



Optometric
Education
Consultants



OCT Interpretation

Red, Yellow, and Blue Disease, What is Real
Disease, and What is Physiologically Normal?

Greg Caldwell, OD, FAAO

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
- Lectured for: B&L, BioTissue, Dompe, Santen
 - Disclosure: Receive speaker honorariums
- Advisory Board: Dompe, Tarsus
 - Disclosure: Receive participant honorariums
- I have no direct financial or proprietary interest in any companies, products or services mentioned in this presentation
 - Disclosure: Non-salaried financial affiliation with Pharmanex
- Envolve: PA Medical Director, Credential Committee
- Healthcare Registries – Chairman of Advisory Council for Diabetes and AMD
- The content and format of this course is presented without commercial bias and does not claim superiority of any commercial product or service
- Optometric Education Consultants – Scottsdale, AZ, Pittsburgh, PA, Sarasota, FL Barcelona, Spain, Orlando, FL, Mackinac Island, MI, Quebec City, Canada, and Nashville, TN- Owner



Disclosures- Greg Caldwell, OD, FAAO

All relevant relationships have been mitigated

Optovue/Visionix

Concepts discussed in this lecture can be applied to any OCT platform

The content and format of this course is presented without commercial bias and does not claim superiority of any commercial product or service



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

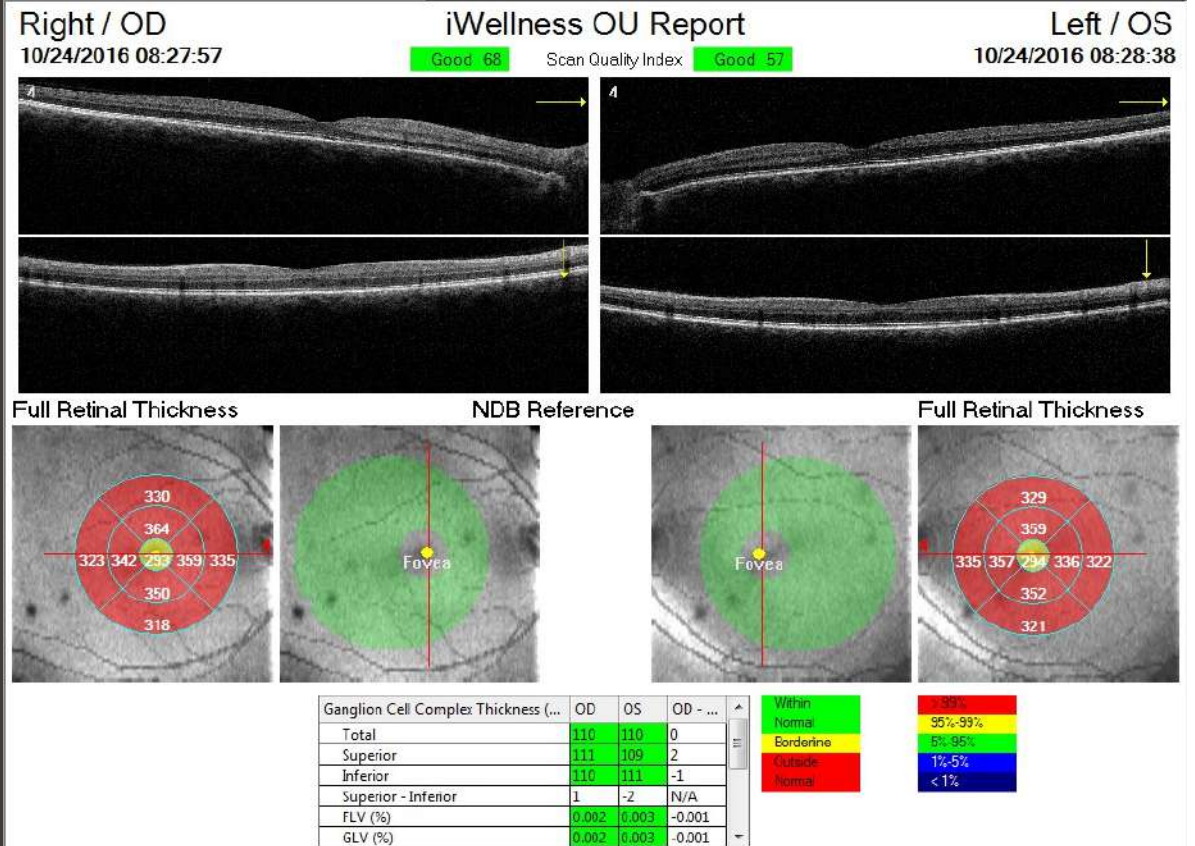
Question

This OCT is most likely

Real Disease

or

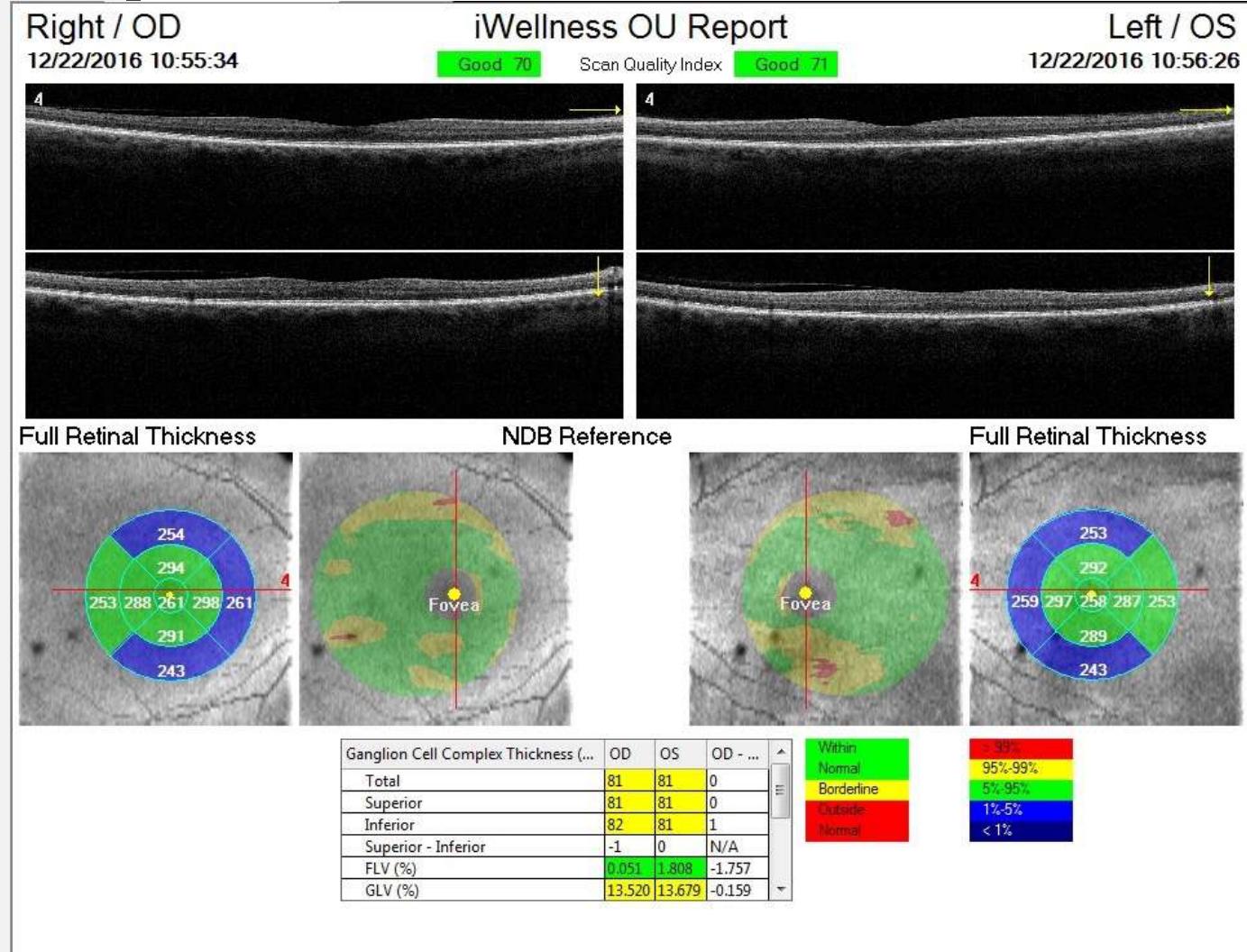
Physiologically Normal



Question

This OCT is most likely

Real Disease
or
Physiologically Normal

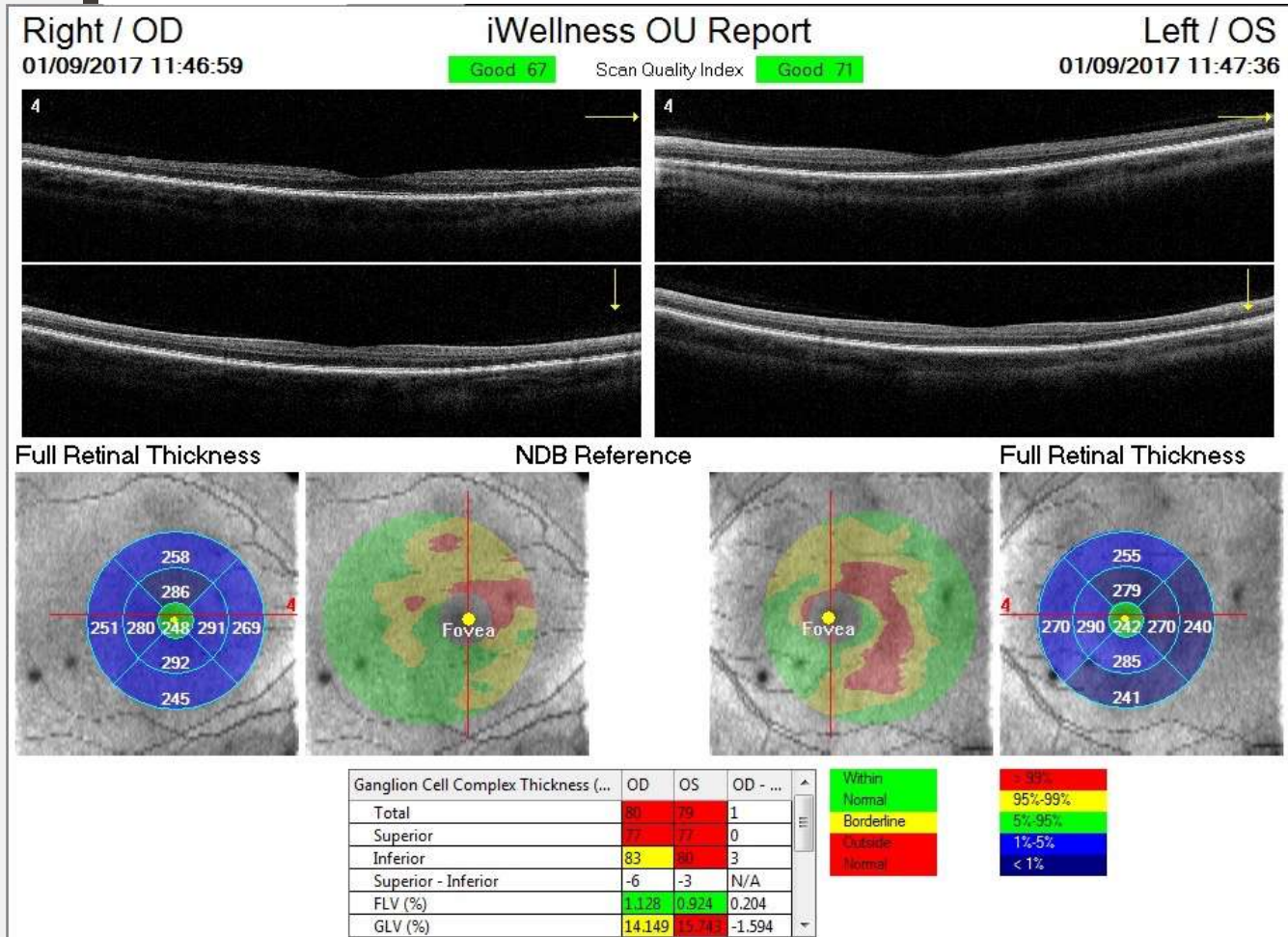


Question

This OCT is most likely

Real Disease
or

Physiologically Normal



Green, Red, Yellow, and Blue Disease

Physiologically Normal
OCT measure structure

Green, Red, Yellow, and Blue Disease

Hints to this Disease

👁️ Prefer to start evaluating an OCT with bilateral scan

👁️ If the disease is a bilateral disease

- ★ Glaucoma

- 📋 It is usually asymmetric

👁️ If the scans are symmetric

- ★ Then it most likely not disease – physiologically normal

- ★ Anatomical variation

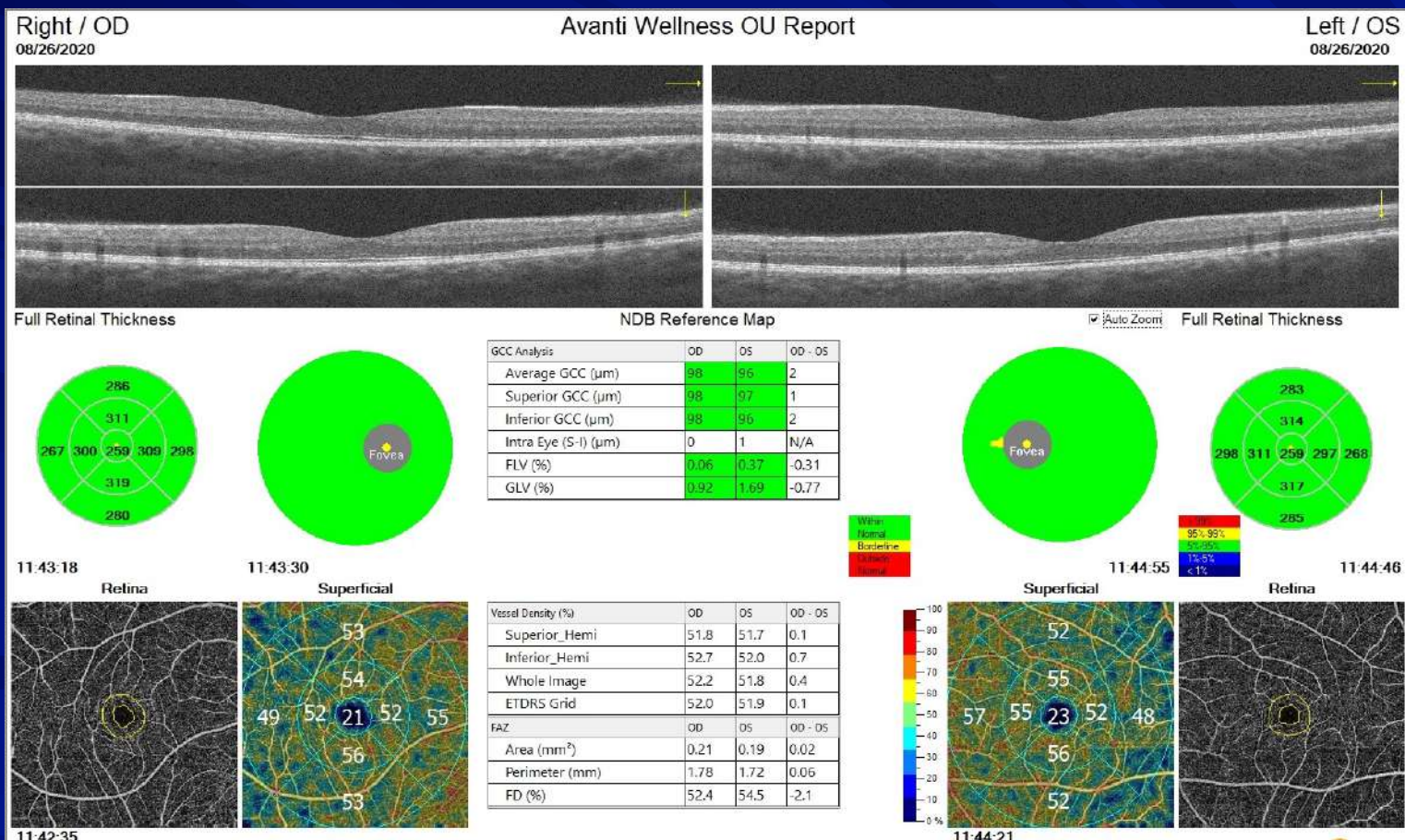
- 📋 Normal for that patient

👁️ Another hint is the GCC expected values

- ★ 85-100 microns

- ★ 92-95 microns

Symmetry and What is Being Tested



46-year-old woman with red-yellow disease

👁️ OD -0.75 20/20

👁️ OS -1.25 20/20

👁️ Systemic hx: thyroid dysfunction, high cholesterol

★ Medications for the above

👁️ IOPs 15 mm Hg OU 8:30 am

Right / OD
10/24/2016 08:27:57

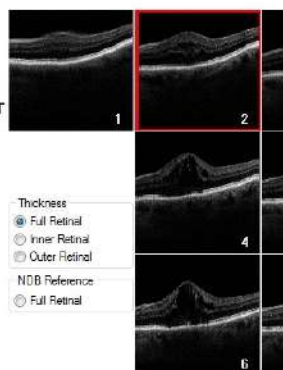
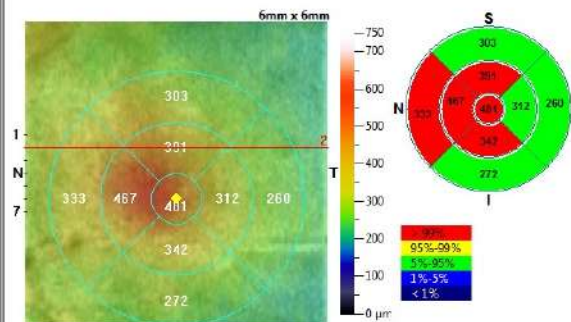
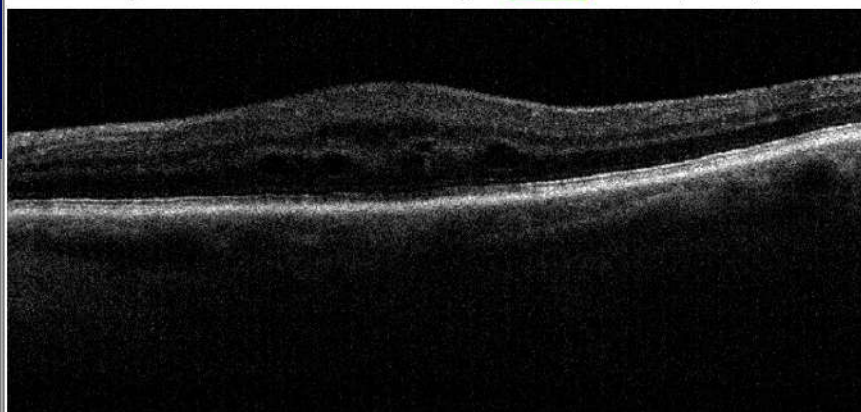
iWellness OU Report

Good: 68 Scan Quality Index Good: 57

Left / OS
10/24/2016 08:28:38

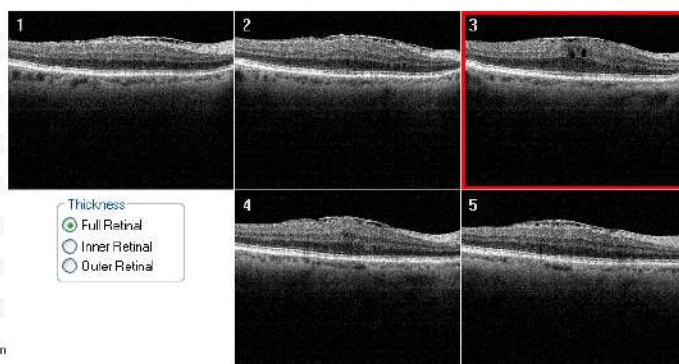
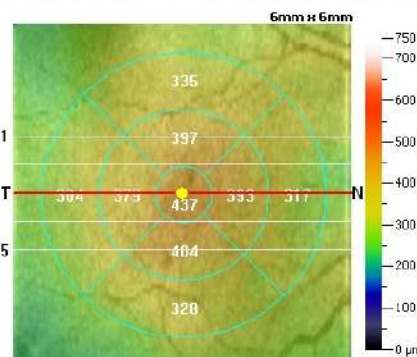
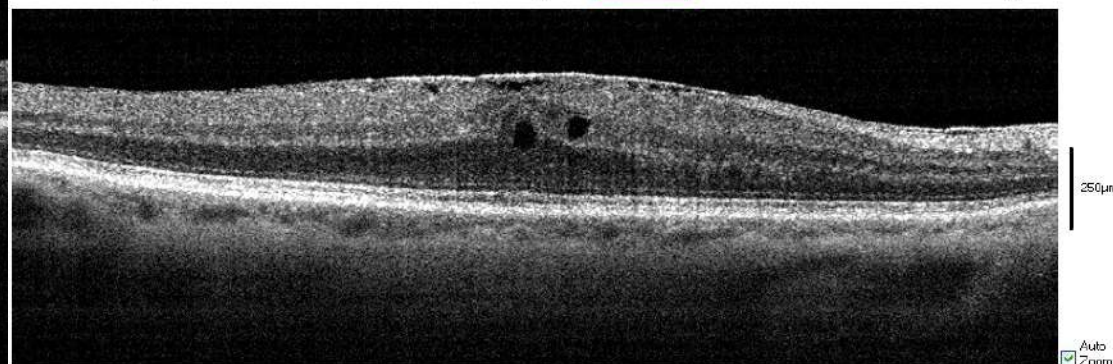
Retina Map

Scan Quality Index Good: 57 ☐ View Reproducibility



Retina Map

Scan Quality Index Good: 64



Print

Change Analysis

Comment

Print

Change Analysis

OU Report

Comment

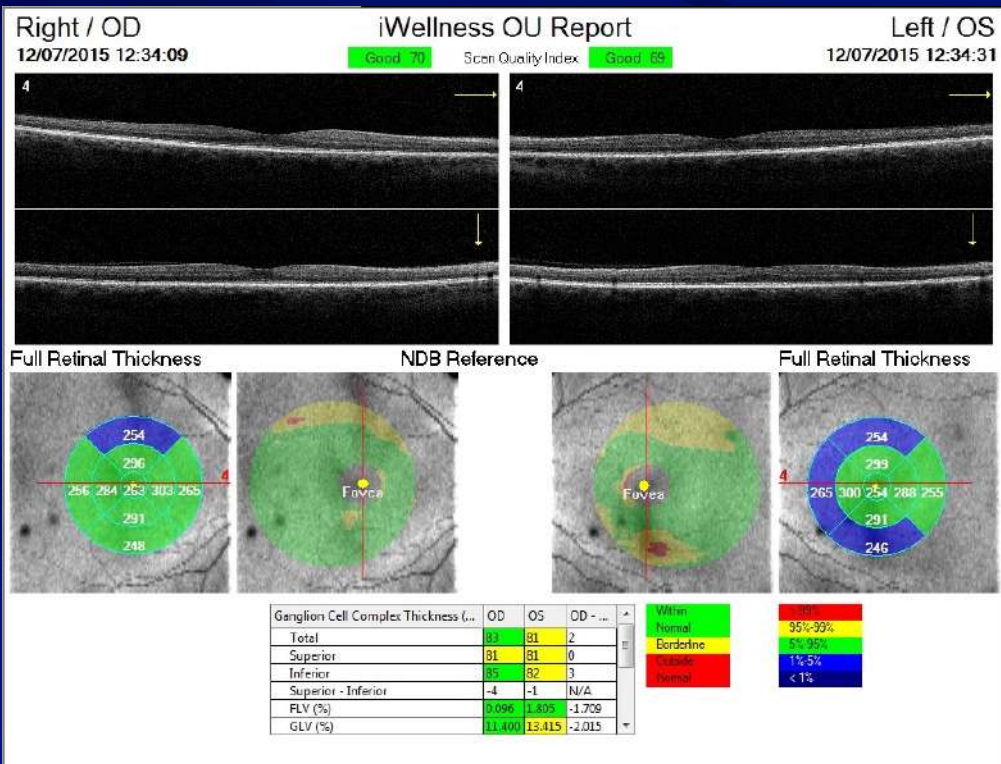
Comment

63-year-old woman with red, yellow, blue, and green disease

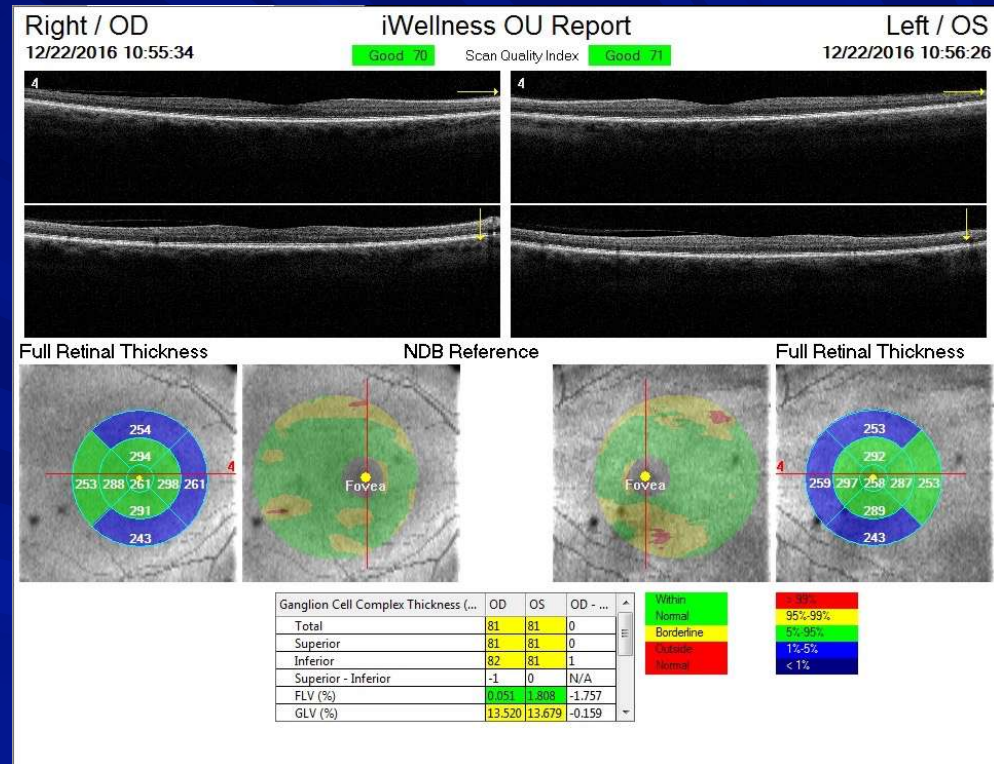
👁 OD plano/ +2.00 20/20

👁 OS -0.50/ +2.00 20/20

👁 IOPs 15-18 mm Hg OU 2011-2015



2015



2016

58-year-old with yellow disease

👁 OD +1.00 20/20

👁 OS +1.25 20/20

👁 IOPs: 13/15 mm Hg at 11:24 am

👁 (pay attention to FLV and GLV)

Right / OD

11/15/2016 10:53:43

iWellness OU Report

Good 77

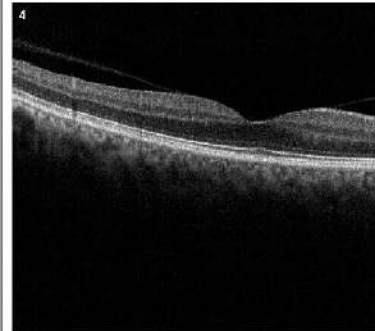
Scan Quality Index

Good 71

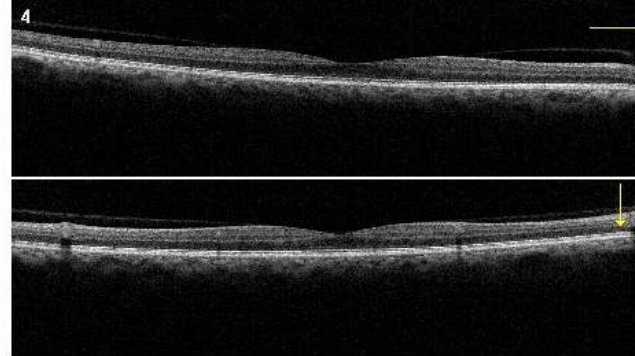
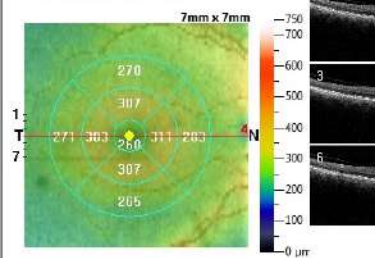
Left / OS

11/15/2016 10:54:21

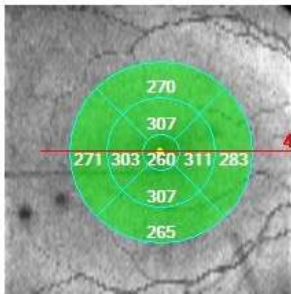
iWellness



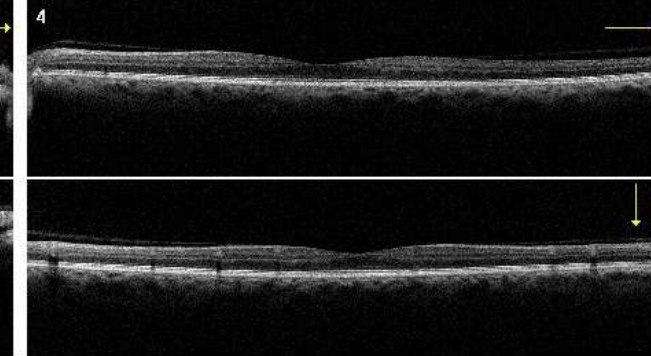
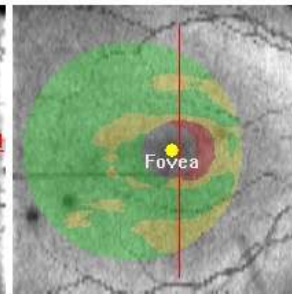
Full Retinal Thickness



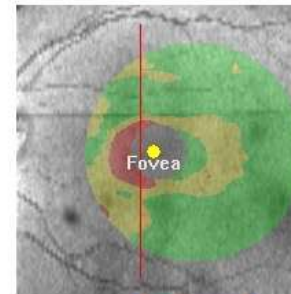
Full Retinal Thickness



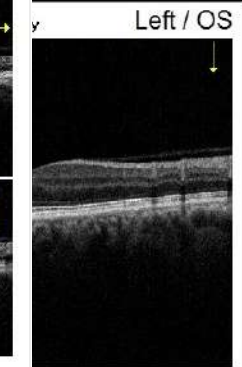
NDB Reference



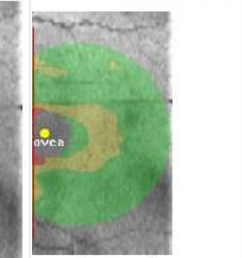
Full Retinal Thickness



NDB Reference



Full Retinal Thickness

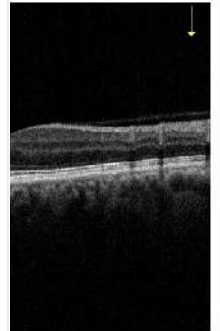


Ganglion Cell Complex Thickness (...)	OD	OS	OD - OS
Total	82	81	1
Superior	82	81	1
Inferior	81	81	0
Superior - Inferior	1	0	N/A
FLV (%)	0.942	2.210	-1.268
GLV (%)	12.517	12.785	-0.268

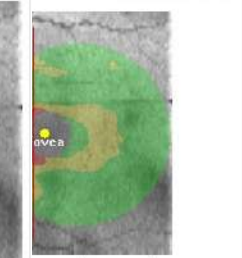
Within Normal
Borderline
Outside Normal

> 99%
95%-99%
5%-95%
1%-5%
< 1%

Left / OS



NDB Reference



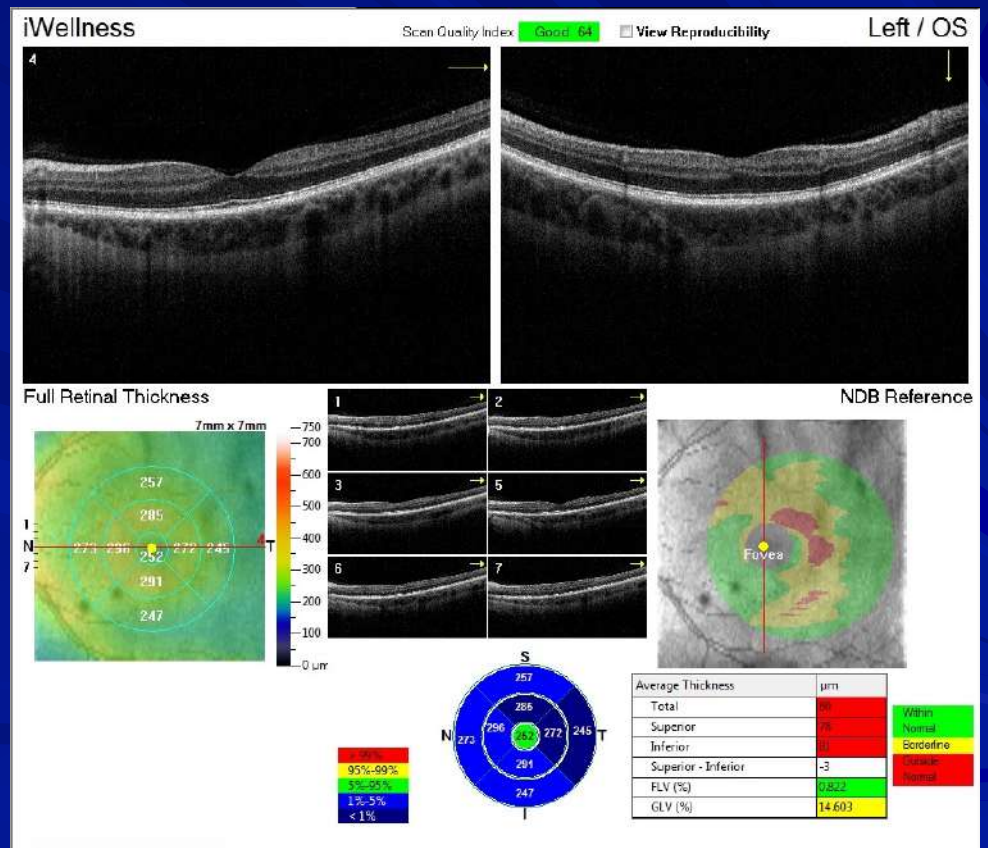
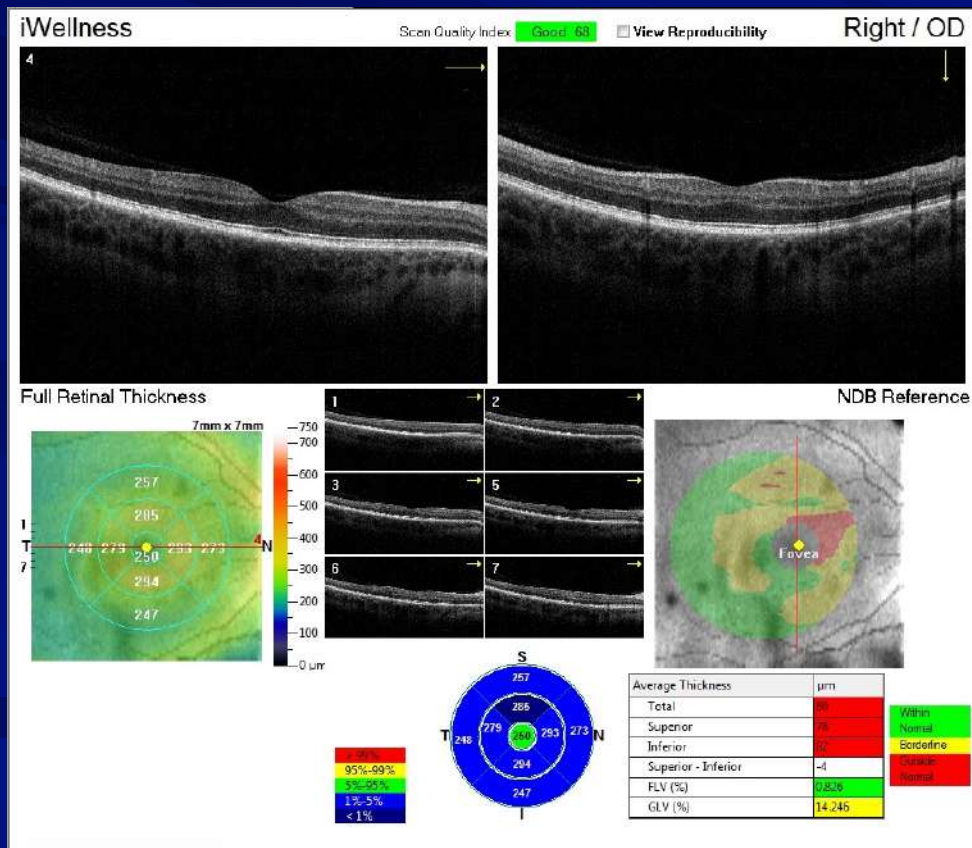
40 yo man with red, blue, green disease

👁️ OD -7.50 – 0.75 x 110 20/20

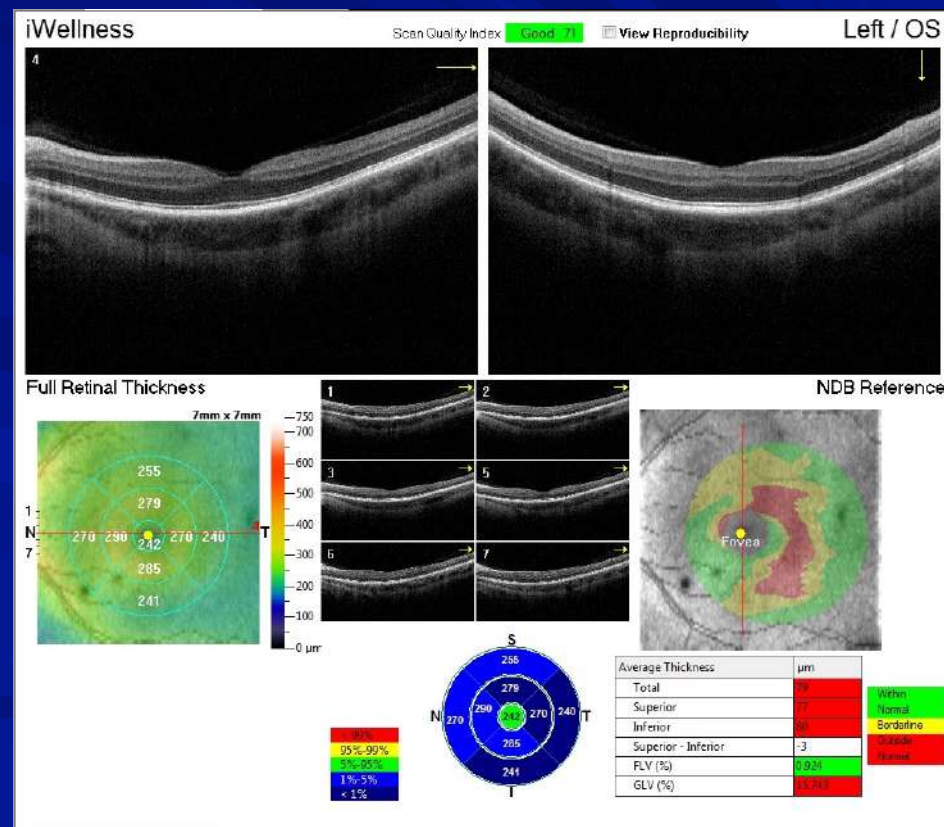
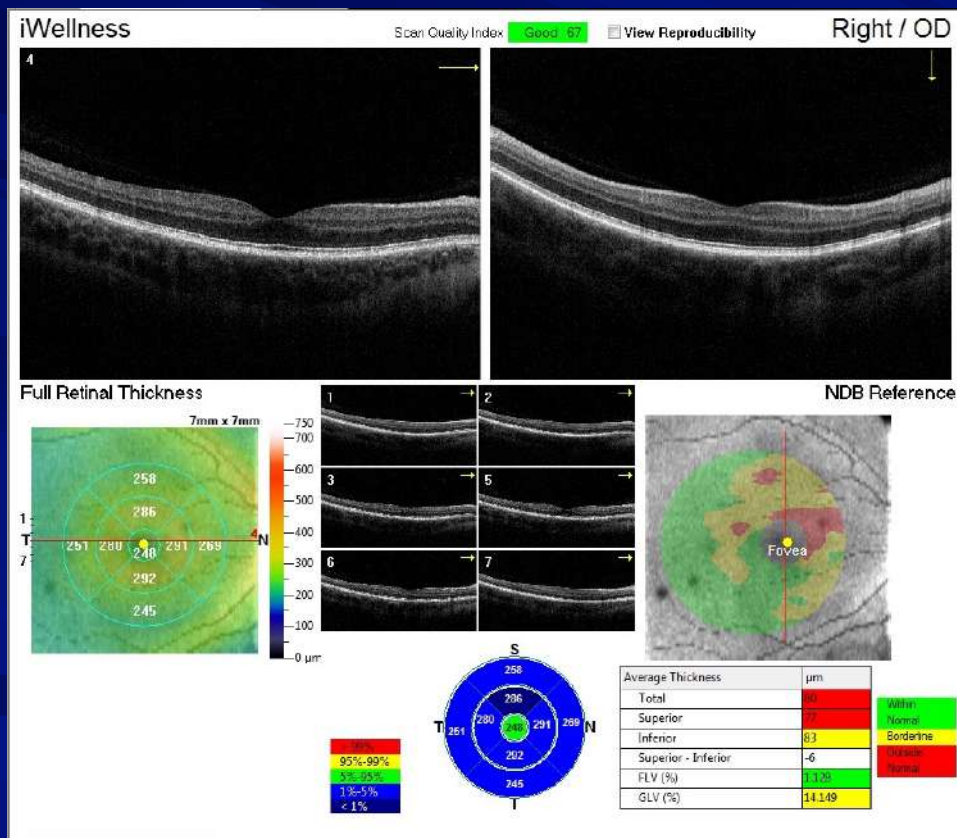
👁️ OS -7.50 – 0.75 x 105 20/20

👁️ IOPs: 15/13 mm Hg at 6:30 pm

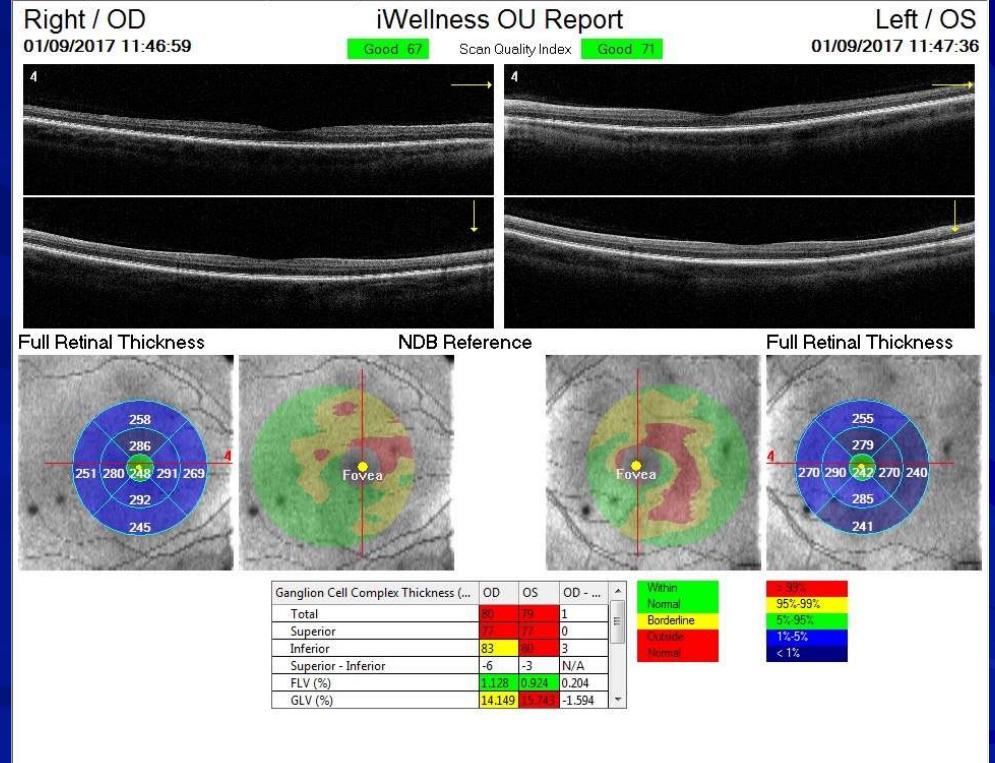
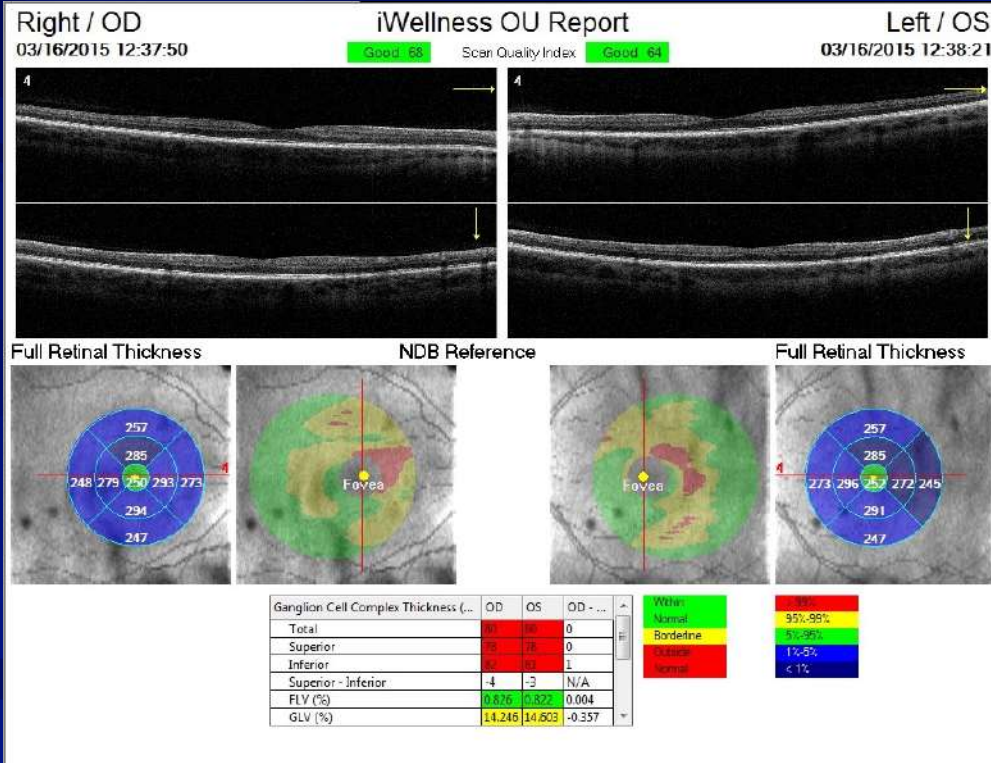
March 16, 2015



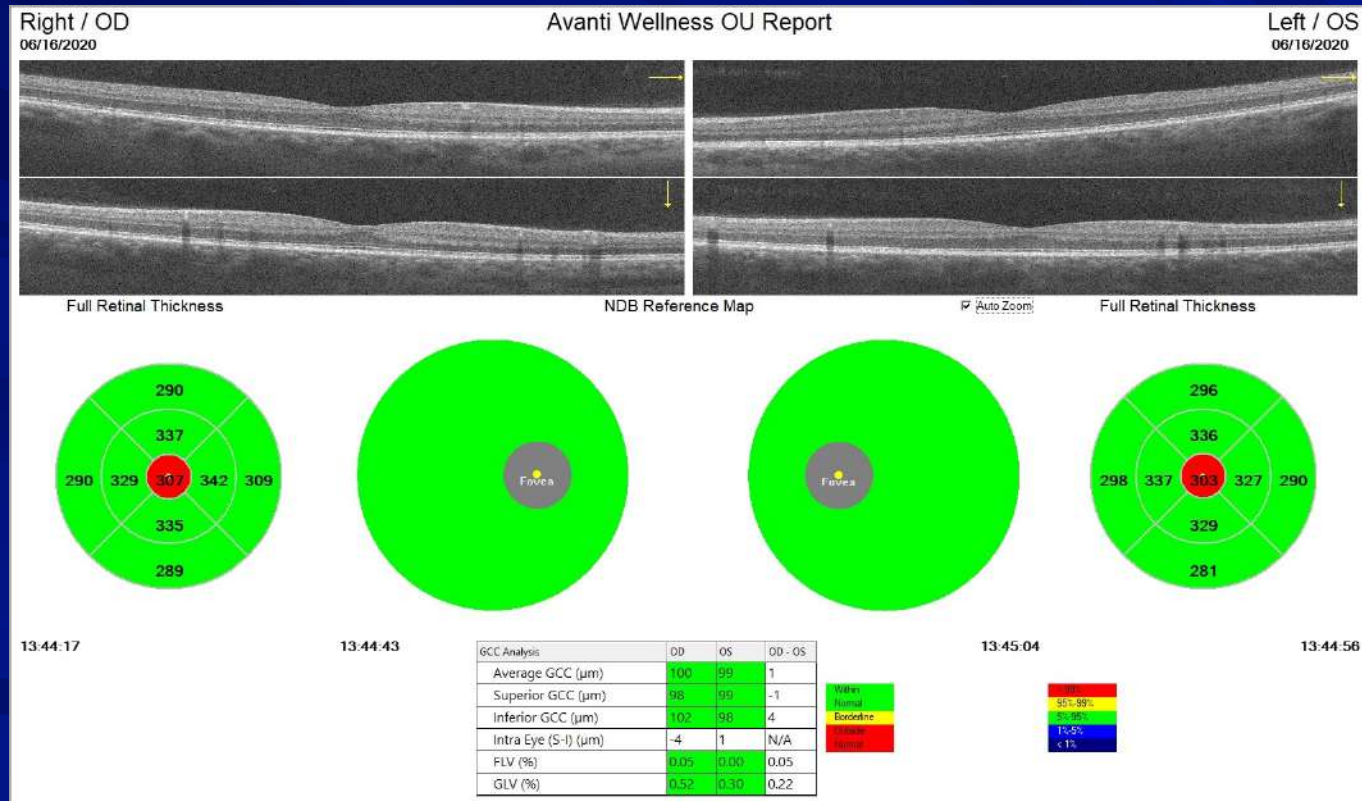
January 9, 2017



22 months apart



28-year-old man with myopia

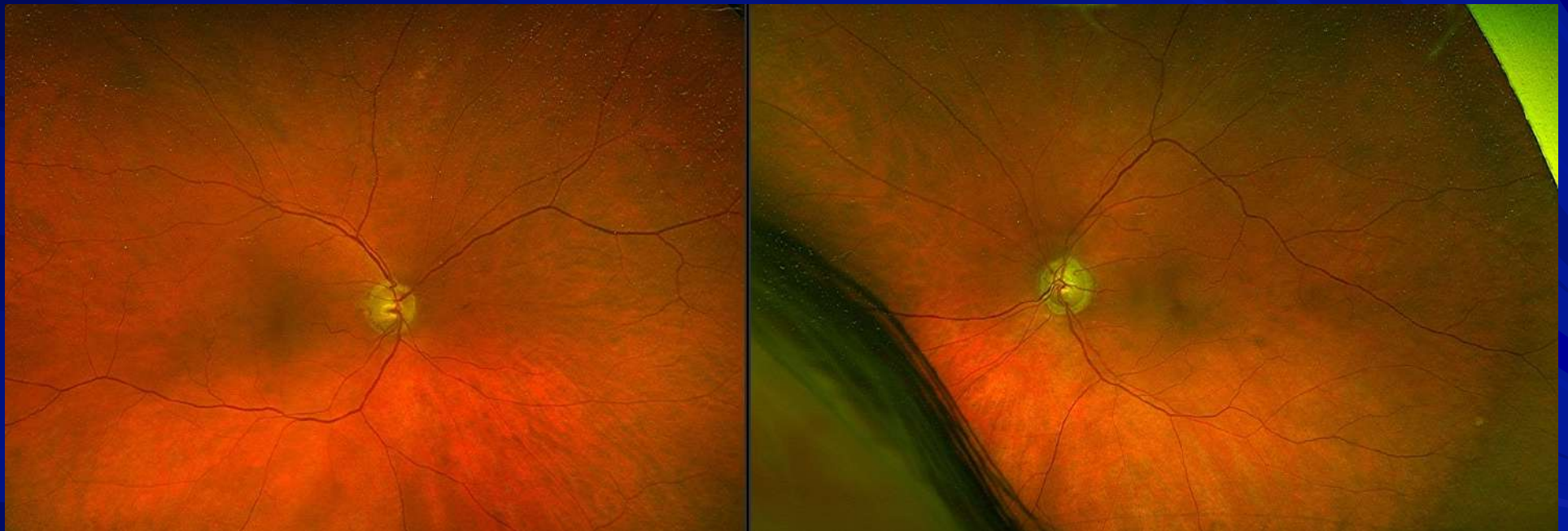


Green, Red, Yellow, and Blue Disease

Real Disease

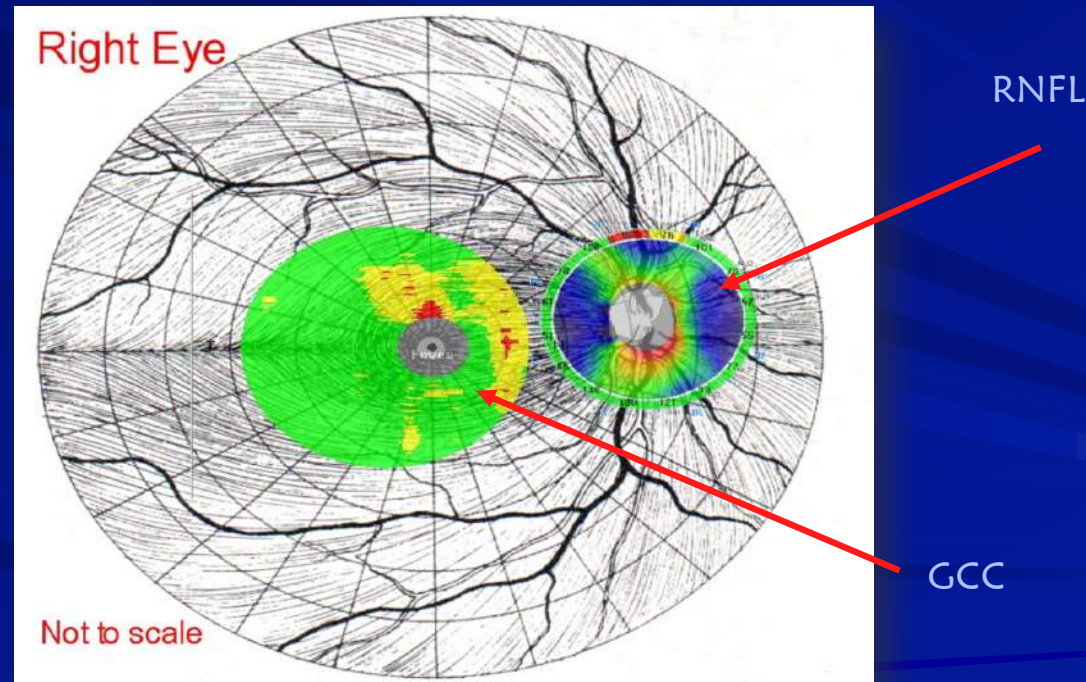
Glaucoma

Where does glaucoma damage the NRR of the ONH?

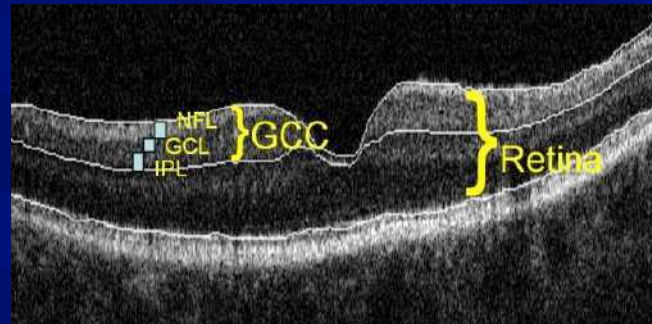




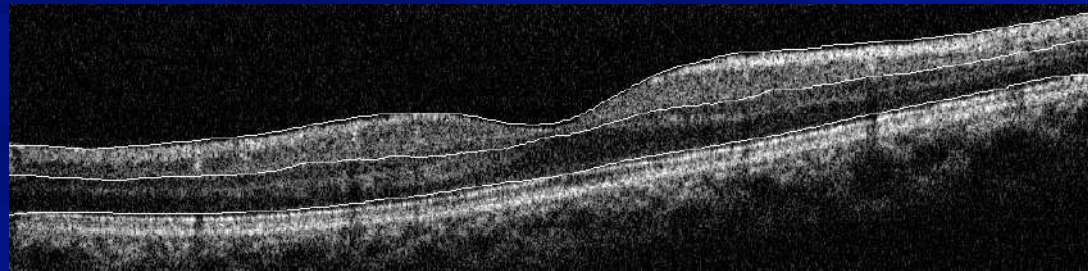
Overlay of the RNFL and GCC



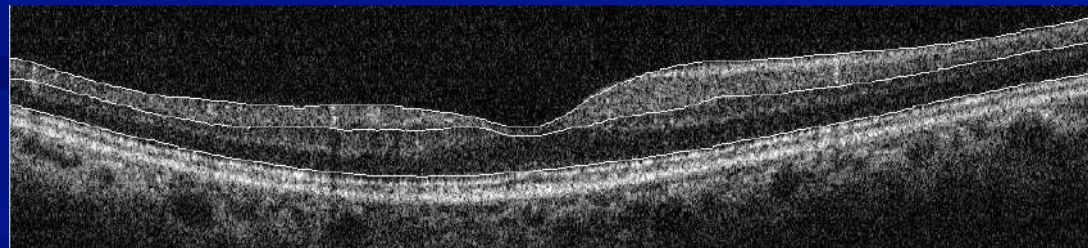
GCC Thinning in Glaucoma



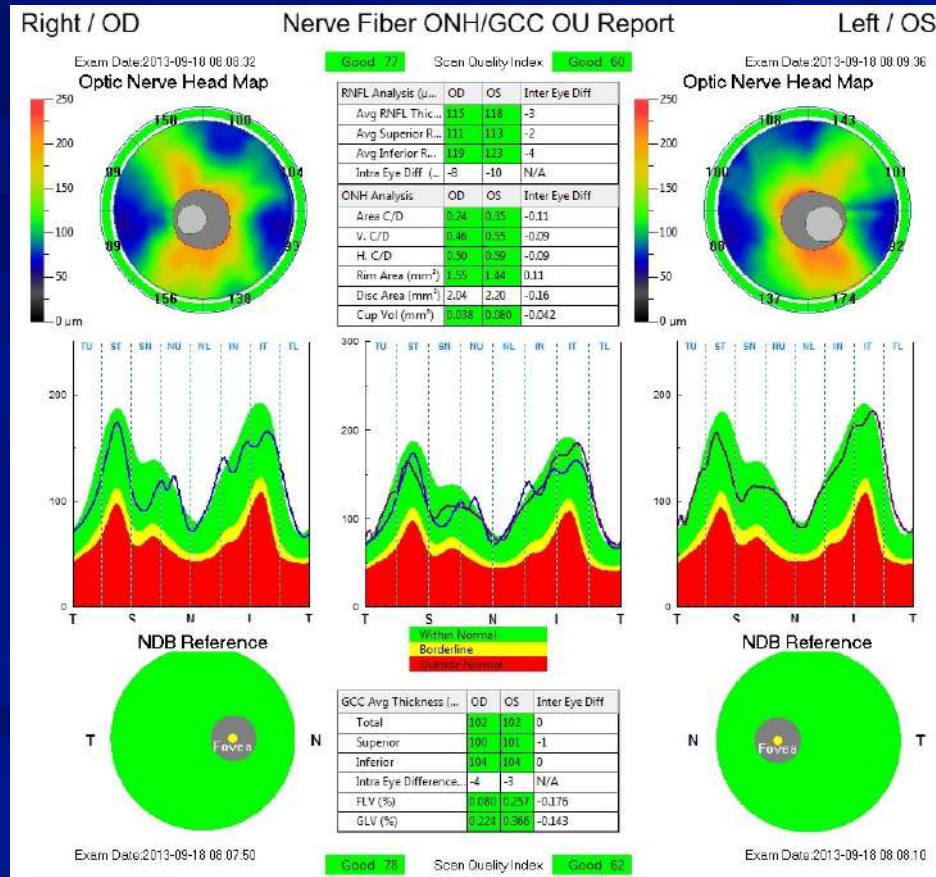
Normal



Glaucoma with thinner GCC



NFL and GCC



Right / OD

Nerve Fiber ONH/GCC OU Report

Left / OS

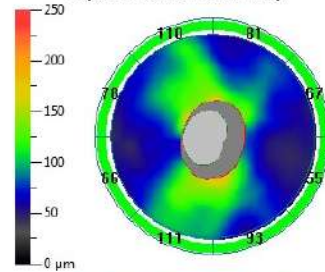
Exam Date:2013-09-13 07:43:11

Good 65

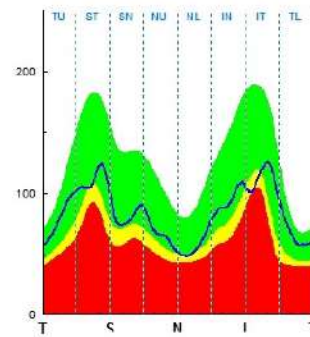
Scan Quality Index

Good 54

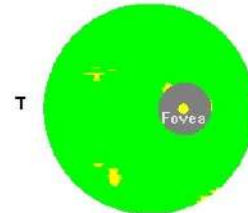
Optic Nerve Head Map



RNFL Analysis (μm)			
	OD	OS	Inter Eye Diff
Avg RNFL Thic...	83	77	6
Avg Superior R...	84	69	15
Avg Inferior R...	81	86	-5
Intra Eye Diff (...)	3	-17	N/A
ONH Analysis			
	OD	OS	Inter Eye Diff
Area C/D	0.47	0.76	-0.29
V. C/D	0.72	0.87	-0.15
H. C/D	0.70	0.95	-0.25
Rim Area (mm²)	1.20	1.51	0.63
Disc Area (mm²)	2.26	2.43	-0.17
Cup Vol (mm³)	0.206	0.458	-0.252



NDB Reference



Exam Date:2013-09-13 07:47:30

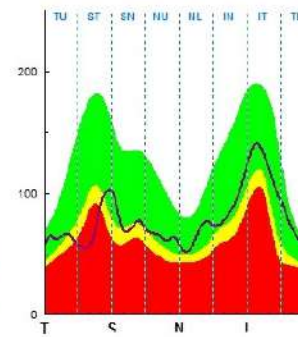
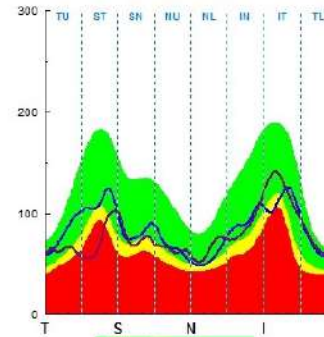
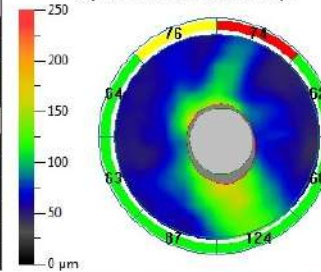
Good 65

Scan Quality Index

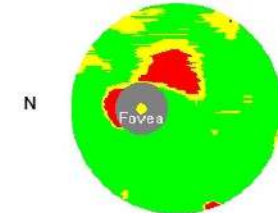
Good 56

Exam Date:2013-09-13 07:50:43

Optic Nerve Head Map



NDB Reference



Exam Date:2013-09-13 07:50:09

GCC Avg Thickness (μm)			
	OD	OS	Inter Eye Diff
Total	92	87	5
Superior	93	78	15
Inferior	92	96	-4
Intra Eye Difference...	1	-18	N/A
FLV (%)	1.060	4.583	-3.522
GLV (%)	1.130	6.583	-6.453

Right / OD

Nerve Fiber ONH/GCC OU Report

Left / OS

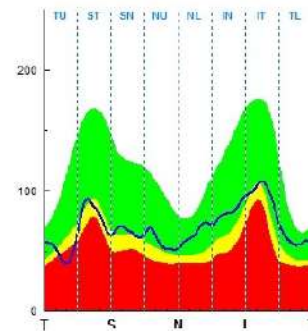
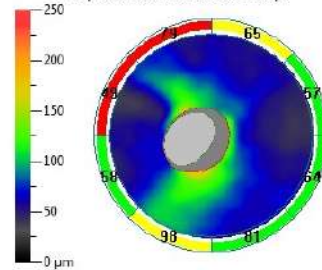
Exam Date: 2013-09-03 10:42:29

Good 51

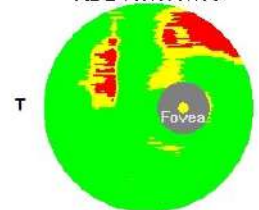
Scan Quality Index

Good 47

Optic Nerve Head Map



NDB Reference



Exam Date: 2013-09-03 10:40:29

Good 51

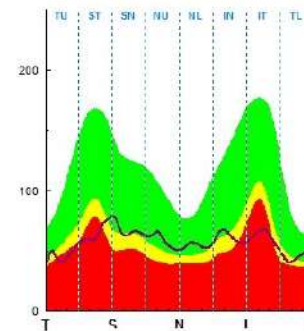
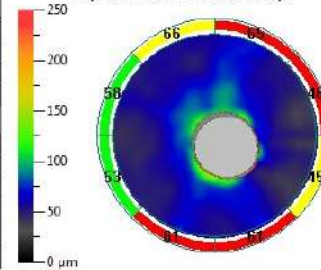
Scan Quality Index

Good 53

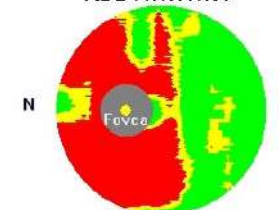
RNFL Analysis (μm)	OD	OS	Inter Eye Diff
Avg RNFL Thic...	69	59	12
Avg Superior R...	63	58	4
Avg Inferior R...	75	63	20
Intra Eye Diff (...)	-12	4	N/A
ONH Analysis	OD	OS	Inter Eye Diff
Area C/D	0.61	0.83	-0.24
V. C/D	0.85	0.91	-0.10
H. C/D	0.75	0.97	-0.18
Rim Area (mm²)	0.77	0.30	0.47
Disc Area (mm²)	1.94	2.03	-0.09
Cup Vol (mm³)	0.101	0.554	-0.393

Exam Date: 2013-09-03 10:43:43

Optic Nerve Head Map



NDB Reference



Exam Date: 2013-09-03 10:41:07

GCC Avg Thickness (μm)	OD	OS	Inter Eye Diff
Total	62	78	12
Superior	78	73	5
Inferior	65	69	18
Intra Eye Difference...	-7	6	N/A
FLV (%)	2.953	2.235	-6.225
GLV (%)	10.8	21.6	-10.765

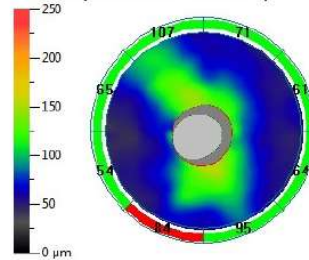
Right / OD

Nerve Fiber ONH/GCC OU Report

Left / OS

Exam Date:2013-03-28 09:57:13

Optic Nerve Head Map



Good 42

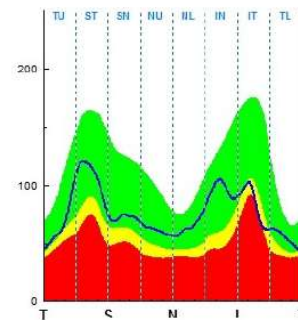
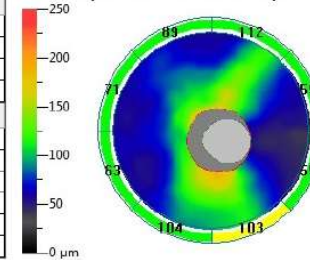
Scan Quality Index

Good 42

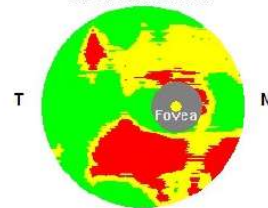
RNFL Analysis (u...)			
OD	OS	Inter Eye Diff	
Avg RNFL Thic...	75	87	-7
Avg Superior R...	76	83	-7
Avg Inferior R...	74	81	-7
Intra Eye Diff (...)	2	2	N/A
ONH Analysis			
OD	OS	Inter Eye Diff	
Area C/D	0.61	0.51	0.10
V. C/D	0.77	0.70	0.07
H. C/D	0.86	0.78	0.08
Rim Area (mm ²)	0.69	0.97	-0.28
Disc Area (mm ²)	1.78	2.00	-0.22
Cup Vol (mm ³)	0.520	0.324	0.196

Exam Date:2013-08-28 09:56:22

Optic Nerve Head Map



NDB Reference



Exam Date:2013-03-28 09:56:22

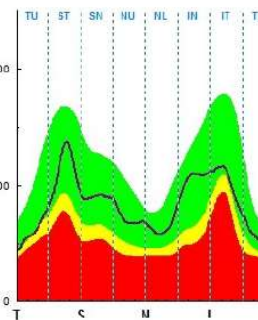
Good 51

Scan Quality Index

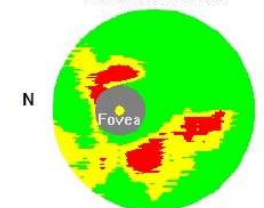
Good 60

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

Within Normal
Borderline
Outside Normal



NDB Reference



Exam Date:2013-08-28 09:56:42

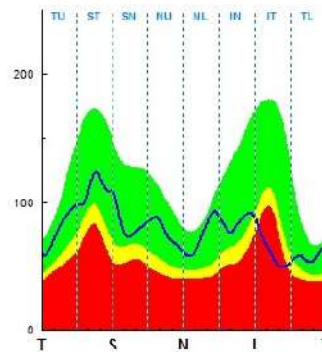
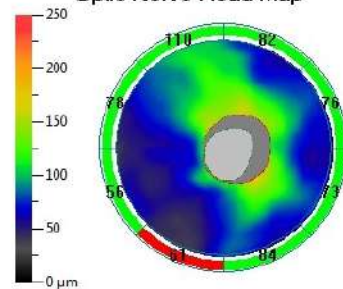
Right / OD

Nerve Fiber ONH/GCC OU Report

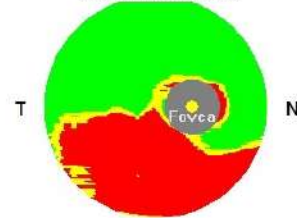
Left / OS

Exam Date: 2013-06-13 10:03:42

Optic Nerve Head Map



NDB Reference



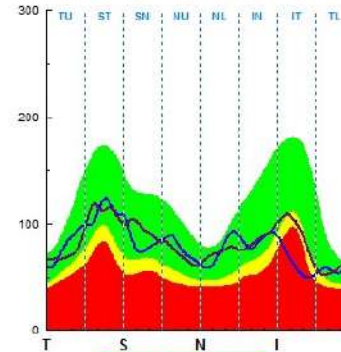
Exam Date: 2013-06-13 10:02:16

Good 58

Scan Quality Index

Good 53

RNFL Analysis (μm)	OD	OS	Inter Eye Diff
Avg RNFL Thic...	78	81	-3
Avg Superior R...	86	86	0
Avg Inferior R...	66	76	-10
Intra Eye Diff (...)	17	10	N/A
ONH Analysis	OD	OS	Inter Eye Diff
Area C/D	0.33	0.49	0.04
V. C/D	0.79	0.77	0.02
H. C/D	0.75	0.68	0.07
Rim Area (mm²)	0.90	1.03	-0.13
Disc Area (mm²)	1.93	2.01	-0.08
Cup Vol (mm³)	0.228	0.197	0.031



Within Normal
Borderline
Outside Normal

GCC Avg Thickness (μm)	OD	OS	Inter Eye Diff
Total	74	83	-11
Superior	87	91	-4
Inferior	63	79	-16
Intra Eye Difference...	26	12	N/A
FLV (%)	19.3	4.899	8.424
GLV (%)	19.0	8.073	10.936

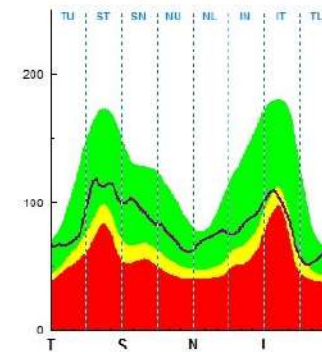
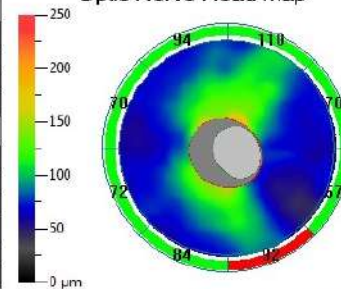
Good 61

Scan Quality Index

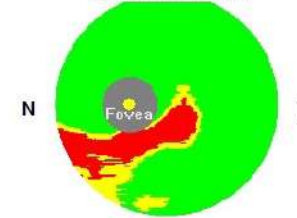
Good 57

Exam Date: 2013-06-13 10:04:49

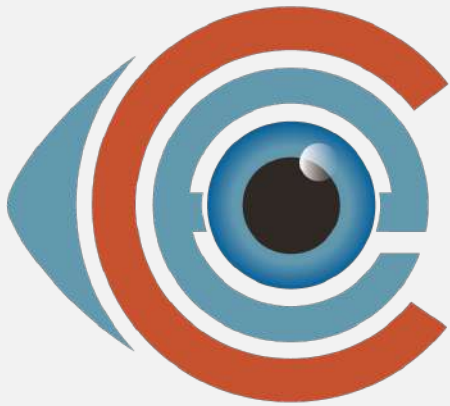
Optic Nerve Head Map



NDB Reference



Exam Date: 2013-06-13 10:02:48



Optometric
Education
Consultants

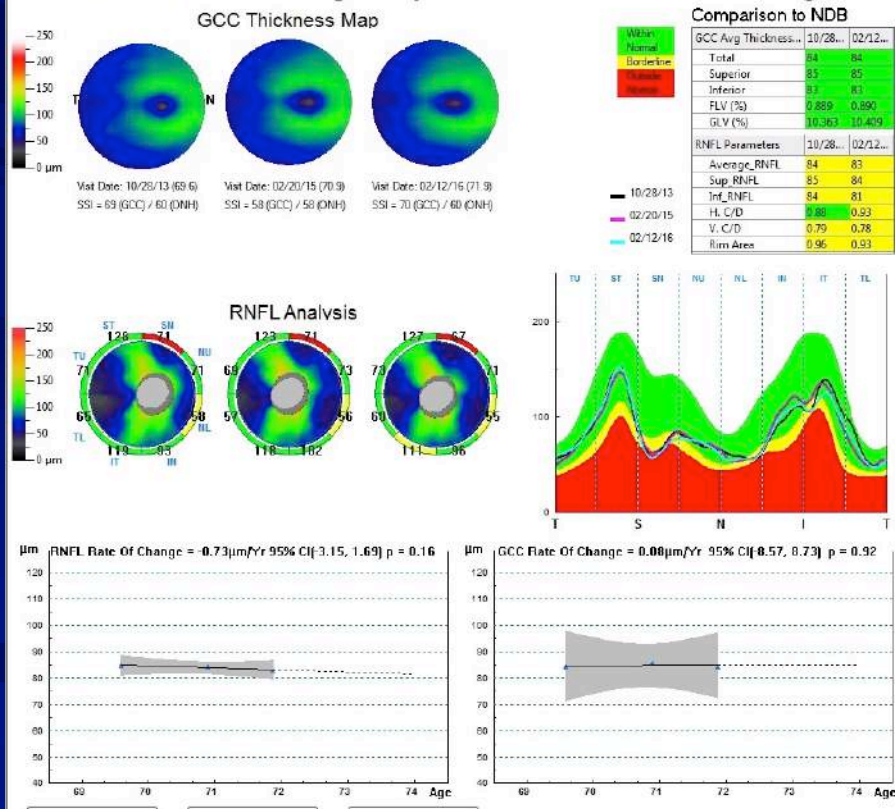
Question

Which measurement on the OCT for glaucoma assessment will typically be more accurate?

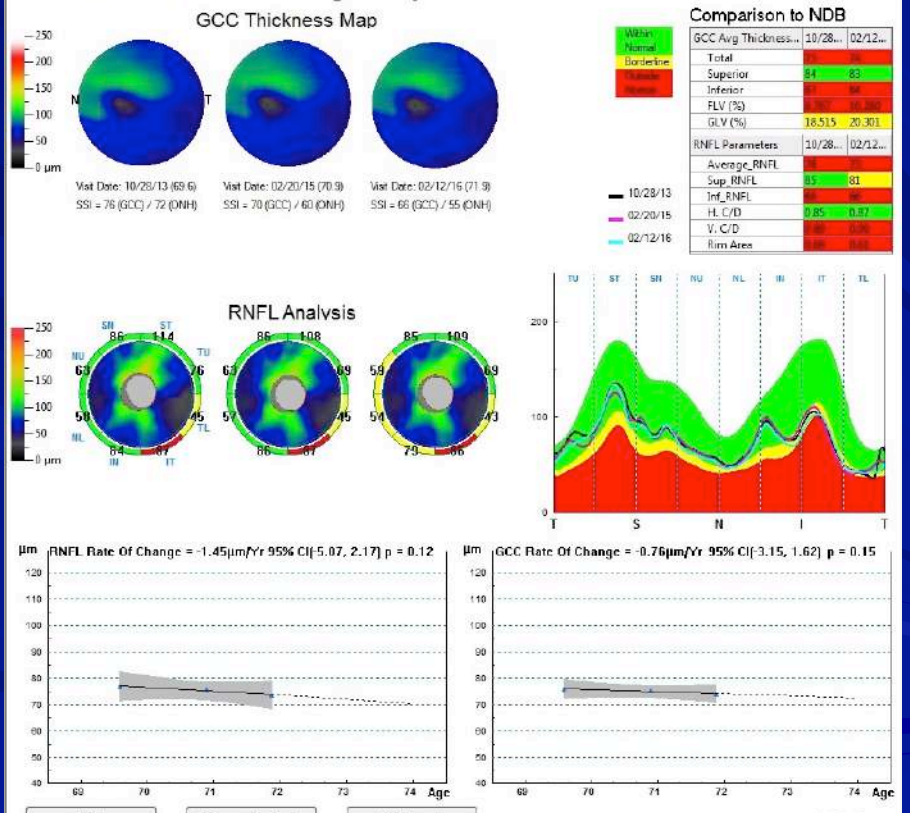
- A. Nerve Fiber Layer - NFL
- B. Ganglion Cell Complex - GCC

POAG

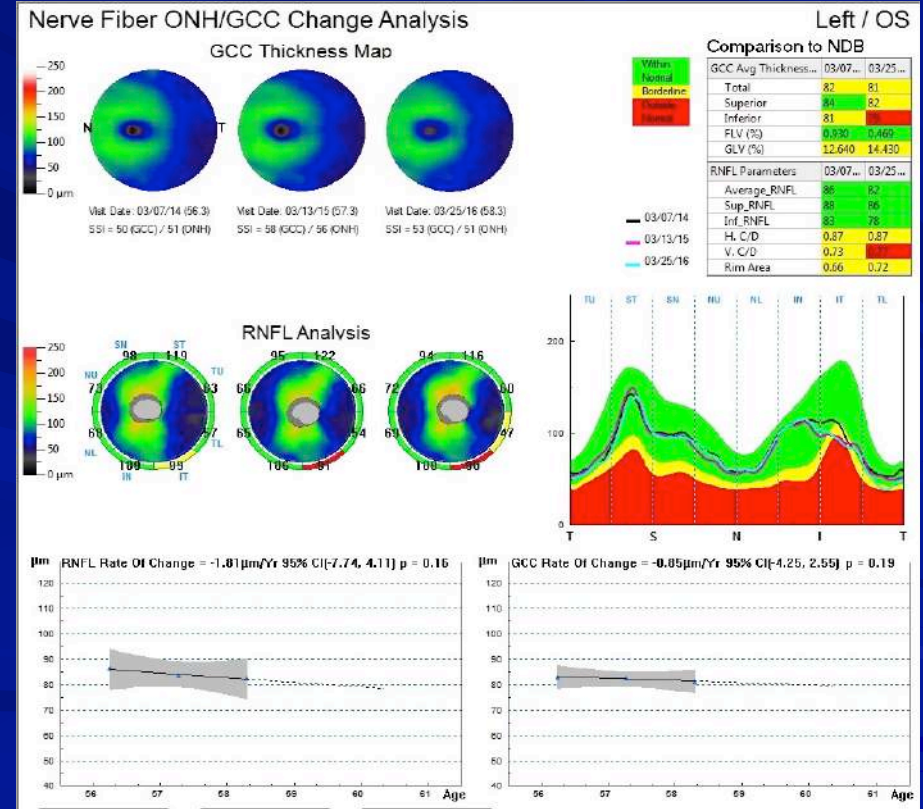
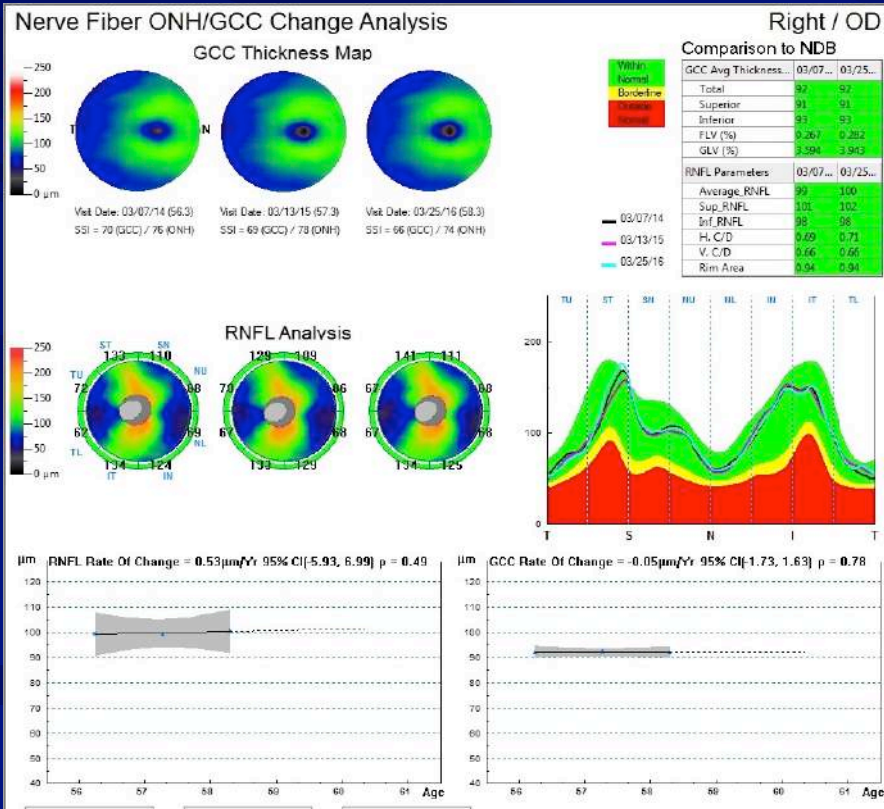
Nerve Fiber ONH/GCC Change Analysis



Nerve Fiber ONH/GCC Change Analysis

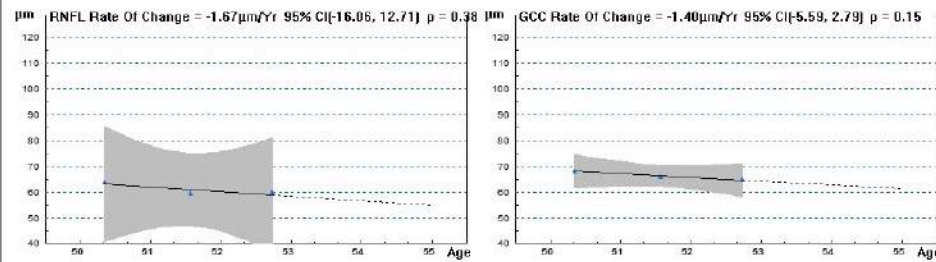
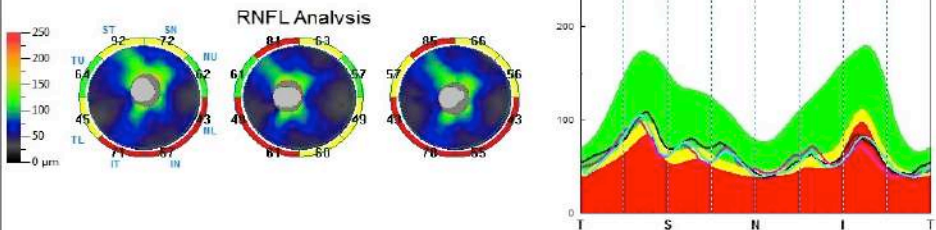
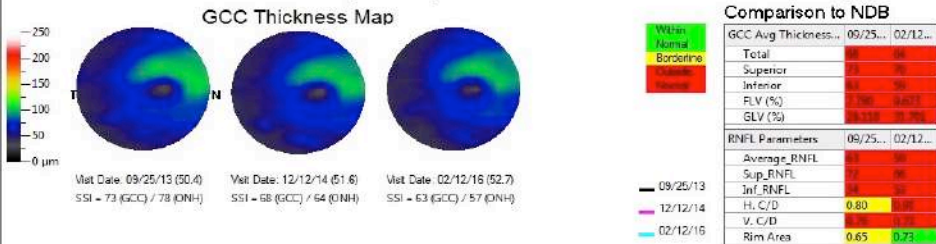


POAG

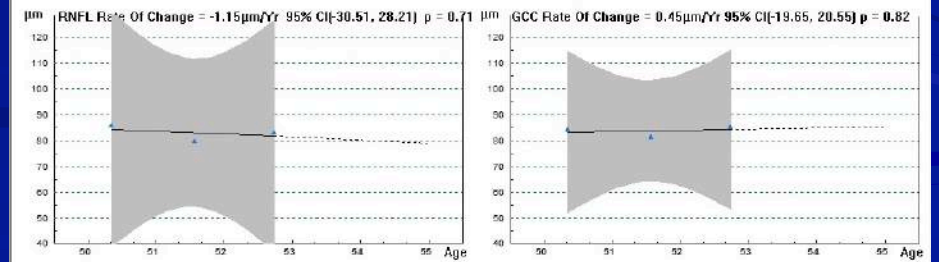
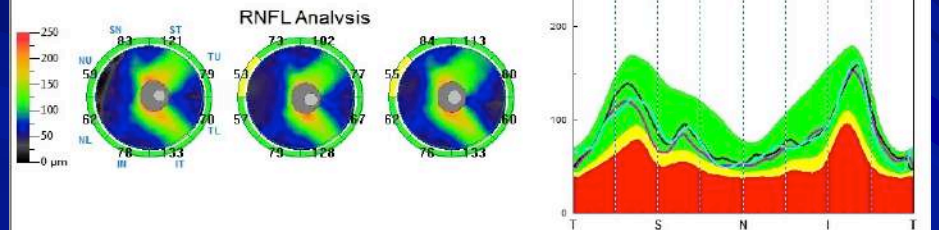
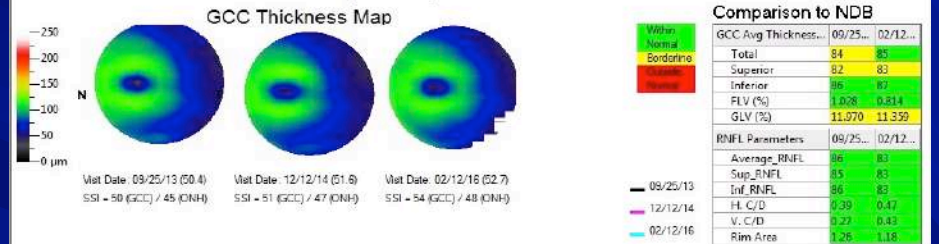


POAG

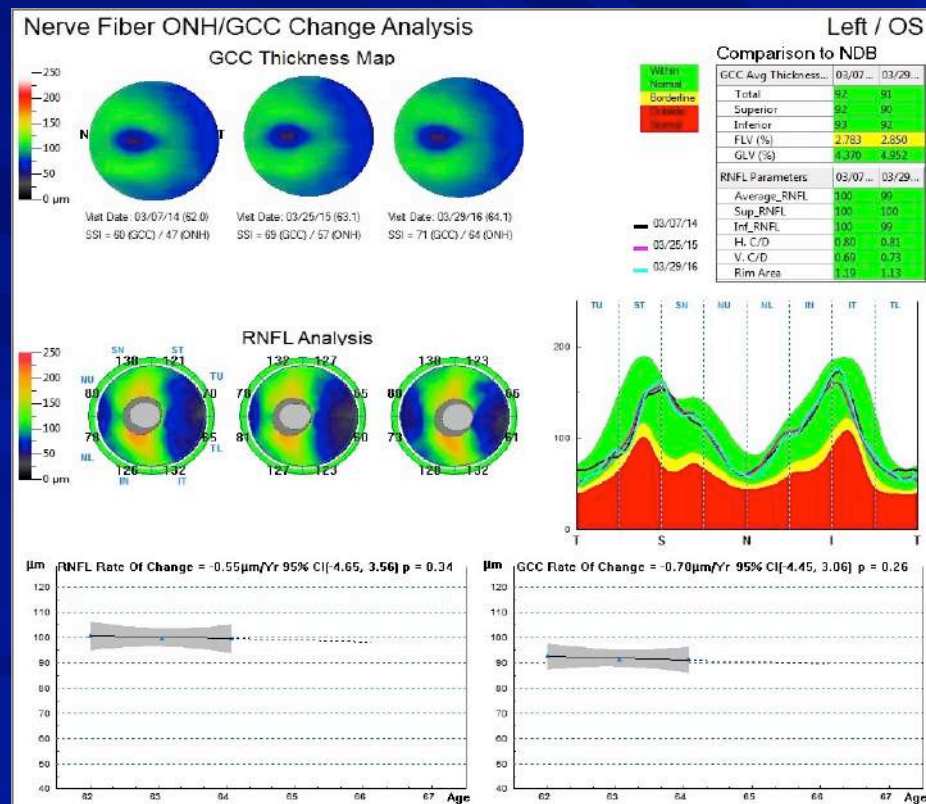
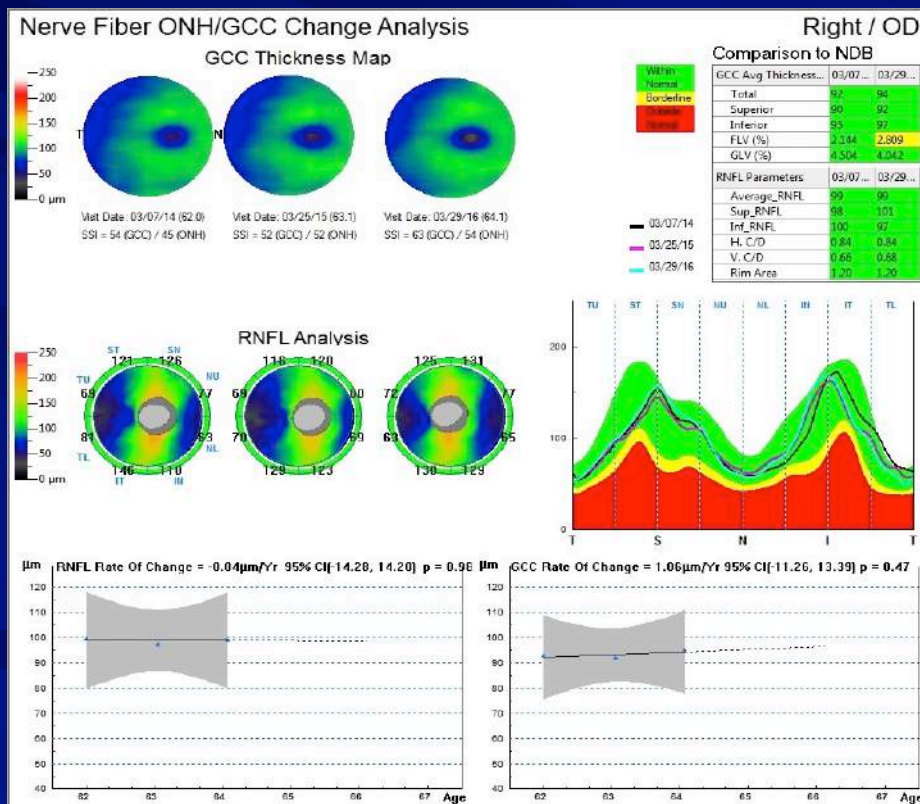
Nerve Fiber ONH/GCC Change Analysis



Nerve Fiber ONH/GCC Change Analysis



Glaucoma Suspect strong family history



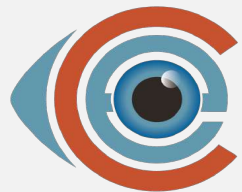


Optometric
Education
Consultants

Question

Which part of the eye is most likely to change due to age?

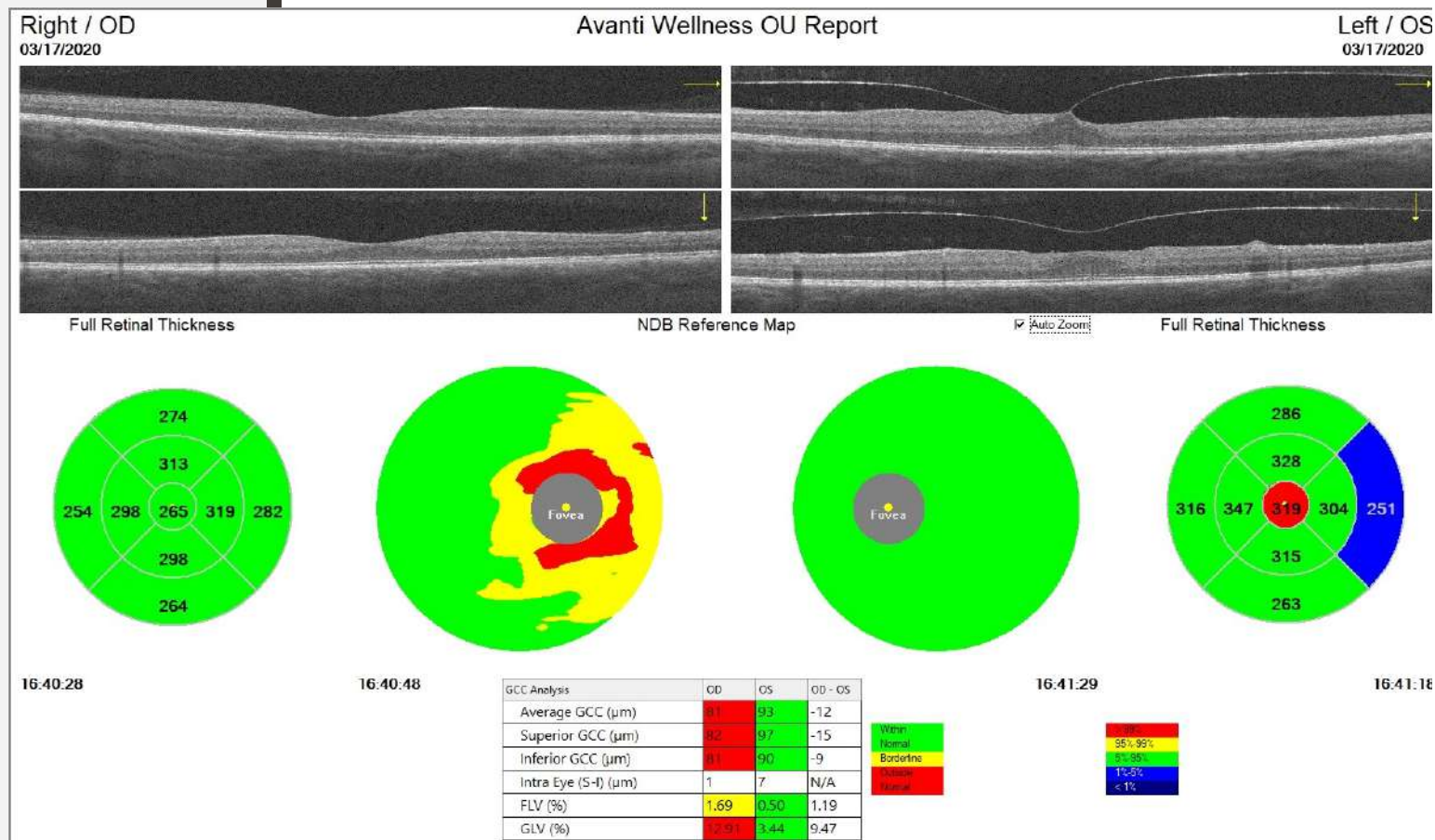
- A. Cornea
- B. Retina
- C. Vitreous
- D. Optic Nerve



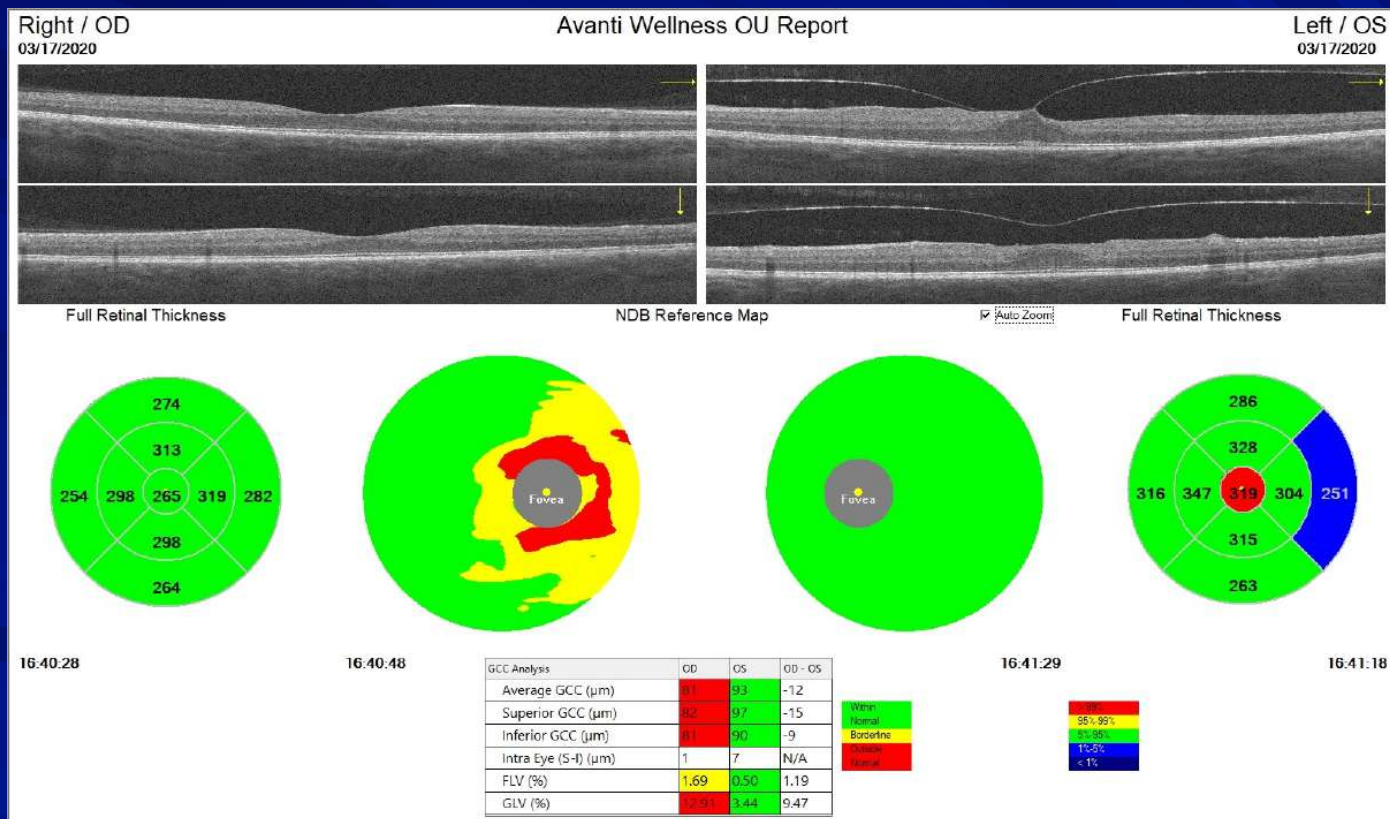
Optometric
Education
Consultants

Question

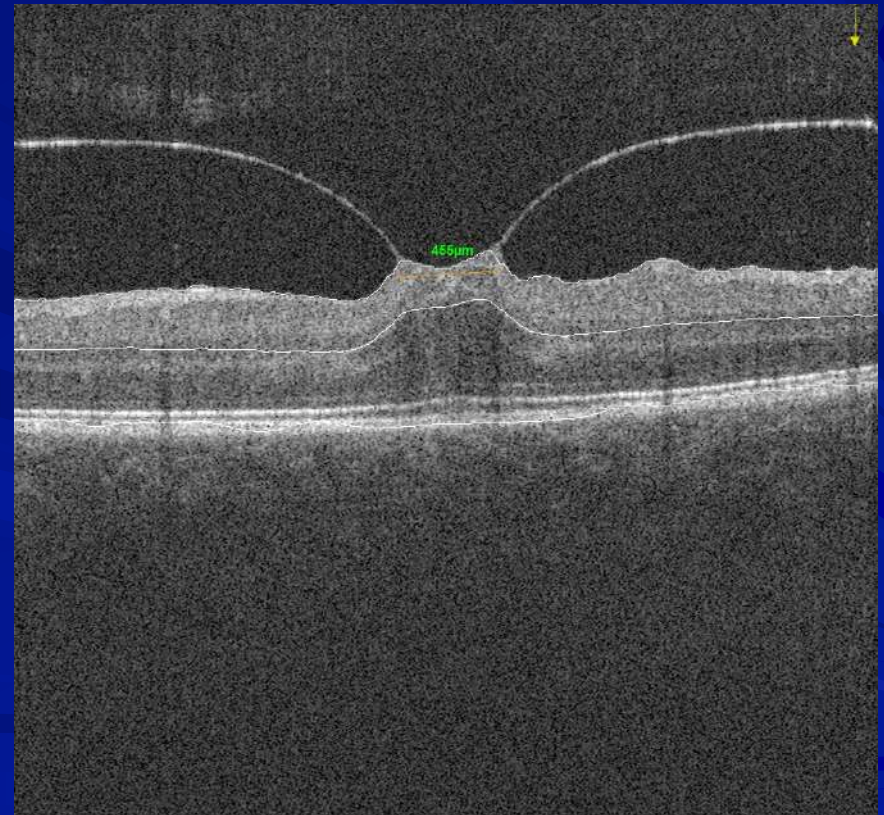
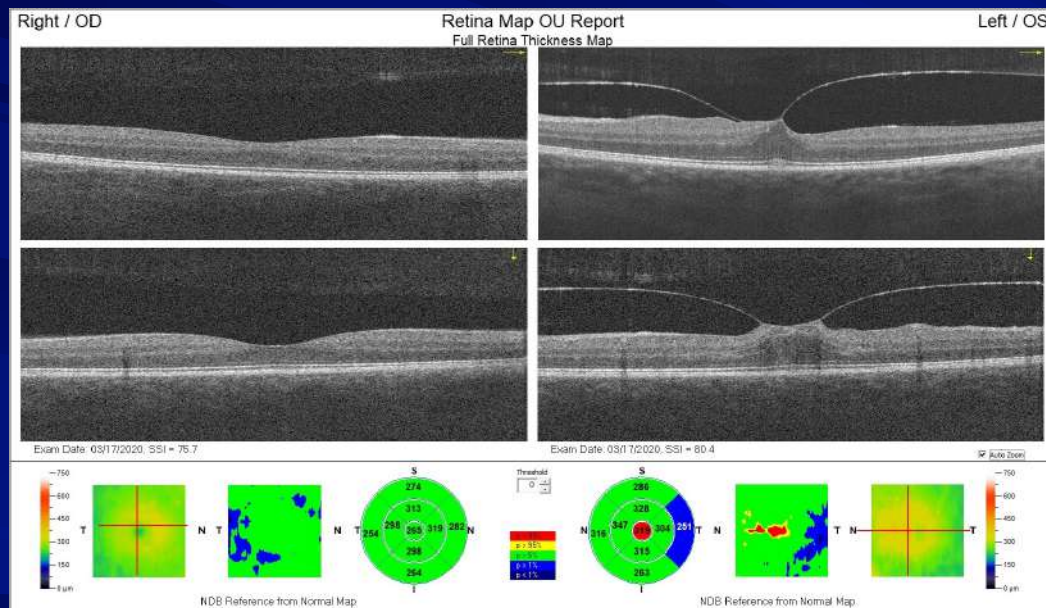
Which eye is most abnormal?



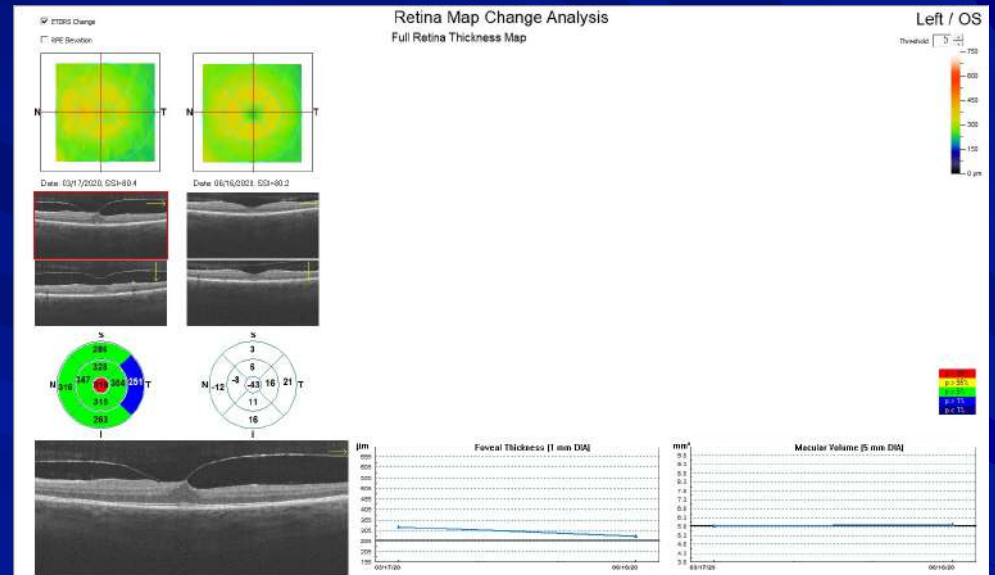
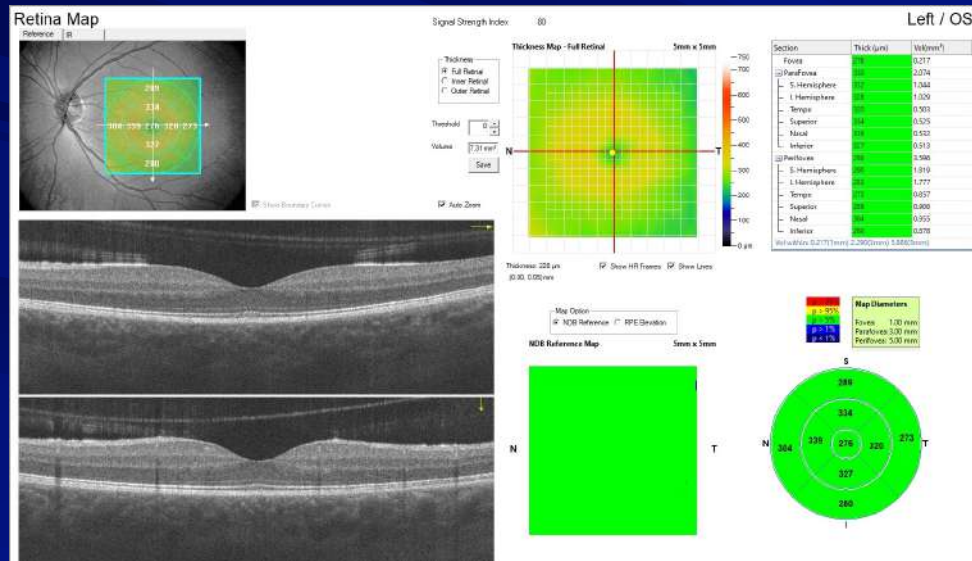
30-year-old woman “Need my CL updated”



A Closer Look – Oh no!



Phew – Lucky! June 16, 2020



Jay S. Duker, MD,¹ Peter K. Kaiser, MD,² Susanne Binder, MD,^{3,4} Marc D. de Smet, MD,⁵ Alain Gaudric, MD,⁶ Ellen Reichel, MD,¹ Srinivas D. Sridhar, MD,⁷ James S. Shum, MD,^{7,8} Richard E. Smith, MD,⁹

Results: Vitreomacular adhesion is defined as perifoveal vitreous separation with remaining vitreomacular attachment and unperturbed foveal morphologic features. It is an OCT finding that is almost always the result of normal vitreous aging, which may lead to pathologic conditions. Vitreomacular traction is characterized by anomalous posterior vitreous detachment accompanied by anatomic distortion of the fovea, which may include pseudocysts, macular schisis, cystoid macular edema, and subretinal fluid. Vitreomacular traction can be subclassified by the diameter of vitreous attachment to the macular surface as measured by OCT, with attachment of 1500 μm or less defined as focal and attachment of more than 1500 μm as broad. When associated with other macular disease, VMT is classified as concurrent. Full-thickness macular hole (FTMH) is defined as a foveal lesion with interruption of all retinal layers from the internal limiting membrane to the retinal pigment epithelium. Full-thickness macular hole is primary if caused by vitreous traction or secondary if directly the result of pathologic characteristics other than VMT. Full-thickness macular hole is subclassified by size of the hole as determined by OCT and the presence or absence of VMT.

Conclusions: This classification system will support systematic diagnosis and management by creating a clinically applicable system that is predictive of therapeutic outcomes and is useful for the execution and analysis of clinical studies.

using OCT-based findings to characterize and define VMI conditions; however, there is currently no consensus on their definition and classification, which hinders clinical practice, consistent reporting, and the evaluation of potential therapies to treat these conditions.¹⁻⁴

A panel of vitreoretinal disease experts, the International Vitreomacular Traction Study (IVTS) Group, was convened to develop

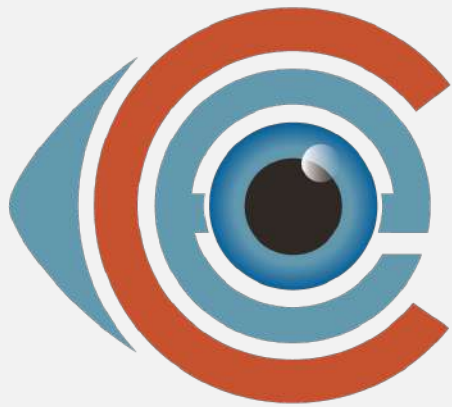
VMA versus VMT

Focal or Broad Attachment

Duker et al • Classification of VMI Diseases

Table 4. The IVTS Classification System for Vitreomacular Adhesion, Traction, and Macular Hole

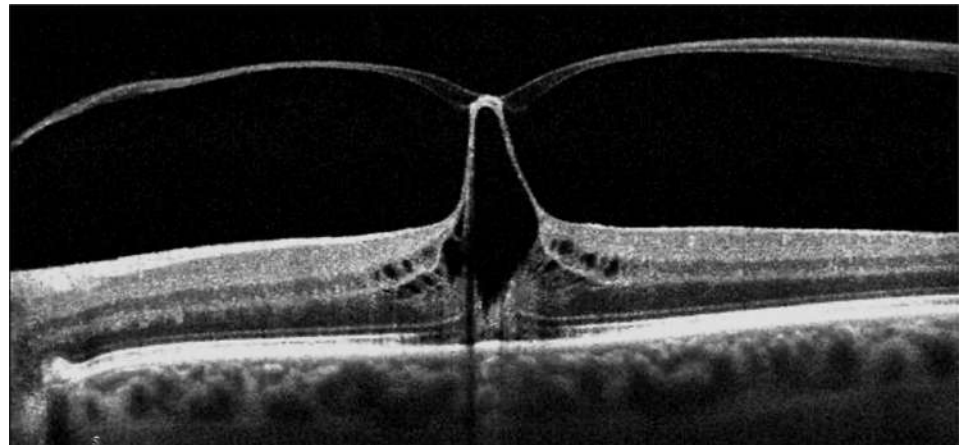
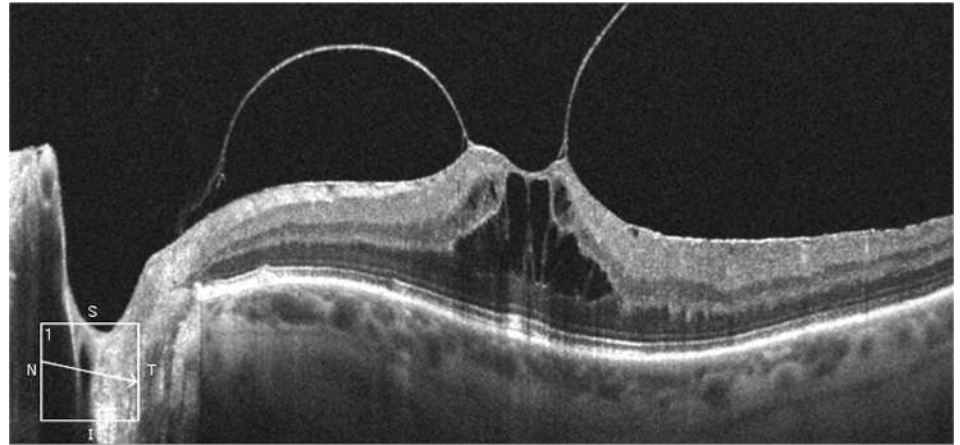
Anatomic State	IVTS Classification System for Vitreomacular Adhesion, Traction, and Macular Hole
VMA	<p>Definition</p> <ul style="list-style-type: none"> Evidence of perifoveal vitreous cortex detachment from the retinal surface Macular attachment of the vitreous cortex within a 3-mm radius of the fovea No detectable change in foveal contour or underlying retinal tissues <p>Classification</p> <ul style="list-style-type: none"> By size of attachment area <ul style="list-style-type: none"> Focal ($\leq 1500 \mu\text{m}$) Broad ($> 1500 \mu\text{m}$, parallel to RPE and may include areas of dehiscence) By presence of concurrent retinal conditions <ul style="list-style-type: none"> Isolated Concurrent
VMT	<p>Definition</p> <ul style="list-style-type: none"> Evidence of perifoveal vitreous cortex detachment from the retinal surface Macular attachment of the vitreous cortex within a 3-mm radius of the fovea Association of attachment with distortion of the foveal surface, intraretinal structural changes, and/or elevation of the fovea above the RPE, but no full-thickness interruption of all retinal layers <p>Classification</p> <ul style="list-style-type: none"> By size of attachment area <ul style="list-style-type: none"> Focal ($\leq 1500 \mu\text{m}$) Broad ($> 1500 \mu\text{m}$, parallel to RPE and may include areas of dehiscence) By presence of concurrent retinal conditions <ul style="list-style-type: none"> Isolated Concurrent



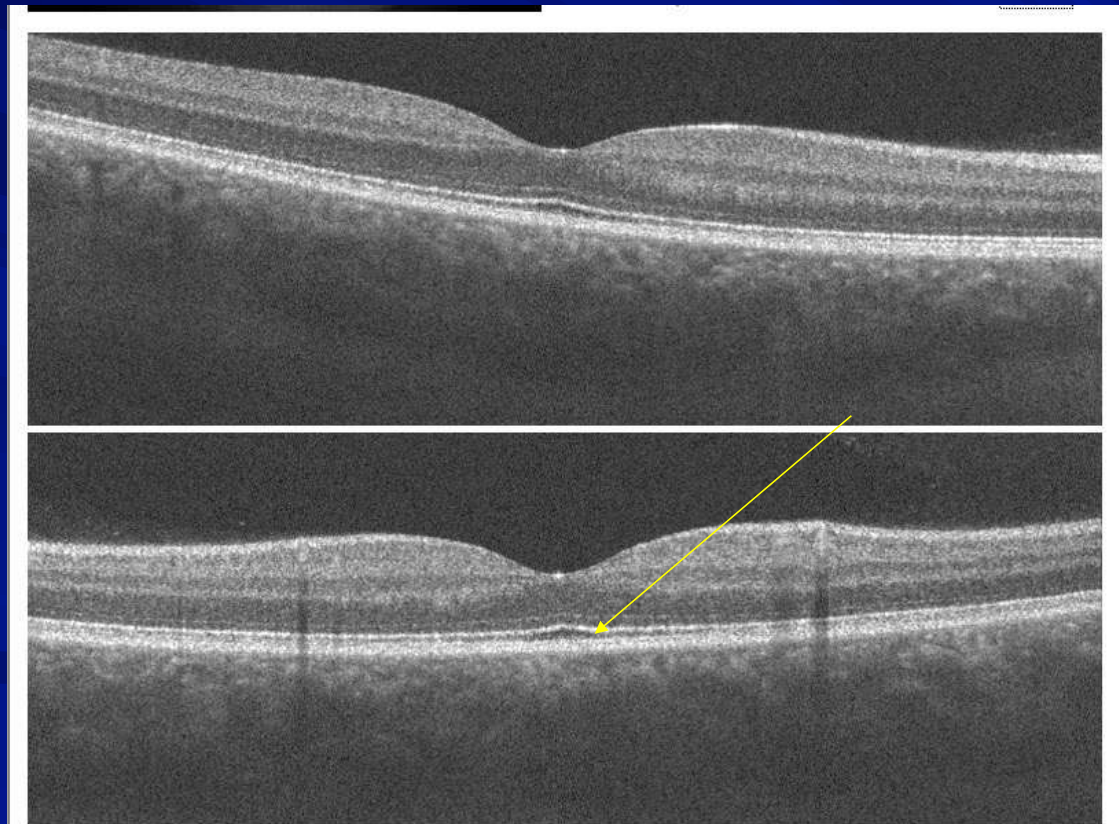
Optometric
Education
Consultants

Question

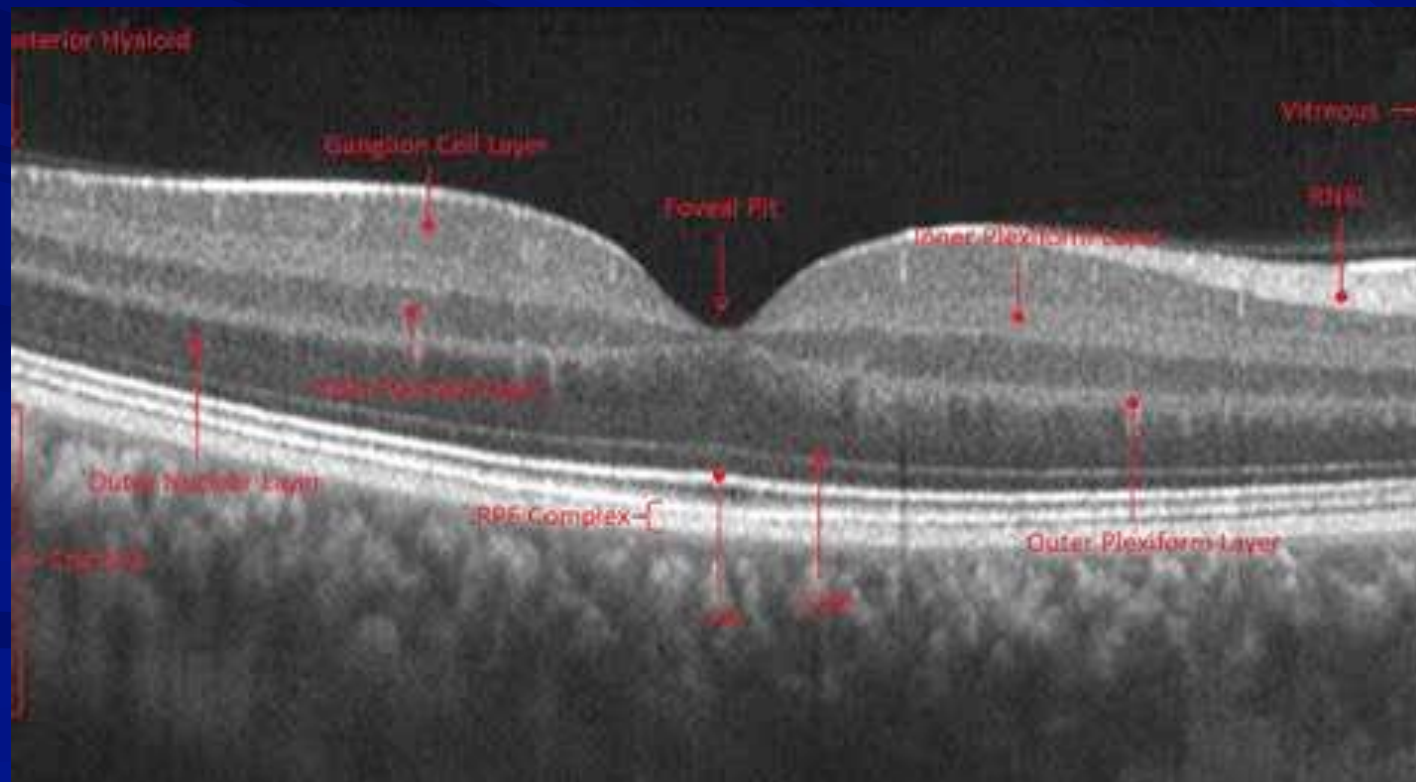
Which eye has the better visual prognosis?

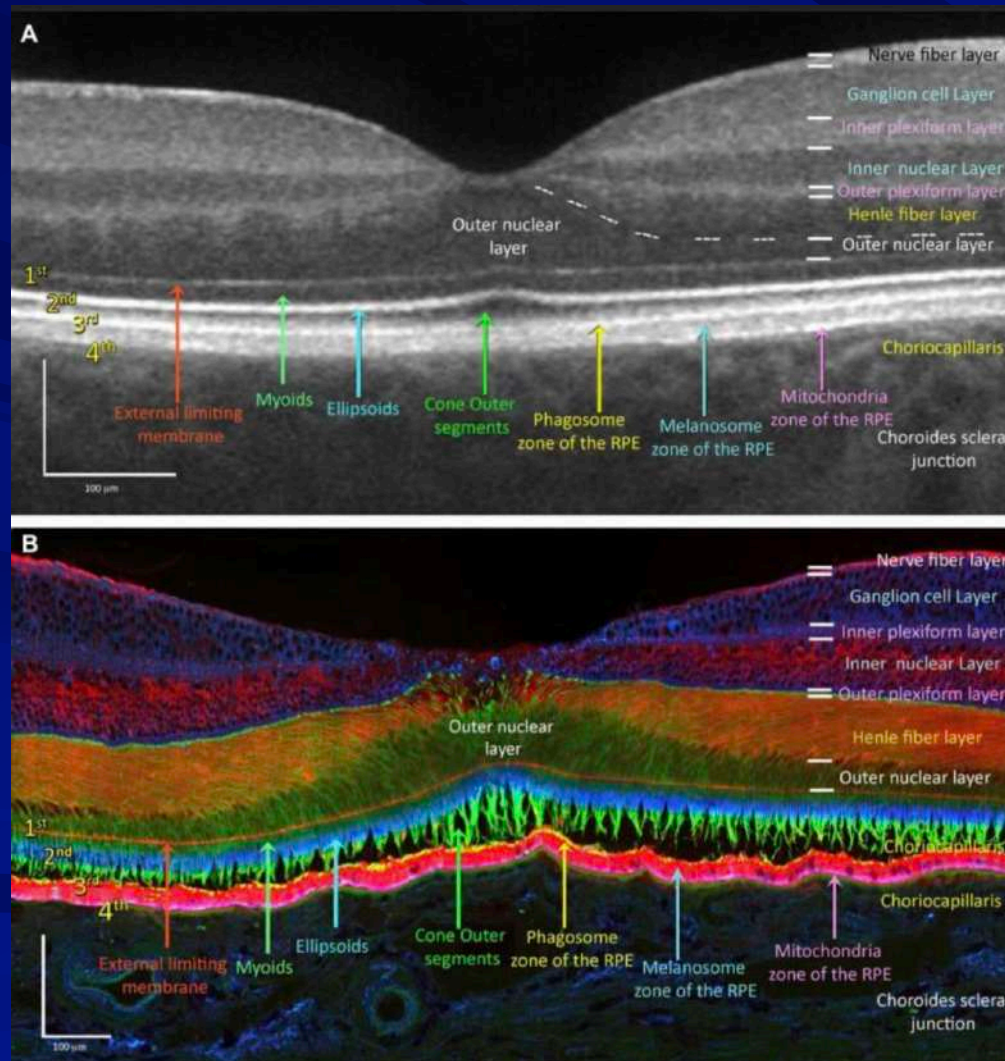


What is this layer called?



The ellipsoid zone (EZ) is considered to be formed mainly by mitochondria within the ellipsoid layer of the outer portion of the inner segments of the photoreceptors. However, it was previously known as the junction between the photoreceptor IS/OS).





Progress in Retinal and Eye Research

Volume 77, July 2020, 100828

Interpretation of OCT and OCTA images from a histological approach: Clinical and experimental implications

Nicolás Cuenca ^{a, b, 1} ... Isabel Pinilla ^{f, 1}

Show more

Outline | Share | Cite

<https://doi.org/10.1016/j.preteyeres.2019.100828>

Get rights and content

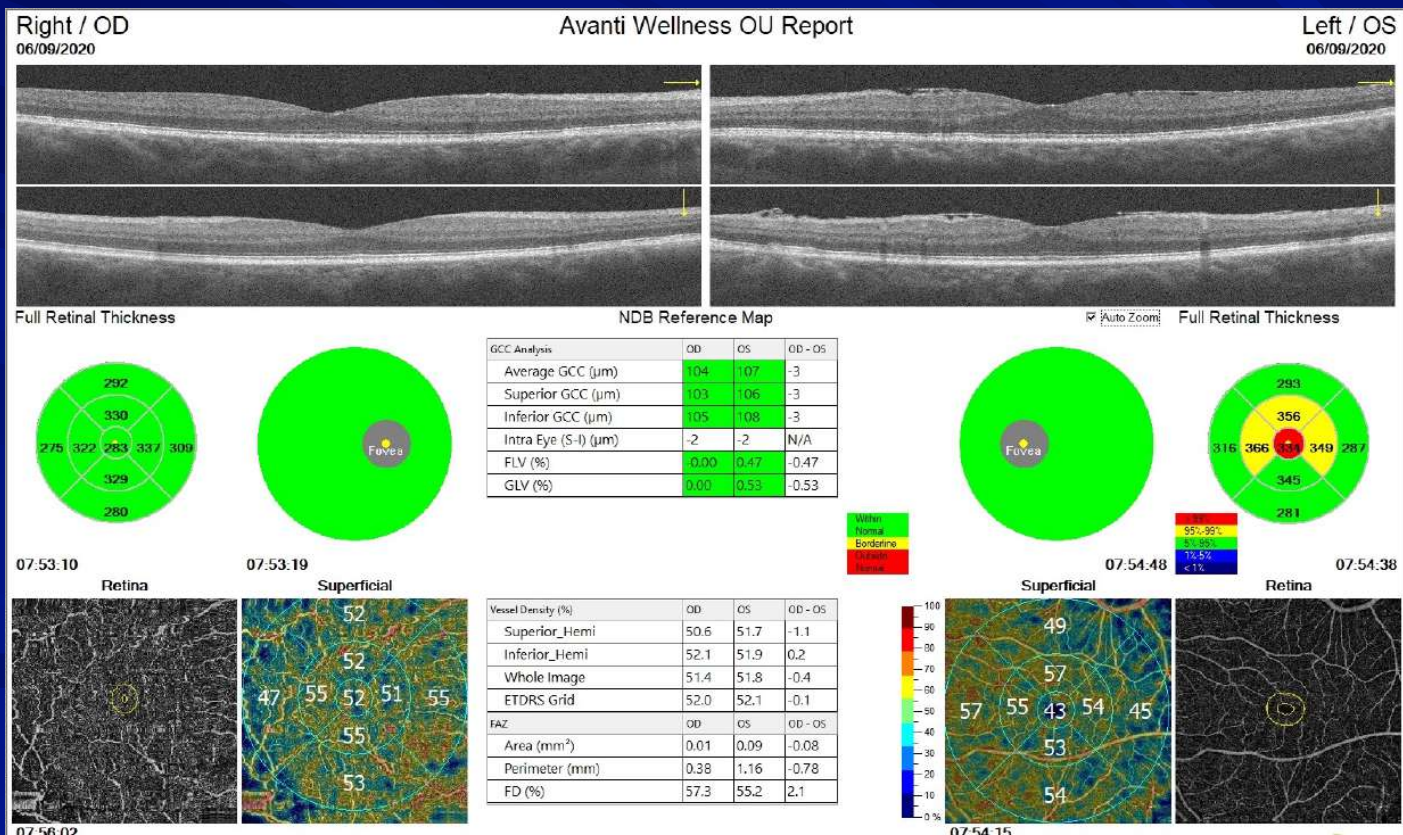
Abstract

Optical coherence tomography (OCT) and OCT angiography (OCTA) have been a techn

FEEDBACK

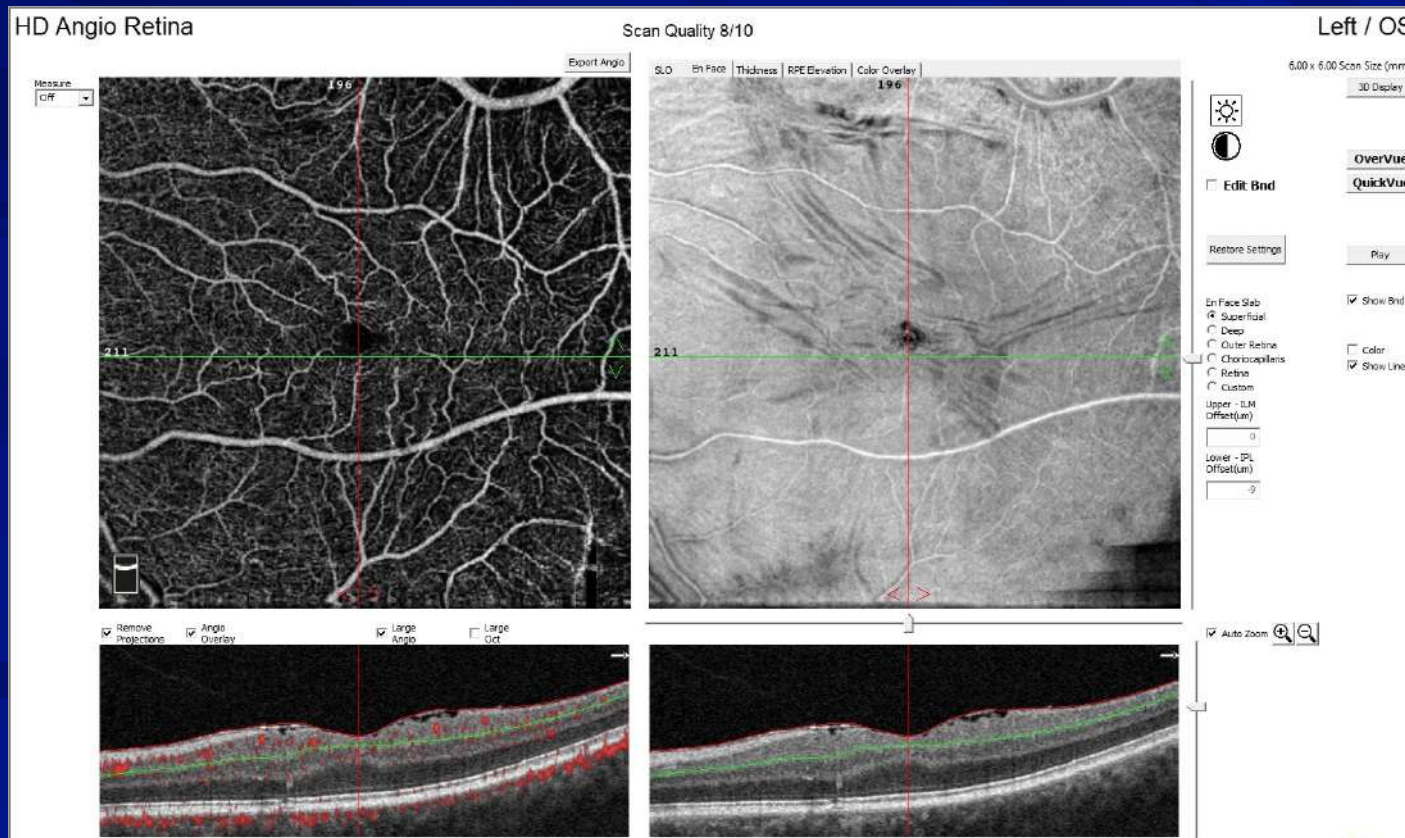
72-year-old man

Cataract check



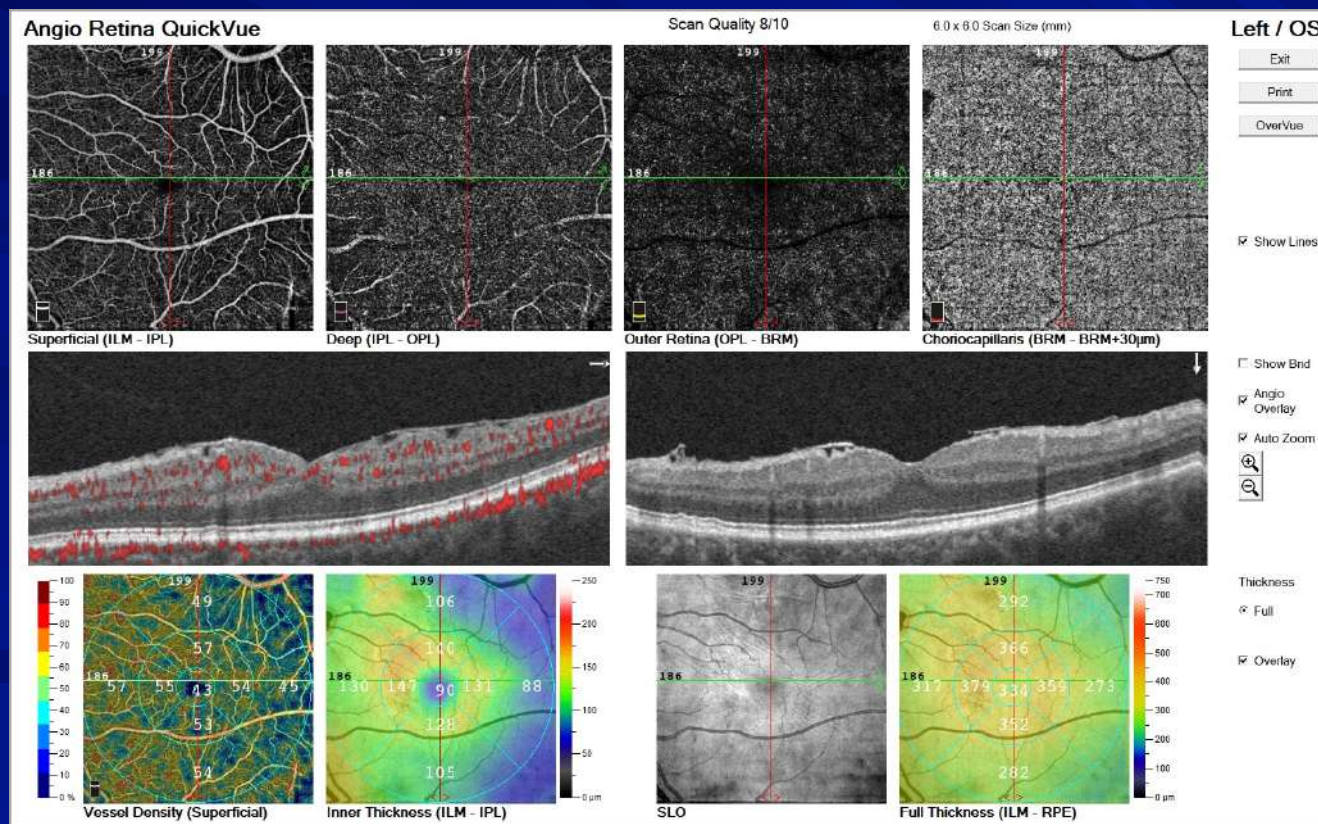
72-year-old man

Cataract check



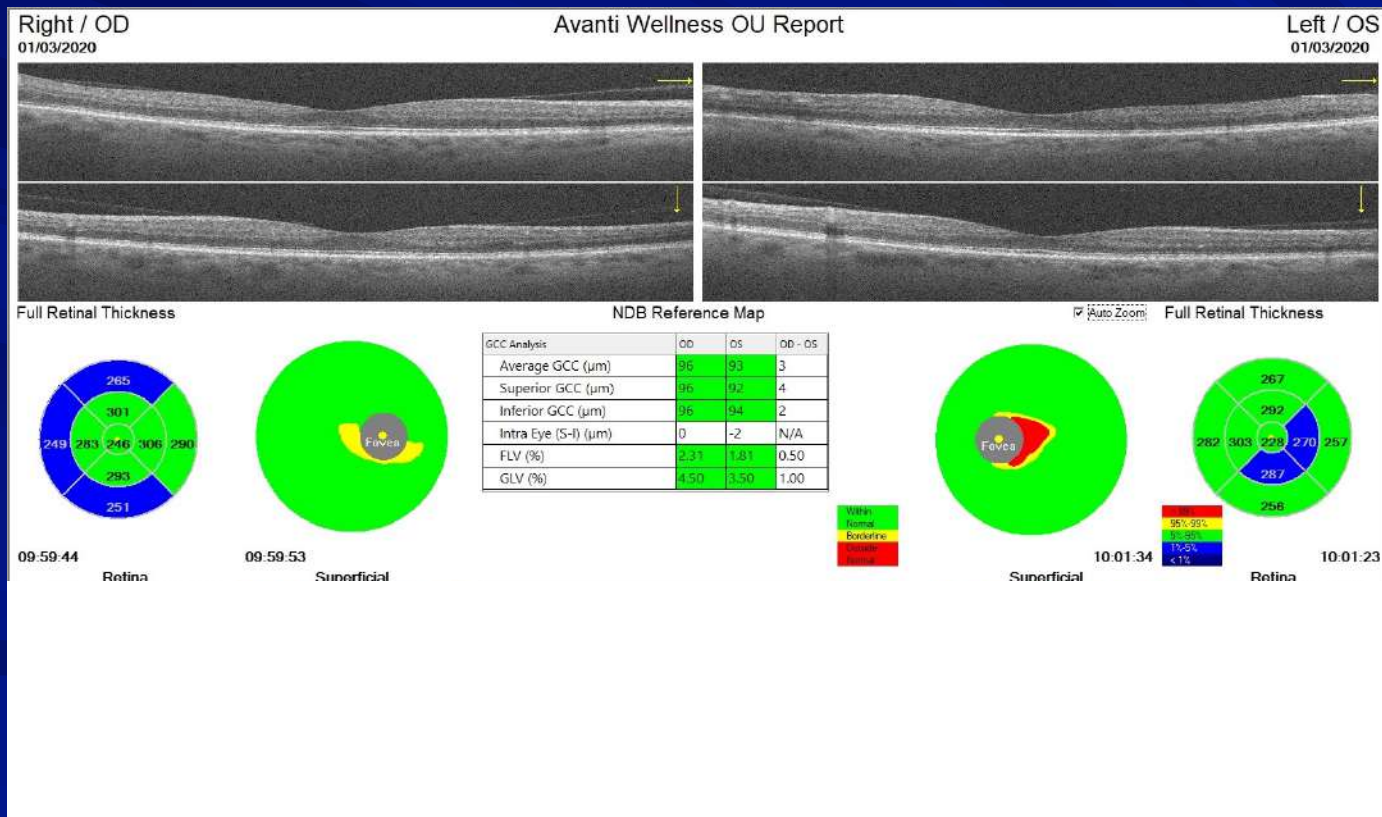
72-year-old man

Cataract check



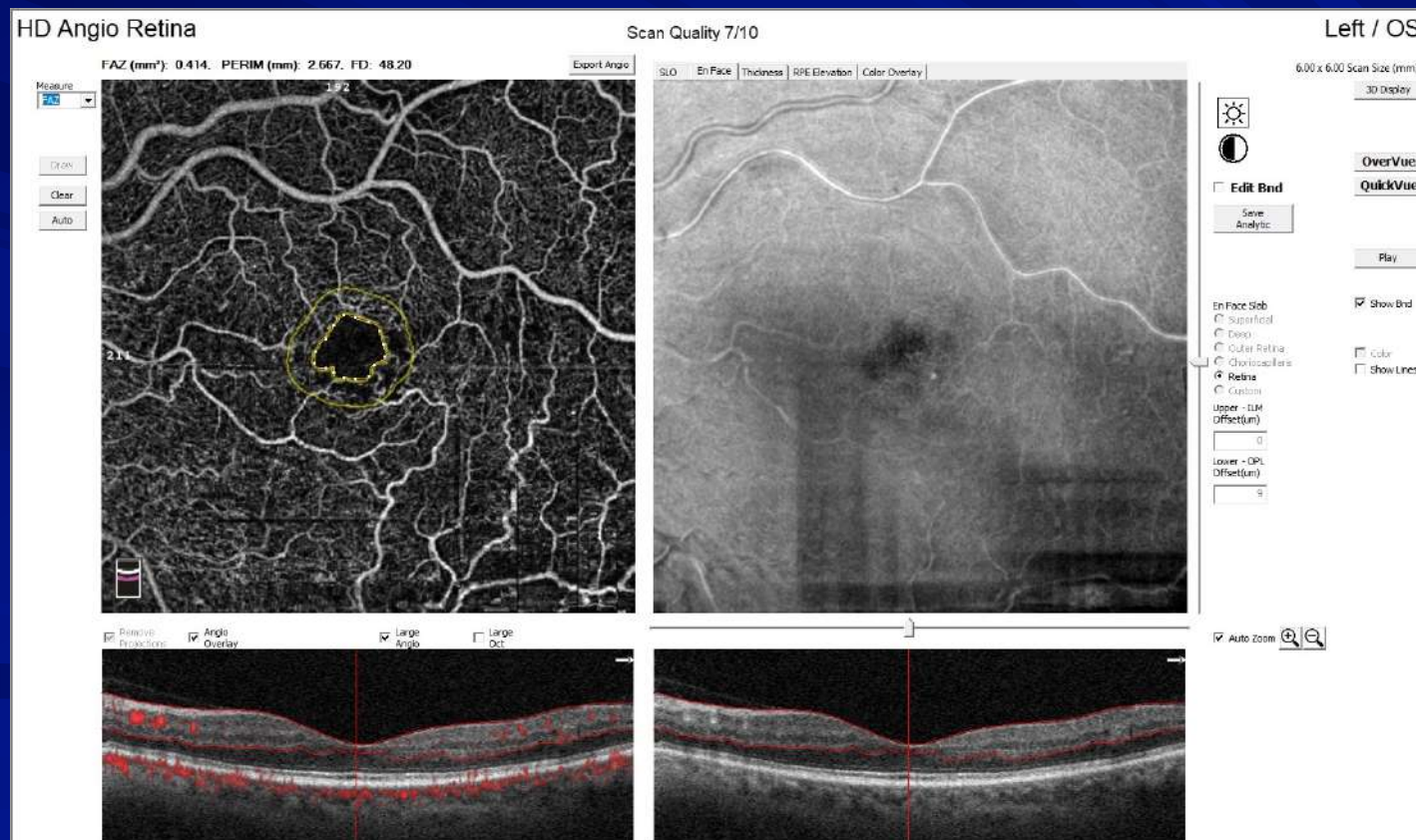
63-year-old woman with DM

HbA1c = 8.0



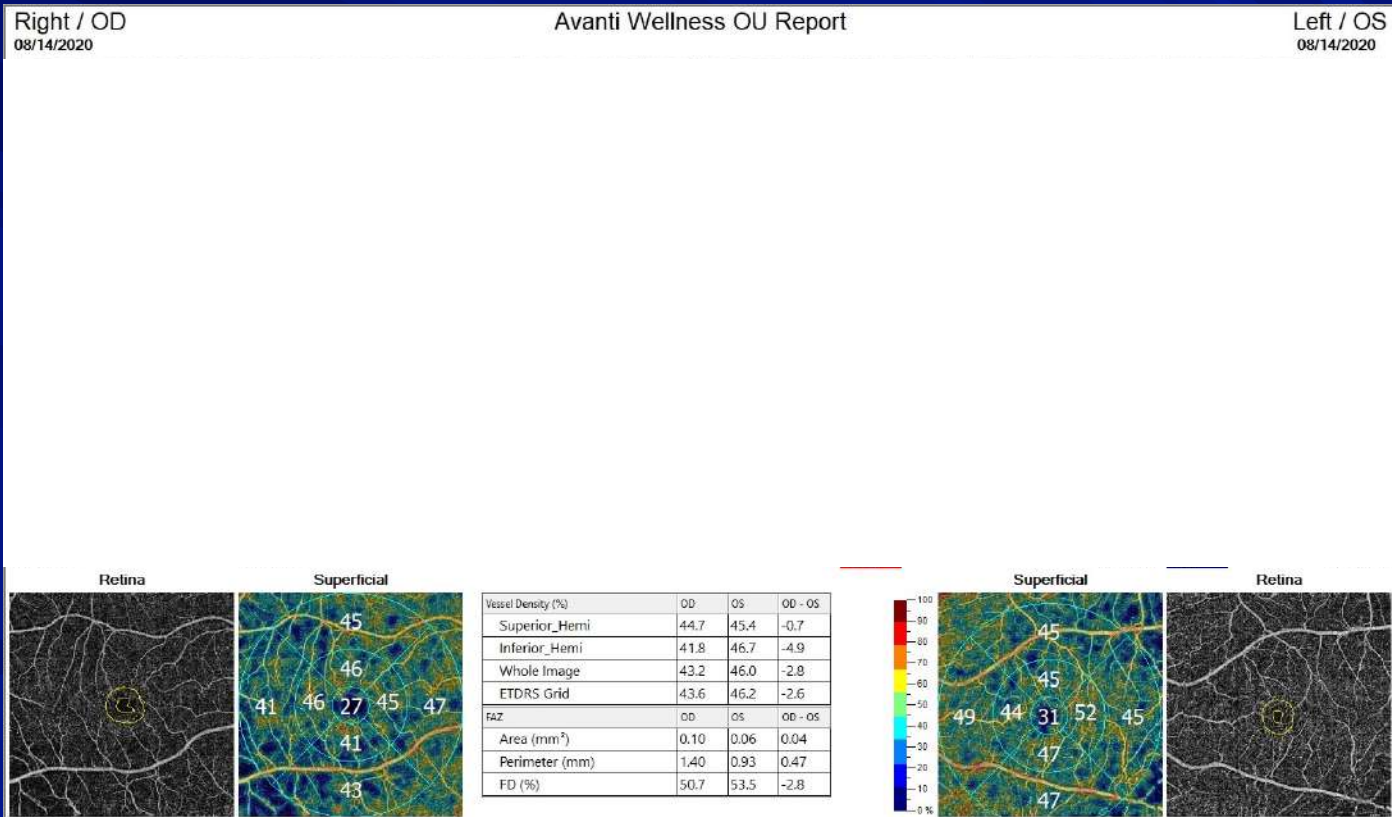
63-year-old woman with DM

HbA1c = 8.0



59-year-old man with DM

HbA1c = 7.8

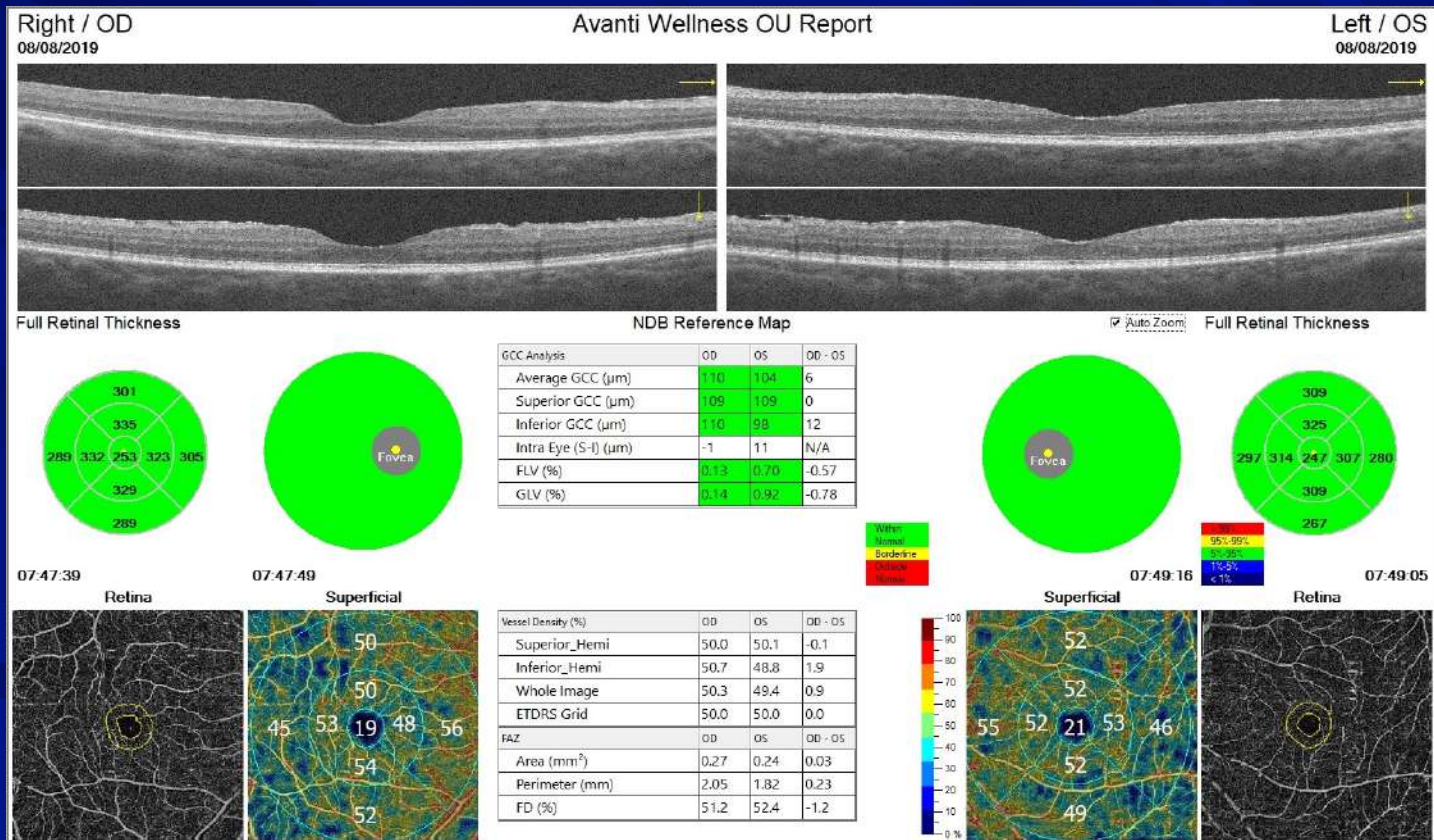


Advanced Interpretation

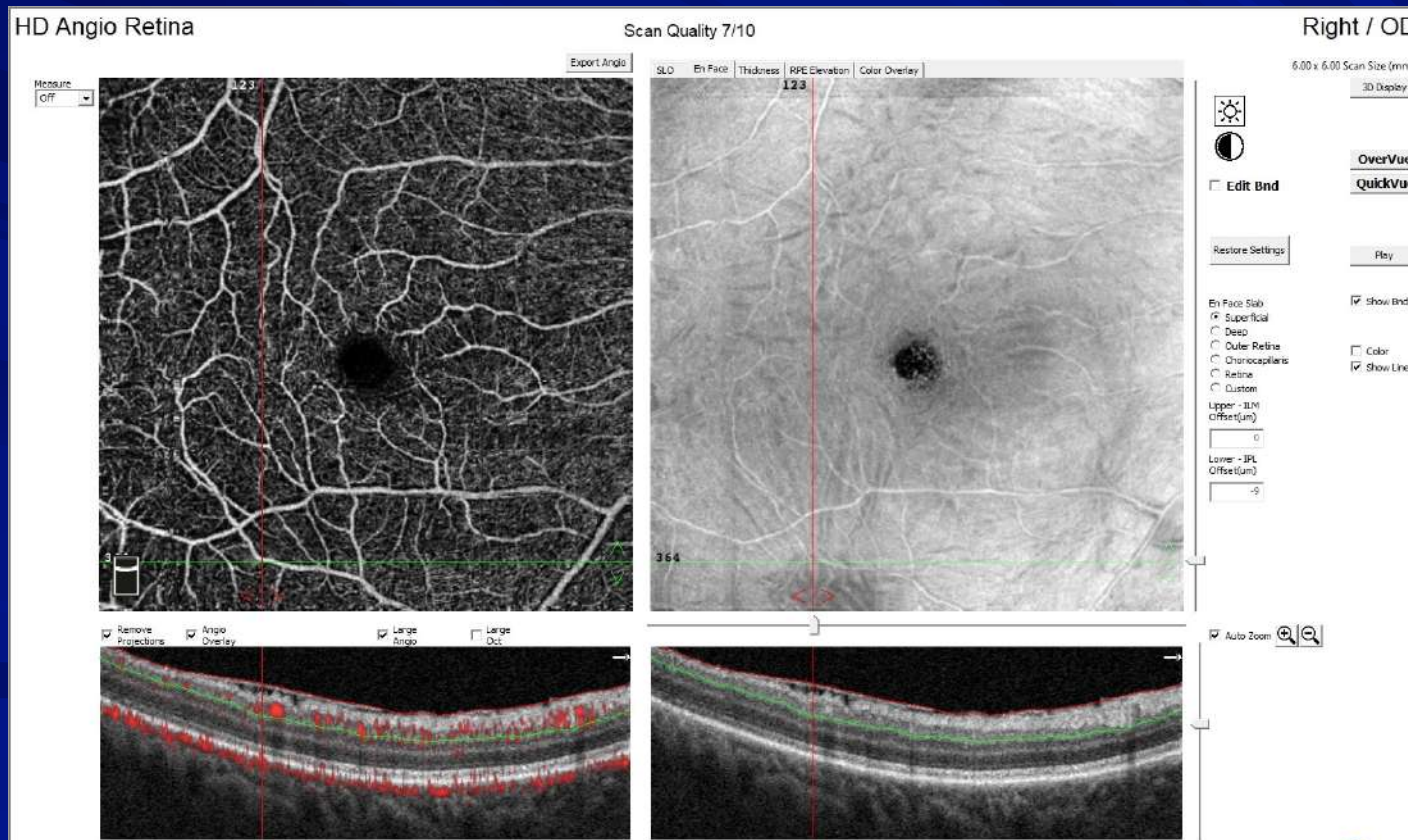
Green Disease

71-year-old woman

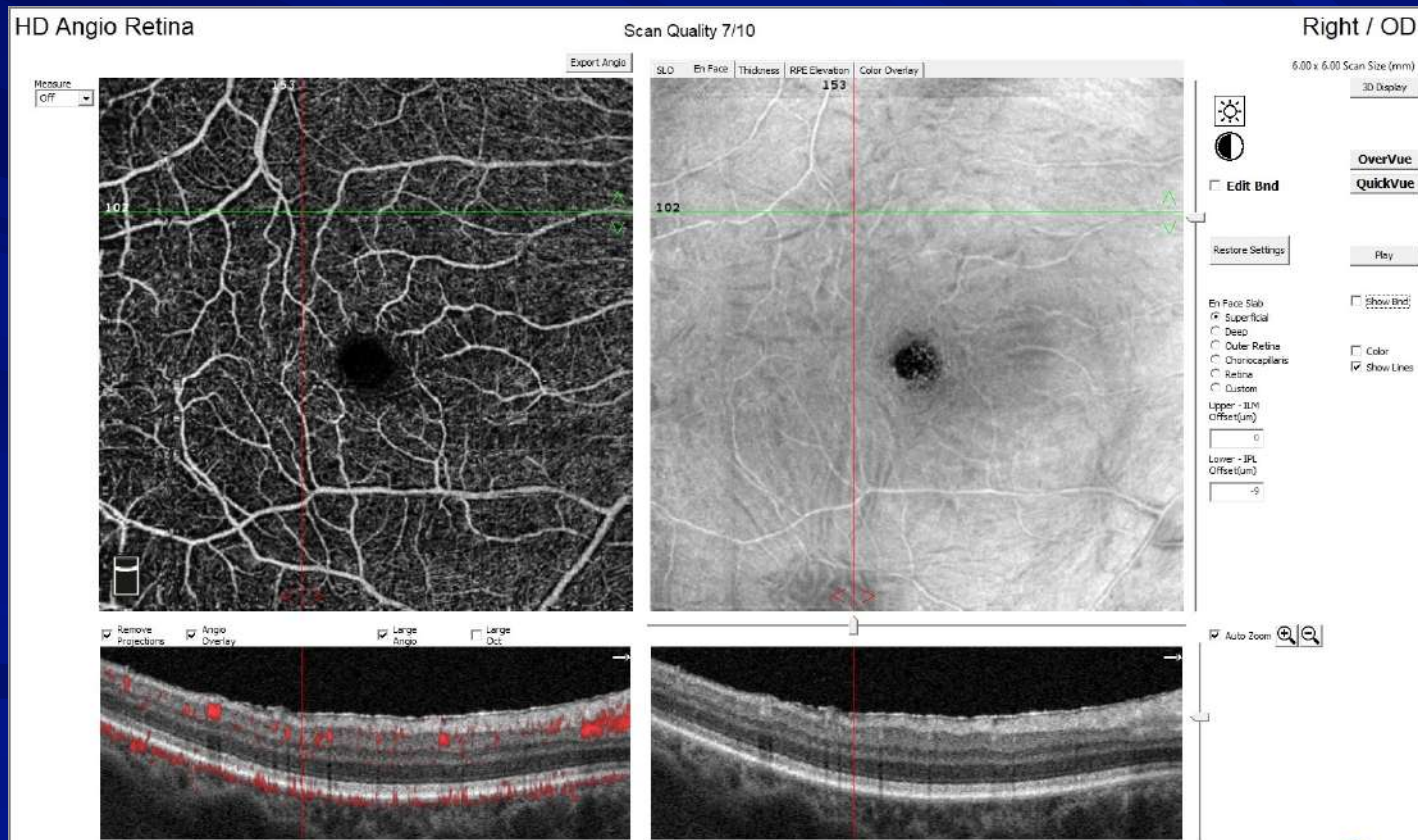
Cataract Check



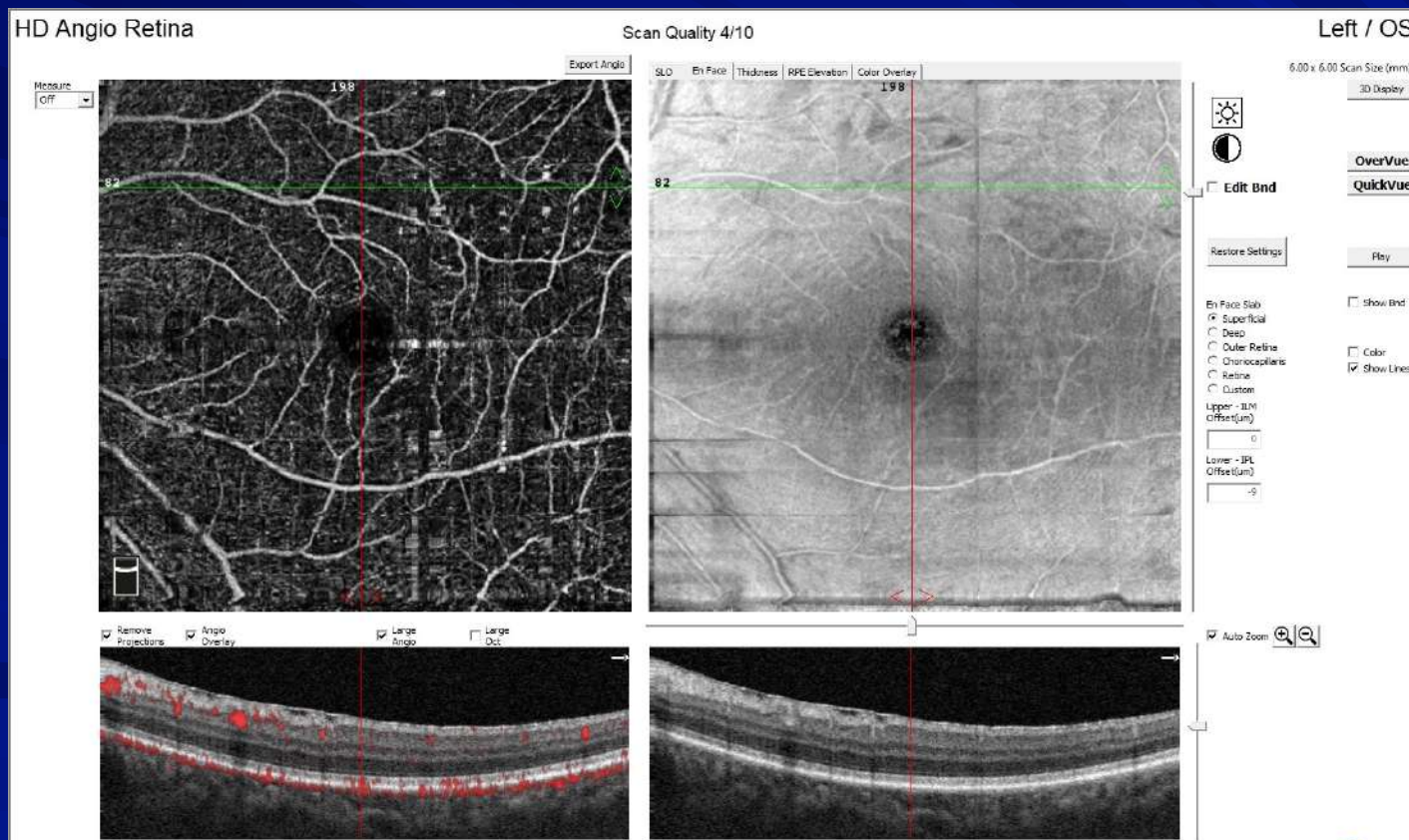
71-year-old woman Cataract Check



71-year-old woman Cataract Check

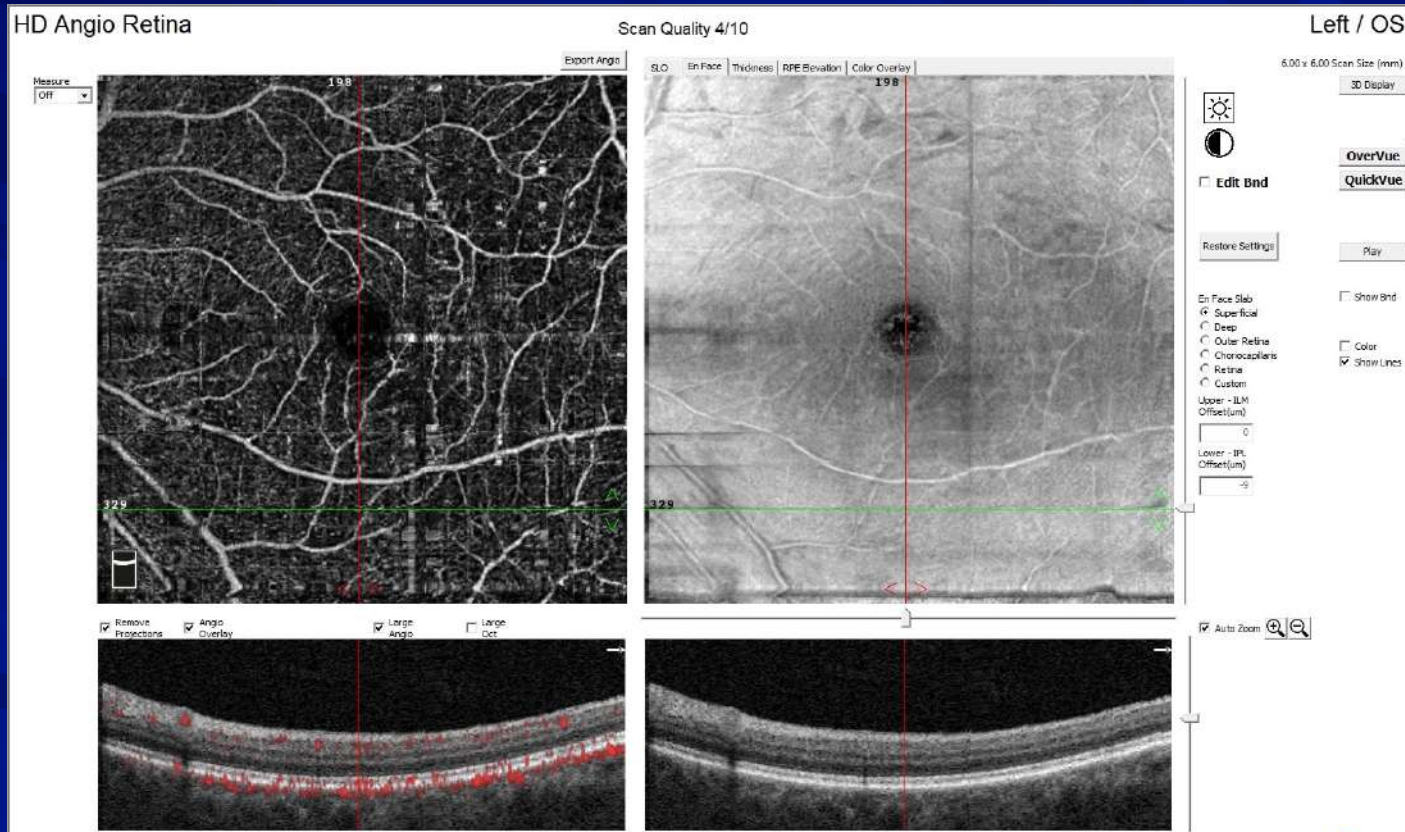


71-year-old woman Cataract Check



71-year-old woman

Cataract Check



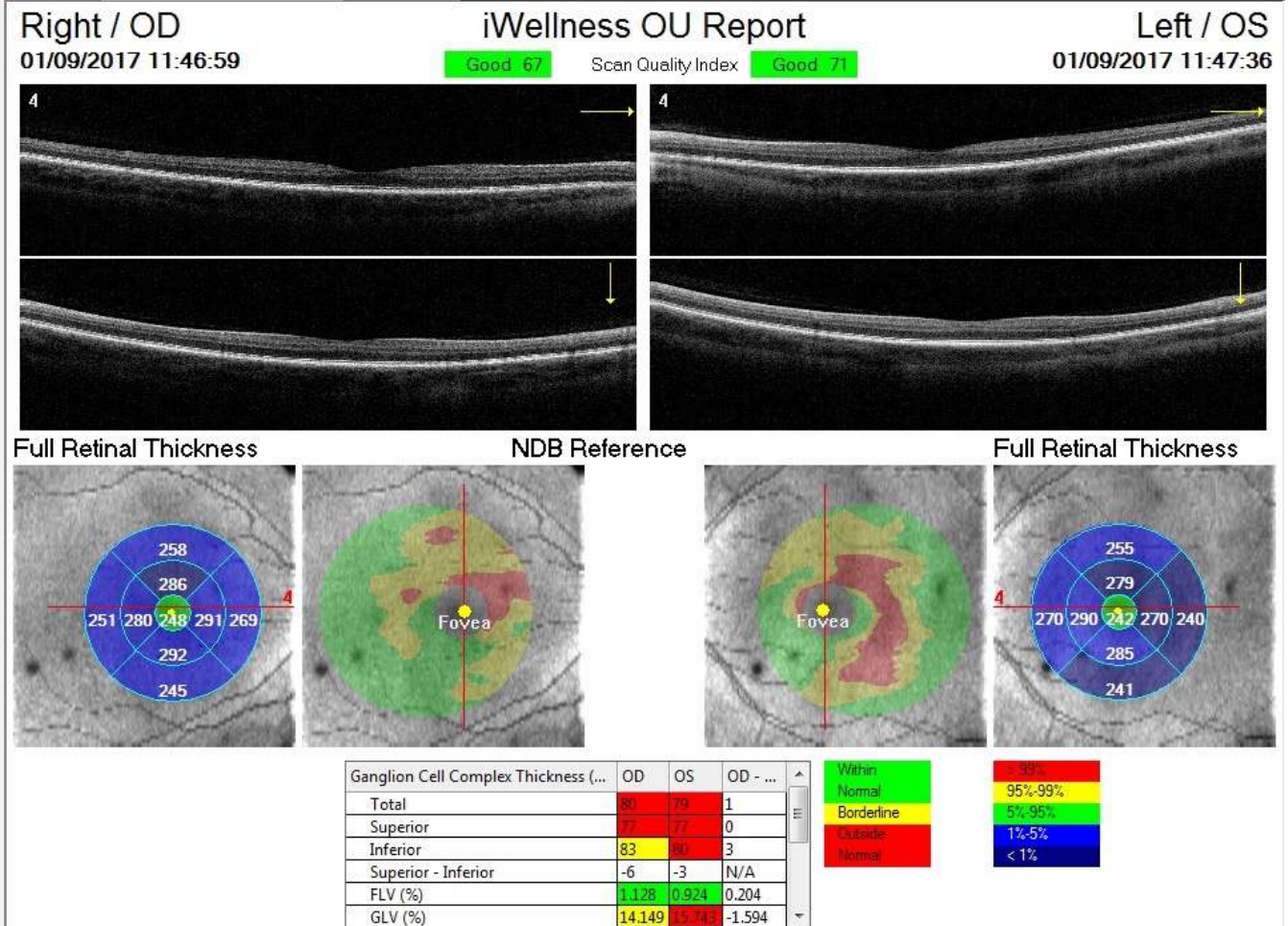
The background is a solid dark blue color. It features a series of lighter blue diagonal lines that sweep across the frame from the top-left towards the bottom-right. These lines vary in thickness and brightness, creating a sense of depth and movement. The overall effect is a modern, geometric pattern.

Let's See How We Did

Question

This OCT is most likely

Real Disease
or
Physiologically Normal



Question

This OCT is most likely

Real Disease
or
Physiologically Normal

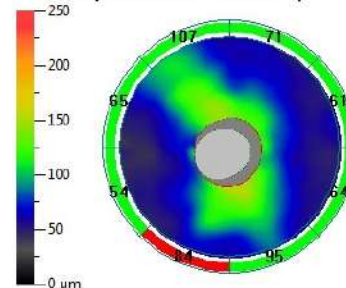
Right / OD

Nerve Fiber ONH/GCC OU Report

Left / OS

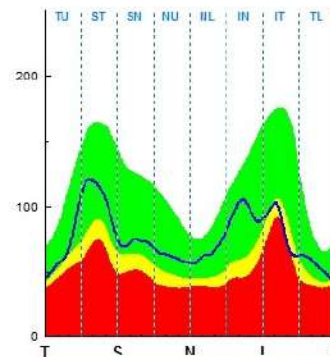
Exam Date: 2013-08-28 09:57:13

Optic Nerve Head Map

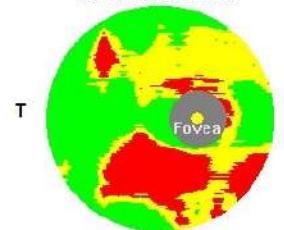


Good 42 Scan Quality Index Good 42

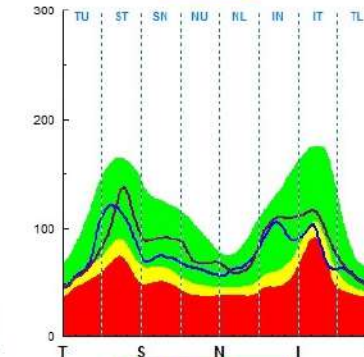
RNFL Analysis (μm)			
OD	OS	Inter Eye Diff	
Avg RNFL Thick...	75	82	-7
Avg Superior R...	76	83	-7
Avg Inferior R...	74	81	-7
Intra Eye Diff (...)	2	2	N/A
ONH Analysis			
OD	OS	Inter Eye Diff	
Area C/D	0.61	0.51	0.10
V. C/D	0.77	0.70	0.07
H. C/D	0.86	0.78	0.08
Rim Area (mm ²)	0.69	0.97	-0.28
Disc Area (mm ²)	1.78	2.00	-0.22
Cup Vol (mm ³)	0.520	0.324	0.196



NDB Reference



Exam Date: 2013-08-28 09:56:22



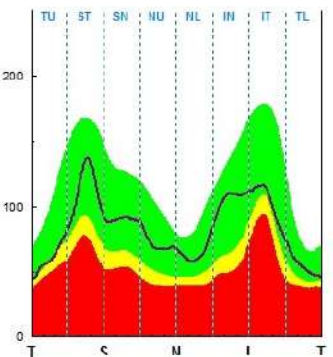
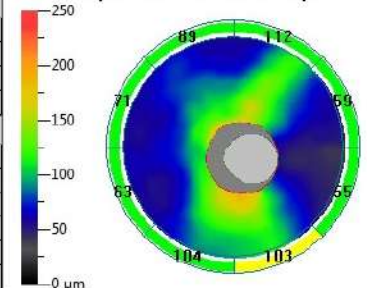
Within Normal
Borderline
Outside Normal

GCC Avg Thickness (μm)			
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

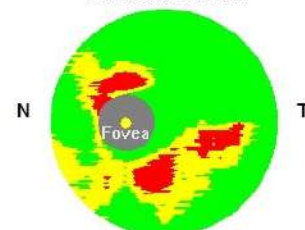
Good 51 Scan Quality Index Good 60

Exam Date: 2013-08-28 09:56:22

Optic Nerve Head Map



NDB Reference

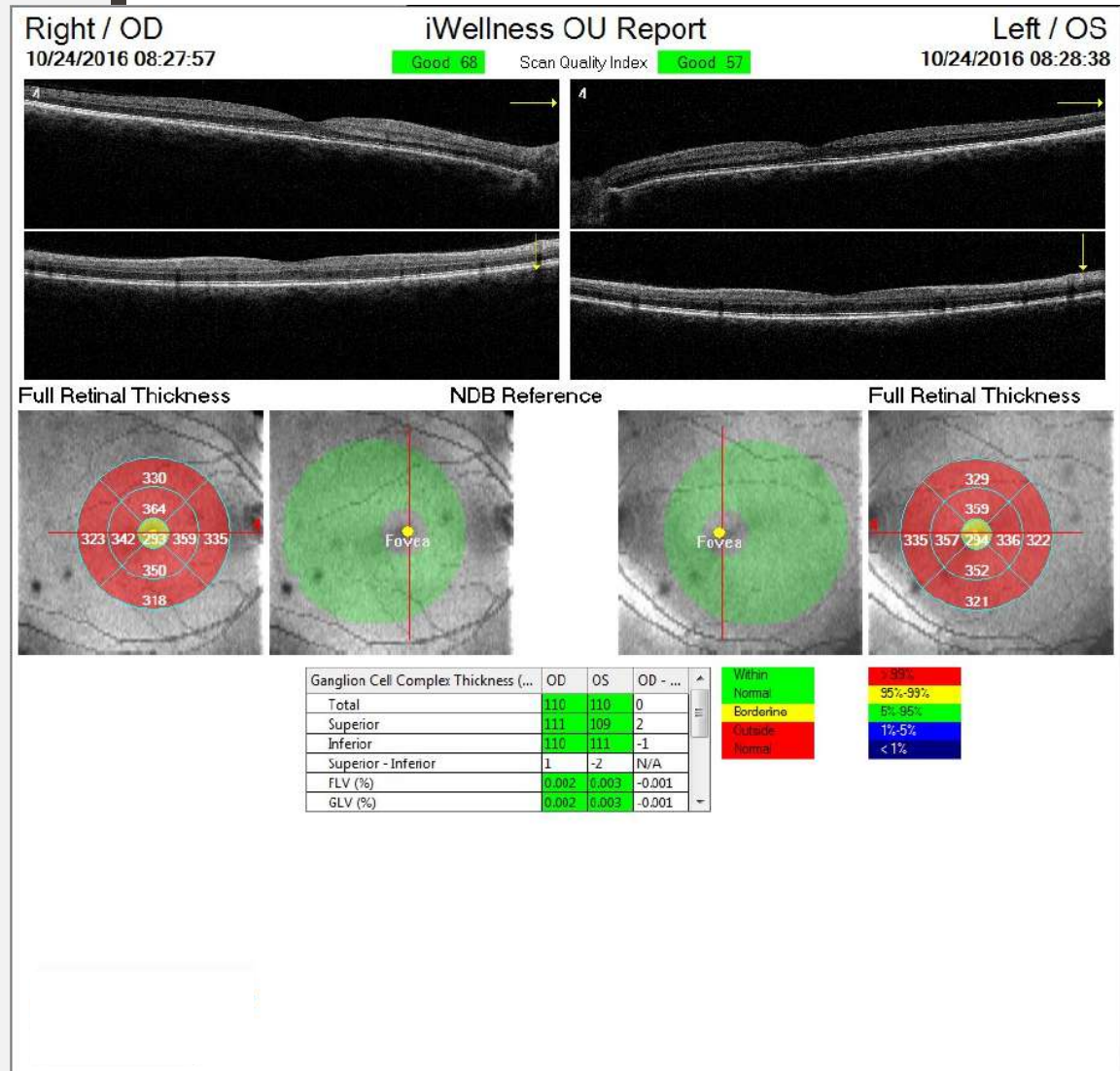


Exam Date: 2013-08-28 09:56:42

Question

This OCT is most likely

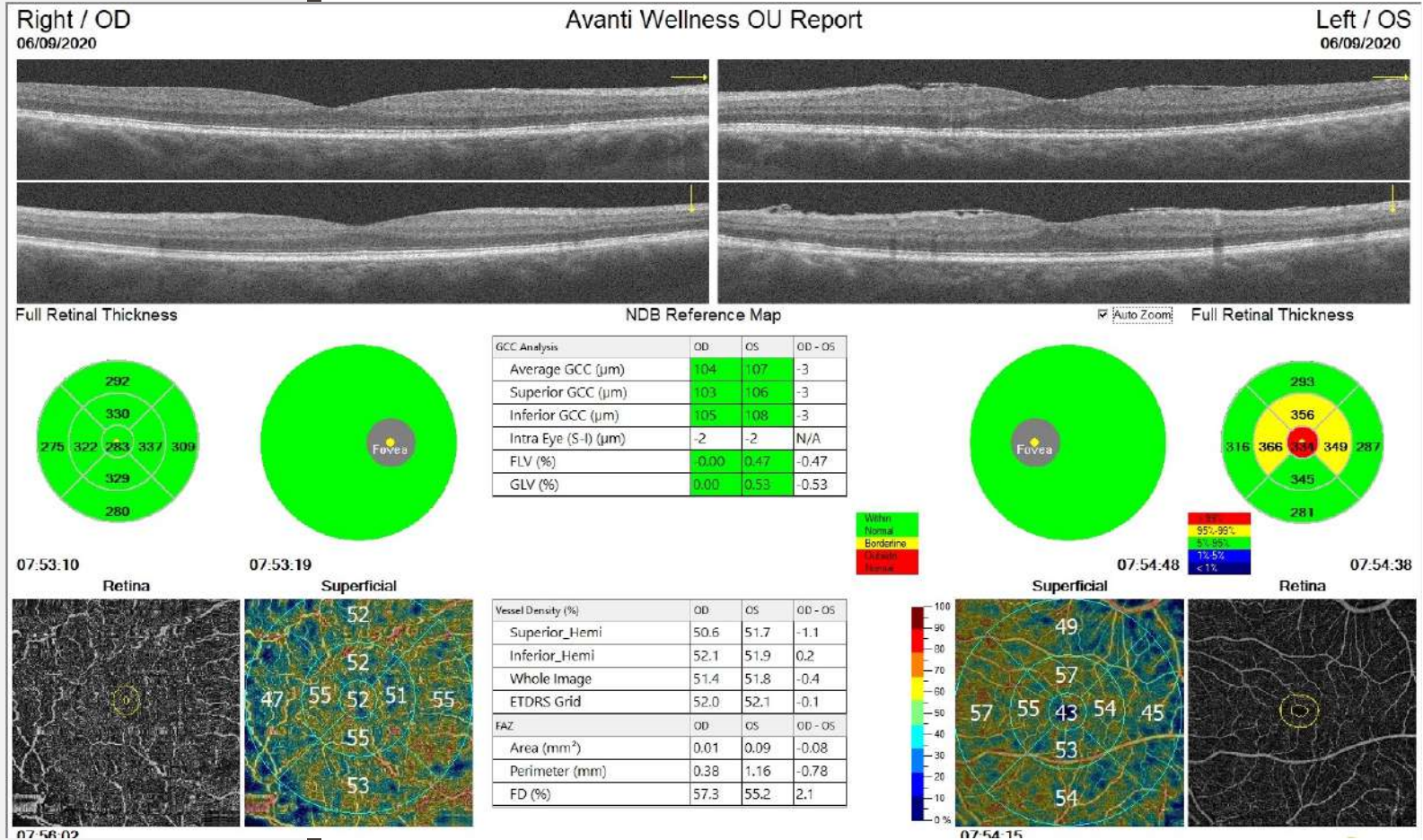
Real Disease
or
Physiologically Normal



Question

This OCT is most likely

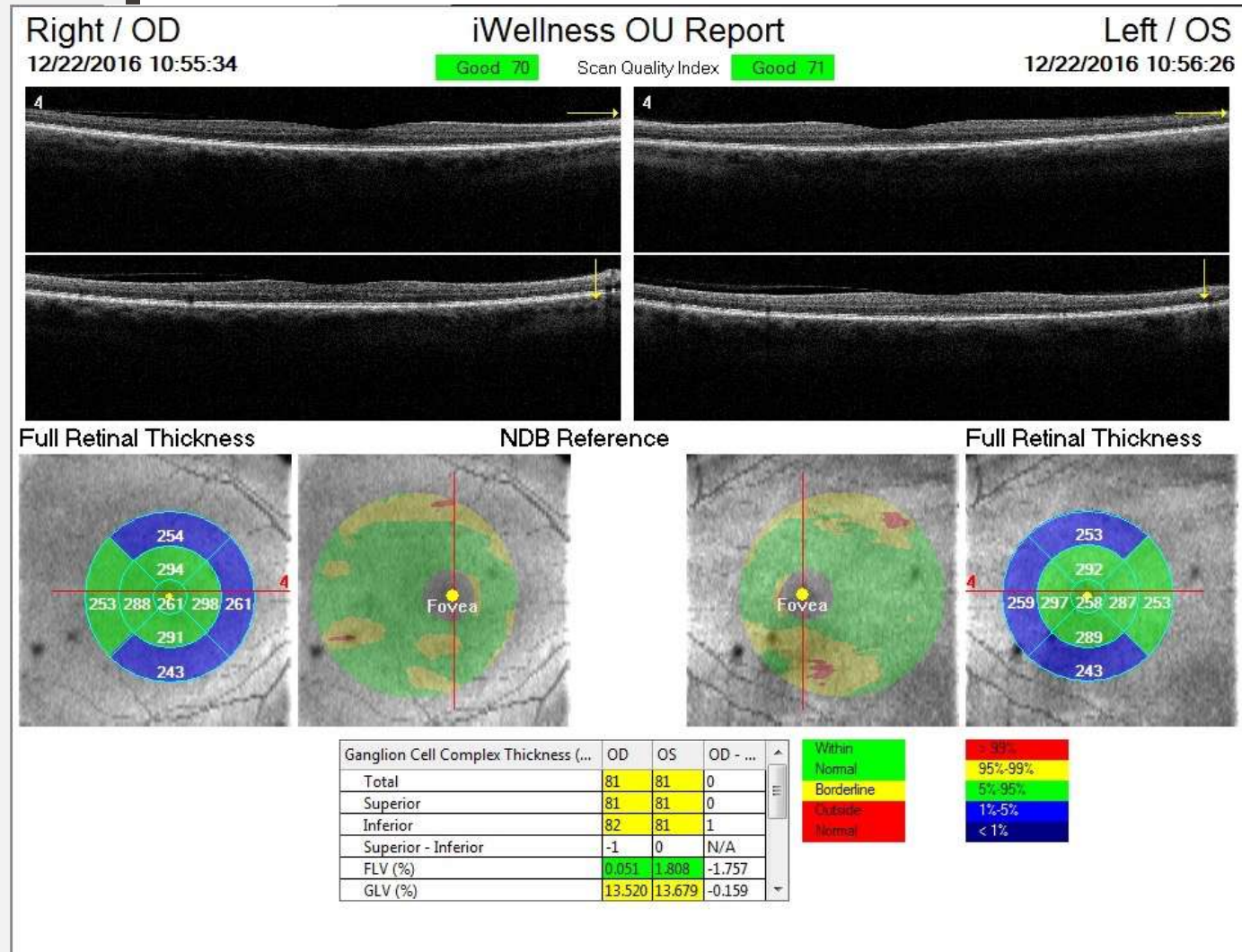
Real Disease
or
Physiologically Normal



Question

This OCT is most likely

Real Disease
or
Physiologically Normal



Green, Red, Yellow, and Blue Disease

Hints to this Disease

👁️ Prefer to start evaluating an OCT with bilateral scan

👁️ If the disease is a bilateral disease

- ★ Glaucoma

- 📋 It is usually asymmetric

👁️ If the scans are symmetric

- ★ Then it most likely not disease – physiologically normal

- ★ Anatomical variation

- 📋 Normal for that patient

👁️ Another hint is the GCC expected values

- ★ 85-100 microns

- ★ 92-95 microns

The background is a solid dark blue with a pattern of lighter blue diagonal lines and rays emanating from the top right corner, creating a sense of motion or depth.

A Few Cases to Pull it Together

54-year-old man

👁 Ocular Hypertension since 2014

★ No treatment

👁 Pigment Dispersion

👁 Baseline IOP or Tmax 26/26

★ 2014— March 2018

👁 Today 30/32, new Tmax 9-25-18

I S

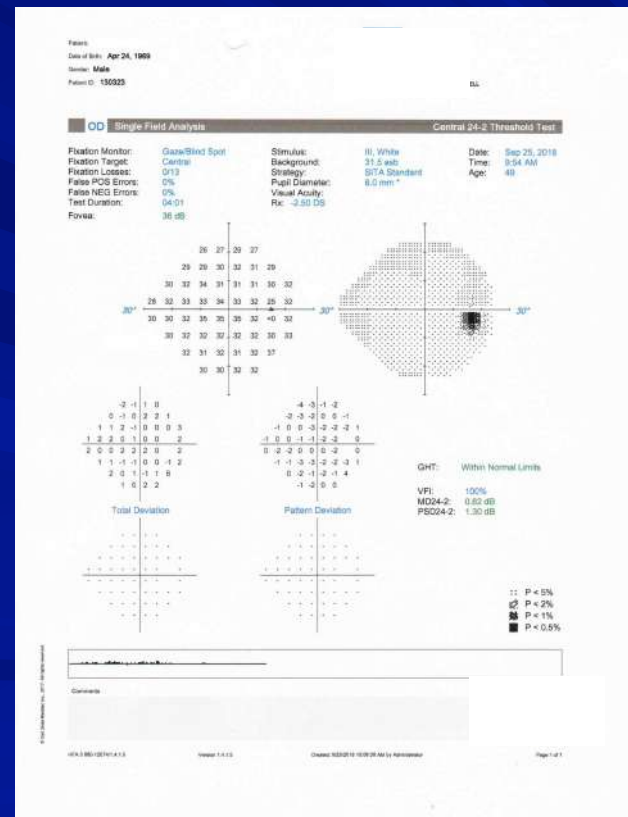
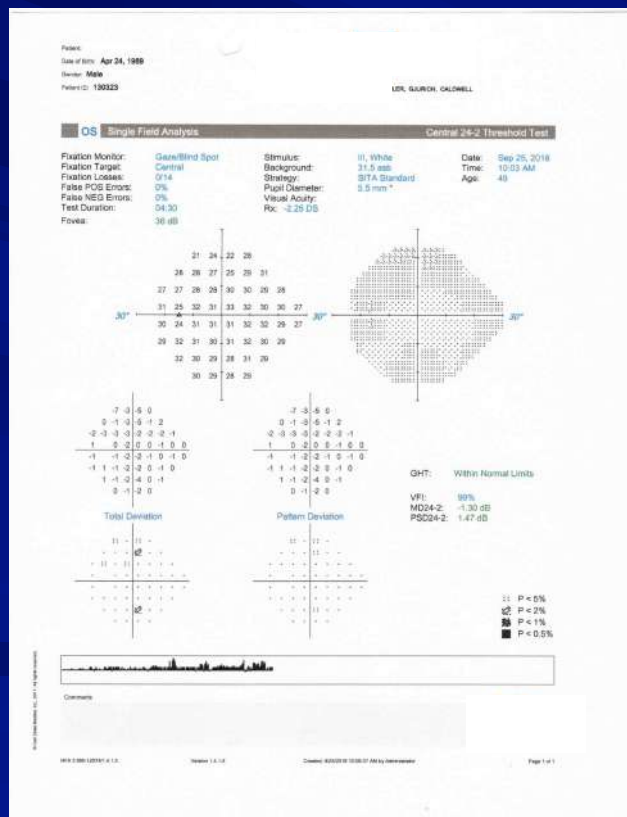
DFE - 3-22-18, 9-27-19, 9-28-20, 2-21-22, 6-27-23
VF - 9-25-18, 9-27-19, 9-28-20, 2-21-22, 6-27-23
OCT - 3-22-18, 3-27-19, 9-27-19, 9-28-20, 2-21-22, 6-27-23
gonio - 1-10-15, 3-24-20 ^{good video}, 3-25-21, 4-5-23
Photos - 3-24-20, 3-25-21, 4-5-23
Pachys - 589/589
OCT-A - 9/25/18, 9-28-20, 2-21-22, 6-27-23
disc

Baseline 26/26 1-9-14 to current
20/32 9-25-18
35/31 3-27-19

Pigment Dispersion

Fam Hx - mother?

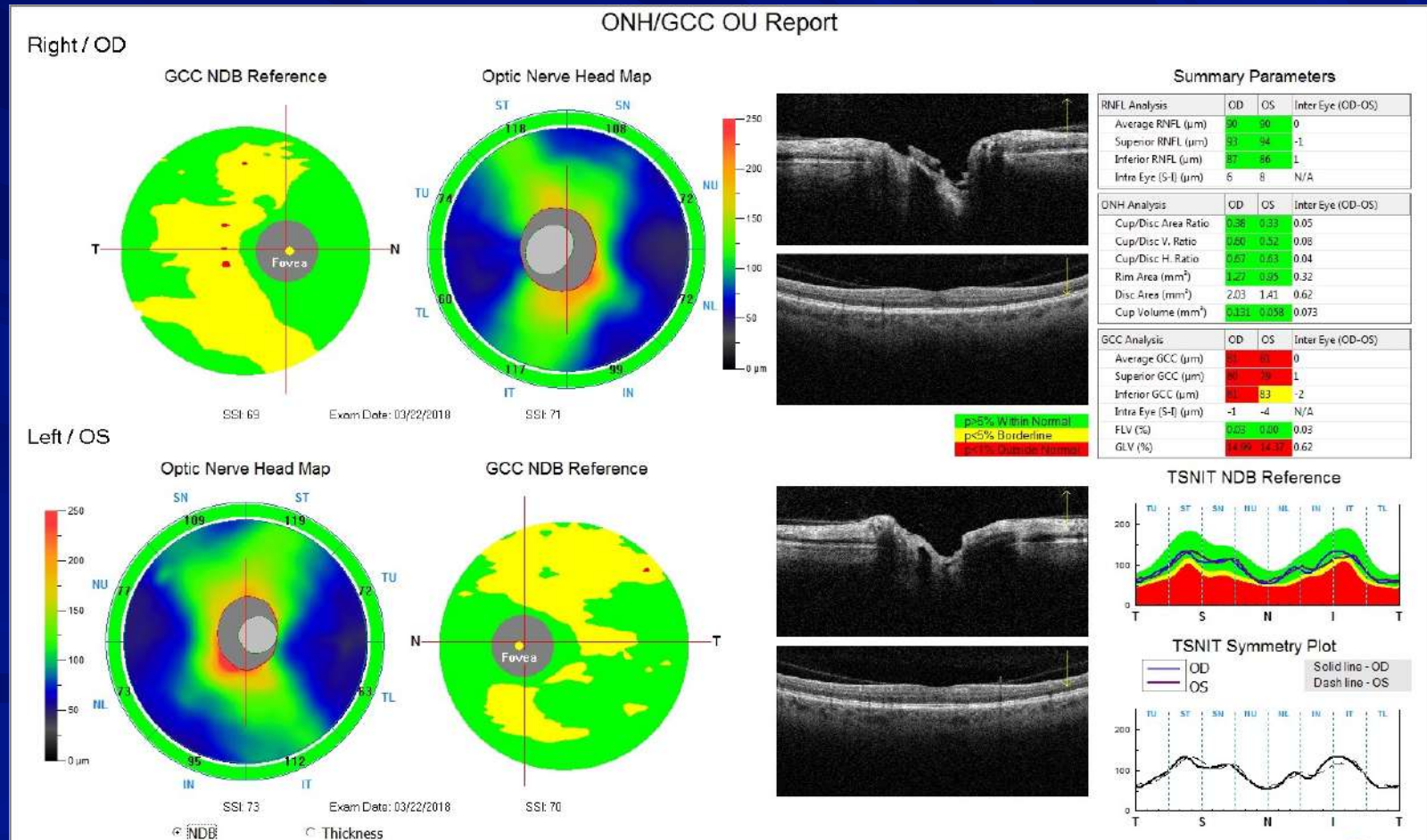
VF 24-2 Sita-Faster 9-25-2018



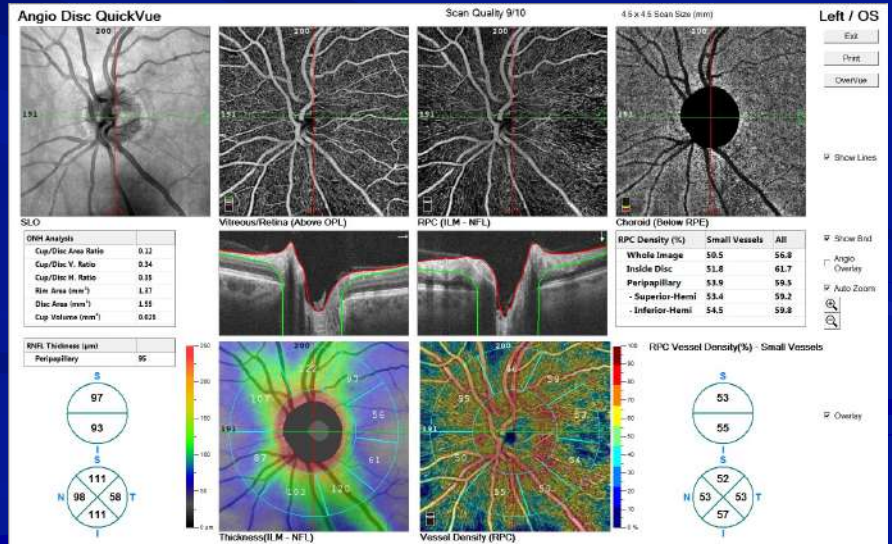
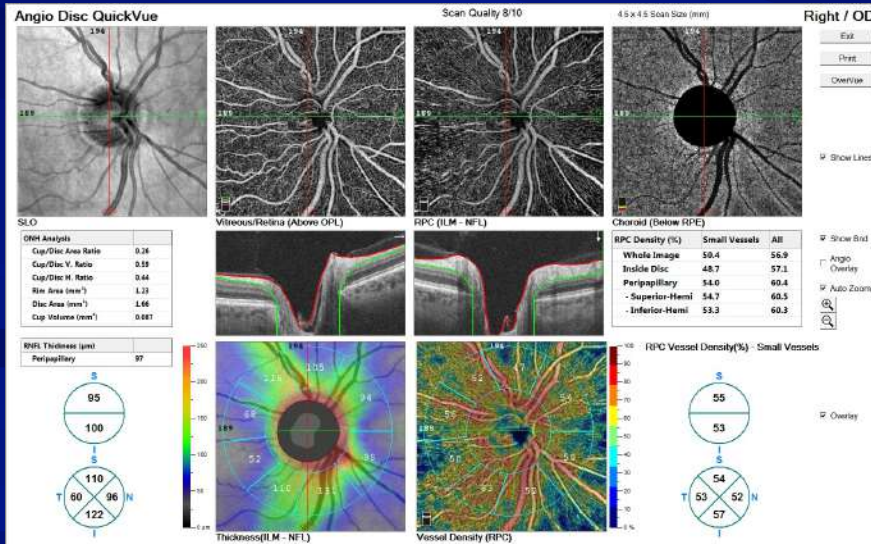
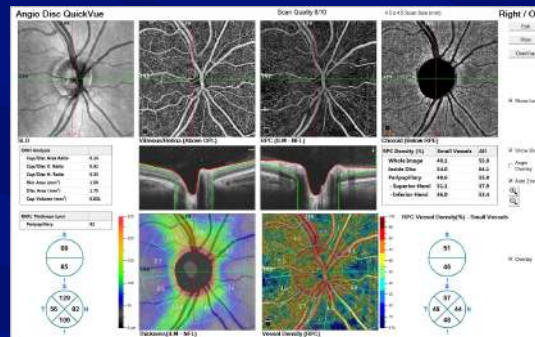
OCT NFL and GCC 3-22-18

Question

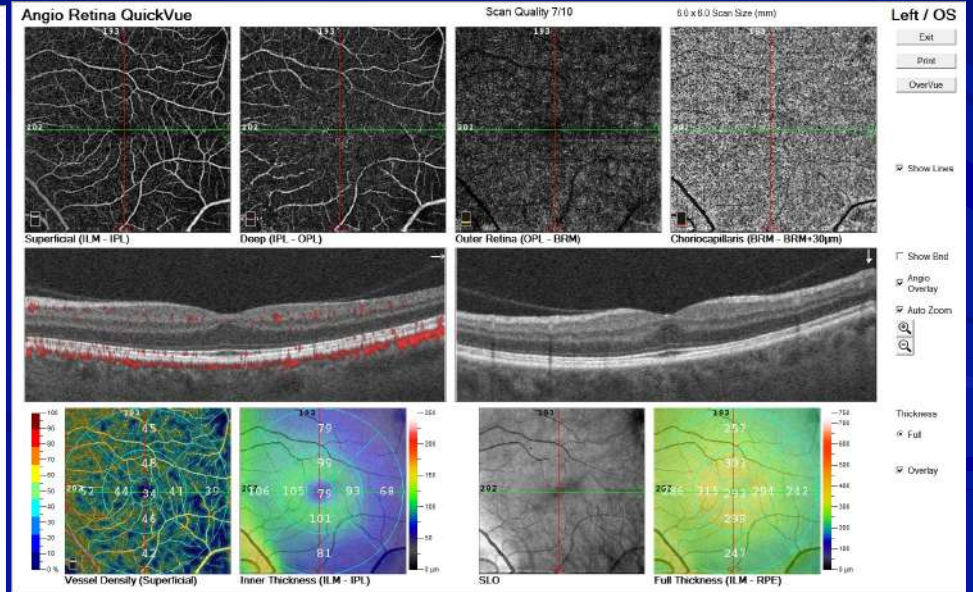
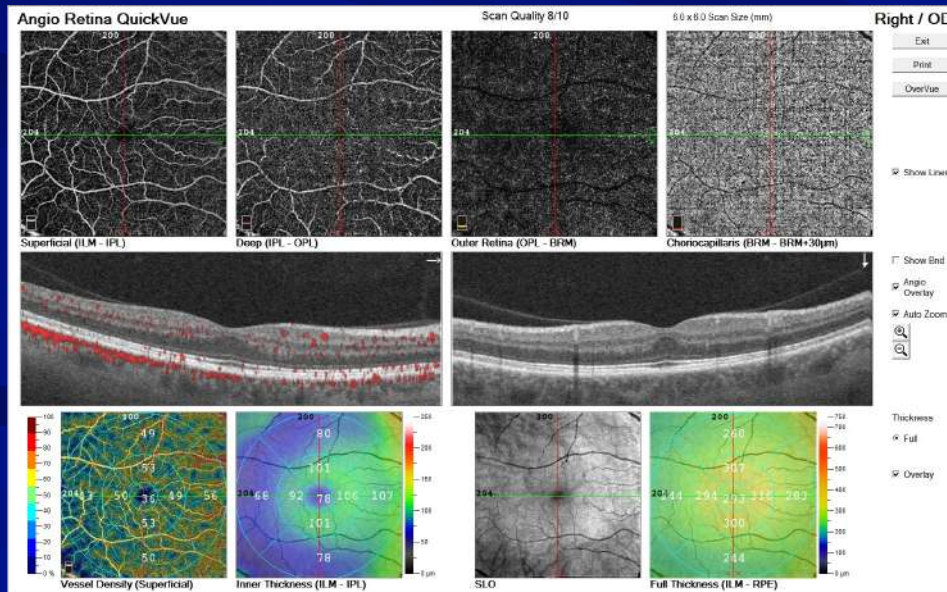
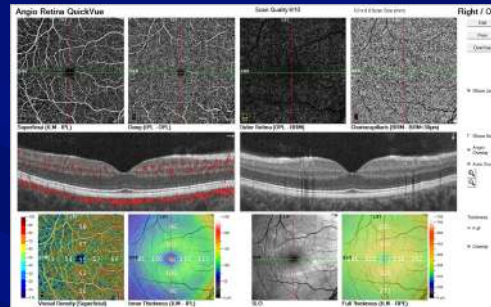
This GCC is most likely
Real Disease
or
Physiologically Normal



OCT-A 9-25-2018

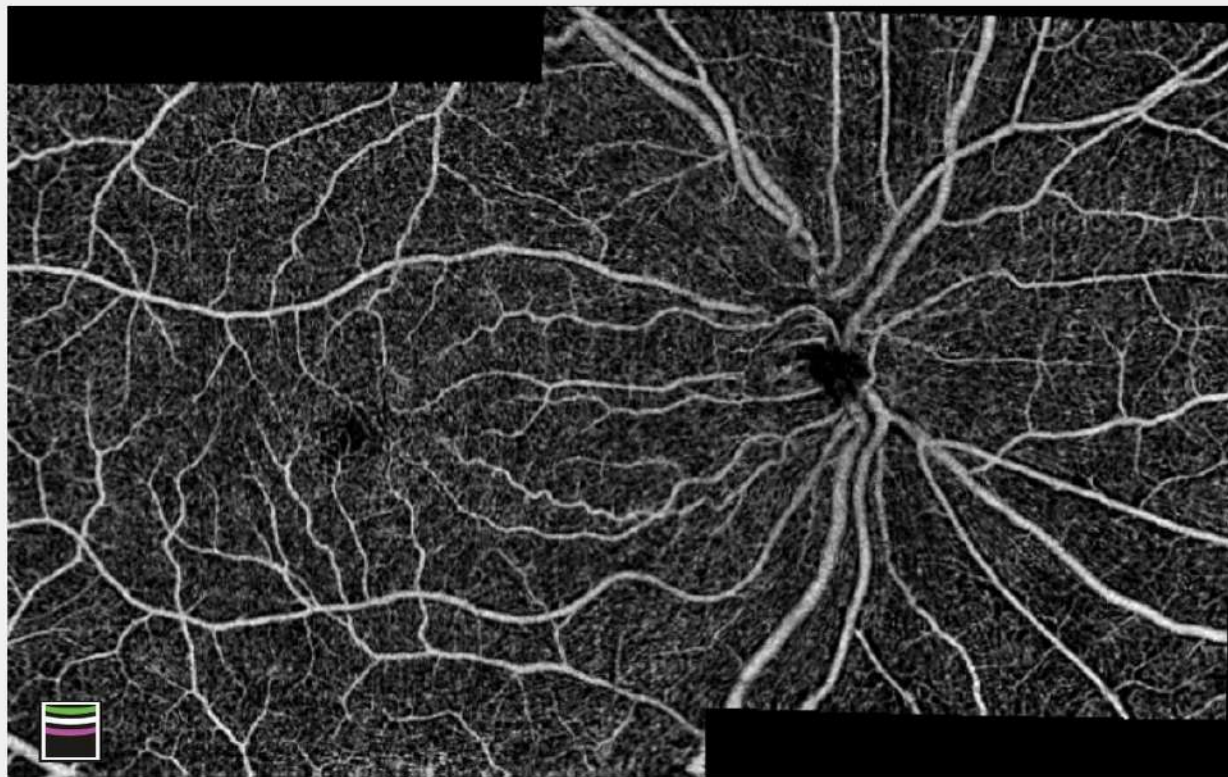


OCT-A 9-25-2018



Montage OD

Angio Montage



Right / OD

Exit

OverVue

Print

Reset View

☐ Edit

Montage Display

☒ Vitreous/Retina

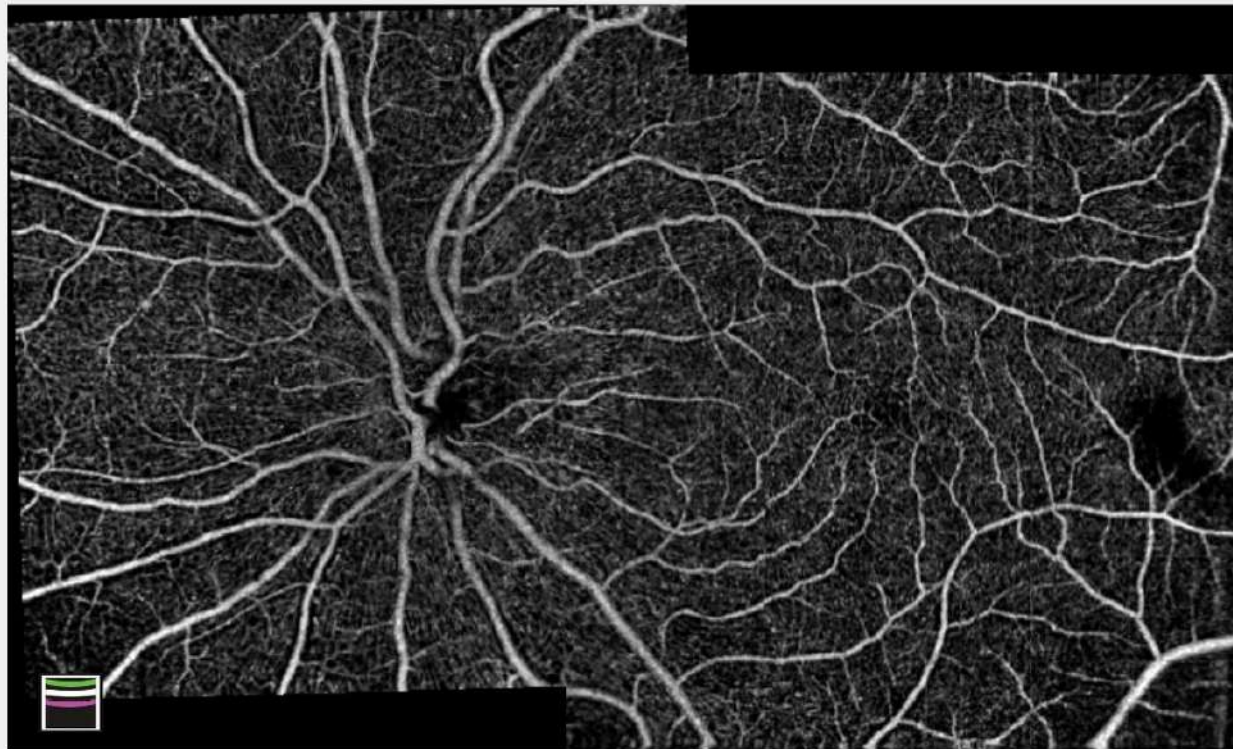
☐ Outer/Choroid

☒ Greyscale

Click image to
select layer.
Use scrollwheel
to adjust layer.

Montage OS

Angio Montage



Left / OS

Exit

OverVue

Print

Reset View

☐ Edit

Montage Display

☒ Vitreous/Retina

☐ Outer/Choroid

☒ Greyscale

Click image to
select layer.
Use scrollwheel
to adjust layer.

Montage OU



Update 2023

MaximEyes - Electronic Health Records

MaximEyes Find Common Tasks Office Admin Incentive Programs Misc Windows

History Exam Other

Chief Complaint & HPI
Eye Conditions
Family History
Review of Systems
Family History

Edit Encounter

Record 7 of 7

Save Cancel Print ?

Exam 3/29/2021 DOB 4/24/1969 Age 51 Prov. Gregory Caldwell Tech Sarah A. Cobler Established

Exclude from IP Type BOV Page Preliminaries

MaximEyes - Electronic Health Records

MaximEyes Find Common Tasks Office Admin Incentive Programs Misc Windows

History Exam Other

Chief Complaint & HPI
Eye Conditions
Family History
Review of Systems
Family History

View Encounter

Record 19 of 19

Save Cancel Print ?

Exam 3/29/2021 DOB 4/24/1969 Age 54 Prov. Gregory Caldwell Tech Mallory Tucker Established

No Patient Alerts

Pl Complaint: month #/J Glaucoma Suspect eval /TOP/ GCC-ONH/ VF-24-2 SS HPIN Notes pt states OD has been bloodshot at least twice since his last visit.

HPID Details

Previous Spectacles

Add Full View Copy from Previous Encounter Copy from Ref History

Previous Spectacles 1 (General) and 2

Rx Date	Sph	Cyl	Axis	Add	Add 2	H. Prism Base	V. Prism Base	Status
03/29/2021	-5.00	-1.25	025	+2.25				
03/29/2021	-5.00	-0.75	170	+2.25				

Notes Prog/166/P066

Rx Date

Rx Date	Sph	Cyl	Axis	Add	Add 2	H. Prism Base	V. Prism Base	Status

Notes

Unaided VA

Test Used at Dr. Snellen

OD	OS	OU

Notes

Spectacles VA

Test Used at Dr. Snellen

OD	OS	OU

Notes

Blood Pressure

Posture & Cuff Size

B.P. /

Not Medically Necessary

Blood Pressure Management Not Required

Reason Medical Reason Reason Code 11703 - Ineffective

Pupils

OD OS

Pupils

OD	OS

Shape

OD	OS

Direct & Cons

OD	OS

Size

OD	OS

Tonometer

Date	Method	Time	OD	OS	Method	Time	OD	OS
06/28/2023	ICPcc ORA	11:13:05 AM	27.6	23.5	ICPcc ORA	11:44:28 AM	30.0	32.9
04/05/2023	Fwick	9:25:30 AM	22	23.5	ICPcc ORA	8:59:08 AM	31.6	31.5
02/21/2022	ICPcc ORA	9:07:21 AM	35.0	37.6	ICPcc ORA	9:07:25 AM	36.5	38.0
03/29/2021	ICPcc ORA	8:34:51 AM	38.2	32.9	ICPcc ORA	8:34:58 AM	29.2	34.7
09/28/2020	GAT Goldmann applanation tonometry	9:33:17 AM	31	28	ICare Rebound tonometry	9:06:09 AM	40	38
03/24/2020	GAT Goldmann applanation tonometry	10:20:56 AM	30	30	ICare Rebound tonometry	9:22:30 AM	39	40
06/17/2019	GAT Goldmann applanation tonometry	8:41:07 AM	26	25	ICare Rebound tonometry	8:41:07 AM	25	28
03/27/2019	GAT Goldmann applanation tonometry	8:05:52 AM	35	31	ICare Rebound tonometry	7:55:53 AM	42	38
09/25/2018	GAT Goldmann applanation tonometry	9:20:10 AM	20	22	ICare Rebound tonometry	9:09:51 AM	36	24
03/22/2018	GAT Goldmann applanation tonometry	2:29:03 PM	26	26	ICare Rebound tonometry (air-puff tonometry)	2:03:47 PM	29.30	29.30

Notes

Cover Test

Correction Used Spectacles

Results

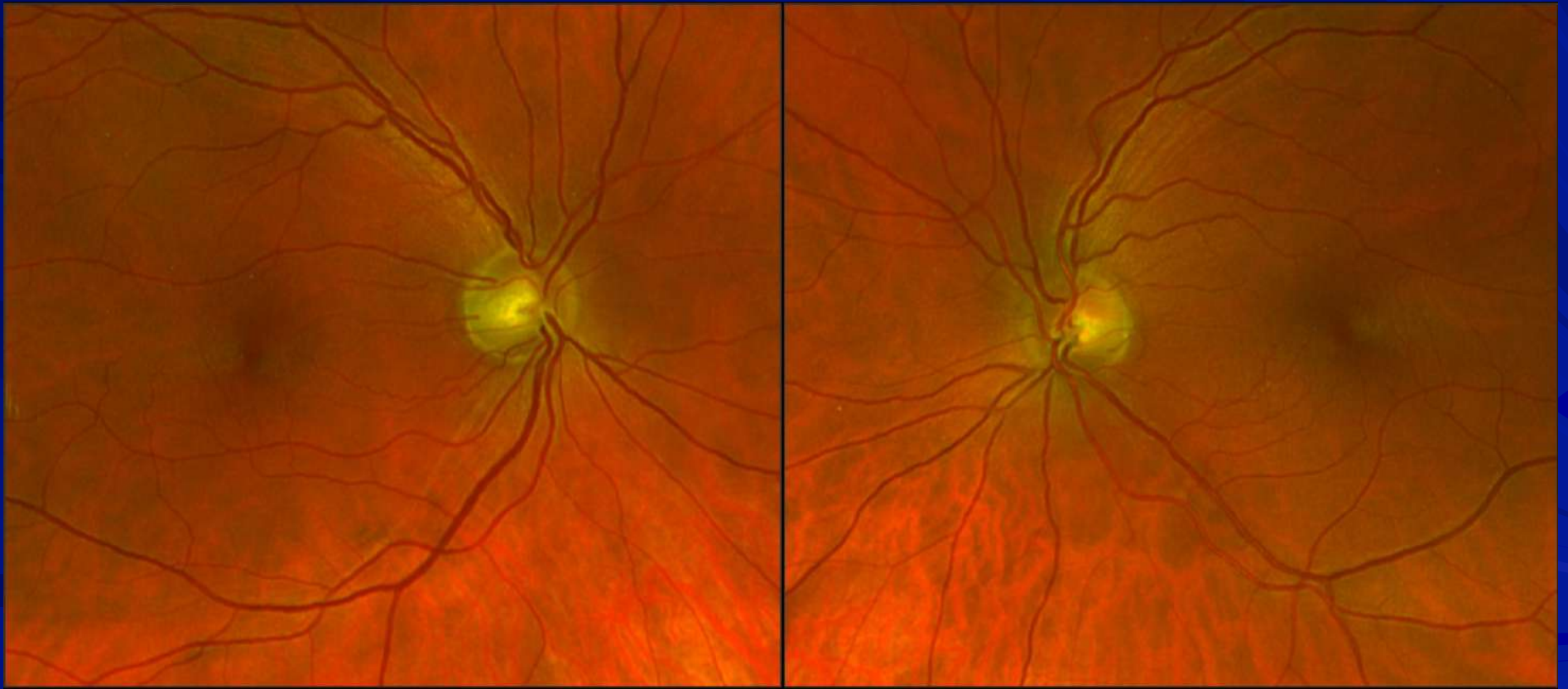
Notes

Dt At 6 m Ortho

Nr At 40 cm 6 Exo

Exam Navigator

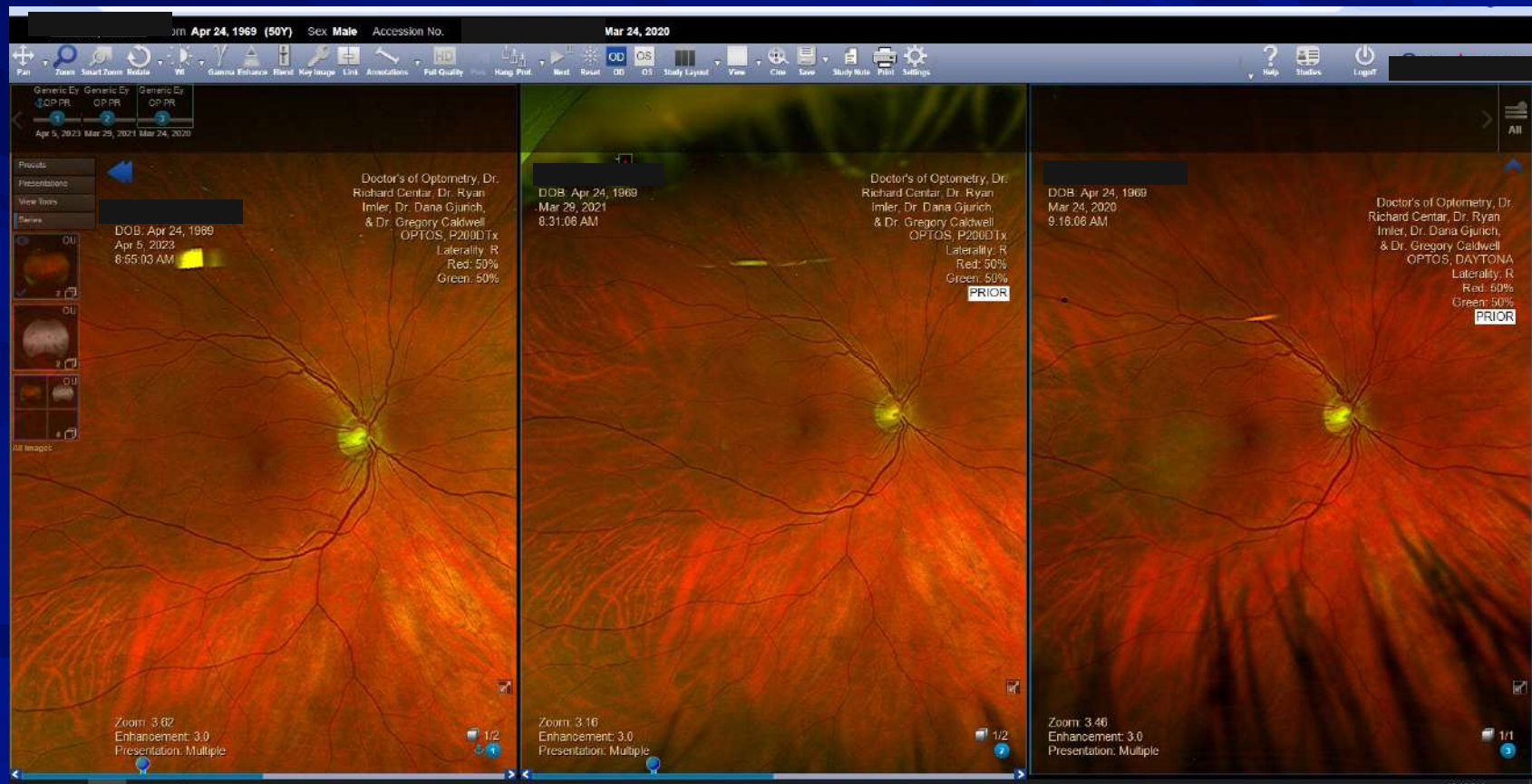
March 29, 2021



April 5, 2023



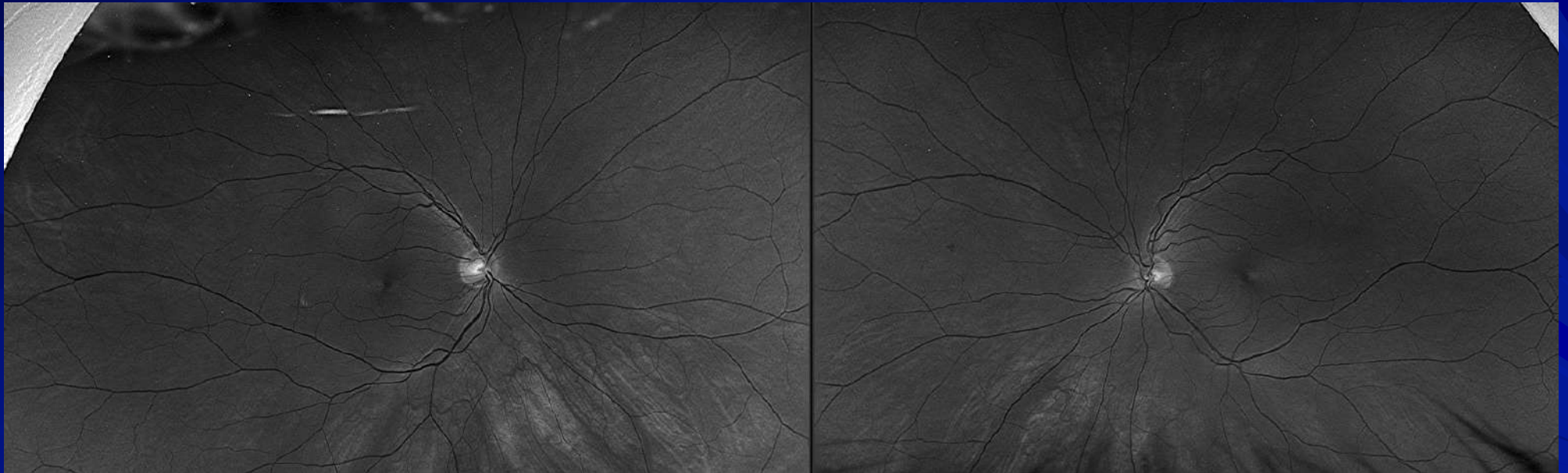
2020- 2023



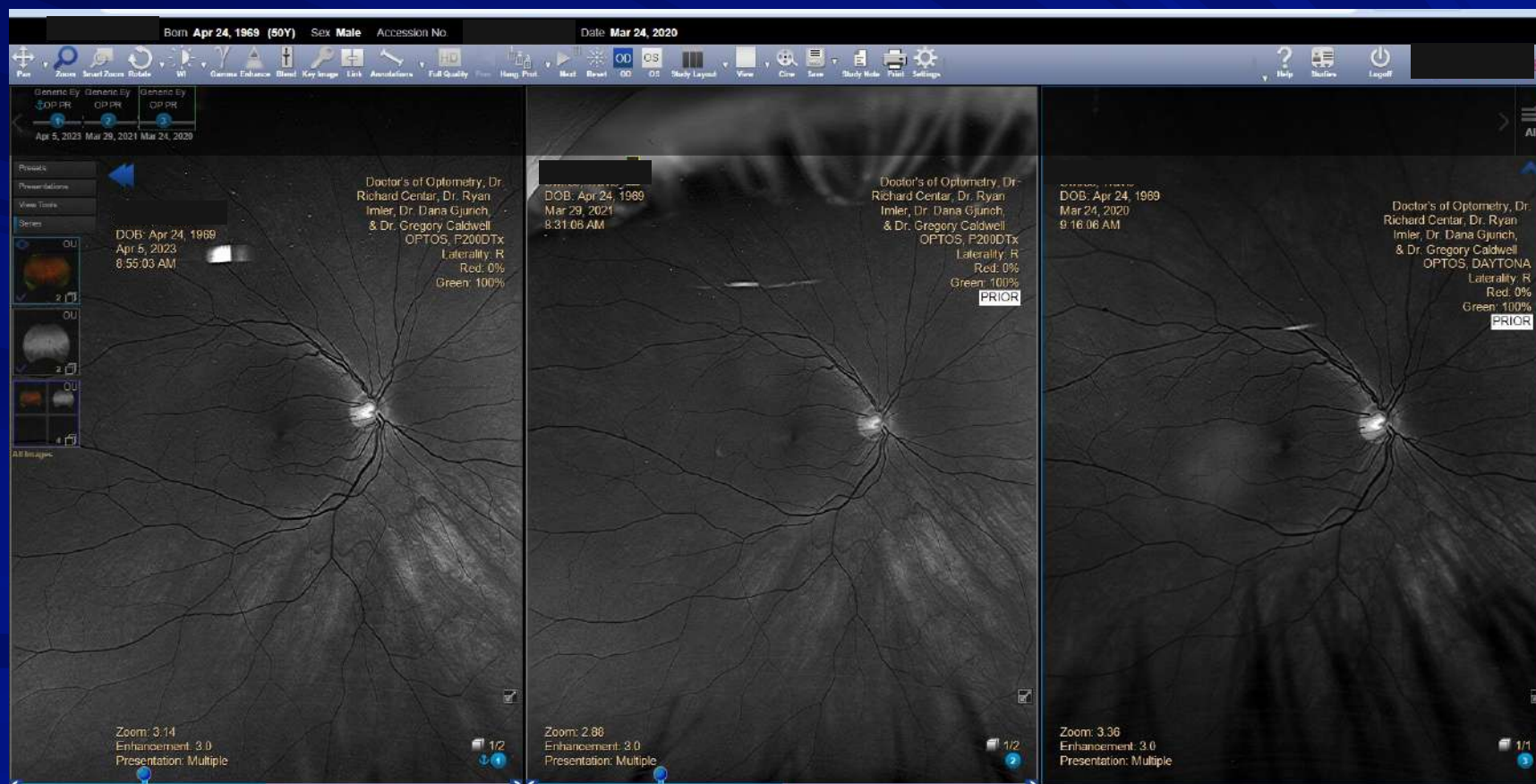
2020-2023



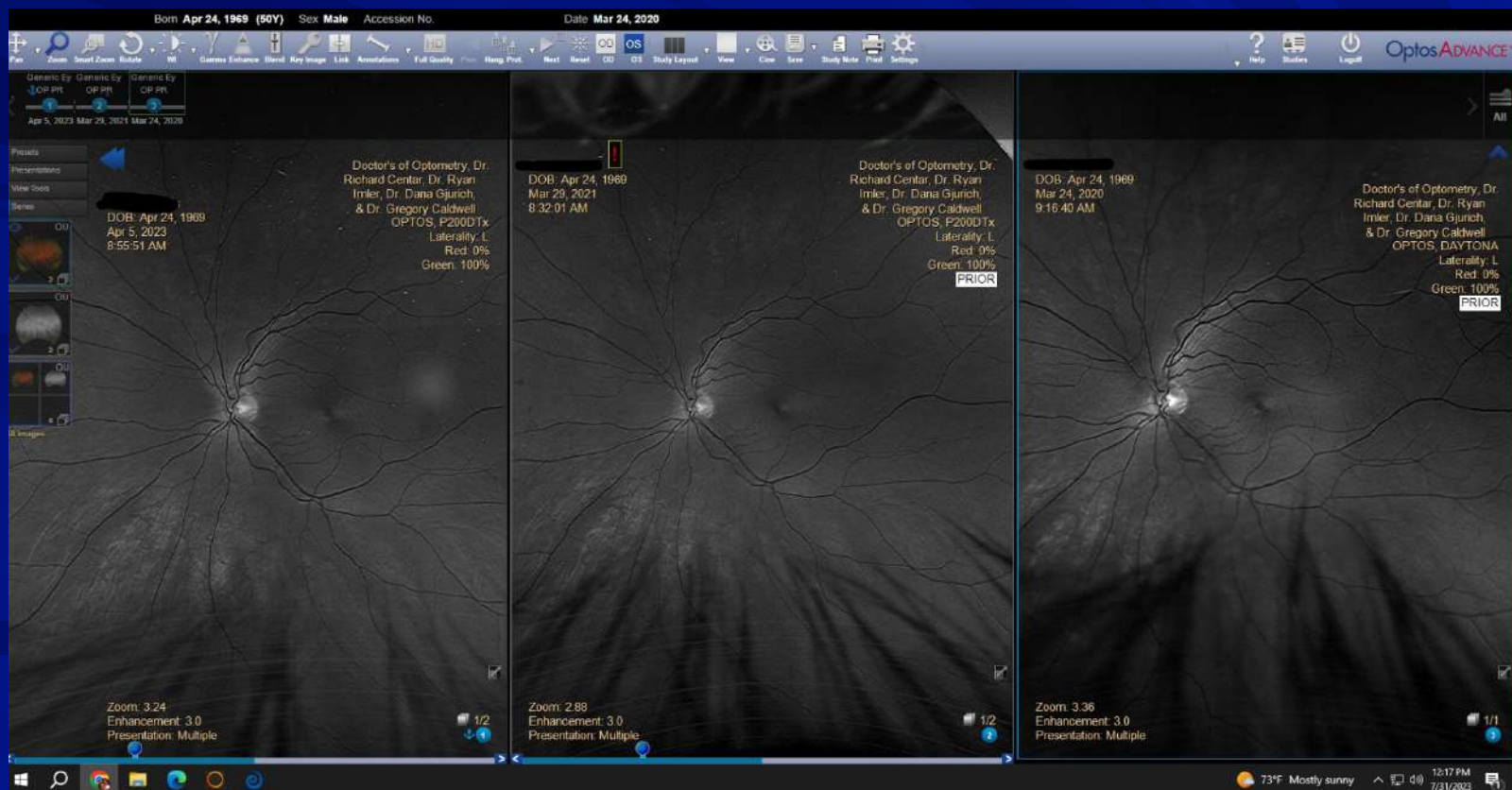
March 29, 2021



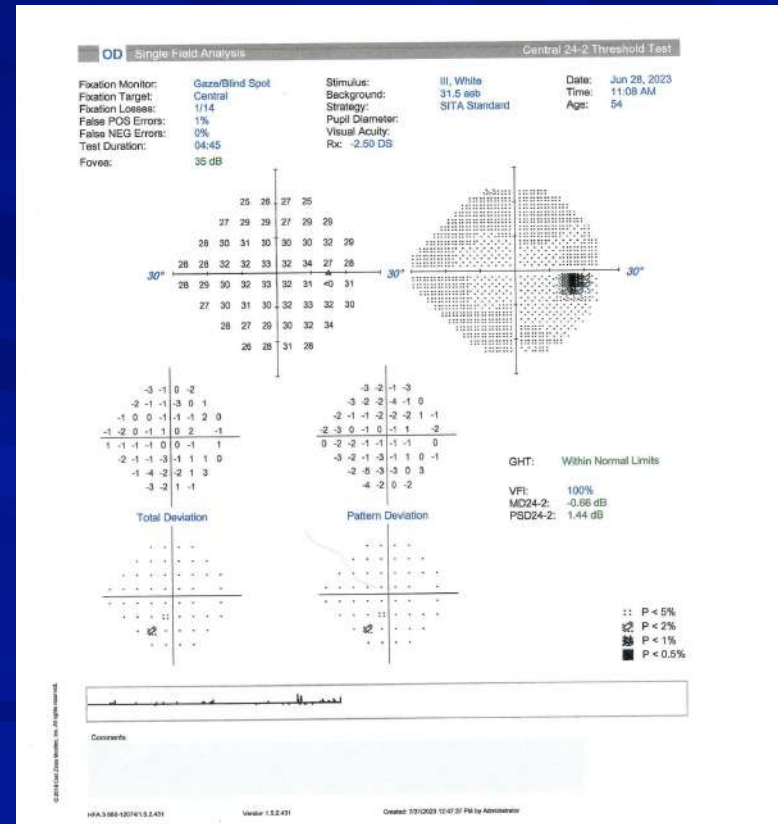
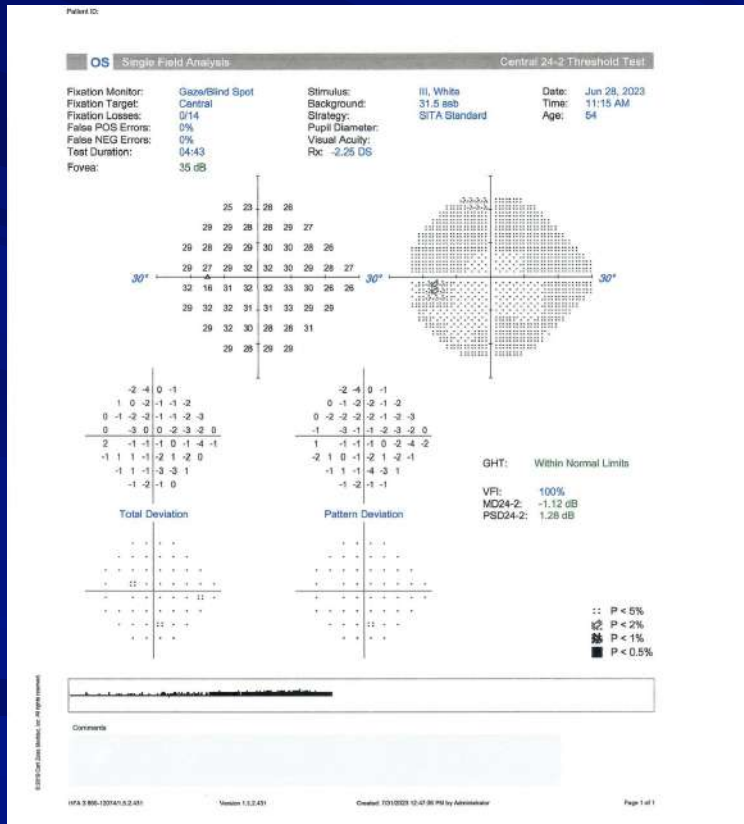
2020 -2023



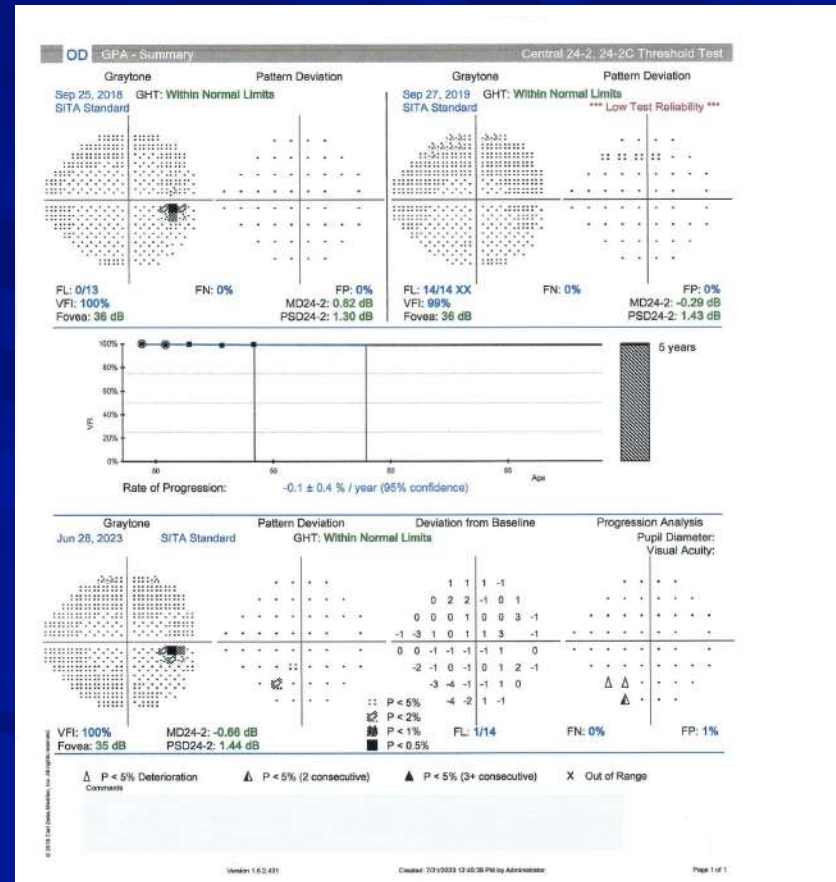
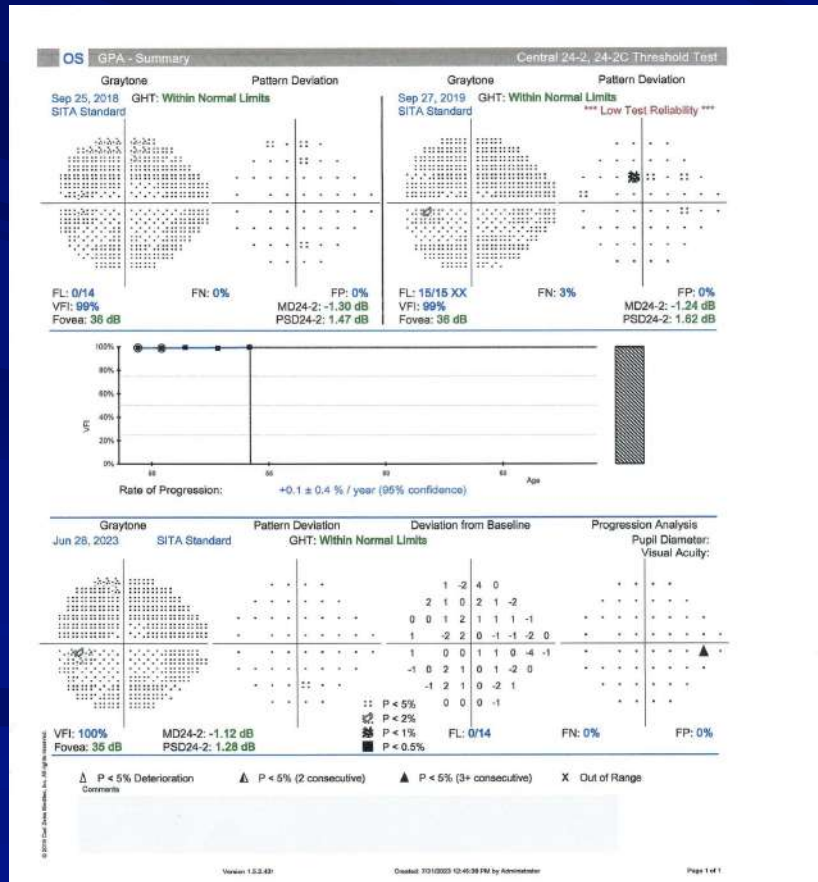
2020 -2023



June 28, 2023



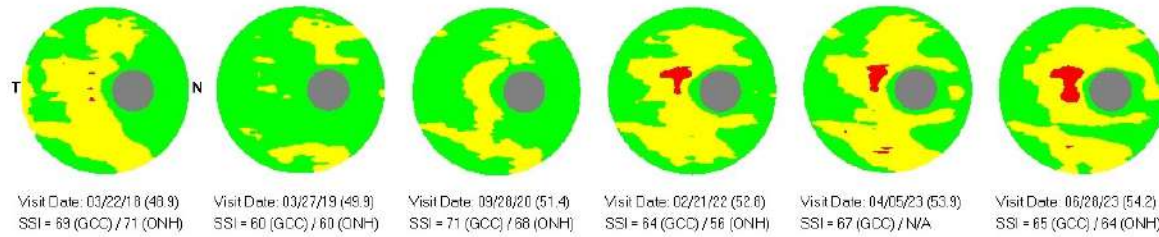
2018 - 2023



Nerve Fiber ONH/GCC Change Analysis

Right / OD

GCC NDB Reference



NDB

Thickness

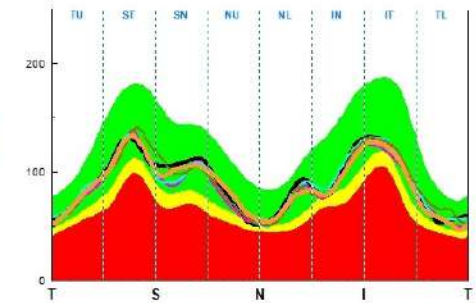
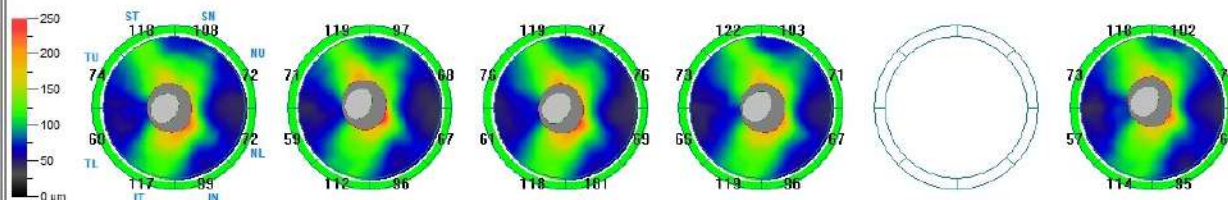
Normal
Borderline
Abnormal

Comparison to NDB

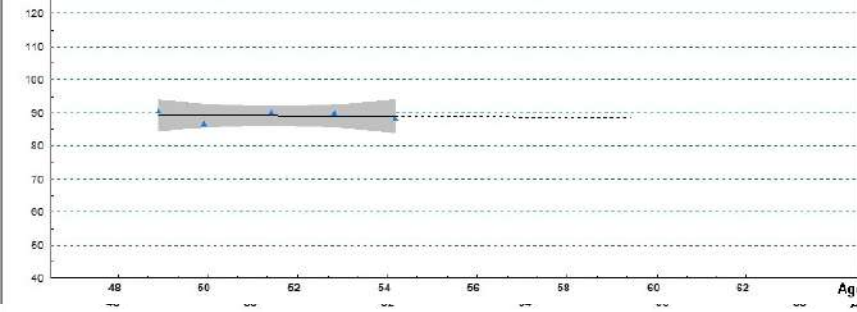
GCC Analysis	03/22/18	06/28/23
Average GCC (μm)	81	75
Superior GCC (μm)	80	76
Inferior GCC (μm)	81	80
FLV (%)	0.02	0.12
GLV (%)	5.80	16.19
RNFL/ONH Analysis	03/22/18	06/28/23
Average RNFL (μm)	90	88
Superior RNFL (μm)	93	92
Inferior RNFL (μm)	87	83
Cup/Disc H. Ratio	0.67	0.64
Cup/Disc V. Ratio	0.60	0.61
Rim Area (mm ²)	1.27	1.27

03/22/18
03/27/19
09/20/20
02/21/22
04/05/23
06/28/23

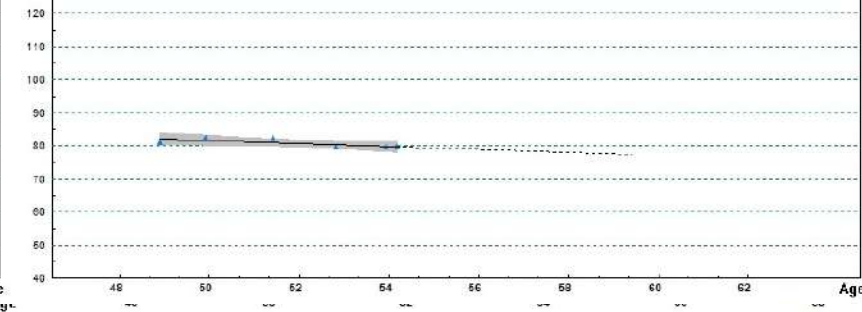
RNFL Analysis



μm RNFL Rate Of Change = -0.04 μm/Yr 95% CI [-1.50, 1.41] p = 0.93



μm GCC Rate Of Change = -0.44 μm/Yr 95% CI [-0.96, 0.08] p = 0.077



Nerve Fiber ONH/GCC Change Analysis

Left / OS

GCC NDB Reference

NDB

Thickness



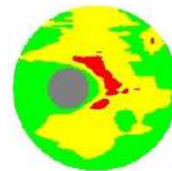
Visit Date: 03/22/18 (48.9)
SSI = 70 (GCC) / 73 (ONH)



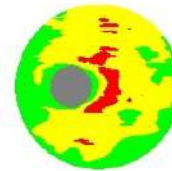
Visit Date: 03/27/19 (49.9)
SSI = 72 (GCC) / 64 (ONH)



Visit Date: 09/28/20 (51.4)
SSI = 65 (GCC) / 69 (ONH)



Visit Date: 02/21/22 (52.8)
SSI = 64 (GCC) / 60 (ONH)



Visit Date: 04/05/23 (53.9)
SSI = 64 (GCC) / N/A



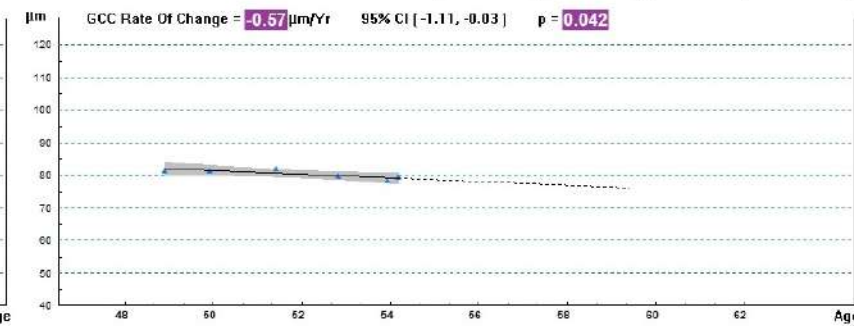
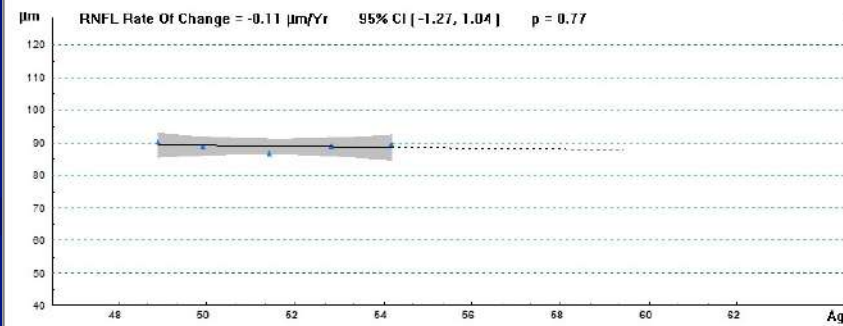
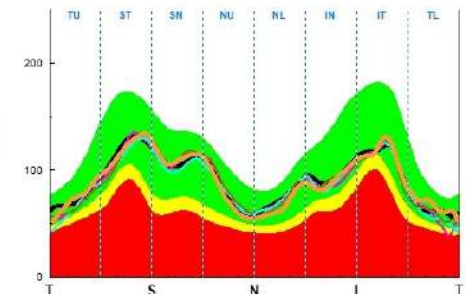
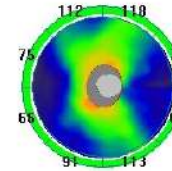
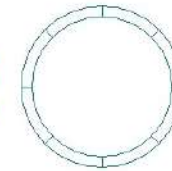
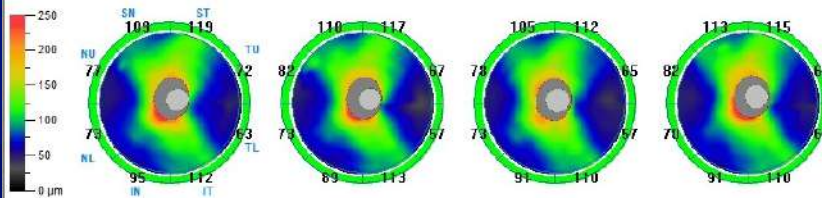
Visit Date: 06/28/23 (54.2)
SSI = 72 (GCC) / 61 (ONH)

Within:
Normal
Borderline
Outside
Normal

Comparison to NDB

GCC Analysis	03/22/18	06/28/23
Average GCC (μm)	81	79
Superior GCC (μm)	78	77
Inferior GCC (μm)	83	81
FLV (%)	0.00	0.04
GLV (%)	14.57	16.80
RNFL/ONH Analysis	03/22/18	06/28/23
Average RNFL (μm)	90	89
Superior RNFL (μm)	94	94
Inferior RNFL (μm)	86	84
Cup/Disc H. Ratio	0.53	0.71
Cup/Disc V. Ratio	0.52	0.59
Rim Area (mm ²)	0.95	0.87

RNFL Analysis



HD Angio Disc Trend Analysis

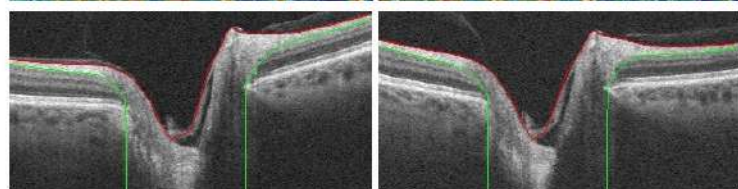
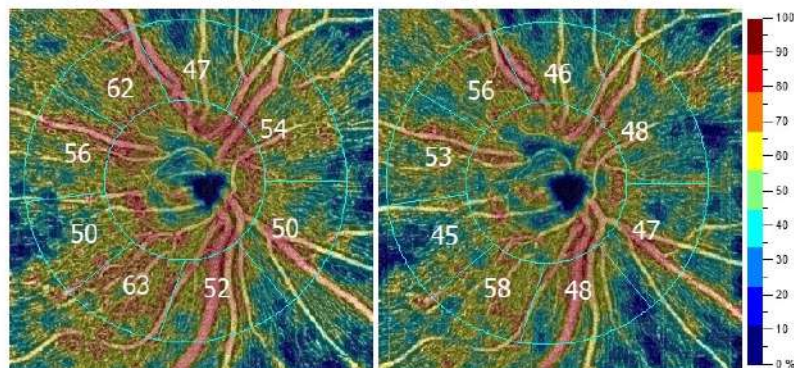
OD

OS

4.5 x 4.5 Scan Size (mm)

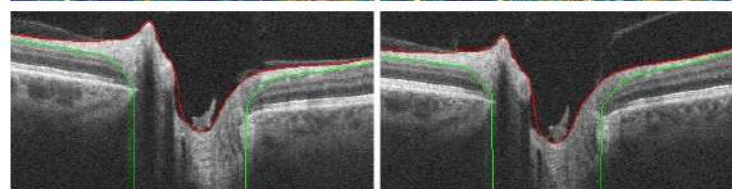
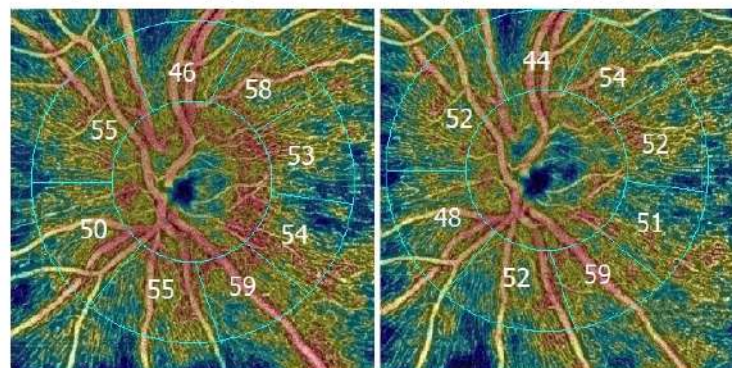
First: 09/25/2018 09:52:34; SQ: 8; 49 yrs

Last: 06/28/2023 11:46:14; SQ: 8; 54 yrs



First: 09/25/2018 09:53:48; SQ: 9; 49 yrs

Last: 06/28/2023 11:49:36; SQ: 9; 54 yrs



Thickness

☐ RNFL

Vessel
Density

☒ RPC

☒ Show Lines

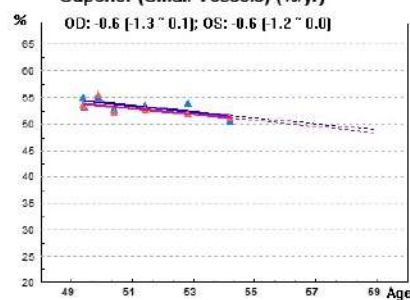
☒ Show Bnd

☒ Auto Zoom



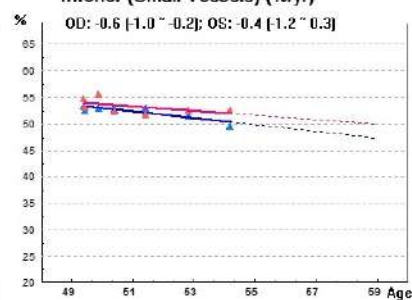
Superior (Small Vessels) (%/yr)

OD: -0.6 [-1.3 ~ 0.1]; OS: -0.6 [-1.2 ~ 0.0]



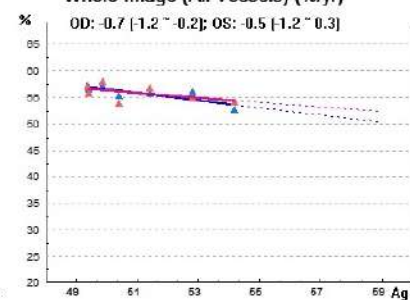
Inferior (Small Vessels) (%/yr)

OD: -0.6 [-1.0 ~ -0.2]; OS: -0.4 [-1.2 ~ 0.3]



Whole Image (All Vessels) (%/yr)

OD: -0.7 [-1.2 ~ -0.2]; OS: -0.5 [-1.2 ~ 0.3]



Vessel	OD			OS		
	Density (%)	First	Last	Diff	First	Last
Superior (Small)	54.7	50.3	-4.4	53.4	50.9	-2.4
Inferior (Small)	53.3	49.4	-3.8	54.5	52.4	-2.1
Average (Small)	54.0	49.9	-4.1	53.9	51.6	-2.3
Whole Image (All)	56.9	52.5	-4.4	56.8	54.1	-2.7

— OD
— OS

HD Angio Retina Trend Analysis

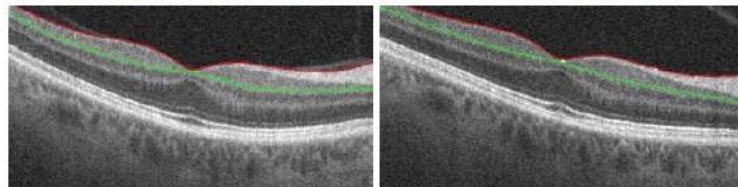
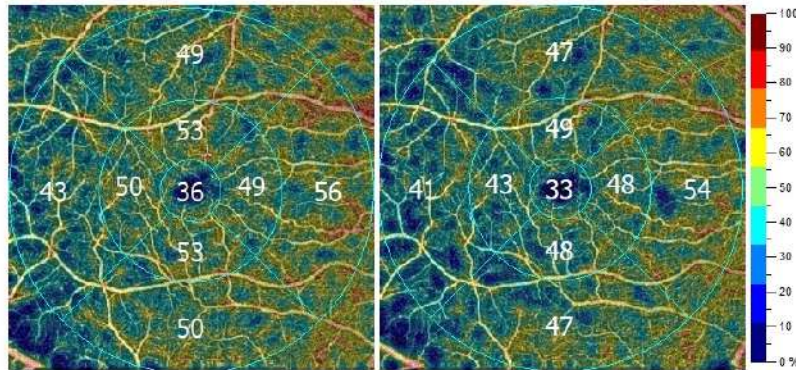
OD

OS

6.0 x 6.0 Scan Size (mm)

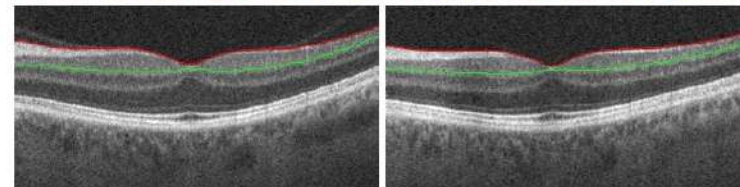
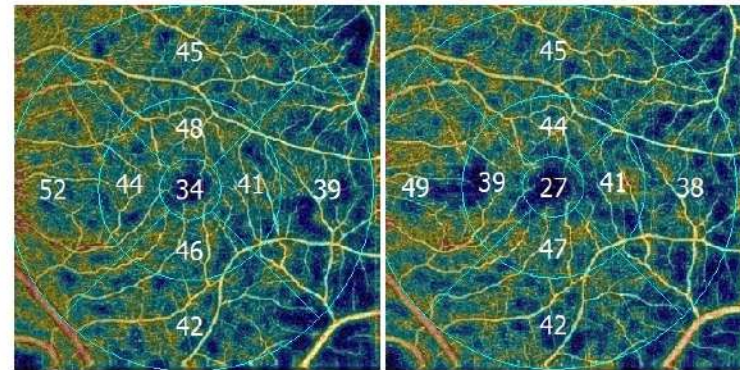
First: 09/26/2018 13:20:29; SQ: 8; 49 yrs

Last: 06/28/2023 11:45:15; SQ: 8; 54 yrs



First: 09/26/2018 14:00:23; SQ: 7; 49 yrs

Last: 06/28/2023 11:48:46; SQ: 8; 54 yrs



Thickness

☐ GCC

☐ Retina

Vessel

Density

☒ Superficial

☐ Deep

Measurement

☐ FAZ

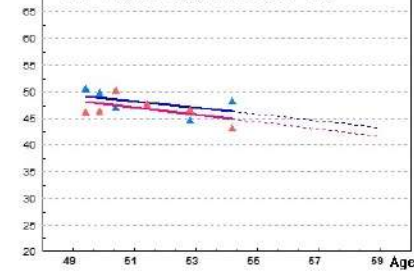
☒ Show Lines

☒ Show Bnd

☒ Auto Zoom

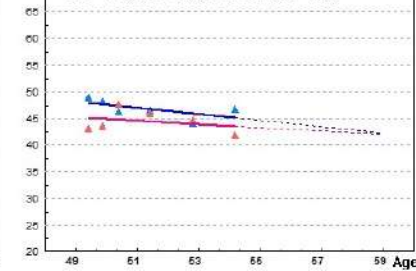
Superior_Hemi (%/yr)

OD: -0.6 [-1.9 ~ 0.7] OS: -0.7 [-2.2 ~ 0.8]



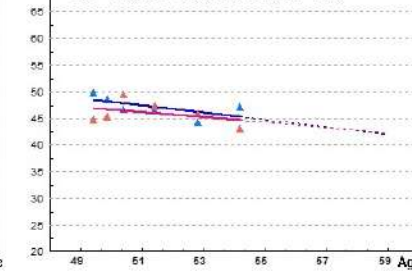
Inferior_Hemi (%/yr)

OD: -0.6 [-1.6 ~ 0.4] OS: -0.3 [-1.6 ~ 1.2]



ETDRS Grid (%/yr)

OD: -0.7 [-1.8 ~ 0.4] OS: -0.5 [-2.1 ~ 1.1]



Vessel	OD			OS		
	Density(%)	First	Last	First	Last	Diff
Superior_Hemi		50.3	48.1	45.9	43.0	-2.9
Inferior_Hemi		48.8	46.6	42.9	41.8	-1.2
Whole Image		49.6	47.4	44.4	42.4	-2.0
ETDRS Grid		49.6	46.9	44.4	42.8	-1.6

— OD
— OS

HD Angio Disc Trend Analysis

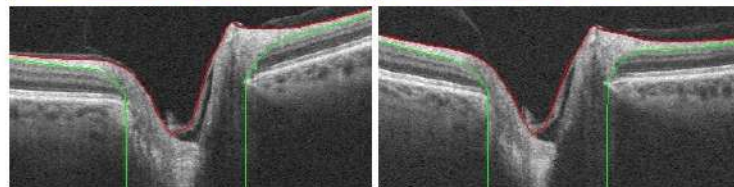
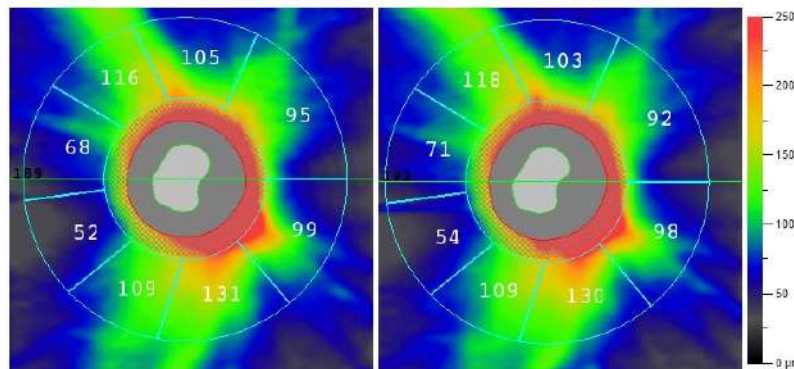
OD

OS

4.5 x 4.5 Scan Size (mm)

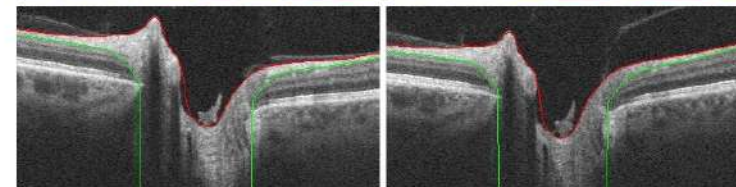
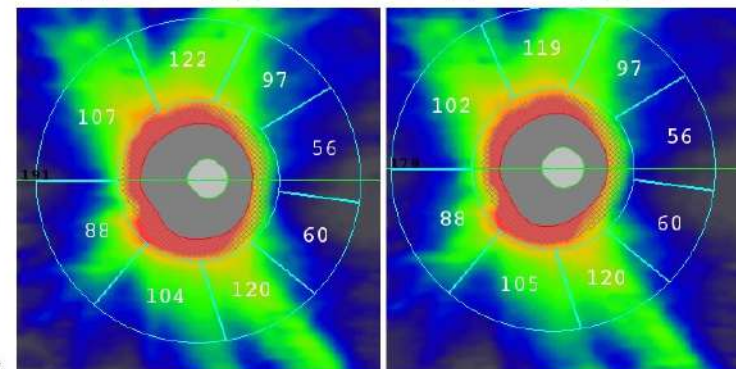
First: 09/25/2018 09:52:34; SQ: 8; 49 yrs

Last: 06/28/2023 11:46:14; SQ: 8; 54 yrs



First: 09/25/2018 09:53:48; SQ: 9; 49 yrs

Last: 06/28/2023 11:49:36; SQ: 9; 54 yrs



Thickness

● RNFL

Vessel Density

○ RPC

☒ Show Lines

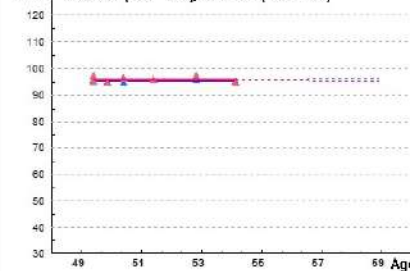
☒ Show Bnd

☒ Auto Zoom



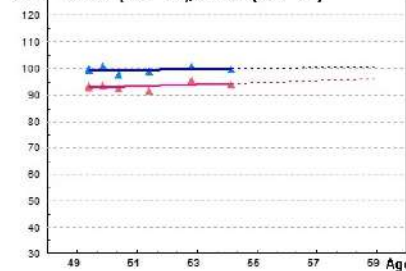
Superior RNFL (μm/yr)

OD: 0.1 [-0.2 ~ 0.3]; OS: -0.1 [-0.7 ~ 0.5]



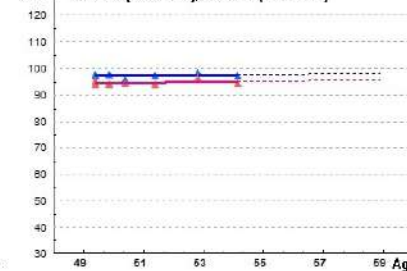
Inferior RNFL (μm/yr)

OD: 0.1 [-0.6 ~ 0.8]; OS: 0.3 [-0.4 ~ 1.0]



Average RNFL (μm/yr)

OD: 0.1 [-0.3 ~ 0.5]; OS: 0.1 [-0.4 ~ 0.7]



	OD			OS		
	First	Last	Diff	First	Last	Diff
Avg RNFL(μm)	97	97	0	95	94	-1
Superior RNFL(μm)	95	95	0	97	94	-3
Inferior RNFL(μm)	100	99	-1	93	93	0
Disc Area (mm ²)	1.66	1.64	-0.01	1.55	1.43	-0.12
Rim Area (mm ²)	1.23	1.24	0.01	1.37	1.23	-0.14
Cup Area (mm ²)	0.43	0.40	-0.02	0.18	0.20	0.02
C/D Area Ratio	0.26	0.25	-0.01	0.12	0.14	0.02
C/D V. Ratio	0.44	0.40	0	0.34	0.40	0

— OD
— OS

HD Angio Retina Trend Analysis

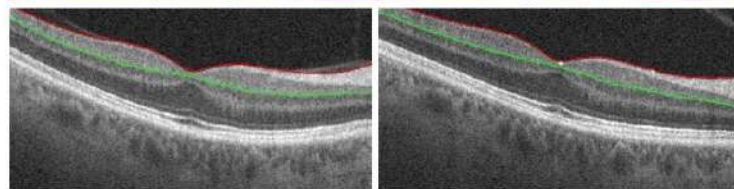
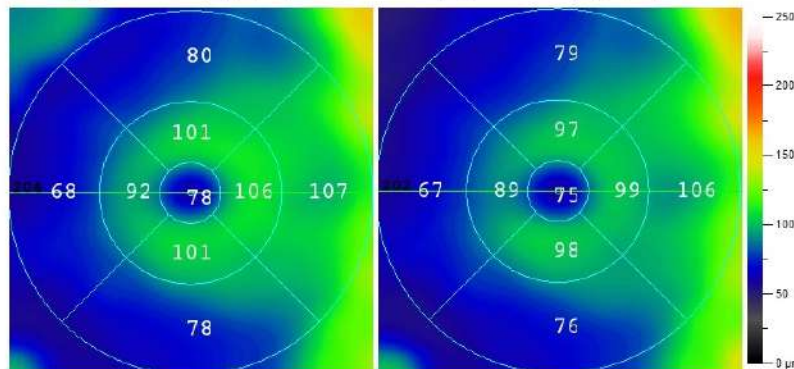
OD

OS

6.0 x 6.0 Scan Size (mm)

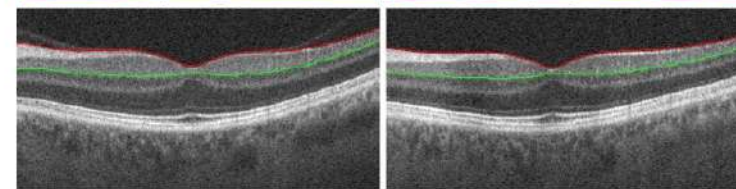
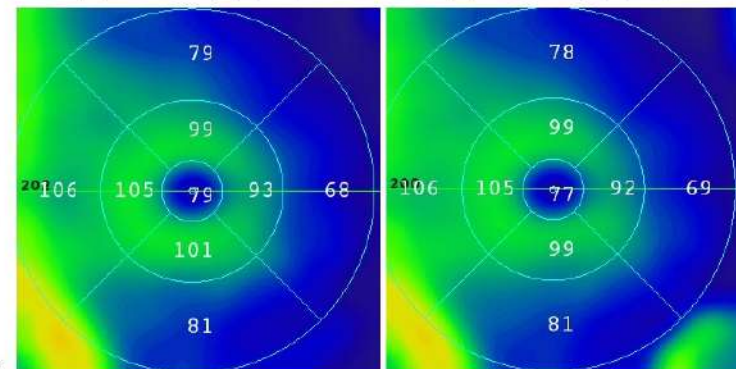
First: 09/26/2018 13:20:29; SQ: 8; 49 yrs

Last: 06/28/2023 11:45:15; SQ: 8; 54 yrs



First: 09/26/2018 14:00:23; SQ: 7; 49 yrs

Last: 06/28/2023 11:48:46; SQ: 8; 54 yrs



Thickness

☒ GCC

☐ Retina

Vessel

Density

☐ Superficial

☐ Deep

Measurement

☐ FAZ

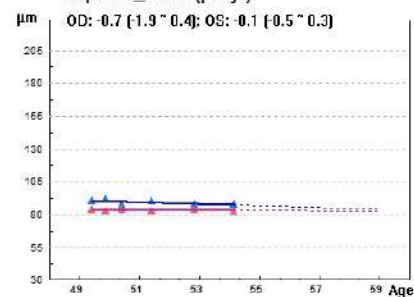
☒ Show Lines

☒ Show Bnd

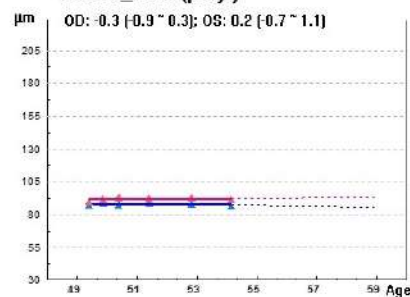
☒ Auto Zoom

☐ ☐

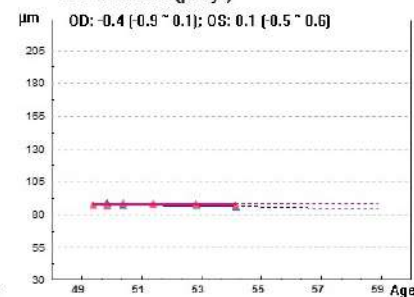
Superior_Hemi (μm/yr)



Inferior_Hemi (μm/yr)



ETDRS Grid (μm/yr)



	OD			OS		
Thickness(μm)	First	Last	Diff	First	Last	Diff
Superior_Hemi	90	87	-3	83	82	-1
Inferior_Hemi	87	86	-1	89	91	2
Whole Image	89	87	-2	86	86	0
ETDRS Grid	87	85	-2	87	87	0

— OD
— OS

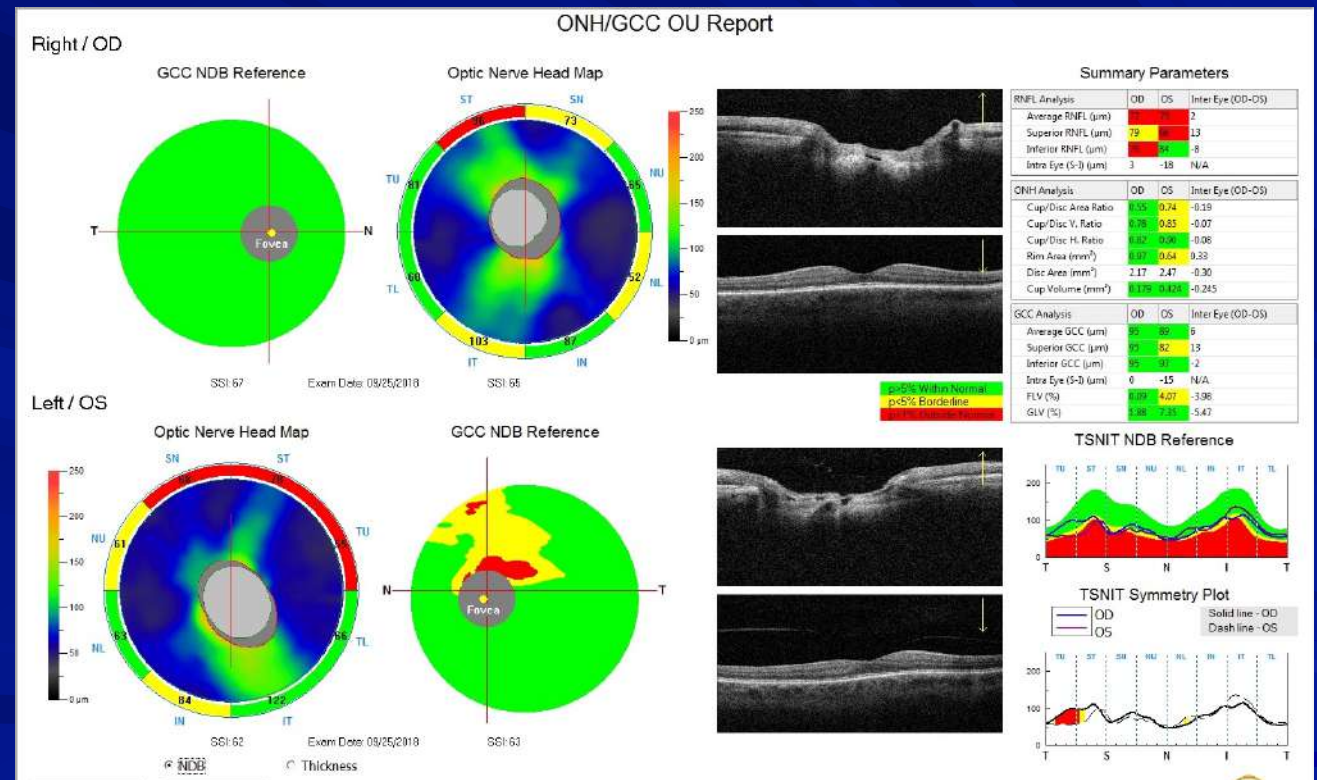
IOPs 38 and 32

- 👁️ Ocular hypertension versus glaucoma reviewed with patient
- 👁️ OCT results reviewed with patient
- 👁️ Patient elects to monitor
 - ★ RTC in 4 months for IOP ck and Visual Field 24-2 OU

OCT NFL and GCC 9-25-2018

Question

This GCC is most likely
Real Disease
or
Physiologically Normal



79-year-old man

POAG, OS > OD

Lumigan 0.01% QD OU

Combigan BID OU

Changed to Cosopt (generic)

★ June 2020 due to insurance

★ Did get

NAME: E C				FAMILY HISTORY: YES _____ NO _____			
REFERRED BY:				TMAXX: 38/35			
BASELINE IOP: 38/35		TARGET IOP: ≤ 20		PACHYMETRY: 541 527			

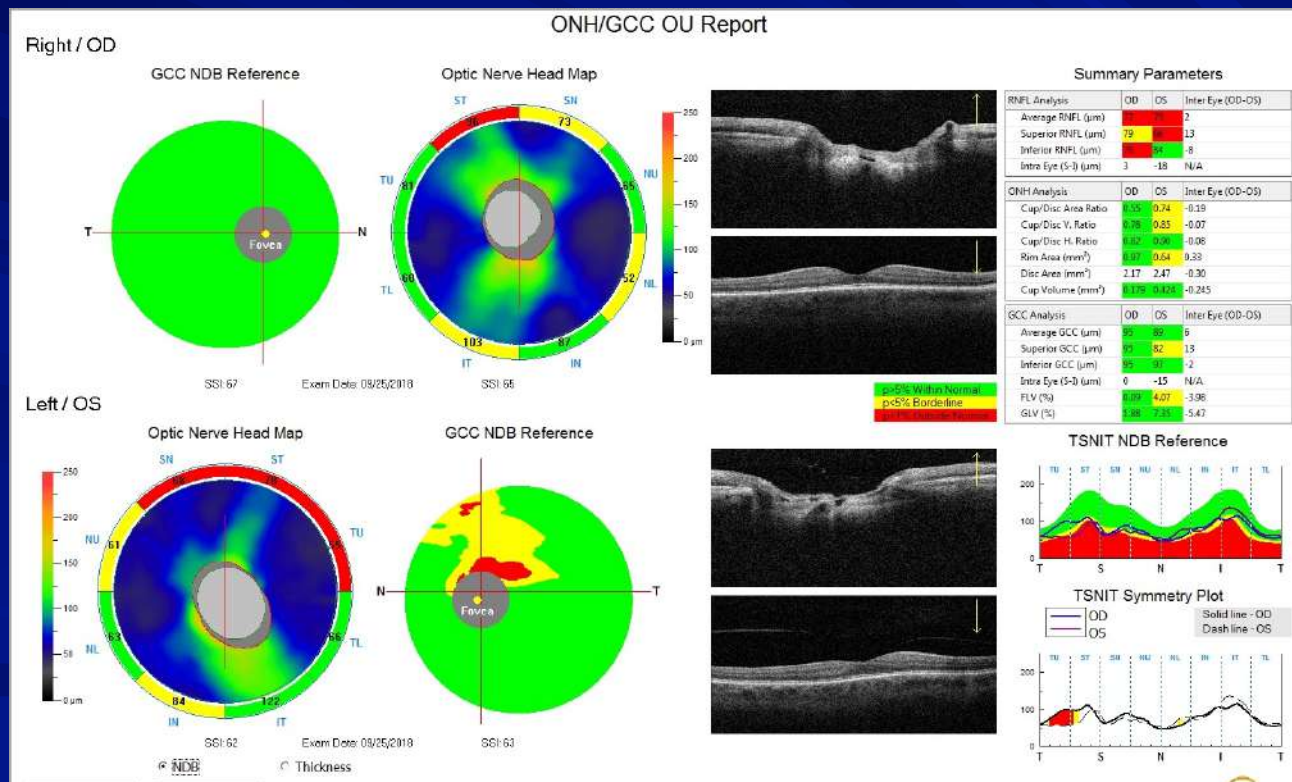
TEST	DATE	DATE	DATE	DATE	DATE	DATE	DATE
VISUAL FIELD	1-29-20	1-29-2020	2/14/22	3/22/23			
OCT	9-25-18	9-30-2020	6/5/21	6/14/22	7/26/23		
OCT-A	9-30-18	9-30-2020					
GONIO	5-28-19	5-27-2020	10/8/21	11-3-22			
DFE	9-30-19	9-30-2020	6/5/21	6/14/22	7/26/23		
PHOTOS	5-30-19	9-25-2020	6/5/21	11-3-22			
EHR 1-11-2012							
NOTES:							

TEST	DATE	DATE	DATE	DATE	DATE	DATE	DATE
VISUAL FIELD							
OCT							
OCT-A							
GONIO							
DFE							
PHOTOS							
NOTES:							

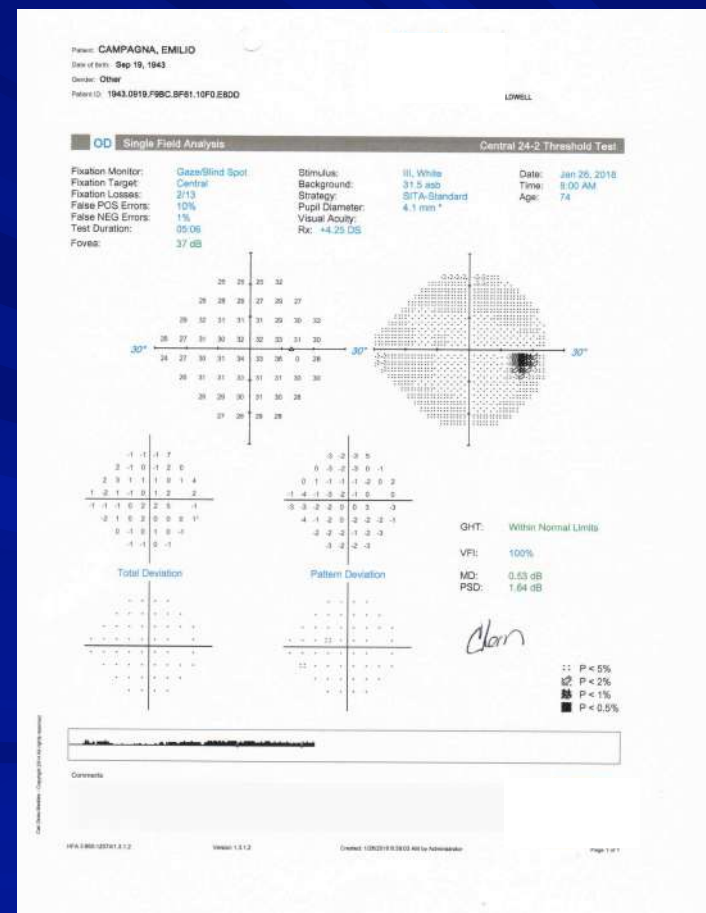
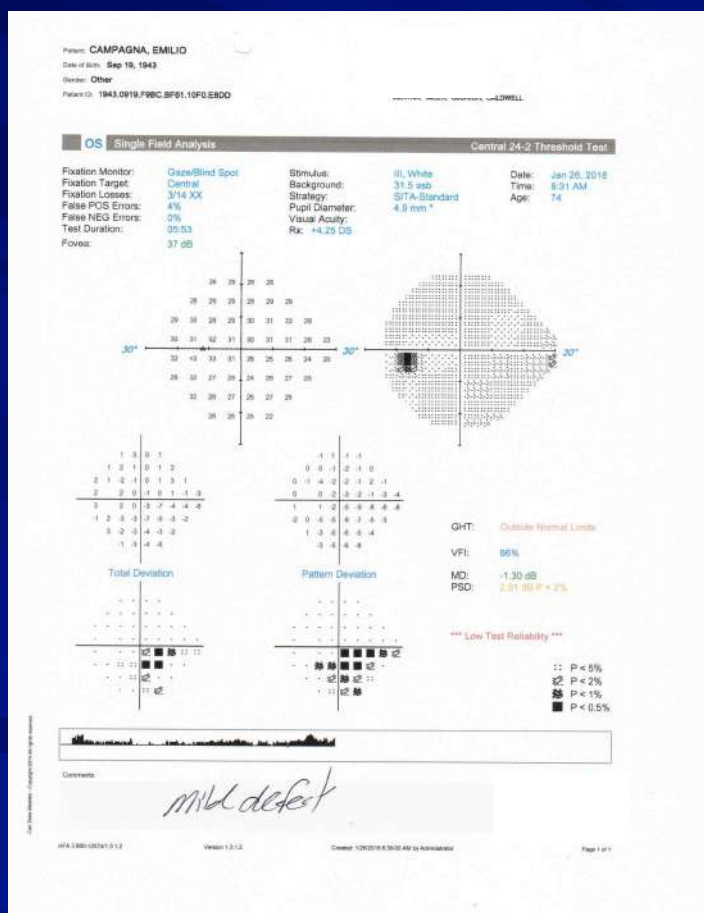
ENI
DFE
VF
OCT
gonio
Photo.
Pach.
OCT-A
Boehl
Target

9-30-19
9-25-18
18, 1-25-19
17, 9-25-18
9-3-19
1/21/22

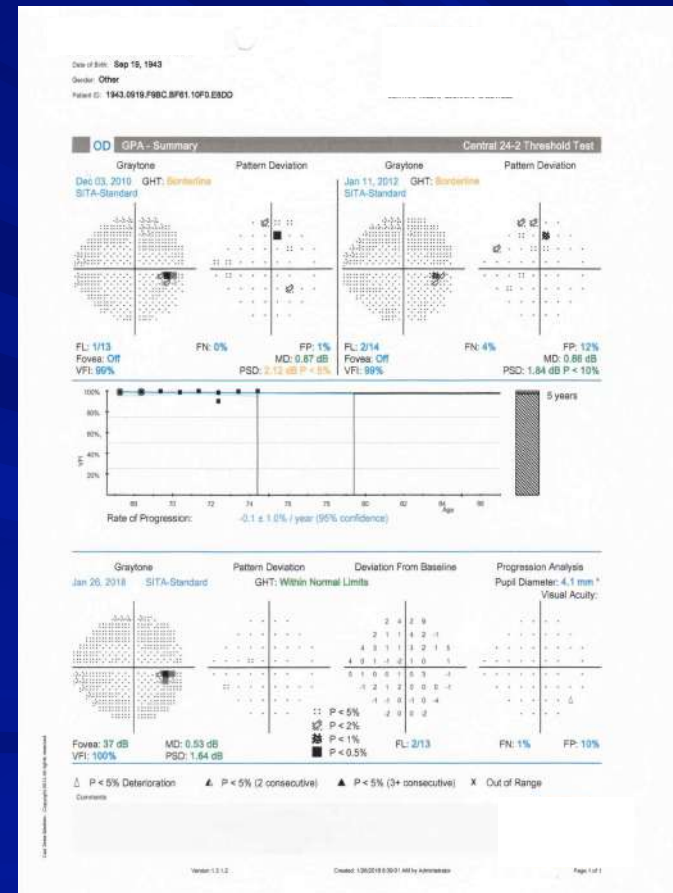
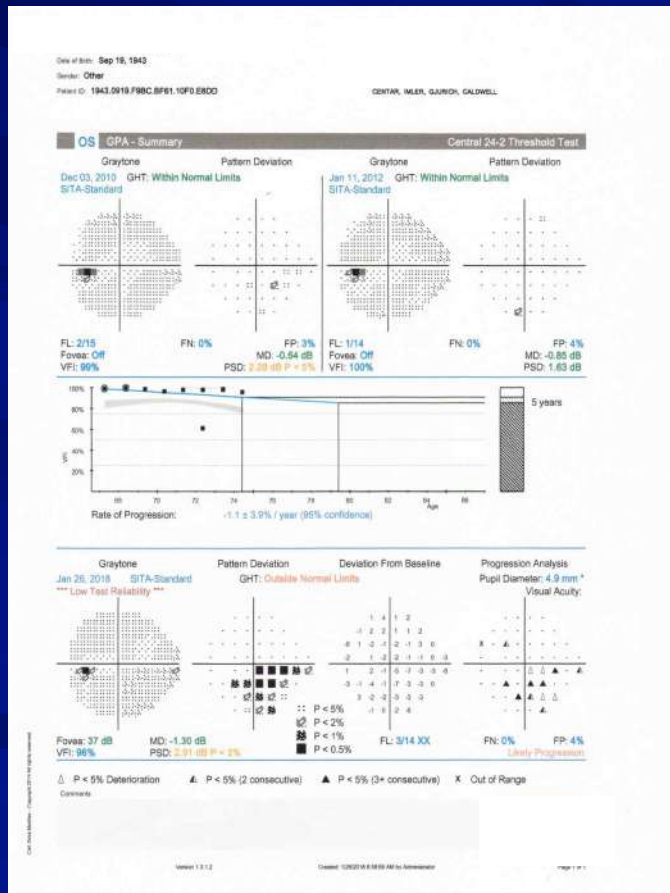
OCT NFL and GCC 9-25-2018



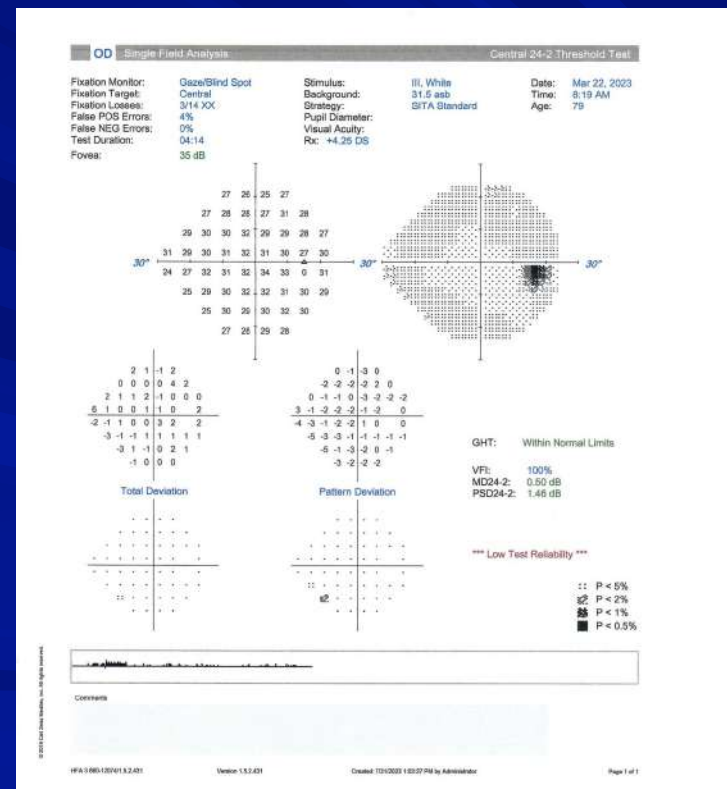
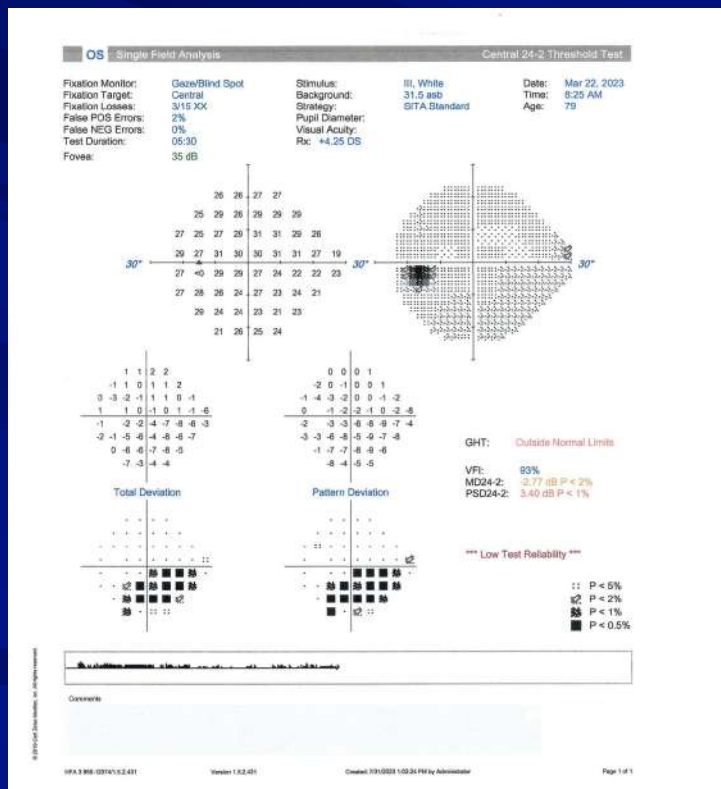
VF OD and OS 1-26-2018



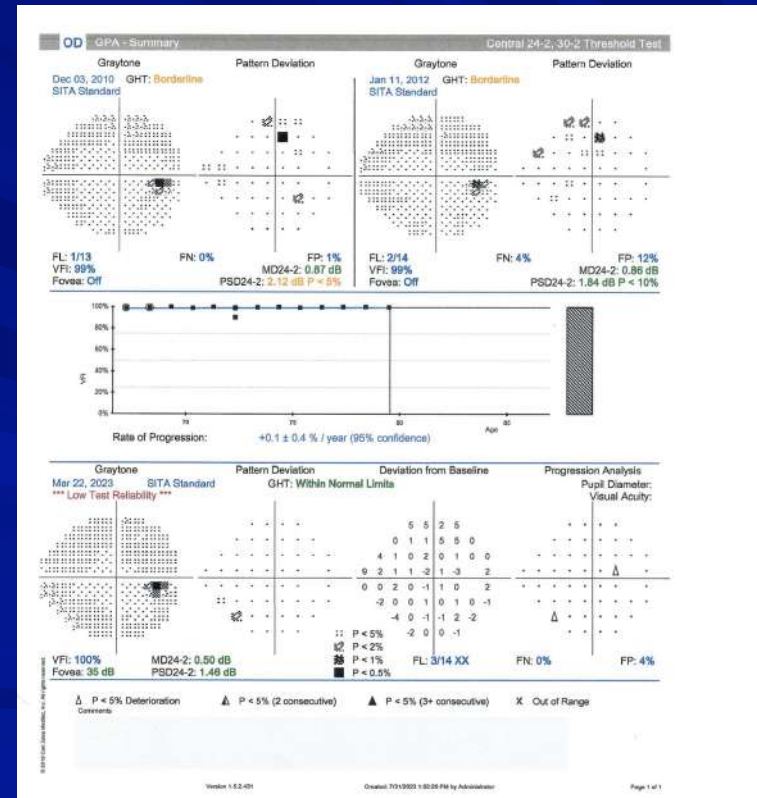
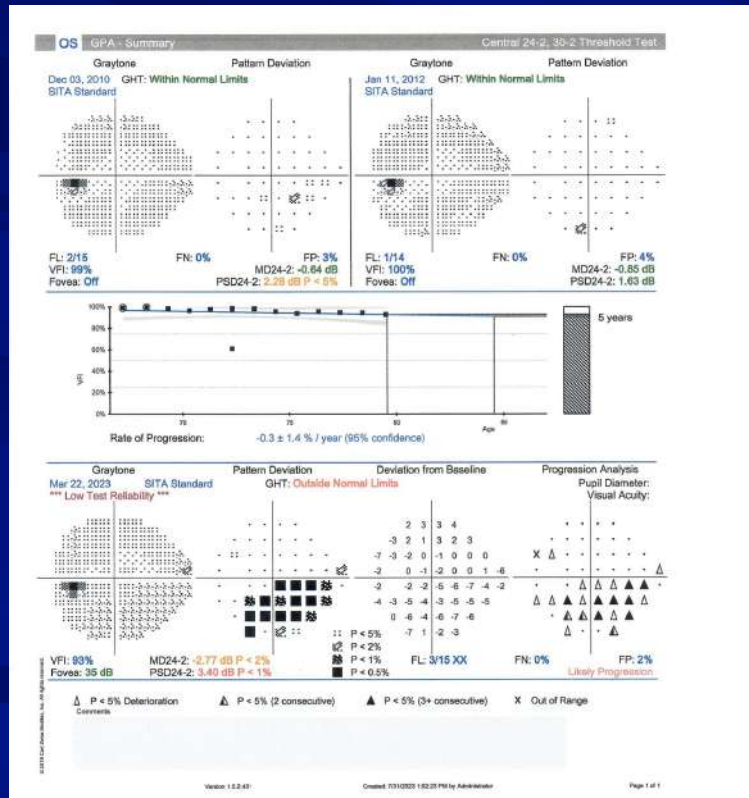
VF OD and OS GPA 1-26-2018



March 22, 2023

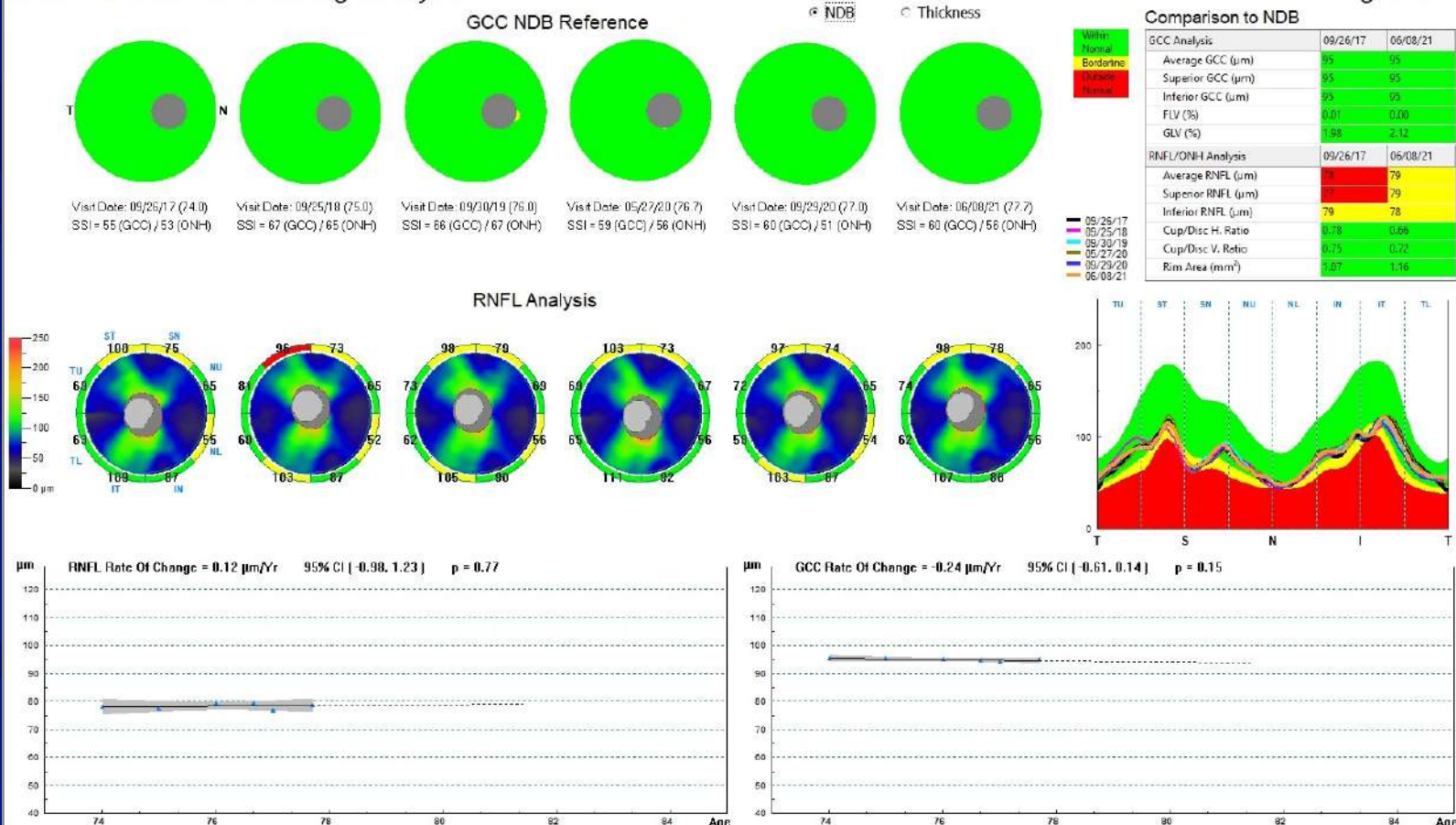


12-03-2010 to 3-22-2023



Update 2021- June 8, 2021

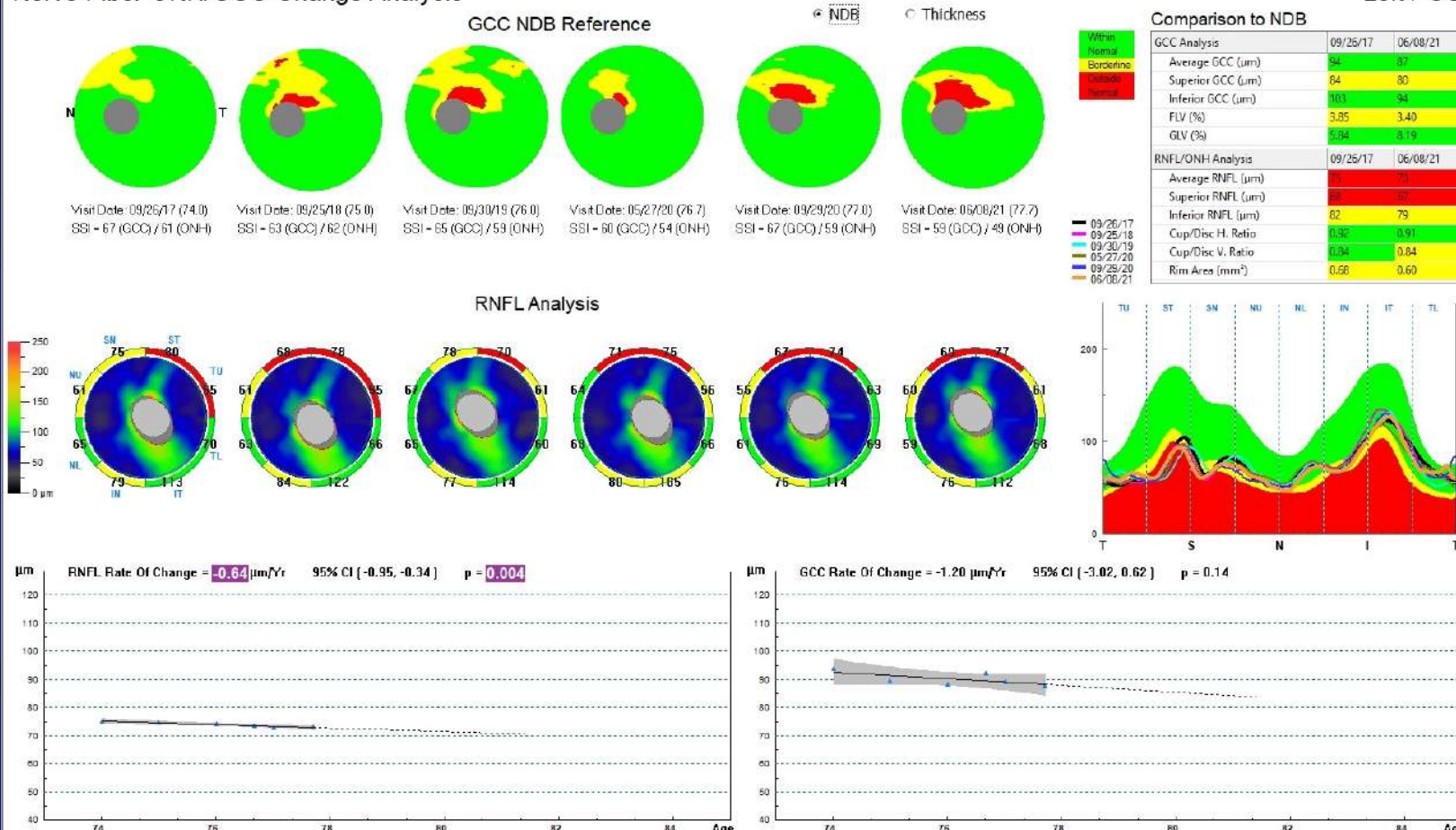
Nerve Fiber ONH/GCC Change Analysis



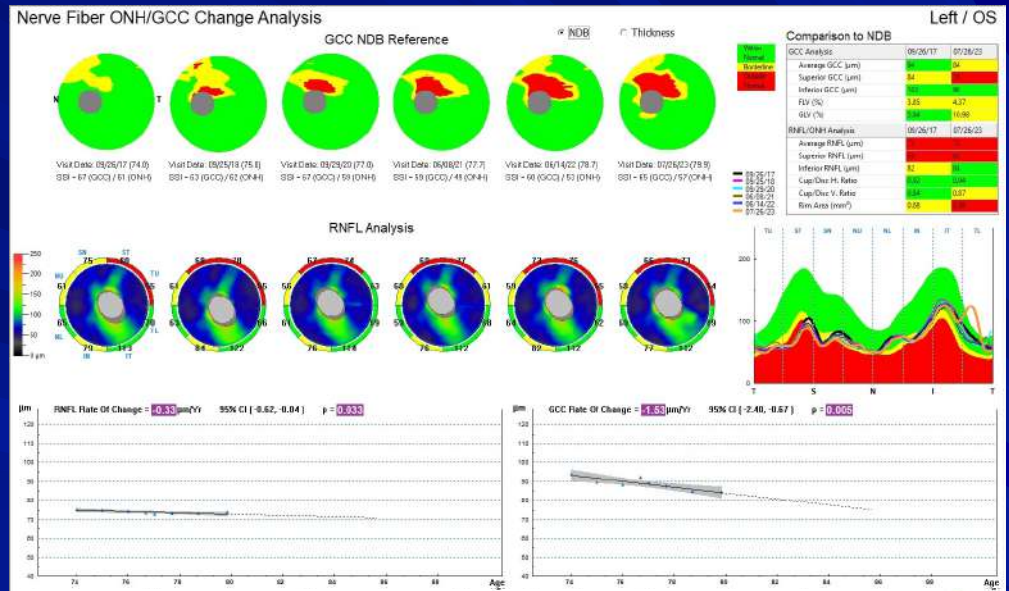
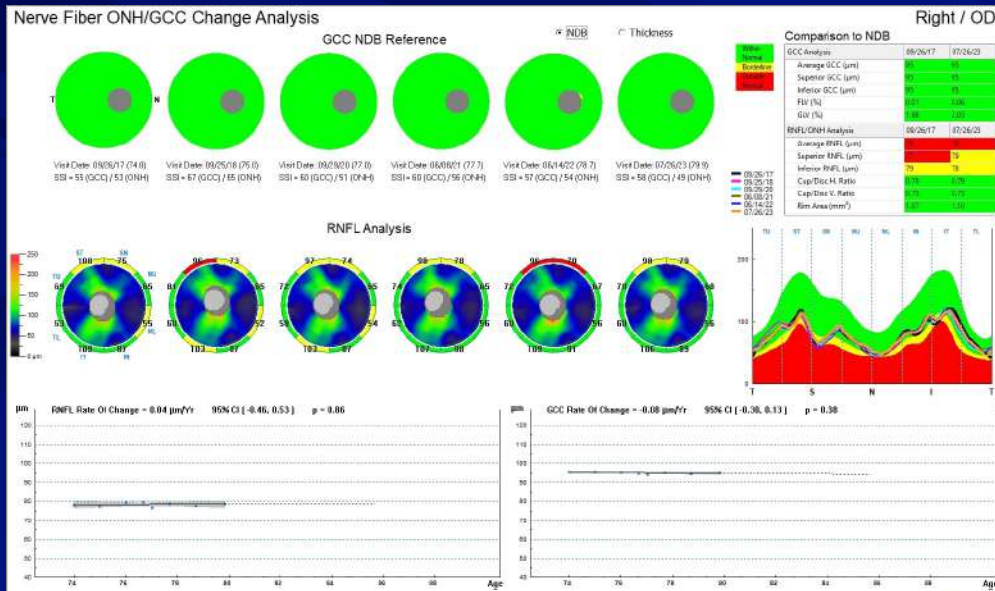
Update 2021- June 8, 2021

Nerve Fiber ONH/GCC Change Analysis

Left / OS

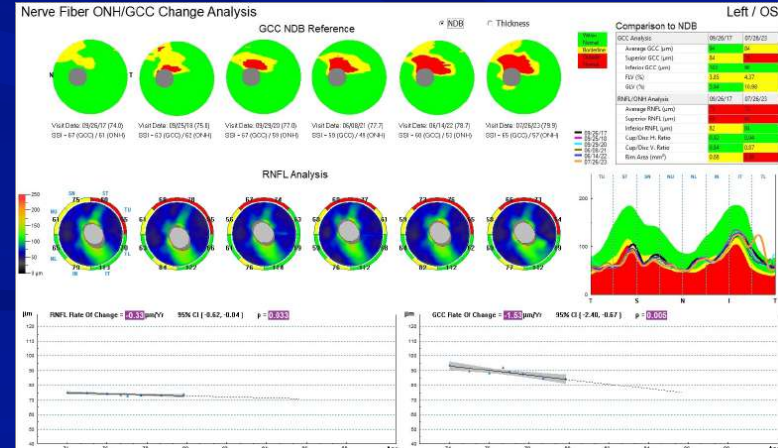
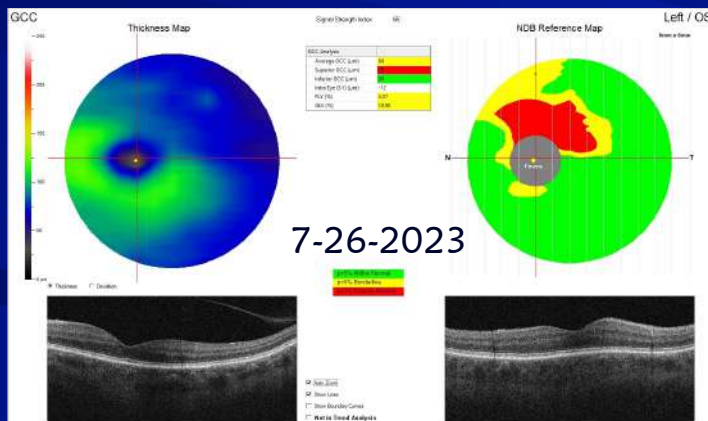
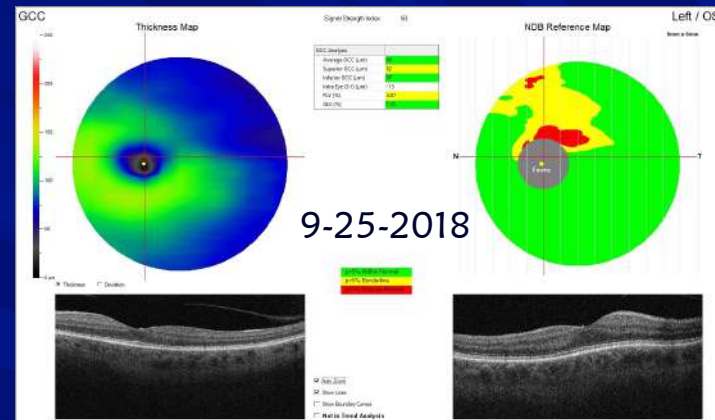
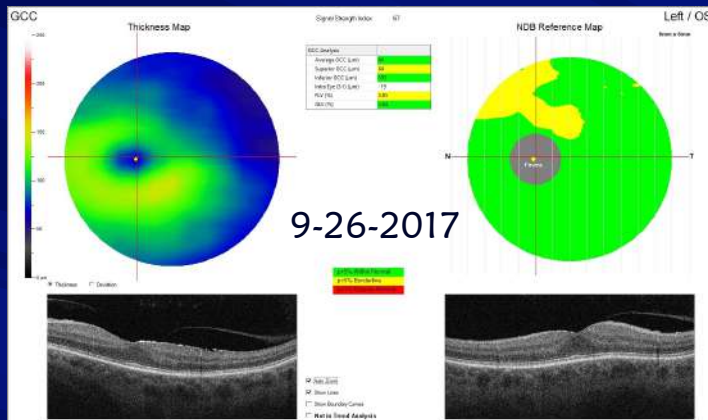


Change Analysis NFL-GCC

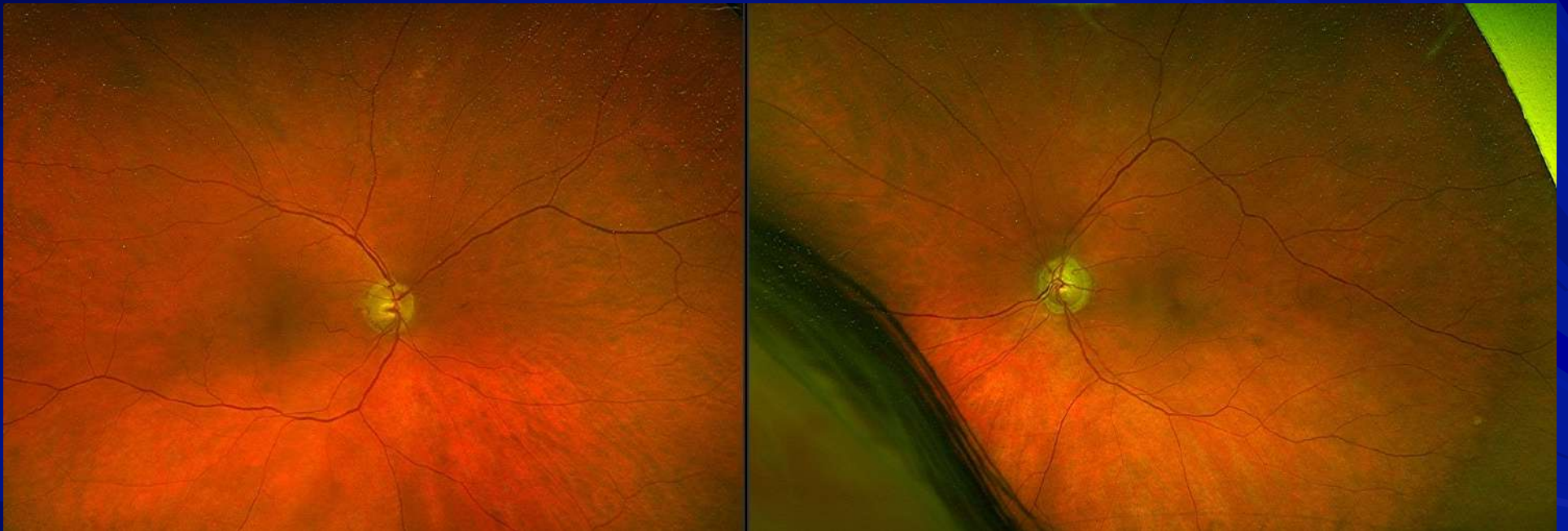


Do you see the OS GCC change?
Thoughts?

Thoughts?



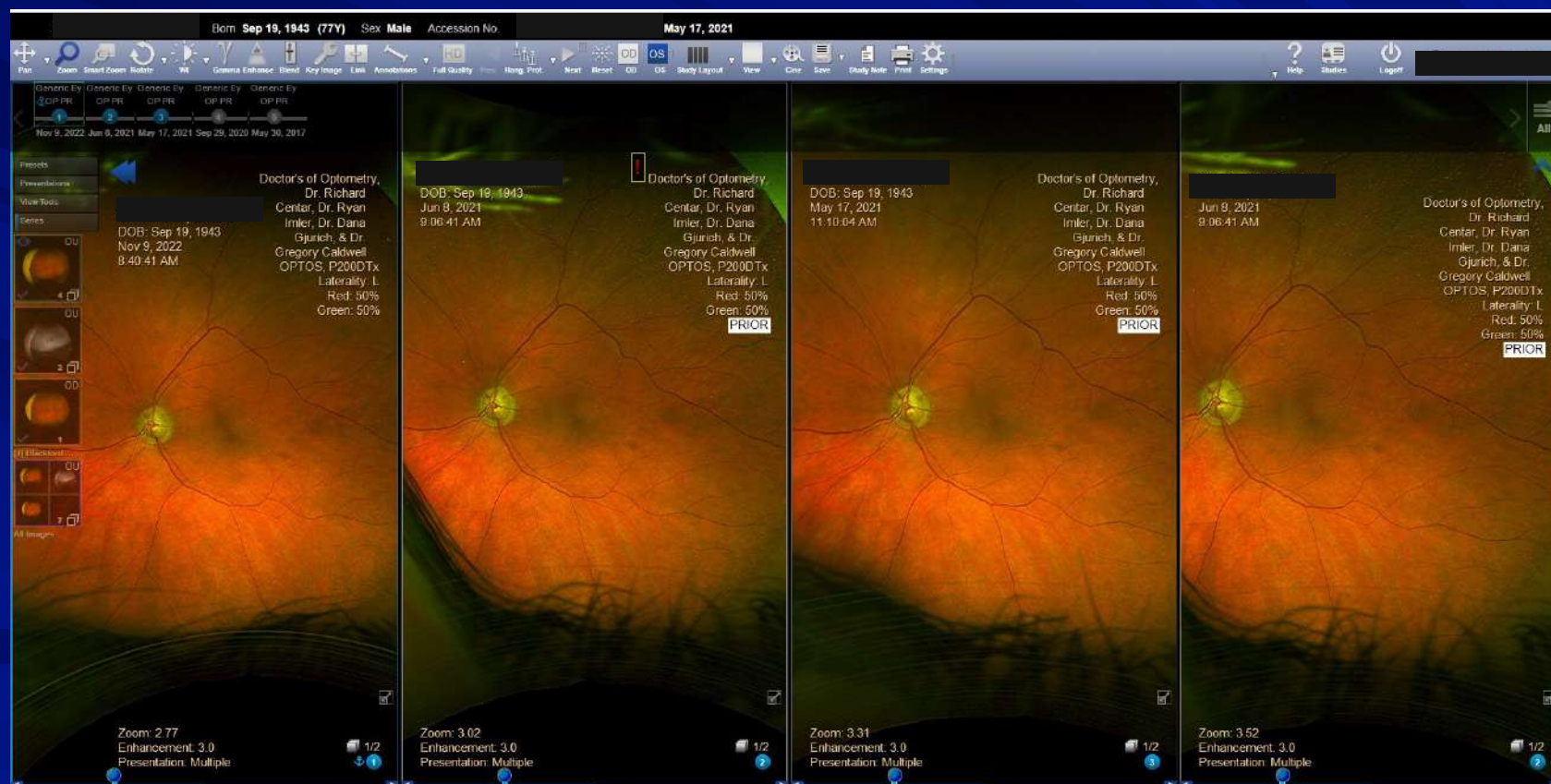
Update 2021- June 8, 2021



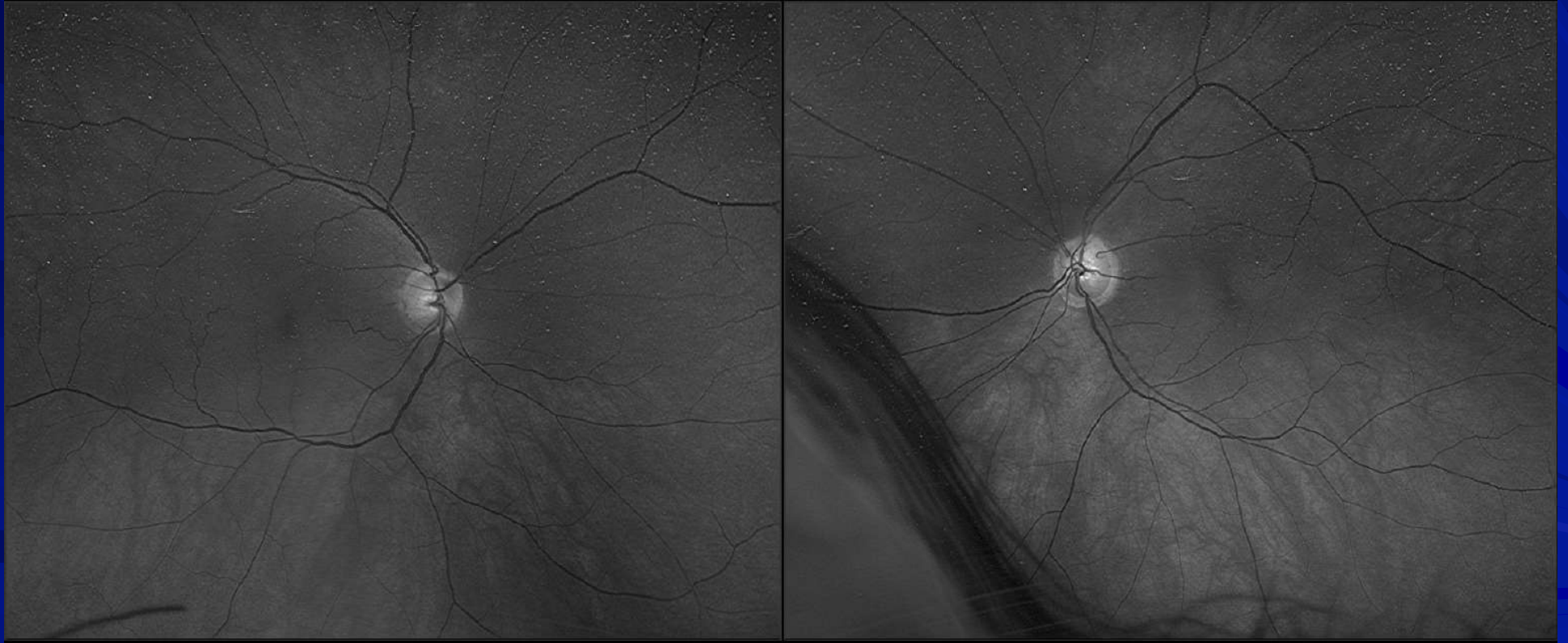
2017 - 2022



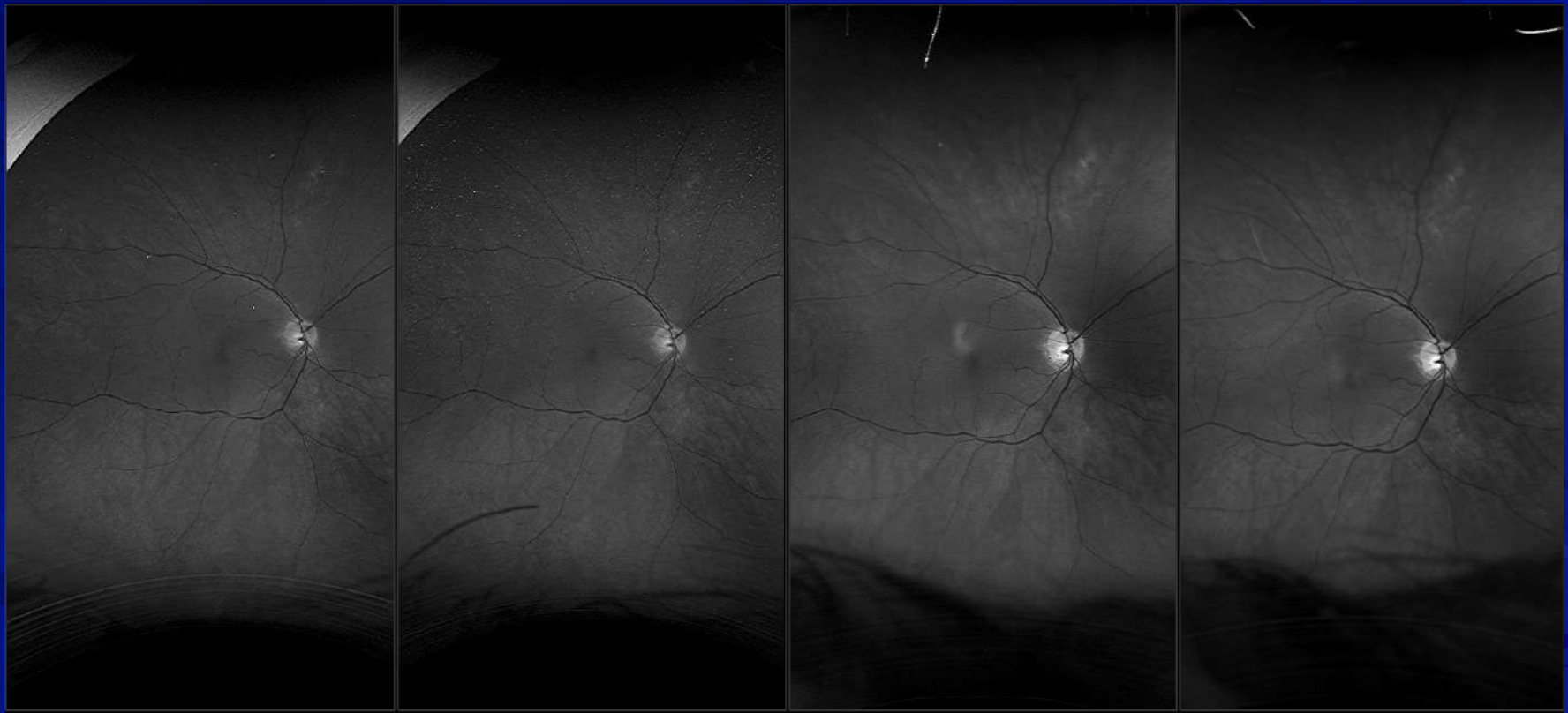
2017 - 2022



Update 2021- June 8, 2021



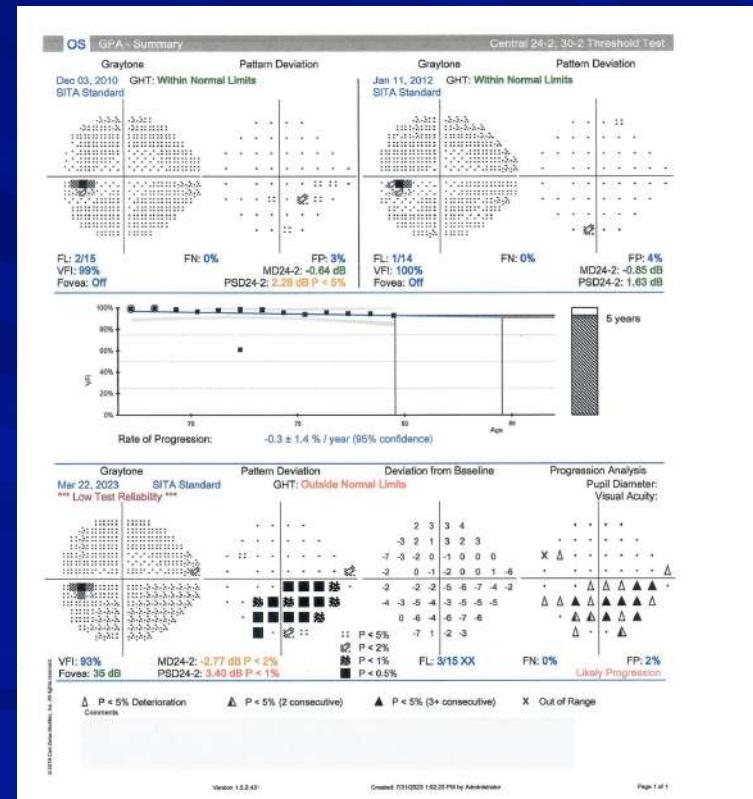
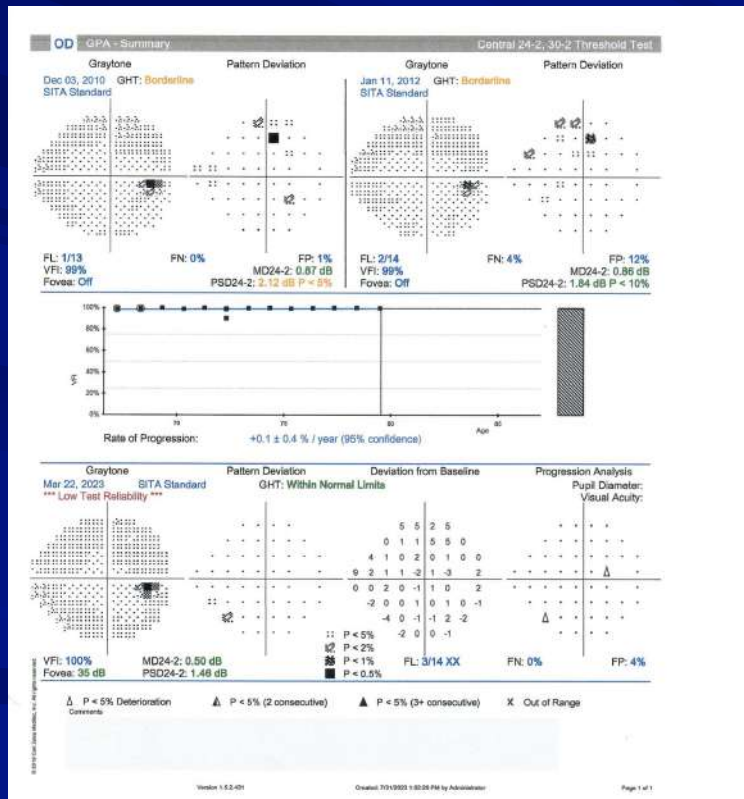
2022 – 2017



2022 – 2017

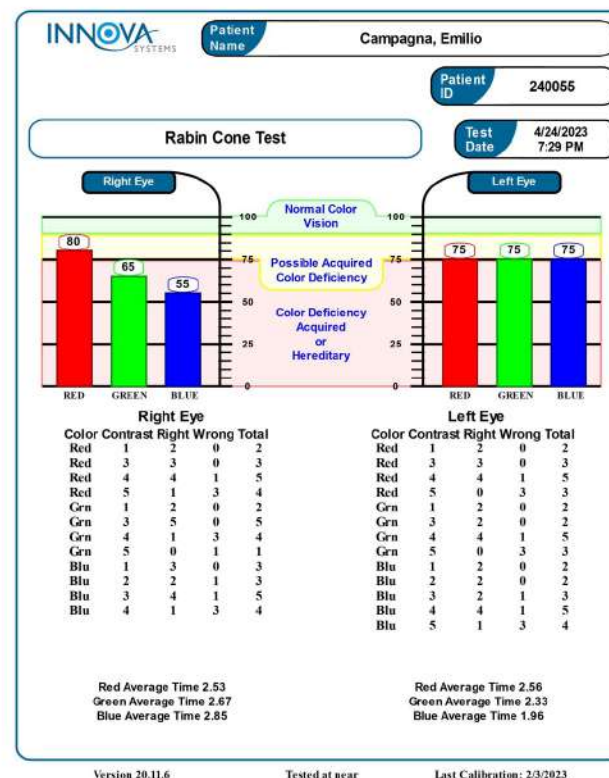


12-03-2010 to 3-22-2023



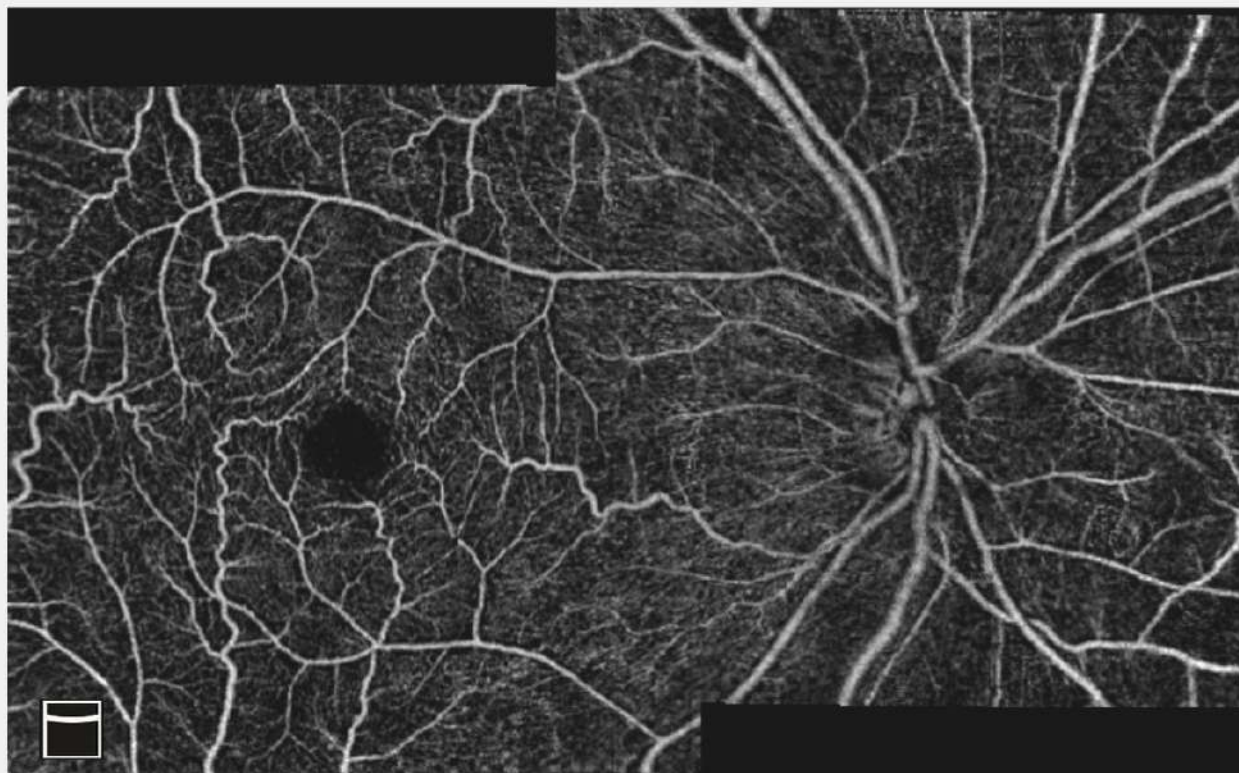
Rabin Color Vision

Cataract OD > OS



Montage OD

Angio Montage



Right / OD

Exit

OverView

Print

Reset View

☐ Edit

Montage Display

☒ Vitreous/Retina

☐ Outer/Choroid

Layers:

Vitreous

Superficial

Deep

☐ Greyscale

Click image to
select layer.
Use scrollwheel
to adjust layer.

Montage OS

Angio Montage



Left / OS

Exit

OverVue

Print

Reset View

☐ Edit

Montage Display

☒ Vitreous/Retina

☐ Outer/Choroid

Layers:

Vitreous

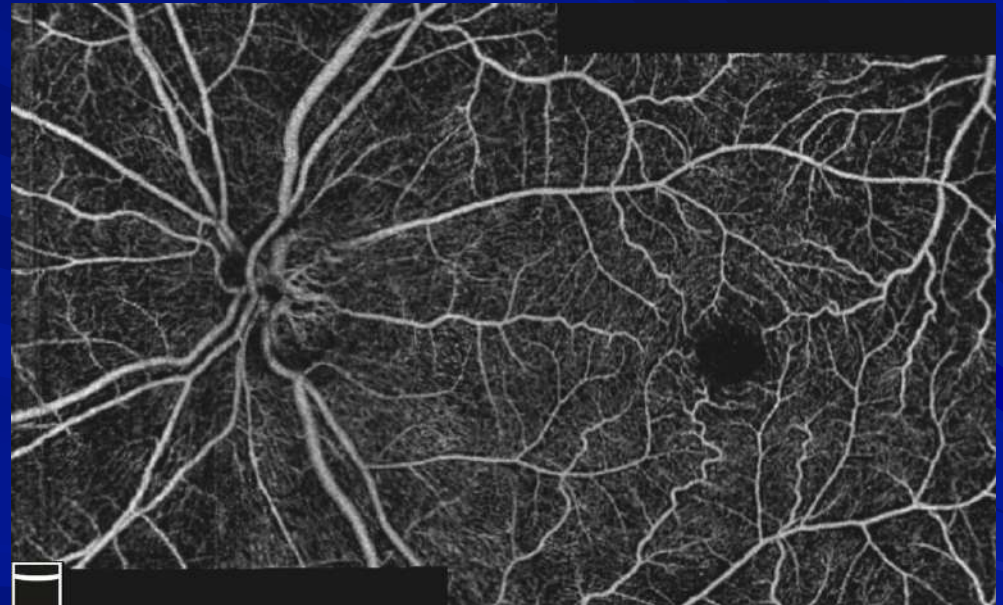
Superficial

Deep

☐ Grayscale

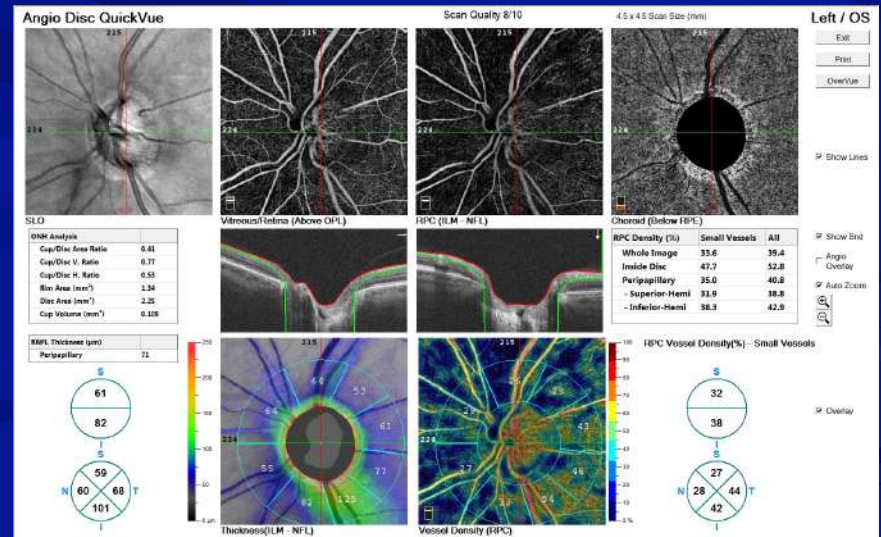
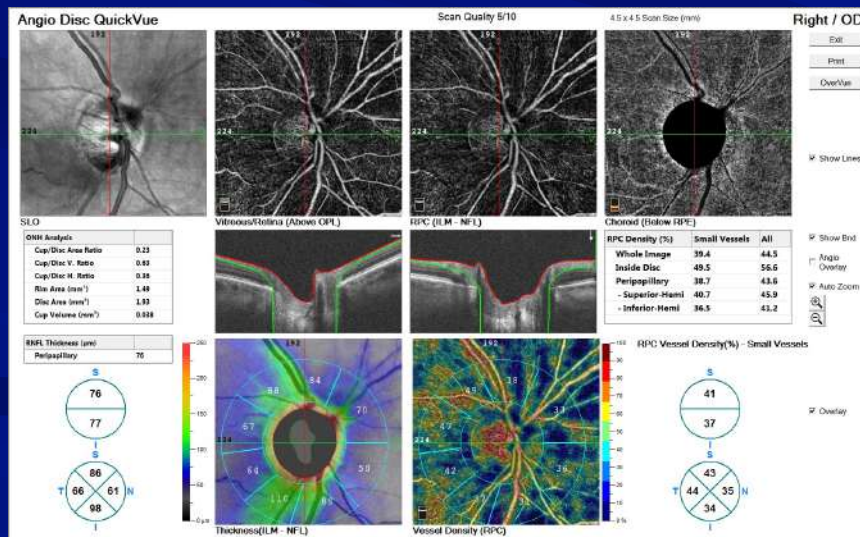
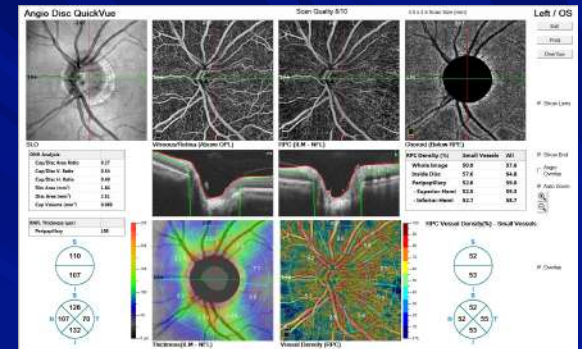
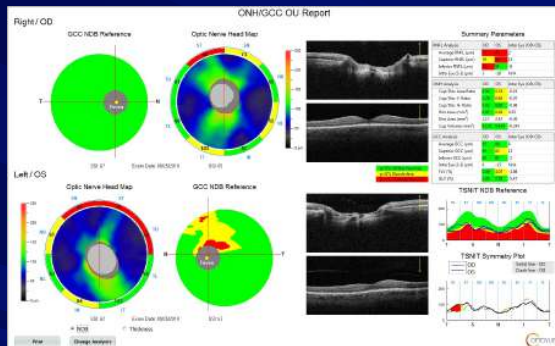
Click image to
select layer.
Use scrollwheel
to adjust layer.

Montage OU

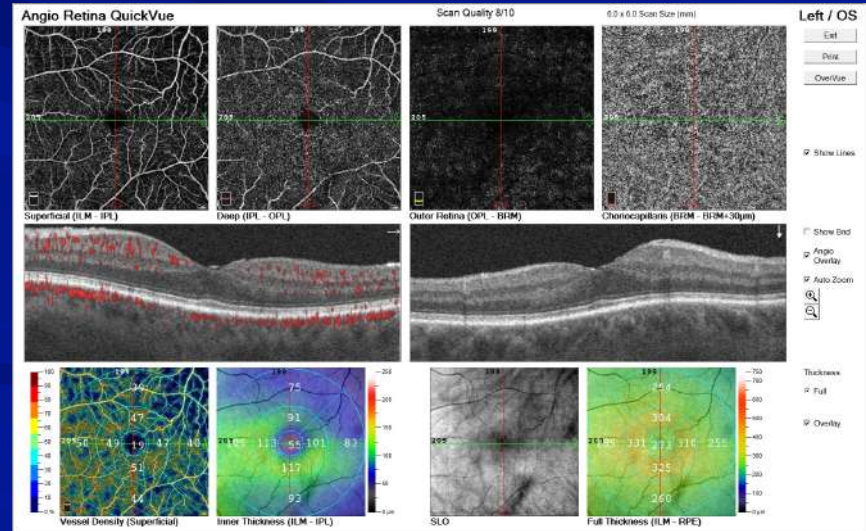
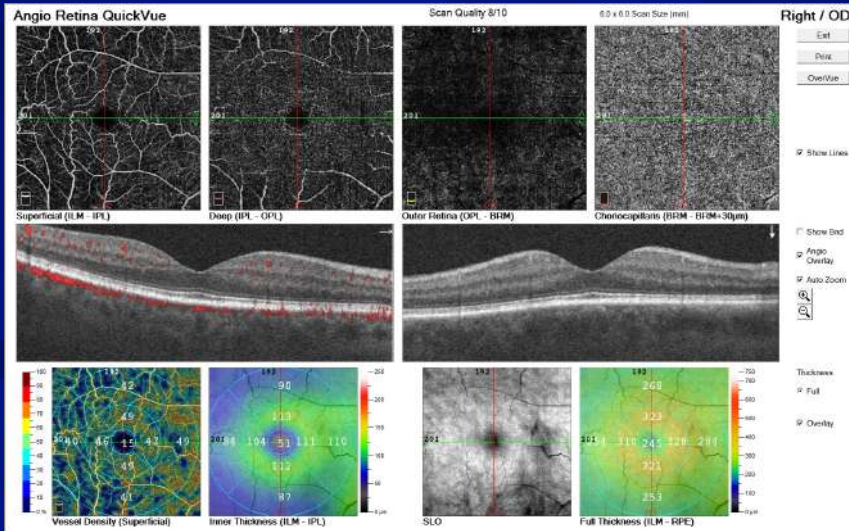
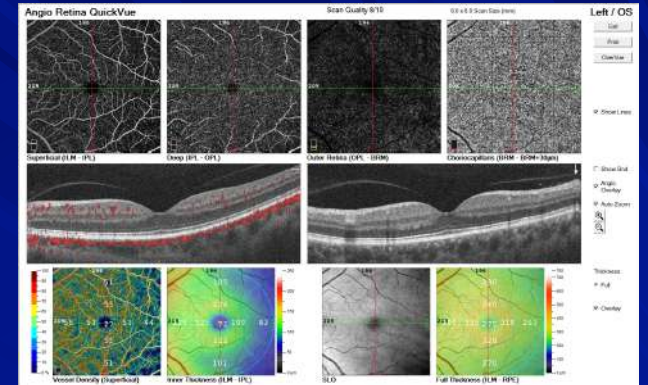
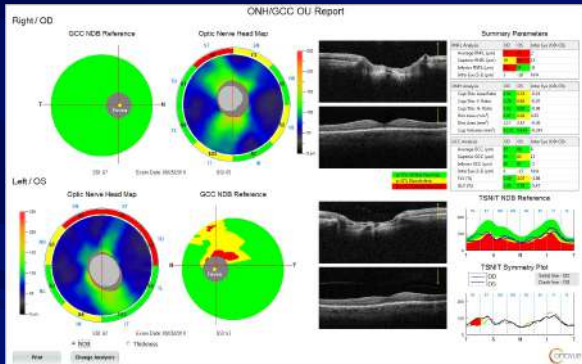


OCT-A 9-25-2018

POAG OS > OD



OCT-A 9-25-2018
POAG OS > OD



Update 2023

HD Angio Disc Trend Analysis

OD

OS

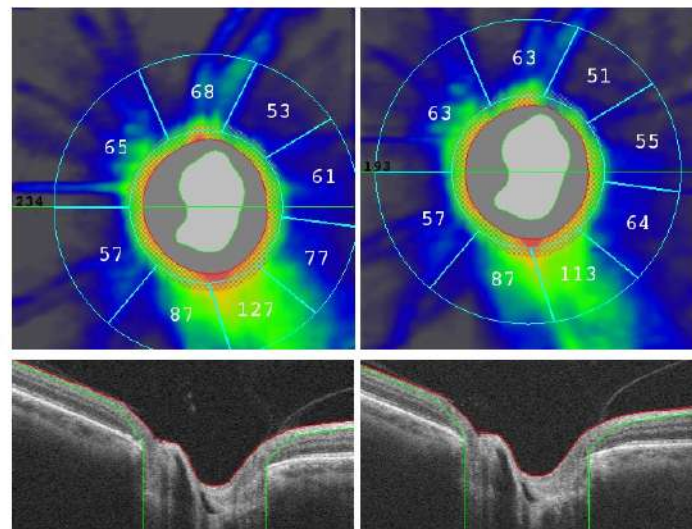
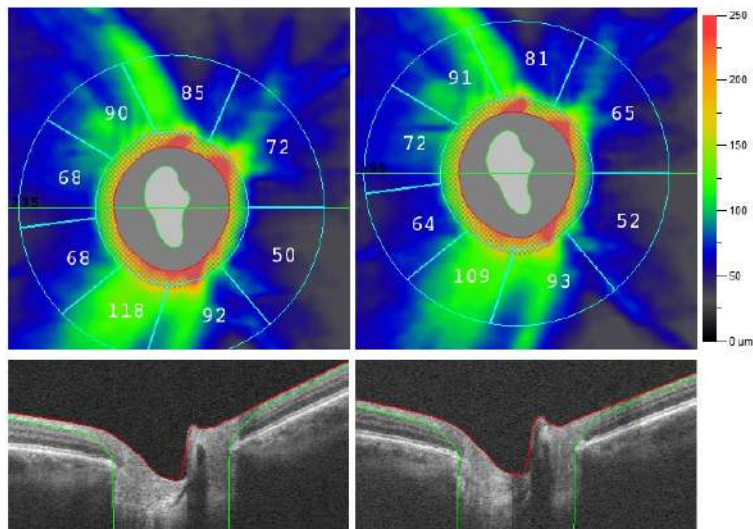
4.5 x 4.5 Scan Size (mm)

First: 09/26/2018 10:01:37; SQ: 8; 75 yrs

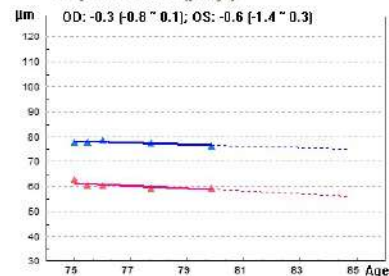
Last: 08/09/2023 14:44:41; SQ: 7; 80 yrs

First: 09/26/2018 10:04:04; SQ: 8; 75 yrs

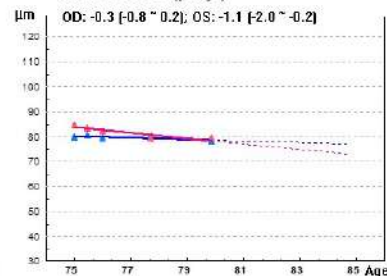
Last: 08/09/2023 14:48:42; SQ: 7; 80 yrs



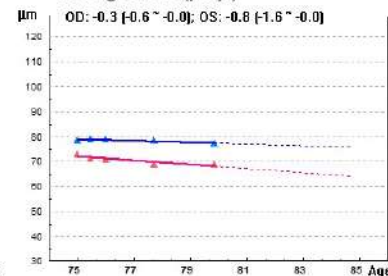
Superior RNFL (μm/yr)



Inferior RNFL (μm/yr)



Average RNFL (μm/yr)



	OD			OS		
	First	Last	Diff	First	Last	Diff
Avg RNFL (μm)	78	77	-1	73	68	-5
Superior RNFL (μm)	77	76	-1	62	59	-3
Inferior RNFL (μm)	79	78	-1	84	79	-5
Disc Area (mm ²)	1.92	1.93	0.01	2.23	2.23	-0.00
Rim Area (mm ²)	1.50	1.49	-0.01	1.34	1.26	-0.08
Cup Area (mm ²)	0.42	0.44	0.02	0.89	0.96	0.07
C/D Area Ratio	0.22	0.23	0.01	0.40	0.43	0.03
C/D V. Ratio	0.35	0.35	0	0.52	0.54	0

— OD
 — OS

Update 2023

HD Angio Disc Trend Analysis

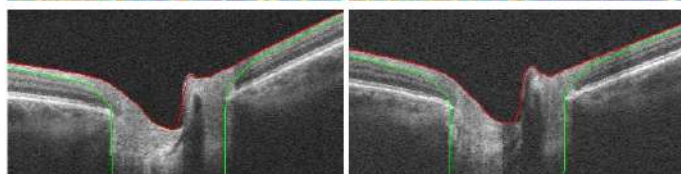
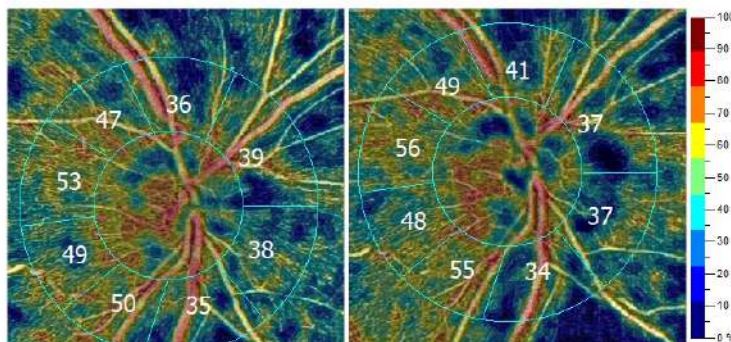
OD

OS

4.5 x 4.5 Scan Size (mm)

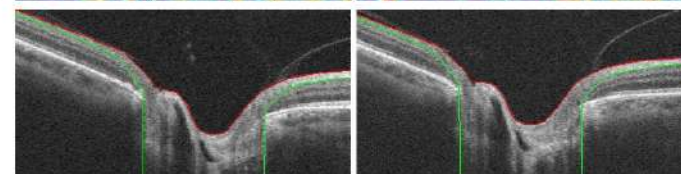
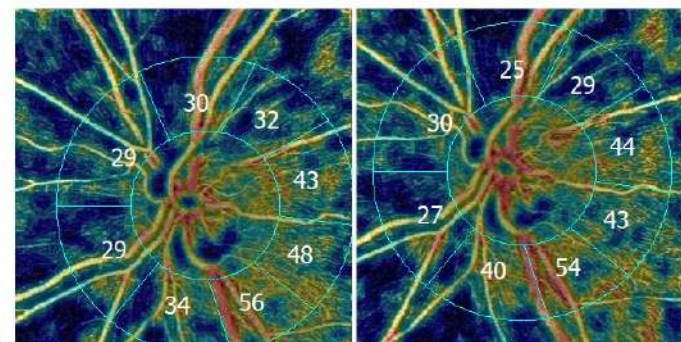
First: 09/26/2018 10:01:37; SQ: 8; 75 yrs

Last: 08/09/2023 14:44:41; SQ: 7; 80 yrs



First: 09/26/2018 10:04:04; SQ: 8; 75 yrs

Last: 08/09/2023 14:48:42; SQ: 7; 80 yrs



Thickness

○ RNFL

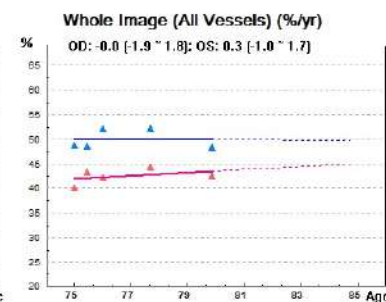
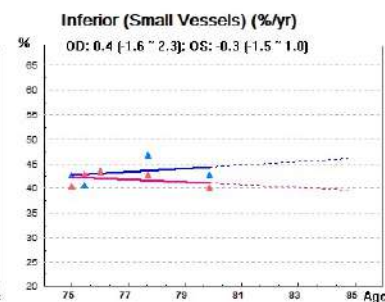
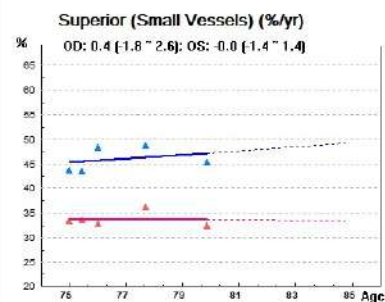
Vessel
Density

● RPC

☒ Show Lines

☒ Show Bnd

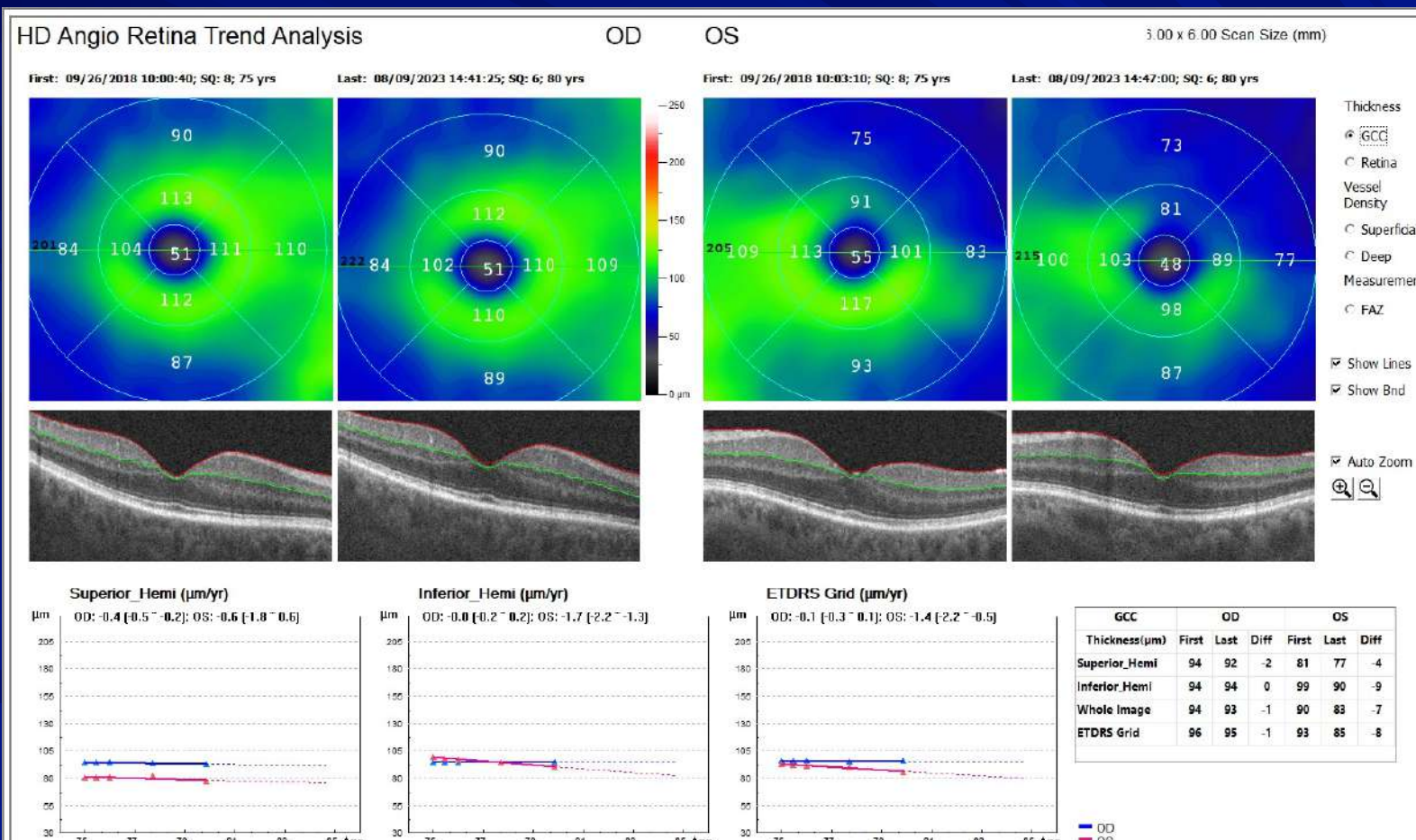
☒ Auto Zoom



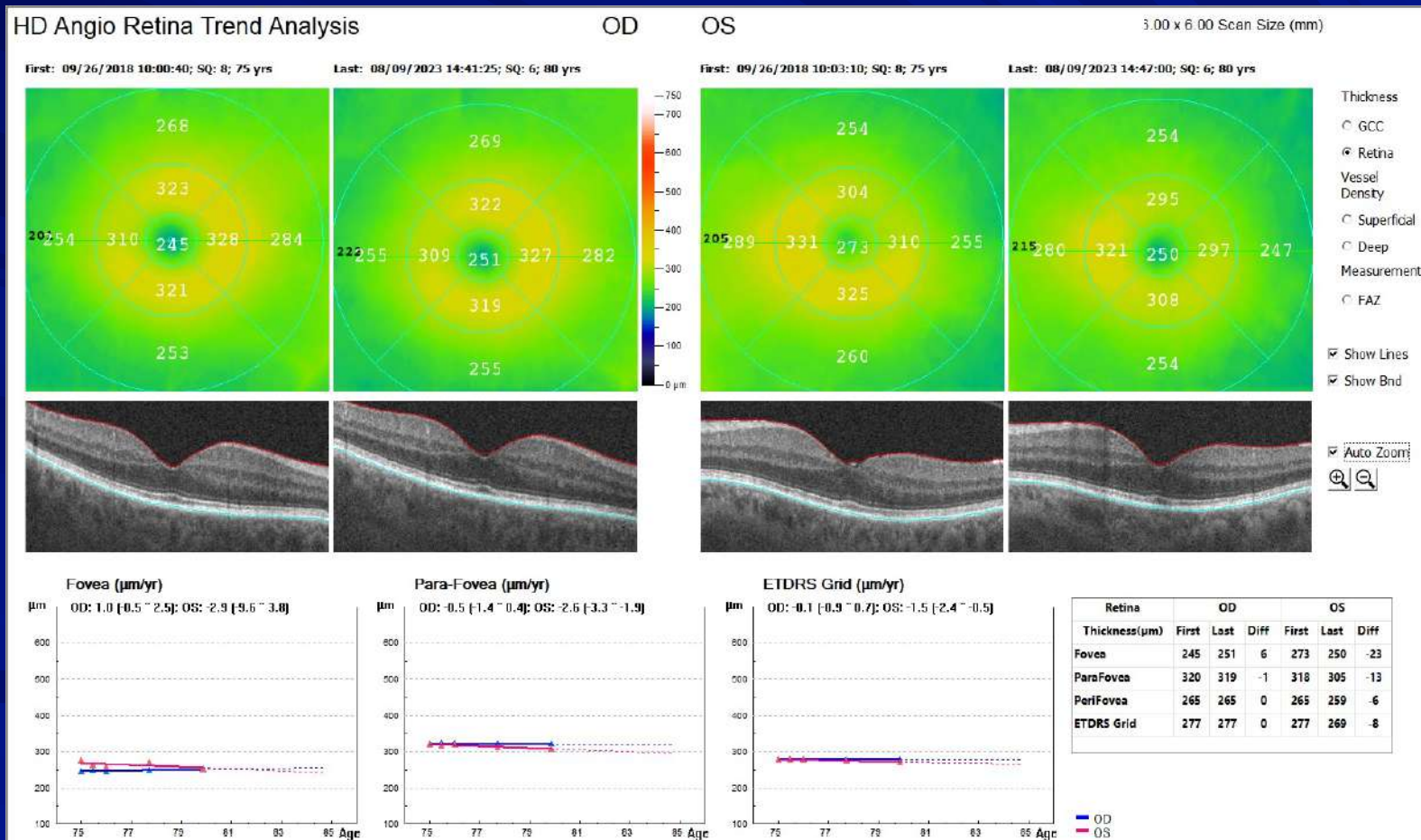
Vessel	OD			OS		
	First	Last	Diff	First	Last	Diff
Superior (Small)	43.5	45.2	1.7	33.2	32.1	-1.1
Inferior (Small)	42.4	42.4	0.0	40.3	39.9	-0.3
Average (Small)	43.0	43.9	0.9	36.6	35.9	-0.7
Whole Image (All)	46.5	48.2	-0.4	39.8	42.2	2.4

— OD
— OS

Update 2023



Update 2023



Update 2023

HD Angio Retina Trend Analysis

OD

OS

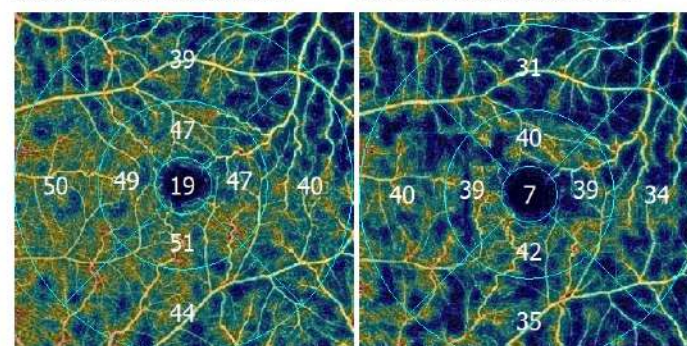
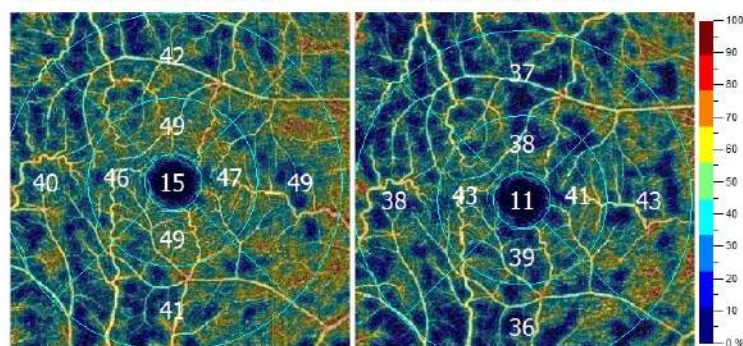
6.0 x 6.0 Scan Size (mm)

First: 09/26/2018 10:00:40; SQ: 8; 75 yrs

Last: 08/09/2023 14:41:25; SQ: 6; 80 yrs

First: 09/26/2018 10:03:10; SQ: 8; 75 yrs

Last: 08/09/2023 14:47:00; SQ: 6; 80 yrs



Thickness

☐ GCC

☐ Retina

Vessel
Density

☒ Superficial

☐ Deep

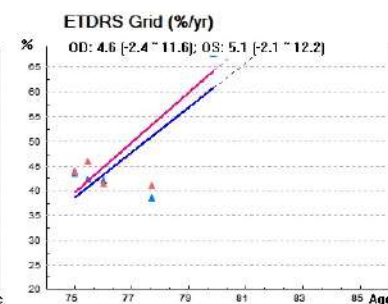
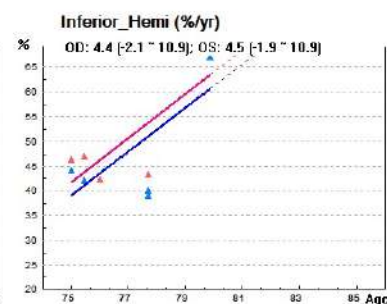
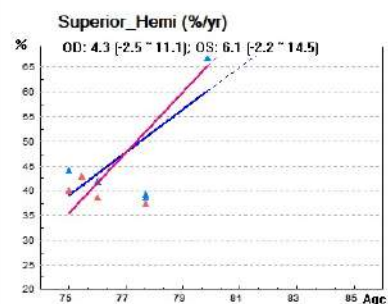
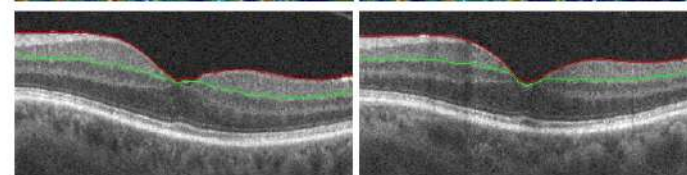
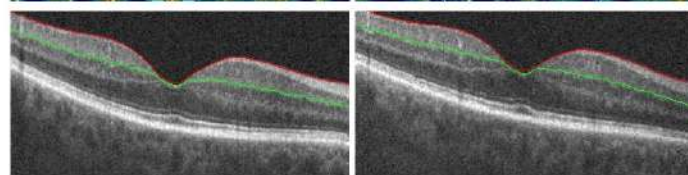
Measurement

☐ FAZ

☒ Show Lines

☒ Show Bnd

☒ Auto Zoom



Vessel	OD			OS		
Density(%)	First	Last	Diff	First	Last	Diff
Superior_Hemi	43.8	66.7	22.8	39.8	73.2	33.4
Inferior_Hemi	44.0	66.8	22.8	46.1	69.4	23.3
Whole Image	43.9	66.7	22.8	42.9	71.5	28.6
ETDRS Grid	43.4	67.6	24.2	43.8	71.1	27.3

— OD
— OS

Update 2023

HD Angio Retina Trend Analysis

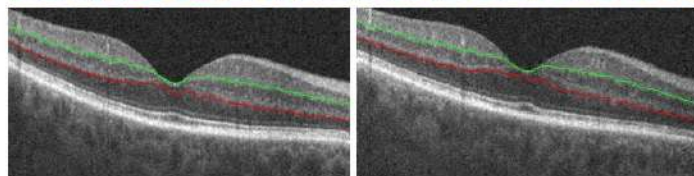
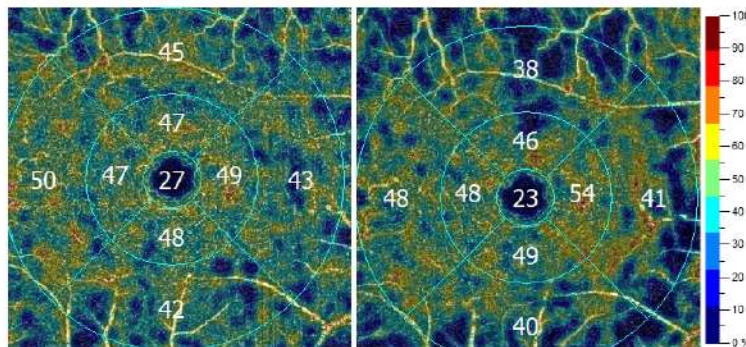
OD

OS

6.0 x 6.0 Scan Size (mm)

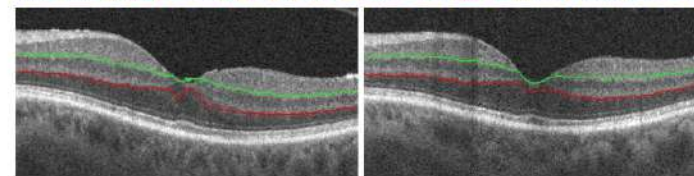
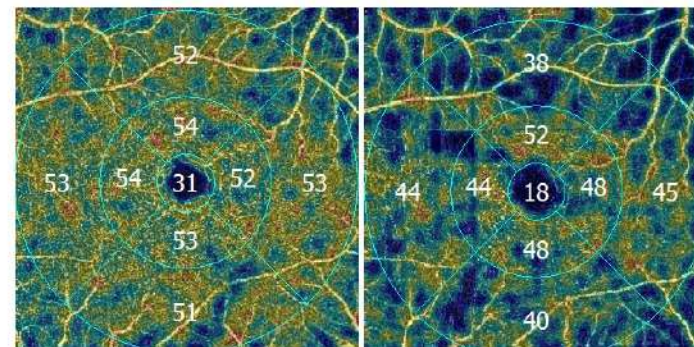
First: 09/26/2018 10:00:40; SQ: 8; 75 yrs

Last: 08/09/2023 14:41:25; SQ: 6; 80 yrs



First: 09/26/2018 10:03:10; SQ: 8; 75 yrs

Last: 08/09/2023 14:47:00; SQ: 6; 80 yrs



Thickness

☐ GCC

☐ Retina

Vessel

Density

☐ Superficial

☒ Deep

Measurement

☐ FAZ

☒ Show Lines

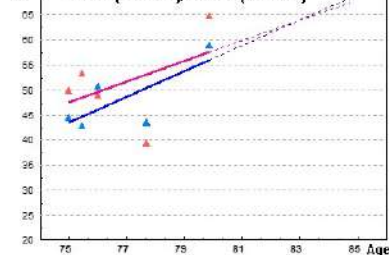
☒ Show Bnd

☒ Auto Zoom



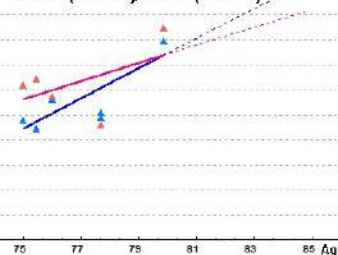
Superior_Hemi (%/yr)

OD: 2.6 [-1.6 ~ 6.7]; OS: 2.1 [-5.5 ~ 9.6]



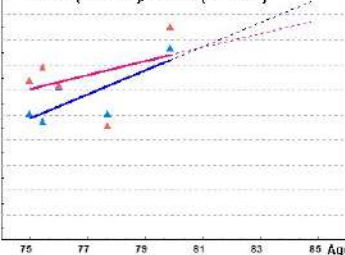
Inferior_Hemi (%/yr)

OD: 3.0 [-0.3 ~ 6.3]; OS: 1.8 [-3.8 ~ 7.4]



ETDRS Grid (%/yr)

OD: 2.4 [-1.0 ~ 5.8]; OS: 1.4 [-4.6 ~ 7.4]



Vessel	OD			OS		
Density(%)	First	Last	Diff	First	Last	Diff
Superior_Hemi	44.3	58.8	14.5	49.7	64.6	15.0
Inferior_Hemi	43.7	59.5	15.8	50.7	62.2	11.5
Whole Image	44.0	59.1	15.1	50.2	63.5	13.3
ETDRS Grid	45.2	58.2	13.0	51.8	62.5	10.7

— OD
— OS



Optometric
Education
Consultants



Questions and Thank You!

OCT Interpretation

Red, Yellow, and Blue Disease, What is Real
Disease, and What is Physiologically Normal?

Greg Caldwell, OD, FAAO

Mackinac Island Northern Escape
Optometric Education Consultants

Sunday, August 20, 2023

