

# 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

---

---

---

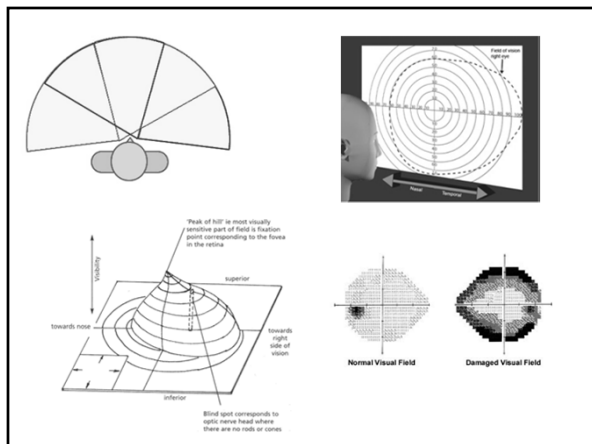
---

---

---

---

---



---

---

---

---

---

---

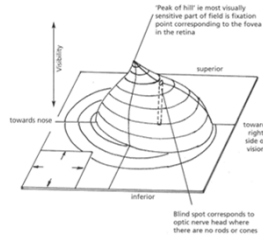
---

---

## 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.

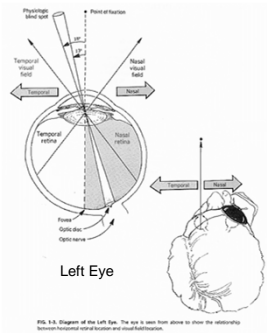


FIG. 3-5. Diagram of the Left Eye. The eye is seen from above to show the relationship between horizontal visual field and nasal field.

---

---

---

---

---

---

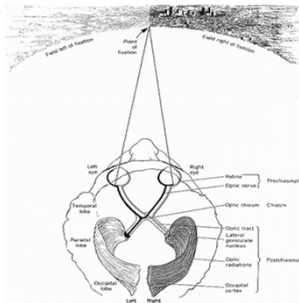
---

---

## 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.

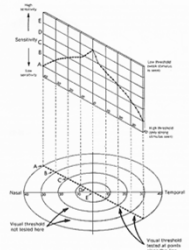


FIG. 11.6. Vision Thresholds: Thresholds Performed Along an Oblique Meridian. In this case, the threshold is generated from the center and is shown through the center of fixation. The curve indicates the intensity of light that can be perceived 50% of the time. The curve is higher in the center and lower towards the periphery, indicating that sensitivity is lower in the periphery.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

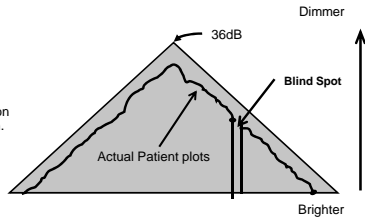
---

---

## 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.




---

---

---

---

---

---

---

---

---

---

---

---

---

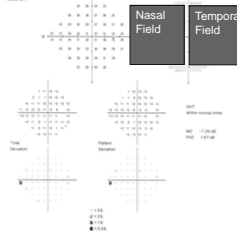
---

---

---

## Normal Right Eye

02/03/2023 10:52:00 AM  
Patient Name: John Doe  
Patient Age: 65  
Patient Sex: M  
Patient Race: W  
Patient ID: 12345  
Test Location: 12345  
Patient ID: 12345  
Test Location: 12345



Location of normal physiologic blind spot

---

---

---

---

---

---

---

---

---

---

---

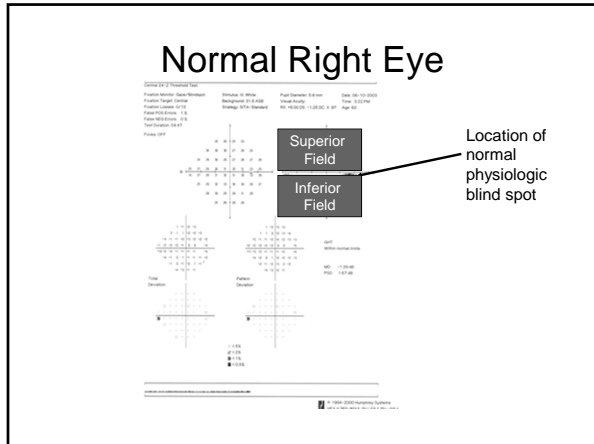
---

---

---

---

---




---

---

---

---

---

---

---

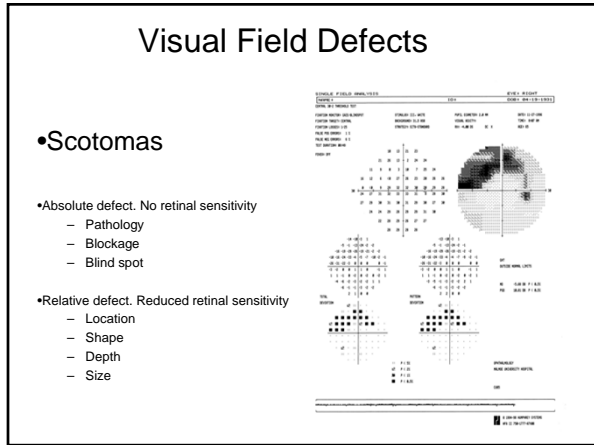
---

---

---

---

---




---

---

---

---

---

---

---

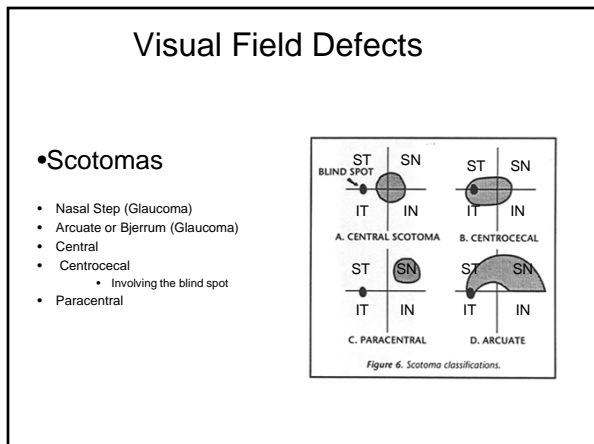
---

---

---

---

---




---

---

---

---

---

---

---

---

---

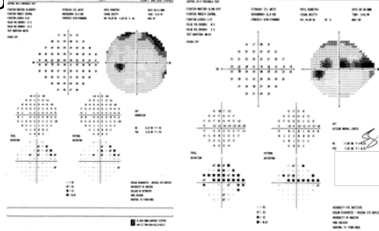
---

---

---

## 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

---

---

---

---

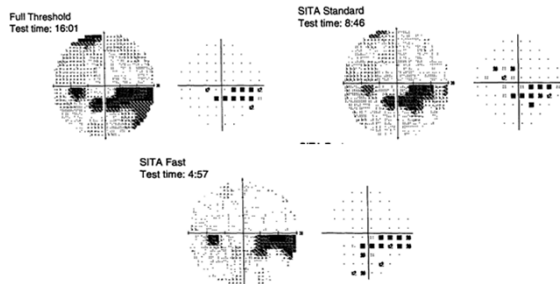
---

---

---

---

## SITA Test Time Comparison



---

---

---

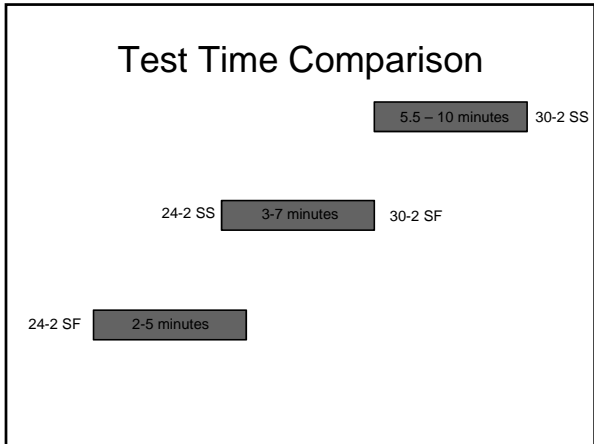
---

---

---

---

---




---

---

---

---

---

---

---

---

- ### Administering the Test
- Correct Test
  - Correct Patient
  - Correct Trial Lens
  - Correct Instructions

---

---

---

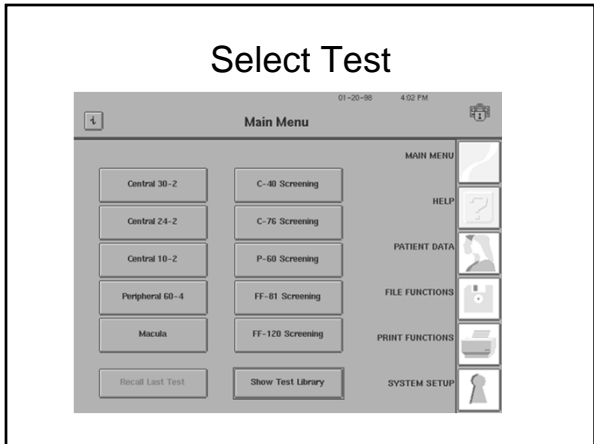
---

---

---

---

---




---

---

---

---

---

---

---

---

## Trial Lens

---

---

---

---

---

---

---

---

## Trial Lens – Be Careful!

Table 11-1. Add (to the best distance correction) for perimetry with a 30- to 33-cm bowl radius with intact accommodation\*

Age (yrs) 30 cm	Add (diopters)
30 to 40	+1.00
40 to 45	+1.50
45 to 50	+2.00
50 to 55	+2.50
55 to 60	+3.00
60 to 65	+3.25

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

---

---

---

---

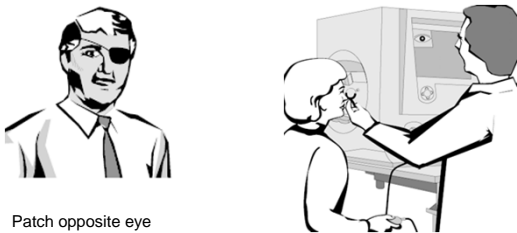
---

---

---

---

## 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

---

---

---

---

---

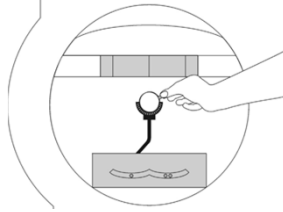
---

---

---

## 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 effect test results.

---

---

---

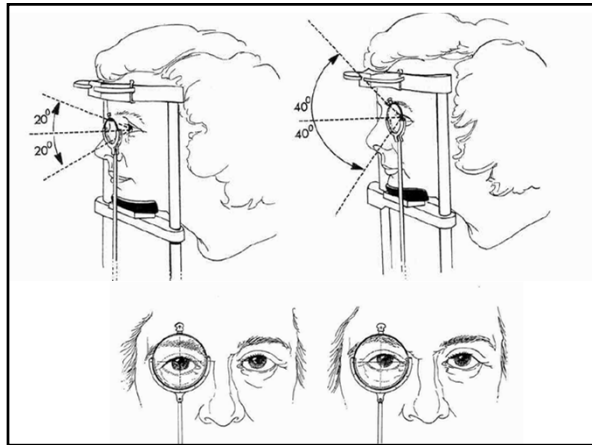
---

---

---

---

---




---

---

---

---

---

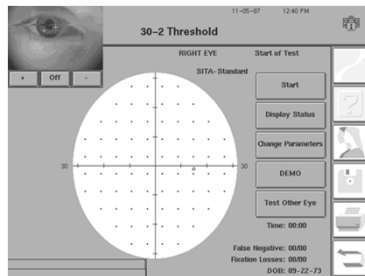
---

---

---

## 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




---

---

---

---

---

---

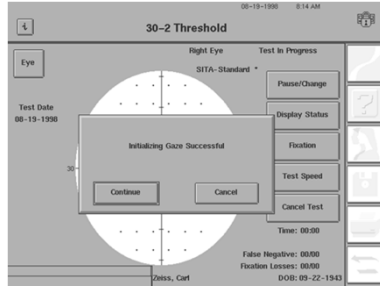
---

---



## 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



---

---

---

---

---

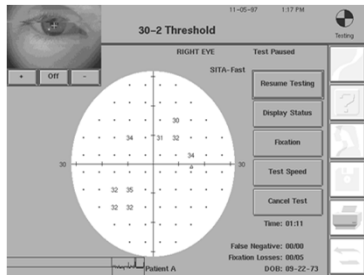
---

---

---

## 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

---

---

---

---

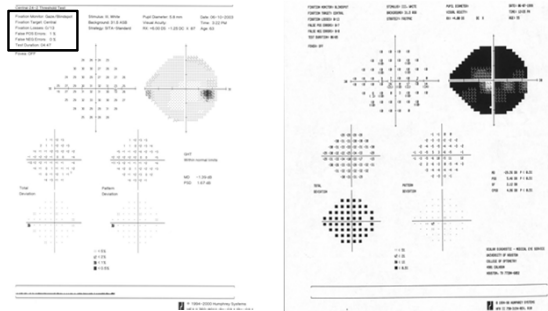
---

---

---

---

## INTERPRETATION




---

---

---

---

---

---

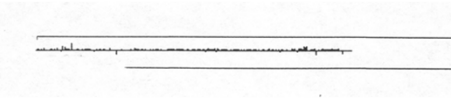
---

---

## RELIABILITY

- **CATCH TRIALS**
  - FIXATION LOSSES (20%)
  - FALSE POSITIVES (20%)\*\*\*
  - FALSE NEGATIVES (33%)
- **GAZE TRACKER**

FIXATION MONITOR: BLINDSPOT  
 FIXATION TARGET: CENTRAL  
 FIXATION LOSSES: 0/23  
 FALSE POS ERRORS: 1/15  
 FALSE NEG ERRORS: 0/14  
 TEST DURATION: 13:43




---

---

---

---

---

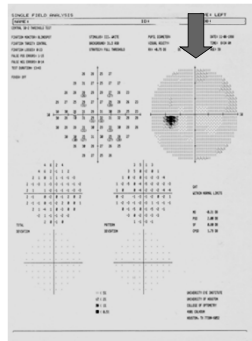
---

---

---

## METHODS OF DATA PRESENTATION

- **GRAYSCALE**
  - GIVES A GRAY TONE TO A GIVEN RANGE OF THRESHOLD VALUES (DARKER = LOWER THRESHOLD VALUE)
  - QUICKLY IDENTIFIES OVERALL DEPRESSIONS




---

---

---

---

---

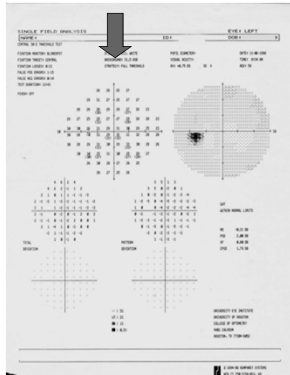
---

---

---

## METHODS OF DATA PRESENTATION

- **NUMERIC GRID**
  - RAW DATA (THRESHOLD LEVELS)




---

---

---

---

---

---

---

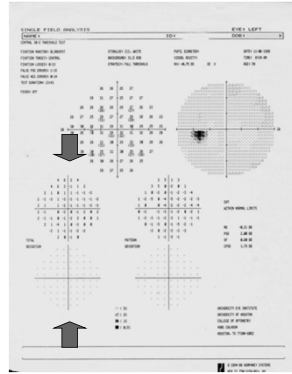
---

---

---

## 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




---

---

---

---

---

---

---

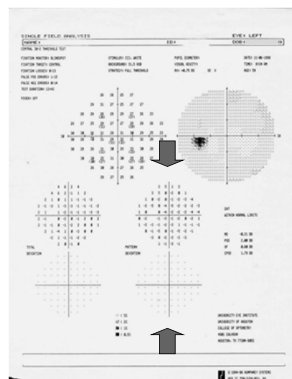
---

---

---

## 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**




---

---

---

---

---

---

---

---

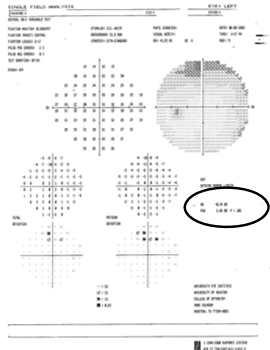
---

---



## 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




---

---

---

---

---

---

---

---

---

---

---

---

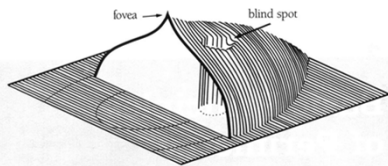


Figure 1. The normal hill of vision. Visual sensitivity is greatest in the fovea where the hill of vision peaks.

---

---

---

---

---

---

---

---

---

---

---

---

## 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

---

---

---

---

---

---

---

---

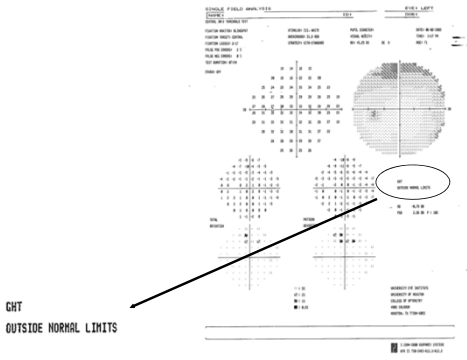
---

---

---

---

# Glaucoma Hemifield Test




---

---

---

---

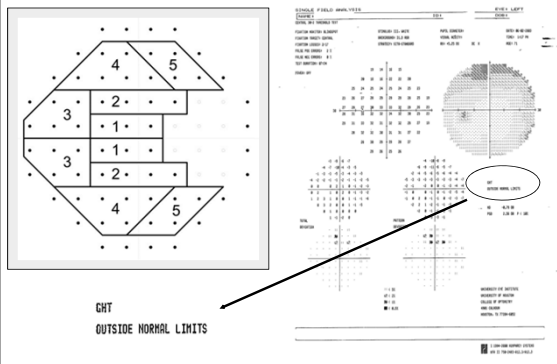
---

---

---

---

# Glaucoma Hemifield Test




---

---

---

---

---

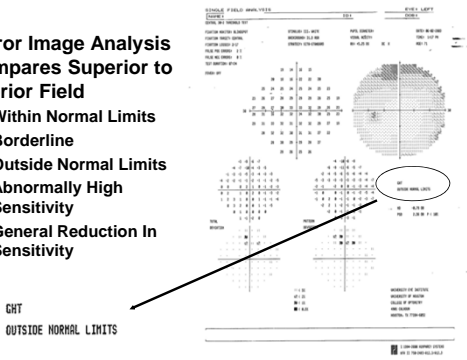
---

---

---

# 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




---

---

---

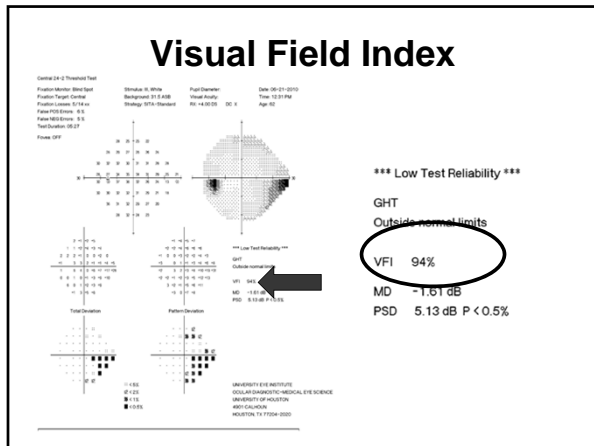
---

---

---

---

---




---

---

---

---

---

---

---

---

## 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%)

FIXATION MONITOR: BLINDSPOT  
 FIXATION TARGET: CENTRAL  
 FIXATION LOSSES: 0/23  
 FALSE POS ERRORS: 1/15  
 FALSE NEG ERRORS: 0/14  
 TEST DURATION: 13:43

---

---

---

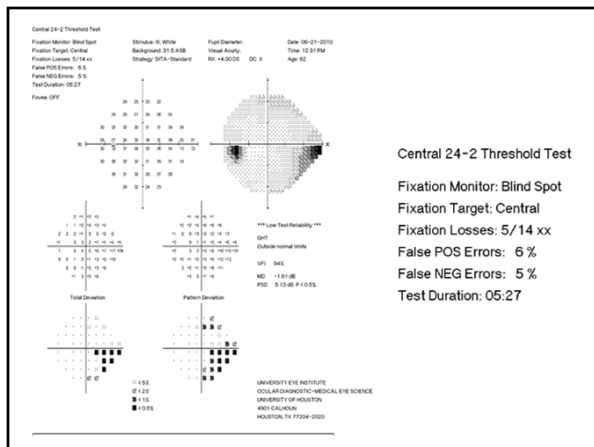
---

---

---

---

---



Central 24-2 Threshold Test  
 Fixation Monitor: Blind Spot  
 Fixation Target: Central  
 Fixation Losses: 5/14 xx  
 False POS Errors: 6 %  
 False NEG Errors: 5 %  
 Test Duration: 05:27

---

---

---

---

---

---

---

---

## 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

---

---

---

---

---

---

---

---

## RECOGNIZING VISUAL FIELD DEFECTS

- 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

---

---

---

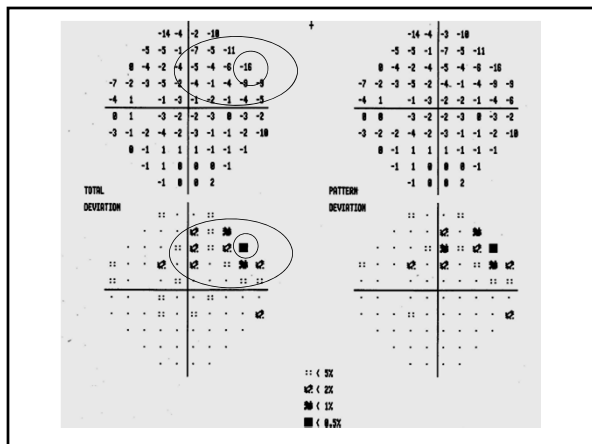
---

---

---

---

---




---

---

---

---

---

---

---

---



## 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  $P < 0.5\%$

---

---

---

---

---

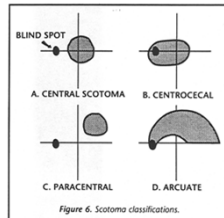
---

---

---

## RECOGNIZING VISUAL FIELD DEFECTS

- SCOTOMAS AND DEPRESSIONS IN AREAS KNOWN FOR GLAUCOMA (PARACENTRAL, NASAL STEP, ARCULATE 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

---

---

---

---

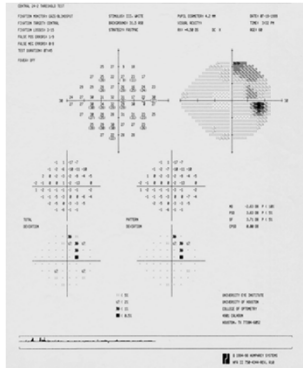
---

---

---

---

## Look At Both Fields Together



---

---

---

---

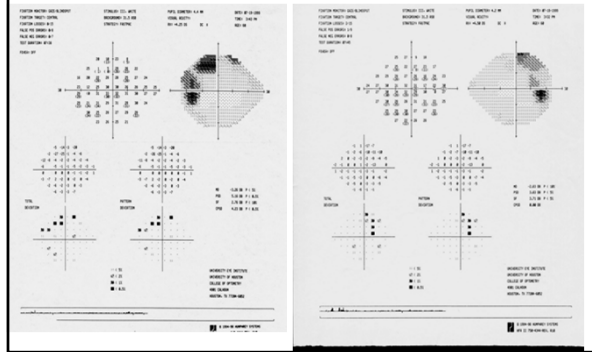
---

---

---

---

## Look At Both Fields Together



---

---

---

---

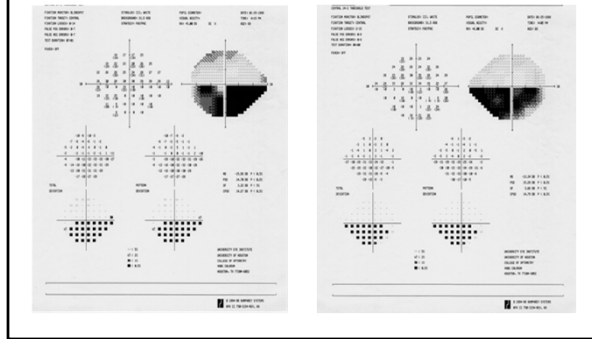
---

---

---

---

## LOOK AT FIELD WITH RELATION TO OTHER CLINICAL FINDINGS



---

---

---

---

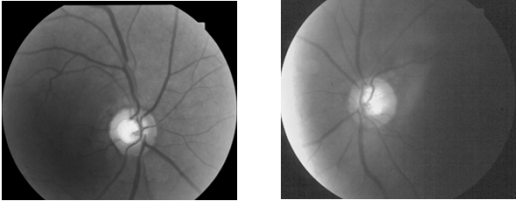
---

---

---

---

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




---

---

---

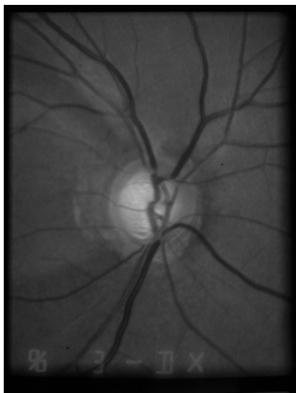
---

---

---

---

---



**Predict the Visual Field...**

---

---

---

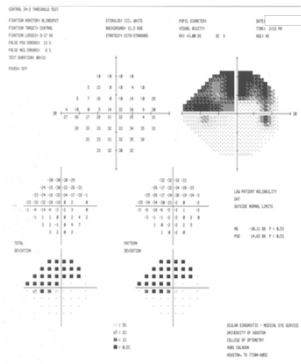
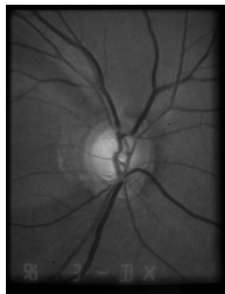
---

---

---

---

---




---

---

---

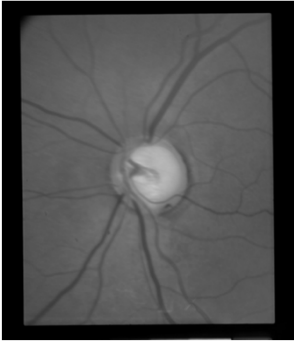
---

---

---

---

---



**Predict the Visual Field...**

---

---

---

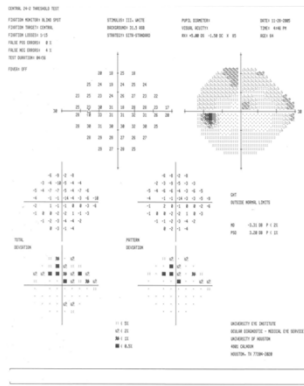
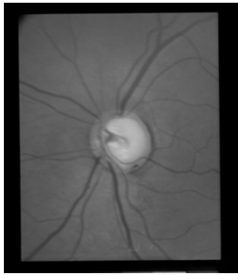
---

---

---

---

---



---

---

---

---

---

---

---

---

## **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)

---

---

---

---

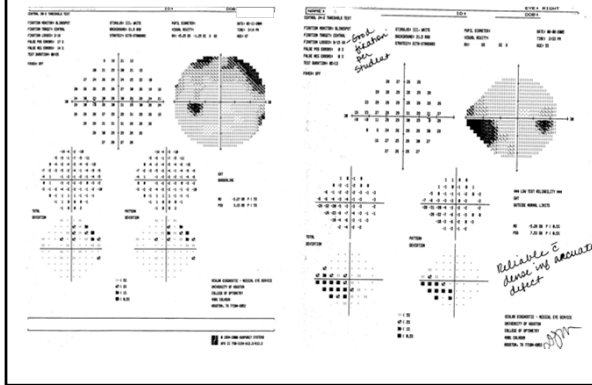
---

---

---

---

### 30-2 versus 24-2




---

---

---

---

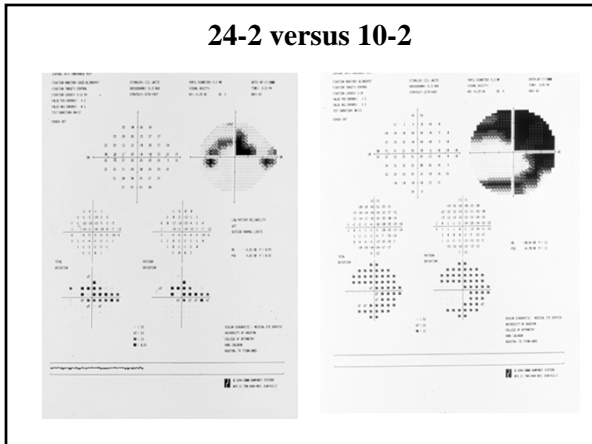
---

---

---

---

### 24-2 versus 10-2




---

---

---

---

---

---

---

---

**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**
- (ON 24-2, USE ALL POINTS)
- OR-**
- |   |        |
|---|--------|
| ∴ | < 5%   |
| ✱ | < 2%   |
| ✱ | < 1%   |
| ■ | < 0.5% |

---

---

---

---

---

---

---

---

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

- 3. PSD FLAGGED AT p<5% OR  
WORSE ON TWO CONSECUTIVE  
FIELDS**

---

---

---

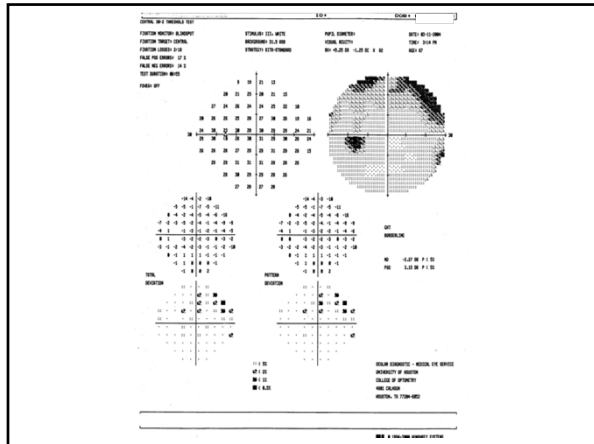
---

---

---

---

---




---

---

---

---

---

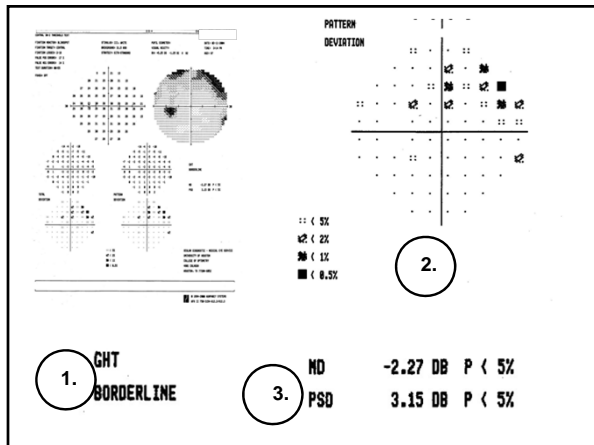
---

---

---

---

---




---

---

---

---

---

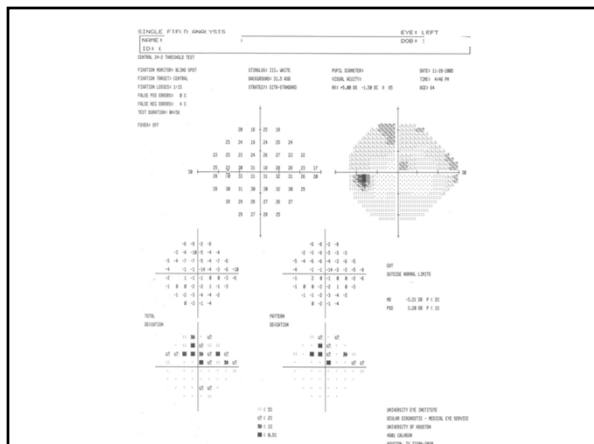
---

---

---

---

---




---

---

---

---

---

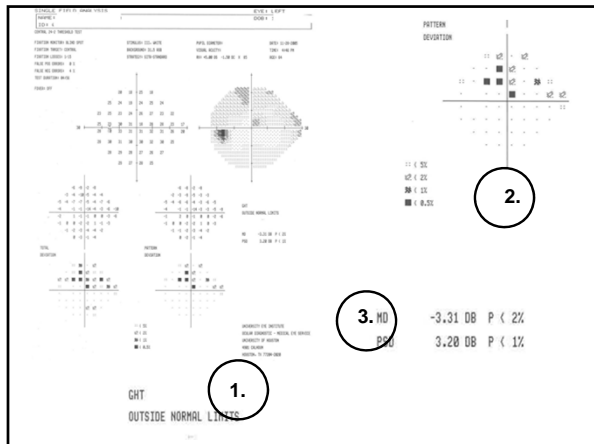
---

---

---

---

---




---

---

---

---

---

---

---

---

**CLASSIFICATION OF FIELD LOSS**  
(Modified from Hodapp, et al)

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

---

---

---

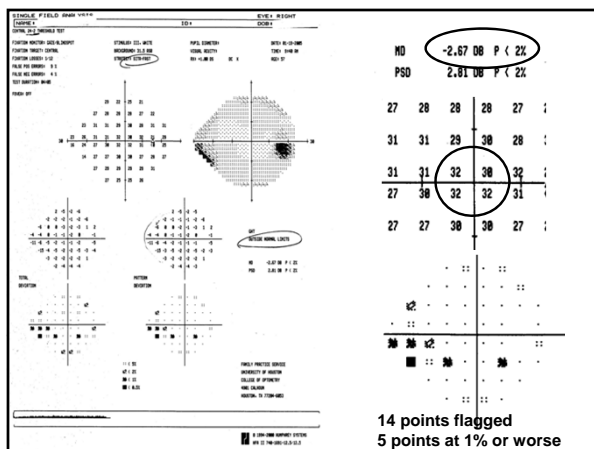
---

---

---

---

---




---

---

---

---

---

---

---

---



# 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)

---

---

---

---

---

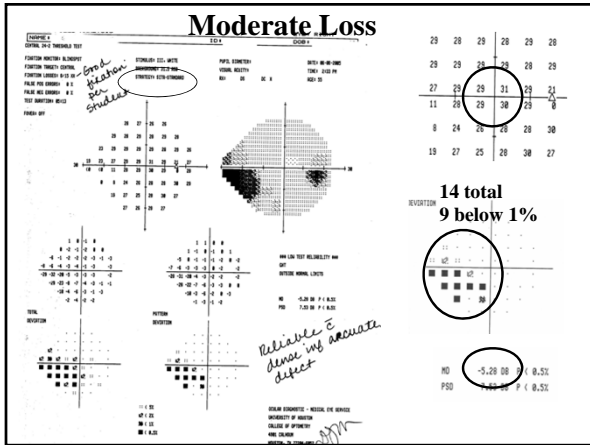
---

---

---

---

---




---

---

---

---

---

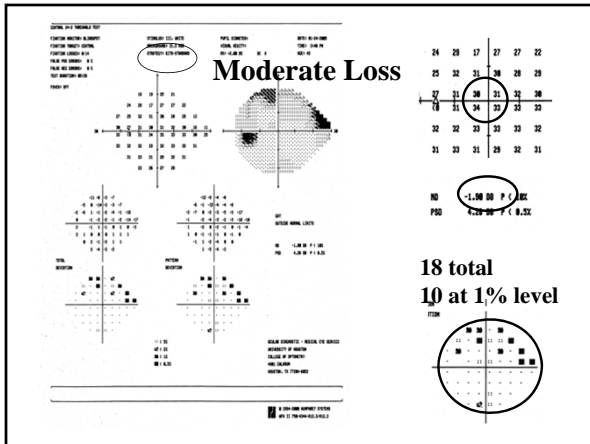
---

---

---

---

---




---

---

---

---

---

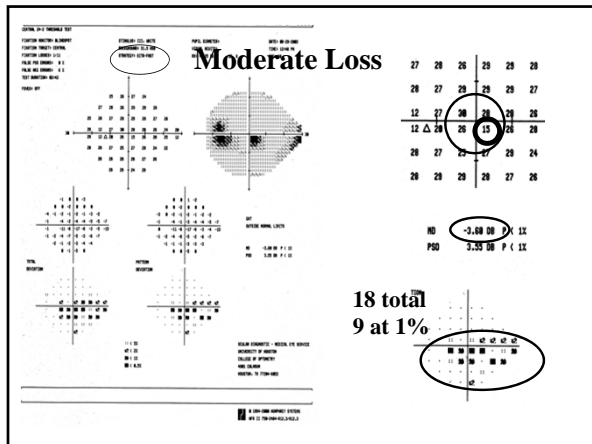
---

---

---

---

---




---

---

---

---

---

---

---

---

### 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

---

---

---

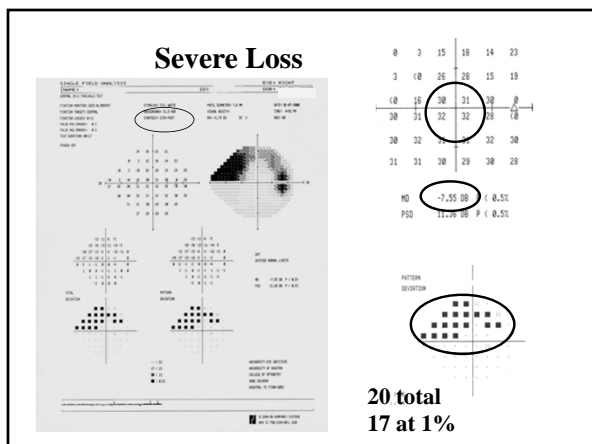
---

---

---

---

---




---

---

---

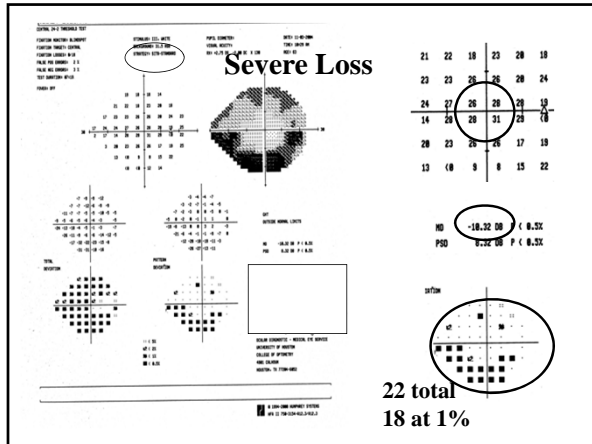
---

---

---

---

---




---

---

---

---

---

---

---

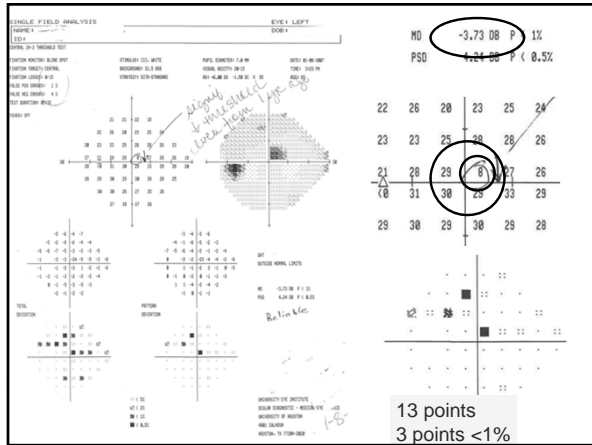
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

## 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) ???

---

---

---

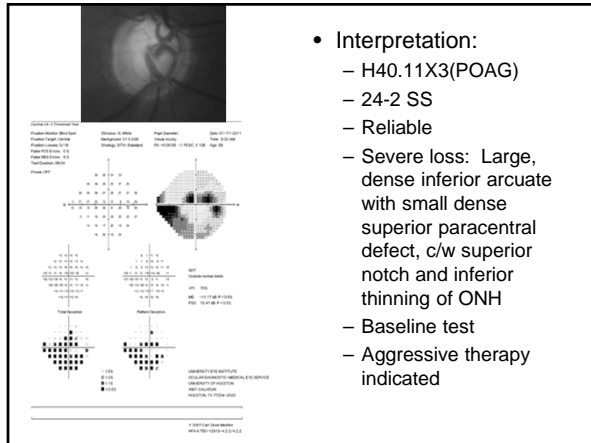
---

---

---

---

---



---

---

---

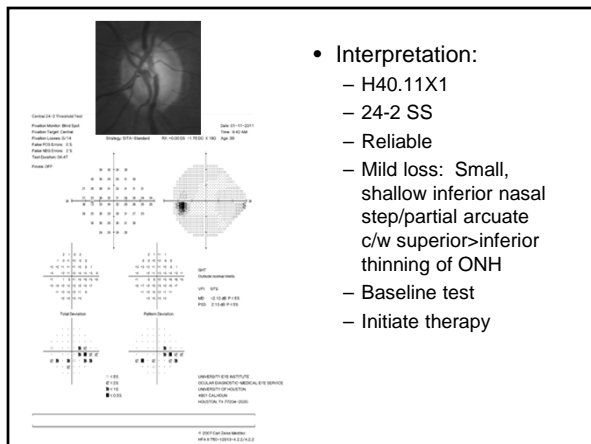
---

---

---

---

---



---

---

---

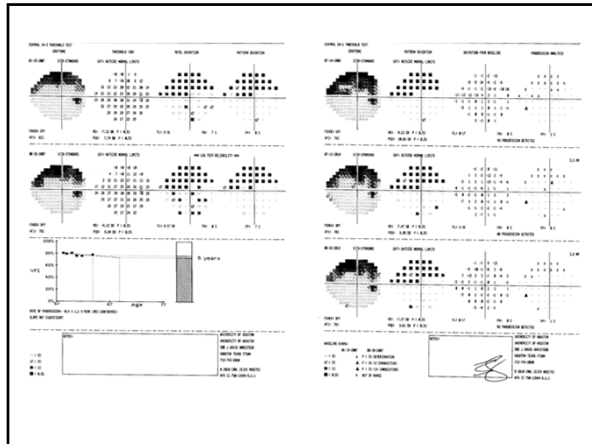
---

---

---

---

---




---

---

---

---

---

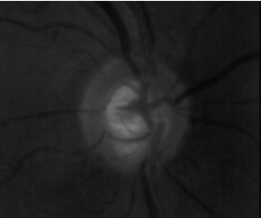
---

---

---

**Interpretation**

- H40.11X3
- 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](mailto:Dmarrelli@uh.edu)

---

---

---

---

---

---

---

---