Evaluation of macular pigment optical density (MPOD) with a color perimetry technique. Normal values and influence of diet

M. Crochet¹, S. Defoort-Dhellemmes², J.R. Charlier³;
¹Ophthamology, Creil, France, ²University Hospital, Lille, France. ³Research Dpt, Metrovision, Péréniches, France

Introduction:
In 2005 Age-related Macular Degeneration (AMD) involved 8 percent of the French population over 50 years and more than 25 percent over 75 years, ie 1,500 000 people. These figures should double in 30 years (Soubrie, 2000). At present, no treatment is efficient for most of this population.

The macular pigment (MP) is thought to have a protective role in age-related macular degeneration by reducing the oxidative stress on the retina (Cal, 2000) and reducing the deleterious effects of short-wave light (Taylor, 1989, Beatty, 2001).

The macular pigment density peaks at the foveal center (Snodderly, Bone, 1985).

The macular pigment is composed of xanthophylls, lutein and zeaxanthin, obtained in the diet (Seddon, 1994). Dietary intake of lutein and zeaxanthin, for most individuals, is related to retinal concentrations of macular pigment (Nolan 2007) but absorption varies (Ciulla 2001, Nolan 2007). It decreases in smokers and overweight people (Hammond, 2002) in those L and Z fat-soluble nutrients, are carried first to fat cells.

Purpose:
Our purpose was to study the clinical applicability of a color perimetry technique (CPT) for the evaluation of the optical density of macular pigments and to establish normal values taking into account the diet of subjects.

Methods:
Luminance differential thresholds were measured for 2 stimuli: a blue stimulus (450-480 nm) absorbed by the MP, and a red one (615 nm) not absorbed. The stimuli were presented at the fovea and at 6 peripheral locations with an eccentricity of 3 to 10 degrees. Tests parameters were Goldmann size III or a white background of 10 cd m⁻². Tests were presented on a T/F monitor calibrated according to the DICKOM standard. A staircase 4-2-2-2 full thresholding strategy was used.

Exams were performed on 84 subjects with normal visual acuity, normal eye fundus and no ophthalmic disease. The subjects were interviewed about their diet.

Results:
- The optical density of macular pigment (MPOD) was estimated as the difference between the thresholds of blue and red stimul at the fovea. A correction for the blue absorption by the lens was made based on the difference between the thresholds of blue and red stimuli at 10 degrees eccentricity. The average value of the tested population was 3.49 dB (0.349 log units) with a standard deviation of 0.2 log units.

Discussion:
• heterochromatic flicker photometry: 0.43 log units (SD 0.20) (Hammond, 2005),
• fundus autofluorescence: 0.28 log units (SD 0.10) (Hammond, 2005),
• fundus reflectometry: 0.60 log units (SD 0.20) (Van der Veen, 2009).

However, these studies showed a large inter-individual variability and did not take into account the diet of subjects.

Influence of diet:
The estimated values for MPOD are significantly affected by the diet. This is in agreement with the results of previous studies.

Conclusions:
The color perimetry technique provides an estimation of the optical density of the macular pigment quite similar to values found with other techniques. It can be used on a standard visual perimetry equipment with natural pupil.

Our results show a significant effect of the dietary habits. Therefore, dietary information should be taken into account for the establishment of reference data.

Even if it is not yet established that macular pigment density is a risk factor for ARMD, these results suggest that the measurement of macular pigment density may be used to support dietary recommendations and / or the prescription of nutritional supplements.

References:
[References list provided in the document]