



Optometric
Education
Consultants

OCT-Angiography

What You Need to Know with this New Technology

Greg Caldwell, OD, FAAO

November 14, 20/20



Disclosures- Greg Caldwell, OD, FAAO

- Will mention many products, instruments and companies during our discussion
 - ★ I don't have any financial interest in any of these products, instruments or companies
- Pennsylvania Optometric Association –President 2010
 - POA Board of Directors 2006-2011
- American Optometric Association, Trustee 2013-2016
- I never used or will use my volunteer positions to further my lecturing career
- Lectured for: Alcon, Allergan, Aerie, BioTissue, Maculogix, Optovue
- Advisory Board: Allergan, Maculogix, Sun, Kala
- Involve: PA Medical Director, Credential Committee
- HealthCare Registries: Consultant
- Optometric Education Consultants - Scottsdale, WDW, St. Paul, Quebec City, and Nashville, Owner






OCT CONNECT

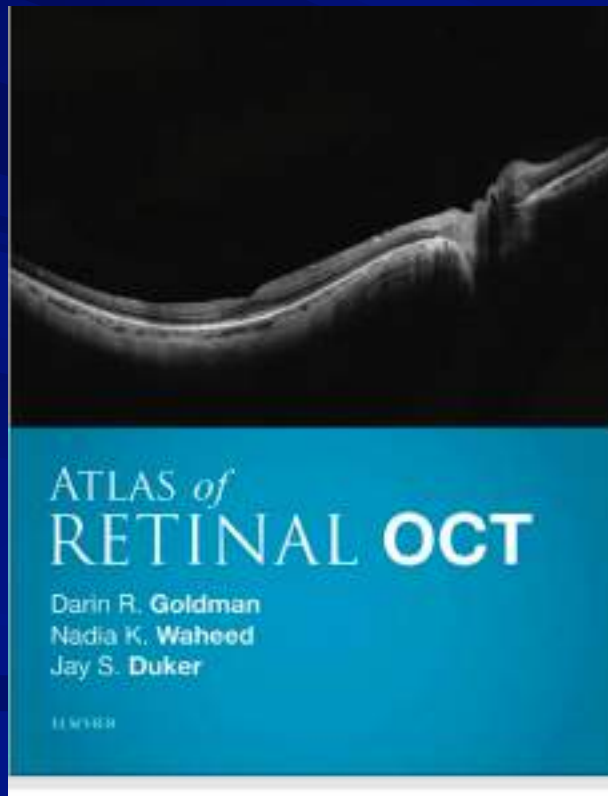
Post your questions & cases so we can #OCTConnect!



Join this group to become part of our
OCT Connect Family!

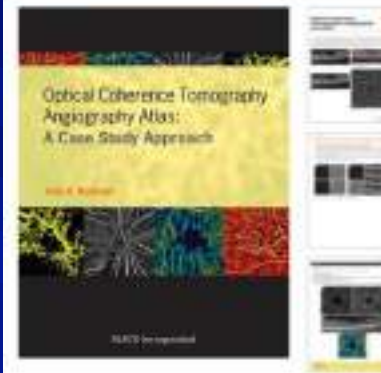


Book Resources



Optical Coherence Tomography Angiography Atlas: A Case Study Approach

Julie A Rodman, OD MSc FAAO



\$149.95

ISBN 10 1-63001-641-2

ISBN 13 978-1-63001-641-1

200 pp Hard Cover

Pub. Date: 2019

Order# 66411

How Many People Here Have an OCT?

Optical Coherence Tomography

☞ OCT is an optical signal acquisition and processing method

☞ Time domain OCT

- ★ 15-16 microns of resolution
- ★ Stratus (Zeiss)

☞ Spectral domain (SD-OCT) or Fourier domain OCT

- ★ Spatially encoded frequency domain OCT (SEFD-OCT)
- ★ 5-6 microns of resolution
 - ☐ Able to see photoreceptor morphology (inner/outer segments)
- ★ 50 times faster than time domain

☞ Swept source OCT

- ★ Time encoded frequency domain OCT
- ★ 1 micron of resolution

☞ Future of OCT- intraoperative imaging, blood flow and oxygenation measurements

☞ May have the possibility to assess retinal pathology like a pathologist

Daily Digest

Eye Care



JOURNAL SCANS

Recovering Vision in Corneal Epithelial Stem Cell-Deficient Eyes

Cori Leno, Andrew Day, 2019 Apr 26. *OPINION* Ahead of Print, HK Sains, H Palanca, C Boleyn, et al
#Cornea #Ophthalmology #Contact Lenses #Cornea and External Diseases #Lentical Stem Cell Deficiency
#Ophthalmology/Ophthalmology #Primary Care Ophthalmology

Anterior Segment OCTA Assessment of Acute Chemical Injury

Am J Ophthalmol. 2019 May 06. *OPINION* Ahead of Print, SGM Fung, RM Stewart, SK Dhalla, et al
#Ophthalmology/Ophthalmology #Cornea and External Diseases #Lentical Stem Cell Deficiency
#Ophthalmology/Ophthalmology #Primary Care Ophthalmology

Incidence, Epidemiology, and Transformation of Ocular Myasthenia Gravis

Am J Ophthalmol. 2019 May 05. *OPINION* Ahead of Print, TM Heroldts, MT Black, OD Hodge, et al
#Ophthalmology/Ophthalmology #Ocular Eye Care #Neuro Ophthalmology #Ophthalmology/Ophthalmology #Primary
Care Ophthalmology

NEWS

Therapeutic Folds for Unilateral Optic Nerve Lesions in MS

HealthDay. 2019 May 17
#Optic Nerve Pathology #Optic Nerve Pathology



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Published in Eye Care

Journal Scan / Research - May 11, 2019

Detection of Choroidal Neovascularization in Pigment Epithelial Detachment

Acta Ophthalmologica

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TAKE-HOME MESSAGE

- This study evaluated the agreement between OCTA and multimodal imaging for the detection of choroidal neovascularization (CNV) in patients with pigment epithelial detachment with and without subretinal/intraretinal fluid (PED+F and PED-F). OCTA demonstrated concordance with the other modalities in determining the presence of CNV in patients with PED+F, with an accuracy of 85.45%.
- The authors suggest that the diagnosis of PED can be made without the need for dye angiography in eyes indicating signs of CNV on OCTA.

— Raza Shah, MD

Abstract

Macular and Peripapillary Angiographic Changes With Intravitreal Injections

Retina (Philadelphia, Pa.)

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TAKE-HOME MESSAGE

- This retrospective observational study of 39 patients with various retinopathies assessed retinal perfusion density changes on OCT. Results showed that an acute change in intraocular pressure due to intravitreal injections was associated with a decrease in macular and peripapillary perfusion density.
- These findings suggest that intravitreal injections may lead to the development of glaucoma, causing damage to the macula and optic nerve.

—Raza M. Shah, MD

Abstract

This abstract is available on the publisher's site.

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PURPOSE

Intravitreal injections acutely and temporarily increase intraocular pressure (IOP), and this may have cumulative long-term effects including an increased risk for glaucoma surgery. This study was designed to measure retinal perfusion density changes on optical coherence tomography (OCT) angiography and OCT thickness alterations associated with acutely increased IOP after intravitreal injections.

METHODS

Retrospective observational clinical study of 40 eyes (39 patients) with various retinopathies from October 2016 to June 2017 at a tertiary care retina clinic in NYC. Patients were older than 18 years, with vision



practice
UPDATE

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Published in Eye Care

Journal Scan / Research - March 30, 2019

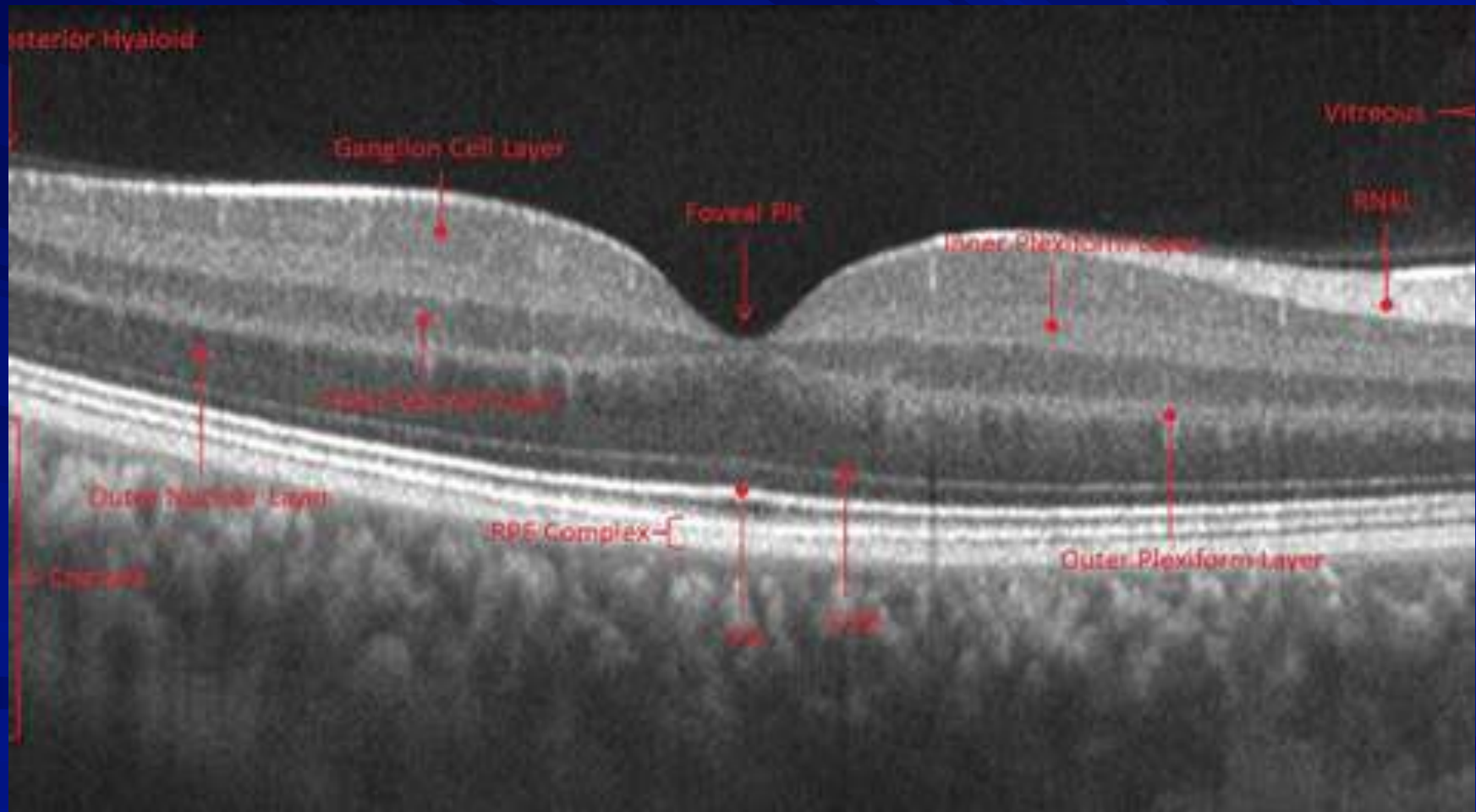
Detection of Clinically Unsuspected Retinal Neovascularization With Wide-Field OCTA

Retina (Philadelphia, Pa.)

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TAKE-HOME MESSAGE

- This study evaluated the accuracy of wide-field optical coherence tomography angiography (OCTA) for detection of clinically unsuspected neovascularization (NV) in patients with diabetic retinopathy. There were 27 participants, who underwent a clinical examination, standard 7-field color photography, and OCTA with commercial and prototype swept-source devices. Nonproliferative diabetic retinopathy was found to be mild in 13 patients, moderate in 7, and severe in 7 based on photographic grading. The conventional 6- x 6-mm OCTA detected NV in 2 eyes (7%) and the 3- x 3-mm scan detected none. Both prototype and commercial wide-field OCTA detected NV in 2 additional eyes. All eyes with OCTA-detected NV were photographically graded as severe nonproliferative DR.
- Wide-field OCTA can aid in the detection of retinal changes that would seemingly escape detection otherwise. However, the study population in this study was small, and the positive findings were particularly few, which makes it difficult to draw any significant conclusions.

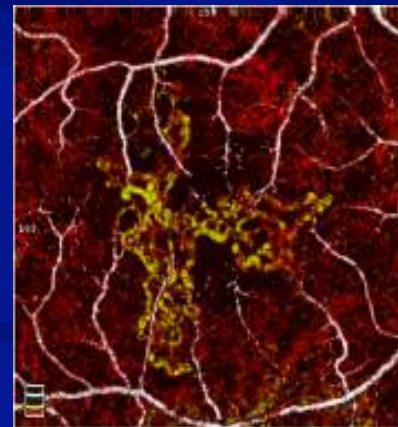


OCT Angiography A New Approach to Protecting Vision

- ▶ Non-invasive visualization of individual layers of retinal vasculature
- ▶ Pathology not obscured by fluorescein staining or pooling
- ▶ Image acquisition requires less time than a dye-based procedure
- ▶ Reduced patient burden allows more frequent imaging to better follow disease progression and treatment response

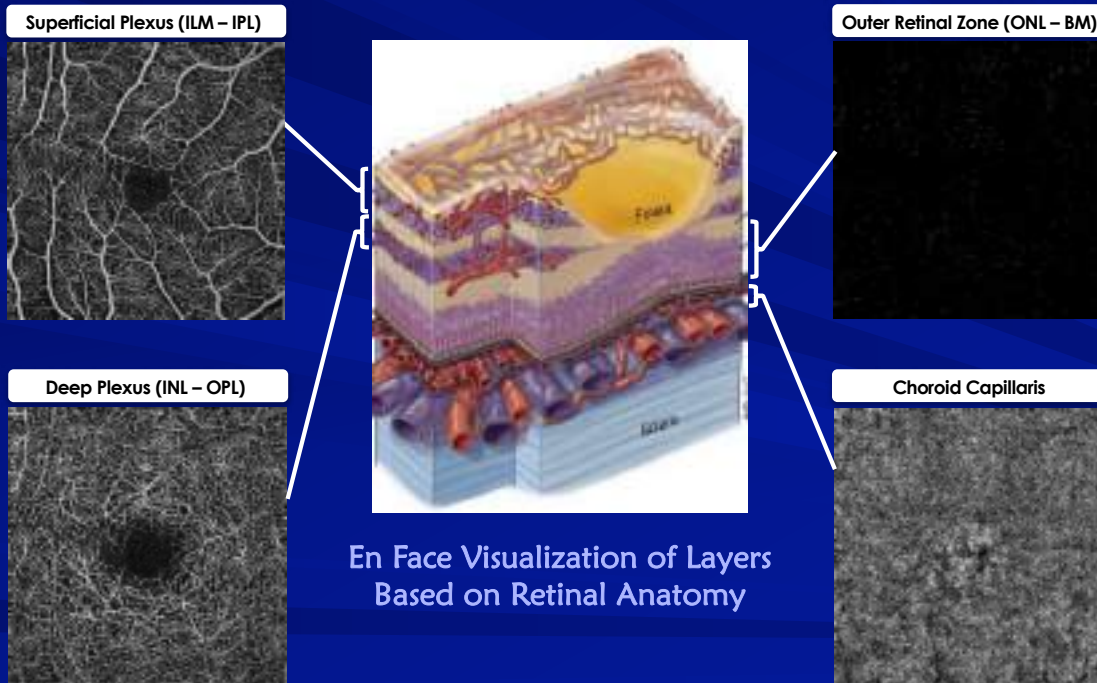


FA of CNV

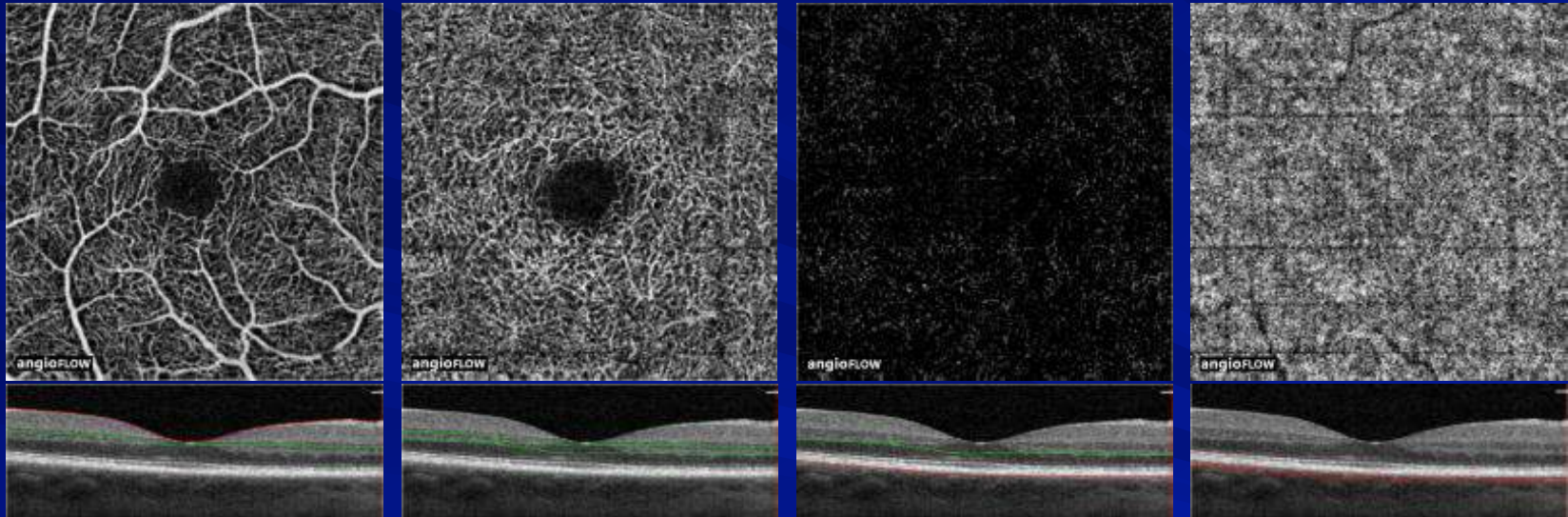


OCTA of CNV

Enface OCT-A Slabs Based on Retinal Anatomy



Normal Retinal Vasculature



Superficial Capillary Plexus

3 μ m Below ILM \rightarrow 15 μ m
Below IPL

Deep Capillary Plexus

15 μ m Below ILM \rightarrow 70 μ m
Below IPL

Outer Retina

70 μ m Below IPL \rightarrow 30 μ m
Below RPE Reference

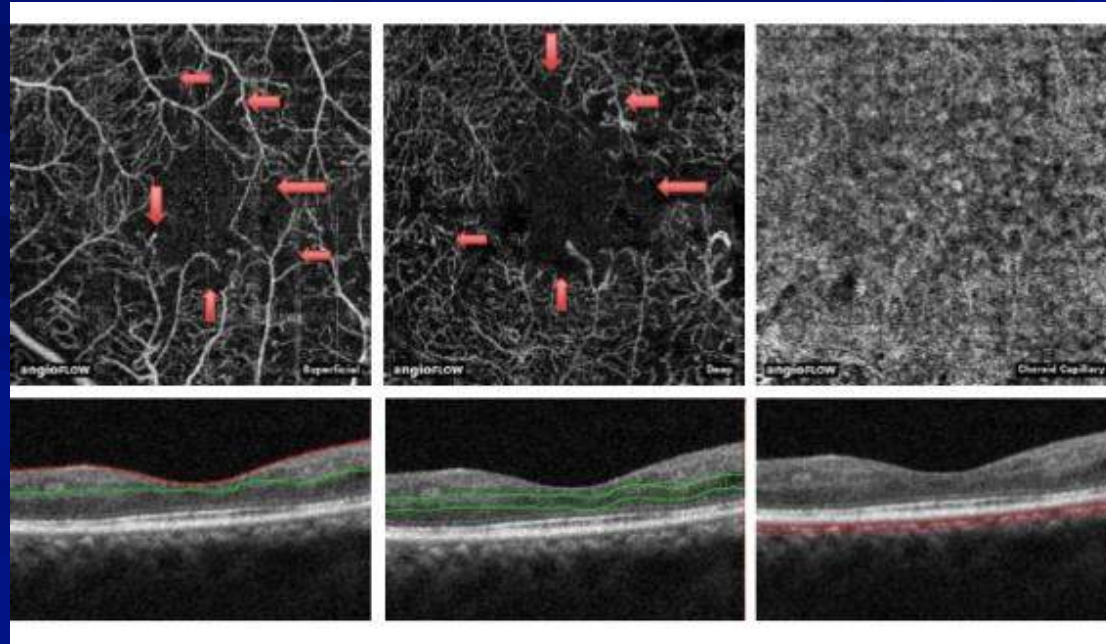
Choriocapillaris

30 μ m Below RPE Reference \rightarrow 60 μ m
Below RPE Reference

Metrics and Analytics

Make a Difference
Important

Diabetic Retinopathy



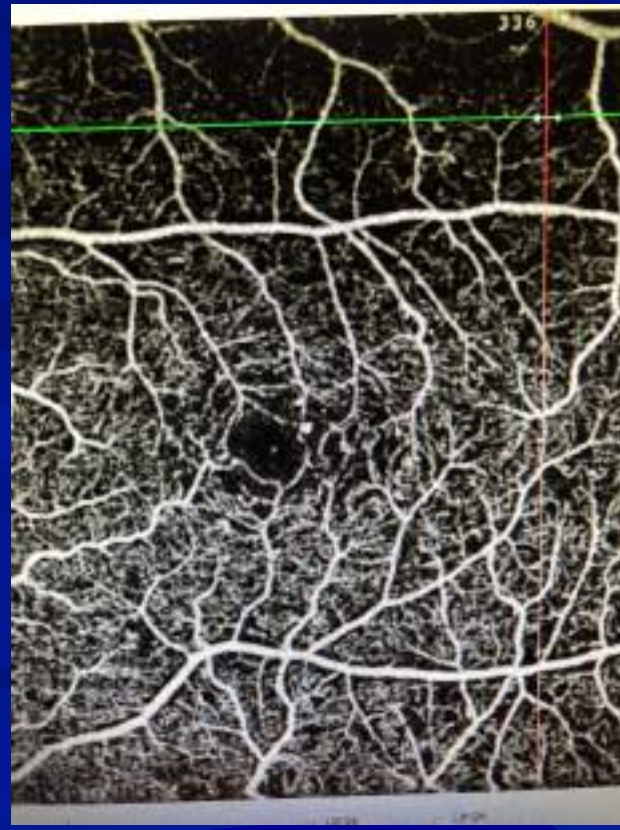
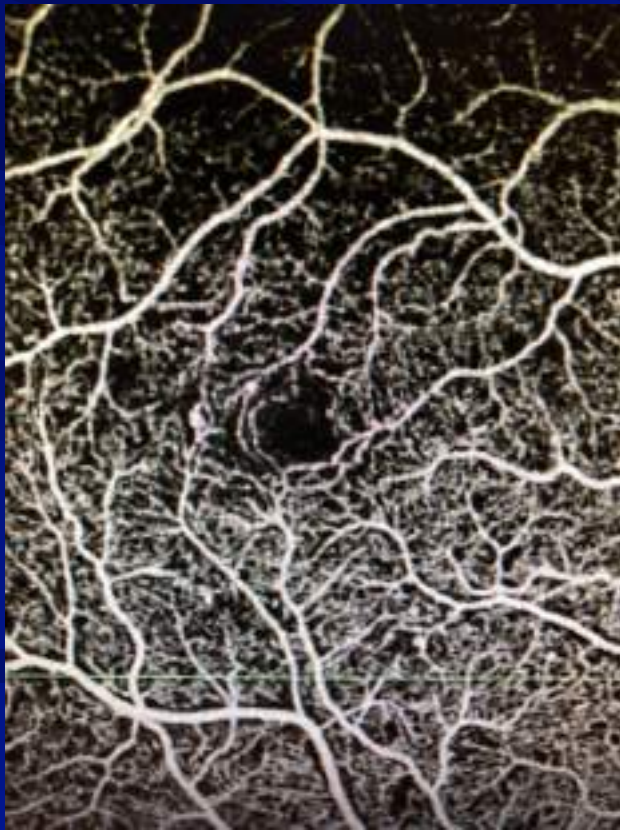
Superficial Capillary Plexus

Deep Capillary Plexus

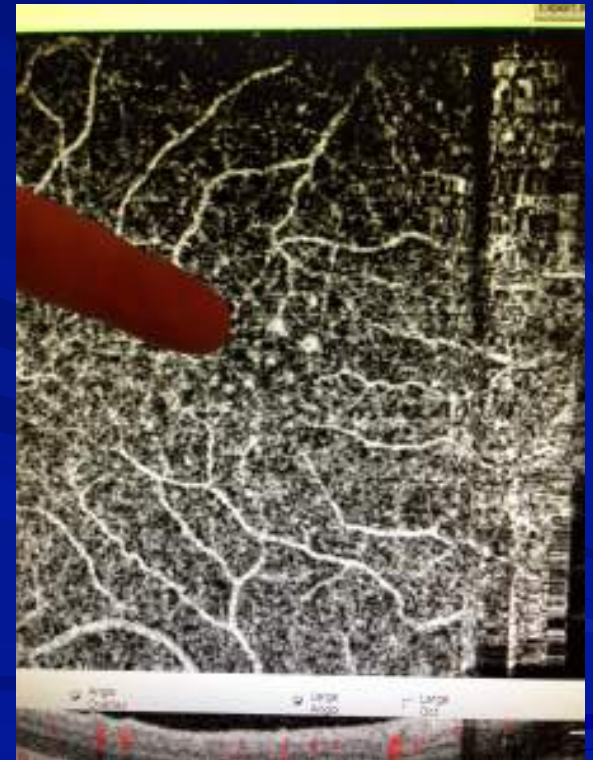
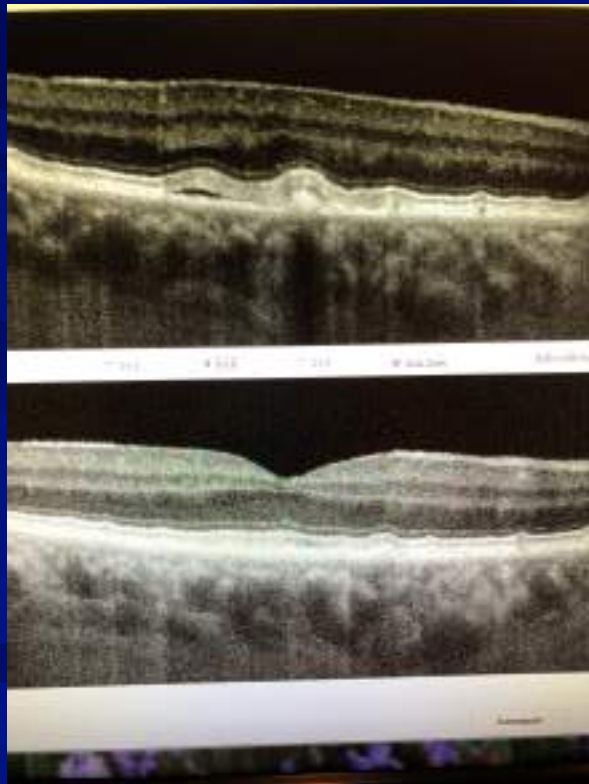
Choriocapillaris

- ▶ Retinal capillary non-perfusion – seen as blackened area without blood flow outside FAZ
- ▶ Microaneurysms
- ▶ Enlarged FAZ

Diabetes

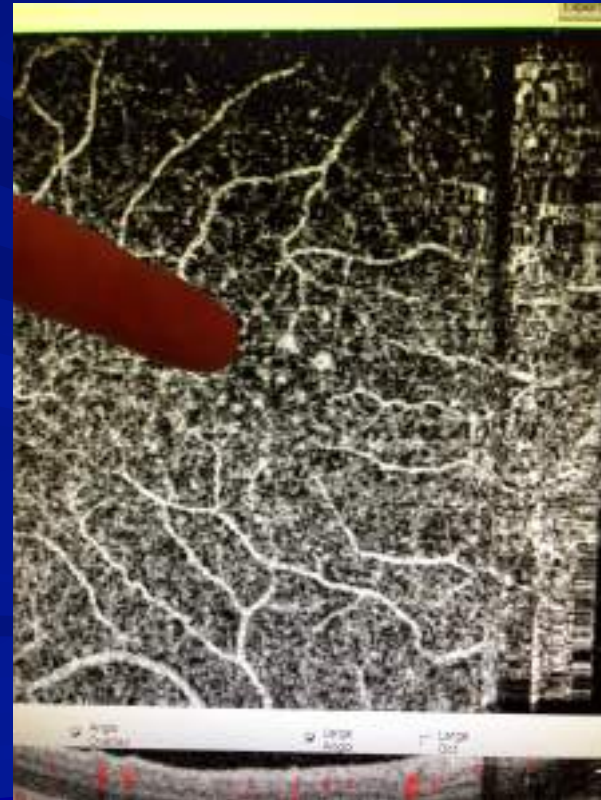


Wet AMD



Glad to Have it in the Office

Disappointing without Quantitative Measurements



AngioAnalytics

↳ AngioAnalytics is the world's first OCTA metrics

↳ The package includes the following tools:

- ★ **Foveal Avascular Zone (FAZ) measurements**

- 📄 FAZ area, perimeter, A-circularity index and foveal vessel density

- ★ **Flow and Non-Flow Area measurements**

- 📄 Measure the area of abnormal flow by outlining a region for vessel detection. The extracted Flow Area measurement is based on the Outer Retina slab (OPL ~ BRM)

- ★ **Vessel Density mapping**

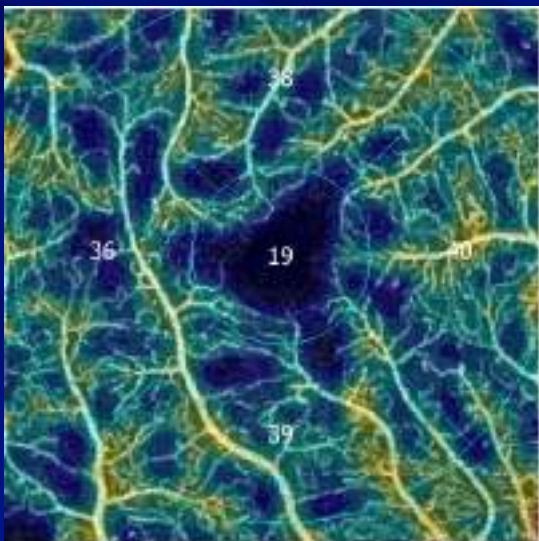
- 📄 Measures the vessel density of the superficial and deep plexi of the retina as well as the radial peripapillary capillary layer of the optic disc

Clinical Applications of AngioAnalytics

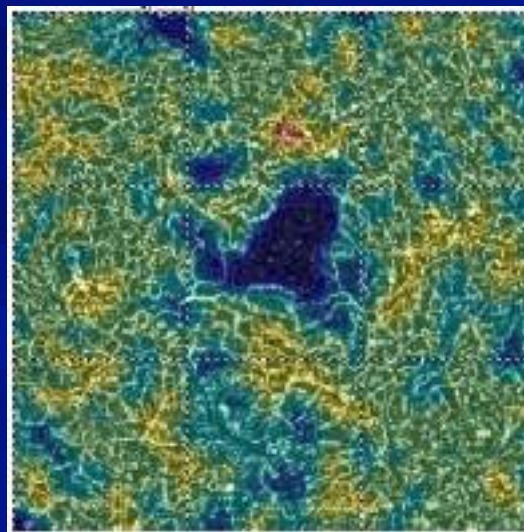
- 👁️ Identify early vascular changes in diabetic eyes
- 👁️ Assess disease progression
- 👁️ Compare structure and vasculature in glaucoma
- 👁️ Assess rate of change in optic disc vessel density

AngioAnalytics

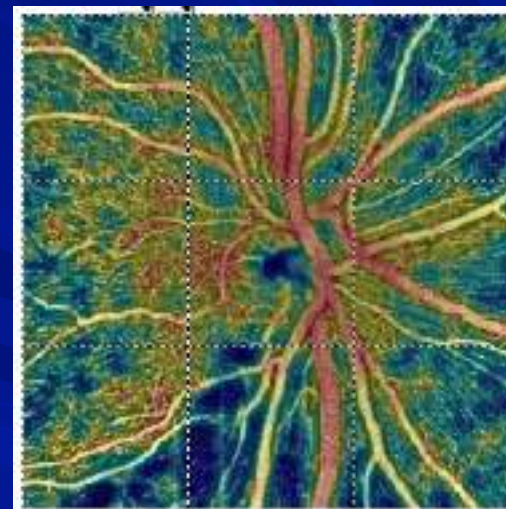
Vessel Density Mapping



Vessel Density
Superficial Plexus



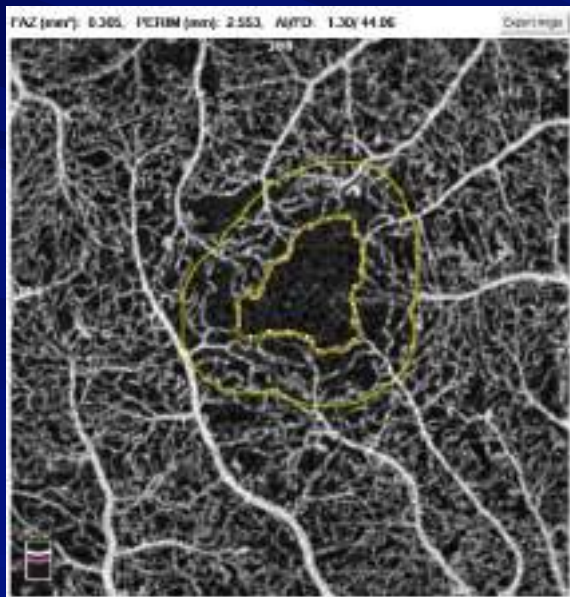
Vessel Density
Deep Plexus



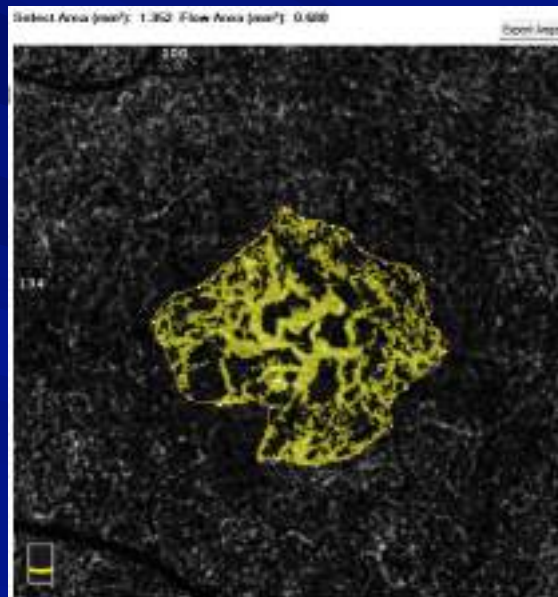
Vessel Density
Radial Peripapillary Capillaries

AngioAnalytics

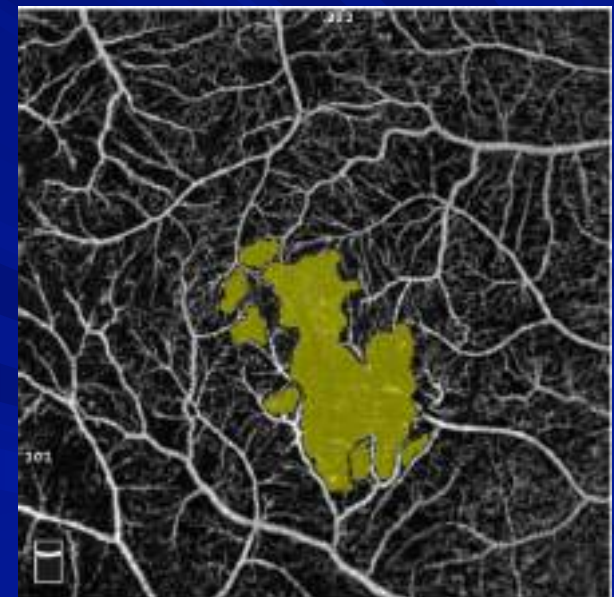
FAZ, Flow & Non-Flow Area Measurements



Foveal Avascular Zone Metrics



Flow Area Measurements

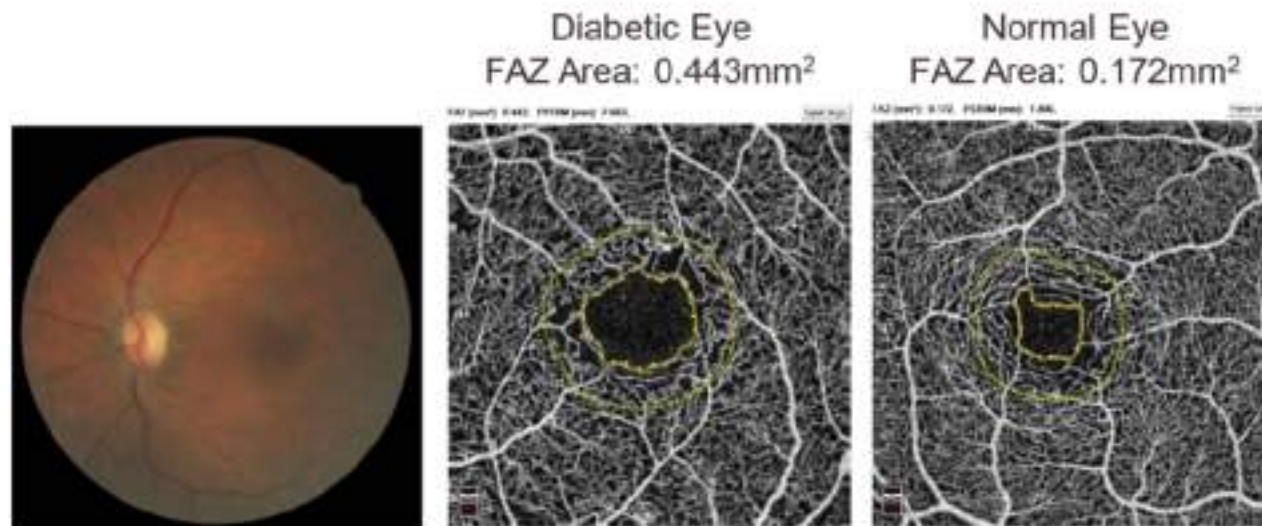


Non-Flow Area Measurements

Identify Early Vascular Changes in Diabetic Eyes



Patients with DM have a larger FAZ than healthy eyes.³

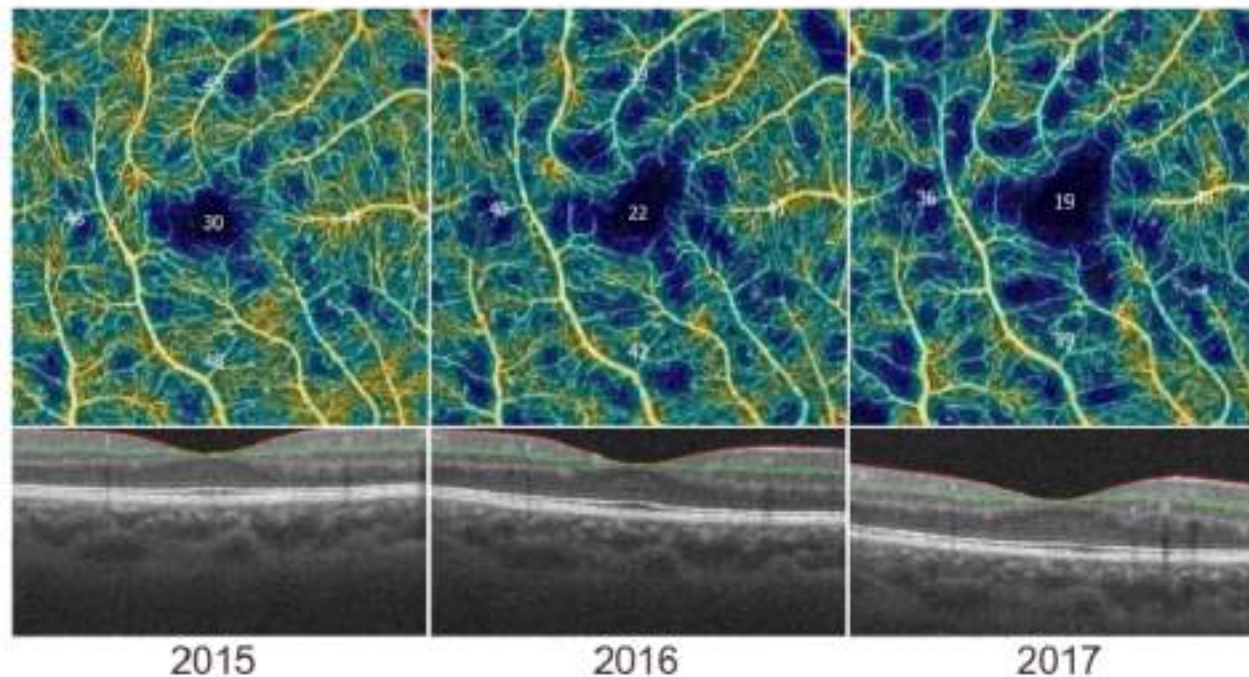


3. Di, G., Weihong, Y., Xiao, Z. et al. *Graefes Arch Clin Exp Ophthalmology* (2016) 254: 873. <https://doi.org/10.1007/s00417-015-3143-7>
Images courtesy of Julie Rodman, OD, FAAD

Assess Disease Progression with Multiscan View

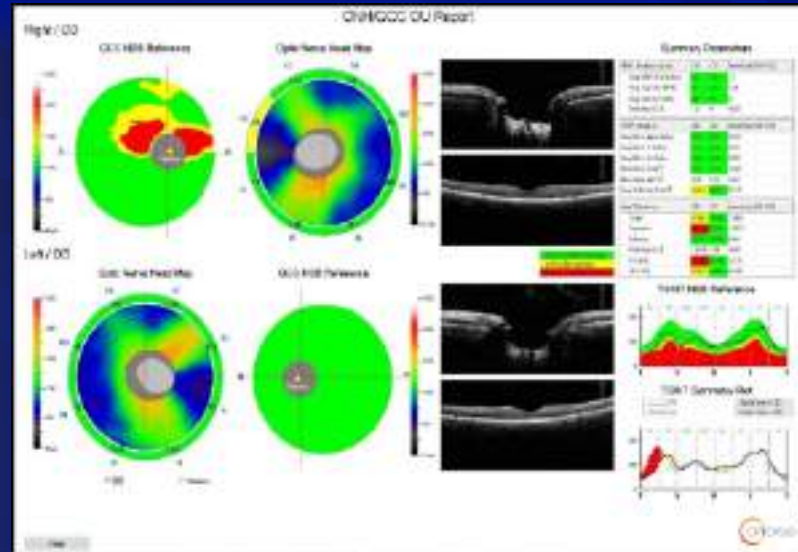
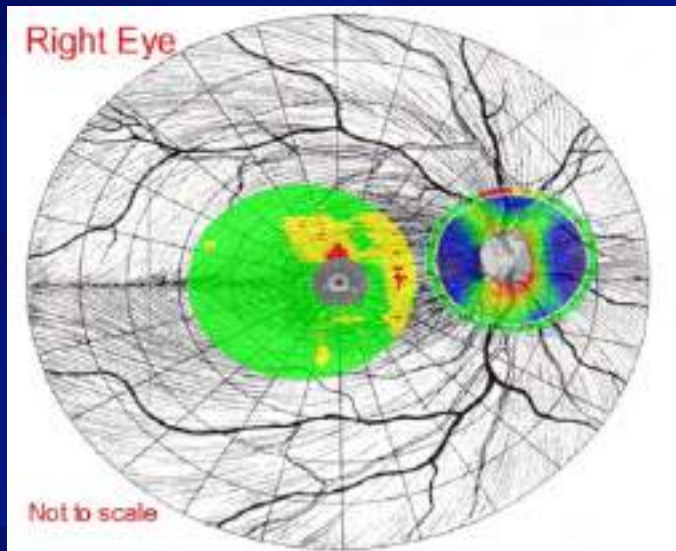


Vessel Density Decreases Significantly with Disease Severity⁴



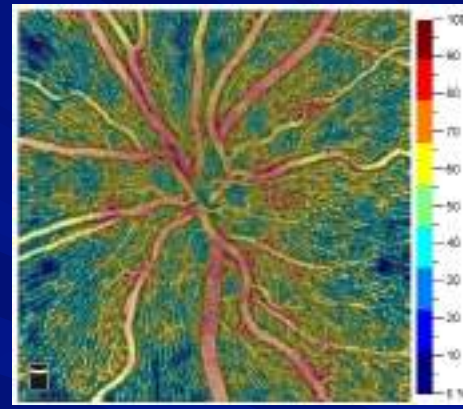
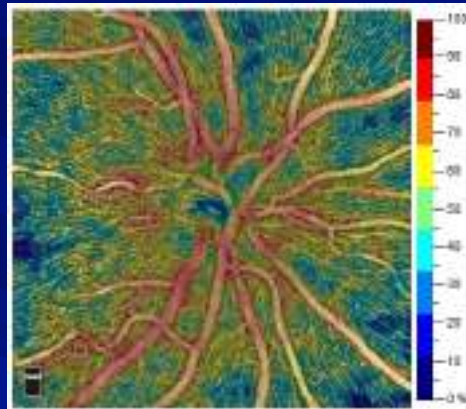
4. Nesper FL, Roberts PK, Orishi AC, et al. Quantifying Microvascular Abnormalities With Increasing Severity of Diabetic Retinopathy Using Optical Coherence Tomography Angiography. *Investigative Ophthalmology & Visual Science*. 2017;58(6):Bio307-Bio315. doi:10.1167/iov.17-21787.

Next Generation Glaucoma Analysis with OCT + OCTA

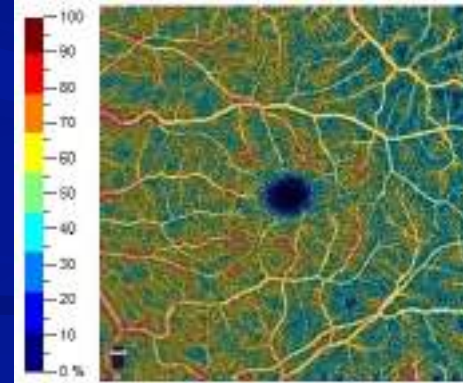
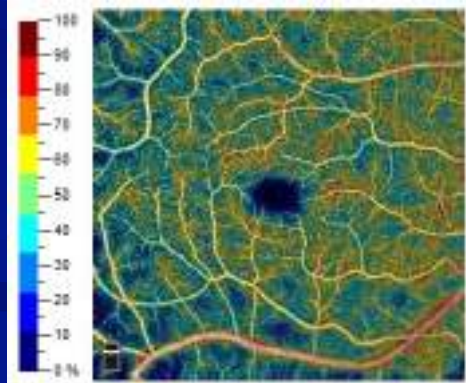


Learn What Normal Looks Like

Disc:
Radial Peripapillary
Capillaries



Retina:
Superficial Vascular
Complex



OD

OS

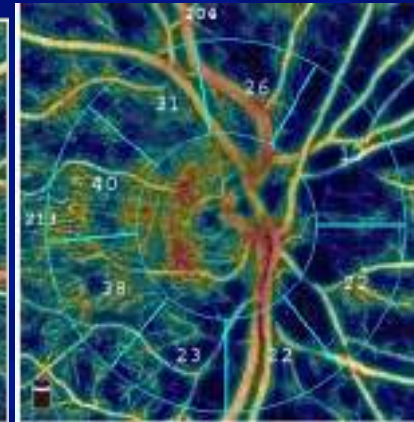
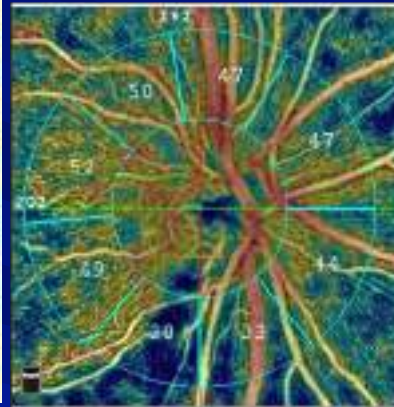
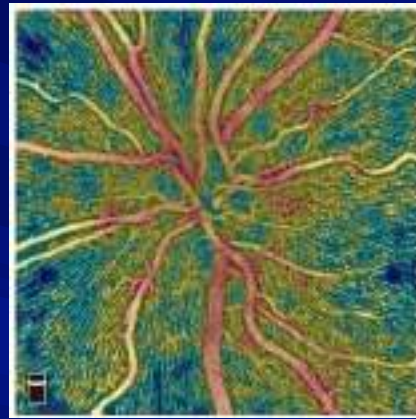
What Does Glaucoma Look Like?

Normal

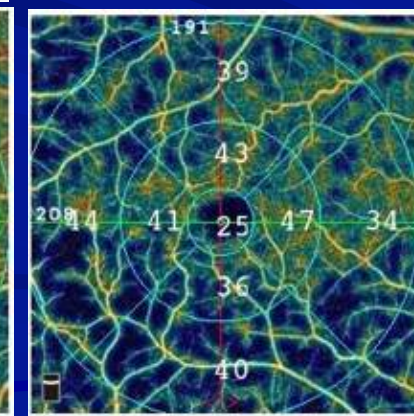
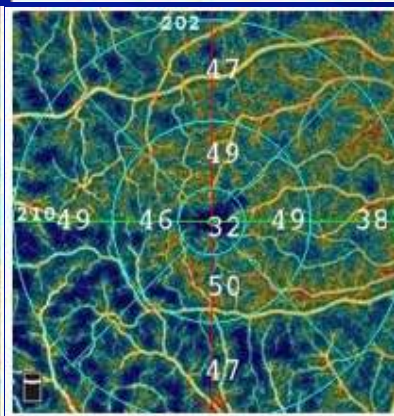
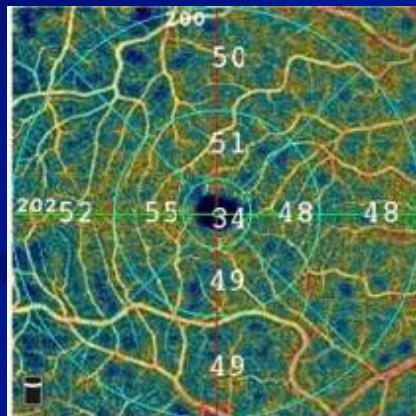
Moderate Glaucoma

Advanced Glaucoma

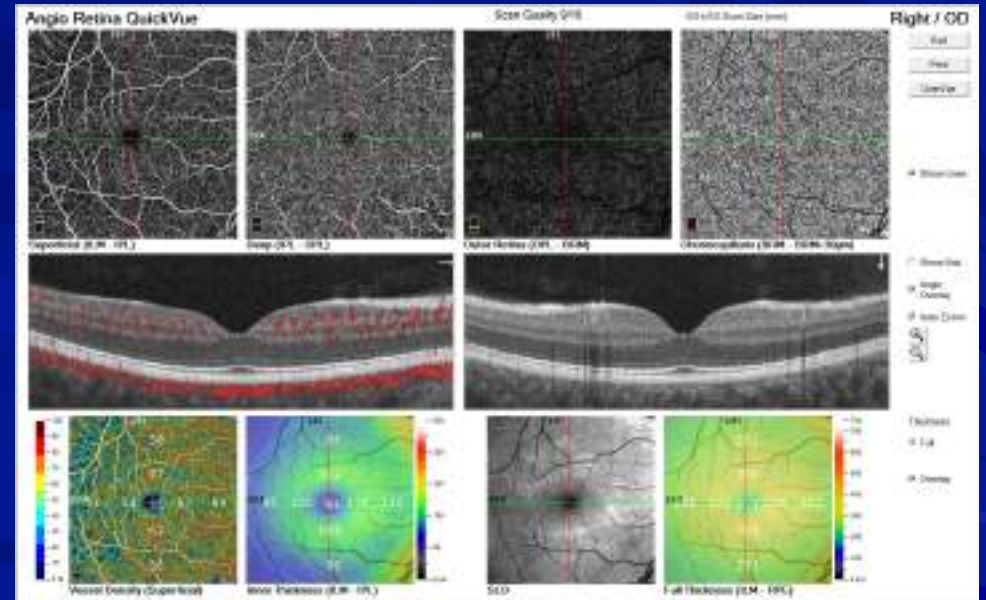
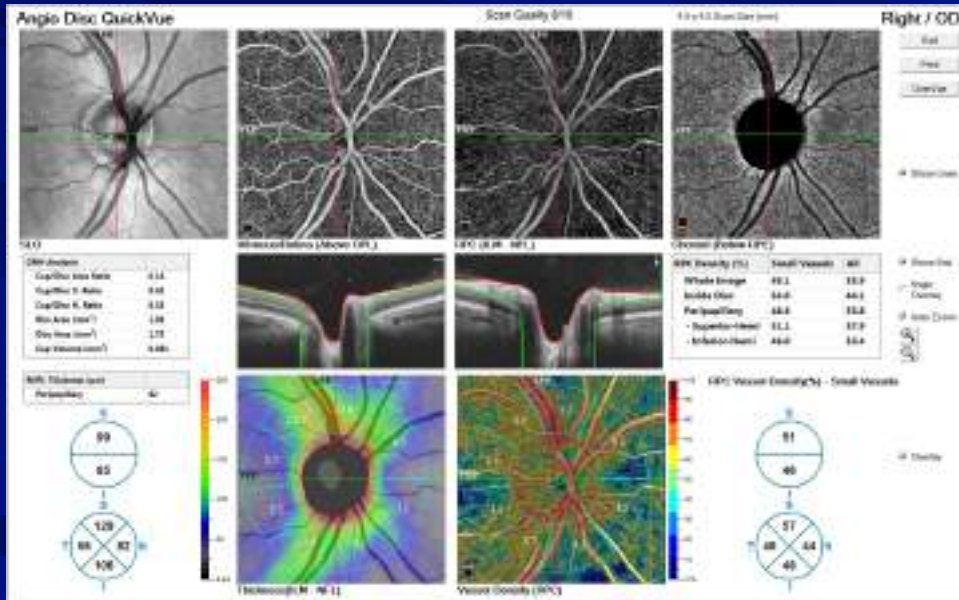
Disc



Retina

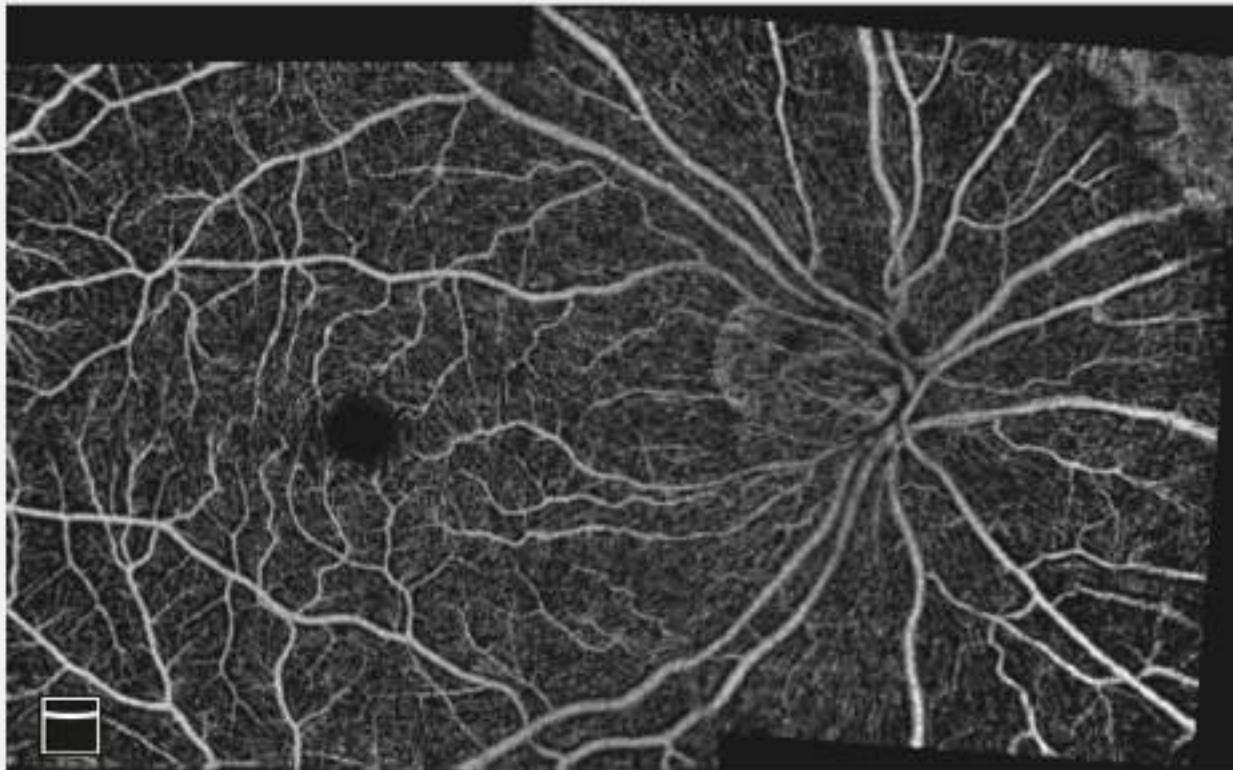


Review of Normal 25 year old man



60 Year Old Montage OD

Angio Montage



Right / OD

Exit

OverView

BackView

Print

Reset View

Edit

Montage Copy to:

Vitreous/Retina

Outer/Choroid

Layers:

Vitreous

Superficial

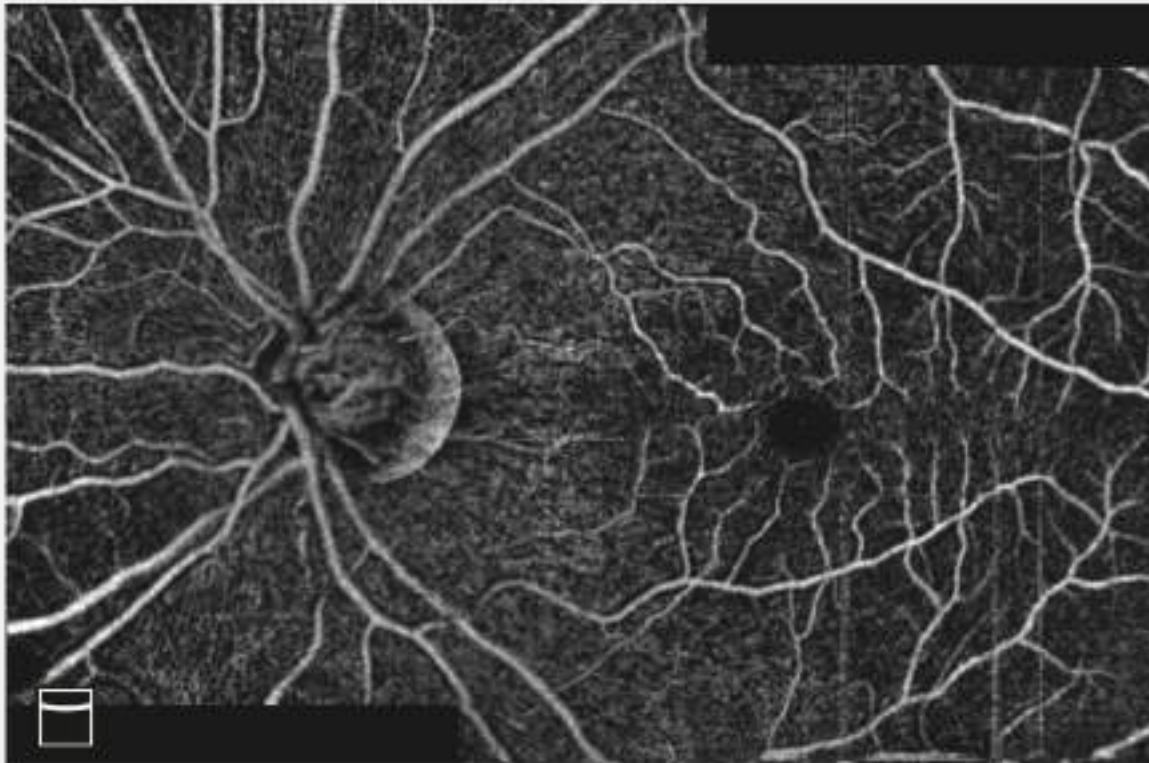
Deep

Grayscale

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

60 Year Old Montage OS

Angio Montage



Left / OS

Exit

Overview

Print

Reset View

⌵ Edit

View/Edit Layer:

Vitreous/Retina

Outer/Choroid

Layers:

Vitreous

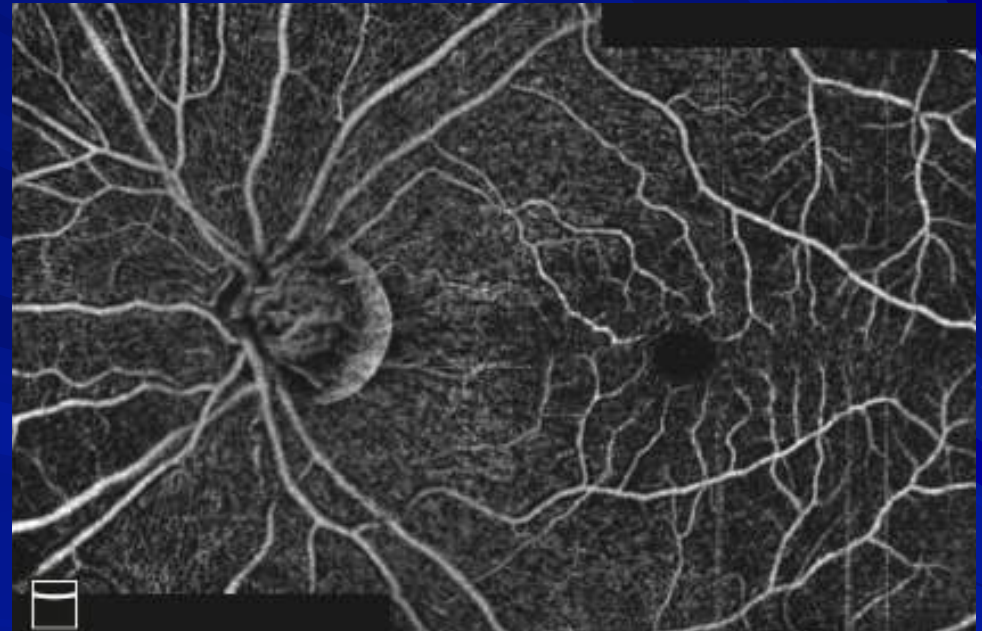
Superficial

Deep

⌵ Graphics

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

60 Year Old Montage OU



68 year old woman with glaucoma

Wants second opinion for glaucoma management

Recently had cataract surgery OS with iStent

★ September 25, 2017

★ Dorzolamide 2% BID OS, Lumigan 0.01% QD OS

Our practice recently performed cataract surgery and Kahook dual blade (KDB) MIGS

★ July 24, 2018

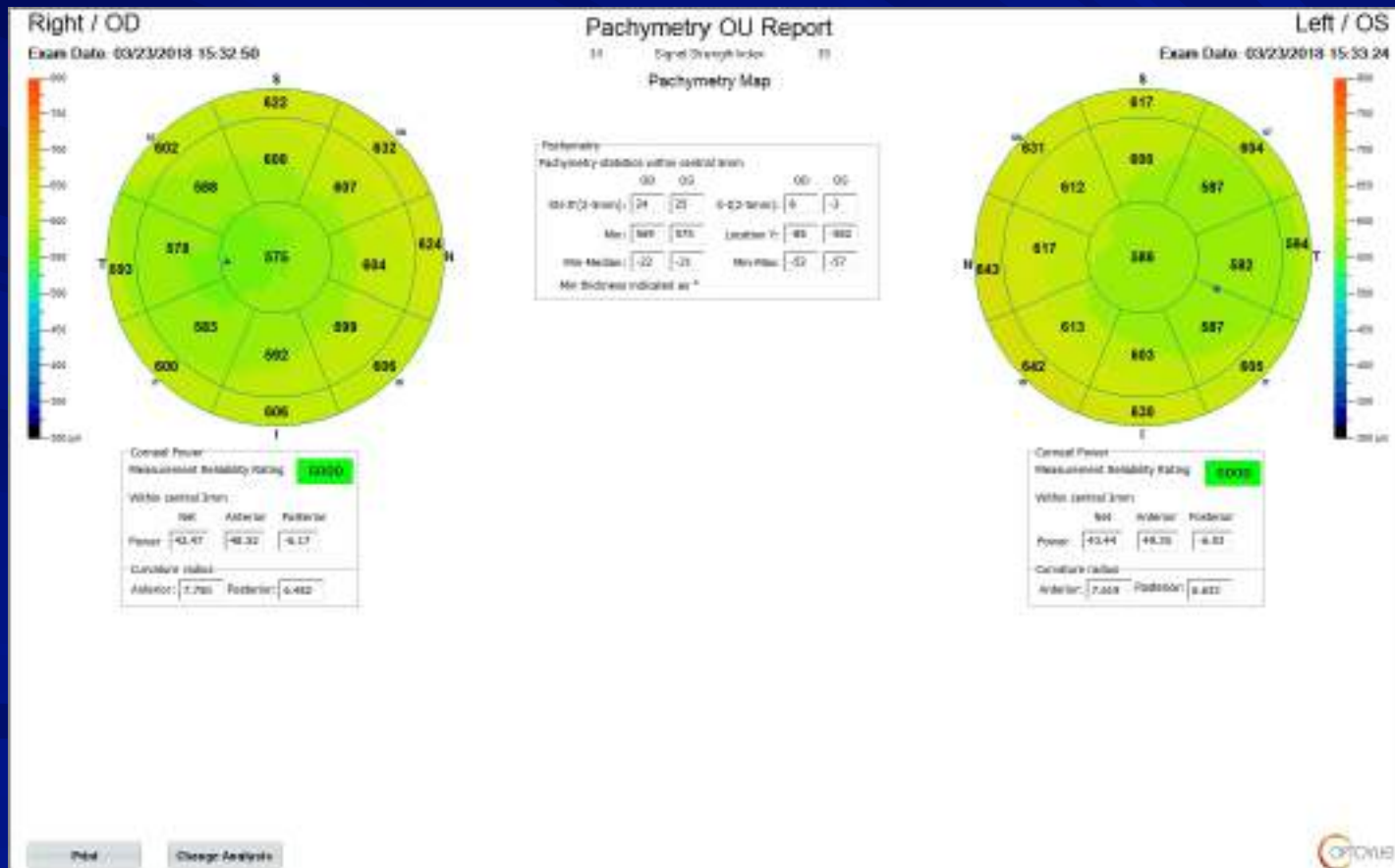
IOP_{GAT}: 12 and 16 at 11:27 am

J S

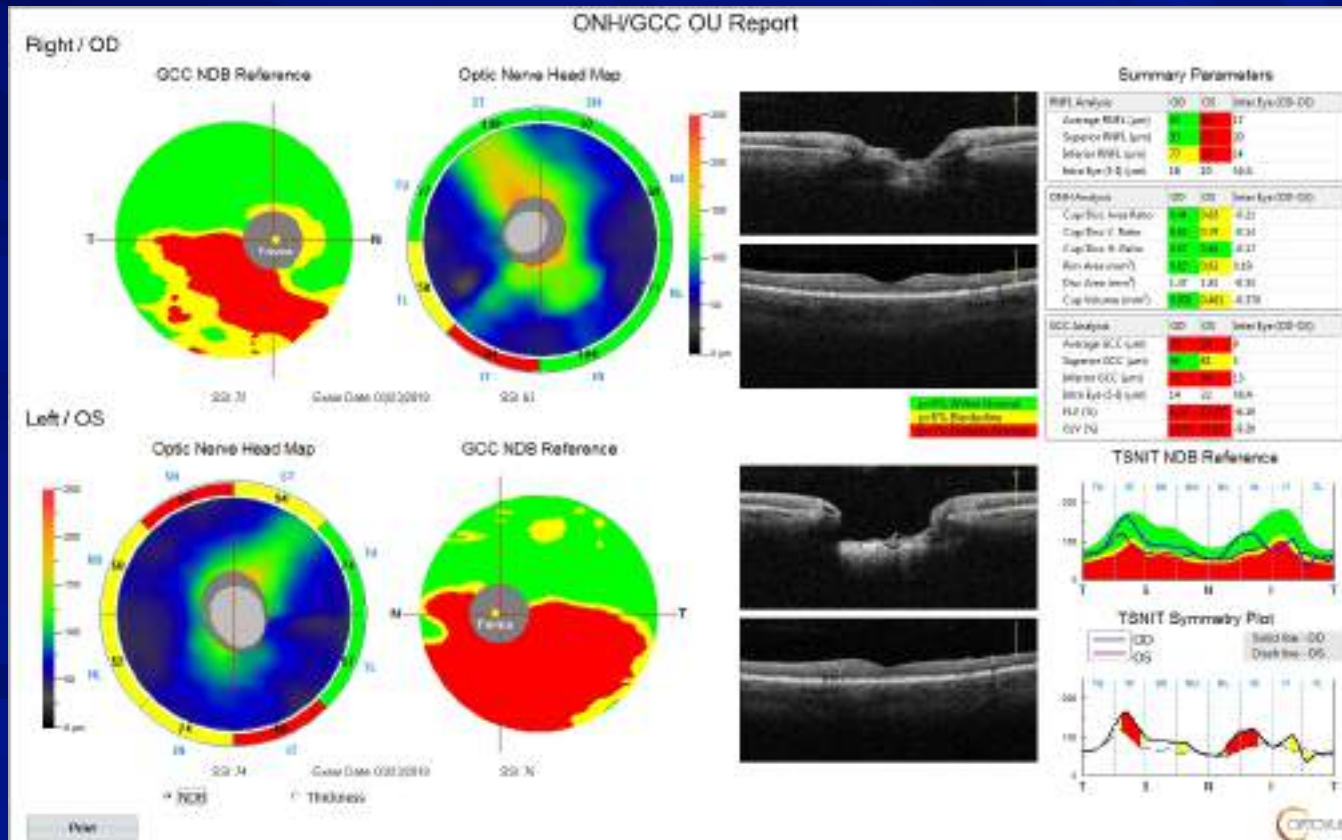
DFE - 3-28-18
VF - 3-28-18
OCT - 3-28-18
gonio -
Phos -
Puls - 569/575
OCT-A - 2-28-18

I-stent = (2)
KDB = (2)

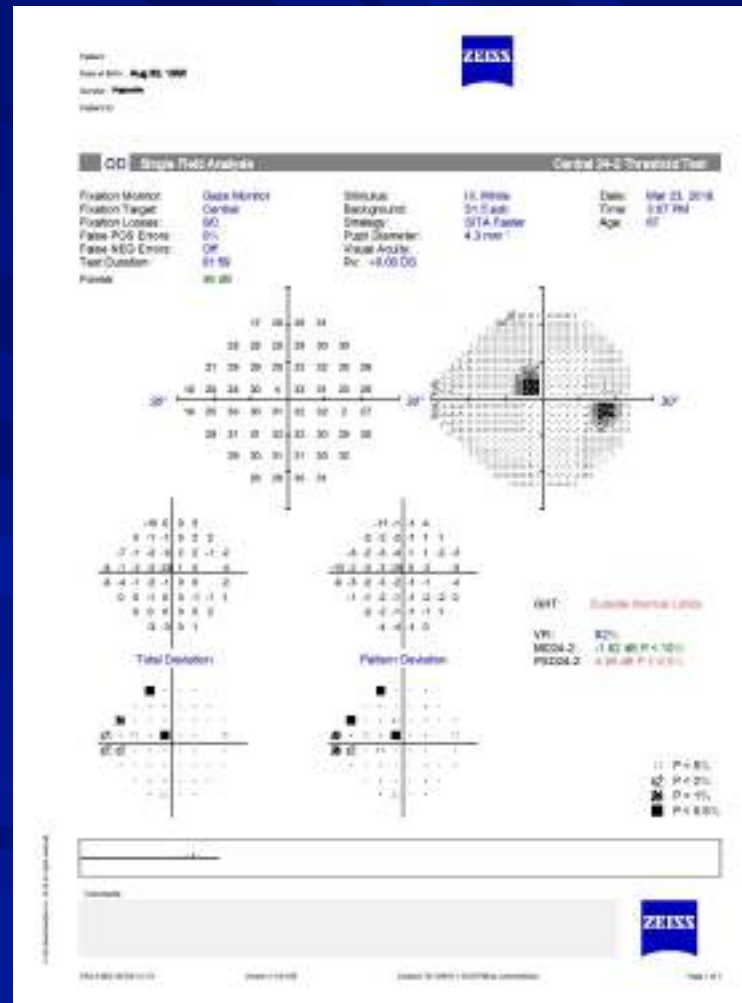
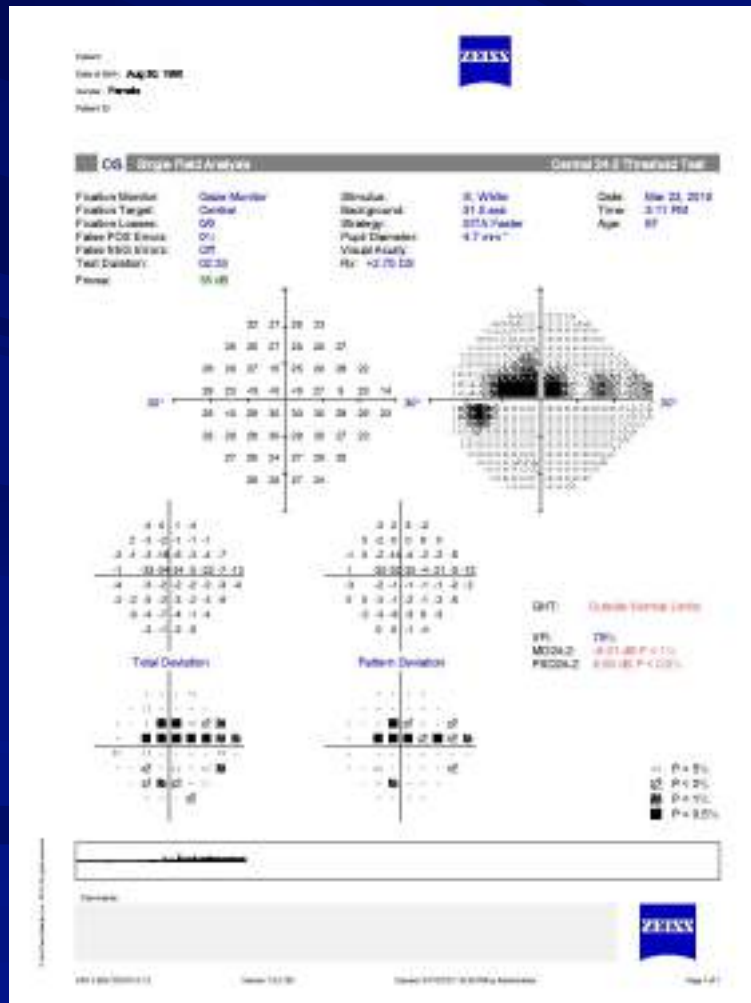
OCT for Pachymetry in Glaucoma



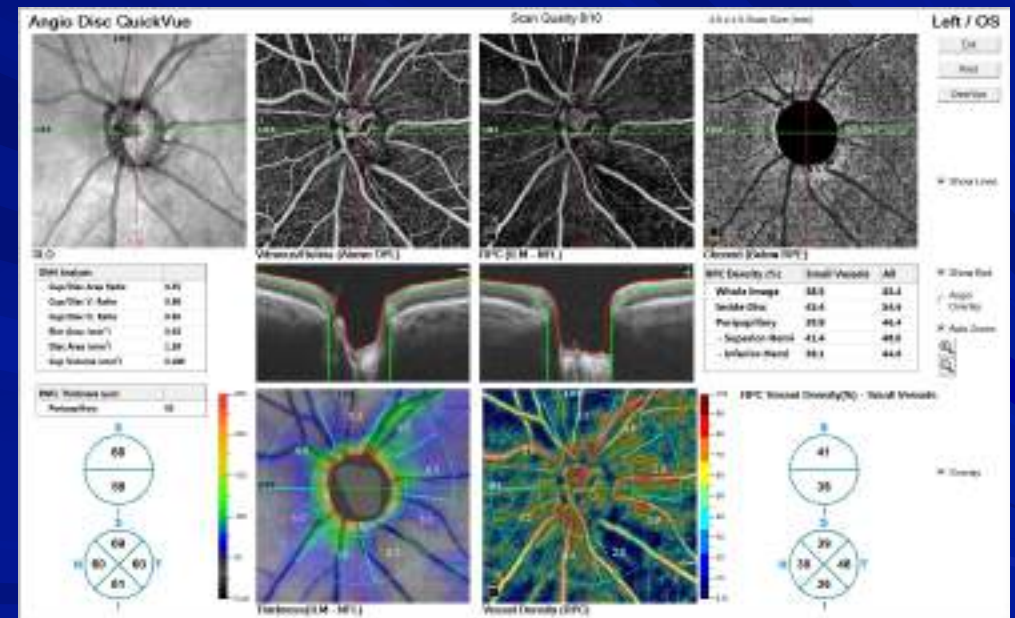
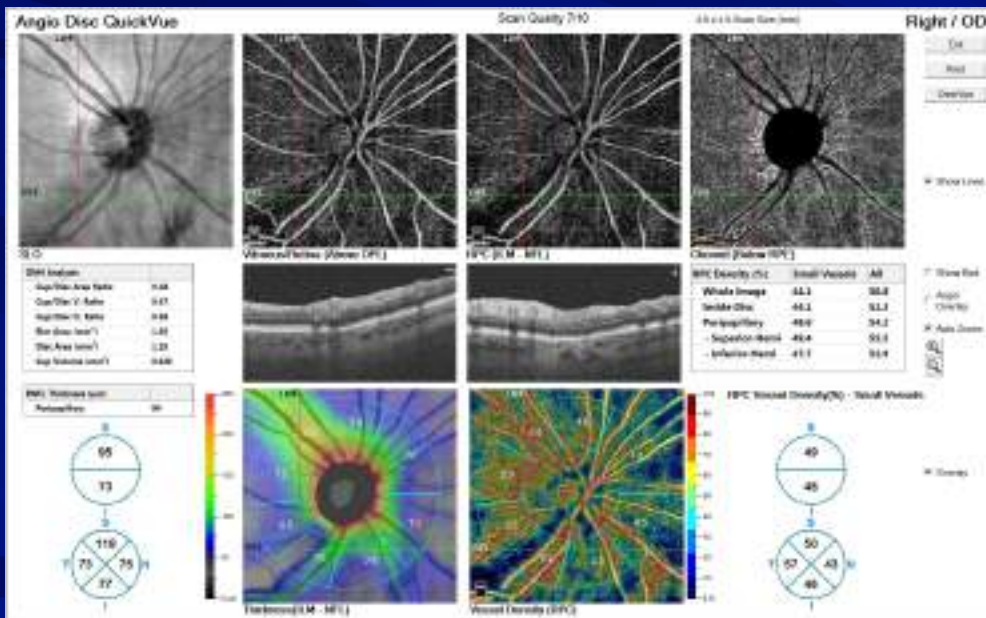
OCT GCC and NFL



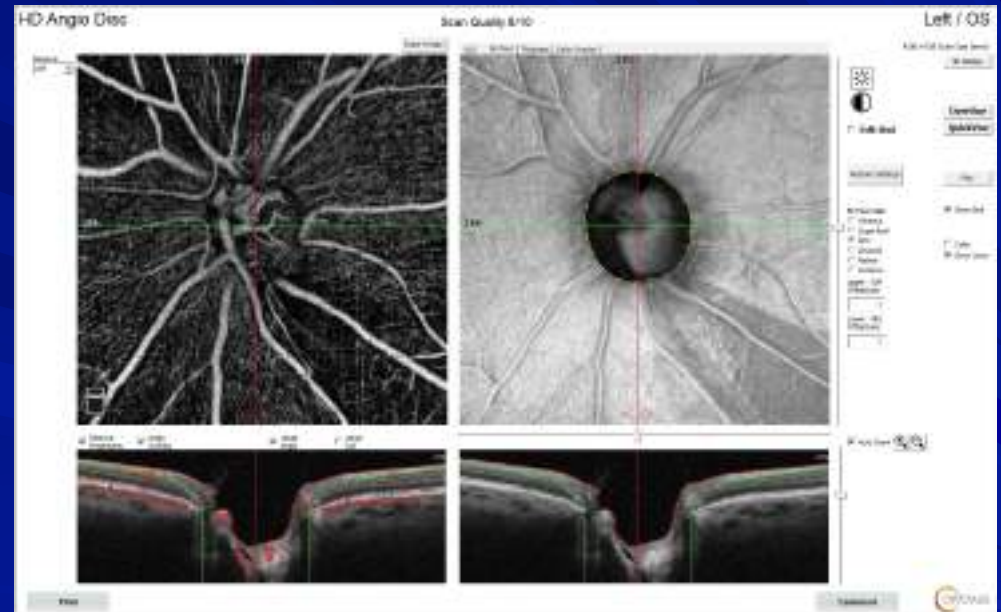
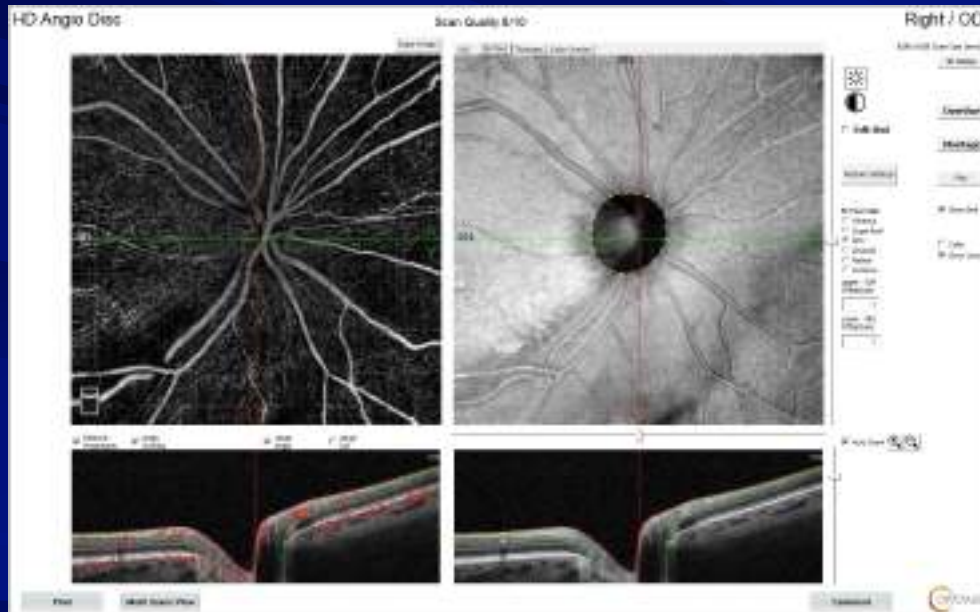
Visual Fields



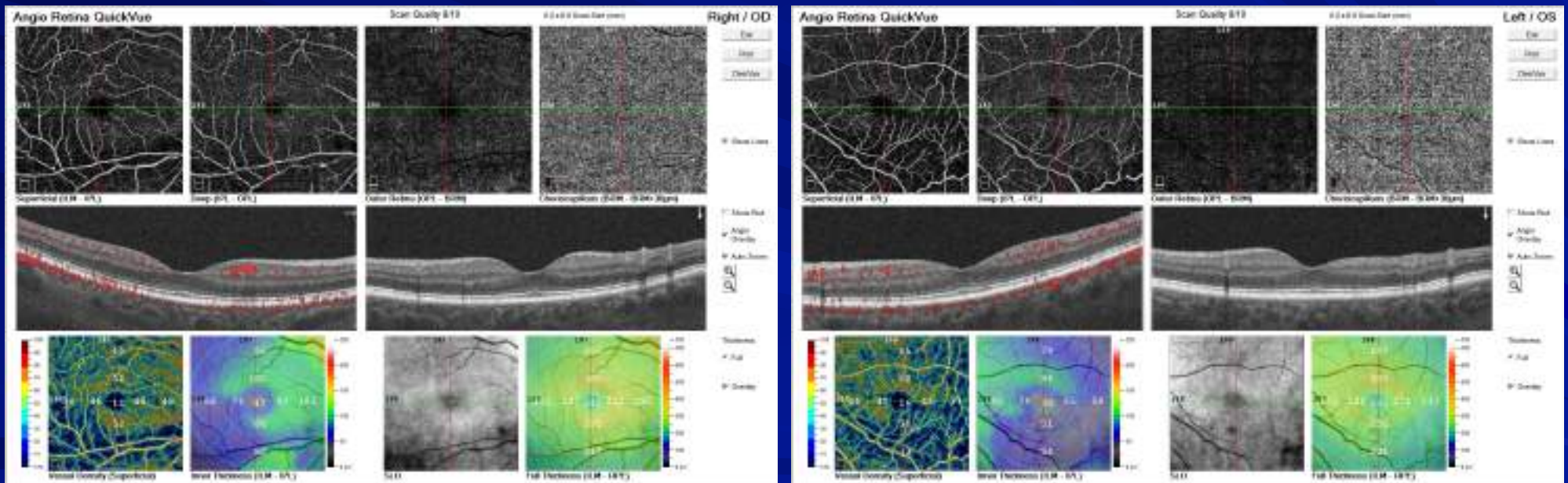
Angiography and AngioAnalytics of Disc



En Face Radial Peripapillary Capillaries (RPC)



Angiography and AngioAnalytics of Retina



Montage OD

Angio Montage



Right / OD

Exit

Over/Use

Print

Reset View

⌵ Edit

Image Display

Vitreous/Retina

Outer/Choroid

Layers

Vitreous

Superficial

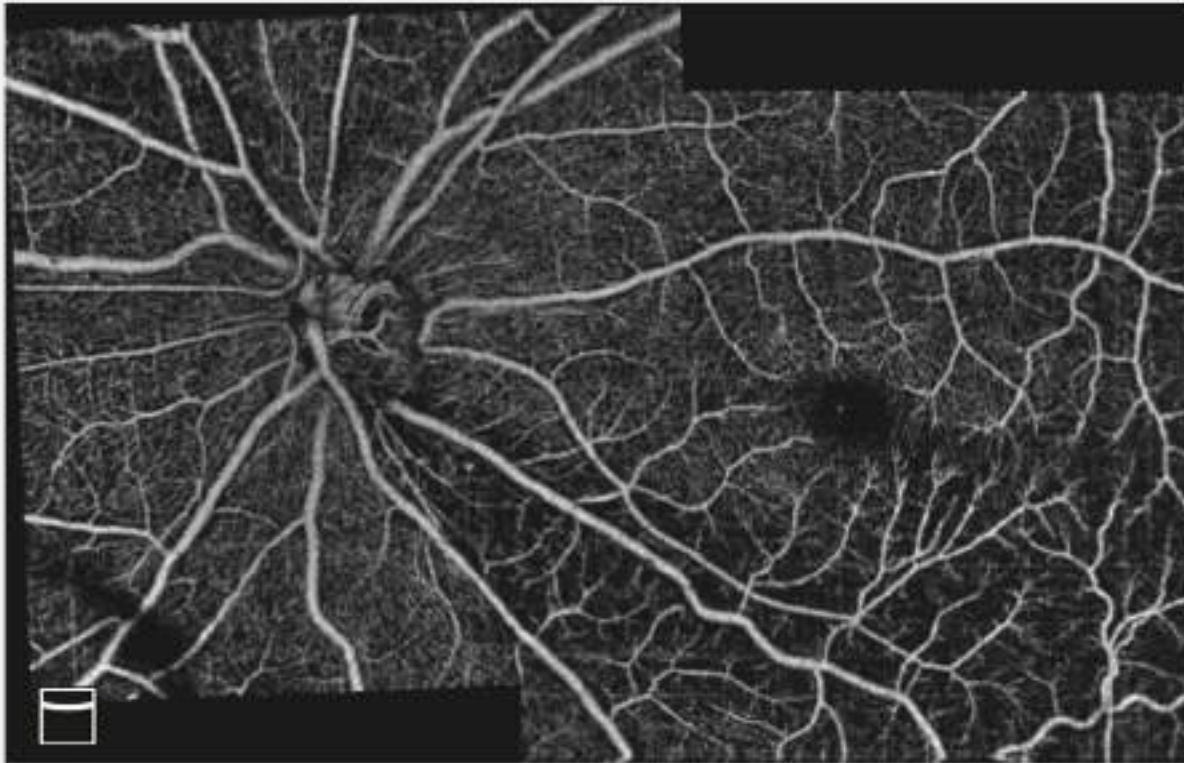
Deep

Grayscale

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

Montage OS

Angio Montage



Left / OS

Edit

Over/In

QuickView

Print

Reset View

Edit

Montage Details

Vitreous/Retina

OuterChoroid

Layers

Vitreous

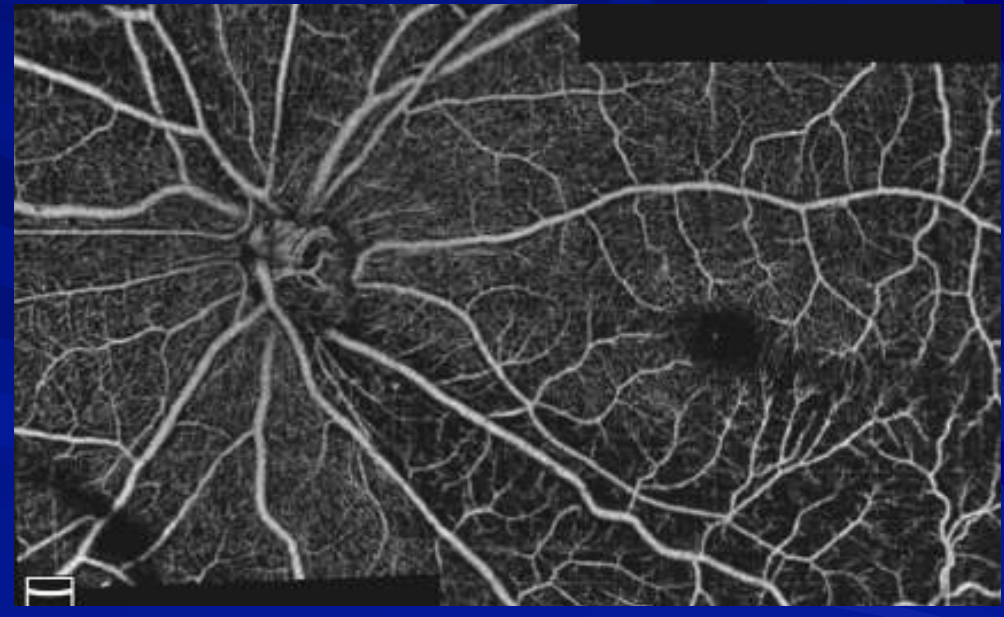
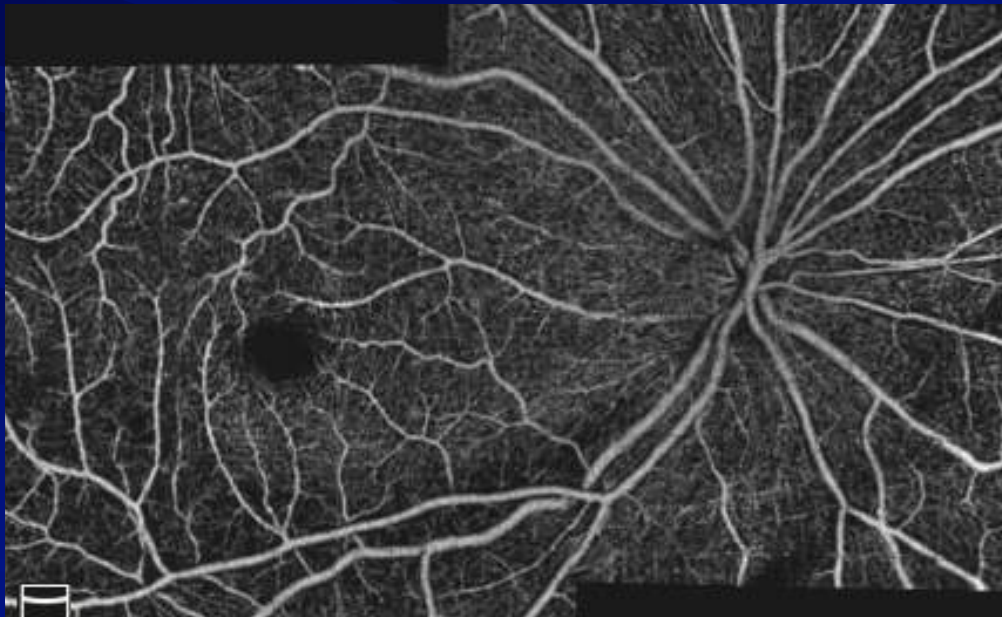
Superficial

Deep

Greyscale

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

Montage OU



74 year old man

POAG, OS > OD

Lumigan 0.01% QD OU

Combigan BID OU

E C

ENR - 1-11-2012

DFE - 8-15-11, 9-1-12, 9-13-13, 9-9-14, 9-1-15, 9-27-16, 9-26-17, 9-25-18

VF - 1-11-12, 1-13-14, 1-15-15, 1-25-17, 1-26-18,

OCT - 8-15-11, 9-1-12, 9-13-13, 9-9-14, 9-1-15, 9-27-16, 9-26-17, 9-25-18

gnia - 4-11-11, 1-14-13, 5-10-16, 5-21-18

Photos - 3-24-11, 5-11-13, 5-30-17

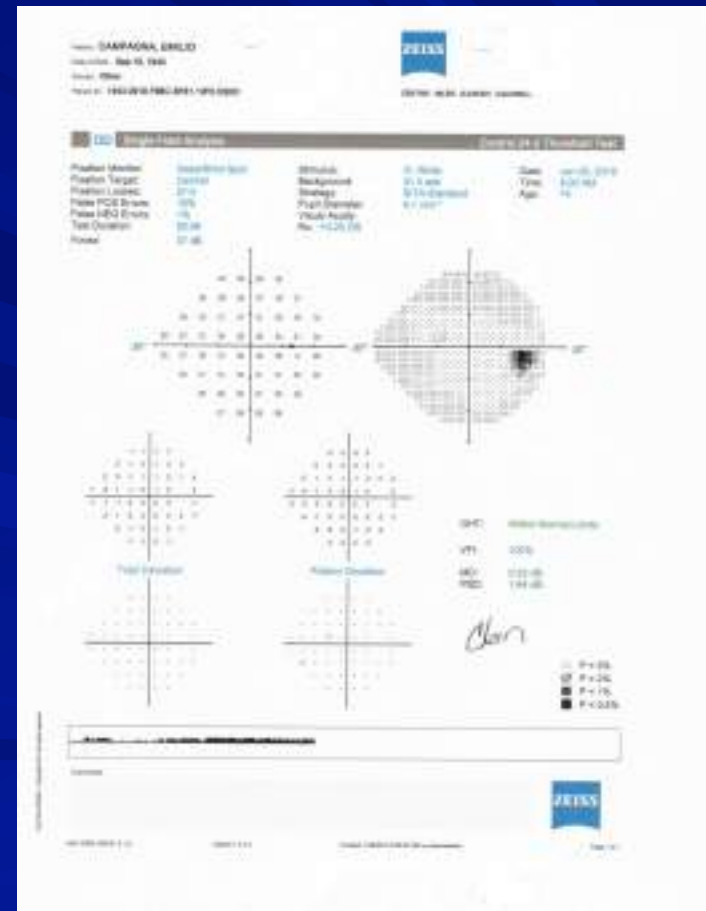
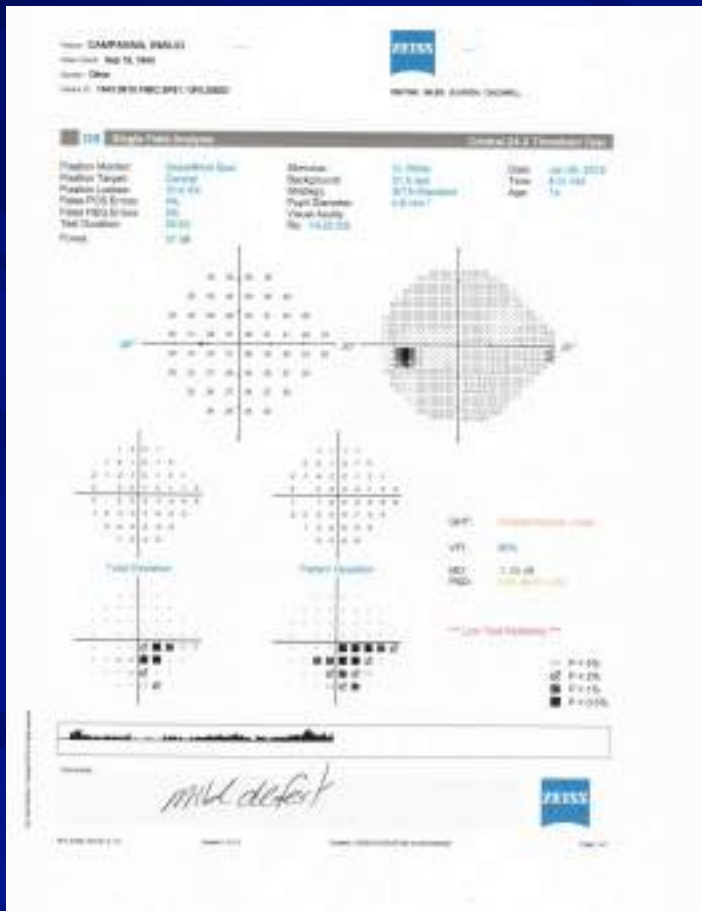
Picks - 5/11/527

OCT-A - 9-25-18

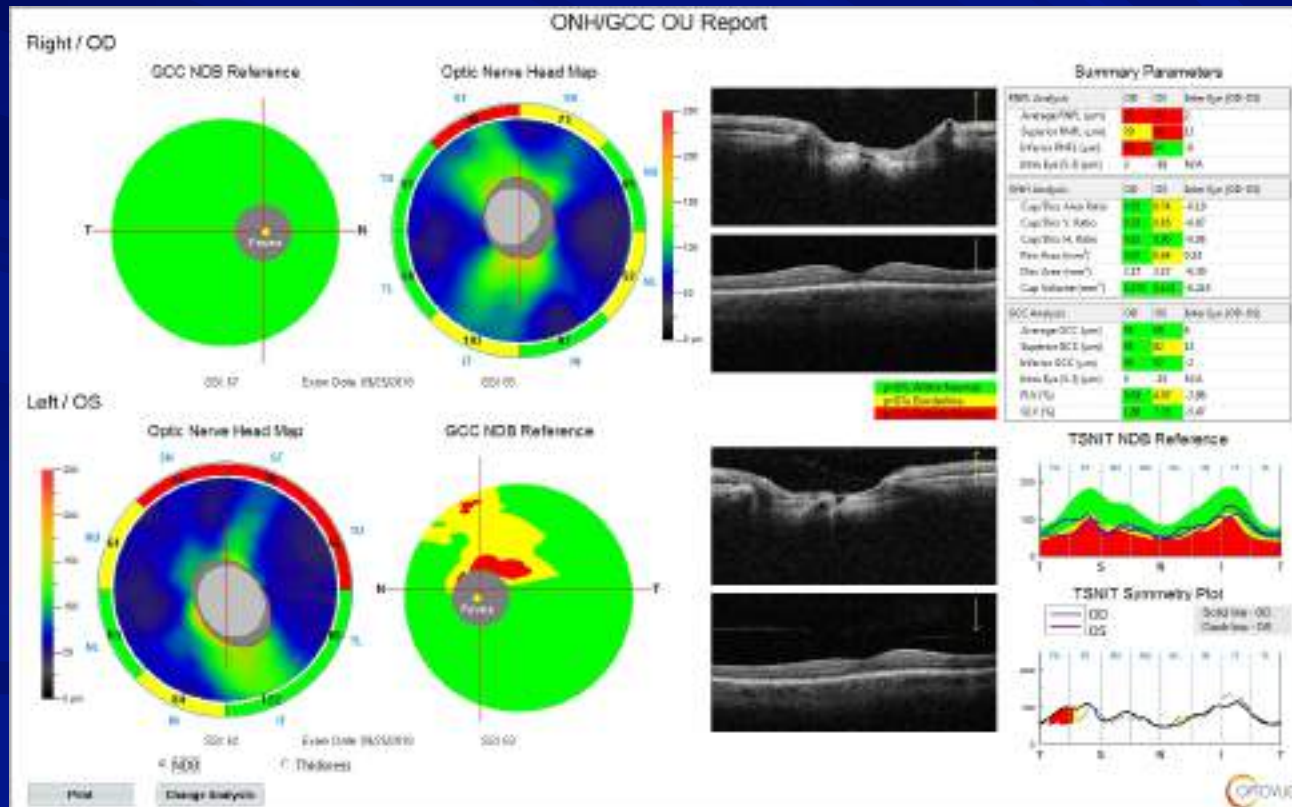
Baseline 38/35

Test 500

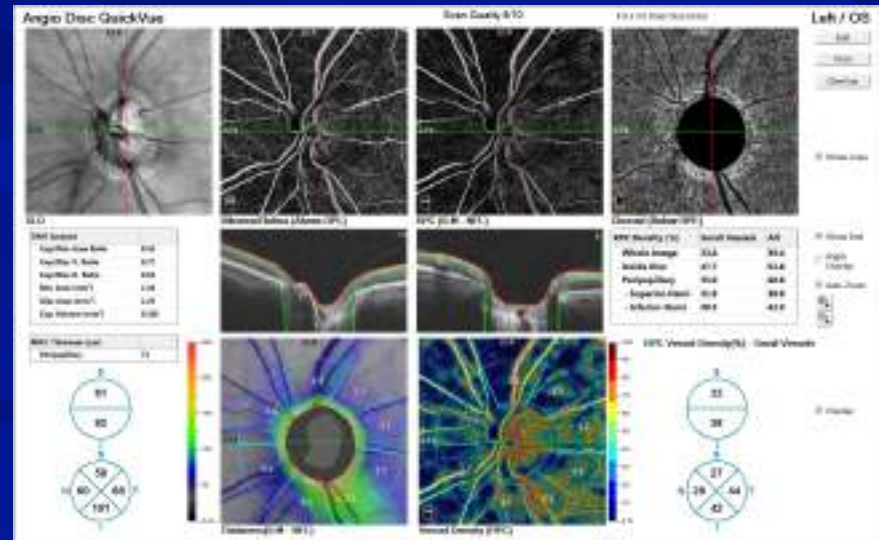
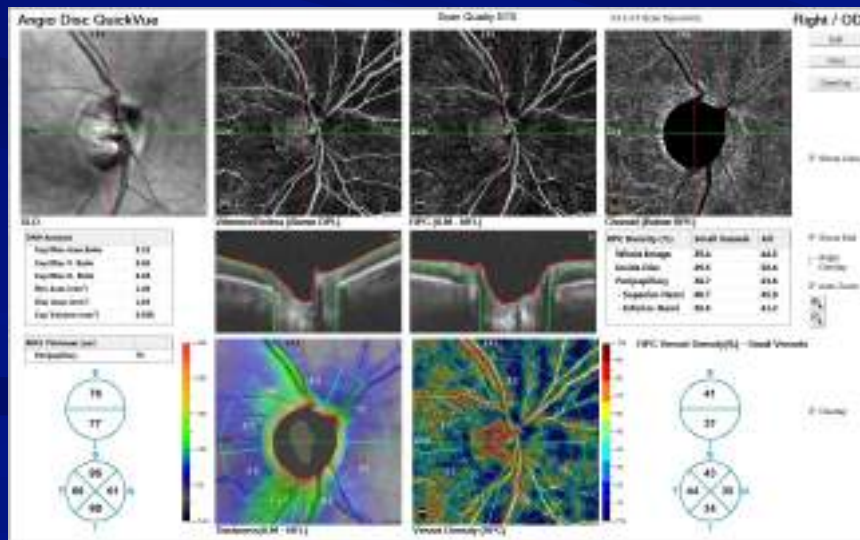
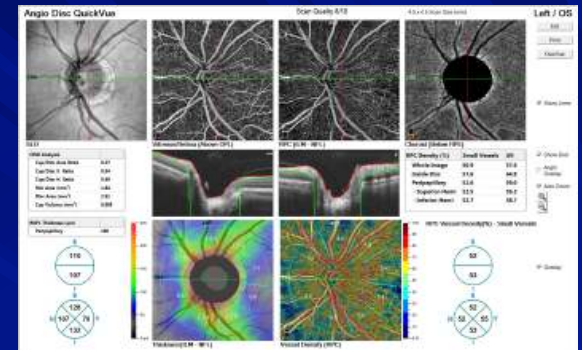
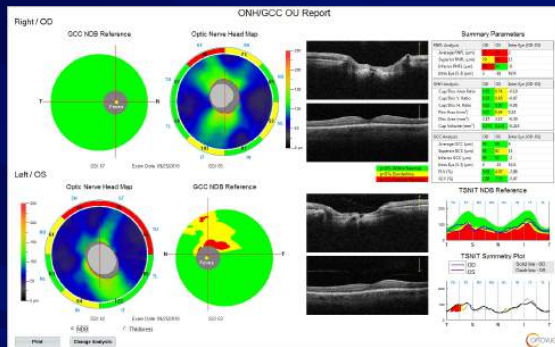
VF OD and OS 1-26-2018



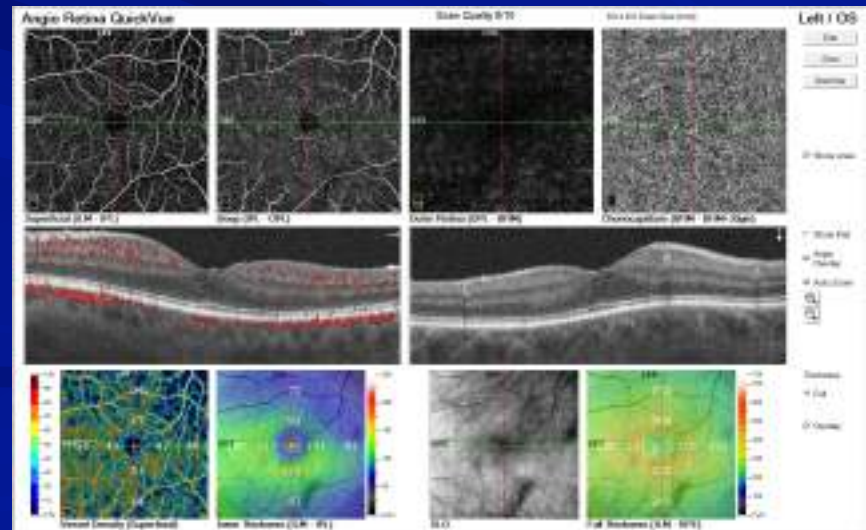
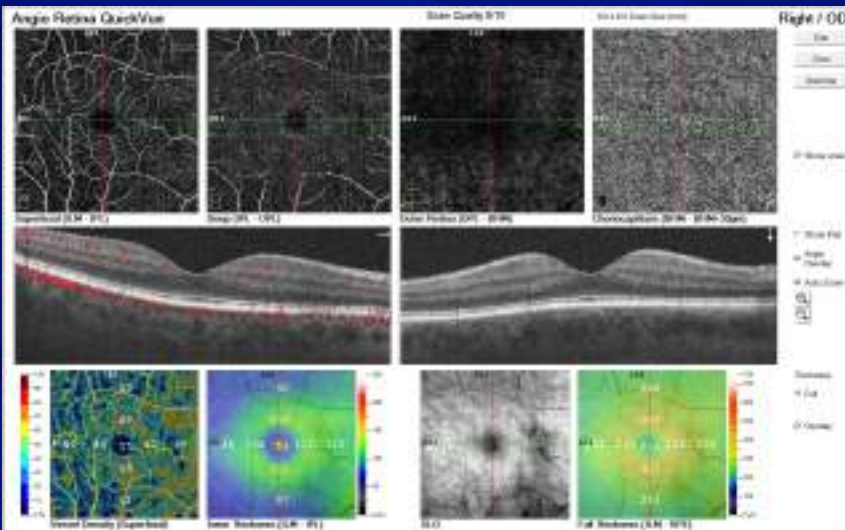
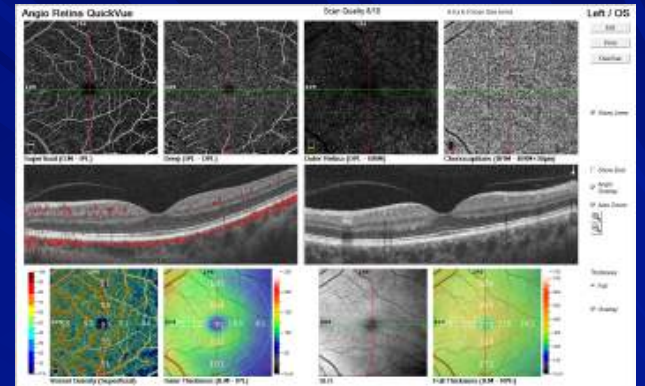
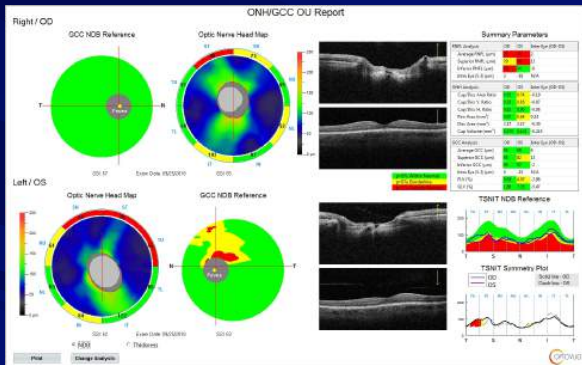
OCT NFL and GCC 9-25-2018



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

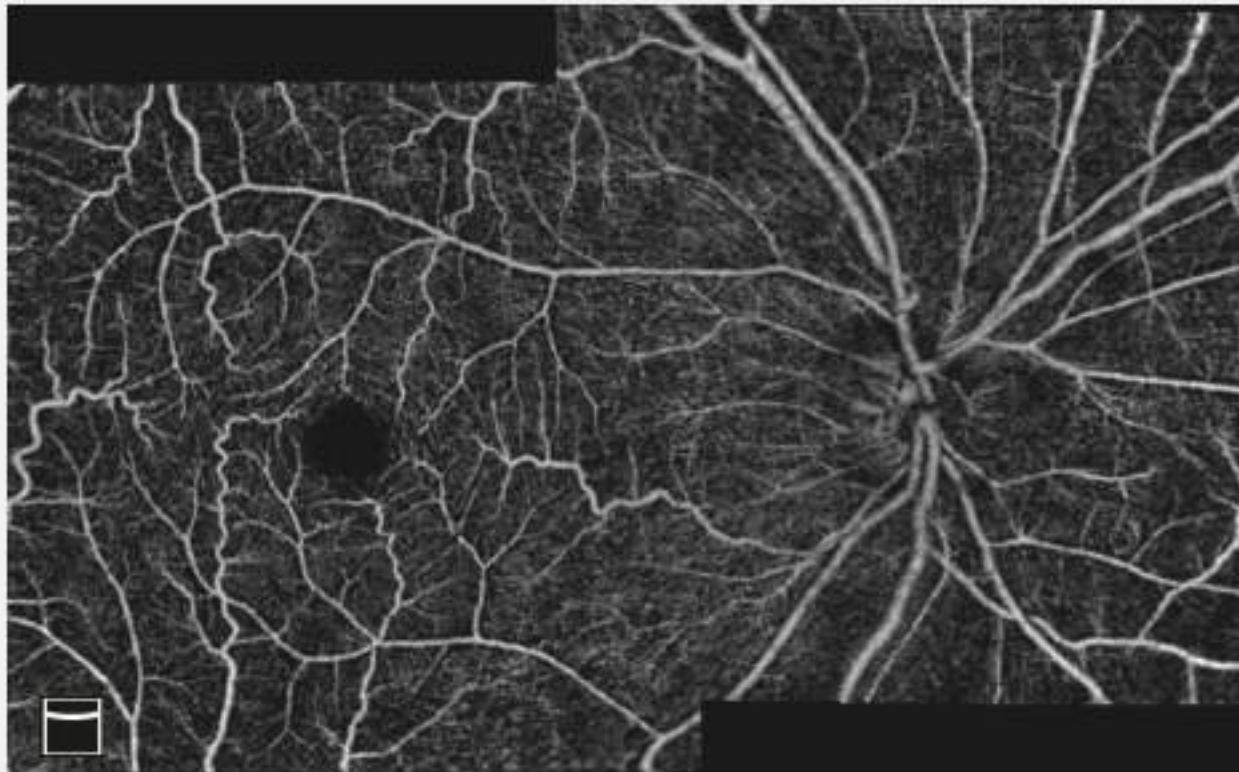


OCT-A 9-25-2018 POAG OS > OD



Montage OD

Angio Montage



Right / OD

Exit

Over/View

Print

Reset View

Edit

Active Layer Cluster:

Vitreous/Retina

Outer/Choroid

Layers:

Vitreous

Superficial

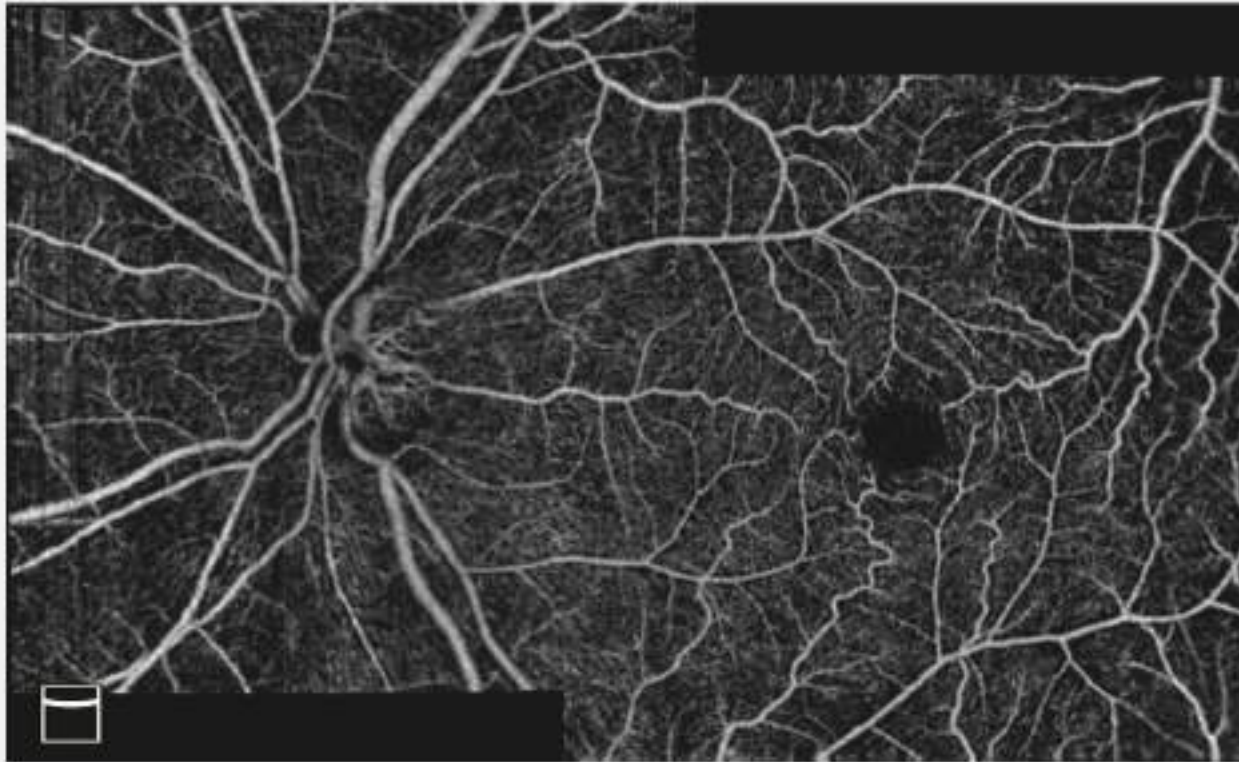
Deep

Greyscale

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

Montage OS

Angio Montage



Left / OS

Exit

OverView

Print

Reset View

Edit

Visibility Of info:

Vitreous/Retina

Outer/Choroid

Layers

Vitreous

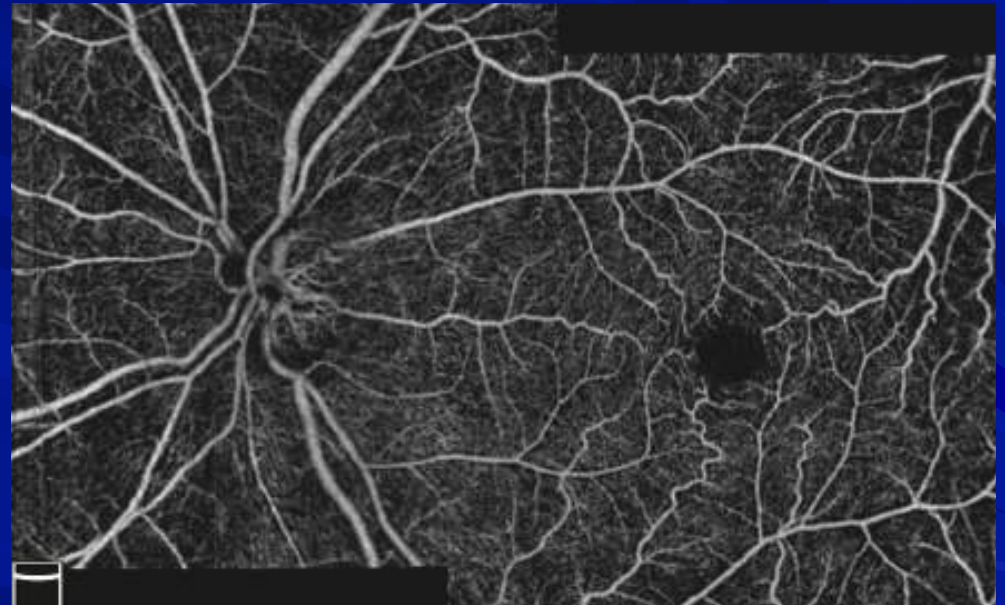
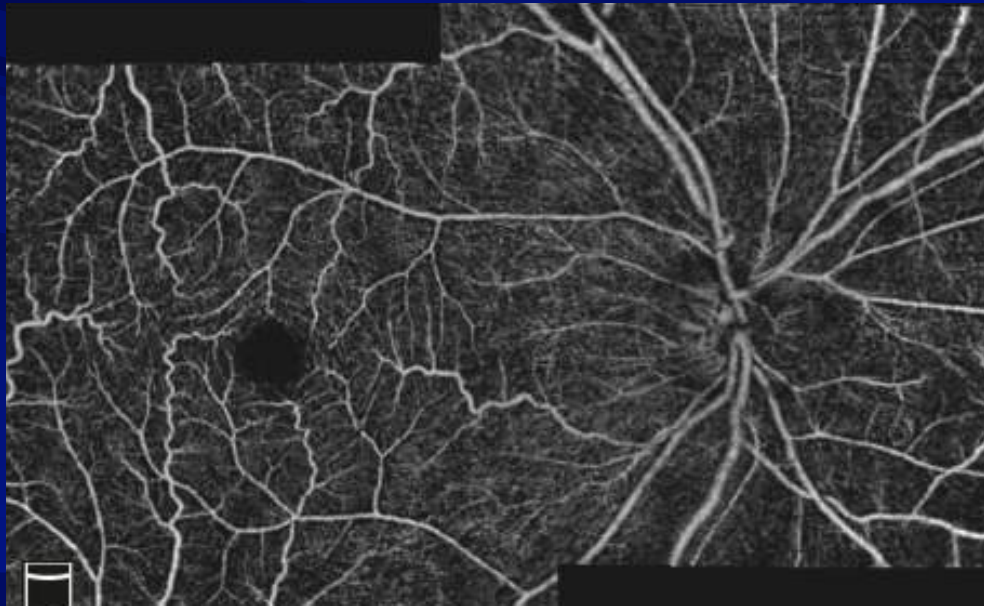
Superficial

Deep

Greyscale

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

Montage OU



They do read their EHR communication

Page 1 of 1

Drs. Centar & Imler

From:
Date: Tuesday, September 25, 2018 1:07 PM
To: <centariml@atlantacbb.net>
Subject:

To Whom it may concern:

I was reading my patient chart online, which was emailed to me right after my office visit today. I noticed they have my weight recorded as 344 pounds. That weight is incorrect because I'm now at 333, which has been holding steady between 332 and 334 for several months now.

Sincerely,

Sent from my iPhone™

49 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

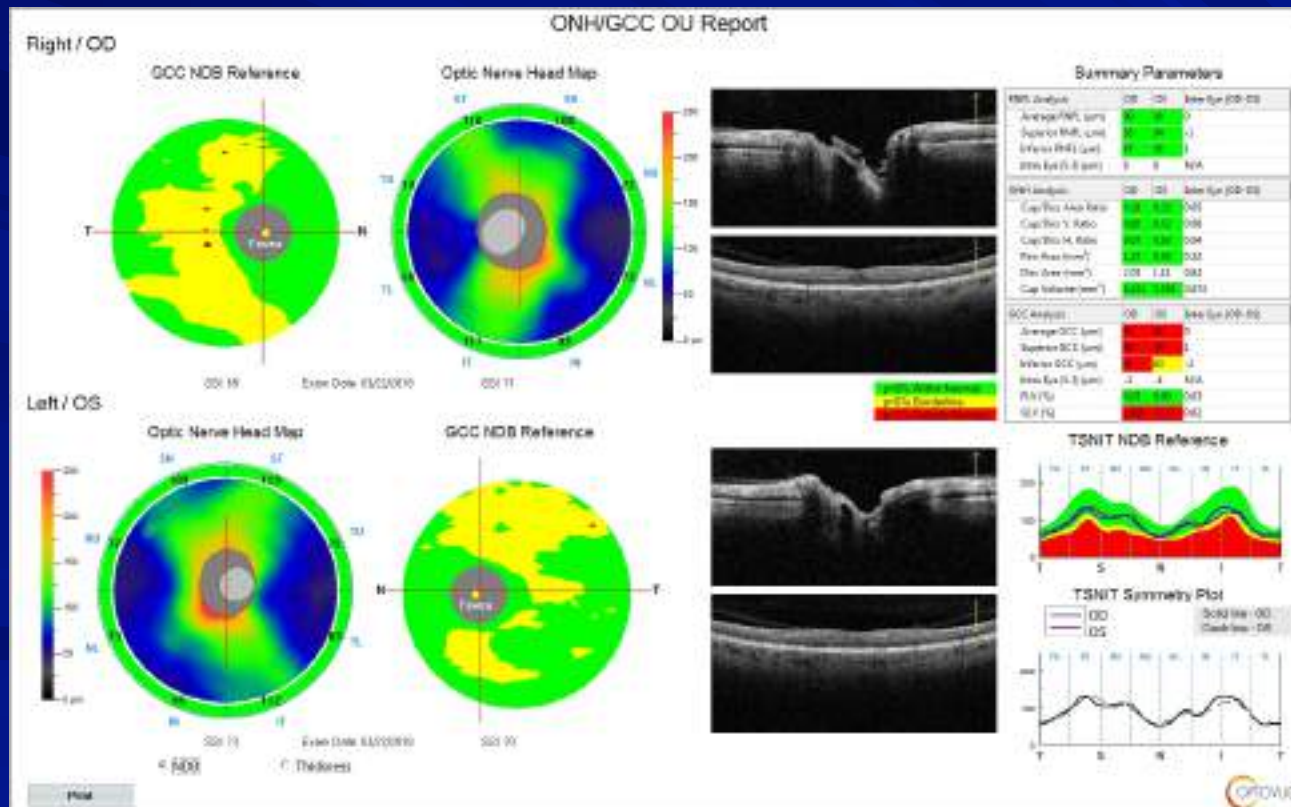
DFE - 3-22-18
VF - 9-25-18
OCT - 3-22-18
Gonio - 1-10-18
Photos -
Aclis - 589/589
OCT-A - 9/25/18
dec

Baseline 26/26 1-3-14 30/32
20/32 9-25-18

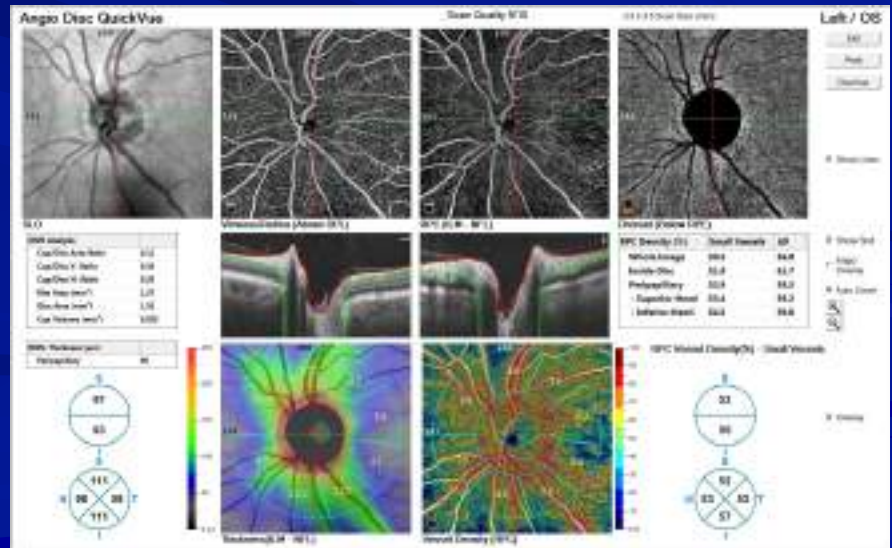
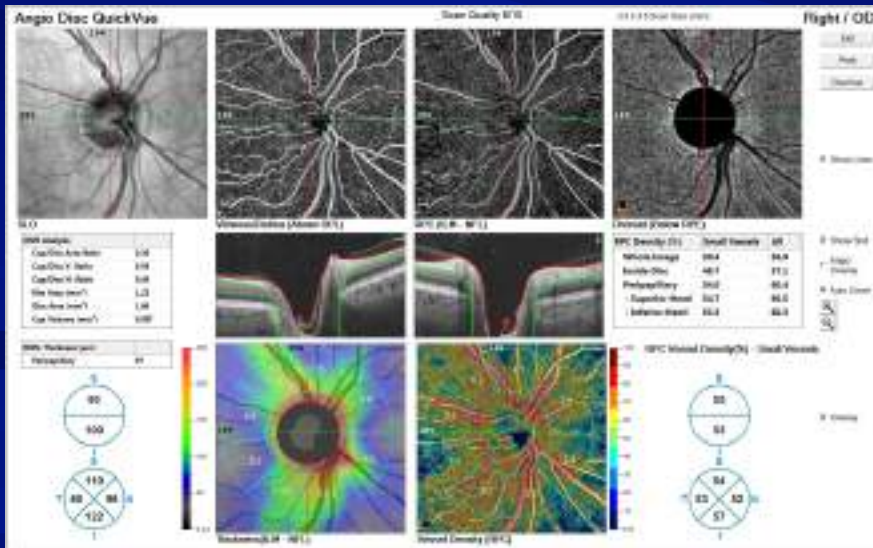
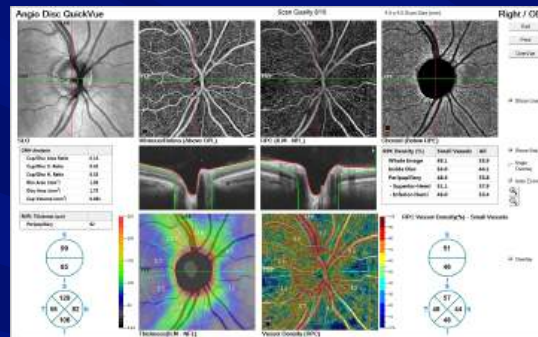
Pigment Dispersion
Fam Hx - mother?

OCT NFL and GCC

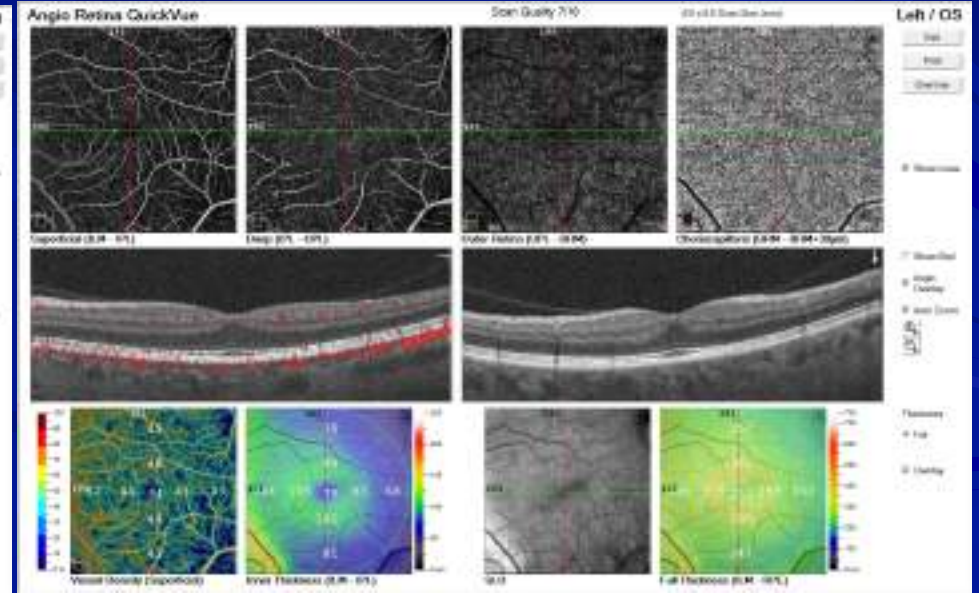
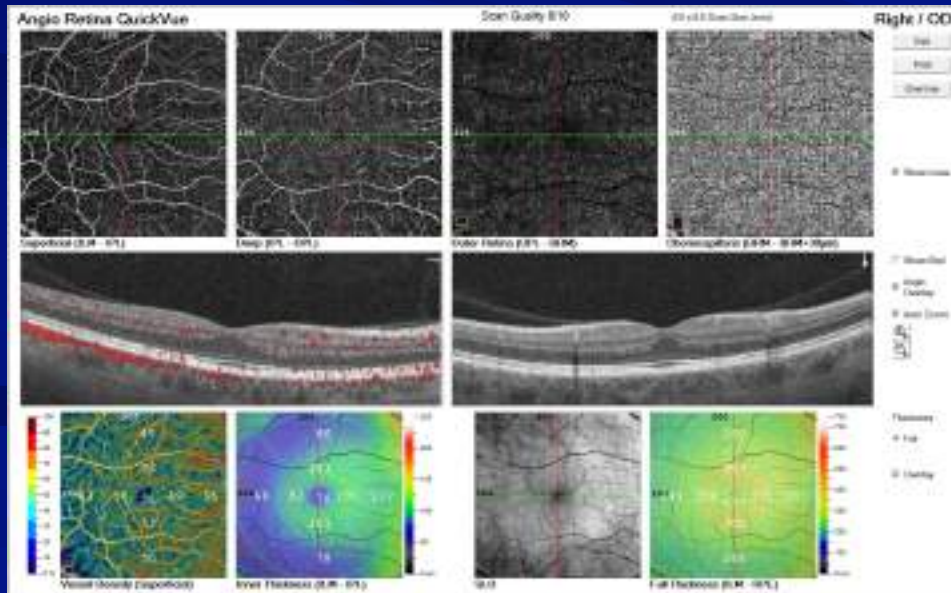
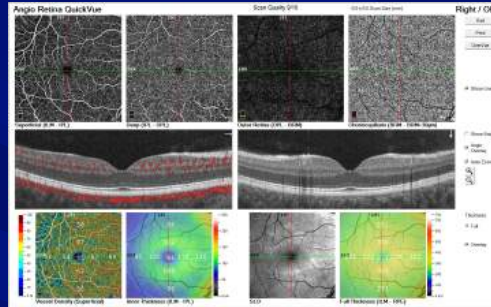
3-22-18



OCT-A 9-25-2018

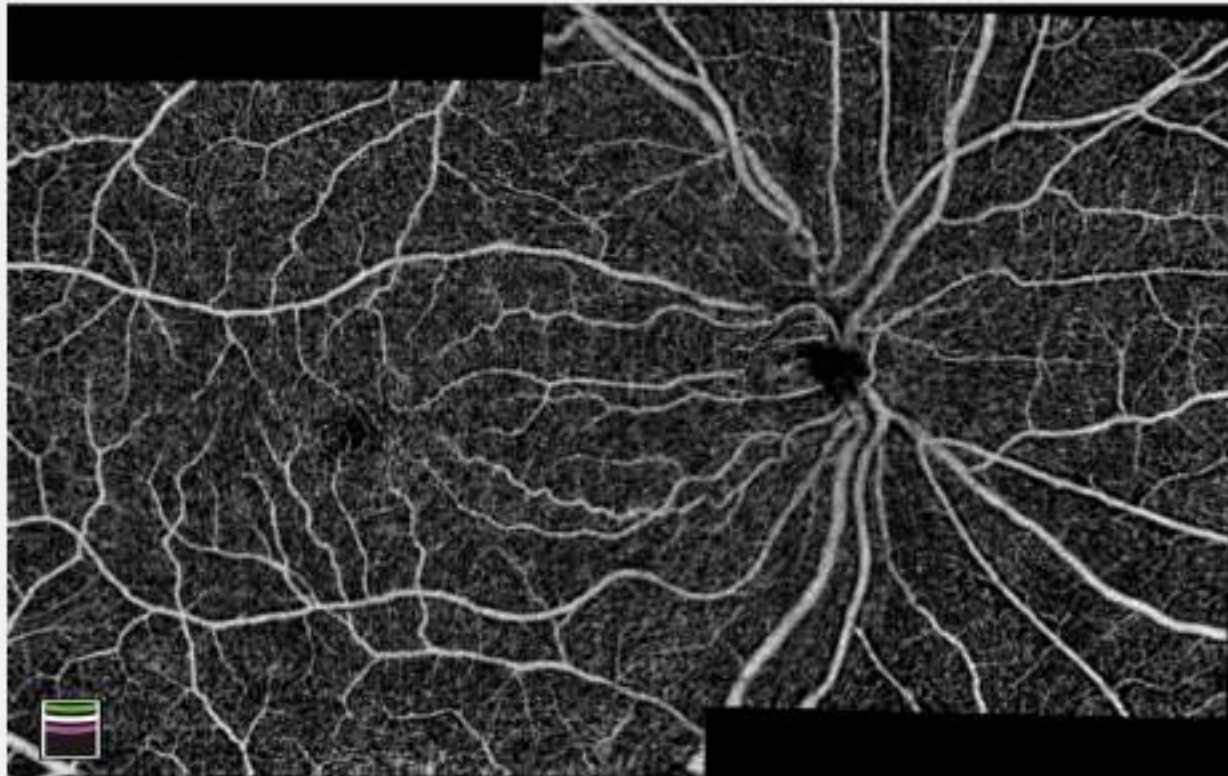


OCT-A 9-25-2018



Montage OD

Angio Montage



Right / OD

Exit

Over/Inn

Print

Reset View

Edit

Montage Display

Vitreous/Petina

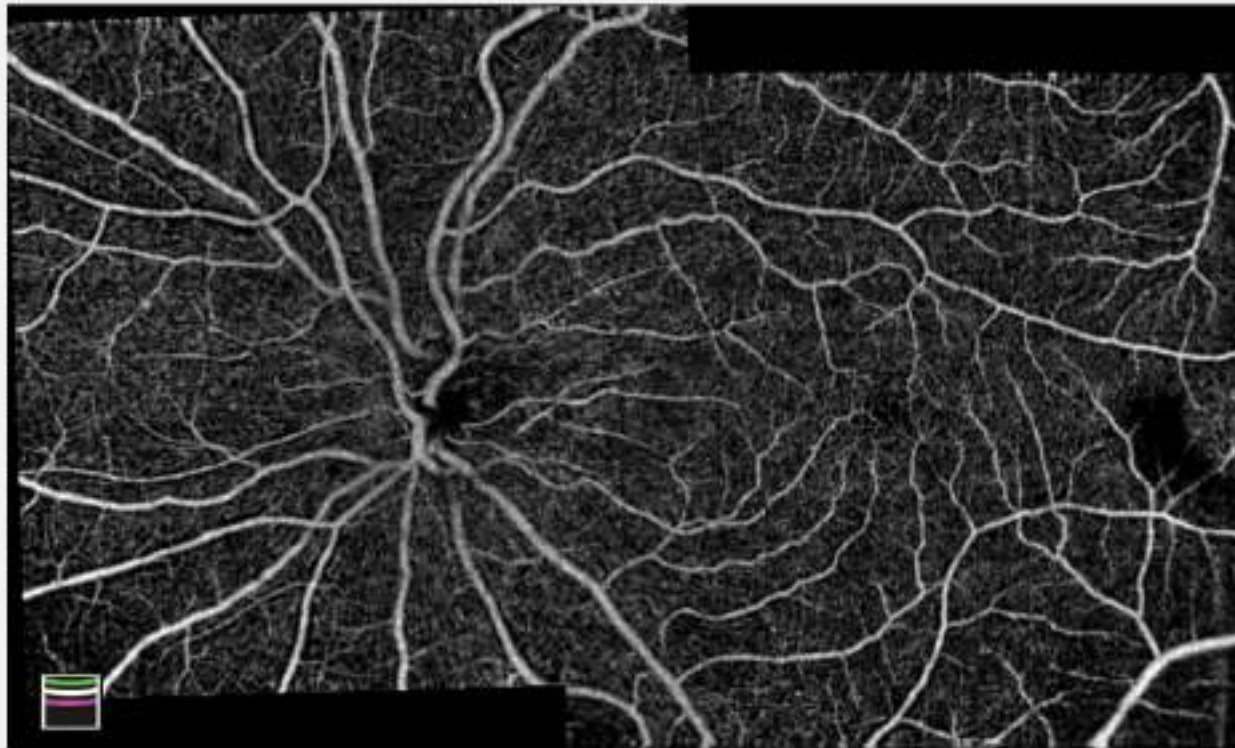
Outer/Choroid

Grayscale

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

Montage OS

Angio Montage



Left / OS

Exit

Overview

Print

Reset View

Edit

Montage Overlay

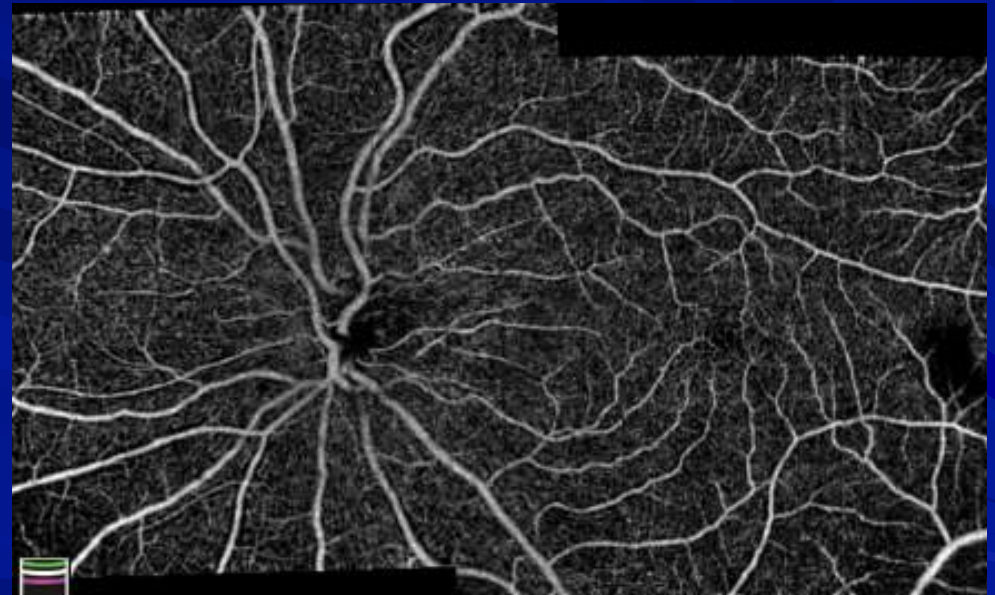
Vitreous/Retina

Outer/Choroid

Grayscale

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

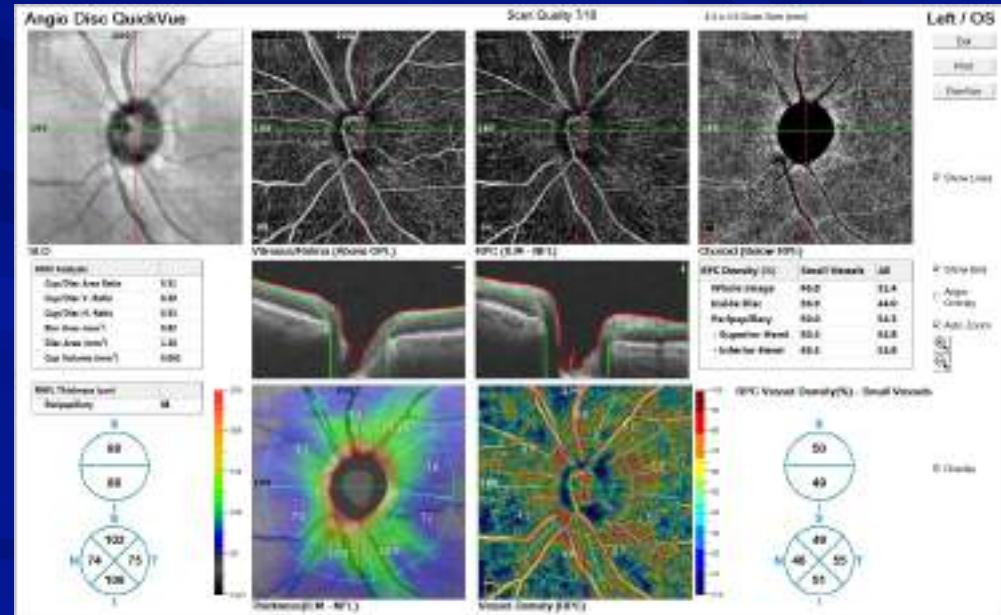
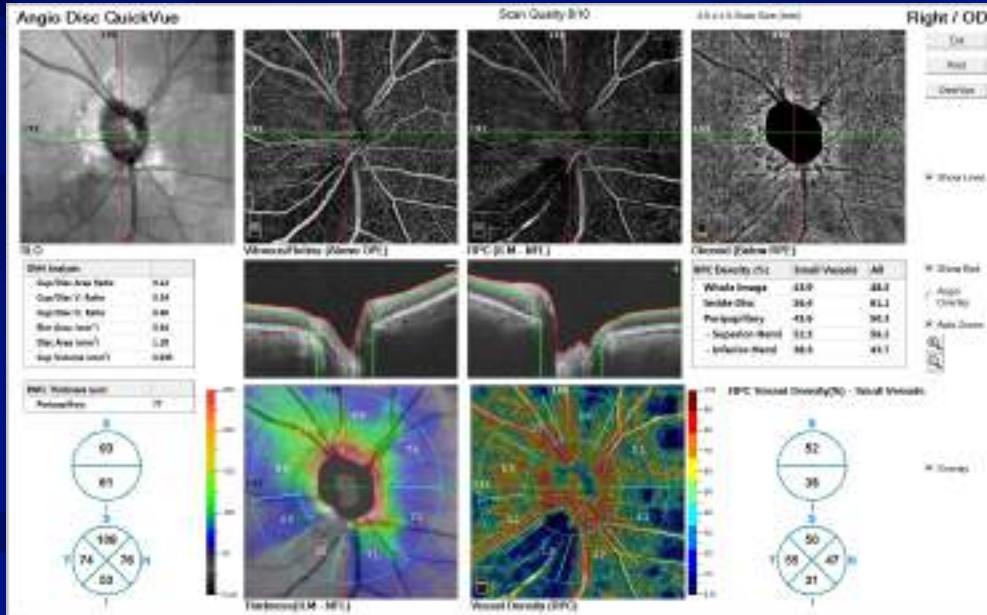
Montage OU



How Does OCTA Change the Way You See Glaucoma?

- ↳ Shows early changes in the retina and optic disc
- ↳ Adds new information to the diagnosis
- ↳ Aids in progression detection

Glaucoma versus Other Optic Neuropathy



Next Generation Diabetes and Retina
Analysis with OCT + OCTA

29 year old man with diabetes

👁️ Yearly diabetic exam, reports no changes to vision

- ★ Type 1 DM

👁️ BS: 190 this AM, last HbA1c 8.6

👁️ Vision 20/20

👁️ Anterior segment: normal

👁️ Posterior segment:

- ★ Non-proliferative DR

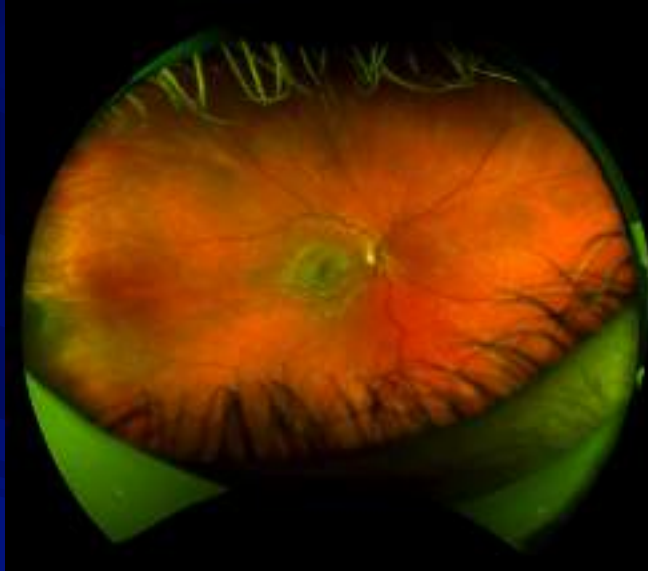
 - ☐ Hemes and exudates

- ★ No CSME

👁️ Billed for:

- ★ Exam- 99214

- ★ Optomap, OCT-Wellness, and OCT-A (Angiography)



10-31-2017



12-19-2018



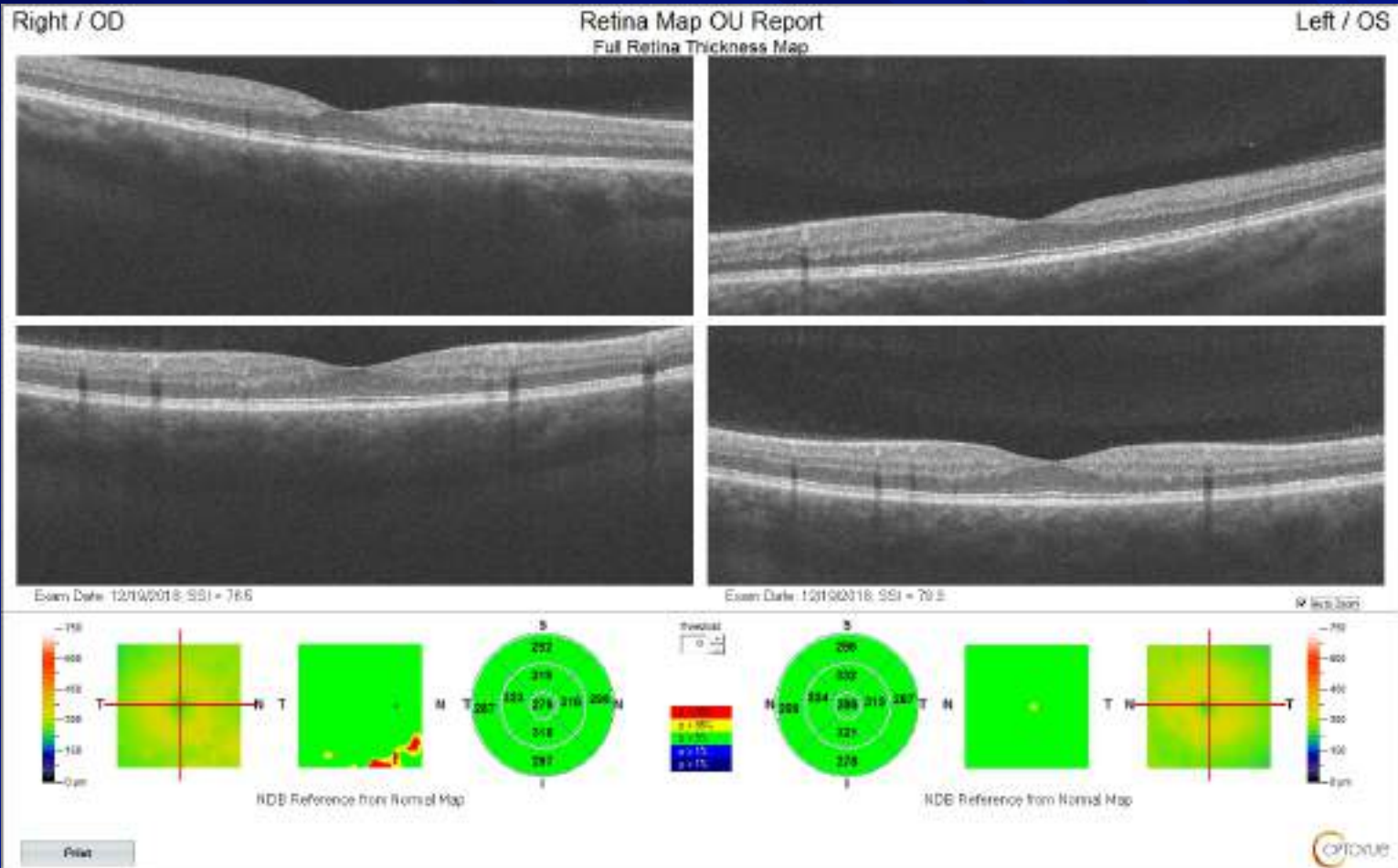


12-19-2018

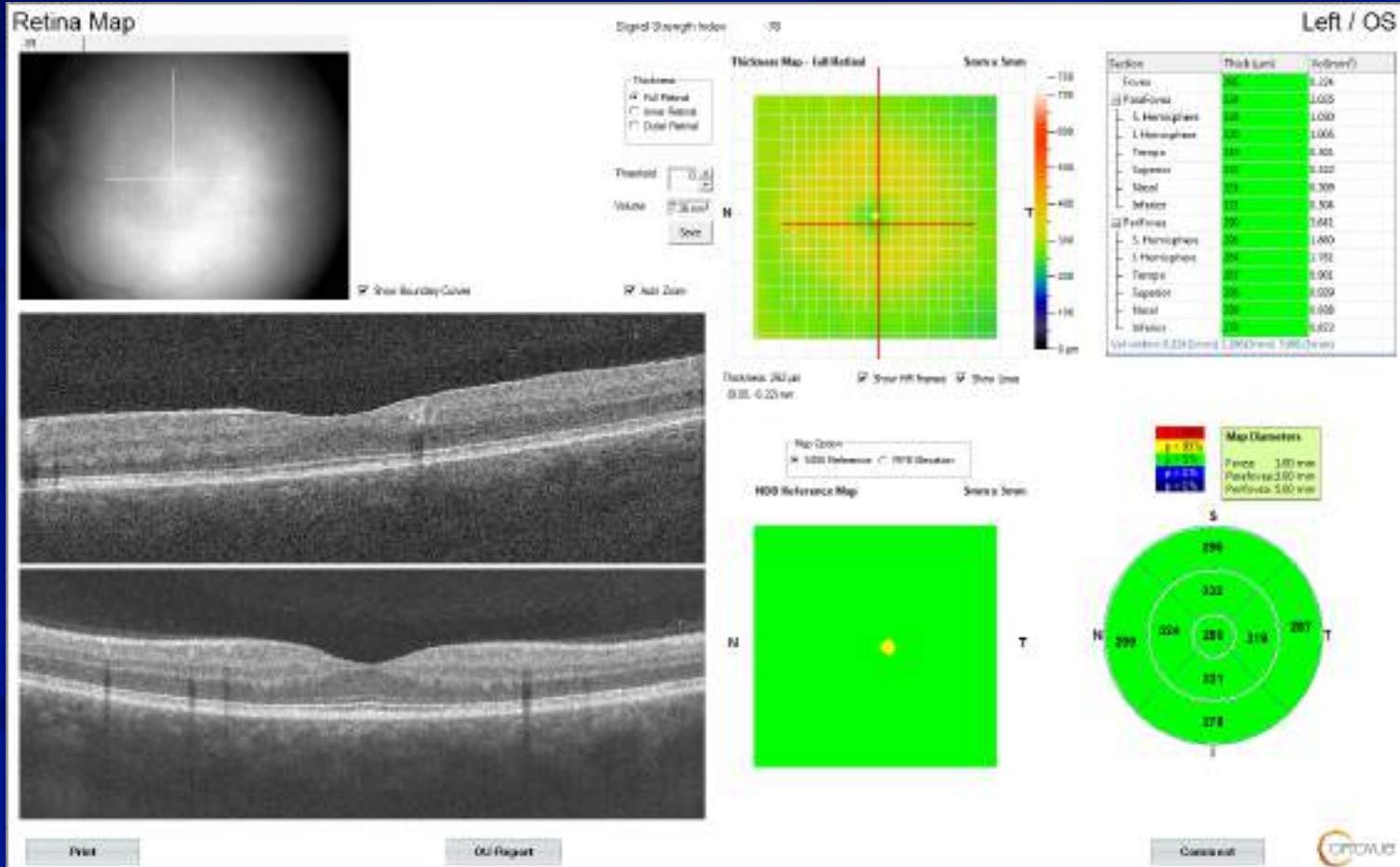


12-19-2018

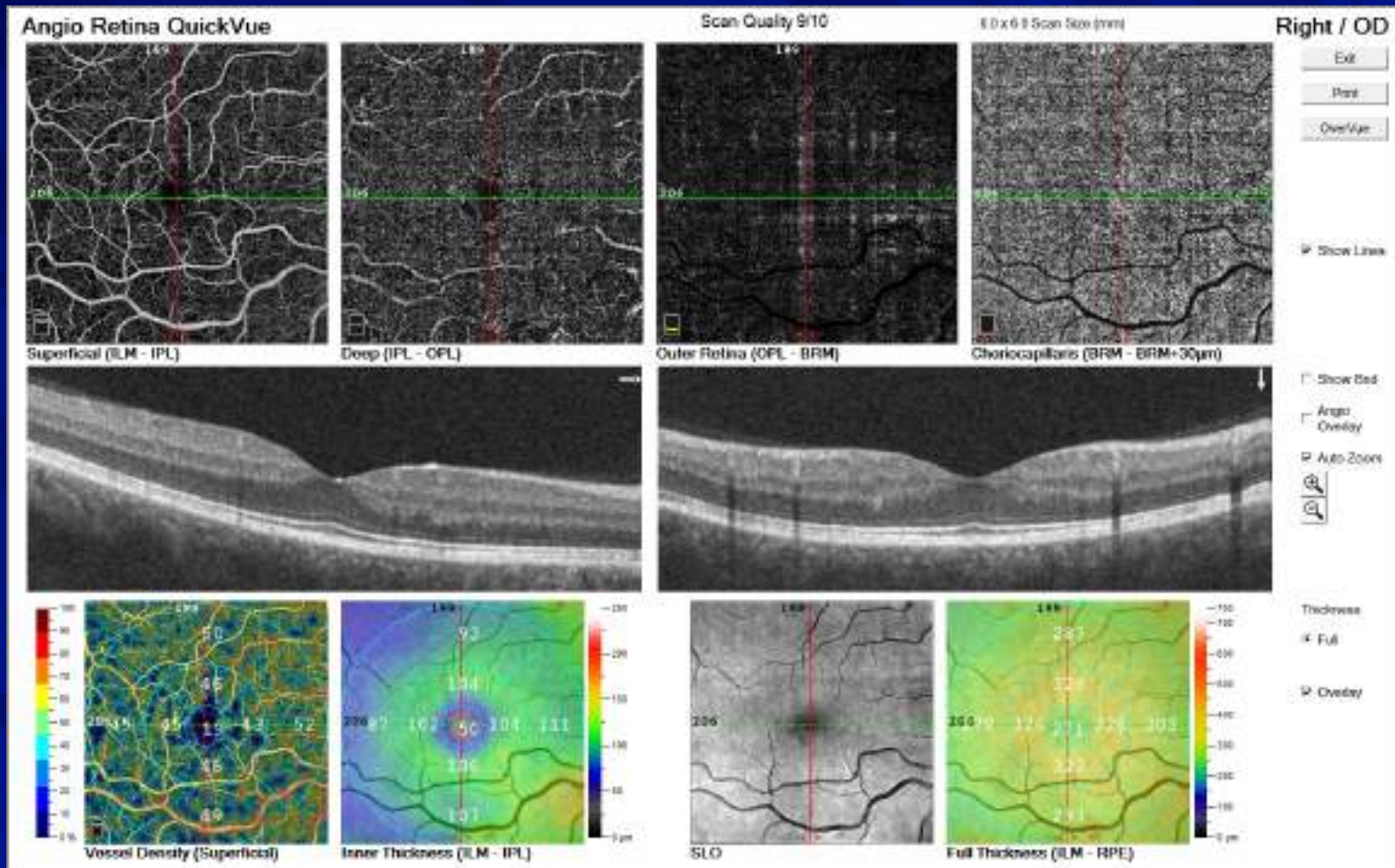
12-19-18



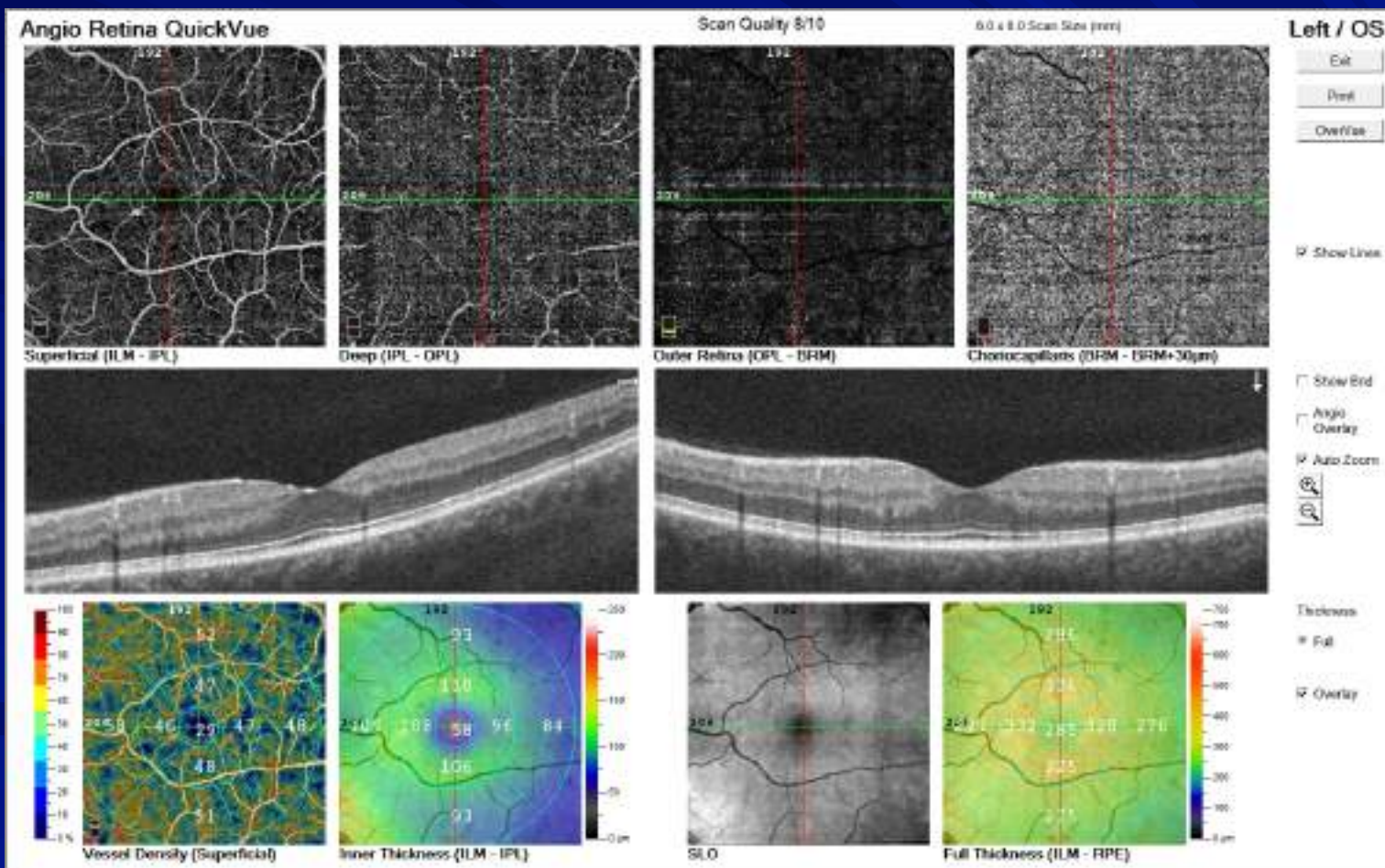
12-19-18 what do you see?



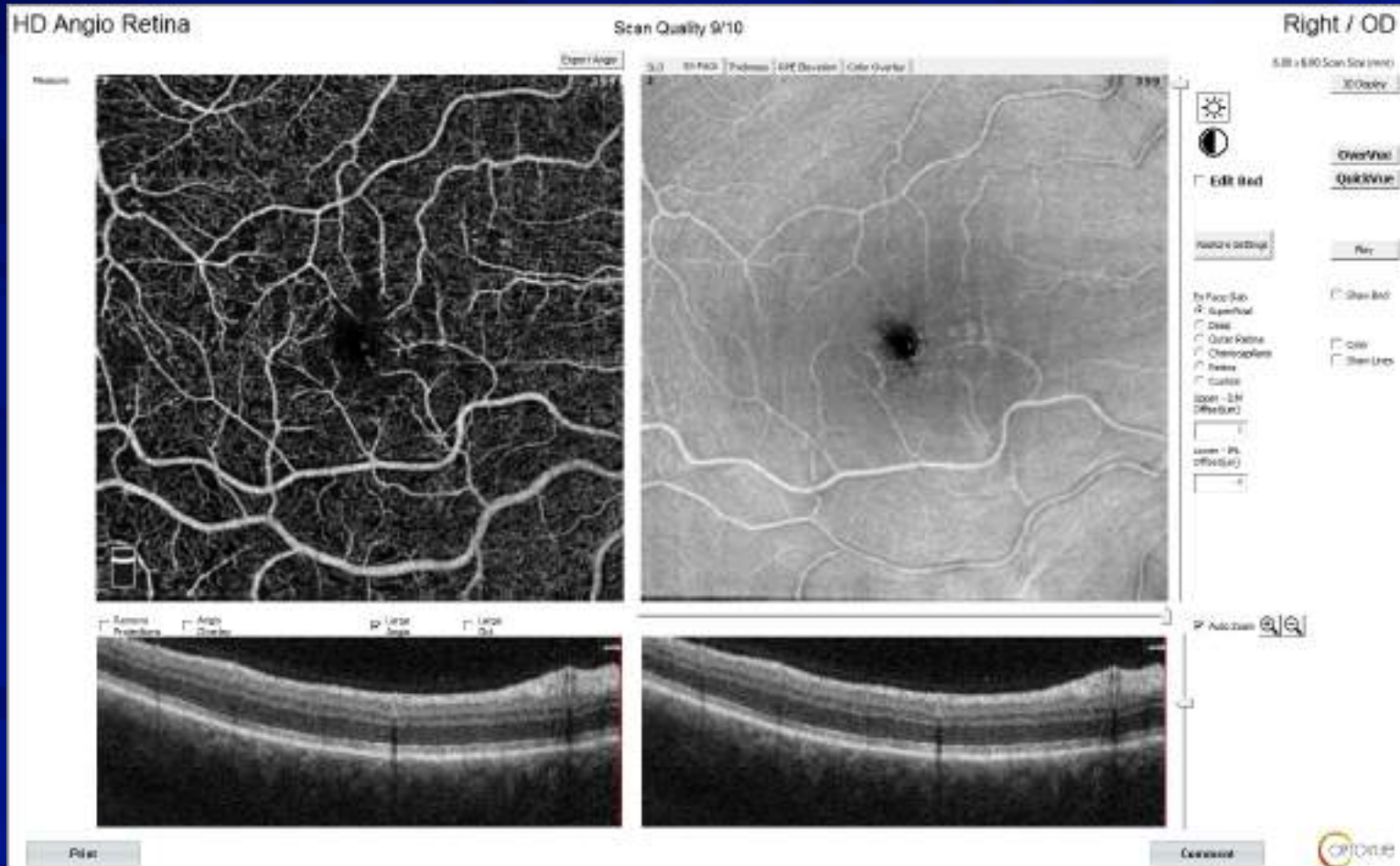
12-19-2018



12-19-18



12-19-2018



12-19-2018

HD Angio Retina

Scan Quality 8/10

Left / OS

6.00 x 6.00 Scan Size (mm)

2D Display

Overview

QuickView

Edit Ang

System Settings

File

Show Ang

Color

Show Lines

Eye View

Superficial

Deep

Outer Retina

Choroid

Retina

Custom

Upper - 500 (Pixel/cm)

Lower - 500 (Pixel/cm)

Scale Bar

Print

Closest

Superficial

Deep

Outer Retina

Choroid

Retina

Custom

Upper - 500 (Pixel/cm)

Lower - 500 (Pixel/cm)

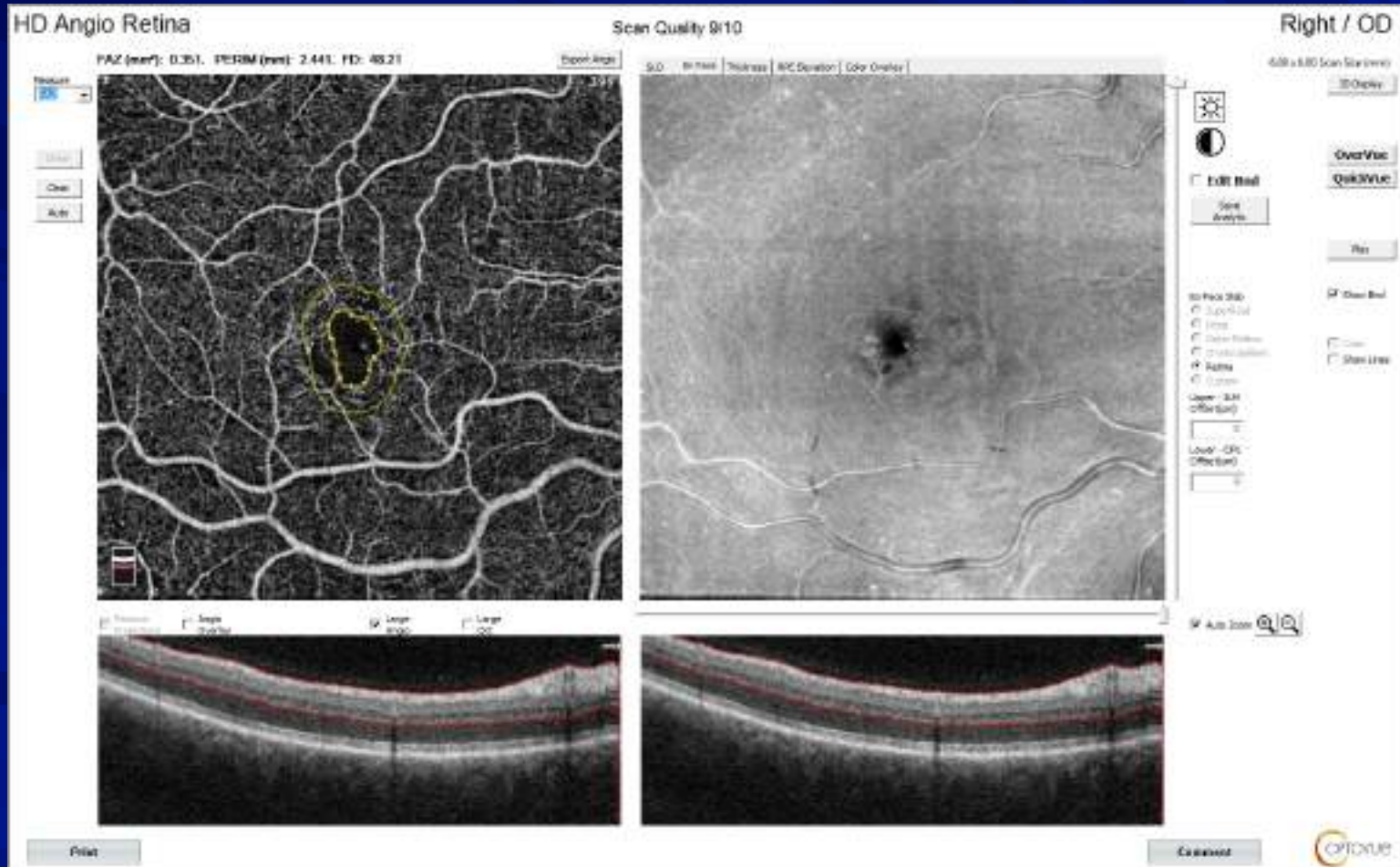
Scale Bar

Print

Closest

OPCON

12-19-2018



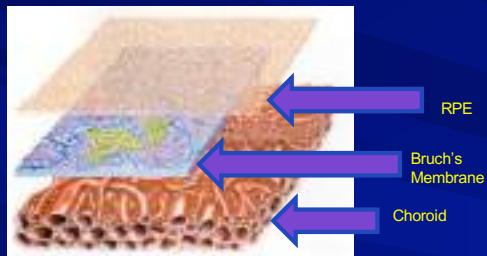
OCT and OCT-A

👁️ Treatment?

👁️ Certainly useful, beneficial, essential, and important in following the patient with diabetes

👁️ Improved HbA1c

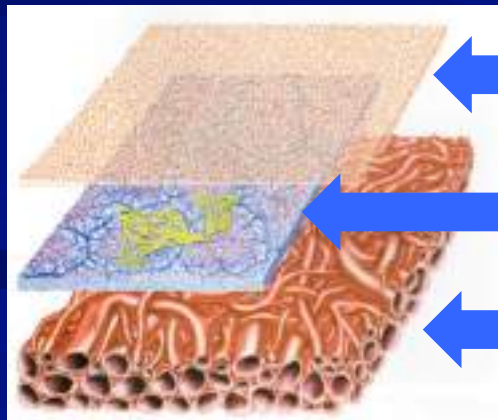
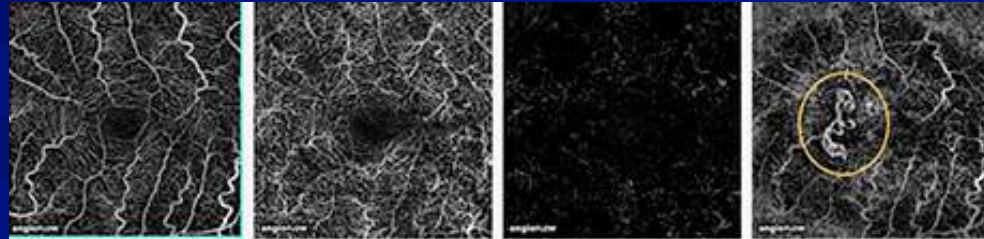
Type 1 “Occult” CNV



- ▶ New vessels develop in the choroid
- ▶ New vessels located below RPE and above Bruch's membrane

Type 1 “Occult” CNV

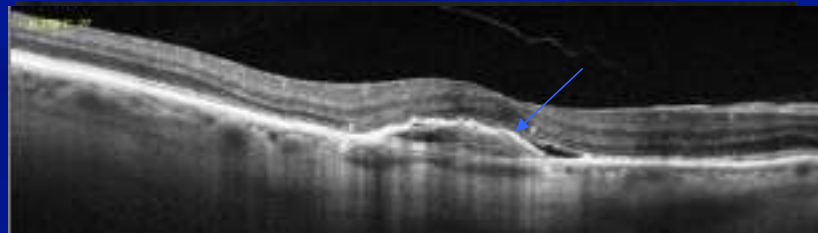
- ↳ New vessels develop in the choroid
- ↳ New vessels located **BELOW RPE** and **ABOVE** Bruch’s membrane



RPE

Bruch's
Membrane

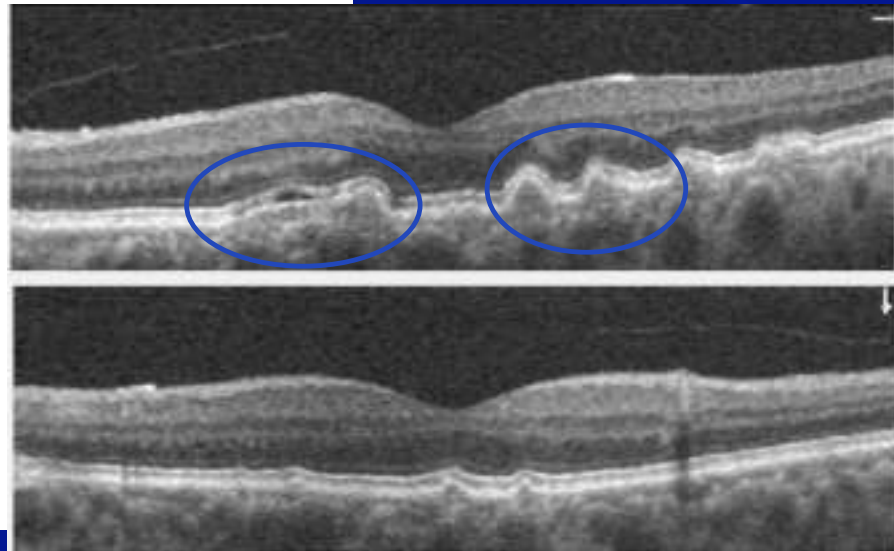
Choroid



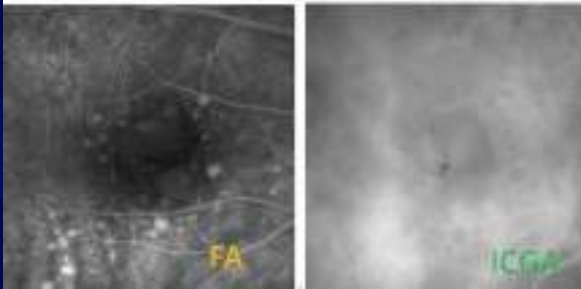
CNV?



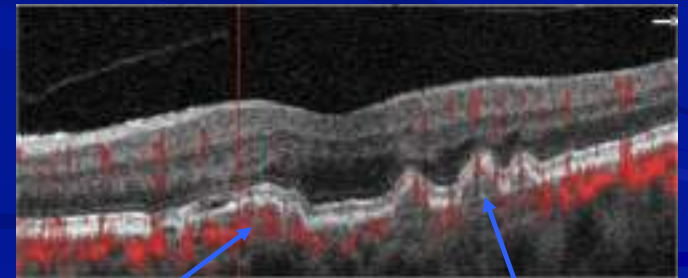
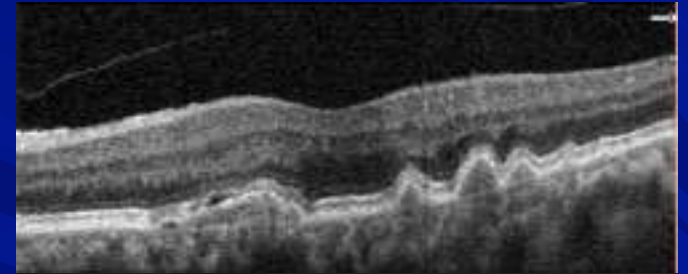
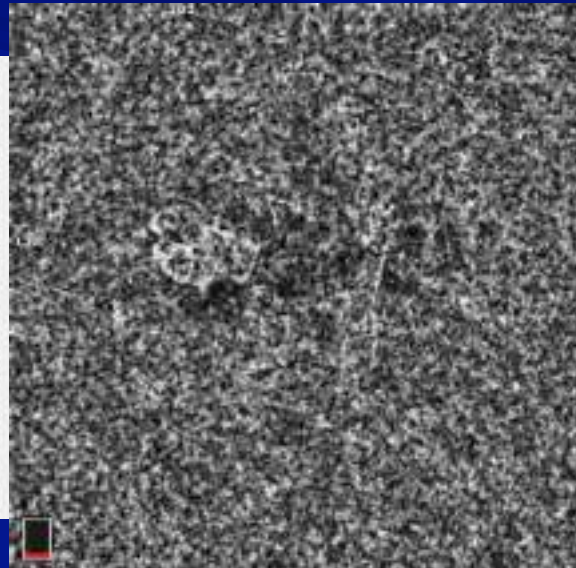
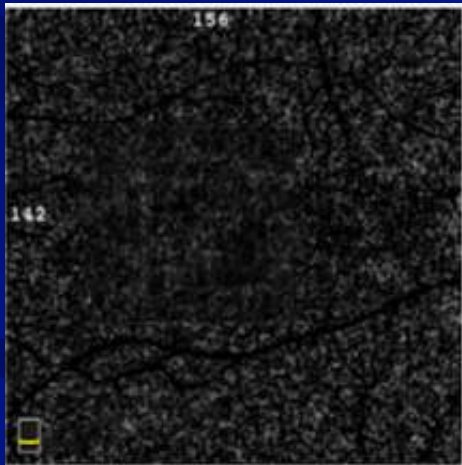
72 y/o Hispanic male
20/30
History of "Dry AMD"



Multimodal imaging and OCTA



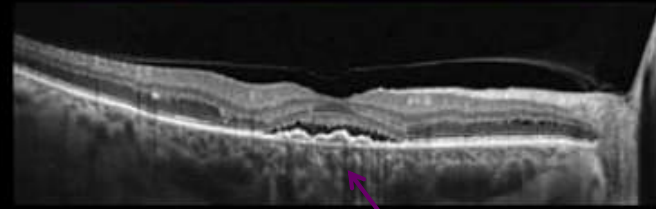
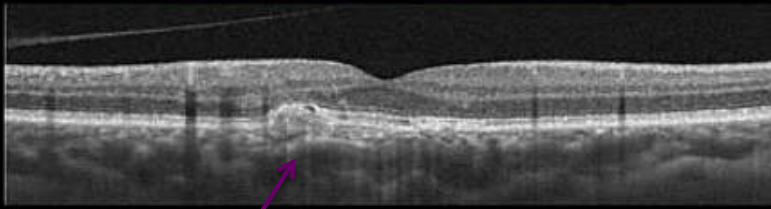
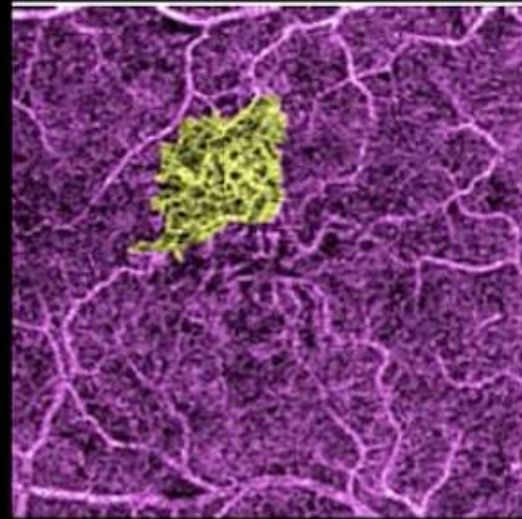
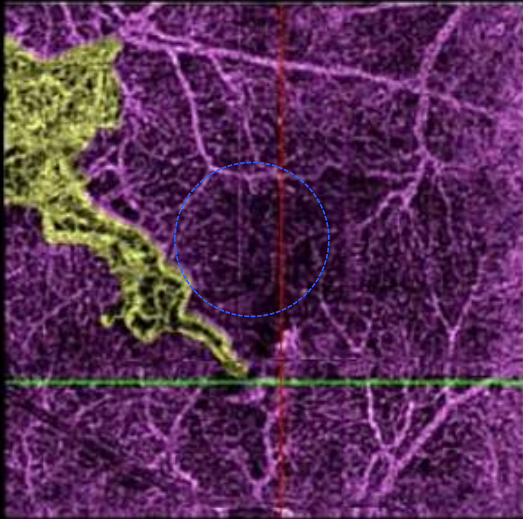
VAGUE???



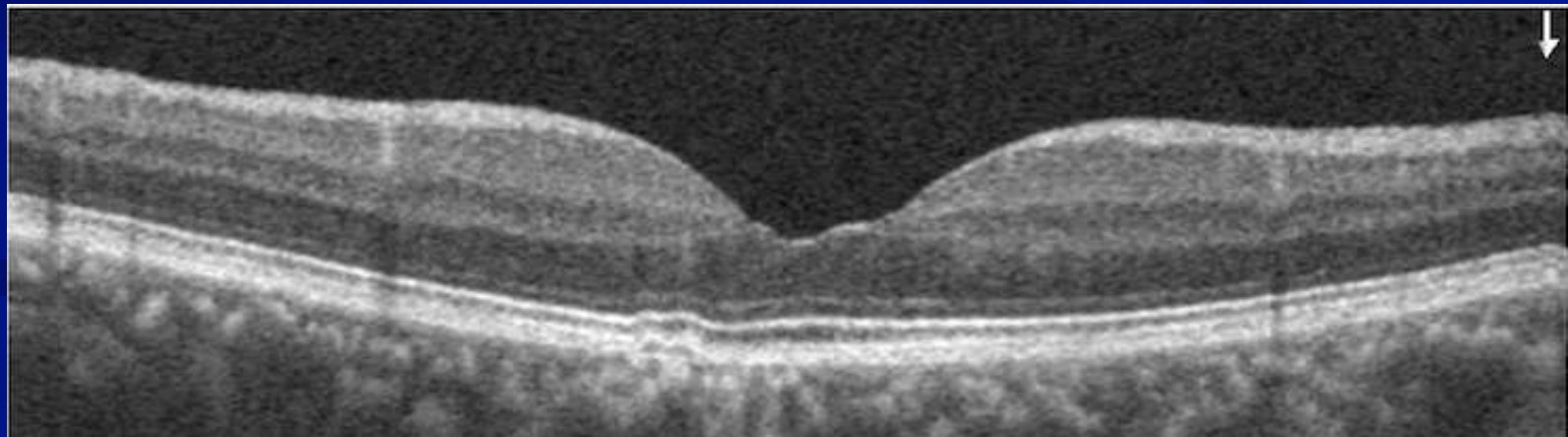
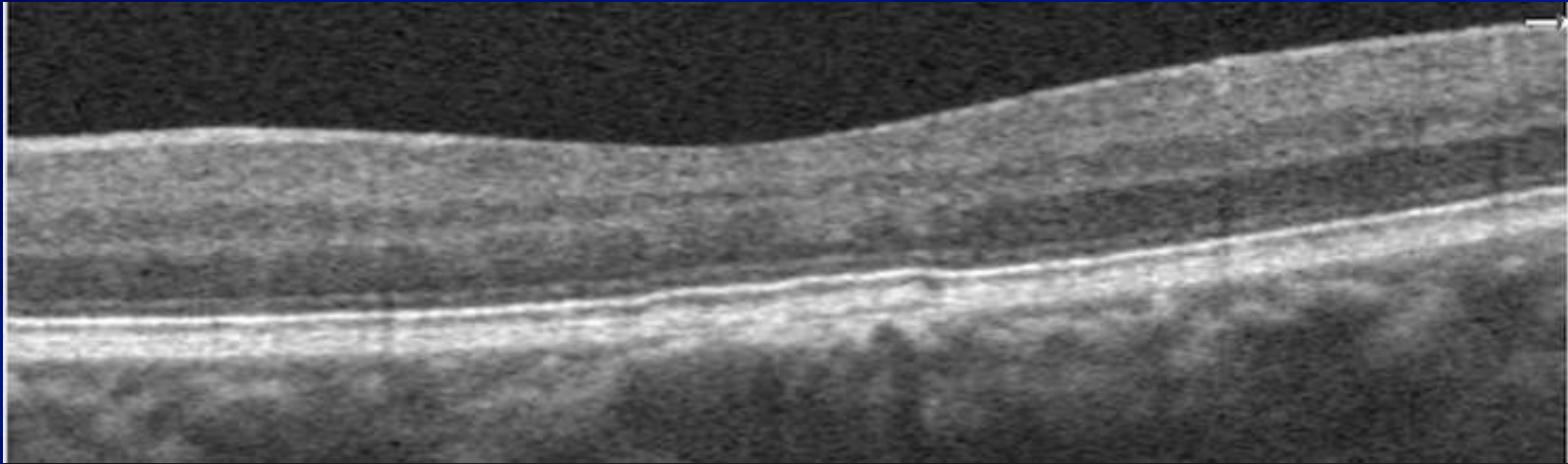
Vascularized

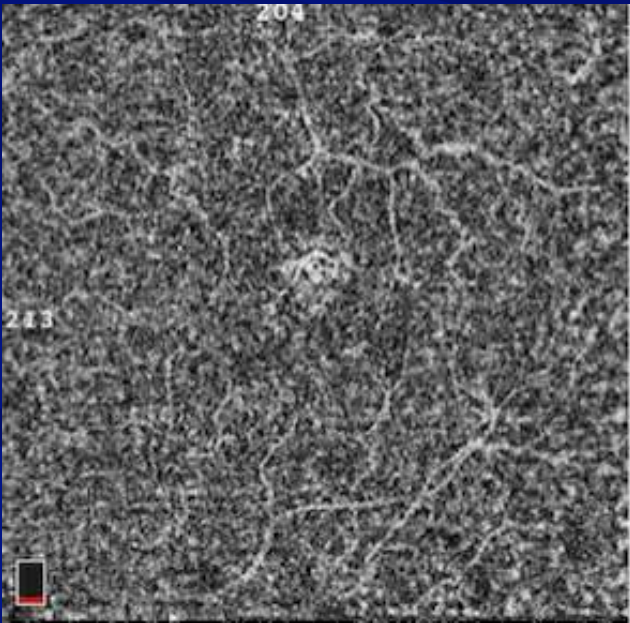
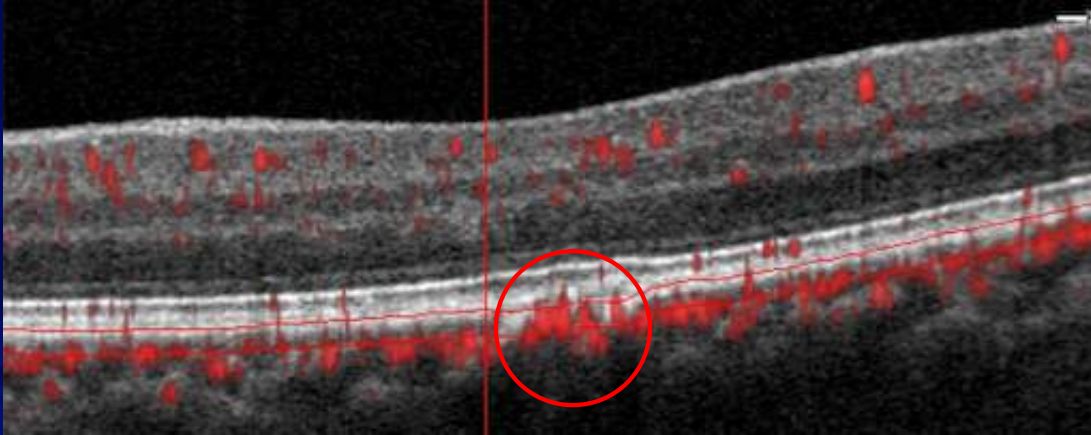
Non-vascularized

Type 1 CNV: Below RPE, Wider than Type 2, Avascular Zone Usually Not Involved



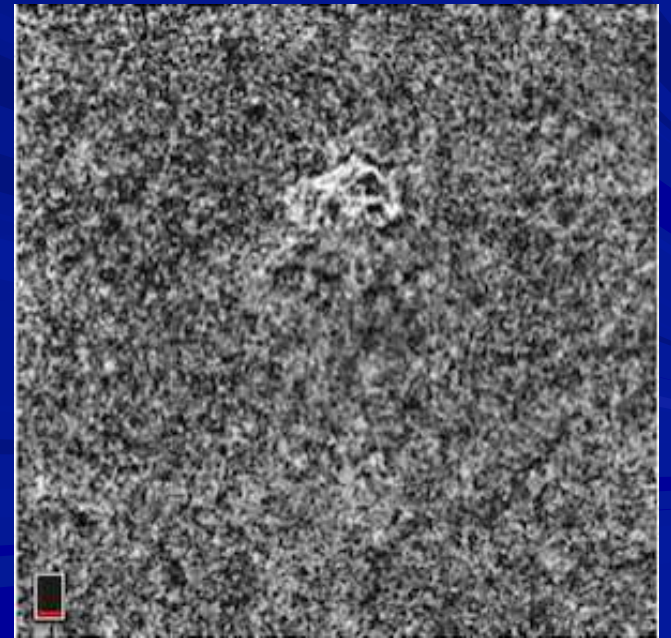
And the not so obvious ones...



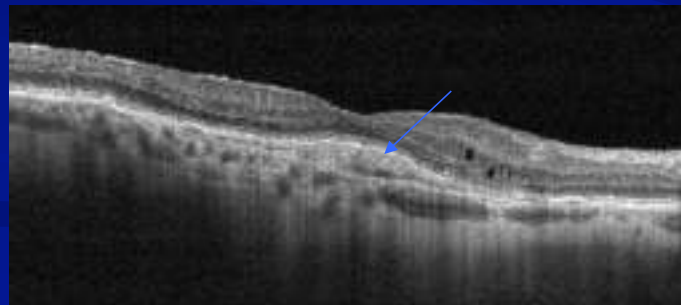
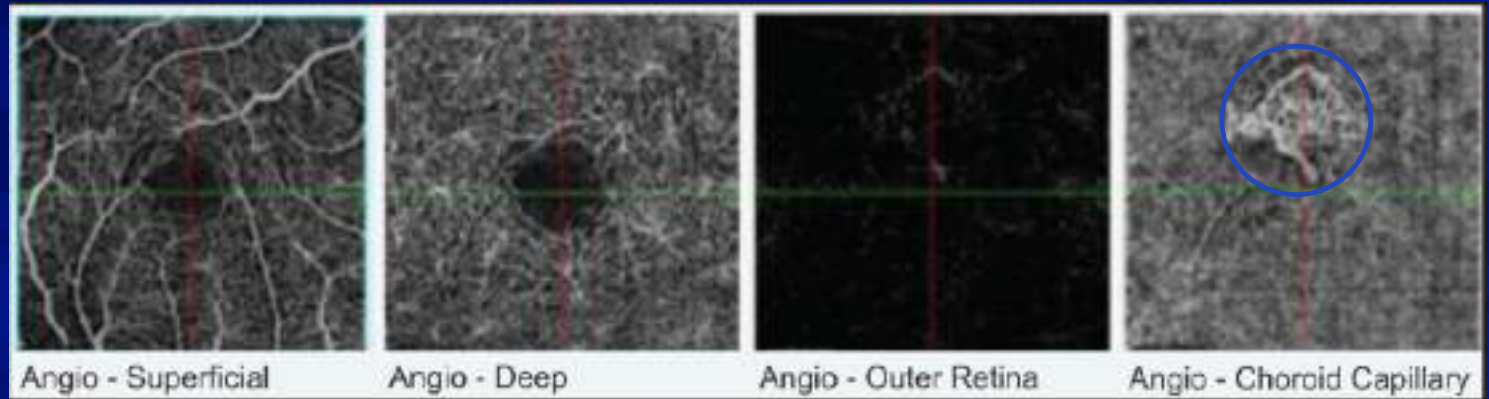
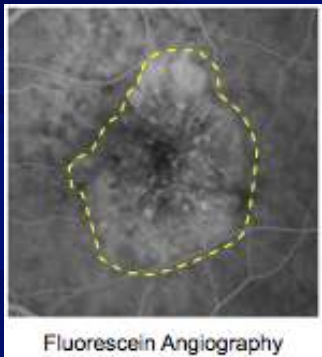


6x6

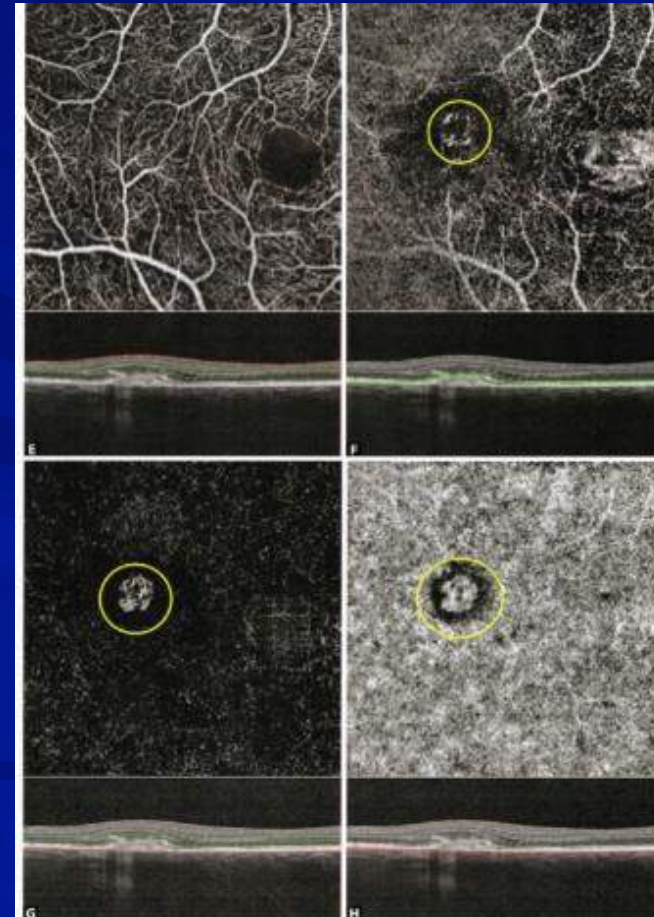
3x3



Case example: 70 y/o WM, AMD



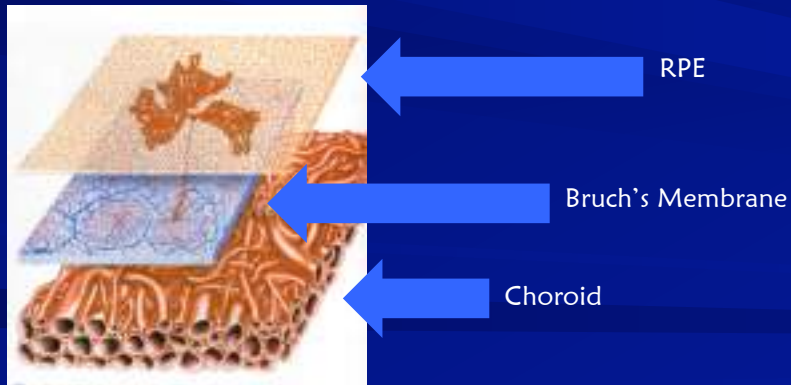
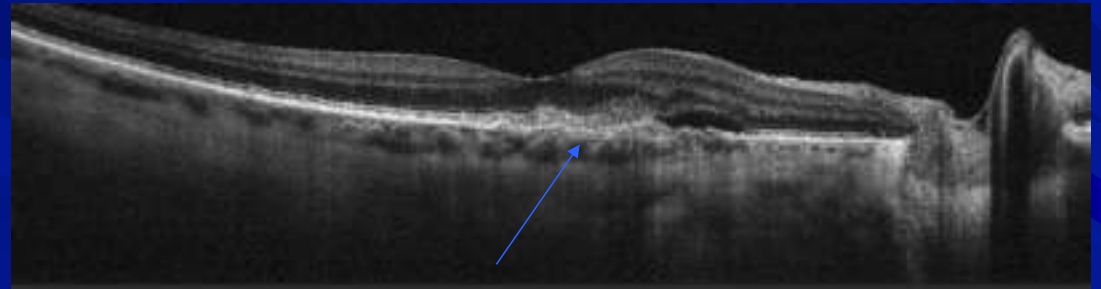
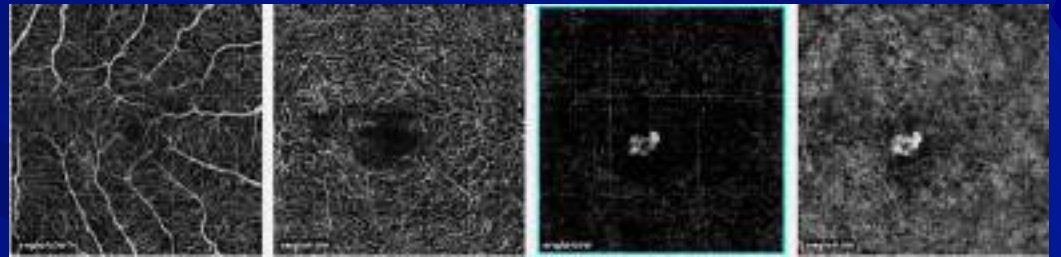
Type 2 “Classic” CNV



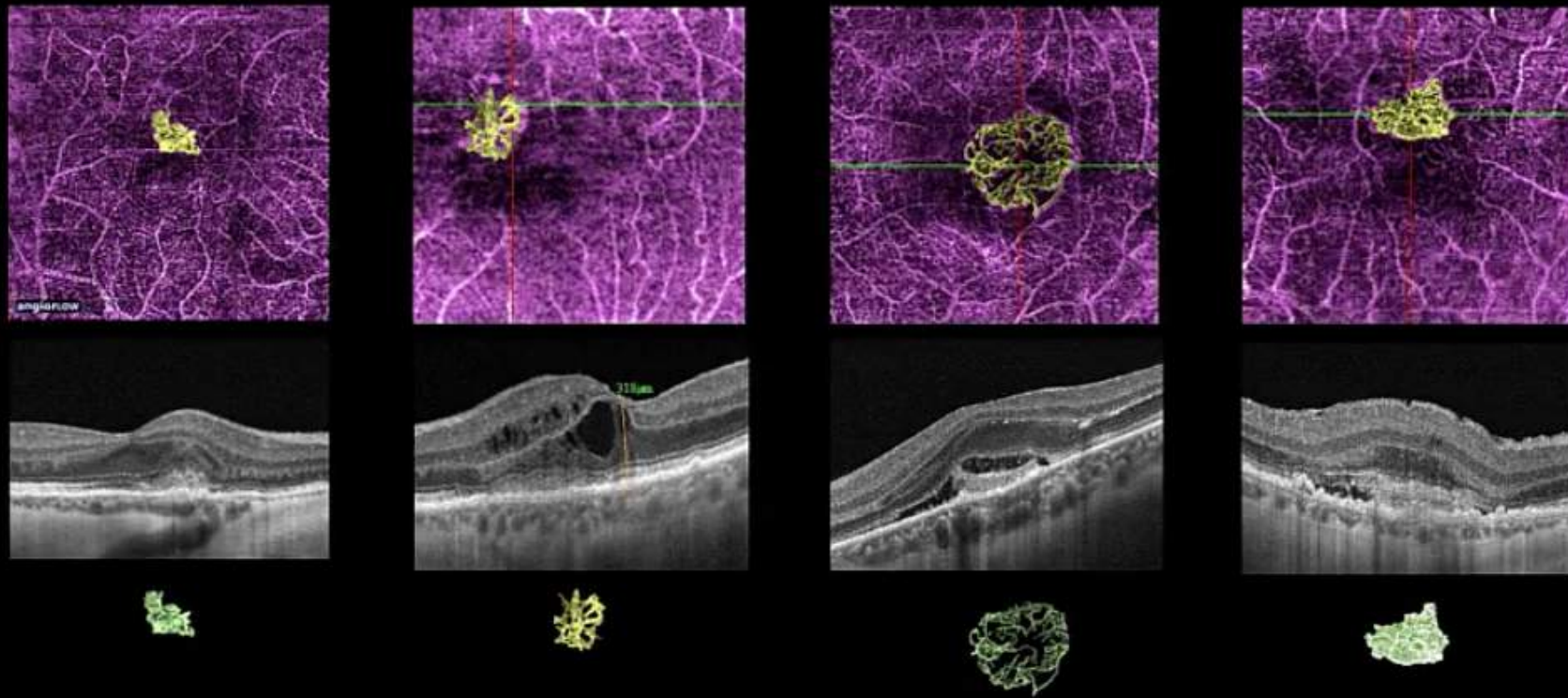
- ☞ New vessels develop in choroid
- ☞ New vessels located above the RPE and above Bruch's membrane

Type 2 “Classic” CNV

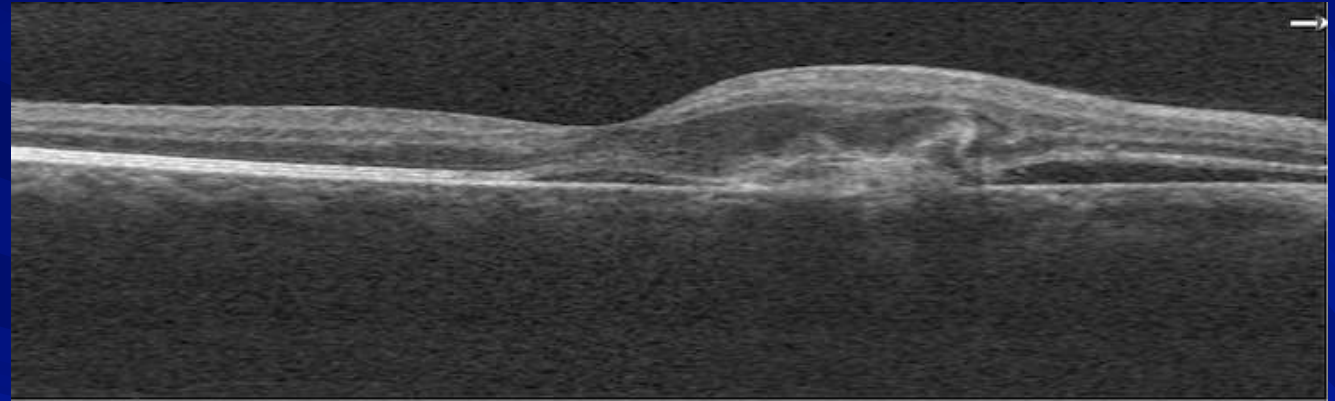
- ↪ New vessels develop in choroid
- ↪ New vessels located **ABOVE** the RPE and **ABOVE** Bruch’s membrane



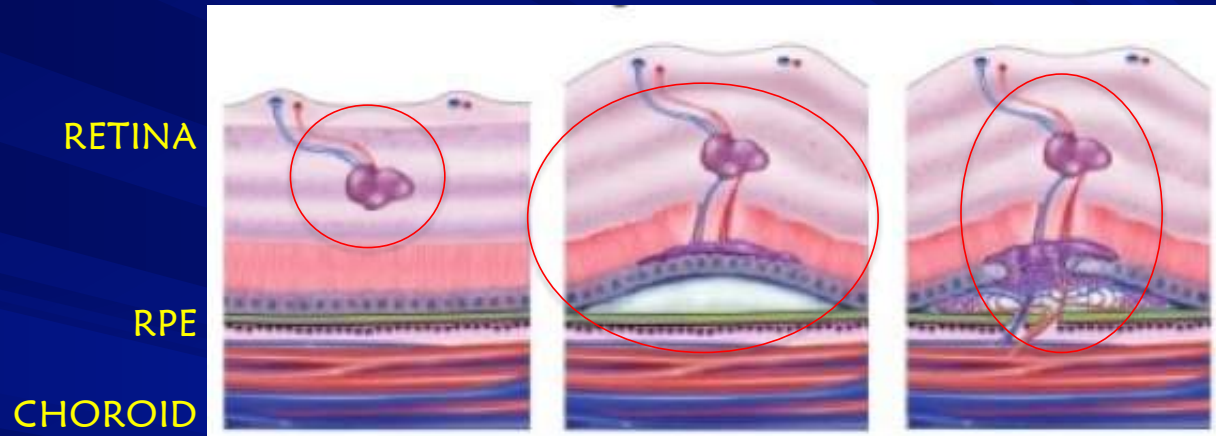
**Type 2 CNV: Above RPE, Smaller than Type 1, Avascular Zone Always Involved.
Very Heterogeneous Shapes**



48 y/o WM 2 week history of “dark spot” OD



Retinal Angiomatous Proliferation



Stage 1

Intra-retinal proliferation

- *Hemes
- *Edema
- *Exudate

Stage 2

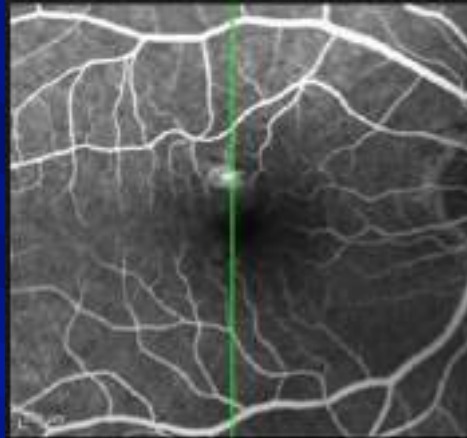
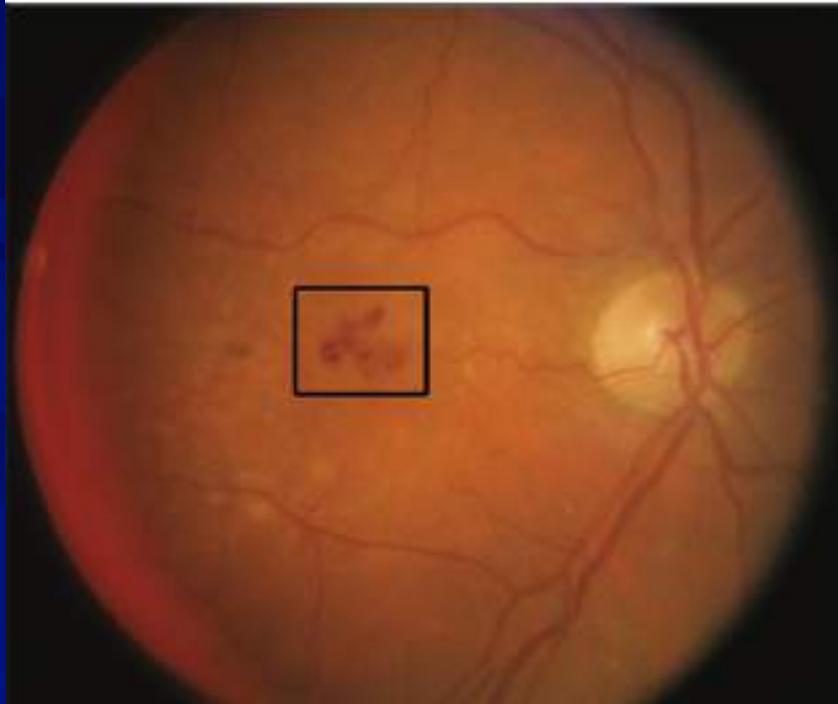
Neovascularization penetrates the sub-retinal space

- *Neurosensory detachment
- *Serous PED

Stage 3

Neovascularization penetrates the RPE space

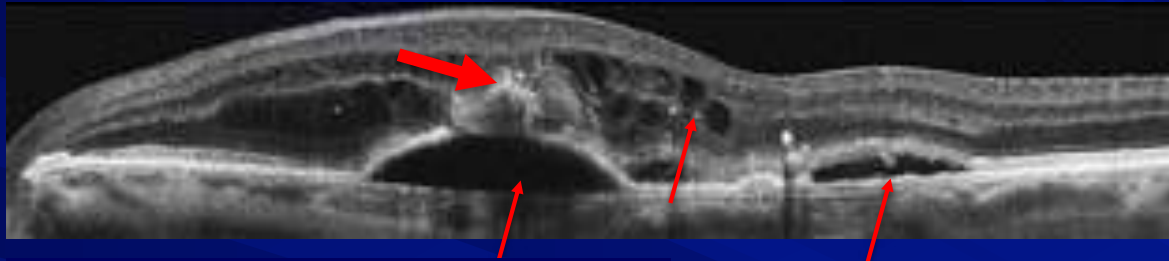
- *Vascularized PED; CNVM



https://www.researchgate.net/figure/In-retinal-angiomatous-proliferation-fluorescein-angiography-FA-shows-a-hot-spot-in_fig8_264903506

<https://jamanetwork.com/journals/jamaophthalmology/fullarticle/42089>

Inspect the SD-OCT carefully!!



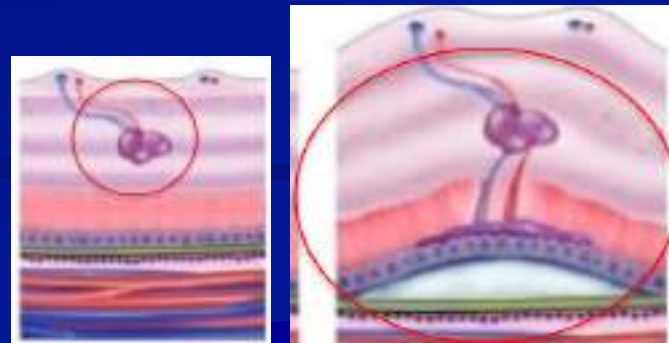
VA 20/40

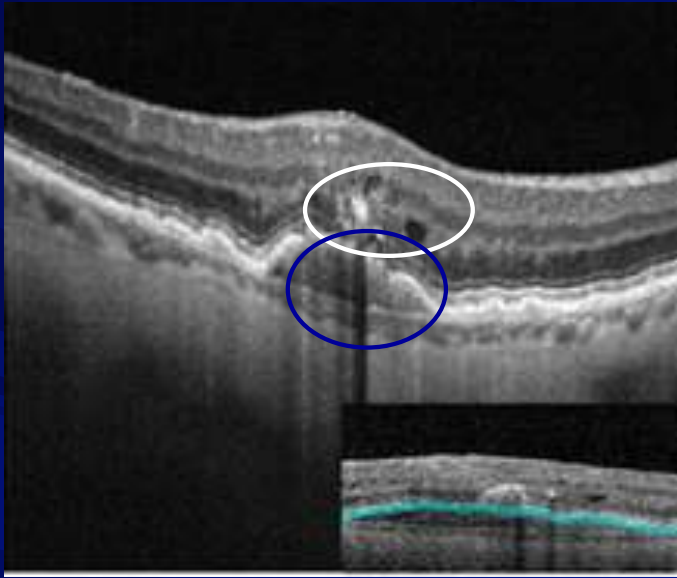
HYPER-REFLECTIVE lesion above pigment epithelial detachment

Intraretinal cysts

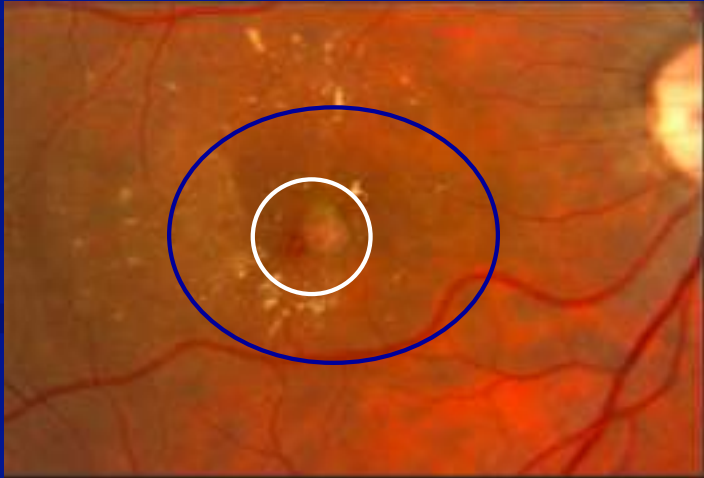
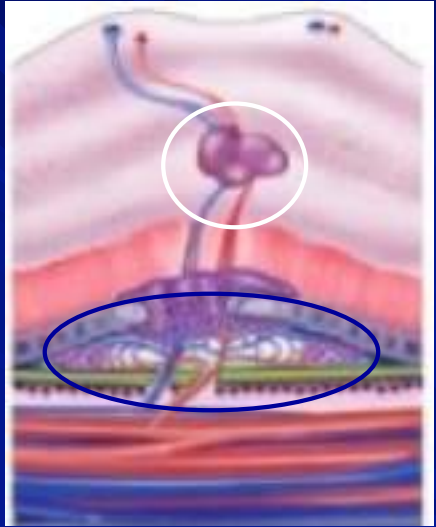
Serous pigment epithelial detachment/ neurosensory detachment

Stage 2





Stage 3



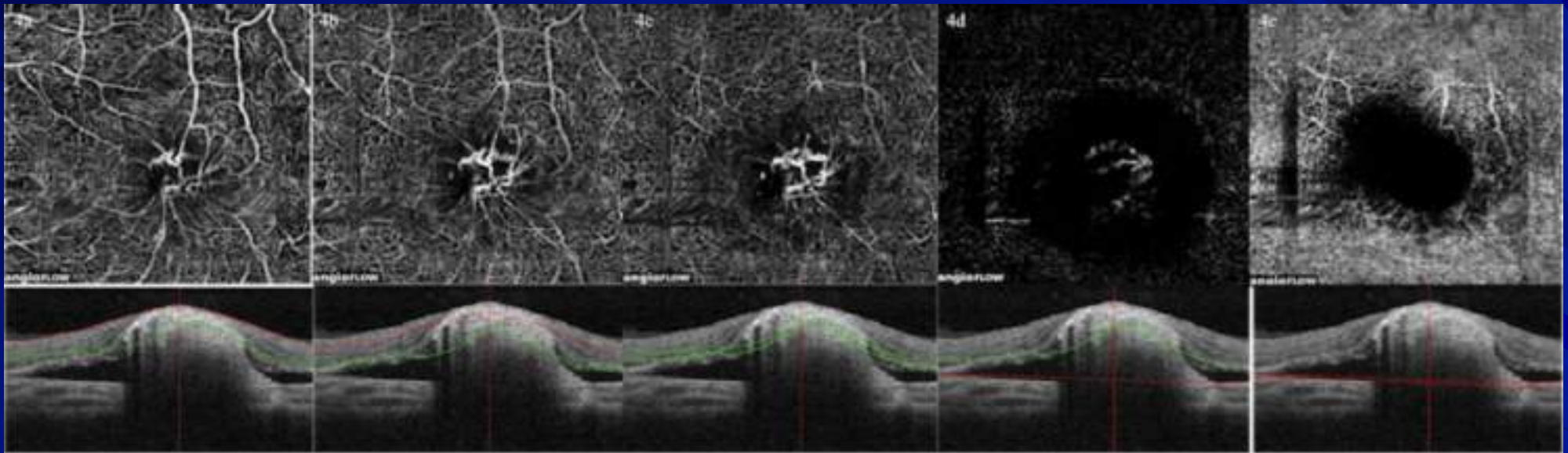
<http://imagebank.asrs.org/file/26943/retinal-angiomatous-proliferation>
<https://www.ncbi.nlm.nih.gov/pubmed/29019795>

What about the OCTA?

OCT angiography demonstrates retinal angiomatic proliferation and chorioretinal anastomosis of type 3 neovascularization

Swati Bansal · Virendra Bansal · Sameek Mukherjee · Rameshwar Singh ·
Yishai Gupta · Manoj K. Datta · Anand Gupta

Type 3 CNV: Intraretinal Anastomosis: THROUGH RPE



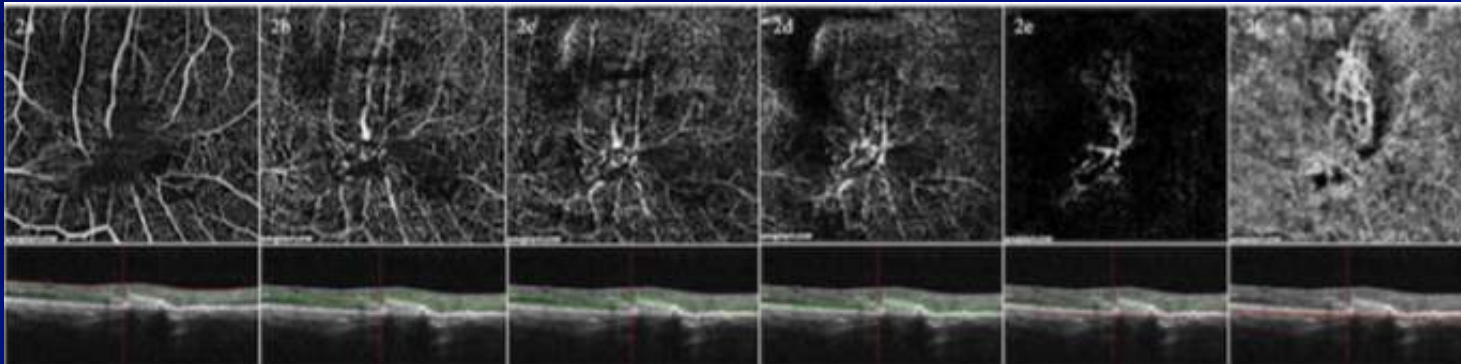
Inner retina (SCP+DCP) to Outer retina (Avascular/choriocapillaris)

What about the OCTA?

OCT angiography demonstrates retinal angiomatic proliferation and choriorretinal anastomosis of type 3 neovascularization

Roopa Bansal - Scribble Demuth - Sanyal Mukherjee - Ramakrishna Shetty -
Yishai Gupta - Manoj K. Deyra - Anand Gupta.

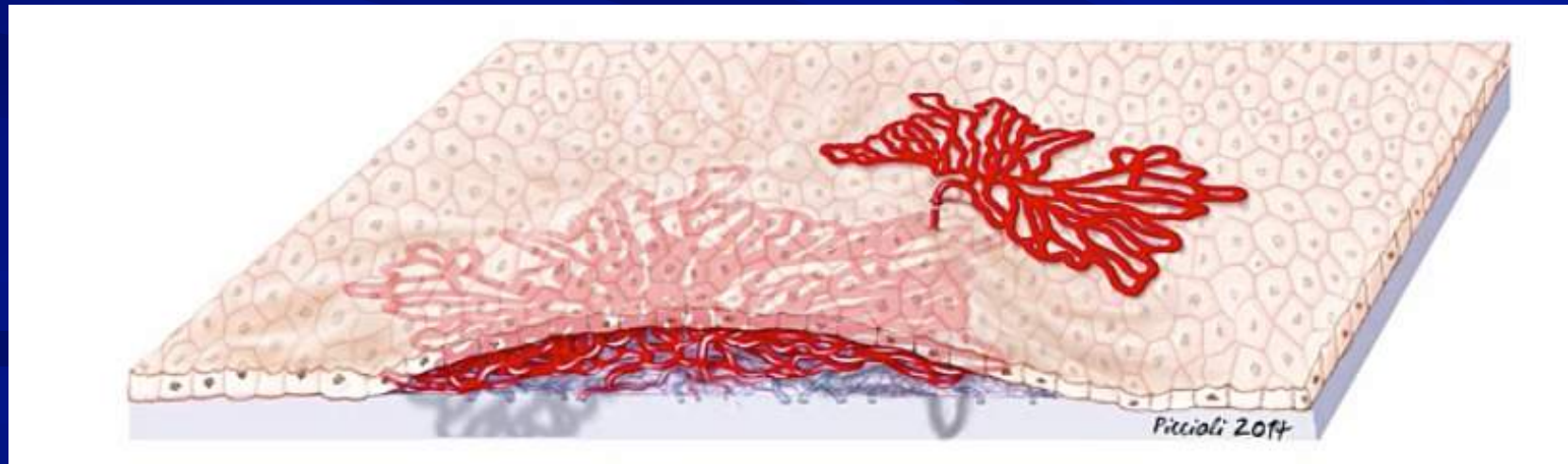
Type 3 CNV: Retinal/Choroidal Anastomosis: INTO CHOROID



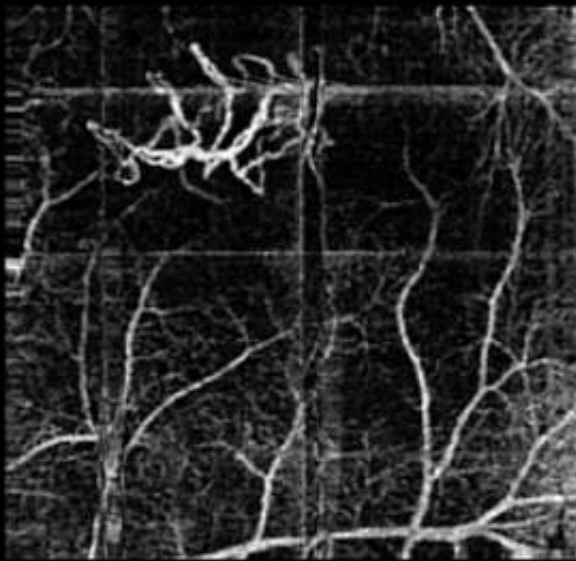
Inner retina (SCP+DCP) to Outer retina (Avascular/choriocapillaris)

Type 4 “Mixed” - Subretinal and Sub-RPE

- Two or more CNV layers
 - ★ One above the RPE, one below the RPE
- High flow lesions



Type 4 CNV : Initially Located Below the RPE, NV Spreads into the Outer Retina



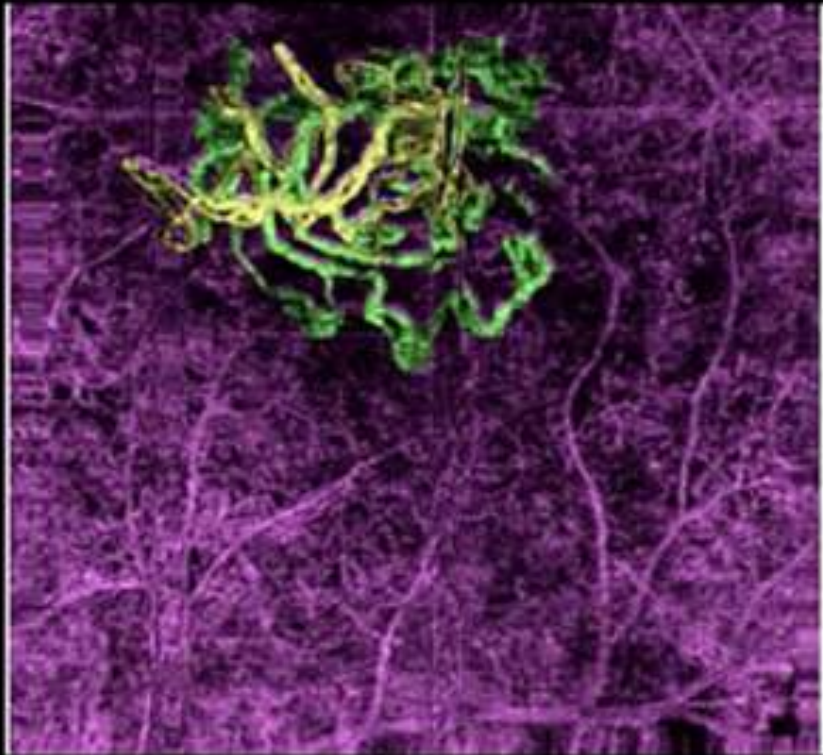
Angio - Deep



Angio - Outer Retina

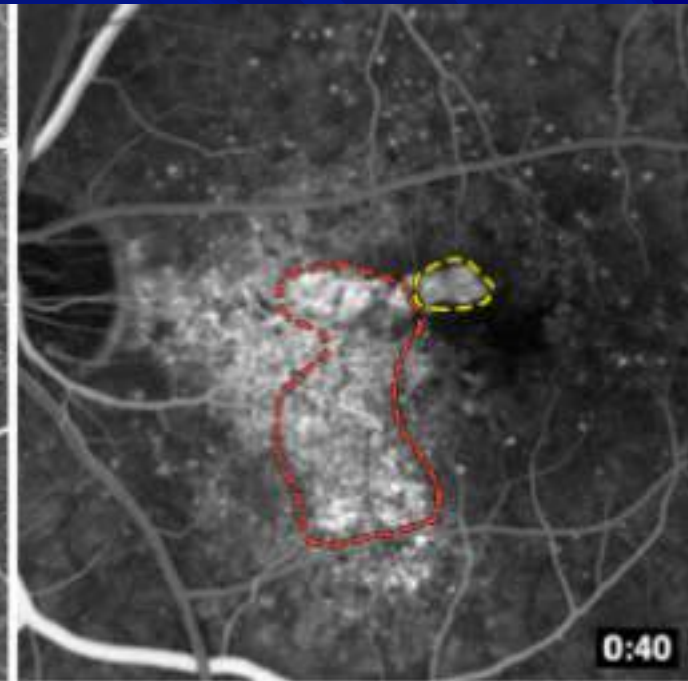
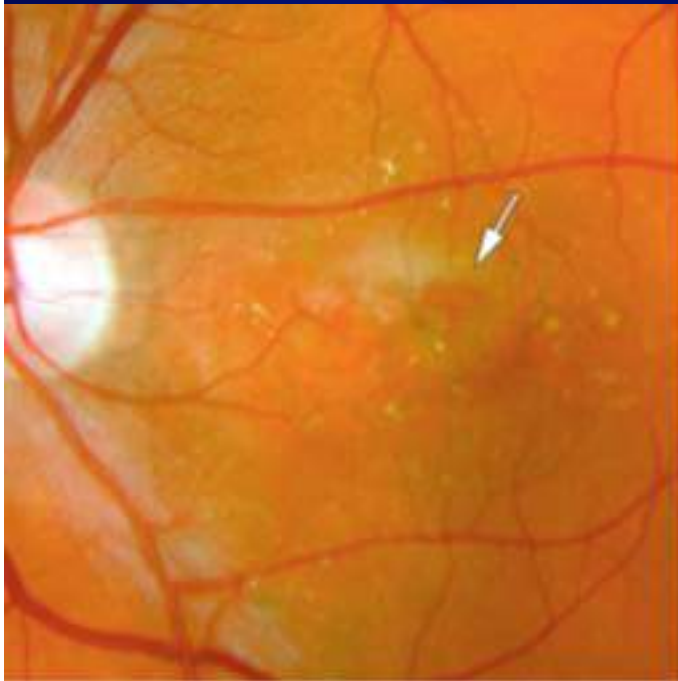


Angio - Choroid Capillary



Green: Type 1 (Sub RPE)
Yellow: Type 2 (Subretinal)

Case Example: Multimodal imaging of 66 y/o Caucasian male

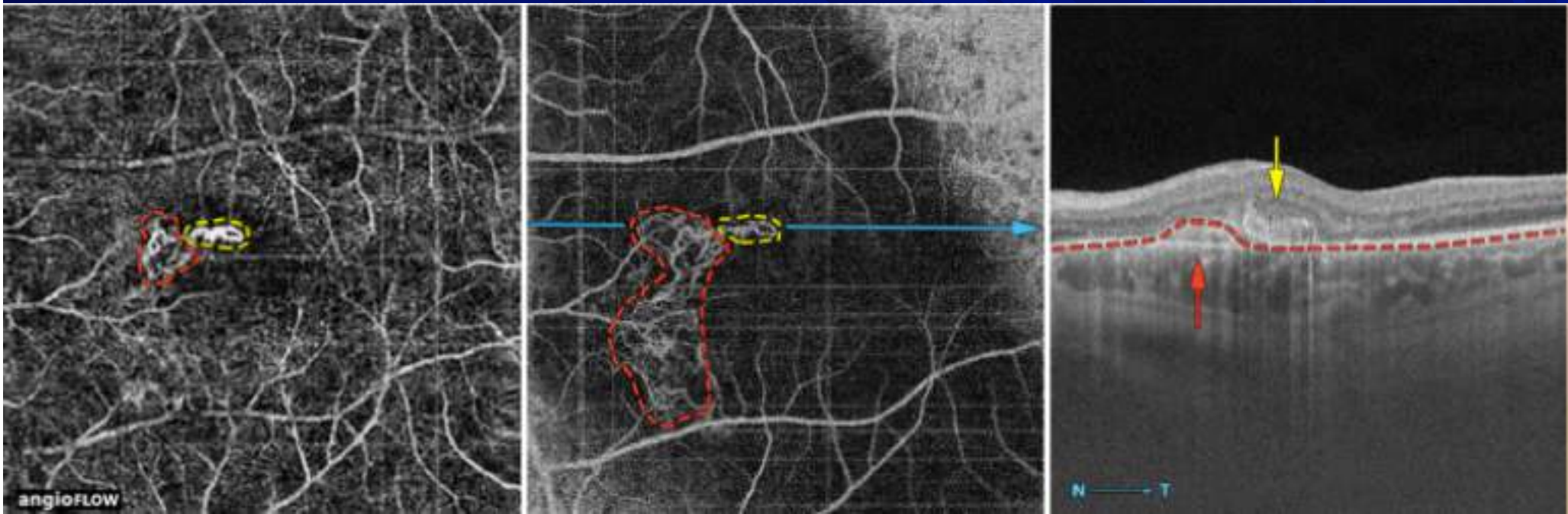


Fundus image
and Occult

FFA: Early; Classic component

FFA: Late; Classic

Courtesy of Novais et al.



Choriocapillaris

Red: Occult; Yellow: Classic

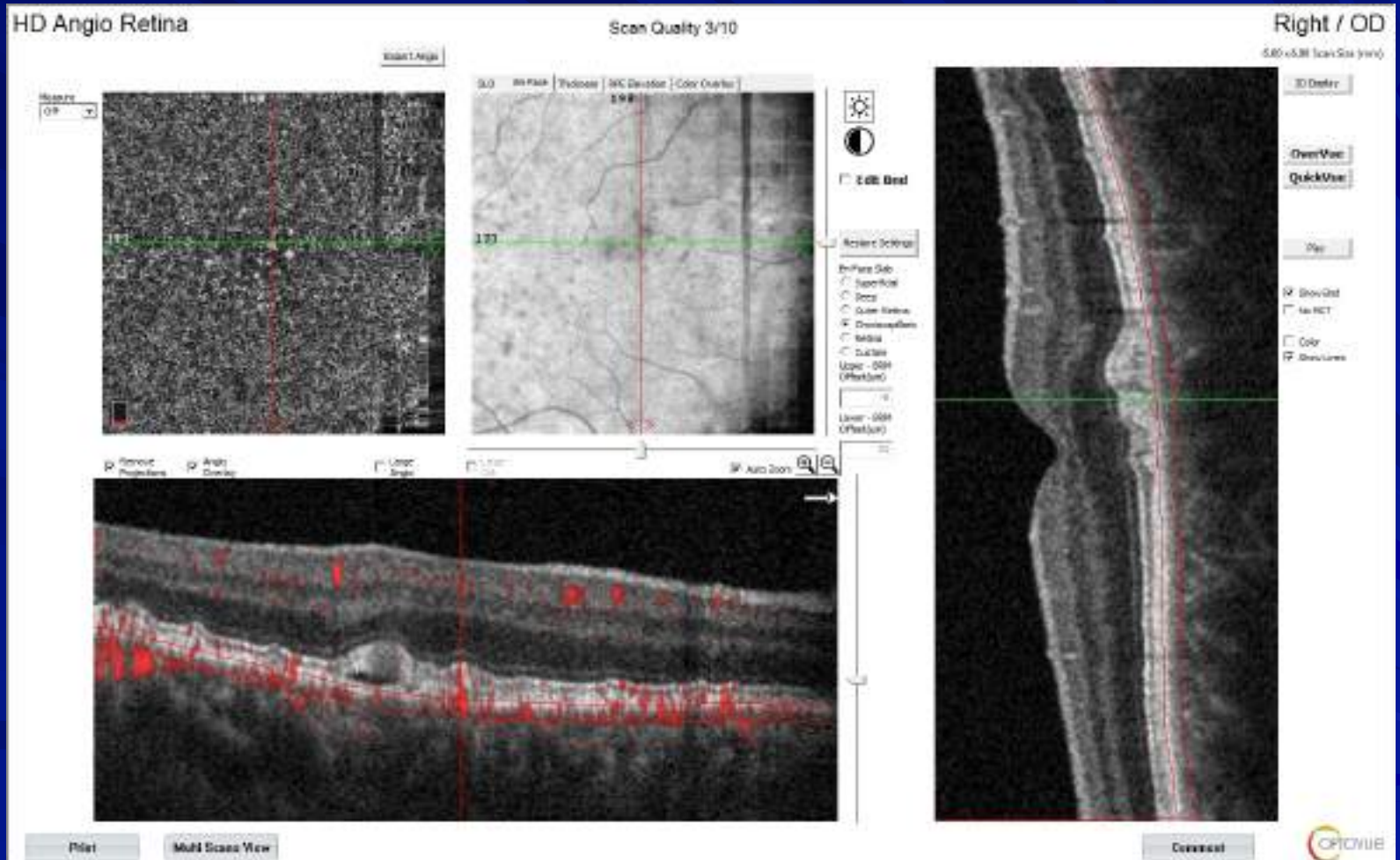
Courtesy of Novais et al.

OCT Angiography

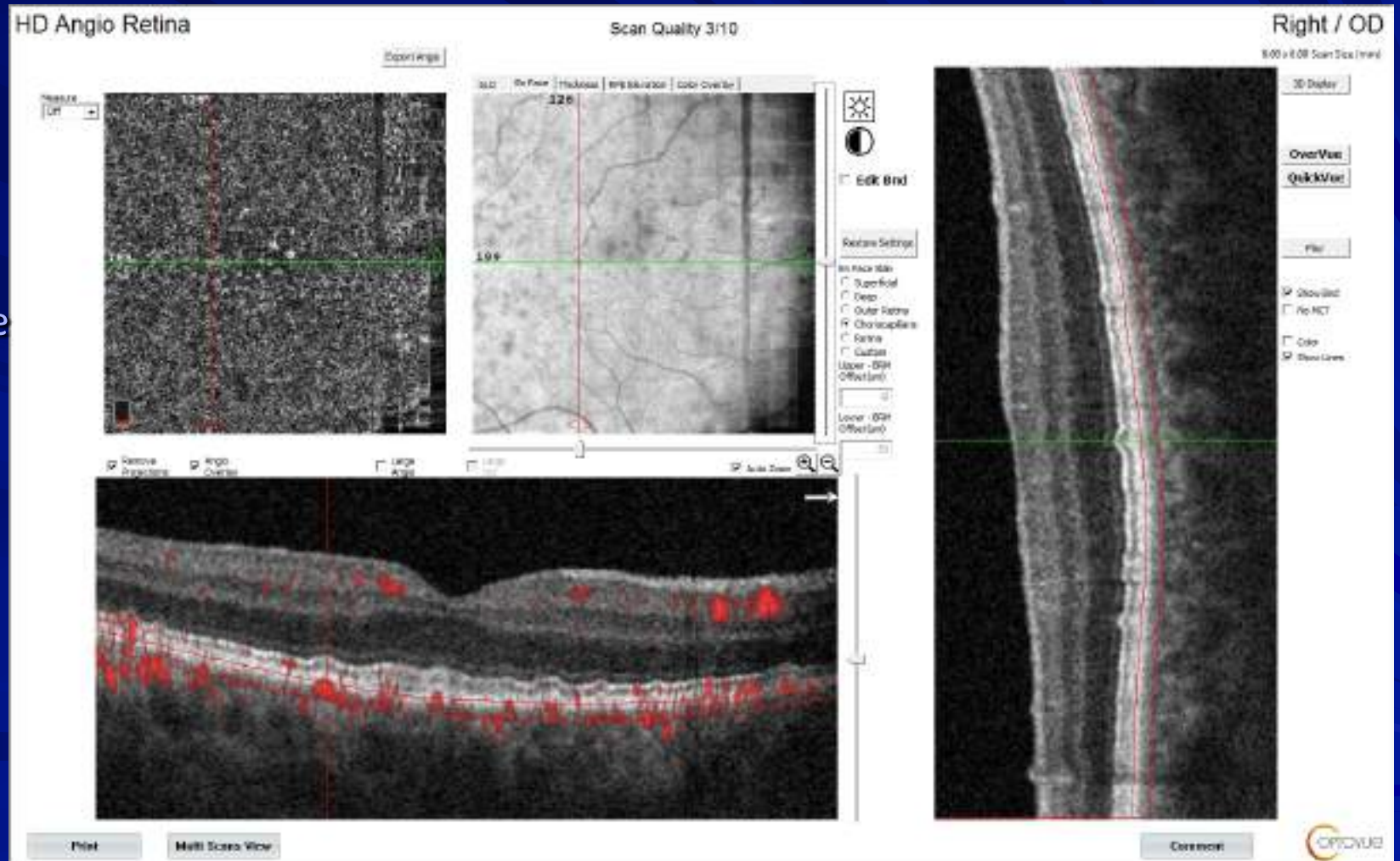
Subclinical CNV or “Occult non-exudative CNV”

Risk of exudation at 12 months is 15.2 times greater compared to eyes without subclinical CNV

Occult
Non-Exudative
CNV
Patient A



Occult
Non-Exudative
CNV
Patient A



Which is More Suspicious?

HD Angio Retina

Scan Quality 7/10

Right / OD

6.00 x 6.00 Scan Size (mm)

3D Display

OverVue

QuickVue

Edit Bed

Restore Settings

Play

Measure: OCT

Export Angio

SLD En Face Thickness RPE Elevation Color Overlay

1.07

1.06

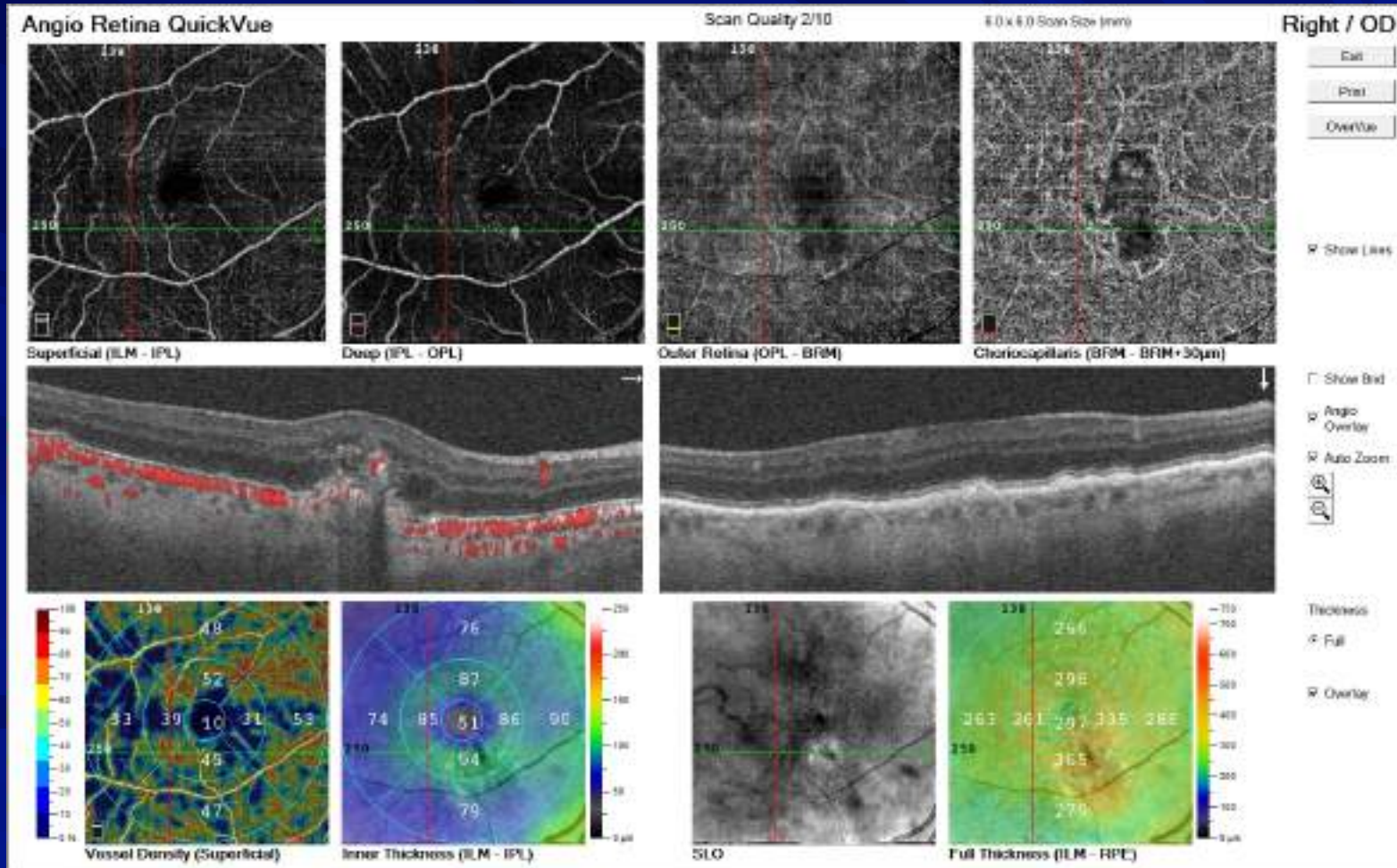
Print

Multi Scans View

Comment

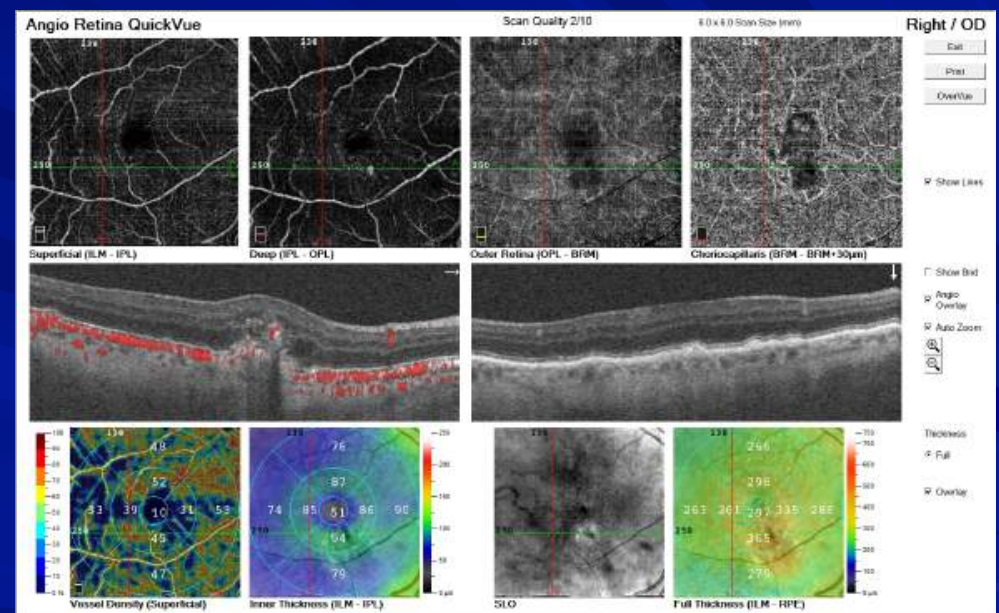
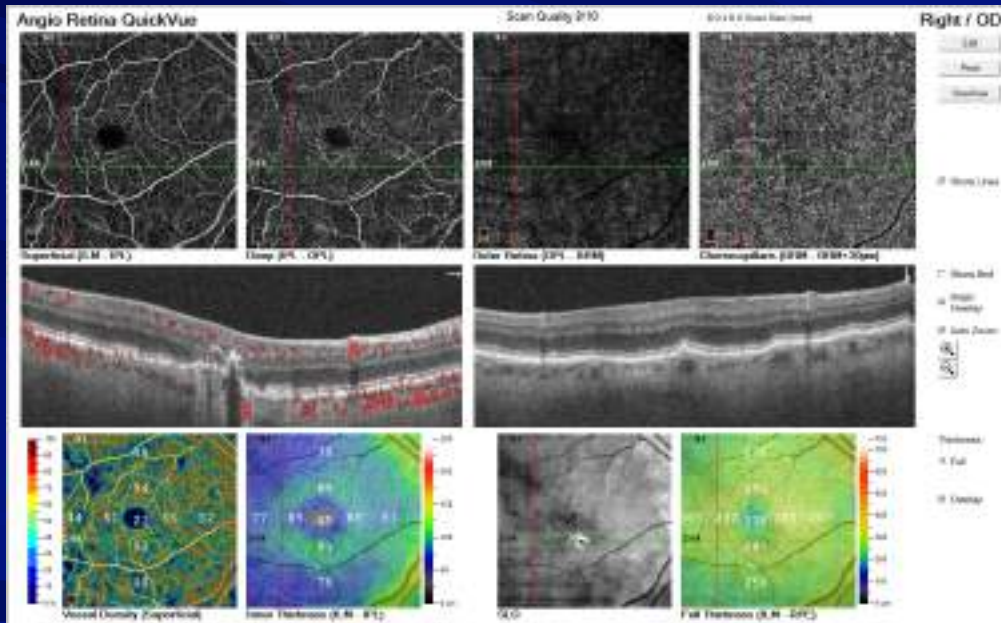
OPTOVUE

OCT Angiography Evaluation AMD



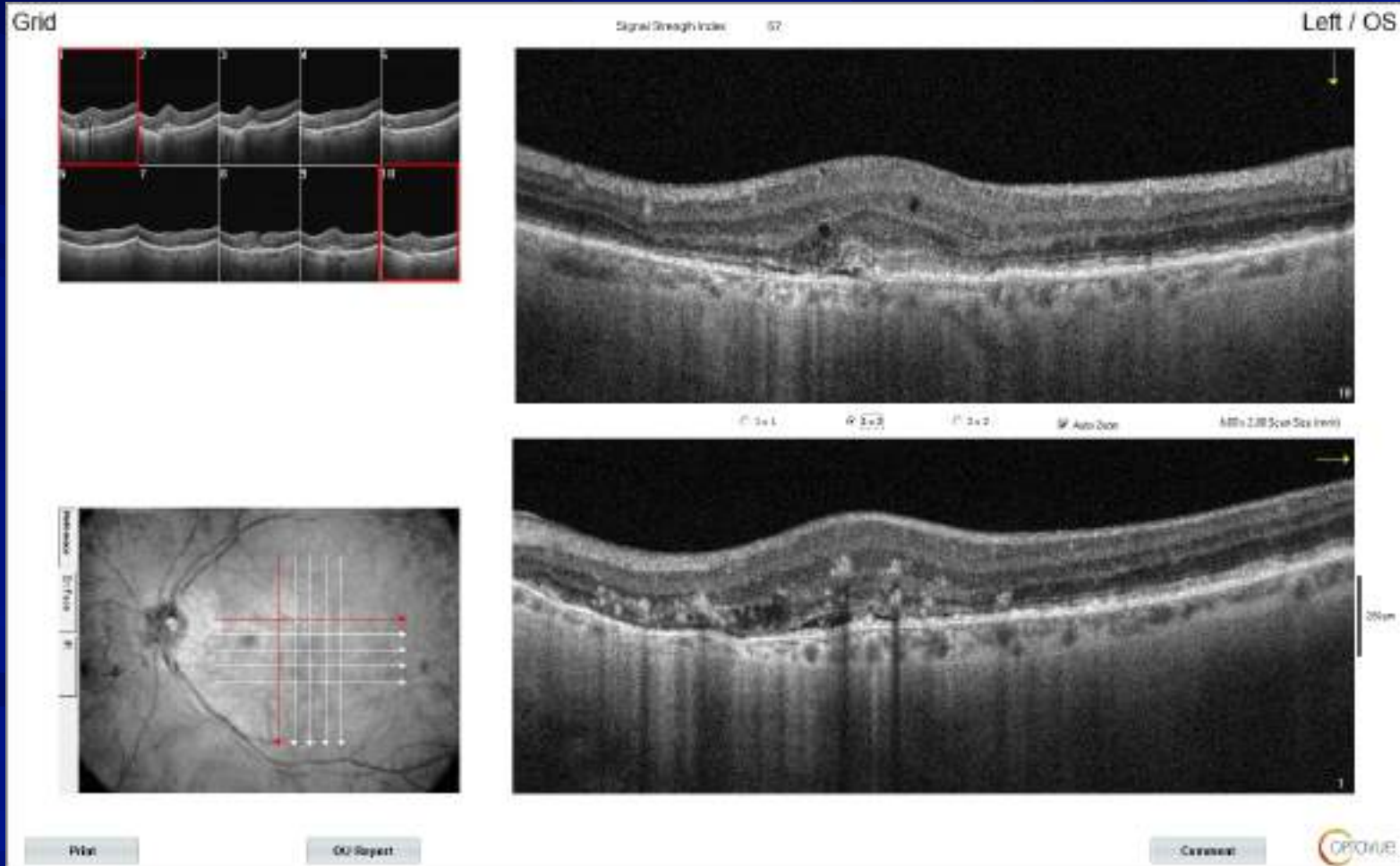
OCT Angiography Evaluation AMD

After and Before Bevacizumab (Avastin)



Evaluation AMD Patients for Neovascularization

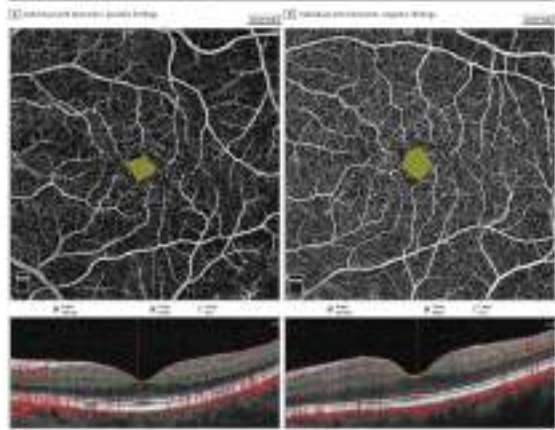
OCT Grid



Other Uses Endothelial Disease

Alzheimer
Dementia

Figure 1. Representative Free-RAM Measurements



Measurements were obtained using quantitative susceptibility MRI (qSMR) to measure myelin thickness. Representative Free-RAM measurements were obtained for a 70-year-old female (top left) and a 70-year-old male (top right).

tion) and previous white matter damage. Additional cortical volume effects included diabetes and recent mild traumatic brain injury.

Study Population

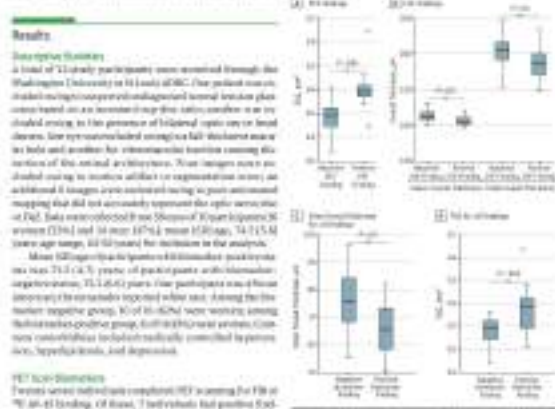
All participants underwent a comprehensive cognitive examination, including a scaled assessment of function and specific tests for episodic memory, visuospatial ability, working memory, attention, executive function, and processing speed. The anterior hippocampal dorsal bundle. Corticospinal tract, hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software. The hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software. The hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software.

Results. Data were analyzed for each voxel and grouped into 10 clusters. The largest cluster was located in the anterior hippocampal dorsal bundle. Corticospinal tract, hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software.

Data Analysis

Data were analyzed from July 20, 2015, through December 31, 2015. Data analyses included voxelwise analyses and region-of-interest analyses. The region-of-interest analyses were performed using the FreeSurfer 5.3.0 software. The region-of-interest analyses were performed using the FreeSurfer 5.3.0 software.

Figure 2. Representative Free-RAM Measurements



Measurements were obtained using quantitative susceptibility MRI (qSMR) to measure myelin thickness. Representative Free-RAM measurements were obtained for a 70-year-old female (top left) and a 70-year-old male (top right).

tion) and previous white matter damage. Additional cortical volume effects included diabetes and recent mild traumatic brain injury.

Study Population

All participants underwent a comprehensive cognitive examination, including a scaled assessment of function and specific tests for episodic memory, visuospatial ability, working memory, attention, executive function, and processing speed. The anterior hippocampal dorsal bundle. Corticospinal tract, hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software. The hippocampal tail, fornix, and corpus callosum were segmented using the FreeSurfer 5.3.0 software.

Figure 1. Receiver-Operating Characteristic Curve for Retinal Vessel Density



generations from 1940 to 2010, and the study was designed to evaluate the prevalence of AD. The prevalence of preclinical dementia was 14.1% (95% CI, 11.8% to 16.4%), and the prevalence of AD was 1.1% (95% CI, 0.6% to 1.6%). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$).

likely these discrepancies are merely associated with the specificity of the individual test and are in line with a low rate of discordance.⁴⁵⁻⁴⁷ As such, any individual with a positive marker was considered to have biomarker-positive findings in the collective analysis.

A major limitation of our study is the small sample size, including a limited number of nonwhite individuals. An additional limitation is exclusion of individuals with known vascular disease from our study; we are therefore unable to determine whether these results are translatable to individuals who may have retinal microvascular changes due to other causes. Also, inclusion only of those with preclinical, biomarker-positive disease limits comparison to those with cognitive changes or advanced AD. Recruitment is under way to evalu-

negative. Overall, the prevalence of preclinical AD was 14.1% (95% CI, 11.8% to 16.4%), and the prevalence of AD was 1.1% (95% CI, 0.6% to 1.6%). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$). The prevalence of preclinical dementia was significantly higher than the prevalence of AD (14.1% vs 1.1%, $P < .001$).

any individuals with biomarker-positive OCT and cognitive-normal AD and to follow up individuals with biomarker-positive findings over time for longitudinal evaluation of changes in retinal vasculature.

Conclusions

changes in retinal vasculature.

Conclusions

At present, preclinical AD is diagnosable only by invasive, expensive, and time-consuming PET or CSF testing. Our data suggest that OCTA may enable quick, inexpensive, and noninvasive screening for individuals with preclinical AD based on FAZ enlargement. However, these findings could be owing to confounding factors unrelated to the FAZ enlargement. Longitudinal studies in larger cohorts would be needed to determine whether this finding has value in identifying preclinical AD, so that these individuals may receive appropriate care.

ARTICLE INFORMATION

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Education
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Thank you!

OCT-Angiography
What You Need to Know with
this New Technology

