

# RETINA TODAY



## VITREORETINAL SURGERY THEN & NOW

Sponsored by Alcon



# Alcon: Then and Now

A look at Alcon's past and present, and how technology is guiding the company for the future.

*Alcon has a long history of innovation in ophthalmic surgery, including cutting edge developments for use in anterior segment cataract and refractive surgery, glaucoma surgery, and for the posterior segment.*

*For vitreoretinal surgeons, Alcon offers a comprehensive portfolio of surgical products designed to enable us to achieve optimal results for our patients. Yet, the company is committed most of all to innovation—to developing the tools and instruments we need to exceed our patients' expectations. Coupled with their level of commitment to innovation and supporting their offerings through technical support, Alcon's focus on unmet surgical needs makes them a trusted industry partner to the retina community.*

*Vitreoretinal surgery requires the delicate manipulation of sometimes fragile ocular tissue under often stressful circumstances. From my perspective, it is reassuring to have in my hands a line of reliable and expertly engineered surgical instruments for use in surgery. I enter the OR with confidence knowing that I can use the Constellation vitrectomy platform to manage just about any pathology I encounter in my practice and that, through Alcon, I have access to an extensive line of high-quality tools and instruments. In turn, affording me the ability to more repeatedly and predictably perform delicate retina operations should translate to improved outcomes and enhanced safety.*

*I recently joined an international panel of surgeons convened to discuss the latest Alcon offerings for retina surgery, in particular the features of the Constellation vitrectomy platform and what it has meant for patients' outcomes. What follows is a summary of this panel discussion. We hope readers will find this discussion as enlightening as those who participated.*

—Peter K. Kaiser, MD

Cole Eye Institute, Cleveland, Ohio

## MEET THE FACULTY



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### INNOVATIONS IN VITREORETINAL SURGERY

When King Khasekhemwy, the second ruler of Upper Egypt, died and was buried sometime around 2700 BCE, a small, flat copper needle was placed in his tomb. This device, it was later realized, was used to lance a cataract and pluck it from the eye. Such a technique would be unimaginable in the modern era, but the technique must have seeded an incredible innovation in its own time.

As crude and rudimentary as it was, the flat copper needle may be considered the first ophthalmic instrument. Today, modern eye surgery involves the use of advanced machinery that is precisely manufactured so as to give surgeons more control over the many nuances of surgery.

As sophisticated as ophthalmic surgery is, however, it is still a relatively new discipline. In the anterior segment, much of innovation in cataract surgery can be traced to the work of Charles Kelman, MD, who introduced the concept of phacoemulsification in 1967. Interestingly, Dr. Kelman also pioneered the technique of retinal cryopexy in 1963, which remains a viable option in retinal surgery. For the posterior segment, Robert Machemer, MD, is widely recognized as the father of vitreoretinal surgery; in 1970, he performed the first cases of pars plana vitrectomy (PPV) using the Vitreous Infusion Suction Cutter (VISC) he had invented.

Each of these surgeons—Drs. Kelman and Machemer—made truly lasting impressions on ophthalmic surgery. Yet, while Dr. Kelman's stood on the shoulders of many notable inventor-surgeons and his inventions followed from several earlier attempts to remove a cataractous lens (namely, intra- and extracapsular cataract extraction), Dr. Machemer's first surgeries were, quite literally, the first time vitreoretinal surgery involved anything more than scleral buckling and cryotherapy. In fact, many at the time believed that removal of vitreous would cause irreparable collapse of the globe.

While the history of vitreoretinal surgery is limited, the notion that innovation can help drive better safety and efficacious outcomes is well entrenched. Today, companies such as Alcon continue to push the envelope on what is possible, enabling surgeons to more safely and effectively manage a full range of retinal pathologies. At the center of all Alcon's development activities for vitreoretinal surgery is the Constellation Vision System, the modern iteration of the VISC that Dr. Machemer introduced over four decades ago. Used in conjunction with 19-gauge instruments, the VISC is crude by today's standards; however, it is the necessary precursor to the modern vitrectomy platform. And, although the Constellation bears almost no resemblance to Machemer's VISC, these two disparate devices share a similar principle: Dr. Machemer introduced the VISC as a way to improve

the ability of surgeons to help patients with aberrant retinal pathology save or restore vision; in the minds of some surgeons, the Constellation may just be the ultimate realization of that ideal.

"Constellation's combination of options and level of intuitive control provides surgeons the tools to help them perform safe and efficient surgery and achieve good visual outcomes.<sup>1,2,3</sup> Moreover, in the hands of experienced surgeons, the precision and performance of this platform gives us the opportunity to do some unique maneuvers and techniques that were not available with previous generations," said Peter K. Kaiser, MD.

### THE CONSTELLATION: FEATURES AND OPTIONS

The Constellation system (Figure 1) is the centerpiece of the Alcon retina portfolio, offering a significant upgrade over previous iterations of vitrectomy platforms. It was designed with the idea of helping surgeons improve their performance through increased precision and control of surgical parameters.

Fundamentally, the Constellation platform's major advantage is that it is the result of careful innovation from Alcon. According to Szilárd Kiss, MD, that commitment to innovation is particularly important because the only constant about retina surgery is its continual



**Figure 1. At the center of all Alcon's development activities for vitreoretinal surgery is the Constellation Vision System.**

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evolution. New scientific understandings gleaned from advanced level diagnostics and cutting edge research in various disease states are advancing the retina field at a breathtaking pace. Yet, at the core of retina practice is a need for surgeons to be able to perform extremely delicate operations in a safe, efficient, and timely manner in order to help patients preserve, protect, and restore their visual ability.

“My parting words to the graduating retina fellows is that if you are doing the same thing that we taught you during retina fellowship 5 years from now, we failed. The pace of innovation, especially in surgical retina, is such that you have to keep up, or you are going to be behind. I think that is true for us as surgeons, but also for industry so that we can continue to elevate patient care,” Dr. Kiss said.

One of the key underlying principles of the Constellation’s design is to give the surgeon greater control over the unpredictable elements of a surgery, as well as help maintain control of the globe.<sup>1</sup> These two are indeed complimentary, in that giving the surgeon enhanced control of his or her intraoperative maneuvers lessens the impact of inherent consequences of ocular manipulations; in turn, when such things as potentially negative tractional forces can be controlled for, the surgeon can be more confident in the ability to perform surgery.

On-board features of the updated Constellation system offer to impart greater control over crucial parameters, namely the system’s on-board duty cycle control options and intuitive dynamic intraocular pressure (IOP) control.<sup>4</sup>

Surgeon-controlled duty cycle describes the ability to control how frequently the cutter port is open proportional to the total time of the cut cycle. During surgery, variable duty cycle affords the surgeons a degree of flexibility in terms of flow.<sup>3,4,5,6</sup> For instance, the cut rate can be reduced to manage very thick membranes while

keeping the cutter port full open, thus equalizing fluidic resistance at the port opening. This functions to reduce traction associated with pulling on thick membranes with firm attachments to the retina and, therefore, reduces the potential to induce iatrogenic breaks.<sup>4,7,8,9</sup> If desired, the surgeon can complete the maneuver using the cutter alone, and the need to switch to scissors is obviated. In any case, the surgeon can focus on performing the maneuver because the Constellation is managing the duty cycle.

Further advantages in terms of fluidic resistance are imparted by smaller gauge instrumentation, whereas a smaller opening limits the amount of vitreous uptake to be cut. Overall, port-based flow limiting, the term coined by Steve Charles, MD, to describe how higher speed cutting combined with smaller gauge instruments increase fluidic resistance, serves to increase vitreous stability and reduce cutter chatter, thus allowing the surgeon to safely shave close to mobile retina.

“With the controlled duty cycle and the dual pneumatic drive of the Constellation vitrector, you can now use 7,500 or 10,000 cuts per minute (cpm) with 50% open port. This has very important implications for flow and it simplifies the procedure. In my surgeries, I use the highest cut rate possible because the machine controls duty cycle. This gives me confidence that the duty cycle is always at least 50%,” said Dr. Rizzo.

One result of the Constellation’s intuitive duty cycle control is that it allows the surgeon to reduce the number of parameter adjustments that are necessary. For instance, a high cut rate with linear vacuum can be used throughout the procedure, and the surgeon can adjust aspiration using the foot pedal to slow down or speed up according to his or her comfort level.

“With the Constellation, I have the option to keep the cutter at a high speed and to adjust with the foot pedal,” said Manish Nagpal, MS, DO, FRCS(UK). “If I am close to the retina, I can ease off and take it slow, but if I am in the core, I am confident in the machine’s dynamic duty cycle control,<sup>4</sup> so I can push the foot pedal to use higher cut rate.”

Simplifying the procedure has obvious benefits for maximizing efficiency, potentially reducing time inside the eye and of the overall surgical procedure.<sup>2</sup> A less appreciated benefit of streamlined surgery is in the training of new surgeons. Dr. Kiss said that he now teaches fellows to think less about “core” and “shave” modes; instead, he emphasizes the need to think about how much vacuum power is being used and how much time the ports need to be open to perform the desired maneuver.

For instance, with Constellation, because of the controlled duty cycle and, hence, fluidic control, the cutter

can be used for several different aspects of the surgery.<sup>4</sup> In a recent case in which he was peeling a diabetic membrane, Dr. Kiss used the vitrector to simulate scissors. By using a biased open port with moderate vacuum to create a plane between the tissue being removed and the retina; once achieved, he was able to get under the membrane and safely remove it without the need to switch to manual scissors.

"In fact, I cannot remember the last time I used scissors," Dr. Kiss said. "With small gauge vitrectomy and the ability to control the duty cycle, we can often times efficiently peel the membrane using the cutter alone."

Such a change in operating technique does come with important caveats, however. Reduced tractional forces in the eye mean there is less pulling of the vitreous,<sup>7,8,9,10,11</sup>—which is indeed a benefit—yet it also means that the vitreous is going to be quieter and less turbulent—again, a benefit. However, as Audina Berrocal, MD, explained, young surgeons should be instructed to go after the vitreous rather than allowing it to come to the cutter opening.

"It is difficult for the training surgeon to discern if he or she is engaging the vitreous or if the cutter plane is below the vitreous. I think this is a crucial albeit tricky teaching point for young surgeons," Dr. Berrocal said. "They need to be encouraged to have confidence to go after the vitreous rather than sitting in the core and waiting for the vitreous to come to the tip."

### DYNAMIC IOP CONTROL

Another feature of Constellation, dynamic IOP control, serves as a safety net against sudden pressure changes.<sup>1,5</sup> With most vitrectomy platforms, the surgeon has to be mindful of sudden occlusions of the port opening and globe collapse. In such situations, the surgeon has to react quickly, back off the foot pedal to reduce aspiration, and hope to avoid a negative situation. But with dynamic IOP control, the Constellation senses variations of IOP  $\pm 2$  mm Hg and intervenes in sudden high and low flow situations to compensate fluid infusion.<sup>1,3,5,6</sup>

Surgeons by and large appreciate having such a safety net to prevent sudden pressure changes, keeping it active during almost every procedure.

"Many other vitrectomy devices nowadays offer a form of IOP control in the fact that they increase infusion based on how much you are pressing on the pedal,"<sup>4</sup> Dr. Kaiser said. "The Constellation is engineered with proprietary noninvasive flow sensors that provide continuous monitoring of flow to help maintain a stable ocular environment at all times.<sup>6</sup> Using the system, infusion pressure is adjusted dynamically to deliver target IOP even in the most demanding surgical situations. This

is one of the key aspects of the Constellation system: it has really spectacular fluidics.<sup>4</sup> When combining this with valved cannulas, it really gives us an exceptional level of intraocular pressure control."<sup>12,13</sup>

### THE RIGHT TOOLS FOR SUCCESSFUL SURGERY

A wide suite of surgical instrumentation and adjuncts offered by Alcon complements the onboard options and features of the Constellation. One parsimonious example of this is the availability of valved cannulas—a design idea that is elegantly simple yet exceedingly meaningful. In principle, valved cannulas utilize low-friction silicone valves to allow easy passage of instruments while preventing egress of intraocular fluid and air; in practice, these devices aid greatly to the ability to control the IOP,<sup>12,13</sup> and thus lessen the risk of hypotony and other pressure-related complications.

"One small but important benefit of valved cannula systems is that all the cannulas can be placed before the infusion line is engaged, which becomes particularly useful to avoid hypotony and sudden pressure changes in previously vitrectomized eyes," said Dr. Berrocal.

Pressure loss during surgery can lead to serious complication, such as suprachoroidal or intraoperative hemorrhage. However, use of a closed system vis-a-vis a valved cannula system can create a much more stable intraocular environment.

"I consider the availability of valved trocars to be one of the most important innovations in retina surgery, and using them now with 25+ and 27+ instruments is even an upgrade over using them with 20-gauge. They provide a surgical safety net and it is amazing how much control we have in the eye now," said Dr. Berrocal. "Valved trocars are really beneficial in special circumstances, such as when there is risk of a choroidal hemorrhage and it feels like the globe is about to collapse. Because the valved cannula creates a closed system,<sup>13</sup> you can maintain the eye at high pressures, and you can more safely perform



Figure 2. The UltraVit High Speed Vitrectomy Probe uses a dual drive pulse.

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maneuvers with the knowledge that the pressure is not going anywhere and you are not going to induce a bleed.”

Stepwise improvements have also been made in the design of the cutter. At its most basic level, a cutter draws vitreous into the port near the distal end of the instrument; vitreous is cleaved by an action of an inner tube sliding forward to close the port and the material is then aspirated through the inner tube. Such cutting action can be either guillotine in nature (ie, linear along the longitudinal axis) or rotational around the longitudinal axis.

The cutter movement can be created by electrical pulses or via a pneumatic drive. In designing the UltraVit High Speed Vitrectomy Probe (Figure 2), Alcon took the design further than available instruments on the market today, opting for a pneumatic probe that uses a dual drive pulse to drive the cutter faster than was previously possible.<sup>14</sup>

Older style single-drive pneumatic drive guillotine cutters were limited in terms of cut rate by the properties of the return spring that served to reopen the cutting mechanism. As such, the highest cutting rate achieved with such a design was 2,500 cpm. Newer pneumatic designs that have come to market are capable of faster cut speeds in the range of 5,000 to 8,000 cpm.

Absolute cutter speed, however, is only half the story when it comes to clearing the vitreous and maneuvering within the delicate tissue of the posterior chamber. The UltraVit incorporates two pneumatic drive pulses, the first to create a cleaving action in the forward linear position, and a second in the opposite direction to reopen the cutter. As such, it takes far less time to vent air from the

system (stored up from the initial drive pulse), and, as a result, much higher cut rates are achievable with stable fluidic control.<sup>6</sup> The dual cutting action adds precision and an ability to control duty cycle.

#### ADVANTAGES OF HIGH SPEED CUT RATE

One of the first things most surgeons notice about Constellation is the ability to use significantly enhanced cutting speed—now as fast as 10,000 cpm. However, when coupled with the platform’s intuitive duty cycle control and dual-pneumatic drive vitrectors, the cpm rate is controlled and fluidics remain at optimum levels.<sup>6</sup> Additionally, faster cut speed coupled with duty cycle control may reduce tractional forces that are a consequence of intraoperative maneuvers.<sup>7,8,9,11</sup>

Tractional forces on the retina increase proportionally relative to the rate at which the vitreous is cut in a negative correlation, such that slower cut rates impart larger tractional forces.<sup>8</sup> This has particular implications at the periphery, where distal attachment points are affected by greater tension and where the retina-vitreous interface may be weaker to begin with. When a slower moving cutter is used, larger sections of vitreous are cleaved with each cut, thereby pulling more of the vitreous centrally and stressing the more distant connections to the retina. By comparison, as a general principle, a faster moving cutter creates less turbulence because smaller bits of the vitreous are cleaved with each pass. As a result, tractional forces are reduced.

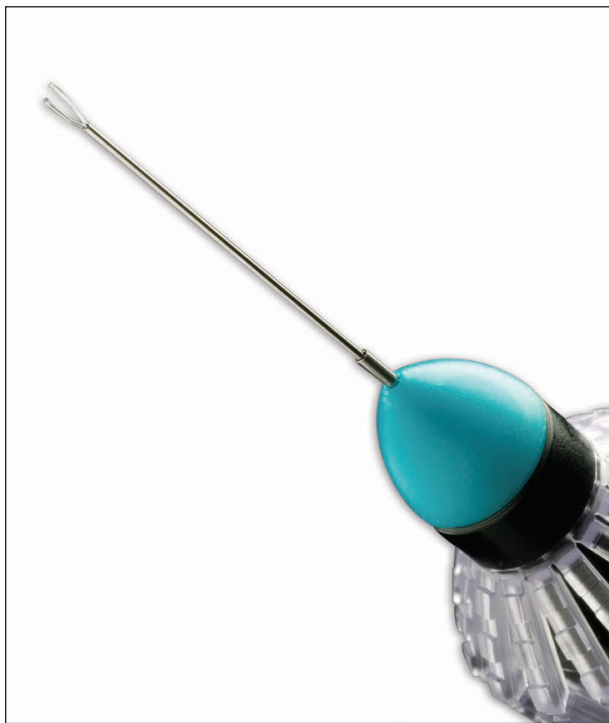
“The higher the cut rate, the smaller the fragments that are cut, and the less turbulence and traction there is on the retina,”<sup>6</sup> said Marco Mura, MD. “You almost get a continuous aspiration of this vitreous because of this.”

Intuitively, reduced tractional force as a result of a smaller cleavage plane would seem to establish ideal parameters in which to reduce potential complications. In a post hoc analysis performed by Stanislaw Rizzo, MD, that studied the difference in peripheral retinal breaks comparing 2,500 and 5,000 cpm, the rate of iatrogenic breaks was significantly higher in the group of cases operated with slower cut rates.<sup>8</sup>

“What this very simple paper demonstrated was the advantage in terms of safety of using a higher cut rate compared with less cut rate per minute,” Dr. Rizzo said.

Beyond the flashy numbers, though, what high speed cutting combined with the Constellation’s features really adds is a degree of versatility with the surgical instruments.<sup>4,10</sup>

“One of the big things with this platform is that with the combination of small-gauge and then your control of the fluidics allows you to remove membranes like never before.<sup>4</sup> I cannot remember the last time I used the scissor. You can really get in there, even with forceps,” Dr. Kiss



**Figure 3.** Stiffening sleeve on 25-gauge shaft (27mm) for improved control. The movement from 20-gauge to 27+ instruments allows surgeons to move around the vitreous cavity and manipulate ocular tissue with more precision than ever.

said. “One reason this is possible is because of how close the port is to the end of the tip as well as the exquisite control you can have with that small instrument. I remember during my training attendings having three or four different forceps on the field depending on the situation. And now, we have forceps on standby, but in most cases, we do not have to open up anything more even for complex cases than just the vitrectomy probe.”

“I cannot think of any case type we cannot do with the current level of surgical technology we have at our disposal,” Dr. Berrocal said. “Even more so, the upgrades in small gauge combined with the improvement with the platform, I feel like we have the flexibility to use small gauge instruments for all kinds of operations.”

### STIFFER ENGINEERING, SMALLER DESIGN

One of the criticisms of when the original 25-gauge instruments were introduced was a noticeable downgrade in instrument stiffness and flow compared to 23- and 20-gauge instruments. Such flexibility made surgery highly inefficient and potentially unpredictable. Surgeons complaining about this flaw led Alcon to go back to the drawing board and engineer a new line of 25+ instruments that offered greater stability.<sup>10,15</sup>

The new line of 25+ products was introduced in 2008

and has grown in popularity globally. Increases in fluidics and stiffness were addressed alleviating most surgeons’ concerns.<sup>10,15</sup> One benefit of 25+ is their small lumen size and universal applicability to almost all pathologies. With the reengineering of 25+, Alcon also introduced the 25+ Short product line offering a shorter, stiffer probe to address cases where this technology might be more useful, such as eyes with shorter axial length (Figure 3).

“Before Alcon introduced the 25+ Short line, I actually preferred to use 23-gauge on my pediatric cases, because every time I would use the 25-gauge to do any anterior pediatric work, the instruments would bend, and I could not maneuver to where I wanted to go. I never felt I had that much space in the eye,” Dr. Berrocal said.

The 25+ Short instruments were specifically designed to be shorter and stiffer. The 25+ UltraVit probe, for example, is 18 mm long, considerably shorter than the 31 mm 20-gauge probe.<sup>14</sup> The line also includes a 25+ Short Endoilluminator which measures 14 mm.<sup>14</sup>

“Now that we have the short line of instruments, I am confident I have the tools I need to perform pediatric cases,” Dr. Berrocal said. “I have used these instruments in eyes with an axial length as long as 24 mm in children, whose sclera is less rigid. I wish the surgical pack for 25+ included valved cannulas because I am a big believer in them, but I always can get them as standalones.”

As much as 25+ Short is an advantage for cases with small eyes, their use is not limited to younger eyes. According to Dr. Rizzo, the shorter, stiffer instruments may be used in such cases as a congenital cataract where a longer probe is not necessary to remove the lens.

“These instruments are not just used in young people. We can use them in certain older patients, such as to take the cataract. The shorter probe is enough to get to the periphery and remove lens remnants,” Dr. Rizzo said.

### SPECIALTY TOOLS

Among the new offerings from Alcon are two specially designed instruments from Alcon’s Grieshaber line, the Finesse Flex Loop (Figure 4) and the Finesse MaxGrip Forceps (Figure 5).

The Flex Loop is a proprietary nitinol loop possessing 41 tines on each side and has been designed to optimize consistency when creating an edge on the internal limiting membrane (ILM). The concave tines are designed to sink no more than 85% into the ILM when loop is fully extended (Figure 6). Further, the thin loop design allows for excellent visibility to the contact area and the flexibility can be adjusted for desired stiffness.<sup>14</sup>

“I use the Flex Loop to gain an edge and the vitrector to remove the membrane, which has allowed me to stop using forceps around the macula,” said Dr. Berrocal. “It is also easier for me to teach that to the fellows.”





Figure 4. The Flex Loop has been designed to optimize consistency when creating an edge on the ILM. The sliding mechanism allows surgeon to increase or decrease the stiffness as needed.

In many ways, the Flex Loop is meant to be an upgrade over the Diamond Dusted Membrane Scraper (DDMS, Synergetics), which performs a similar function during retinal surgery. Its design allows the surgeon to delicately manipulate around the optic nerve and capture the edge of the hyaloid.

“Compared to the DDMS, I like the fact that I can see through the middle. With the DDMS you were never sure how much pressure you were putting on the retina until you took it away, and then you would see that maybe you were going too deep,” Dr. Berrocal said.

“I have used the DDMS for many years,” added Dr. Mura, “but I feel the Flex Loop is an upgrade over that instrument. With the Flex Loop, I can do the same things I wanted to do with the DDMS but with a clearer view of the tissue that I am manipulating.”

Dr. Mura attributes this fact to the 82 tiny teeth on the face of the Flex Loop, which he said penetrate just deep enough into delicate tissue to remove them, but not so deep that iatrogenic breaks are induced.

“You can also adjust the rigidity depending on the length of the Flex Loop. This is a great instrument to add to retinal surgery,” Dr. Mura said.

Adjusting the length of the Flex Loop is one the crucial teaching points for fellows, said Dr. Berrocal, because the instinct is to extend it out to its longest point.

“When I start fellows with the Flex Loop, I have them use it at midpoint length for work on the macula to get a sense of how it feels in their hands and how it manipulates tissue in the eye,” said Dr. Berrocal.

The MaxGrip Forceps have a microtextured grasping surface for secure grasping of heavy fibrous or adherent membranes. They offer a 10-times greater surface area compared to ILM forceps, and tend to create less

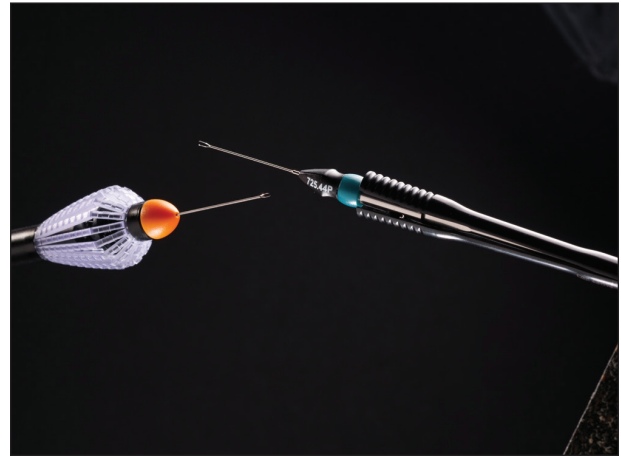


Figure 5. The MaxGrip Forceps have a microtextured grasping surface for secure grasping of heavy fibrous or adherent membranes.

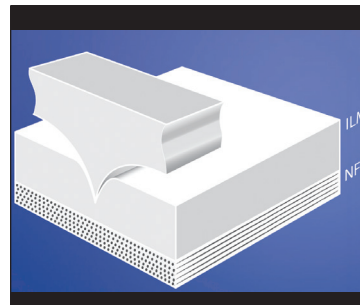


Figure 6. The loops on the Flex Loop are designed to penetrate 50% to 85% into the ILM when the loop is fully extended. The concave tine shape impedes penetration exponentially with increasing indentation.

tissue shredding when peeling membranes (Figure 7).<sup>14</sup> According to Dr. Berrocal, MaxGrip Forceps add to the ability to manage just about every situation with a minimum of instrumentation, at once streamlining surgery, making it more efficient, and reducing the number of instrument exchanges inside the eye.

“I use the Flex Loop and the MaxGrip in almost every case,” said Dr. Berrocal. “With the dual pneumatic vitrector—which I can use as a multifunction tool to cut and aspirate but also to lift and peel some membranes—and the Flex Loop and MaxGrip, I can handle just about any case from simple to complex.”

“For ILM peeling, I use ILM forceps because I prefer to pinch the tissue when I perform this maneuver, and the purchase on the MaxGrip is too large for that delicate operation,” said Dr. Mura. “However, for a tougher membrane, I need to have a larger grasping surface and then it’s with a MaxGrip or a serrated forceps. That is a real advantage in this case to avoid shredding.”

## DISPOSABLE VERSUS REUSABLE

One of the ongoing trends in retina surgery is the popularization of disposable instruments. Reduction in gauge size from 23-gauge to 25+ and 27+ makes cleaning

and flushing more difficult, increasing the potential for damage due to fragility. Many surgeons also feel the hidden costs associated with upkeep of reusable instruments, their initial cost, and the cost of replacing those expensive instruments (even reusable instruments have a shelf life) coupled with the expense of maintaining sterility make their long-term use unsustainable. In the early days of disposable instruments, there was a sense that options were too limited in disposable offerings, and the instruments themselves were unreliable and unsuitable for regular use.

Regardless of which side of the debate one falls on, the Alcon line of Grieshaber instruments give surgeons the option to choose disposable tools with the confidence that they will perform the same way every time. The Grieshaber line is designed to provide precise, reliable, and repeatable performance.

#### FINDING COMFORT WITH 27+

An undeniable trend in retina surgery (and actually, in all ophthalmic surgery) is the advent of microinstrumentation for less invasive surgery. In the anterior segment, smaller incisions induce proportionally less surgically induced astigmatism, and microinvasive cataract surgery is made possible by smaller instruments. Similarly, for the posterior segment, the movement from 20-gauge, to 23-gauge, to 25+, and now 27+ instruments allow surgeons to more delicately move around the vitreous cavity and manipulate ocular tissue with more precision than ever.<sup>10</sup>

“In the last couple of years, there has been a huge evolution in the move to small gauge instruments that has allowed me to perform in the small gauge all the cases that I used to do with 20-gauge,” Dr. Mura said. “I remember the first-generation 25-gauge, and it really was not sufficient for use. But now the lighting is much better, the cutter is much improved, and the flow is really comparable to what we used to have in 20-gauge. I think this has advantages for patients, primarily reduced discomfort and faster healing.”<sup>16,17,18</sup>

Micro-incision vitrectomy surgery (MIVS) is believed to offer several advantages for patients, namely faster visual recovery,<sup>18</sup> decreased discomfort,<sup>17</sup> reduced astigmatism,<sup>19</sup> and less inflammation and disruption to the conjunctiva. When 25-gauge instruments were introduced, many surgeons believed it filled a niche for delicate macular surgery, but that its applicability beyond that may be limited.

“Now we have sort of flipped that notion on its head,” said Dr. Kaiser, “and now small gauge is really preferred, while larger gauges are reserved for speciality cases, such as dislocated nuclear lens.”

“I feel we may see that same type of evolution of



**Figure 7.** Close-up images of the ILM Forceps (Top) and the MaxGrip Forceps (Bottom) demonstrate a wider surface area for membrane peeling on the MaxGrip design.

greater utility for 27+ as we become more comfortable with it in the future,” Dr. Mura said. “In fact, I am able to do almost 100% of my cases with either 25+ or 27+gauge. I do trauma cases with 27+. Of course, there is a learning curve, but there really is no need to be worried about performance of the cutter, for example. The performance is great and the flow, especially with the Constellation, is fantastic.”<sup>6</sup>

According to Dr. Mura, he is able to perform most cases, including working in the periphery with some scleral depression. For dropped nucleus, he positions the lens close to the anterior chamber, performs the vitrectomy, and then brings the lens up to the anterior chamber.

“By doing that, there is no need to open the sclera. I use the phaco to remove the lens from the anterior chamber, and I can do this whole maneuver using 27+,” Dr. Mura said.

Other surgeons in the panel use 27+ in a more limited fashion while still preferring smaller gauge surgery for most, if not all, operations.

“I am most comfortable with 25+, actually,” Dr. Mura said. “When 27+ came out, I used it for simpler cases like floaters and then macular holes. Next I tried it in a few cases of peeling a diabetic membrane, and really

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“The capability to use Constellation for posterior and anterior chamber operations is very important for some eyes, such as in myopic eye where you have prolapsed vitreous.”

-Stanislao Rizzo, MD

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noticed an upgrade over what I could do with 25+. I find it insinuates into the membrane much better than 25+ or 23-gauge, and so now, I selectively use 27+ for all my posterior diabetic membrane cases, while I still use 25+ for things like PVR.”

#### COMBINED SURGERY: CATARACT SURGERY ON THE CONSTELLATION

The versatility of the Constellation platform extends into its ability to be used for a full range of posterior segment operations as well as for cataract surgery.<sup>20</sup> The Constellation is fully integrated with Alcon’s full line of anterior segment offerings, including the AutoSert IOL Injector and OZil torsional handpiece. It also includes an upgrade in 2016 to add OZil Intelligent Phaco (IP), the proprietary system that allows on the fly adjustments between longitudinal and torsional phacoemulsification operations.

In clinical studies, the OZil handpiece has been demonstrated to decrease repulsion and increase followability,<sup>21,22</sup> effect optimal energy delivery to nuclear fragments,<sup>23</sup> potentially decrease nuclear fragment dispersion,<sup>21,22</sup> and potentially reduce thermal output.<sup>24,25</sup>

“The capability to use Constellation for posterior and anterior chamber operations is very important for some eyes, such as in myopic eyes where you have prolapsed vitreous,” said Dr. Rizzo. “There needs to some support in the posterior chamber. I do this by placing the infusion line in the posterior chamber and opening it to 10 mm Hg to have a complete stable anterior chamber.”

“About 50% of my cases are combined surgeries and I also do cataract surgery by itself,” added Dr. Mura. “I have used almost all of the platforms on the market today. Once IP was introduced in the Infiniti Vision System platform, I realized I could use a lot less phaco power for cataract removal,<sup>24,25</sup> because the machine

automatically adjusted depending on the situation when you need longitudinal or torsional power. That is a huge advantage for protecting the cornea. The fact that the OZil is present and IP is coming to the Constellation is great, because I can see this really benefitting me in my combined cases.”

Although combined surgeries are predominantly performed in Europe, some US-based surgeons do prefer this option.

“I operate on a lot of children and I have to manage a cataract after these patients have oil in their eye for an extended period of time,” said Dr. Berrocal. “I like that I can use the Constellation to take the oil out, deal with the cataract, place the lens, and then deal with the retina. It is very efficient when I can do this all using only one machine.”

Some of the user options available on the Constellation that make it a flexible multifunction platform for retina surgery also add to its abilities for use in combined surgery settings.

“What I like about the fact of the Constellation is that it can simulate peristaltic flow, because when I did my training in cataract, I used a lot of peristaltic,” said Dr. Mura. “The flow mode with the Constellation in the chop phase for nucleus removal is very similar to using peristaltic.<sup>20</sup> I use the peristaltic flow mode with aspiration for the nucleus then switch to venturi mode removal for the cortex because I think it is more efficient.”

#### COMMITMENT TO INNOVATION AND SERVICE

The fact that the Constellation is manufactured and supported by Alcon, which has a longstanding interest in the ophthalmic industry, adds an extra sense of confidence for surgeons.

“I think what is important in the machine is that it makes me secure. I like to have a machine in my OR that I can depend on, that I know is reliable,” said Dr. Mura.

“I would add that Constellation is a truly an all-in-one platform,” said Dr. Kiss. “I think when you look at the Constellation you look at it as all-in-one plus retina plus phaco.”

“The uniformity in manufacturing is excellent from a company like Alcon,” said Dr. Nagpal. “I do a lot of training in my center, and the surgeons who come to my OR to learn know that, if they have a Constellation, they can go back to their center and perform the same procedure in the same way and expect the same results. The fact that the broad range of applications is so simplified and streamlined is a tremendous improvement.<sup>3</sup> It used to be that we had to stay aware of many, many parameters and up to date on different instruments and how to use them. With all the upgrades by Alcon, and because many of the instruments can be used for multiple purposes,<sup>4</sup> I

can simplify my surgical tray knowing I can probably use about 5 instruments for about 90% of cases. That simplifies my surgery and my training.”

Although the manufacture of high-quality equipment is important, many surgeons also stress that Alcon readily supports its products.

“The support system is better than most other companies I work with. I was having an issue recently with my system and we called in a rep who addressed the issue almost immediately. You honestly do not get that from most companies,” said Dr. Berrocal.

“We have been working with Alcon for a number of years now,” said Dr. Nagpal, “and I would agree that the support is tremendous. I would add that the company does a good job creating and supporting a network of surgeons with whom I can collaborate with and learn from. I think it’s really excellent about Alcon that they support not only their innovations, but also the people who use their innovations. I have made a lot of professional connections and have developed many friendships through working with Alcon.”

“The support system is very important, because it really does not matter how good the equipment is if either, (1) it does not work, or (2) the company behind it is not willing or able to be there if something goes wrong,” said Dr. Mura.

Other surgeons highlight the experience of seeing Alcon engineer—and then reengineer—the line of 25+ instruments as emblematic of how it remains responsive to its user base.

“One of the things that sets Alcon apart is their ability to listen to us about what we need and then deliver what we need. Alcon has been a very scientific company for all of the years that I have worked with them, and I really appreciate that,” said Dr. Kaiser.

And it is not just a matter of Alcon continuing to innovate, but also in how it innovates that makes a difference, according to Dr. Kiss.

“Alcon is not a gimmicky company. I find them to be very deliberate in the way they innovate in the fact that they only bring to market those things that the company feels have a purpose. A lot of companies invent a product and put it on the market hoping it will find a place. I think there is something to be said for being methodical toward addressing unmet needs, and there is something to be said for not just putting something out there because you can do it,” Dr. Kiss said.

### CLOSING WORDS

Participating in this event on behalf of Alcon has been an interesting experience. It has given me an opportunity to reflect on just how far our field has advanced. Many of

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“We have been working with Alcon for a number of years now, and I would agree that the support is tremendous. I would add that the company does a good job creating and supporting a network of surgeons with whom I can collaborate with and learn from.”  
-Manish Nagpal, MS, DO, FRCS (UK)

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us learned vitreoretinal surgery using chandelier lighting and 20-gauge instruments. Over the years, we have been inundated with step-wise evolutions in the tools and instruments we use during surgery.

On the one hand, the pace of innovation in retina surgery has forced us to learn, and often relearn, how we perform intraocular maneuvers. And yet, we should readily accept the challenge of trying to stay current, because, in the end, innovation in retina surgery is all about improving the odds for our patients.

I think that one of the participants in this discussion, Dr. Kiss, may have expressed this sentiment best when he shared the message he tells the retina fellows he trains:

“My parting words to the graduating retina fellows is that if you are doing the same thing that we taught you during retina fellowship 5 years from now, we failed. The pace of innovation, especially in surgical retina, is such that you have to keep up, or you are going to be behind. I think that is true for us as surgeons, but also for industry so that we can continue to elevate patient care.”

I wholeheartedly agree with Dr. Kiss’ words and I wish I could express them as elegantly as he. We should strive to maximize this innovation and readily accept new technologies and techniques that help us to improve safety and patient outcomes.

I, for one, welcome the pace of innovation in retina surgery, and I am excited to see what future developments companies like Alcon will offer. If history is any precedent, I am confident that the next generation of vitreoretinal surgeons will hold in their hands instruments and devices that will allow them to do truly incredible things for their patients. ■

-Peter K. Kaiser, MD

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### Constellation Brief Statement

**Caution:** Federal law restricts this device to sale by, or on the order of, a physician.

**Indications for Use:** The CONSTELLATION® Vision System is an ophthalmic microsurgical system that is indicated for both anterior segment (i.e., phacoemulsification and removal of cataracts) and posterior segment (i.e., vitreoretinal) ophthalmic surgery.

The ULTRAVIT® Vitrectomy Probe is indicated for vitreous cutting and aspiration, membrane cutting and aspiration, dissection of tissue and lens removal. The valved entry system is indicated for scleral incision, cannulae for posterior instrument access and venting of valved cannulae. The infusion cannula is indicated for posterior segment infusion of liquid or gas.

#### Warnings and Precautions:

- The infusion cannula is contraindicated for use of oil infusion.
- The disposables used in conjunction with ALCON® instrument products constitute a complete surgical system. Use of disposables and handpieces other than those manufactured by Alcon may affect system performance and create potential hazards.
- Attach only ALCON® supplied consumables to console and cassette luer fittings. Do not connect consumables to the patient's intravenous connections.
- Mismatch of consumable components and use of settings not specifically adjusted for a particular combination of consumable components may create a patient hazard.
- Vitreous traction has been known to create retinal tears and retinal detachments.
- The closed loop system of the CONSTELLATION® Vision System that adjusts IOP cannot replace the standard of care in judging IOP intraoperatively. If the surgeon believes that the IOP is not responding to the system settings and is dangerously high or low, this may represent a system failure. Note: To ensure proper IOP Compensation calibration, place infusion tubing and infusion cannula on a sterile draped tray at mid-cassette level during the priming cycle.
- Leaking sclerotomy may lead to post operative hypotony.

**Attention:** Please refer to the CONSTELLATION® Vision System Operators Manual for a complete listing of indications, warnings, and precautions.

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### MIVS Brief Statement

**Caution:** Federal law restricts this device to sale by, or on the order of, a physician.

**Indications for Use:** The CONSTELLATION® Vision System is an ophthalmic microsurgical system that is indicated for both anterior segment (i.e., phacoemulsification and removal of cataracts) and posterior segment (i.e., vitreoretinal) ophthalmic surgery.

The ULTRAVIT® Vitrectomy Probe is indicated for vitreous cutting and aspiration, membrane cutting and aspiration, dissection of tissue and lens removal. The valved entry system is indicated for scleral incision, canulae for posterior instrument access and venting of valved cannulae. The infusion cannula is indicated for posterior segment infusion of liquid or gas.

#### Warnings and Precautions:

- The infusion cannula is contraindicated for use of oil infusion.
- Attach only Alcon supplied products to console and cassette luer fittings. Improper usage or assembly could result in a potentially hazardous condition for the patient. Mismatch of surgical components and use of settings not specifically adjusted for a particular combination of surgical components may affect system performance and create a patient hazard. Do not connect surgical components to the patient's intravenous connections.
- Each surgical equipment/component combination may require specific surgical setting adjustments. Ensure that appropriate system settings are used with each product combination. Prior to initial use, contact your Alcon sales representative for in-service information.
- Care should be taken when inserting sharp instruments through the valve of the Valved Trocar Cannula. Cutting instrument such as vitreous cutters should not be actuated during insertion or removal to avoid cutting the valve membrane. Use the Valved Cannula Vent to vent fluids or gases as needed during injection of viscous oils or heavy liquids.
- Visually confirm that adequate air and liquid infusion flow occurs prior to attachment of infusion cannula to the eye.
- Ensure proper placement of trocar cannulas to prevent sub-retinal infusion.
- Leaking sclerotomies may lead to post operative hypotony.
- Vitreous traction has been known to create retinal tears and retinal detachments.
- Minimize light intensity and duration of exposure to the retina to reduce the risk of retinal photic injury.

**ATTENTION:** Please refer to the CONSTELLATION® Vision System Operators Manual for a complete listing of indications, warnings and precautions.

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**Indications for Use:** The Finesse™ Flex Loop is a manual ophthalmic surgical instrument intended to aid in ophthalmic surgical procedures. The device may be used in posterior segment surgery to create an edge on a membrane to begin peeling with forceps. The device is provided sterile and is intended for single use.

**Caution:** Federal (USA) law restricts this device to sale by, or on the order of, a physician.

#### Warning and Precautions:

- It is not recommended to remove the ILM (internal limiting membrane) with the device. Scraping the retina can cause irreversible damage to the nerve fibers.
- Inspect tip for damage (e.g. burrs, bending or loosening), check loop functionality (extendability), and ensure the loop is fully retracted before inserting instrument into the eye.

**Attention:** Reference the Directions for Use for a complete listing of indications, warnings, and precautions.

### Grieshaber® DSP Important Product Information

**Caution:** Federal (USA) law restricts this device to sale by, or on the order of, a physician.

Indications for Use: GRIESHABER® DSP instruments are a line of single-use vitreoretinal micro-instruments which are used in ophthalmic surgery, for cases either in the anterior or the posterior segment. The GRIESHABER® Advanced Backflush Handles DSP are a family of instruments for fluid and gas handling in vitreoretinal surgery.

#### Warnings and Precautions:

- Potential risk from reuse or reprocessing GRIESHABER® DSP instruments include: foreign particle introduction to the eye; reduced cutting or grasping performance; path leaks or obstruction resulting in reduced fluidics performance.
- Verify correct tip attachment, function and tip actuation before placing it into the eye for surgery.
- For light fiber instruments: Minimize light intensity and duration of exposure to the retina to reduce risk of retinal photic injury. The light fiber instruments are designed for use with an ALCON® illumination source.
- Good clinical practice dictates the testing for adequate irrigation and aspiration flow prior to entering the eye. If stream of fluid is weak or absent, good fluidics response will be jeopardized.
- Use appropriate pressure supply to ensure a stable IOP.
- If unwanted tissue gets engaged to the aspiration port, it should be released by interrupting aspiration before moving the instrument.

**Attention:** Please refer to the product labeling for a complete listing of indications, warnings, and precautions.

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### CENTURION® Vision System Important Product Information

**Caution:** Federal law restricts this device to sale by, or on the order of, a physician.

As part of a properly maintained surgical environment, it is recommended that a backup IOL Injector be made available in the event the AutoSert® IOL Injector Handpiece does not perform as expected.

**Indication:** The INFINITI® Vision System is indicated for emulsification, separation, and removal of cataracts, the removal of residual cortical material and lens epithelial cells, vitreous aspiration and cutting associated with anterior vitrectomy, bipolar coagulation, and intra-ocular lens injection. The INTREPID® AutoSert® IOL Injector Handpiece is intended to deliver qualified AcrySof® intraocular lenses into the eye following cataract removal.

The following system modalities additionally support the described indications:

- Ultrasound with UltraChopper® Tip achieves the functionality of cataract separation.
- The INTREPID® AutoSert® IOL Injector Handpiece achieves the functionality of injection of intraocular lenses. The INTREPID® AutoSert® IOL Injector Handpiece is indicated for use with AcrySof® lenses SN60WF, SN6AD1, SN6AT3 through SN6AT9, as well as approved AcrySof® lenses that are specifically indicated for use with this inserter, as indicated in the approved labeling of those lenses.

**Warnings:** Appropriate use of INFINITI® Vision System parameters and accessories is important for successful procedures. Use of low vacuum limits, low flow rates, low bottle heights, high power settings, extended power usage, power usage during occlusion conditions (beeping tones), failure to sufficiently aspirate viscoelastic prior to using power, excessively tight incisions, and combinations of the above actions may result in significant temperature increases at incision site and inside the eye, and lead to severe thermal eye tissue damage.

Adjusting aspiration rates or vacuum limits above the preset values, or lowering the IV pole below the preset values, may cause chamber shallowing or collapse which may result in patient injury.

When filling handpiece test chamber, if stream of fluid is weak or absent, good fluidics response will be jeopardized. Good clinical practice dictates the testing for adequate irrigation and aspiration flow prior to entering the eye.

Ensure that tubings are not occluded or pinched during any phase of operation.

**AEs/Complications:** Use of the INFINITI® Vision System handpieces in the absence of irrigation flow and/or in the presence of reduced or lost aspiration flow can cause excessive heating and potential thermal injury to adjacent eye tissues.

**ATTENTION:** Refer to the directions for use for a complete listing of indications, warnings and precautions.

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