

Added Dimension Enhances Surgery and Other Aspects of Practice *A 3D viewing system has multiple applications in the OR and the clinic*

By Colin E. Brown, MD; D. James Schumer, MD; and David W. Friess, OD

Just as the world of photography experienced a transition from optical to digital format in recent years, so too has there been a transition in the practice of medicine. As imaging technologies have improved, providing greater detail and depth, medical innovations have provided deeper understandings of diseases and allowed physicians to manipulate these advances toward better clinical outcomes.

Our practice has embraced some of these new imaging technologies. We now use three-dimensional (3D) visualization systems in a variety of ways that have positive impacts on our surgeons, our referring doctors, our staff, and, most importantly, our patients.

Our experience with digital 3D imaging began with the use of a stereoscopic surgical camera system from TrueVision 3D Surgical. With this 3D imaging system, surgeons can visualize the full ophthalmic surgical field on a large-format high-definition 1080p 3D LCD monitor. The monitor can stream the live view of the surgical field from a specialized camera attached to the operating microscope (Figures 1-4). The quality and depth of field from this real-time 3D imaging enables heads-up surgery using a pair of passive circular polarized glasses. We perform anterior segment surgery at our practice; the 3D system is also used for posterior segment surgery.

This technology has made considerable strides since its market introduction in 2008. With the introduction in 2014 of a fifth-generation platform, the view during real-time 3D surgery is now equivalent to, if not better than, the quality and depth viewed through traditional microscope oculars.

Medical 3D camera systems compatible with ophthalmic microscopes are now also available from other manufacturers including Sony.

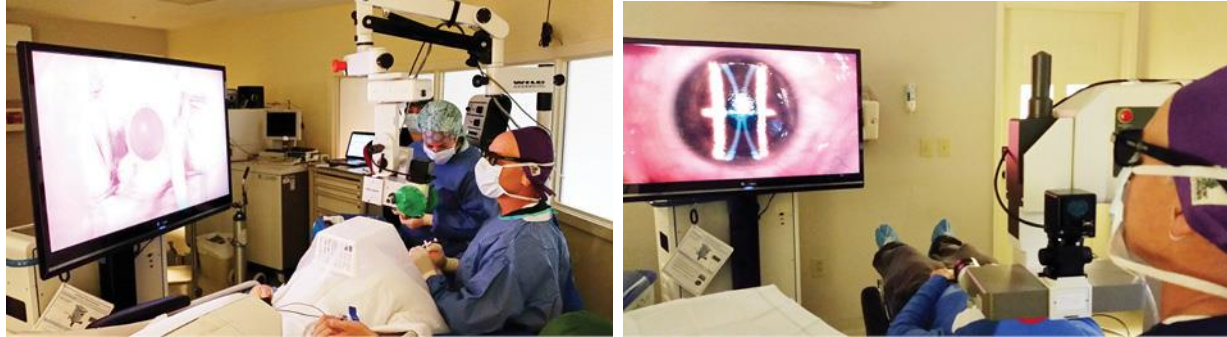
ERGONOMIC ADVANTAGE

One key advantage for surgeons operating with heads-up 3D imaging is the ergonomic freedom from the traditional microscope oculars. Surgeons in our practice experience far less neck and lower back fatigue during long days of consecutive cases using this technology. Like many practices, we often host visiting colleagues or industry representatives to discuss new surgical equipment or to demonstrate techniques. The live 3D view in the OR provides an ideal way for visitors to see exactly what the surgeons are seeing during each case, rather than using the observer oculars on the microscope or a 2D camera monitor.



Figures 1 and 2. Dr. Schumer performing phacoemulsification during cataract surgery with the TrueVision® 3-D imaging system coupled to his femtosecond laser platform.

Feedback from visiting co-managing doctors has been outstanding since we have adopted this technology. We have found that the immersive experience of viewing live surgery with full depth and stereo imaging is a powerful learning experience.



*Figure 3. The imaging system coupled with excimer laser platform during LASIK procedure.
Figure 4. Dr. Schumer maintains upright and relaxed posture with the heads-up operating capabilities.*

CROSS-PLATFORM COMPATIBILITY

Another advantage of the technology is that the 3D camera system attaches not only to our practice's traditional surgical microscope, but also to our excimer and femtosecond laser microscopes. Additionally, we have the ability to use the 3D camera for slit-lamp imaging of unique cases in our clinic. This can be a powerful educational tool for patients, allowing us to show them their ocular pathology in high resolution. This cross-platform compatibility makes 3D imaging an indispensable part of our daily operations.

The heads-up capability works seamlessly with specialized procedures, such as endocyclophotocoagulation and intraoperative gonioscopy. The surgical staff benefits from seeing exactly what the surgeon sees in real time, allowing a greater understanding of the surgical procedure, improved operating room communications, and increased efficiency of our procedural flow.

We routinely use the TrueGuide® computer-guided surgery system (TrueVision), a 3D surgical guidance software application and integrated toolset, to aid with cataract incision and limbal relaxing incision placement, alignment of toric IOLs, and centration of multifocal IOLs. The 3D format allows precise preoperative image registration and cyclotorsion alignment without parallax error. Nomograms integrated into the TrueGuide system allow surgeon-specific parameters to be accounted for, such as correction for surgeon-induced astigmatism.

This system received 510(k) clearance from the US Food and Drug Administration in 2010. The category of surgical guidance equipment continues to grow, with market introductions including the Verion (Alcon) and Callisto Eye (Carl Zeiss Meditec) systems, and the Cirle system in development by Bausch + Lomb. A unique aspect of our surgery experience has been the ability to broadcast a real-time 3D feed to a private monitor outside the operating room for the patient's family to view.

We have received tremendous positive feedback from our patients regarding this high-tech experience. Our staff has embraced the use of 3D imaging throughout the practice, elevating the patient experience.

Additionally, because we can record and edit our cases for either 3D or 2D playback, our continuing education lectures have grown in attendance. The recordings allow us to educate young surgeons on

proper surgical techniques and to review complicated cases to discuss how best to manage the surgery and postoperative care.

CONCLUSION

The future of ophthalmic imaging has arrived in the form of 3D imaging, and this ability has added a new dimension to our practice. We have found that in making the transition to 3D imaging technology we have created a new identity for ourselves. We have become a more cohesive and efficient surgical team. The surgeons feel less stressed and more refreshed after a day of operating, and the clinical staff has access to a deeper understanding of ocular pathology and can help educate patients more effectively. All of this is due to our integration of 3D visualization systems in all aspects of our practice.

Colin E. Brown, MD, is a clinical research fellow at ReVision LASIK & Cataract Surgery Center in Columbus, Ohio. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Brown may be reached at colinb@revisioneyes.com.

D. James Schumer, MD, is the founder and medical director of ReVision LASIK & Cataract Surgery Center in Columbus, Ohio. He is a member of the medical advisory board of TrueVision 3D Surgical. Dr. Schumer may be reached at schumer@revisioneyes.com.

David W. Friess, OD, is the president of Optimus Clinical Partners, LLC, in Glen Mills, Pennsylvania. He is a consultant to Alcon/WaveLight, i-Optics, and TrueVision 3D Surgical. Dr. Friess may be reached at dwfriess@gmail.com.

1. BioOptics World. Ophthalmology/image-guided surgery: "Heads-up" 3D-enabled retinal surgery broadcast live <http://tinyurl.com/k8x3nt7>. Accessed October 14, 2014.

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