Standard LASIK refractive surgery disrupts the natural eye’s aberration compensation

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Purpose:
In most young subjects, the aberrations of the cornea are partially compensated by the crystalline lens producing an improved retinal image (Artal et al., Journal of Vision, 1, 1, 2001). Since standard LASIK modifies the higher order aberrations of the cornea, this fine aberration tuning could be disrupted. In this work, we explore how the induced changes of aberrations due to LASIK affect the ocular aberration compensation. The different effects of both myopic and hyperopic LASIK will be specially addressed.

Methods:
We measured the ocular and corneal high-order aberrations for a 6 mm pupil size, in 21 young eyes (15 myopic and 6 hyperopic), before and six months after standard LASIK refractive surgery. Ocular wave-front aberrations were measured using our own developed Hartmann-Shack wave-front sensor, while corneal aberrations were estimated by ray-tracing from the elevation maps provided by videokeratography.

Results:
The mean ocular high-order RMS increased after hyperopic LASIK (2.3–fold) more than after myopic LASIK (1.6-fold). However, in average the corneal aberrations increased in the myopic group by a factor of 1.8, while remained nearly constant in the hyperopic. The internal aberrations remained nearly the same for both groups.

Conclusion:
After myopic LASIK eye’s aberrations increases due to a more positive corneal SA, still partially compensated by the lens, and the induced corneal coma. The hyperopic standard treatments reverse the sign of the corneal SA (to negative) and tend to modify the corneal coma. In both cases, this goes against the natural lens compensation producing a lower overall quality. While planning customized corrections, the balance of aberrations within the eye should be considered to obtain improved outcomes.