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Intraocular Scattering Estimation From Double-Pass MTFs

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Abstract

Purpose: To estimate intraocular scattering by analyzing the modulation-transfer function (MTF) obtained from double-pass images. This method can be used in situations of clinical interest like in patients at different stages of cataract development.

Methods: Double-pass retinal images are influenced by both aberrations and scattering (*Diaz-Douton et al. IOVS, 2006*). Measurements of double-pass images were performed with a clinical instrument (*OQAS, Visiometrics, Spain*). To minimize aberrations effects we used entrance and exit pupils of 2 mm in diameter. Defocus and astigmatism were corrected by using a Badal system integrated in the instrument and cylindrical trial lenses respectively. Under these conditions the effects of aberrations were severely reduced and MTFs obtained were mainly affected by intraocular scattering. To verify if the MTF worsening was due either to intraocular scattering or high order aberrations, we measured the wave-front aberrations using a Hartmann-Shack wave front sensor. We performed radial profiles of the double-pass MTFs and the area under this curve was computed to estimate the degree of intraocular scattering. The normalization in the MTF was realized at the the 3th digital frequency (1.6 cycles per degree), instead of the zero frequency, to minimize the effect of reflections and back-scattering.

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Results: The procedure was applied in a group of 50 eyes: 10 normal young eyes as a reference and 40 eyes of cataract patients with different level of scatter whose ages ranged between 45 to 70 years. The double-pass measurements and the computed MTF areas presented a high repeatability. A few cases of cataract patients showed a lower repeatability. We found statistically significant differences in the MTF areas values between cataract and healthy patients ($p < 0.01$).

Conclusions: The method proposed allows us to quantify the degree of intraocular scattering and, because of the high-pass filter applied, only forward scattering was taken into account. In a future work comparison of this method with current subjective methods used presently should be performed.

Keywords: cataract • optical properties



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