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## Lasik Refractive Surgery Disrupts The Natural Compensation Of Aberrations In The Eye

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### Abstract

**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. We explore here how the induced changes of aberrations after LASIK may affect this aberration compensation. The different effects of both myopic and hyperopic LASIK are 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 research prototype Hartmann–Shack wave-front sensor and corneal aberrations were estimated by ray-tracing from the elevation maps provided by a corneal topographer.

**Results:** The average root mean-squared (RMS) of the ocular high-order aberrations 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 group. The internal aberrations remained nearly the same for both groups. These results indicate that especially hyperopic LASIK procedures induce larger aberrations partially because a greater disruption of the mechanism of aberration compensation present in the eye before the surgery.

**Conclusions:** After myopic LASIK, aberrations increased mainly due to a more positive corneal spherical

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aberration, still partially compensated by the lens, and the induced corneal coma. The hyperopic standard treatments reversed the sign of the corneal natural spherical aberration (to negative) and tend to modify the corneal coma. This goes against the natural lens compensation producing a lower overall image quality. These findings indicate that when planning optimized corrections, the balance of aberrations within the eye should be considered to improve the final outcomes.

**Keywords:** refractive surgery: optical quality • refractive surgery: LASIK



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