

VISUAL FUNCTION BIOMARKERS NEEDED FOR DRY AMD

Early detection may allow treatment and possible reversal. Part 1 of a 2-part series.

BY ARON SHAPIRO



The development of therapies for dry age-related macular degeneration (AMD) has largely been focused on geographic atrophy, a late disease stage at which progression rates are faster and more predictable than at earlier stages of the disease. The ability to identify changes in visual function in earlier AMD might lead to development of more

effective treatments, perhaps even with the possibility of reversing the condition.

AMD is characterized by retinal damage involving the retinal pigment epithelium (RPE)-photoreceptor complex. Identifying visual function assessment tools to target this region could be valuable in diagnosing deficiencies in visual function before patients experience a change in visual acuity.

A good visual function biomarker should enable early detection, be sensitive to subtle changes in disease progression, provide prognostic information, have a high degree of reproducibility, and allow rapid assessment in the clinic. Visual acuity alone is insufficient to provide this information, as it has been found to be relatively unaffected in early AMD.

A number of tests could potentially provide useful information on visual function in AMD. This installment of Innovations discusses the Lanthony D-15 Desaturated Color Test (available from multiple vendors), the Colour Assessment and Diagnosis (CAD) test (City Occupational) and other color tests, shape discrimination hyperacuity testing with the myVision Track system (mVT, Vital Art and Science), and low-luminance vision testing. In the next issue of *Retina Today*, this column will review standard automated perimetry, flicker perimetry, microperimetry testing, photostress testing, and dark adaptation testing.

COLOR DISCRIMINATION TESTS

The Lanthony D-15 Desaturated Color Test is a color arrangement test in which the patient is asked to arrange 15 colored chips in order of similarity, as in the hues of a

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rainbow (Figure). Because this test uses chips with low color saturation, distinguishing the colors is more difficult than in other color arrangement tests, allowing the detection of more subtle color vision deficiencies.¹ This test has been useful in distinguishing individuals with retinal pigmentary changes and/or drusen with normal visual acuity from age-matched normal counterparts. Although the test is highly sensitive to early AMD, it has a high rate of false positives and is best included in a series of tests to detect early AMD.²

The CAD test is another color discrimination test, taking 12 to 15 minutes, that measures the patient's threshold for detecting red-green and yellow-blue checkered stimuli as it moves over a randomly fluctuating achromatic checkered background. The color intensity is gradually reduced, following a two-down, one-up pattern, until the stimulus is indistinguishable to the subject from the background or until a final step size of 0.002 units is attained. The area of the macula being assessed in this test extends to around

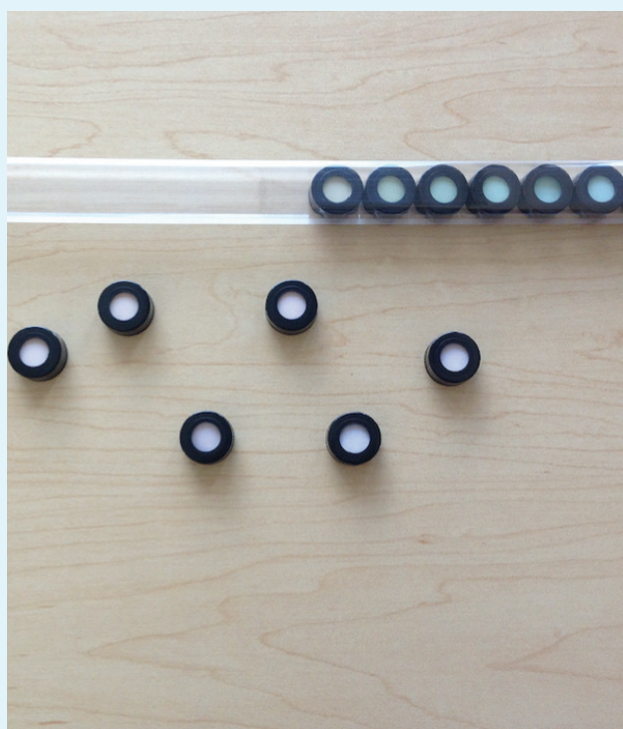


Figure. A desaturated color test requires a patient to arrange a group of disks in order of color similarity.

2° from fixation, targeting the parafoveal region that has been shown to have functional deficiencies early in AMD, making the test sensitive to disease severity.³

The Farnsworth-Munsell 100 Hue test (Munsell Color and other vendors) is a well-established color discrimination test, and the maximum color contrast sensitivity (MCCS) test was more recently developed. The two instruments were compared in 100 healthy individuals and 100 AMD patients. Color contrast sensitivity was found to decrease by half in patients with AMD compared with ophthalmologically healthy patients measured with the Farnsworth-Munsell test and by 1.5-fold when measured with the MCCS test performed in the blue color range.⁴

SHAPE DISCRIMINATION TESTING

Shape discrimination hyperacuity testing is conducted to assess a person's ability to discriminate between normal and contorted circular shapes. The minimum radial modulation amplitude at which an individual can distinguish a distorted circular shape from a normal circle is recorded. Stimuli are digitally generated on a desktop computer or a handheld device, and the degree of distortion is gradually modulated by a two-down, one-up procedure. This test is good for measuring the severity of AMD and can be used for early detection and progression monitoring, as shape discrimination hyperacuity is much less affected by normal aging than

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By Raj K. Maturi, MD

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visual acuity, and it is significantly reduced in AMD patients even when they still have normal visual acuity.⁵

The mVT system is an automated monitoring system approved by the US Food and Drug Administration that operates on handheld electronic devices that enable shape discrimination hyperacuity testing. The results are stored in a secure database, and a retina specialist is alerted of any vision changes that exceed a set limit. The shape discrimination algorithm used in this test has been shown to be more sensitive than tests for visual acuity in early AMD, and this testing modality is useful for monitoring disease progression.⁶

LOW-LUMINANCE VISUAL ACUITY

Low-luminance visual acuity (LLVA) is more sensitive than best corrected visual acuity (BCVA) in AMD patients, even though normal subjects respond well to both tests. AMD patients have significantly reduced visual acuity in low light, and LLVA is useful for detecting foveal deficits in these patients.⁷

MORE TO COME

In the next issue of *Retina Today*, the Innovations column will review perimetry-based tests and dynamic tests, two types of tests poised to provide information that will guide a physician's treatment patterns for patients experiencing disease progression but no vision loss. Stay tuned. ■

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