FREE
ARVO Annual Meeting Abstract | May 2006

Estimating Ocular Aberrations With the Curvature Sensing Technique: Comparison With the Hartmann–Shack Method

F.D. Douton; S.O. Luque; V. Lapuente; M. Arjona; J. Pujol; F. Sanabria

+ Author Affiliations & Notes

Investigative Ophthalmology & Visual Science May 2006, Vol.47, 1191. doi:

Abstract

Purpose: : We have recently developed a curvature wave–front sensor adapted for ocular aberrations determination. With this technique, results comparable to those obtained using other wave–front sensors can be achieved for low and mid order aberrations, while at the same time retrieving the higher order aberrations information currently missed. Our purpose is to verify the capabilities of our system, comparing its results with Hartmann–Shack sensor estimations.

Methods: : Curvature sensing is based on the recording of two symmetrically defocused images from the pupil plane. It can be proved that the contrast between them is related to the wave–front's curvature and from this the wave aberration can be retrieved by means of an iterative Fourier transform algorithm. We have improved the performance of this algorithm, introducing new features which make it faster with an increase in accuracy. The experimental set–up is based on a classical double–pass system, with infrared illumination (= 780 nm). A splitting system permits the registering of both images at once by the camera. It has been performed a complete set of numerical simulations and artificial eye measurements placing different trial lenses in order to analyze the behaviour of the system. We have compared results for 15 young healthy eyes obtained with our system and with our own clinical Hartmann–Shack sensor prototype. The microlenses had a 0.2 mm diameter, with a focal length of 6.3 mm. The wave–front was reconstructed up to 6^{th} Zernike order.

Results: : For the artificial eye measurements, we have obtained a perfect correlation between experimental and theoretical values for spherical (r^2 = 0.9996) and astigmatic (r^2 = 0.9993) trial lenses, confirming the simulations results. We have also found that our technique is in very good agreement with Hartmann–Shack estimations for the analyzed eyes. The difference between the RMS for each technique was found to be inter–subject dependent, although in each case it was on the order of the standard deviation.

Conclusions: : We have proved the possibility of using a curvature wave–front sensor for ocular aberrations determination. Its performance is comparable to current aberrometric systems. In future work, we will perform a similar comparative study for post surgical eyes, expecting to show the potential of curvature sensing for high order aberrations measurement in cases where they are supposed to be significant.

Keywords: refractive surgery: optical quality • refractive surgery: other technologies