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Ellipsoid Zone Change according to Glaucoma-Stage Advancement

Ahnul Ha, Young Kook Kim, Jin Wook Jeoung, Ki Ho Park

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## Abstract

***Purpose:*** Retinal photoreceptor ellipsoid zone (EZ) intensity comparison between normal eyes and those with different stages of glaucoma.

***Design:*** Retrospective cross-sectional study

***Methods:*** The study included 37 normal, 38 pre-perimetric, 39 mild-to-moderate (visual field [VF] mean deviation [MD]: -7.7±2.0 dB), and 36 severe glaucoma eyes (VF MD: -17.8±3.2 dB). The subjects underwent high-resolution horizontal and vertical-line scans through the fovea by spectral-domain optical coherence tomography [SD-OCT] (Spectralis HRA+OCT; Heidelberg). Image processing software was employed to quantify the intensity of the first and second hyper-reflective bands corresponding with the external limiting membrane (ELM) and EZ. In order to account for the brightness variation among scans, the relative EZ intensity as the ratio of the second to first reflective band (EZ/ELM) was determined.

***Results:*** The relative EZ intensity in severe glaucoma eyes was significantly lower than in mild-to-moderate glaucoma eyes (2.46±0.38 *vs*. 3.15±0.43, $P<0.001$); also, it was lower in mild-to-moderate than in pre-perimetric glaucoma eyes (3.15±0.43 *vs*. 3.86±0.44, $P<0.001$). However, the comparison between pre-perimetric glaucoma and normal eyes showed no significant difference (3.86±0.44 *vs*. 4.06±0.40, $P=0.751$). In 75 glaucomatous eyes with VF defect, there was a significant correlation between relative EZ intensity and VF MD ($r=0.83$ and $P<0.001$).

***Conclusions:*** According to SD-OCT, relative EZ intensity reduction occurs in the mild-to-moderate and severe glaucoma stages. These findings suggest, at least provisionally, that in the course of glaucoma progression, mitochondrial changes in the inner segments of photoreceptors occur. Further investigation is warranted to evaluate the potential clinical significance of EZ intensity reduction in glaucoma.