

A New Double-pass Instrument for Clinical Evaluation Of The Optical Quality After Refractive Surgery

J Pujol¹, M Arjona², J Guell³ and P Artal⁴

¹ Centre de Desenvolupament de Sensors Instrumentació i Sistemes (CD6) Universitat Politècnica de Catalunya Terrassa Spain

² Centre de Desenvolupament de Sensors Instrumentació i Sistemes (CD6) Universitat Politècnica Catalunya Terrassa Spain

³ Instituto Microcirugía Ocular Barcelona Spain

⁴ Laboratorio de Optica Departamento de Física Universidad de Murcia Murcia Spain

Abstract

Purpose: To develop a new instrument based in the double-pass technique to evaluate in the clinical environment the quality of vision after refractive surgery

Methods: 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 (Artal et al., J.Opt.Soc.Am.A., 12, 2358, 1995). 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.

Results: 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. 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

Conclusion: A new instrument based on the double-pass technique has been developed to perform objective clinical evaluation of the ocular optical quality. The instrument has been tested in patients after refractive surgery. The main advantage of this instrument compared to aberrometers is that permits to obtain directly actual retinal images including higher order aberrations.