

Intraoperative Guidance

Surgeons discuss how innovative technologies improve surgical accuracy.

By James A. Katz, MD

Intraoperative Guidance for Heads-up, Three-Dimensional Surgery
BY JAMES A. KATZ, MD

The transition from manual marking methods for astigmatic correction and toric IOL alignment to digital technologies took a leap forward in 2010 with the FDA's 510(k) clearance of the TrueVision guidance software application (TrueVision 3D Surgical). The software, now called TrueGuide, uses both data and image inputs that act as an incision and IOL calculator for surgical planning and during live surgery.

CUSTOMIZABLE SETUP

With TrueGuide, I can use the ecosystem in total or in parts, based on my microscope configuration and interests. My setup includes the presurgical planning software called TruePlan, which has been configured to accept both image and data exports from the Cassini corneal analyzer (i-Optics). Patients' parameters, including white-to-white, mesopic pupillary center and diameter, keratometry values, and high-resolution eye images, are exported from a standard Cassini topography acquisition into the TruePlan software. The software automatically suggests a primary incision axis, a toric IOL power and axis or an arc length, and an axis for limbal relaxing incisions (LRIs), depending on the magnitude of astigmatism and the surgical plan. The software uses a fully customizable, doctor-specific profile to create surgical plans that are unique to the surgeon's preferences such as the operating position and surgically induced astigmatism (SIA). The software generates guidance templates and predicted residual astigmatism values that can be easily adjusted during surgical planning or live surgical setup. I also find the system useful for IOL centration guidance.

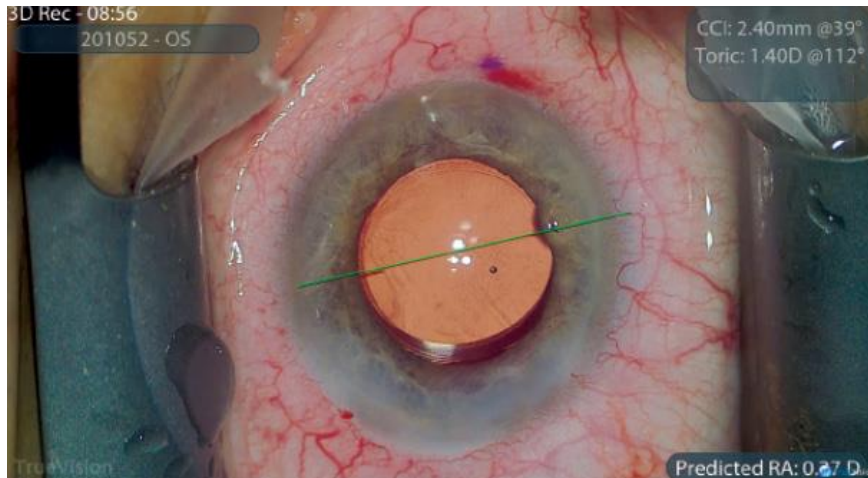


Figure 1. Toric IOL alignment using TrueGuide.



Figure 2. Heads-up 3-D cataract surgery.

The TrueGuide software was designed to automatically link the surgeon-specific SIA and astigmatic correction via a process called dynamic optimization, which allows for adjusting the location of incisions due to parameters such as the surgeon's seated position and customized incision range. Real-time vector analysis recommends a placement for an incision that predicts the least residual astigmatism for toric IOL and LRI positioning (Figure 1).

LIVE SURGICAL FIELD

Using the latest generation of the TrueVision camera module and ultra HD 4K imaging, I routinely perform heads-up three-dimensional (3-D) cataract surgery, which enables 3-D registration and live eye tracking of the TrueGuide images and guidance templates (Figure 2). The camera module streams the live surgical field to a large or small 3-D monitor, depending on the surgeon's preference for image size

and ergonomics. I position TrueVision's 55-inch 4K monitor perpendicular to me, which allows my surgical support staff to view the case easily.

PRESURGICAL PLANNING

The ecosystem can consist of the presurgical planning software in combination with the Cassini device or as standalone planning software with inputs for keratometry values and preoperative images. The surgical setup can be used in a heads-up live surgical manner with guidance provided on demand throughout the incision and IOL alignment stages, or it can simply be employed during the steps of astigmatic correction. Although the system works with any existing surgical microscope, its combination with the Leica microscope foot pedal increases surgeons' control of the guidance features. They can use the system with a portable cart or by integration with a Leica microscope. The touchscreen control monitor and the Cassini axial topography map overlay provide an additional intuitive guide for astigmatic correction. The software allows for other secondary inputs such as an intraoperative aberrometry feed to be viewed in additional software windows. These controls permit the surgeon to operate with a fighter pilot's cockpit-like setup and call up guidance tools as needed, while maintaining focus on the surgical field.

AT A GLANCE

- The Zeiss Cataract Suite features products that assist physicians with the centration of IOLs along the visual axis and the alignment of toric IOLs along the optimal target axis via the use of graphical overlays projected in the eyepieces of the surgical microscope in a heads-up display-like fashion.
- TrueGuide uses both data and image inputs that act as an incision and IOL calculator for surgical planning and during live surgery. The software is customizable to the surgeon's preferences.
- Verion assists with preoperative planning, and ORA with VerifEye is used for intraoperative guidance.

CONCLUSION

In my hands, version 10 of the TrueGuide software, which works with the 4K visualization setup, is a digitally precise tool for positioning the surgical incision and IOL. As the rapid pace of digital guidance innovation continues, I look forward to further customization.



