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CENTURION® Vision System: Insights and Experiences on Leveraging Innovative Phaco Technology

Highlights from the Amsterdam 2015 CENTURION® Vision System Council Meeting

Chair	
Khiun Tjia	*Zwolle, The Netherlands*
Panel	
Christer Johansson	*Kalmar, Sweden*
Gabor Scharioth	*Recklinghausen, Germany/ Szeged, Hungary*
Damian Lake	*East Grinstead, UK*
Bekir Sıtkı Aslan	*Ankara, Turkey*
Carlo Cagini	*Perugia, Italy*
Ozana Moraru	*Bucharest, Romania*
Cyrus Tabatabay	*Geneva, Switzerland*
Khaled A. Khalifa	*Cairo, Egypt*
Detlev Breyer	*Heidelberg, Germany*
Ramón Ruiz Mesa	*Jerez, Spain*
Philippe Crozafon	*Nice, France*
Saleh Al-Messabi	*Abu Dhabi, UAE*
Ramón Lorente Moore	*Orense, Spain*
Abdallah Hassouna	*Cairo, Egypt*

This supplement reflects the opinions and experiences of meeting participants in Amsterdam on October 17th, 2015 and is subject to change as they adjust technique to respond to patient needs.

Marching in step with Centurion – the advantages are legion

For some, cataract surgery today is routine, high volume work – but often, it can be one of the most challenging procedures to perform in the eye. Patients present with a range of ocular comorbidities, some of which may challenge the capability of both surgeons and their instruments. But getting it wrong is not an option – the consequences can be life-changing for the patient. Achieving ideal outcomes in difficult cases, however, requires much hard-won experience with an instrument. Wouldn't it be useful to have a brief vade mecum of optimal instrument settings for different circumstances, including the most challenging patients. Alas, no such thing exists – every situation is unique. But here, we present the next-best thing: esteemed surgeons, sharing their insight from their experience with Alcon's Centurion Vision System.

Active fluidics – taking the strain

Before taking on a complex cataract surgery case, you first need to have confidence that your phacoemulsification platform can cope with everyday challenges. For example, does it maintain the intraocular pressure (IOP) target? How easily can it handle occlusion and occlusion break-related pressure fluctuations? Christer Johansson has been using the Centurion for two years, and is convinced of the benefits. "We've shown that actual IOP remained identical to target IOP (55 mmHg) under a broad range of aspiration rates – namely, 12 or 35 cc/min at a vacuum setting of 300 mmHg, and 60 cc/min at a vacuum setting of 600 mmHg." He ascribes this stability to a responsive, intelligent, software-driven irrigation system which, under non-occluded conditions, accurately maintains targeted IOP independent of pump speed. Post-occlusion, however, the change in IOP is too fast to be accommodated by the active components of the system. Instead, the fluctuation is resisted by passive surge protection elements – high resistance tubing and a low compliance pump. These limit post-occlusion pressure changes to a drop of ~30 mmHg – as compared to a ~80 mmHg fall with Infiniti (Figure 1) (1).

Special settings for special cases

The case studies of Centurion's performance in challenging cases (Box 1) emphasize the importance of parameter optimization. IOP settings are particularly important to get right – especially in patients with glaucoma – as setting a high IOP target might result in compression and damage of the optic nerve. The longer the duration of high intra-operative IOP, the greater the chance of optic nerve damage; trainee surgeons, who often need more time to carry out these procedures, therefore might benefit from clear direction.

Guideline documents should point new surgeons to the best intra-operative target IOP settings, but it's not always that straightforward – indeed, different approaches to settings exist between US and EMEA surgeons. So what does our expert panel think? Their target IOPs vary

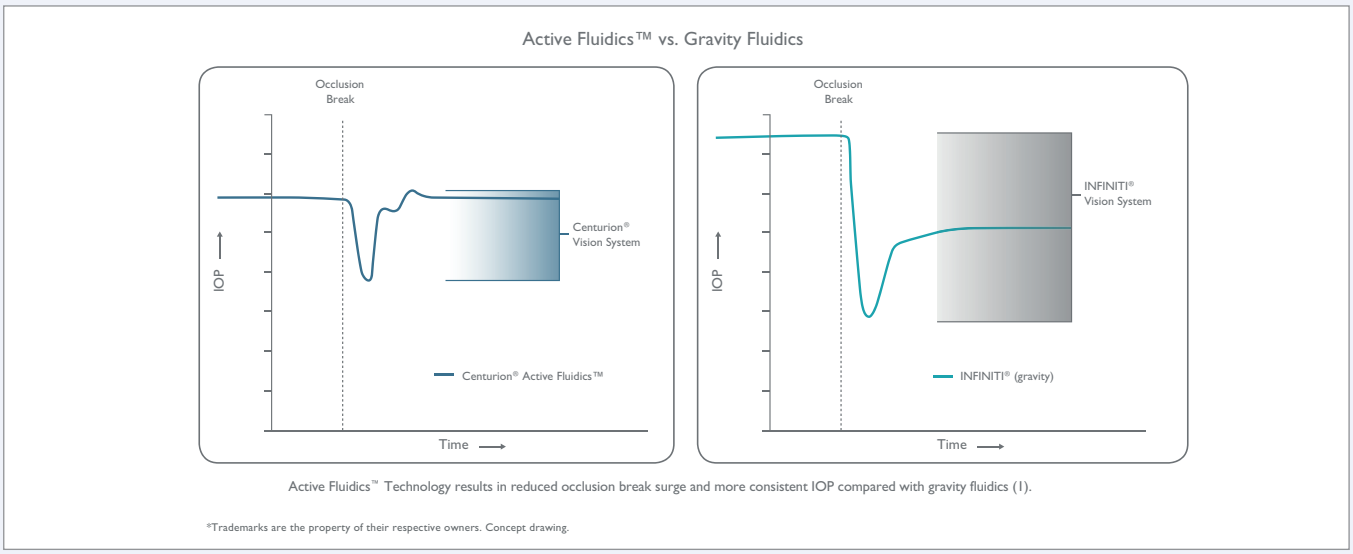
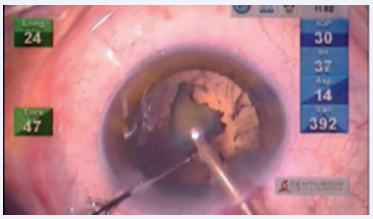


Figure 1. Surge reduction with Active Fluidics™ Technology results in reduced occlusion break surge and more consistent IOP compared with gravity fluidics. Through its Active Fluidics Technology, the Centurion® Vision System is designed to significantly reduce occlusion break surge versus the AMO WHITESTAR Signature® and INFINITI® Vision Systems (1). Concept drawing only,

Box 1: Case studies of Centurion in challenging patients

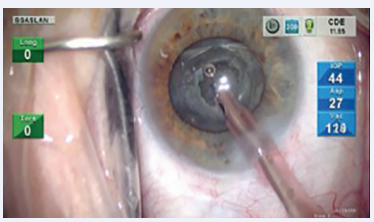
LIPMICS, *Gabor Scharioth*

- Situation: low IOP microincisional cataract surgery (LIPMICS) for standard and hard cataracts
- "Remember the option to use a higher vacuum in pedal position 2 than in position 3. The dramatic drop in vacuum at position 3 helps prevent surges – especially important given the lower IOP settings in LIPMICS"
- Result: "Lens fragments move and tumble freely, and are easily aspirated"
- Settings: Target IOP 30 mmHg



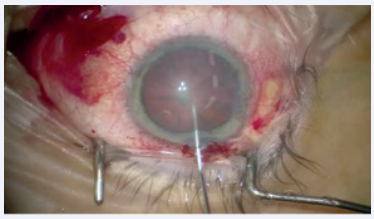
Hard cataract, *Bekir Aslan*

- Situation: Hard cataract in an 85 year-old diabetic patient. The nuclei were fragmented slowly
- "Requirements: good visibility and low anterior chamber turbulence – no lens fragments moving around"
- "Centurion gives excellent followability. And I could control every aspect of operation, e.g. adapting aspiration rate based on surgical need."
- Result: Consistent chamber stability throughout surgery
- Settings: Target IOP 44 mmHg; aspiration flow rate of 27 cc/min



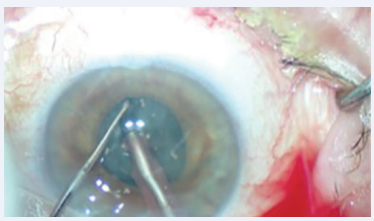
ICE and Glaucoma, *Damian Lake*

- Situation: irido-corneal endothelial (ICE) syndrome in a patient with glaucoma and an Ahmed valve-capsulorhexis performed manually instead of with femtosecond laser
- Phacoemulsification complicated by deteriorating visibility during hydro-dissection: "That's why you need a phacoemulsification instrument in which you have complete confidence"
- Instead of 'trench and chop', increase vacuum so as to stick the lens to the tip
- Result: "The pupil remained very stable"
- Settings: Target IOP 40 mmHg; vacuum 400–550 mmHg; aspiration 30–35 cc/min



Small pupil, *Carlo Cagini*

- Situation: phacoemulsification through a 2.2 mm scleral incision in a patient with a small pupil
- "In my experience Centurion goes smoothly even in difficult cases"
- Scleral incisions are more corneal-sparing than corneal incisions, and patients have less post-op foreign body sensation.
- Result: Anterior chamber remained very stable
- Settings: Target IOP 40 mmHg; aspiration flow rate 30 cc/min; vacuum 400 mmHg



Divide & Conquer or Stop & Chop Technique

Centurion Settings[7]	*Sculpt*	**Chop*[5]	*Quad*	*Epi*	*Cortex*[3]	*Polish*	*Visco*
Ozil Amplit. %	0–85 LINEAR[1]	0–50 LINEAR	0–65 LINEAR	0–30 LINEAR			
Vacuum mmHg	0-140 LINEAR	575 FIX[6]	0-550-450[4]	0-350 LINEAR	0-600 LINEAR	0-50 LINEAR	0-500 LINEAR
ASP cc/min	20 FIXED	30 FIXED	30 FIXED	0–25 LINEAR	0–18 LINEAR	0–10 LINEAR	0–18 LINEAR
IOP mmHg	40...55[2]	40...55[2]	40...55[2]	40...55[2]	55	55	55
Irr. Factor	1.0	1.0	1.0	1.0	2.0	2.0	2.0

Chop Technique

Centurion Settings[7]	*Pre–Phaco*	*Chop*[5]	*Quad or Segment*	*Epi*	*Cortex*[3]	*Polish*	*Visco*
Ozil Amplit. %	0–30 LINEAR	0–50 LINEAR	0–65 LINEAR	0–30 LINEAR			
Vacuum mmHg	0–250 LINEAR	575 FIX[6]	0–550–450[4]	0–350 LINEAR	0–600 LINEAR	0–50 LINEAR	0–500 LINEAR
ASP cc/min	20 FIXED	30 FIXED	30 FIXED	0–25 LINEAR	0–18 LINEAR	0–10 LINEAR	0–18 LINEAR
IOP mmHg	40...55[2]	40...55[2]	40...55[2]	40...55[2]	55	55	55
Irr. Factor	1.0	1.0	1.0	1.0	2.0	2.0	2.0

Cataract Grade 2/3 – Balanced Tip – Ultra Sleeve – incision size 2.2-2.4 mm-Bi-manual I/A 23G polymer tip

Box 2: Collateral settings

- Longitudinal ultrasound in general not to blend
- Energy modulation continuous mode
- IP settings: 95% 10ms 0.5 ratio
- PEL according to case need
- Vacuum rise 0 for all steps
- IOP ramp 1.0

Footswitch treadle	Pos 1) 15%	Pos 2) 50%	Pos 3) 30%
AutoSert	Initial Velocity 3.0 mm/sec	Pause 0.5 sec	End Velocity 3.0 mm/sec

Notes

*Optional step in case of Stop and Chop

1. Harder nuclei may require up to 100% amplitude
2. IOP range according to surgeon preference
3. I/A settings might differ with other I/A handpieces
4. Vacuum in POS 2 linear increasing – vacuum in POS 3 linear decreasing (see picture below)

5. In case of hard nuclei or difficulty to dislodging the first quadrant, longitudinal ultrasound might be preferred. The following table by courtesy of Khiun Tija.

Centurion Settings[7]	*Chop*[5]
Longitudinal Power (%)	25–50 LINEAR
Pulse On Time	5...25%
Pulse Rate	6 pps
Vacuum (mmHg)	650 FIX[6]
ASP (cc/min)	25...30 FIXED
IOP (mmHg)	40...55[2]
Irrigation Factor	1.0

6. Inadvertent use of chop settings for quadrant removal may expose to surge
7. Appropriate use of system parameters and accessories is important for successful procedures. Please read the user manual and accessories' DFU

carefully before operating the instrument. Recommended settings are given only as guidelines, and are not meant to restrict the surgeon; however, before trying other settings, the surgeon and support personnel should be experienced with the system and familiar with the new settings.

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Reported Capabilities	*Reported Results*
Efficiently fragments even very hard cataract nuclei at low torsional ultrasound settings	Low cumulative dissipated energy / ultrasound energy result in reduced stress on tissues in anterior chamber
No need for a minimal torsional setting – good results even at below 40% amplitude	Can dispense with less efficient systems, e.g. Mini-Flared and Mini Tips, which require 40–80% amplitude
Rapid removal of cataract fragments	Speedier operation may decrease ocular trauma

Table 1. Reported capabilities and results of the Balanced Tip - Intrepid Ultra Sleeve unit

from 40–55 mmHg, depending on the exact combination of vacuum and aspiration flow rate; however, their common approach is that a target IOP of 30–40 mmHg is ideal, and suggest that IOP settings above 60 mmHg are usually unnecessary, and that the absolute upper limit should be 70 mmHg.

That said, there are also dangers associated with straying too far towards the low end of the acceptable IOP spectrum. In this context, choosing an appropriate Irrigation Factor parameter from Centurion Vision System's screen may support surgeons who prefer to work at the extremes of the IOP range. Nevertheless, adjusting the Irrigation Factor feature appropriately, might permit you to work with a target IOP as low as 40 mmHg, there's still a risk that the flow and the vacuum might be set a little too high, risking instability of the anterior chamber. The advice for new users? Start at 55 mmHg and then lower the IOP as you accumulate experience, rather than starting with a 40 mmHg target IOP straight away – especially if using Centurion for the first time. If you prefer not to use Irrigation Factor, set the target IOP above 40 mmHg.

Another issue is how best to reduce wound leakage, so as to prevent pressure fluctuations and maintain anterior chamber stability? Historically, ophthalmic surgeons had few options – with the Infiniti system, for example, maintenance of a low flow rate/ low IOP might have required the balanced salt solution (BSS) bottle to be manually lowered. Contrast this with the Centurion instrument, in which the Active Fluidics system automatically mitigates the pressure fluctuation issue. Furthermore, leakage may be avoided by working with one hand, not both – and it's notable that Centurion requires only one hand to remove lens fragments. This is a consequence of the followability of the instrument and the torsional movement of the phacoemulsification tip.

Tipping points – The balanced tip for cataract removal

In a competitive marketplace, technology evolves, and it's no different in the market for tips that deliver phacoemulsification ultrasound energy. So, over the years, cataract fragmentation techniques that rely on longitudinal ultrasound have been replaced by energy technology such as OZil Torsional technology, which benefits from very good followability, no chatter, and high phacoemulsification speed. But even OZil has room for improvement: not least, it can suffer from tip occlusion and misting along the tip shaft. These issues represent market demands, and – as usual – market demands are answered by innovation.

One particularly innovative response is the Intelligent Phaco (IP) suite of products in which torsional and longitudinal ultrasound capabilities are combined and integrated with innovations in tip and sleeve design. These devices ensure that the ultrasound energy distribution is confined to the end of the tip, instead of along the shaft. In particular, the combination of the Intrepid Balanced Tip and the Intrepid Ultra Sleeve provides maximal torsional displacement at the cutting edge, and reduced movement and stress at the incision site. The result? Increased efficiency and reduced heat generation along the shaft (see Table 1).

Q&A: Going for the flow – irrigation factors and wound leakage

Q. During quadrant removal, with a 2.2 mm incision (Ultra Sleeve), would you use an irrigation factor other than 1.0?

A. Moraru: "Routinely, I stay at 1.0, but I increase it in cases with a flat anterior chamber. And for myopic or vitrectomized eyes I decrease it to 0.5."

A. Aslan: "I stay at 1.0 in most cases, but I may go up to 1.2, depending on the circumstances."

Q. In routine cases, would you consider eliminating the irrigation factor?

A. Hashem: "Where incisions are larger than usual, for example 2.4 mm in patients with very hard cataracts, you need leakage compensation and therefore Irrigation Factor."

A. Lake: "It's the same in corneal transplant patients – fluid seems to leak out more easily in this group, so you have to compensate with Irrigation Factor."

Box 3: Case studies

How to improve the protection of the cornea, *Cyrus Tabatabay*

- Situation: A case series of 27 grade I–III cataracts removed via 1.8 mm limbal incisions.
- "Consider limbal rather than corneal incisions, to reduce scarring" so as to spare the cornea.
- Result: For Grade I and II cataracts, >80% of the cumulative dissipated energy (CDE) was required for lens sculpture phase whereas <60% of CDE was required for Grade III cataracts for the same phase.
- "Choose sculpture or chopping, use viscoelastic, opt for femtosecond laser during the first phase"
- Settings: Target IOP 46 mmHg, vacuum 140 mmHg, aspiration rate 27 cc/min

Nigra Cataract, *Khaled A. Khalifa*

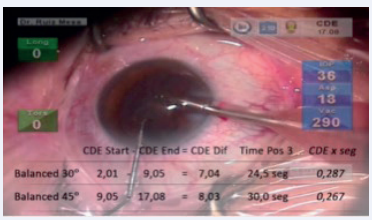
- Situation: phacoemulsification of cataracts with very hard nuclei
- "Torsional phacoemulsification is more efficient than longitudinal;
  Balanced Tips are more efficient than Mini-Flared or Kelman"
- Result: "At 60–65% torsional amplitude, nucleus was quite easy to fragment"
- Settings: Target IOP 40 mmHg; vacuum 50/500/300 mmHg; aspiration rate 25 cc/min

Balanced tip for 20/20 first day postop. in RLE, *Detlev Breyer*

- Situation: Grade II and III cataract removal
- FLACS for phacoemulsification and aspiration
- Aims: Minimal energy delivery and BSS use, good holdability and followability – hence no nuclear chatter, no bouncing anterior chamber
- Results: Easy fragmentation and removal of the most difficult cataract – only required 20 cc of BSS
- Settings: Target IOP 46 mmHg; vacuum start at 250 mmHg (pedal position 1) and end at 500 mmHg (pedal position 2), reducing to 350 mmHg (pedal position 3)

Dense cataract fragmentations with the Balanced Tip, *Ruiz Mesa*

- Situation: Fragmentation of dense cataracts
- Comparing 30° and 45° bevel Balanced Tips
- Results: "Cumulative dissipated energy was similar in each tip; 45° tip effective for hard cataracts"
- Settings: Target IOP of 36 mmHg and torsional ultrasound of 40%



The expert's view

Image of the Centurion screen during cataract fragment removal by Ozana Moraru, showing her usual settings.

The experts' consensus for optimized ultrasound settings

What is the maximum ultrasound amplitude for routine and dense cataracts respectively?

For routine cataracts, surgeons apply torsional ultrasound in a range of amplitudes from 0 to 85 percent the common approach being that 65 is the average amplitude recommended with the Balanced Tip. For dense cataracts, amplitudes of up to 85 percent may be applied; settings higher than this are not advocated as they may result in sub-optimal performance.

Times change, of course; in the past, surgeons might have dealt with hard cataracts by mixing torsional and longitudinal modes, as opposed to increasing torsional amplitude. The idea is that small bursts of longitudinal energy can clear or prevent occlusions; this 'mode mixing' therefore made sense with flared tip designs in which clogging might occur. The development of the non-flared Balanced Tip, however, suggests that there is little need for mode mixing, especially as the delivery of longitudinal energy may resurrect issues such as fragment chatter, repulsion of the cataract nucleus, and wound burn. These shortcomings, which may complicate the phacoemulsification procedure and / or damage ocular tissues, are avoided when using torsional ultrasound alone.

What are the advantages of 30° *vs.* 45° bevels in the Balanced Tip?

When options were limited to the Mini-Flare tip, surgeons might have opted for the 45° over the 30° tip, because the former is usually considered to clog less frequently and to cut more efficiently. Since the advent of the non-flared Balanced Tip in both bevel forms, however, clogging is less frequent. Four participants said they use the 30°-bevel tip, whereas the others use the 45°-bevel tip. This is not a problem anymore with 30° and 45° Balanced Tip. "Choosing one or the other is a matter of preference," noted Khiun Tjia. There are nuanced views, some assert that with the 30° tip you get easier occlusion that allows the machine to build vacuum, while others suggest that, based on mathematics and physics, the holdability of the 45° tip would be preferable. A reasonable conclusion might be that, with the Balanced Tip, there is little practical difference between the options, and choosing one or the other is a matter of preference.

How relevant is Intelligent Phaco (IP) in cataract surgery today?

The OZil IP system was developed to overcome the clogging problems associated with flared tips. Surgeons agree that it was useful in this regard; however, the field has moved on. In particular now that non-flared designs like the Balanced Tip are available, the advantages of OZil IP are less obvious, because clogging occurs less frequently. Certainly, some surgeons take the view that the phacoemulsification of any cataract can now be handled without IP, and that the movement of the Balanced Tip in the incision plane is so small that application of OZil IP makes little difference. The broad conclusion is that application or omission of OZil IP makes little difference. Nevertheless, it's clear that some surgeons like OZil IP and continue to use it. Probably, this is another case where the decision to use or abstain comes down to personal preference.

Reference

1. *M Nicoli, K Miller, R Dimalanta, D Loke; Jules Stein Eye Institute. "IOP Stability Measurement and Comparison Between Gravity-Fed and Actively Controlled Phacoemulsification Systems" (2014).*

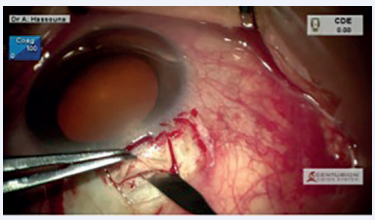
Box 4: Case studies

FLACS with Centurion, *Philippe Crozafon*

- Situation: FLACS combined with Centurion for capsulotomy and lens fragmentation
- The average CDE is usually 2.0 for Grade I–II cataracts. For very hard cataracts, CDE never climbs beyond 12–15
- Advantages of FLACS combined with the removal of lens fragmentation: stability and low CDE when separating lens fragments
- Results: Reduced complications, improved refractive results; "94 percent of my patients are within 0.5 diopters post-operatively"
- Settings: Target IOP 40 mmHg; vacuum 350 mmHg (linear); flow rate 25 cc/min (fixed)

Cataract Surgery + Ex-PRESS shunt procedure, *Abdallah Hassouna*

- Situation: Phacoemulsification combined with Ex-PRESS shunt implantation in a glaucomatous patient
- "I prepared the flap in the sclera before phacoemulsification, and inserted the IOL before implanting Ex-PRESS"
- Results: Successful
- Settings: Target IOP 50 mmHg; vacuum 150/500 mmHg; aspiration rate 35 cc/min; torsion amplitude 20 to 50 percent for sculpting



Posterior polar cataract, *Saleh Al-Messabi*

- Situation: Posterior polar cataract fragmented by LenSx laser
- "I used Viscoat to prolapse the nucleus, I did not use hydro"
- Results: Effective cataract removal
- Settings: Target IOP 50 mmHg; vacuum 700 mmHg; aspiration rate 35 cc/min

Pseudoexfoliation syndrome, *Ramon Lorente Moore*

- Situation: Pseudoexfoliative cataract procedure
- "Chopping was performed vertically not horizontally – required high vacuum to stick the nucleus to the tip when fractionating"
- Results: Effective capsulorhexis, cortex removal and IOL insertion
- Settings: Target IOP 44mmHg; vacuum 600 mmHg; aspiration rate 25 cc/min