The MPS II; comparison with the Macular Pigment Reflectometer and the Macular Densitometer

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1. Introduction

Macular pigment (MP) is purported to reduce the risk of age-related macular degeneration through its antioxidant and blue-wavelength light filtering capacity. As such, the measurement of MP has become of great interest in recent years both for clinical and research purposes. Measuring macular pigment optical density (MPOD) with different methods appear to produce differing results in the same individuals, especially when dissimilar principles are employed. Ascertaining to what degree these methods correlate will enable the scientific community to interpret past and future research studies in this field. Here we describe two series of experiments which compare recent techniques used to measure MPOD.

2. Methods

Exp 1

We used a macular pigment reflectometer[1] (MPR) with capture angle 1°, modified to measure at eccentricities of 0°, 1°, 2°, 4°, 6° and 8°. These data were compared with those obtained from the Macular Pigment Screener[2] (MPS; Elektron Technology PLC) modified to assess MPOD at 0.5°, 1°, 2°, 4°, 5°, 6° and 7°. Nineteen healthy individuals (mean age 26 ±8 years) were tested. Centre only measurement and spatial MPOD profiles were compared.

Exp 2

We compared the right eyes of twenty-five healthy individuals (mean age 23 ±3 years) using MPS II and a Macular Densitometer[3] (MD; Macular Metrics, Rehoboth, MA, USA).

Test-retest variability was evaluated for MPS II and MD (exp 2) by taking readings separated by 1 week. Data were accepted if the standard deviation (SD) was less than 0.1 between readings. MPOD evaluations were repeated 5 times with each device. Repeatability was assessed using the standard correlation coefficient (Pearson's *r*) and by calculating the correlation of repeatability (CoR; 1.96 * SD of the differences between measure 1 and measure 2).

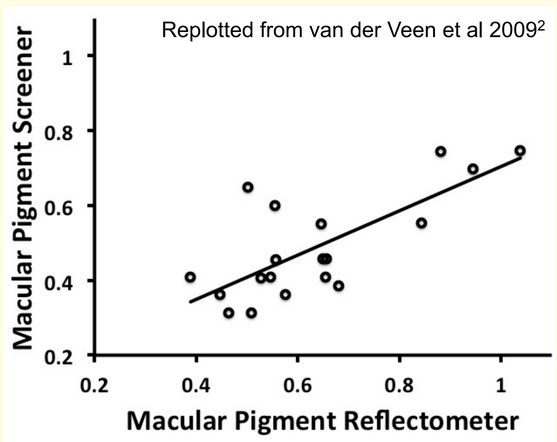
MD was calibrated and testing was carried out according to the manufacturer's instructions. The procedure for each test was clearly explained to the participant before the start. The MPS II 'expert mode' was used to collect data. This device also features the 'Data Quality Indicator' software which provides advice on the quality and accuracy of the collected data. Data designated "green" are accepted and data designated "orange" and "red" are repeated.

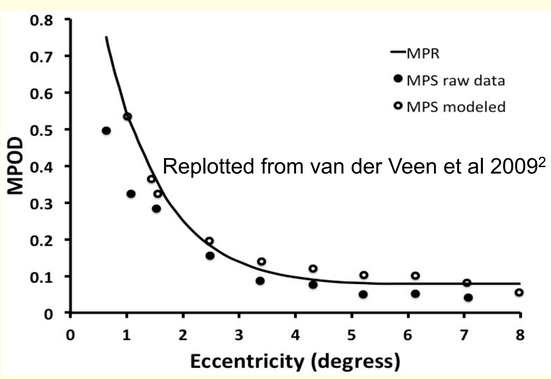
3. Results

Exp 1

Central measurements (0°) with both devices were strongly correlated (r=0.72, p=0.001) with the absolute estimates obtained by MPS being lower than by MPR.

These differences could be explained by i) non-zero values at 8° eccentricity and ii) assuming the subjects used a point 0.4° from the centre of the stimulus to set flicker thresholds.
The mean value for the MPR at 8° was 0.04, whereas the MPS assumes this point to be zero.



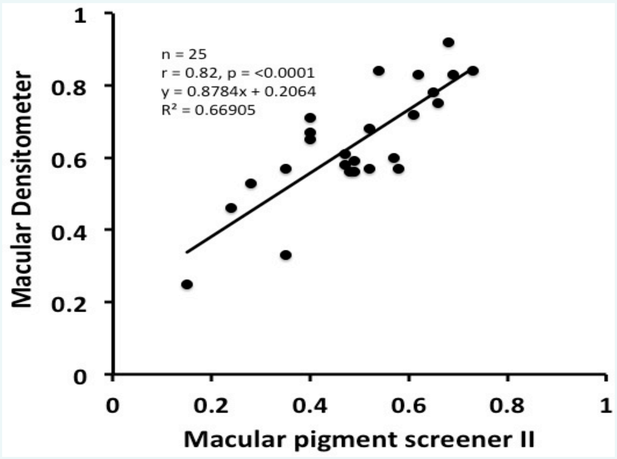


Increasing all MPS values by 0.05 then multiplying by an individual correction factor that depended on the steepness of the spatial distribution of MP made the data sets highly compatible. Eccentricities of >1° showed very good agreement between the two methods. For eccentricities <1° mathematical modelling, allowing for distributions of lutein and zeaxanthin, was used[1].

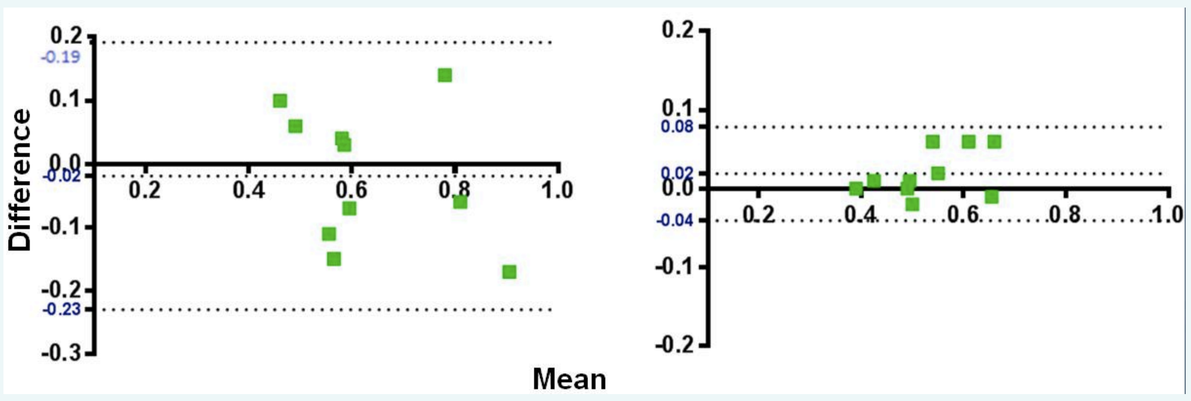
3. Results

Exp 2

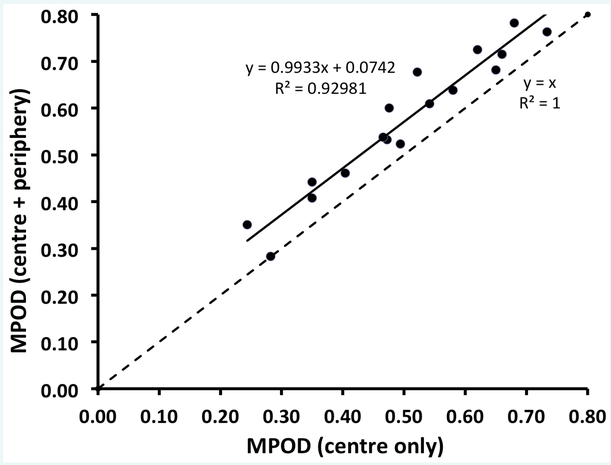
Mean group MPOD measured with MD and MPS II was 0.64 (±0.04) and 0.49 (±0.04), respectively. 80% of the participants displayed lower MPOD values measured with MPS II compared to MD. On average, MPOD derived from MPS II was 0.14 (±0.09) lower than that derived from MD. There was excellent correlation between the two methods (r=0.82, p=<0.0001).



Correlation coefficients between first and second measurements with MD was 0.78 (p=0.008) and 0.96 (p=<0.001) with MPS II. Coefficients of repeatability for MD and MPS II were 0.21 and 0.06, respectively.



The centre only (estimated from age) vs centre + periphery measurements correlated very highly (r=0.96, p=<0.0001). On average, the centre only estimate overestimated MPOD by 0.07. This was a consistent 'DC' shift unrelated to MPOD or age.
The mean SD of MPOD from centre only and from centre + periphery was virtually the same (0.044 and 0.042, respectively).



4. Conclusions

The MPS II, the MPR and the MD provide broadly similar results. It is inevitable that different absolute values are obtained. The important factor is the predictability from one method to another. It is essential that practitioners obtain normative data for any particular instrument as it is well known that many factors influence the assessment of MPOD. The MPS II has the advantage of the centre only facility. This enables rapid determination of MPOD and is ideal when differences between consecutive measurements are required when monitoring the results of supplementing with retinal carotenoids.

5. References

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3. Wooten BR, Hammond BR, Land RI & Snodderly DM (1999): A practical method for measuring macular pigment optical density. Invest Ophthalmol Vis Sci 40:2481–2489.

6. Disclosures

The MPS II is protected by a patent owned by Ian Murray and David Carden.