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

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Western Pennsylvania Optometric Society
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Disclosure Statement
(next slide)

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: Shire, BioTissue, Optovue, Alcon, Allergan, Aerie
- Advisory Board: Allergan, Sun
- Envolve: PA Medical Director, Credential Committee
- Optometric Education Consultants- Scottsdale, Quebec City, and Nashville - Owner

Optometry's Instrument
2018 with 2.8 Full Time Equivalent

Wellness

- 2355 scans
- Optos/Optovue Wellness
  - 1315, $50, $65,750
- Optos/Optovue Wellness and Retina OCT-A
  - 984, $70, $68,880
- OCT-A
  - 37, $35, $1,295
- OCT-Wellness
  - 19, $35, $665
- $136,590
  - $48,782

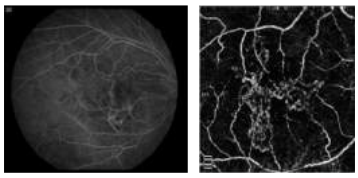
Medical OCTs

- 765 scans
- Glaucoma
  - 92133 406
  - Approx $37, $15,022
- Retina
  - 92134 356
  - Approx $40, $14,240
- Anterior Segment
  - 92132 3*
  - Approx $31, $93
- $29,355
  - $10,484

$165,945
- $59,266

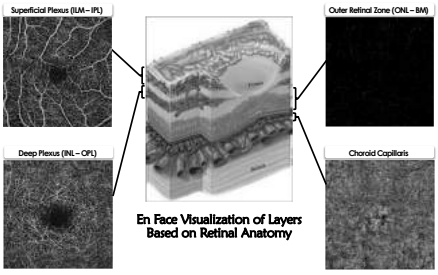
OCT Angiography
A New Approach to Protecting Vision

- 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



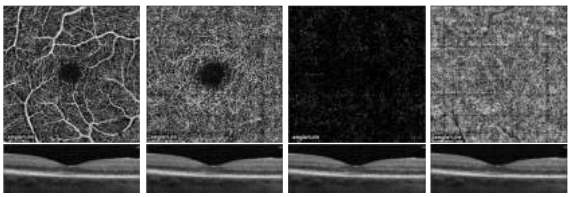
FA of CNV | OCTA of CNV

Enface OCT-A Slabs
Based on Retinal Anatomy



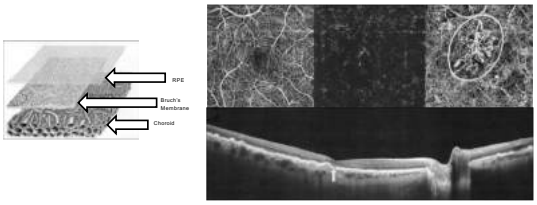
En Face Visualization of Layers Based on Retinal Anatomy

Normal Retinal Vasculature



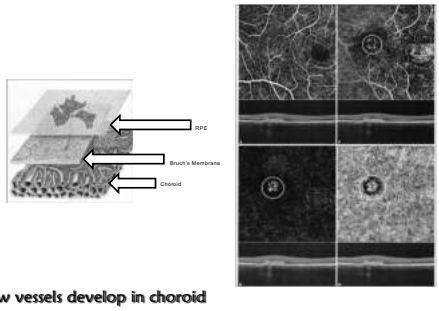
Superficial Capillary Plexus	Deep Capillary Plexus	Outer Retina	Choriocapillaris
3µm Below ILM → 15 µm Below IPL	15µm Below ILM → 70 µm Below IPL	70µm Below IPL → 30 µm Below RPE Reference	30 µm Below RPE Reference → 60 µm Below RPE Reference

Type 1 "Occult" CNV



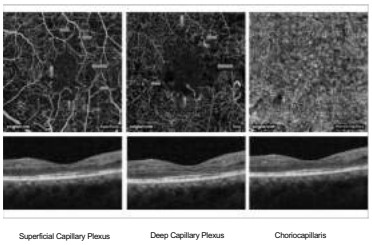
- New vessels develop in the choroid
- New vessels located below RPE and above Bruch's membrane

Type 2 "Classic" CNV



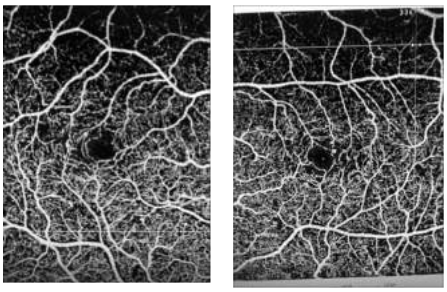
- New vessels develop in choroid
- New vessels located above the RPE and above Bruch's membrane

Diabetic Retinopathy

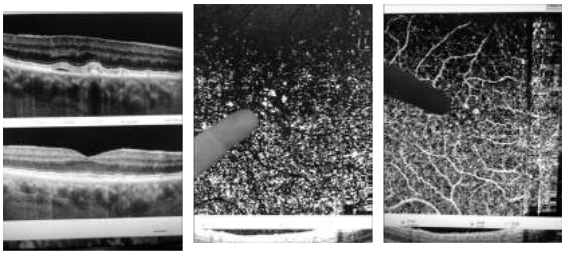


- Retinal capillary non-perfusion – seen as blackened area without blood flow outside FAZ
- Microaneurysms
- Enlarged FAZ

Diabetes

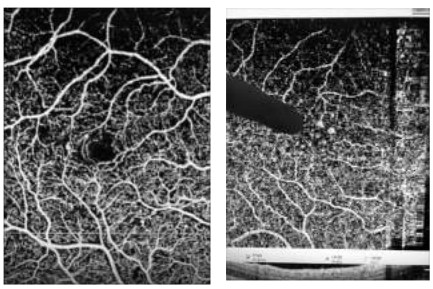


Wet AMD



Glad to Have it in the Office

Disappointing without Quantitative Measurements



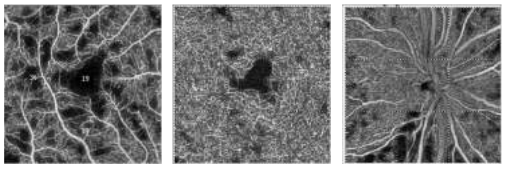
AngioAnalytics

- 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

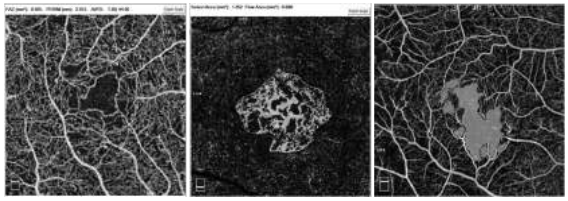


Vessel Density
Superficial Plexus

Vessel Density
Deep Plexus

Vessel Density
Radial Peripapillary Capillaries

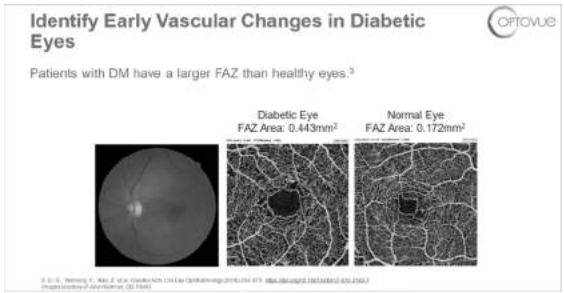
AngioAnalytics
FAZ, Flow & Non-Flow Area Measurements

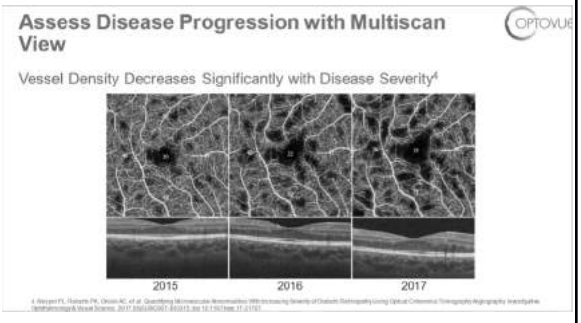


Foveal Avascular Zone Metrics

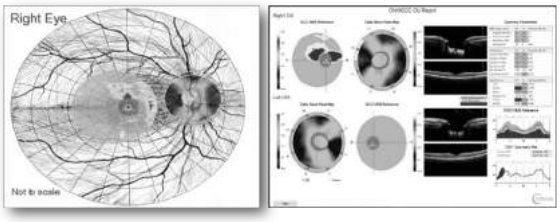
Flow Area Measurements

Non-Flow Area Measurements

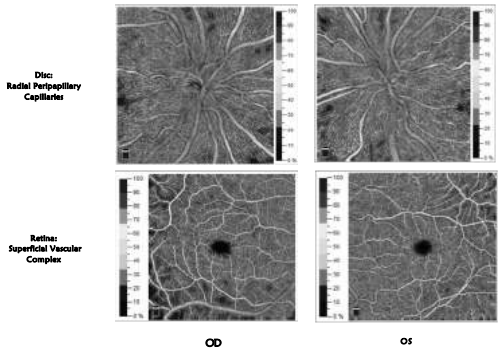




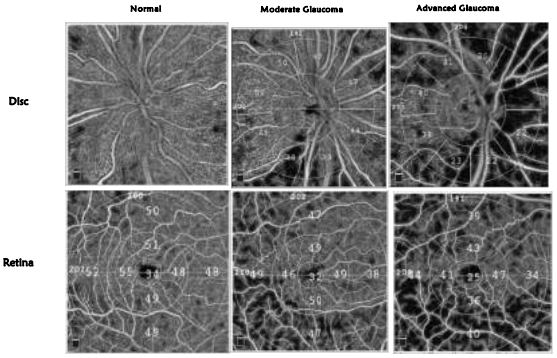
Next Generation Glaucoma Analysis with OCT + OCTA



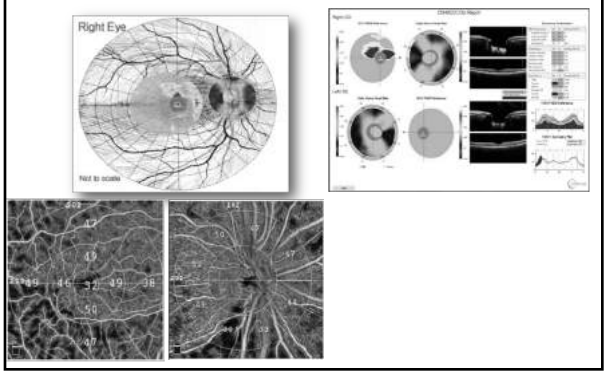
Learn What Normal Looks Like



What Does Glaucoma Look Like?



Glaucoma



Research Has Revealed the Importance of OCTA in Glaucoma Diagnosis and Management

- **Early Detection, Diagnosis[1]**
  - Vessel density loss may serve as an additional marker for glaucoma diagnosis and progression
  - Vessel density loss occurred in early glaucoma eyes with no detectable visual field defect
- **Confirm Diagnosis by Correlating Structure-Function**
  - Vessel density loss had stronger association with visual field loss than that of structural loss in Glaucoma eyes[2]
  - Macular vessel density loss was associated with central visual field loss in Glaucoma eyes[3]

1. Yarmohammadi A, Zangwill LM, Manalastas PIC, Fuller NJ, Diniz-Filho A, Saunders LJ, Suh MH, Hasenstab K, Weinreb RN. Peripapillary and Macular Vessel Density in Patients with Primary Open-Angle Glaucoma and Unilateral Visual Field Loss. Ophthalmology. 2018 Apr;125(4):578-587. doi: 10.1016/j.ophtha.2017.10.029. Epub 2017 Nov 22.PMID: 29174012
2. Yarmohammadi A, Zangwill LM, Diniz-Filho A, Saunders LJ, Suh MH, Wu Z, Manalastas PIC, Akagi T, Medeiros FA, Weinreb RN. Peripapillary and Macular Vessel Density in Patients with Glaucoma and Single-Hemifield Visual Field Defect. Ophthalmology. 2017 May;124(5):709-719. doi: 10.1016/j.ophtha.2017.01.004. Epub 2017 Feb 10. PMID: 28196732
3. Penteado RC, Zangwill LM, Daga FB, Saunders LJ, Manalastas PIC, Shoji T, Akagi T, Christopher M, Yarmohammadi A, Moghimi S, Weinreb RN. Optical Coherence Tomography Angiography Macular Vascular Density Measurements and the Central 10-2 Visual Field in Glaucoma. J Glaucoma. 2018 Jun;27(6):481-489. doi: 10.1097/IJG.0000000000000964.PMID: 29664832

Research Has Revealed the Importance of OCTA in Glaucoma Diagnosis and Management

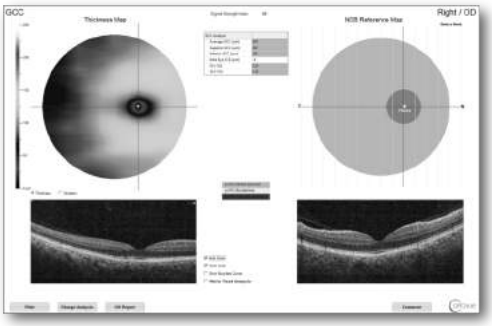
- **Progression Detection**
  - Baseline OCTA measurements may serve as an additionall marker in the assessment of the risk of progression in POAG patients[4]
  - Macular vessel density loss occurs faster in eyes with POAG than either glaucoma-suspect or healthy eyes[5]
  - Macula vessel density change may precede GCC thickness change[5]

4. Moghimi S, Zangwill LM, Penteado RC, Hasenstab K, Ghahari E, Hou H, Christopher M, Yarmohammadi A, Manalastas PIC, Shoji T, Bowd C, Weinreb RN.
Macular and Optic Nerve Head Vessel Density and Progressive Retinal Nerve Fiber Layer Loss in Glaucoma. Ophthalmology. 2018 Jun 12. doi: 10.1016/j.ophtha.2018.05.006. [Epub ahead of print].
5. Shoji T, Zangwill LM, Akagi T, Saunders LJ, Yarmohammadi A, Manalastas PIC, Penteado RC, Weinreb RN. Progressive Macula Vessel Density Loss in Primary Open-Angle Glaucoma: A Longitudinal Study. Am J Ophthalmol. 2017 Oct;182:107-117. Epub 2017 Jul 20

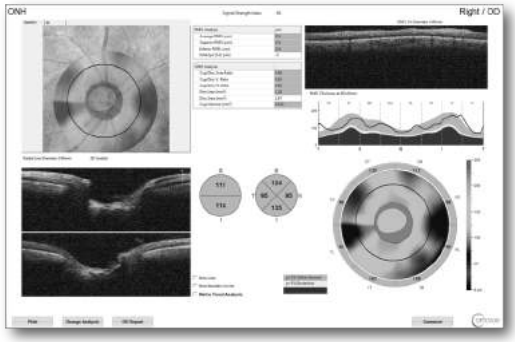
Case Study: Early Detection

- 60 year old black man
- History of hypertension
- Family history of glaucoma
- Pachymetry 455, 481
- TMax pressures 24, 26 mm Hg

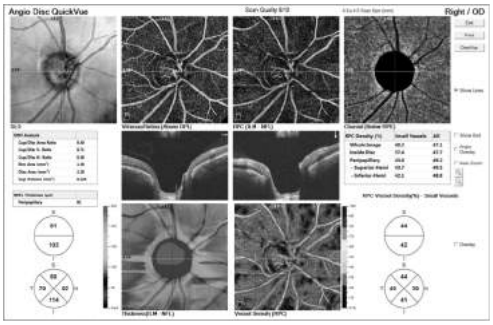
Normal GCC Thickness



Normal RNFL Thickness



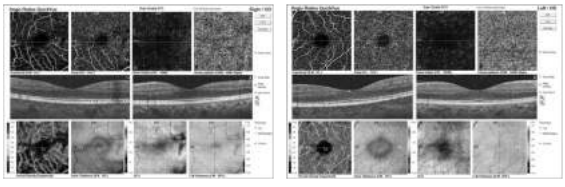
Decreased RPC Vessel Density



Case Study: Confirm Diagnosis by Correlating Structure-Function

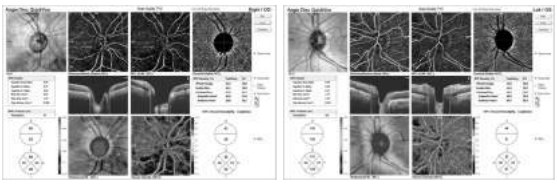
- 62 year old man
- Strong family history of glaucoma

Decreased Retina Vessel Density OD

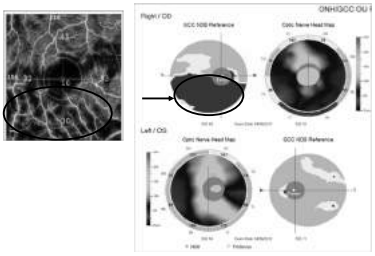


Normal

Decreased Disc Vessel Density OD



Inferior GCC and RNFL Thinning Correlates with Decreased Vessel Density



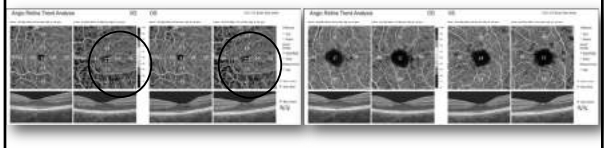
OCTA Vessel Density + GCC + RNFL Increases Diagnostic Confidence

Case Study: Progression Detection

Assess Rate of Change in Vessel Density with Trend Analysis

Eyes with POAG show significantly faster loss of macula vessel density than either glaucoma-suspect or healthy eyes.[6]

Glaucoma | Normal

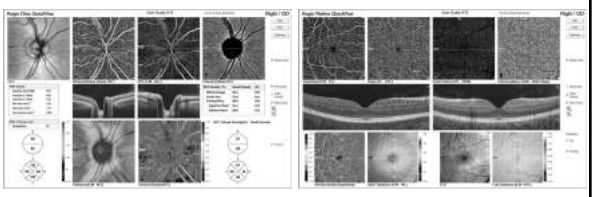


6. Shoji, Takuhei & Zangwill, Linda & Akagi, Tadamichi & Saunders, Luke & Yarmohammadi, Adeleh & Manalastas, Patricia Isabel & Penteado, Rafaella & Weinreb, Robert. (2017). Progressive Macula Vessel Density Loss in Primary Open Angle Glaucoma: A Longitudinal Study. American Journal of Ophthalmology. 182. 10.1016/j.ajo.2017.07.011.

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

Review of Normal 25 year old man



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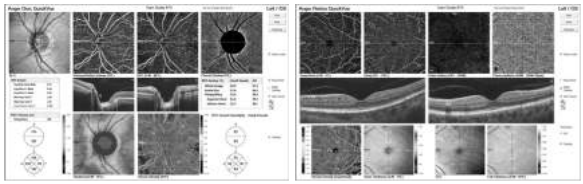
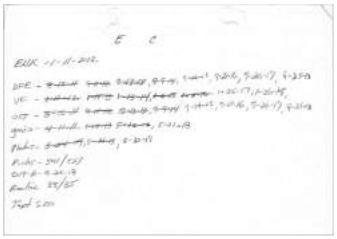
Review of Normal 60 year old man

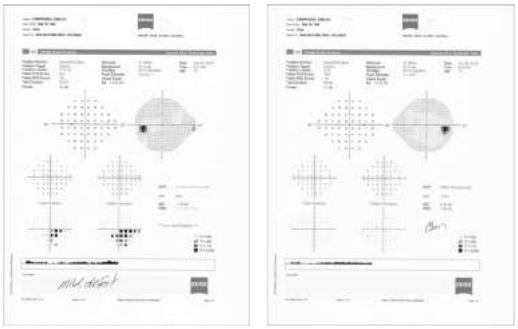


74 year old man

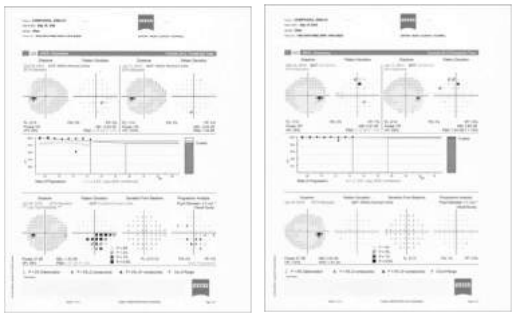
- POAG, OS > OD
- Lumigan 0.01% QD OU
- Combigan BID OU



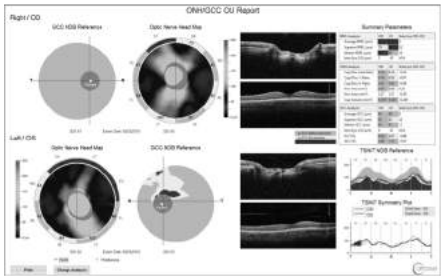
VF OD and OS 1-26-2018



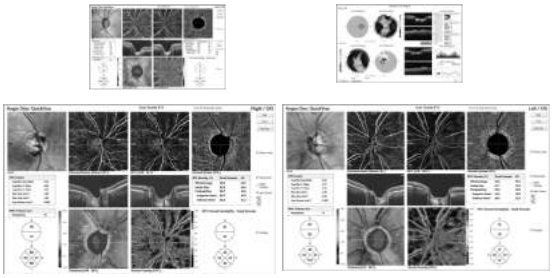
VF OD and OS GPA 1-26-2018



OCT NFL and GCC 9-25-2018



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



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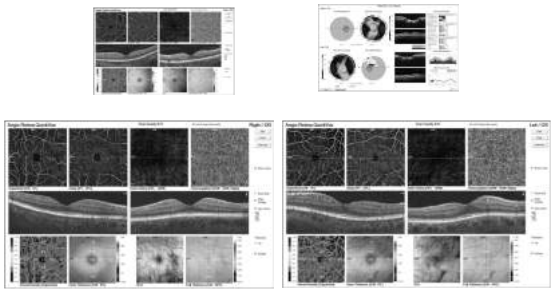
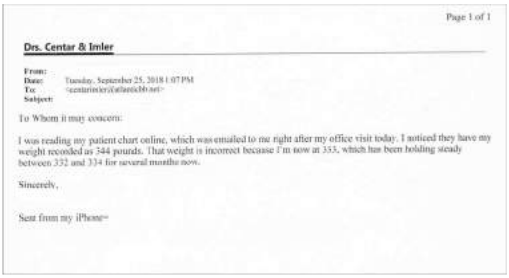
OCT-A 9-25-2018
POAG OS > OD



They do read their EHR communication



Page 1 of 1

Drs. Centar & Imler

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

To Whom it may concern:

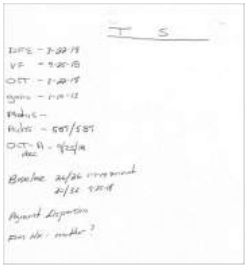
I was reading my patient chart online, which was emailed to me right after my office visit today. I noticed they have my weight recorded as 344 pounds. That weight is incorrect because I'm now at 333, which has been holding steady between 332 and 334 for several months now.

Sincerely,

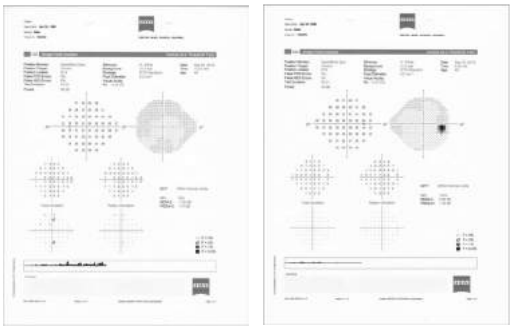
Sent from my iPhone

49 year old man

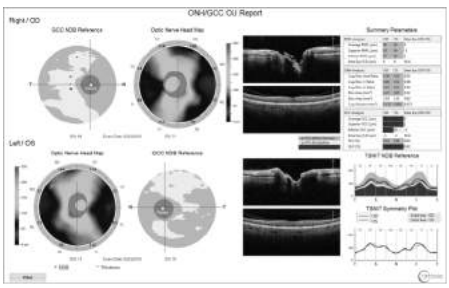
- Ocular Hypertension since 2014
  - No treatment
- Pigment Dispersion
- Baseline IOP or Tmax 26/26
  - 2014— March 2018
- Today 30/32, new Tmax 9-25-18



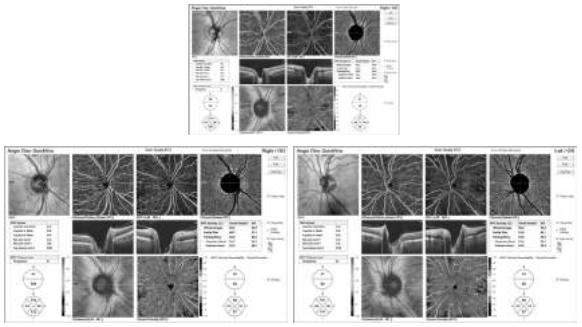
VF 24-2 Sita-Faster 9-25-2018



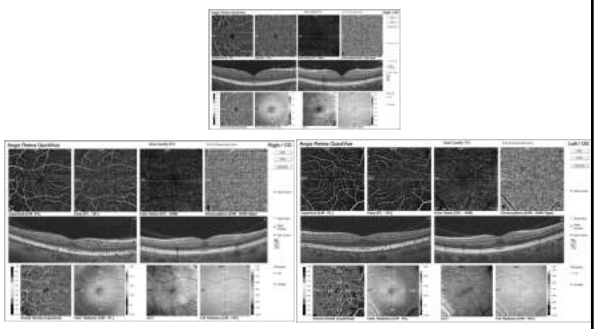
OCT NFL and GCC 3-22-18



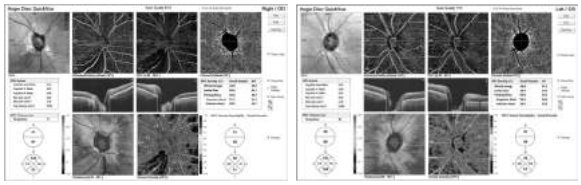
OCT-A 9-25-2018



OCT-A 9-25-2018



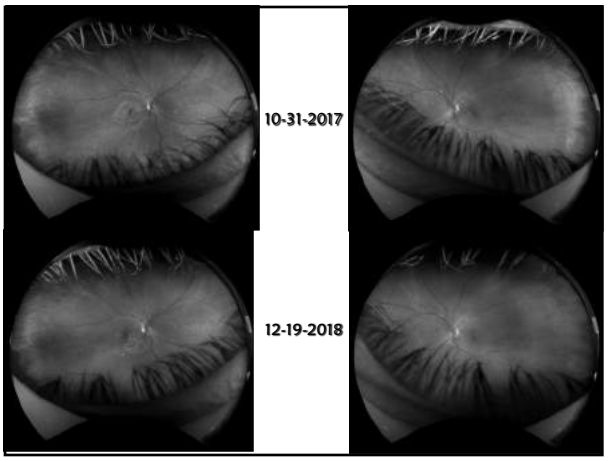
Glaucoma versus Other Optic Neuropathy

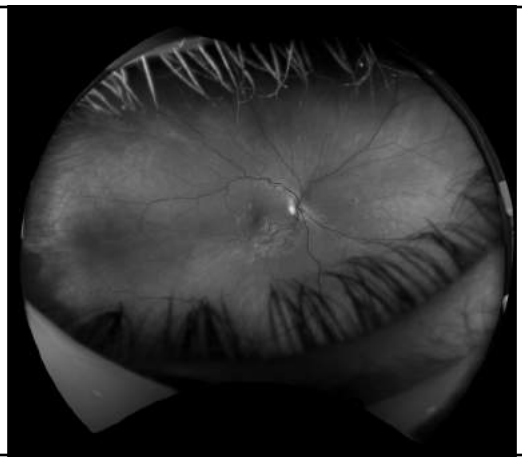


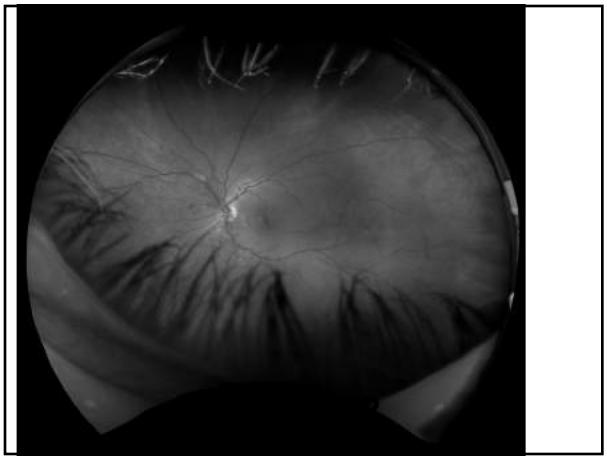
Next Generation Diabetes and Retina Analysis with OCT + OCTA

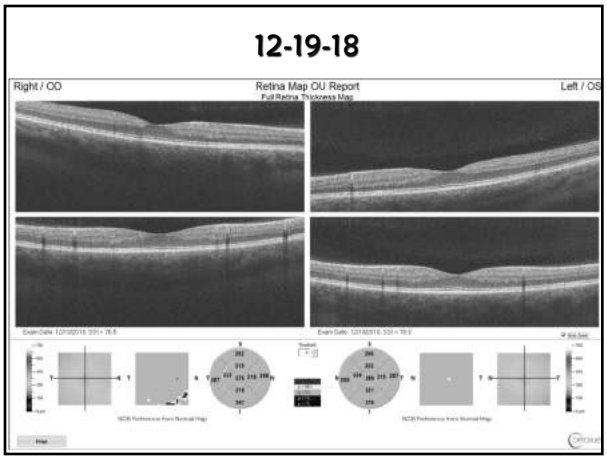
29 year old man with diabetes

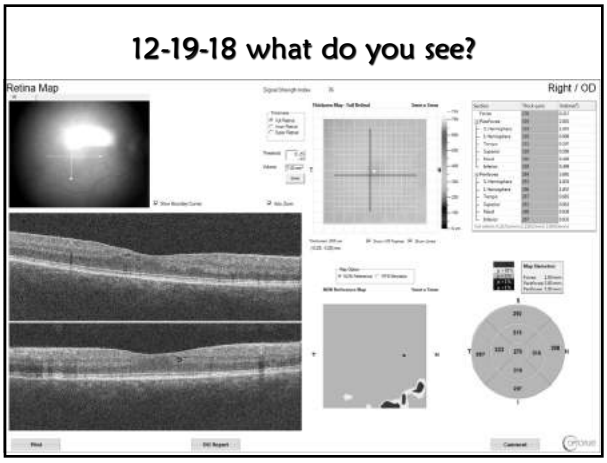
- Yearly diabetic exam, reports no changes to vision
  - Type 1 DM
- BS: 190 this AM, last HbA1c 8.6
- Vision 20/20
- Anterior segment: normal
- Posterior segment:
  - Non-proliferative DR
    - Hemes and exudates
  - No CSME
- Billed for:
  - Exam- 99214
  - Optomap, OCT-Wellness, and OCT-A (Angiography)

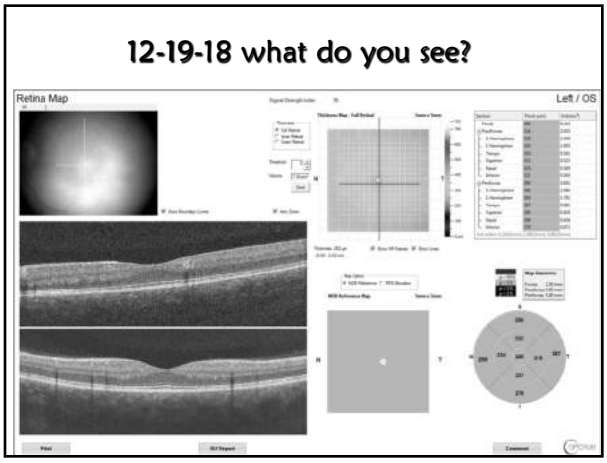


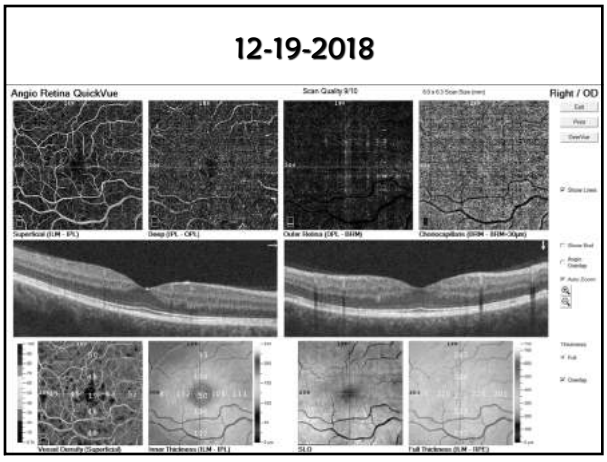


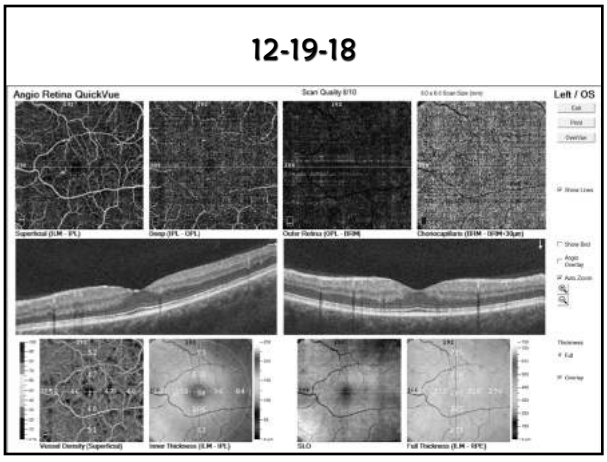












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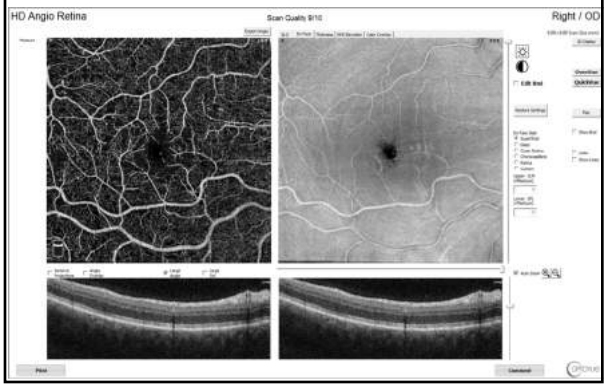
12-19-2018



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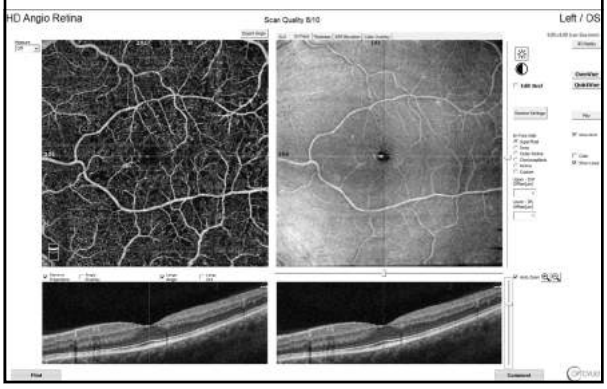

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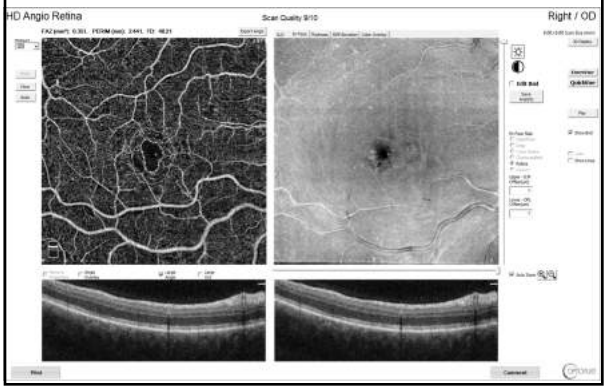

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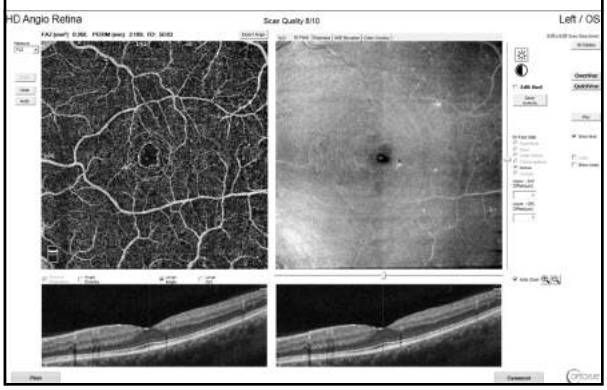
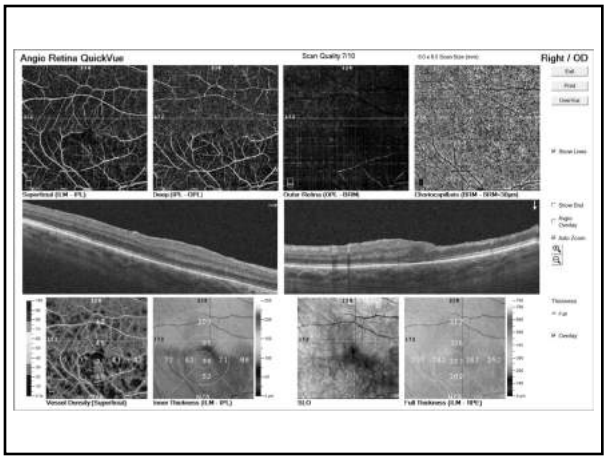


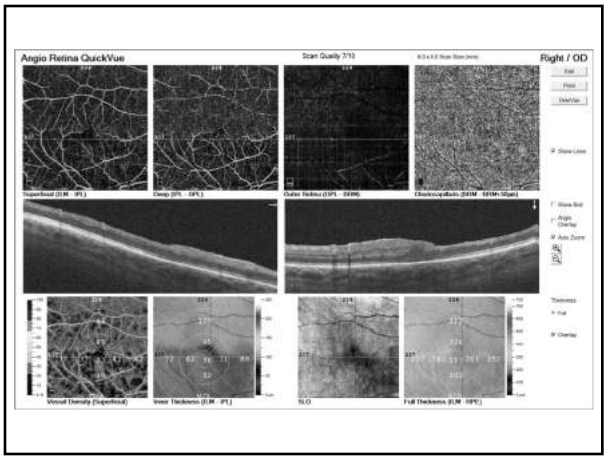
OCT and OCT-A

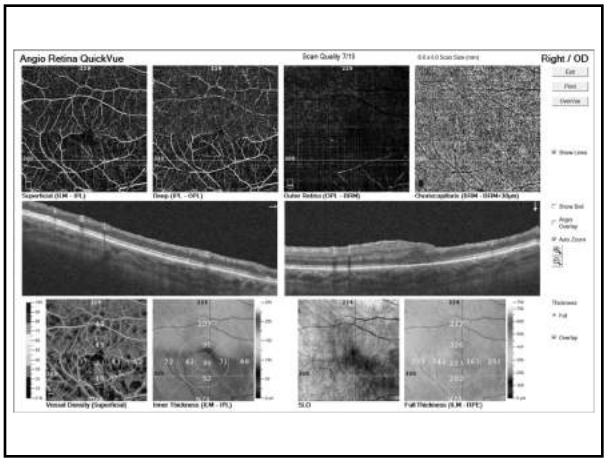
- Treatment?
- Certainly useful, beneficial, essential, and important in following the patient with diabetes
- Improved HbA1c

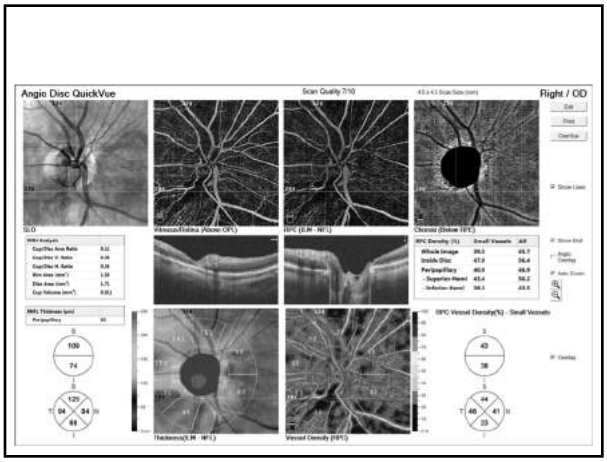
63 year old man

- Complicated ERM surgery OD
  - Increased IOP
  - Vitreous hemorrhage
- ERM peel 8-16-2018
  - My visit 11-20-18
    - IOP 18/13
- Vision 20/20
  - But "can not see top part of vision in right eye"
- Patient returned to me because the surgeon said it will take time for vision to return
- OCT and OCT-A reveals the diagnosis and prognosis

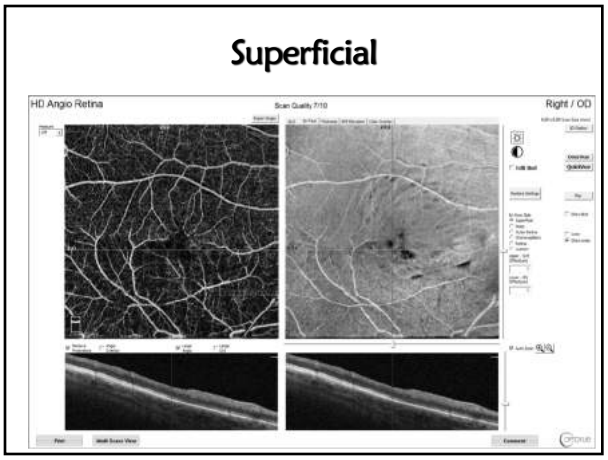




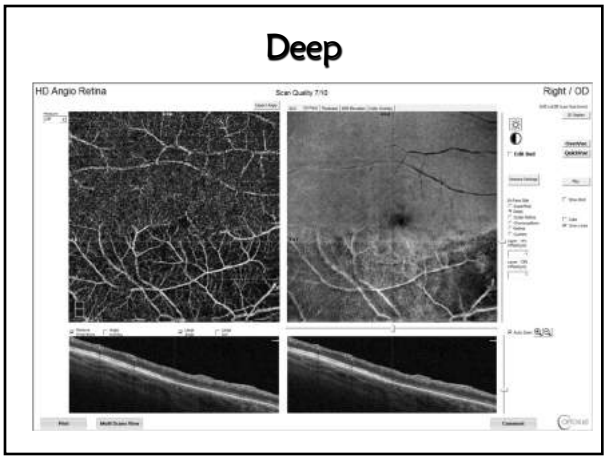




Superficial



Deep



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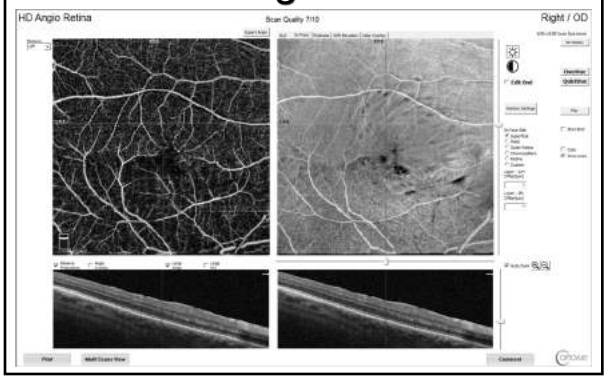
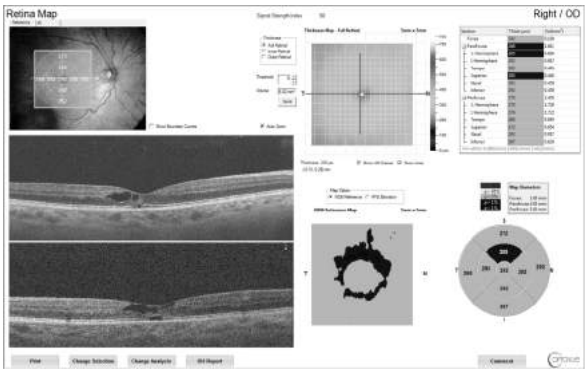
Diagnosis?



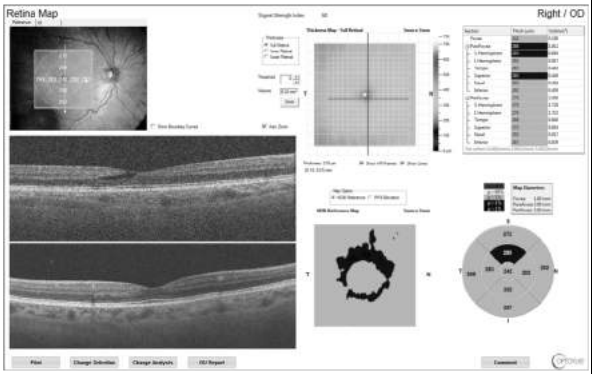
69 year old woman

- In for 6 month diabetic check
  - History of idiopathic juxtafoveal telangiectasia
- BVA OD 20/80 OS 20/40
- Thoughts are the macula changes DM and IJT?
- OCT and OCT-A

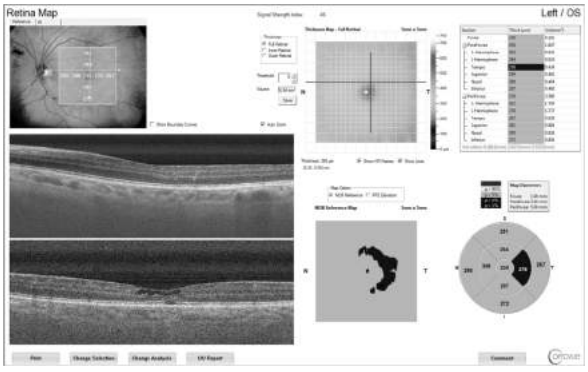
OD OCT



OD OCT



OS OCT



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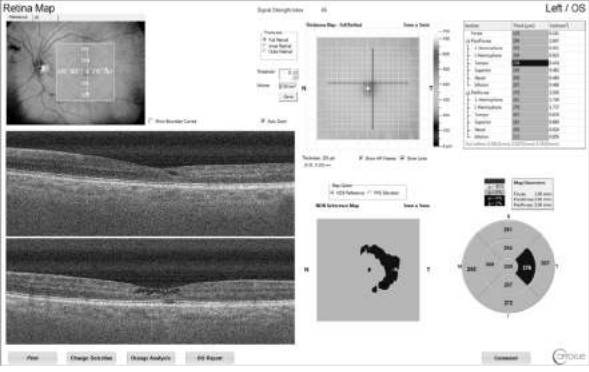
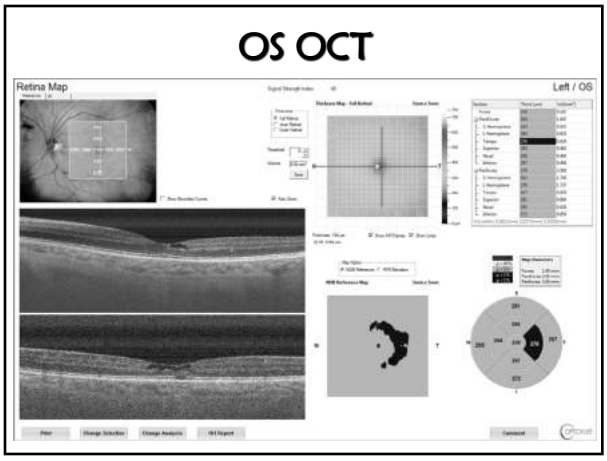
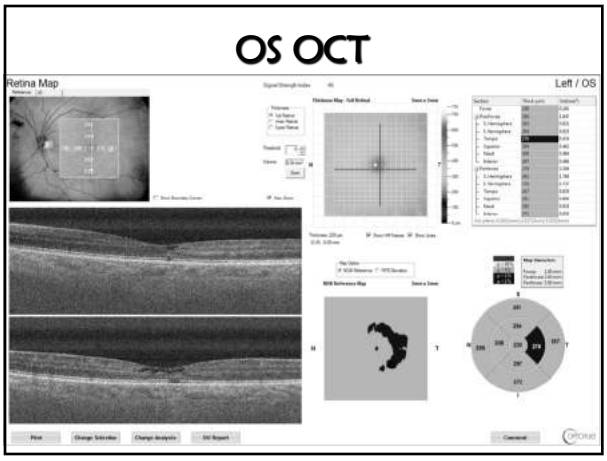


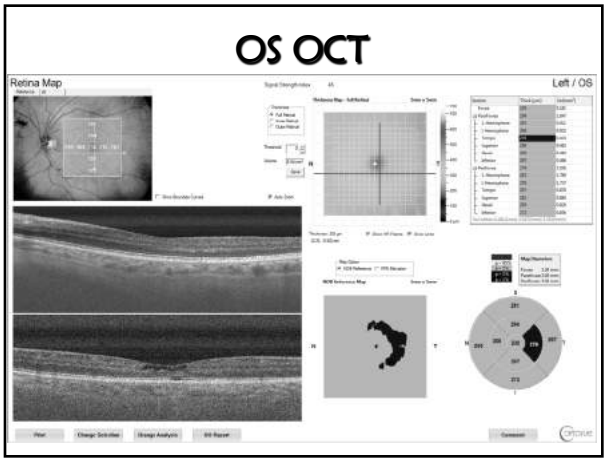
OS OCT



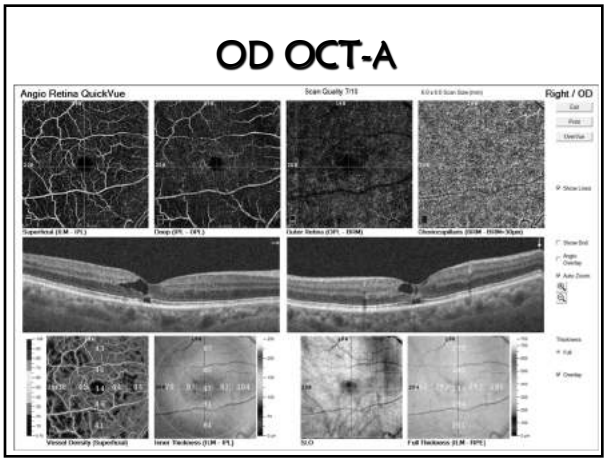
OS OCT



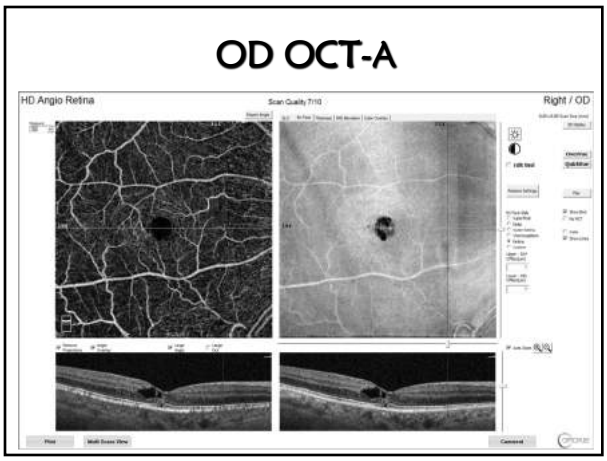
OS OCT



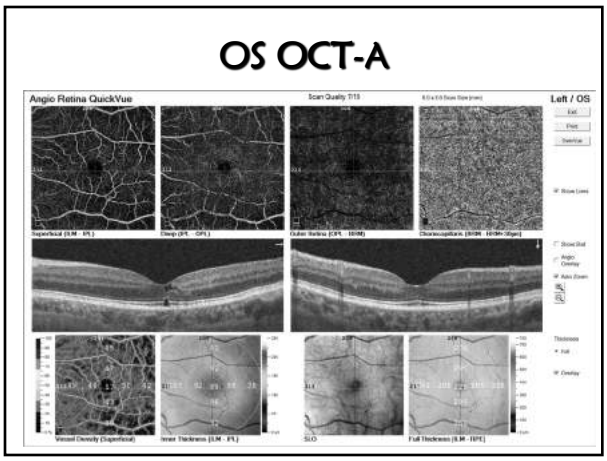
OD OCT-A



OD OCT-A



OS OCT-A



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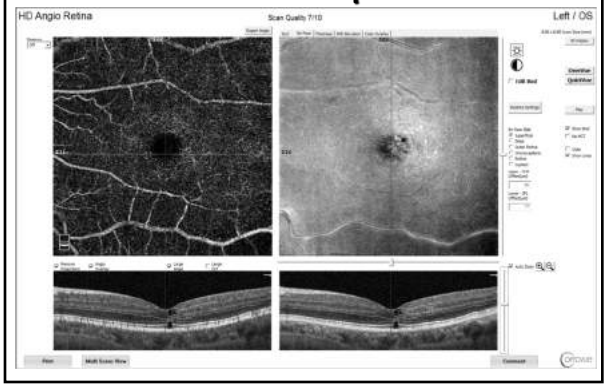
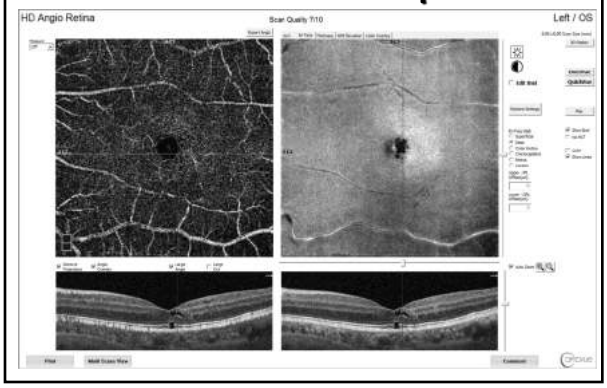
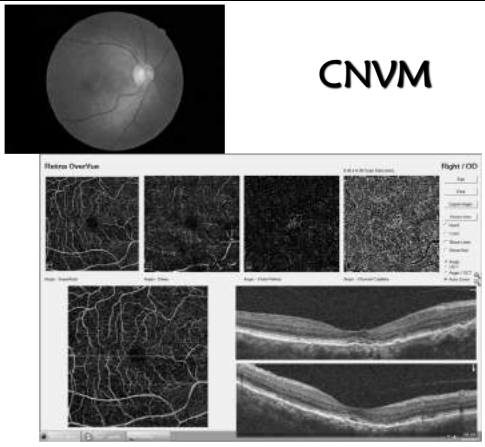
OS OCT-A Superficial



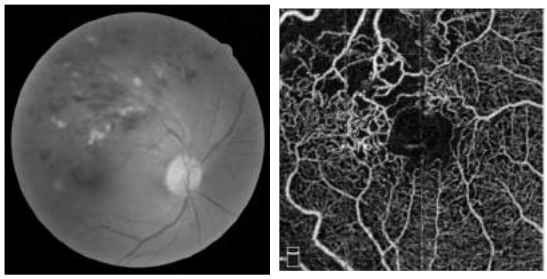
OS OCT-A Deep



CNVM



BRVO



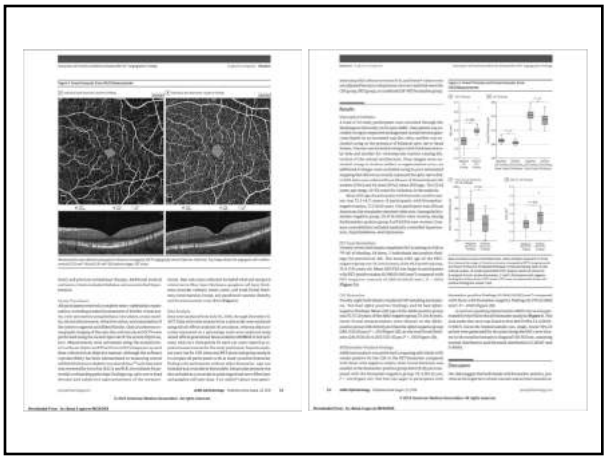
BRVO

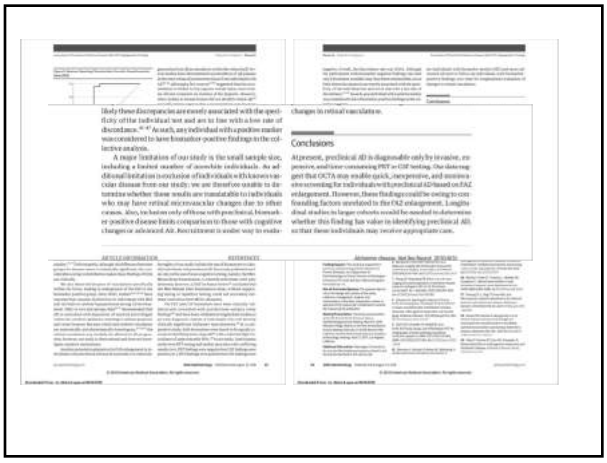
Other Uses
Endothelial Disease

Alzheimer

Dementia


Association of Preclinical Alzheimer Disease
With Optical Coherence Tomographic Angiography Findings




Conclusions