The association between macular pigment optical density and glaucoma-related structural and functional parameters

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Purpose: Glaucoma subjects have recently been observed to exhibit significantly lower macular pigment optical density (MPOD) compared to age-matched healthy controls. MP consisting of lutein, zeaxanthin and meso-zeaxanthin, is highly concentrated at the macula. It possesses antioxidant properties and has a vital role in visual performance. This study comprises an analysis of the baseline glaucoma-related structural and functional data collected as part of the Macular Pigment and Glaucoma Trial (ISRCTN56985060).

Methods: All glaucoma participants underwent a detailed slit-lamp exam, MPOD measurement (heterochromatic flicker photometry), spectral domain optical coherence tomography (SD-OCT, Optovue), contrast and glare sensitivity, Humphrey Visual Field (HVF) standard 24-2 and 10-2, and vision-related quality of life questionnaires. Results were analysed using the SPSS statistics software (version 21).

Results: A total of 71 glaucoma subjects were recruited to the trial, of which 40 were male, and 31 female (37 primary open angle glaucoma, 24 low-tension glaucoma, 8 pseudoexfoliation glaucoma, 2 pigment dispersion glaucoma). The mean age of participants was 64.6 years (range 36-84 years). A positive, and statistically significant relationship was observed between ganglion cell count (GCC) measures and MPOD levels at 0.25 degrees (r = 0.36, p = 0.02) and 0.50 degrees (r = 0.34, p = 0.016) of retinal eccentricity respectively. An inverse and statistically significant correlation was found between mesopic glare disability and MPOD at 0.25 degrees (r = -0.33, p = 0.04), 0.50 degrees (r = -0.41, p 0.003) and 1.0 degrees (r = -0.45, p = 0.005) of retinal eccentricity. Glaucoma severity, as determined by HVF mean deviation (dB), was positively correlated with MPOD at 0.50 degrees [r = 0.31, p = 0.03 (standard 24-2 test)] and at 1.0 degrees [r = 0.43, p = 0.01 (10-2 test) and r = 0.34, p = 0.04 (24-2 test)] of retinal eccentricity, respectively. Duration of glaucoma was also inversely and statistically significantly correlated with MPOD.

Conclusions: There is emerging evidence that the macula is affected early in glaucoma. Our baseline results suggest a significant relationship between MPOD and glaucoma structural-functional parameters. Increased oxidative stress or compromised ocular blood flow levels with chronicity of glaucoma may be linked to low MPOD.