SmartSight NOVA with CenTrax – Intelligent Centration and Eye Tracking for a New Standard of Precision

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BACKGROUND AND TECHNOLOGICAL CONTEXT OF FEMTOSECOND LASERS

Femtosecond laser technology has become a cornerstone of modern refractive surgery, enabling highly precise and reproducible corneal procedures. Ongoing developments increasingly focus on improving centration accuracy, alignment, and workflow reliability to address real-world challenges such as eye movement, cyclotorsion, and variable patient fixation. The integration of intelligent eye tracking, automated cyclotorsion compensation, and diagnostic-image-based eye registration represents a significant advancement in femtosecond laser systems. These innovations enhance procedural precision, reduce operator dependency, and improve consistency of clinical outcomes, particularly in astigmatism correction. Collectively, such developments mark an important step toward more predictable and robust femtosecond laser–assisted refractive treatments.

SMARTSIGHT NOVA WITH CENTRAX AND THE EVOLUTION OF SEMI-AUTOMATED FEMTOSECOND LASER PROCEDURES

Previous research has established permissible thresholds for decentration based on various optical measurement techniques;[1] however, commonly used methods for assessing lenticule centration often rely on operator input or subjective judgment.[2]

Scanning SmartSight already compensates for cyclotorsion movements and sets a new benchmark in precision and reliability. **SmartSight NOVA** is the procedure brand name whereas **CenTrax** is its enabling feature. In other words, SmartSight NOVA is the SmartSight treatment performed using the CenTrax feature, which significantly enhances the precision of semi-automated docking.

CenTrax provides **intelligent centration and active eye tracking**, incorporating fully automated cyclotorsion compensation as well as active compensation of residual docking errors. This advanced functionality elevates the accuracy and consistency of the procedure.

CenTrax is an intelligent centration and active eye-tracking system integrated into **SCHWIND ATOS®**. The system is digitally connected to SCHWIND diagnostic devices—including **SCHWIND SIRIUS, SCHWIND SIRIUS+, SCHWIND PERAMIS, and SCHWIND MS-39 OCT**—and automatically imports diagnostic images as references, without any human intervention. This seamless digital workflow ensures consistency and eliminates potential sources of error.

The active eye-tracking component continuously recognizes pupil movement and precisely identifies the pupil center, enabling highly accurate centration with no margin for error. Cyclotorsion movements are detected and compensated for automatically, ensuring stable and reliable alignment throughout the procedure.

In addition to smart docking assistance, CenTrax actively compensates for residual errors after docking. As a result, there is no longer a need to manually shift the cutting pattern after docking, and manual marking becomes unnecessary. This simplifies the workflow while improving precision and reproducibility.

SmartSight NOVA optimizes clinical outcomes, reduces outliers, and has further potential to enhance astigmatism correction results. NOVA represents the right step toward the pursuit of perfection—especially in real-world conditions where patient fixation may vary. You never know whether the next patient will fixate perfectly or struggle to maintain stable focus, and SmartSight NOVA is designed to address this variability.

In a nutshell CenTrax can be described with the following points:

CENtration
- Centration on visual axis
- Pupil Offset compensation

TRAXing
- Active eye tracking with compensation of the remaining docking error
- Active docking guide
- Cyclotorsion compensation with link to diagnostic devices

The compact **ATOS system** offers eye registration based on diagnostic images and integrates an objective treatment offset imported directly from SCHWIND diagnostic devices. It includes semi-automated, eye-tracking-guided centration with pupil recognition, leading to improved lenticule positioning relative to the visual axis. Users also have the option to pre-offset treatments during the planning stage to further optimize the lenticule's target position.

CLINICAL IMPACT ON PRECISION AND VISUAL ACUITY

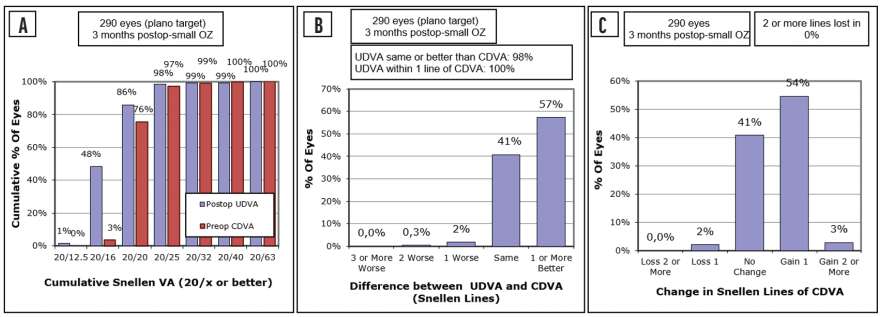
Furthermore, the fully automated cyclotorsion compensation integrated

into the system ensures precise alignment of the lenticule with respect to the meridional orientation, which is critical for accurate astigmatism correction. The eye-tracker-guided centration and docking enabled by CenTrax result in robust, accurate, and precise eye alignment with the system—playing a decisive role in the effective and predictable correction of refractive errors, particularly astigmatism.

In a retrospective analysis of 376 eyes who underwent KLEx procedure at the SCHWIND ATOS we compared clinical outcomes with classical SmartSight and SmartSight NOVA with CenTrax.

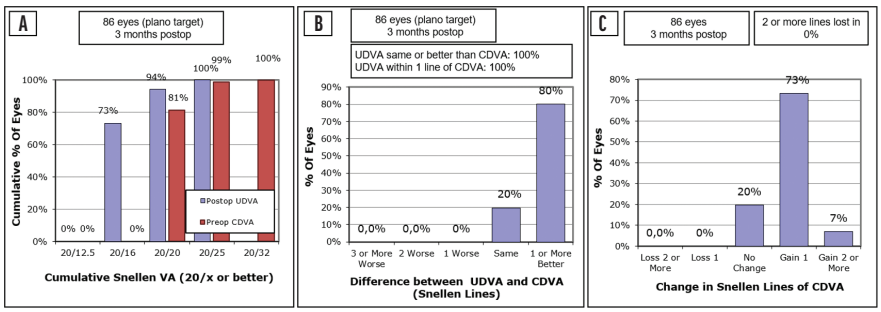
Preoperative clinical parameters, such as age, gender, spherical equivalent (SEQ), corrected distance visual acuity (CDVA) and central corneal thickness (CCT), showed no statistically significant differences between the two groups.

At the 3-month postoperative follow-up, a noticeable difference between the two groups was observed, particularly in visual acuity. Figure 1 shows the visual acuity outcomes of conventional SmartSight without CenTrax, whereas Figure 2 presents the results of SmartSight NOVA with the CenTrax feature. In line with findings reported in other studies, both groups demonstrated a postoperative improvement in visual acuity.[3,4] However, the improvement was more pronounced in the SmartSight NOVA group, suggesting a beneficial effect of CenTrax-enhanced centration and eye tracking. Table 1 shows a direct comparison of SmartSight and SmartSight NOVA.



Uncorrected Distance Visual Acuity | **Uncorrected Distance Visual Acuity vs. Corrected Distance Visual Acuity** | **Change in Corrected Distance Visual Acuity**

Image 1: Outcomes for Visual Acuity with the classical SmartSight



Uncorrected Distance Visual Acuity | **Uncorrected Distance Visual Acuity vs. Corrected Distance Visual Acuity** | **Change in Corrected Distance Visual Acuity**

Image 2: Outcomes for Visual Acuity using SmartSight NOVA with the CenTrax feature in place

TABLE 1: DIFFERENCE OF VISUAL ACUITY USING CLASSICAL SMARTSIGHT AND SMARTSIGHT NOVA WITH THE CENTRAX FEATURE

	SmartSight	SmartSight NOVA
Postop UDVA and preop CDVA	20/16 = 48%	20/16 = 73%
Difference between postop UDVA and preop CDVA	same = 41% 1 or more = 57%	same = 20% 1 or more = 80%
Change in Snellen Lines of CDVA	gain 1 = 54% gain 2 or more = 3%	gain 1 = 73% gain 2 or more = 7%

UDVA=uncorrected distance visual acuity; CDVA=corrected distance visual acuity

CONCLUSION

Advances in femtosecond laser technology increasingly focus on improving alignment accuracy, workflow reliability, and outcome consistency under real-world conditions. The integration of intelligent centration, active eye tracking, automated cyclotorsion compensation, and diagnostic-image-based eye registration represents a meaningful step with SmartSight NOVA towards more predictable and reproducible refractive procedures. By reducing operator dependency and compensating for patient-related variability, these developments contribute to optimized clinical outcomes—particularly in astigmatism correction—and mark continued progress toward highly precise, semi-automated femtosecond laser–assisted refractive surgery. ■

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