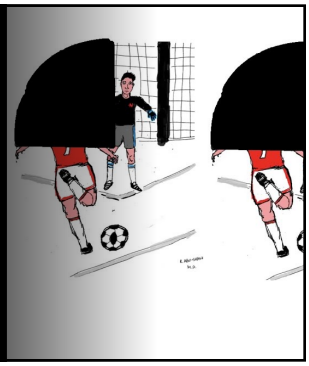
Visual Fields, A Virtual Reality

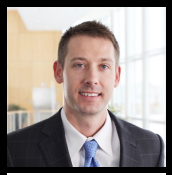
Mitch Ibach, OD FAAO
Vance Thompson Vision
Residency Co-coordinator



1

Financial Disclosures- Ibach

Disclosure Statement:
Aerie - consultant/speaker
Alcon - speaker
Allergan – consultant
Avellino – consultant
Bausch Health -- consultant
Dompe – consultant/speaker
Equinox LLC.– shareholder
Glaukos - consultant/speaker
Heru – consultant/speaker
Kala -- consultant
Ocular Therapeutix – consultant/speaker
Oyster Point – consultant/speaker
Sight Sciences – consultant/speaker
Sun Pharma – speaker



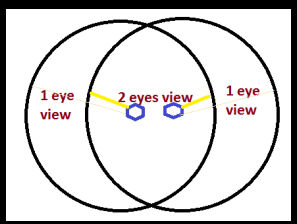
VANCE THOMPSON VISION

All relevant relationships have been mitigated.

2

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

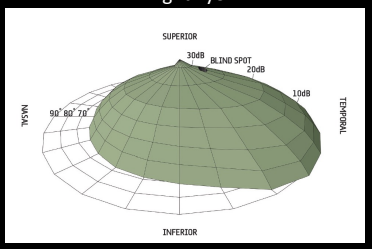
3

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



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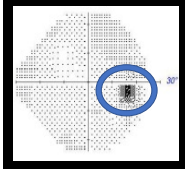
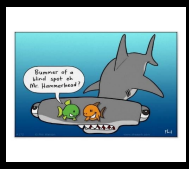
4

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*



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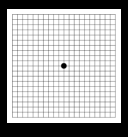
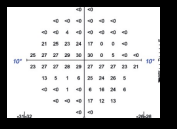
Types of Visual Field

Amsler Grid → Testing macular/GCC function
Central 10*



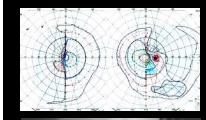
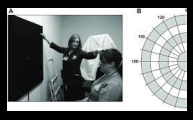
Confrontational VF → Screening test

Perimetry → Automated and manual
Commonly 20*, 48*, 60*



6

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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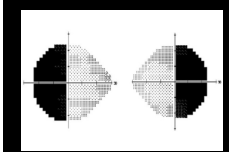
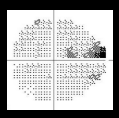
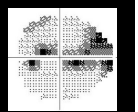
2 Goals of Perimetry

Detect and Diagnose Visual Field Abnormalities

Determine progression of Visual Field Abnormalities

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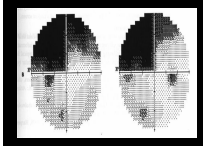
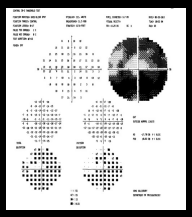
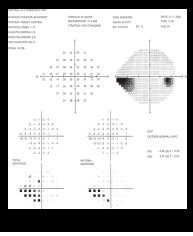
Conditions that may require VF's

Neurologic diseases | **Retinal diseases** | **Glaucoma**

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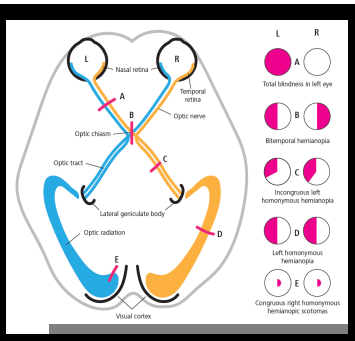
Neurologic - Understanding the Visual Pathway

1. Retina damage can be partial scotomas

2. Optic chiasm and posterior = bilateral VF loss (B)

3. More posterior damage = more congruent (matching) defects



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

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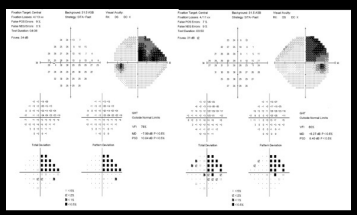
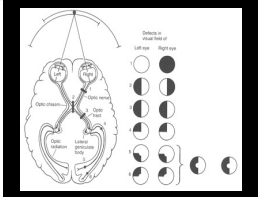
Where is the Cut/damage?

https://casebasedneuroophthalmology.pressbooks.com/chapter/superior-homonymous-hemianopia/

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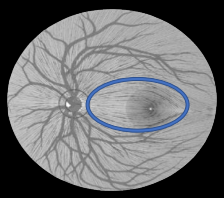
Retina VF Loss

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



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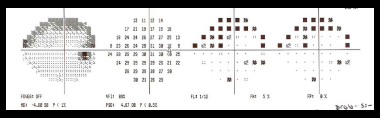
Glaucoma VF Loss



- 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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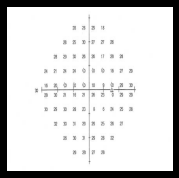
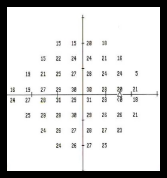
Zeroing in on Threshold VF's for Glaucoma

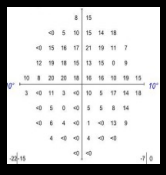
30-2 Test
76 test points, 6* spacing



24-2 Test
54 test points, 6* spacing



10-2 Test
68 test points, 2* spacing



Heil. Anders. et al. *The Field Analyzer Primer: Fifth Edition*. 5th ed.. Carl Zeiss Meditec. 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 Meditec. 2021.

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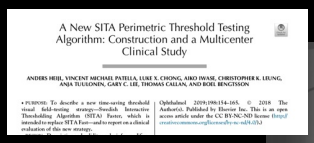

A New SITA Perimetric Threshold Testing Algorithm: Construction and a Multicenter Clinical Study

ANDERS HEIJL, VINCENT MICHAEL PATELLA, LUKE X. CHONG, AIKO IWASE, CHRISTOPHER K. LEUNG, ANJA TUULONEN, GARY C. LEE, THOMAS CALLAN, AND BORIL BENGTSSON

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

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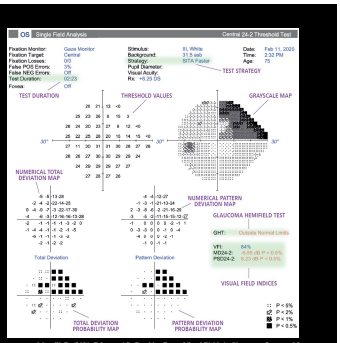
Analyzing a Threshold VF



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

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

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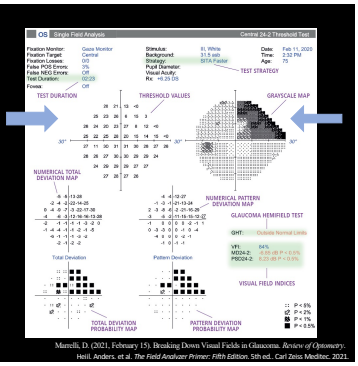
Analyzing a Threshold VF

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



Mamelli, D. (2021, February 15). Breaking Down Visual Fields in Glaucoma. *Review of Optometry*.
Heil. Anders. et al. *The Field Analyzer Primer: Fifth Edition*. 5th ed. Carl Zeiss Meditec. 2021.

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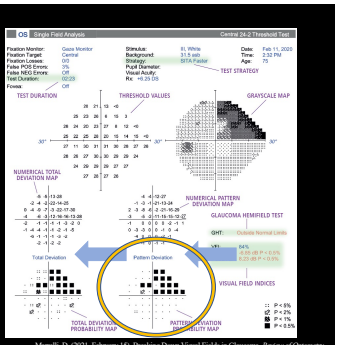
Analyzing a Threshold VF

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



Mamelli, D. (2021, February 15). Breaking Down Visual Fields in Glaucoma. *Review of Optometry*.
Heil. Anders. et al. *The Field Analyzer Primer: Fifth Edition*. 5th ed. Carl Zeiss Meditec. 2021.

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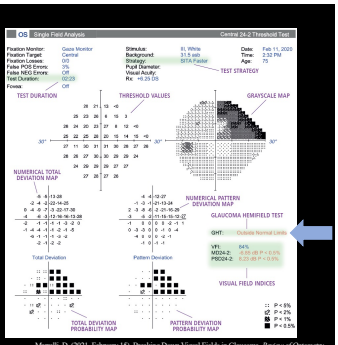
Analyzing a Threshold VF

1. GHT: 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



Mamelli, D. (2021, February 15). Breaking Down Visual Fields in Glaucoma. *Review of Optometry*.
Heil. Anders. et al. *The Field Analyzer Primer: Fifth Edition*. 5th ed. Carl Zeiss Meditec. 2021.

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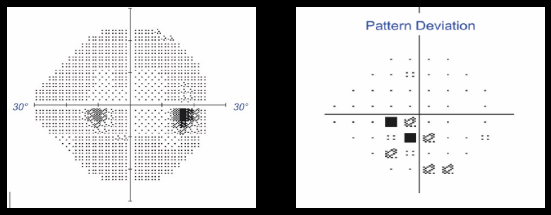
Common Glaucomatous Visual Field Defects

Paracentral Scotoma/Defect



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

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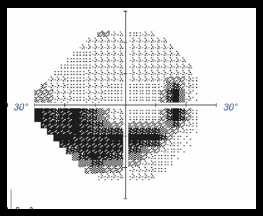
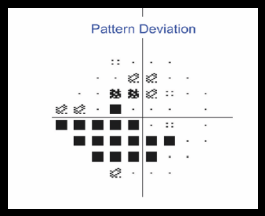
Common Glaucomatous Visual Field Defects

Arcuate Defect: Bjerrum scotoma





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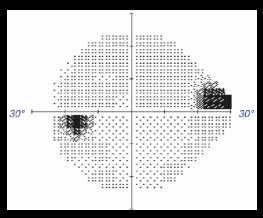
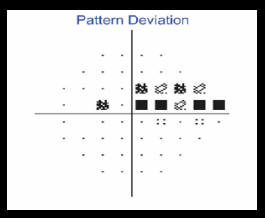
Common Glaucomatous Visual Field Defects

Nasal step defect





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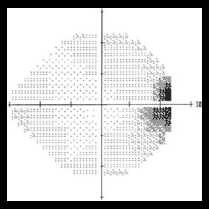
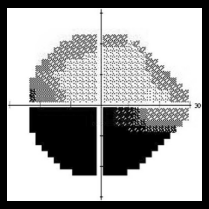
Less Common 1* Glaucomatous VF Loss

Temporal wedge



Altitudinal defect



Wall, M., Lee, E., Wanzek, R., Chong, L., & Turpin, A. (2020, March). Temporal Wedge Defects in Glaucoma: Structure/Function Correlation With Threshold Automated Perimetry of the Full Visual Field. *Journal of Glaucoma*, *29*(3).

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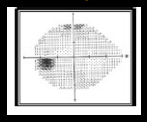
What Stage of VF Loss?

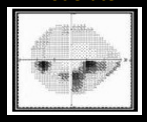
American Glaucoma Society /AAOphthalmology PP Guidelines

Mild



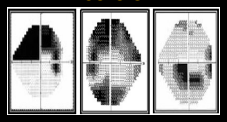
- ONH abnormalities
  &
- No VF loss
- Screening VF loss Ok

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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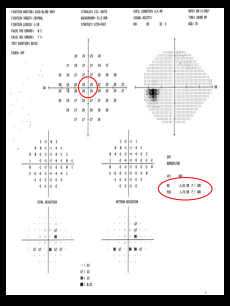
Hoddapp-Parrish-Anderson: Mild

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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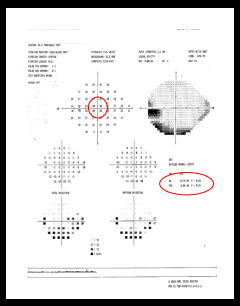
HPA: Moderate

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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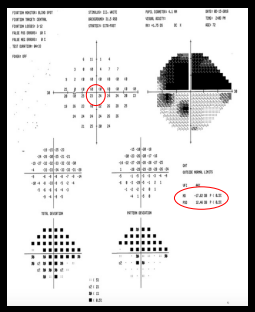
HPA: Severe

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

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

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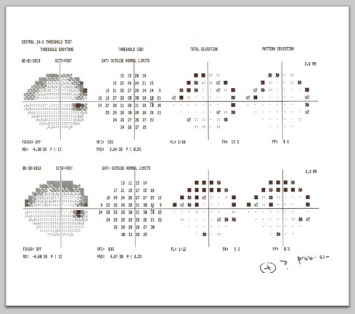
Manual Progression Analysis

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



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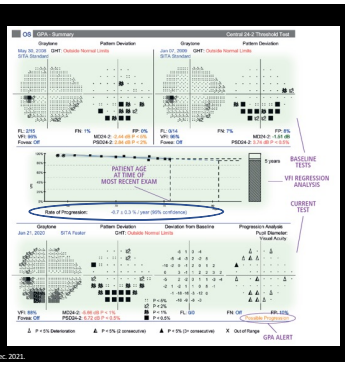
Guided Progression Analysis (Zeiss)

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



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

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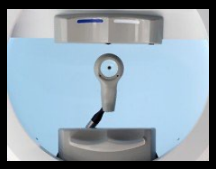
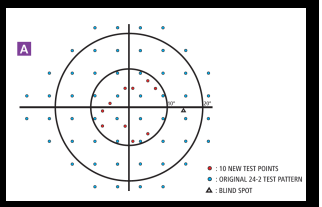
What's New in Visual Field Testing?

Humphrey Field Analyzer





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

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Current Potential Problems	Virtual VF Solutions
• Bottleneck to clinic flow	• Improved efficiency with multiple devices
• Declining reimbursements	• Allows for potential home testing and telehealth
• Requires dedicated room & lighting	• No dedicated room/space needed
• Reduced patient comfort, positioning	• Automated tests, easier on patient positioning

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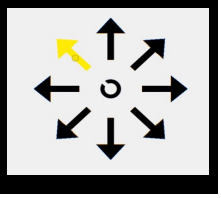
Olleyes VisuALL VR VF

- VisuALL S
  - In Office
  - 24-2/10-2/Suprathreshold
- VisuALL H
  - Home model
- VisuALL Acuity
  - Landolt C



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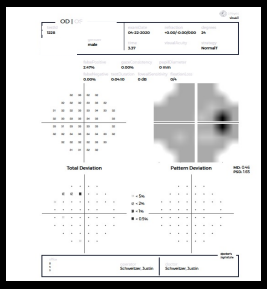
Portable Wearable VR Testing



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Heru Portable VR VF

re:I Threshold Algorithm

Adapts and predicts an optimized full-threshold testing workflow in a shorter testing time without compromising clinical performance.

Autoflow™

Autoflows from a screening test to a threshold test

ActiveTrack™

Real-time gaze tracking confirms the patient's fixation is always appropriate, improving data quality and lessening repeat testing

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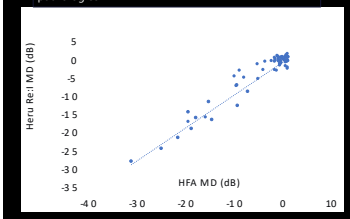
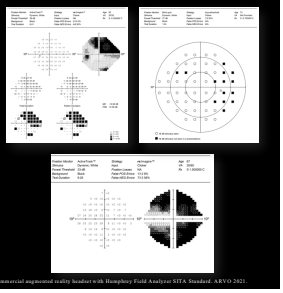
Portable Wearable VF Testing

R=0.91, P<0.001, in normal eyes and

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





Kashem et al. Comparison of Heru Visual field as a cloud based artificial intelligence-powered software application downloadable on commercial augmented reality headset with Humphrey Field Analyzer SITA Standard. ARVO 2021.

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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 Mithun Thulasidas

Glaucoma Service, Centre for Sight, B-32A, Safdarjung Enclave, New Delhi 110029, India

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

Kumar, H., & Thulasidas, M. (2020, August 24). Comparison of Perimetric Outcomes from Melbourne Rapid Fields Tablet Perimeter Software and Humphrey Field Analyzer in Glaucoma Patients. *Journal of Ophthalmology*.

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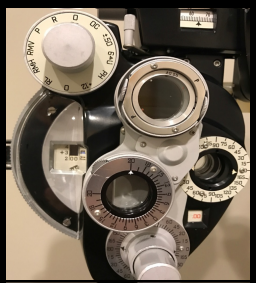
Which is better, 1 or 2?



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Visual Field Pearls

Perimetry allows function assessment

Neurologic d**E**fects are bilateral

Retinal defects **A**re monocular

match pe**R**imetry 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

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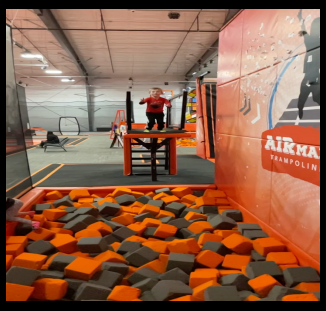

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On behalf of Vision Expo, we sincerely thank you for being with us this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Conference Advisory Board considers content and speakers for future meetings to provide you with the best education possible.

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