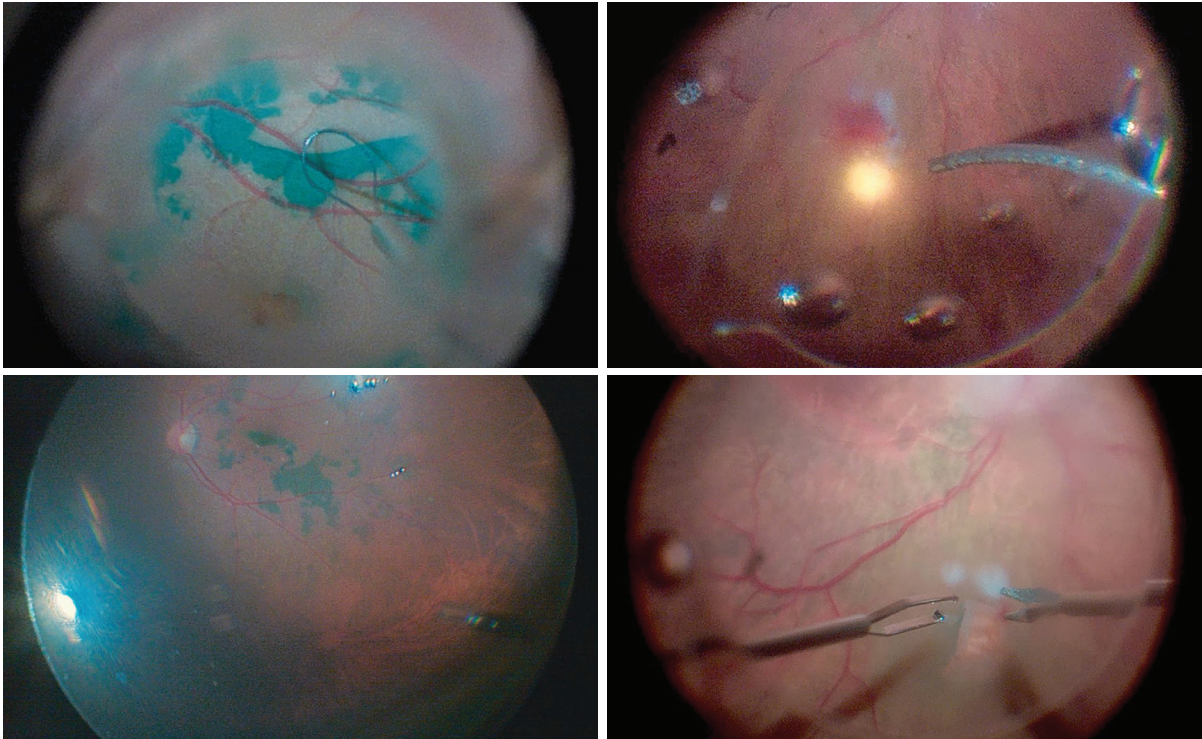


Retinal PHYSICIAN

OCTOBER 2018



Operating with the **NGENUITY[®] System**



Learn what early adopters are saying about
this revolutionary surgical visualization system

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IMPORTANT PRODUCT INFORMATION FOR NGENUITY™ 3D VISUALIZATION SYSTEM FOR THE DIGITALLY ASSISTED VITREORETINAL SURGERY PLATFORM

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

Indication: The NGenuity™ 3D Visualization System consists of a 3D stereoscopic, high-definition digital video camera and workstation to provide magnified stereoscopic images of objects during microsurgery. It acts as an adjunct to the surgical microscope during surgery displaying real-time images or images from recordings.

Warnings: The system is not suitable for use in the presence of flammable anesthetics mixture with air or oxygen. There are no known contraindications for use of this device.

Precautions: Do not touch any system component and the patient at the same time during a procedure to prevent electric shock. When operating in 3D, to ensure optimal image quality, use only approved passive-polarized glasses. Use of polarized prescription glasses will cause the 3D effect to be distorted. In case of emergency, keep the microscope oculars and mounting accessories in the cart top drawer. If there are any concerns regarding the continued safe use of the Ngenuity™ 3D Visualization System, consider returning to using the microscope oculars.

ATTENTION: Refer to the User Manual for a complete list of appropriate uses, warnings and precautions.

FACULTY*



Steve Charles, MD, FACS, FICS

Dr. Charles, a surgeon, engineer, and inventor, is the founder of Charles Retina Institute in Germantown, Tenn.



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John W. Kitchens, MD

Dr. Kitchens is a vitreoretinal surgeon with Retina Associates of Kentucky in Lexington.



Rishi P. Singh, MD

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**All faculty members have received compensation from Alcon for their participation in this supplement.*

Operating with the **NGENUITY**[®] System

Learn what early adopters are saying about this revolutionary surgical visualization system



→ WHAT IS THE ALCON **NGENUITY**[®] 3D VISUALIZATION SYSTEM?

The **NGENUITY**[®] 3D Visualization System is a platform for digitally assisted vitreo-retinal surgery. It is designed to improve the surgeon's experience by enhancing visualization. The 3D stereoscopic, high-definition digital video camera and workstation provide magnified stereoscopic images of the surgical field. Magnification can be increased while a greater field of view is maintained, and digital filters can be used to customize the view and highlight ocular structures and tissue layers. The **NGENUITY**[®] 3D Visualization System is an adjunct to the surgical microscope, but rather than looking through the microscope eye-piece, the surgeon sees what he or she is doing in 3D on a 55-inch high-definition TV screen. As an additional benefit, the immersive, 3D view is ideal for facilitating collaboration; and teaching in the operating room. Everyone sees what the surgeon sees in real time.

Learn what early adopters are saying about this revolutionary surgical visualization system that provides up to 5 times depth of field, up to 48% greater magnification, and up to 42% finer depth resolution with a lower light requirement compared to analog microscopes.¹

Recently introduced, the **DATAFUSION** (1.2) software integrates the viewing system with the **CONSTELLATION**[®] Vision System. Data from the **CONSTELLATION**[®] surgical platform can be overlaid in the four corners of the 55-inch, high-definition TV screen that aren't occupied by the circular eye image.

How does the **NGENUITY**[®] 3D Visualization System change the surgical experience?

David R. Chow, MD, FRCSC: Based on mathematical modeling used to compare **NGENUITY**[®] with the three most commonly used microscopes, **NGENUITY**[®] provides approximately 20% more magnification — that's in any situation, looking either at the macula or other tissue, regardless of how much

the microscopes are zoomed in.

Steve Charles, MD, FACS, FICS:

The magnification is enormous, and the depth of field is 5 times greater than with a surgical microscope alone. Even though I have presbyopia and very little ability to accommodate, I can still get that 5 times advantage. The biggest advantage of the system is the 48% greater magnification, which is enabled by the 5 times greater depth of field.



Rishi P. Singh, MD: The increased depth of field compared with a traditional microscope is very useful. It essentially restores the depth of field that was lost to presbyopia. I don't have to change my plane of focus to visualize tissues nearly as much.

John W. Kitchens, MD: The NGENUITY® 3D Visualization System has a high dynamic range (HDR) camera, which is an important component of the system. Photographers are likely familiar with this terminology, whereas most surgeons probably are not. Simply stated, HDR cameras allow the capture of a larger spectrum of light than standard range cameras. As such, they help to solve a problem associated with

video systems, which is bright areas (such as near the light pipe) looking washed out, and darker areas (such as in the periphery of the illumination) looking too dark and shadowy. An HDR camera captures 13 to 15 stops of range, which smooths out these variabilities in detail. It's that high dynamic range that gives us the ability to perform surgery with NGENUITY®.

HDR will become more familiar to people in the realm of video. It's becoming more prominent in televisions, for example, and Apple TV already supports streaming HDR. This technology will be coming to the forefront of what we expect from video output. If we were to operate with a standard-range camera,

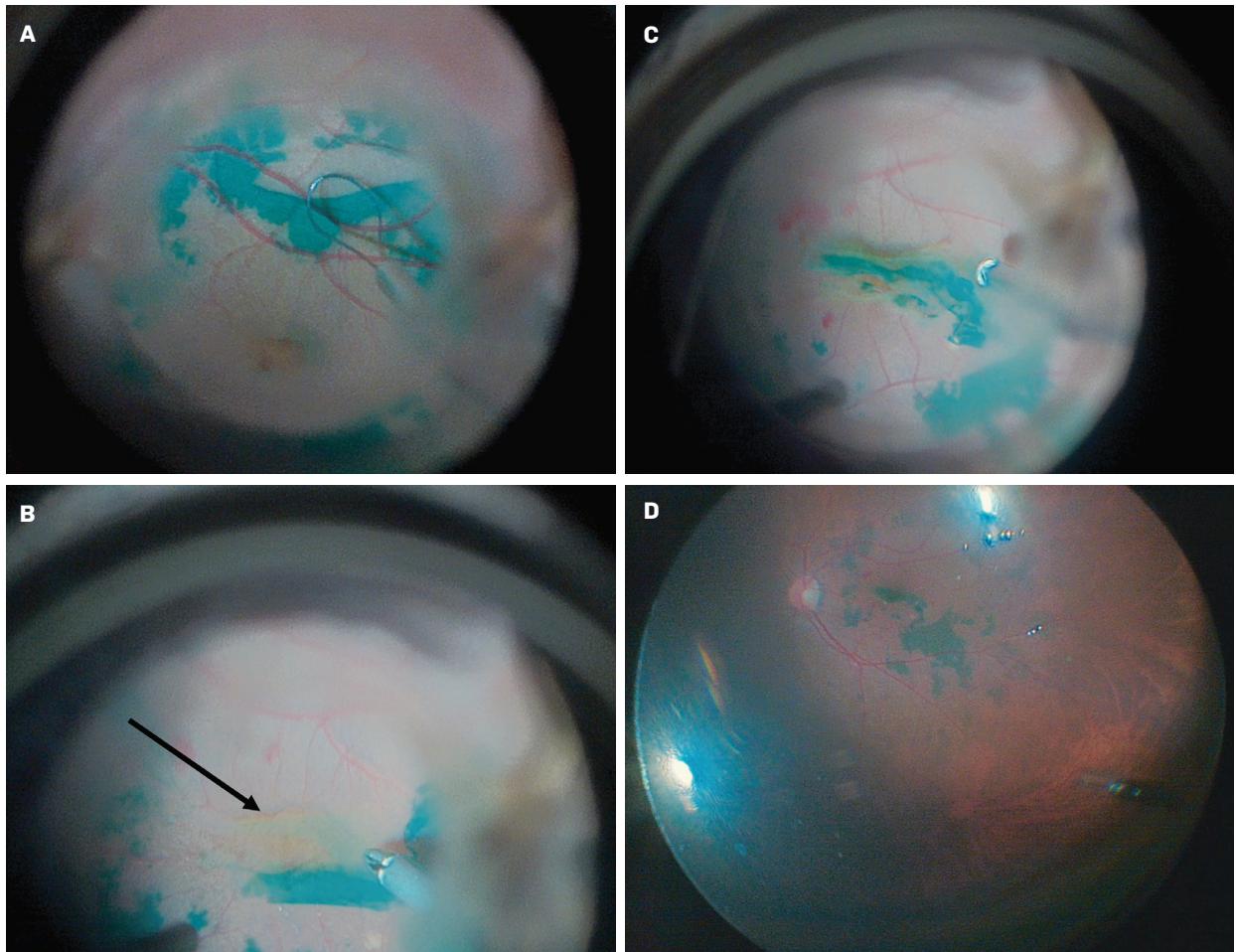


Figure 1. (A) ICG staining demonstrates lamellar hole with epithelial proliferation surrounding the hole, a poor prognostic sign for vision loss in this setting. (B) The ILM and epithelial proliferation were peeled from the macular surface with care taken not to dissociate the tissue from the edges of the lamellar hole. (C) The epithelial proliferative tissue was trimmed from around the hole. (D) A complete air-fluid exchange was performed with insufflation of 16% SF₆ gas. During the entire case, NGENUITY® provided an unprecedented view of the epithelial tissue, the ILM, and the entire retina under air.

Images courtesy of Dr. Rishi Singh, MD



too much information would be lost, and we'd have too much variation in dark areas and bright areas. It wouldn't be desirable.

What are some of the situations in which the NGENUITY® System is most helpful?

Dr. Charles: People often ask whether there are cases in which I wouldn't want to use NGENUITY®, and my answer is no. I use it in every case. It's better than the microscope alone for every case and it is never disadvantageous.

Take macular surgery, for example, which accounts for approximately 50% of the surgeries we perform every day. Or consider peeling the ILM, which is 3 µm thick and transparent. The greater depth of field with NGENUITY® is an enormous advantage. In cases of vitreomacular schisis, the eye is often highly myopic, and the retina is quite thin and fragile. The pigmentation at the back of the eye may be very light. The increased depth of field and magnification provided by NGENUITY® are extremely helpful in this scenario. The depth of field is also a major advantage in cases of tractional retinal detachment, where we are, of course, dealing with complex anatomy and multiple tissue planes.

Dr. Kitchens: I find that NGENUITY® allows me to more easily complete a membrane peel, hence my procedures are less traumatic to the macula. I find it's also easier to perform bimanual surgery with this system. It's preferable to sit back in a more relaxed position to operate bimanually in cases such as diabetic tractional detachment repairs.

Dr. Chow: NGENUITY® changes the whole story when it comes to scleral buckling. It's no longer necessary to take the old-school approach of using the overhead surgical lights and standing over the patient. The surgeon can take advantage of the magnification the system provides and the fact that he or she needn't accommodate. The tissue is crystal clear, and the precision is orders of magnification better.

How do you set up and optimize the NGENUITY® System for maximum performance?

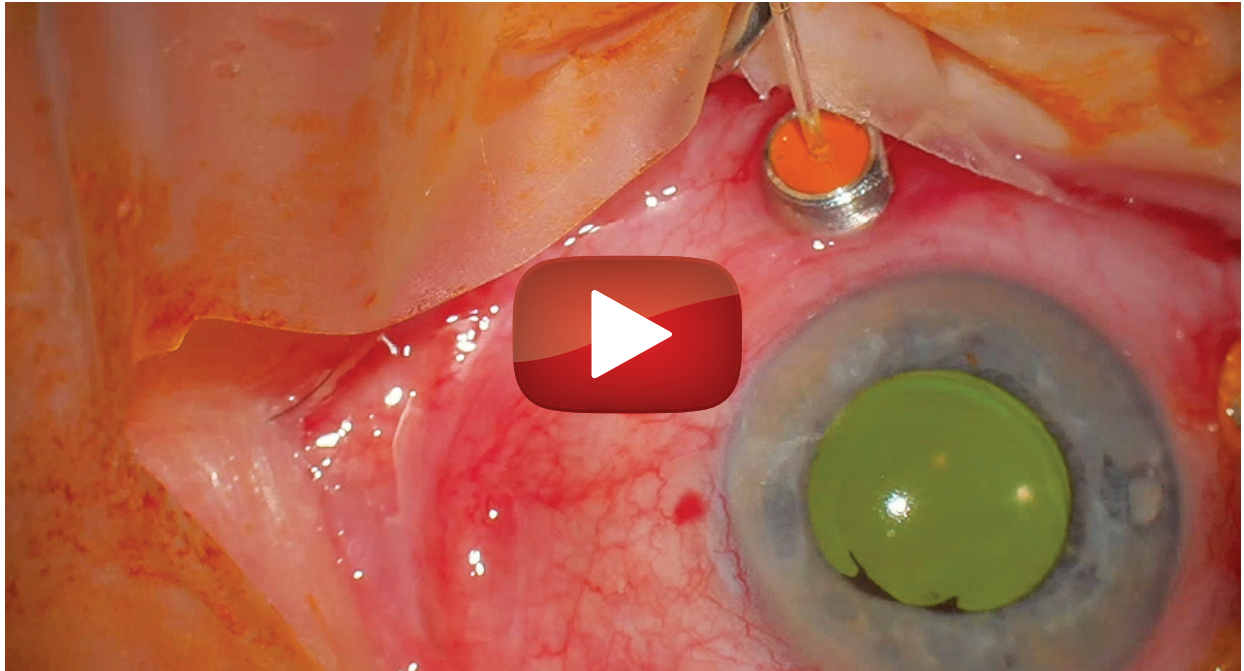
Dr. Charles: I set the camera aperture at 30% to take advantage of the depth of field and have the 55-inch OLED display positioned 4 feet from me. I fill the TV screen vertically with the image. If you don't fill the screen vertically, you're not taking advantage of the magnification. The optic disc would look about the size of a pie on the 55-inch screen. Another advantage to magnifying the image so it fills the screen vertically is that the resolution is outstanding from edge to edge. With a traditional microscope, only the optical access view is undistorted; the rest of the image is affected by spherical aberration.



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—Steve Charles, MD, FACS, FICS

Dr. Chow: I've been involved with research and development and the vision science group that has focused on the science of the NGENUITY® 3D Visualization System and how it performs compared with a traditional surgical microscope. With mathematical modeling, some interesting insights about the enhanced depth of field emerged. Depth of field with a traditional operating microscope is related mostly to the user's ability to accommodate. Surgeons who are around age 45 or 50 are likely to have about two diopters of accommodation, but their ability to accommodate has been gradually decreasing over decades. They haven't really noticed that their depth of field with the microscope has been decreasing as well. For them, if the NGENUITY® camera aperture is set at 30%, the system will always outperform a



White balancing the mercury vapor light source. Video provided by David R. Chow, MD, FRCSC

microscope for depth of field, and very noticeably so. The data show this is true even if the magnification is increased. It's highly unlikely that an older surgeon would fail to appreciate the better depth of field on the **NGENUITY**[®] 3D Visualization System if the camera aperture is at 30%. With increasing age, the user can open the aperture further to continue to appreciate the better depth of field. For example, a 60-year-old surgeon with no accommodation can open the aperture to 70% and still perceive better depth of field than with a microscope.

In contrast, younger surgeons have a significant amount of accommodation capability. Therefore, they have orders of magnitude more depth of field using a standard microscope than older surgeons. As a result, they are less likely to be able to perceive the improved depth of field of the **NGENUITY**[®], even with the camera aperture set at 30%. They are far more likely to perceive the depth of field as better on the microscope. The only way to change that would be to close down the aperture on the camera. Closing it to 20% can create a situation where a younger surgeon will have as much depth of field on the **NGENUITY**[®] as he or she does on a microscope, but there's a trade-off because

less light will be coming through the camera.

Dr. Singh: As you go along, you can determine whether you need to open the aperture more or less.

Dr. Kitchens: Right away, I knew I preferred the **NGENUITY**[®] System for operating on the macula, but I wasn't quite sure why until I became familiar with the vision science group's work. The reason I feel better and more comfortable using **NGENUITY**[®] rather than the traditional microscope alone is the greater magnification and greater depth of field. Binocularity is enhanced; my own ability to resolve what I need to visualize is expanded. As it turns out, my clinical observations and perceptions of a better view are based on rational science.

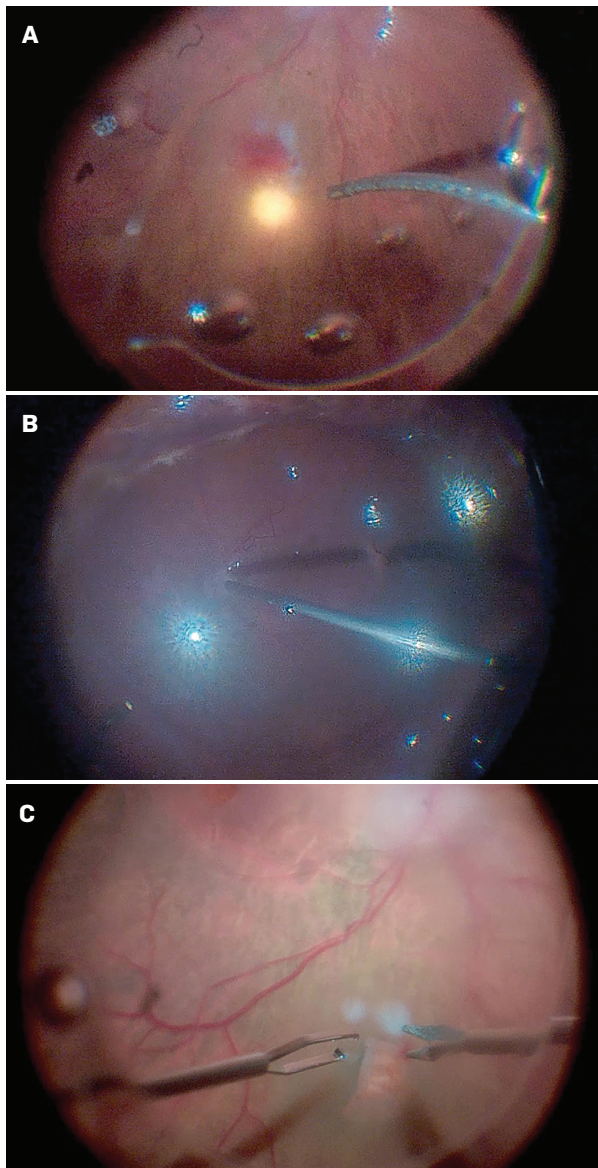
Dr. Chow: In addition to depth of field, depth resolution is a tangible characteristic that's amenable to mathematic modeling for comparing the performance of **NGENUITY**[®] with the performance of traditional microscopes. While depth resolution isn't a familiar term to most surgeons, they've actually been experiencing it throughout their entire careers. Depth resolution is the ability of the surgeon to perceive differences in tissues at different depths, and it correlates with magnification. As surgeons zoom microscope magnification



up and down, which they've always done instinctively and intuitively to get the clearest view of the task at hand, they also improve the depth resolution variable. Depth resolution is more important than depth of field when it comes to maneuvers such as peeling membranes as tiny pieces of tissue are being removed from the retina. It's been shown that depth resolution is significantly better with the **NGENUITY®** 3D Visualization System than with a microscope, and the maximal depth resolution occurs when the **NGENUITY®** System screen is placed 4 feet (approximately 1.2 meters) from the surgeon. Nothing is gained by placing the screen closer than 1.2 meters because that would exceed the limit of the eye's ability to perceive differences in the spacing of the pixels on the TV screen.

Dr. Charles: Right, 4 feet is the only proper working distance. Without thinking it through, someone might be tempted to put the screen at the foot of the operating table. That would be like looking at your watch across the room. If you tried to place it 2 feet away from the surgeon rather than 4, you'd not only have pixelation you'd also have a conflict between vergence and accommodation. You can't fake your brain into thinking the screen is at infinity. The results, such as eye fatigue and nausea, would be quite unpleasant.

Dr. Chow: There's been a difference of opinion on how best to focus **NGENUITY®**. Some surgeons use the mid-vitreous as the site of your initial focusing and then zoom out from there. Others do what traditionally has been done with a microscope, which is to focus on the disc or the macula, zoom up to put that tissue into focus, and then zoom out. The reality for clinical use, however, is that you can't set up focus so that everything from the top to the bottom of the eye is in focus at the same time. However, you can take advantage of the depth of field associated with the site you choose for your initial focusing. That means setting the focus should be pathology dependent. For example, if you're repairing a retinal detachment with anterior breaks or anterior PVR, you may want to set your focus from the mid-vitreous because that will likely keep the anterior vitreous in focus for most of the case. On the other hand, if you're working with the posterior pole during macular surgery, you may want to focus on the retina and work from there.



Images courtesy of John Kitchens, MD

Figure 2. (A) Laser to the harvest site of an autologous retinal transplant in a patient with a chronic macular hole. **(B)** Air-fluid exchange in a retinal detachment repair. **(C)** Bimanual surgery to create autologous retinal transplant patch in a patient with a chronic macular hole.

Dr. Charles: I find it best to focus on the cannulas as the target objects for focusing properly at the beginning of the case. That's where the surgical instruments are going to enter the eye. With focus on the cannulas, the instruments are in focus right behind the lens or IOL. From there, as I remove vitreous and move deeper into the eye, I continuously follow focus down. When I reach the retinal surface for membrane

THIS IS INTEGRA

This is

NOENUITY[®]
DIGITALLY ASSISTED VITREORETINAL SURGERY

with

DATA FUSION

Real-time CONSTELLATION[®] Surgical System Parameters

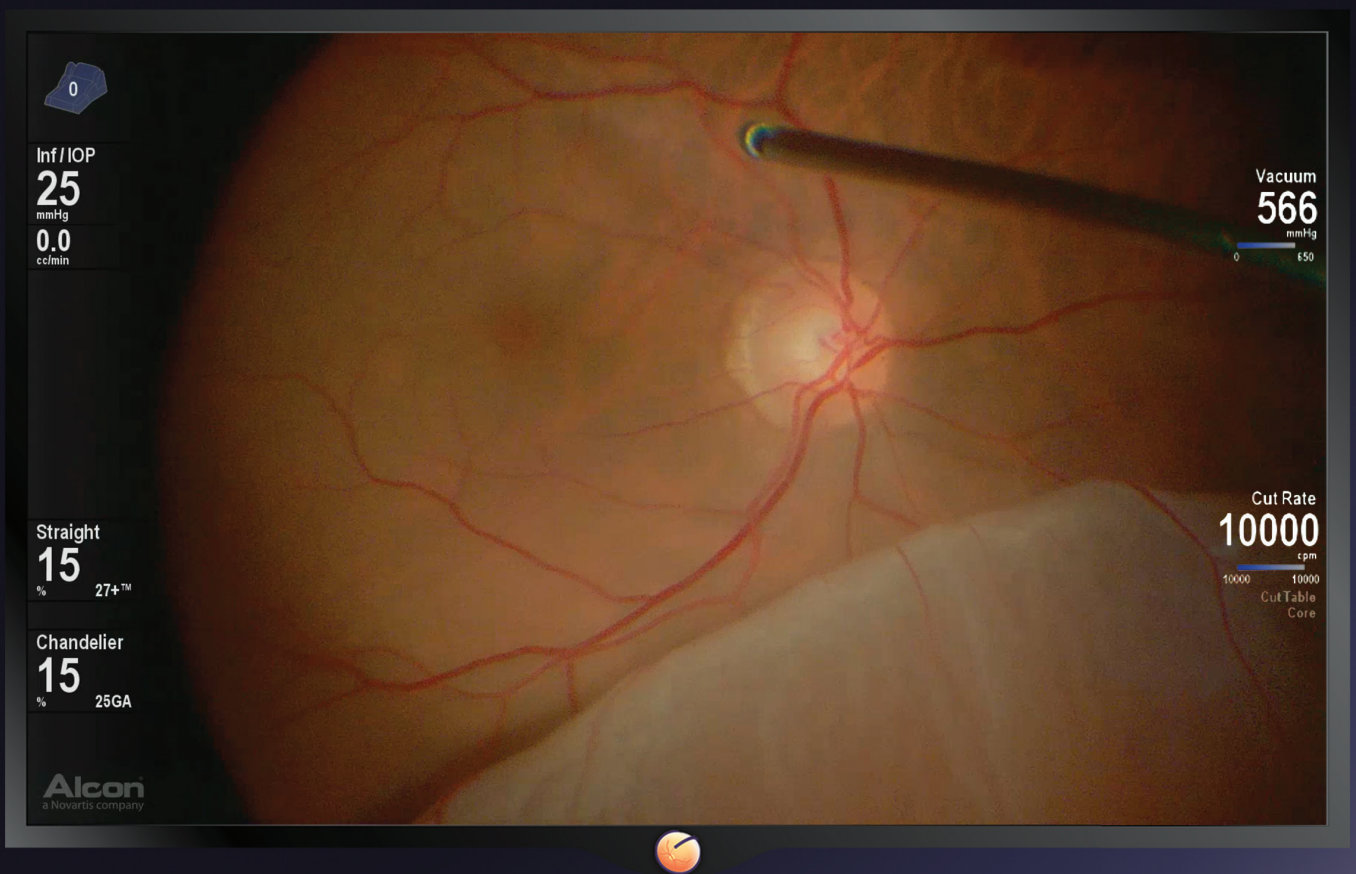
Custom Image Profiles

Intuitive Procedural Workflow

IMPORTANT PRODUCT INFORMATION

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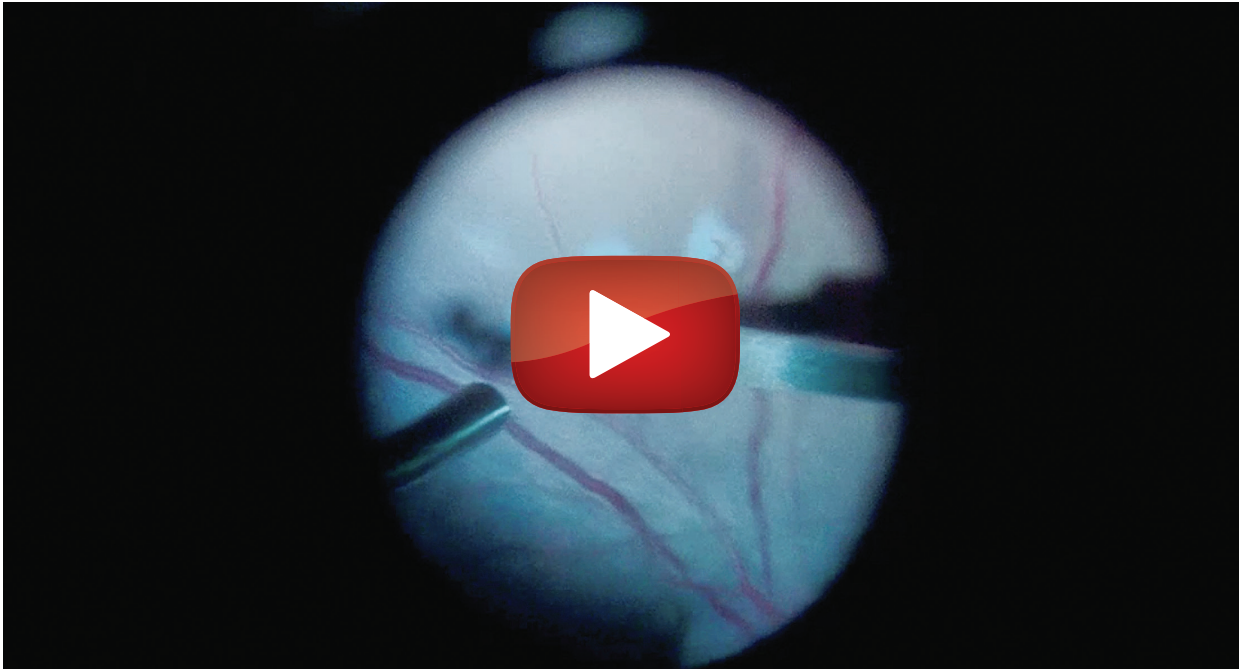


SEE IT BETTER. DO IT BETTER.

The CONSTELLATION® Vision System can be connected to the NGENUITY® 3D Digital Visualization System. Please refer to the CONSTELLATION® Vision System user manual for complete instructions, warnings and precautions.

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Macular patch graft. Video provided by Steve Charles, MD

or ILM peeling, I optimize focus again at the highest magnification. You can't focus two or three places and think everything will be in focus. That's not possible.

What do you like about the new software for the NGENUITY® System, DATAFUSION (1.2)?

Dr. Charles: DATAFUSION (1.2) integrates the NGENUITY® 3D Visualization System with the CONSTELLATION® surgical platform. Data from the CONSTELLATION® can be displayed in the four corners of the 16:9 aspect ratio screen that aren't occupied by the circular eye image. It's extraordinary to see critical parameters such as flow rate, infusion pressure, laser power, what mode is activated, and so on, as you work. Glare isn't an issue because the overlay is transparent. The information is always available but unobtrusive.

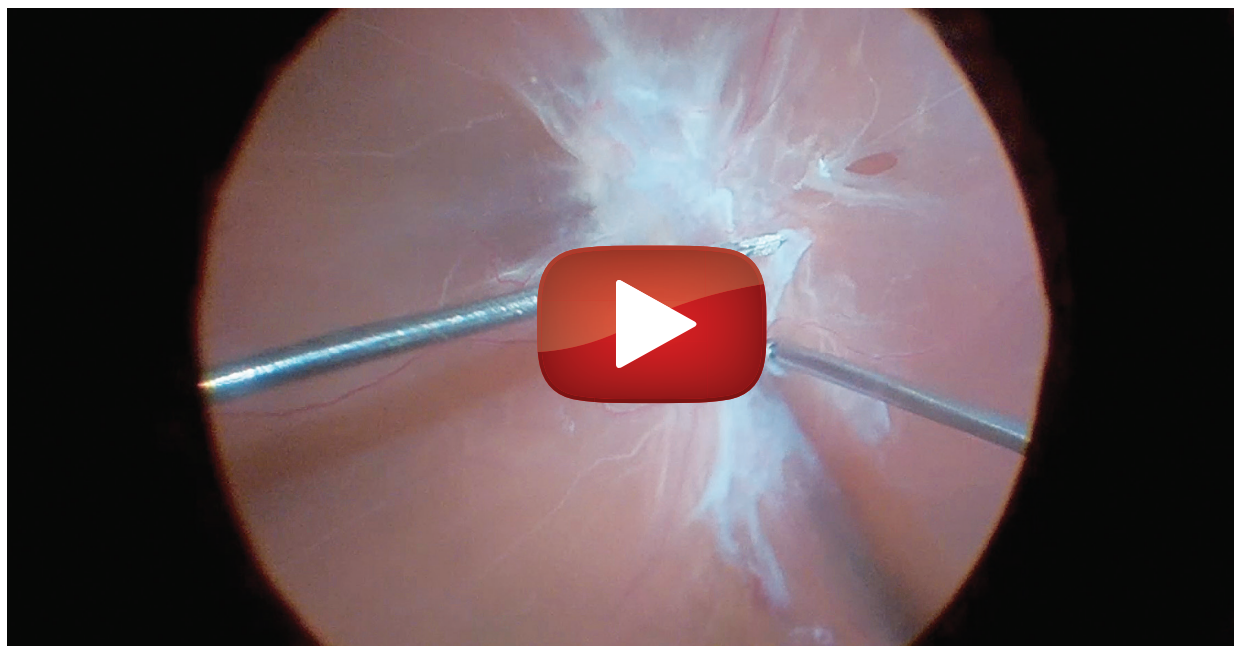
Dr. Kitchens: The DATAFUSION (1.2) software is a tremendous upgrade for the system. I liken the CONSTELLATION® data overlay to driving a car with a speedometer and RPM gauge. We don't drive a car continuously staring at the speedometer, but occasionally we look down, check, and adjust our speed. Similarly, we now have awareness of parameters such as IOP,

cut rate, aspiration, and other data very conveniently viewable whenever we need them. I agree entirely with the assessment that the overlay is designed well. I completely block it out when I'm zoned into a portion of a case, which is great because it means it's not distracting me. The information is there when I want it, but not bothering me otherwise.

DATAFUSION (1.2) also comes with four preset image modes (anterior, hemorrhage, macular, and posterior), and new imaging modes can be created.

Dr. Singh: I compare the data overlay to a pilot's cockpit view where you have all the parameters you need to monitor right in front of you. Rather than having to look away from the surgical field or call out to someone else in the OR to check a setting, I can easily see it for myself.

Dr. Chow: The fact that we're now operating in a digital environment creates amazing opportunities for overlays, beyond the surgical system parameters. Other information can be superimposed onto the digital image, and a variety of features can be integrated. Imagine getting a warning signal when the bottle is nearing empty. Or, similar to a fighter pilot receiving a performance alert, your screen flashes red when the



Combined tractional and rhegmatogenous retinal detachment repair using a bimanual technique.

Video provided by John W. Kitchens, MD

cutter gets too close to the retina. Advances such as these are on the horizon.

How have the various features and ways to customize the NGENUITY® 3D Visualization System to your preferences been helpful?

Dr. Singh: New features such as filters and color channels have really improved tissue visualization. For example, it's possible to turn hemorrhage from red to yellow so that you can see around the blood, see the tissue better, determine your depth, and ensure you're accomplishing your surgical goals overall. We also use a separate color channel for ILM peeling with indocyanine green (ICG) that creates a great view of the dye and the tissue. This has allowed us to reduce the concentration of ICG dye that we use.

Dr. Kitchens: The ability to adjust the color channels by bringing out different hues or saturations is interesting, and I have used that, but I'm more likely to stick with the preset profiles. The profile for working outside the eye provides normal inversion of the image and good exterior saturation. The conjunctiva, sclera, and conjunctival vessels all look very natural and normal in color. When the scrub nurse inverts, the

system automatically applies, as the surgeon is going into the eye, the profile that's tuned specifically for use with the CONSTELLATION® Vision System and its light source. This creates a natural-looking balance and even contrast and saturation in the back of the eye for the core vitrectomy. It also inverts the image to compensate for the BIOM that's been moved into position. This profile allows great visualization of vitreous, and the work can be done at 10% to 20% light levels compared with the 30% to 40% levels that would typically be used without the NGENUITY® system. The macula profile, which is also optimized for the CONSTELLATION® Vision System, provides the upright image that we're accustomed to when working with a contact lens as well as the fine detail and good contrast necessary for peeling across the macula.

Dr. Charles: The ability to easily toggle to the electronic inversion of the surgical image is another huge advantage. It renders bulky optical inverters unnecessary. Another option many surgeons like is turning down the red channel to make the image appear bluish. When the red reflex is diminished, you can see the clear vitreous better. Dr. Marta Figueroa in Spain was the first to bring this to our attention. It



works very well, although I don't have a habit of doing it. For me, the image quality is so great that I tend to white balance and leave it as it is.

Dr. Chow: Speaking of white balancing, the process has been improved with the introduction of the DATAFUSION (1.2) software, and it's a crucial part of setup. Currently, surgeons have different opinions on how often to do this. Once a month? Once a week? At the beginning of each day? However, if the color performance doesn't seem ideal, it's likely because the white balance sequence needs to be run. Because the color environment inside the eye is most important in

follow the surgeries. In the past, on our smaller monitor, it wasn't easy for her to discern what I was doing. But now she knows when I'm going to want forceps or a laser probe. I no longer have to ask for my view to be inverted; she knows when to do it.

Dr. Singh: NGENUITY® is an immersive technology for everyone in the room. While I'm pointing out tissue planes for residents or fellows, the nurse anesthetist can be observing how the patient is moving, for example.

Dr. Charles: Our experience has been similar. The NGENUITY® is most people's first opportunity to

have a complete view of what the vitreoretinal surgeon is actually doing. They're amazed by it. More importantly, it intensifies team engagement and coordination. It helps the circulating nurse, the scrub tech, the anesthetist — everyone — to anticipate and plan. They're all anticipating my next step. For example, they can spot a retinal tear and ask if I'm ready for the laser. It makes me think of the crew resource management (CRM) concept in aviation, which focuses on crew communication and decision-making in the cock-

“ I EXPECTED THE NGENUITY® SYSTEM WOULD IMPROVE MY TEACHING, AND IT DEFINITELY DID. THE BENEFITS OF HAVING FELLOWS SEEING EXACTLY WHERE I AM IN THE EYE AND WHAT MANEUVERS I'M MAKING — OR ME BEING ABLE TO SUPERVISE AS IF I'M DOING THE CASE MYSELF — ARE QUITE OBVIOUS.”

— John W. Kitchens, MD

vitreoretinal surgery, the system should be white balanced to the light pipe on the proper NGENUITY® 3D Visualization System algorithm, i.e., the setting for the CONSTELLATION® Vision System's xenon light source.

Dr. Singh: I find that if we white balance the system each morning prior to the first surgery, we don't need to rebalance unless we change microscopes or move the camera.

Dr. Kitchens: Our nurses white balance our system at the beginning of each day. It takes 2 to 5 minutes.

What benefits does the NGENUITY® System provide for operating room staff? What has their response been to the system?

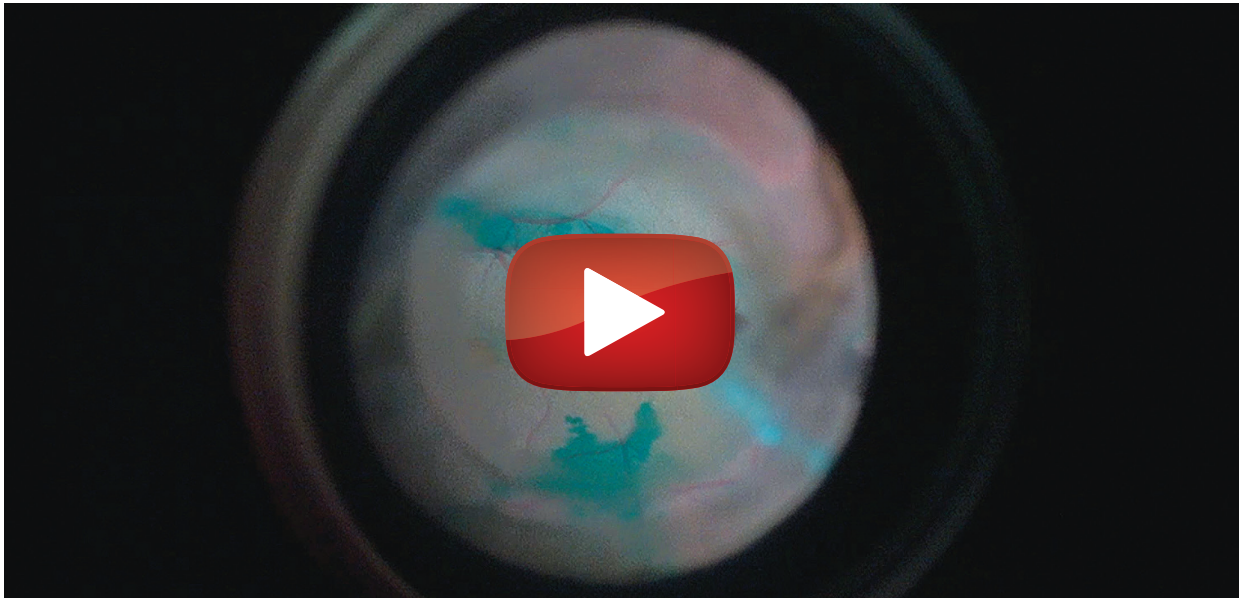
Dr. Kitchens: Our operating room staff members really love the system, and it brings the team together. My scrub nurse wears the 3D glasses so she can

pit. NGENUITY® reinforces a kind of CRM — people in the operating room are excited about what they see, they learn about it, they ask questions about it, and so on. One exception to keep in mind, however, is that if a surgical assistant is holding a surgical contact lens during a procedure, it's very challenging for him or her to also properly view the NGENUITY® screen. It would be like using the rear camera to look out the side window of your car. On the other hand, with non-contact visualization, this isn't an issue.

Describe your experience & the benefits of using the NGENUITY® System as a teaching tool.

Dr. Charles: Residents, fellows, and visitors in the OR see exactly what the surgeon is seeing, in 3D.

Dr. Kitchens: I expected that the NGENUITY® 3D Visualization System would improve my



Repair of lamellar macular hole with lamellar hole-associated epiretinal proliferation. Video provided by Rishi P. Singh, MD.

teaching, and it definitely did. The benefits of having fellows seeing exactly where I am in the eye and what maneuvers I'm making — or me being able to supervise as if I'm doing the case myself — are quite obvious. What I didn't expect is how the system engages me so much more. I'm actively participating and actively involved whether it's me or the fellow who's performing the case. I'm not struggling to see what he or she is doing, trying to ergonomically fit myself into the assistant scope. The **NGENUITY**® is a much better way to teach.

Dr. Charles: While most laptops and televisions don't yet have the capability to play 3D video, many of the national retina meetings are set up to provide a big-screen 3D display. In live settings, **NGENUITY**® can facilitate an extraordinary educational experience. At a recent meeting, an audience of more than 2,000 surgeons wore 3D glasses and watched live surgery from three different operating rooms.

Dr. Kitchens: **NGENUITY**® is also a valuable marketing tool for our practice. We routinely bring referring doctors to our OR to watch surgeries. We host continuing education events in an IMAX movie theater where we can show our surgical videos in 3D. We take a 3D television with us to a variety of local conferences and meetings, as well. This engages our referral base.

When they can actually see and better understand the surgeries we do and how we do them, they're more likely to appreciate the differences in quality between practices and make a better decision for their patients as far as where they want to refer.

Does the **NGENUITY® System enable better surgical video recording than previous methods?**

Dr. Singh: Absolutely. This is 1080p fully integrated video with the added capability of overlaying the **CONSTELLATION**® Vision System's surgical parameters, which are significant improvements.

Dr. Kitchens: I felt I was a pretty good videographer with our standard video systems, but the surgical video quality with **NGENUITY**® is incredible — like night and day compared to what we had before. To be able to perform an incredibly interesting case is one thing. But to have such high-quality video for teaching and showing at conferences and other venues makes it that much more rewarding.

I've edited video of some of my more basic procedures and put them on YouTube. I give my patients the links as part of educating them on the procedure they have scheduled. It's beneficial for them to see the highlights of the surgery in about 2 minutes, narrated by me. They engage with the videos and

enjoy seeing them. We could, of course, do this with almost any surgical video setup, but the video quality is unprecedented with the **NGENUITY®** 3D Visualization system.

What benefits does the **NGENUITY®** System provide for patients?

Dr. Kitchens: The benefit to patients of the stellar depth of field and depth resolution is huge and direct. With such great visualization, I've found that I'm far less likely to pinch the retina or have an inadvertent grab of the retinal tissue. The iatrogenic injury that these touches or grabs can create can be significant and include hemorrhaging, scotoma, or a macular break.

Dr. Singh: With **NGENUITY®**, I've been able to decrease my illumination significantly. Also, as I mentioned previously, because of the overall improvement in visualization, I've been able to reduce significantly the concentration of ICG that I use.

I think, too, that patients can appreciate that the surgeon is more at ease. I personally schedule my cases based on complexity. They get more complex as the day goes on. **NGENUITY®** allows for organization around the team approach and allows me to operate for those longer periods in an ergonomic, comfortable position.

Dr. Chow: I've heard surgeon after surgeon saying from the podium that they're able to reduce their light pipe setting to 10% when they're using **NGENUITY®**. We know that at 10%, the amount of light emitting from the light pipe is approximately one and a half lumens. It's astounding that surgeons are happy with that amount of light given that about 10 years ago, as 25-gauge surgery was emerging, and xenon light sources weren't in use, four lumens of light were considered inadequate. According to the data, this is a testament to the ability of the **NGENUITY®** camera to amplify the signal in low-lighting conditions and transmit it onto the screen at a level that the surgeon is clinically happy with it.¹

Dr. Charles: Yes, I'm using one-fourth as much light as I previously used. In addition to the reduced light level, **NGENUITY®** enables better macular surgery. It's all about seeing better. "See it better; do it better" is what I like to say.

Is the **NGENUITY®** System user-friendly? How would you describe the learning curve?

Dr. Singh: One might expect a significant learning curve given the way the system changes the angle of visualization. But it's pretty impressive how it takes only about 1 day to get used to it. It may be daunting to imagine looking up at a screen versus looking down at your hands and the surgical field, but in practice, it works very well without much difficulty.

Dr. Charles: Right. I'd say the learning curve amounts to a few cases.

Dr. Kitchens: **NGENUITY®** is very user-friendly. When we started to demo the unit, we thought we might need perhaps 20% more time per case until we were accustomed to it, and we built that into the schedule. As it turned out, that extra time wasn't necessary. When we reviewed our first 2 months of using the system across all three surgeons, our surgery times were exactly the same as what they had been before the system. Initially we made some minor adjustments in the OR to accommodate the large screen, but there's no slowdown of cases.

At the surgeon level, I'd say the biggest adjustment in transitioning to **NGENUITY®** from a standalone microscope is the depth perception in the eye being exaggerated, especially during core vitrectomy.

Dr. Singh: A new aspect that comes into play with **NGENUITY®** is the 3D glasses. I thought that wearing them could potentially be strange, but it's not. They're passive 3D glasses, and not obstructive at all. I've done scleral buckles through them. I've kept them on while doing a local procedure and then switched to a 3D procedure without any difficulty.

Dr. Kitchens: You might think the scrub nurse would have some trouble with tasks such as loading sutures while wearing the glasses, but she's able to accomplish everything just fine.

How important to you is the heads-up aspect of the **NGENUITY®** System?

Dr. Charles: I feel as if the most impressive aspects of the **NGENUITY®** 3D Visualization System are the magnification and depth of field, especially considering that we haven't been operating heads-down for years since tilt microscope oculars have been around.



Dr. Kitchens: The way I see it is that compared with cataract surgery, where there's more leeway with the angle of the microscope, retina surgery needs a relatively vertical microscope orientation. It requires the surgeon to lean forward over the patient somewhat, and not much can be done to be in a more relaxed position and take that pressure off. Even though I don't have any neck, back, or shoulder problems, the ergonomic aspect of the **NGENUITY**[®] System is of value to me. I like the fact that I can get into any posture. That allows me to have steadier hands, which, for example, facilitates better bimanual surgery. For surgeons who do have difficulty sitting at a microscope, I would think **NGENUITY**[®] would be a great solution.

How does the **NGENUITY**[®] System perform with regard to patient movement?

Dr. Charles: The surgeon can utilize moderate rather than maximum screen-filling magnification and follow lateral movement around the 55-inch display. Up-down motion due to the patient's breathing is solved by the system's 5 times increased depth of field.

Dr. Kitchens: Frank patient movement, such as an over-sedated patient moving his or her head side to side, is an issue regardless of viewing system type. But, as Dr. Charles said, **NGENUITY**[®] negates patient movement in the more common situation of a heavy breather. With a traditional microscope, the macula will be in focus during the inhale and out of focus during the exhale, or vice versa, and the surgeon has two choices. He or she can either wake the patient, which can be time-consuming and startling for the patient, or attempt to time the grasping of the ILM or epiretinal membrane without iatrogenically injuring the retina. With **NGENUITY**[®], the macula stays in focus, making it much easier to perform these delicate maneuvers in patients who are asleep or heavy breathers.

How would you describe your overall experience with the **NGENUITY**[®] System?

Dr. Charles: Superb.

Dr. Singh: In addition to all of the benefits we've discussed, the **NGENUITY**[®] system is a cost-effective way to replace a surgical camera system while extending the life of a microscope.

Dr. Kitchens: All four of the surgeons who operate at our surgery center love **NGENUITY**[®]. We've had the system for almost 2 years, and through all of our cases, approximately 1,000 per year, we've never taken it off our microscope. To me, that's the biggest tribute to its value.



THE **NGENUITY**[®] SYSTEM CERTAINLY DELIVERS A 'WOW' FACTOR, AND I FEEL IT'S MADE SURGERY A WHOLE LOT OF FUN AGAIN. IT PROVIDES GROUNDBREAKING TECHNOLOGY THAT'S CHANGING THE WAY WE'VE OPERATED FOR DECADES. AS TIME GOES BY, THE ADVANTAGES OF THE SYSTEM IN TERMS OF GLOBAL INTEGRATION WILL BE MASSIVE."

— David R. Chow, MD, FRCSC

Furthermore, it's not a situation in which the system has to be removed, so an anterior segment case can be done. Every case can be done with **NGENUITY**[®].

Dr. Chow: **NGENUITY**[®] certainly delivers a "wow" factor, and I feel it's made surgery a whole lot of fun again. It provides groundbreaking technology that's changing the way we've operated for decades.

As time goes by, the advantages of the system in terms of global integration will be massive. I believe it's only a matter of time before we see almost everybody adopting this system. ●

Reference

1. Alcon, data on file, December 2017.

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

Reference: 1. Data on File. Alcon Laboratories Inc; May 2018. 2. Data on File. Alcon Laboratories Inc; September 2017.