Visual Field Screening and Analysis - PART 1

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Three Levels of VF Testing
- VF Screening
  - General screening
  - Problem-specific screening
  - Diagnostic perimetry
  - Quantitative perimetry

VF Screening - Two Types
- General
- Problem specific

General VF Screening
Purpose
To rapidly detect VF loss or prove that the VF is normal in patients not thought to have VF loss

General VF Screening
Critical Characteristics
- Rapid
- High specificity - few false field defects
- Good sensitivity
- Low cost

General VF Screening
The Effect of Sensitivity and Specificity
- Compromised specificity
  Many false field defects
- Compromised sensitivity
  Many true defects missed
VF Screening
Sensitivity and Specificity

- Sensitivity - the ability to detect a VF defect when present
  100% sensitivity → all VF defects are detected
- Specificity - the ability to identify a normal VF as normal
  100% specificity → all normal VFs are identified as normal; no false field defects

NOTE: These are very dependent on the technique used and the interpretation criteria, i.e., what constitutes a VF defect.

Example 1
- 1000 patients
- 5% have field defects → 50 patients (1000 X .05)
- 95% are normal → 950 patients (1000 X .95)
- If VF screening has 90% specificity → 85 (950 X .9) normals are identified as normal. But 95 (950 -85) normals show a false field defect
- If VF screening has 90% sensitivity → 45 (95 X .9) patients with VF defects are identified. But 5 patients with VF defects are missed.

19 times (95/5) more false VF defects found than true defects missed!!!
Specificity is very important when screening a population that has a high % of normals.

Example 2
- 1000 patients, 3% have VF defects (30), 97% normal (970)
- If VF screening has 90% specificity/90% sensitivity, then:
  False field defects found = 97 (970 - 970 X .9)
  True field defects missed = 3 (30 - 30 X .9)

32 X more false VF defects found than true defects missed!
In a more normal population the “cost” of compromised specificity represents an even greater problem in practice.

Example 3
- 1000 patients, 3% have VF defects (30), 97% normal (970)
- If VF screening has 85% specificity / 95% sensitivity, then:
  o False field defects = 140 (970 - 970 X .85)
  o True field defects missed = 1 (30 - 30 X .95)

140 X more false VF defects found than true defects missed.
We must achieve high specificity in screening a population which has a high % of normal or we will have MANY more false VF defects than true ones.

What Happens In Clinical Practice When When Your VF Screening Results in Many More False VF Defects Than Real Ones??

Early, when you first start using the perimeter, you retest or do more extensive testing (92083, threshold perimeter)
What is wrong with using 92083 to determine normal or not?
  Much worse specificity than general VF screening
  More difficult to interpret than a VF screening
  Much more expensive than VF screening
You figure out the there are very few true VF defects
Later you no longer retest or do more extensive testing rather you go on your “gut” impression that there is no true VF loss
However... there are true VF defects out there and you become much less effective at recognizing them!!!
CAUTION: This results in true defects being ignored!!!

Sensitivity/Specificity Balance

- An increase in sensitivity often causes a decrease in specificity
- A good balance of sensitivity and specificity is needed
- In general VF screening high specificity is necessary
- Why? Because the vast majority of patients seen for general exams are normal. So a specificity problem results in MANY more normals being called “abnormal” than VF defects missed.
General VF Screening CPT Code

- No specific indication for the test
  No VF loss is suspected
  Simply determining normal or not which is not higher level decision making
- No CPT code
- At ECC we include a general VF screening within the comprehensive exam fee; code 92004 (new patient) or 92014 (established patient)

General VF Screening at ECC
Recommended Instruments & Field Programs

- Humphrey Field Analyzer (HFA) in Rm 224
  Use Central 40 Test (40 points in the central 30°)
- FDT in Rms 224 & 215
  Use C20 (17 test areas in the central 20°) or N30 (the 17 test areas in central 20° plus 2 more in nasal step areas between 20 & 30°)
  N-30 is a better choice
- Humphrey Matrix in Rm 206
  Use C20 or N30

(See Manual 2, Section J, “VF Screening in the Primary Eye Care Service” page 3)

VF Screening Instruments at ECC

- Humphrey FDT – call it “FDT”
- Humphrey Matrix – call it “Matrix”
- Humphrey Field Analyzer (HFA) – call it “Humphrey” or “HFA”

Appropriate Terminology at ECC

Which Humphrey is “the Humphrey”? They all say Humphrey on them so which is it?

The Humphrey Field Analyzer (HFA)

Results:
OD: 2 misses at p<1% surrounded by P<2 misses and a p<5% miss. Sup nasal step pattern.
Also possible inf nasal step.
OS: 2 adjacent misses at p<5% - probably abnormal. Sup nasal step pattern.
Why Screen VFs??

**Prevalence of VF Loss in a General Population**

- 20,000 eyes/10,000 patients at DMV → 3.3% overall incidence with a 1st generation automated perimeter. 13% incidence in those >65 y/o. ~60% were unaware of the VF loss (Ophthalmology 87:785, 1980)
- Baltimore Eye Study → 4735 people in a community in Baltimore > 40 y/o → 26% had apparent VF defects on a Humphrey Full Field 120 test; after more extensive testing about 9% of total population were confirmed VF loss (Invest Ophthal Vis Sci 34:3271, 1993)
- 1500 new patients of all ages in OD office → 4.4% had VF loss (Am Opt Phy Opt 62:275, 1985)

Why Screen VF at Each Comprehensive Exam?

- Incidence of visual field loss in the general population is about 3-6%; incidence increases with age
- The cause of visual field loss may be of great clinical significance - sight or life threatening!
- A normal visual field may be diagnostically important
- In some cases, a visual field defect is the only evidence of a disease/disorder or other clinical signs are not detected
Three Levels of VF Testing

• VF Screening
  General screening
  Problem-specific screening
• Diagnostic perimetry
• Quantitative perimetry

Problem Specific VF Screening
(92081)

• Purpose:
  Primary purpose: To detect suspected VF loss - normal or not?
  Secondary: To define (location, shape, pattern etc.) for diagnostic purposes a known or suspected VF defect
• CPT Code 92081. Must have a specific reason/diagnosis for performing the VF, i.e., VF defect (368.40), glaucoma suspect (365.01), glaucoma (365.00) etc.

Problem Specific VF Screening Possible Uses

• Low risk glaucoma suspect such as mildly elevated IOP without other risk factors for primary open angle glaucoma (POAG)
• Patients who need more advanced VF testing but who are unable to perform more extensive tests such as threshold perimetry
• Not used much at ECC

Problem Specific VF Screening (92081) Typical Strategy & Test Point Patterns

• Testing Strategy: Suprathreshold strategy most often, possibly quantify detect strategy but can be very time consuming
  Quantify defect strategy screens all points then thresholds only the points that are missed on the screening
• Test point patterns: HFA Central 80 Test, HFA Full Field 81 test
  More test points are used to better detect & possibly define the VF defect- size, shape, borders, pattern of VF loss etc.

MV
HFA
Central 80 test

OD: Pattern?
Double (sup & inf) arcuate scotomas
(Only centro-cecal area is spared)
OS: Definitely abnormal.
Pattern?
Inferior arcuate scotoma
Qualitative/Diagnostic Perimetry

**Purpose**
To determine the characteristics of a VF defect - location, borders, size, shape (pattern), some info of density/depth, homonymous or heteronymous, etc. in order to determine the site of the lesion and/or the cause of the VF defect.

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**Diagnostic Perimetry (92082)**

- **Testing strategy:** Often some quantification of VF defects is needed - quantify defect or 3 zone strategy.
- **Test points:** Best to use 75 or more test points.
  
  Most common at ECC: Full Field 120
- **Takes more time, greater perimetric capability/ greater diagnostic skill/medical decision-making**
- **CPT code 92082 - must have a specific reason/diagnosis.**

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**Quantitative Perimetry (92083)**

**Purpose**

- To quantify the VF of a patient at higher risk of VF loss in order to detect the onset of VF loss as early as possible. Glaucoma detection and management is the most common use.
- To fully quantify a visual field defect in order to detect progression of a VF defect as early as possible.
Quantitative Perimetry (92083)

- **Testing strategy:** Threshold (all points tested) - full threshold, FAST PAC, SITA Standard or SITA Fast
- **Test point pattern:** Usually 50 to 76 points in the central field.
- **Typical programs:** 30-2 (76 points in central 30°), 24-2 (54 points in the central 24°) using a threshold strategy such as full threshold or SITA, G1 program Octopus in Dynamic strategy or TOP strategy.

Quantitative Perimetry (92083) *Characteristics & Disadvantages*

- **High sensitivity** (at the cost of specificity and time)
  - Many more false VF defects with threshold perimetry and more difficult to interpret
  - Much slower than screening
  - Do not screen with a threshold test
- **Must quantify (threshold) all tested points**

Quantitative Perimetry *CPT Code*

- **92083** - fully quantify (threshold) all points tested
- **Highest reimbursement but limited acceptable diagnoses, i.e., glaucoma suspect, glaucoma, VF defect, etc.**

The Normal Visual Field

- **VF** - the area of space a person can see at one time with one eye
- **VF is tested monocularly** (though most people function binocularly)
- **VF is 3-dimensional**
  - Lateral extent
  - Vertical extent
  - Deep (sensitivity)
Three Dimensional Concept
The Hill of Vision

Normal Monocular Vision Field
The Absolute Limits
- Superior: ~60°
  Superior is highly variable due to variations in lids, lashes, brows, deep set eyes etc.
- Inferior: ~75°
- Nasal: ~60°
- Temporal: ~100°
- Total lateral extent (monocular): 60° + 100° = 160°
- Total vertical extent (monocular): 60° + 75° = 135°

The Normal Binocular VF
Green - seen OU
Yellow – seen by OD only, Blue-seen by OS only

Normal Binocular Vision Field
- Total lateral extent: 100° + 100° = 200°
  NOTE: The nasal field of one eye overlaps into the temporal field of the contralateral eye (binocular overlap)
- Central 60° to each side of fixation (120° total extent) is binocular overlap
  Each point in the central 60° (60° to all sides of fixation) has a corresponding point in the field of each eye.
- Temporal 30-40° on each side of the binocular field is the monocular, temporal crescent
  There are no corresponding retinal points in the temporal crescent, i.e., right temporal crescent is seen only by right eye

Sensitivity
- The ability to detect a small and/or dim white target against a white background - “white-on-white perimetry”
- Recent perimeters use alternative stimuli to isolate various ganglion cells subgroups
  Blue stimulus on yellow background - short wavelength automated perimetry (SWAP)
  Low spatial frequency grating undergoing rapid phase shift - frequency doubling illusion → FDT (frequency doubling tester) & Matrix (same stimulus as FDT)

Hill of Vision (HOV) Concept
- Surface of HOV - represents sensitivity at different loci in VF
- Peak of HOV - sensitivity at the fovea - highest to white stimuli on a white background when testing under photopic conditions
- Hole in the HOV at 15° temporal to fixation - normal physiological blindspot
- Edge of the HOV - absolute limits of the VF is about 60° superior, 60° nasal, 75° inferior and 100° inferior - no sensitivity beyond these limits
Hill of Vision Profile View
Sensitivity along the 180° (nasal to temporal) meridian of the VF

Physiological Blindspot (BS)
- Location: Center of BS is 15-1/2° temporal to fixation & 1-1/2° inferior to horizontal midline
- Sensitivity: None (BS is an absolute scotoma). Note: area above and below BS has reduced and variable sensitivity in normal patients.
- Cause: Lack of retinal receptors on the optic nervehead (ONH)
- Size: 7-1/2° vertical X 5-1/2° horizontal (vertical oval)

The Blindspot - Significance
- BS may enlarge vertically in glaucoma but this is not a consistent early sign in glaucoma
- BS changes can be found in normals due to normal variation in sensitivity above/below the BS – a very non-specific sign of glaucoma
- BS enlarges in all directions in papilledema
- BS used to check fixation quality in automated perimetry but is not plotted for diagnostic purposes in automated perimetry

Hill of Vision
Height and Slope
- Height - the greater the height, the higher the sensitivity
- Sensitivity at fovea (the peak of the HOV) is the greatest & is about 3 or 4 dB higher than points just outside of fovea
- Sensitivity at BS – 0 dB (absolute scotoma)
- Sensitivity declines gradually from fixation to absolute limits of HOV - slope roughly 3dB/10º
- Steeper & more variable slope in superior VF.
- Flatter slope temporally

Fluctuation
- Variability of sensitivity in vision field testing
- Two types:
  - Short term fluctuation - variability during a test
  - Long term fluctuation - variability from test to test

Short Term Fluctuation (SF)
- Variability of sensitivity / threshold during test
- Usually averages 1 to 2-1/2 dB in central (central 30º radius around fixation) field
- Can be up to 6 dB at a single point in normals
- Tends to be greater further from fixation, greater in the peripheral (outside the central 30º) VF
- Two causes for increased SF in central VF:
  - Abnormal VF - VF loss especially in early glaucomatous VF loss
  - Reduced patient reliability and consistency of responses
Decibel - Unit of Current Perimetry

- A relative unit
  Relative to the brightest stimulus available on the instrument therefore dB values will vary from brand to brand of perimeter – can’t compare dB values on one brand to dB values on another brand of perimeter
- 1 dB = 1/10 of 1 log unit; 10 dB = 1 log unit
- Decibel scale
  0 dB stimulus = brightest stimulus available
  10 dB stimulus = 1/10 of the brightness of the brightest stimulus available on that perimeter
  20 dB = 1/100 of the brightness of the brightest stimuli

Decibel Values on the Humphrey Field Analyzer (HFA)

<table>
<thead>
<tr>
<th>Stimulus Luminance (asb)</th>
<th>dB Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>0 dB</td>
</tr>
<tr>
<td>1,000</td>
<td>10 dB</td>
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<td>1</td>
<td>40 dB</td>
</tr>
<tr>
<td>0.1</td>
<td>50 dB</td>
</tr>
</tbody>
</table>

Clinical Use of dB Values in Threshold Perimetry

- dBs are the units of sensitivity used in threshold perimetry
- dBs are directly related to sensitivity → the higher the sensitivity, the higher the dB value
- Highest dB value normally at the fovea (the fixation point of the VF)
- NOTE ON CLINICAL TERMINOLOGY: Even though dBs are a unit of sensitivity they are often referred to as “thresholds” on threshold perimetry. Examples:
  o “The threshold at that point is 30 dBs.”
  o “Those 2 points appear to be defective; their thresholds are 20 dBs but the neighboring points have thresholds of 28 and 30 dBs.”

VISUAL FIELD TESTING STRATEGIES

- Kinetic
- Static
  - Suprathreshold
  - Threshold
Kinetic VF Testing

- Select a test stimulus
- Move the stimulus from non-seeing to seeing (approach the HOV horizontally)
- Plot points where the stimulus is first seen - all points where it is first seen are of equal sensitivity
- Isopter line - a plot of points of equal sensitivity connected by a line

Kinetic Perimetry

Advantages

- Can rapidly evaluate the peripheral visual field
- Can rapidly plot deep defects
- Quick and accurate for steep-bordered defects like the BS, retinoschisis, some retinal detachments etc.
- Possibly useful for localization, characterization of neurological defects – these types of VF defects “respect” (do not cross) the vertical midline

Disadvantages

- Compromised ability to detect scotomas, particularly small, shallow, or fluctuating scotomas, as in glaucoma
- No effective system of quantifying the results of kinetic perimetry; difficult to recognize early visual field defects
- If performed manually examiner has much influence on visual field outcome
- The examiner must be well trained; he or she controls the test and the results
### Use of Kinetic Perimetry

#### Effect of the Slope of the Borders of a VF Defect

- Kinetic perimetry is very good for deep, steep bordered VF defects due to the very abrupt change in sensitivity at the border of the VF defect → very narrow “zone of uncertainty”
- Not good for VF defects with sloping borders → wide “zone of uncertainty” → highly variable patient responses when plotting the borders of VF defects with sloping borders

### Steep-Bordered, Deep VF Defects

- Physiological blindspot
- Retinoschisis
- Some retinal detachments
- Many advanced diseases such as retinitis pigmentosa, stroke involving the visual pathways, advanced macular degeneration etc.

### Characteristics of VF Defects

- Depth
  - Absolute - no sensitivity → cannot see the brightest available (0 dB) stimulus on the instrument
  - Relative - sees some stimuli but not dimmer or smaller stimuli
- Slope of the Border
  - Sloping - gradual change in VF defect from less sensitivity greater sensitivity
  - Steep - rapid change in sensitivity at the edge of a VF defect; sensitivity drops rapidly at the edge of the VF defect

### General Types of VF Defects

- Scotoma
  - Area of reduced sensitivity surrounded by higher (but not necessarily normal) sensitivity
- Depression
  - Area of reduced sensitivity extending into the VF from the edge of the VF defect
  - Generalized depression - all sensitivities in VF are reduced including at sensitivity at fixation (foveal sensitivity)
- Contraction
  - Absolute loss of sensitivity extending into VF from the periphery

### Static Perimetry - General Types

- Static threshold perimetry
  - Select locations then vary a stimulus parameter, i.e. brightness (or for FDT contrast) to determine the just detectable level. In automated or computerized threshold perimetry only the one stimulus (brightness) is varied.
- Static suprathreshold perimetry
  - Select the test locations
  - Present a stimulus that the patient should be able to see (suprathreshold) a the selected locations

### Suprathreshold Testing Strategies

- Single intensity
  - Same stimulus intensity used at all test points
- Threshold-related, eccentricity compensated
  - Stimulus intensity is varied by the test location (eccentricity-compensated)
  - Intensity also varies depending on the expected thresholds at each location (threshold-related)
  - Varies based on a patient’s general sensitivity (threshold-related) and the distance from fixation (eccentricity compensated)
Single Intensity Suprathreshold Strategy - Compromises

- Same stimulus intensity used at all points in the VF
- Often stimulus not adequately suprathreshold at 20-40° → many artifactuous misses near edge of VF
- Often stimulus too suprathreshold (too bright) in central 10° → can easily miss shallow VF defects near fixation

Threshold-Related, Eccentricity Compensated Strategies

- Either of 2 strategies used
  - Sample threshold at 4 points (1 in each quadrant) at beginning of the screening test → threshold sampling.
  - Use patient’s age to predict - very common strategy
  - All screening stimuli are set at a brightness that is 4 dB or 6 dB brighter than the expected threshold level → reduces artifactuous misses caused by normal short term fluctuation
  - Much better sensitivity and specificity than single intensity strategy

Suprathreshold Screening Methods of Enhancing Specificity

- Brighter stimuli at greater eccentricities - eccentricity compensated strategy
- Stimuli set ~6 dB brighter than expected threshold - threshold related strategy
- 2 chances to hit the stimulus once (Octopus 1-2-3 does not do this therefore there are more false, artifactuous misses)

Suprathreshold Screening Semi-Quantitative Strategies

- Quantify missed points
  - Threshold determined at any point missed twice Caution: this turns a screening test into a threshold test → may take much more time!!
  - Three zone
    - If a point is missed twice, the brightest stimulus (0 dB) is presented
    - 3 possible sensitivity levels:
      - Absolute VF defect - did not detect the 0 dB stimulus
      - Relative - missed normal screening stimulus but hit 0 dB stimulus
      - Normal - hit the normal screening stimuli (4 to 6 dB brighter than expected threshold level)

Results:

OD: 2 misses at p<1% surrounded by P<2 misses and a p<5% miss. Sup nasal step pattern.
OS: 2 adjacent misses at p<5% - probably abnormal. Sup nasal step pattern.
Static Threshold Perimetry

- Sensitivity determined at all points
  - All points thresholded (slow ~8 to 20 mins.) or
  - In the new fast threshold strategies the thresholds are predicted based on surrounding sensitivities (~2 to 8 minutes)
- MUCH more time consuming than suprathreshold tests
- Better sensitivity than suprathreshold tests
- IMPORTANT: Specificity is not nearly as good as screening & threshold test is much longer – DO NOT screen with a threshold test!!!
  - Many normals show areas that look like VF defects – do not run threshold tests on normal patients!!!
- Much more difficult to interpret

Static Threshold Perimetry vs. Suprathreshold Perimetry in Early Glaucoma

- Static threshold perimetry is superior for the detection of early glaucomatous VF loss.
  - So clinically on glaucoma suspects we will run a threshold test even when the general VF screening has been normal
  - “White-on-white suprathreshold perimetry is NOT adequate for detection of early glaucomatous VF loss in glaucoma suspects.” (Ophthalmology 101:1596:1994)
- Alternative forms of perimetry (FDT, Matrix, HEP) are very often superior to white on white screening and even threshold for simple detection of glaucomatous VF loss
  - Therefore I prefer to screen glaucoma suspects and glaucoma patients with alternative screening like FDT to ensure that the white-on-white threshold test is not missing anything

What VF Testing Strategy to Use

General Guidelines

- Normal patients, no known or suspected VF loss with general screening - suprathreshold screening
- Very low risk glaucoma suspect - problem specific screening with suprathreshold strategy
- Any central VF defect which may progress - threshold perimetry
- Most peripheral VF defects - kinetic perimetry
- Glaucoma management - threshold perimetry
- Glaucoma detection (except very low risk suspects or those who cannot cooperate on threshold) - threshold perimetry

GENERAL VF SCREENING

NON-AUTOMATED TECHNIQUES

General VF Screening

Non-Automated Instruments and Techniques

- Confrontation fields
- Count fingers confrontations
- Field limits confrontations
- Color confrontations (red cap)
  - “Face confrontations”
- Tangent screen
- DeMata campimeter

Confrontations - Advantages

- Rapid
- Simple
- Cheap & informal, no special instrumentation
- Reasonable first approximation of VF
- May be only VF test possible in some cases
Confrontations - Disadvantages

- Sensitivity is not good
  Can detect deep & large defects but not shallow or small defects
- Diagnostic info often lacking

Confrontations - Sensitivity

- Sensitivity to all types of VF loss: 50 to 60%
- Sensitivity to ON-related VF loss: 20-30%
  Except central scotoma - high sensitivity with face confrontations
- Sensitivity to chiasmal VF loss: 40-50%
- Sensitivity to post-chiasmal VF loss: >75%

Count Fingers Confrontations

- Rapid, informal VF test
- Very gross
- Often used
- Can check for extinction phenomenon

Extinction Phenomenon

- Occurs in some cases of parietal cortex damage
- Homonymous hemianopsia contralateral to the lesion
- May be found on confrontations only if fingers are presented on both sides of the vertical midline simultaneously

Field - Limits Confrontations

- Only tests the absolute limits of the VF
- Much variability/fluctuation in peripheral VF
- Very limited usefulness - much less useful than count fingers
- Few VF defects affect peripheral VF limits only

Field - Limits Confrontations Technique

- Sit in front of the patient
- Have patient fixate on your left eye when testing the right eye and visa versa
- Use 10 mm white ball (NPC ball)
- Move to a position outside the peripheral limits of the VF
- Advise the patient to say now when the ball is first seen but keep looking at your eye
- Move the ball in an arc with its center the patient’s eye about 40 cm from the patient’s eye
- Field limits should be:
  Superior ~60º, temporal ~100º, inferior ~75º, nasal ~60º
Color Confrontations

Red Cap Test - at Fixation

- Red cap presented at fixation for the right eye then the left eye
- Compare the “redness” of the cap (saturation and hue) OD vs OS
- Very helpful in detecting mild central or centrocecal scotomas due to optic nerve disease

Red Cap Test & Red Cap Quadrant Comparison

Color Confrontations

Red Cap - Quadrant Comparison

- Red cap presented against uniform background (tangent screen works real well) in nasal then temporal quadrant
- Compare redness nasal to temporal
- Very helpful in detecting VF loss from chiasmal compression
  - Pituitary adenoma - superior temporal quadrant red cap is less red than superior nasal
  - Craniopharyngioma - in inferior temporal quadrant red cap is less red than in inferior nasal

Face Confrontations

- Patient looks at the eye or nose of the examiner
- Patient comments on surrounding facial features, i.e., distorted, dimmer, missing
- Useful in detection of central scotoma, centrocecal and scotomas, altitudinal hemanopsias and metamorphopsia

Tangent Screen

Advantages

- Inexpensive instrumentation
- Great flexibility in testing process and conditions
- Very useful in diagnosis of functional vision loss
- Test distance magnifies visual field defects

Disadvantages

- Difficult to achieve consistent test conditions and testing process; introduces variability, which makes it much more difficult to determine if the VF defect is changing
- Works best as a kinetic test; static techniques are possible but crude
- Requires a perimetrist at higher skill level than with automated instruments; requires much higher skill level for quantitative perimetry
PROPER TECHNIQUES
(How to do it right)
in VF SCREENING with AUTOMATED PERIMETRY

Proper Techniques in VF Screening with Automated Perimeters

- Selection of proper test / test point pattern
- Selection of appropriate testing strategy
- Duties of the perimetrist

VF Screening with Automated Perimeters

Test Point Pattern

- 40 or more test points recommended (limited by time)
  - FDT has 10° by 10° square test areas not points – use C20-5 (17 test areas) or N30-5 (19 test areas)
  - Matrix has 5° by 5° square test areas not points but can do the C20-5 (5° test areas) & N30-5 (10° test areas) that are on the FDT
- Sensitivity of automated perimetry increases logarithmically with the number of test points but limited by time
- If there are more test points a VF defect will more likely affect more points, i.e., only one point on a C40 test. The more points affected the easier it is to tell that it is a true VF defect
- Points should be concentrated in or limited to central 30°. We screen only the central 20° to 30° in general VF screening
AtN Matrix C24-2-5 screening 52 total 5° by 5° test areas in the C24 test

HFA C40 Screening Test
Sensitivity and Specificity
• Sensitivity: >85%
• Specificity: 95%
• Criteria for VF defect:
  o Any one miss in central 20°
  o Two adjacent misses outside of central 20°
• Interpretation criteria greatly affects sensitivity/specificity
  (Journal Am Optometric Assoc:59:605, 1987)

General VF Screening Testing Strategy
• Use the eccentricity-compensated, threshold-related suprathreshold strategy
• Do NOT use a single intensity strategy
• For a threshold-related strategy a very quick sampling threshold must be determined or the instrument may set the stimuli brightness based on the patient’s age
  MUST enter the correct age

Common Causes of Generalized Depression
• Blur (wrong trial lens)
• Media opacity
• Small pupil (<3 mm)
• Fatigue
• Age
• Wrong age keyed into perimetry

Strategies to Determine Appropriate Testing Level on Threshold-Related Screening
• Threshold sampling
• Age

Threshold Sampling
• Determines a sample of sensitivity in each quadrant
• To determine the overall, general height of the HOV
• First ~30 seconds are used for thresholding 4 points - one point in each quadrant
• MUST ensure good fixation and low false responses during the first ~30 seconds
• This allows the instrument to adapt the screening to that specific patient → less false misses from testing with a stimulus that is too dim (subthreshold stimulus) & less chance of testing with a stimulus which is too bright to detect shallow defects
**Age Adjusted Threshold-Related Suprathreshold Screening**

- Key in the **correct** age or birthdate before the test
  - If the instrument asks for the birthdate or age and will not continue unless you key it in this is why it is doing it
- Saves 30 to 50 seconds of the test time
- Used on most current perimeters

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**VF Screening - Perimetrist’s Duties**

- Patient education
- Room illumination
- Occlude one eye, position head/chin
- Enter appropriate patient info, i.e., birthdate
- Select appropriate trial lens/position lensholder
- Monitor patient & patient responses
- Maintain patient alertness
- Monitor for artifact

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**Perimetrist’s Duties**

**Patient Education**

- Explain test purpose
- Look only at the point in the middle (fixation point)
  - “Hit the button if you see or think you see a light.”
- On FDT or Matrix “Hit the button if you see or think you see a wavy, flickering area.”
- Change this if the patient is giving a lot of false positive responses. Then change to, “Hit the button when you see the light, only when you see the light.”

**Room Illumination**

- Lights off
- No lights shining on bowl or into instrument

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**Automated Perimetry**

**Occlude Eye and Position Patient’s Head**

- Occlude eye (translucent occluder is better than black occluder)
- Head against forehead rest
- Chin down on chin rest, teeth together

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**Automated VF Screening**

**Trial Lens Use - General Rules**

- If instrument uses threshold sampling it adjusts to the degree of general depression
- Use lens for central 30° only
- Place the lensholder as close to the eye as possible
- Correct patient for test distance: 30 cm on HFA, infinity on the FDT & Matrix
- For astigmatism of equal to or greater than 1 D, use the full cylinder power
- If the pupil is dilated, simply assume full cycloplegia and use a full add for the test distance e.g. +3.00 Add for HFA, no add for FDT/Matrix
- For spherical lenses of greater than +8.00, it is best to use a contact lens vertexed to the cornea
**LENS RULES FOR FDT & MATRIX**

- FDT & Matrix are less sensitive to blur of +6 to -6 for FDT and +3 to -3 for Matrix
- FDT & Matrix are set for infinity viewing
- No lens necessary for Rxs of +6 to -6 on FDT but probably best to use patient’s glasses
- Patient’s glasses or trial frame (no lens holder on instrument) for Rxs higher than +6 to -6

**Lens Rim Artifact**

- Misses in the area of the VF behind the lensholder and/or the lens
- Location depends on lensholder → for HFA many are inferior and temporal to BS
- May occur in up to 10% of cases
- Most missed points temporal to the BS are lens rim artifact
- Prevention:
  - Keep the lens/lensholder as close to the eye as possible
  - Be sure that the patient’s head stays firmly against the headrest (HFA) throughout the test; they cannot rock their head back from the headrest

**Perimetrist’s Duties**

**Evaluation of Patient Responses**

- Initial 30 to 60 seconds of test - CRITICAL
  - Most fixation losses and false responses occur in the first few seconds
  - Threshold sampling is performed at this time
- Ensure good fixation – watch closely and give feedback if fixation losses
- Ensure no false positive responses – false positives can totally negate the validity of the test → may have to rerun the test
- Why do the test if the patient responds to something other than actually seeing the stimuli???
- IMPORTANT: DO NOT ALLOW FALSE POSITIVES TO CONTINUE

**Perimetrist’s Duties**

**Maintaining Patient Alertness**

- Stay with the patient
- Give additional instructions as needed e.g. “Look only at the black spot (FDT) in the middle.”
- Encourage periodically – “You are doing great”
- “The test is almost finished”

**Perimetrist’s Duties**

**Minimizing Artifactous Misses**

- Artifacts undermine ability to diagnose true VF loss
- Artifacts often make additional VF testing necessary
- MUST minimize artifact

**SB N30-5**

Reliable? Yes for both eyes.

OD: Record in Examwriter as “No misses”

OS: VF loss OS or is it artifact?
Possible sup paracentral scotoma

Note: On FDT/Matrix screening 2 adjacent misses (1 at p< 5% & 1 at p< 2%) in this same area

Did FDT/Matrix screening show it better than white-on-white threshold with HFA 24-2??!