

VISION ACADEMY VIEWPOINT

The Vision Academy is a partnership between Bayer and ophthalmic specialists established with the aim of addressing key unmet needs in the field of retinal diseases: www.visionacademy.org.

Additional Measures of Visual Function Beyond Acuity

Background

Human vision is a complex phenomenon that can be quantified by discrete measurable functions including visual acuity (VA), contrast sensitivity, and retinal fixation. Despite being the most common measure of vision, VA provides only a partial representation of a patient's overall visual function.^{1,2} Some patients with normal VA often report subjectively impaired sight.^{1,2} Similarly, patients undergoing anti-VEGF therapy often report subjective changes to their vision independent of VA and OCT-derived parameters.

Additional measurements of visual function may provide an opportunity to better characterize a patient's vision and its likely impact on day-to-day functioning and quality of life. Additionally, because VA measurements may not be sensitive enough to detect a slow progression of disease in patients with normal vision, additional measurements of visual function may help to identify patients who might benefit from earlier intervention.³

Endorsed by the Vision Academy
in March 2017.



Full consensus



Variations in opinion

Viewpoint

There are several measurements other than VA that should be considered fundamental measures of visual function. Of these, dark adaptation, contrast sensitivity and retinal fixation should be prioritized for further clinical testing in diseases affecting central vision, such as age-related maculopathy (ARM), age-related macular degeneration (AMD) and diabetic eye disease:

- 1. Low luminance VA and dark adaptation** – the change in vision when moving from bright light to low illumination, is compromised in AMD patients – even among those with normal VA.⁴ Recent studies have shown that low luminance VA is significantly reduced in early AMD.⁵ As such, testing VA in dim light, i.e. low luminance, would be of potential benefit for patients presenting with AMD and might allow for earlier detection and characterization of the disease.
- 2. Contrast sensitivity** – the ability to detect boundaries or transitions between areas of relative darkness and relative lightness – is reported to be a more sensitive measure of early retinal changes in diabetic patients than VA.³ A test measuring contrast sensitivity could therefore be useful for the evaluation of visual function in patients presenting with diabetic eye disease, including DME or diabetic retinopathy.
- 3. Retinal fixation** – maintaining focus on a single location – can also be compromised in patients with nAMD and DME.^{1,6,7} Instability in fixation is associated with reduced reading speed and reading ability, which influences a patient's ability to perform everyday tasks. Other ophthalmological examinations that require stable fixation may also be compromised in these cases. A test measuring fixation characteristics would therefore be useful to identify such patients.

The slow progression of some retinal diseases, such as ARM, can hamper the feasibility of clinical trials, since currently accepted endpoints of acuity are relatively insensitive to the disease's progression through its earliest stages.⁴ New and additional functional endpoints are required to fully understand the early stages of macular disease, potentially enabling earlier detection.

Additional vision tests should also be incorporated into future clinical trials of therapeutic agents in order to fully characterize, standardize and confirm the utility of additional measures of visual function, including their use in retreatment criteria algorithms. Further data are also required to characterize how these

Vision Academy Viewpoints are intended to raise awareness of an unmet need within ophthalmology and provide an expert opinion to engage in further discussion.

They can be downloaded from <https://www.visionacademy.org/recommendations-and-resources>

The Vision Academy is sponsored by Bayer. This document reflects the views of a majority of Vision Academy members; individual views may vary.

The Vision Academy Steering Committee comprises Bora Eldem, Alex Hunyor, Antonia M. Joussem, Adrian Koh, Jean-François Korobelnik, Paolo Lanzetta, Anat Loewenstein, Monica Lövestam-Adrian, Rafael Navarro, Márcio Nehemy, Annabelle A. Okada, Ian Pearce, Francisco J. Rodriguez, Sebastian Wolf and David Wong. Edoardo Midena was also involved in the preparation of this Viewpoint.

Always refer to local treatment guidelines and relevant prescribing information.

The views represented in this document do not necessarily reflect those of Bayer.

March 2017 | G.COM.SM.STH.03.2017.1257

References

1. Tran BK and Herbert CP Jr. Discrepancy between visual acuity and microperimetry in AMD patients: visual acuity appears as an inadequate parameter to test macular function. *Klin Monatsbl Augenheilkd* 2015; 232: 529–532.
2. McClure M *et al.* Macular degeneration: do conventional measurements of impaired visual function equate with visual disability? *Br J Ophthalmol* 2000; 84: 244–250.
3. Nasrallah Z *et al.* Measuring visual function in diabetic retinopathy: Progress in basic and clinical research. *Clin Exp Ophthalmol* 2013; 4: 306. doi: 10.4172/2155-9570.1000306.
4. Jackson GR and Edwards JG. A short-duration dark adaptation protocol for assessment of age-related maculopathy. *J Ocul Biol Dis Infor* 2008; 1: 7–11.
5. Chandramohan A *et al.* Visual function measures in early and intermediate age-related macular degeneration. *Retina* 2016; 36: 1021–1031.
6. Midena E and Vujosevic S. Microperimetry in diabetic retinopathy. *Saudi J Ophthalmol* 2011; 25: 131–135.
7. Pearce E *et al.* Factors affecting reading speed in patients with diabetic macular edema treated with laser photocoagulation. *PLoS One* 2014; 9 (9): e105696.
8. Midena E *et al.* Microperimetry and fundus autofluorescence in patients with early age-related macular degeneration. *Br J Ophthalmol* 2007; 91: 1499–1503.
9. Nowacka B *et al.* The macular function and structure in patients with diabetic macular edema before and after ranibizumab treatment. *Doc Ophthalmol* 2016; 132: 111–122.
10. Pilotto E *et al.* Microperimetry features of geographic atrophy identified with en face optical coherence tomography. *JAMA Ophthalmol* 2016; 134: 873–879.
11. Midena E and Vujosevic S. Metamorphopsia: An overlooked visual symptom. *Ophthalmic Res* 2016; 55: 26–36.
12. Loewenstein A *et al.* Toward earlier detection of choroidal neovascularization secondary to age-related macular degeneration: multicenter evaluation of a preferential hyperacuity perimeter designed as a home device. *Retina* 2010; 30: 1058–1064.
13. Lai Y *et al.* Functional and morphologic benefits in early detection of neovascular age-related macular degeneration using the preferential hyperacuity perimeter. *Retina* 2011; 31: 1620–1626.

measures may impact overall quality of life.

Further considerations



Additional tests to measure and quantify other aspects of visual function have shown promising results in independent studies.^{6,8,9} However, a lack of access to the equipment, the potential impracticality of the measurement or a lack of standardization mean that they are not routinely used in clinical practice. Alternative testing methods are required, including measurements that could be carried out by the patient at home. Home testing could reduce the impact of additional testing on clinic capacity and flow.



In addition to the above prioritized measures, the Vision Academy Steering Committee identified other key considerations for the treating retinal community:

- Microperimetry can be used to measure retinal sensitivity and fixation and the current technology has improved timing and quality of the examination. While this technique has demonstrated promising results across the retinal disease spectrum, further validation and standardization is required.^{1,6,10}
 - Reading speed, as a measure of reading ability, not only depends on retinal fixation but is also affected by the patient's cognitive functions, making it difficult to standardize results. Microperimetry allows the quantification of retinal fixation characteristics, which are relevant for understanding a patient's reading ability and can therefore be used as a substitute.⁶
- Contrast sensitivity is most routinely measured by the Pelli–Robson chart. It is included in the most recent maculopathy clinical trials, but is not standardized. Further research is ongoing and required to fully standardize this technique.
- Metamorphopsia is a common symptom of visual function disturbance in various macular disorders and can often be disabling for the patient. Despite the prevalence of this symptom in the most common eye diseases (such as AMD) there are no clinically validated tests.¹¹ While there are several tests currently undergoing investigation including preferential hyperacuity perimetry (PHP)^{12,13}, metamorphopsia remains a key area for further research and evaluation.



Full consensus



Variations in opinion

Vision Academy Viewpoints are intended to raise awareness of an unmet need within ophthalmology and provide an expert opinion to engage in further discussion.

They can be downloaded from <https://www.visionacademy.org/recommendations-and-resources>

The Vision Academy is sponsored by Bayer. This document reflects the views of a majority of Vision Academy members; individual views may vary.

The Vision Academy Steering Committee comprises Bora Eldem, Alex Hunyor, Antonia M. Joussem, Adrian Koh, Jean-François Korobelnik, Paolo Lanzetta, Anat Loewenstein, Monica Lövestam-Adrian, Rafael Navarro, Márcio Nehemy, Annabelle A. Okada, Ian Pearce, Francisco J. Rodriguez, Sebastian Wolf and David Wong. Edoardo Midena was also involved in the preparation of this Viewpoint.

Always refer to local treatment guidelines and relevant prescribing information.

The views represented in this document do not necessarily reflect those of Bayer.

March 2017 | G.COM.SM.STH.03.2017.1257