APPLICATION*NOTE*

1/2009

Oertli *easy*Phaco®technology: Fluidics is your best friend in cataract removal

Motivation

Which properties would you expect from a good phaco tip? What would a perfect tip look like? What about a well-designed tip with good followability, excellent chamber stability, and a very efficient phaco emulsification?

Oertli® has developed such a needle that makes every surgeon's dreams come true! It ensures the patient's safety and keeps the surgery time short.

The ***easy*Tip®2.2mm** is based on the successful ***easy*Phaco®** design. It combines the advantages of a 20G-tip (good emulsification, short operation time) with outstanding fluidic properties. The tip is optimized for **maximum chamber stability** and therefore patient safety.

It also makes the surgeon's work easier with its **excellent followability and holdability.**

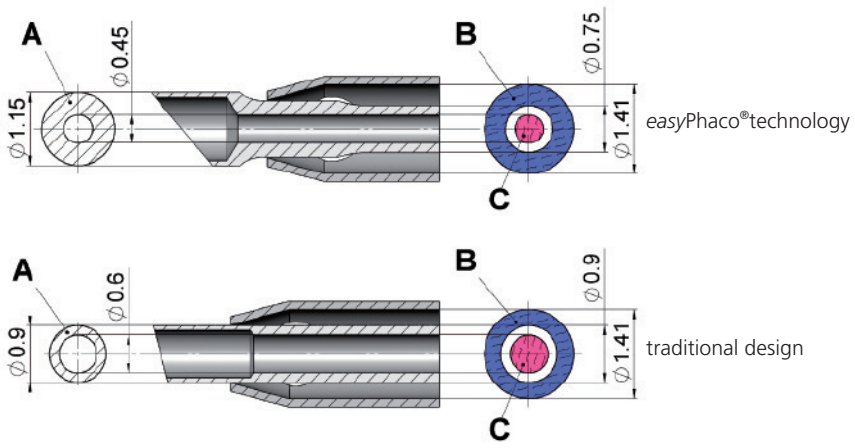


Figure 1

Fig. 1: The difference between the ***easy*Tip®2.2mm** and the traditional design is shown in figure 1. The ***easy*Phaco® technology** delivers more irrigation flow (area B) without increasing the effective size of the tip. This and the small diameter of the aspiration tube (area C) strongly enhance chamber stability.

Chamber Stability

The Oertli ***easy*Phaco®technology** is a real breakthrough in the field of cataract surgery: Assuming that all the equipment is mounted and applied correctly, the following pump settings can be selected (please remember that this only applies for free irrigation outflow, and care should be taken not to pinch the sleeve on the incision by mistake. In addition, you should make sure that the bottle height is correctly calibrated on your machine):

Bottle height:	100 cm (above patient's eye!)
For Venturi pump:	500 mmHg vacuum limit
For Peristaltic pump:	50 ml/min flow and 600 mmHg vacuum limit

The ***easy*Tip®2.2mm** is by far our safest needle!

Fig. 2 shows the behaviour of different tip-models. The occurrence of a post-occlusion surge is experimentally investigated in a test chamber acting as an "eye". Here the pressure is measured shortly after the occlusion break, (occurring at the time t=0) and is recorded until the steady-state has been fully re-established.

The curve shows the post-occlusion pressure inside a test chamber. The pressure is measured for different tip models.

The diagram shows that the pressure inside the eye drops far below atmospheric pressure for other tips shortly after the break of occlusion. This means that the anterior chamber becomes unstable. These tips are therefore usually not used with such high pump settings.

However, in the case of the ***easy*Tip®2.2mm**, the red curve shows that a bottle height of 100 cm is sufficient to hold the pressure continuously close to or above atmospheric pressure, even though the aspiration flow on the peristaltic pump is set to 50 ml/min and the vacuum limit to 600 mmHg.

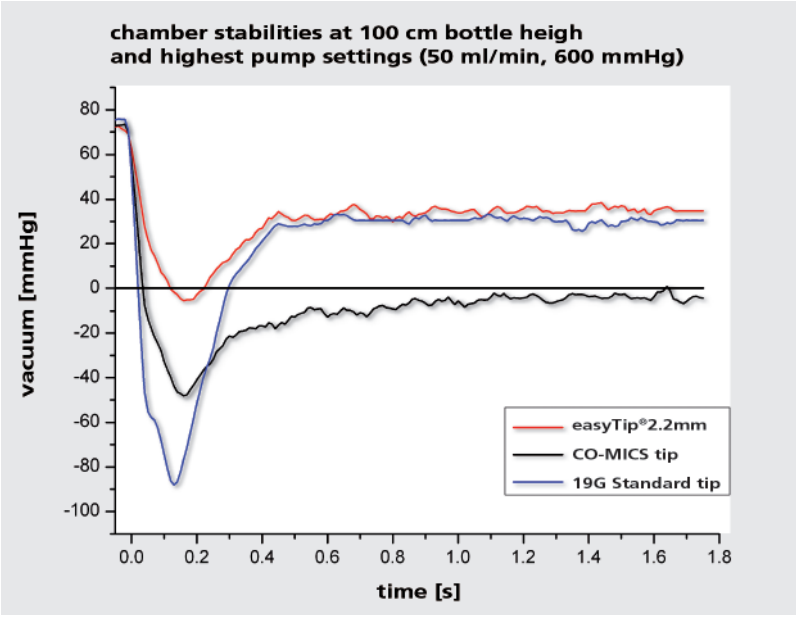


Figure 2

For an arbitrary bottle height, the following table indicates the limit for the maximum vacuum and flow rate:

Bottle height	**100 cm**
Venturi: maximum vacuum	**500 mmHg**
Peristaltic: maximum vacuum	**600 mmHg**
maximum flow rate	**50 ml/min**

These values correspond to the maximum limits when using the ***easy*Tip®2.2mm**. In several surgical situations they may even be exceeded. Please note that the bottle height refers to the level above the patient's eye. Venturi speed settings (% rise time) can be chosen freely; it does not influence chamber stability.

Followability

In addition to the substantial improvements in chamber stability, there is another major advantage which cannot be quantified but is attested by experienced surgeons:

Due to the excellent fluidics of the ***easy*Tip®2.2mm**, quiet handling and gentle movements can be applied for nucleus removal, which guarantees a gentle treatment of the eye. Initial trials in the operating theatre show that the nuclear fragments literally fly to the tip. (See also the two paragraphs at the end of this application note.)

One reason for this favourable property is the fact that higher flow rates can be appropriate with the new tip. The attractive force of the needle is therefore increased and the time during which occlusion occurs is longer. As a result, there is less chatter in the anterior chamber.

Phako Emulsification

A high level of holdability is a requirement for an efficient phaco emulsification. It ensures that nuclear fragments stick on the tip and can easily be shattered to pieces. A high vacuum is therefore required. When using traditional phaco tips a compromise has to be found between chamber stability – which improves at low vacuum settings – and the holdability. The ***easy*Tip®2.2mm** shifts this vacuum limit towards higher values due to its excellent chamber stability.

A second advantage is the bevel angle of the tip which maximises the area of the opening. These two effects significantly increase holdability with respect to traditional designs.

In addition, the large cross-section (see Fig. 1, shaded area, perfectly transmits the ultrasonic energy into the nuclear fragments. For these reasons, the ***easy*Tip®2.2mm** displays very high emulsification performance.

Conclusion

In conclusion, Oertli® has designed a new phaco technology (***easy*Phaco®technology**) which sets new standards regarding chamber stability. The ***easy*Tip®2.2mm** also demonstrates good followability which facilitates handling for the surgeon and keeps the total operation time short. In addition, the excellent chamber stability and the optimised front shape of the needle result in an outstanding phaco emulsification power.

In order to take full advantage of the ***easy*Phaco®technology** flow and vacuum both limits have to be increased substantially!

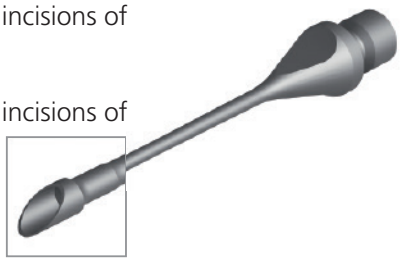
Try it out!

Order your ***easy*Tip®**, set your Oertli® machine to the values listed above and operate with your standard technique.

The ***easy*Tip®** is available single-use or reusable with different angles:

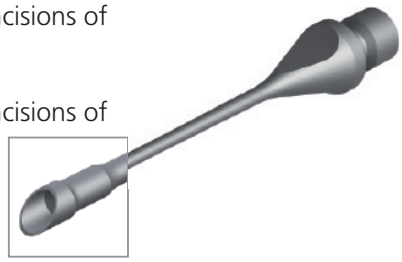
***easy*Tip®** CO-MICS for incisions of 1.6 – 1.8 mm, 30°

***easy*Tip®** CO-MICS for incisions of 1.6 – 1.8 mm, 53°



***easy*Tip®2.2 mm** for incisions of 2.2 – 2.4 mm, 30°

***easy*Tip®2.2 mm** for incisions of 2.2 – 2.4 mm, 40°



***easy*Tip®2.8 mm** for incisions of 2.8 – 3.2 mm, 30°

The principle of *easy*Phaco®: Fluidics on!

Fig. 1: No turbulences
The high vacuum setting of ***easy*Phaco®** and a wide infusion path create a strong, axially directed flow. The result: no turbulences, no floating fragments, magnetic attraction of material and perfect followability.

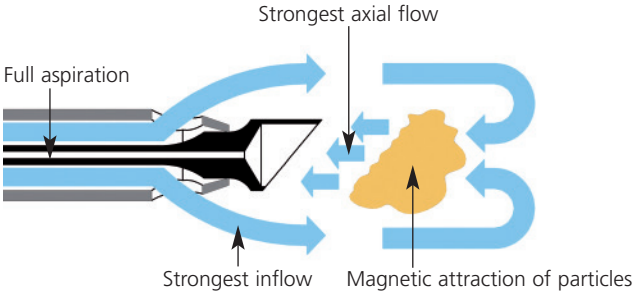


Fig. 2: No repulsion
The high vacuum setting of ***easy*Phaco®** and the optimized bevel of the ***easy*Phaco®** tip lock fragments firmly to the tip mouth with magnetic holdability, strong enough to prevent repulsion.

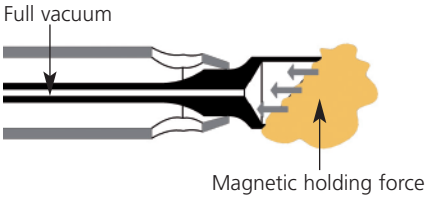


Fig. 3: No laterally radiating energy
US energy is applied axially and totally absorbed within the high vacuum locked core material.

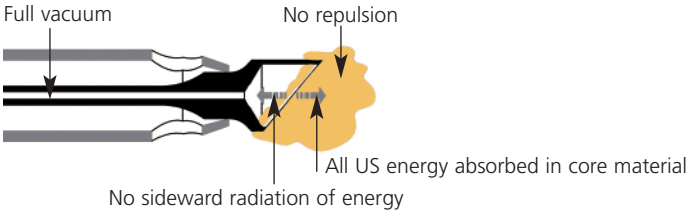


Fig. 4: Perfect emulsification
High vacuum locking and optimized tip design provide superb coupling of US energy to the core material. Energy transfer to core material is increased by a factor of 6. Hard and mature nuclei create no problems.

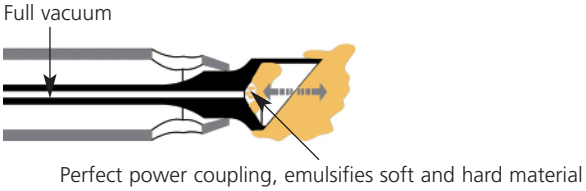


Fig. 5: Efficient fragment aspiration
Finely emulsified nuclear particles are smoothly aspirated by high vacuum through the capillary aspiration channel. No risk of clogging.

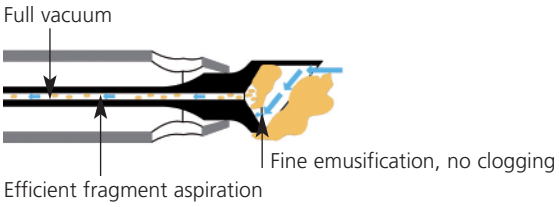
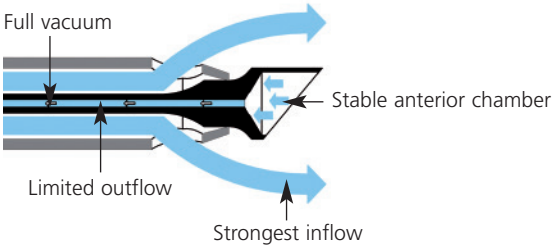


Fig. 6: No surge
Upon occlusion break, the capillary aspiration channel resists a sudden liquid flow while the wide infusion path provides constant IOP. Infusion capacity is 7 times larger than aspiration volume. The AC remains almost unconditionally stable.



APPLICATION*NOTE*

Prof. Rupert Menapace
Medical University of Vienna, Austria

I use the Oertli ***easy*Tip®2.2mm** with a 2.4 mm incision, which coincides with the incision size required for the most recent mini-incision lens implantation systems. My preferred pump system is the flow controlled peristaltic pump.
The swollen tip head and its 40° bevel doubles the area of the front opening, and thus its holdability. The slim-shaft design combines several advantages: The stepped transition from a swollen tip head to a slim shaft increases the projection area of the frontal plane, resulting in an increase of emulsification power by a factor of six. The flow resistance inherent to the very small aspiration bore allows and requires working with a high vacuum to obtain adequate flow.
The waisted design of the tip allows using a reduced-in-diameter sleeve which runs almost flush with the tip head, minimizing the incision size required. Also, it eases insertion into the incision and more snugly adapts to its inner contour due to its increased flexibility. The wider space between sleeve and slim shaft increases the distance to the tunnel wall and allows more fluid to pass. This augments fluid supply and allows for higher flow rates. It further enhances cooling when emulsifying with the tip not fully occluded. Because of the thin bore and thus high resistance of the shaft, a higher vacuum is required to produce the flow rate desired. Similar to a venturi pump, this provides for a flow-rate-dependent un-occluded primary vacuum, or vacuum preload at the tip opening, which enhances followability and promotes tip occlusion while reducing rise time to the preset occlusion level. On the other hand, increased inflow of infusion fluid combined with the increased flow resistance in the aspiration channel suppresses surge when occlusion breaks.
Clinical experience and ongoing studies fully support the efficiency of this technically elaborated phaco tip, which enriches the control provided by a peristaltic pump with a vacuum preload as a widely appreciated feature of the otherwise more aggressive venturi pump. Of course, the tip may also be used with a venturi pump.

Dr. Giovanni Prosdocimo
Ospedale di Conegliano, Italy

The ***easy*Tip®2.2mm** by Oertli® is based on the successful design of the CO-MICS needle, combining the advantages of the 20G tip (good emulsification, short operation time) with superb fluidic properties.
The tip is optimized for maximum chamber stability and improved followability and holdability. These last two factors are critical aspects of efficiency in any cataract procedure and are also related to safety issues. They refer to how lens material remains at the tip so that large pieces of nucleus are not bouncing around the anterior chamber and the surgeon does not have to reacquire them, increasing the risks of inflammation, endothelia damage and capsular breakage. Increased fluidics also minimizes the trampolining of the posterior capsule occurring with fluctuations in chamber depth, thus reducing the risk factors for posterior vitreous detachment, retinal tears and macular edema, particularly in patients with high levels of myopia.
Apart from the tip and the machine settings, the usual surgical techniques do not need to be modified; the ***easy*Tip®2.2mm** can be used in nearly all cataracts and combines the ease and astigmatic neutrality of traditional small incision phaco with a very high degree of safety and efficiency.

oertli® SWITZERLAND

Oertli Instrumente AG CH-9442 Berneck Switzerland Phone +41 (0)71 747 42 00
Fax +41 (0)71 747 42 90 www.oertli-instruments.com info@oertli-instruments.com

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