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Perimetry Primer: Fundamentals of Visual Fields

Dr. Mitch Ibach


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Host: Dr. Stephanie Woo

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Speaker Bio

Dr. Mitch Ibach is a residency trained optometrist at Vance Thompson Vision in Sioux Falls, SD. Dr. Ibach attended the Pacific University College of Optometry where he graduated summa cum laude. Mitch completed his residency training at Minnesota Eye Consultants with a concentration on cataracts, refractive surgery, external disease and glaucoma. In September of 2014, he joined Vance Thompson Vision to focus on advanced anterior segment surgery care and pathology. Mitch is a fellow of the American Academy of Optometry, an Intrepid Eye Society member, a member with the American Optometric Association, Optometric Glaucoma Society (OGS), and the South Dakota Optometric Society. Mitch serves as the associate residency director at Vance Thompson Vision and is also an adjunct clinical faculty for the Illinois College of Optometry and the Pikesville College of Optometry.



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- Sun pharms lecturer honoraria

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Perimetry Primer: fundamentals of visual fields

Mitch Ibach, OD FAAO
Vance Thompson Vision
Associate residency coordinator

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What is a visual field?

- Visual Field (VF) - Everything visible at a single time from one eye

Performing a VF allows examiners to identify field loss in a specific location

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What is the Normal Field of Vision?

1. Temporal > 90*
2. Superior = 60*
3. Nasal = 60*
4. Inferior ~ 70*

*relative to a fixation point

Right Eye

Holl, Anderson, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Meditec, 2021.

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Physiologic Blind Spot – everyone has one

Physiologic Blind Spot - absolute scotoma (no sensitivity to light)

- Location of the optic nerve (ON) entering the eye (15° nasal)
- Optic nerve lacks photoreceptors
- Located 15° temporal to fixation
- Avg. blind spot is 7.5°

Holl, Anderson, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Meditec, 2021.

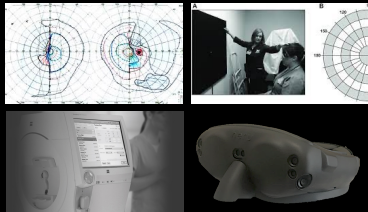
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Types of Visual Field

- Amsler Grid → Testing macular/GCC function Central 10°
- Confrontational VF → Screening test
- Perimetry → Automated and manual Commonly 20°, 48°, 60°

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Perimetry




- **Kinetic Perimetry** - Test object is moved, but brightness and size are fixed.
ie: Goldmann Perimetry and Tangent Screen
- **Static Perimetry** - Test object is fixed, but brightness and size are varied.
ie: HFA, Octopus VF, Headset VF

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Standard Automated Perimetry (SAP)

Quantifies the sensitivity of a patient's peripheral vision (Not all or none)

- Standardized testing algorithms
- Quantifiable threshold test (grading)
- Measures 30° from fovea/fixation

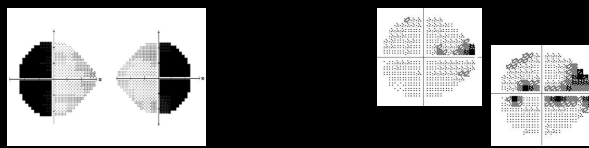


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2 Goals of Perimetry

Detect and Diagnose Visual Field Abnormalities

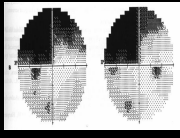
Determine progression of Visual Field Abnormalities



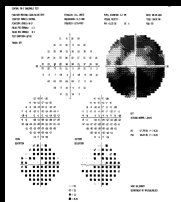
16

Conditions that may require VF's

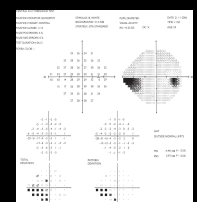
Neurologic diseases



Retinal diseases



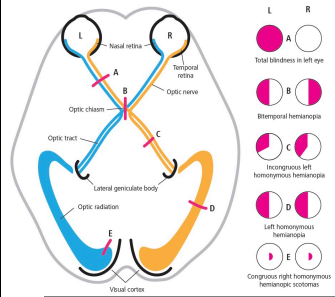
Glaucoma



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Neurologic - Understanding the Visual Pathway

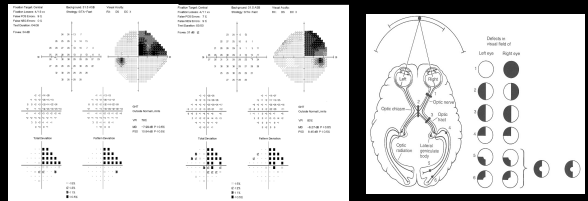
1. Retina damage can be partial scotomas
2. Optic chiasm and posterior = bilateral VF loss (B)
3. More posterior damage = more congruent (matching) defects



Hogg, Anderson, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Meditec, 2021.

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Where is the Cut/damage?

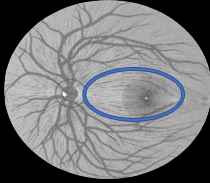


<https://casebasicoftocophthalmology.pressbooks.com/chapter/superior-homonymous-hemianopia/>

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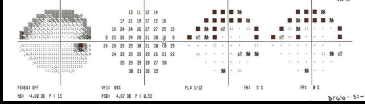
Retina VF Loss

- Monocular VF loss
- Commonly more central VF loss
- 60-70% of optic nerve fibers compose the macular region



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Glaucoma VF Loss

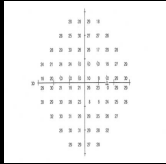


- Definition of glaucoma includes the VF
- Perimetry is the #1 way to assess VF
- #1 goal of glaucoma therapy is to preserve VF and ultimately visual acuity (VA)

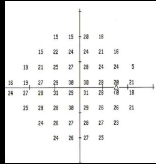
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Zeroing in on Threshold VF's for Glaucoma

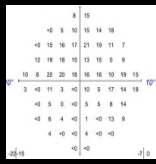
30-2 Test
76 test points, 6° spacing



24-2 Test
54 test points, 6° spacing



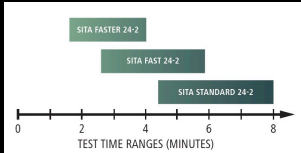

10-2 Test
68 test points, 2° spacing



Heijl, Anders, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Medtec, 2021.

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If Fast is Good, Faster is Better

ReVive 2: Threshold test avg.- 3min 30 sec.

Heijl, Anders, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Medtec, 2021.

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A New SITA Perimetric Threshold Testing Algorithm: Construction and a Multicenter Clinical Study

ANDERS HEIJL, VINCENT ANDREAS PERILLA, LIKHA K. CHONG, AND DWAY CHRISTOPHER LEUNG, ANNE TULLOCH, GARY C. DE THORNS GILGAN, AND PETER REICHGOTTEN

*PURPOSE: To describe a new time-saving threshold visual field-testing strategy—SITA-Faster, which is a modification of the SITA Standard algorithm to a threshold algorithm of the new generation.

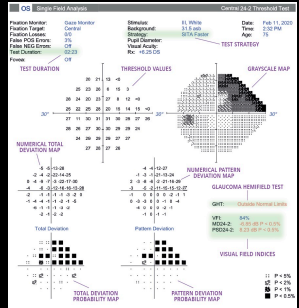
©Published 2020, 09/18/2020, 14:16:55. © 2020. The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

30.4% shorter than SITA Fast
53.5% shorter than SITA Standard



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Analyzing a Threshold VF



1. Fixation losses – poor fixator <30%, or restart
2. False Positives: happy clicker <15% or repeat
3. False Negatives: bored sleeper <20%

Mansfield D (2021, February 15). Breaking Down Visual Fields in Glaucoma. Review of Ophthalmology. Heijl, Anders, et al. The Field Analyzer Primer: Fifth Edition, 5th ed., Carl Zeiss Medtec, 2021.

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Analyzing a Threshold VF

1. Threshold values: measured decibel sensitivity at each point
2. Gray scale: Patient education map. Darker areas equals less sensitivity

Mansfield, D. (2021, February 15). Interpreting Deviant Visual Fields in Glaucoma. *Review of Ophthalmology*. Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

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Analyzing a Threshold VF

1. Total Deviation: deviation from age-matched normal on each test point
2. Pattern Deviation: deviation measured in decibels but removes distractors
3. Probability maps: TD and PSD → plots statistical significance of missed points

Mansfield, D. (2021, February 15). Interpreting Deviant Visual Fields in Glaucoma. *Review of Ophthalmology*. Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

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Analyzing a Threshold VF

1. GHY: compares mirror image clusters of points above and below midline
2. MD-24: weighted average of values in TD plot
3. Visual Field Index (VFI): enhancement of MD with emphasis on central field
4. PSD-24: summarizes VF loss but ignores general depression

Mansfield, D. (2021, February 15). Interpreting Deviant Visual Fields in Glaucoma. *Review of Ophthalmology*. Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

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Common Glaucomatous Visual Field Defects

Paracentral Scotoma/Defect

Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

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Common Glaucomatous Visual Field Defects

Acuate Defect: Bjerrum scotoma

Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

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Common Glaucomatous Visual Field Defects

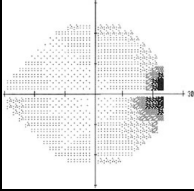
Nasal step defect

Heijl, Anders, et al. *The Field Analyst Primer: Fifth Edition*. 5th ed., Carl Zeiss Medtec, 2021.

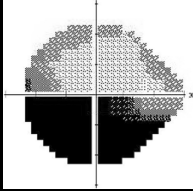
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Less Common 1* Glaucomatous VF Loss

Temporal wedge



Altitudinal defect



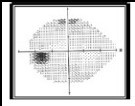
Walt, M., Leo, E., Watson, R., Chang, L., & Turpin, A. (2020, March). Temporal Wedge Defects in Glaucoma: Structure Function Correlations With Threshold Automated Perimetry of the Full Visual Field. *Journal of Glaucoma*, 29(3).

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What Stage of VF Loss?

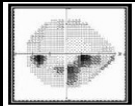
American Glaucoma Society /AAOphthalmology PP Guidelines

Mild



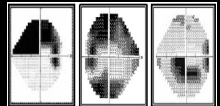
- ONH abnormalities &
- No VF loss
- Screening VF loss Ok

Moderate



- ONH abnormalities &
- GL VF loss 1 hemifield
- No VF loss within 5* fixation

Severe



- ONH abnormalities &
- GL VF both hemifields &/or
- VF loss within 5* fixation

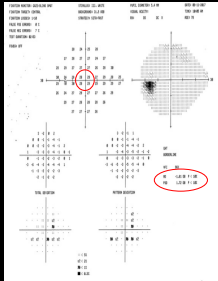
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Hodapp-Parrish-Anderson: Mild

MD < -6dB

PD Plot – less than 14 points are depressed below the 5% significance level and fewer than half of those points are depressed below the 1% level

None of central four points has sensitivity of <15dB



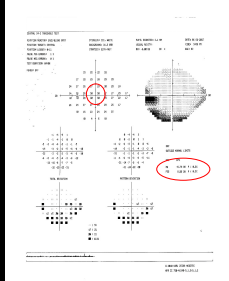
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HPA: Moderate

MD -6dB to -12dB

PD Plot – 14 -28 points are depressed below the 5% significance level or 8-16 points are below the 1% level

One central point measures < 15 dB



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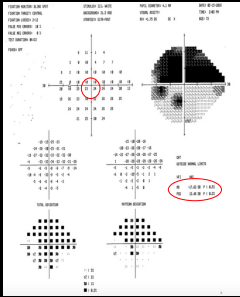
HPA: Severe

MD > -12db

PD Plot – 28 points or more are depressed below the 5% significance level or more than 16 points are below the 1% level

Any one central point at 0 dB


Both Hemifields in central 5 degrees <15dB



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What is VF Progression?

- How many fields are needed?
 - Event based— can detect worsening on 2 fields
 - Trend based— Need minimum 3 tests
- What is the gold standard for VF progression?
 - See picture
 - Negative rate change 1db/year minimum 2 tests/year
 - Rapid progression 2db/year minimum 6tests/year



And, A., & Bakker, D. (2017, December). Detecting Visual Field Progression. *Ophthalmology*, 124(12)

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Manual Progression Analysis

1. MD and PSD quantitative values
2. PSD Plot
3. **Compare to structure**

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Guided Progression Analysis (Zeiss)

1. 3 tests needed to assess
2. Focus on glaucoma shifting from "Is there progression?" to "What is the rate of progression?"

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What's New in Visual Field Testing?

Humphrey Field Analyzer

● 10 NEW TEST POINTS
● ORIGINAL 24-2 TEST PATTERN
▲ BLIND SPOT

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Portable Wearable VR Testing

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Portable Wearable VR Testing

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Portable Wearable VF Testing

$R=0.91, P<0.001$, in normal eyes and
 $R=0.81, P<0.001$, in eyes with glaucoma and other pathologies

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Melbourne Rapid Fields



Clinical Study
Comparison of Perimetric Outcomes from Melbourne Rapid Fields Tablet Perimeter Software and Humphrey Field Analyzer in Glaucoma Patients

Harsh Kumar and Mihina Thilakadas

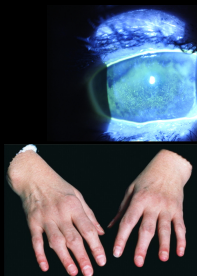
Conclusion: MRF may be questionable for early detection compared to other options.

Kumar, H., & Thilakadas, M. (2021, August 24). Comparison of Perimetric Outcomes from Melbourne Rapid Fields Tablet Perimeter Software and Humphrey Field Analyzer in Glaucoma Patients. *Journal of Ophthalmology*.
 https://doi.org/10.1155/2021/2103193

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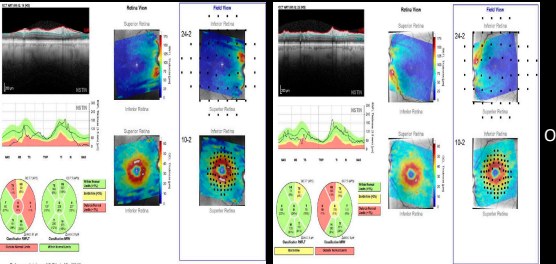
Patient GM- Demographics & Entrance Testing

- New Glaucoma eval
- GAT → 17, Tmax 20
 → 21, Tmax 22
- Meds: Artificial tears, struggles with drops
- PACH → 550
 → 560
- C/D → 0.75v
 → 0.80v
- Gonio: open to CB OU, mild pigment



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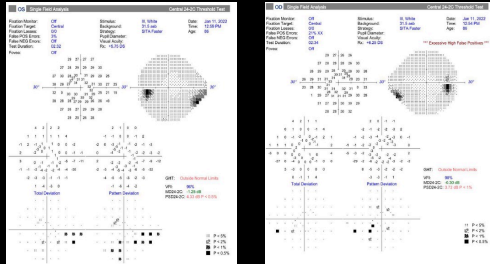
OCT (RNFL/GCC)



OD OS

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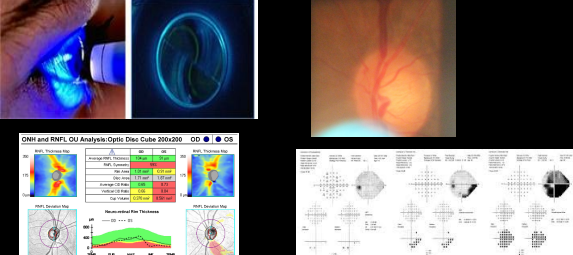
HFA Visual Field



OS OD

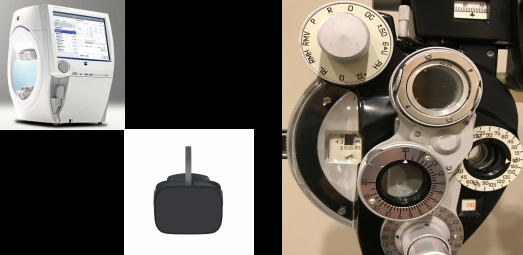
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To manage glaucoma effectively minimum 4 things

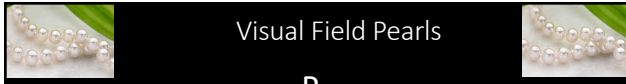


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Which is better, 1 or 2?



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Visual Field Pearls

Perimetry allows function assessment

Neurologic **dE**fects are bilateral

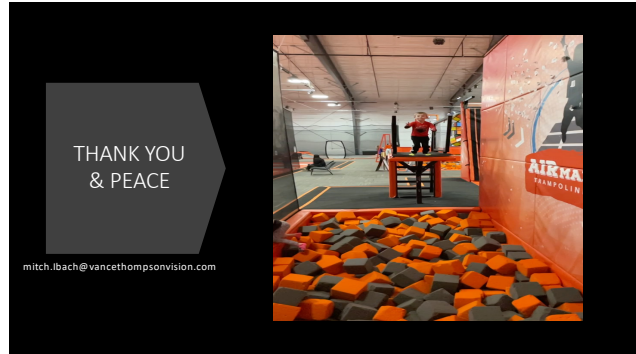
Retinal defects **A**re monocular

match **pE**rimetry to nerve cupping

Wearab**L**e Devices compare well to HFA

Visual field **S** are a must in glaucoma

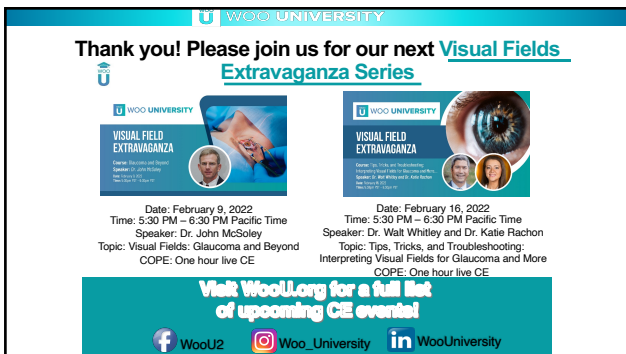
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THANK YOU & PEACE

mitch.libach@vancethompsonvision.com

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Thank you! Please join us for our next Visual Fields Extravaganza Series

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VISUAL FIELD EXTRAVAGANZA

Date: February 9, 2022
Time: 5:30 PM – 6:30 PM Pacific Time
Speaker: Dr. John McSoley
Topic: Visual Fields: Glaucoma and Beyond
COPE: One hour live CE

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VISUAL FIELD EXTRAVAGANZA

Date: February 16, 2022
Time: 5:30 PM – 6:30 PM Pacific Time
Speakers: Dr. Wai Whitley and Dr. Katie Rachon
Topic: Tips, Tricks, and Troubleshooting: Interpreting Visual Fields for Glaucoma and More
COPE: One hour live CE

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