seven times greater than outflow (from aspiration) – virtually guaranteeing a stable anterior chamber, even at maximum flow and vacuum settings.



Excellent followability – which means that the nucleus comes directly to the tip for quick occlusion construction



Once there, the fragments can easily be aspirated (image). The phaco energy is directly transferred into the nucleus.



The speed and ease of the procedure as a whole means that, thanks to the excellent followability, you can work more in the center of the anterior chamber and avoid risky maneuvers toward the rear of the capsular bag

Figure 3. *easy*Tip® and benefits of using high vacuum and flow settings.

compared with standard phaco equipment is also significant.

So what are my take-home messages for getting the most out of this platform?

- Maximum flow and vacuum are recommended to obtain the best possible traction, and under high traction, ultrasound is particularly effective – even a small burst has a big impact.
- Ultrasound should only be given under occlusion, in cases where the nucleus fragments can't be aspirated.
- This means that after constructing the occlusion, surgeons should remain at maximum outflow settings, as the occlusion often dissolves anyway due to the strength of the aspiration.
- Finally, when removing a fragmented nucleus, use the angled end of the *easy*Tip® as a work surface, turning the handpiece to manipulate the nucleus material.

One valuable contributor remains constant regardless of the type of procedure. A good surgeon is still the most important thing – whether for traditional or for laser-assisted cataract surgery.

See the videos online at:
http://top.txp.to/femto-phaco
http://top.txp.to/lens-aspiration

HFDS® – a true MIGS alternative in modern glaucoma surgery

By Bojan Pajic, Medical Director, Eye Clinic ORASIS, Reinach AG, Switzerland

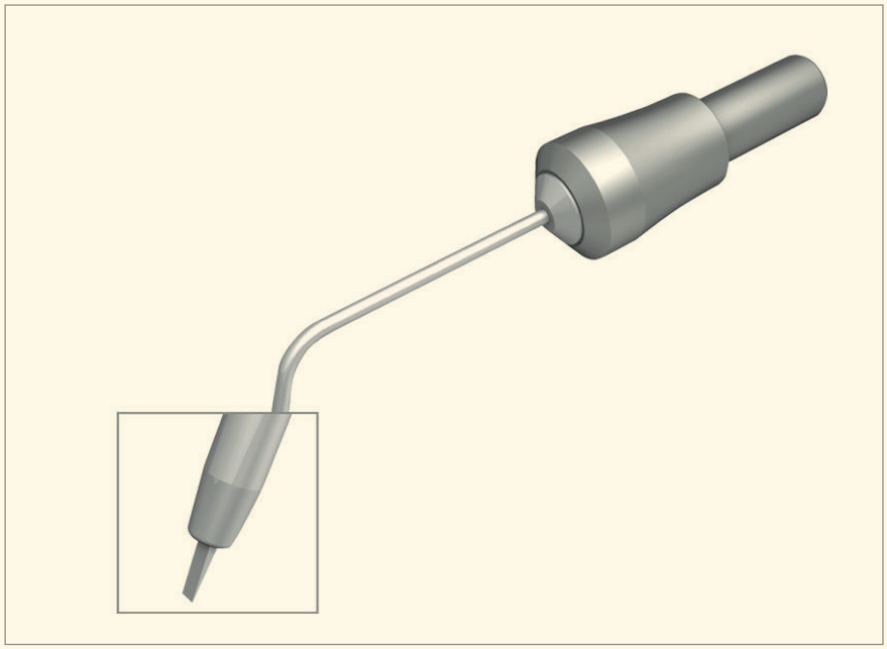
One important aspect of the OS4 system's capabilities is its contribution to glaucoma procedures. I use the OS4 to perform a true MIGS alternative in modern glaucoma treatment.

Any surgical procedure that requires the creation of external access runs the risk of fibroblast proliferation and filtration closure – so in 1999, I developed a non-penetrating ab interno approach known as High Frequency Deep Sclerotomy (HFDS®). With this procedure, the surgeon is able to make a pocket through the trabecular meshwork and Schlemm's canal into the sclera (Figure 1), while reducing the risk of complications and decreasing the need for pressure-reducing medication after surgery (1,2).

To perform the procedure, I use Oertli's abee® Glaucoma Tip and high frequency diathermy handpiece, connected to the OS4 surgical system. HFDS® can be performed either alone (with the use of high-viscosity viscoelastic and pupil-constricting drops) or in a combined cataract and HFDS® procedure.

It's an eight-step process in which the surgeon:

1. Applies carbachol to constrict the pupil,
2. Fills the anterior chamber with viscoelastic,
3. Applies METHOCEL to the cornea,
4. Inserts the abee® tip through the temporal paracentesis into the target point,
5. Places a four-mirror gonioscopy lens onto the cornea to visualize the iridocorneal angle,
6. Places the abee® tip at the level of the trabecular meshwork, then depresses the pedal and moves the tip forward, using bipolar radiofrequency energy to create a pocket 0.3 mm high, 0.6 mm wide, and 1.0 mm deep



Oertli's abee® Glaucoma Tip

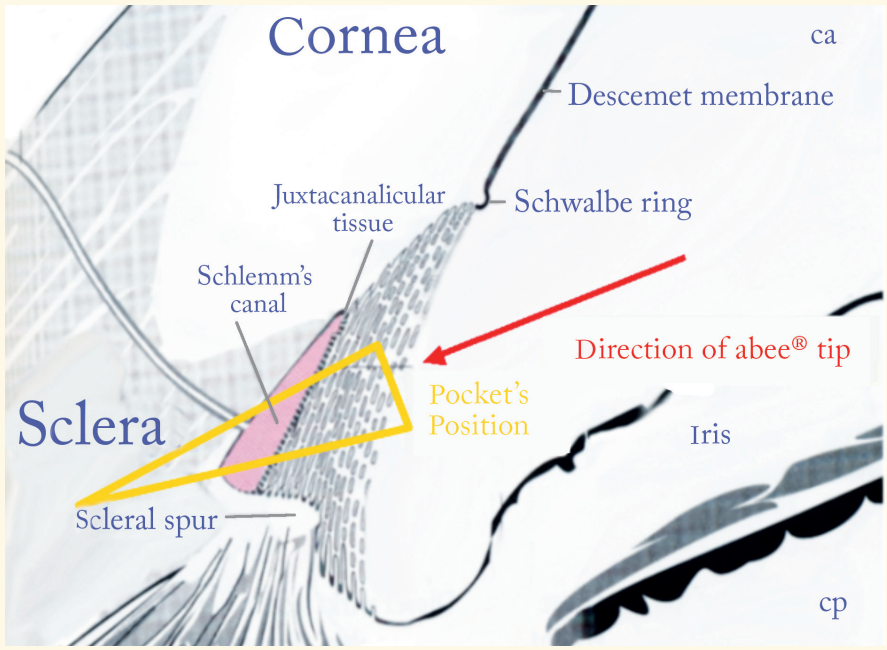


Figure 1. The pockets need to be targeted through Schlemm's canal, just above the scleral spur.

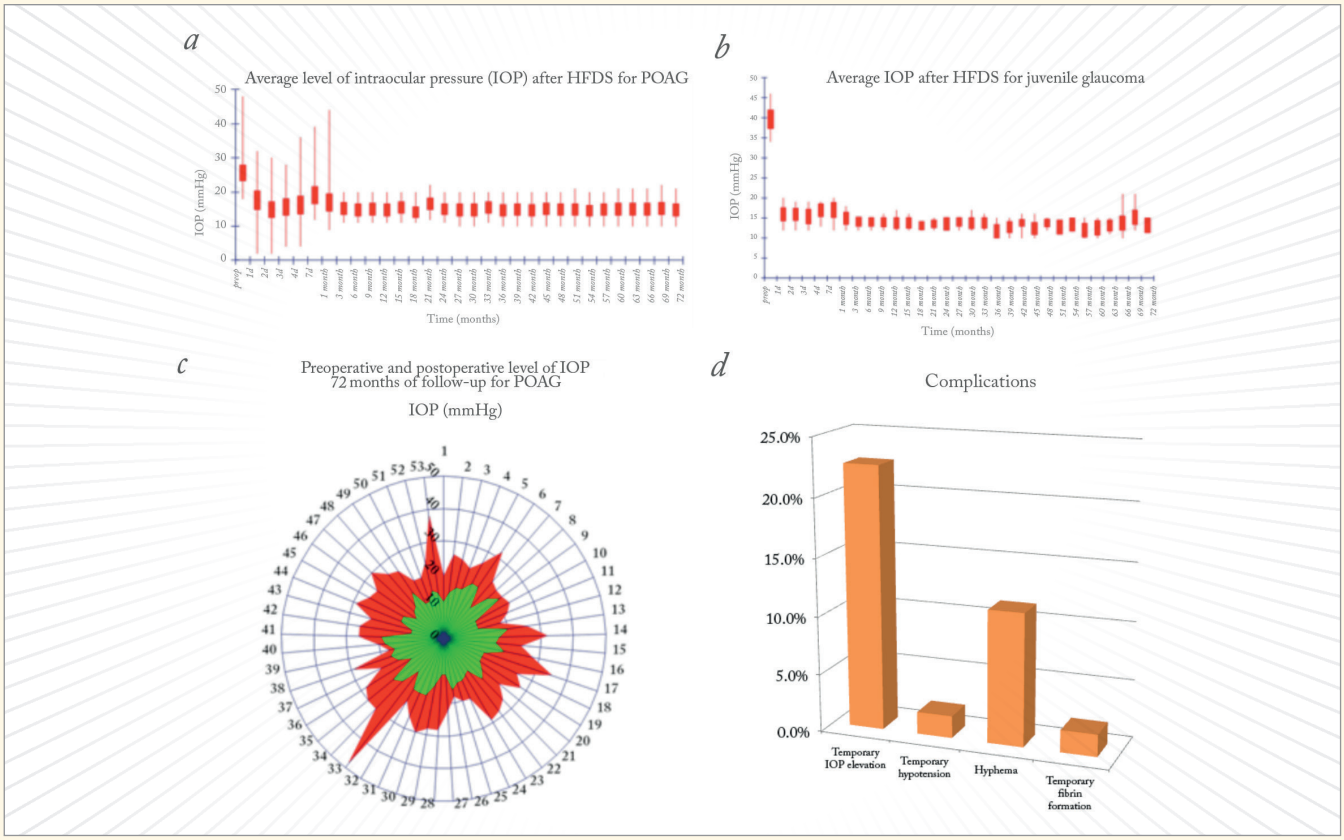


Figure 2. a. Mean IOP after HFDS® for a) primary open angle glaucoma, and b) juvenile glaucoma. c) Pre- and postoperative IOP for patients after 72 months of follow-up. d) Complication rates.

(see Figure 1),

7. Retracts the abee® tip after the pocket has been created (three beeps),
8. Repeats the procedure five more times in close proximity for a total of six pockets.

The procedure (see http://top.txp.to/abeeHFDS) takes only a few seconds per pocket, or only a few minutes in total. After completion, prophylactic antibiotics and anti-inflammatories, as well as pilocarpine 2% to prevent pocket closure and spikes in intraocular pressure (IOP), should be applied for four weeks (2,3).

Presented below are the results of a prospective HFDS® study (2) performed on 53 patients with primary open angle glaucoma (mean age 72.3±12.3 years) and five juvenile glaucoma patients (mean age 9.0±1.4 years). In the case of this pilot study, only four pockets were made, though making six carries the potential for a greater decrease in IOP. Nonetheless, with four pockets, the POAG patients' average intraocular pressure decreased significantly after about one month post-HFDS®, from a preoperative IOP of approximately 26 mmHg to a postoperative IOP of approximately 15 mmHg (sustained up to the final measurement at 72 months postop) as shown in Figure 2a. Juvenile glaucoma patients showed an even more marked decrease, from approximately 40 mmHg preoperatively to approximately 15 mmHg postoperatively (see Figure 2b). The need for pressure-reducing eye agents among POAG patients reflected the decrease in IOP, from approximately 2.6 administrations preoperatively to fewer than 0.2 (at 12 months postop), stabilizing at approximately 0.5 from 36 months postop onward as shown in Figure 2c. The study was not free of complications, but involved no major adverse events – 22.6 percent of POAG patients experienced temporary IOP elevation, 11.4 percent experienced small hyphema, and 1.9 percent each experienced temporary hypotension and temporary fibrin formation (see Figure 2d).

HFDS® is an effective, minimally invasive procedure with a good safety profile for treating patients with primary open angle or juvenile glaucoma. The resulting decrease in IOP is stable in the long term, and postoperative complications are minimal. I believe that all glaucoma surgeons could benefit from adopting this procedure.

References

1. *B Pajic, et al., "New minimally invasive, deep sclerotomy ab interno surgical procedure for glaucoma, six years of follow-up", J Glaucoma, 20, 109–114 (2011). PMID: 20520572.*
2. *B Pajic, et al., "Long-term results of a novel minimally invasive high-frequency deep sclerotomy ab interno surgical procedure for glaucoma", Eur Ophthal Rev, 6, 17020 (2012).*
3. *Oertli Instruments AG, "HFDS Glaucoma Procedure with abee® Tip", available at: bit.ly/HFDAabee. Accessed October 09, 2015.*

See the video online at: http://top.txp.to/abeeHFDS

The power of fluidics in phaco and vitrectomy surgery

By Levent Karabas, Ophthalmologist and associate professor at Kocaeli University, Kocaeli, Turkey.

As any ophthalmic surgeon knows, fluidics – the science of using controlled flow and pressure – is key to performing surgical procedures in the eye. I regularly perform procedures that require both phacoemulsification and vitrectomy, and its precision fluidics that is central to making those procedures run smoothly.

The goal of fluidics for phaco is to maintain a stable anterior chamber and avoid oscillations. Several instrument-based factors can affect this stability, and these include:

- inflow/outflow equality
- surge prevention
- pump characteristics
- ultrasonic modulation, and
- tip design.

There are two main pump types that can be used to generate vacuum in phacoemulsification and vitrectomy: peristaltic and Venturi (Figure 1). In peristaltic pumps, the flow is controlled by the surgeon, and the vacuum is limited by preset values; this offers the surgeon the opportunity to work with low flow rates even at high vacuum. In contrast, in Venturi pump mode, the surgeon controls the vacuum, whereas the flow results from a combination of the vacuum settings and resistance based on the diameter of the cannula. In this case, flow and vacuum can't be controlled independently of one another, and the vacuum level remains constant at the surgeon's chosen level, even in the event of a stubborn occlusion.

Oertli's OS4 platform contains an alternative to peristaltic and Venturi pumps. Known as SPEEP® (Speed and Precision) mode, it's a form of peristaltic pump in which the characteristics are reversed – vacuum is controlled by the surgeon, whereas flow is stably maintained within preset limits. The pump system in the OS4 includes new sensors and electronics, making it 10,000 times more precise than previous Oertli peristaltics. The SPEEP® mode works in accordance with Poiseuille's Law (see Figure 2), which governs flow rate in a tube; according to the law, vacuum (as controlled by the surgeon) increases flow rate (within preset limits) in a linear fashion. This makes for an extremely speedy and precise lens aspiration

The devices retinal surgeons use for their vitrectomy procedures have changed dramatically over time, but the principles of the surgery have not – the surgeon still needs to gain access to the vitreous humor, aspirate it, and replace by infusion the amount that was removed. Clearly, great care is needed to avoid tearing the retina while aspirating the vitreous, and this is why good illumination of the vitreous cavity during the procedure is crucial – something with which the OS4's two LED light sources with user-controllable color and intensity variation help immensely.

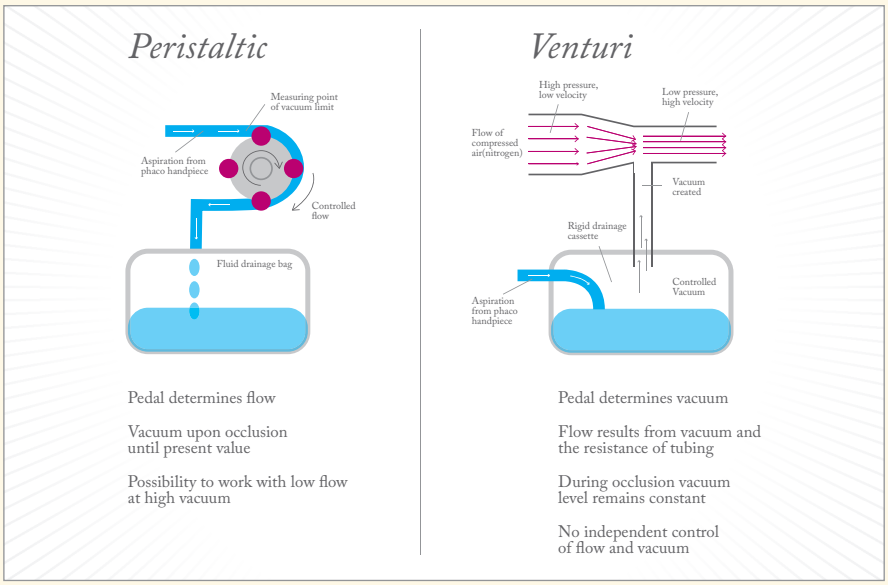


Figure 1. The conceptual differences between peristaltic and Venturi pumps.

The OS4's LED light control screen, allowing the user to alter the color and intensity of the lights.

To date, the peristaltic pump has been the gold standard for phaco, whereas the Venturi pump is generally considered to be a faster option for vitrectomy. I, however, feel that safety is more important than speed. A 2011 European VitreoRetinal Society study (1) on the correlation between pump type and rate of retinal detachment after vitrectomy showed that Venturi pumps led to a higher rate of severe proliferative vitreoretinopathy (16.9 percent versus 10.1 percent), as well as nearly twice the rate of failure (2.3 percent versus 1.3 percent) or remaining

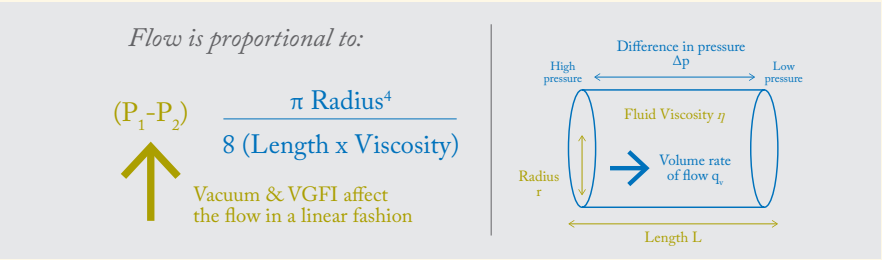


Figure 2. Poiseuille's Law of total volume that flows through the tube: vacuum affects the flow in a linear fashion.

	Peristaltic pump	*Venturi pump*	*SPEEP® mode*
Vacuum	Limited by presets	Controlled by surgeon	Controlled by surgeon
Flow	Controlled by surgeon	Results from resistance	Limited by presets

Table 1. The operational differences between peristaltic, Venturi and SPEEP® modes.

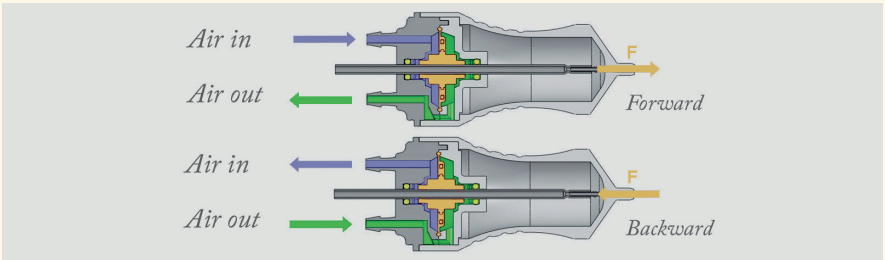


Figure 3. With spring-driven pneumatic probes, the higher the cut rate, the greater the probability of the port being closed by the cutter, making maintaining a constant flow rate a real challenge. With Oertli's dual pneumatic probe, one pneumatic pulse pushes the guillotine, while the second pulse pulls. This means that 50 percent of the duty cycle can be maintained at cut rates of 5,000–10,000 cpm.

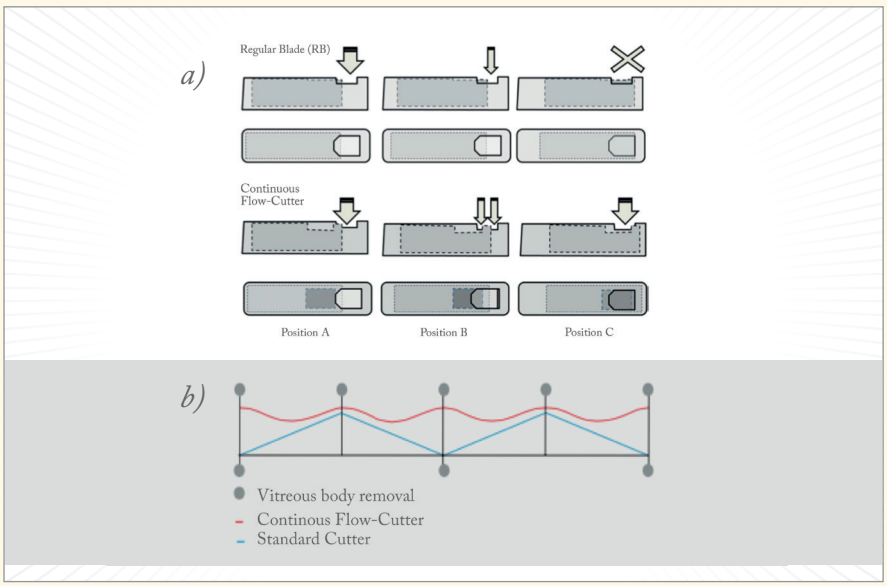


Figure 4. Standard cutter versus the OS4's Continuous Flow-Cutter. a) The Continuous Flow-Cutter always has at least half of the port open, and the blade cuts in both directions, doubling the cut rate. b) The Continuous Flow-Cutter (red) gives rise to continuous flow without noticeable fluctuations (as with each cycle, the vitreous body is removed twice), compared with the Standard Cutter (blue), where flow is interrupted each cycle, with vitreous body being removed only once per cycle

silicone (8.2 percent versus 4.2 percent) as peristaltic pumps. In a multivariate analysis of risk, use of a Venturi pump emerged as one of two independently significant parameters, with three times the risk of failure compared to using a peristaltic pump. But Oertli's SPEEP® pump mode gives users the best of both worlds: a peristaltic-style pump that offers incredible precision and places vacuum control in the hands – or rather at the foot – of the surgeon (Table 1).

The new cutter concepts pioneered in the OS4 have the same potential to change surgical procedures as its SPEEP® mode. In any vitrectomy, the goal is to maintain high cut rates and make the flow constant. But spring-driven pneumatic probes are only capable of working at a rate of 1,000 to 1,500 cpm – so, back in 2002, Oertli developed the dual pneumatic probe to increase cut rates while maintaining a stable duty cycle. In this kind of probe, one pneumatic pulse pushes the guillotine, while the second pulse pulls it back. In this way, 50 percent of the duty cycle (Figure 3) can be used to achieve a cut rate of as much as 5,000 to 10,000 cpm. But even in the dual pneumatic probe, the port undergoes an open-and-close cycle, interrupting the flow. You need a port that never closes to maintain a constant flow, and the OS4's new Continuous Flow-Cutter features exactly that (see Figure 4). This means that the blade cuts twice – once when it moves forward, and again when it moves back, so that the overall cut rate doubles.

The major advantage of the Oertli OS4, in my opinion, lies in its excellent fluidics for both phacoemulsification and vitrectomy. With its peristaltic, Venturi and SPEEP® pump modes, its active infusion system, and the *easy*Phaco® technology, it offers plenty of possibilities for anterior and posterior segment surgeries.

Reference

1. *European VitreoRetinal Society, "Vitrectomy machine parameters impact", available at: bit.ky/EVRSEU. Accessed October 09, 2015.*

See the video online at: http://top.txp.to/leventkarabas