

*Invest Ophthalmol Vis Sci* 2009;50: E-Abstract 6159.

© 2009 [ARVO](#)

6159

## Optical Alignment and Aberrations of Human Eyes as a Function of Age

E. Berrio<sup>1</sup>, J. Tabernero<sup>1</sup>, P. Perez<sup>2</sup> and P. Artal<sup>1</sup>

<sup>1</sup>Laboratorio de Optica, Universidad de Murcia, Murcia, Spain

<sup>2</sup>Hospital Virgen de la Arrixaca, Servicio de Oftalmologia, Murcia, Spain

**Commercial Relationships:** E. Berrio, None; J. Tabernero, None; P. Perez, None; P. Artal, None.

**Support:** "Ministerio de Educación y Ciencia", Spain (grant n° FIS2007-64765) and "Fundación Séneca", Murcia, Spain (grant 04524/GERM/06).

### Abstract

**Purpose:** To explore the relative changes in ocular and corneal aberrations associated to normal aging, with special emphasis in the role of the ocular alignment (Kappa angle) and the lens shape factor in the balance of aberrations with age.

**Methods:** We measured corneal, ocular aberrations and the kappa angle in 50 nearly emmetropic eyes within different age ranges: 10 young eyes (mean age 21.4±1.6 yrs), 13 mature eyes (48.5±5.5 yrs), and 27 old eyes (67.4±5.5 yrs). All subjects had normal eyes with good ocular transparency evaluated with a double-pass instrument. Corneal aberrations were estimated from corneal topography, ocular aberrations were measured with our own clinical prototype Hartmann-Shack wave-front sensor, and kappa angle was measured with an instrument based in the recording of Purkinje images (Tabernero et al., *Opt. Express*, 2006). In all cases the aberrations were estimated for a 5 mm pupil, reconstructed up to the sixth order in the Zernike expansion, and referred to the line of sight. Customized ray-tracing modeling was used to predict the measured aberrations to gain insight in the mechanism of aberration distributions within the eye for different ages.

**Results:** The root mean squared (RMS) of the high-order ocular and corneal aberrations increases with age at a rate of 0.0023 microns/yr and 0.0015 microns/yr, respectively. While in young eyes the cornea has almost two times more aberrations than the eye (indicating a partial compensation by the lens), no significant difference was found between corneal and ocular RMS in the older groups. The ocular spherical aberration increases moderately with age (0.0013 microns/yr; p= 0.01). Horizontal coma also

*This Article*

*Services*

- ▶ [Email this article to a friend](#)
- ▶ [Similar articles in this journal](#)
- ▶ [Alert me to new issues of the journal](#)
- ▶ [Download to citation manager](#)

*Citing Articles*

- ▶ [Citing Articles via Google Scholar](#)

*Google Scholar*

- ▶ [Articles by Berrio, E.](#)
- ▶ [Articles by Artal, P.](#)
- ▶ [Search for Related Content](#)

*PubMed*

- ▶ [Articles by Berrio, E.](#)
- ▶ [Articles by Artal, P.](#)

increases in the eye with age (0.0018 microns/yr;  $p=0.005$ ) due to a reduction in the compensation. This is not due to changes in the optical alignment, since the Kappa angle does not vary significantly with age ( $p=0.14$ ). Changes in the lens curvature radii with age modify slightly the shape factor of the lens in such a way that the coma compensation is reduced and the eye's coma increased.

**Conclusions:** The geometrical changes in the crystalline lens with age (radii and asphericity) produce modifications in its aberrations structure that reduces the compensation mechanism. This explains most of the measured increment of ocular aberrations with age.

**Keywords:** optical properties • aging



© 2009, The Association for Research in Vision and Ophthalmology, Inc., all rights reserved. Permission to republish any abstract or part of an abstract in any form must be obtained in writing from the ARVO Office prior to publication.

---

[HOME](#)   [HELP](#)   [FEEDBACK](#)   [SUBSCRIPTIONS](#)   [ARCHIVE](#)   [SEARCH](#)