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Bring the Love Back to the Visual Field

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Mackinac Island Northern Escape
Optometric Education Consultants

Sunday, August 20, 2023

Disclosures- Greg Caldwell, OD, FAAO

All relevant relationships have been mitigated

- The content of this activity was prepared independently by me - Dr. Caldwell
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  - Disclosure: Receive speaker honorariums
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- I have no direct financial or proprietary interest in any companies, products or services mentioned in this presentation
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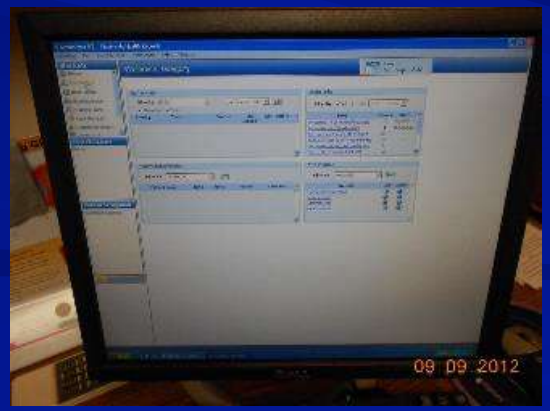
Optometric Education Consultants

Financial Obligations

My Practice

I am a clinician first then a scientist

- Some are scientists first then clinician
- I need to simplify for patient and patient care.
- Science is great, but not good if there isn't a clinical application.
- Some lectures are science based without clinical application.
- My lecture will be a hybrid. Showing clinical applications of the science



It is wonderful to have someone who's juggling so many aspects of optometry [scientific, clinical experience, teacher & lecturer]. It is refreshing and very informative. -Sarah

Question

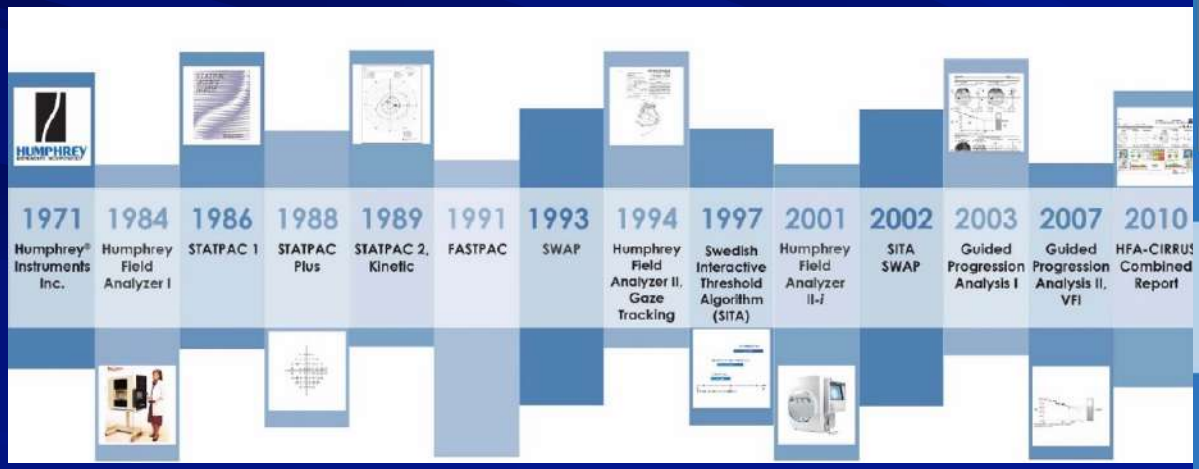
- With advanced imagining and modern electrophysiology
  - OCT imagining
    - Nerve Fiber Layer
    - Ganglion Cell Complex
  - OCT-Angiograpghy
    - ONH – Radial Peripapillary Capillaries
    - Retina – Capillary density around the macula
  - Diopsys – electrophysiology
    - Electroretinography (ERG)
      - Pattern, flicker, and multifocal ERG
    - Visual evoked potential (VEP)
- Do we really need to be doing Visual Fields
  - Especially in glaucoma?

Visual Fields - Perimetry

- The future is exciting
- Should be done on every glaucoma patient
- Be careful relying on structure and function agreement with current technology
  - Agreement is low
  - Discordance is high
- Let's now bring some love back to the visual field

Humphrey Field

Humphrey Field Analyzer 3 Continuous Innovation



2015

Humphrey Field Analyzer 3

- *Liquid Trial Lens™*
- *RelEYE™*
- *SmartTouch™*

With the best of over 30 years of standard-setting technologies:

- STATPAC
- SITA
- Gaze Tracking
- GPA
- VFI

2017

SITA Faster

Mixed SITA GPA

With the best of over 45 years of Standard-setting Technologies:

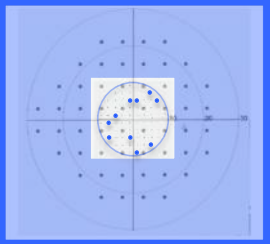
-STATPAC

-SITA

-Gaze tracking

-GPA

-VFI



2018

24-2C

Synchronize & Review

With the best of over 45 years of Standard-setting Technologies:

-STATPAC

-SITA

-Gaze tracking

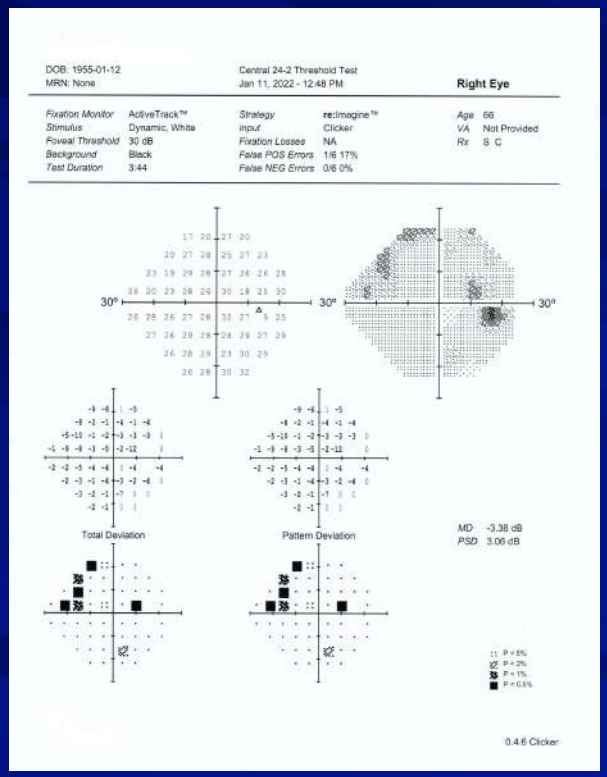
-GPA

-VFI

Latest HFA3 Innovation

New Features, HFA3 v. 1.5	Description
SITA Faster 24-2	• 24-2 tests in about 2 minutes or less
SITA Faster 24-2C	• More information in the central visual field than 24-2
Mixed SITA GPA	• Use complete patient test history for GPA reports
Data Synchronization	• Synchronize patient tests in a network of multiple HFA3 units
Review Software	• View and analyze HFA reports in exam lanes
Automated Patient Alignment	• Automated pupil and lens finding centers patient's eye to the lens

Wearable Visual Fields

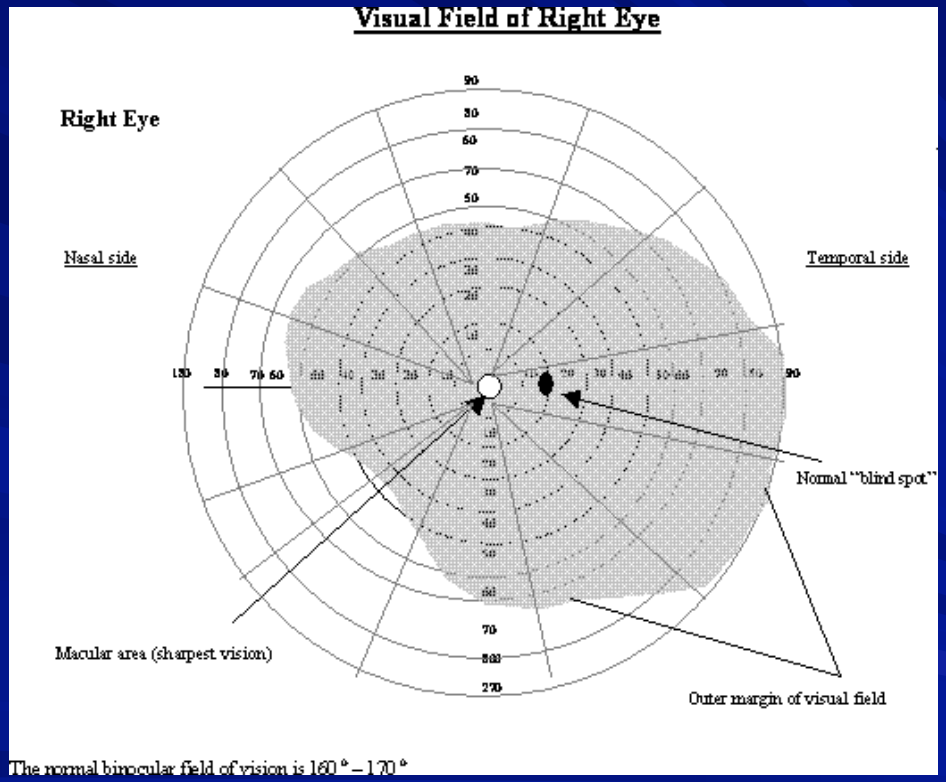


Old School is
Impactful and Useful

Normal Visual Field Parameters

- 60° superior
- 60° nasal
- 75° inferior
- 100° temporal

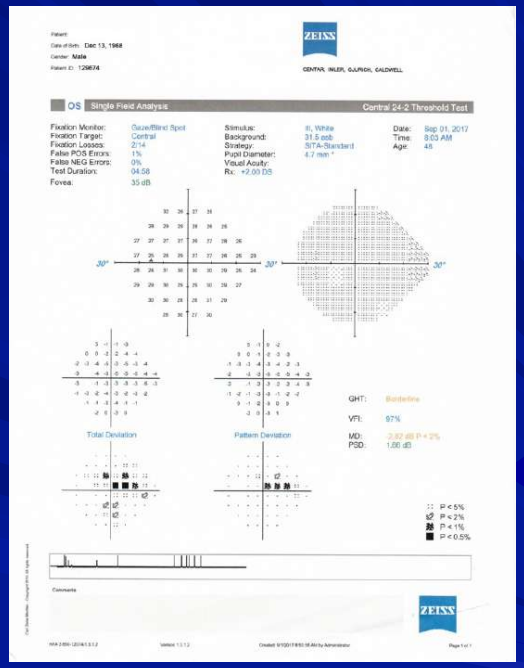
- Macula the central 13°
- Fovea the central 3°



- Visual field is limited by the size of the retina and margins of the orbit

Pearls on Static Visual Fields

- Most visual fields test 0-51 decibels
  - 41-51 decibels is outside human vision
- 1 diopter of refractive blur in undilated patient
  - A little more than 1 decibel of depression of the hill of vision
    - With Goldmann III stimulus
- Leave cylindrical errors of less than 2 diopters uncorrected
  - Adjusted with spherical equivalent
  - Above 2 diopters correct the astigmatism with trial lens
- Background of a visual field illuminated (31.5 apostilbs)
  - Minimum brightness for photopic or daylight
  - Cones are isolated, test photopic system
    - More on contrast, less on absolute brightness
  - Changes in pupil size, crystalline lens color and transparency have less effect on result

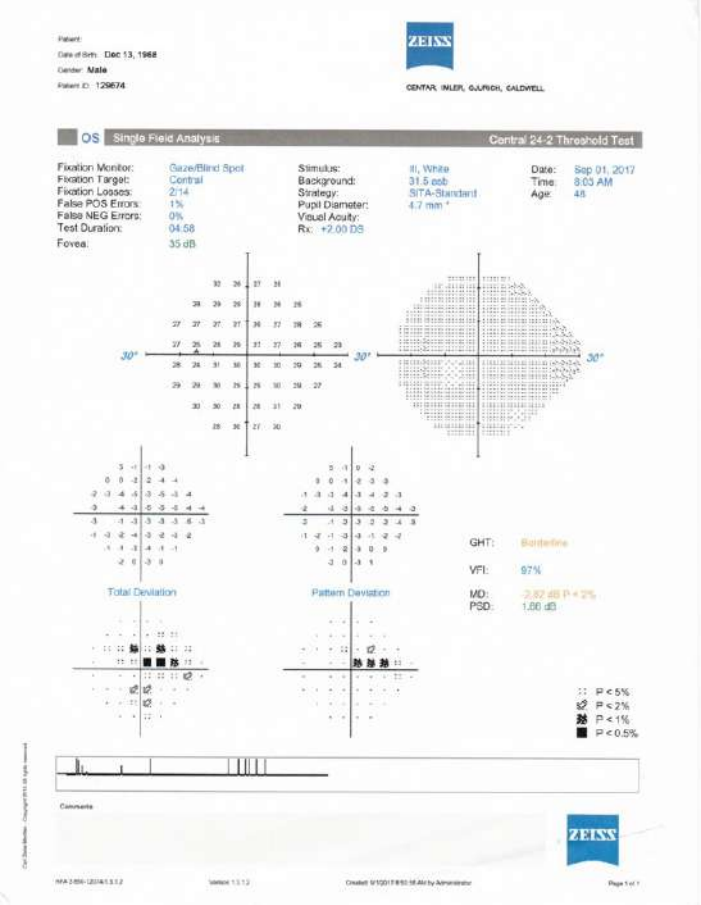


Static Perimetry in Eye Care

- Neurological disease
- Retinal disease
- Glaucoma
  - Perimetry is essential in diagnosis and management
  - Why test the central 24-30 degrees?
    - Only a small percentage of glaucomatous defects occur in the peripheral visual field alone
    - Testing the central 24-30-degree field is preferred in glaucoma management
    - Most of the retinal ganglion cells are within the 30 degrees of fixation

24-2 versus 30-2 Static Visual Field

- 30-2 tests 76 locations
- 24-2 tests 54 locations
  - Tests 30 degrees nasal
  - Little diagnostic information lost in 24-2
  - Time is saved
  - Fewer trial lens and lid artifacts
- 24-2 has become the VF for glaucoma
  - Only downside, 30-2 can sometimes find progression earlier due to more test points

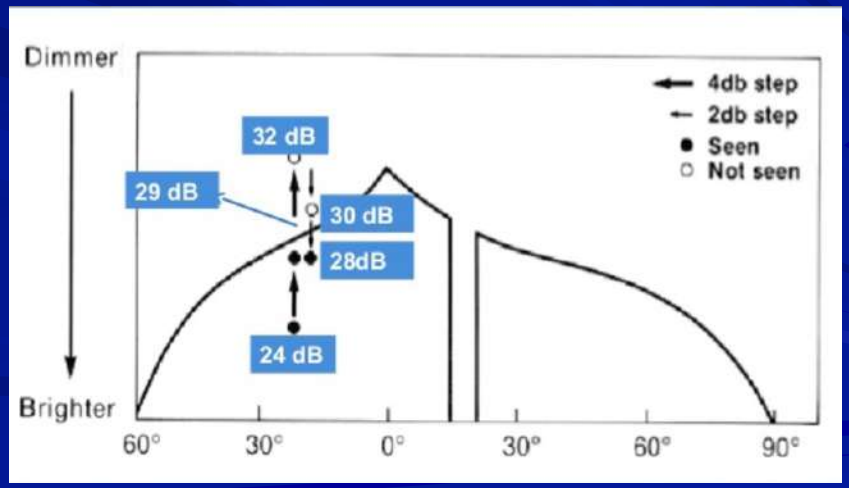


SAP and SITA

- SAP- Standard Automated Perimetry
  - Determines the threshold (how dim of light) can be seen at various points
  - Various algorithms have been developed to determine this threshold using few to numerous individual points in a single visual field test
- SITA-Swedish Interactive Thresholding Algorithm
  - Optimizes the determination of perimetry thresholds
  - Continuously estimating what the expected threshold is based on the patient's age and neighboring thresholds
  - Reduce the time necessary to acquire a visual field by up to 50%.
  - Decreases patient fatigue and increases reliability
  - SITA mode is now widely used in many computerized automated perimeters
- SITA- can be applied to:
  - SAP- Standard Automated Perimetry
  - SWAP-Short Wavelength Automated Perimetry (SWAP)

Sita Standard versus Sita Fast

- Sita strategies are twice as fast as order strategies
- Sita fast takes 67% the time of Sita standard
  - Sita fast has larger retest variability
- Primary difference is between the two strategies is the amount of certainty that is required before testing is stopped
- Sita standard
  - More precise
  - More tolerate of mistakes
  - Easier test as stimuli are brighter



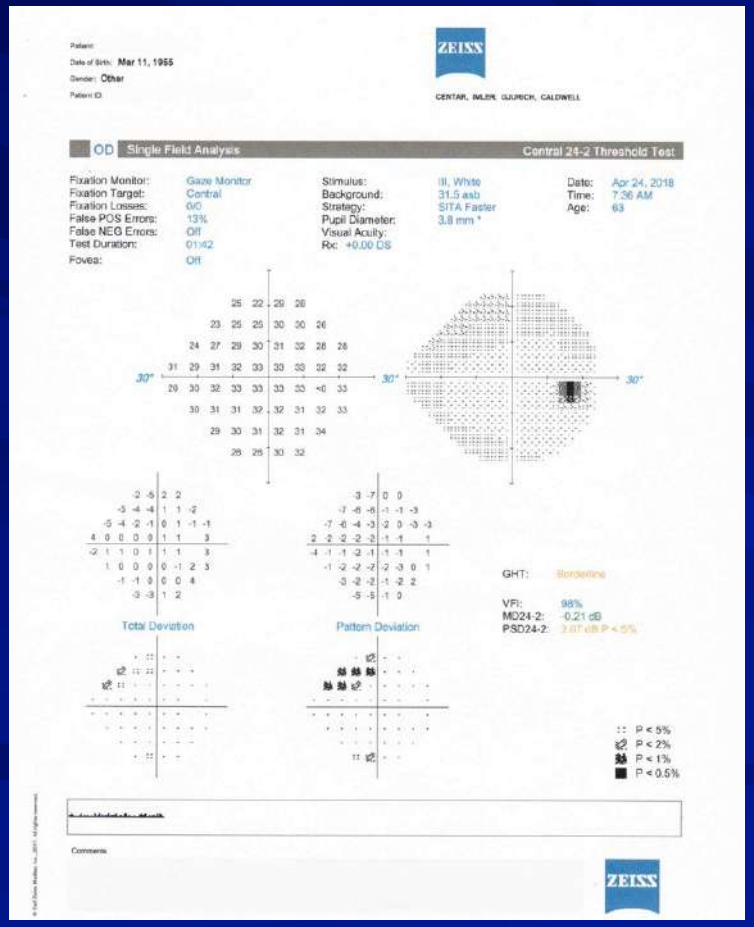
- Stay tuned: "Sita-Faster" ~~Coming Soon~~ is here

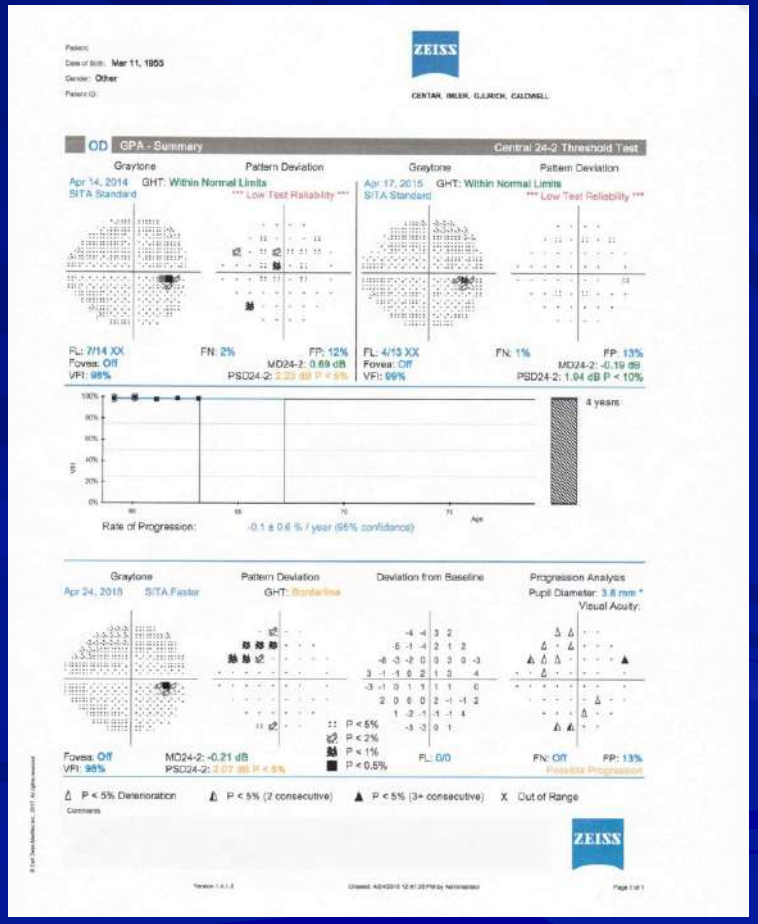
Sita Faster

- Turns off False Negatives
- Turns off Blind Spot monitor
- Leaves on False Positives
- Leaves on Gaze Tracking

- Faster test with same reliability

Sita Faster


Date of Birth: Mar 11, 1955
Gender: Other
CENTAR, IMLER, GJURICH, CALDWELL
OD Single Field Analysis
Central 24-2 Threshold Test
Fixation Monitor: Gaze Monitor
Fixation Target: Central
Fixation Losses: 0/0
False POS Errors: 13%
False NEG Errors: Off
Test Duration: 01:42
Fovea: Off
Stimulus: III, White
Background: 31.5 asb
Strategy: SITA Faster
Pupil Diameter: 3.8 mm *
Visual Acuity:
Rx: +0.00 DS
Date: Apr 24, 2018
Time: 7:36 AM
Age: 63
30°
GHT: Borderline
VFI: 98%
MD24-2: -0.21 dB
PSD24-2: 2.07 dB P < 5%
Total Deviation
Pattern Deviation
P < 5%
P < 2%
P < 1%
P < 0.5%
Comments


Date of Birth: Mar 11, 1955
Gender: Other
CENTAR, IMLER, GJURICH, CALDWELL
OD GPA - Summary
Central 24-2 Threshold Test
Graytone
Pattern Deviation
Apr 14, 2014 GHT: Within Normal Limits
SITA Standard
*** Low Test Reliability ***
FL: 7/14 XX
FN: 2%
FP: 12%
Fovea: Off
MD24-2: 0.69 dB
VFI: 98%
PSD24-2: 2.23 dB P < 5%
Apr 17, 2015 GHT: Within Normal Limits
SITA Standard
*** Low Test Reliability ***
FL: 4/13 XX
FN: 1%
FP: 13%
Fovea: Off
MD24-2: -0.19 dB
VFI: 99%
PSD24-2: 1.94 dB P < 10%
4 years
Rate of Progression: -0.1 ± 0.6 % / year (95% confidence)
Graytone
Pattern Deviation
Deviation from Baseline
Progression Analysis
Apr 24, 2018 SITA Faster
GHT: Borderline
Pupil Diameter: 3.8 mm *
Visual Acuity:
Fovea: Off
VFI: 98%
MD24-2: -0.21 dB
PSD24-2: 2.07 dB P < 5%
FL: 0/0
FN: Off
FP: 13%
Possible Progression
P < 5%
P < 2%
P < 1%
P < 0.5%
P < 5% Deterioration
P < 5% (2 consecutive)
P < 5% (3+ consecutive)
X Out of Range
Comments

Sita Faster

HFA3 SITA FASTER RESULTS ARE EQUIVALENT TO SITA FAST AND SITA STANDARD

Authors: Thomas Callan, OD, Gary C. Lee, PhD, Eric Larson, Carl Zeiss Meditec, Inc., Dublin, CA USA

Introduction

ZEISS recently introduced a new visual field test strategy for the HFA3 known as SITA™ Faster. The SITA Faster 24-2 test has been shown to run 30% faster compared to SITA Fast, and 50% faster compared to SITA Standard. This white paper provides additional information to demonstrate that SITA Faster results are comparable to the established SITA Fast and SITA Standard tests and thus may be suitable for use instead of 24-2 SITA Standard or SITA Fast strategies.

A study was conducted at Carl Zeiss Meditec, Inc., to assess comparability of SITA Faster, SITA Fast, and SITA Standard with the primary endpoint of Mean Deviation (MD) and an acceptance criteria of <± 1.00 dB. A total of 25 normal subjects and 25 glaucoma subjects participated in the study. Measures reported are:

1. The agreement of the MD parameter between SITA Faster 24-2, SITA Fast 24-2, and SITA Standard 24-2 threshold visual field tests.

2. The similarities in the flagging of total and pattern deviation probability symbols between SITA Faster 24-2, SITA Fast 24-2, and SITA Standard 24-2 threshold visual field tests.

3. The test times between the SITA Faster 24-2, SITA Fast 24-2, and SITA Standard 24-2 threshold visual field tests.

Study results and discussion

- **MD Based Equivalence**

For the normal group, the MD average difference for "SITA Faster – SITA Fast" was -0.144 dB, and for the glaucoma group, the mean difference was just 0.002 dB, Table 1.

Comparison of SITA Faster results to SITA Standard also show that SITA Faster was well within the ± 1.0 dB equivalence limit range. For the normal group, the MD average difference for "SITA Faster – SITA Standard" was 0.175 dB, and it was 0.301 dB for the glaucoma group, Table 1.

Agreement of MD Between SITA Faster, SITA Fast, and SITA Standard

Parameter	N	SITA Faster	SITA Fast	SITA Faster – SITA Fast Difference (95% CI)	SITA Faster	SITA Standard	SITA Faster – SITA Standard Difference (95% CI)
		Mean (SD)					
		Normal					
MD (Analytic)	25	4.749 (1.13)	4.892 (1.09)	-0.14 (0.710) (-0.437, 0.149) p =0.06	4.966 (1.13)	4.791 (1.11)	0.175 (0.693) (-0.312, 0.701) p =0.021
		Glaucoma					
MD	25	-2.81 (7.13)	-2.83 (7.14)	0.002 (0.193) (-0.293, 0.298) p =0.99	-2.82 (7.13)	-3.11 (7.56)	0.301 (0.667) (-0.045, 0.6 2) p =0.091

Table 1

In both groups, the MD average difference was significantly lower than the limit of ± 1.00 dB. Therefore, for this study cohort, all three studies generated comparable results on MD.

- **Total Deviation and Pattern Deviation Probability Symbol Analysis**

The MD average difference shown in Table 1 is the criteria used to confirm equivalence. Additional support for equivalence is shown in the similarity of number of flagged points on the total deviation (TD) and pattern deviation (PD) plots and compared between the SITA Faster, SITA Fast, and SITA Standard tests.

Descriptive statistics of the number of flagged points are provided separately for the probability levels of <5%, <2%, <1%, and <0.5% in Table 2. These descriptive statistics summarize the total number of flagged points for the SITA Faster, SITA Fast, and SITA Standard tests.

Agreement of Pattern Deviation Points Between SITA Faster, SITA Fast, and SITA Standard

Parameter	N	Number of Pattern Deviation Points Mean (SD) SITA Faster – SITA Fast					Number of Pattern Deviation Points Mean (SD) SITA Faster – SITA Standard				
		SITA Faster	SITA Fast	Difference	95% CI	P Value	SITA Faster	SITA Standard	Difference	95% CI	P Value
		Normal									
PD Points <5%	25	1.6 (0.8)	1.5 (1.0)	0.1 (1.4)	(-0.5, 0.8) (-0.496, 0.696)	0.68	1.4 (1.7)	1.5 (1.8)	-0.1 (2.4)	(-0.9, 1.1) (-0.9, 0.9)	0.87
PD Points <2%	25	0.7 (0.1)	0.7 (0.1)	0.1 (0.1)	(-0.1, 0.2) (-0.05, 0.25)	0.07	0.7 (1.2)	0.7 (1.3)	0.0 (1.7)	(-0.6, 0.6) (-0.8, 0.8)	0.99
PD Points <1%	25	0.4 (0.1)	0.4 (0.1)	0.0 (0.1)	(-0.1, 0.1) (-0.05, 0.05)	0.80	0.3 (0.4)	0.3 (0.5)	0.0 (0.7)	(-0.3, 0.3) (-0.4, 0.4)	0.99
PD Points <0.5%	25	0.2 (0.1)	0.2 (0.1)	0.0 (0.1)	(-0.1, 0.1) (-0.05, 0.05)	0.50	0.2 (0.2)	0.2 (0.3)	0.0 (0.3)	(-0.1, 0.1) (-0.1, 0.1)	0.98
		Glaucoma									
PD Points <5%	25	15.8 (9.0)	15.8 (9.0)	0.0 (0.0)	(0.0, 0.0) (0.0, 0.0)	0.0	15.7 (9.0)	15.7 (9.0)	0.0 (0.0)	(0.0, 0.0) (0.0, 0.0)	0.0
PD Points <2%	25	7.6 (8.0)	7.6 (8.1)	0.0 (0.3)	(-0.1, 0.1) (-0.07, 0.07)	0.28	7.4 (8.0)	7.5 (8.0)	0.1 (0.4)	(-0.1, 0.3) (-0.08, 0.28)	0.09
PD Points <1%	25	5.6 (8.0)	5.6 (8.0)	0.0 (0.0)	(0.0, 0.0) (0.0, 0.0)	0.00	5.4 (8.0)	5.4 (8.0)	0.0 (0.0)	(-0.1, 0.1) (-0.1, 0.1)	0.00
PD Points <0.5%	25	4.3 (8.0)	4.3 (8.0)	0.0 (0.0)	(0.0, 0.0) (0.0, 0.0)	0.00	4.1 (8.0)	4.1 (8.0)	0.0 (0.0)	(-0.1, 0.1) (-0.1, 0.1)	0.00

Table 2

Analysis of the total and pattern deviation plots from the SITA Faster, SITA Fast, and SITA Standard tests found that there were no statistically significant differences between the numbers of flagged points at any of the probability levels except the glaucoma < 0.5% level for SITA Faster and SITA Standard, which had a difference of only 1 point flagged (4 versus 5 points).

The findings of similar numbers of flagged points in both total and pattern deviation analyses indicate that the SITA Faster test results are equivalent with SITA Fast and SITA Standard test results, and therefore, the test results from any of these tests can be mixed together to assess visual field defect progression. This equivalence is important, particularly when following progression with the Guided Progression Analysis (GPA).

- **Test Time Analysis**

A second objective of this study was to compare the test times of the SITA Faster test strategy to the test times of both the SITA Fast and SITA Standard strategies for the 24-2 test pattern. The reduction in test time primarily comes from (in order of most significant to least) i) removing built-in delays following unseen stimuli, ii) optimizing starting values of test points, iii) eliminating the determination of the blind spot location, iv) and elimination of the false negative check stimuli. Table 3 shows the mean and SD values for the three test strategies and indicates the percent improvement in test time for SITA Faster over SITA Fast and SITA Standard.

Descriptive Statistics of Test Times

Parameter	N	Mean (SD)	SITA Faster time improvement over	Min, Max
		Normal		
Faster test time (sec)	25	136.6 (9.3)		90, 117
Fast	25	166.0 (16.2)	35.5%	133, 208
Standard	25	277.2 (21.8)	68.6%	292, 327
		Glaucoma		
Faster test time (sec)	25	174.0 (37.6)		99, 245
Fast	25	188.8 (48.4)	32.6%	147, 444
Standard	25	221.0 (59.8)	38.2%	225, 487

Table 3

The SITA Faster mean test time was 36% faster than SITA Fast in normals and 33% faster than SITA Fast in the glaucoma group. The mean time difference between SITA Faster and SITA Standard was even greater. SITA Faster was 62% faster than SITA Standard in the normal group and 58% faster in the glaucoma group. These differences in test times were statistically significant.

Conclusions

The results of this study demonstrate the equivalence of the SITA Faster test strategy to both SITA Fast and SITA Standard in this cohort of normal and glaucoma subjects. SITA Faster showed very similar mean MD results for both groups studied and was easily within the equivalence limits established for the study. This indicates that a user should feel confident using the SITA Faster test strategy as an alternative to either the SITA Fast or SITA Standard strategies. The similar numbers of the flagged total deviation and pattern deviation points in SITA Faster, SITA Fast, and SITA Standard indicate that the SITA Faster test is equivalent when following visual field progression. Based on the findings of this study, the SITA Faster strategy is considered to be equivalent to SITA Fast as well as SITA Standard.

The improvement in test time with SITA Faster was shown to be greater than 30% over SITA Fast and greater than 50% over SITA Standard. The shorter test times should make the task of taking a visual field a better experience for many patients. A number of subjects in this study mentioned their preference for the SITA Faster test based on the reduced test duration.

The combination of equivalent test results to SITA Fast and SITA Standard, and the faster test times, will allow doctors to switch over their patients to the SITA Faster test and be assured that the test results are equivalent while their patients benefit from the shorter test times.

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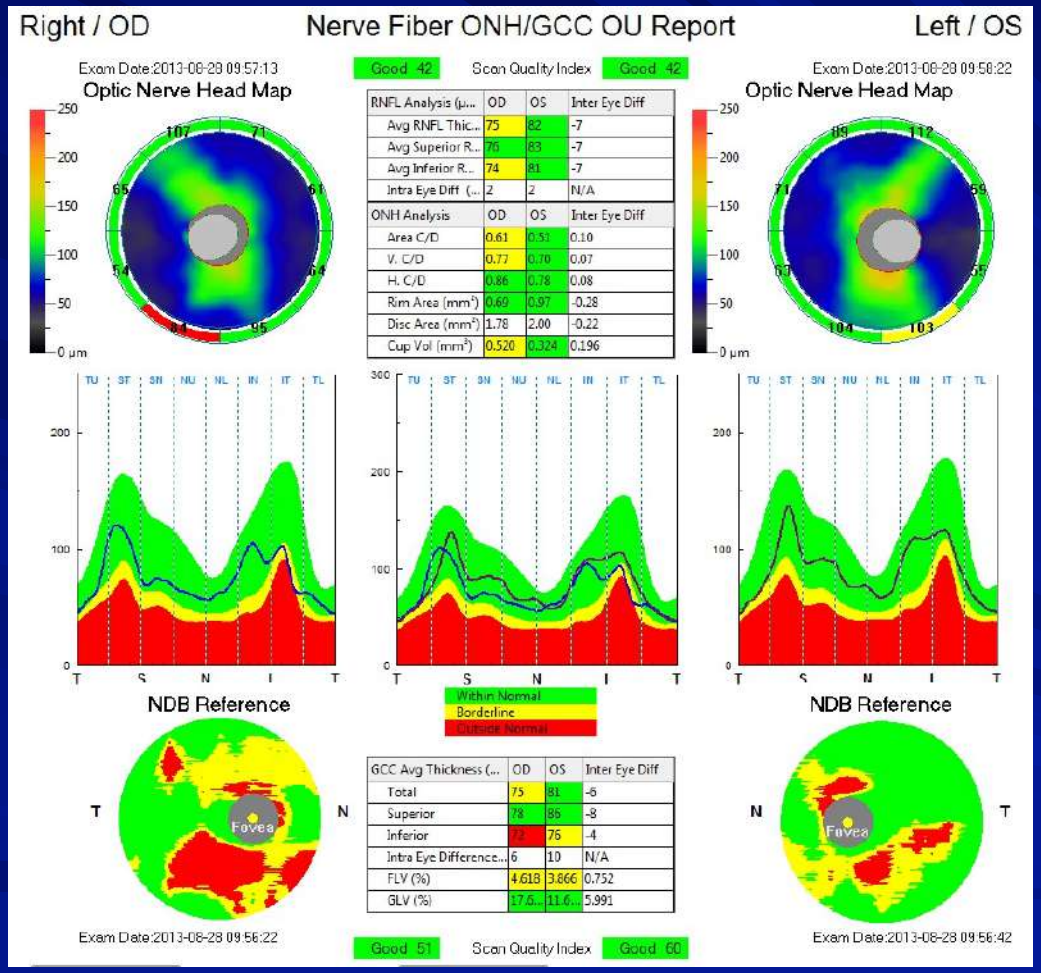
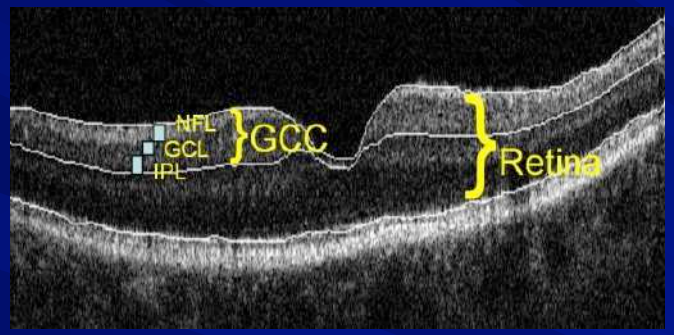
Question

Do you consider glaucoma a disease of the macula?

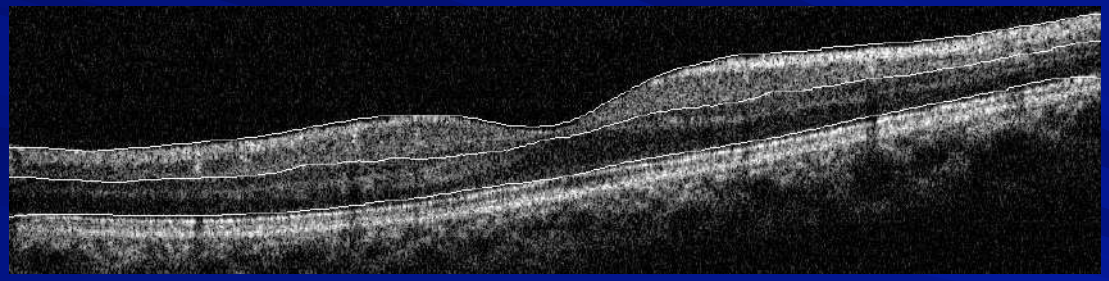
A. Yes
B. No
c. Not sure – that is why I am here


Right / OD
Nerve Fiber ONH/GCC OU Report
Left / OS
Exam Date:2013-08-28 09:57:13
Good 42
Scan Quality Index
Good 42
Exam Date:2013-08-28 09:58:22
Optic Nerve Head Map
Optic Nerve Head Map
250
200
150
100
50
0 µm
RNFL Analysis (µ... OD OS Inter Eye Diff
Avg RNFL Thic... 75 82 -7
Avg Superior R... 76 83 -7
Avg Inferior R... 74 81 -7
Intra Eye Diff (... 2 2 N/A
ONH Analysis OD OS Inter Eye Diff
Area C/D 0.61 0.51 0.10
V. C/D 0.77 0.70 0.07
H. C/D 0.86 0.78 0.08
Rim Area (mm²) 0.69 0.97 -0.28
Disc Area (mm²) 1.78 2.00 -0.22
Cup Vol (mm³) 0.520 0.324 0.196
TU ST SN NU NL IN IT TL
T S N I T
Within Normal
Borderline
Outside Normal
NDB Reference
NDB Reference
T
N
Fovea
GCC Avg Thickness (... OD OS Inter Eye Diff
Total 75 81 -6
Superior 78 86 -8
Inferior 72 76 -4
Intra Eye Difference... 6 10 N/A
FLV (%) 4.618 3.866 0.752
GLV (%) 17.6... 11.6... 5.991
Exam Date:2013-08-28 09:56:22
Good 51
Scan Quality Index
Good 60
Exam Date:2013-08-28 09:56:42

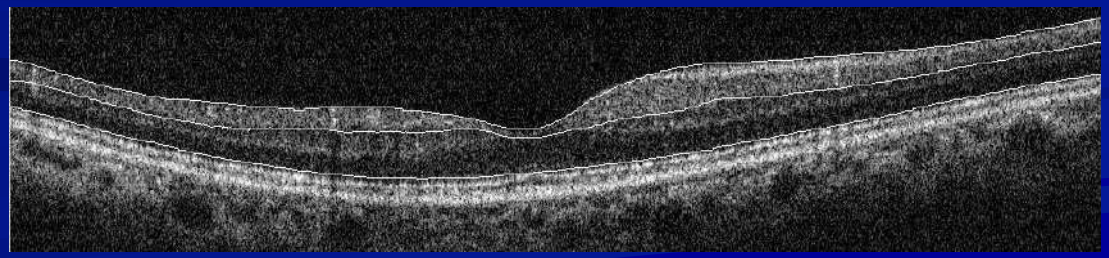
GCC Thinning in Glaucoma



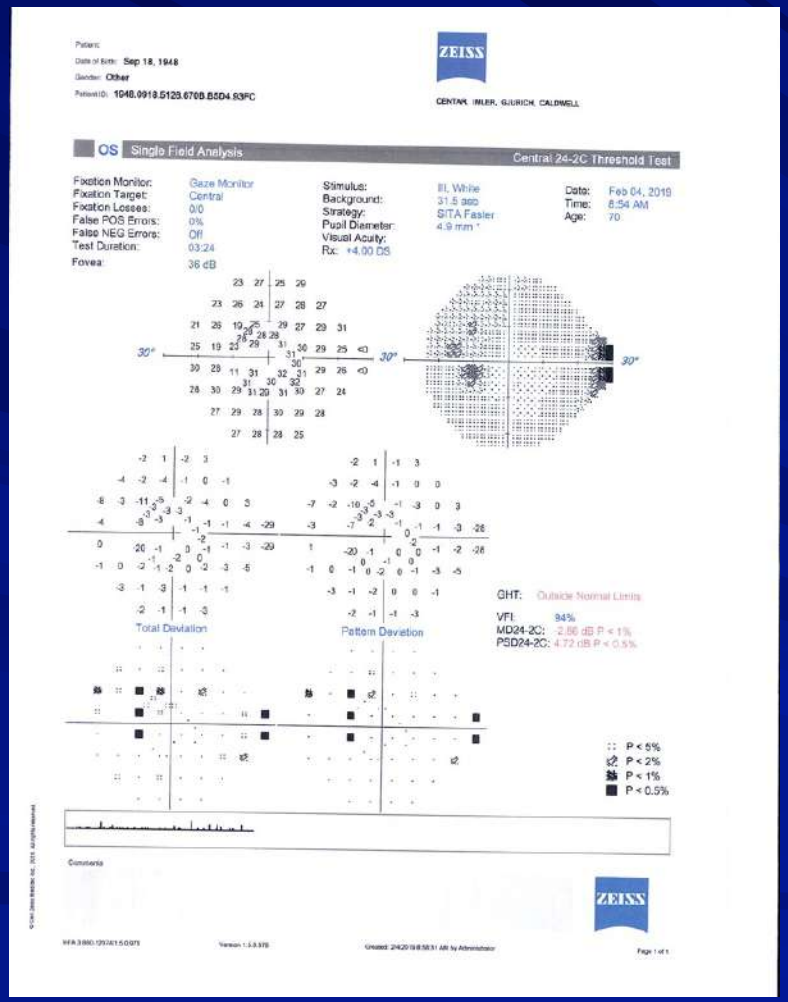
Normal

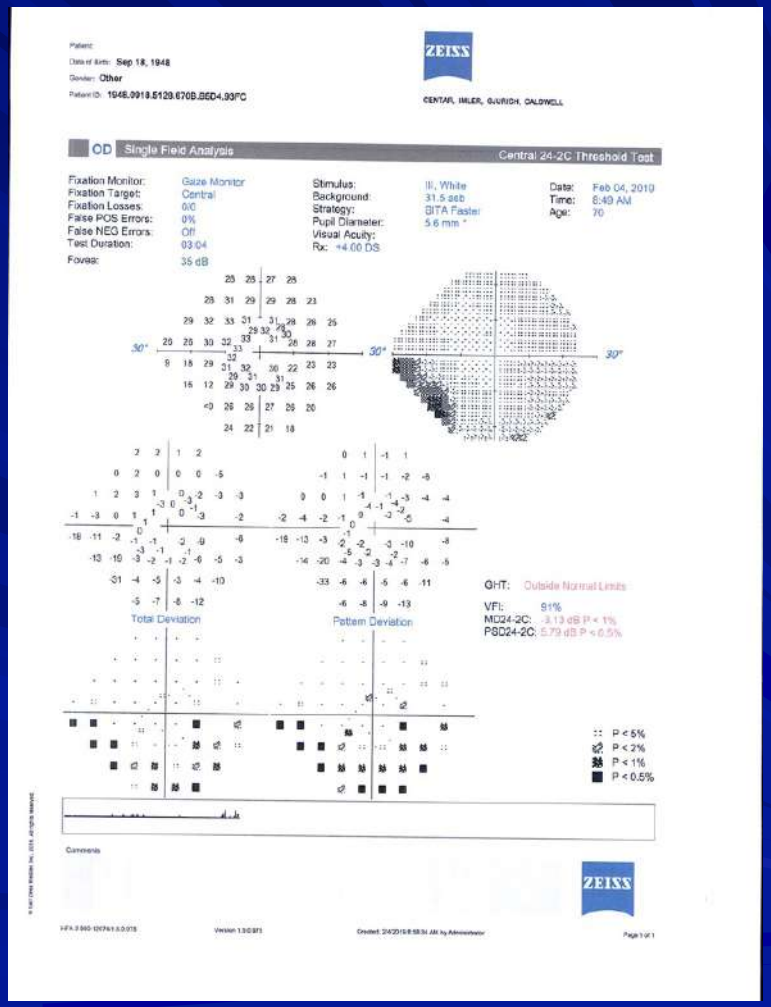


Glaucoma with thinner GCC



SITA Faster
24-2C





Opportunities for Improvement in Central 10 Degrees

Glaucomatous damage of the macula

Prog Retin Eye Res. 2013 Jan; 32C: 1–21.

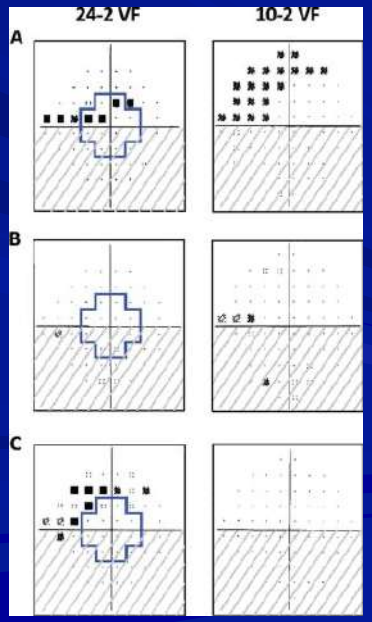
Donald C. Hood,[a,b,*,1] Ali S. Raza,[a,c,1] Carlos Gustavo V. de Moraes,[d,e,1] Jeffrey M. Liebmann,[d,e,1] and Robert Ritch[d,f,1]

- Glaucomatous damage of the macula is common and can occur early in the disease
- Can be missed or underestimated or both, with standard 24-2 VF tests that use a 6 grid

JAMA Ophthalmol. 2014 Mar; 132(3): 291–297.

The Prevalence and Nature of Early Glaucomatous Defects in the Central 10° of the Visual Field

Ilana Traynis, B.S.,[1,2] Carlos G. De Moraes, M.D.,[4,5] Ali S. Raza, B.A.,[1] Jeffrey M. Liebmann, M.D.,[4,5] Robert Ritch, M.D.,[4,6] and Donald C. Hood, Ph.D.[1,3]



24-2 and 10-2 VF Examples

Blue cross region on the 24-2 VF = central 10-2 VF
(A) Both are abnormal.
(B) 24-2 VF normal; 10-2 VF abnormal
(C) 24-2 VF abnormal; 10-2 VF normal

Highest Importance Locations Chosen from 10-2 Pattern

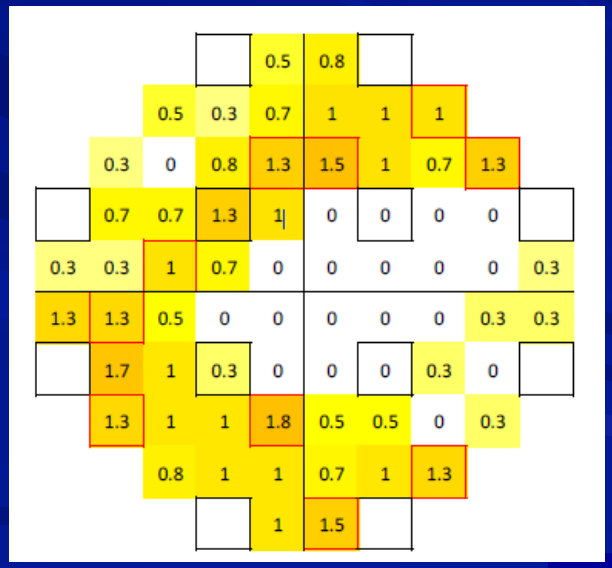
Selecting additional test locations to enhance the 24-2 pattern using a scoring system

Matthias Monhart [1], Gary Lee [2], Aiko Iwase [3], John Flanagan [4]
[1] Carl Zeiss AG, Feldbach, Switzerland, [2] Carl Zeiss Meditec, Dublin CA, United States, [3] Tajimi Iwase Eye Clinic, Tajimi, Japan,
[4] University of California Berkeley, Berkeley, United States

WGCSUB-1642 / P-WT-309

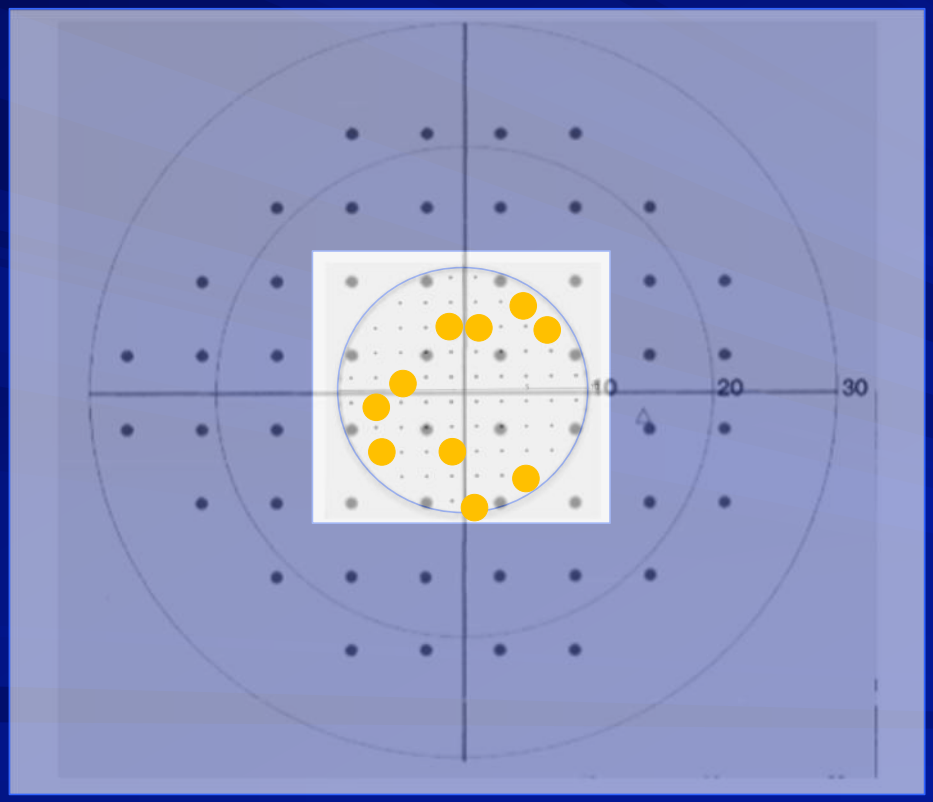
- The expert group selected specific 10-2 test point locations
- Prevalence and depth of glaucomatous macular defects were systematically evaluated to select optimum test points
- Pattern covers areas known to be susceptible to glaucomatous defects both from structural and functional studies

Selected test locations are shown in red boxes



The expert group: Donald C. Hood, Stuart K. Gardiner, Allison M. McKendrick and William H. Swanson.

Resulting SITA Faster 24-2C Pattern on HFA3



The 24-2C test pattern combines all 24-2 points + ten selected 10-2 points (shown in OD orientation)

Large Gray	24-2 pattern
Large Orange	Ten additional 24-2C points
Small Gray	10-2 pattern

Minimize Time and Maximize Information with HFA3

SITA Faster 24-2

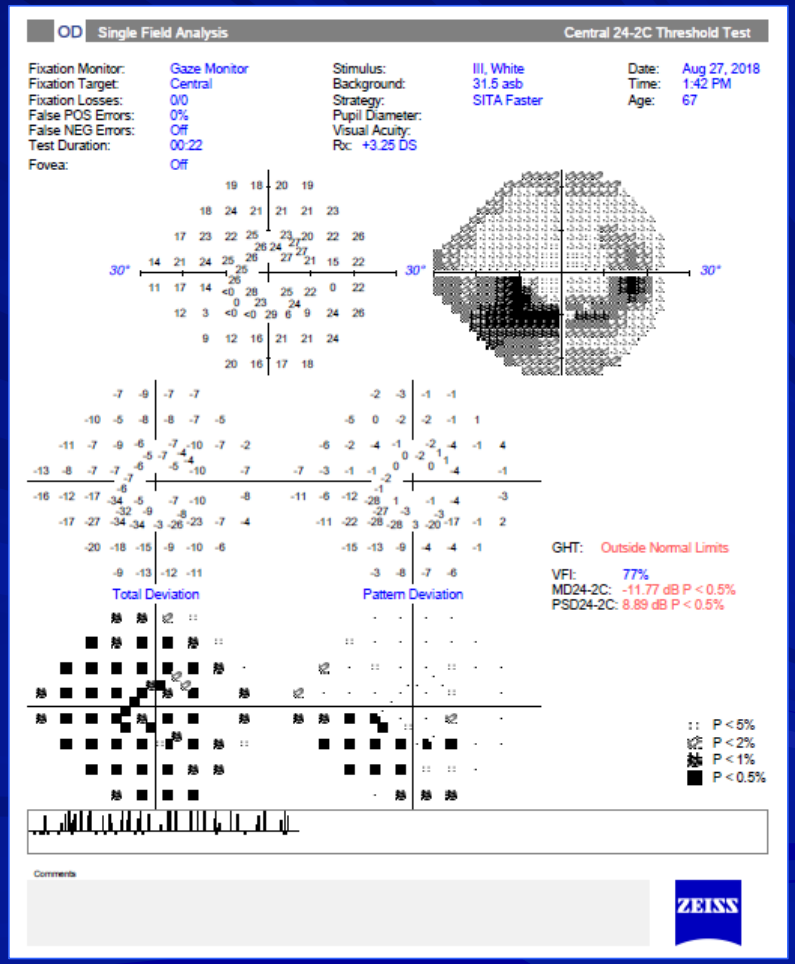
- test in 2 minutes or less
- ~50% faster than SITA Standard; ~30% faster than SITA Fast

SITA Faster 24-2C

- More information in the central field
- ~20% faster than SITA Fast 24-2

Mixed SITA GPA

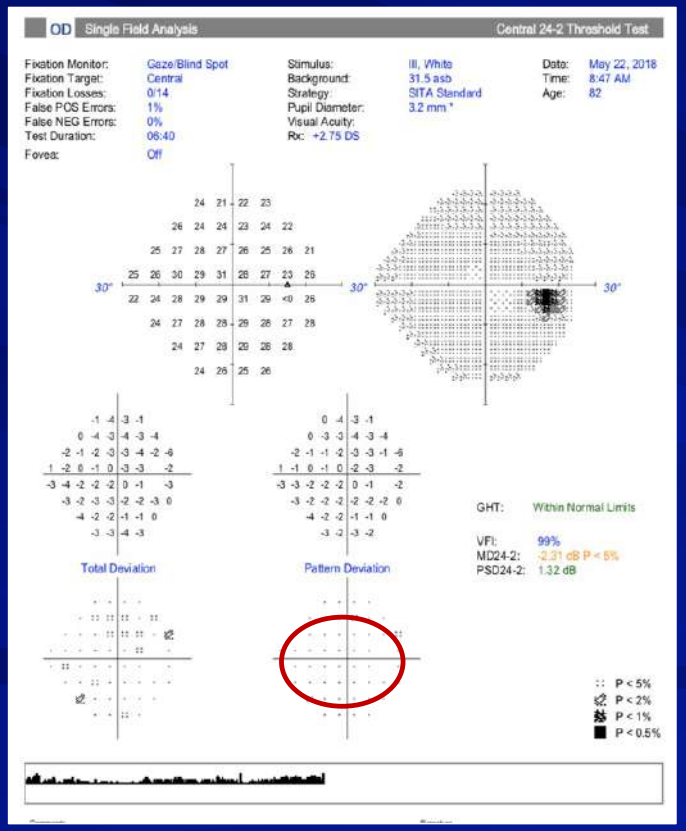
- Clinical equivalence of tests allows intermixing SITA Faster, Fast, Standard, 24-2, 30-2, and 24-2C in progression analysis
- Add new tests to patient progression
- Helps immediately adopt SITA Faster



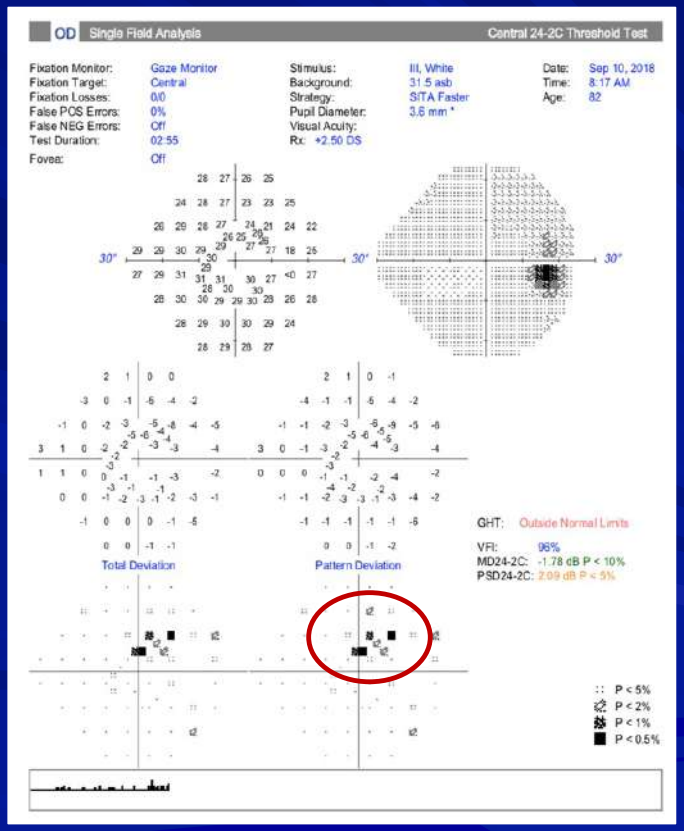
24-2C SITA Faster

Flagged points detected centrally in OD

24-2 SITA Standard



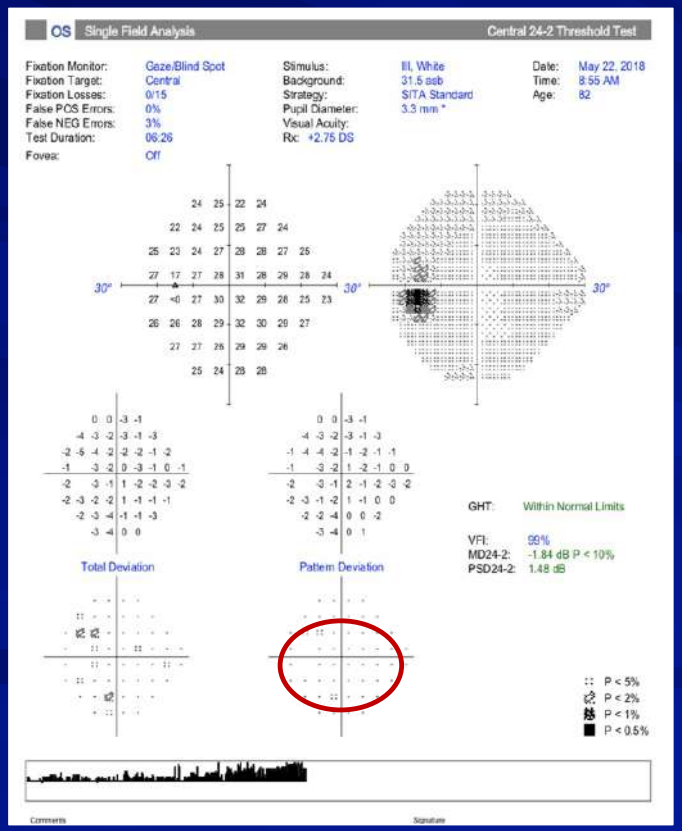
24-2C SITA Faster



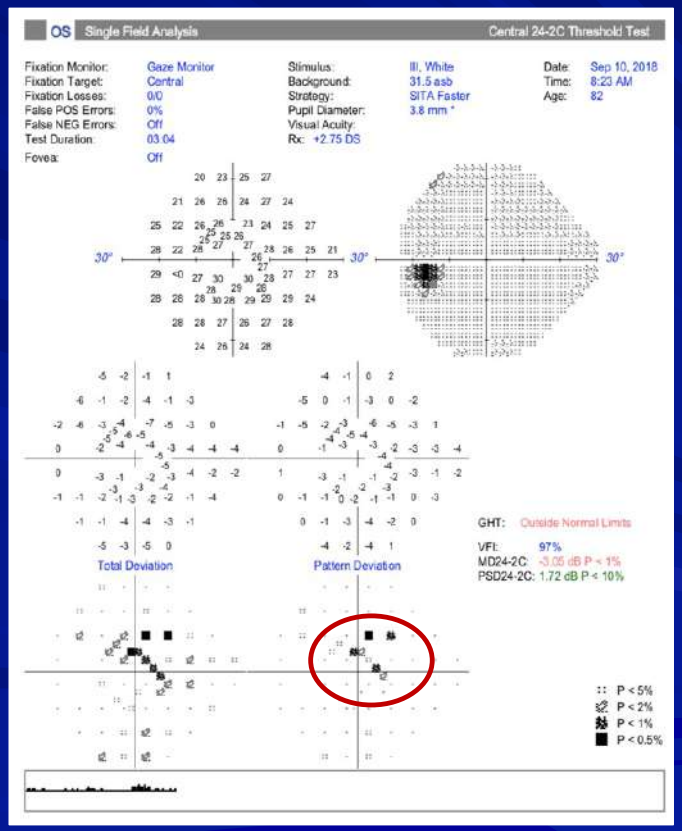
24-2C SITA Faster

Flagged points detected centrally in OS

24-2 SITA Standard



24-2C SITA Faster



Optometric
Education
Consultants

Question

Do you consider glaucoma a disease of the macula?

A. Yes
B. No
c. Not sure – that is why I am here

Foveal Threshold

Fovea "On" versus "Off"

- Instrument can do 51 db
  - Perfect macula and perimetrically trained young person = 40 db
- Visual acuity and foveal threshold should correlate
  - Each validate each other
  - Visual acuity is good and threshold is low
    - Possible early damage to fovea
      - Glaucoma
      - Plaquenil toxicity
- 47% of patients with 20/20 had threshold better than 37db [1]
  - This method may be useful to predict visual acuity in eyes with possible nonorganic visual acuity loss.

1 Flaxel CJ[1], Samples JR, Dustin L., **Relationship between foveal threshold and visual acuity using the Humphrey visual field analyzer.** Am J Ophthalmol. 2007 May;143(5):875-7. Epub 2007 Jan 2

Short Wavelength Automated Perimetry (SWAP)

- Blue-yellow perimetry
- Goldmann V stimuli on yellow background
- Thought to detect glaucomatous defect earlier than white on white
- Due to Sita standard strategy can find defect as early

Glaucoma Visual Field

- Need a current refraction
  - Cataracts cause refractive shifts
- 24-2
- Sita-Standard (not fast)
- Fovea "on"

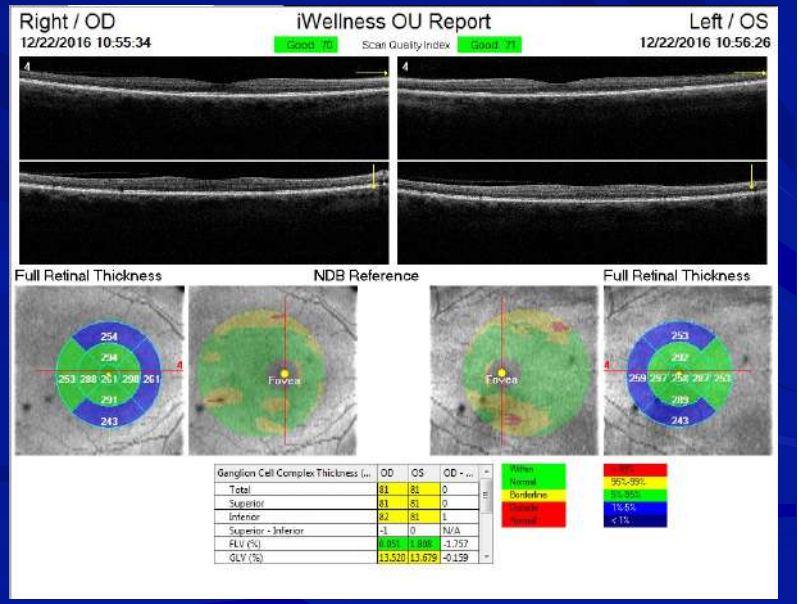
Interpreting Visual Fields

- No longer reliable or unreliable
  - A continuum from highly reliable to marginally informative
- False positives
  - More destructive to interpretation than formerly believed
- False negatives
  - Expected to be abnormal in a glaucomatous visual field
  - Even in attentive tester
- Gaze tracker
  - Typically a better indicator than blind spot
- Progression is not present or absent
  - Is the rate of change acceptable

Perimetry versus Imaging
The Other "False Positive"

- Perimetry in healthy eyes can yield scotomas (p < 0.5%)
  - However, the pattern will not be repeatable
- Retesting with perimetry will only be reproductible in damaged eyes
- Perimetry can identify false positives by repeating the test several times

- Imagining is typically very repeatable
  - False positives cannot be detected or eliminated with repeated testing



Optometric
Education
Consultants

Question?

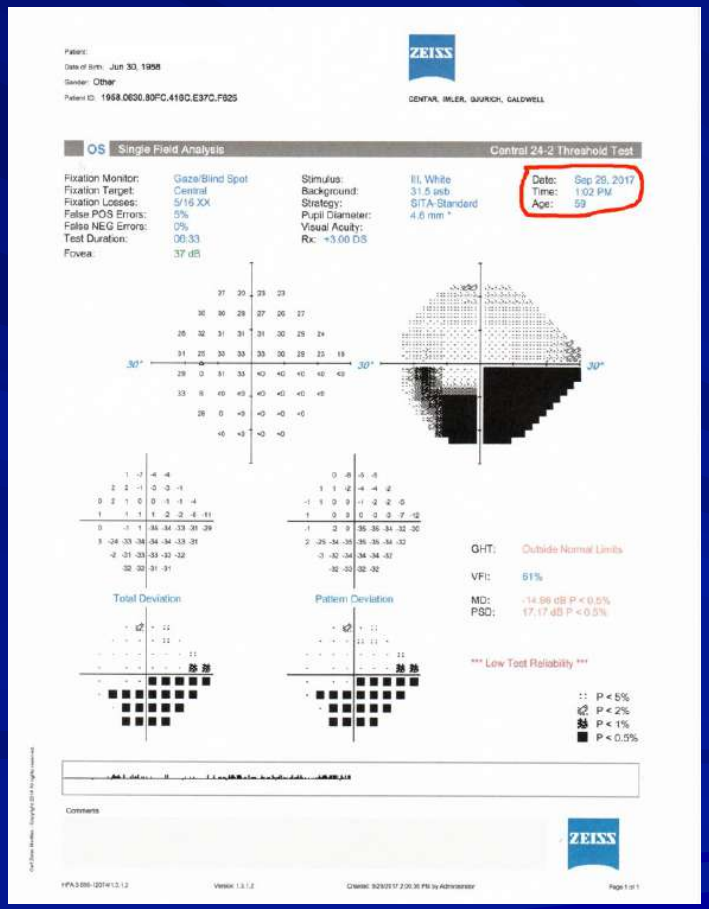
Do you consider a Mean Deviation (-5 db) loss on a visual field significant?

A. Yes
B. No

5 Decibel Loss

- Read slower
- Don't leave home as much
- Walk slower
- Increase in car accidents

Which is the closest representation?



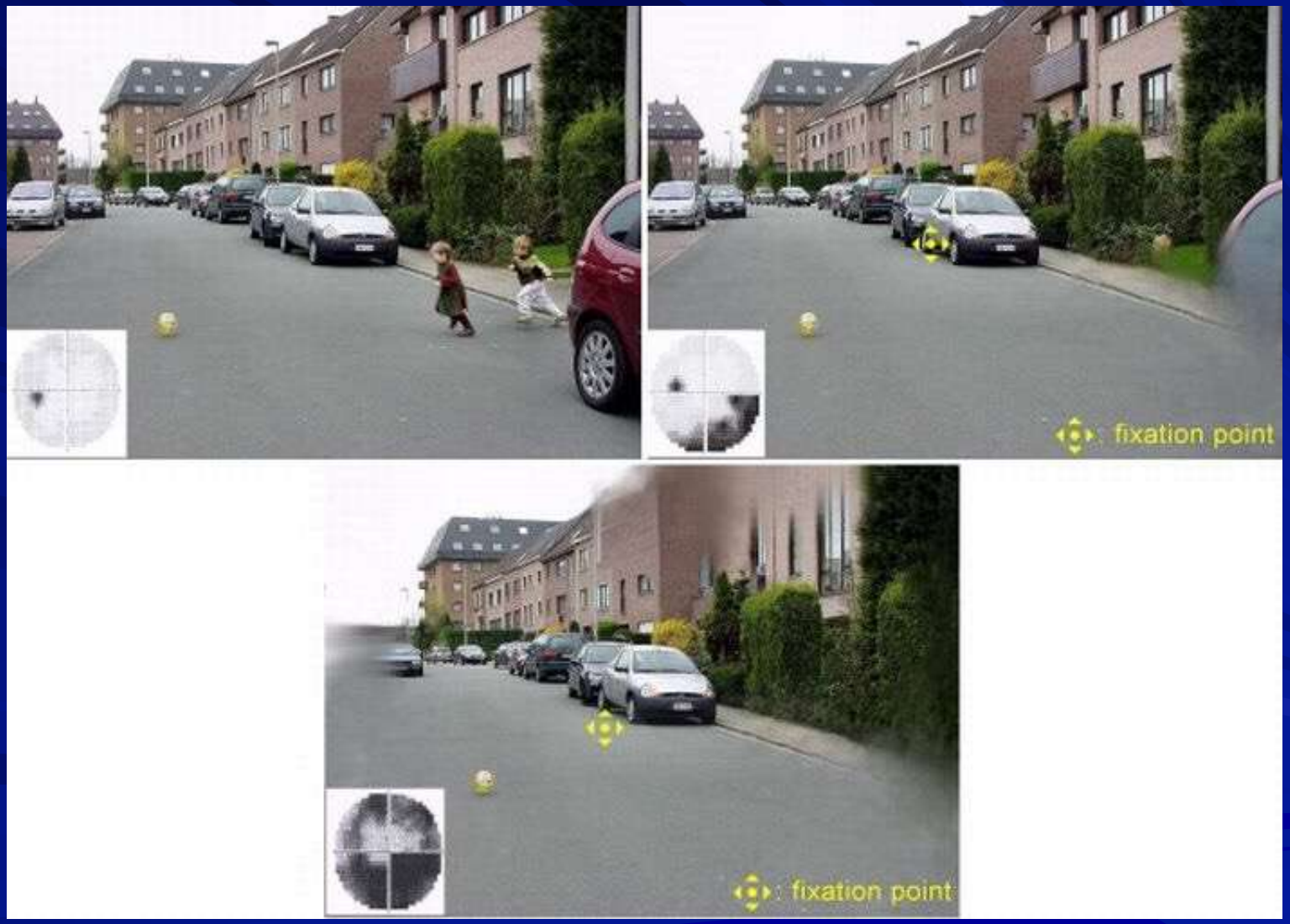
EXTREME GLAUCOMA

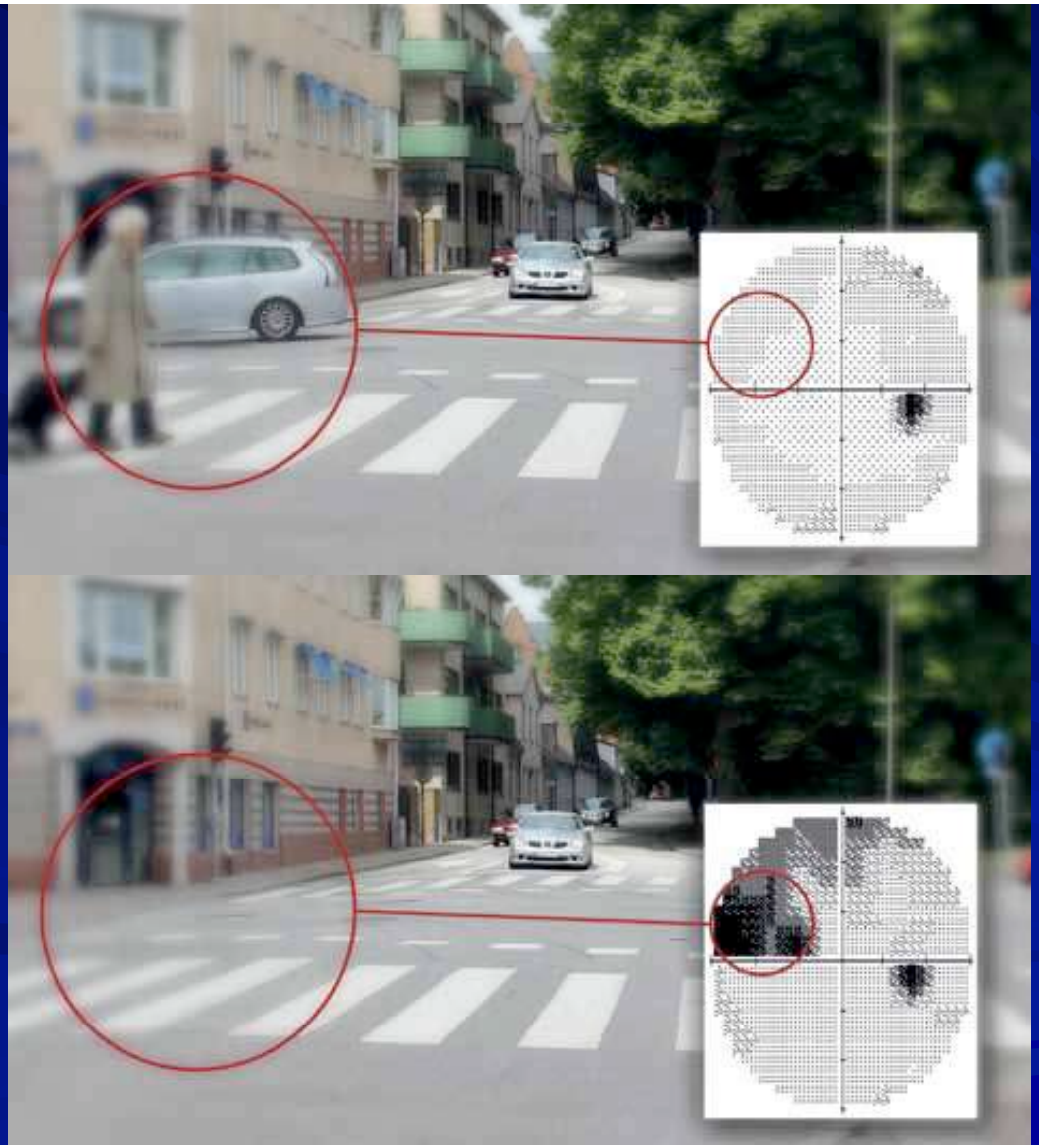
ADVANCED GLAUCOMA

EARLY GLAUCOMA

NORMAL VISION

Old School is
Impactful and Useful

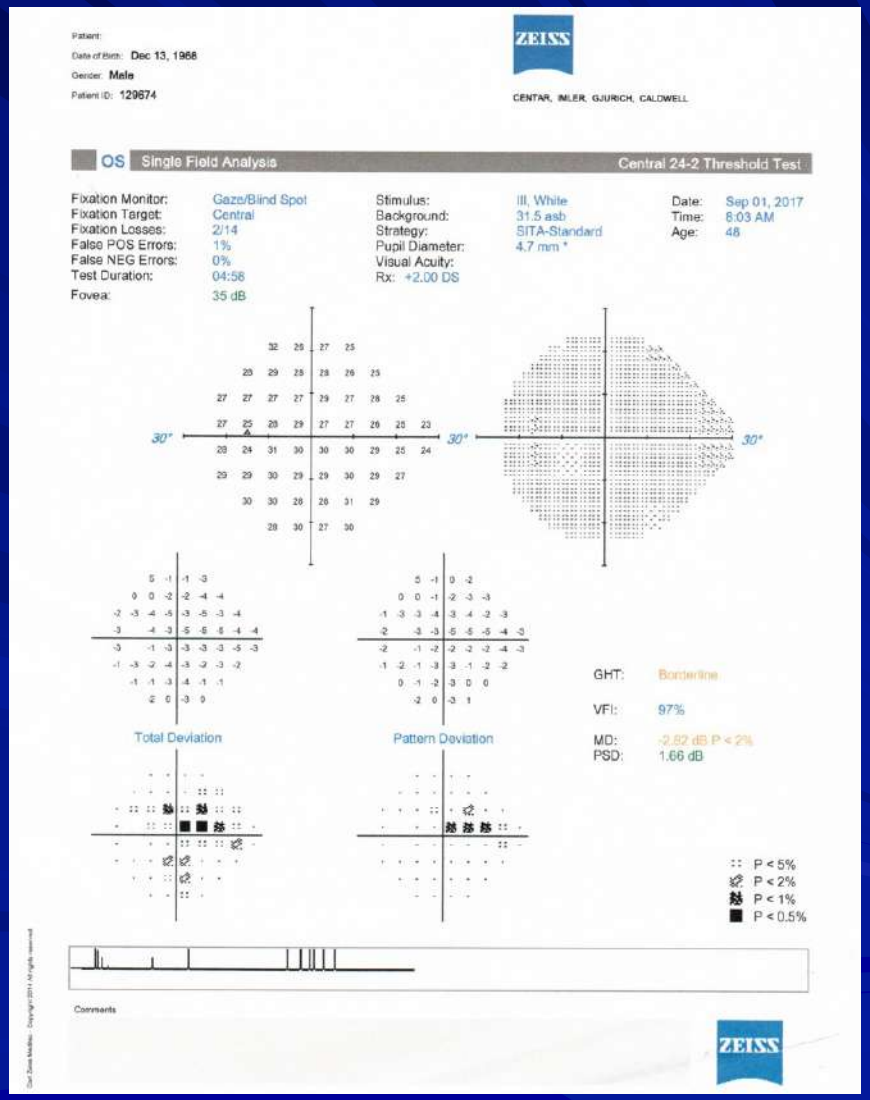

fixation point
fixation point



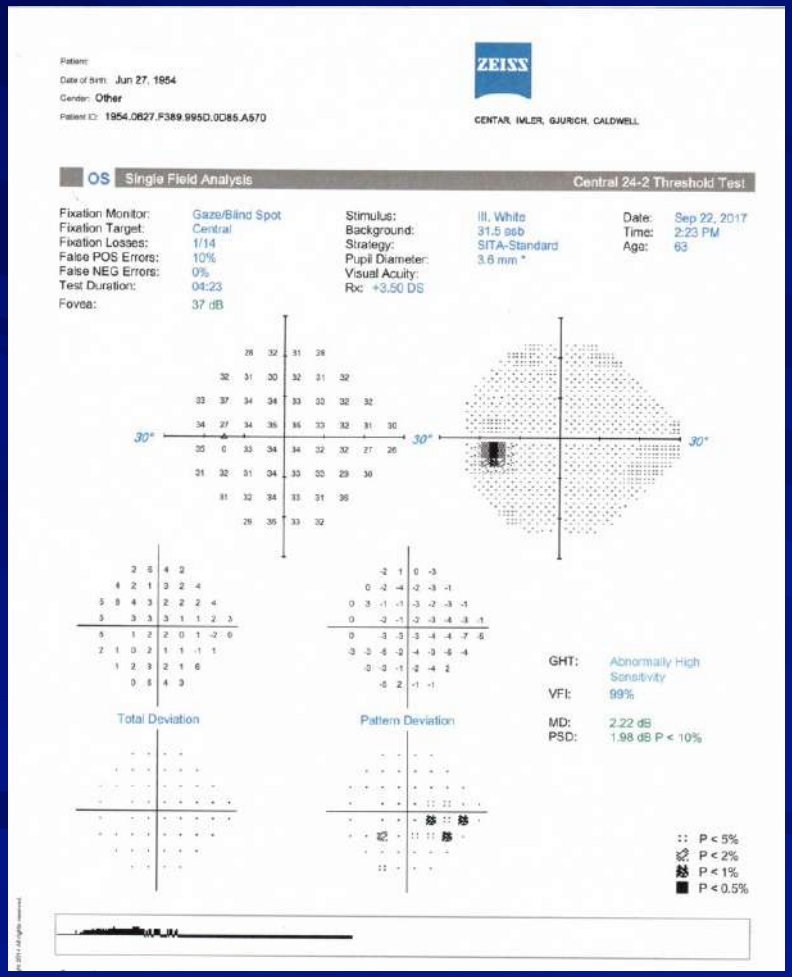
Interpreting Visual Fields

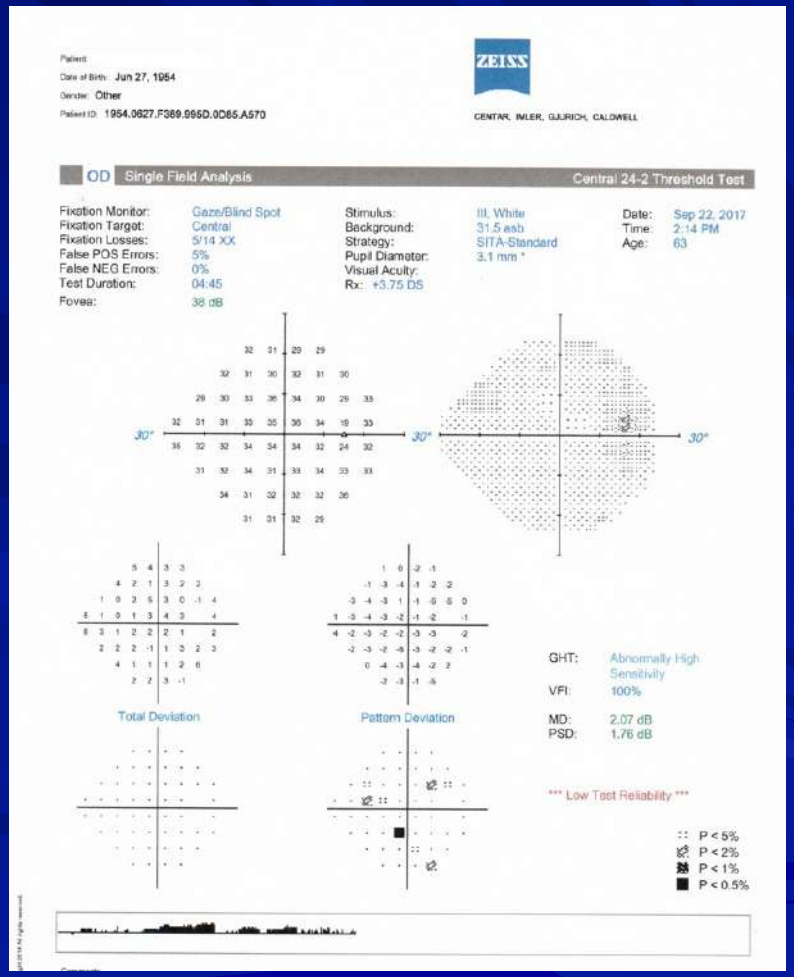
- Diagnosis
  - Probability Plots
  - Glaucoma Hemifield Test
- Staging and following over time
  - Mean Deviation
  - Visual Field Index

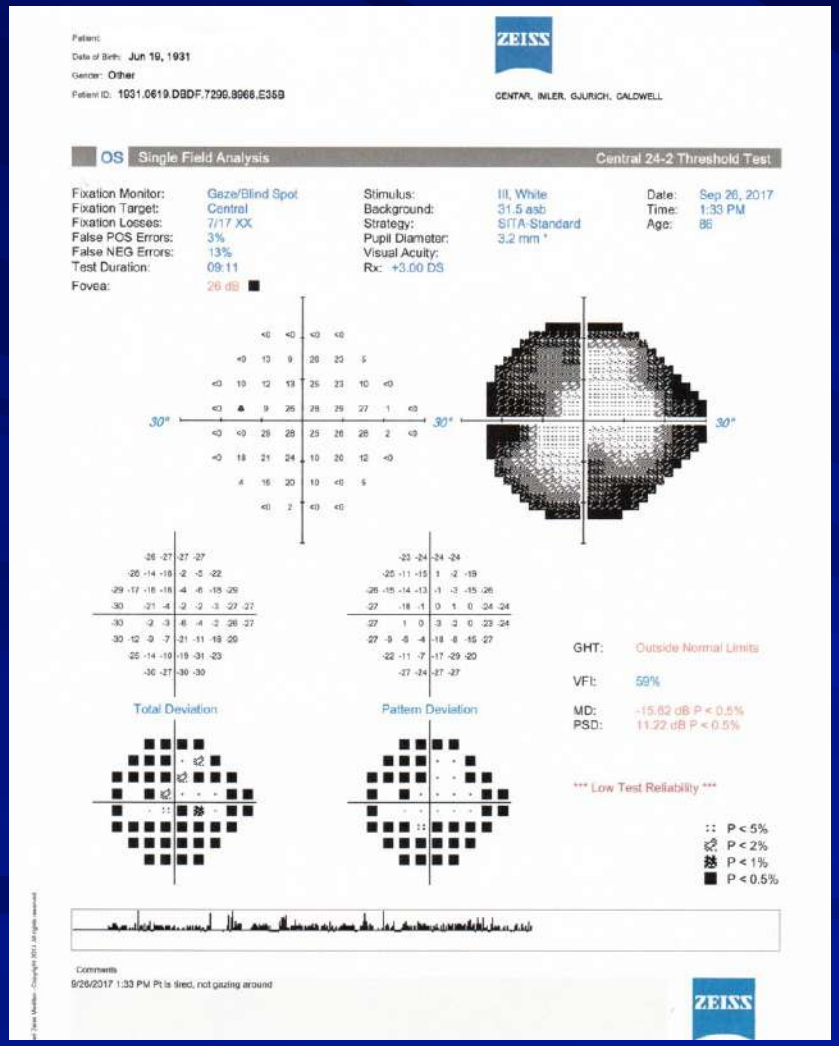
Probability Plots
Total Deviation to Pattern Deviation
What We Expect- Raises the Hill of Vision



Probability Plots- Total Deviation to Pattern Deviation-Now What Happened?

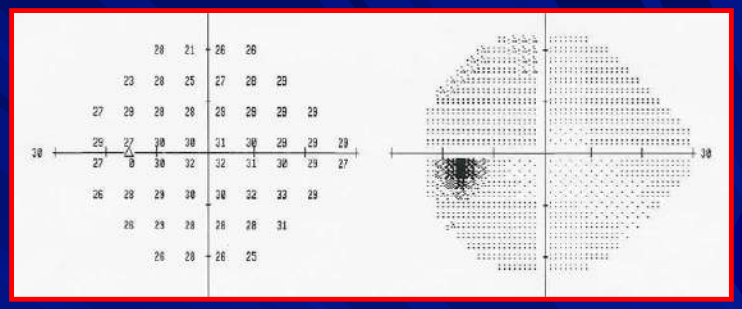






Probability Plot
Butterfly/Cloverleaf
The patient is zoning out

MD and PSD

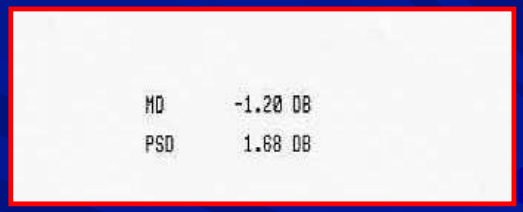


MD

- 54 spots on 24-2
  - All 54 spots reduced by 1 DB (54DB)
  - MD 1DB
- 54 spots on 24-2
  - 27 spots reduced by 2 DB (54 DB)
  - MD 1 DB
- 54 spots on 24-2
  - 13.5 spots reduced by 4 DB (54DB)
  - MD 1 DB

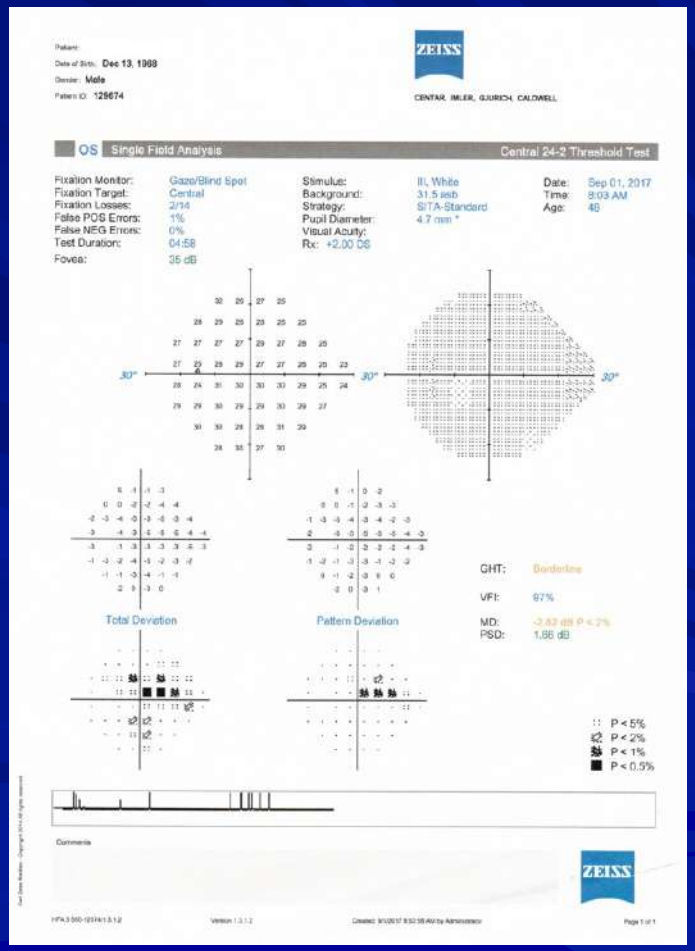
PSD

- Low PSD (Generalized loss)
  - 1.00 DB
- Moderate PSD (More localized loss)
  - 3.00 DB
- High PSD (Localized loss)
  - 5.00 DB



Visual Field Index-VFI

- Part of the visual field indices
  - MD, PSD, and VFI
- Mean Deviation- zero indicates, no deviation
  - "How deep" is the defect (or elevated)
- Pattern Standard Deviation
  - "How localized" is the defect
- Visual Field Index
  - Enhanced Mean Deviation
    - Designed to be less affected by cataracts
    - More sensitive to changes in the center of the visual field
      - Better correlates with ganglion cell loss
  - Normal 100%
  - Perimetric blindness 0%
- VFI and MD helpful in:
  - Staging
  - Following over time



Optometric
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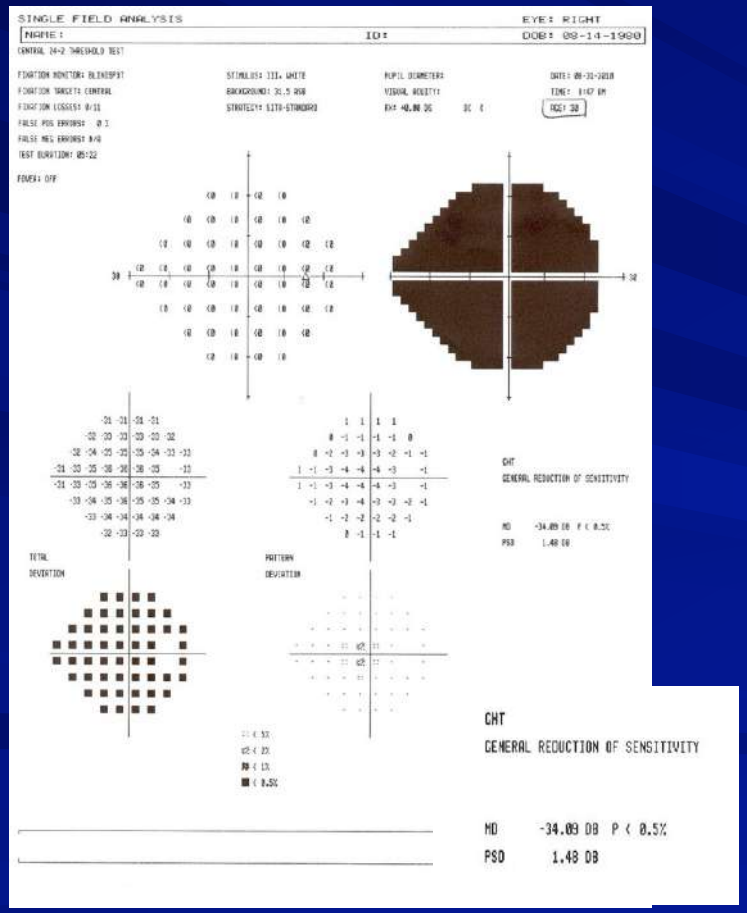
Question?

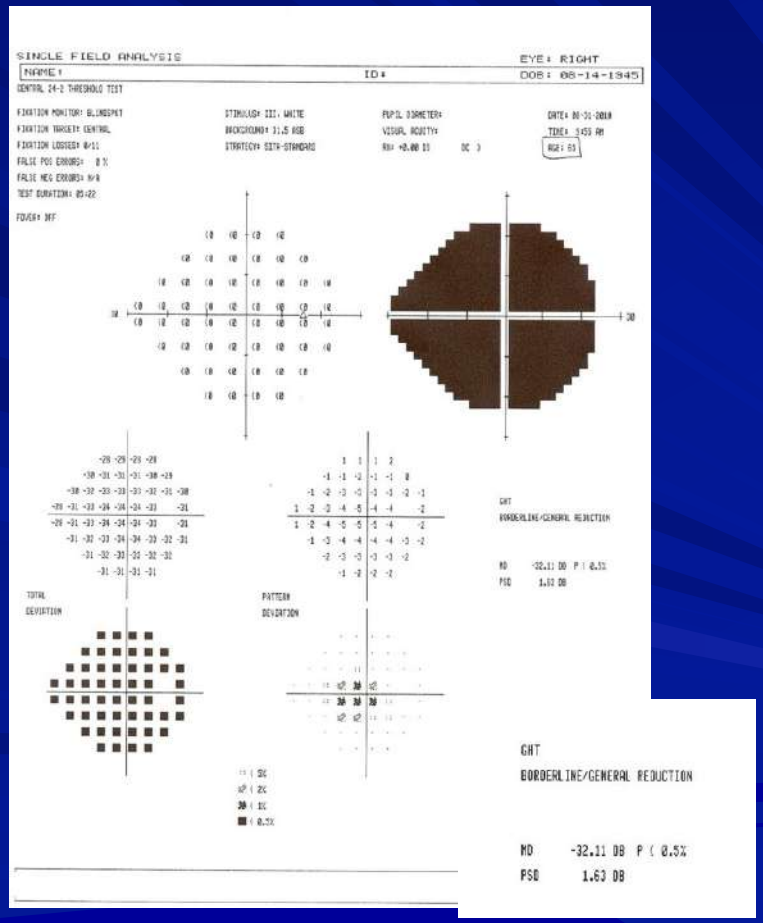
What is the Mean Deviation of a blind eye?

A. 100 db
B. 32 db
C. 0 db
D. -32 db
E. -100 db
F. Not sure – never considered it

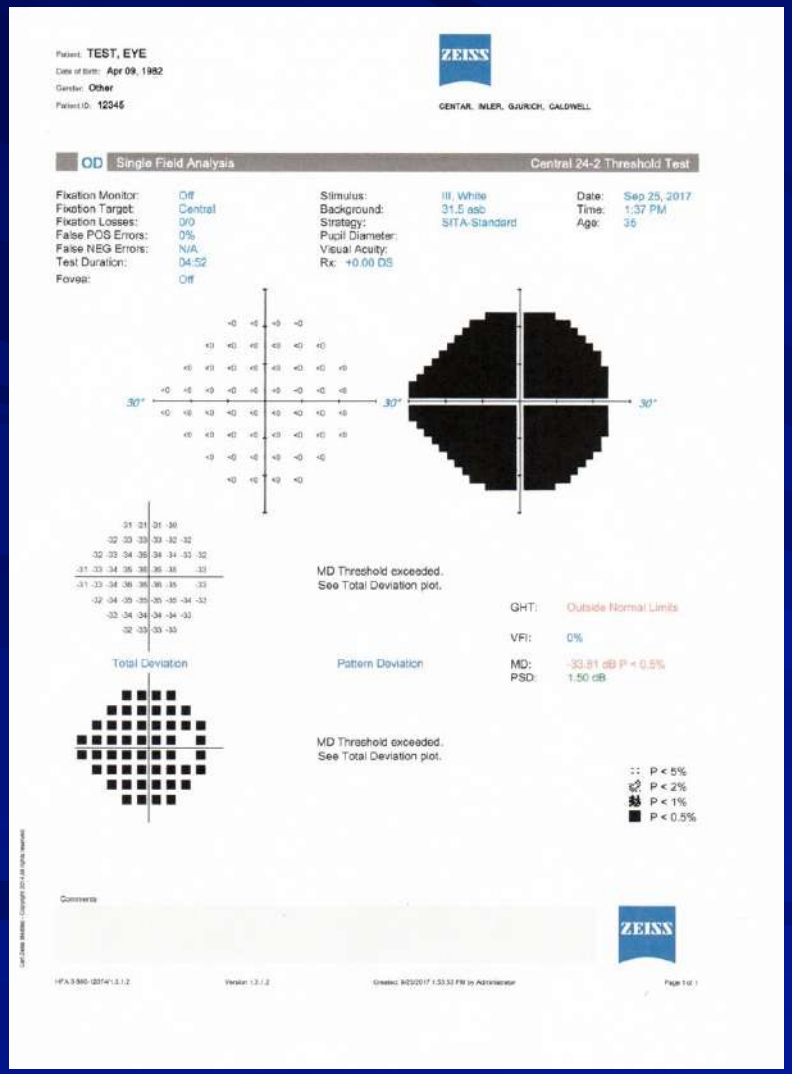
Thoughts on Mean Deviation (MD)

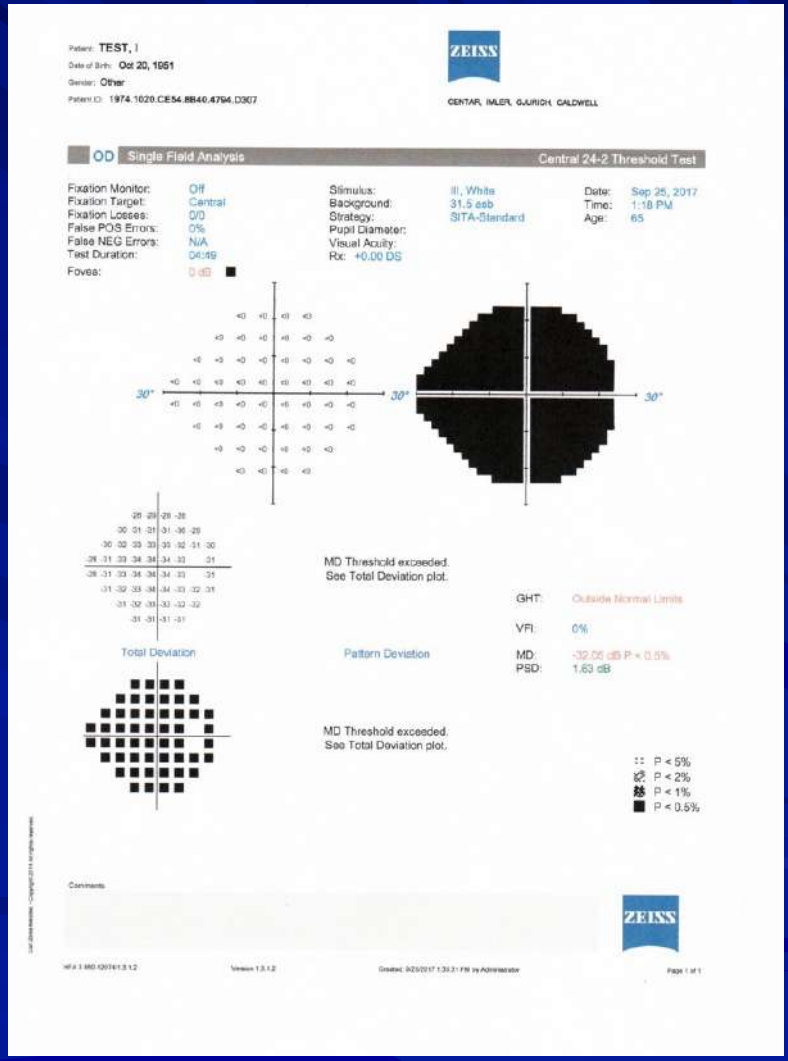
What is the Mean Deviation on a visual field of a blind eye?





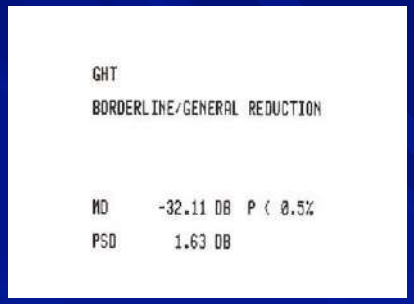
HFA-3


Patient: TEST, EYE
Date of Birth: Apr 09, 1982
Gender: Other
Patient ID: 12345
ZEISS
CENTAR, IMLER, GJURICH, CALDWELL
OD Single Field Analysis
Central 24-2 Threshold Test
Fixation Monitor: Off
Fixation Target: Central
Fixation Losses: 0/0
False POS Errors: 0%
False NEG Errors: N/A
Test Duration: 04:52
Fovea: Off
Stimulus: III, White
Background: 31.5 asb
Strategy: SITA-Standard
Pupil Diameter:
Visual Acuity:
Rx: +0.00 DS
Date: Sep 25, 2017
Time: 1:37 PM
Age: 35
30°
MD Threshold exceeded.
See Total Deviation plot.
GHT: Outside Normal Limits
VFI: 0%
MD: -33.81 dB P < 0.5%
PSD: 1.50 dB
Total Deviation
Pattern Deviation
MD Threshold exceeded.
See Total Deviation plot.
P < 5%
P < 2%
P < 1%
P < 0.5%
Comments
ZEISS


Patient: TEST, I
Date of Birth: Oct 20, 1951
Gender: Other
Patient ID: 1974.1020.CE54.8840.4794.D307
ZEISS
CENTAR, IMLER, GJURICH, CALDWELL
OD Single Field Analysis
Central 24-2 Threshold Test
Fixation Monitor: Off
Fixation Target: Central
Fixation Losses: 0/0
False POS Errors: 0%
False NEG Errors: N/A
Test Duration: 04:49
Fovea: 0 dB
Stimulus: III, White
Background: 31.5 asb
Strategy: SITA-Standard
Pupil Diameter:
Visual Acuity:
Rx: +0.00 DS
Date: Sep 25, 2017
Time: 1:18 PM
Age: 65
30°
MD Threshold exceeded.
See Total Deviation plot.
GHT: Outside Normal Limits
VFI: 0%
MD: -32.05 dB P < 0.5%
PSD: 1.63 dB
Total Deviation
Pattern Deviation
MD Threshold exceeded.
See Total Deviation plot.
P < 5%
P < 2%
P < 1%
P < 0.5%
Comments
ZEISS

Thoughts on Mean Deviation (MD)

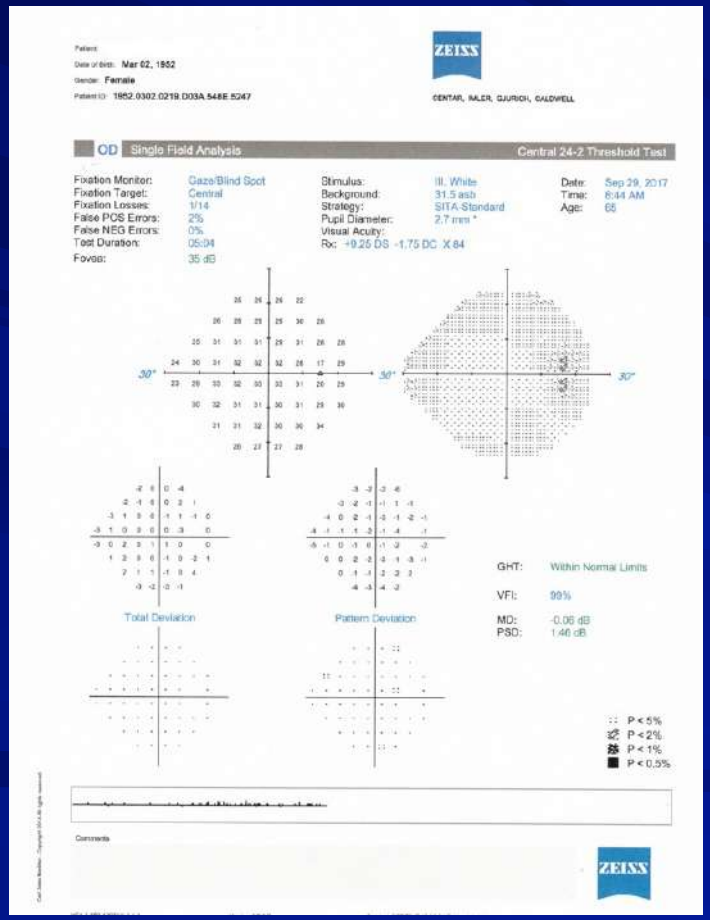
- Turn on your VF let it run
  - 30 DB (decibel)
- 0-5 (1/6) 30% reduction
- 5-10 (1/3) 40% reduction
- >10 (1/2) 50% reduction

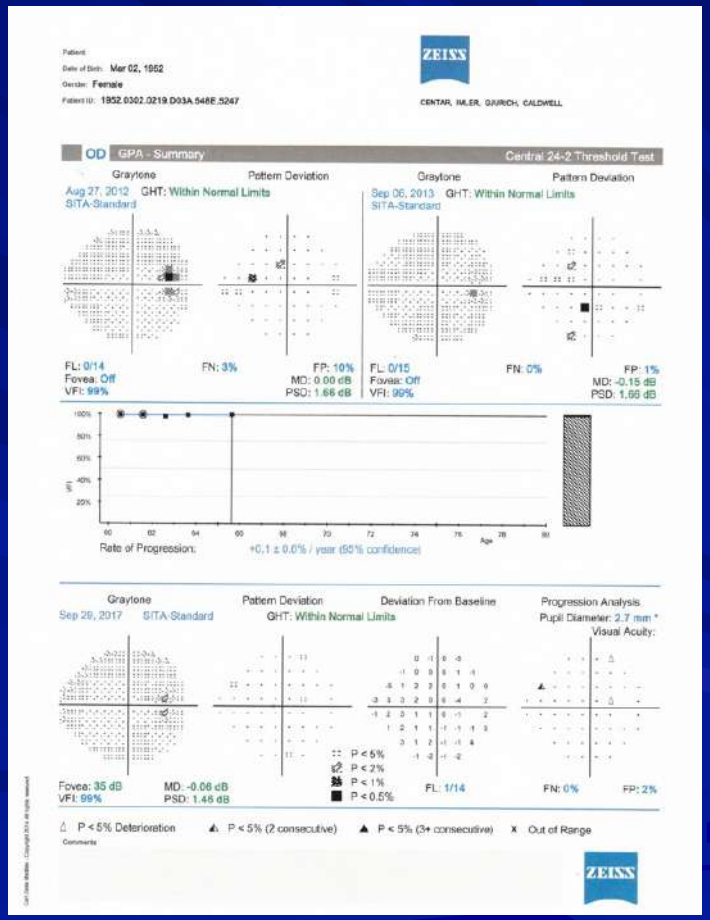


- How many DB difference to reliable VF should cause a RAPD?
  - 3 DB for a small APD, the larger the difference the greater the APD

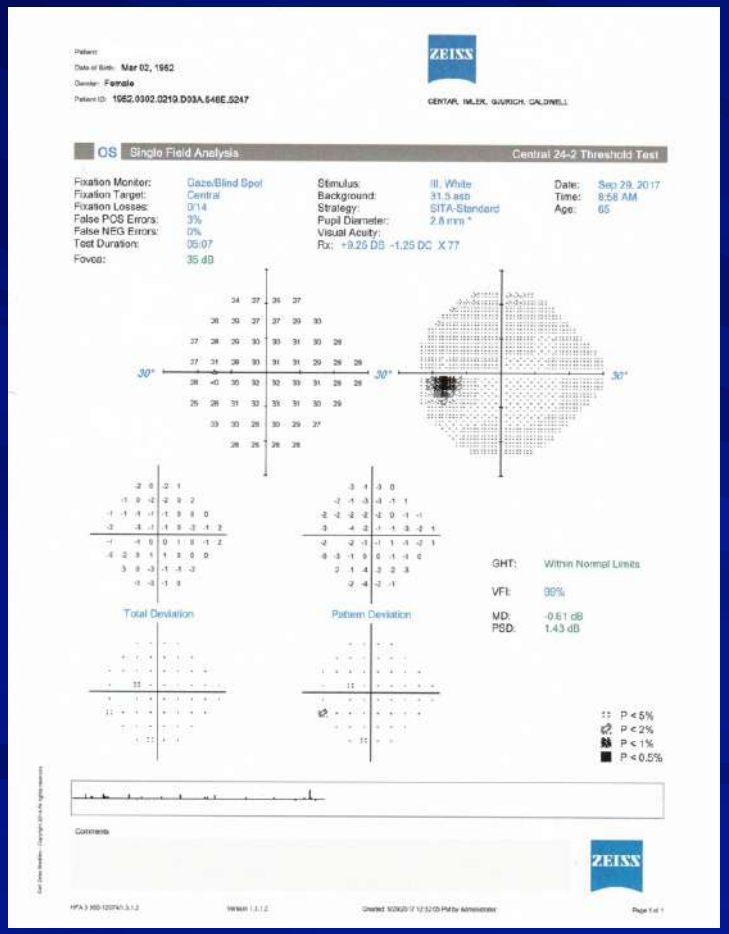
Let's Pull it All Together

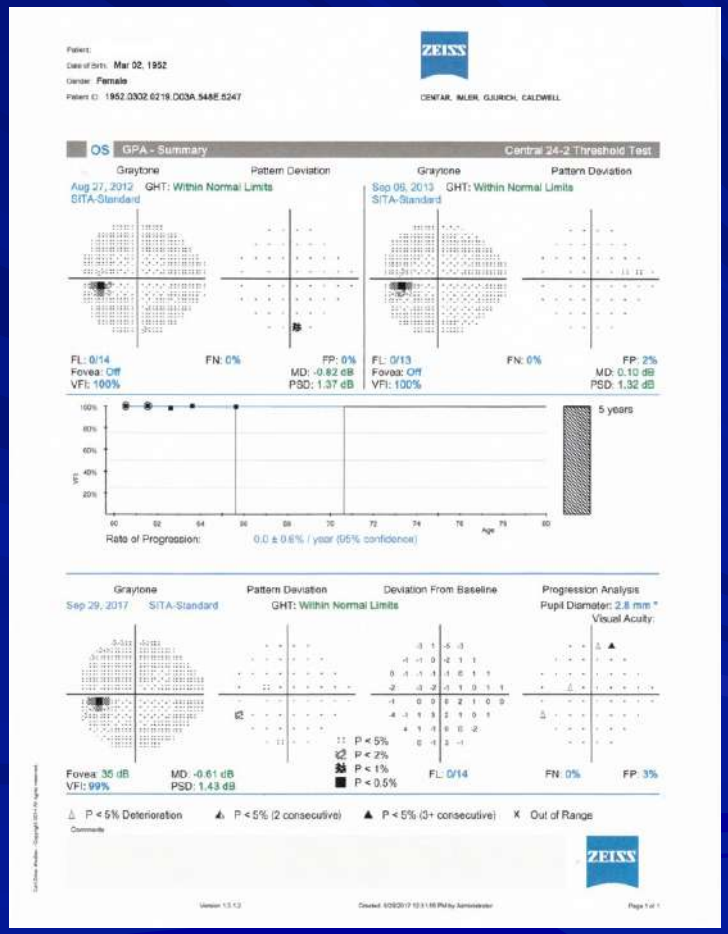
65 YO woman, IOPs Tmax 24/24, Pachs 585/588



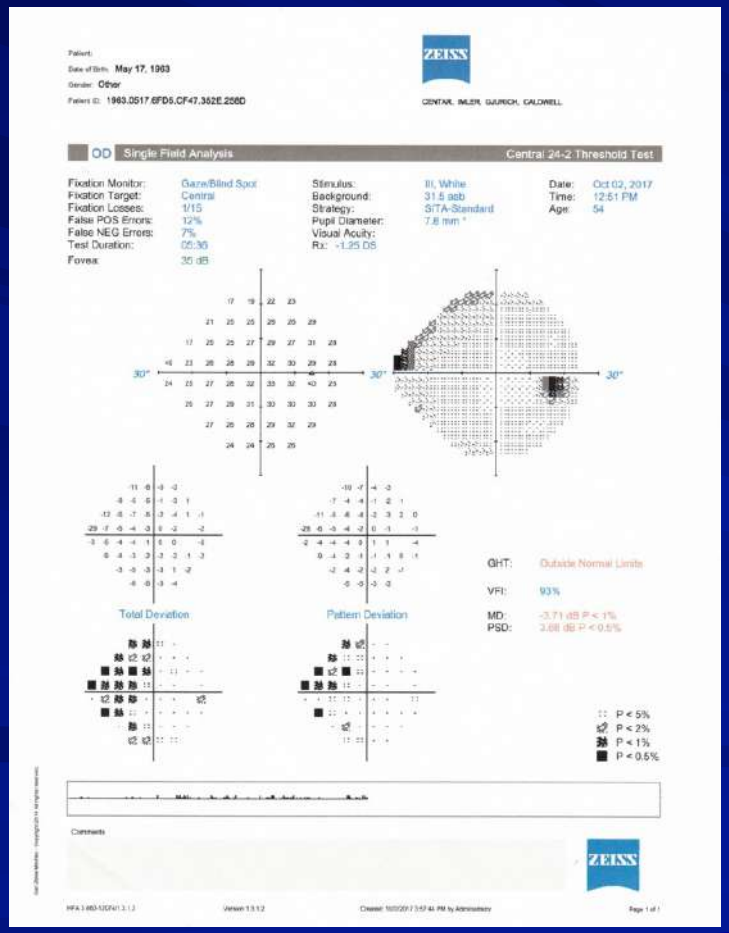


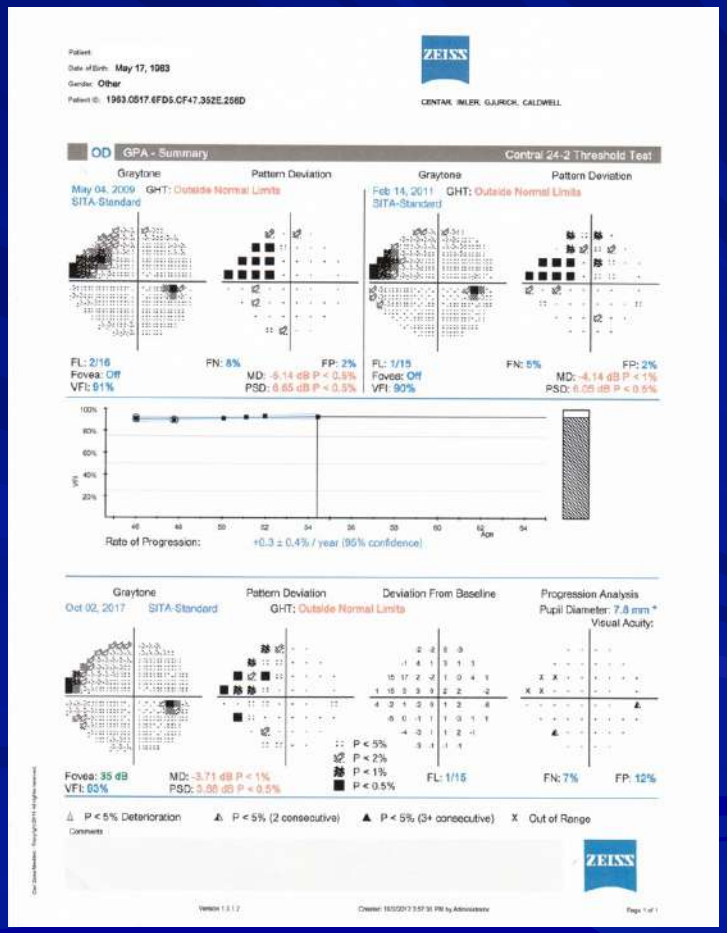
65 YO woman, IOPs Tmax 24/24, Pachs 585/588



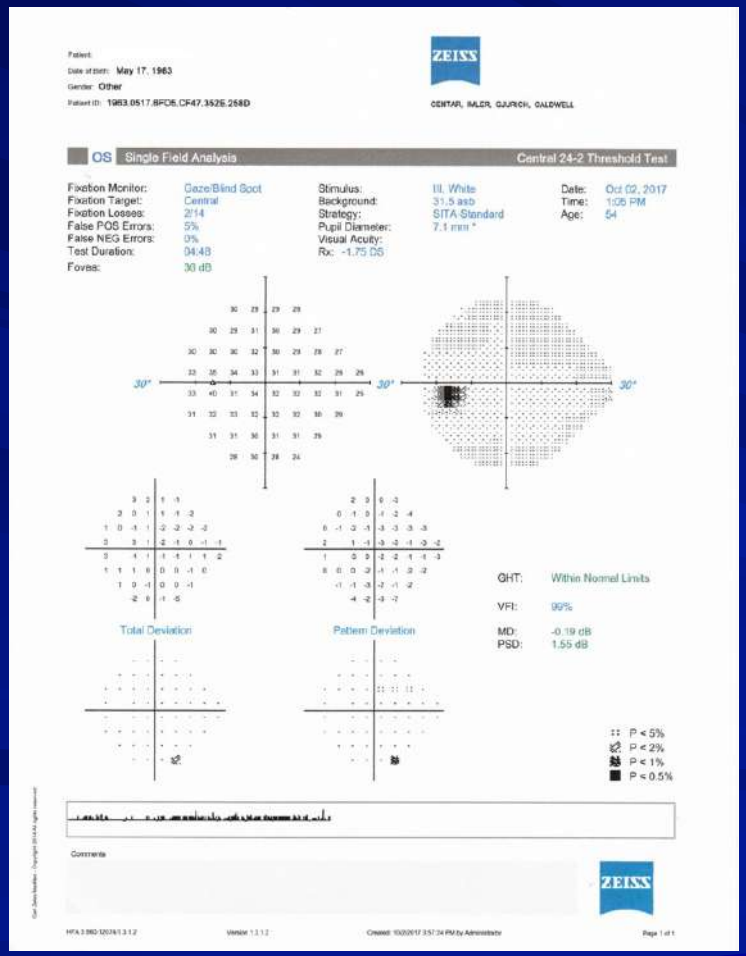


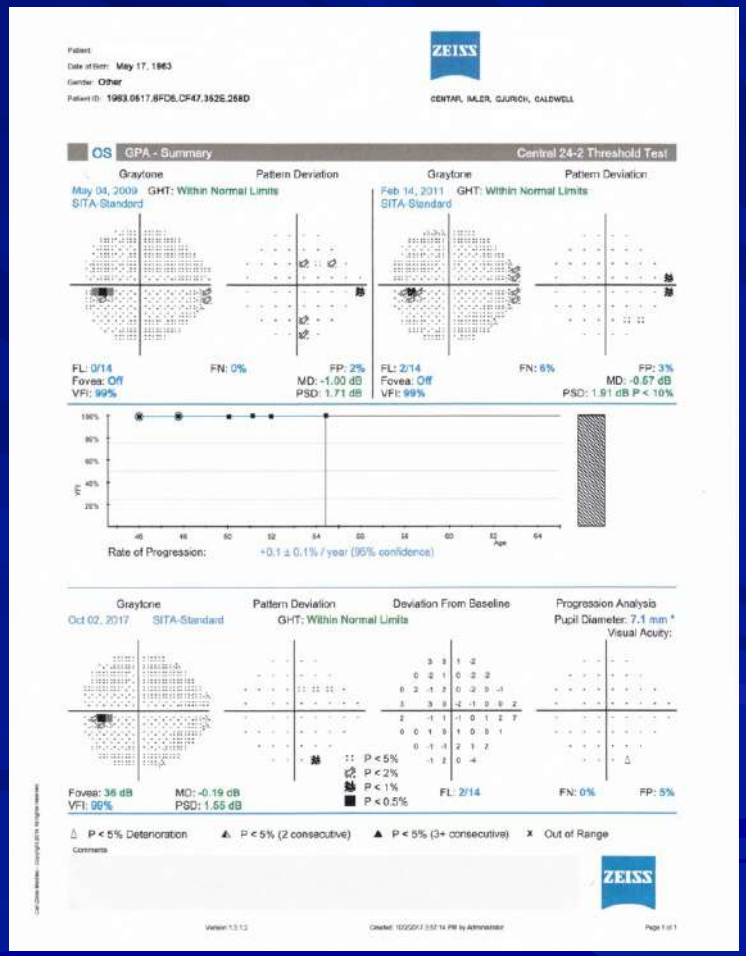
54 YO Woman with POAG



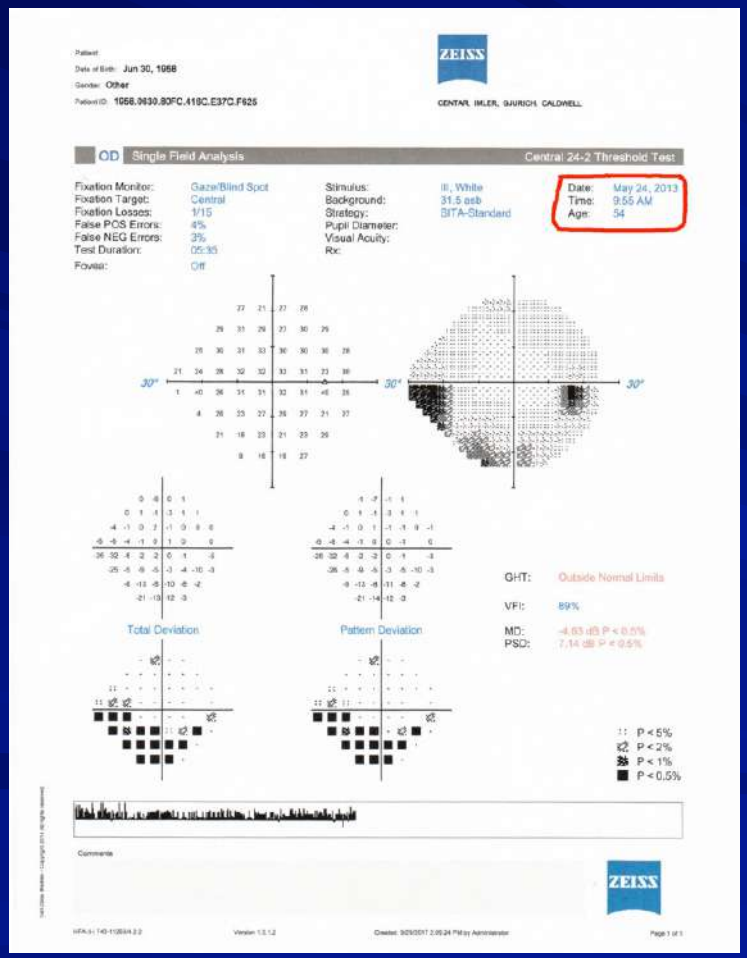


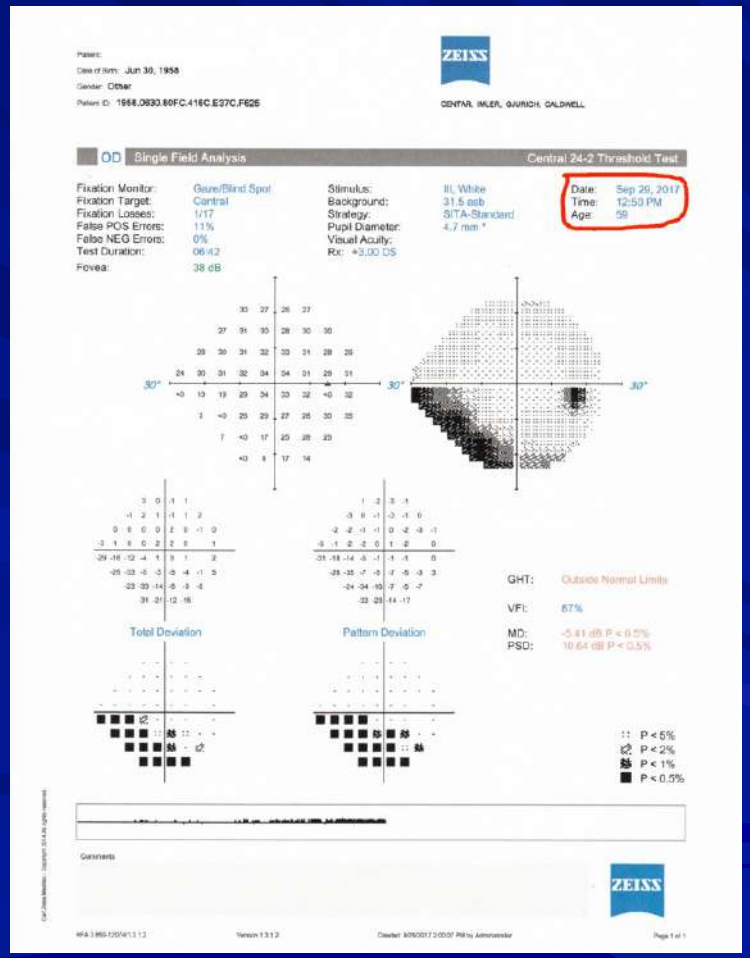
54 YO Woman with POAG



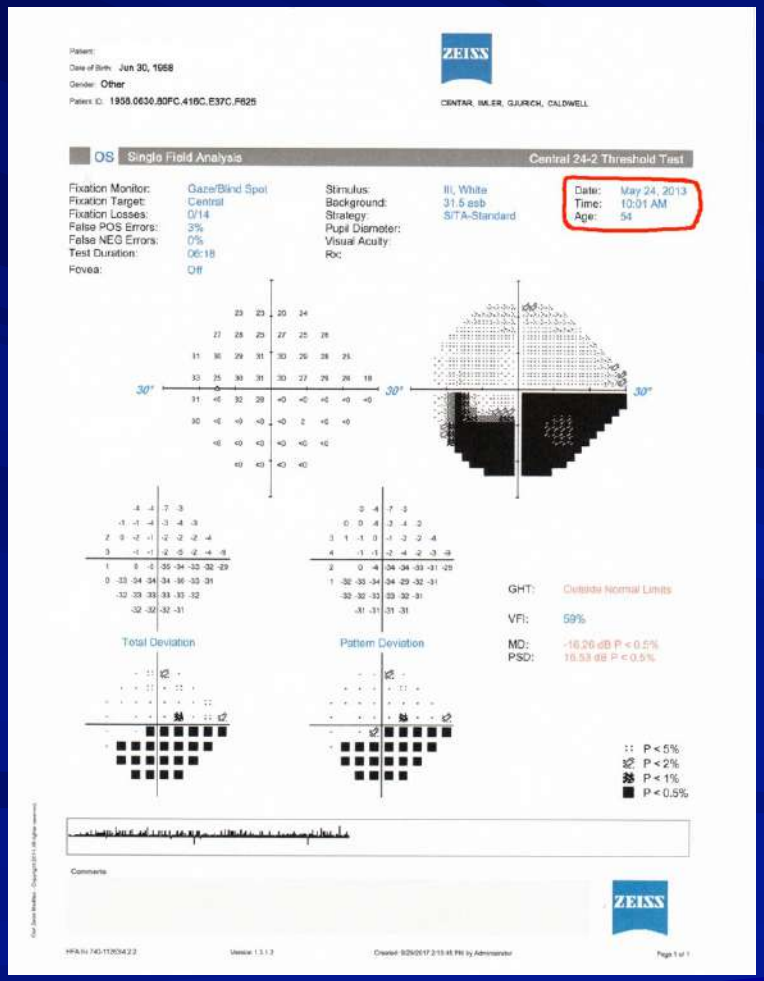


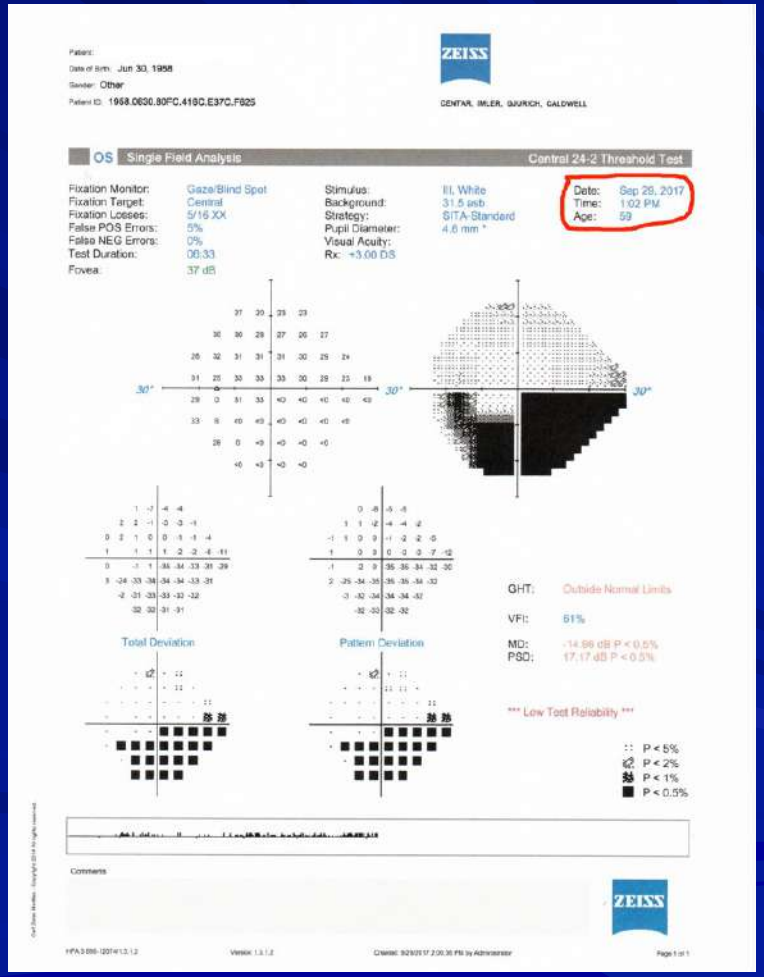
59 YO Man, Severe POAG (over 4.5 years)



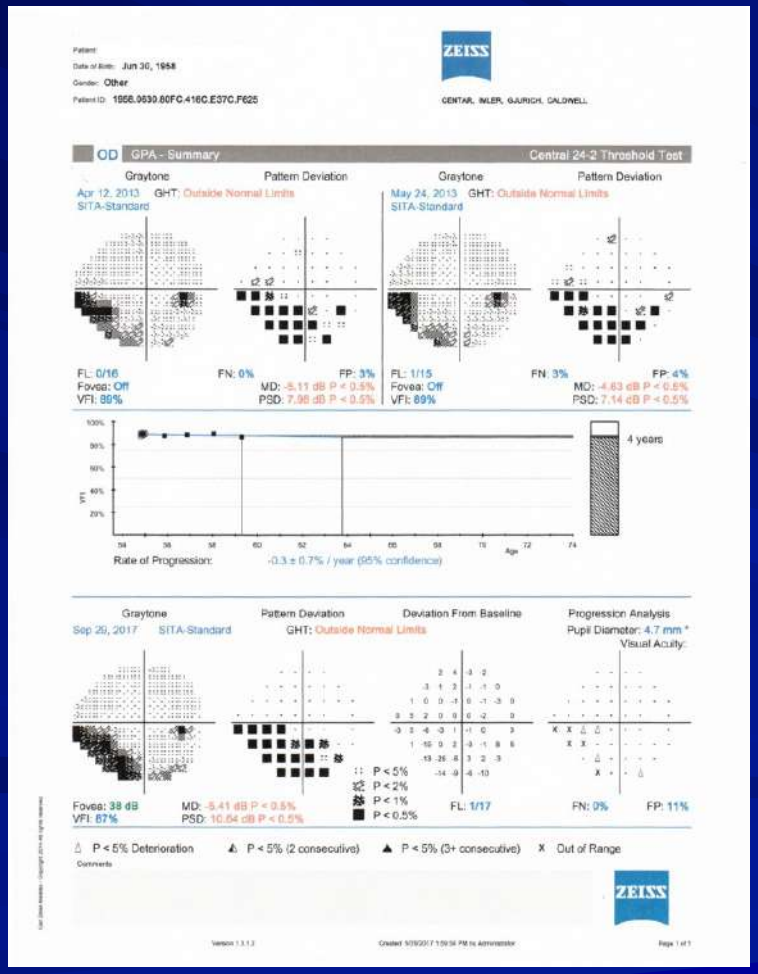


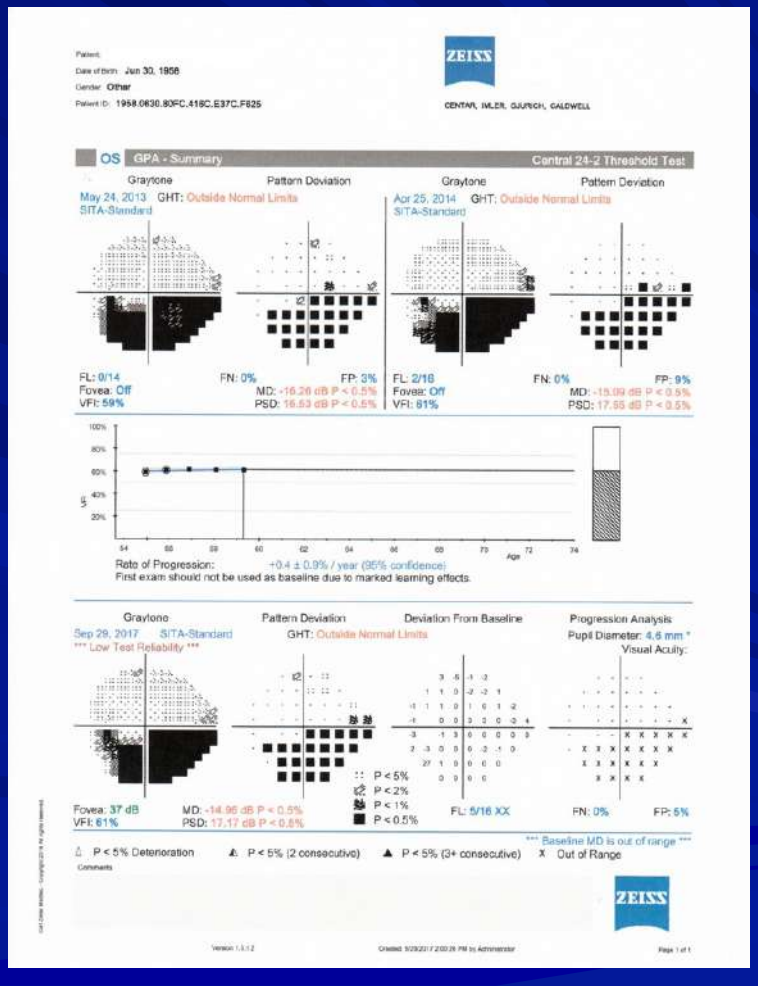
59 YO Man, Severe POAG (over 4.5 years)





59 YO Man, Severe POAG (over 4.5 years)





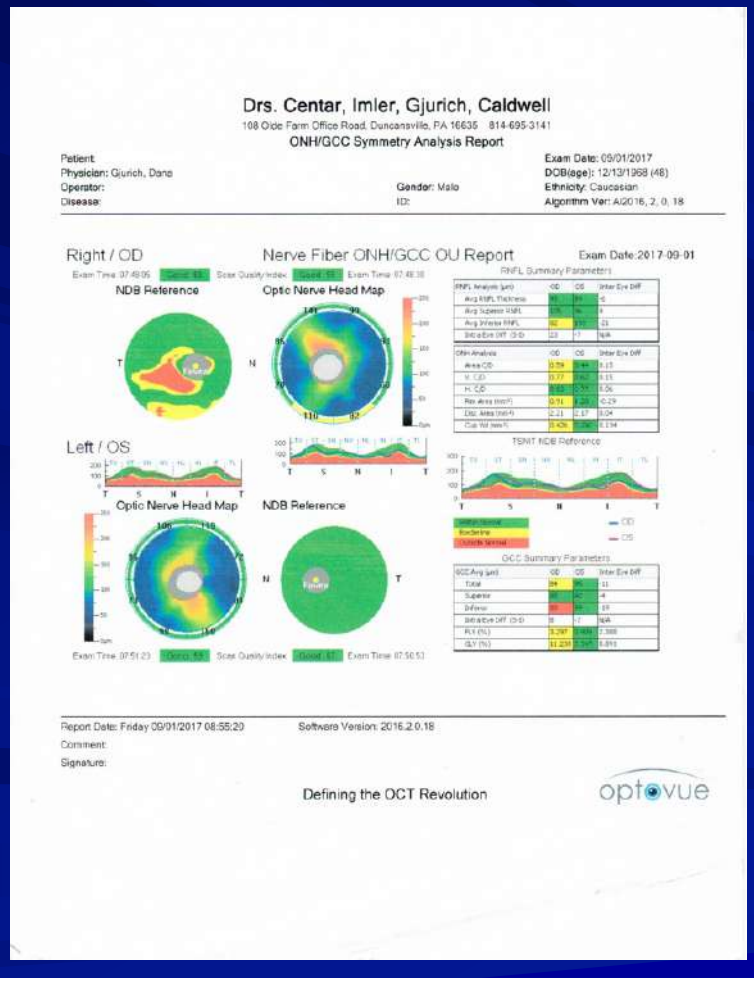
Structure versus Function Debate

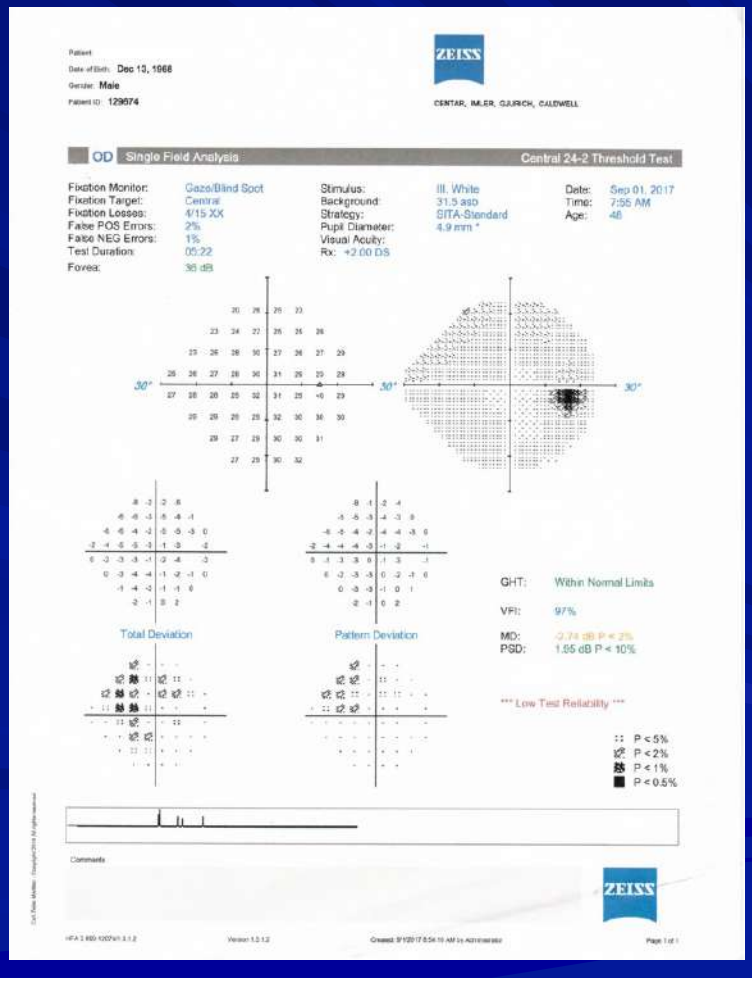
48 YO man

Tmax 36/38

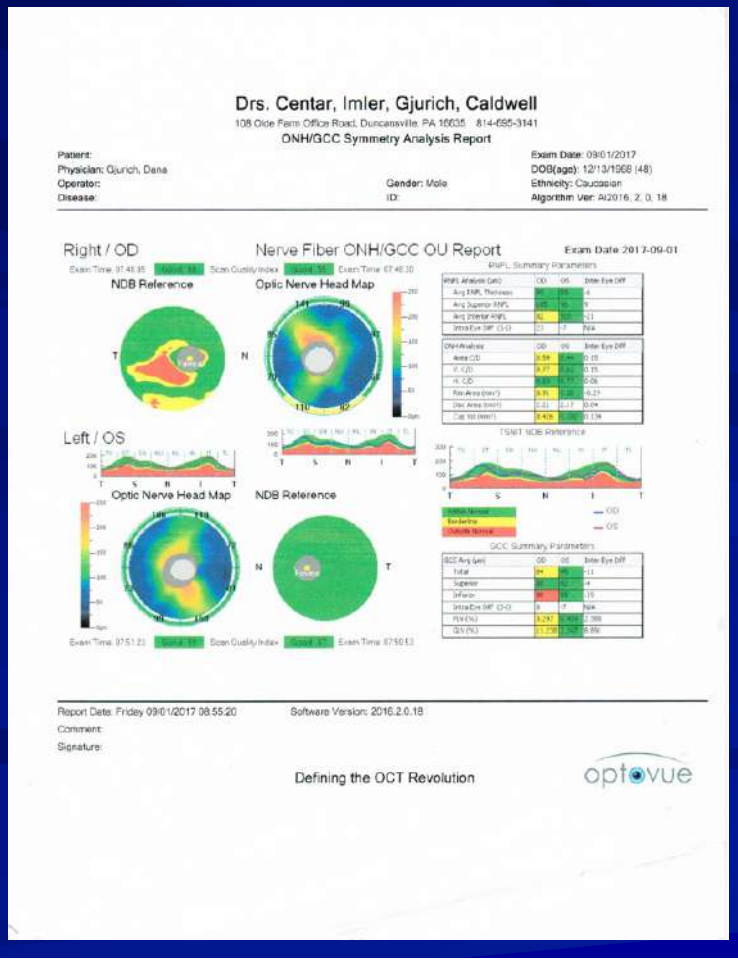
Strong family history of POAG

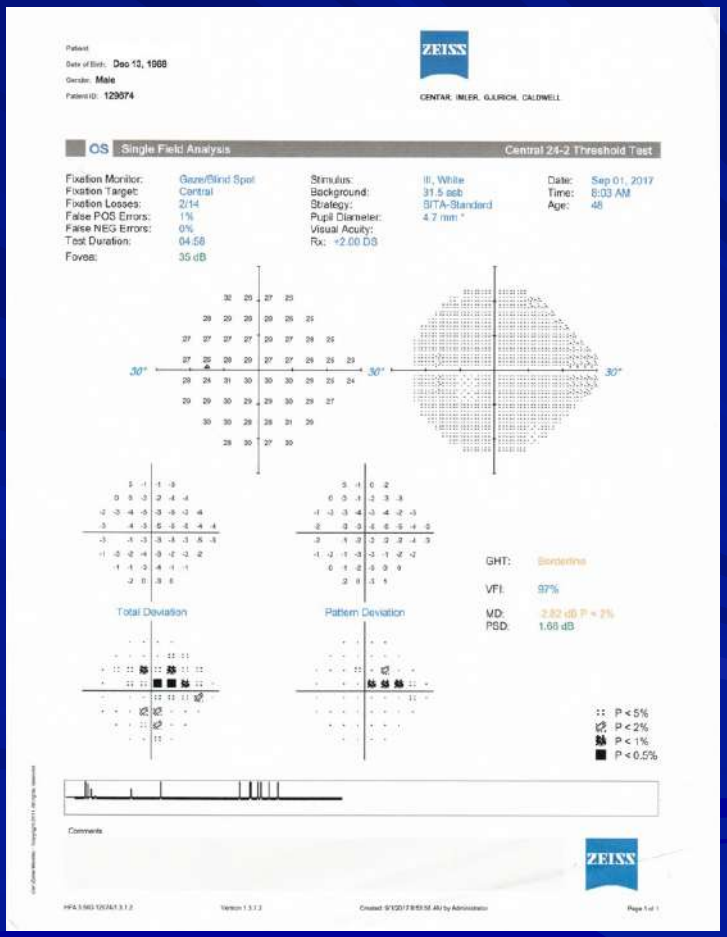
Structure and Function





Structure (okay) and Function



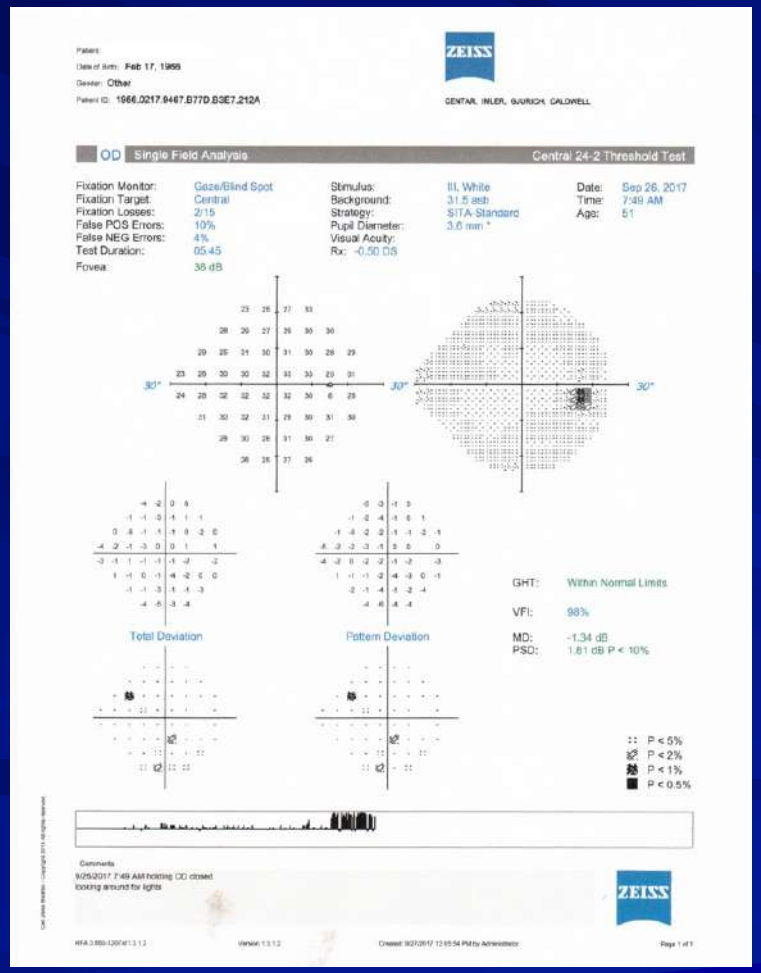


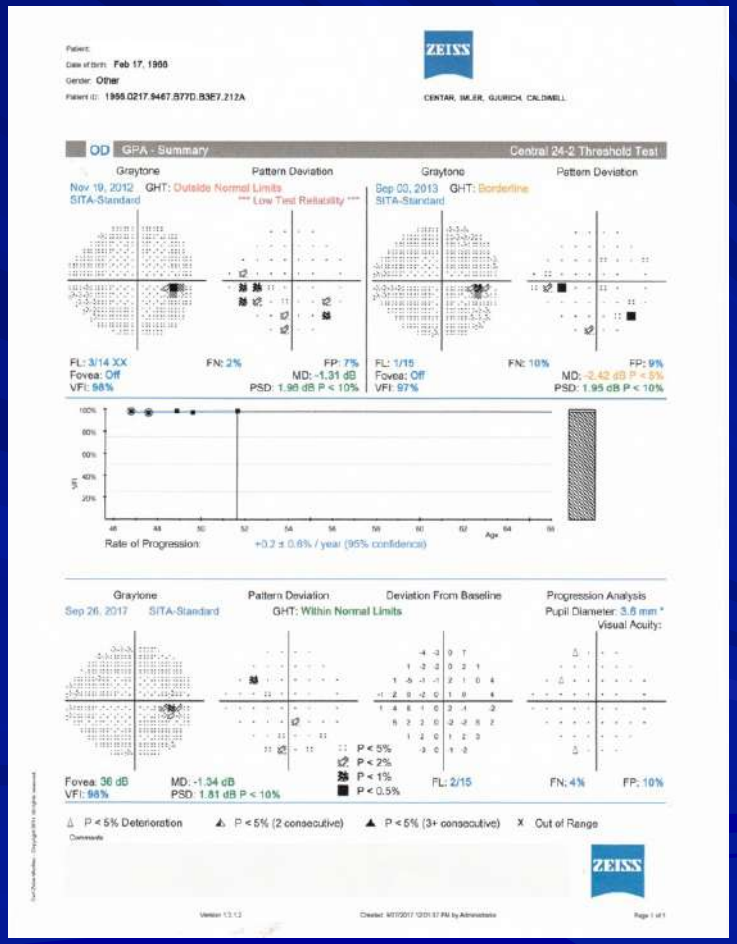
At 48 years old I will take my glaucoma serious

Tmax at diagnosis 26/32

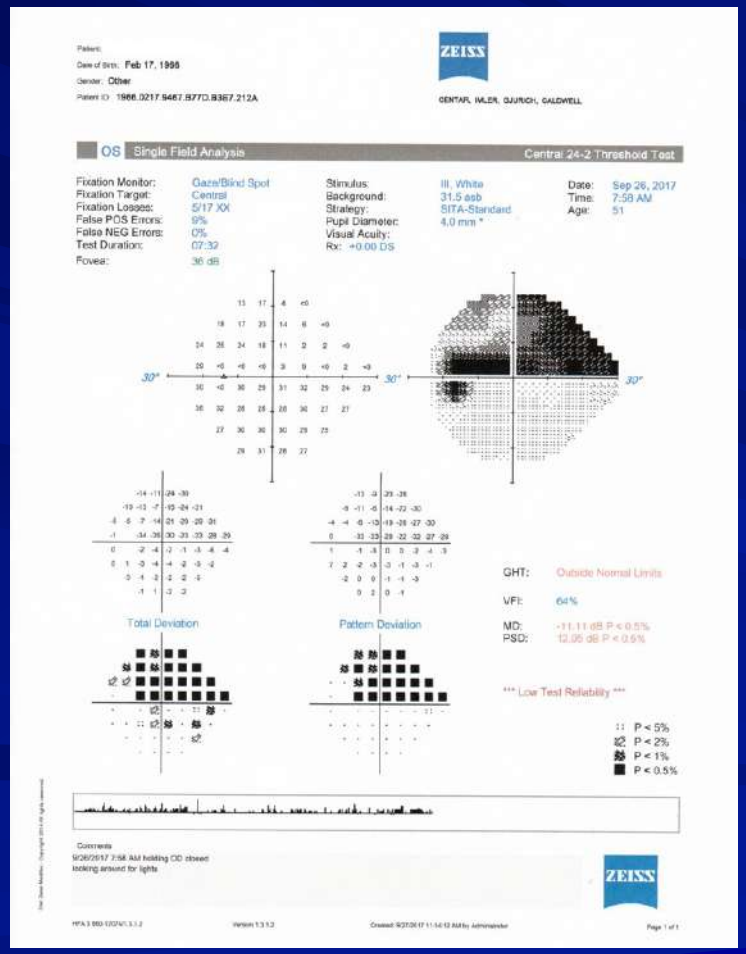
Poor compliance from 44-48 YO

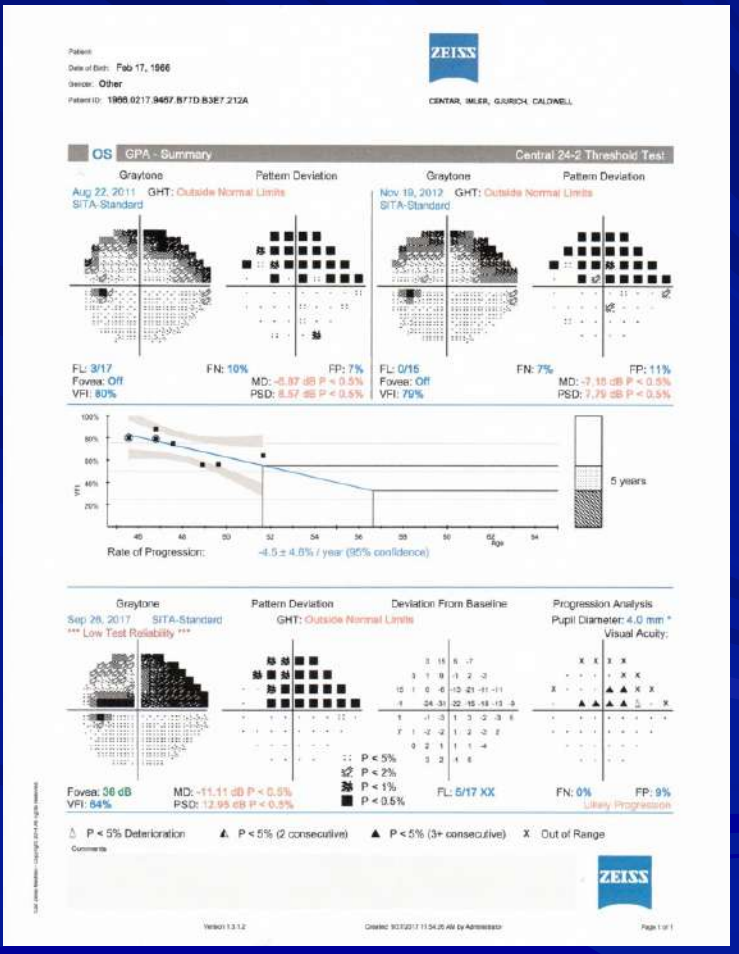
Now 51 Years Old Staying Compliant





Now 51 Years Old Staying Compliant

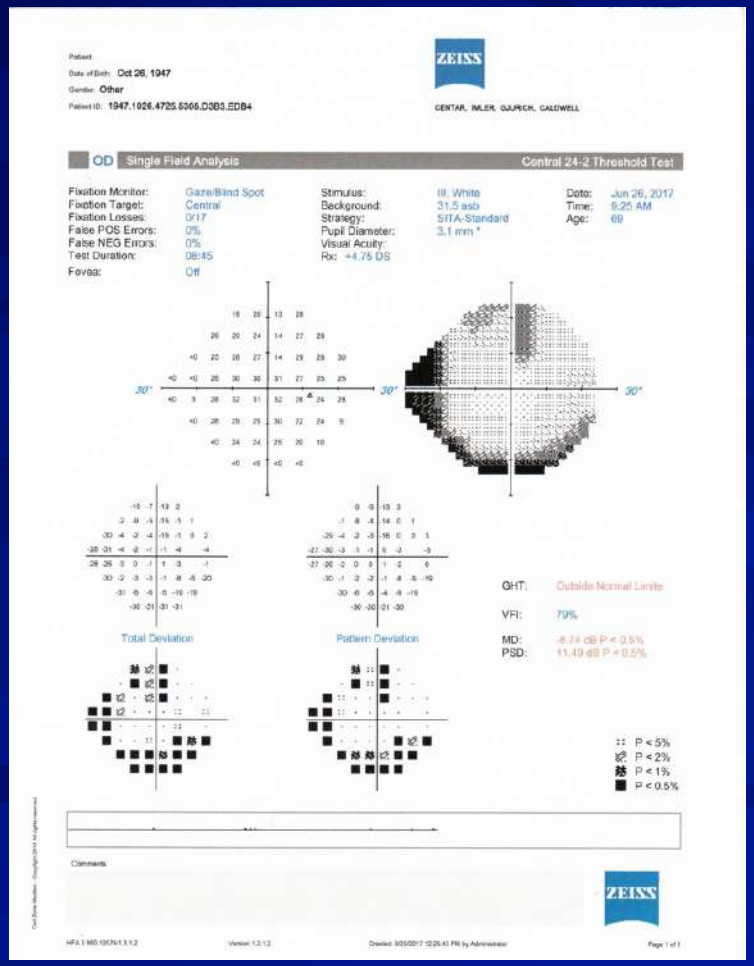


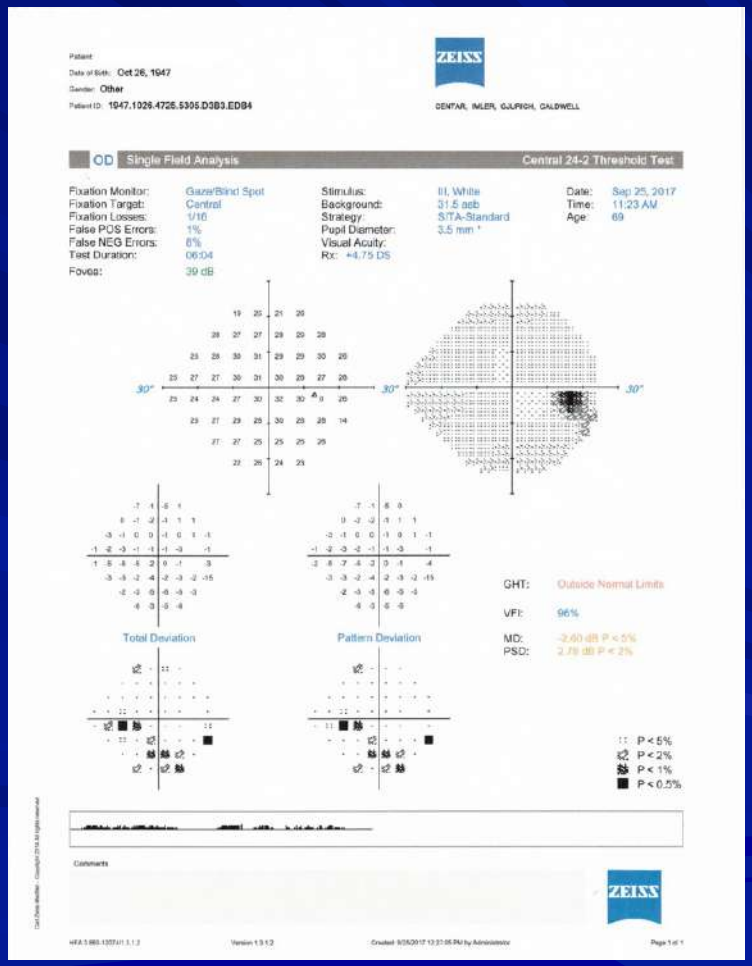


69 Year Old Man with POAG

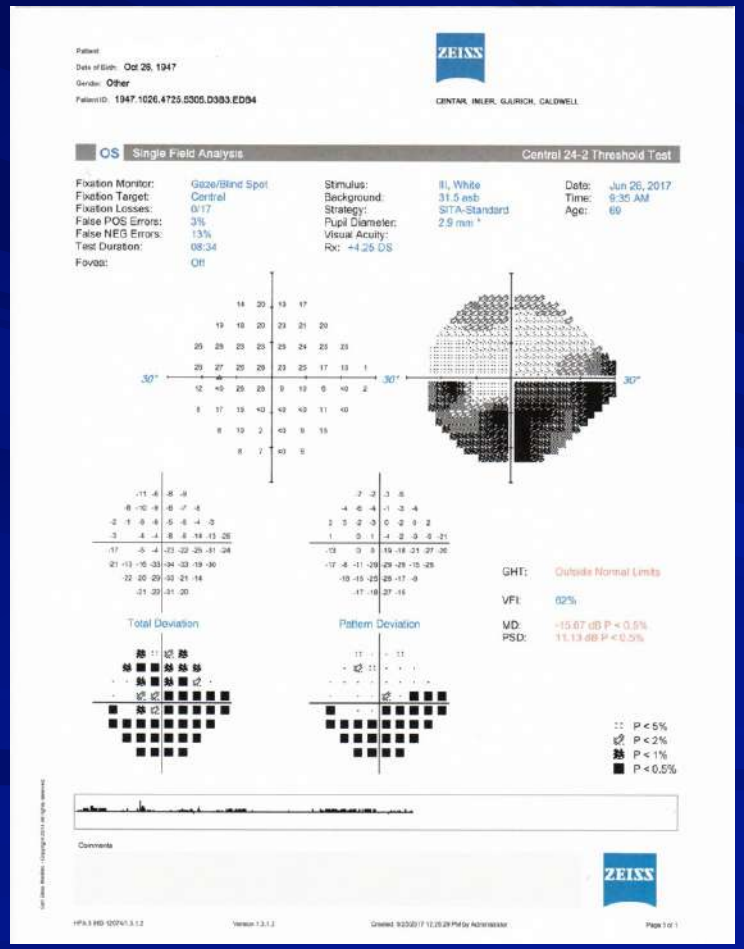
Be careful OD VF looks reliable with
FL, FP,FN, and gaze monitor

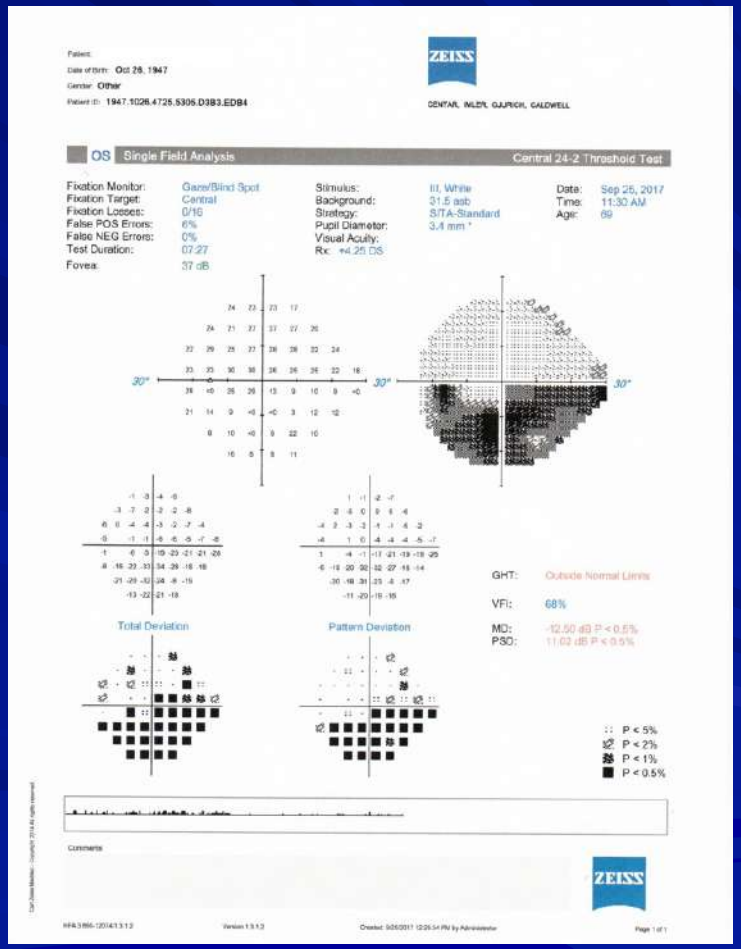
69 Year Old Man- Be Careful Even the VF Says Reliable





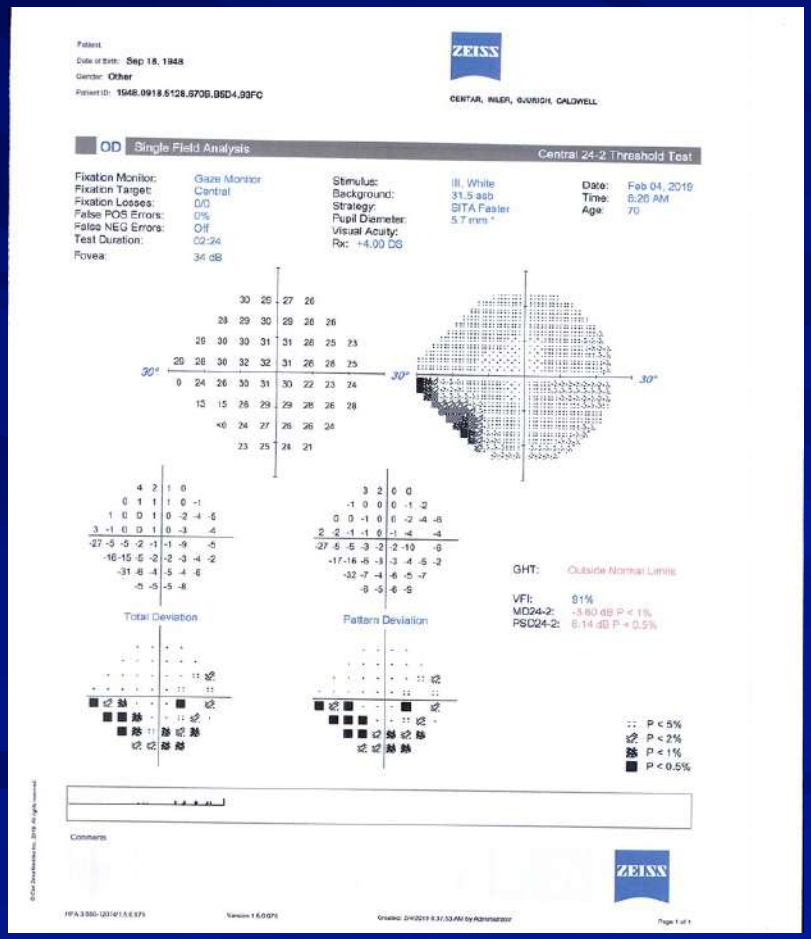
69 year old- Be Careful Even the VF Say Reliable

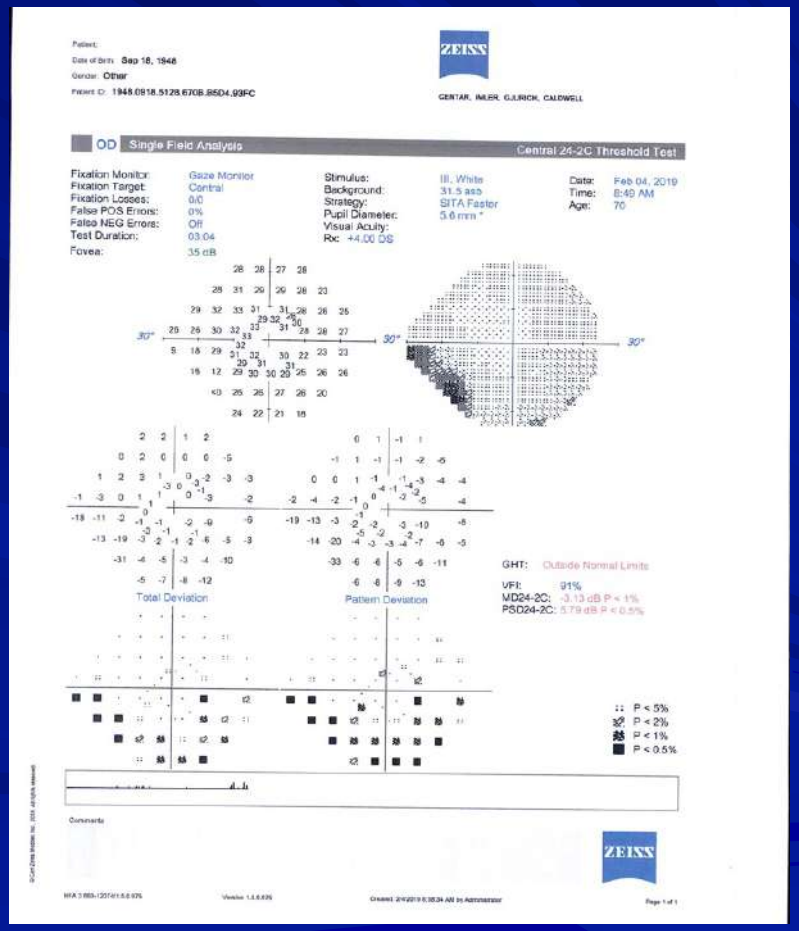




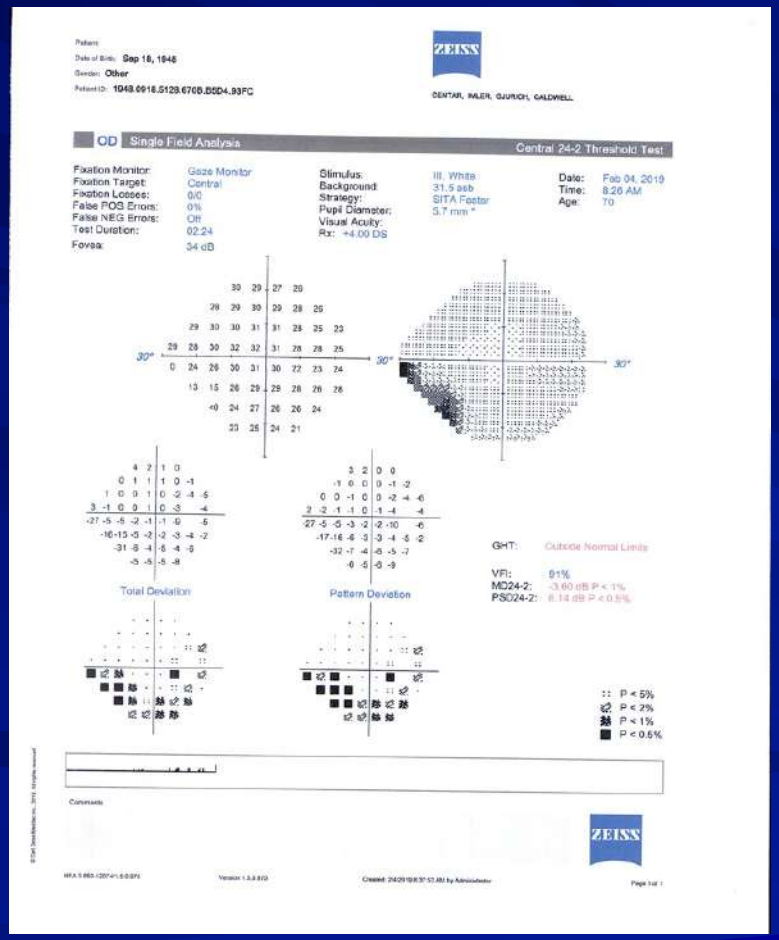
What Did We Learn?

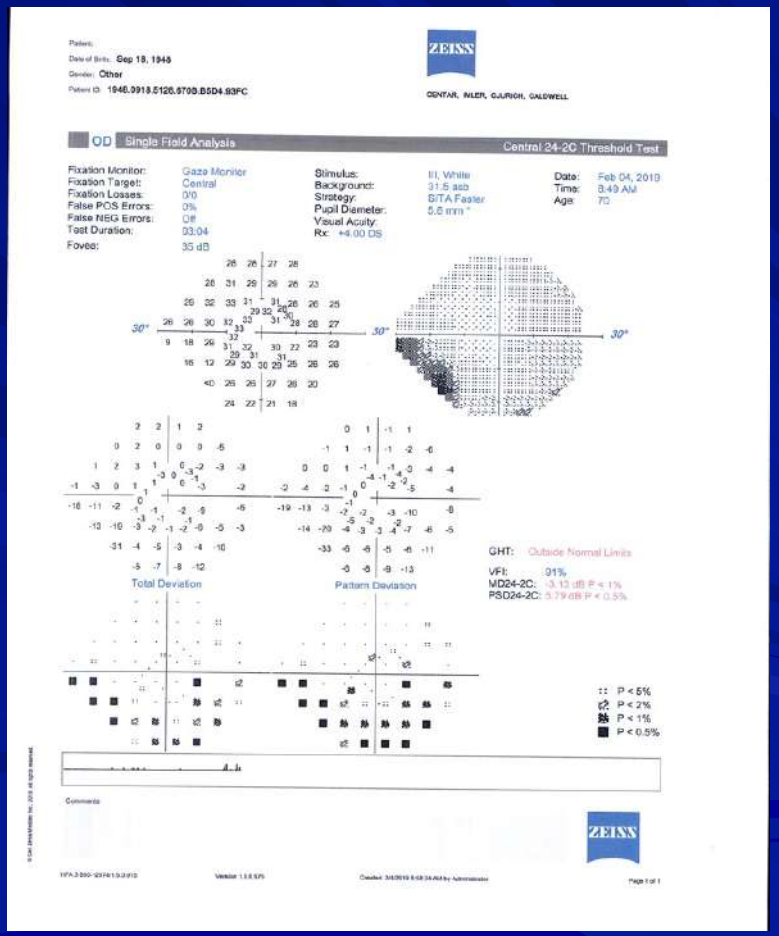
24-2 and 24-2C OD



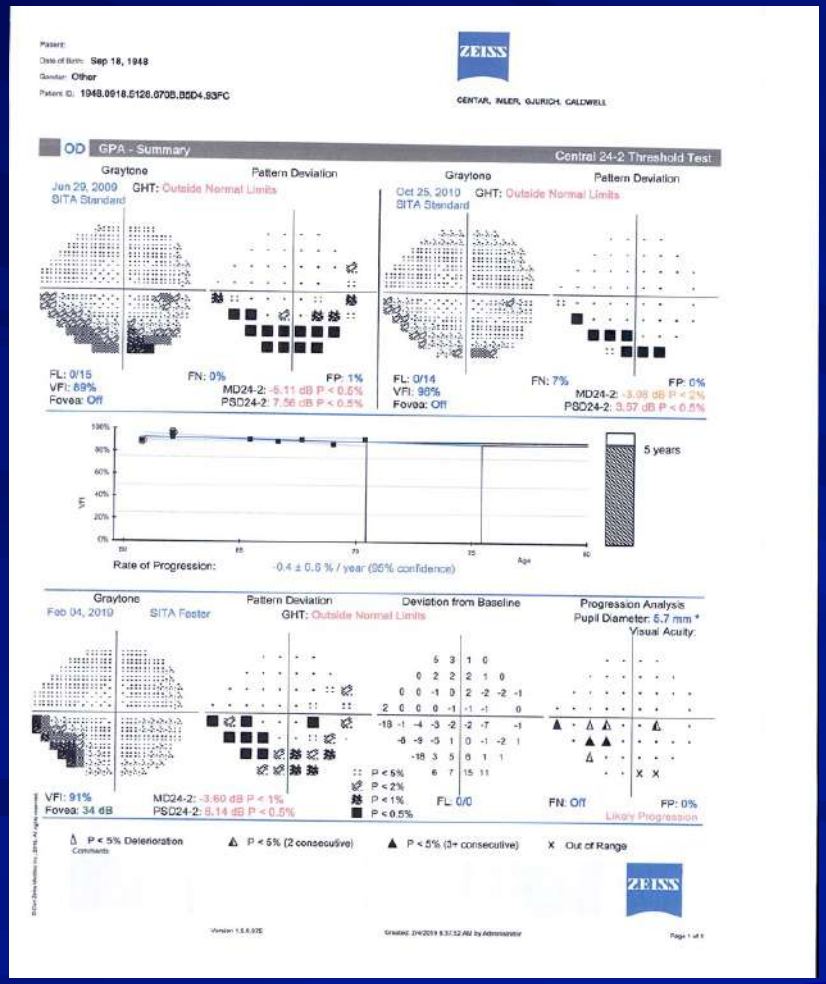


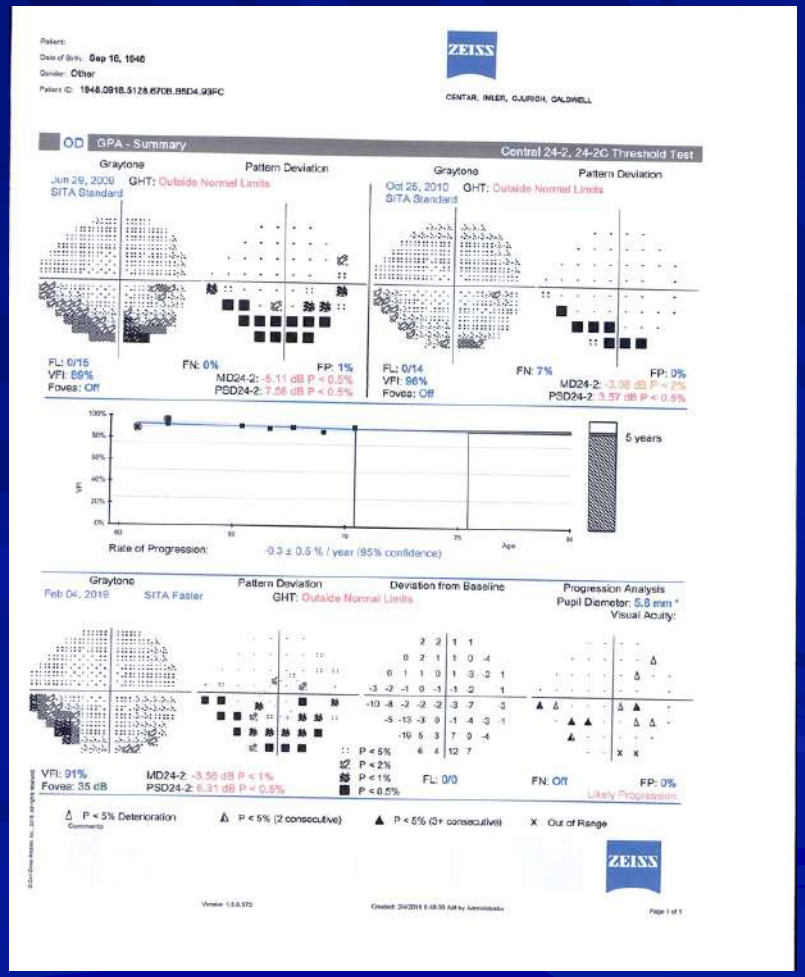
24-2 and 24-2C OS





24-2C


Date of Birth: Sep 18, 1949
Gender: Other
CENTAR, INLER, GJURICH, CALDWELL
OD GPA - Summary
Central 24-2 Threshold Test
Graytone
Pattern Deviation
Jun 29, 2009 GHT: Outside Normal Limits
SITA Standard
Oct 25, 2010 GHT: Outside Normal Limits
SITA Standard
FL: 0/15
VFI: 89%
Fovea: Off
FN: 0%
FP: 1%
MD24-2: -5.11 dB P < 0.5%
PSD24-2: 7.56 dB P < 0.5%
FL: 0/14
VFI: 96%
Fovea: Off
FN: 7%
FP: 0%
MD24-2: -3.98 dB P < 2%
PSD24-2: 3.57 dB P < 0.5%
5 years
Rate of Progression: -0.4 ± 0.8 % / year (95% confidence)
Graytone
Pattern Deviation
Deviation from Baseline
Progression Analysis
Feb 04, 2019 SITA Faster
GHT: Outside Normal Limits
Pupil Diameter: 5.7 mm *
Visual Acuity:
VFI: 91%
Fovea: 34 dB
MD24-2: -3.60 dB P < 1%
PSD24-2: 6.14 dB P < 0.5%
FL: 0/0
FN: Off
FP: 0%
Likely Progression
P < 5% Deterioration
P < 5% (2 consecutive)
P < 5% (3+ consecutive)
X Out of Range


Date of Birth: Sep 16, 1946
Gender: Other
CENTAR, INLER, GJURICH, CALDWELL
OD GPA - Summary
Central 24-2, 24-2C Threshold Test
Graytone
Pattern Deviation
Jun 29, 2009 GHT: Outside Normal Limits
SITA Standard
Oct 26, 2010 GHT: Outside Normal Limits
SITA Standard
FL: 0/15
VFI: 89%
Fovea: Off
FN: 0%
FP: 1%
MD24-2: -5.11 dB P < 0.5%
PSD24-2: 7.56 dB P < 0.5%
FL: 0/14
VFI: 96%
Fovea: Off
FN: 7%
FP: 0%
MD24-2: -3.98 dB P < 2%
PSD24-2: 3.57 dB P < 0.5%
5 years
Rate of Progression: -0.3 ± 0.5 % / year (95% confidence)
Graytone
Pattern Deviation
Deviation from Baseline
Progression Analysis
Feb 04, 2019 SITA Faster
GHT: Outside Normal Limits
Pupil Diameter: 5.8 mm *
Visual Acuity:
VFI: 91%
Fovea: 35 dB
MD24-2: -3.56 dB P < 1%
PSD24-2: 6.31 dB P < 0.5%
FL: 0/0
FN: Off
FP: 0%
Likely Progression
P < 5% Deterioration
P < 5% (2 consecutive)
P < 5% (3+ consecutive)
X Out of Range

Patient:

Date of Birth: **Nov 09, 1942**

Gender:

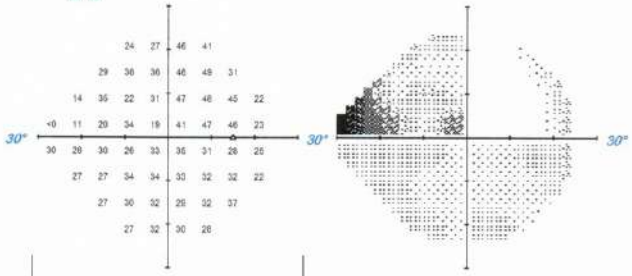
Patient ID:

ZEISS

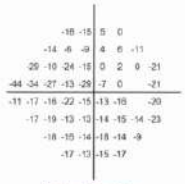
CENTAR, IMLER, GJURICH, CALDWELL

OD Single Field Analysis — Central 24-2 Threshold Test

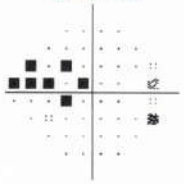
Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Nov 20, 2017
Fixation Target:	Central	Background:	31.5 asb	Time:	12:40 PM
Fixation Losses:	8/17 XX	Strategy:	SITA-Standard	Age:	75
False POS Errors:	20% XX	Pupil Diameter:	4.2 mm *		
False NEG Errors:	9%	Visual Acuity:			
Test Duration:	09:37	Rx: +4.00 DS			
Fovea:	35 dB				



Total Deviation



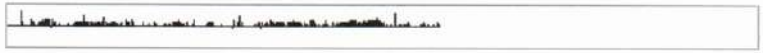
Pattern Deviation



GHT:	Abnormally High Sensitivity
VFI:	86%
MD:	1.71 dB
PSD:	9.29 dB P < 0.5%

*** Excessive High False Positives ***

:: P < 5%
P < 2%
P < 1%
■ P < 0.5%



Comments

ZEISS

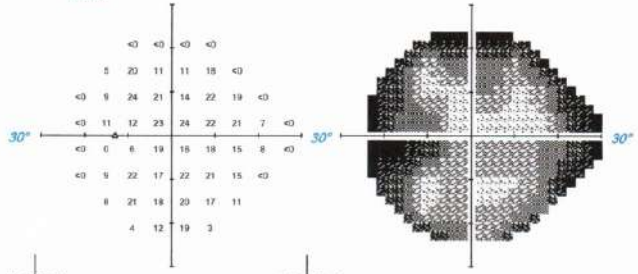
Patient:
Date of Birth: May 14, 1942
Gender:
Patient ID:

ZEISS

CENTAR, IMLER, GJURICH, CALDWELL

OS Single Field Analysis — Central 24-2 Threshold Test

Fixation Monitor:	Gaze/Blind Spot	Stimulus:	III, White	Date:	Nov 22, 2017
Fixation Target:	Central	Background:	31.5 asb	Time:	8:24 AM
Fixation Losses:	9/17 XX	Strategy:	SITA-Standard	Age:	75
False POS Errors:	3%	Pupil Diameter:	5.9 mm *		
False NEG Errors:	53%	Visual Acuity:			
Test Duration:	06:48	Rx:	+3.50 DS		
Fovea:	32 dB				



Total Deviation

Pattern Deviation

GHT: Outside Normal Limits

VFI: 59%

MD: -16.11 dB P < 0.5%
PSD: 8.04 dB P < 0.5%

*** Low Test Reliability ***

:: P < 5%
P < 2%
P < 1%
■ P < 0.5%

Comments
11/22/2017 8:24 AM pt looking around for lights
have to reposition

ZEISS

Optometric
Education
Consultants

Questions and Thank You!

Bring the Love Back to the Visual Field

Greg Caldwell, OD, FAAO

Mackinac Island Northern Escape
Optometric Education Consultants

Sunday, August 20, 2023