How to Optimize Your Patient’s Retinal Health Over a Lifetime

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Disclosures – Damon Dierker, OD, FAAO

- Alcon - A
- Allergan – C/S/R
- ArcticDx - R
- Bio-Tissue - S/A/R
- Genentech - A
- Glaukos - A
- MacuHealth - S
- MacuLogix - C/S/A
- NovaBay - C
- Optovue - S
- Quidel - C
- ScienceBased Health - S
- Shire – S/A
- TearLab - S
- TearScience – S/A
- Notal Vision – C/A
- ScienceBased Health - S
- Shire – S/A
- TearScience – S/A

Some slides provided by the Nutrition Research Center of Ireland

Aging Population

Course Objectives
Early AMD

Normal retinal appearance

NUTRITION AND THE EYE: MACULAR PIGMENT (MP)

CHEMICAL STRUCTURE OF MACULAR CAROTENOIDS

DISTRIBUTION OF CAROTENOIDS IN THE MACULA

FUNCTIONS OF MACULAR PIGMENT

Antioxidant

Anti-inflammatory

Filters short wavelength blue light
WHO HAS LOW MACULAR PIGMENT?

- Older patients
- Smokers
- FxHx of AMD

COGNITIVE FUNCTION

Carotenoids strongly related to cognitive function

Patients with AD are deficient in carotenoids

Carotenoids are related to improved function in AMD

Memory improvement following carotenoid supplementation in healthy subjects

SOURCES OF MACULAR CAROTENOIDS

HOW MANY MACULAR CAROTENOIDS DO WE ACTUALLY EAT?
HOW MANY MACULAR CAROTENOIDS DO WE ACTUALLY EAT?

OUR FOOD SOURCES ARE “DEVOLVING”

SOURCES OF MACULAR CAROTENOIDS

RESEARCH SUPPORTING CAROTENOID SUPPLEMENTATION

DIETARY SUPPLEMENTS

Is Meso-Zeaxanthin necessary?
OBJECTIVE: Serum concentrations of carotenoids increases
Macular pigment optical density (MPOD) improves with
Bioavailable
REFORMING CENTRAL DIPS
Subjects supplemented with all three macular carotenoids (in a MZ:L:Z [mg] ratio of 10:10:2) exhibited significant increases in serum concentrations of MZ, L and Z. Pathology analysis realised in subjects with atypical spatial profiles, following supplementation in AMD subjects, and a formulation containing equal amounts of L and MZ (20 mg of each) appears to result in a greater augmentation of MP across the retina.

RESULTS: Inclusion of MZ in a supplement lacking MZ, achieved after supplementation in AMD subjects, and a formulation containing equal amounts of L and MZ (20 mg of each) appears to result in a greater augmentation of MP across the retina.

In subjects with early AMD

This study reported increases in serum concentrations of MZ and L following supplementation with all three macular carotenoids (in a MZ:L:Z [mg] ratio of 10:10:2) and significant increases in MPOD (after two weeks of supplementation).

Carotenoid formulations on:
1. Serum concentrations of carotenoids
2. Macular pigment optical density (MPOD)
3. Visual performance
4. AMD progression
in subjects with early AMD

This final report from MOST found that the inclusion of MZ in a supplement formulation offers benefits in terms of MP augmentation and in terms of enhanced contrast sensitivity in subjects with early AMD.
Is Meso-Zeaxanthin necessary?

**YES**

**TRIAL 1 - CREST NORMAL**

**Objective:**
To study the effects of nutritional supplementation with the macular carotenoids on visual performance in normal subjects with low central MP (<0.56 ODU).

**Design:**
1-year, placebo-controlled, double-blind, intervention study with the active intervention: 10 mg lutein, 10 mg meso-zeaxanthin, 2 mg zeaxanthin versus placebo.

**CREST NORMAL - ELIGIBILITY CRITERIA**

18+ years
BCVA 6/6 or better
≤5 diopters spherical equivalence of refraction
No previous use of supplements containing macular carotenoids
No ocular pathology
Central MP (0.23°) <0.56 ODU
Normal = "no vision-related abnormalities"

**CREST NORMAL - OUTCOME MEASURES**

**Primary Measure:**
Contrast Sensitivity at 6 cpd

**Secondary Measures:**
- Visual Acuity
- Contrast Sensitivity
- Light Scatter
- Glare Disability
- Photostress Recovery
- Serum Carotenoids
- Macular Pigment Density/Volume
- Cognitive Function

**MEASURING MACULAR PIGMENT**

MP was measured using the dual-wavelength fundus autofluorescence (AF) technique using the Spectralis from Heidelberg Engineering and the Macular Densitometer.
CREST NORMAL - RESULTS

- All subjects in active intervention exhibited augmentation of MP
- MP Volume mean ± SD = 2436 (±1451), range 738 to 6464
- In percentage terms, mean ± SD = 73% (±62%), range 16% to 337%

MACULAR PIGMENT RESPONSE

- A statistically significant improvement was identified in the active group for the primary outcome measure:
  - Contrast sensitivity at 6 cycles per degree

SERUM CAROTENOID RESPONSE

- Statistically significant improvements were also identified in the active group for the following secondary outcome variables:
  - Contrast sensitivity at 1.2 cpd
  - Central macular pigment
  - Macular pigment volume
  - Serum L, Z and MZ concentrations
  - Cognitive function variables (memory and reaction)
IMPACT FOR OUR PATIENTS
Glare Disability – Night

IMPACT FOR OUR PATIENTS
Glare Disability - Daytime

IMPACT FOR OUR PATIENTS
Reduced contrast in high light conditions

MACULAR CAROTENOIDS AND AMD

- 10% additional reduction in the rate of progression to advanced AMD when L+Z was used compared to the patient groups taking an AREDS formula, but not taking L+Z
- In patients with the lowest dietary intake of macular carotenoids, the rate of progression to advanced AMD was reduced by 26% in the group taking L+Z

TRIAL 2 – CREST AMD

Purpose: To evaluate the impact of supplemental macular carotenoids (with and without meso-zeaxanthin [MZ]) in combination with co-antioxidants on visual function in patients with non-advanced age-related macular degeneration (AMD).
ELIGIBILITY CRITERIA

• Non-advanced AMD (one to eight on AREDS 11-step severity scale in at least study eye)
• BCVA 6/12 (20/40) or better
• No more than 5D spherical equivalence of refraction in study eye
• No previous use of supplements containing macular carotenoids
• No retinal pathology other than AMD
• No diabetes mellitus (by self-report)

OUTCOME MEASURES

Primary Measure:
Change in contrast sensitivity (CS) at 6 cpd following 24 months of supplementation

Secondary Measures:
- CS at the other spatial frequencies
- AMD morphology
- BCVA
- Glare disability
- Photostress recovery
- Macular pigment
- Retinal straylight
- Reading acuity; reading speed and subjective visual function

SERUM CAROTENOID RESPONSE

• Group 1, 10mg/day meso-zeaxanthin [MZ], 10mg/day lutein, 2mg/day zeaxanthin plus 500mg/day vitamin C, 400 international units [IU]/day of vitamin E, 25mg/day zinc and 2mg/day copper;
• Group 2, 10mg/day lutein, 2mg/day zeaxanthin plus 500mg/day vitamin C, 400 international units /day of vitamin E, 25mg/day zinc and 2mg/day copper;

MACULAR PIGMENT SPACIAL PROFILE

• Group 1, 10mg/day meso-zeaxanthin [MZ], 10mg/day lutein, 2mg/day zeaxanthin plus 500mg/day vitamin C, 400 international units [IU]/day of vitamin E, 25mg/day zinc and 2mg/day copper;
• Group 2, 10mg/day lutein, 2mg/day zeaxanthin plus 500mg/day vitamin C, 400 international units /day of vitamin E, 25mg/day zinc and 2mg/day copper;

CHANGE IN AMD MORPHOLOGY

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CHANGE IN PHOTOPIC CONTRAST SENSITIVITY

CREST AMD - CONCLUSION

In terms of macular pigment augmentation and visual improvement, the AREDS intervention with the addition of meso-zeaxanthin is as efficacious (as effective) as the AREDS2 formula.

WHEN TO RECOMMEND CAROTENOID SUPPLEMENTS

INTERMEDIATE AMD
AREDS2
CREST AMD

EARLY AMD
CREST AMD

NORMAL RETINA
CREST NORMAL

OPTIMIZING RETINAL HEALTH - SUMMARY

• MP supplementation improves visual performance
• MP supplementation slows AMD progression
• Do not limit your discussion to AMD patients
• Prescribe a specific supplement
• Carry supplements in your office
• Follow-up as clinically appropriate

THANK YOU
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