By Eric Donnenfeld, MD

VISX ActiveTrak System facilitates ablation centration with built in passive limitations

Tracking devices that can follow extremely small eye movements are among the most useful developments for enabling refractive surgeons to fine-tune ablations to improve outcomes.

But various tracking devices function differently and not all ensure precise ablation centration. Just centering the laser treatment on the pupil will not ensure that the treatment zone is centered postoperatively. Beam shape and placement affect treatment outcomes.

In evaluating the principles of optimal eye tracking, our team at Nassau University Hospital and Ophthalmic Consultants of Long Island found significant advantages with the VISX ActiveTrak system compared with other systems requiring pupil dilation. The ActiveTrak provides direct pupil measurement in real time. Moreover, the entire pupil can be tracked without being dilated. And because the position of the pupil is measured directly, the system is much more accurate.

It is important to note that the shape of the beam that reaches the corneal plane can differ significantly from what leaves the laser. Moreover, the angle of the beam relative to the corneal and iris planes is a key factor in centration.

Eye tracking gives surgeons more control of the ablation and helps ensure centration. But, even when using a tracker, it is critical to make sure patients maintain fixation during refractive procedures.

All trackers track the iris plane, not the corneal surface, to center the laser beam over the pupil. When the patient does not fixate properly, the eye drifts and the cornea moves a greater distance than the pupil does. At this point, pupil centration is no longer accurate and the beam becomes more ovalized because of the increased angle. When this occurs, the ablation should be temporarily halted until patient fixation is regained.

The tracker must have boundaries to prevent the laser from firing if the eye moves too far, in order to ensure proper beam placement and avoid tilted oval shapes. These passive limitations are designed into the VISX Star S3 ActiveTrak. When the laser fires, it hits perpendicular to the corneal plane. This facilitates a uniform ablation pattern and prevents the beam from extending outside an optimal boundary.

The ActiveTrak's passive limitations enable tracking to stay active, but stop the laser from firing if the eye moves more than 1.5 mm from the starting position. This allows the tracker to maintain a direct relationship between tracking the iris and the target ablation zone on the cornea.

Precise ablation centration is essential for maximizing outcomes and customized ablations. The design of the VISX ActiveTrak system should make it the tracker of choice for surgeons who want precise control of critically important ablations.

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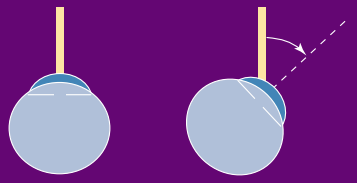
TRACKING AND CENTERING ISSUES

Beam Placement

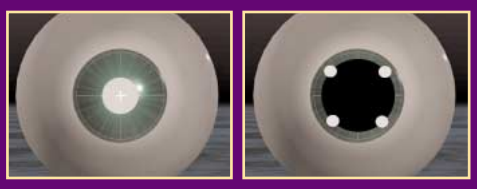
All trackers track the iris plane, NOT the corneal surface

As the eye rotates, the corneal surface translates farther than the iris.



In each case, laser beam is centered over pupil

Pupil Tracking: Direct vs. Indirect

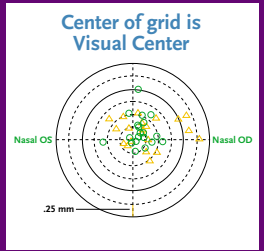


VISX ActiveTrak LADAR™Tracker

Beam Shape

Circular Oval

Autonomous Tracking Centration



- Ablated center does NOT correlate to pre-op center
- 32.7% are decentered more than 0.5 mm (6% more than 1 mm)
- "It is unclear why centration ... did not show a marked improvement."

THE ACTIVETRAK PROVIDES DIRECT PUPIL