

eyetracking in new dimensions

Improve clinical outcome by compensating for all six eye motions!

During refractive surgery the eye moves in six dimensions. Patient **eye motion results in three types of rotations** of the eye: in cyclotorsion, Y eye roll and X eye roll. Patient **head motion results in three types of translation** of the eye: Y translation, X translation and height/distance as Z translation (see figure 1).

Today's state of the art eye trackers in refractive lasers utilize only pupil, iris or limbus and inaccurately interpret eye motions only as 2 dimensional translations (X & Y), some already extended with rotation (cyclotorsion or even height control), but do not separate correctly between rotations and translations of the eye.

All eye motions have an impact on clinical outcome!

Not separating correctly between rotation and translation can result in inaccurate positioning of the laser shots on the cornea (see figure 2). Over the course of a refractive treatment this introduces **clinically significant aberrations!**

A clinical assessment performed by M. Bueeler, PhD and M. Mrochen, PhD from the Institute of Refractive and Ophthalmic Surgery IROC showed that in the correction of sphere and cylinder significant amounts of coma is introduced by uncompensated eye roll motions (see figure 3).

According to this study post-operative **visual acuity is negatively affected** by intra-operative eye roll motions **in one out of three** patients.

SMI's NEW 6D Eye Tracking Solution compensates for all eye motions and improves your clinical outcome!

Utilizing all eye features SMI 6D Eye Tracking system is able to differentiate completely between eye rotation and eye translation. Now it is possible to assess the real position of any point on the cornea during refractive surgery. All systematic errors due to poor fixation and head motion of your patient can be eliminated.

With SMI solutions for refractive surgery you gain full control of all eye motions. It will optimize your workflow, reduce outliers, improve outcome and increase comfort for you and your patient. See www.smi.de for details.

Rotations



Translations

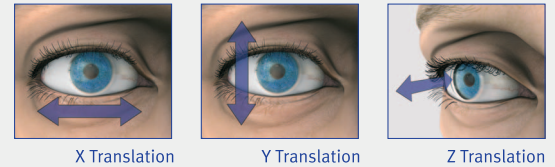


Figure 1: All 6 independent types of eye motions.

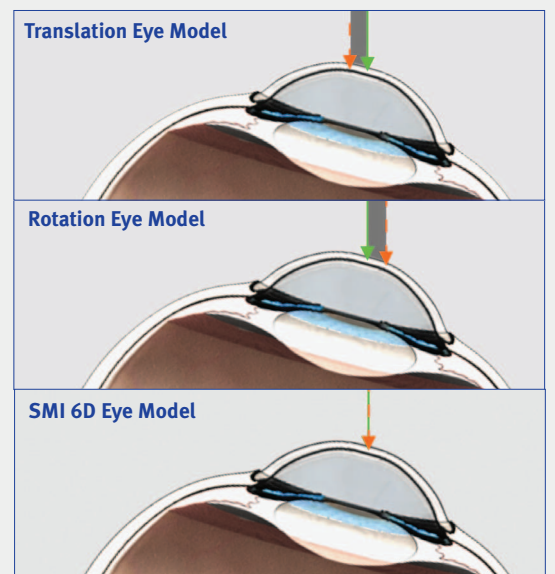


Figure 2: Green arrow shows intended shot position. Orange arrow shows resulting shot position. Systematic laser positioning error introduced by misinterpreted translational motion (top) and positioning error introduced by misinterpreted rotational motion (middle). Fully compensated eye motion with SMI's 6D Eye Tracking (bottom).

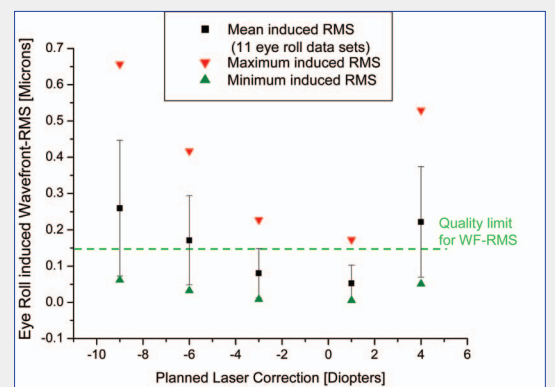


Figure 3: Eye-roll-induced wavefront-RMS in dependence of the planned spherical correction in diopters.