

Real-World Experience With 3D Surgical Viewing



Knowing the ins and outs of a new system before use makes for a smoother adaptation process.

BY S.K. STEVEN HOUSTON III, MD

Adaptation to any new technology takes time and a change in muscle memory. I have used the Ngenuity 3D Visualization System (Alcon) for all (150-plus) of my cases since its arrival in our office in December 2017. From sutured IOLs and choroidal drainages to membrane peels and retinal detachments, if I am operating, I am using the Ngenuity system (Figure 1). In this article I share the ins and outs of the system that I have observed during my adaptation from analog to digital.

AT A GLANCE

- The location of the 3D monitor relative to the surgeon determines whether the platform will maximize resolution or stereopsis.
- It is good practice to perform white balance each day before starting cases if the camera is removed from the operating microscope. If the camera stays in place and the parameters are kept consistent, performing a white balance monthly or when the image begins to degrade will suffice.
- Switching to the Ngenuity 3D Visualization System may require surgeons to adapt to slightly modified light manipulation, especially during membrane peeling.

FIRST THINGS FIRST: SETTING UP

A critical aspect that can be overlooked with a new digital platform is the importance of the setup.

Determine the Best Positioning

First, the surgeon must determine the optimal positioning for his or her needs. Each OR is unique in size, dimen-

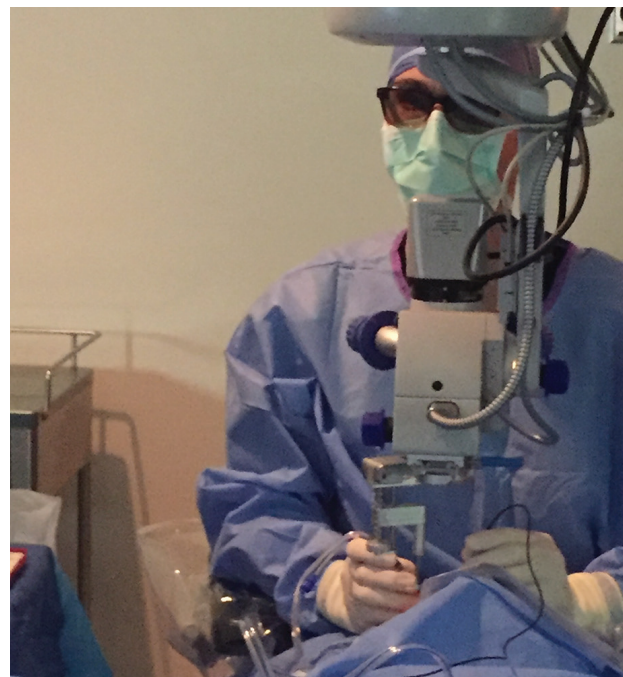


Figure 1. From sutured IOLs and choroidal drainages to membrane peels and retinal detachments, the Ngenuity 3D Visualization System is the author's new go-to.

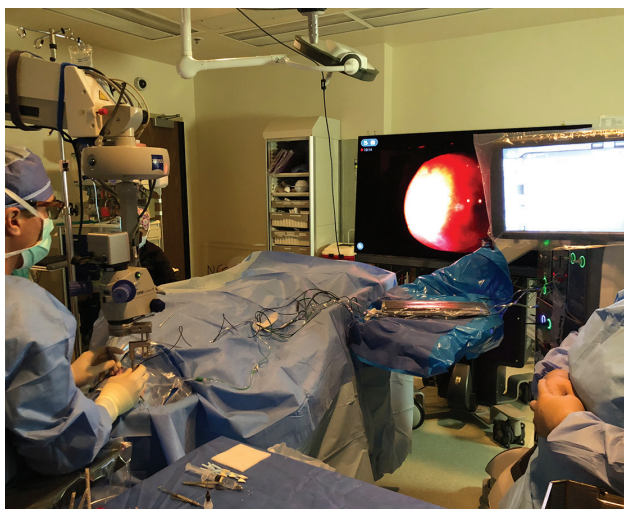


Figure 2. The author performs most surgical cases with the 3D monitor near the end of the stretcher, which maximizes stereopsis.

sions, and space. The location of the 3D monitor from the surgeon determines whether the platform maximizes resolution (monitor closer to the surgeon) or stereopsis (monitor farther from the surgeon). I have experimented with both positions, and each has its benefits. However, I have performed most of my cases with the monitor near the end of the stretcher (far configuration, Figure 2), and I slightly prefer this positioning. I recommend trying both configurations before deciding which one to stick with.

Once the optimal position of the platform is decided, you can work with your scrub tech and OR staff to coordinate placement of the vitrectomy platform and scrub table in order to best utilize the space.

Power and Data Storage

As with any modern computer, the Ngenuity system must be turned on and off appropriately. Ensure that the OR staff members follow instructions at the beginning and end of each day to avoid system problems. Use an external hard drive to store cases, or record to the internal hard drive and transfer the files at a later time. Our staff recently ran into operating issues with the system because we filled the internal hard drive within 6 months. Therefore, I recommend using an external hard drive at the beginning of each OR day to record cases directly. (The new software version 1.2/1.3 won't record to the drive simultaneously; rather, it will transfer at the conclusion of the case.) Delete the duplicates on the surgical system once you have confirmed that transfer is complete.

White Balance and Clear Panel Noise

Before starting cases for the day, I have staff members perform a white balance. *White balance* is the process of removing unrealistic colors, so that objects that appear white in real life are rendered white on the monitor. Failure

to perform this function on a daily basis may not have a significant effect on that day, but it will be only a matter of time before the color hues and saturation begin to change, signifying a need to adjust with white balancing. If the camera stays in place and the parameters are kept consistent, performing a white balance monthly or when the image begins to degrade will suffice.

Proper technique for the white balancing process begins with turning off all ambient room lights. Next, the microscope is zoomed to the highest magnification and the desired light (the microscope light for anterior work or the Constellation's light source for posterior work) is turned on to the white balance setting and adjusted to the surgeon's desired intensity for surgical use. The white balance card is held at a 45° angle under the microscope and slowly moved away from the scope until the white balance icon appears on the display. The person performing the balance presses the icon while holding the card in place until the process is completed (approximately 3-5 seconds). Watch for the potential of new software that automatically white balances and eliminates the need for staff to perform this function.

No matter how diligent you and your staff are at white balancing and handling the system, organic LED monitors can develop image retention or burn-in. During typical use, these monitors don't have issues because the images and pixel usage vary significantly with use of a variety of programs. But when you are operating for an extended period of time, an image can burn in and result in changes in the color hues and saturations, leading to red-saturated, pixilated, or double images. To correct this problem, your staff should periodically perform the "clear panel noise" function to reset the pixels of the monitor. This will eliminate image retention and return images to normal. *Insider tip: the "clear panel noise" function takes anywhere from 20 minutes to 2 hours, so plan for this to be done at the end of the day or during an off day.*

Inverting With the Keyboard

The current software (consider first-generation software) and footpedal do not allow inversion of images on the microscope controls. Inversion when using the BIOM (Oculus Surgical) requires someone to invert through the software on screen. My scrub tech puts the keyboard in a sterile bag and keeps it on the surgical field to quickly and efficiently invert when needed. Because staff members can see and follow the case on the screen, they can anticipate when inversion is needed. Note that this function will soon be incorporated in the footpedal for control by the surgeon.

THE ADAPTATION PROCESS: POINTS TO CONSIDER

Most surgeons, fellows included, readily adapt to digital 3D viewing systems over the course of a day's cases. However, adapting to the system and favoring the system over a standard microscope are two different things.

Depth of Field

One of the key features of the Ngenuity system is its depth of field, which allows me to maintain crisp focus as I magnify an image without the need to use a contact lens for dissection. To maintain the best focus during the surgical case and to have parfocal (maintaining fine focus during magnification), the surgeon must initially set a focal plane. Ideally, focus adjustment is performed on the external eye (focusing on the iris) and internally (focusing on the optic nerve). To achieve the best focus, the surgeon should first adjust to the highest magnification, then adjust the microscope focus (footpedal focus) for external viewing, and the BIOM focus for internal viewing. With my current Zeiss microscope and the Oculus BIOM HD Disposable Lens (Oculus Surgical), I can set my focal plane on the optic nerve or macula and not need to adjust the focus again during surgery. For other surgeons using different microscopes and BIOM setups, however, some flexibility and adjusting of the desired focal plane may be required. If you are trying Ngenuity for the first time or considering switching to the 3D system, consult with your Alcon surgical representative to determine the best compatibility for your current surgical system.

Light Manipulation

When I began using the heads-up 3D system, I quickly realized that, after thousands of cases using a standard microscope platform, my hands and brain had developed muscle memory and spatial awareness. On the new system, I determined that I needed to adapt my light manipulation to maximize my viewing. This realization was as critical as learning to focus properly in order to unleash the potential of the digital system.

In switching to the Ngenuity system, the surgeon must adapt to a slightly modified light manipulation, especially

during membrane peeling. I found that the light pipe had to be moved slightly away from the retina during membrane peeling; otherwise, the image appeared washed out or too bright. This phenomenon is caused by the high-dynamic range (HDR) camera, which exposes images multiple times (overexposed, underexposed, and normal exposure). This basic principle of HDR imaging allows us to see details in the shadowy areas and to see more detail in bright areas, resulting in greater scene contrast range and richer colors. It is important to note that during extremes of light exposure, such as high magnification viewing of the macula and lighting under air, subtle differences in light manipulation are needed.

Field of View

Although Ngenuity's enhanced depth of field has many benefits, a drawback is its reduced field of view (FoV) when magnification is increased. This isn't an issue when performing dissections or membrane peeling in the macula or out to the midperiphery, but I experienced two situations in which a surgeon might notice a reduced FoV.

The first situation occurred when I was performing peripheral work—shaving, marking breaks, lasering, etc. I found that when doing these tasks superiorly or inferiorly, it is best to adjust to the lowest magnification. This provides the widest field of view and focus for peripheral work, although I have found that increased magnification limits my viewing of the periphery, primarily in the superior quadrant.

The second situation where reduced FoV may affect the surgeon's viewing is during anterior segment work, notably suturing. The digital system has a slightly reduced FoV, and I have adjusted my suturing technique as a result.

PREPARATION IS KEY

After 6 months of consistently using the Ngenuity 3D Visualization System, I now prefer operating with it rather than with a standard operating microscope. As with vitrectomy platforms, knowing the ins and outs of a technology can enhance the user's experience. Familiarizing yourself and your staff with key aspects of the Ngenuity system will allow you to maximize your performance and make the most of your switch to the digital 3D system. Eyetube3D offers an immersive video experience that explores and shares what retina surgeons can see in the OR and beyond. To learn more, see the sidebar *Up Close and Personal*. ■

UP CLOSE AND PERSONAL

Visit eyetube.net/3d to check out the collection of 3D surgical videos uploaded by your colleagues using the Ngenuity system. Watch as these skilled surgeons perform bimanual repairs of tractional retinal detachments, close large macular holes, remove foreign bodies, and more.



Have a video of your own that you'd like to share? It's easy! Find out how at bit.ly/submit3D.

S.K. STEVEN HOUSTON III, MD

- Vitreoretinal Surgeon, Florida Retina Institute, Orlando, Florida
- Member, *Retina Today* Editorial Advisory Board
- shouston3@gmail.com
- Financial disclosure: None