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Macular pigment spatial profile classification: are our eyes deceiving us?

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Purpose: Currently, definitions of typical and atypical macular pigment (MP) spatial profiles vary and there is no consensus on a method for classification that can be applied to all MP measuring techniques. Moreover, classification is often based on subjective visual assessment without consideration of measurement error. We investigated repeatability of MP optical density (MPOD) measurements and evaluated objective MP spatial profiling compared to subjective visual assessment.

Methods: We measured MPOD in one eye from 0 to 3.8° retinal eccentricity using heterochromatic flicker photometry (HFP) (MAP test, City University London), repeated at a second visit (n=15 males, n=25 females; 24±6 years). Participants with visual acuity worse than 0.3 logMAR or ocular pathology were excluded. The Coefficient of Repeatability (CoR) was calculated for MPOD from 0° to 3.8°. A MP profile phenotype was assigned to each participant's MPOD data. This was objectively classified as exponential, ring-like or central dip, based on deviations away from the exponential fit. Kappa agreement between visits was calculated.

Additionally, two dual-wavelength fundus autofluorescence (FAF) scans (Spectralis, Heidelberg, Germany) were acquired in a single session (n=40 females; 39±9 years). As well as our objective classification, each FAF scan underwent subjective visual assessment. Kappa agreement was calculated between scans and also between profiling methods.

Results: Using HFP, a between visits CoR of 0.12 for MPOD at 0° and 0.8° was found with excellent agreement of objective profile classification (k=0.89, 95% CI 0.74 to 1.00; P<0.0005). Using FAF, a CoR of 0.23 at 0° reducing to 0.05 at 0.8° was calculated with excellent agreement of objective profile classification (k=0.85, 95% CI 0.69 to 1.00; P<0.0005). Subjective visual profiling showed moderate agreement (k=0.48, 95% CI 0.23 to 0.73; P<0.0005). Agreement between objective and subjective classification was low (k=0.23, 95% CI 0.04 to 0.42; P=0.02).

Conclusions: We must not underestimate the importance of using a consistent objective profiling method to compare data obtained from different measurement techniques. Applying an objective method of MP profiling resulted in improved agreement compared to visual assessment. Since objective classification takes into account measurement error, we propose this is a more reliable method for MP spatial profiling.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.: Although generally the spatial profile of macular pigment optical density (MPOD) declines exponentially away from the fovea, there have also been reports of atypical profiles such as central dips and ring-like structures or secondary peaks. However, variation in measurement techniques makes comparison between studies difficult. In order to achieve a systematic study framework, we propose a universal objective classification system to compare MPOD profiles

between studies, which can then be applied to any MPOD measurement technique.