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TITLE: Quantifying ocular scattering in cataract patients using wide angle double-pass images

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Commercial Relationships Disclosure (Abstract): Juan Martinez-Roda: Commercial Relationship: Code N (No Commercial Relationship) | Meritxell Vilaseca: Commercial Relationship: Code N (No Commercial Relationship) | Marta Salvador: Commercial Relationship: Code N (No Commercial Relationship) | Mariona Fons: Commercial Relationship: Code N (No Commercial Relationship) | Olga Herrera: Commercial Relationship: Code N (No Commercial Relationship) | Antoni Salvador: Commercial Relationship: Code N (No Commercial Relationship) | Jaume Pujol: Commercial Relationship: Code N (No Commercial Relationship)

Study Group:

ABSTRACT BODY:

Purpose: To evaluate ocular scattering (OS) in patients with nuclear cataracts using wide angle double-pass (DP) images. To compare the results with those obtained with the objective scatter index (OSI) (Artal et al. PlosOne 2011, 6(2):e16823).

Methods: A control group of 10 eyes and another group of 30 eyes with early to moderate nuclear cataracts were included in the study (4 NO2, 16 NO3, 10 NO4 according to the LOCS III classification system). Wide angle DP images (5 degrees) were recorded using an experimental setup with a high-sensitivity EMCCD camera (14-bit). OS was assessed as the ratio between the integrated intensity within a peripheral annular area of 8 minutes of arc (') and that comprised in a central circular area with a radius of 1'. Several peripheral rings with different eccentricity were tested: from 12'-20' to 140'-148'. To compensate for the difference in area of each ring, we divided the integrated intensity by the square of the distance to the center of the image in order to calculate a normalized peripheral scatter index (PSI), being the PSI value for the first area considered equivalent to OSI. The outer parts of the DP images are mainly affected by scattering, although it is still possible the presence of aberrations affecting the PSI value. To analyze this effect we recorded series of DP images in 3 young eyes for different amounts of induced defocus (from 0 to 3 D) and the PSI values were calculated.

Results: The stability of the PSI as a function of defocus increased from the 12'-20' area (0.75D) to the 108'-116' area (1.75D). For outer parts of the image the stability decreased, probably due to the presence of noise. Therefore, the 100'-108' area was the one allowing a better quantification of the PSI. Significant ($p<0.001$) correlations between the PSI at all eccentricities and the LOCS III grades were obtained ($0.588<rho<0.503$), and among all the PSI at different eccentricities ($0.986<rho<0.840$). The 108'-116' area was found to provide the largest discrimination in terms of OS among eyes with different LOCS III grade. The mean PSI (± SD) for the 12'-20' and the 108'-116' areas were of 1.15±1.13 and 1.31±0.64 (control group); 2.52±3.59 and 2.74±3.16 (NO2); 5.78±3.96 and 6.69±5.40 (NO3); and 7.45±3.43 and 8.42±5.55 (NO4).

Conclusions: Wide angle DP images can be successfully used to quantify ocular scattering in cataract patients minimizing the effect of aberrations and allowing a better gradation. PSI shows a good correlation with LOCSIII and OSI.

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