What We Don’t See Matters-What’s This Pigment All About?

Pamela A. Lowe, OD, FAAO
Diplomate, American Board of Optometry
Medical Director, Vision Source Chicagoland
President, Professional Eye Care Center, Inc, Niles/Chicago, Illinois

Disclosures
Disclosures

Speaker's Bureau/Consultant for:
- Alcon
- Diopsys
- Heidelberg
- Maculogix
- Optos
- Reichert
- Zeavision

The Why?
Lecture Objectives

• Understand the connection between macular pigment optical density (MPOD) and macular health
• Benefits of measuring MPOD
• Discuss enhancing visual performance and long term macular health through nutrition and/or supplements
• **Challenge: How does one maximize visual performance and macular health nutritionally?**

Carotenoids/MPOD

• Carotenoids are pigments in nature that protect:

  • **“Carotenoids are plant pigments responsible for bright red, yellow and orange hues in many fruits and vegetables. These pigments play an important role in plant health. People who eat foods containing carotenoids get protective health benefits as well.”**
  • Fruit and vegetables provide the majority of the 40 to 50 carotenoids found in the human diet.

**www.livescience.com**
Dietary Carotenoids – Zeaxanthin & Lutein

~50 in diet

~20 in blood

2 in the eye:
Lutein and zeaxanthin concentrate in the eye
(over 1000x the concentration in human serum)

Lutein and Zx Protect the eye and brain

Dietary Zeaxanthin & Lutein Presence in the Eye

2:1 ratio of Zeaxanthin to Lutein in the fovea
Zeaxanthin is “nature’s cone protectant”
Macular Pigment (MP)

MP is comprised of lutein (L) and zeaxanthin (Z), and their isomer, meso-zeaxanthin (MZ).

MP screens central cones

Central Fovea
Cell nuclei (purple), LM cones (green), rods (red), lipofuscin (orange)
Macular Pigment - What does it do?

1. Blocks the **Harmful Blue Light** portion of the light spectrum
2. Provides localized and systemic antioxidant protection
**Lutein and Zeaxanthin influence visual function through optical and biological mechanisms**

- Optical mechanisms
  - Glare Disability
  - Glare Recovery
  - Color Contrast
  - Visual Range
  - Contrast Sensitivity
- Biological mechanisms

**U.S. Population Lacking Optimal MPOD**

- **78 percent** of the U.S. population has less than optimal macular pigment (<.50).

- Increases in MPOD can be achieved through nutritional intake and supplements containing Zeaxanthin and Lutein.

www.eyespromise.com
MPOD is the Eye’s Internal Sunglass

MPOD is important for three specific reasons:

1-Low macular pigment is a key risk factor for AMD, the leading cause of significant vision loss over age 55

2-Macular pigment absorbs harmful blue light, protecting the photo-receptors from damage

3-Macular pigment improves visual performance

www.eyepromise.com
MPOD Improves Visual Performance:

– **Visual acuity** – ability to see clearly, especially in fine detail like performing small near tasks or reading in low light situations

– **Contrast sensitivity** – ability to discern objects from their background (i.e. seeing a white golf ball or baseball clearly against a light blue sky)

– **Light sensitivity** – visual discomfort in sunlight or when exposed to bright light

– **Glare recovery** – recovery from temporary “blindness” caused by high intensity lighting, such as automobiles or stadium lights

AMD-The Bohemoth!!

- Prevalence of AMD
  - 9.2 million Americans
  - 7 out of every 100 adults over 40 years old
  - 1 out of every 8 adults over 60 years old
  - 1 out of every 3 adults over 75 years old

- Prevalence of diabetic retinopathy
  - 4.9 million Americans
  - 3 out of every 100 adults over 40 years old

- Prevalence of glaucoma
  - 2.7 million Americans
  - 2 out of every 100 adults over 40 years old

Klein et al. (2011) Arch Ophthalmology 129:75
2010 United States Census
# Large Unmet Need

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prevalence</th>
<th>Description</th>
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<tbody>
<tr>
<td>Prevalence of AMD</td>
<td>9.2 million Americans</td>
<td>7 out of every 100 adults over 40 years old</td>
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June 16, 1922-February 19, 2012

Nicholas C. Farella
Gap in Diagnosis of AMD

- Up to 78% of AMD patients have irreversible vision loss at first diagnosis, including 37% who are legally blind in at least one eye
- Early AMD is not adequately detected by current methods

Call for Early Diagnosis

David Brown, MD, FACS
Retina Consultants of Houston

“Many AMD patients are arriving at our practice with unnecessary vision loss. Ideally these patients would see their primary eye physician and be diagnosed earlier.”

Call for Prevention!!!!

When is the time to talk about macular health??
When is the time to talk about macular health??

• **NOW**
  - Blue-violet is everywhere and affects all patients
  - Youth have greatest BV exposure!!!
    - Cell phones, tablets, computers
    - Sunlight
    - Television, indoor lighting

DIETARY CAROTENOIDS
(LUTEIN / ZEAXANTHIN)

MINIMIZE

BLUE LIGHT INSULT
Blue light absorption: Macular Pigment

- Blue light hazard
- Low-energy light
- 530 nm
- 420 nm
- Peak optical density of lutein and zeaxanthin


AMD-Risk Factors

Risk factors are understood
AMD Lifestyle Risks

- **Smokers**- educating and recommending cessation strategies
- **Obesity & Poor Diet**- educating and recommending diet/exercise strategies
- **Low Macular Pigment**- educating and recommending measurement

Smoking Cessation

- Cold turkey
- Psychological
  - Hypnosis
  - Emotional Therapy
- Pharmacology
  - Dermal Patch
  - Oral
    - Gum-Nicorette
    - Capsules
The Crisis - Obesity

• Today two-thirds of adults and nearly one-third of children struggle with overweight and obesity.¹

• If obesity rates stay consistent, 51 percent of the population will be obese by 2030.²

• Twenty years ago, no state had an obesity rate above 15 percent. Today there are 41 states with obesity rates over 25 percent, according to the Trust for America’s Health.³

• Since 1980, the rate of obesity in children and adolescents has almost tripled.⁴

• 72% of older men and 67% of older women are now overweight or obese.²²

http://www.obesitycampaign.org/obesity_facts.asp

The Crisis - What We Put In!!

95% of Chronic disease is caused by food choice, toxic food ingredients, nutritional deficiencies and lack of physical exercise
The Crisis—What We Put In!!

The Standard American Diet (SAD) promotes chronic disease and suppressed immune function.

SURGEON GENERAL’S WARNING:
The Standard American Diet causes approximately two-thirds of the deaths due to disease in America.

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The Crisis—Movement (lack there-of)
The Crisis-Movement (lack there-of)

- Less than 15 percent of school-aged children walk or bike to school today, compared to 48 percent that did in 1969, according to the Safe Routes to School Partnership.\(^{17}\)

- Only 4 percent of elementary schools, 8 percent of middle schools and 2 percent of high schools provide daily physical education for all students.\(^{18}\)

- Approximately 50 percent of U.S. adults and 65 percent of adolescents do not currently get the recommended amount of daily physical activity.\(^{19}\)

http://www.obesitycampaign.org/obesity_facts.asp

The Relationship between Lutein and Zeaxanthin Status and Body Fat

- “Higher body fat percentage, even within relatively healthy limits, is associated with lower tissue LZ status. The results indicate that adiposity may affect the nutritional state of the retina. Such links may be one of the reasons that obesity promotes age-related degenerative conditions of the retina.”

How to Best Move

• Cardiovascular Training (heart rate up 20-30min, 3-4x/week)
  – Steady State
  – Interval Training
  – High Intensity Interval Training

• Resistance Training (20-30 minutes 2-3x/week)
  – Important for bone density and joints
  – Increases muscle endurance and strength

Cardiovascular Training (3-4x/week)

• Steady State
  – Constant moderate pace 20-30 minutes

• Interval
  – Equal cycles of high-pace/moderate-pace (2-3min intervals)

• High Intensity Interval
  – 4-6 cycles of 30sec/4min high intensity/steady state moderate
  – Lowers BP, cholesterol, BS more efficiently than SS or interval
Resistance Training (2-3 days/week)

- 40-60% of 1 repetition max is recommended weight (adjusting for injury or age)

- 8-10 different moves (i.e. circuit training of muscle groups)

- Repetition range of 8-12 is recommended for healthy participants younger than 50-60 years and 10-15 repetitions at a lower relative resistance for cardiac patients and healthy participants older than 50-60 years.

- *Important to establish good cardiovascular habits first*

MPOD Testing

- Any patient at risk should be educated and consider measurement

- Proactively identify during pre-testing
  - Utilize questionnaire
  - Pre-tester determination

- Complete testing where best in your patient flow
  - End of entrance tests prior to doctor exam
  - End of full exam per doctor recommendation
Macular Pigment and AMD Risk Factors

Risk factors + Low Dietary Consumption of key carotenoids = Low Macular Pigment Level = Increased Risk of AMD

“MPOD testing is a very valuable, if not critical, clinical tool for not only detecting low levels of macular pigment density, but identifying the population at risk for AMD and giving the clinician the ability to follow the progress of treatment plans.”

Dr. John Herman, O.D., FAAO
Pittsfield, MA

Dietary Supplements Improve Macular Pigment and Visual Function
(Herman, Kleiner Goudy, Davis: Advances in Ophthalmology & Visual Systems, 2017) - 521 patients

Copy of this landmark study available at booth 614!
Mean MPOD increased 82.6% across the group at 24 months with EyePromise Restore supplementation. 88.3% of patients achieved an MPOD increase of at least 30%. The QuantifEye MPOD instrument provided accurate and repeatable test results.

<table>
<thead>
<tr>
<th>Initial MPOD Reading</th>
<th>6m MPOD Mean Increase</th>
<th>12m MPOD Mean Increase</th>
<th>18m MPOD Mean Increase</th>
<th>24m MPOD Mean Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;.20</td>
<td>171%</td>
<td>297%</td>
<td>421%</td>
<td>502%</td>
</tr>
<tr>
<td>.21-.30</td>
<td>91.2%</td>
<td>131.4%</td>
<td>166.6%</td>
<td>191.2%</td>
</tr>
<tr>
<td>.31-.40</td>
<td>29.2%</td>
<td>56.1%</td>
<td>72.6%</td>
<td>84.2%</td>
</tr>
<tr>
<td>.41-.50</td>
<td>9.4%</td>
<td>13.2%</td>
<td>31.1%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Over .50</td>
<td>6.7%</td>
<td>11.9%</td>
<td>21.2%</td>
<td>20.4%</td>
</tr>
</tbody>
</table>

“Two welcomed significant findings in this study were somewhat unanticipated at the outset”

- “First 62-68% of patients showed an improvement in visual function related to glare recovery and contrast sensitivity”
- “The second was the improvement in hard and soft drusen in the posterior pole associated with improving MPOD scores throughout the study. Eyes with notable hard drusen showed the greatest improvement with OCT evaluation.”
- Improvement in structure and function!!!

Results. Improvements were recorded in macular pigment density and visual functions, with improvement in macular appearance and changes in metamorphopsia.
AMD & Ocular Nutrition: Two Choices

1. Begin supplementing “after” AMD presents
   or
2. Begin supplementing BEFORE AMD presents

Which option best serves our patients?

MPOD affects clinical testing!

MPOD Measurement
Heterochromic Flicker Photometry (HFP) is the Gold Standard

Metrics matter and instrumentation has improved significantly!

MPOD Testing Repeatability

Macular Pigment Optical Density: Repeatability, intereye correlation, and effect of ocular dominance
Pinakin Gunvant Davey, et. al., College of Optometry, Western University of Health Sciences (Clinical Ophthalmology, August, 2016)

- 72 test subjects
- MPOD measurements obtained using the QuantifEye show good short-term repeatability.
- There is excellent intereye correlation, indicating that the MPOD values of one eye data can predict the fellow eye value with 89% accuracy.
- Ocular dominance had no bearing on the outcome of this psychophysical test in ocular healthy eyes.
MPOD Testing Repeatability

Desktop Macular Pigment Optical Density Measurement: A New approach based on Heterochromatic Flicker Photometry

Berendschot, et. al. - University Eye Clinic Maastricht, Department of Ophthalmology, Academic Medical Center, Amsterdam, The Netherlands (Journal Eye, 2011)

• 53 subjects
• A significant correlation of \( r = 0.87 \) (\( P=0.001 \)) was found between QuantifEye and the fundus reflectance method.
• We found high agreement between test and retest measurements of QuantifEye and the fundus reflectance method.

MPOD Testing Repeatability

A New Desktop Instrument for Measuring Macular Pigment Optical Density.

Van Der Veen, et al., University Eye Clinic Maastricht, Maastricht, The Netherlands, and Faculty of Life Sciences, University of Manchester, Manchester M60 1QD, UK (Ophthalmology and Physiological Optics, 2009)

• MPOD values from \textbf{5581} (2435 females and 3146 males) individuals were measured in 48 optometric practices
• MPOD was measured with the QuantifEye instrument and the method demonstrated good repeatability with \( r = .97 \) and the data are comparable with retinal reflectometry \( (r = .78) \)
MPOD Testing Repeatability

“Macular pigment measurement in clinics: Controlling the effect of the aging media” M. Makridaki, D. Carden, I. Murray, Faculty of Life Sciences, Moffat Building, University of Manchester, UK (Ophthal. Physiol. Opt. 2009)

• The QuantifEye instrument measures central, peripheral, and total MPOD
• Total MPOD can be calculated with a foveal (center-only) measurement.
• We assessed the performance of the center-only MPOD testing with that obtained from both central and peripheral measurements in 5616 eyes.
• The measured central and peripheral MPOD showed a highly significant correlation with central only measurement, significantly reducing MPOD testing time.

Turn Key Private Pay Revenue “Blue Light” Model

![Diagram showing vitamins, internal nutraceutical protection, external blue light lens protection, and MPOD measurement.](image)
The Lens Market Has Embraced Blue Light Protection

- Hoya Recharge®
- BluTech®
- Essilor Crizal Prevencia®
- & Transitions 7

MPOD Testing

- No CPT codes for wellness/preventive testing/Determine cost of test
- Determine if change of diet appropriate
- Determine if prescription for vitamin supplements appropriate
- Determine appropriate follow up/testing
MPOD Results

Traditional ranges:
• Low MPOD \(<0.25\)
• Mid-range MPOD 0.26-0.45
• High MPOD \(\geq 0.46\)
• Best BV protection with \(\geq 0.50\)

*78% of Americans have less than optimal MPOD (lower than 0.50)

Diet

• Every at risk patient (no matter what pigment level) should be educated on a healthy diet
All about choices!

Junk Food v's Healthy Food
Diet-Restrictions

• Sugar Intake Over Time

1. Sugar Consumption per/American per/year
   1. 1908 Study- 5 lbs/year
   2. 2012 Study -188 lbs/year

Added Sugar

American Heart Association:
25g for women
36g for men

(2000 calorie diet should never exceed 50g)

1-can Coke 39g
1-cup of hot chocolate 24g
1-bottle of Snapple 39g
Breastast

- Brown sugar oatmea 13g
- 1tbsp. Vanilla coffee creamer 5g
- Drizzle of honey 11g
- 29g Total

- OR-
- 1cup of vanilla almond milk 16g
- ¾ cup of HoneyNut Cheerios 9g
- 25g Total

Lunch/Dinner

- Lunch
  - PBJ 18g, 6oz lowfat yogurt 12g
  - Total 30g
  - OR
  - Subway tomato basil soup 8g and 6 inch Sweet Onion Chicken Teriyaki 16g, Total 24g

- Dinner
  - 2tbsp. French dressing 6g, 1.5 cups cheese tortellini, ¾ cup tomato sauce, Total 24g
  - OR
  - 2 tbsp. BBQ sauce 16g, ¼ cup glazed walnut salad 9g, Total 25g
**Snacks/Drinks**

- **Snacks**
  - ½ cup vanilla ice cream 19g, granola bar 7g
  - Total 26
  - 1 blueberry muffin 38g

- **Beverages**
  - 1 can Coca-Cola or Snapple
    - Total 39g
  - OR
  - 1 cup hot chocolate Total 25g

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**The Deceiving Beverage**

**7 Side Effects of Soda**

- Phosphoric Acid - Weakened bones and eats teeth
- Excessive artificial sweeteners makes you crave more
- Caramel Color - Made from the chemical benzene, it is purely cosmetic, it doesn’t add flavor, yet is treated with carcinogens
- Formaldehyde - Carcinogen, it is not added in soda but when you digest it later, it will break down into 2 amino acids and formaldehyde
- High Fructose Corn Syrup is a concentrated form of sugar, fructose derived from corn. It increases body fat, cholesterol and triglycerides and it also makes you hungry
- Preservatives that can be broken down to become in your body
- Keep your soda in the sun and increase: CARCINOGEN

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Beverages

- 1 can Coca-Cola or Snapple
  - Total 39g
  - OR
  - 1 cup hot chocolate Total 25g
The Deceiving Beverage

- Phosphoric Acid weakens bones and rots teeth
- Artificial sweeteners make you crave more
- High fructose corn syrup increases body fat, cholesterol and triglycerides AND makes you hungry
- Food Dyes cause impaired brain function, hyperactive behavior, lack of focus and lack of impulse control.
- Carcinogens: caramel color, potassium benzoate (preservative broken down in the body = benzene + sun), Aspertame from diet soda breaks down into two amino acids and methanol = formic acid + formaldehyde

Sodium

Here are the approximate amounts of sodium in a given amount of table salt:

1/4 teaspoon salt = 575 mg sodium
1/2 teaspoon salt = 1,150 mg sodium
3/4 teaspoon salt = 1,725 mg sodium
1 teaspoon salt = 2,300 mg sodium

**average American eats >3400mg**

“For optimal heart-health, the American Heart Association recommends people aim to eat no more than 1,500 milligrams of sodium per day. That level is associated with a significant reduction in blood pressure, which in turn reduces the risk of heart disease and stroke.” AHA

“More than 75 percent of the sodium Americans eat comes from some processed, prepackaged and restaurant foods – not from the salt shaker.”
Here are sodium-related terms you may see on food packages:

- **Sodium-free** – Less than 5 milligrams of sodium per serving and contains no sodium chloride
- **Very low sodium** – 35 milligrams or less per serving
- **Low sodium** – 140 milligrams or less per serving
- **Reduced (or less) sodium** – At least 25 percent less sodium per serving than the usual sodium level
- **Light (for sodium-reduced products)** – If the food is “low calorie” and “low fat” and sodium is reduced by at least 50 percent per serving
- **Light in sodium** – If sodium is reduced by at least 50 percent per serving

Shop the perimeter!
Shop the perimeter!

- Fresh fruits and vegetables
  - color, color, color
- Dark Green Leafy
- Berries (darker better)
- Omega 3’s (fish but not tilapia), healthy oils in almonds, walnuts, flaxseed
- Hydration-13 cups/men, 9 cups/women minimum
- Natural juices low in added sugars (AHA-women no more that 24g, men 36g) 50mg general rule
- Caffeine—a good antioxidant in moderation (2 servings)
- Teas—not overheated!! Greater than 180-190 degrees denatures, especially oolong!!
Healthy Indulgences

- Dark chocolate-70% cocoa or greater
- Red wine-pinot grape the highest concentration of Resveratrol
Who Should Supplement?

- Anyone with a family Hx of AMD
- Anyone with Low MPOD
- Smokers-Formula without Vitamin A
- Drusen/peripheral or central-along with further testing/monitoring
- Macular Risk Assessment Recommendation-Targeted Tx implementing genetic testing

Follow-up Recommendation
(No retinal findings)

- At risk patients have dark adaptation testing to measure rod intercept time to determine if subclinical AMD exists.
- Any diet/supplement prescribed should mandate a 3-6 month follow up-MPOD retested to see impact
- F/U visit requires treatment plan
- After nutrition/nutraceutical clinical balance found yearly monitoring important
Retinal findings increasing risks

- Peripheral drusen- “form of cholesterol”
- Macular changes-drusen in macula
- Diagnosed AMD

Preventing Unnecessary Vision Loss

Available Interventions Prior to Advanced AMD
- AREDS2 nutritional supplements lower risk of progression by 25%
- Behavior modification also lowers risk of progression

Available Interventions for Choroidal Neovascularization (CNV)-Wet AMD
- Prompt anti-VEGF therapy can save up to 5 lines of visual acuity
- Dramatic loss can occur in as little as 8 weeks

VEGF, vascular endothelial growth factor.
AMD Prevention

• As primary care doctors, identifying those at risk while vision is normal and patient is asymptomatic IS THE MOST EFFICIENT time to treat.

Prevention Key/Enhancement Bonus
Studies

A randomized placebo-controlled study on the effects of lutein and zeaxanthin on visual processing speed in young healthy subjects
Emily R. Boviera, Billy R. Hammond. Archives of Biochemistry and Biophysics
Volume 572, 15 April 2015, Pages 54–57

Conclusions: In this study we found that MPOD was positively correlated with temporal processing speed even when young healthy subjects were targeted. This latter point is significant since young healthy subjects are typically considered to be at peak efficiency and might be expected to be most resistant to change due to ceiling effects.

A role for the macular carotenoids in visual motor response.

RESULTS: MP optical density was significantly (P < 0.05) related to reaction time and to balance ability for the older subjects. Even for the younger group, MP optical density was significantly (P < 0.05) related to fixed and variable position reaction time, as well as coincidence anticipation errors, at high speed.

Key Take-Away Enhancement

“More generally, these data fit in with a widening body of literature that has linked diet to central nervous system function even in young subjects. It can be generally remarked that improving diet is not simply to prevent acquired or deficiency disease, but rather to optimize function throughout life.”
Supplements to Enhance

• Opportunity to grow practice for young & old who are sports active and motivated for better performance!

• Practice growth through medically optimizing vision with supplements instead of just visual correction

• These supplements contain higher doses of Zeaxanthin than supplements for prevention.

“Ocular nutrition is a critical component in the practice of medical model optometry”

Dr. Stuart Richer
President – Ocular Nutrition Society
Dr. Stuart Richer, President – Ocular Nutrition Society

Reasons to measure MPOD:

- To identify AMD susceptible patients
- To establish a baseline for nutritional therapy
- To monitor patient adherence and nutritional therapy success (AMD, Visual Function, Performance)
- To identify those with inadequate protection against blue light and free radical exposure to the photoreceptors and RPE.

Dr. Joe Pizzementi-Expert at Booth #614

Reason to measure MPOD:

“The peer reviewed science is clear, Low MPOD is associated with signs of age-related maculopathy, while high MPOD may be protective against degenerative change in the macula. A quick, easy, accurate, noninvasive assessment with the QuantifEye MPS II makes it possible for me to assess a patient’s risk, as well as monitor effects of nutritional therapy. MPOD is the new IOP. Just as measuring IOP helps us identify patients at risk for glaucoma, MPOD performs a similar function for AMD”.
Key Take-Aways

• **Identify those at risk**
  – It starts with scheduling appointment, key questions
    • Age
    • Spectacle lens needs
  – It ends with history
    • Family Hx
    • Environmental exposure/habits
      – UV, BV,
      – Diet
      – Exercise
      – Need for visual enhancement

Key Take-Aways

• **Exam lane strategies to empower patients**
  – Key Phrases to stress macular importance
    • 95% of daily functional vision
    • How long do you want to see clearly?
    • When would you like to give up driving?
  – Give ‘em what they need
    • In office dispensing
      – Vitamins practice doctors prescribe
      – Spectacle lens coatings for UV, BV, Transitions
    • On-line dispensing
      – Vitamins available per doctor Rx
THANKS!  QUESTIONS?

• PLOWE@PROEYECARECENTER.COM