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 Education Planning Committee considers content and speakers for future meetings to provide you with the best education possible.

vision expo

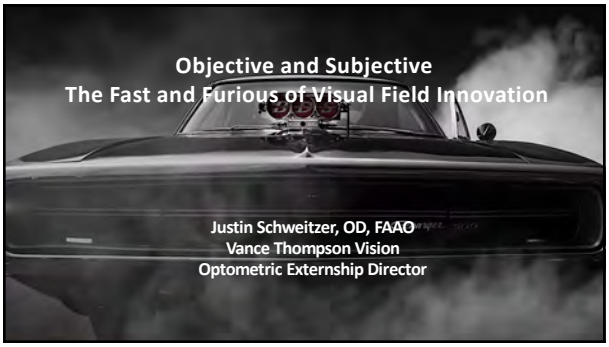
1

Financial Disclosure – Justin Schweitzer, OD, FAAO

- Alcon – C/L
- Aldeyra - C
- Allergan – C/L
- Bausch + Lomb – C/L
- Bruder - C
- Sight Sciences – C/L
- Dompe – C/L
- Zeiss – C/L
- Visus - C
- Science Based Health – C
- Tarsus – C/L
- Santen - C
- Sun – C/L
- Reichert - C
- Glaukos – C/L
- MediPrint – C
- LKC – C/L
- Avellino – C
- Iveric bio – C
- Ocuphire – C
- Viatris – C
- Thea – C
- Heru – C
- Eyenovia - C

All relevant relationships have been mitigated

2

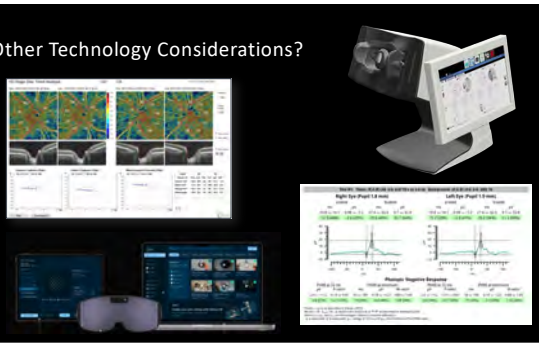


3

Visual Field Testing remains the gold standard of care for diagnosing and monitoring glaucoma, as it is the most RELIABLE way to measure visual function and track progression of the disease.

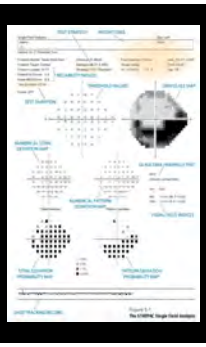
4

Other Technology Considerations?



5

Visual Field Cram Session



Amrit Bilkhu, OD (2021, Jun 3). *An Optometrist's Refresher on Visual Field Indices*. Eyes On Eyecare.https://eyesoneyecare.com/resources/an-optometrists-refresher-on-visual-field-indices/

6

Key Points To Interpretation

Data needs to be Trustworthy

3-4 tests to achieve baseline
6 VFT's in first 2 years

Does it make sense with other findings?

7

Field Reliability

Fixation Losses
Less than 15-20%

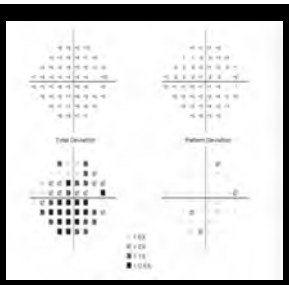
False Positives or "trigger happy"
10—15% = Unreliable

False Negative or "zoning out"
10-15% = Unreliable

8

Graphs and Plots

Grey Scale



Total Deviation Plot Pattern Deviation Plot

9

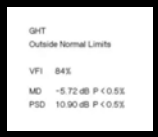
Global Indices

Glaucoma Hemifield Test (GHT)
- ONL or Borderline indicates field loss that resembles glaucomatous defects.

Visual Field Index (VFI)
- Total amount of field loss in a percentage.

Mean Deviation (MD)
- Total amount of field loss in decibels.
- Is impacted by media opacities

Pattern Standard Deviation (PSD)
- Localized field loss



10

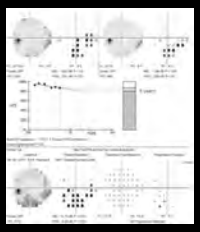
Guided Progression Analysis

Need 3 consecutive VFT's

Plotting the VFI

> or = -1.5 raises a red flag

Beware of subtle localized defects



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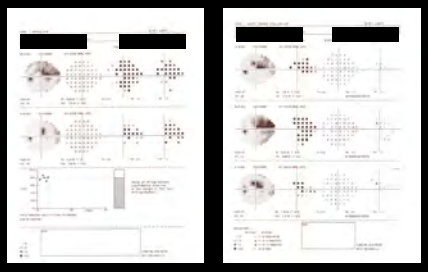
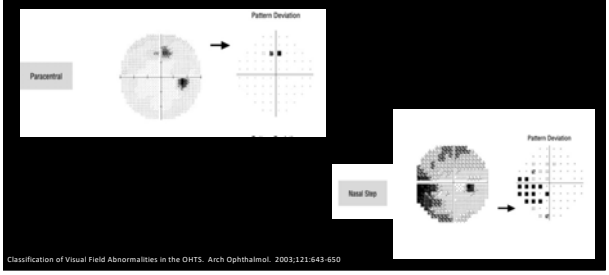


12

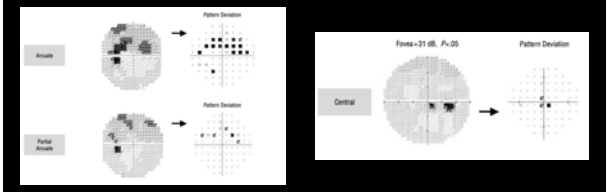
Common Visual Field Defects Associated WITH Glaucoma



Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

13

Common Visual Field Defects Associated WITH Glaucoma



Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

14

Common Visual Field Defects Associated WITH Glaucoma

Glaucoma → Partial Arcuate (Arcuate)

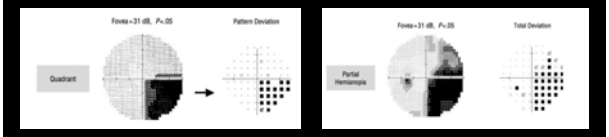
Paracentral (central)

Nasal Steps

Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

15

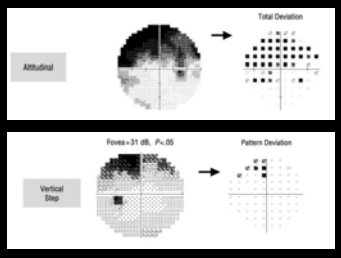
Common Visual Field Defects That Should Raise a Red Flag



Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

16

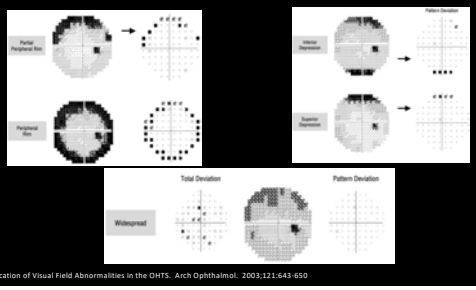
Common Visual Field Defects That Should Raise a Red Flag



Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

17

Common Visual Field Defects That Indicate Artifacts



Classification of Visual Field Abnormalities in the OHTS. Arch Ophthalmol. 2003;121:643-650

18

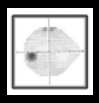
Staging Systems for Glaucoma

- Hodapp-Parrish-Anderson
- American Glaucoma Society (AGS)/AAO
- Advanced Glaucoma Intervention Study (AGIS) System
- Glaucoma Staging System (GSS)
- Systematic Classification of Humphrey Visual Fields-Easy Interpretation and Evaluation (SCHEIE)

19

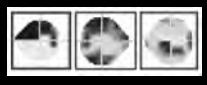
AGS/AAO Staging

Mild or Early Stage Glaucoma
- Optic nerve abnormalities consistent with glaucoma
- but NO visual field abnormalities on any visual field test.



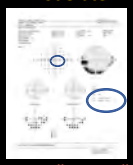
Moderate Stage Glaucoma
- Optic nerve abnormalities consistent with glaucoma
- AND glaucomatous visual field abnormalities in ONE hemifield and
- NOT within 5 degrees of fixation

Advanced, Late, Severe Stage
- Optic nerve abnormalities consistent with glaucoma
- AND glaucomatous visual field abnormalities in BOTH hemifields
- AND/OR loss within 5 degrees of fixation in at least one hemifield



20

Hoddap – Parrish - Anderson

Mild	Moderate	Severe
		
1. MD <-6db	1. MD -6db to -12db	1. MD > -12db
2. <25% depressed below 5% & <10 pts depressed below 1% PSD	2. <50% depressed below 5% & <20 pts depressed below 1% PSD	2. >50% depressed below 5% or >20 pts depressed below 1% PSD
3. Central 4 pts. all > 15db	3. 1 Central pt. < 15db	3. Both hemifields 1 pt < 15db

21

Glaucoma Staging System (GSS)

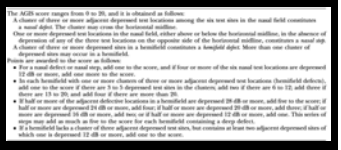
Stage	Humphrey MD Score	Probability Plot/Pattern Deviation		dB Plot (Stages 2–4) or CPSD/PSD (Stage 1)		dB Plot (Stages 2–4) or Hemifield Test (Stage 1)
Stage 0 – Ocular hypertension/earliest glaucoma	>0.00			Does not meet any criteria for Stage 1.		
Stage 1 – Early glaucoma	−0.01 to −5.00 ($P < .05$)	Points below 5%: >3 contiguous AND >1 of the points below 1%		CPSD/PSD significant at $P < .05$		Glaucoma hemifield test "outside normal limits"
Stage 2 – Moderate glaucoma	−5.01 to −12.00	Points below 5%: 19–36 AND Points below 1%: 12–18	OR	Point(s) within the central 5° with sensitivity of <15 dB: >1 AND point(s) within the central 5° with sensitivity of <0 dB: None (0)	OR	Point(s) with sensitivity <15 dB within 5° of fixation: Only 1 hemifield (1 or 2)
Stage 3 – Advanced glaucoma	−12.01 to −20.00	Points below 5%: 37–55 AND Points below 1%: 19–36		Point(s) within the central 5° with sensitivity of <0 dB: 1 only		Point(s) with sensitivity <15 dB within 5° of fixation: Both hemifields, at least 1 in each
Stage 4 – Severe glaucoma	−20.01 or worse	Points below 5%: 56–74 AND Points below 1%: 37–74		Point(s) within the central 5° with sensitivity of <0 dB: 2–4		Point(s) with sensitivity <15 dB within 5° of fixation: Both hemifields, 2 in each (ALL)
Stage 5 – End-stage glaucoma/blind	No HVF in "worst eye"	HVF not possible attributable to central scotoma in "worst eye" OR "worst eye" acuity of 20/200 or worse attributable to glaucoma. "Best eye" may fall into any of above stages.				

Mills RP, Budenz DL, Lee PP, Noecker RJ, Walt JG, Siegartel LR, Evans SJ, Doyle JJ. Categorizing the stage of glaucoma from pre-diagnosis to end-stage disease. Am J Ophthalmol. 2006 Jan;141(1):24-30. doi: 10.1016/j.ajo.2005.07.044. PMID: 16386972.

22

AGIS Scoring Method

- Not ideal for clinical application
- Divided into 5 stages
  - 0 = normal VF
  - 1-5 = mild damage
  - 6-11 = moderate damage
  - 12-17 = severe damage
  - 18-20 = end stage



The AGIS score ranges from 0 to 20, and it is obtained as follows:
A cluster of three or more adjacent depressed test locations among the six test sites in the nasal field constitutes a nasal defect. The cluster may cross the horizontal midline.
One or more depressed test locations in the nasal field, either above or below the horizontal midline, in the absence of depression of any of the three test locations on the opposite side of the horizontal midline, constitutes a nasal step.
A cluster of three or more depressed sites in a hemifield constitutes a hemifield defect. More than one cluster of depressed sites may occur in a hemifield.
Points are awarded to the score as follows:
- For a nasal defect or nasal step, add one to the score, and if four or more of the six nasal test locations are depressed 12 dB or more, add one more to the score.
- In each hemifield with one or more clusters of three or more adjacent depressed test locations (hemifield defect), add two to the score if there are 5 to 10 depressed sites in the clusters, add two if there are 6 to 12, add three if there are 13 to 20, and add four if there are more than 20.
- If half or more of the adjacent defective locations in a hemifield are depressed 18 dB or more, add five to the score; if half or more are depressed 24 dB or more, add four; if half or more are depressed 30 dB or more, add three; if half or more are depressed 36 dB or more, add two; or if half or more are depressed 12 dB or more, add one. This series of steps may add as much as five to the score for each hemifield containing a deep defect.
- If a hemifield lacks a cluster of three adjacent depressed test sites, but contains at least two adjacent depressed sites of which one is depressed 12 dB or more, add one to the score.

Brusini, Paolo & Johnson, Chris. (2007). Staging Functional Damage in Glaucoma: Review of Different Classification Methods. Survey of ophthalmology. 52. 156-79. 10.1016/j.survophthal.2006.12.008

23

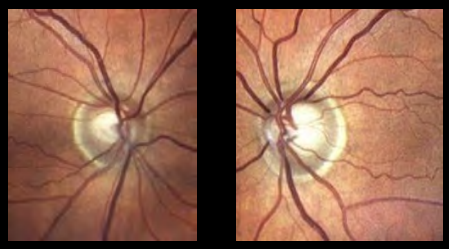
Case

- **57-year-old Caucasian male**
- **Referred for GLC Eval**
- **Medical History:** HTN, Hyperlidpidema
- **BCVA**: 20/20 -1 OU
- TMAX: 27 mmHG OU
- Medications: None

- **IOP**: 26 mm Hg OD; 27 mm Hg OS
- **C/D**: 0.60/0.60 OD 0.70/0.70 OS
- **Pachymetry**: 553 OD; 543 OS
- **Corneal hysteresis**: 8.0 OD 7.4 OS
- **Gonioscopy**: Open to CB OU w/ trace pigment in TM
- SLE: Unremarkable
- **VF's** – See next slide(s)
- **OCT's** – See next slide(s)
- ONH – See next slide(s)

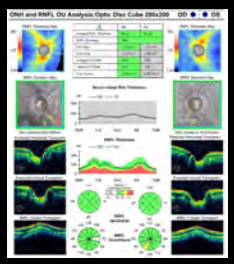
24

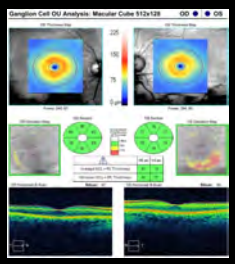
ONH's



25

OCT





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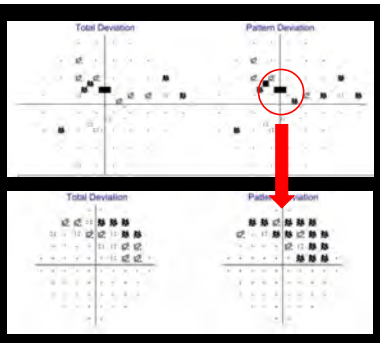
OS VFT's

24-2

10-2



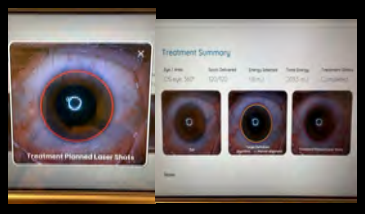
27

Treatment Considerations

- Monitor
- Glaucoma Drops
- SLT
- Drug Delivery
- Surgical Intervention

28

Case Summary:



IOP @ 6 weeks: 16 mm Hg OD; 15 mm Hg OS

29

The Case for 10-2's

Early Central Defects are Common

- 50% of mild to moderate GLC have defects within central 3 degrees[1]
- 16% of patients have central defect when using 24-2 alone[2]
- 9% classified as normal on 30-2 with damage on 10-2[3]
- 13% of the time 30-2 underestimates level of glaucoma[3]
- 24-2 testing found to be normal[4]
  - 10-2 defects found in:
    - 35% of OHTN
    - 39% of glaucoma suspects
    - 61% of early glaucoma

1. Schiefer U, Papageorgiou E, Sample PA, et al. Spatial pattern of glaucomatous visual field loss obtained with regionally condensed stimulus arrangements. Invest Ophthalmol Vis Sci. 2010;51(11):5685-9.
2. Traynis I, de Moraes CG, Raza AS, et al. Prevalence and nature of early glaucomatous defects in the central 10 degrees of the visual field. JAMA Ophthalmol. 2014;132(2):291-97.
3. Langerhorst C, Carenini L, Bakker D, et al. Measurements for description of very early glaucomatous field defects. In: Wall M, Heijl A, eds. Perimetry Update 1996/1997. New York, NY: Kugler Publications;1997:67-72
4. de Moraes C, Hood D, Liebmann J, et al. 24-2 visual fields miss central defects shown on 10-2 tests in glaucoma suspects, ocular hypertensives, and early glaucoma. Ophthalmology. May 24, 2017.

30

The Case for 10-2's

When to Run the Test?

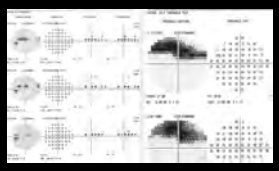
1. Any depressed points in the central 12 degrees on the 24-2 or 30-2
2. A Paracentral defect is present on 24-2
3. Any abnormal points in the central 12 points on 24-2 that correlates with thinning on GCIPL
4. GCL –IPL abnormality

Park H, Hwang B, Shin H, et al. Clinical clues to predict the presence of parafoveal scotoma on humphrey 10-2 visual field using a humphrey 24-2 visual field. Am J Ophthalmol. 2016 Jan;161:150-9.

31

Baseline 10-2 Visual Field Loss as a Predictor for Future Glaucoma Progression

Studied 394 Eyes of 202 Subjects (119 POAG and 83 Glaucoma Suspects) over 6.7 Years



22 x greater risk of developing future VF loss event if you had 10-2 defect

32

Alternative Visual Field Tests

34

PROS	CONS
1. **Improved patient comfort**. 2. **Increased accessibility.** 3. **Real-time data and analytics.** 4. **Customized testing**. 5. **Patient engagement**.	1. **Not Well Studied in Comparison** 2. **Questionable underestimation in advanced disease.**

35

Virtual Reality–Based and Conventional Visual Field Examination Comparison in Healthy and Glaucoma Patients

"VR System slightly underestimated VF defects in glaucoma patients"

Assessment of Remote Training, At-Home Testing, and Test-Retest Variability of a Novel Test for Clustered Virtual Reality Perimetry

Stapelfeldt J, Kucur SS, Huber N, Höhn R, Sznitman R. Virtual Reality-Based and Conventional Visual Field Examination Comparison in Healthy and Glaucoma Patients. Transl Vis Sci Technol. 2021 Oct 4;10(12):10. doi: 10.1167/tvst.10.12.10. PMID: 34614166; PMCID: PMC8496417.

Chia ZK, Kong AW, Turner ML, Salfee M, Damato BE, Backus BT, Blaha JJ, Schuman JS, Deiner MS, Ou Y. Assessment of Remote Training, At-Home Testing, and Test-Retest Variability of a Novel Test for Clustered Virtual Reality Perimetry. Ophthalmol Glaucoma. 2023 Aug 22:S2589-4196(23)00160-6. doi: 10.1016/j.ogla.2023.08.006.

36

Validation of a Wearable Virtual Reality Perimeter for Glaucoma Staging, The NOVA Trial: Novel Virtual Reality Field Assessment

Statistically noninferior to HFA when staging glaucoma using Medicare definitions

Limitations: Monitoring advanced glaucoma

Bradley C, Ahmed IIK, Samuelson TW, Chaglasian M, Barnebey H, Radcliffe N, Bacharach J. Validation of a Wearable Virtual Reality Perimeter for Glaucoma Staging, The NOVA Trial: Novel Virtual Reality Field Assessment. Transl Vis Sci Technol. 2024 Mar 1;13(3):10. doi: 10.1167/tvst.13.3.10. PMID: 38488433; PMCID: PMC10946691.

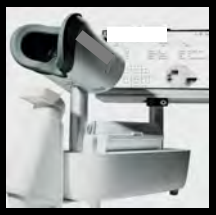
37

Subjective/Binocular Visual Field Testing

39% faster than SAP in clinical testing and functions in ambient light.[1]

Equivalent to SAP with repeatability.[1]

Random binocular testing



1. Comparison between New Perimetry Device (IMOvifa®) and Humphrey Field Analyzer" M Eslani, T Nishida, S Moghimi, JM Arias, C Vasile, V Mohammadzadeh, RN Weinreb; Invest. Ophthalmol. Vis. Sci. 2022;63(7):1272 – A0412.

38

Objective Visual Field Testing

FDA 510(K) Cleared
Tests OU simultaneously in 7 minutes
Measures the response of the pupils to a stimulus

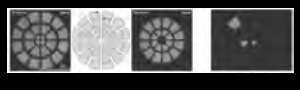
39

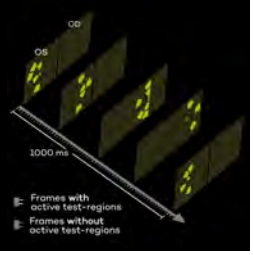
Multi-Focal Pupillographic Objective Perimetry (mfPOP) - like Multi-Focal ERG/VEP, but without electrodes

Statistically independent clusters of visual stimuli are presented concurrently and bilaterally at multiple locations in the subject's visual field.

The resulting set of pupillary responses evoked by each of the visual stimuli provides a map of visual field function across the visual field of one or both eyes.

The appearance or non-appearance of stimuli, and their intensity, color and spatial frequency are controlled by statistically independent sequences.





40

Advantages of objective perimetry

- Nothing to learn for the patient
- One *bilateral* test
- Less susceptible to refractive error and media opacity
- Easy to take
- Learning effect - results can improve with experience
- Two monocular tests
- Susceptible to refractive error and media opacity
- More susceptible to anxiety, frustration, fatigue - "I just guess"

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Advantages of objective perimetry

- No patient response required
- Patients just need to look straight ahead and not fall asleep
- Dark room *not* required
- *Predictable* Exam time
  - ~7 minutes, for *both eyes* (30-2 & 24-2 together!) OR
  - ~90 seconds, for *both* eyes
- If analysis improves can refresh reports
- Patients must click a button
- Reliant upon the patient's ability, dexterity, cooperation
- Dark room required
- *Variable* exam time (24-2)
  - 3 to >7 mins *per eye (longer for some patients)*
- No, SAP discards raw data

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Considerations when using OFA

- No dilation
- Use artificial tears when needed
- *One* functioning pupil is required to obtain a visual field for *both* eyes
- Any drug that effects pupil responses (a lot) is contraindicated
- Testing environment should be quiet and free of distractions
- Operating the device is easy, but patients should be observed closely for the duration of the test (as in SAP)

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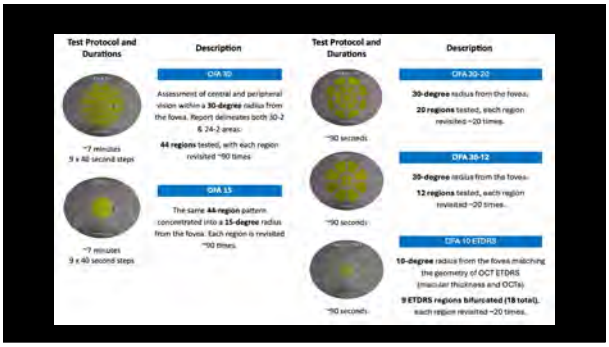
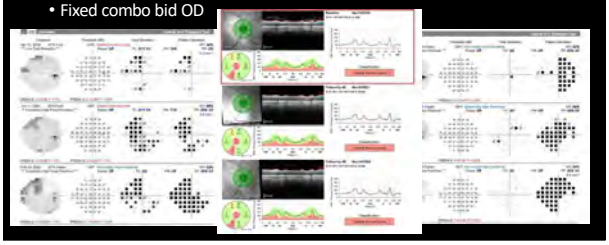


44

69 YO Male Glaucoma Patient

- Visual field reliability has been poor for many, many years.
- IOP – Mid teens, down from a TMAX of 24 mm HG
- Fixed combo bid OD



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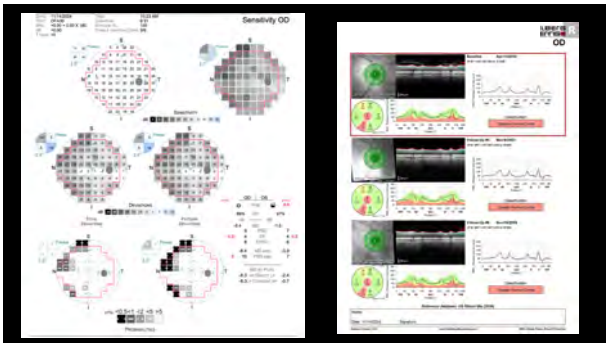

48

62 YO Female Glaucoma NTG Patient

- PEHX: Moderate OAG, Cataract Extraction 08/24 + MIGS OU.
- Meds: Latanoprostene bunod qd OU
- TMAX IOP: 19 mm HG OU
- IOP consistently mid to low teens
- Questioned if SAP VFT was getting worse OD slowly over time and OCT's are not reliable due to ONH anatomy.

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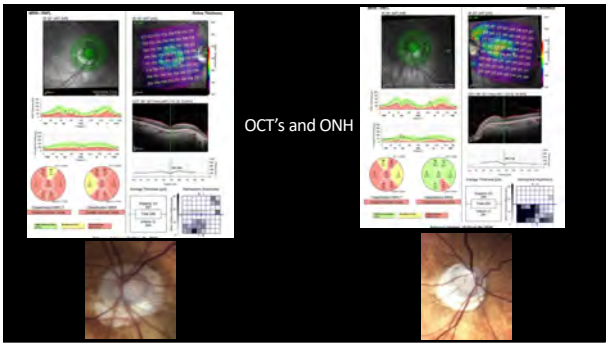

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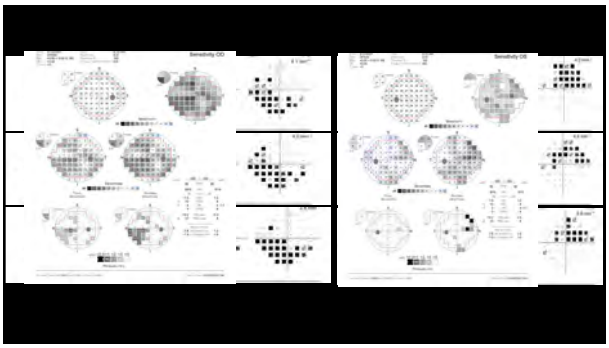

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78 YO Female Glaucoma Patient

- PEHX: Moderate POAG, currently undergoing injections for BRVO macular edema OD
- Meds: Dorzolamide/timolol bid OU, latanoprost/netarsudil qd OU
- TMAX IOP: 23 mm HG OU
- Previous SLT in 2021
- IOP (in office x 3 visits): OD – 14, 14, 14 mmHG OS – 11, 12, 13 mmHG
- My main concern: IOP is low, VFT's are not accurate, and OCT shows progression over time. Can we match structure and function.

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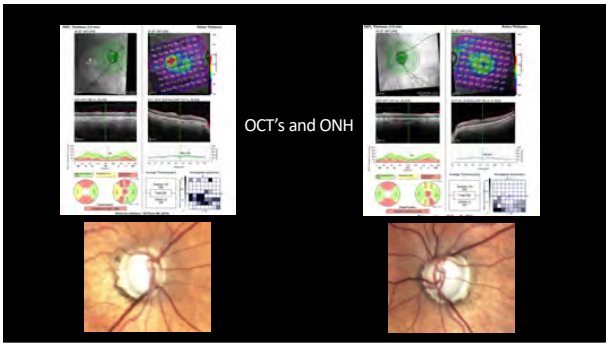

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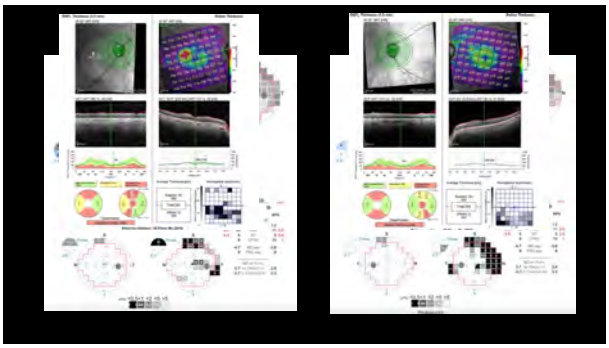

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Conclusions

VFT Testing Remains the Gold Standard for Function
Reliability is Key and Run Multiple Tests Early in the Disease Process
Value the 10-2 (SAP and Objective Visual Field Testing)
Alternative VFT Options Serve as Great Adjunctive Options

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