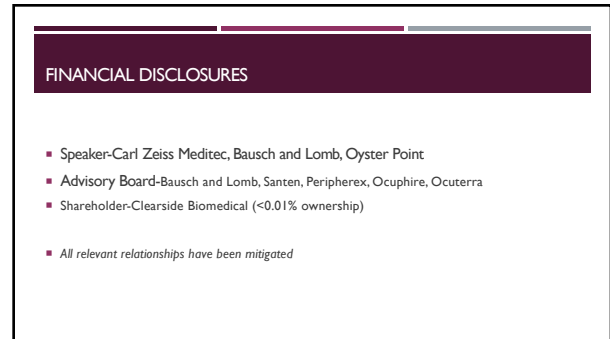




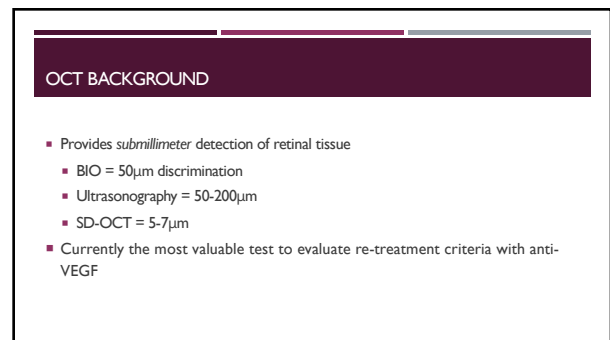
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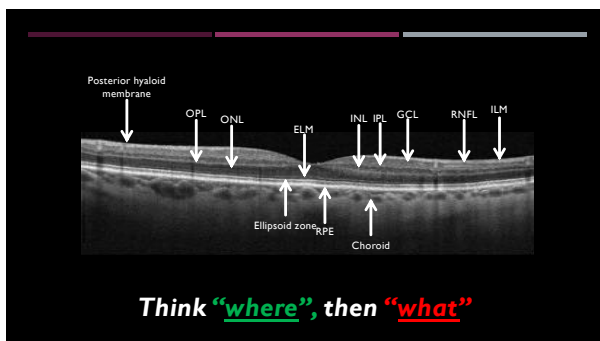
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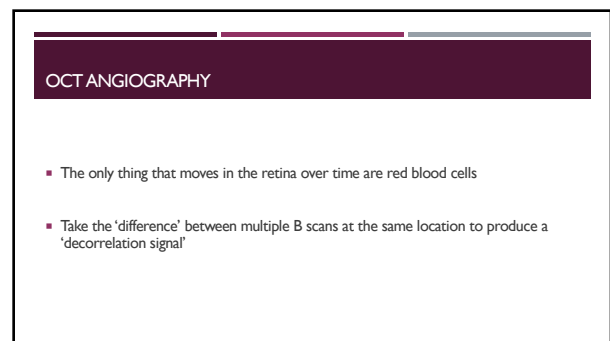
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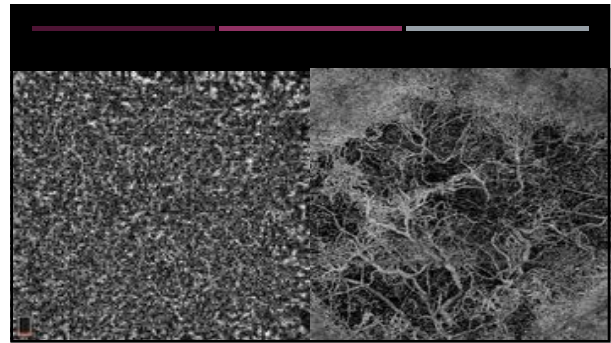


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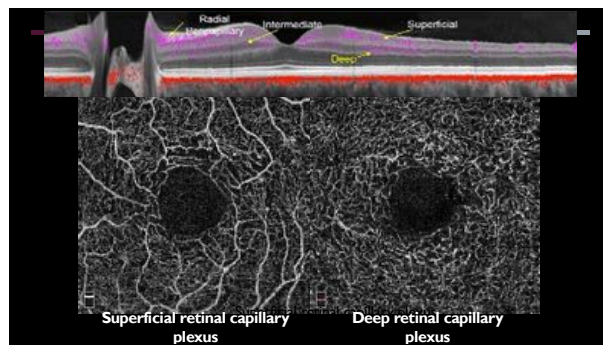
OCT ANGIOGRAPHY

- En face flow formation and cross sectional structural information
- Not a replacement for FA/OCT
 - Provides new information
- Valuable for detection of choroidal and retinal neovascularization, macular ischemia, segmentation of the deep and superficial capillary plexi—and maybe early glaucoma?

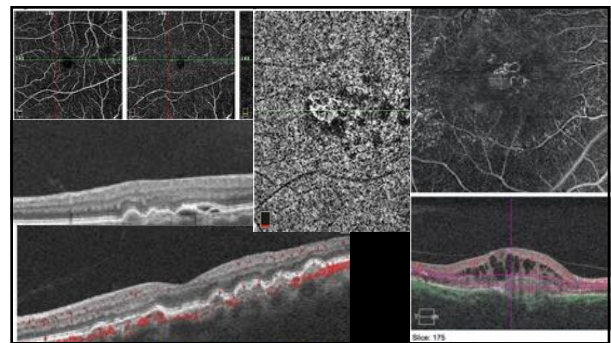
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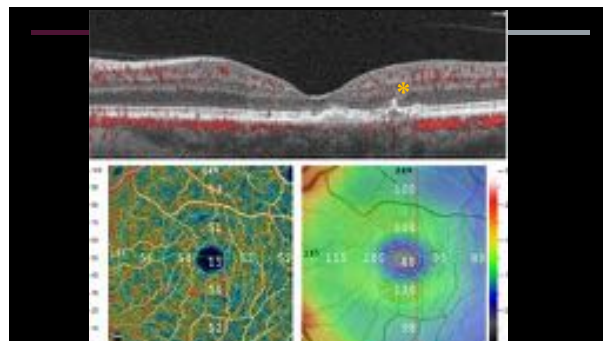
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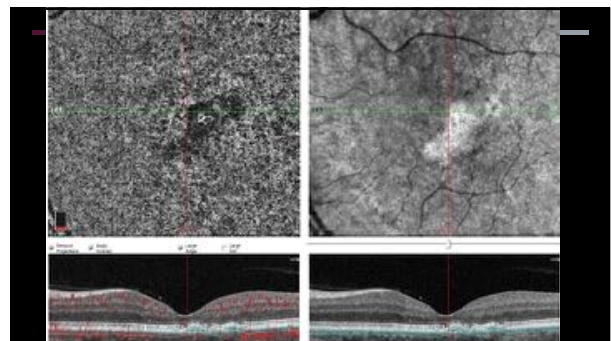
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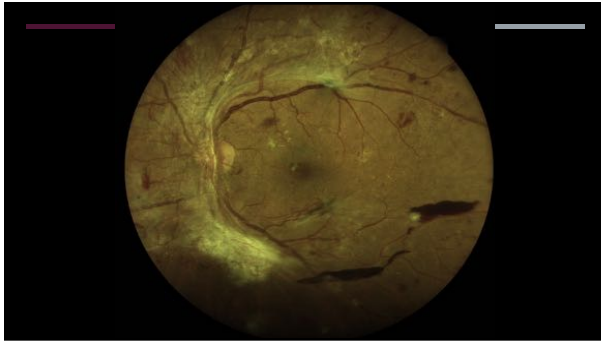
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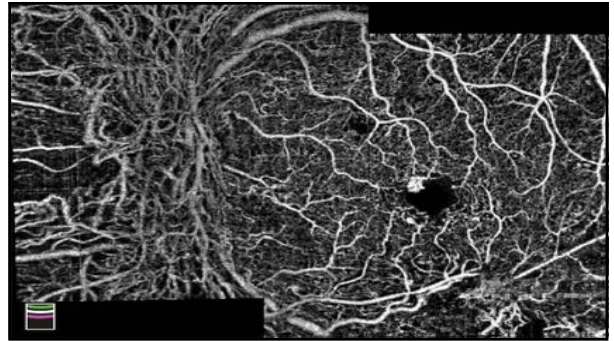
11



12



13



14

Challenges in OCTA


Static blood flow information
No leakage, pooling or staining

Small field of view 3x3mm; 6x6mm; 8x8mm (or 12x12mm) with current systems

Motion artifacts are a big deal

Sensitivity is a challenge in eyes with pathology

Quantification of blood flow-not yet



15


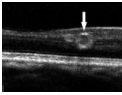
VASCULAR RESPONSE TO DISEASE

- 1) Exudation
 - Loss of blood retinal barrier
 - Accumulation of plasma fluid and lipid
 - Hard exudate and intraretinal edema
- 2) Ischemia
 - Capillary drop out leads to hypoxia
 - Microaneurysms, capillary drop out, neovascularization
- 3) Both

16

MICROANEURYSMS

- Weakening of capillary wall
- Large MAs visible clinically
- Leak
 - Cause intraretinal edema
- May be visible on OCT, OCTA, and FA

17

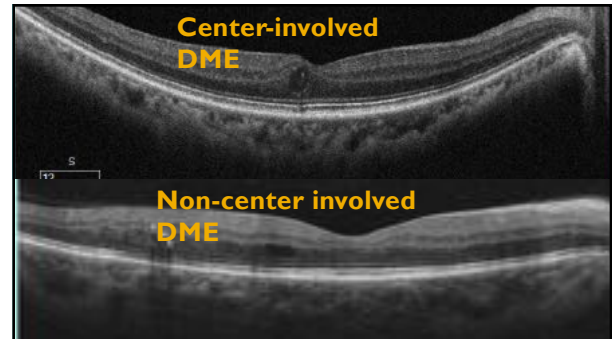


19

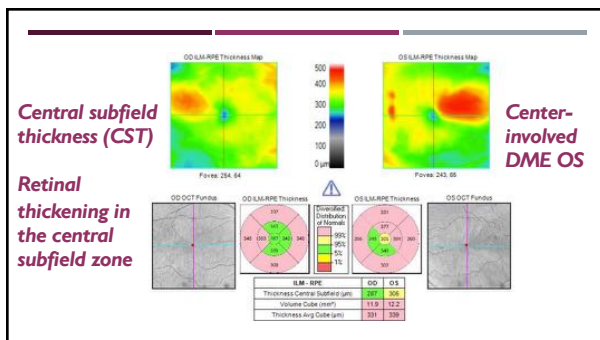
NOW

- Is macular edema present?
- Yes, or no?
 - Sometimes OCT is needed to aid in diagnosis

20



21



22

How do we manage these patients?

24

Anti-VEGF in DME & DR

DRCRnet Protocol S (2016): Ranibizumab (Lucentis) in non-inferior to PDR

Protocol T (2018) Aflibercept vs. bevacizumab vs. ranibizumab in DME: For VA 20/50 or worse, aflibercept (Eylea) better at improving VA

Protocol V (2019): Center-involved DME (20/25+) no difference in vision at 2 years between prompt treatment and initial observation

25

Anti-VEGF in DME & DR

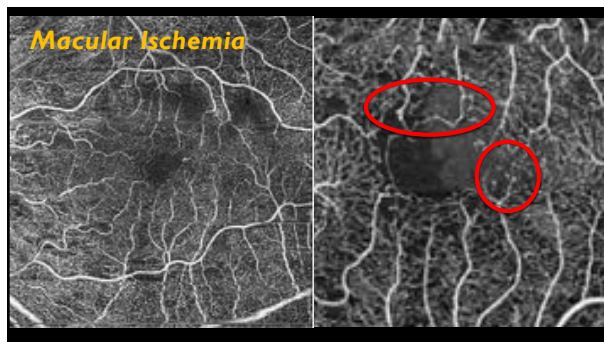
DRCRnet Protocol AC (2022)

Bevacizumab patients did really well at 2 years-is it reasonable to begin with bevacizumab and switch to aflibercept if "clinically" indicated?

70% of patients met switch criteria; almost all within the first year

Monotherapy was \$12000 more costly than switch

26

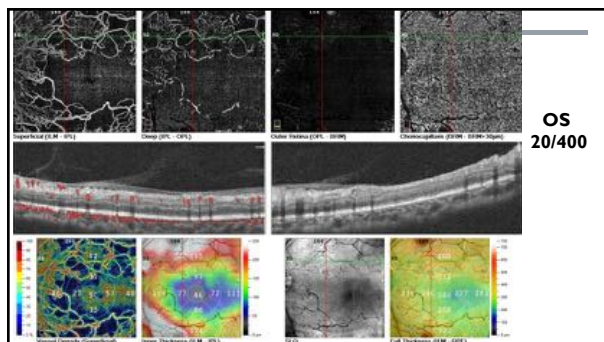


27

MACULAR ISCHEMIA

- Vision loss either due to fluid within the macula or a poorly perfused macula
- **Macular ischemia** in the absence of DME/hemorrhage/exudate
- Enlargement of the foveal avascular zone is a sign of ischemia

28



29

ISCHEMIA IN DIABETIC RETINOPATHY

- Cotton wool spot
- Really *not* an "infarct"

This figure shows a fundus image of a cotton wool spot, which is a pale, fluffy lesion on the retina. The text 'ISCHEMIA IN DIABETIC RETINOPATHY' is written in white on a purple background at the top. Below the text are two images: a fundus image on the right and an OCT cross-section on the left showing the lesion's location within the retina.

30

CUTICULAR DRUSEN

- Drusen subtype
- AKA basal laminar deposits
- Between the basal lamina of RPE and the inner collagenous layer of Bruch's membrane
- Can progress to geographic atrophy and MNV

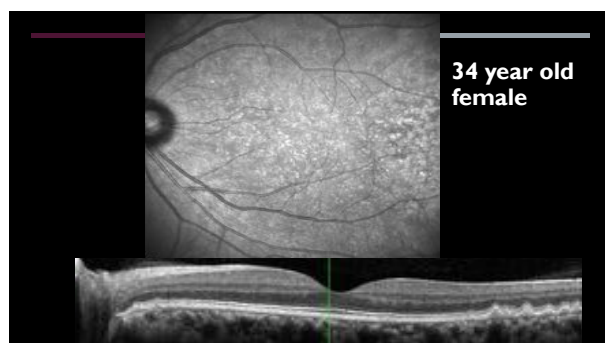
This figure shows an OCT cross-section of the retina with cuticular drusen, which appear as small, discrete deposits between the RPE and Bruch's membrane. The text 'CUTICULAR DRUSEN' is written in white on a purple background at the top.

31

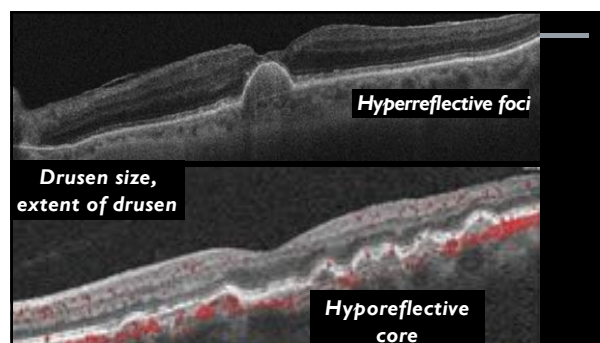
Colloid drusen

This figure shows a fundus image of a colloid drusen, which is a large, yellowish, well-defined lesion. Below the fundus image is an OCT cross-section showing the lesion's location. The text 'Colloid drusen' is written in red on the right side.

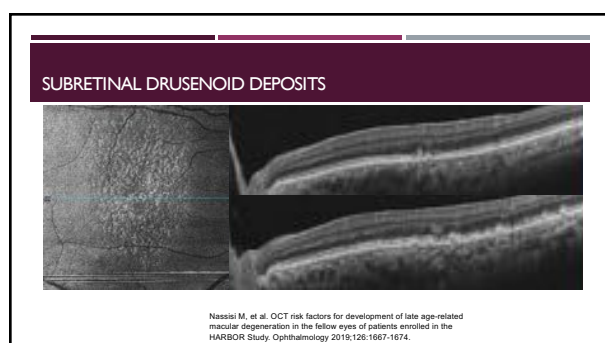
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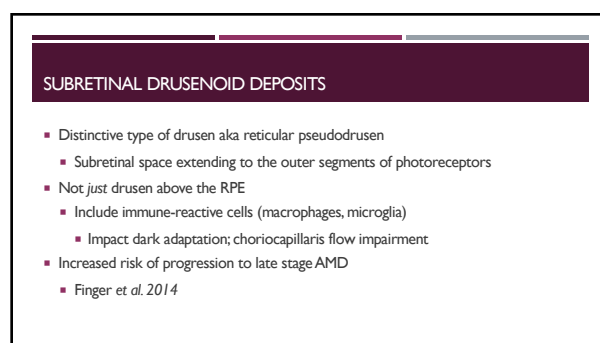
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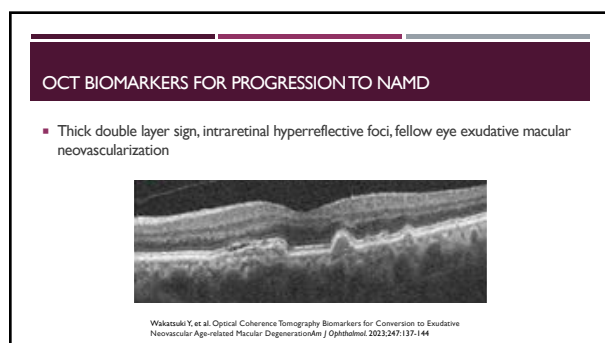
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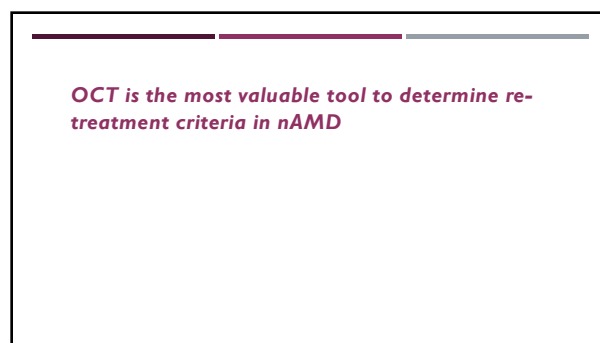
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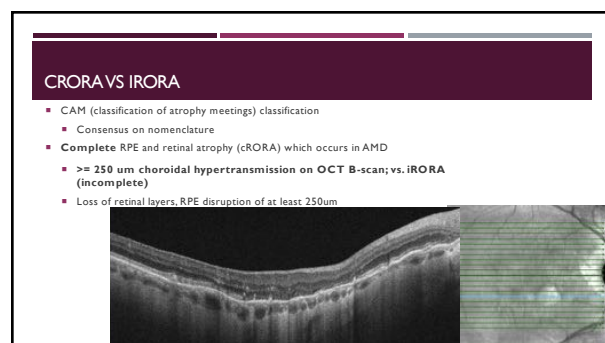
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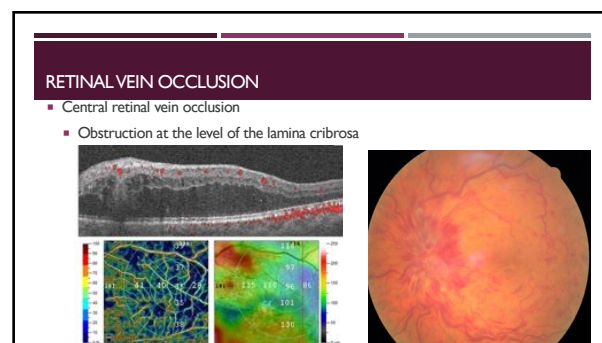
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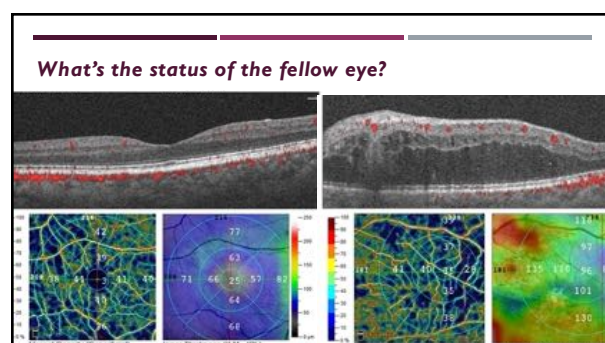
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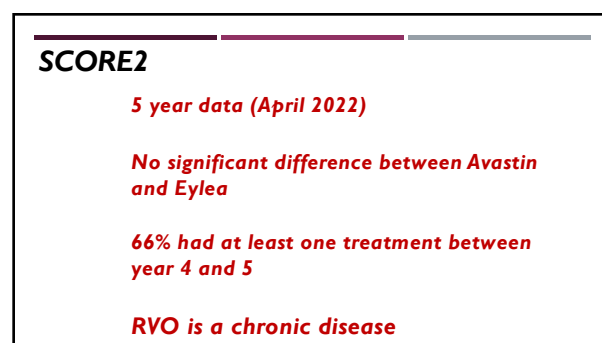
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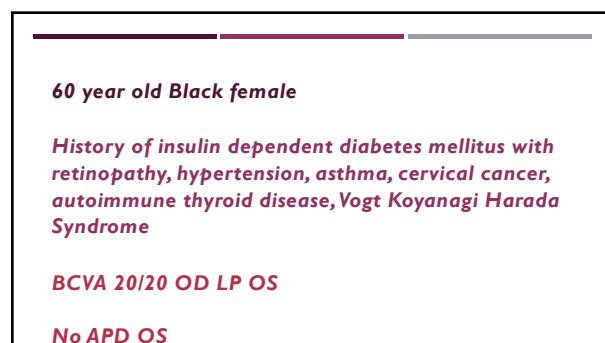
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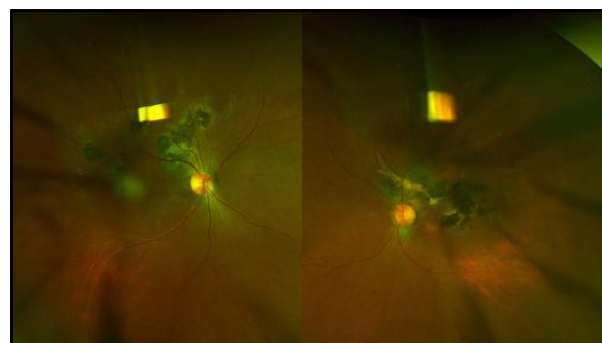
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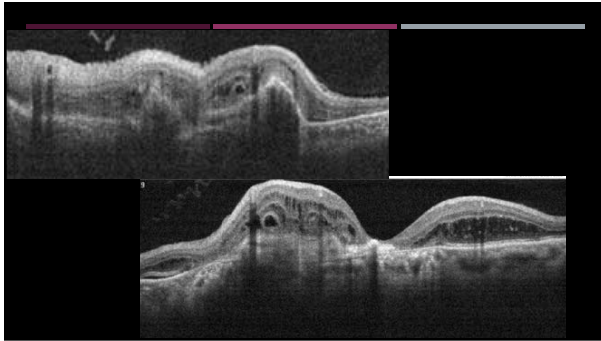
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CLINICAL DIAGNOSTIC CHALLENGE

- Uncertain diagnosis follow clinical examination
- Differential diagnosis
 - Choroidal melanoma
 - Choroidal nevus
 - Epiretinal membrane
 -something else?

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IN OTHER WORDS...

- Bottom line:
 - Melanoma or not?
- Urgent referral to ocular oncology...or not?

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DOCTOR GASS (based on 1977 data)

TFSOM (2002)

TFSOM-UHHD (2009)

TFSOM-DI (2019)

54

TFSOM "DOING IMAGING"

- Finally incorporates multimodal imaging
- Thickness >2mm (US)
- Fluid (OCT)
- (Subretinal fluid) overlying lesion or 3mm or less from lesion margin
- Symptoms
 - Vision loss (<20/50)
 - Differ based on location-iris melanoma vs choroid
 - Typically flashes, floaters/vision loss
 - Eye pain/red eye secondary to tumor-related inflammation or secondary glaucoma
 - 25% of choroidal melanoma are asymptomatic

CHOROIDAL NEVUS IMAGING FEATURES IN 3,806 CASES AND RISK FACTORS FOR TRANSFORMATION INTO MELANOMA IN 2,355 CASES

The 2020 Taylor R. Smith and Victor T. Curtin Lecture

CAROL L. SHIELDS, MD, LAUREN A. DOLAN, MD, DAVID ANTONIA-LIGAMAS, MD, MICHAEL D. YU, BA, MARIA-TERESA A. MD, RASHI B. WELLS, MD, J. ANTONIO LUYER-ALVAREZ, MD, SU HAN AND, BS, SEAN MALONEY, BS, R. JOEL WELCH, MD, JERRY A. SHIELDS, MD

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TFSOM-DI

Orange pigment (AF)

Lipofuscin

Cellular stress vs. cellular death

Melanoma hollow (US)

Diameter >5mm (photography)

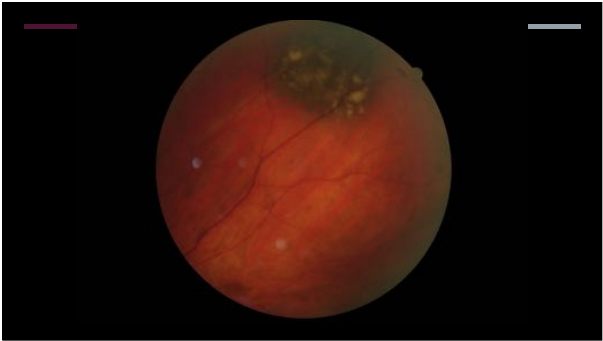
0 risk factors: 1%

1 risk factor: 11%

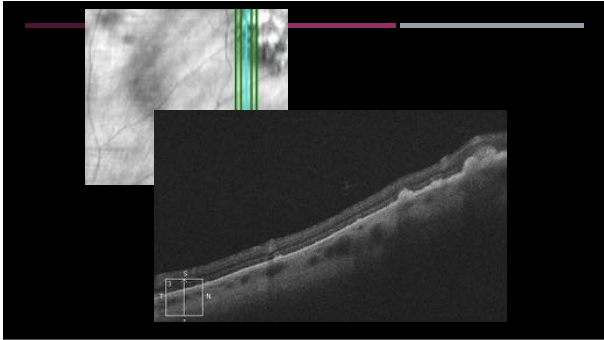
2 risk factors: 34%

3 risk factors: 51%

56



57



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Article

The MOLES System for Planning Management of Melanocytic Choroidal Tumors: Is It Safe?

Kelsey A. Roelofs¹, Roderick O'Day^{1,2}, Lamis Al Harby¹, Amit K. Arora^{1,3}, Victoria M.L. Cohen^{1,3}, Mandeep S. Sagoo^{1,3} and Bertil Damato^{1,4,*}

MOLES Score	Suggested Management
0 = Common naevus	Monitoring in community with color photography every 1-2 yrs.
1 = Low-risk naevus	Non-urgent referral for specialist investigation comprising wide-field photography, autofluorescence imaging, optical coherence tomography and, in selected cases, ultrasonography. Subsequent surveillance to be undertaken at a specialist clinic or in the community according to risk of malignancy.
2 = High-risk naevus	Urgent referral to ophthalmologist with urgent onward referral to ocular oncologist if suspicion of malignancy is confirmed.
3 = Probable melanoma	

Designed for non-specialists

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MOLES Scoring Chart

Indicator	Finding	Score
Mushroom shape	0 = Absent	
	1 = Incipient (erosion through RPE) / uncertain	
	2 = Present (i.e. definitive mushroom shape with overhang)	
Orange pigment	0 = Absent	
	1 = Dusting / unsure	
	2 = Confluent (i.e. easily visible clumps of orange pigment)	
Large size	0 = Flat (<1mm thick) and less than 3 disc diameters (DD) wide	
	1 = Subtle dome shape (1-2mm thick) AND/OR 3-4DD wide	
	2 = Significant thickening (>2mm) AND/OR more than 4DD wide	
Enlargement	0 = None (or no baseline photography)	
	1 = Suspected change on comparing photographs	
	2 = Definite growth confirmed by sequential imaging	
Subretinal fluid	0 = Nil	
	1 = Trace (limited retinal detachment seen only with OCT)	
	2 = Definite subretinal fluid visible with ophthalmoscopy	
Moles total score =		

MOLES Score

0 = Common naevus

1 = Low-risk naevus

2 = High-risk naevus

3 = Probable melanoma

Suggested Management

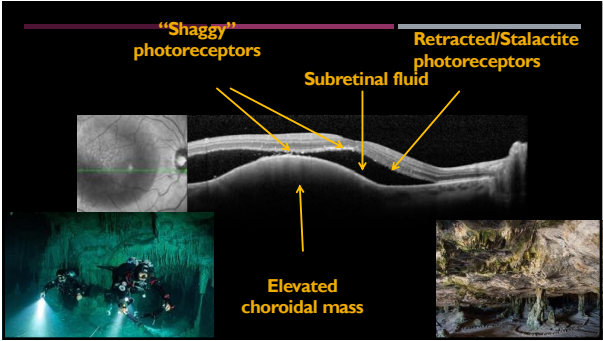
Monitoring in community with color photography every 1-2 yrs.

Non-urgent referral for specialist investigation comprising wide-field photography, autofluorescence imaging, optical coherence tomography and, in selected cases, ultrasonography. Subsequent surveillance to be undertaken at a specialist clinic or in the community according to risk of malignancy.

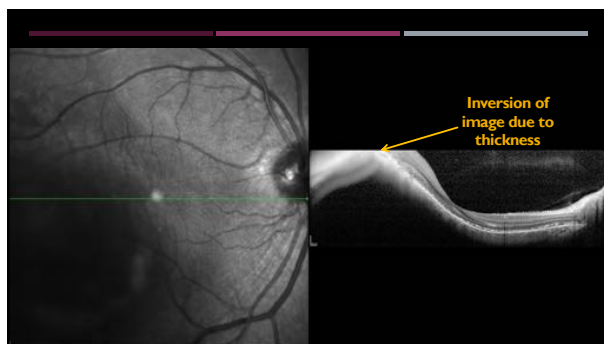
Urgent referral to ophthalmologist with urgent onward referral to ocular oncologist if suspicion of malignancy is confirmed.

Bertil Damato, PhD, FRCOphth, University of Oxford

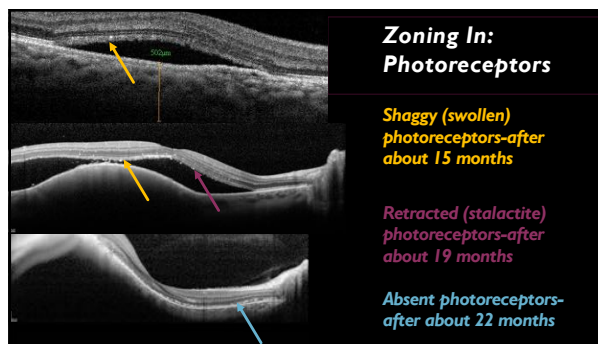
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61



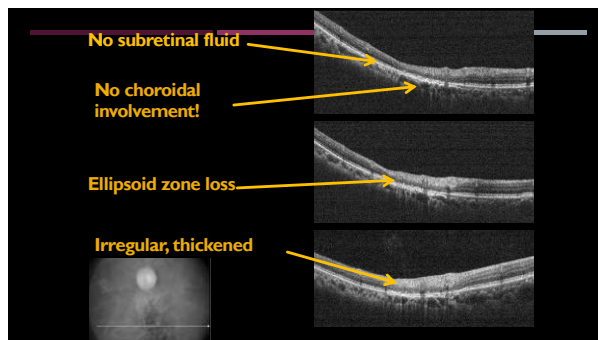
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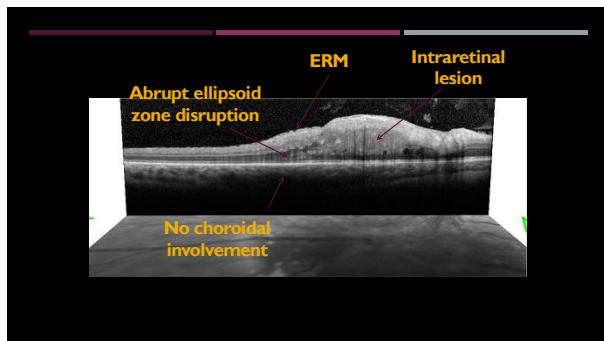
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64



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66



67

BY DEFINITION

- Retina & RPE disorganization with overlying ERM
- Combined hamartoma of retina and retinal pigment epithelium**

68

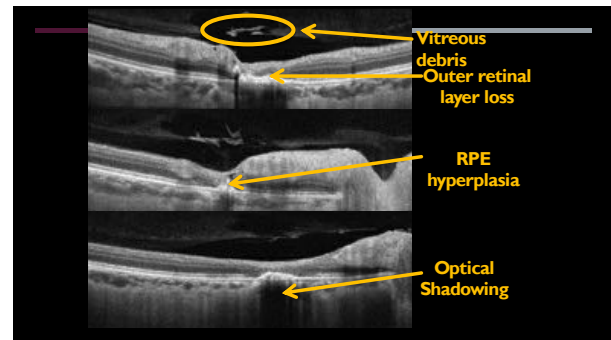
"PIGMENTED RETINAL LESION"

- 63 year old African American female
- 12 year history of a 'pigmented retinal lesion'...CHRPE...choroidal nevus...

69



70



71



72

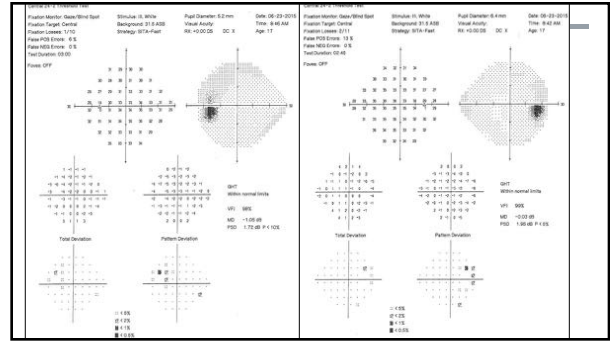
CASE

- 17 year old female presented for comprehensive eye examination
 - No history of headache, no neurological symptoms
 - (-) TVO, (-) pulsatile tinnitus, (-) whooshing in head
 - BCVA 20/20 OD and OS
- Trace APD OS?
- Alert, oriented, and awake
- No systemic medications
- Blood pressure 110/85mmHg
- BMI 36.6kg/m²
 - 5'2", 200lbs

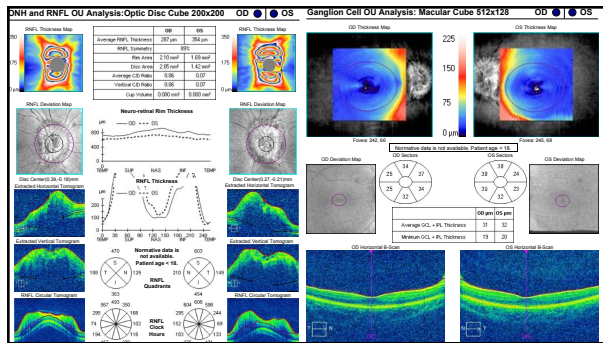
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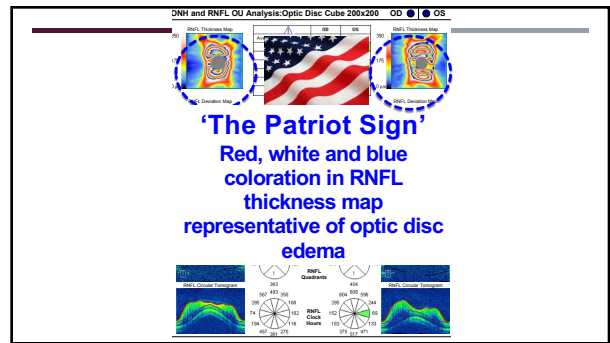
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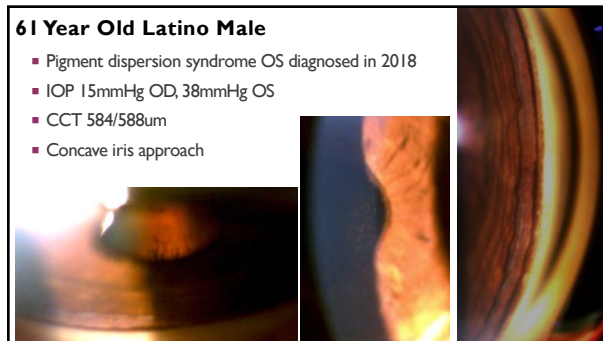
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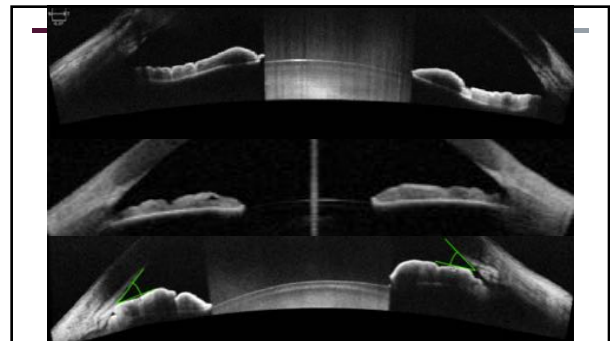
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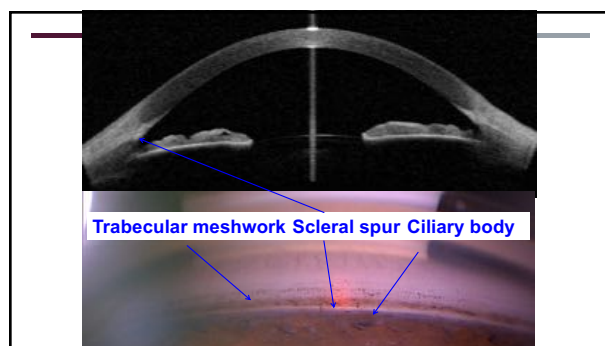
77



84



85



86

OCT Evaluation of the Anterior Chamber

- No inadvertent compression
- May be performed in complete darkness
- Most valuable to determine if the angle is open or closed


87

There is no one test for detection of glaucoma, or to determine if and when disease progression occurs

88

OCT: RNFL AND GCC ANALYSIS

- Objective structural (anatomic) assessment
- Used as an adjunct to clinical examination and automated perimetry
- Normative database provides comparative information



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RETINAL NERVE FIBER LAYER VS. GANGLION CELL COMPLEX

- We use both
- Ganglion cell complex (not just the cell layer-usually IPL-may also include RNFL)
 - Difficult to segment ganglion cell layer ONLY
 - Retinal ganglion cells most dense at the macula
 - More than 30%; 2% of retinal area
 - Lack of retinal blood vessels and support cells
- Retinal nerve fiber layer contains non-neuronal elements
 - Thickness impacted by blood vessels, glial elements
 - BUT-contains all (100%) of retinal ganglion cell axons

90

56 YEAR OLD AFRICAN AMERICAN FEMALE

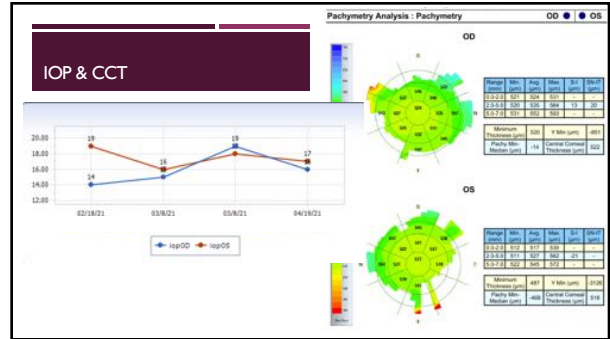
- 56 year old African American female referred for evaluation due to suspicion of glaucoma secondary to optic disc appearance
- No family history of glaucoma
- No systemic diagnoses; no systemic medications

Date	IOP OD (mmHg)	IOP OS (mmHg)
02/18/21	14	18
03/06/21	15	16
03/08/21	18	18
04/18/21	16	17

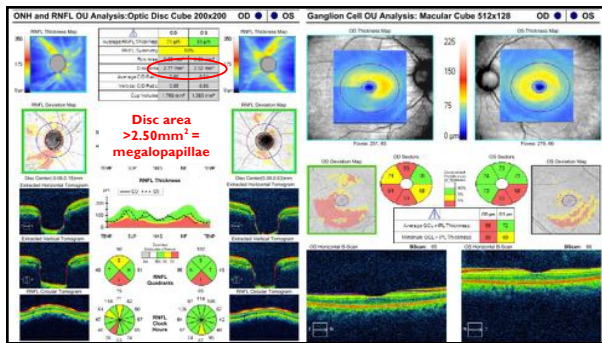
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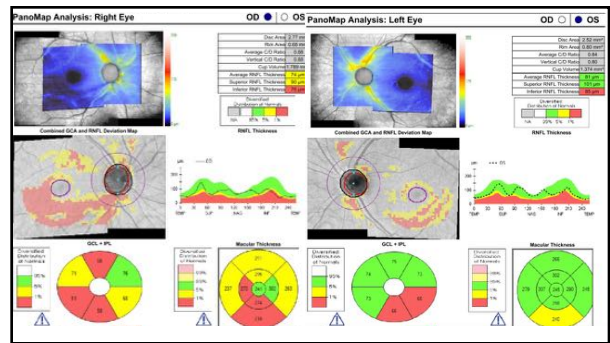
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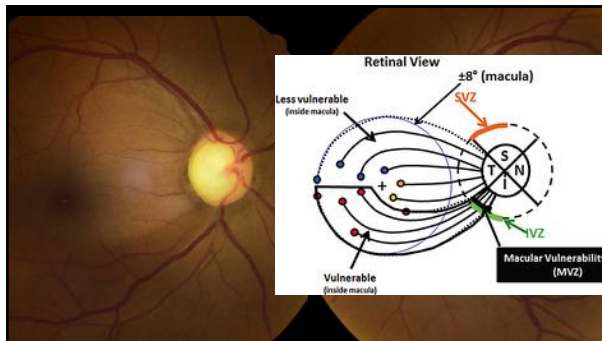
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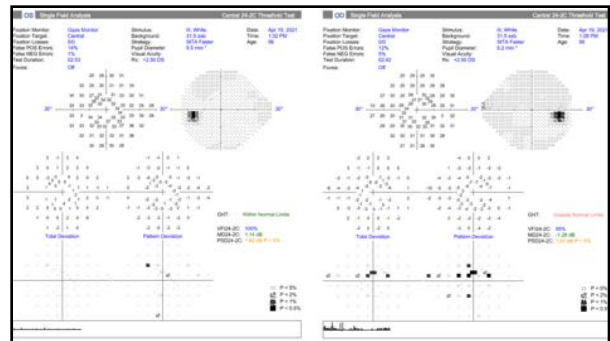
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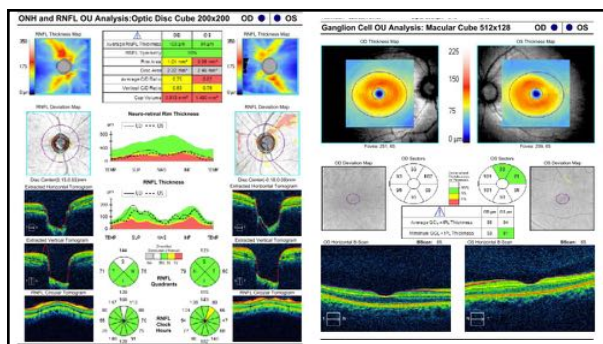
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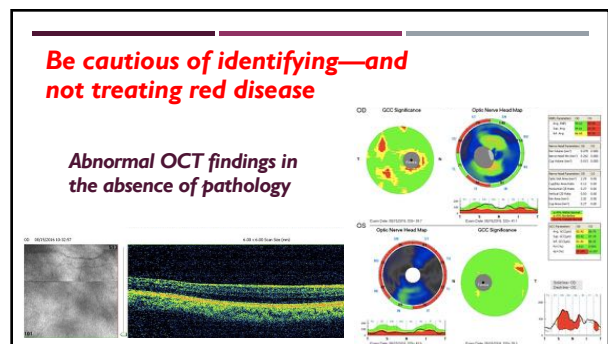
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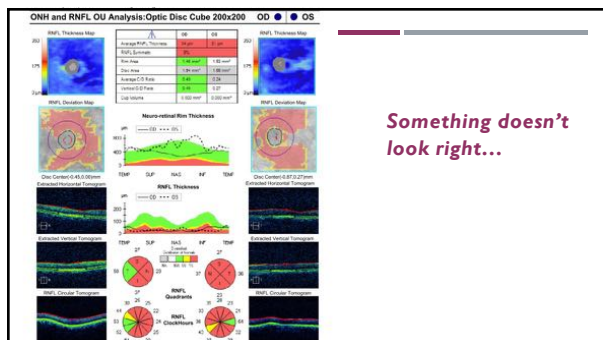
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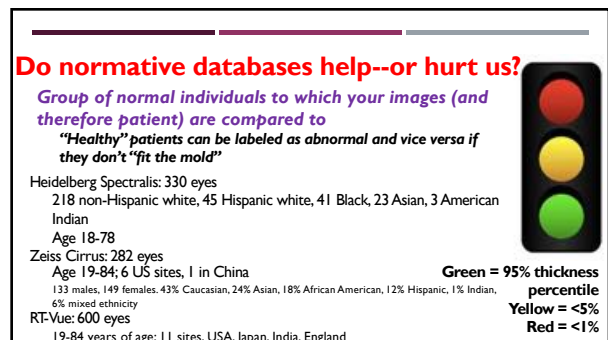
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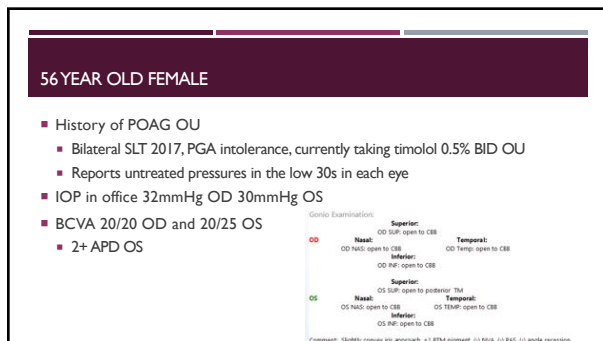
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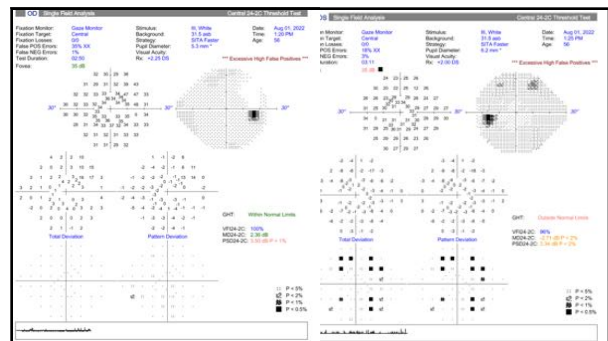
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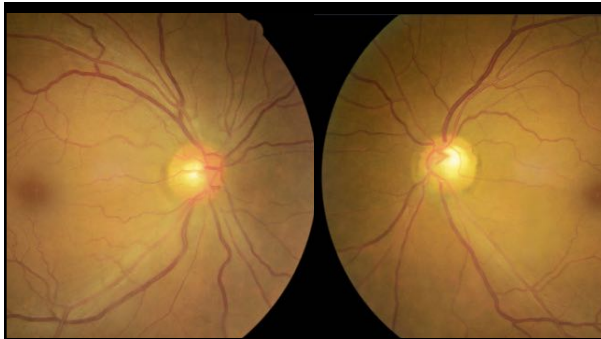
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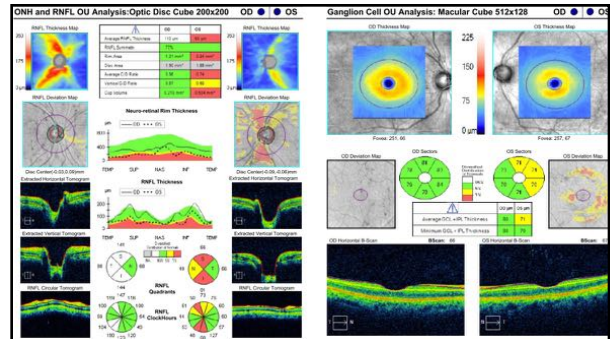
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112

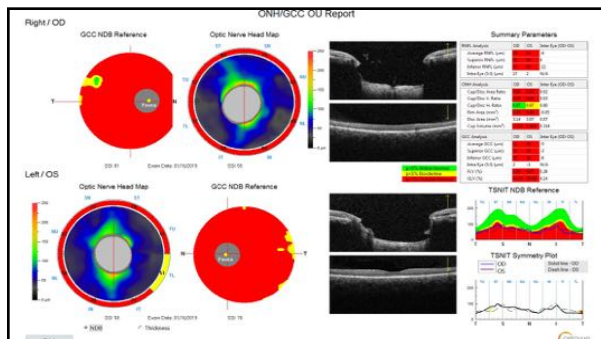
27 YEAR OLD MALE

- 27 year old black male presents for evaluation of blurred vision in the right eye for about a year; he reports 'good' vision in the left eye
- Thinks it has been a gradual change the visual reduction in the right eye
- First eye examination
- 3+ APD OD
- BCVA:
 - 20/400 OD
 - 20/30 OS
- Unremarkable anterior segment
- IOP 41/36mmHg
- Now what?!

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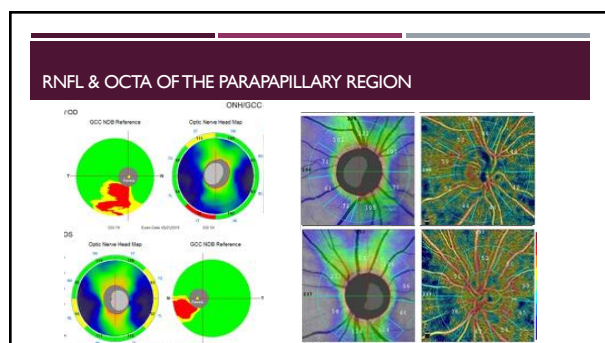


115

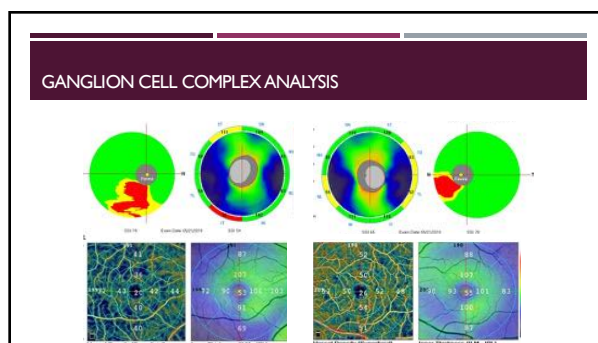
FLOOR EFFECT

- When RNFL reaches approximately 50 μ m, even with further disease progression, thickness measurement will not change
- Blood vessels and glial support cells

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WHAT HAPPENS FIRST?

- Glaucomatous eyes have reduced ocular blood flow
- Reduced peripapillary capillary density may be observed in glaucomatous eyes
- Does decreased ocular blood flow cause optic neuropathy--or does optic disc damage cause decreased blood flow?**
 - A) Ischemia leads to ganglion cell death
 - B) GC loss results in reduced metabolic demand

121

CHICKEN OR EGG?

- Metaphysical questions have metaphysical answers
- We're clinicians.

122

IT'S NOT ACTUALLY THAT SIMPLE

- Neurons, glial cells, cerebral microvascular endothelium function together = neurovascular unit
- Remember, we are limited in a clinical environment by the parameters that we are given
 - Velocity of blood flow
 - Variation of interscan time
 - Research parameters are developed into clinical parameters--eventually

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BOTTOM LINE

- No device is better than the human eye and common sense
- No device is better than a skilled and experienced clinician
- Know the limitations of the technology
- Technology is only as good as the clinician using it.

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