RAY-TRACING PREDICTION OF INTRAOCULAR LENSES POWER: EFFECT OF CORNEAL ABERRATIONS

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INTRODUCTION

• IOL power calculations based on empirical approaches are usually suitable for normal patients. However, these procedures typically fail in those patients that had undergone previously refractive (LASIK) surgery.
• We have developed a customized ray-tracing method to predict the optimum IOL power. The accuracy and limitations of this procedure is evaluated for both normal and post-LASIK patients.

METHODS

Computational ray-tracing procedure

Polychromatic exact ray-tracing procedure using individualized data (4.0 mm diameter pupil)

RESULTS

1) Normal cataract patients

Final spherical equivalent of the ray-tracing power predictions was similar to that obtained with standard calculations. Ray-tracing predictions with or without considering corneal aberrations were also similar.

The difference between the IOL powers predicted by ray-tracing with and without aberrations was lower than 0.5D, with small dependence on the amount of corneal aberrations (figure below).

2) Post-LASIK cataract patients

In these patients, ray-tracing predictions with corneal aberrations were more accurate than both single and double - K empirical approaches.

The impact of corneal aberrations in the IOL power prediction is clearly correlated with the amount of corneal aberrations. Those patients with abnormally elevated corneal aberrations will experience the larger benefit of a ray-tracing approach.

CONCLUSIONS

- We have developed a robust customized ray-tracing procedure to predict the optimum IOL power.
- The procedure produces similar results in normal cataract patients compared to the empirical calculations. The reason may be a larger effect of errors in the biometric data than the actual calculation approach. This is reinforced by the fact that considering corneal aberrations does not improve in average the predictions.
- However, in the case post-LASIK patients, ray-tracing is clearly superior to standard calculations, especially in those patients with large amounts of corneal spherical aberration.