

Invest Ophthalmol Vis Sci 2004;45: E-Abstract 2191.© 2004 [ARVO](#)

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Lenticular spherical aberration in eyes implanted with IOLs is well predicted from ocular and corneal measurements

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Abstract

Purpose: To evaluate eye models used for the prediction of lenticular spherical aberration (SA) using measurements taken from pseudophakic patients implanted with intraocular lenses (IOLs) with known values of SA.

Methods: The SA of the eye and the cornea was estimated from Shack–Hartmann wavefront measurements and from corneal topography (Zeiss–Humphrey) in eyes implanted with two types of IOLs: 71 with CeeOn 911 (Pfizer) and 51 with Tecnis Z9000 (Pfizer). The surgical technique implemented was phacoemulsification with a small incision, followed by implantation of the foldable IOL. All optical measurements were performed 3 months postoperatively for a 4 mm pupil. The 911 and Tecnis lenses have different optical designs (the 911 has a known amount of positive SA while the Tecnis has a known amount of negative SA). Corneal SA is derived from corneal elevation maps using both the vertex position (model 1) and the center of the pupil position (model 2) as the reference axis. Eye models are constructed from the clinical data to investigate the theory that lenticular SA can be calculated from the difference between the total ocular SA and the corneal SA. The resulting measured lenticular SA is compared with the known design values for the 911 and the Tecnis lenses.

Results: The average lenticular SA value calculated from the clinical data is very similar to the known design SA value for both lenses (0.003 μm difference for the Tecnis lens and 0.009 μm difference for the 911A lens). Additionally, lenticular SA values calculated using the eye model (lens SA = eye SA – cornea

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SA) result in a normal distribution of values around the known design value. Finally, the calculated values of corneal and lenticular SA obtained using the two different reference axes are highly correlated ($R^2 = 0.91$, $R^2 = 0.99$).

Conclusions: The difference between measured values of ocular and corneal SA is an accurate estimate of the lenticular SA in eyes implanted with IOLs.

Keywords: optical properties • cataract



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