Suppression In Age-related Macular Degeneration: When Does It Happen?

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- AMD is the leading cause of visual impairment among adults in North America
- It is characterized by progressive degeneration of central retina
- The disease is asymmetric in both eyes

Image Courtesy: Shaun Dmello, Dr.Simi Paknikar, medindia.net
Quality of Vision in AMD

Change in fixation in AMD

• Due to damage in central retina an eccentric point of fixation on the healthier retina termed as Preferred Retinal Locus is used to see objects. OCT/SLOs (Optical Coherence Tomograph/Scanning Laser Ophthalmoscope) are used to locate monocular PRLs.

Normal Retinal correspondence

• In normal eyes binocular single vision occurs because there is perfect retinal correspondence.
• Each retinal point in one eye has a corresponding point in the other eye sharing a common visual direction & enables us to perceive a single image.

• The 2 foveal centres are such corresponding points by which a target located straight ahead is perceived as one object.
What happens in Macular pathology?

- The retinal tissue in the macula is anatomically displaced resulting in visual distortion & diplopia
- This results in abnormal retinal correspondence disrupting fusional mechanism in the brain

Monocular & Binocular PRLs

- Monocular PRL may not always be in corresponding points
- Worse eye shifts to align itself with the better-seeing eye

Monocular PRLs (MP-1 and eye-tracker)

Binocular PRLs (eye-tracker)

Fovea

OCT image of an eye with AMD

Image courtesy: medicine.uiowa.edu
Suppression

• Visual confusion is produced by the superimposition of dissimilar images.
• Different clarity in each eye results in diplopia and confusion.
• Due to confusion, the brain chooses to suppress the image of poor quality—monocular vision.

Monocular vision results in acquired loss of stereopsis/depth perception:
• Eye hand coordination,
• Depth judgments,
• Orientation & mobility,
• Driving,
• Climbing stairs,
• Crossing the street.

Goal

TO STUDY
• Binocular interactions in eyes with AMD
• Is it possible to measure suppression in AMD using this program?

Hypothesis

• Greater the difference in BCVA lesser the amount of suppression
• Greater the eccentricity of PRL lesser the amount of suppression
• Greater the BCEA lesser the amount of suppression
Participants

**INCLUDED**
- Confirmed diagnosis of AMD
- Asymmetry in visual acuities

**EXCLUDED**
- Diagnosed cognitive impairment

Recruitment

- University of Montreal Optometry Clinic at the School of Optometry, Montreal
- MAB-Mackay Rehabilitation Centre, Montreal
- Time taken: 90 minutes for each participant

Methods

- ETDRS charts for distance acuity
- The Titmus Stereotest
- Mars Contrast sensitivity Test
- ‘my3D’ viewer powered by an Apple iPod
## Methods

**OCT/ SLO**

- Fixation stability quantified - BCEA
- PRL Eccentricity

**Step 1:** Motion Coherence Threshold

**Step 2:** Dichoptic threshold

### Summary of visual functions in the better eye and worse eye

- 9 Participants, 7 females and 2 males
- 75 to 90 years, mean 80 ± 5.5

<table>
<thead>
<tr>
<th></th>
<th>n=9</th>
<th>Better eye</th>
<th>Worse eye</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Duration of AMD</td>
<td>7.06 ± 5.9</td>
<td>1 to 17 years</td>
<td>7.34 ± 5.6</td>
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<tr>
<td>BCVA (logMAR)</td>
<td>0.50 ± 0.4 (20/64)</td>
<td>0.04 to 1.10 (20/22 to 20/252)</td>
<td>0.80 ± 0.5 (20/126)</td>
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<tr>
<td>Mars (logMAR)</td>
<td>1.18 ± 0.3</td>
<td>0.52 to 1.64</td>
<td>0.98 ± 0.4</td>
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<tr>
<td>Near acuity (logMAR)</td>
<td>0.54 ± 0.5 (20/69)</td>
<td>-0.1 to 1.3 (20/16 to 20/399)</td>
<td>0.74 ± 0.5 (20/110)</td>
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## Summary of findings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
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<tr>
<td>Difference in distance BCVA between the two eyes (logMAR)</td>
<td>$0.3 \pm 2.0$</td>
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<tr>
<td>Difference in contrast sensitivity between the two eyes (logMAR)</td>
<td>$0.2 \pm 0.1$</td>
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<tr>
<td>Difference in near corrected VA between the two eyes (logMAR)</td>
<td>$0.23 \pm 0.3$</td>
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<td>Dichoptic threshold (%)</td>
<td>$10.85 \pm 15$</td>
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<td>Stereopsis (Seconds)</td>
<td>$779 \pm 1154$</td>
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<td>Eccentricity of PRL of better eye (Degrees)</td>
<td>$2.23 \pm 3.34$</td>
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<tr>
<td>BCEA of better eye (Degrees square)</td>
<td>$1.72 \pm 1.74$</td>
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</tbody>
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Limitations

• OCT/SLO - Inability to find PRL
• Learning curve
• Tiredness
• Number of participants

Conclusion

• Requires further study with larger sample sizes.

• Difference in BCVA between the two eyes, eccentricity of PRL of better seeing eye, BCEA of better eye was compared with the Dichoptic threshold
• No significant correlation was seen in any of these comparisons
• Difference in near BCVA between the two eyes showed a positive correlation when compared with the amount of stereopsis measured using Titmus stereo test

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References


