

Building a Visual Performance Clinic

Pay attention to your patients' macular pigment optical density.

BY JEFFREY MORRIS, MD, MPH

Cataract surgery is an exceptional procedure. Surgeons can correct distance vision, near vision, and astigmatism with one operation, and patients often come out of surgery with only a minimal need—or none at all—for reading glasses. Although most anterior segment surgeons concentrate on the ocular lens, I have found that also paying attention to my patients' macular pigment optical density (MPOD) may provide a hidden, yet rather profound benefit for their vision and overall satisfaction following surgery.

COMPONENTS OF THE MACULAR PIGMENT

The macular pigment is made up of the carotenoids lutein, zeaxanthin, and meso-zeaxanthin and is known to function as a blue-light filter. Additionally, the carotenoids themselves are potent antioxidants.¹ Studies have shown that increases in the dietary intake of lutein, zeaxanthin, and importantly, meso-zeaxanthin, result in subsequent rises in serum and MPOD levels.² Major epidemiology studies have linked MPOD amounts and higher serum and dietary levels of lutein and zeaxanthin to significantly lower the incidence of age-related macular degeneration (AMD),^{3,4} and a higher intake of these carotenoids may reduce the risk of dry AMD progression.⁵ A case-control study has demonstrated a direct correlation between measured macular pigment in post-mortem retinas and the risk for AMD.

As a cataract surgeon, these indications concern me greatly. The recent Beaver Dam Eye Study found a strong association between patients having had cataract surgery and their subsequent development of late AMD.⁶ The exact nature of this relationship has not been established, however, it is hypothesized that the cataract acts as a natural filter of blue light.

Many surgeons believe that a loss of this natural blue light filtering results from the removal of the cataractous lens and is accompanied by an increase in the photic stress on the senescent retina. The aging retina has a very limited capacity to respond because of an already com-



Figure 1. The MAPCATsf (Guardion Health Sciences) is a desktop heterochromatic flicker photometer.

promised retinal pigment epithelium originating from the lifelong accumulation of lipofuscin. It therefore becomes overwhelmed by the increased rate of generation of reactive oxygen species culminating in release of vascular endothelial growth factor and vascular neogenesis.

NUTRITION-RELATED VISUAL SYMPTOMS

MPOD has been found to be strongly correlated to improvements in contrast sensitivity, glare disability, and photostress recovery times.⁷ In patients given an oral supplementation of 12 mg of lutein and zeaxanthin daily for 6 months, the average MPOD increased, and the deleterious effects of glare on these two visual performance tasks was significantly reduced.⁸

The availability of a newly developed tool to measure MPOD as well as the effective age of the lens, lens optical density, and the percentage of blue light blocked in the eye, has compelled me to develop a visual performance and ocular nutrition clinic within my practice that specifically addresses MPOD levels in my patients. The MAPCATsf is a desktop heterochromatic flicker photometer that is designed to measure MPOD but also provides assessment of the lens and its functions (Figures 1 and 2). The

device was invented by physicist Richard Bone, PhD, who, along with chemist John Landrum, PhD, identified the biological mechanisms responsible for the protective role of lutein, zeaxanthin, and meso-zeaxanthin in the eye. The MAPCATsf provides measurements in a reliable, non-mydratic, and noninvasive manner. Its ability to produce accurate, serialized data makes it simple to test patients at baseline and subsequently at regular intervals to objectively determine if a recommended change in diet or supplementation has produced the desired effect in MPOD.

In a discussion of the importance of MPOD with all of my patients, I recommend that they make an appointment to visit my practice's visual performance clinic. This visit starts with my staff's obtaining baseline measurements of glare and contrast sensitivity. A dedicated ocular nutritionist then performs testing with the MAPCATsf, collecting baseline measurements of MPOD, the effective lens age, lens optical density, and information about the patient's current diet and any vitamins or supplements he or she takes.

My patients have been delighted with having a resource to help them reduce overlapping and perhaps unnecessary vitamin and supplement intake. Depending on the patient's profile, the nutritionist might also recommend supplementation as a way to improve levels of lutein, zeaxanthin, and meso-zeaxanthin in the retina.

If MPOD measurements have not improved when patients return for their follow-up visit, further adjustments are made to their nutritional regimen. Subsequent visits are scheduled every 3 months until a successful diet and supplement routine is established and then every 6 months thereafter. Among my patients who begin taking supplements, MPOD typically increases between 15% and 30% during the first 3 months. That increase often doubles in the second 3 months.

LONG-TERM VISUAL PERFORMANCE

Given that the removal of the cataractous lens allows more damaging blue light to enter the macula, it is highly desirable that the MPOD be sufficiently high that the increased photic stress will not overwhelm the antioxidant capacity of the retina.⁹

To this end, I have most of my cataract patients speak with our nutritionist prior to surgery. I explain that we want to make every effort to ensure the best outcome possible, in both the short and long term, and that while I do not delay their surgery due to low MPOD measurements, my team and I will work to increase patients' MPOD both prior to and after cataract surgery. In most patients, the inevitability of the need for cataract surgery is known well in advance, and there is adequate opportunity to address MPOD levels before surgery.

Physicians are experts at diagnosing pathology and deter-



Figure 2. The MAPCATsf measures MPOD and provides an assessment of the lens and its functions.

mining a course of treatment for the lens, but collaboration of a nutritionist has been found essential to the success of the visual performance clinic. Two of the three carotenoids that make up the macular pigment—zeaxanthin and lutein—can be obtained through diet. Meso-zeaxanthin, however, is a metabolite of lutein and is synthesized within the eye; it is rarely found in nature. For patients who may have an enzymatic insufficiency for converting lutein to meso-zeaxanthin, it has been argued that including a dietary source of this metabolite may be critical to ocular health.⁷

CONCLUSION

Adopting new technologies such as the MAPCATsf can make possible a comprehensive, efficient, and effective approach to ocular nutrition. It is time to address our patients' macular health via a quantitative assessment of the health of their MPOD as we strive to achieve better vision and preserve the integrity of the most critically important component of the eye. ■

Jeffrey Morris, MD, MPH, is in practice at Morris Eye Group, located in Encinitas and Vista, California. He has a financial interest in Guardion Health Sciences. Dr. Morris may be reached at (760) 631-3500; drmorris@morriseyegroup.com.



1. Ahmed SS, Lott MN, Marcus DM. The macular xanthophylls. *Surv Ophthalmol.* 2005;50(2):183-193.
2. Bone RA, Landrum JT, Guerra LH, Ruiz CA. Lutein and zeaxanthin dietary supplements raise macular pigment density and serum concentrations of these carotenoids in humans. *J Nutr.* 2003;133(4):992-998.
3. Seddon JM, Ajani UA, Sperduto RD, et al. Dietary carotenoids, vitamins A, C, and E, and advanced age-related macular degeneration. Eye Disease Case-Control Study Group. *JAMA.* 1994;272:1413-1420.
4. Ho L, van Leeuwen R, Witteman J, et al. Reducing the genetic risk of age-related macular degeneration with dietary antioxidants, zinc, and omega-3 fatty acids: the Rotterdam Study. *Arch Ophthalmol.* 2011;129(6):758-766.
5. San Giovanni JP, Chew EY, Clemons TE, et al. for the Age-Related Eye Disease Study Research Group. The relationship of dietary carotenoid and vitamin A, E, and C intake with age-related macular degeneration in a case-control study: AREDS Report No. 22. *Arch Ophthalmol.* 2007;125(9):1225-1232.
6. Klein BE, Howard KP, Lee KE, Jyengar SK, et al. The relationship of cataract and cataract extraction to age-related macular degeneration: the Beaver Dam Eye Study. *Ophthalmology.* 2012;118(8):1628-1633.
7. Nolan JM, Loughman J, Akkali MC, et al. The impact of macular pigment augmentation on visual performance in normal subjects: COMPASS. *Vision Res.* 2011;51(5):459-469.
8. Stringham JM, Hammond BR. Macular pigment and visual performance under glare. *Optom Vis Sci.* 2008;85(2):82-88.
9. van de Kraats J, van Norren D. Optical density of the aging human ocular media in the visible and the UV. *J Opt Soc Am A Opt Image Sci Vis.* 2007;24(7):1842-1857.