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The Functional Optical Zone (FOZ) After Keratorefractive Surgery

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Abstract

Purpose: In keratorefractive surgery, the size of the corneal area treated that has achieved good post-operative optical performance has been defined as the Functional Optical Zone (FOZ). In this study, we develop three objective methods to determine the FOZ after refractive surgery aiming to provide assessment techniques to evaluate, compare, and improve upon current keratorefractive surgical algorithms.

Methods: Magellan corneal topography examinations (NIDEK, Inc) from one eye of 34 normal, unoperated patients and 32 eyes corrected with LASIK for myopia were evaluated. The LASIK eyes were selected from among many examinations collected from several clinical sites to obtain a broad range of treatment FOZs. The criterion for functional vision was set to a predicted acuity of 20/30 (LogMar 0.1) or better. Three approaches were explored to measure the FOZ; two were referenced to the corneal plane, and one was referenced to the retinal plane. 1. A uniform axial power method (FOZ_A) assessed the area of the post-operative cornea that was within a ± 0.5 D window centered on the mathematical mode. 2. Determination of the FOZ based on the corneal wavefront true RMS error as a function of simulated pupil size (FOZ_R). 3. Determination of the FOZ from the radial MTF determined at the retinal plane as a function of pupil size (FOZ_M).

Results: The unoperated group had functional optical zones ranging from 5–9 mm (mean = 7 mm) while those for the LASIK corneas ranged from 2.5–7 mm (mean = 5 mm). The measurements made with the

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three methods correlated well with each other for the LASIK group with a Pearson correlation coefficients ranging from 0.72 to 0.81 (Table 1).

Conclusions: These methods will be useful to more fully characterize the corneal treatment profiles following keratorefractive surgery. Being able to measure the size of the FOZ should permit the further evolution of laser algorithms to reduce the night vision complaints that can arise from FOZs that do not encompass the entire mesopic pupil.

Table 1. Correlation coefficients (*p < 0.01)

	FOZ_A	FOZ_R	FOZ_M
FOZ_A	1	0.76*	0.72*
FOZ_R	0.76*	1	0.81*
FOZ_M	0.72*	0.81*	1

Keywords: cornea: clinical science • refractive surgery: corneal topography • visual acuity



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