Investigative Ophthalmology & Visual Science

Invest Ophthalmol Vis Sci 2009;50: E-Abstract 6122.

6122—D863

Interferometric Measurements of Aberrations in Isolated Porcine Crystalline Lenses

E. Acosta[1], C. Schwarz[2], J. M. Bueno[2] and P. Artal[2]

[1]Applied Physics, University of Santiago de Compostela, Santiago de Compostela, Spain
[2]Laboratory of Optics, University of Murcia, Murcia, Spain

Commercial Relationships: E. Acosta, None; **C. Schwarz**, None; **J.M. Bueno**, None; **P. Artal**, None.

Support: supported by "Ministerio de Educación y Ciencia", Spain (grants nº FIS2007-63123, FIS2007-64765 & Consolider SAUUL) and "Fundación Séneca", Murcia, Spain (grant 04524/GERM/06).

Abstract

Purpose: To study the nature of aberrations in isolated pig eye lenses from interferometric phase measurements. Deviation from a symmetric model and the systematic presence of dominant aberrations will be specifically analyzed.

Methods: Wave aberrations in 12 crystalline lenses were measured by using point-diffraction interferometry. The principle behind this technique is the interference between a reference spherical beam generated by diffraction through a clear pinhole placed in a semitransparent plate and the beam under test focusing in the vicinity of the pinhole. Lenses were analyzed within just a few hours post-mortem and kept inside the globe at room temperature. For the study, lenses were inserted in a glass cell with plane-parallel faces filled with BSS plus solution. The anterior face of lenses was illuminated with a monochromatic (633nm) plane wave. All lenses were measured under the same alignment conditions with respect to the axis of the interferometric set up. The dark fringes of the recorded interferograms were tracked semi-automatically for fitting. Fringe data was used to fit the phase aberrations of the lenses to a set of Zernike polynomials.

Results: In all lenses, only Zernike polynomials with azimuthal frequencies of 0, 1, 2 and 3 were significant in the fits. On average, the dominant aberration terms were astigmatisms (2,±2), (4,±2) and (6,±2); spherical aberrations (4,0), (6,0) and (8,0); comas (3, ±1), (5, ±1) and (7, ±1) and trefoils (3, ±3) and (5, ±3). The axis of the primary astigmatism was highly correlated with the direction of one of the lens sutures. The contribution of trefoils increases with post-mortem time and is practically negligible for lenses measured within 1-2 hours post-mortem. This indicates that suture degeneration may be responsible for increasing the aberrations of the azimuthal frequency of 3. The mean value for the primary astigmatism was

0.6±0.2; for the primary spherical aberration -0.3±0.1; for the secondary spherical aberration, 0.16±0.04; for the primary coma 0.10±0.05 and for the primary trefoil 0.10±0.07 (results in microns for a pupil of 5.5mm)

Conclusions: Wave aberrations of isolated porcine crystalline lenses were accurately measured with a point diffraction interferometer. The method allowed for greater insight into the aberration structure of porcine crystalline lenses showing that there is a systematic astigmatism in all lenses, the axis of which is closely correlated with the direction of one of the sutures of the lenses. In ruling order astigmatisms, together with spherical aberrations, comas and trefoils, are the main aberrations

Keywords: aberrations • optical properties