Print this Page

1. Genetics and Gene Expression
2. Development
3. Physiology and Pathology
4. Processing and Perception
5. Inflammation, Infection and Ischemia
6. Degenerations, Dystrophies and Death
7. Repair, Regeneration and Restoration
8. Imaging and Other Methods
9. Diagnosis and Treatment
CME Session

Presentation Abstract

Program#/Poster#:	2834/D683
Abstract Title:	**Optical Modelling In Real Eyes Of A Corneal Small Aperture Inlay To Increase Depth Of Focus**
Presentation Start/End Time:	Tuesday, May 03, 2011, 8:30 AM -10:15 AM
Session Number:	318
Session Title:	Aberrations and Refractive Errors: Change, Correction, Manipulation and Visual Impact
Location:	Hall B/C
Reviewing Code:	340 physiological optics, optical design and optical models - VI
Author Block:	*Juan Tabernero, Pablo Artal.* Laboratorio de Optica, University of Murcia, Murcia, Spain.
Keywords:	650 presbyopia; 681 refractive surgery: optical quality; 623 aberrations
Abstract Body:	**Purpose:** To investigate the optical quality in eyes with a small aperture inlay (1.6 mm diameter) placed at the cornea. The through-focus Strehl ratio (SR), as an optical quality metrics, will be calculated in a group of real presbyopic eyes as a function of the relative position of the aperture and the residual defocus. **Methods:** Corneal and total eye aberrations together with angle kappa and the corneal reflex position with respect to the pupil centre were measured in 16 normal presbyopic subjects with no ocular pathologies. For each eye, a customized optical modeling was built by using exact ray-tracing. To simulate the inlay, a small aperture of 1.6-mm diameter placed at the corneal plane was incorporated to each of the eyes. The SR was calculated as a function of the aperture position, displacing the pinhole every 0.25 mm steps. For each position, the SR was calculated as a function of residual defocus (every 0.25 D from -1.5 to 3 D). **Results:** The optimum centration of the aperture depends on the particular optical characteristics of each eye: corneal aberrations, kappa angle and eye length. In particular, for 11 of the 16 subjects, the location that produced the best SR for far vision was found to be near the corneal reflex position. The horizontal average position of the corneal reflex was 0.45 ± 0.21 mm nasal from the pupil center while the position for the optimum SR was at 0.53 ± 0.50 mm Nasal. Vertically, the corneal reflex was located at 0.12 ± 0.17 mm from the

pupil centre while the Best Strehl position was at -0.18 ± 0.43 mm. The SR at both positions for each subject was similar. However, in the remaining five subjects the position that optimized Strehl ratio were more peripheral and different than the corneal reflex. A significant larger corneal astigmatism was present in these subjects. The best compromise of depth of focus was obtained with the addition of myopic defocus in the ranges from -0.75 to -1 D. SR values were over 0.1 for far distance what assured visual acuities superior than 20/20. The depth of focus was 2.5 D with a near visual acuity in average J1 or better. In emmetropic eyes, without the addition of myopic defocus, the depth of focus decreased to around 1.75 D.

Conclusions: The effect in the retinal image quality of a small-aperture to increase depth of focus was accurately evaluated using real eyes data. This approach may provide a simple and effective solution to increase near vision. In eyes with small astigmatism and aberrations the optimum centration of the aperture was near the corneal reflex position. For improved optical outcomes, some small residual myopia and correction of corneal astigmatism might be required.

CommercialRelationships: **Juan Tabernero**, None; **Pablo Artal**, AcuFocus (C)

Support: Ministerio de Educación y Ciencia", Spain (grants nº FIS2007-64765) and "Fundación Séneca, Murcia, Spain (grant 04524/GERM/06)