

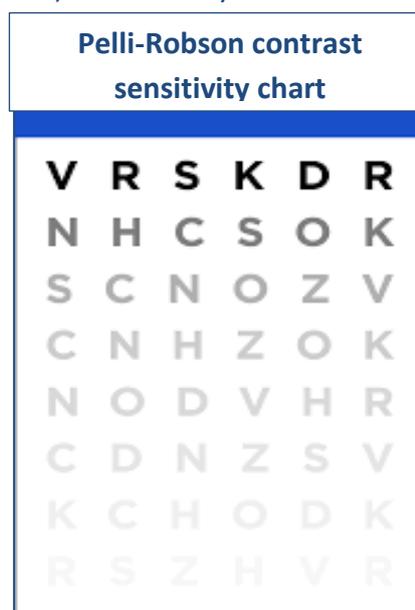
Functional Tests for GA

Multifocal electroretinography (mfERG) is an objective, non-invasive technique that measures activity of retinal photoreceptor cells in response to light stimulation. Electrical responses from the retina are recorded by an electrode attached to the cornea. mfERG can be used to generate a detailed topographic map of retinal function, allowing identification of dysfunctional areas.¹

A few studies have examined the clinical utility of mfERG for the early detection of visual defects in AMD. A small study involving subjects with early AMD found a strong correlation between areas of retinal dysfunction identified using mfERG and morphological structural degradation of the photoreceptor layer detected by SD-OCT.² The use of mfERG to evaluate the impact of reticular pseudodrusen on visual function (a documented risk factor for GA development) is another area of ongoing research.¹

Low-luminance visual acuity (LLVA) is a test where a neutral-density filter is placed over the eye in order to create dim light conditions. Participants are asked to read the normally illuminated Early Treatment Diabetic Retinopathy Study (ETDRS) visual acuity chart.¹ Scores obtained with the BCVA test are subtracted from those of the LLVA test to calculate the 'low-luminance deficit (LLD)'. LLD can be used to identify visual function deficits that would not otherwise be detected using BCVA alone. A cohort study showed that LLD was strongly predictive of subsequent visual acuity loss among people with GA over a 2-year period, regardless of baseline visual acuity.³

Contrast sensitivity can be measured using the Pelli-Robson contrast sensitivity chart⁴ or with a chart showing sine wave gratings. A study evaluating the natural history of GA showed that contrast sensitivity is significantly reduced among eyes with GA, in comparison with eyes with early or intermediate AMD.⁵



¹ Sadda SR, Chakravarthy U, Birch DG, Staurengi G, Henry EC, Brittain C. Clinical Endpoints for the Study of Geographic Atrophy Secondary to Age-Related Macular Degeneration. *Retina*. 2016;36(10): 1806-1822.

² Wu Z, Ayton LN, Guymer RH, Luu CD. Relationship between the second reflective band on optical coherence tomography and multifocal electroretinography in age-related macular degeneration. *Investigative ophthalmology & visual science*. 2013;54(4): 2800-2806.

³ Sunness JS, Rubin GS, Broman A, Applegate CA, Bressler NM, Hawkins BS. Low luminance visual dysfunction as a predictor of subsequent visual acuity loss from geographic atrophy in age-related macular degeneration. *Ophthalmology*. 2008;115(9): 1480-1488, 1488 e1481-1482.

⁴ Pelli DG, Robson JG, Wilkins AJ. The design of a new letter chart for measuring contrast sensitivity. *Clinical Vision Sciences*. 1988;2(3): 187-199.

⁵ Sunness JS, Rubin GS, Applegate CA, Bressler NM, Marsh MJ, Hawkins BS, Haselwood D. Visual function abnormalities and prognosis in eyes with age-related geographic atrophy of the macula and good visual acuity. *Ophthalmology*. 1997;104(10): 1677-1691.

Functional Tests for GA

Microperimetry (also known as fundus-guided perimetry) is a visual function test in which specific areas of the retina are stimulated with spots of light. Areas of the retina where the patient cannot detect light indicate the presence of scotomas (blind-spots) in the visual field. The responses are monitored to create a map of retinal sensitivity that can be superimposed to a fundus photo and compared with structural images obtained by other imaging modalities, such as FAF or SD-OCT.¹

A study conducted in patients with GA demonstrated found the decline of retinal sensitivity over time detected by microperimetry was correlated with growth of GA lesion areas (evaluated by FAF and CFP) during the 2-year follow-up period. This study also demonstrated that the loss of retinal function detected by microperimetry extended to areas well beyond the GA lesions.⁶

Reading Speed

Reading speed, calculated as correctly read words per minute, may be used to evaluate changes in visual function. A study investigating the natural history of GA demonstrated that even among patients with good BCVA, reading speed was significantly lower in those with GA, compared with those with early or intermediate AMD.^{5,7}

⁶ Meleth AD, Mettu P, Agron E, Chew EY, Sadda SR, Ferris FL, Wong WT. Changes in retinal sensitivity in geographic atrophy progression as measured by microperimetry. *Investigative ophthalmology & visual science*. 2011;52(2): 1119-1126.

⁷ Sunness JS, Margalit E, Srikumaran D, Applegate CA, Tian Y, Perry D, *et al*. The long-term natural history of geographic atrophy from age-related macular degeneration: enlargement of atrophy and implications for interventional clinical trials. *Ophthalmology*. 2007;114(2): 271-277.