The Relationship Between Macular Pigment and Visual Performance

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INTRODUCTION
Macular pigment (MP), which is composed of three dietary carotenoids, lutein (L), zeaxanthin (Z) and meso-zeaxanthin (MZ), is predominantly located at the site of maximum visual acuity in the human retina. MP absorbs short wavelength light prior to photoreceptor stimulation. Filtering such defocused short wavelength (blue) light could enhance visual performance by reducing the effects of chromatic aberration and light scatter.1

PURPOSE
In this poster, we present baseline data from the Collaborative Optical Macular Pigment Assessment Study (COMPASS), which represents a cross sectional evaluation of the relationship between MP optical density (MPOD) and visual performance and comfort across a broad and refined range of functional tests. We also present preliminary data from the COMPASS longitudinal lutein supplementation investigation.

SUBJECTS and METHODS
At baseline, we recruited 142 young healthy subjects (mean ± SD age = 28.85 ± 6.37 years). A typical study visit lasted approximately four hours. Those aspects of visual performance assessed, and their sequence, is presented in Table 1.

MPOD measurement
MPOD measurements were obtained by customised heterochromatic flicker photometry (cHFP, using the Macular DensitometerTM) at five loci (0.25°, 0.50°, 1°, 1.75° and 3° of retinal eccentricity), with a reference point at 7°, to generate a complete spatial profile of MP.

Best corrected visual acuity (BCVA)
BCVA was assessed using a computer-generated LogMAR, high contrast chart, employing a SLOAN ETDRS letterset. A visual acuity rating (VAR) was computed to quantify precise acuity limits.

Contrast sensitivity function (CSF)
Mesopic (3 cd/m²) and photopic (100cd/m²) CSF curves were plotted using spatial frequencies of 1 cycle per degree (cpd), 4.1 cpd, 7.5 cpd, 12 cpd and 20.7 cpd.

Glare sensitivity
Mesopic (3 cd/m²) contrast sensitivity was also tested under medium (42 Lux) and high (84 Lux) glare conditions using a sine grating functional acuity contrast test.

Photostress Recovery Time (PRT)
PRT was evaluated using a previously described macular automated photostress test2 using a Humphrey 745 visual field analyzer.

Statistical analysis
Pearson correlation coefficients were calculated to investigate bivariate relationships and partial correlation coefficients when controlling for confounding variables. We used the 5% level of significance throughout our analysis. Repeated measures analysis was conducted for longitudinal data.

RESULTS
Reliability testing of methods
Following pre-test training, repeat testing on 10 subjects at three separate study visits (over a 10 day period) was conducted. The intraclass correlations (ICC) obtained for all methods were high (Mean ± S.D = 0.705 ± 0.158).

The mean (±SD) MPOD, at all degrees of retinal eccentricity measured at baseline are summarized in Table 2. There was a statistically significant positive relationship between BCVA and MPOD at all retinal eccentricities measured (r = 0.237 to 0.308, p < 0.01) [e.g. Figure 1].

There was a statistically significant positive relationship between mesopic and photopic contrast sensitivities (at 7.5 and 11.8 cpd) and central MPOD (r = 0.167 to 0.220, p < 0.05) [e.g. Figure 2].

CONCLUSION
Photostress recovery and glare sensitivity were unrelated to MPOD cross-sectionally. However, measures of central visual function, including BCVA and contrast sensitivity, were positively associated with MPOD. These effects of MP on visual performance are likely to apply equally and possibly more significantly in an older population, where, for example, the incidence of driving accidents and falls directly relate to visual performance. The COMPASS longitudinal, placebo-controlled and randomized, supplementation trial will ascertain whether augmentation of MPOD can influence visual performance in such a young, healthy subject group.

REFERENCES