

On behalf of Vision Expo, we sincerely thank you for being with us this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Conference Advisory Board considers content and speakers for future meetings to provide you with the best education possible.



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OCT ANGIOGRAPHY

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Disclosures:

- Paid consultant/speaker for:
 - Carl Zeiss Meditec
 - Regeneron Pharmaceuticals
- Paid advisory board member for Apellis Pharmaceuticals and LENZ Therapeutics
- Non-financial support (writing assistance) from Roche

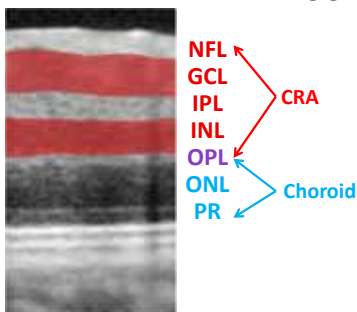
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OVERVIEW

- Retinal blood supply
- Technology
- Principle (motion contrast)
- Displays
- Comparison to intravenous fluorescein angiography (IVFA)
- Artifacts unique to OCTA
- OCTA clinical applications

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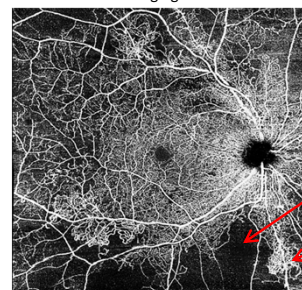
RETINAL BLOOD SUPPLY



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OCT ANGIOGRAPHY: THE BASICS

- Non-invasive "flow" imaging



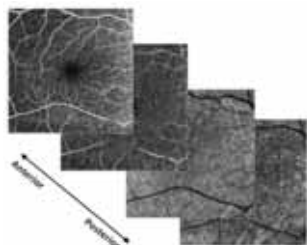
Dark → no flow or too slow to detect

Bright → blood flow

6

OCT ANGIOGRAPHY: THE BASICS

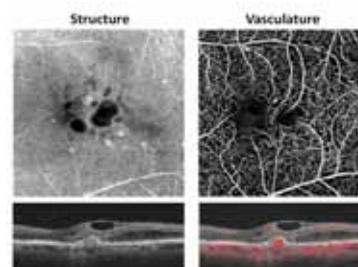
- Non-invasive “flow” imaging
- 3D volumetric data



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OCT ANGIOGRAPHY: THE BASICS

- Structure/ vasculature in tandem



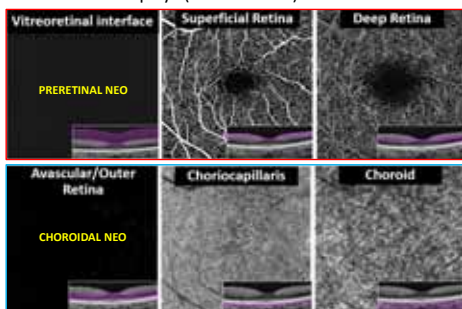
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DISPLAY – En Face

Preset Enface Displays (3mm macula)

Look here for
inner retina
disease (DR,
VO, etc.)

Look here for
outer retina
disease (AMD,
CSCR, myopic
degen, etc.)

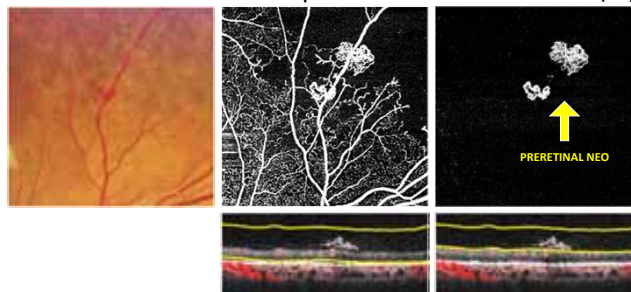


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DISPLAY – En Face

Superficial

Vitreoretinal Interface (VRI)

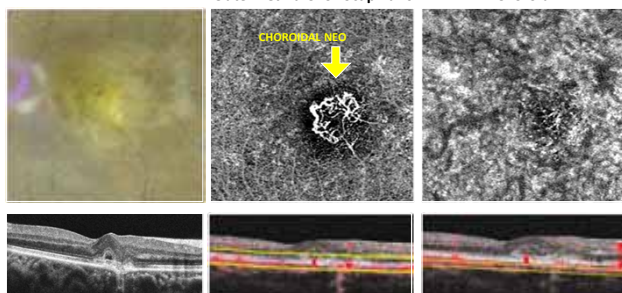


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DISPLAY – En Face

Outer Retina Choriocapillaris

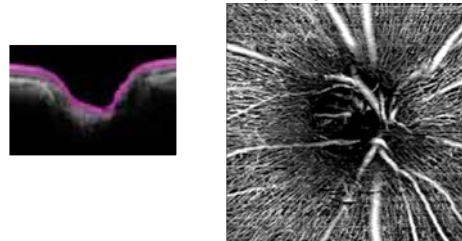
Choroid



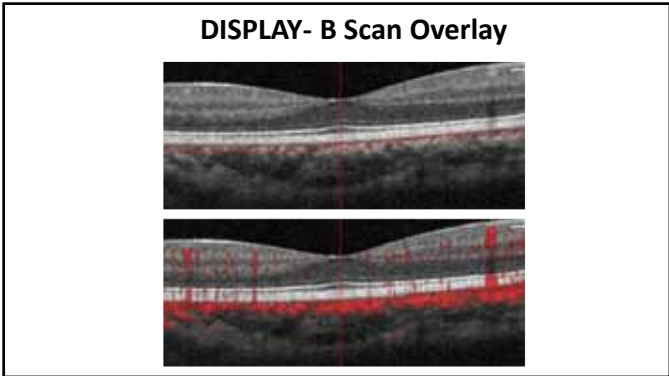
11

DISPLAY- Optic Nerve En Face

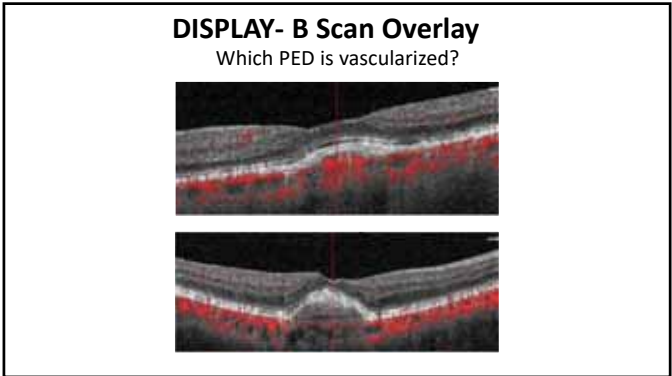
Radial Peripapillary
Capillary Plexus (RPCP)



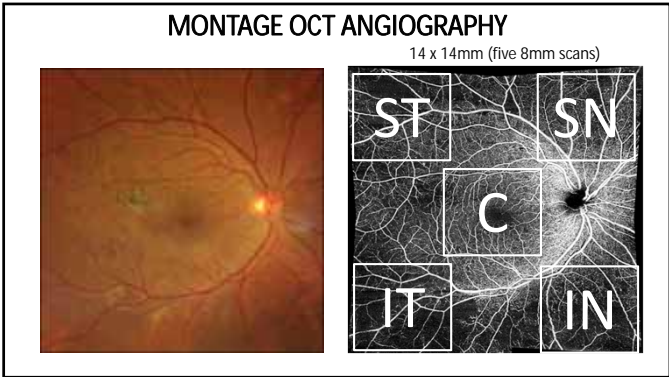
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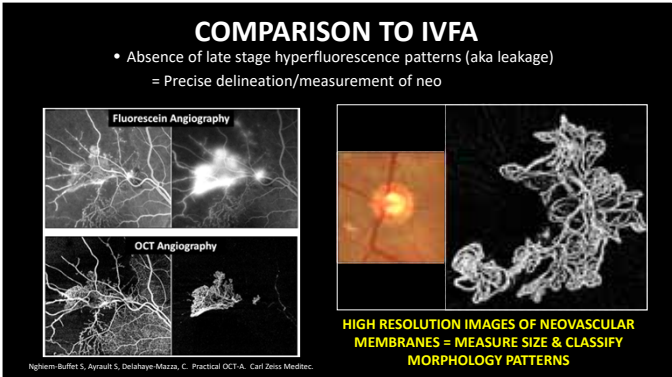
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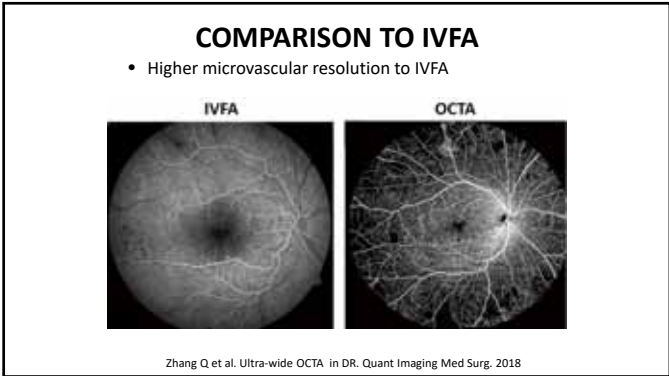
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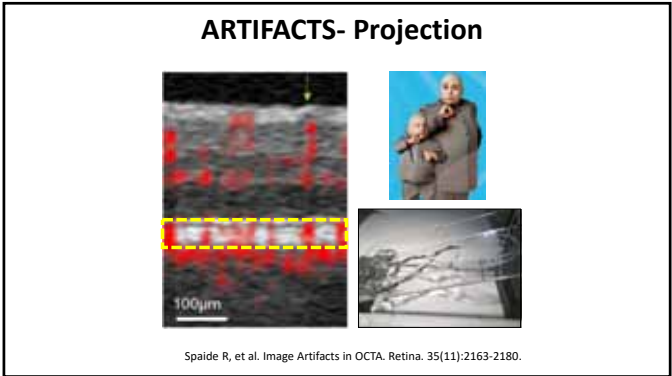
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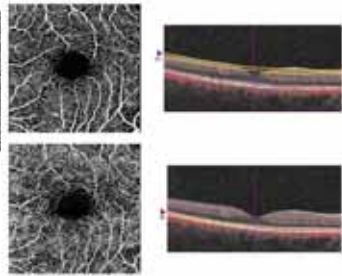


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ARTIFACTS- Projection



Most often encountered on the avascular/ORCC enface images and interfere with CNV detection

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OCTA Clinical Applications

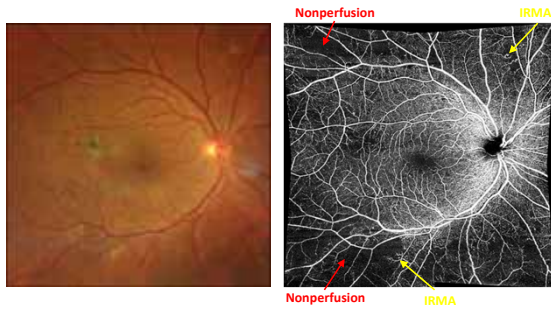
Highlight and localize vascular abnormalities

- Sub-clinical disease detection
- Identify sources of macular edema
- Visualize vascular abnormalities in the deep plexus

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HIGHLIGHT VASCULAR ABNORMALITIES

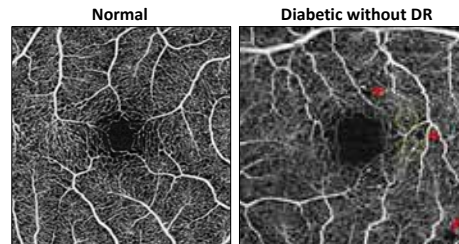
- OCTA highlights subtle vascular abnormalities = more accurate DR staging



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OCTA DETECTION OF SUBCLINICAL DR

NO CLINICALLY DETECTABLE DR!!!



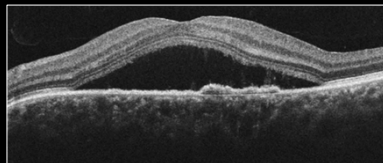
De Carlo TE, et al. Detection of microvascular changes in eyes of patients with diabetes but not clinical DR using OCTA. Retina 2015.

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HIGHLIGHT VASCULAR ABNORMALITIES Central Serous Chorioretinopathy

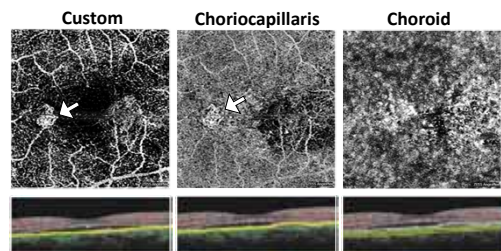
58yo Hispanic male

- Recurrent bouts of CSCR OS
- VAs: OD 20/20, OS 20/60



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HIGHLIGHT VASCULAR ABNORMALITIES Central Serous Chorioretinopathy



~1/3rd of CSCR eyes have abnormal choroidal vessels, of which 2/3rds are confirmed CNV membranes.
Costanzo et al. OCTA in CSCR. J Ophthalmol 2015.


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SUBCLINICAL DISEASE DETECTION

39yo American Indian female – Presents for routine diabetic exam

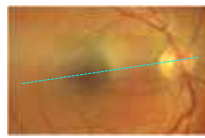
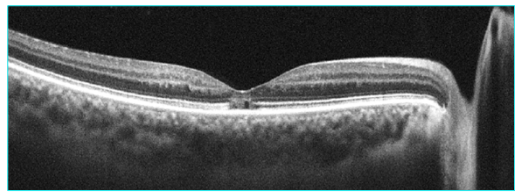
OD 1 year ago (20/30)

- Oc Hx: Unremarkable, LEE 1 year ago
- Med Hx:
 - DM Type 2 x 2 yrs, last HbA1C 5.8%
 - HTN, dyslipidemia, IBS
- BCVAs @dist:
 - OD -1.75 -1.00 x 011 **20/40 PHNI**
 - OS -1.75 -1.50 x 004 **20/30 PHNI**
- Entrance testing: WNL
- SLE: Trace NS cat OU
- BP: 145/81



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SUBCLINICAL DISEASE DETECTION

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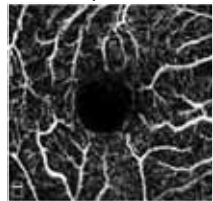
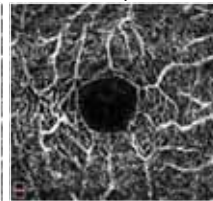
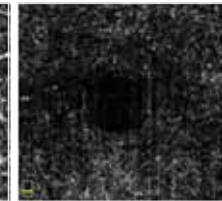


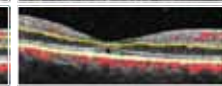
SUBCLINICAL DISEASE DETECTION




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SUBCLINICAL DISEASE DETECTION

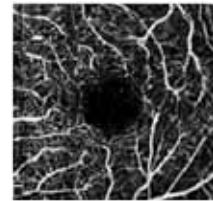
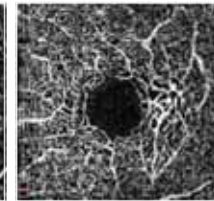
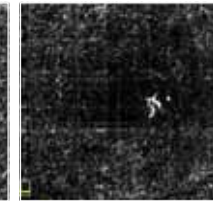



OCTA 3mm Macula OD

Superficial	Deep	Outer Retina
		
		

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SUBCLINICAL DISEASE DETECTION


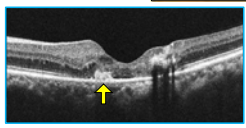

OCTA 3mm Macula OS

Superficial	Deep	Outer Retina
		
		

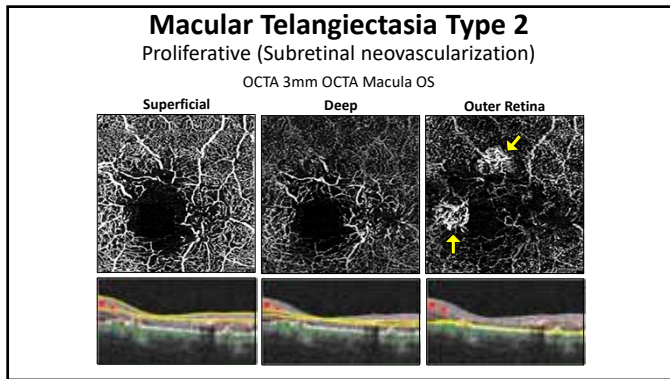
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Macular Telangiectasia Type 2

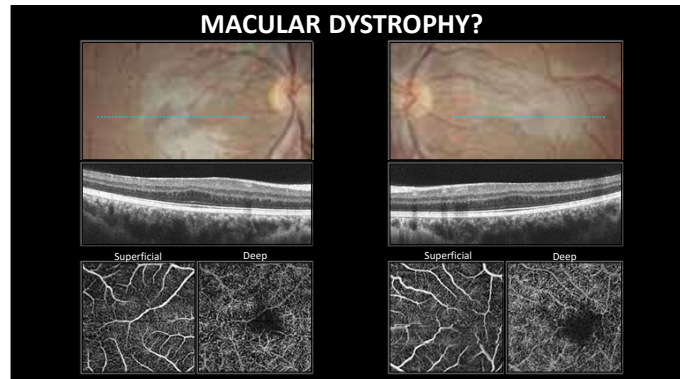
Proliferative (Subretinal neovascularization)

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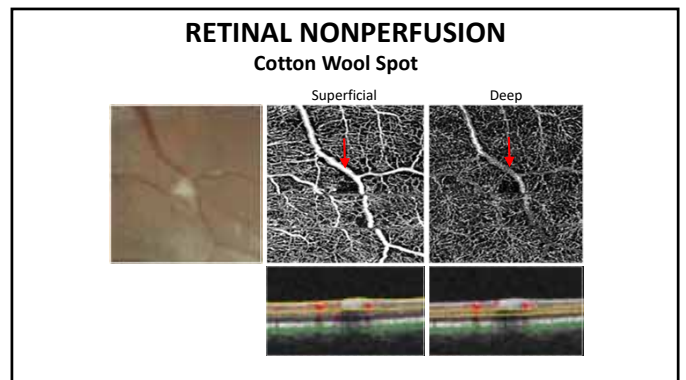
OCTA Clinical Applications

Nonperfusion

Detecting, localizing, and quantifying nonperfusion

- Retinal
 - Diabetic retinopathy
 - Risk of progression to PDR?
 - Venous occlusion
 - Ischemic vs nonischemic?
 - NVG risk?
 - Macular ischemia/detailed evaluation of the foveal avascular zone (FAZ)
- Choroidal
 - AMD, peripapillary atrophy, giant cell arteritis, ocular ischemic syndrome
 - Neovascular/geographic atrophy precursor?
- Disc/radial peripapillary capillaries
 - Glaucoma
 - Neuropathy

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RETINAL NONPERFUSION- DIABETIC RETINOPATHY

Normal Very Severe NPDR

• Increased risk for progression to PDR
• Consider early anti-VEGF/PRP treatment

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RETINAL NONPERFUSION- VENOUS OCCLUSION

Non -ischemic BRVO Ischemic BRVO

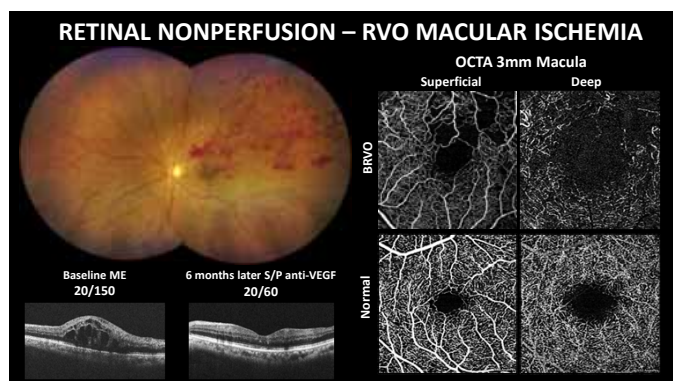
- Estimate the degree of NP and classify as ischemic or nonischemic
 - CRVO → ant seg neo
 - BRVO → post seg neo

Predictive Value of Retinal NP!!!

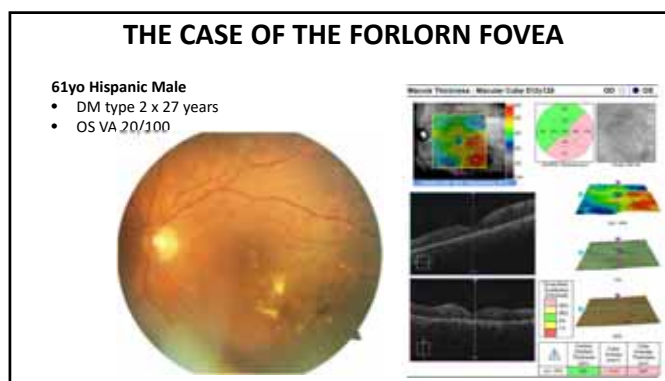
BVS 50/50/50 rule: ~ 50% of eyes with ischemic BRVO will develop NVD/NVE

Branch Vein Occlusion Study Grp. Argon laser scatter photocoagulation for prevention of neovascularization and vit heme in BVO. A RCT. Arch Ophthalmol. 1986.

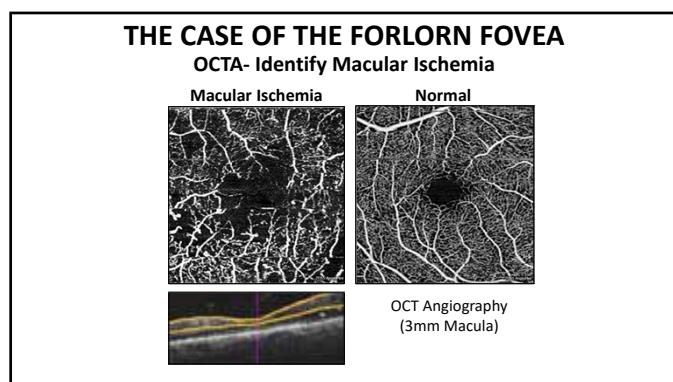
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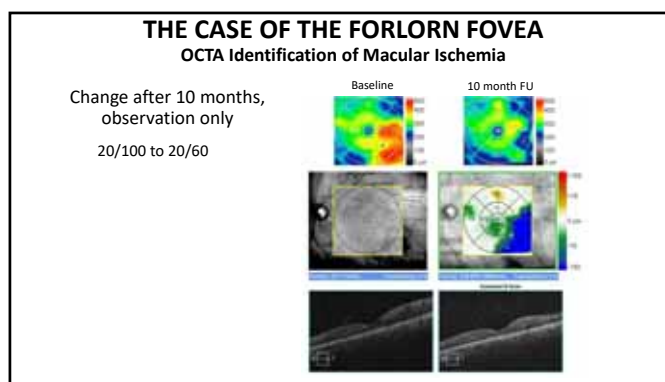
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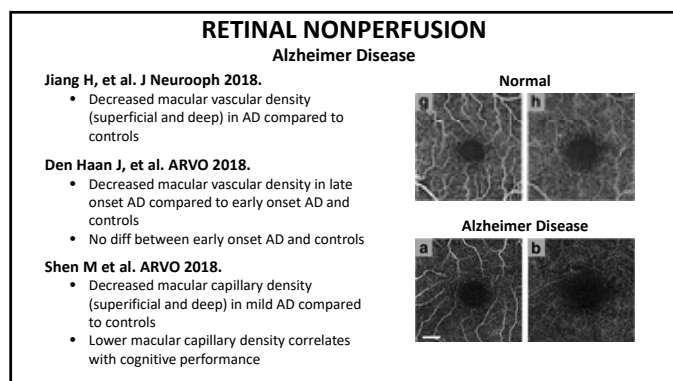
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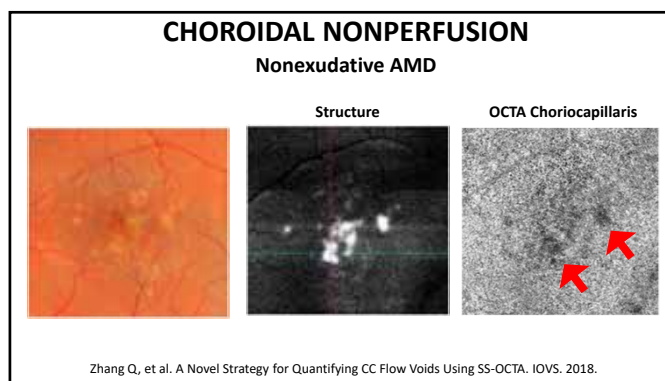
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CHOROIDAL NONPERFUSION AMD Geographic Atrophy

- Impairment of choriocapillaris flow is present immediately surrounding GA lesions
- \uparrow degree of choriocapillaris flow impairment = faster GA enlargement!!

Structural EnFace

OCTA Choriocapillaris

Nassissi M, et al. Choriocapillaris impairment around the atrophic lesions in patients with GA: a SS-OCTA study. Br J Oph. 2018.

Correlation between CC flow impairment around atrophic lesions and yearly growth rate in patients with GA

% flow voids outside atrophy

GA growth rate (mm/y)

$R = 0.685$
 $p\text{-value} < 0.001$

Nassissi M, et al. Choriocapillaris flow impairment surrounding GA correlates with disease progression. PLoS One 2019.

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CHOROIDAL NONPERFUSION A predictor for CNV development in adult-onset foveomacular vitelliform dystrophy

Initial

9 month FU

44

DISC/RPC NONPERFUSION Glaucoma

Decreased perfusion of the ONH, radial peripapillary capillaries, and macula all well evidenced

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DISC/RPC NONPERFUSION Glaucoma

Decreased perfusion of the ONH, radial peripapillary capillaries, and macula all well evidenced

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GLAUCOMA

Chicken or Egg?

More longitudinal studies PLEASE!!

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GLAUCOMA

Vessel Density Map Change Example

	Superficial	Deep	Radial Peripapillary
Baseline			
IL + 22/moning			
IL + 22/moning			
IL + 22/moning			

Majcher C, Trevino R, Sponkel W. Effect of Transient IOP elevation on OCTA macular and peripapillary vessel density. ARVO 2020.
<https://iovs.arvojournals.org/article.aspx?articleid=2769852>

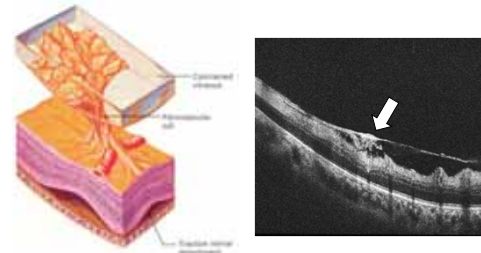
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OCTA Clinical Applications Neovascularization

- Detecting, localizing, and defining neovascularization
 - Preretinal
 - Early detection of PDR
 - Differentiate IRMA from early NVE
 - Differentiate collaterals from NVD
 - Choroidal
 - Early detection of CNV
 - Detection/monitoring nonexudative CNV
- Monitoring regression/progression
- Determining level of exudative activity based on membrane morphology
 - Assess need for retreatment

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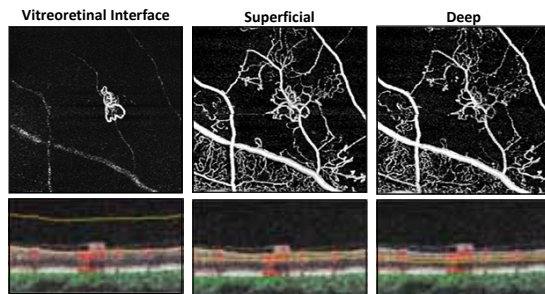
PRERETINAL NEOVASCULARIZATION



Most often characterized by new blood vessel growth located between the ILM and the posterior hyaloid

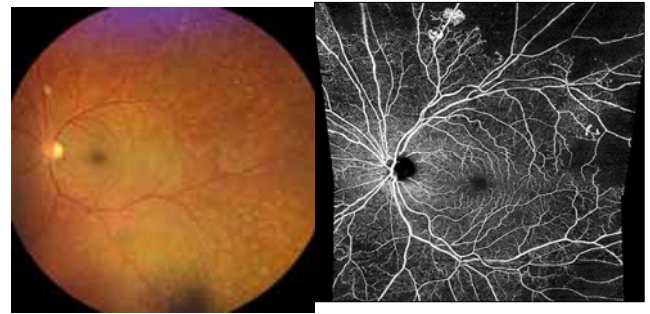
50

PRERETINAL NEOVASCULARIZATION - DR IRMA or early NVE???



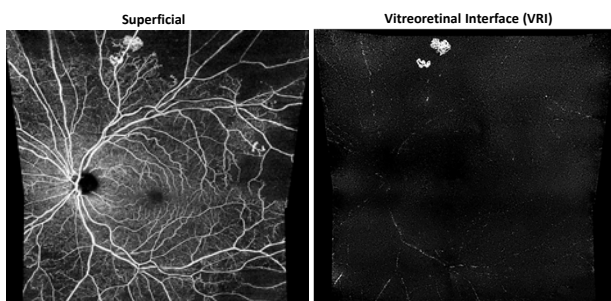
51

PRERETINAL NEOVASCULARIZATION - DR OCTA Enhanced Visualization of NVE



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PRERETINAL NEOVASCULARIZATION - DR OCTA Enhanced Visualization of NVE

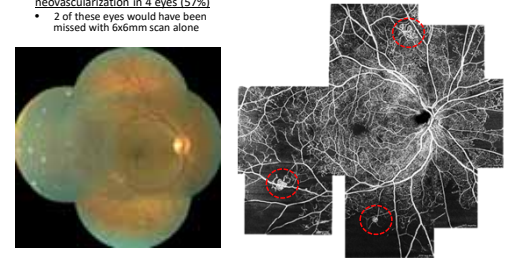


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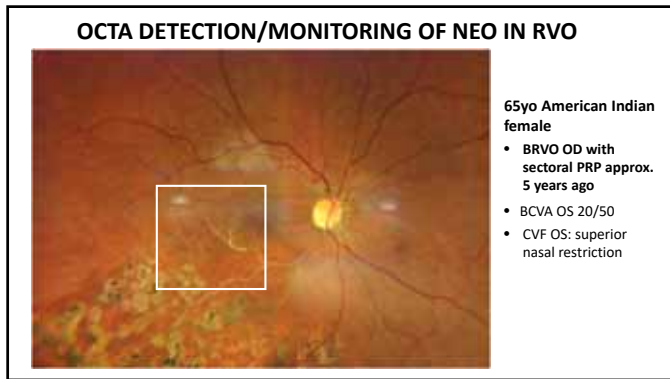
PROLIFERATIVE OR NONPROLIFERATIVE?

You QS et al. Detection of Clinically Unsuspected Retinal Neovascularization with Wide-field OCTA. 2019

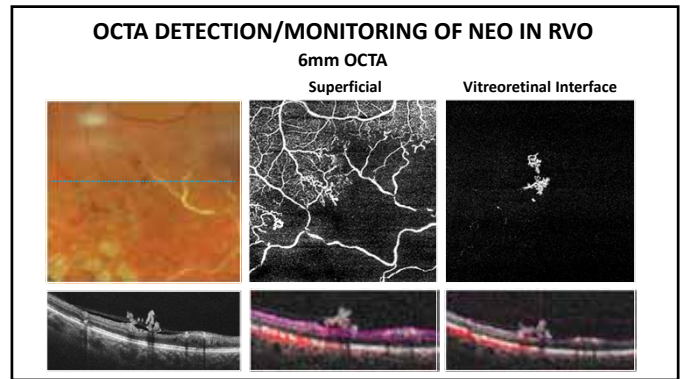
- Performed wide-field OCTA on 27 eyes with NPDR via DFE & color fundus photography
- Of the 7 eyes originally graded as severe NPDR, wide field OCTA detected neovascularization in 4 eyes (57%)
- 2 of these eyes would have been missed with 6x6mm scan alone



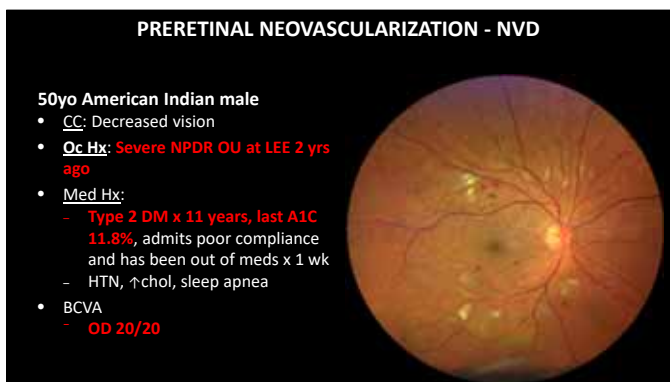
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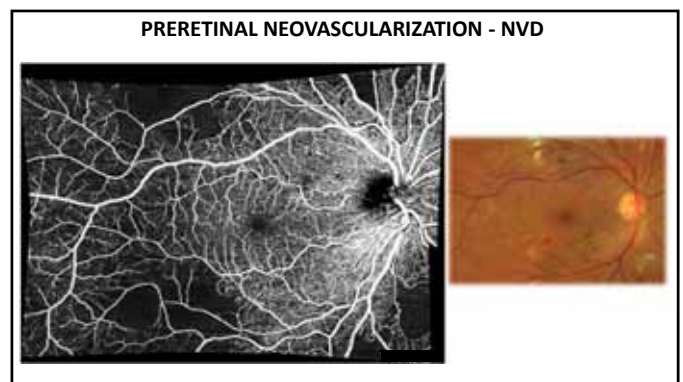
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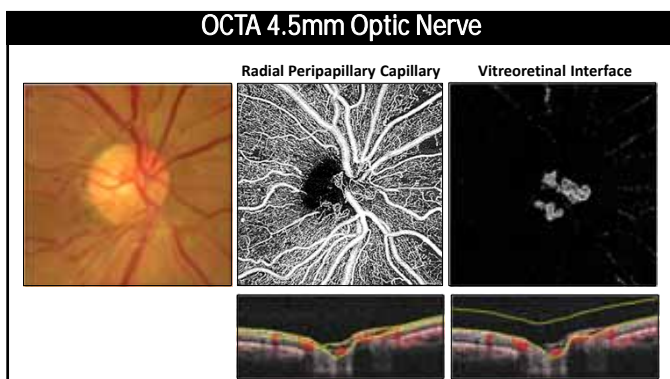
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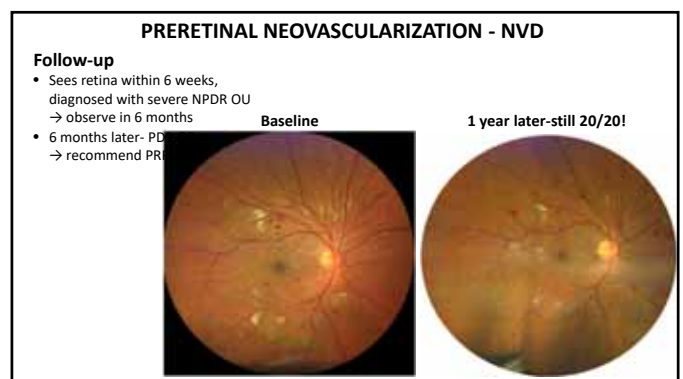
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A MORE EXTERME CASE...

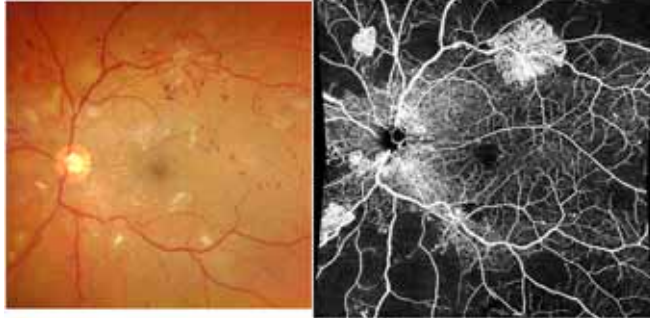
29yo American Indian male – Presents for routine DM exam, needs gls

- POH: **Severe NPDR OU at LEE 5 yrs ago**
- MH:
 - **DM Type 2 x 20 yrs**, last HbA1C 8.2%
 - 2 toes amputated recently due to DM ulcer
- BCVAs @dist:
 - OD 20/30
 - OS **20/30⁻²**
- Entrance testing: WNL
- External exam: Normal OU



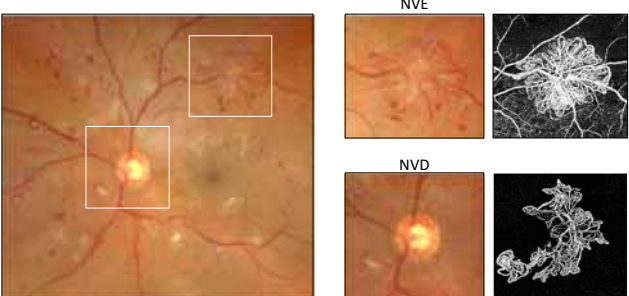
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PRERETINAL NEO - A MORE EXTERME CASE...



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PRERETINAL NEO - A MORE EXTERME CASE...



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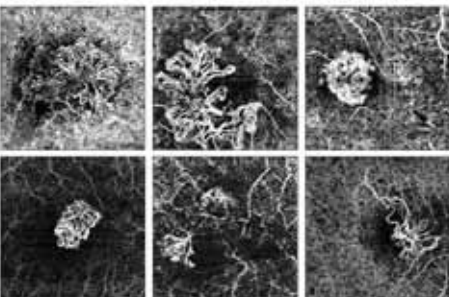
A MORE EXTERME CASE.....1 YEAR FOLLOW-UP

Baseline (20/30⁻²) 1 year later S/P PRP (20/300)



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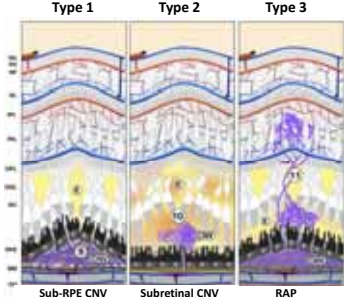
CHOROIDAL NEOVASCULARIZATION



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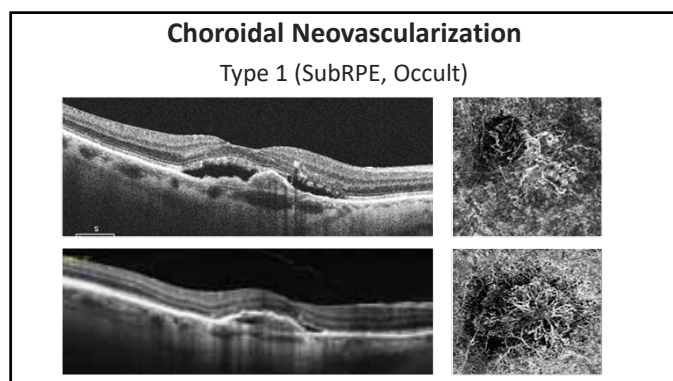
CHOROIDAL NEOVASCULARIZATION

Type 1 Type 2 Type 3

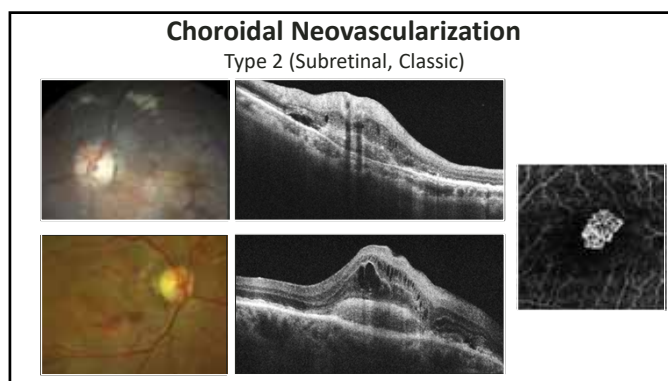


Sub-RPE CNV Subretinal CNV RAP (Retinal Angiomatous Proliferation)

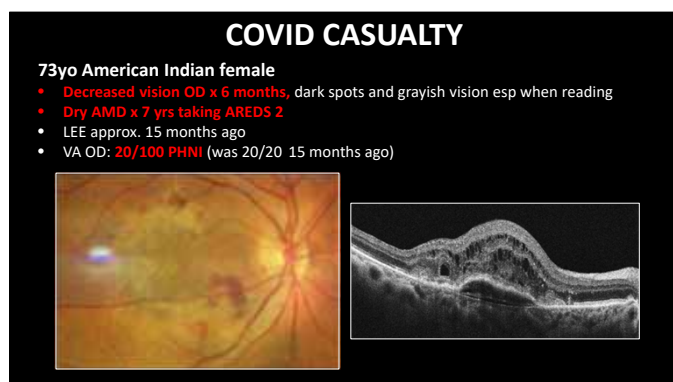
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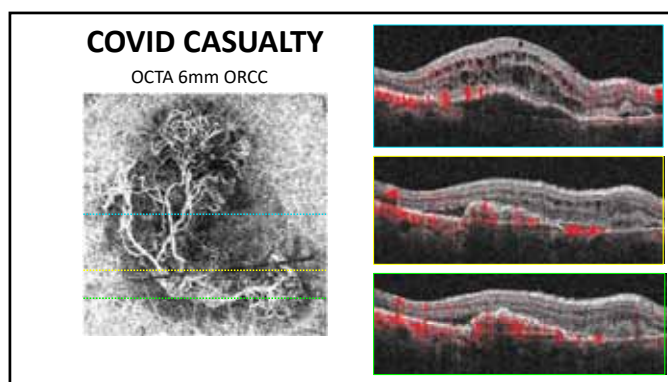
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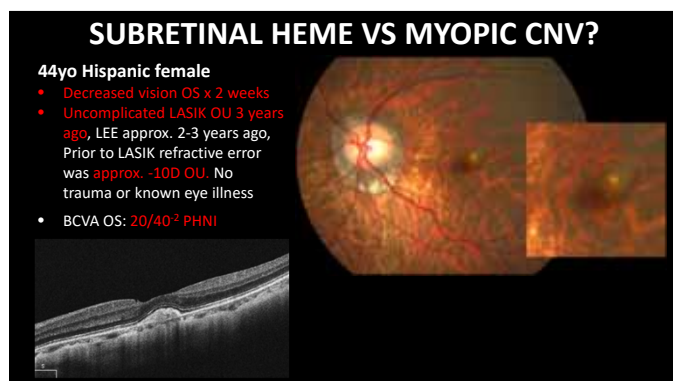
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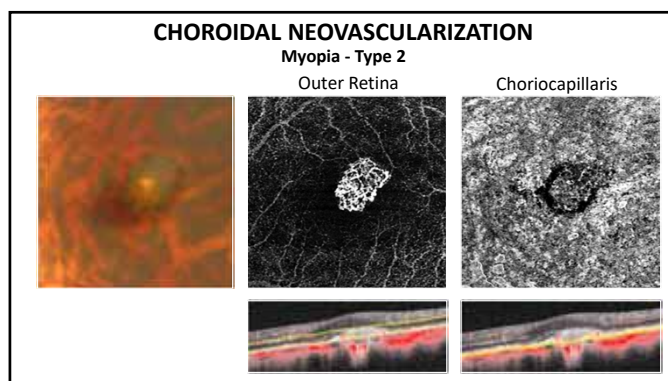
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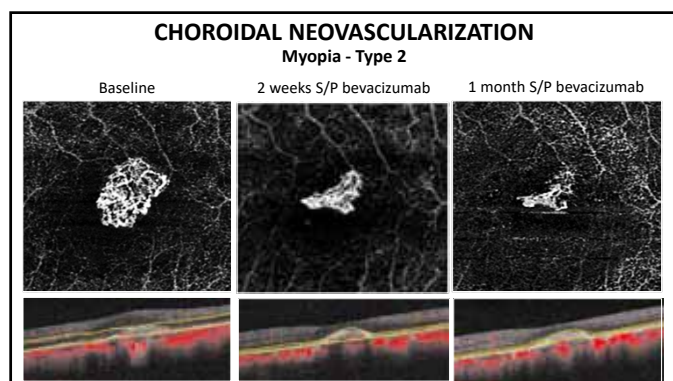
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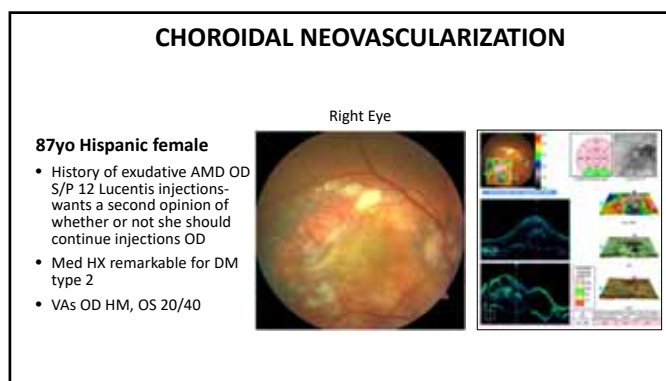
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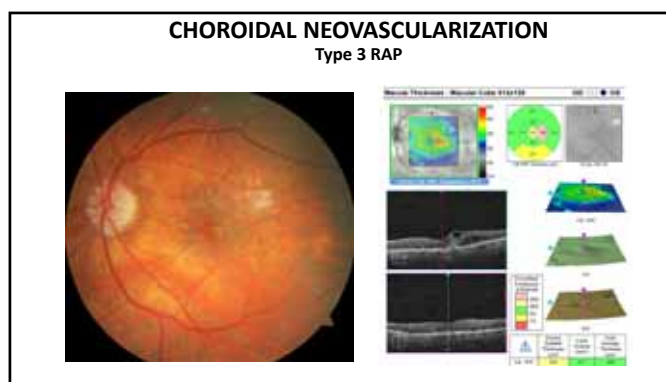
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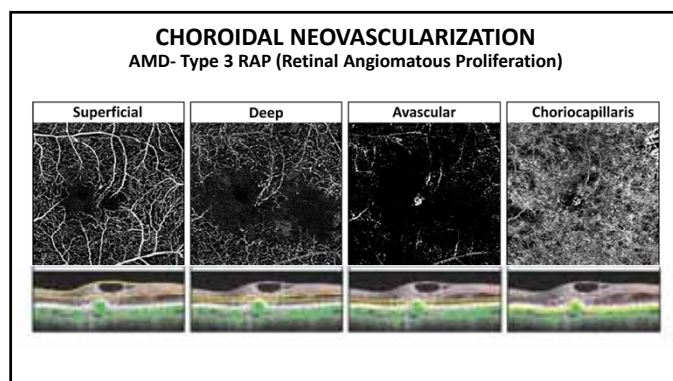
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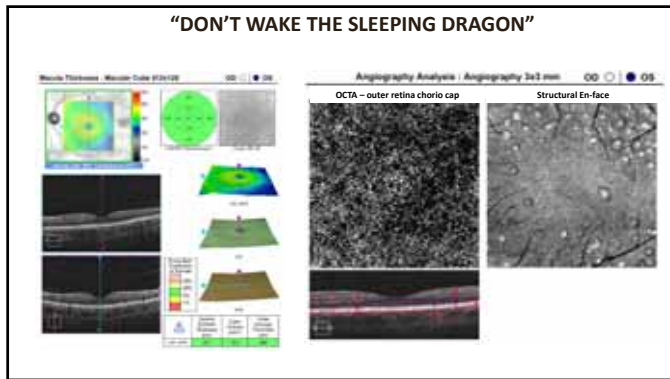
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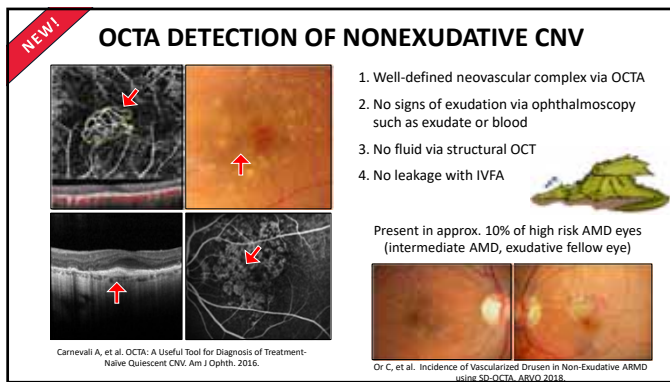
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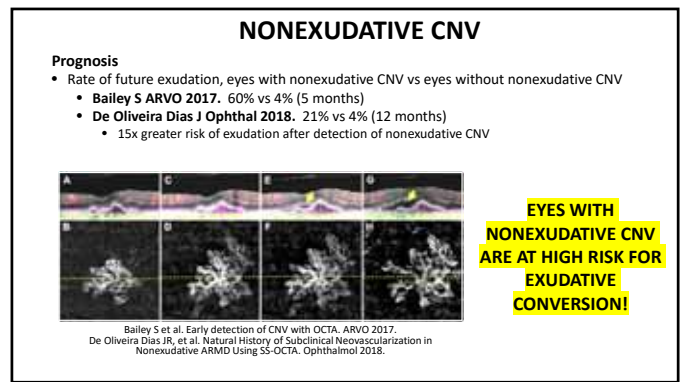
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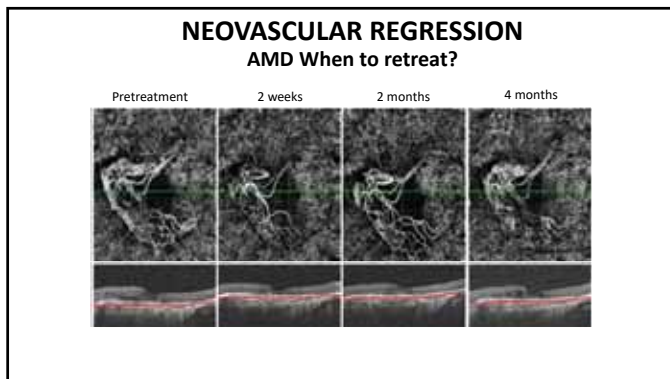
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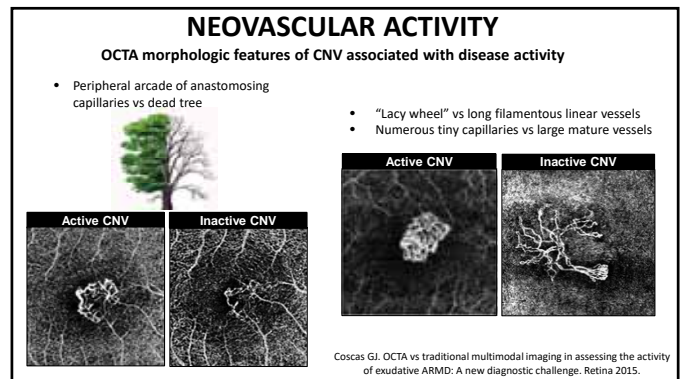
81



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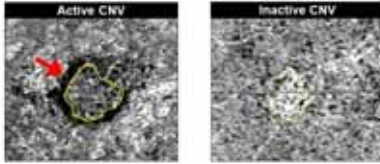
83



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NEOVASCULAR ACTIVITY

- OCTA morphologic features of CNV associated with disease activity
- Perilesional hypointense halo



Coscas GJ. OCTA vs traditional multimodal imaging in assessing the activity of exudative AMD: A new diagnostic challenge. Retina 2015.

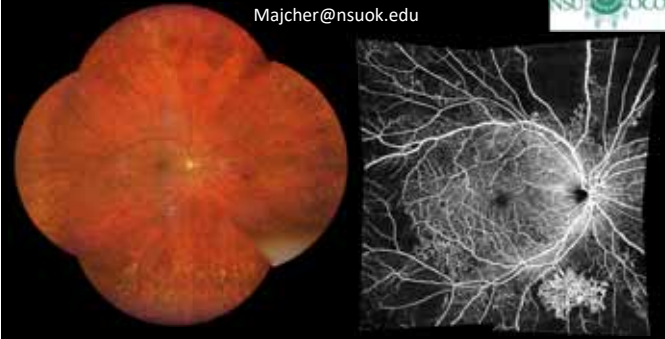
85

THE "TAKE HOME" MESSAGE

- Non-invasive method of visualizing RBC motion
- Many advantages over IVFA
- Good for highlighting and localizing subtle vascular abnormalities
- Detection of subclinical DR
- Better detection of non-perfusion in DR, venous occlusive disease, AMD, and glaucoma
- Earlier detection of pre-retinal and choroidal neovascularization
- Improved visualization of CNV and precursors (nonexudative CNV)

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THANK YOU!
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