

Article Date: 3/1/2016

## From Pac-Man to IOL implants

---

Heads-up surgery — eyes on a 3D screen, hands on the instruments — garners praise and skepticism.

BY VANESSA CACERES, CONTRIBUTING EDITOR

**O**phthalmologists have long bent their heads and necks — to their physical detriment, in some cases — into a microscope that exposes for them the surgical area in need of attention.

They now have an option to unbend their cervical spines. Some surgeons are trying the now-dubbed “heads-up” approach, a visualization system that displays, in real time, the surgical field on a large 3D display screen in the operating room. The system can attach to any surgical microscope. Users viewing the screen wear special 3D glasses.

The TrueVision system (TrueVision 3D Surgical) can be used for all types of ophthalmic surgeries, including vitreoretinal, anterior segment and glaucoma.

### No ‘pain in the neck’

Surgeons are more likely to have neck and back pain from maintaining awkward positions in the OR, and equipment is frequently not adjusted to promote neutral spine posture, says occupational therapist Julia Doty, OTR/L, CHT, of the Hospital for Special Surgery’s Joint Mobility Center, New York. The same goes for ophthalmologists. A 2015 study reported that 50% of ophthalmologists who responded to a survey said they experienced back pain, and 32% experienced neck pain.<sup>1</sup> The study authors cited repetitive tasks, awkward or prolonged work postures and high cognitive load as reasons why ophthalmologists are more vulnerable to occupational musculoskeletal disorders.

With TrueVision, surgeons cite improved ergonomics as a key advantage. Thomas Aaberg, MD, Retina Specialists of Michigan, Grand Rapids, says he has better posture when using the heads-up approach. “My neck and back feel 1000% better as opposed to using a traditional microscope,” says Dr. Aaberg, who has used the TrueVision system for about two years.

A tiny study published this year focused specifically on vitreoretinal surgery in the heads-up position. Researchers found that among 20 volunteers, most preferred the ergonomics of the new system.<sup>2</sup>

### Improved outcomes

That study, led by Claus Eckardt, MD, Department of Ophthalmology, Klinikum Frankfurt Hoechst, Frankfurt, Germany, found a few other benefits of heads up versus head down. “The two methods were judged to be similar regarding speed and ease of microscopic manipulations and sharpness of image. Significantly fewer mistakes were made with the heads-up method,” the authors reported.

“We feel that a large image improves depth perception and allows more precise surgery,”

Dr. Eckardt says of the 3D system.

Dr. Aaberg likes the image enhancement. “When you use a red-free filter, it highlights surface membranes. If you’re working on a complex diabetic patient, you can enhance the fibrovascular tissue that you’re trying to dissect. If you are working on an epiretinal membrane, you can enhance the tissue edges,” he says. For now, someone else on the surgical team must complete the image manipulation. “You basically say, ‘Go to a red-three filter’ or ‘See if you can increase the contrast or decrease the light exposure.’” Because of the ability to enhance images, Dr. Aaberg can operate with a fraction of the light input that he did in the past, reducing the possibility of light toxicity.

Like any new technology, the TrueVision system has refined with time. Users say that another advantage, its computer-guided surgery feature, can assist surgeons with lens placement and astigmatism correction.

## Teaching tool

Another plus: its value as a teaching tool. "Students can see the same image as the surgeon, and it's effective and comfortable for both," says Dr. Eckardt. He and four colleagues have used the system for more than 3,000 cases.

Pravin Dugel, MD, managing partner, Retinal Consultants of Arizona, Phoenix, and clinical professor, USC Eye Institute, Keck School of Medicine, Los Angeles, says the real advantage is the informatics potential. In the office, there is lots of information: optical coherence tomography (OCT), fluorescein angiograms, and so on. But none of this is in the OR: it stays in the office. But, "Once you digitize an image, then you can overlay all that information and more upon that image," Dr Dugel says. "I have been working on overlaying the informatics with various companies for the past year and a half. I believe this has the potential to revolutionize surgical visualization."

## Counterarguments

One initial drawback users might experience with the 3D system is a learning curve. Similar to other technology, transitioning from a traditional microscope to heads-up takes getting used to, says Dr. Aaberg. He recommends that those new to the system begin with easy, uncomplicated cases. "I started out performing straightforward macular puckers, macular holes and retinal detachments, and now I do the most complex diabetic and proliferative vitreoretinopathy cases," Dr. Aaberg says.

The learning curve may be more of a mental — or even generational — issue, says Ike K. Ahmed, MD, assistant professor of ophthalmology, University of Toronto, and head of ophthalmology, Trillium Health Partners, Mississauga, Ontario, Canada, who has used the system for three years. He gives the analogy of growing up playing video games when he used a control with his hands but his eyes were looking at a screen. If someone is accustomed to that setup, then the TrueVision system will be an easier transition, he says.

After getting past the mental and generational challenges, Dr. Dugel believes there is another significant one: the need to continually focus. "The image is on a flat screen. Therefore, the surgeon has no accommodative power. He must constantly focus with the foot-pedal. This, in my opinion, is the biggest challenge."

But he adds, "It is a challenge that [I believe] will be easily met very soon."

Although most users of heads-up surgery cite better ergonomics, Steve Charles, MD, FACS, Charles Retina Institute, Germantown, Tenn., notes that today's operating microscopes don't have the ergonomic issues they did in the past, thanks to tilt oculars. In fact, during a debate on heads-up surgery at the AAO annual meeting in Las Vegas, Dr. Charles questioned whether the system creates its own ergonomic problems depending on where the screen is placed. If the surgeon has to look to the left or right, that may cause new neck, head or back issues. "The ergonomic benefits are minimal at best," he said.

Dr. Charles says, in his opinion, the image quality with the system is not better than an optical view. Other heads-up systems used in aviation or while driving a vehicle don't show an image — users see the actual view in front of them, although it may be accompanied by icons or markers. "So-called heads-up surgery requires the surgeon to view the image electronically with significantly reduced resolution and contrast."

One additional drawback that Dr. Charles notes: A power failure could force the surgeon to rely on a more traditional surgical approach.

Charles C. Wykoff, MD, PhD, Retina Consultants of Houston, Blanton Eye Institute & Houston Methodist Hospital, Houston, Texas, hasn't tried the 3D system yet. Still, years of experience has put him ... squarely on the fence.

Like Dr. Charles, he feels that the current microscopes "provide excellent ergonomics and [I] don't see that being a big advantage of the new digital viewing system."

## Looking ahead

But, Dr. Charles sees how TrueVision has the potential to enhance surgical viewing. "For example, the use of real-time SD-OCT in certain pathologies may enhance visualization of tissue planes not otherwise easily appreciated."

Dr. Aaberg expects the TrueVision System to undergo further refinements, which could include better image quality and multimodality imaging.

One possibility being studied now is whether to import or simultaneously display other modes of retinal imaging, such as OCT or fluorescein angiography. This may involve building an OCT into the system so the user would see the surgical image adjacent to a corresponding OCT image. "You could get an enhanced view of exactly what tissue plane you're working on," Dr. Aaberg says.

He also predicts a change in the future look and feel of the heads-up system. "I think we'll be able to produce a standalone system that will be competitively priced with a traditional microscope," he says.

And Dr. Charles has some recommendations to bolster the system. "The benefits would be significant if image overlay with registration was developed and added to the system, assuming useful image data could be obtained."

Adds Dr. Dugel: "Think of a plane. Would a pilot [like my dear friend, Steve Charles] ever consider flying without a GPS? Of course not! A modern GPS gives a pilot far more information than just the direction. It will give him weather, wind, traffic ... With informatics overlay of the 3D system, we will have a GPS for vitreoretinal surgery soon." **OM**

*Dr. Aaberg, Dr. Eckardt and Dr. Ahmed are consultants for TrueVision 3D Surgical.*

## **REFERENCES**

1. Hyer JN, Lee RM, Chowhurdy HR, et al. National survey of back & neck pain amongst consultant ophthalmologists in the United Kingdom. *Int Ophthalmol*. 2015;35:769-775.
2. Eckardt C, Paulo EG. Heads-up surgery for vitreoretinal procedures: An experimental and clinical study. *Retina*. 2016;36:137-147.