Beyond the Amsler Grid: Current Trends in Vision Self-Monitoring Approaches for AMD

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Disclosures

• Dr. Bittner is a co-investigator on an NIH/NEI phase II SBIR grant: Visual & Memory Stimulating (VMS) Grid Self-Monitoring Tests” R44EY018990
Visual disability due to neovascular AMD
Delay in the start of anti-VEGF treatment & worse vision outcomes
Primary factors associated with delay in patient presentation
Home vision monitoring options for patients
Optometrists’ Role

Why should ODs learn about strategies & tools for AMD self-monitoring?

• Your AMD patients may be using these tools and may ask for your assistance or opinion

• Your AMD patients may not be using any self-monitoring tool and you have an opportunity to educate and offer recommendations
  – Busy ophthalmology/retina specialists offices may not have the time or resources to educate the patient

• You can play a vital role in preventing vision loss in AMD patients who convert from dry to wet!
Dry to Wet AMD

• Over 25% prevalence of atrophic (dry) AMD in elderly over age 85
• Wong et al. 2008: 10-15% of dry AMD will convert to wet (neovascular) AMD

• Even an improvement from current 94% to 99% efficacy in anti-VEGF therapy would not eliminate vision loss because many patients present weeks or months late, after significant loss of vision
The effects of choroidal neovascularization can be quite subtle:

- Lines may look wavy due to the retina being deformed (metamorphopsia)
- Small areas of vision may look blurry due to swelling of the retina
- Areas may look washed out if photoreceptor function deteriorates
- Only in late stage will areas be missing altogether due to photoreceptor dropout (scotoma)

Of course advanced dry AMD patients may have scotomas before CNV occurs...
Treatment Delay & Vision

• Can you think back to these headlines?
Delay in the start of anti-VEGF treatment by several months (>21 wks. vs. <7 wks.) is a significant risk factor for worse vision outcomes (Lim et al. AJ O 2012).

Typical delay in presentation to an eye care professional following newly developed neovascular AMD has been estimated as ~5 months based on typical progression of lesions over time (Vander et al. Ophthalmology 1989).
Various initial symptoms: blurry vision, wavy lines, &/or colored or blank spots

Symptoms may be:
- subtle,
- away from fixation,
- appear gradually enough to go unnoticed,
- masked by filling-in phenomena,
- intermittent,
- in non-dominant eye

... further adding to lack of confidence

Patients may incorrectly attribute symptoms to non-urgent causes (cataracts, a need for new glasses, or just dry AMD progression)
• Fletcher et al., 2012:
  - 88% of AMD patients referred for low vision rehab had binocular scotomas near fixation, & >50% were totally unaware of their presence
  - In patients with scotoma, awareness of scotoma is almost exclusively related to scotoma location, but not to size, density, VA, patient age, or duration since onset
Factors assoc. w/ delay

- Factors influencing the decision to schedule an appointment:
  - primary was lack of confidence in symptoms
  - 2nd was lack of urgency associated with symptoms

(Unpublished Study conducted in 2010; focus groups with AMD patients seen in CT retinal specialist’s private practice)
Binky's Search for Enlightenment
How effective is the gold-standard Amsler Grid?
Suboptimal performance of the Amsler grid for detecting scotomatous areas of macular vision loss reported by several investigators for nearly 20 years.

Schuchard, 1993: 77% of standard & 87% of threshold scotomas were not detected by Amsler.

- Amsler-based distortion may arise from perceived lines filling-in across scotomas or from non-scotomatous retinal impairments.
  - No gap in Amsler incorrectly interpreted as no scotoma.
Amsler Grid

- Schuchard 1993:
• Achard et al., 1995: Results of 2 successively administered Amsler tests were variable in size, shape & location, & therefore not comparable
Amsler Grid

- Achard et al., 1995:
• Zaidi, 2004:
  – Amsler detected choroidal neovascularization in 29/100 patients, 11 of whom received laser treatment
  – Amsler was less effective in older patients
  – Patients with 2nd eye involvement were not more likely to be detected by Amsler
Most likely explanation for the failure of the Amsler grid is that changes are easily missed.

The grid is regular, high contrast, & lacking in distinguishing features, making it hard to remember changes in irregularity.

The Amsler grid does nothing to educate or engage the patient.
1. Test vision with one eye at a time, and use normal glasses for reading.
2. Hold chart at normal reading distance.
3. Shore at central dot and look for distortion or blind spots in the grid.
New approaches to AMD self-monitoring should:

- address the reasons for patients’ delay in presenting after new-onset wet AMD
- be low-cost & low-tech, i.e., amenable to distribution across large populations
- include interactive elements to enhance compliance
- foster appropriate and timely action
Conceptual Model

Increased Significance as you travel along the model to the Clinical Endpoint

- **Intervention**
  - Dry AMD vision self-monitoring diary booklet

- **↑ Behavioral Targets**
  - Treatment
  - Monitoring
  - Compliance; Confidence

- **↓ Behavioral Risk Factors**
  - Delay in Presentation following vision loss

- **↓ Clinical Endpoint**
  - Vision loss in dry to wet AMD conversions

Future Outcomes require ↑ follow-up time
What are the latest strategies and technologies for AMD self-monitoring?
世界看起來很扭曲？
小心是你快失明了！

若你的視覺中心有模糊、扭曲、變形，
這是黃斑部病變的徵兆，
快詢問 “視網膜專科醫生”，尋求專業諮詢。

1. 眼睛距離方格表約30公分
2. 一次用一隻眼看方格
3. 若有老花，請佩戴老花眼鏡檢查
若看見：
線條模糊、扭曲變形，甚至中央有黑影，請儘速向 “視網膜專科醫生”尋求專業諮詢，把握黃金就診期。
• Preferential Hyperacuity Perimeter (PHP)
• 1st generation of the PHP technology in 2004 was the Preview PHP, used by patients in the eye doctor’s office
- Uses Vernier hyperacuity – ability to perceive minute differences in relative spatial localization of 2 objects in space
- Analyzes responses to "dot deviation signals" flashing on a screen
- A series of closely spaced dots in a single straight line w/ ≥1 dots out of alignment, displayed on screen for 160 ms.
- Patient uses stylus pen to touch screen to identify the most prominent distortion in the line
- Typical 3-5 minute test measures 500 retinal data points covering central 14° of macula
- Requires stable fixation
• Retina, 2011 - Sensitivity twice as high as Amsler
• Goldstein et al. 2005, Alster et al. 2005, Isaac et al. 2007: Sensitivity and specificity were superior to the Amsler grid
• Stur et al. 2010: Low false positive rate for detecting dry to wet AMD conversions
Notal Vision received FDA clearance for the ForeseeHome AMD Monitor in Dec 2009.

In 2010, began pre-launch marketing clinical trial, still ongoing.

Teleconnected home-based monitoring system.

Requires stable fixation.
sensitivity & specificity have only been established for in-office monitoring

high false negative rates may occur during in-home monitoring
• Potential limitations: expensive, not readily portable, not easy to distribute
• Acceptance by large elderly population is questionable
• Any technological approach like this will require a complex support network
3D-CTAG

- three-dimensional, contrast modulated, Computerized Threshold Amsler grid

- Operating principle: By lowering the contrast of a dark Amsler grid against a white background, scotomas begin to reveal themselves as “white-out” areas as the contrast goes down

- Notice that this test aims to detect scotomas, not metamorphopsias or blurring
Jivrajka et al., 2009: 24% of wet AMD had a scotoma detectable with the computer test but not with the Amsler grid.

Robison et al., 2011: 100% of wet AMD patients & 20% of dry AMD patients had a scotoma detectable with 3D-CTAG but not with the Amsler grid.
• Potential limitations:
  – previous studies had small sample sizes
  – did not demonstrate value of 3D-CTAG for:
    • detecting dry to wet AMD conversions or
    • whether patients are capable of self-administering this test at home

• Unlikely to detect early/subtle changes such as metamorphopsias
• Berkeley Central Visual Field Test (BCVFT)
• Developed by Ian Bailey, OD, MS at Berkeley
• PC-based Static VF test with 50 points in central 10°
• 20 points in superior field & 30 in the inferior
• 10 meridians: 25, 65, 115, 155, 195, 225, 255, 285, 315, 345
• Eccentricities of 1°, 3°, 5°, 7°, 9°
• Goldmann size III target in black on white
• 1.5 minutes to administer
BCVFT

• No repeats & no variations in target size or contrast during test
  – Option to reverse contrast to white on black

• Saved data records points that were missed & gives a score of points seen
  (good central field = 48/50; bad = 12/50)

• Patients self-administer tests
  – Patients can self-monitor their scores & report changes to their doc
  – Or patients can periodically send their accumulated data file of all completed tests to their doc
PCVTS

- PC-based Vision Test Suite (PCVTS)
- Developed by Gislin Dagnelie, PhD, at JHU
- Monitoring tool in supplement trials for RP
  - Interim vision testing in-between study visits
- Used for screening and monitoring in retirement communities
Configurable for selection from over a dozen tests
Central VF test suitable for AMD scotoma screening

- Default: 6° square grid (80 points)
- 2 out of 3 detection criterion
- Intermediate test points inserted around any missed points
<table>
<thead>
<tr>
<th>Name</th>
<th>108299</th>
<th>Age</th>
<th>82.8</th>
<th>Viewing Distance</th>
</tr>
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<tbody>
<tr>
<td>Test Date</td>
<td>August 02 2010</td>
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<td></td>
<td></td>
</tr>
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<table>
<thead>
<tr>
<th>Right Eye</th>
<th>Age Limit</th>
<th>Result</th>
<th>Viewing Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acuity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snellen</td>
<td>20 / 51</td>
<td>logMAR=</td>
<td>0.41</td>
</tr>
<tr>
<td>Contrast</td>
<td>4.0%</td>
<td>logCS=</td>
<td>1.39</td>
</tr>
<tr>
<td>Field</td>
<td>Total dot=111</td>
<td>Not seen=58</td>
<td>Poor</td>
</tr>
</tbody>
</table>

![Graph showing seen and not seen dots](image-url)
introducing...

The myPhone.

FatSpec
Am I fat?

PersonFeel
How does (name) really feel about me?

AlcKnow
How drunk am I at this moment?

LifeQues
What is the meaning of life?

ShrinkCalc
So far, how much have I spent on therapy?

AptAsk
When will I be able to afford a nicer apartment?

AgeMeter
How old do I look?

VegWhy
If I feel so guilty about eating meat, why aren't I a vegetarian?

GnashStop
Where's the nearest place to stop and gnash my teeth?
myVisionTrack™

- iPhone/iPod app with shape discrimination test conceived by Dr. Yi-Zhong Wang at the Retina Foundation of the Southwest
- NIH/NEI funded, now marketed by Vital Art and Science, Inc.

- Three circles – touch the one that is different
• Self-test in <90 sec.
• Displays 3 circles on a screen, one different from others, patients touch odd-shaped circle.
• With each click, the differentiation becomes more subtle.
• Results stored in device
• If significant vision change detected, patients instructed to see their doctor
Currently recruiting AMD subjects for NIH-sponsored study using iPad

Submitted 510K application to FDA for approval of iPhone version of myVisionTrack

Potential limitations:
- Technology barrier
- Validation study
Key features:

- multiple vision tests (enhanced grid test with colored & dashed lines, near VA, home objects reference test with baseline)

- specific instructions with diagrams on how to correctly use the tests & understand the results
Key features (continued):

- **AMD-related education, including lifestyle changes to reduce risk of vision loss**
- **specific help-seeking steps to take if a change in vision is detected**
- **weekly calendar sticker system to boost and track compliance**
- **quotations and games to boost long-term interest and enjoyment of the process**
- **Low tech, large print**
**Words of WISDOM**

from Mark Twain

1. Check the circle next to each line you can read.

<table>
<thead>
<tr>
<th>Left Eye</th>
<th>Right Eye</th>
</tr>
</thead>
<tbody>
<tr>
<td>1️⃣ N C K Z O 0️⃣</td>
<td></td>
</tr>
<tr>
<td>2️⃣ R H S D K 0️⃣</td>
<td></td>
</tr>
<tr>
<td>3️⃣ D O V H R 0️⃣</td>
<td></td>
</tr>
<tr>
<td>4️⃣ C Z R H S 0️⃣</td>
<td></td>
</tr>
<tr>
<td>5️⃣ D N H K C 0️⃣</td>
<td></td>
</tr>
<tr>
<td>6️⃣ .... 0️⃣</td>
<td></td>
</tr>
</tbody>
</table>

   Compare to your acuity baseline test.
   - Left eye □ Better □ Same □ Worse
   - Right eye □ Better □ Same □ Worse

2. Look at objects in your home with straight lines
   Compare to your home object baseline test.
   - Left eye □ Better □ Same □ Worse
   - Right eye □ Better □ Same □ Worse

3. Focus on the center dot.
   Look for wavy, blurry or spotty lines

   Compare to your grid baseline test.
   - Left eye □ Better □ Same □ Worse
   - Right eye □ Better □ Same □ Worse

To see additional free vision tests, visit www.keepsight.com

To get more free vision tests like this one, mail in the card at the back of this magazine.
RCT with 198 enrolled subjects found significant difference in subjects who reported monitoring their vision at least weekly at 6 & 12 months, respectively: 85% & 80% of the VMS booklet subjects vs. 50% of controls at both follow-ups (p<0.001)

At 6 and 12 months, respectively, 29% & 25% of controls (n=22 & 17) had not checked their vision in the past 6 mos., while only 1.5% & 5% (n=1 & 3) of the VMS booklet subjects reported they did not check their vision.
Vision Self-Monitoring Frequency by Group & Time

- **Never**
- **Rarely**
- **Monthly**
- **Weekly**

# Subjects

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Never</strong></td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td><strong>Rarely</strong></td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td><strong>Monthly</strong></td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Weekly</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
VMS Booklet

• No statistically significant change in weekly vs. less frequent self-monitoring between groups (p=0.68), with 81% of all subjects reporting no change in their frequency between 6 and 12 mos.

• VMS booklet promotes persistence in weekly monitoring over the course of a year
• Significant difference in self-monitoring confidence:
at 6 and 12 mos., respectively, only 15% & 13% of the VMS booklet subjects vs. 53% & 44% of controls did not feel confident they were taking care of their sight by monitoring their vision (p<0.001)
• Potential limitation: cannot objectively measure frequency of vision monitoring; must rely on self-report

• Longer-term follow-up will need to determine efficacy for promoting appropriate self-referrals when vision loss is detected
  – Too few conversions thus far
## Checklist: Which Tools meet the Criteria?

<table>
<thead>
<tr>
<th>Criterion</th>
<th>PHP</th>
<th>3D-CTAG</th>
<th>myVisionTrack</th>
<th>VMS</th>
<th>BCVFT/PCVTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Interactive</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Auto-alert</td>
<td>Yes</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Low-cost</td>
<td>No</td>
<td>Maybe</td>
<td>Maybe</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td>Low-Tech</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Foster action</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Proven detection</td>
<td>Not yet</td>
<td>Not yet</td>
<td>Not yet</td>
<td>Not yet</td>
<td>Not yet</td>
</tr>
</tbody>
</table>
Get your patients involved in these trials!

PHP (FORESEE HOME): NCT01314430 (AREDS2)

VMS: NCT01337414

Contact the investigators for these tools:

3D-CTAG: jsebag@VMRinstitute.com

myVisionTrack: yiwang@retinafoundation.org

BCVFT: ibailey@berkeley.edu

PCVTS: gislin@jhu.edu
Conclusions

• New, emerging field of tools for vision self-monitoring
  – Need additional long-term research to see which is most effective
  – Likely that any or all will be superior to Amsler
  – May need to match to patient’s individual needs

  – OD's are the first line of defense in saving vision