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# Quality of the Tear Film Measured With an Objective Optical Method

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## Abstract

**Purpose:** : The quality of the tear film affects severely the quality of vision. The purpose of this study is to develop a novel optical non-invasive approach to characterize tear film quality. It is based in the analysis of the ocular scattering dynamics measured with a double-pass instrument.

**Methods:** : The procedure consisted in the dynamic recording of double-pass (DP) images (Santamaria et al., JOSAA,1987) during unforced tear film break-up. Series of images (every second) were recorded in the eyes of a group of both healthy and dry-eye patients with a DP-based instrument (OQAS, Visiometrics, Spain). An unstable tear film would produce an elevation of the ocular scattering and in consequence a degraded retinal image. The relative dynamic changes of scatter would be related with modifications in the tear film quality. The dynamics of ocular scattering was evaluated with an Objective Scatter Index (OSI) calculated for each individual DP image. This parameter quantifies the level of scatter and its variations with time will indicate the impact of tear film deterioration.

**Results:** : In healthy eyes with good quality tear film, the analysis of the series of DP images showed that normal tear film break-up process involves minor fluctuations in the OSI value (0.5 ± 0.2), whereas an abnormally accelerated tear film break-up tends to increase slightly this value (0.9 ± 0.3). Patients with diagnosed dry eyes showed both an increased average OSI value and higher fluctuations (3 ± 2). The quality of the tear film can be determined and graded by the average value and standard deviation of the scatter parameter.

**Conclusions:** : A new robust and objective optical method to quantify the quality and stability of the tear film has been developed. It is based on measuring the induced changes in the scattering that affect the retinal image. This technique may be useful to detect and follow-up tear-film related patient's complaints.

**Keywords:** cornea: tears/tear film/dry eye • optical properties • image processing