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Estimating Intraocular Scattering From Combined Hartmann–Shack and Double–Pass Measurements

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Abstract

Purpose: To estimate intraocular scattering by comparing the modulation transfer function (MTF) obtained from both a Hartmann–Shack (HS) wave–front sensor and a double–pass (DP) based instrument. The procedure should provide an objective parameter related to the degree of intraocular scattering.

Methods: The ocular MTF obtained with a HS wave–front sensor does not contain information on the amount of intraocular scattering. On the other hand, the MTF obtained by using the DP technique (Santamaría et al., J.Opt.Soc.Am.A., 1987) is affected by both aberrations and scattering. We propose to estimate the effect of intraocular scattering from combined HS and DP measurements. We have used different parameters to quantify the degree of intraocular scattering based on the Strehl ratio and the areas under of the MTFs. A group of normal subjects with ages ranging between 20 to 60 years old were measured using a 2 mm pupil in the illumination pathway and a 5 mm pupil in the registration pathway with both instruments. In addition, patients with different ocular conditions (after LASIK refractive surgery, cataract) were measured using the same procedure.

Results: The MTFs showed a high repeatability obtained with both techniques. The quotient between the Strehl ratios obtained from the two mentioned techniques seems to be a good indicator of the degree of intraocular scattering. This quotient is equivalent to the ratio of the areas under the MTFs. We found statistically significant differences in the values of these parameters between normal subjects and patients affected by abnormal increases of intraocular scattering.

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Conclusions: We demonstrated the potential of estimating the degree of intraocular scattering by means of the comparison of MTFs obtained from HS and DP techniques in the same eye. This procedure will be of use in determining the actual quality of the retinal image and the quality of vision in patients where increases of intraocular scattering could be suspected.

Keywords: cataract • optical properties • refractive surgery: optical quality



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