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SYMPOSIUM

Simultaneous Noninvasive Clinical Measurement of Lens Autofluorescence and Rayleigh Scattering Using a Fluorescence Biomicroscope

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Abstract

Background:

Lens autofluorescence increases with the age of the subject, and the fluorophores responsible are associated with cataract, retinopathy, and other complications of diabetes. We built a scanning confocal lens fluorescence biomicroscope suitable for routine clinical measurement of lens autofluorescence and light scattering and report data from 127 healthy subjects.

Method:

The fluorescence biomicroscope focuses a beam of light from a blue light-emitting diode on the lens and measures fluorescent green light and blue scattered light using a sensitive silicon photomultiplier. The system includes a target fixation light and a video camera for alignment and automatic pupil tracking. Under software control, a volume of measurement is scanned from behind the posterior lens capsule, through the lens to the aqueous humor, and then back again. Software computes the average ratio of lens autofluorescence to scattered light in the central portion of the lens. Self-reported healthy nondiabetic subjects were examined by an optometrist; if their eyes were healthy and without significant cataract, they were entered into the study.

Results:

Valid lens autofluorescence data were collected from 127 subjects between 21 and 70 years of age. A linear model for lens autofluorescence intensity with age was highly statistically significant, and the improvement in fit for higher-order polynomial models was not statistically significant. The ratio of lens autofluorescence to light scatter was also calculated; regression analysis showed significant curvature for the relationship of the fluorescence ratio to age, so a nonlinear model was used to estimate the mean ratio of autofluorescence to scatter and its prediction intervals as a function of age.

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Abbreviations: (AGE) advanced glycation end product, (IR) infrared, (DFA) 1-deoxyfructosyl glycation adduct, (LED) light-emitting diode, (UV) ultraviolet

Keywords: advanced glycation end products, biomicroscope, diabetes mellitus, fluorescence ratio, lens autofluorescence

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Abstract cont.

Conclusions:

Our observation of a strongly significant linear regression of fluorescence intensity with age of the subjects agrees with the results from previous studies, as does a nonlinear model for the fluorescence ratio. The fluorescence biomicroscope enables the clinician to identify patients with fluorescence ratio significantly higher than expected for their age.

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