Aberrations Caused by Decentrations in Customized Laser Refractive Surgery

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Conventional laser refractive surgery procedures correct defocus and astigmatism but typically induce higher order aberrations. A fundamental limitation on the quality of vision correction with refractive surgery is decentration. Decentration can be caused by shifts in the center of the pupil when aberrations are measured preoperatively (pupil dilated) and when they are corrected surgically (pupil undilated). We measured shifts in the pupil center relative to the limbus with and without dilation in 7 subjects. A wavefront sensor measured each patient's preoperative wave aberration over the dilated pupil. The aberrations that would have been induced by a decentration of a customized ablation were calculated. The average magnitude of the pupil shift was 0.332mm, ranging from 0.080 to 0.631mm, and usually occurred in the inferior-nasal direction. Depending on the magnitude of these shifts, approximately 96% to only 40% of the patients higher order rms wavefront error would theoretically be corrected. A potential solution to reduce higher order aberrations induced by this shift in pupil center is to reference the customized treatment with respect to the limbus.