

DOUBLE-PASS MEASUREMENTS OF RETINAL IMAGE QUALITY

J. Pujol⁽¹⁾, M. Arjona⁽¹⁾, F. Díaz-Doutón⁽¹⁾, S.O. Luque⁽¹⁾, F. Sanabria⁽¹⁾,
P. Artal⁽²⁾, J.L. Guell⁽³⁾

(1) Centre de Desenvolupament de Sensors, Instrumentació i Sistemes (CD6). Departament d'Òptica i Optometria. Universitat Politècnica de Catalunya.

(2) Laboratorio de Óptica. Departamento de Física. Universidad de Murcia. Murcia. Spain.

(3) Instituto Microcirugía Ocular (IMO). Barcelona. Spain.

Correspondence: Jaume Pujol. Centre de Desenvolupament de Sensors, Instrumentació i Sistemes (CD6). Departament d'Òptica i Optometria. Universitat Politècnica de Catalunya. Rambla Sant Nebridi, 10. 08222 Terrassa. Spain . Fax: 34 93 739 89 23. E-mail: pujol@oo.upc.es

The double-pass technique is based on recording images of a point source after reflection in the retina and double-pass through the ocular media. Using a conventional setup, with equivalent first and second passes, the retinal images are always symmetric. With a simple modification of the technique using a small aperture, the double-pass image keeps the asymmetries present in the retinal image (due to odd aberrations such as coma), and the ocular point-spread function (actual retinal image) can be obtained. If the low order aberrations (defocus and astigmatism) are carefully corrected, two-dimensional maps of the retinal images provide a simple and efficient way to evaluate image quality. From the double-pass images, the ocular Modulation Transfer Function (MTF) and single image quality parameters are calculated. The double-pass images contain all the information about the optical quality of the eye, including the contribution of all higher order aberrations, that are generally missed by most of aberrometric techniques. These higher aberrations may have an impact in vision after refractive surgery.

Recently we have developed a new instrument (OQAS, Visiometrics S.L) based in the double-pass technique that permits an objective evaluation of the optical quality of the eye in clinical environments. The main advantage of this instrument compared with aberrometers is that permit to obtain directly the actual retinal images including higher order aberrations and intraocular scattering.

Measurements performed in patients following conventional refractive surgery showed a reduction of image quality when compared with normal eyes. This is in good agreement with the reported increases of aberrations. The diminution of the retinal image quality shows a clear dependence on the pupil diameter and the refractive technique used.

Comparing the MTFs obtained from double-pass and Hartmann-Shack techniques, in eyes with low level of intraocular scattering, these estimates were quite similar. However, in eyes where scatter was more predominant, i.e.; in early cataract eyes, patients after IOL implantation with posterior capsular opacification, etc...; the MTF provided by the Hartmann-Shack sensor was always higher than the MTF obtained from double-pass.