Glaucoma Imaging and Analysis

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Financial disclosures

- None

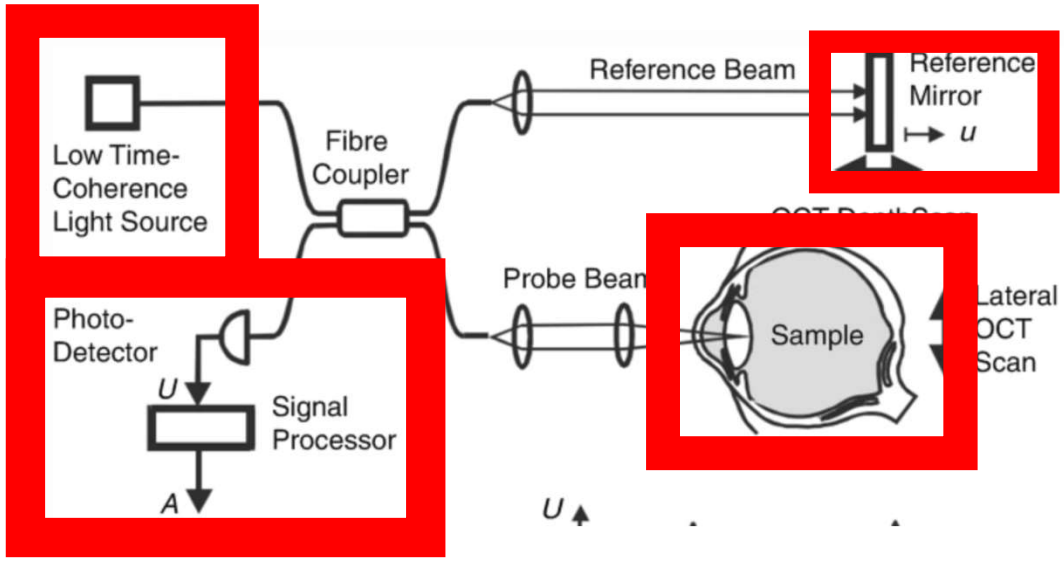
Learning objectives

- How to determine if an OCT or HVF is reliable
- What are common artifacts skewing OCTs
- Identify green and red disease
- Define the global indices of HVF
- Define trend-based and event-based progression
- Note slow progressors vs. fast progressors on HVF

Optical Coherence Tomography

OCT

- Light source
  - Split to reference arm and a media
- Reference arm
  - Mirror reflects light back
- Media
  - eg, the eye
- Detector
  - Returning light from both arms combines to form interference pattern generating cross-sectional image



OCT: distinguishing normal from glaucoma

- Most reliable RNFL parameters:
  - Average RNFL
  - Inferior quadrant RNFL
  - IT clock hour (7/5 OD/OS, respectively)
  - ST clock hour (11/1)
  - Clock hour 6
- Excellent ability
  - AUC 0.923– 0.957
  - AUC 1 = perfect test w/ 100% sensitivity and specificity
- Regardless of disease severity

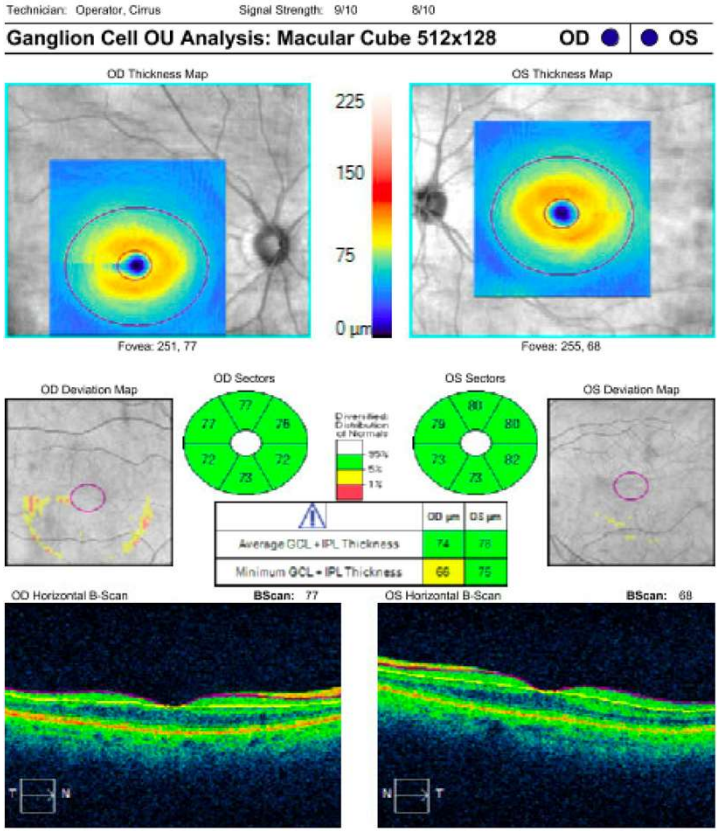
OCT: distinguishing normal from glaucoma

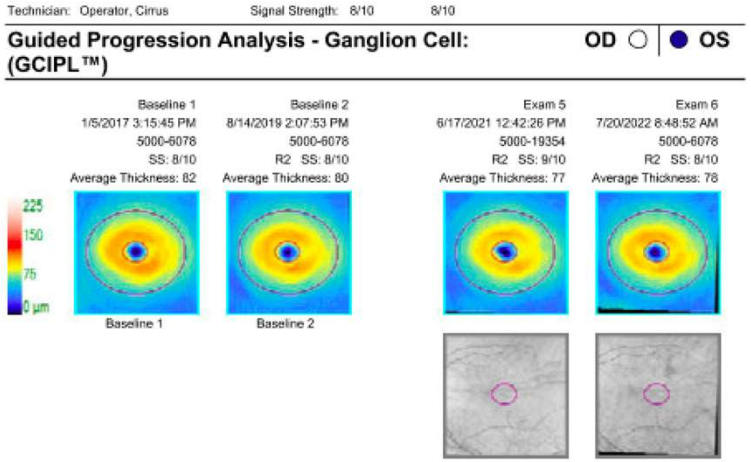
- Most reliable ONH parameters
  - VRT
    - Vertical rim thickness
    - Total rim thickness in vertical meridians
  - Rim area
  - VCDR
  - CDR
  - HRT
    - Horizontal rim thickness
    - Total rim thickness in horizontal meridians
      - AUC 0.901 and 0.963

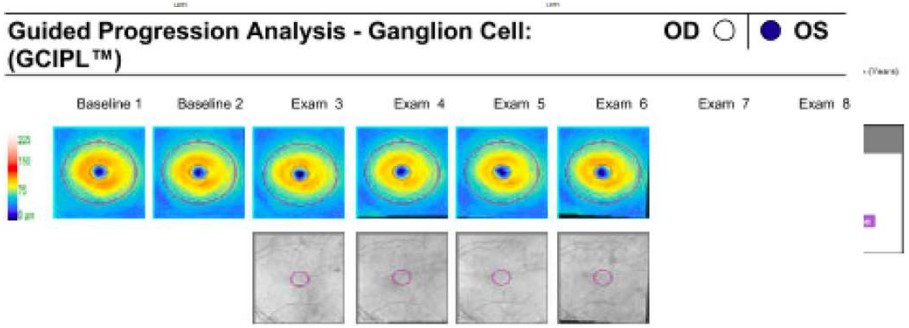
OCT: distinguishing normal from glaucoma

- Macular ganglion cell analysis
  - Higher concentration of ganglion cells
  - Less effected by peripheral chorioretinal disease
  - Useful in early and advanced glaucoma
  - Useful when RNFL reaches ‘floor’
  - Skewed by macular disease

OCT: ganglion cell analysis







GCL + IPL Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Average Thickness:	Total Superior Thickness (µm)	Total Inferior Thickness (µm)
Baseline 1:	1	1/5/2017 3:15:45 PM	5000-6078		8/10	82	83	81
Baseline 2:	2	8/14/2019 2:07:53 PM	5000-6078	R2	8/10	80	81	80
	3	2/11/2020 5:05:23 PM	5000-6138	R1	10/10	78	79	77
	4	5/25/2021 1:15:08 PM	5000-21809	R2	9/10	78	79	77
	5	6/17/2021 12:42:26 PM	5000-19354	R2	9/10	77	78	76
Current:	6	7/20/2022 8:48:52 AM	5000-6078	R2	8/10	78	79	77

OCT: age-related loss

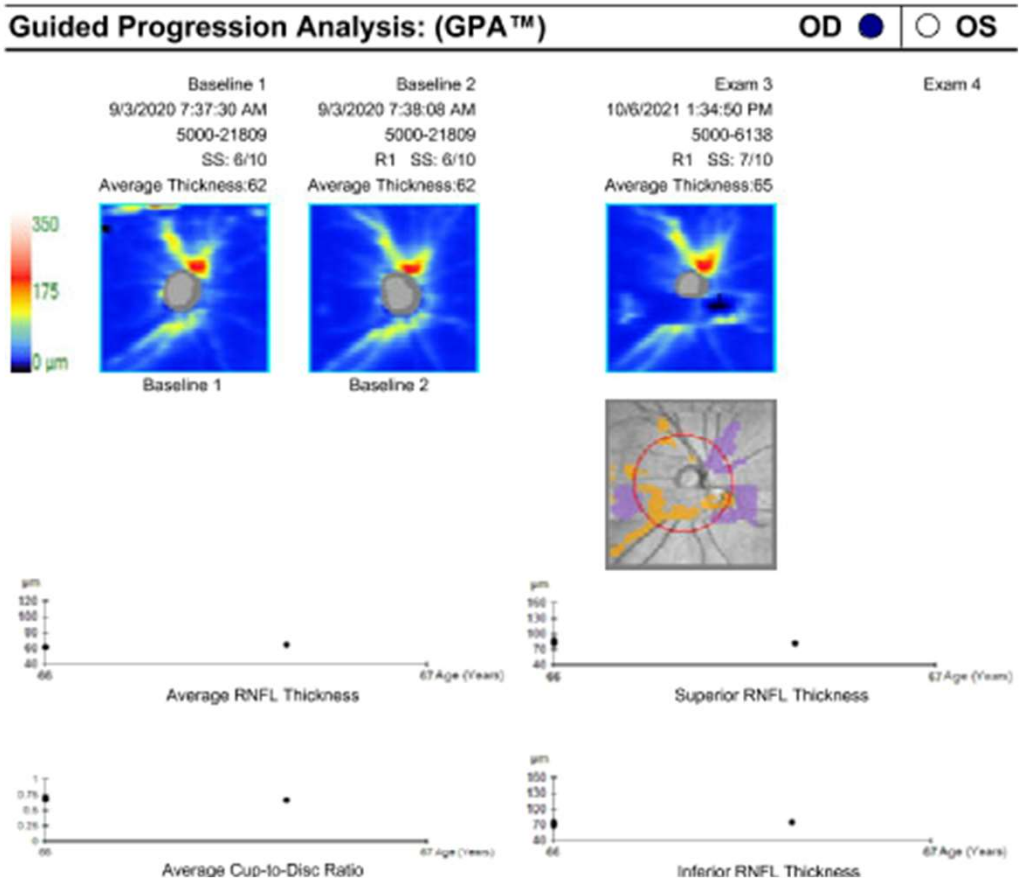
- Histologically, we lose approx. 5,000 axons/year
- OCT-measured average RNFL loss varies: 0.16um/year - 0.44um/year
- 0.365um/year
  - Most consistent approximation
  - Remember approximately 1/3rd micron RNFL loss per year

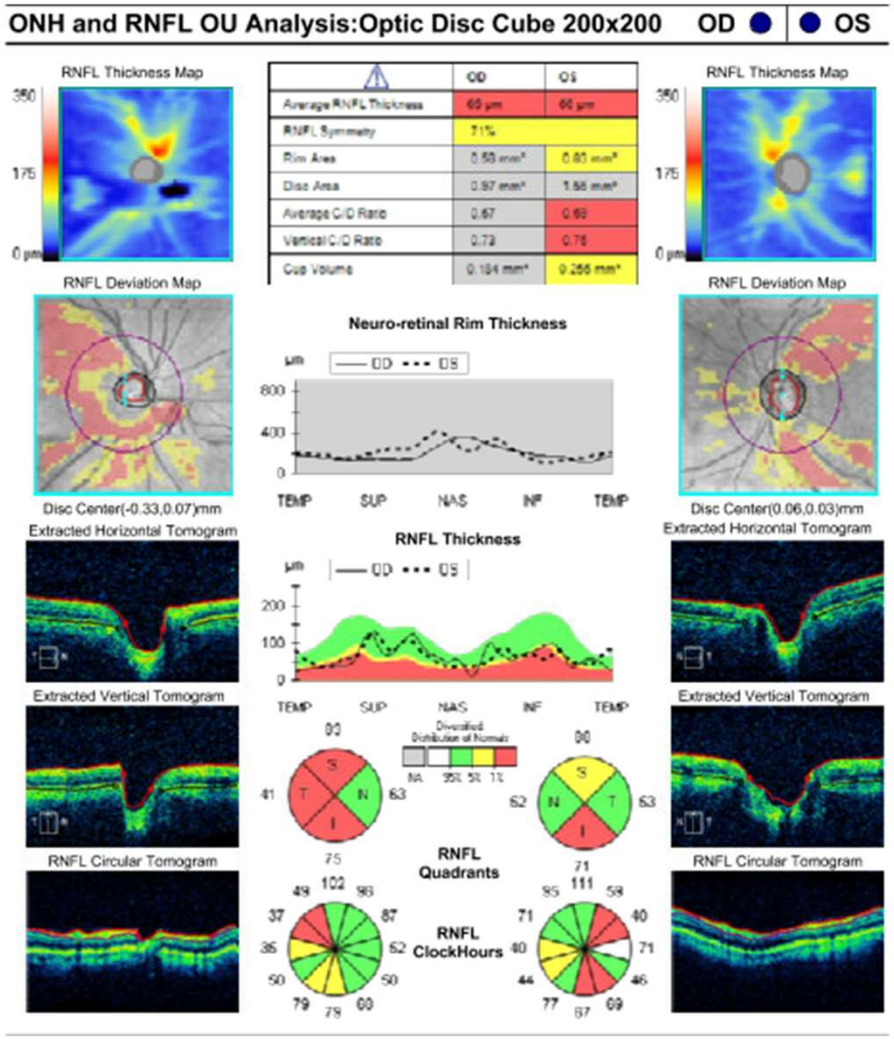
OCT: reliable test

- Signal strength
  - $\geq$ 6
  - Decreasing SS erroneously measures a thinner RNFL
- Artifact
  - Blocking
  - Movement
- Improper identification of ON head
- Segmentation error
  - Improperly identifying RNFL borders

OCT: artifact

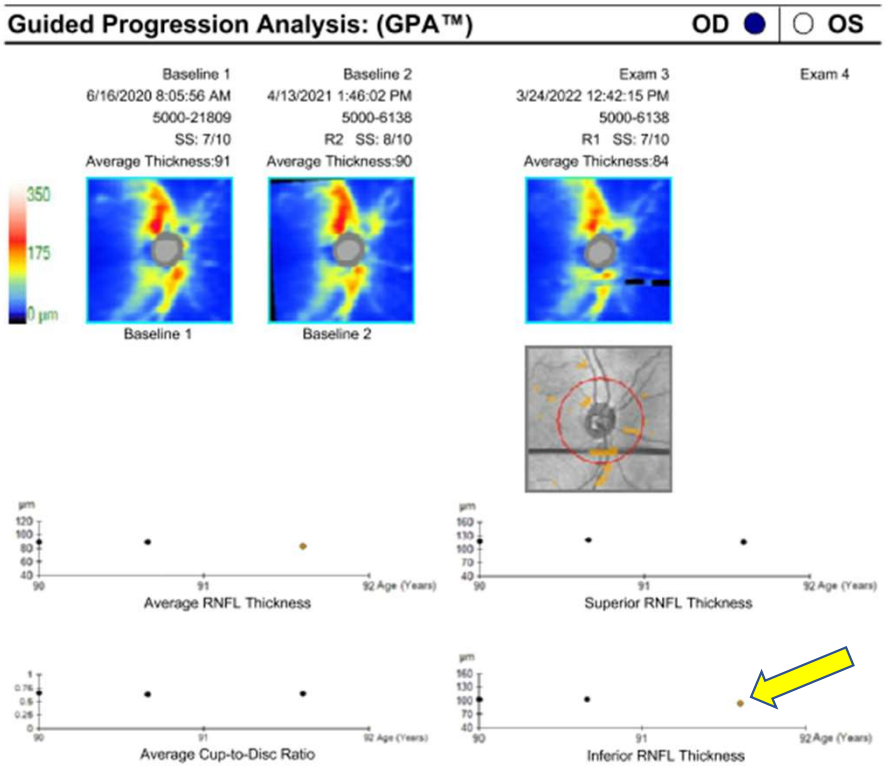
- Saccade Artifact

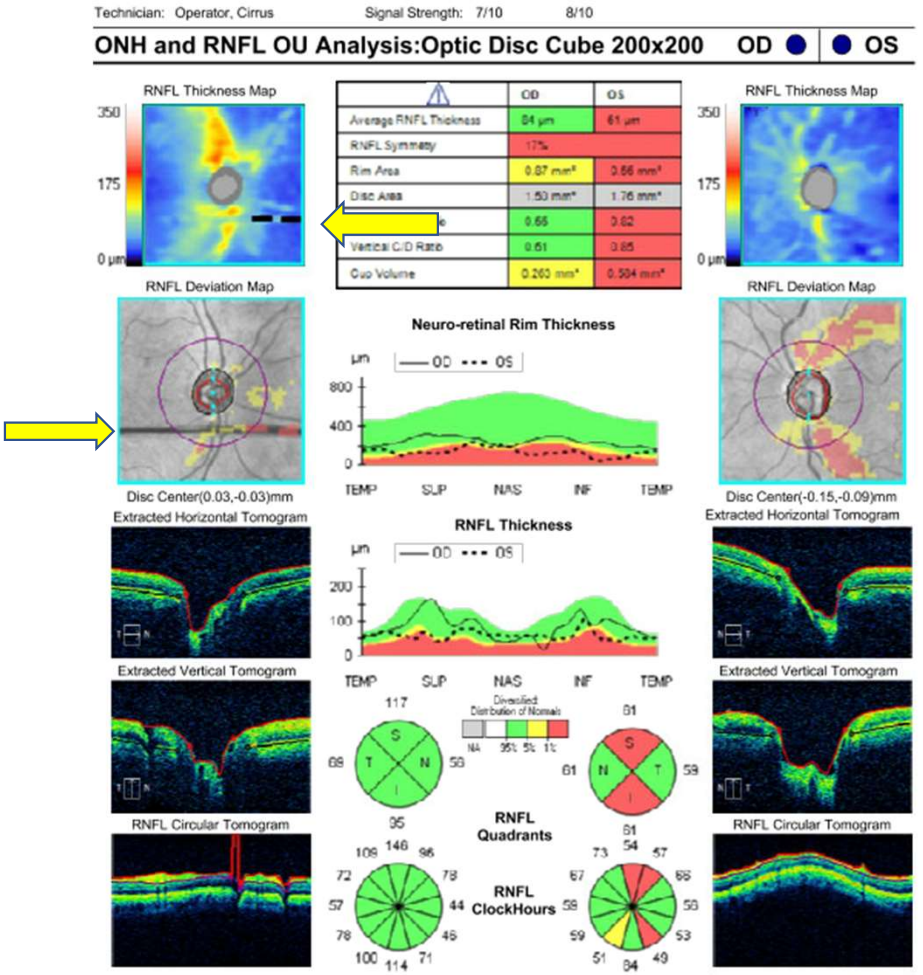




OCT artifact

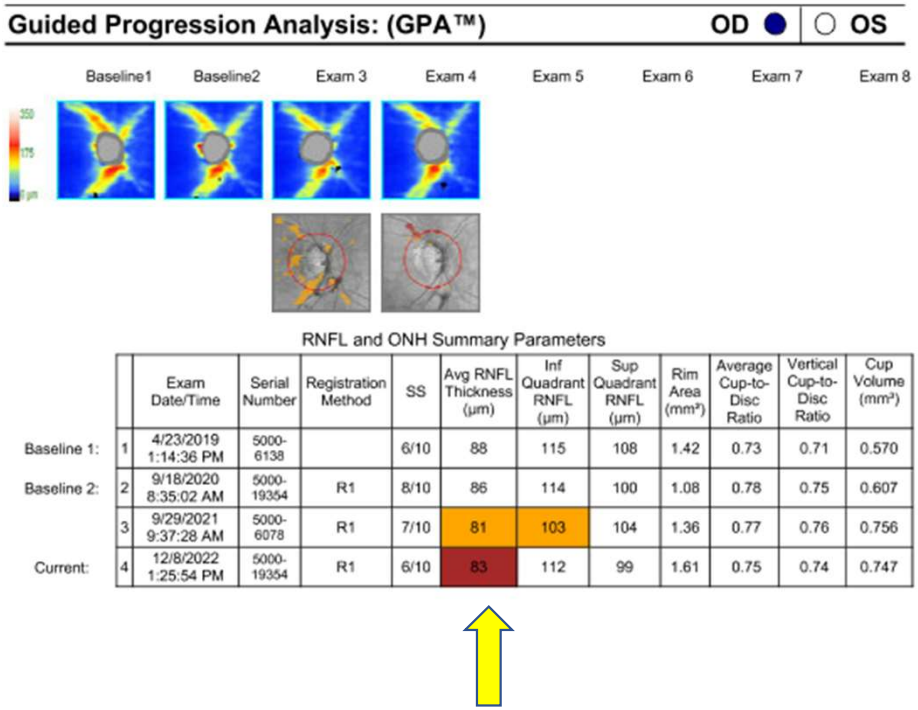
- Blink artifact



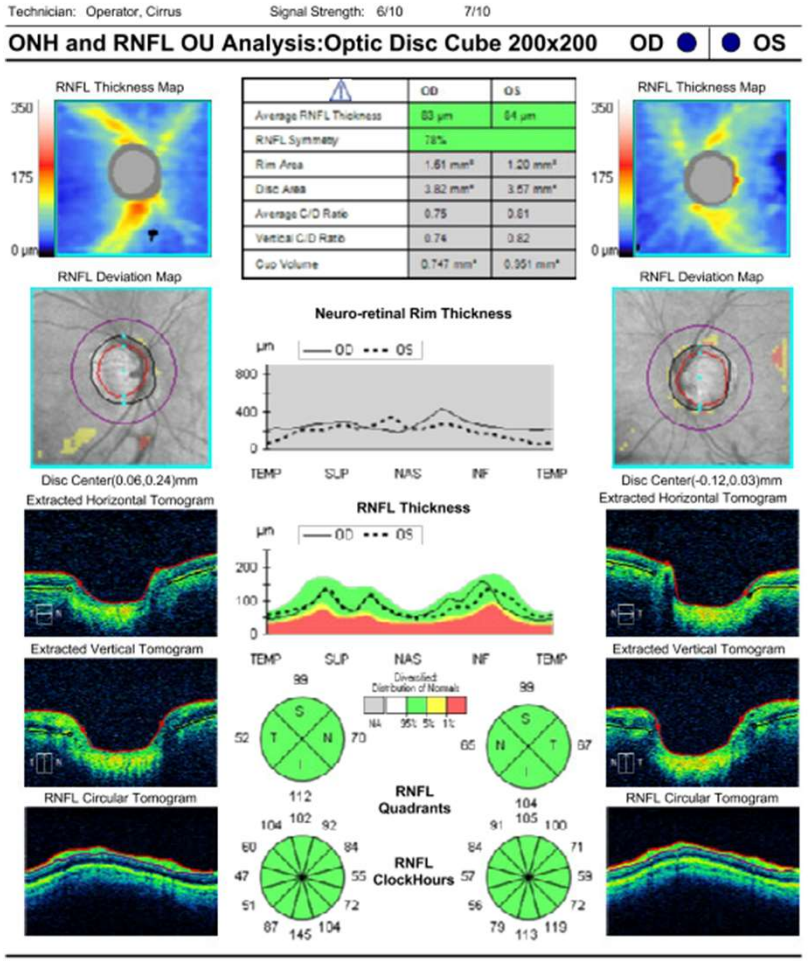


OCT: artifact

- Blocking artifact
  - Vitreous

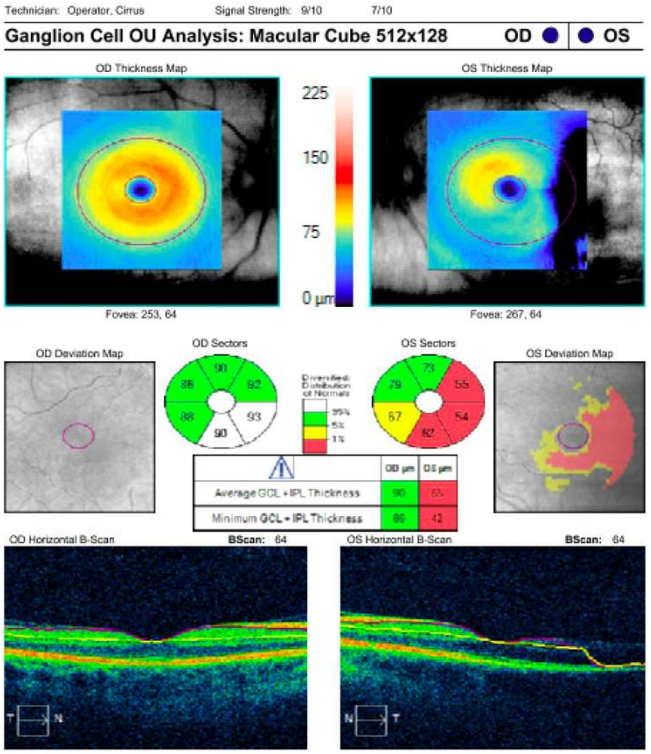


		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	4/23/2019 1:14:36 PM	5000-6138		6/10	88	115	108	1.42	0.73	0.71	0.570
Baseline 2:	2	9/18/2020 8:35:02 AM	5000-19354	R1	8/10	86	114	100	1.08	0.78	0.75	0.607
	3	9/29/2021 9:37:28 AM	5000-6078	R1	7/10	81	103	104	1.36	0.77	0.76	0.756
Current:	4	12/8/2022 1:25:54 PM	5000-19354	R1	6/10	83	112	99	1.61	0.75	0.74	0.747



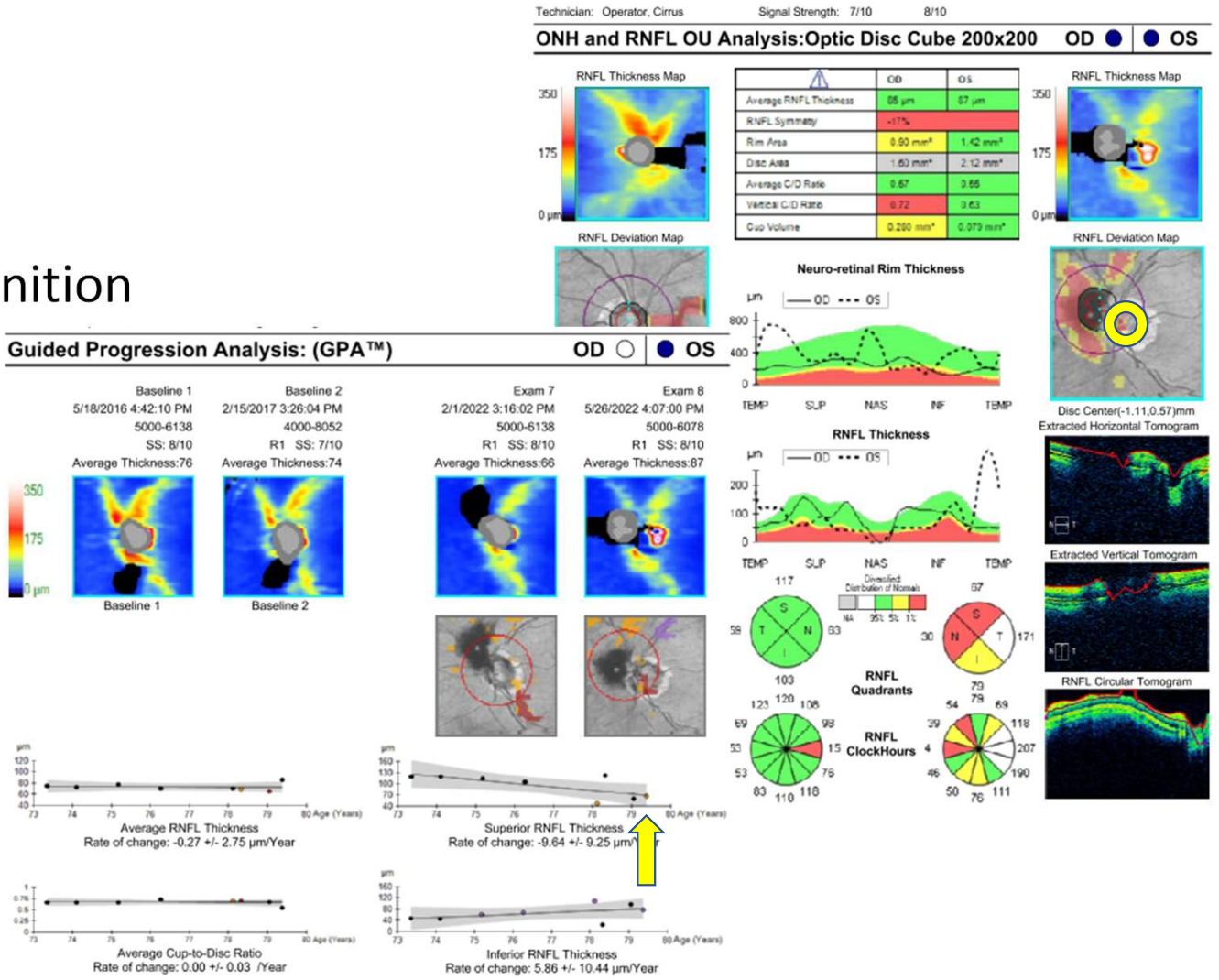
OCT: artifact

- Segmentation failure
  - Improper identification of limits of
    - RNFL, GCIPL, GCC
  - Result in
    - Augmented or exaggerated RNFL measurements
  - Occur when
    - ONH, inner retinal layers, and/or outer retinal layers improperly identified
    - Boundaries of inner and outer layers not completely identified
    - ”Stretching” these segmentation lines up or down



OCT: artifact

- Failure of ONH recognition algorithm
  - Decentration
  - PPA
  - Improper structure
    - Macula
    - PVD



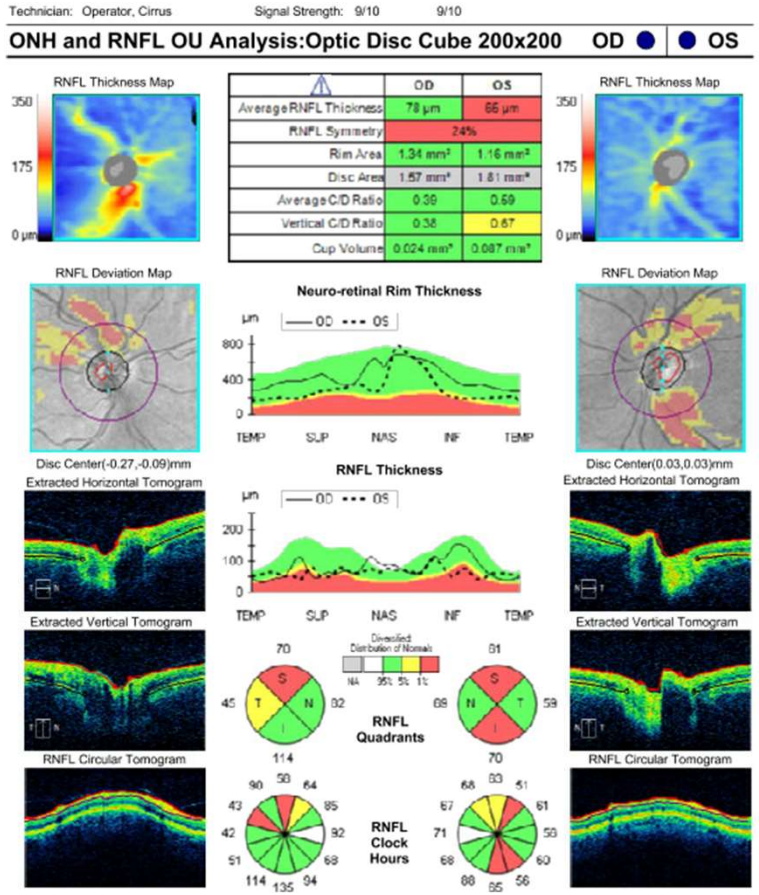
OCT: red and green disease

- Remember:
  - Color coding parameters are based on RNFL measurements compared with age-matched controls
  - Green
    - ‘within normal limits’
    - 95%
  - Yellow
    - ‘borderline’
    - <5%
  - Red
    - ‘outside normal limits’
    - <1%
- Thinner than average RNFL exists without pathology, and
- Pathology can exist with seemingly ‘normal’ RNFL

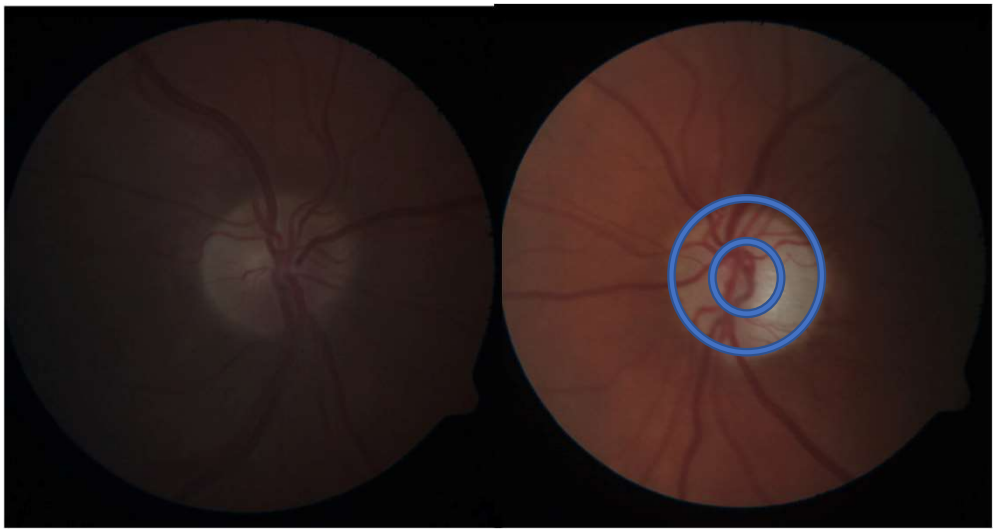
OCT: red disease

- Abnormal OCT w/ no glaucoma, i.e. a false positive
  - ON drusen
  - ON ischemia
  - ON atrophy
  - ON hypoplasia
  - Small ON
  - Tilted ON
  - Congenital anomalies
  - High myopia
  - Poor SS
  - Artifact
  - Peripheral retinal disease
  - PRP/chorioretinal scarring

OCT: Red disease

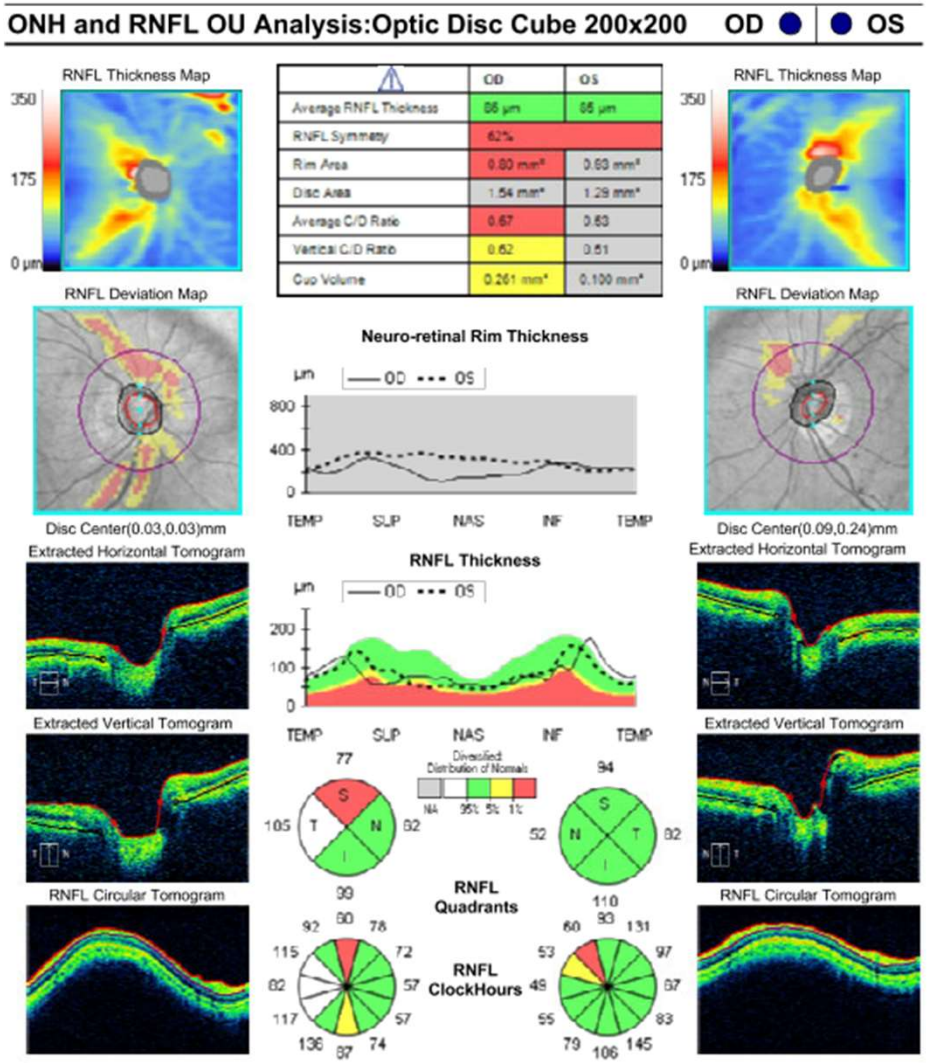


- Patient with h/o OHT
- AND bilateral sequential NAION following cataract surgery



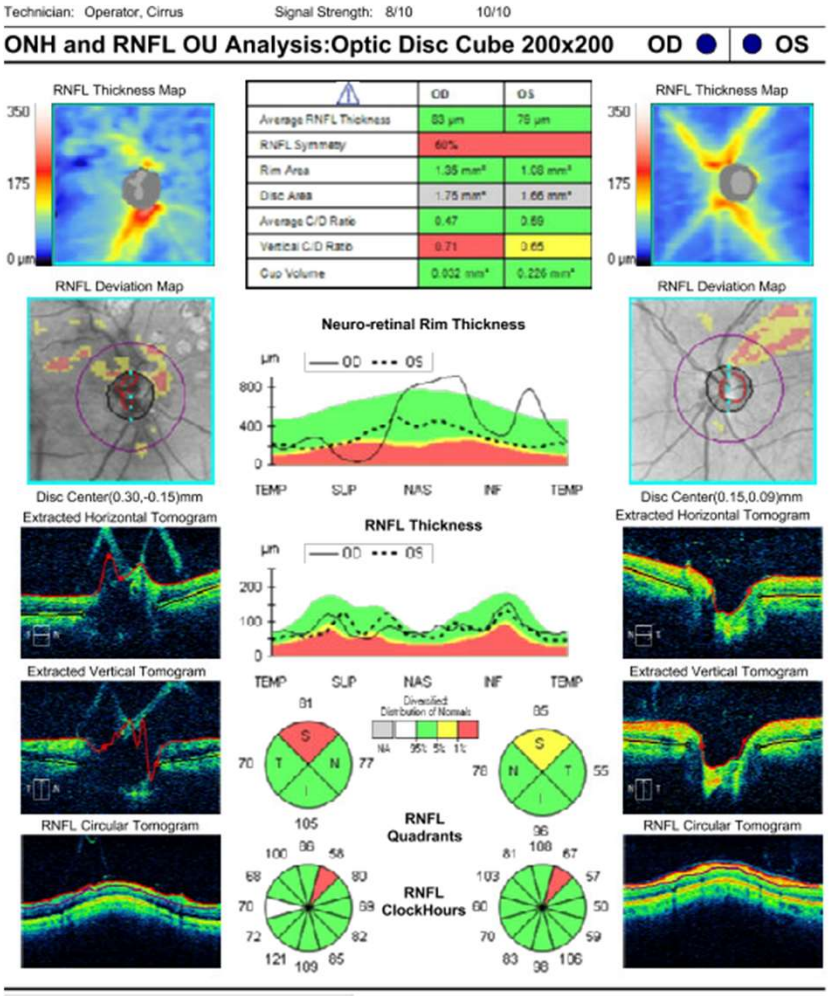
OCT: red disease

- High myopia
  - RNFL thickness decreases w/ increasing AL
  - False positive (red disease) seen more often in
    - RNFL (~50% FP)
    - Macular GCL-IPL (~25% FP)
    - ONH measurements perform best (only 7% FP)
  - Temporal deviation of RNFL ‘butterfly’



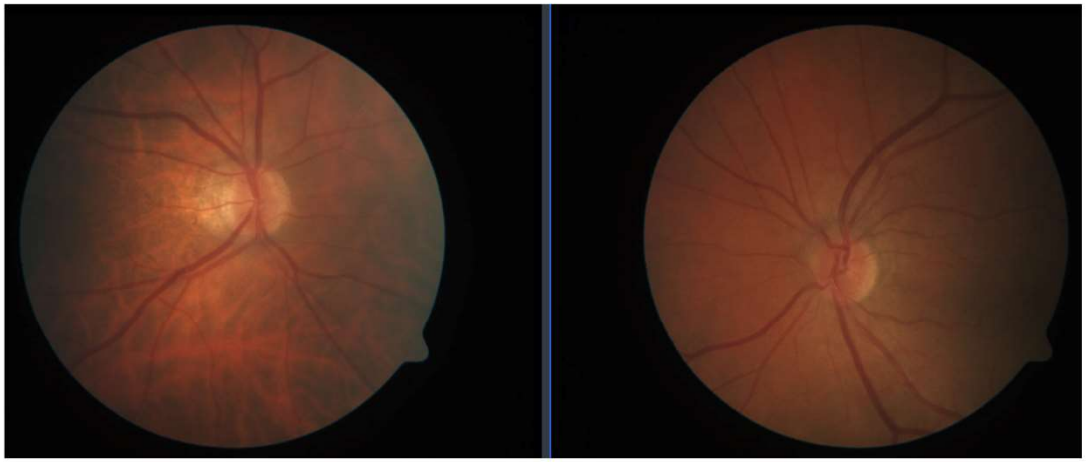
OCT: red disease

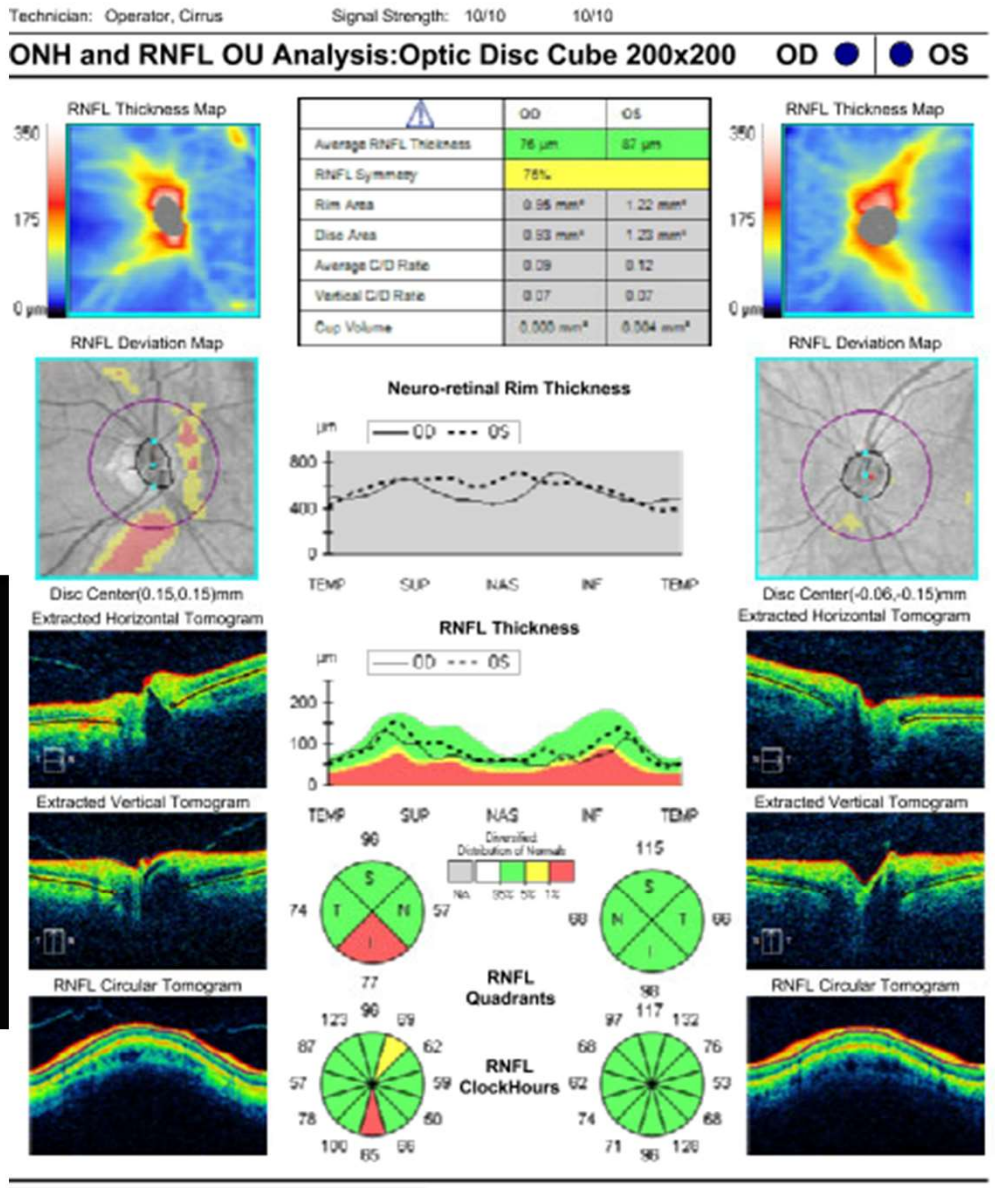
- Red dz 2/2 BRVO S/P PRP



OCT: red disease

- ON hypoplasia or small ON

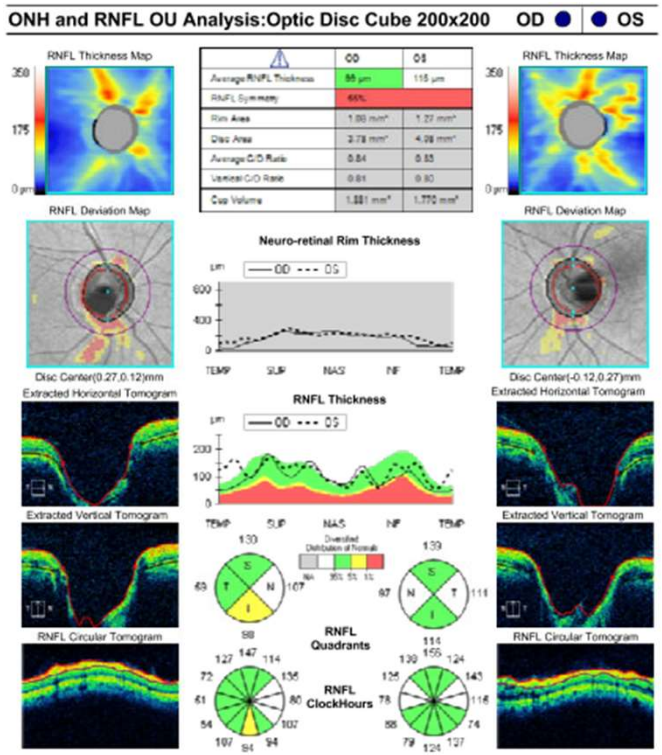




OCT: green disease

- ’Normal’ OCT with glaucomatous pathology, i.e. a false negative
  - Secondary to:
    - Other ocular pathology augmenting RNFL measurement in setting of glaucoma
      - Thickened/edematous RNFL
        - ERM
        - Macular edema
        - DME
        - RVO
        - Uveitis
      - ON edema
        - Acute NAION
        - Uveitis
        - Papilledema
  - OR
    - Pathologic, glaucomatous thinning of RNFL greater than age-related change while still measuring ‘within normal limits.’

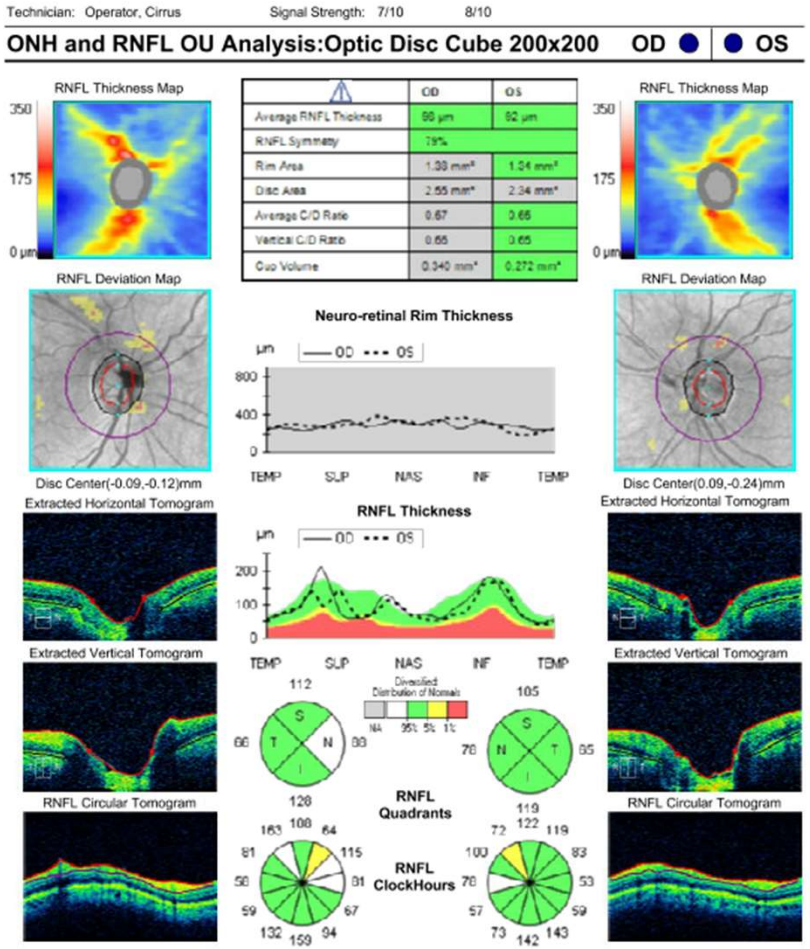
OCT: green disease?



- No
  - ON pit

OCT: green disease

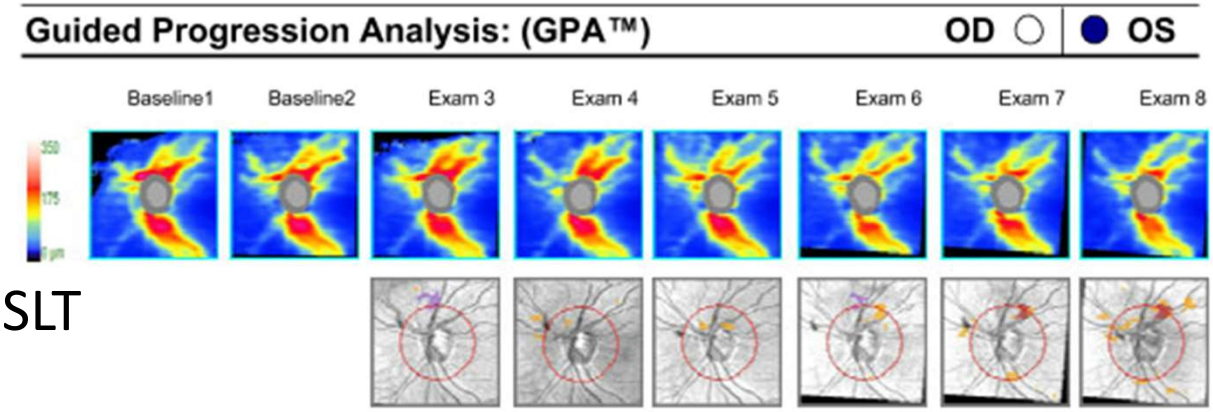
- 66 yo WF
- Tmax 30s
- Originally treated as OHT w/ PGa lowering IOP to low 20s



OCT: green disease

- Subsequent scans revealed progressive loss of RNFL
- Treatment augmented with SLT
- IOP maintained in </= 18

- What next?
  - Reset the baseline OCT exams
  - Or every subsequent exam will appear as progressing

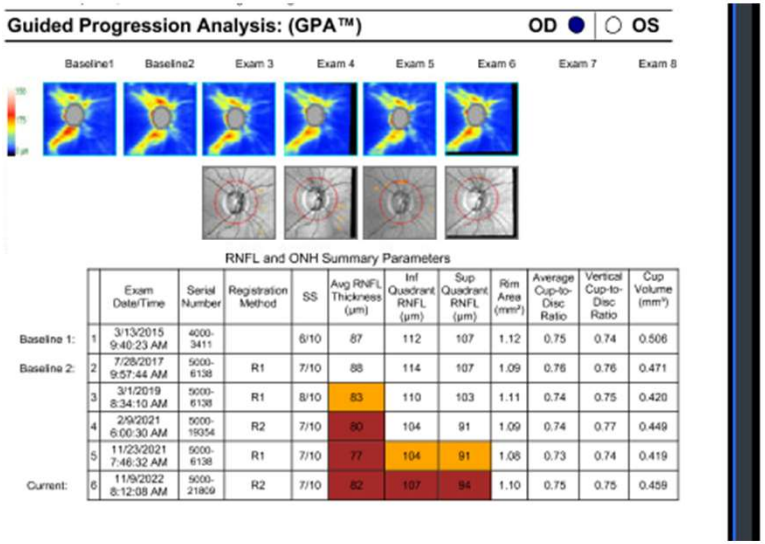


RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	8/9/2013 10:30:06 AM	4000-8052		8/10	104	138	118	1.41	0.62	0.63	0.255
Baseline 2:	2	10/16/2014 9:58:50 AM	4000-8052	R2	8/10	105	142	121	1.35	0.63	0.65	0.255
	3	10/29/2015 1:02:39 PM	5000-6078	R2	9/10	108	138	132	1.35	0.64	0.65	0.273
	4	2/3/2017 2:56:47 PM	5000-6078	R1	8/10	105	138	125	1.34	0.64	0.68	0.270
	5	5/31/2019 8:53:52 AM	5000-19354	R2	9/10	106	134	123	1.32	0.64	0.65	0.283
	6	6/4/2020 7:32:34 AM	5000-19354	R2	8/10	98	125	118	1.33	0.65	0.66	0.294
	7	6/4/2021 7:39:06 AM	5000-19354	R2	9/10	98	129	109	1.30	0.65	0.66	0.277
Current:	8	6/7/2022 11:54:37 AM	5000-19354	R2	8/10	92	120	102	1.34	0.65	0.65	0.272

OCT: green disease

- Originally followed as GS
- Repeat OCT show progressive RNFL loss

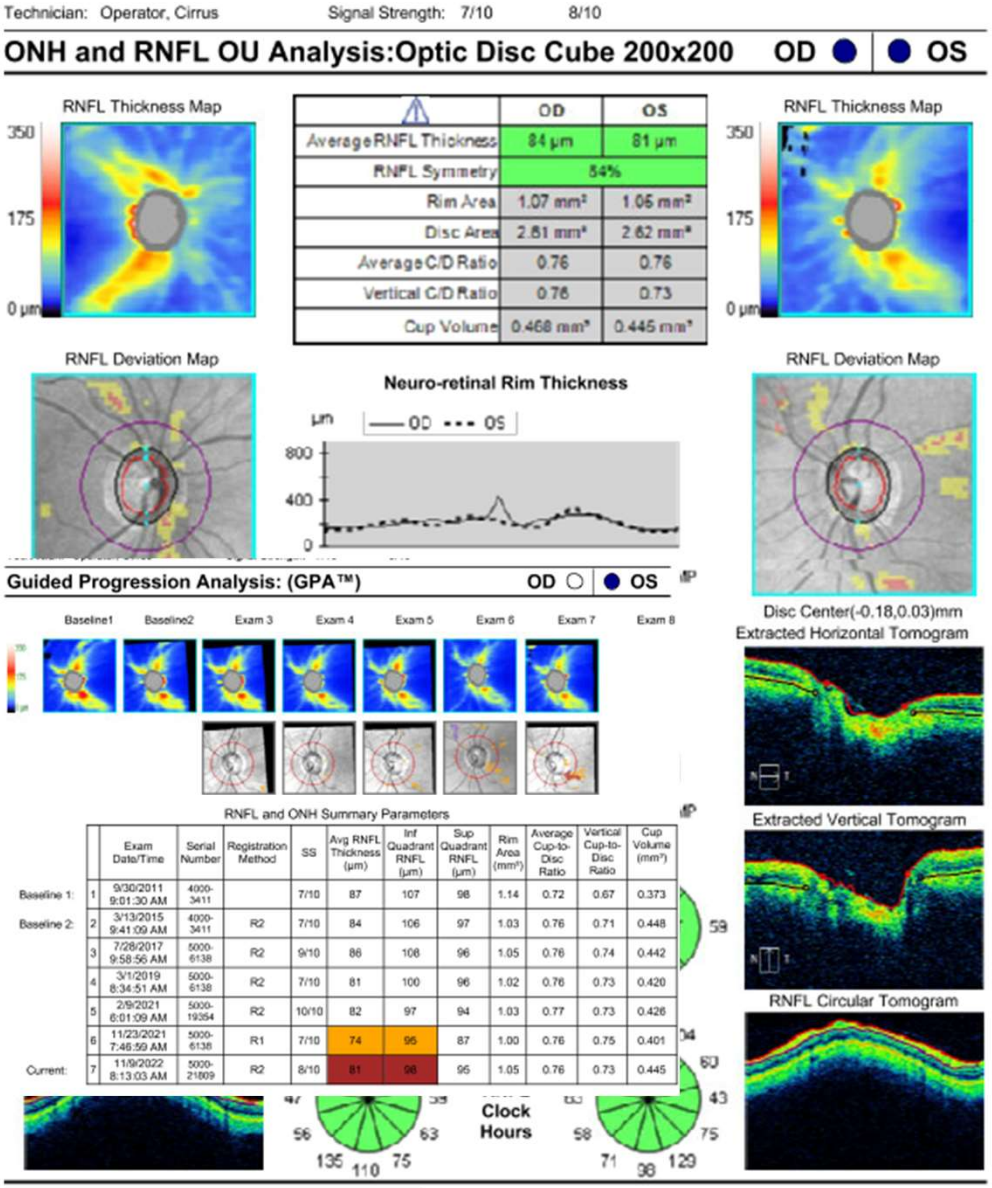


Guided Progression Analysis: (GPA™) OD ● ○ OS

Baseline1 Baseline2 Exam 3 Exam 4 Exam 5 Exam 6 Exam 7 Exam 8

RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	3/13/2015 9:40:23 AM	4000-3411		6/10	87	112	107	1.12	0.75	0.74	0.506
Baseline 2:	2	7/28/2017 9:57:44 AM	5000-6138	R1	7/10	88	114	107	1.09	0.76	0.76	0.471
	3	3/1/2019 8:34:10 AM	5000-6138	R1	8/10	83	110	103	1.11	0.74	0.75	0.420
	4	2/9/2021 6:00:30 AM	5000-19354	R2	7/10	80	104	91	1.09	0.74	0.77	0.449
	5	11/23/2021 7:46:32 AM	5000-6138	R1	7/10	77	104	91	1.08	0.73	0.74	0.419
Current:	6	11/9/2022 8:12:08 AM	5000-21809	R2	7/10	82	107	94	1.10	0.75	0.75	0.459



Technician: Operator, Cirrus Signal Strength: 7/10 8/10

ONH and RNFL OU Analysis:Optic Disc Cube 200x200 OD ● ● OS

RNFL Thickness Map

350 175 0 µm

	OD	OS
Average RNFL Thickness	84 µm	81 µm
RNFL Symmetry	84%	
Rim Area	1.07 mm²	1.06 mm²
Disc Area	2.81 mm²	2.62 mm²
Average C/D Ratio	0.76	0.76
Vertical C/D Ratio	0.76	0.73
Cup Volume	0.468 mm³	0.445 mm³

RNFL Thickness Map

RNFL Deviation Map

Neuro-retinal Rim Thickness

µm OD OS

800 400 0

RNFL Deviation Map

Guided Progression Analysis: (GPA™) OD ○ ● OS

Baseline1 Baseline2 Exam 3 Exam 4 Exam 5 Exam 6 Exam 7 Exam 8

RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	9/30/2011 9:01:30 AM	4000-3411		7/10	87	107	98	1.14	0.72	0.67	0.373
Baseline 2:	2	3/13/2015 9:41:09 AM	4000-3411	R2	7/10	84	106	97	1.03	0.76	0.71	0.448
	3	7/28/2017 9:58:56 AM	5000-6138	R2	9/10	86	108	96	1.05	0.76	0.74	0.442
	4	3/1/2019 8:34:51 AM	5000-6138	R2	7/10	81	100	96	1.02	0.76	0.73	0.420
	5	2/9/2021 6:01:09 AM	5000-19354	R2	10/10	82	97	94	1.03	0.77	0.73	0.426
	6	11/23/2021 7:46:59 AM	5000-6138	R1	7/10	74	95	87	1.00	0.76	0.75	0.401
Current:	7	11/9/2022 8:13:03 AM	5000-21809	R2	8/10	81	98	95	1.05	0.76	0.73	0.445

Clock Hours

Disc Center(-0.18,0.03)mm

Extracted Horizontal Tomogram

Extracted Vertical Tomogram

RNFL Circular Tomogram

Humphrey Visual Fields

HVF

- How it works
- Reliability indices
- Global parameters
- Structure-function correlation
- Trend-based analysis
- Event-based analysis

HVF, what are we measuring?

- Apostalib (asb)
  - Measurement of the intensity of light (AKA luminance (L) = cd/m^2)
    - Cd = candelas
    - Cd/m^2 = asb
  - BUT, our eyes can see large ranges of luminance (3-4 orders of magnitude),
  - Visual function does not have a linear relationship with luminance,
    - eg, luminance increase from 0-100 asb more likely to be appreciated than 1000-1100
  - Luminance is inversely correlated to retinal light sensitivity,
  - VF loss difficult to display w/ luminance levels,
  - THEREFORE, we use decibels (dB) instead
- Decibel
  - Sensitivity threshold of the retina
    - dB = 10*log(Lmax/L)
  - Foveal range: approximately 0-32 dB
  - Brightest stimulus required = 0 dB, dimmer stimulus required = 32 dB
- Threshold
  - “The intensity of light stimulus, which, when presented at a particular location, “n” number of times is detected by the corresponding retinal point at least 50% of the time.”

HVF

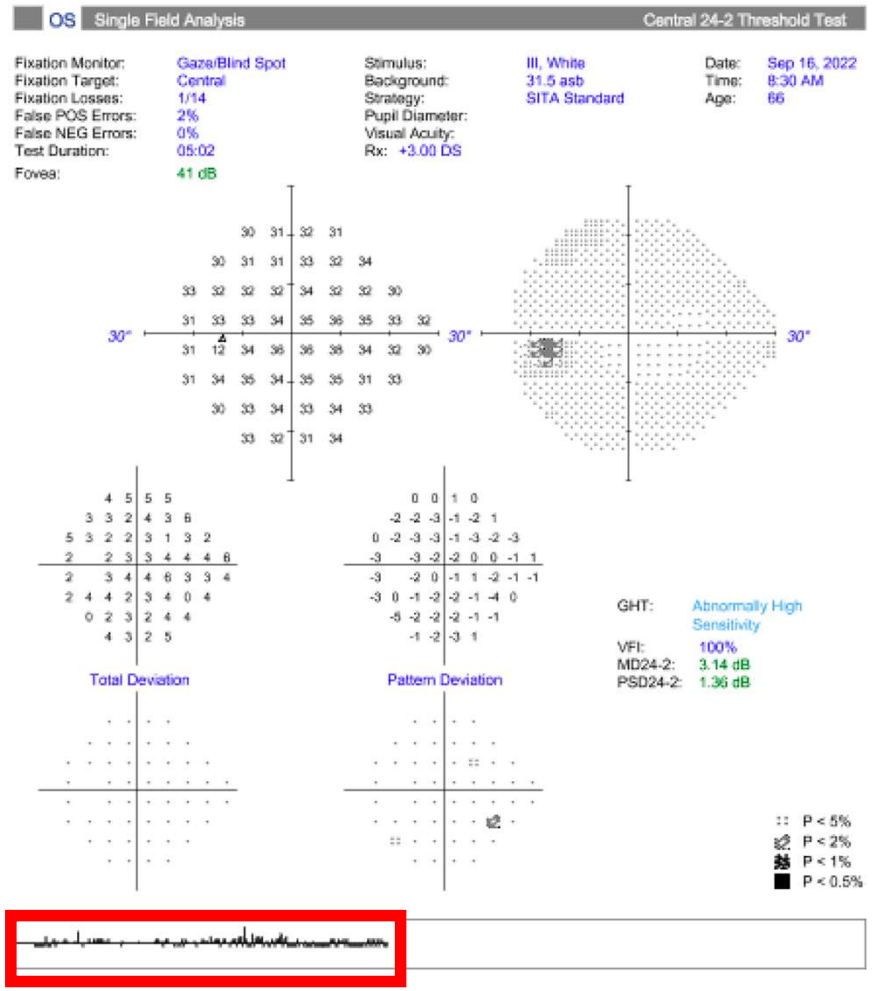
- HVF 24-2 SITA STANDARD
  - Most commonly used
  - SITA = Swedish Interactive Thresholding Algorithm
    - Optimized to reduce time and errors from fatigue
  - 54 points tested
  - 3 degrees from each point
  - 24:
    - central 30 degrees around fixation (fovea)
    - eliminating the outermost points save for the nasal area
  - 2: equidistant points on either side of the vertical and horizontal meridians
    - 6 degrees from point on other side of meridian
    - Vertical: neuro
    - Horizontal: glaucoma

HVF: reliability indices

- Fixation Losses
  - Responding to stimulus presented in the physiologic blind spot
  - $\leq$ 20%
- False Positives
  - Responding although stimulus has not been presented
  - $\leq$ 20%
- False Negatives
  - Lack of response to stimulus presented at a previously seen location at a lower stimulus
  - $\leq$ 33%

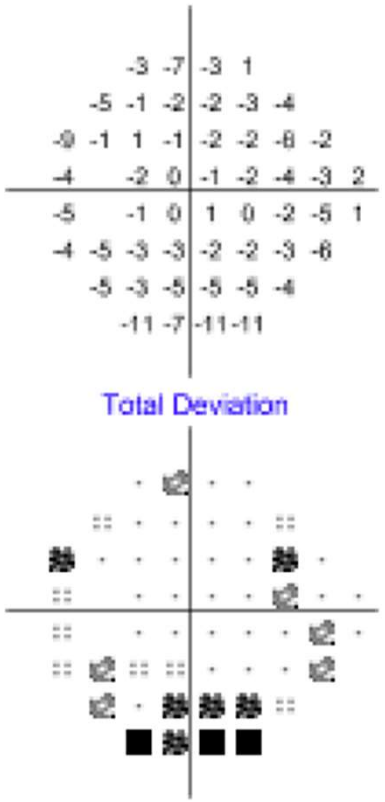
HVF: Gaze tracking

- Upward deflection
  - eye movement
- Downward deflection
  - blink



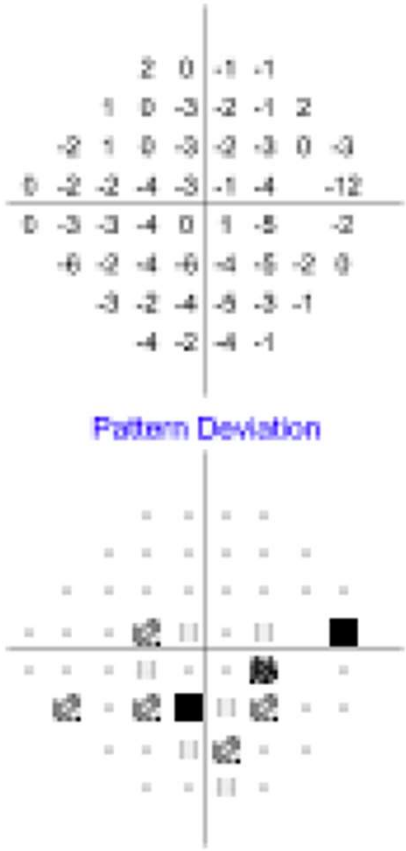
HVF: Total deviation

- Total deviation
  - Sensitivity (dB) at all 54 plot locations
  - Compared w/ age-matched control
  - <5% sensitivity considered abnormal
  - Probability plot color-coded from <5% to <0.5%
  - Used to calculated MD and PSD



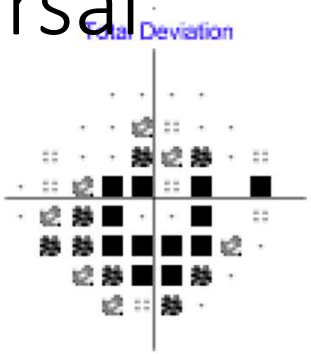
HVF: Pattern deviation

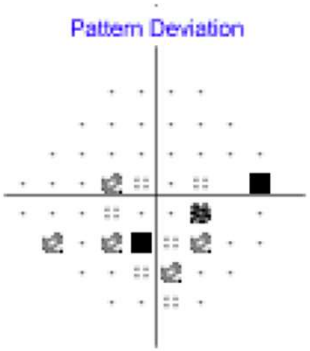
- Pattern deviation
  - Derived from total deviation
  - Localizes patterns of defects
  - Corrects generalized depression

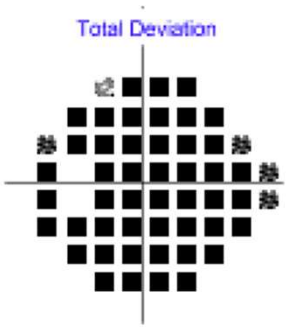


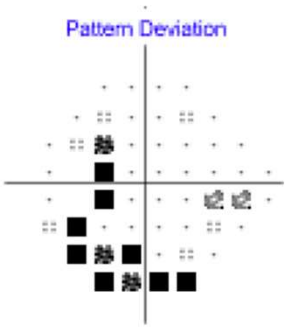
HVF: TD, PD, pattern reversal

- Total deviation
  - Age-matched sensitivities at every location
- Pattern deviation
  - Total deviation adjusted to correct for generalized depressions or ‘shifts in field sensitivities’
- Pattern reversal
  - Pattern deviation with more depressed locations than total deviation
  - The ‘reverse’ of what would be expected in a generalized depression from a media opacity like cataract



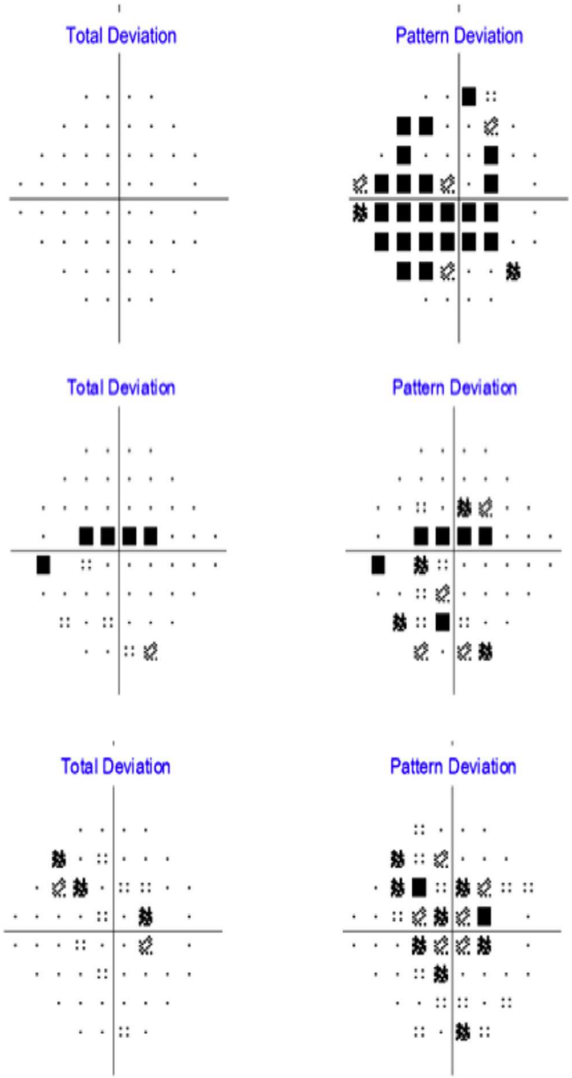






HVF: Pattern reversal

- Pattern reversal
  - Most often to be considered an unreliable test
    - Trigger happy
    - Higher false positives
  - BUT, be careful. . .
  - This can represent true paracentral scotomas
  - Scotomas that may only present on pattern deviation map up to 20% of the time

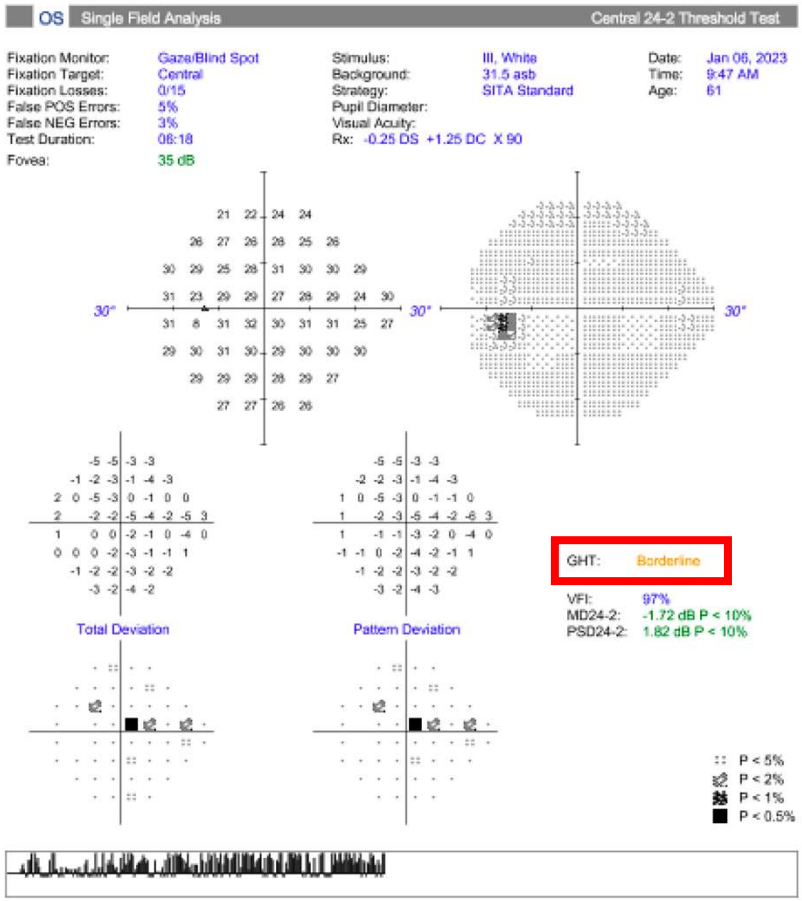


HVF: Global indices

- Mean deviation (MD)
  - Average of all points of total deviation
    - Remember, total deviation is retinal sensitivity (dB) at all points in the VF
    - Positive value
      - Dimmer stimuli seen c/w age-matched controls
    - Negative value indicates defects
      - Brighter stimuli required c/w age-matched controls
- Pattern standard deviation (PSD)
  - Glaucoma defects are usually non uniform
  - Reflects the island or hill of vision
  - Low value (0)
    - Normal hill of vision OR
    - Severely depressed visual field
  - Higher value
    - Irregular shape of hill
    - Severely depressed focal points
    - Helpful in early glaucoma
    - With greater depression of hill of vision (e.g. advanced glaucoma), PSD becomes less useful

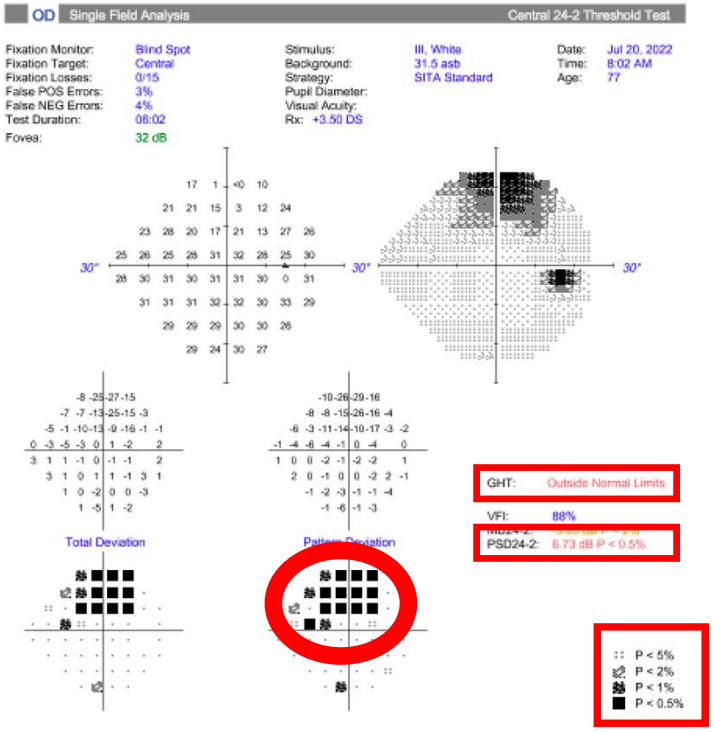
HVF: Global indices

- Glaucoma Hemifield Test (GHT)
  - Compares retinal sensitivity across horizontal meridian
  - Assumes symmetry of upper and lower hemifields
  - Abnormal GHT is early indicator of glaucoma



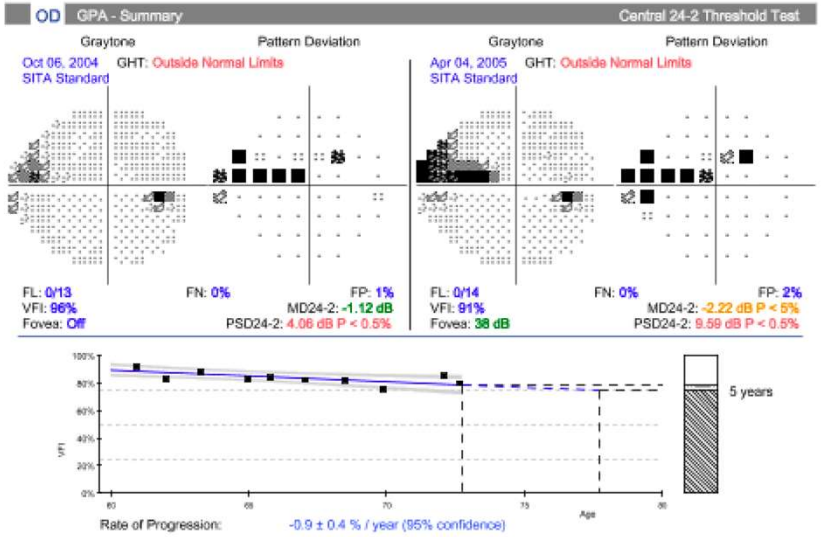
HVF: Glaucomatous findings

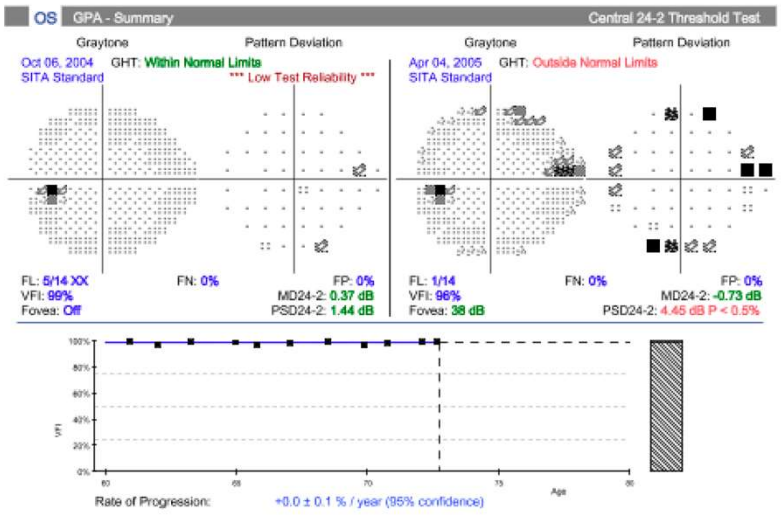
- Anderson criteria:
  - Abnormal GHT
  - Abnormal PSD
    - p-value < 5%
  - 3 contiguous, non-edge defects
    - One w/ p-value <5%
    - One w/ p-value <0.5%



HVF: Trend-based analysis

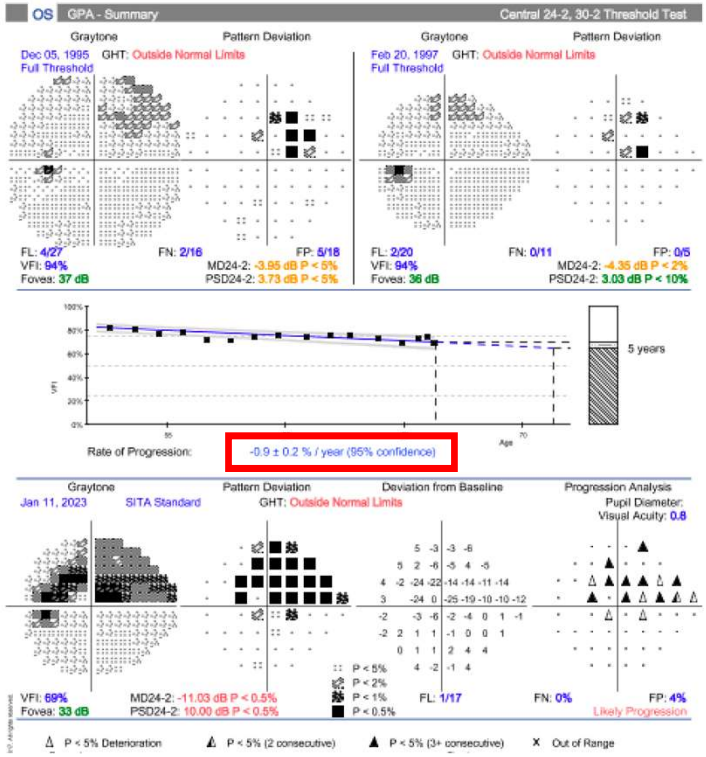
- Based on Visual Field Index
- VFI
  - Direct, linear correlation w/ MD
    - Therefore, affected by anything that reduces retinal sensitivity
  - Central locations weighted more heavily than peripheral points
  - Represents the entire VF as a numerical percentage
- 100%
  - Normal, full, unaffected VF
- 0%
  - Perimetrically blind
- Slope is extrapolated over time to predict future progression





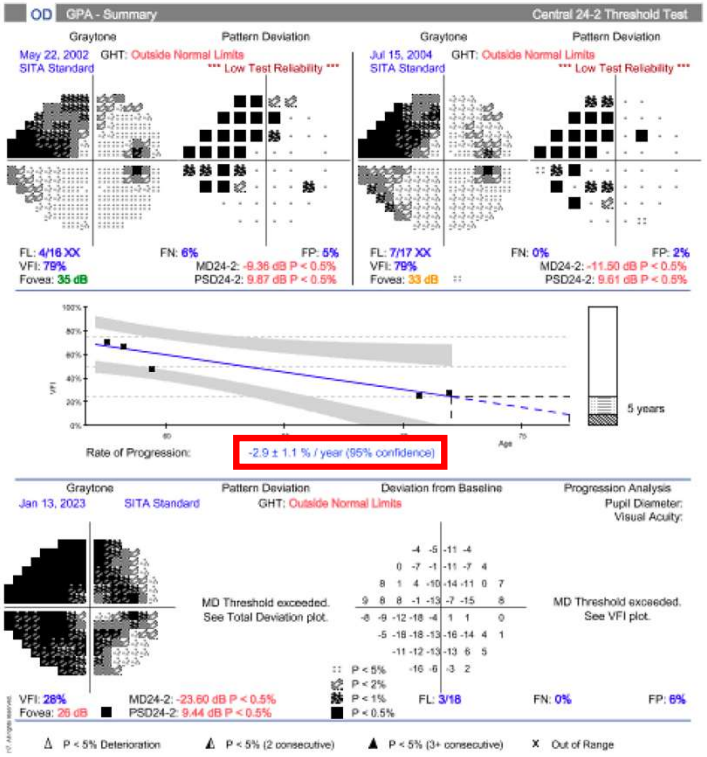
HVF: Trend-based analysis

- VFI slope
  - Expressed as %/year
  - < - 0.5%/year
    - Slow progressor
  - < - 1.0%/year
    - Fast progressor
    - Slow progressor



HVF: Trend-based analysis

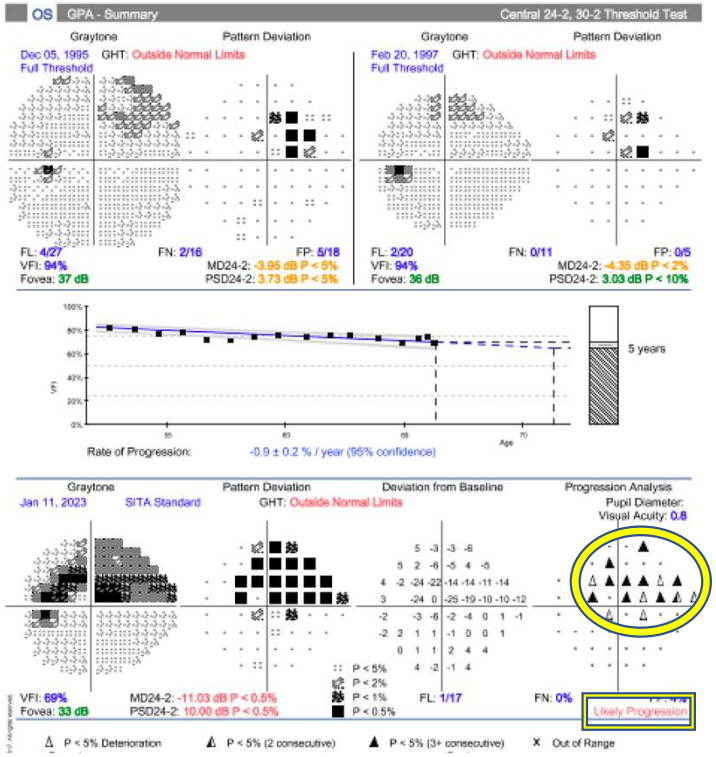
- Fast progressor



HVF: Event-based analysis

- Based on EMGT method of detecting VF progression
- Each point on pattern deviation probability plots evaluated
- Most recent test(s) compared with 2, reliable baseline tests
- Open triangle:
  - 1 location significantly deteriorates c/w baseline
  - Significant if location degrades more so than is expected in < 5% of stable glaucoma patients
- Half-filled triangle:
  - 2 consecutive tests with significant deterioration at same location
- Closed triangle:
  - 3 consecutive tests with significant deterioration at same location
- Possible progression:
  - If $\geq$ 3 same points show significant degradation ($p<0.05$) on 2 consecutive tests
  - Points do not have to be clustered together
- Likely progression:
  - If $\geq$ 3 same points show significant degradation ($p<0.05$) on 3 consecutive tests

HVF: Event-based analysis

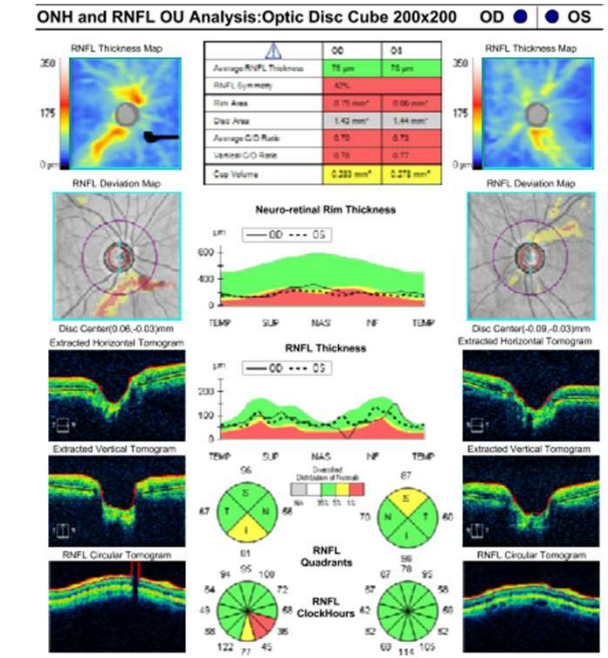


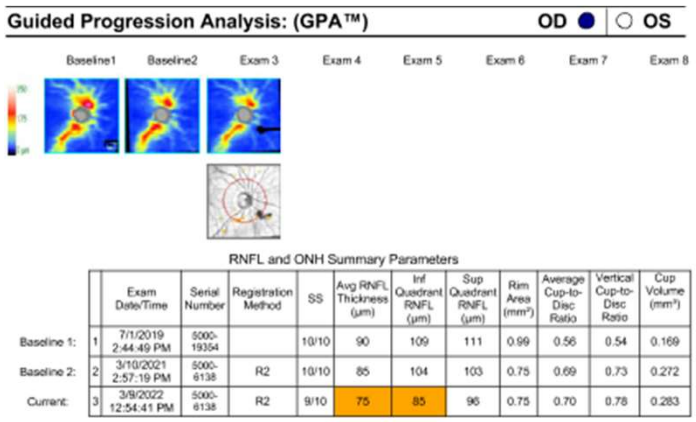
Is my patient progressing????

Every TRRR participant's favorite game

Case 1:

- 78 yo black female
- h/o POAG
- Tmax 30s
- IOP 14/15 on latanoprost and timolol OU
- OCT reveals . . .



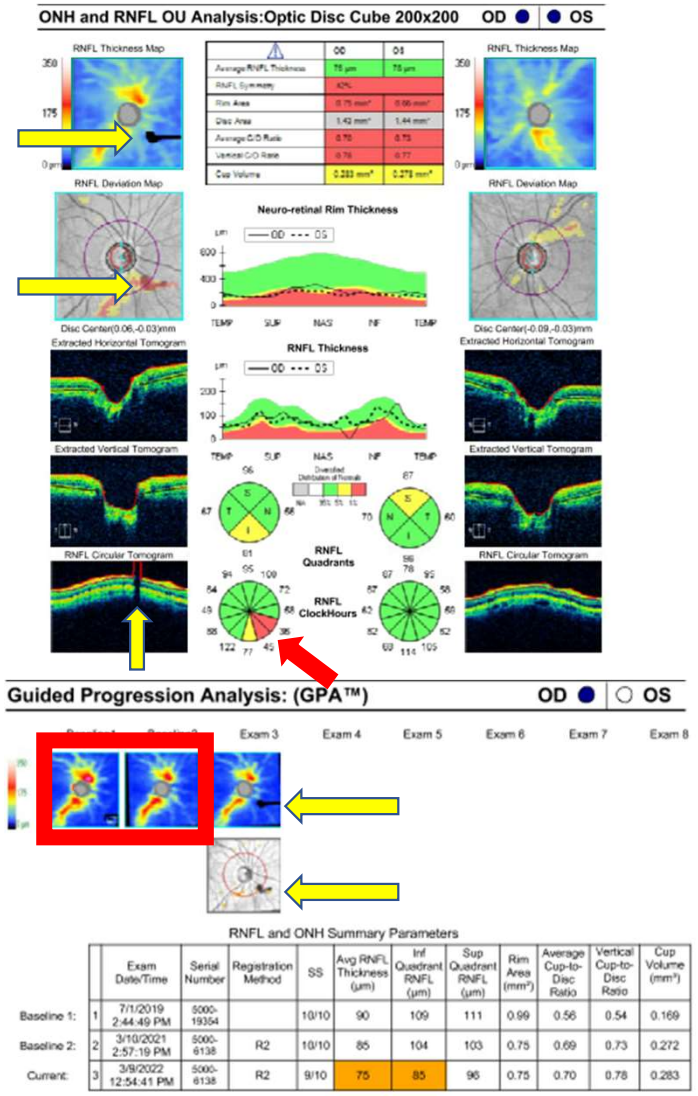


RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	7/1/2019 2:44:49 PM	5000-19354		10/10	90	109	111	0.99	0.56	0.54	0.169
Baseline 2:	2	3/10/2021 2:57:19 PM	5000-6138	R2	10/10	85	104	103	0.75	0.69	0.73	0.272
Current:	3	3/9/2022 12:54:41 PM	5000-6138	R2	9/10	75	85	96	0.75	0.70	0.78	0.283

Case 1, cont:

- Is my patient progressing?
  - NO
- PVD artifact OD
  - Blocking artifact
  - Atypical nasal ‘loss’ of RNFL
  - Note the absence of vitreous artifact in the baseline scans

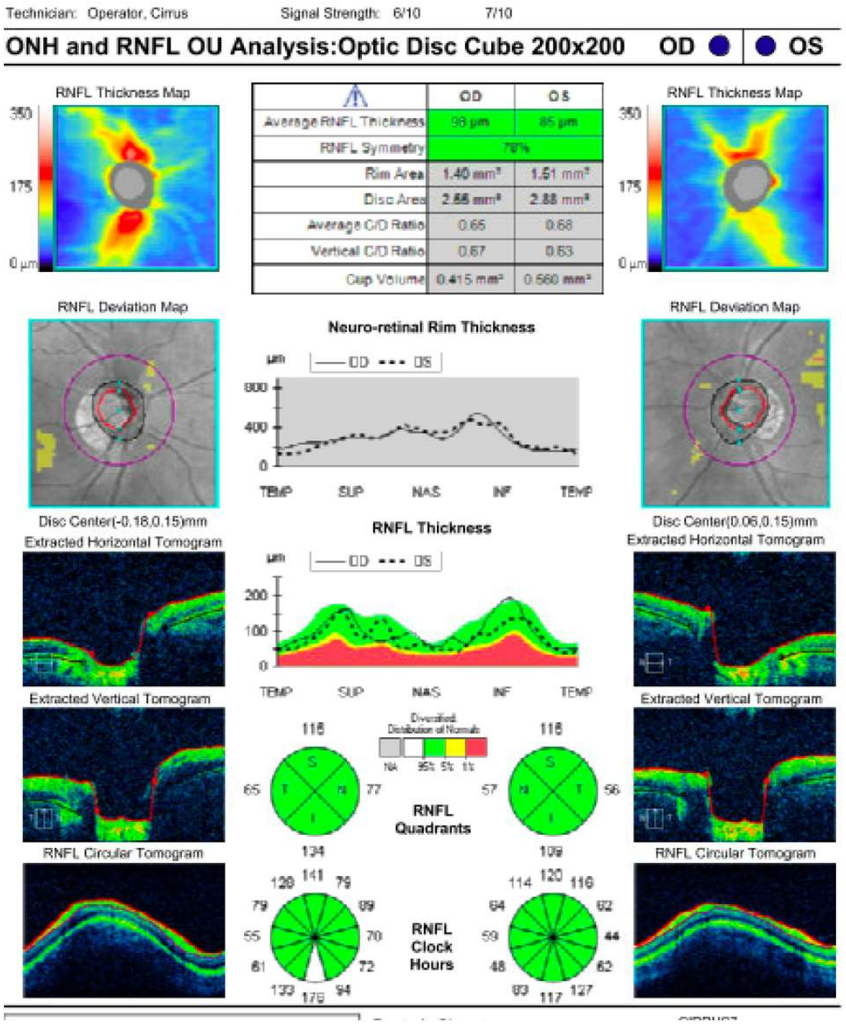


RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	7/1/2019 2:44:49 PM	5000-19354		10/10	90	109	111	0.99	0.56	0.54	0.169
Baseline 2:	2	3/10/2021 2:57:19 PM	5000-6138	R2	10/10	85	104	103	0.75	0.69	0.73	0.272
Current:	3	3/9/2022 12:54:41 PM	5000-6138	R2	9/10	75	85	96	0.75	0.70	0.78	0.283

Case 2:

- 59 yo WF
- Followed as glaucoma suspect
- No fam hx
- Nml Ks
- Nml IOP
- Full fields
- OCT reveals . . .



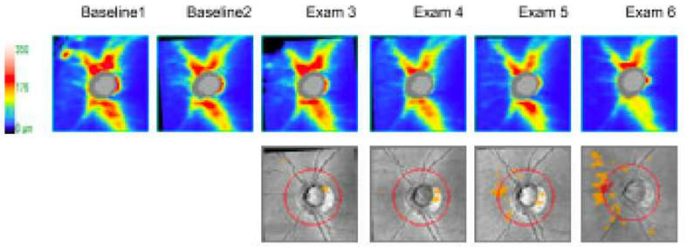
Case 2, cont:

- Is my patient progressing?

- Yes
- Progression in the green
  - Green disease
- Pt diagnosed w/ NTG
- Began treatment w/ PGa

Technician: Operator, Cirrus Signal Strength: 9/10 7/10

Guided Progression Analysis: (GPA™) OD ○ | ● OS



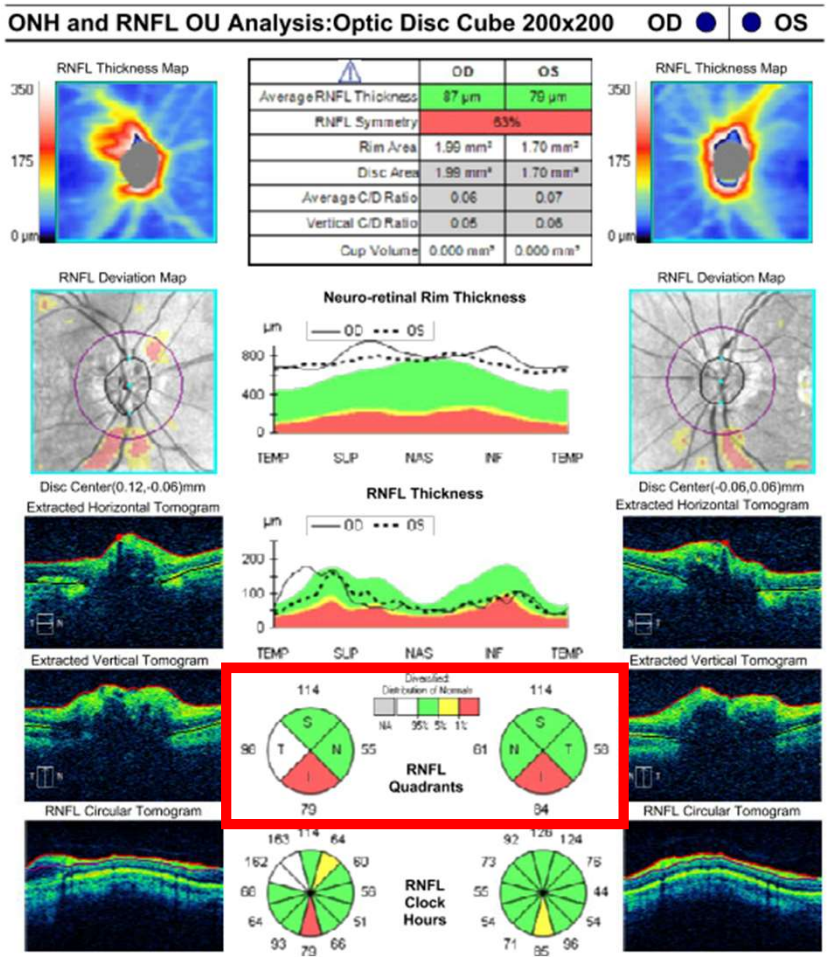
RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm^2)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm^3)
Baseline 1:	1	2/17/2017 1:39:36 PM	5000-6138		9/10	99	128	137	1.33	0.68	0.69	0.506
Baseline 2:	2	2/23/2017 2:03:39 PM	4000-8052	R2	8/10	96	123	131	1.32	0.68	0.70	0.503
	3	9/5/2018 1:34:03 PM	5000-6138	R2	8/10	97	124	131	1.38	0.68	0.68	0.512
	4	10/2/2019 10:26:35 AM	5000-6138	R2	7/10	90	119	121	1.43	0.66	0.66	0.491
	5	10/7/2020 8:43:25 AM	5000-6138	R2	8/10	89	120	122	1.33	0.68	0.71	0.508
Current:	6	11/4/2021 8:56:34 AM	5000-21809	R1	7/10	85	109	116	1.51	0.68	0.63	0.560

Case 3:

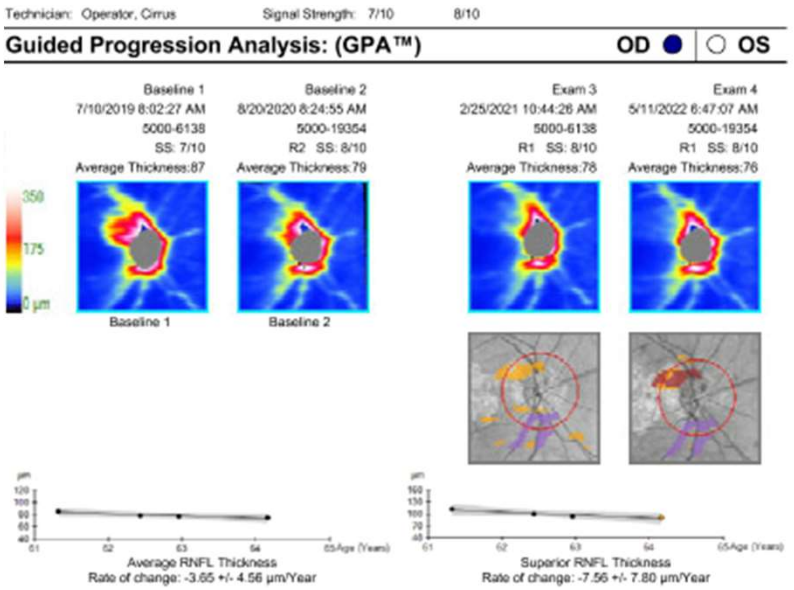
- 64 yo WF
- Referred for glaucoma eval
- h/o AMD
- IOP 24/24
- OCT reveals . . .

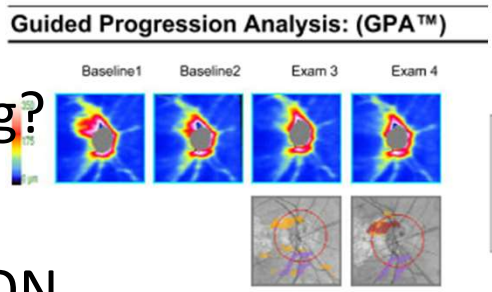
- Is my patient progressing? (from glaucoma suspect to fulminant glaucoma)
  - NO,
    - OHT + ON drusen
    - Red disease



Case 3, cont:

- OHT treated with aqueous suppressants, IOP lowered, followed
- Repeat OCT reveals . . .
- Is my patient progressing?
- Do we have co-existing ON drusen AND glaucoma?



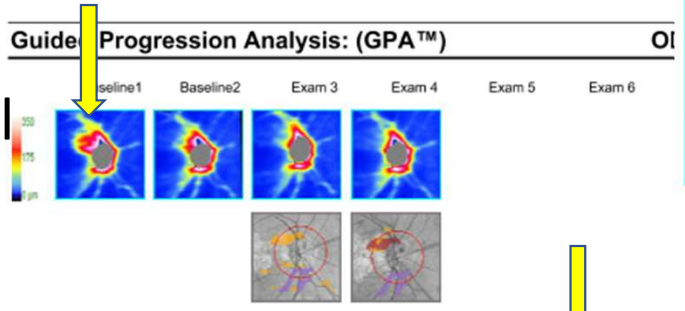


RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	7/10/2019 8:02:27 AM	5000-6138		7/10	87	79	114	1.99	0.06	0.05	0.000
Baseline 2:	2	8/20/2020 8:24:55 AM	5000-19354	R2	8/10	79	80	101	1.81	0.07	0.06	0.000
	3	2/25/2021 10:44:26 AM	5000-6138	R1	8/10	78	89	96	1.93	0.06	0.05	0.000
Current:	4	5/11/2022 6:47:07 AM	5000-19354	R1	8/10	76	85	93	1.82	0.07	0.06	0.000

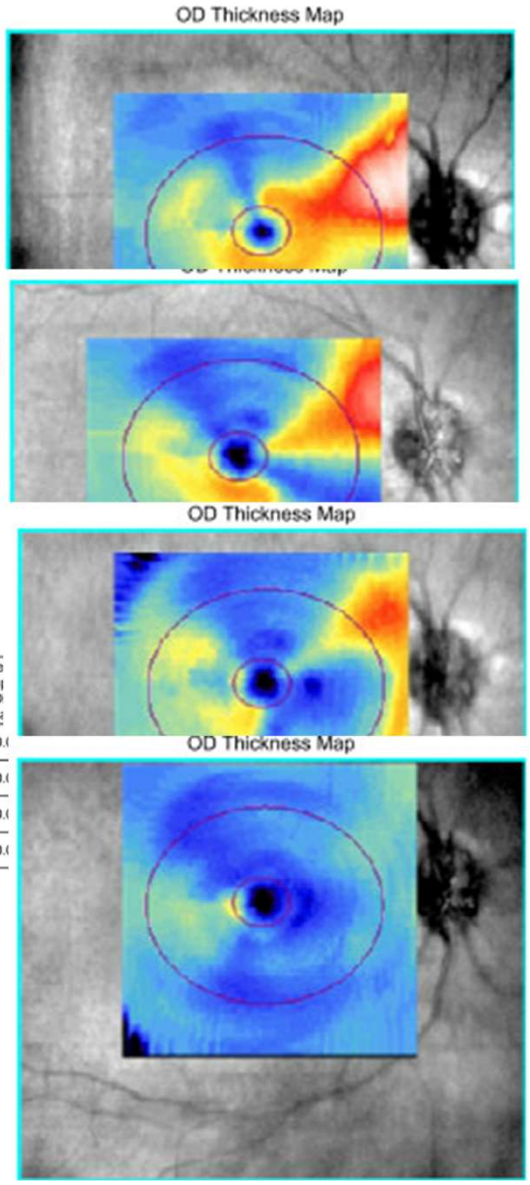
Case 3, cont:

- NO
- Peripapillary CNVM on initial scan resolved over time
- Artificially augmenting RNFL measurement (2019)
- Artificially exaggerating RNFL “loss” once completely resolved (2022)



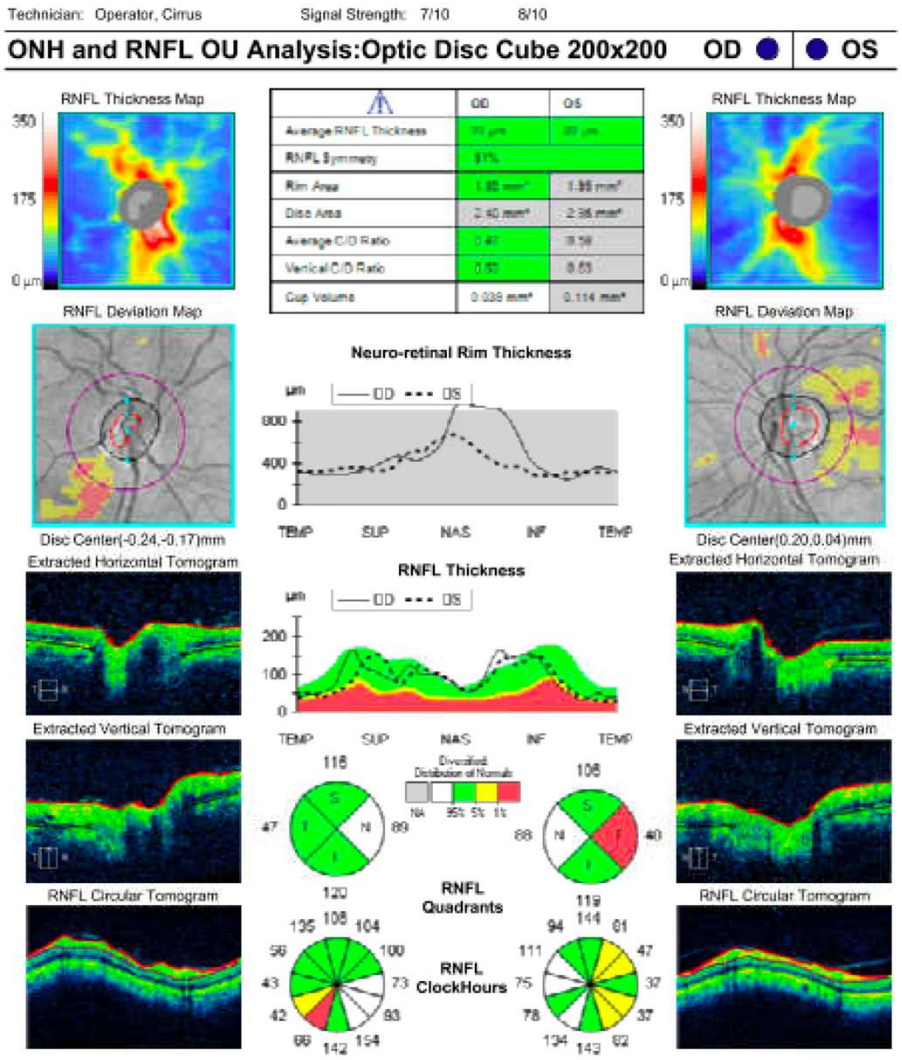
RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Ave Cup D Ra
Baseline 1:	1	7/10/2019 8:02:27 AM	5000-6138		7/10	87	79	114	1.99	0.(
Baseline 2:	2	8/20/2020 8:24:55 AM	5000-19354	R2	8/10	79	80	101	1.81	0.(
	3	2/25/2021 10:44:26 AM	5000-6138	R1	8/10	78	89	96	1.93	0.(
Current:	4	5/11/2022 6:47:07 AM	5000-19354	R1	8/10	76	85	93	1.82	0.(

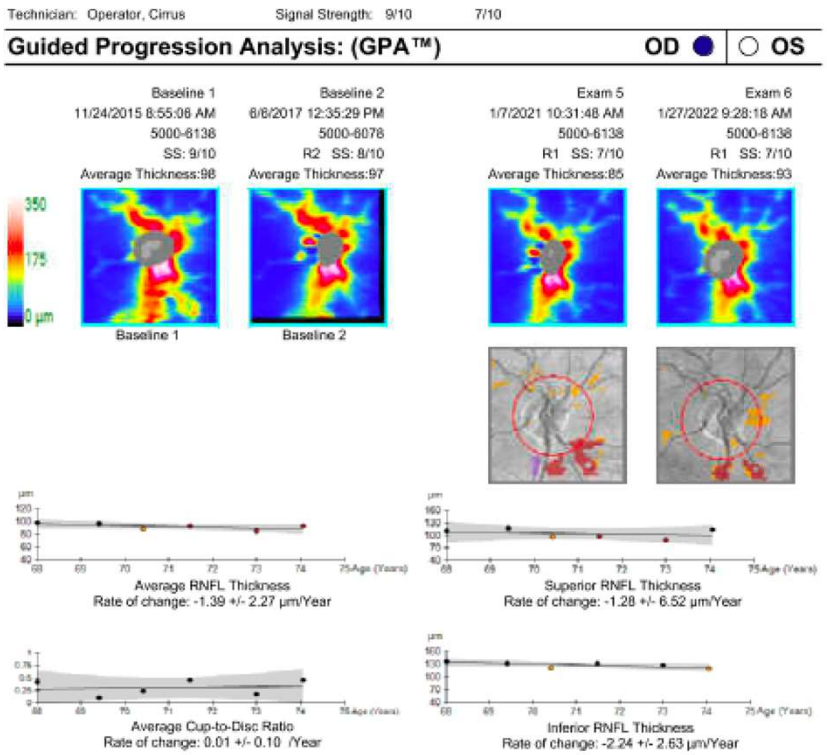


Case 4:

- 75 yo F w/ h/o OHT
- IOP high teens, low 20s
- s/p SLT OU
- On topical CAI OU BID
- Presents for f/u w/ OCT



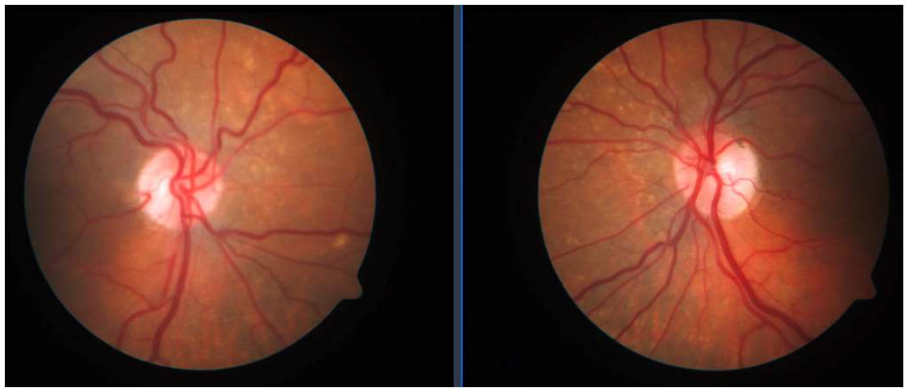
Case 4, cont:

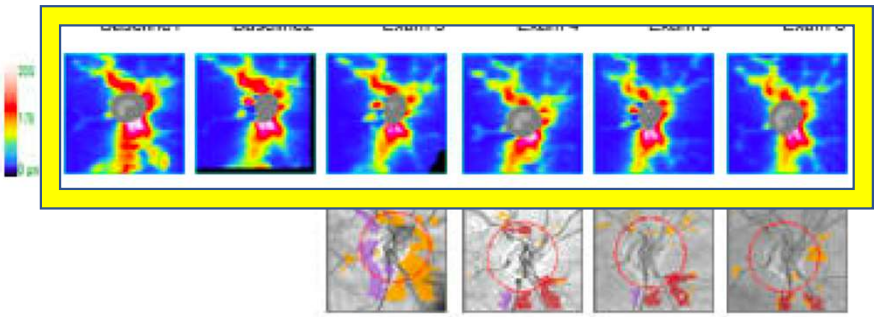


- GPA reveals . . .
- Is my patient progressing?
- Is this POAG instead of OHT?
  - NO
  - Improper identification of ON head

Case 4, cont:

- Failure of ON head recognition



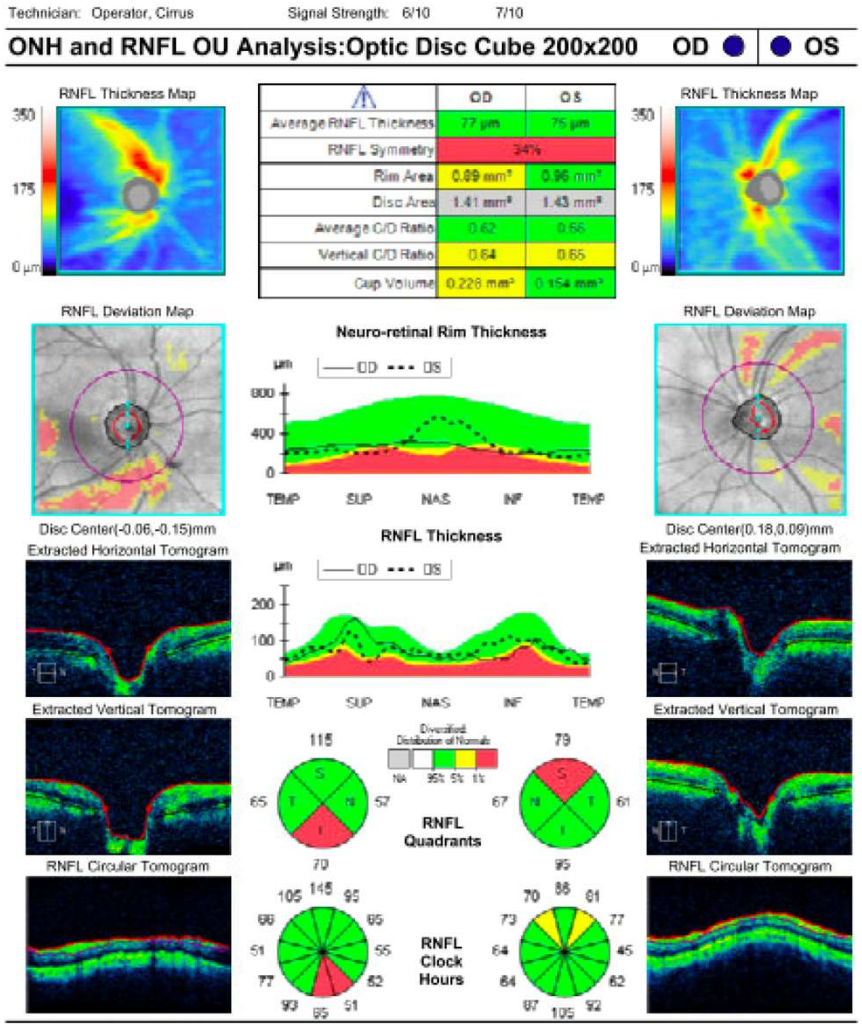


RNFL and ONH Summary Parameters

		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm^2)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm^3)
Baseline 1:	1	11/24/2015 8:55:06 AM	5000-6138		9/10	98	138	111	1.79	0.44	0.50	0.030
Baseline 2:	2	6/6/2017 12:35:29 PM	5000-6078	R2	8/10	97	133	118	1.41	0.11	0.10	0.006
	3	6/13/2018 12:43:58 PM	5000-6138	R1	7/10	89	123	97	1.39	0.24	0.26	0.009
	4	7/2/2019 3:11:27 PM	5000-6078	R1	8/10	94	133	99	1.79	0.46	0.53	0.044
	5	1/7/2021 10:31:48 AM	5000-6138	R1	7/10	85	127	91	1.31	0.18	0.20	0.008
Current:	6	1/27/2022 9:28:18 AM	5000-6138	R1	7/10	93	120	116	1.85	0.47	0.53	0.039

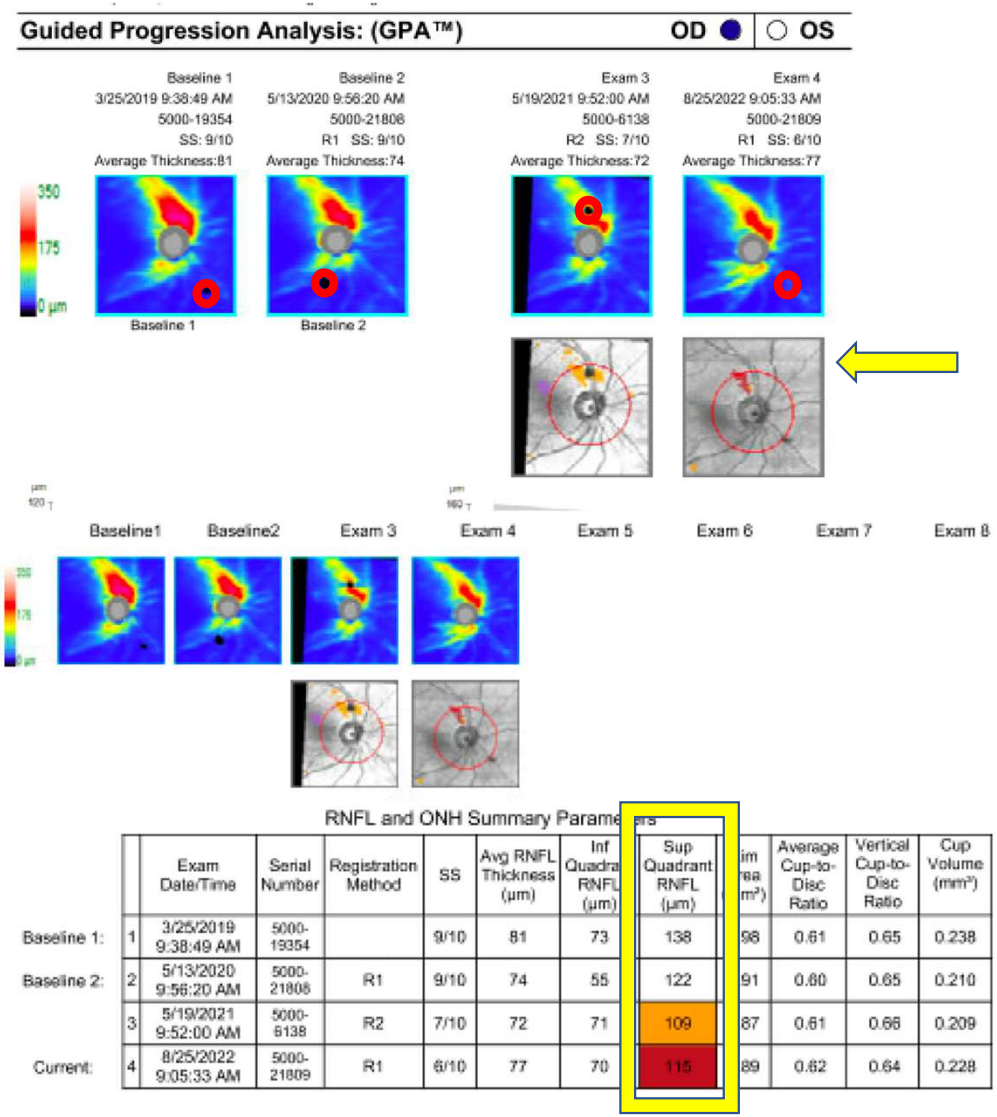
Case 5:

- 75 yo WM
- NTG, mild OD, moderate OS
- Tmax 21
- IOP at target (mid teens) on PGa
- OCT reveals. . .



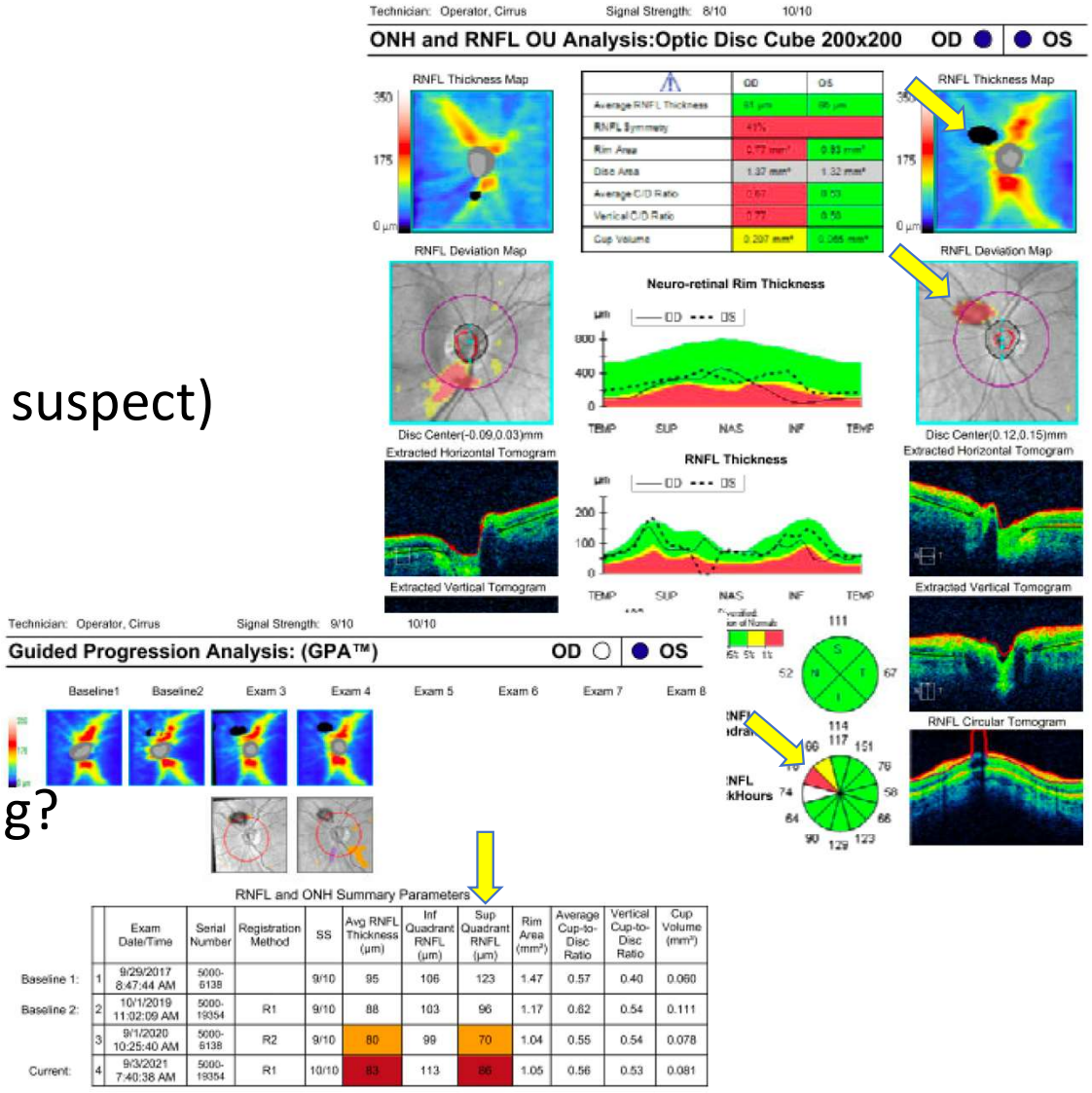
Case 5, cont:

- GPA:
- Is my patient progressing?
  - Maybe
- Roaming vitreous artifact
- Once PVD moves from obscuring superior quadrant, RNFL rebounds
  - But not fully to baseline
  - Does superior saccade artifact play a role?
  - Watch closely



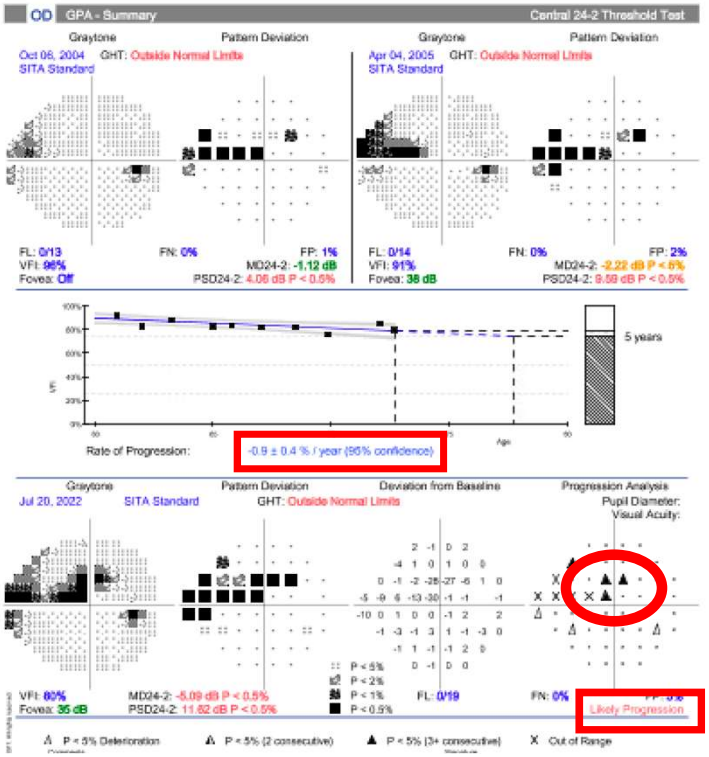
Case 6:

- 37 yo WF
- NTG, severe OD, mild (v suspect) OS
- Target IOP: low teens
- IOP controlled on PGa
- OCT reveals. . .
- Is my patient progressing?
- No,
  - PVD artifact



		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm²)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm³)
Baseline 1:	1	9/29/2017 8:47:44 AM	5000-6138		9/10	95	106	123	1.47	0.57	0.40	0.060
Baseline 2:	2	10/1/2019 11:02:09 AM	5000-19354	R1	9/10	88	103	96	1.17	0.62	0.54	0.111
	3	9/1/2020 10:25:40 AM	5000-6138	R2	9/10	80	99	70	1.04	0.55	0.54	0.078
Current:	4	9/3/2021 7:40:38 AM	5000-19354	R1	10/10	83	113	86	1.05	0.56	0.53	0.081

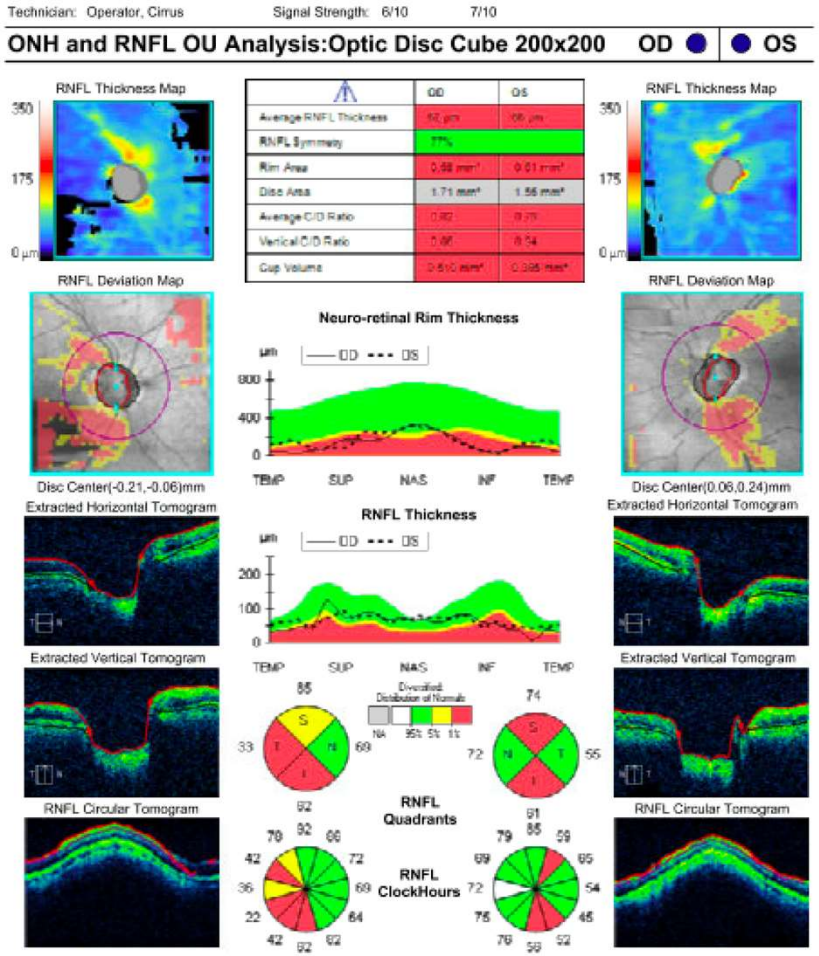
Case 6, cont:



- However, HVF reveals . . .
- ‘Slow progression’ on VFI
- ‘Likely progression’ on GPA
- IMPORTANTLY
  - Event-based analysis revealing extension of scotoma into fixation
- So, is my patient progressing?
  - Structurally, no (OCT GPA was stable OD as well)
  - Functionally, yes

Case 7:

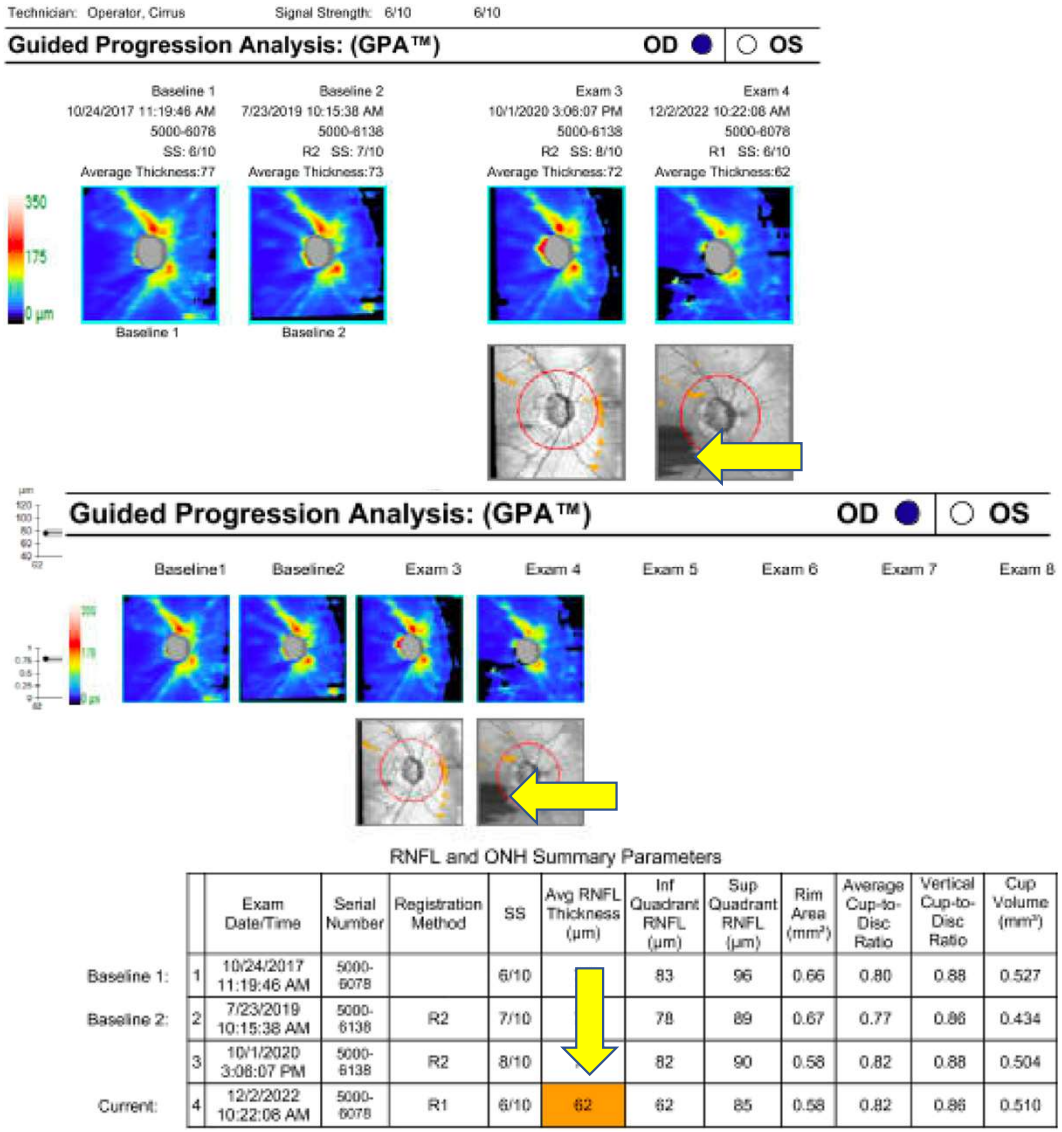
- 67 yo, phakic, WM
- h/o severe NTG
- Tmax 17, tentative target 11-12
- IOP at target on PGa and fixed-combination timolol-brimonidine
- OCT reveals . . .



Case 7, cont:

- OCT GPA reveals. . .
- Is my patient progressing?

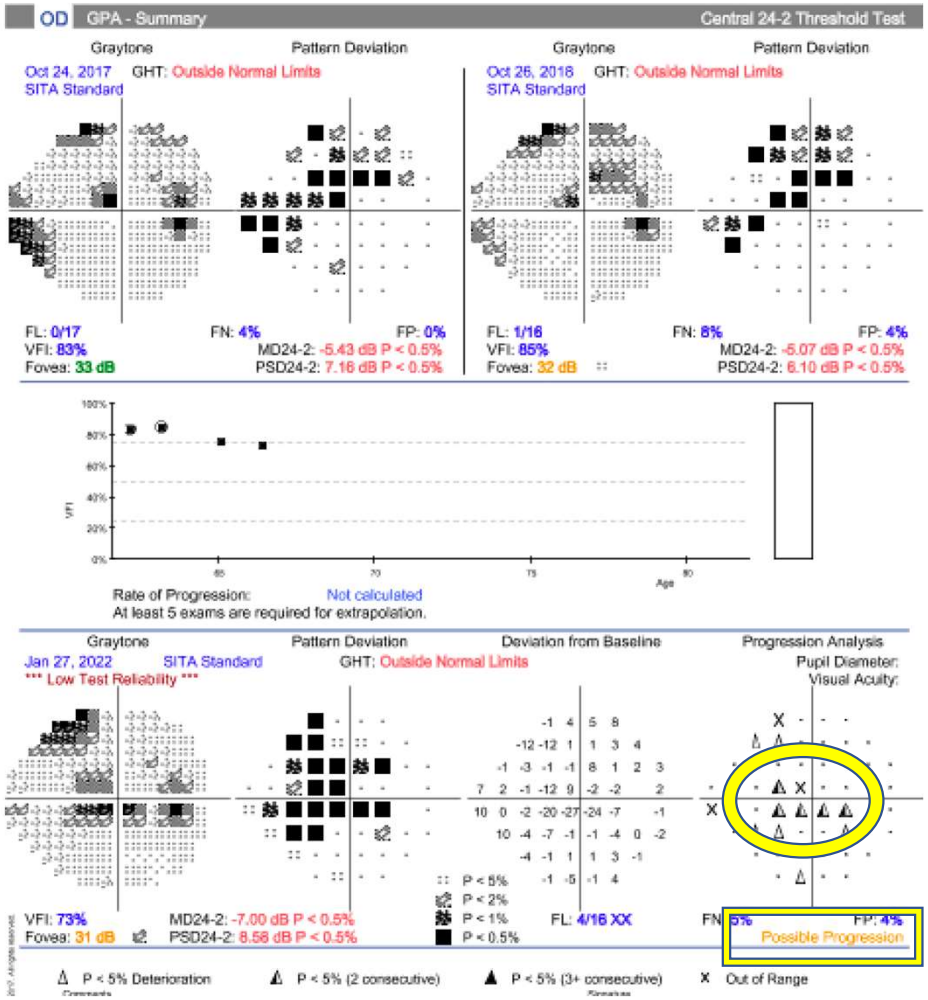
- No
- Blocking artifact



		Exam Date/Time	Serial Number	Registration Method	SS	Avg RNFL Thickness (µm)	Inf Quadrant RNFL (µm)	Sup Quadrant RNFL (µm)	Rim Area (mm^2)	Average Cup-to-Disc Ratio	Vertical Cup-to-Disc Ratio	Cup Volume (mm^3)
Baseline 1:	1	10/24/2017 11:19:46 AM	5000-6078		6/10		83	96	0.66	0.80	0.88	0.527
Baseline 2:	2	7/23/2019 10:15:38 AM	5000-6138	R2	7/10		78	89	0.67	0.77	0.86	0.434
	3	10/1/2020 3:06:07 PM	5000-6138	R2	8/10		82	90	0.58	0.82	0.88	0.504
Current:	4	12/2/2022 10:22:08 AM	5000-6078	R1	6/10	62	62	85	0.58	0.82	0.86	0.510

Case 7, cont:

- BUT
- HVF reveals. . .
- Is my patient progressing?
- Maybe
- But patient has symptomatic cataract which we believe is affecting VF performance,
- So watch closely



Conclusions

- Know your instruments
  - How they work
  - What they are measuring
  - How the measurements can be skewed
- Know your diseases
  - Structure/function correlation
  - How they progress
  - What can mimic them
- Know your patients
  - What do these tests mean when applied individually

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