Measuring macular pigment

This article is written as a rebuttal of a personal viewpoint ‘Measuring macular pigment’ by Beatty and Nolan in a recent article published in Optician (15.02.13).1 Regrettably the article contains a series of misleading and unsubstantiated statements. Specifically, remarks are made about the MPS 9000, and its recently updated version the MPS II, macular pigment screener, manufactured by Elektron Technology PLC and distributed in the UK by Topcon (GB).

As is well known, the retinal carotenoids lutein (L), zeaxanthin (Z) and meso-zeaxanthin (mZ) are the main components of the macular pigment (MP). There is accumulating evidence that, according to visual acuity measurements, enhancing levels of MP by taking supplements containing L, Z or mZ may slow down the progress of early stage age-related macular degeneration (AMD).2,3,4

There is worldwide interest in finding preventative techniques, to minimise the kind of geographic damage illustrated in Figure 1.

Nolan and Beatty say that the Macular Densitometer (to be renamed MacuLux) is the only instrument to validate in terms of the spectral absorption curve of MP. However, this approach to validation was used in a concept instrument, developed in Utrecht, which formed the basis of the MPS9000, in Beatty et al.5 In that paper (well received at the time) the MP spectrum obtained, matched MP absorption spectrum for eight wavelengths.

In their detailed description of the MPS 9000, Loughman et al.6 found a high level of correspondence (r = 0.68) with the macular densitometer. In that paper they do not mention, the opinion, now expressed by Nolan and Beatty, that the MPS is flawed. On the contrary they make the following statement: ‘…our analysis suggests that the fundamental principles and technique of the MPS 9000 seem generally robust’. The MPS was also scrutinised in an excellent review by Howells et al.7 They state ‘…this new CR [coefficient of repeatability, obtained with the MPS] is also as good as, if not better than, any stated HFP reliability of the last 15 years’.

What, we might ask, has prompted the much more critical view of the MPS expressed in the Nolan and Beatty article1 where they assert that the method on which the MPS 9000 and MPS II are based ‘is fundamentally flawed’? It is hard to imagine that they have suddenly found errors in the science; there are a number of peer-reviewed, substantive papers which describe various aspects of the MPS 9000. Some of these are briefly reviewed below:

● In van der Veen8 MPS 9000 measurements were compared with data from a retinal reflectometry-based instrument, developed in Utrecht, the Macular Pigment Reflectometer (MPR) which uses the MP spectrum to calculate MPOD. Hence any correlation between the MPR and the MPS provides strong evidence that the MPS is selectively sensitive to the absorption spectrum of MP. The MPS 9000 data showed a relatively reduced MPOD level, but agreed almost exactly with the MPR when corrected by the 0.5 deg edge effect factor of 1.6.9 In addition, the paper contained the largest published MPOD data set. More than 5,000 eyes of patients from a wide age range under bone fide, real world clinical conditions. The median and distribution of these data was similar to that from smaller samples.

● In a further paper in the prestigious Journal of Biomedical Optics9 we addressed the second issue raised by Nolan and Beatty of retinal distribution of MP. In this case we showed data comparing the MPR and the MPS 9000 for different eccentricities. A mathematical model allowing for distribution of L and Z was used. The MPOD was calculated as the same MPOD. It is hard to imagine a more convincing demonstration of the veracity of the centre-only method.

As seen in Figure 3, the central and peripheral settings form two V-shaped functions. The MPOD is calculated from the difference in dB between the central and peripheral minima. As the crystalline lens absorbs more blue light with age the two curves are shifted along the horizontal axis.

The Makridaki paper establishes that it is possible to predict the amount of yellowing of the lens as it changes more or less linearly with age as described in Xu et al.12 and Pokorny et al.11 The MPS 9000 and MPS II...
and MPS II are ideal for ophthalmic changing diet? Hence the MPS 9000 as a result of taking supplements or to know, ie ‘Has the MP increased is exactly what busy clinicians need sensitive to change. This of course a relative value of MPOD particularly made at say, six-monthly intervals. comparing regular measurements, it acts as a stable reference when has other benefits apart from speed; it is not affected by media yellowing. This is a crucial unique aspect of the technique. It is achieved by reducing the temporal frequency from above the critical flicker point. This ramping reduces Troxler (fading) effects, thus providing a well defined endpoint for when flicker starts and ends. Detecting flicker is much easier than eliminating it, as is required in other HFP-based methods. The task is therefore relatively easy, particularly for the older observer.

Both the MPS 9000 and the MPS II use automatic customised HFP flicker rates. The patient carries out a simple pre-test flicker sensitivity test, pressing a button when they detect flicker, this selects their optimal temporal frequency for the test. This feature takes only a few seconds.

The ‘centre only’ technique allows fast, convenient screening of patients of all ages. The peripheral test is still available to the more expert/scientific users and of course this is advised in cases where lens yellowing is abnormally rapid as is the case in established diabetes.

The broad spectrum bright, white background ensures the measurement is not affected by media yellowing. Such problems may arise using a low level blue light background.

The MPS II includes in-built Data Quality Software to provide the operator with optimal advice on the quality and accuracy of the collected data. (This feature was suggested by authors of papers which reviewed the MPS 9000)

The MPS 9000 and the MPS II are very easy to use. They do not require intensive operator training and can be operated by non-expert staff.

References
Objective achieved

Bill Harvey recommends the Cochrane Library as an essential resource with a refreshing absence of bias

I have long been wary of subjective rating based research. Asking a patient how they feel in a certain type of contact lens or how they rate the vision through a particular spectacle lens seemed to me fraught with potential pitfalls. The question itself will introduce bias (‘is this more comfortable?’ ‘can you see better now?’) and may mask external influences such as a free supply of the new lens/product. I assumed that objectivity had to be the key.

I have revised this view somewhat after hearing the story of Sir Ian Chalmers, an obstetrician who spent some time working in the Middle East. Here he noticed that much of what he had been taught and what had been learned from apparently evidence-based research did not seem to be borne out by his real-life experiences.

He noticed, for example, inconsistencies in the way that Caesarian section births were assumed by many to be the best method of delivering children. He noted how many of the methods ‘proved’ by research to be the best way of offering analgesia during birth were contradicted by statements of the women actually giving birth.

He noticed, in fact, a lack of input from patients and their views in general when researchers were looking at specific therapeutic interventions and that the outcomes were rarely measured in terms of patient satisfaction.

He was thus inspired to become a champion of better designed research, based on the ideal of randomised controlled studies and including all aspects of potential outcome including that of patient inference. In 1992, Chalmers was appointed director of the UK Cochrane Centre. Subsequently, he became founding editor of the James Lind Library, which documents the history and evolution of fair trials of treatments, and helped to establish the James Lind Alliance, a non-profit organisation that ‘aims to identify the most important gaps in knowledge about the effects of treatments’. The aim is to make sure there is ready access for professionals and patients to well-designed research about any particular topic. The online Cochrane resource publishes regular reviews and meta-analyses about a wealth of topics and allows you to view the summated evidence based on well-designed research. There are many that apply to optometry.

How to access findings

Simply go to www.thecochranelibrary.com and register your details and areas of interest. Whenever there is a review of the research in any particular area, you can access a summary. Of recent interest were three recent reviews by Professor John Lawrenson and colleagues. The first looks at the effectiveness of omega-3 supplementation on eye health and concludes: ‘There is currently no evidence to support increasing levels of omega-3 LCPUFA in the diet for the explicit purpose of preventing or slowing the progression of AMD.’

The second report looked at the influence of supplementation on AMD progression and reports: ‘People with AMD may experience delay in progression of the disease with antioxidant vitamin and mineral supplementation. This finding is drawn from one large trial conducted in a relatively well-nourished US population. The generalisability of these findings to other populations is not known. Although generally regarded as safe, vitamin supplements may have harmful effects. A systematic review of the evidence on harms of vitamin supplements is needed.’

Finally, how useful is supplementation at preventing AMD onset? ‘There is accumulating evidence that taking vitamin E or beta-carotene supplements will not prevent or delay the onset of AMD. There is no evidence with respect to other antioxidant supplements, such as vitamin C, lutein and zeaxanthin, or any of the commonly marketed multivitamin combinations. Although generally regarded as safe, vitamin supplements may have harmful effects and clear evidence of benefit is needed before they can be recommended.’ This tallies well with previous meta-analyses suggesting that supplementation may help reduce progression but there is still no evidence of a prophylactic effect when it comes to disease onset.

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Figure 3 The new MPS-II Macular Pigment Screener


● Ian Murray is senior lecturer in the Faculty of Life Sciences, Manchester University and David Carden, an electronics engineer, is a visiting researcher. They are the joint inventors and patent holders of the MPS 9000 and the MPS II. Ian Murray and David Carden declare a financial interest in the Macular Pigment Screener group of devices.