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An Intraocular Lens Correcting Corneal Coma

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Abstract

Purpose: In the last years, a new generation of intraocular lenses (IOLs) that correct partially the spherical aberration of the cornea has been proposed. These IOLs produced an improved quality of vision in most patients. A further step in IOLs correcting corneal aberrations, designed to correct, at least partially, both corneal coma and spherical aberration is presented here.

Methods: A new IOL was designed by using a previously developed computer model to predict the optical performance of individual eyes after IOL implantation from actual data and lens design parameters. We measured ocular aberrations using a Hartmann–Shack wave–front sensor and corneal aberrations by combining ray–tracing techniques with corneal topography. To investigate the relationship between ocular alignment and aberrations we also measured in each eye, angle kappa and lens tilt and decentration by using a new instrument based on recording Purkinje images. The new IOL concept was designed to minimize corneal coma and spherical aberration by using mathematical analytical solutions and Zemax optical software. We compared the optical performance predicted by the model with standard IOLs and the new coma correcting IOL.

Results: Angle kappa, which is formed between the pupillary axis and the visual axis, was established as the major source for ocular misalignments. It generates corneal coma that is automatically compensated by a mechanism that implies opposite coma for the IOL. The magnitude of angle kappa seems to be stable through age. We used an average value of 5 degrees to optimize the IOL design for foveal (non–axial) optical quality. IOLs with a specific shape factor would produce a compensation of corneal coma in most

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eyes. The optical performance of the eye models implanted with the new coma correcting IOL improved as compared with standard IOLs.

Conclusions: A new IOL designed to correct corneal coma shows a remarkable tolerance to large values of ocular misalignment. This new type of IOL would improve the quality of the retinal image after surgery and would eventually lead to a better quality of vision. This is to our knowledge the first attempt to correct corneal coma with intraocular lenses.

Keywords: intraocular lens • cataract • optical properties



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