ADMINISTERING AND INTERPRETING VISUAL FIELDS IN GLAUCOMA

Danica J. Marrelli, OD, FAAO
University of Houston College of Optometry

Visual Fields (aka Perimetry)

• The measurement of the boundaries of the field of vision and of retinal sensitivity, both centrally and peripherally. The standard of care to screen, monitor, and manage eye disease. -- Zeiss Academy
Perimetry Basics

• Hill of Vision

- The field of vision is commonly represented as a hill or island. The height and shape of the normal hill varies by individual but is fairly consistent in normal same age individuals.

Perimetry Basics

• Visual Field Orientation

- The nasal retina sees objects in the temporal field and the superior retina sees objects in the inferior field.

Perimetry Basics

• The Visual Pathway

- One half of the visual field from each eye is projected to one side of the brain. Visual impulses from the right visual field of each eye will be transmitted to the left occipital lobe.
Perimetry Basics

• Threshold
  • Intensity of light that can be perceived 50% of the time and not perceived 50% of the time.

Visual Field Defects

• Defects in the visual field
  • Depression: an overall reduction in the height of the hill of vision. The shape stays intact.
  • Constriction: A reduction in the boundary of the field of vision.
  • Blind Spot: in the temporal visual field of each eye. Located where the optic nerve is.

Normal Right Eye

Location of normal physiologic blind spot
Normal Right Eye

Location of normal physiologic blind spot

Visual Field Defects

• Scotomas
  • Absolute defect. No retinal sensitivity
    – Pathology
    – Blockage
    – Blind spot
  • Relative defect. Reduced retinal sensitivity
    – Location
    – Shape
    – Depth
    – Size

Visual Field Defects

• Scotomas
  • Nasal Step (Glaucoma)
  • Arcuate or Bjerrum (Glaucoma)
  • Central
  • Circumpapillary
    • Involving the blind spot
  • Paracentral
Test Strategies

- How far out do you want to test?
  - CENTRAL
    - 30-2
    - 24-2
  - FULL FIELD
- Threshold or screening?

Test Strategies

- Threshold
  - Standard algorithm ("Full Threshold")
  - Sita Standard
    - Twice as fast as standard algorithm
    - Excellent reproducibility
  - Sita Fast
    - Faster than Sita Standard
    - Subject to more test-test variability
    - Excellent for experienced test takers

SITA Test Time Comparison
Test Time Comparison

- 24-2 SS: 3-7 minutes
- 30-2 SS: 5.5 – 10 minutes
- 24-2 SF: 2-5 minutes

Administering the Test

- Correct Test
- Correct Patient
- Correct Trial Lens
- Correct Instructions

Select Test
Trial Lens

- Use Full Add in:
  - Patients over 60 years old
  - After cataract surgery
  - After cycloplegia (dilation)
  - Patients who are more than 3.00D myopic

Trial Lens – Be Careful!

Table 11-1. Add (to the best distance correction) for perimeter with a 30- to 50-
 cm bowl radius with intact accommodation*

<table>
<thead>
<tr>
<th>Age (yr) 30 cm</th>
<th>Add (cylinders)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 49</td>
<td>+1.00</td>
</tr>
<tr>
<td>50 to 60</td>
<td>+1.50</td>
</tr>
<tr>
<td>61 to 70</td>
<td>+2.00</td>
</tr>
<tr>
<td>71 to 80</td>
<td>+2.50</td>
</tr>
<tr>
<td>81 to 90</td>
<td>+3.00</td>
</tr>
<tr>
<td>91 to 100</td>
<td>+3.50</td>
</tr>
</tbody>
</table>

Patch and Position Patient

- Patch opposite eye
- Adjust table to a comfortable height for patient
- Align patient’s eye on video monitor so that the pupil is centered in the target
- Move the trial lens holder as close to the patient’s eye as possible without touching the lashes
Testing

- Place cylinder lens in slot farthest away from patient and align axis
- Place sphere lens in the slot closest to the patient (in front of the cylinder lens)
- Move lens handle to patient’s temporal side so it doesn’t bump patient’s nose
- Move the trial lens holder as close to the patient’s eye as possible without touching the lashes

Note: Use only the narrow rimmed type of trial lenses to avoid lens artifact. Wide-rimmed variety will interfere with patient’s peripheral vision and adversely affect test results.

Gaze Tracking Initialization

- Provide instructions to look at fixation target and try not to blink. Let them know the instrument is going to take a picture of their eye.
- Press Start
- Gaze initialization will begin
Begin Test

• Now provide instructions about the test itself.
  • Look only at the fixation target.
  • Lights will flash one at a time in the bowl, press the button when you see a light.
  • Some lights are bright and some are dim.
  • You are not supposed to see all of the lights.
• Press Continue

During Testing

• Provide encouragement throughout the test.
  • “You’re doing a good job.”
• Give them status updates.
  • “You’re about 1/2 way through.”
• Tell patient it is OK to blink.
  • “The best time to blink is when you press the button.”
• Pause the test if patient needs a break.

End of Test

• Click “Save and Transmit” and “print”
• Change patch to other eye, change trial lens (if necessary) and begin again
**INTERPRETATION**

**CATCH TRIALS**
- Fixation Losses (20%)
- False Positives (20%)
- False Negatives (33%)

**GAZE TRACKER**

**RELIABILITY**

**CATCH TRIALS**
- Fixation Losses (20%)
- False Positives (20%)
- False Negatives (33%)

**GAZE TRACKER**

**METHODS OF DATA PRESENTATION**

**GRAYSCALE**
- Gives a gray tone to a given range of threshold values (darker = lower threshold value)
- Quickly identifies overall depressions
METHODS OF DATA PRESENTATION

• NUMERIC GRID
  – RAW DATA (THRESHOLD LEVELS)

METHODS OF DATA PRESENTATION

• TOTAL DEVIATION PLOT
  – DIFFERENCE BETWEEN PATIENT’S RESPONSES AND AGE-MATCHED NORMAL POPULATION
• TOTAL DEVIATION PROBABILITY PLOT
  – SIGNIFICANCE OF THE TOTAL DEVIATION PLOT

METHODS OF DATA PRESENTATION

• PATTERN DEVIATION
  – ADJUSTS THE TOTAL DEVIATION FOR THE OVERALL HEIGHT OF THE HILL OF VISION
  – CAN BE ADJUSTED UP OR DOWN
• PROBABILITY PLOT
METHODS OF DATA PRESENTATION

• GLOBAL INDICES
  – SINGLE NUMBER REPRESENTATIONS OF THE VISUAL FIELD
  – OVERALL GUIDELINES TO HELP ASSESS FIELD
  – PROBABILITY VALUES GIVEN WHEN NUMBERS REACH SIGNIFICANT VALUES

GLOBAL INDICES

• MEAN DEVIATION (MD)
  – HEIGHT OF THE HILL OF VISION COMPARED TO AGE-MATCHED NORMALS
• PATTERN STANDARD DEVIATION (PSD)
  – DEGREE TO WHICH THE SHAPE OF THE VISUAL FIELD DIFFERS FROM REFERENCE FIELD
  – DOES NOT CHANGE WITH MEDIA
Glaucoma Hemifield Test

• Mirror Image Analysis Compares Superior to Inferior Field
  – Within Normal Limits
  – Borderline
  – Outside Normal Limits
  – Abnormally High Sensitivity
  – General Reduction In Sensitivity
INTERPRETATION OF THE AUTOMATED VISUAL FIELD

- RELIABILITY
  - MUST KNOW WHETHER OR NOT THE DATA YOU ARE ANALYZING IS RELIABLE
  - FIXATION LOSSES (20%)
  - FALSE POSITIVES (20%)
  - FALSE NEGATIVES (33%)
RECOGNIZING VISUAL FIELD DEFECTS

- GRAYSCALE: NOT APPROPRIATE FOR MAKING DIAGNOSIS
- MUST CONCENTRATE PRIMARILY ON THE DEVIATION PLOTS AND GLOBAL INDICES, SOME ATTENTION TO RAW (THRESHOLD) DATA

USING THE TOTAL OR PATTERN DEVIATION PLOTS:
- FIND MOST DEPRESSED POINTS; EXAMINE POINTS SURROUNDING THOSE
- LOOK FOR PATTERNS CONSISTENT WITH GLAUCOMA
  - NASAL STEP
  - ARCUATE BUNDLE
  - PARACENTRAL
RECOGNIZING VISUAL FIELD DEFECTS

- Look at Global Indices & GHT
  - For diagnosis, look to see if they reach statistical significance
  - For following over time, look for change

| VFI | 94%
| MD  | -1.61 dB
| PSD | 5.13 dB P < 0.5%

RECOGNIZING VISUAL FIELD DEFECTS

- SCOTOMAS AND DEPRESSIONS IN AREAS KNOWN FOR GLAUCOMA (PARACENTRAL, NASAL STEP, ARCUATE BUNDLE)

RECOGNIZING VISUAL FIELD DEFECTS

ALWAYS:
1. LOOK AT BOTH FIELDS TOGETHER
2. LOOK AT FIELD WITH RELATION TO OTHER CLINICAL FINDINGS - DOES THIS MAKE SENSE, IS IT CONSISTENT WITH THE DIAGNOSIS OF GLAUCOMA?
3. DON’T OVERLOOK OTHER CAUSES OF VISUAL FIELD DEFECTS
Look At Both Fields Together

Look At Both Fields Together

LOOK AT FIELD WITH RELATION TO OTHER CLINICAL FINDINGS
LOOK AT FIELD WITH RELATION TO OTHER CLINICAL FINDINGS

Predict the Visual Field…
Predict the Visual Field...

KEY POINTS TO INTERPRETATION

• MAKE SURE YOU ARE LOOKING AT TRUSTWORTHY DATA
• WILL PROBABLY TAKE 3-4 TESTS TO ACHIEVE APPROPRIATE BASELINE
• MAKE SURE IT MAKES SENSE WITH OTHER CLINICAL FINDINGS
STRATEGY DECISIONS

• 30-2 vs. 24-2
• Size III vs. Size V
• 24-2 vs. 10-2
• SITA-Standard vs. SITA-Fast (vs. Threshold or FastPac)
Minimum Criteria for Diagnosis of Glaucoma VF Defect (HODAPP, ET AL, 1993)

1. GHT OUTSIDE NORMAL LIMITS ON AT LEAST TWO OCCASIONS
   -OR-

Minimum Criteria for Diagnosis of Glaucoma VF Defect (HODAPP, ET AL, 1993)

2. CLUSTER OF 3 OR MORE NON-EDGE POINTS (in a typical location for glaucoma), ALL OF WHICH ARE IDENTIFIED AS SIGNIFICANT, WITH AT LEAST ONE AT THE p<1% ON TWO CONSECUTIVE TESTS
   - OR-

Minimum Criteria for Diagnosis of Glaucoma VF Defect (HODAPP, ET AL, 1993)

3. PSD FLAGGED AT p<5% OR WORSE ON TWO CONSECUTIVE FIELDS
CLASSIFICATION OF FIELD LOSS
(Modified from Hodapp, et al)

- MILD (all 3 criteria must be met):
- FOR 24-2 SITA STANDARD
  - MD DEPRESSED BY <-5dB AND
  - ON PD PLOT, <25% (14) POINTS ARE
    DEPRESSED BELOW THE 5%
    SIGNIFICANCE LEVEL and fewer than
    half of those points are depressed
    below the 1% LEVEL AND
  - NONE OF CENTRAL FOUR POINTS
    HAS SENSITIVITY OF <20dB

14 points flagged
5 points at 1% or worse
CLASSIFICATION OF VISUAL FIELD LOSS

- MODERATE (24-2 Sita)
  - MD -5dB TO -10dB OR
  - ON PD PLOT, <50% (14-28) POINTS ARE DEPRESSED BELOW 5% LEVEL, OR 8-16 POINTS ARE BELOW THE 1% LEVEL OR
  - CENTRAL POINTS BETWEEN 10-20dB IN ONE HEMIFIELD (NO POINTS IN CENTRAL 5 DEGREES WITH <10dB)

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**Moderate Loss**

- 14 total
- 9 below 1%

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**Moderate Loss**

- 18 total
- 10 at 1% level
CLASSIFICATION OF VISUAL FIELD LOSS

• SEVERE (24-2 Sita)
  – MD DEPRESSED BY MORE THAN -10dB OR
  – ON PD PLOT, GREATER THAN 50% (28) POINTS ARE DEPRESSED BELOW 5% OR MORE THAN 16 POINTS ARE BELOW THE 1% LEVEL OR
  – BOTH HEMIFIELDS IN THE CENTRAL 5 DEGREES HAVE <20dB OR
  – ANY POINT IN THE CENTRAL 5 DEGREES HAS A VALUE <10dB
Severe Loss

22 total
18 at 1%

INTERPRETATION TEMPLATE

• LOOK AT RELIABILITY
• LOOK AT CENTRAL LEVELS
• FOR VARIATIONS OF >4dB ACROSS HORIZONTAL MIDLINE NASALLY
• TOTAL / PATTERN DEVIATION PLOT - MOST DEPRESSED POINT AND SURROUNDING POINTS
• GLOBAL INDICES (MD, PSD, GHT, VFI)
FOR THE RECORD

- ICD-10
- Specific test performed (24-2 SS)
- Statement with respect to reliability
- Statement with respect to location, size, density, and pattern of the defect
- Statement that correlates other examination findings with this visual field
- Statement about stability/progression (or words “BASELINE”)
- (Statement about how these results influence your management) ???

**Interpretation:**
- H40.11X3 (POAG)
- 24-2 SS
- Reliable
- Severe loss: Large, dense inferior arcuate with small dense superior paracentral defect, c/w superior notch and inferior thinning of ONH
- Baseline test
- Aggressive therapy indicated

**Interpretation:**
- H40.11X1
- 24-2 SS
- Reliable
- Mild loss: Small, shallow inferior nasal step/partial arcuate c/w superior-inferior thinning of ONH
- Baseline test
- Initiate therapy
Interpretation
• H40.11X3
• 24-2 SS with GPA
• Severe loss: Large, dense superior arcuate defect c/w inferior notch of ONH
• GPA shows no progression on trend/event analysis
• Continue current therapy

Thank you for your attention!

Questions?

Email me: Dmarrelli@uh.edu