STATE BOARD OF OPTOMETRY
2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
P (916) 575-7170 F (916) 575-7292 www.optometry .ca.gov

Continuing Education Course Approval Checklist

Title: Common Subclinical Retinal Diseases - Diagnosing & Management Utilizing OCT

Provider Name: Ekelund Vision Center c/o Dr. Margarette Recalde, O.D.

☑Completed Application
Open to all Optometrists? ☑Yes ☐No
Maintain Record Agreement? ☑Yes ☐No

☑Correct Application Fee

☑Detailed Course Summary

☑Detailed Course Outline

☑PowerPoint and/or other Presentation Materials

☑Advertising (optional)

☑CV for EACH Course Instructor

☑License Verification for Each Course Instructor
Disciplinary History? ☑Yes ☐No

1-409/427206/4425508/50

BUSINESS, CONSUMER SERVICES, AND HOUSING AGENCY — GOVERNOR EDMUND G. BROWN JR.

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OPTOMETRY AM 10:43

CONTINUING EDUCATION COURSE APPROVAL APPLICATION

$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title	**Course Presentation Date**
Common Subclinical Retinal Diseases Diagnosing + Management utilizing OCT	09/08/2016

Course Provider Contact Information

Provider Name

Margarette (First) | Recalde, OD (Last) | R. (Middle)

Provider Mailing Address

Street 1843 Decatur Avenue **City** Clovis **State** CA **Zip** 93611

Provider Email Address mrecalde@eyeqvc.com

Will the proposed course be open to all California licensed optometrists?	☑ YES ☐ NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	☑ YES ☐ NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name

Kenneth (First) | Ekelund, OD (Last) | E. (Middle)

License Number OPT 5847	**License Type** California
Phone Number (530) 221-0726	**Email Address** kekelund1947@gmail.com

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Margarette R Recalde — August 5, 2016

Signature of Course Provider — ***Date***

Form CE-01, Rev. 5/16

Central California Optometric Society

December 30, 2016

Dear California Board of Optometry,

This letter is in response to your request regarding "Common Subclinical Retinal Diseases: Diagnosis and Management Utilizing OCT". As you requested, this letter addresses the reason why the application was not submitted within the 45-day deadline prior to the course date.

There was a miscommunication between the sponsor for the dinner program and the Central California Optometric Society. Each party thought the other party had communicated to the speaker, Dr. Ken Ekelund that the lecture needed to be submitted for CE approval ahead of time. In reality, the speaker wasn't contacted until later. By the time the speaker was informed, it was already very close to the 45-day deadline. The speaker did his best to submit the outline as soon as possible.

Thank you again for your patience. If you have any questions, please feel free to contact me.

Respectfully,

Margie R. Recalde, OD, FAAO
CCOS President

Title:
Common Subclinical Retinal Diseases: Diagnosis and Management Utilizing OCT

Speaker:
Kenneth E Ekelund, O.D.
Ekelund Vision Center
2190 Larkspur Lane, Suite 200
Redding, CA 96002

Summary of Presentation:

Optical Coherence Tomography (OCT) is an extremely powerful tool in the identification and assessment of retinal abnormalities. With Spectral Domain OCT, this technology provides quantitative and repeatable measurements to identify diseases of the retina, monitor progression, and evaluate for pharmacological/surgical interventions. The goal is to advance the optometrist's knowledge and clinical/professional skills on the OCT and to aid their decision-making skills for retinal diseases.

1 ## Common Subclinical Retinal Diseases: Diagnosis and Management Utilizing OCT

Kenneth E Ekelund, O.D.
Ekelund Vision Center
2190 Larkspur Lane, Suite 200
Redding, CA 96002

2 ## OCT History/Paradigm Shift

- OCT first introduced in 1991
- OCT provides cross-sectional images of the retina using the reflectivity of light waves to obtain a profile of the retinal layers.
- Specialized anterior segment OCT machines became available in 2005 and the introduction of Spectral (Fourier) Domain OCT (SD-OCT, FD-OCT) technology now provides greater tissue resolving power, significantly higher scan density, and faster data acquisition than original Time Domain OCT.

3 ## Review of Retinal Anatomy with gray scale retinal layers

4 ## OCT Importance in daily practice

- OCT is an extremely powerful tool in the identification and assessment of retina abnormalities
- The high resolving power (10um - Time Domain, 5um – Spectral Domain) provides excellent detail for evaluating the vitreo-retinal interface, neurosensory retinal morphology, and the RPE-choroid complex.
- The ability to perform volumetric and retinal thickness analysis also provides a quantitative and repeatable method to evaluate surgical and pharmacological interventions.

5 ## Review of Retinal History

- Time domain systems acquire approximately 400 A-scans per second using 6 radial slices oriented 30 degrees apart. Because the slices are 30 degrees apart, care must be taken to avoid missing pathology between the slices.

- Spectral domain technology, on the other hand, scans approximately 20,000-40,000 scans per second. This increased scan rate and number diminishes the likelihood of motion artifact, enhances the resolution and decreases the chance of missing lesions.

6 ☐ **Choroid Complex review**

- The choroid is a major vascular layer of the eye and provides oxygen and nourishment to the outer layers of the retina.
- Changes in the choroid, in particular its thickness, have been hypothesized to be of critical importance in the pathophysiology of a number of retinal diseases.

7 ☐ **Mueller glia cell review and function**

- Müller glia are the major glial component of the retina.
- They are one of the last retinal cell types to be born during development and they function to maintain retinal homeostasis and integrity.

8 ☐ **4 Categories of Retinal Disease with OCT**

- Macular Degeneration
- ERM/Vitreo-Macular Traction
- Macular Edema
- Macular Hole

9 ☐ **Diagram review of macula**

10 ☐ **Comparison of fundus photo vs cross section OCT view of posterior pole**

11 ☐ **Outer layer retina view of cross section OCT IS/OS junction and its importance**

12 ☐ **Review of PVD Partial PVD (APVD) development and stats**

- According to autopsy studies, PVD is present in fewer than 10% of persons younger than 50 years
- Has been found in at least one eye in 27% of individuals aged 60 to 69 and in 63% of subjects aged 70 and older.
- Clinical studies also reveal a low incidence of PVD in

individuals younger than 50.

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- Posterior vitreous detachment is believed to develop after liquefied vitreous passes abruptly into the subhyaloid space and separates the posterior hyaloid from the retina.
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- With SD-OCT, we can improve our understanding of the process of PVD.

14 **Review of PVD Partial PVD (APVD) development and stats**

- Gel liquefaction that exceeds the degree of vitro-retinal dehiscence results in anomalous PVD (APVD).
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- At the periphery, APVD results in retinal tears and detachments.
- In the macula, APVD causes vitreo-macular traction syndrome, results in vitreoschisis with macular pucker or macular holes, or contributes to some cases of diabetic macular edema.
- At the optic disc and retina, APVD causes vitreo-papillary traction and promotes retinal and optic disc neovascularization.

16 **Review of PVD Partial PVD (APVD) development and stats**

17 **APVD creating multiple VRI maculopathies**

- The physics of anomalous PVD has the potential to generate forces which split the posterior vitreous cortex causing vitreoschesis.
- When this phenomenon occurs in the periphery, tractional

forces increase the risk of retinal tears and detachments.

- When it occurs in or adjacent to the macula, it has the potential to induce wrinkling of the neurosensory retina referred to as macular pucker.
- Vitreoschisis may contribute to the process of macular hole formation and increase the risk diabetic macular edema.
- Other associations appearing concurrently with VMT include age-related macular degeneration and retinal vein occlusion.

18 **OCT scans of VMA/VMT**

19 **VMA/VMT types and new classification due to OCT**

20 **VMA/VMT types and new classification due to OCT**

21 **VMA/VMT types and new classification due to OCT**

22 **Schematic flow chart of VRI pathology.**

23 **VMA/VMT broad vs focal adhesion with OCT**

- VMA: VMA is a perifoveolar PVD
- VMA is considered stage 1 PVD by Johnson's classification

24 **VMA/VMT broad vs focal adhesion with OCT**

- Focal vs Broad
- Focal Attachment <1500 Microns
- Broad attachment >1500 microns
  - Broad VMA paralllel to the RPE

25 **VMA/VMT broad vs focal adhesion with OCT**

26 **VMA/VMT broad vs focal adhesion with OCT**

- Focal

27 **VMA/VMT broad vs focal adhesion with OCT**

- Broad

28 **New Classification of macular holes due to OCT**

29 **Pre op OCT to create better post op outcomes and expectation with OCT**

30 **OCT thickness maps of macula importance for managing pre and post op retinal pathology**

31 **What makes a good candidate for VMT treatment with Jetrea**

- FDA Approval of Jetra (Ocriplasmin) 2012
- Is the first and only FDA-approved nonsurgical treatment for symptomatic VMA.
- Jetrea has proteolytic activity against protein components of the vitreous body and the vitreoretinal interface (VRI) (e.g. laminin, fibronectin and collagen), thereby dissolving the protein matrix responsible for the vitreomacular adhesion (VMA).
- Success rates for release of traction within 28 days was 26.1% as compared to 10.1% in the placebo group

32 **What makes a good candidate for VMT treatment with Jetrea**

- Also patients who have mild to moderate symptomatic VMA, and also have good visual acuity. Patients may be experiencing metamorphopsia, but test 20/40 or better on a Snellen visual acuity chart.

33 **Measurement for macula hole to determine Jetrea vs PPV**

34 **What makes a good candidate for VMT treatment with Jetrea**

35 **Types of Lamellar Holes interpretation and/management with OCT**

36 **Types of Lamellar Holes interpretation and/management with OCT**

37 **Pseudohole interpretation and management with OCT**

- Retinal lesion that simulates macular hole without actual

tissue loss.

- Clinical features: Altered light reflex and darker appearance of the fovea
- Optical coherent tomography (OCT) demonstrates:
  - Steepening of foveal contour
  - Full thickness retinal tissue is present
  - Reflective epiretinal membrane layer is present on the surface of the retina

38 **Pseudohole interpretation and management with OCT**

- Fluorescein angiography often reveals normal fluorescence except if traction-induced retinal vascular disruption present.
- Management:
  - Treatment of the underlying causes of epiretinal membrane.
  - Observation of progressive contraction, which may lead to macular edema.
  - Surgical vitrectomy to peel the epiretinal membrane may be indicated in patients with worsening vision of 20/80 or less.

39 **Pseudohole interpretation and management with OCT**

40 **Post op macular hole interpretation with OCT**

- The length of time a patient has experienced symptoms is key to predicting likelihood of visual improvement. Less than 6 months is an ideal duration.
- To facilitate macular hole closure, all tractional forces surrounding the open hole should be removed.
- Vitrectomy for macular hole repair has proven highly successful through a number of techniques. Pharmacologic vitreolysis with ocriplasmin is another treatment option, although the effects of ocriplasmin on visual acuity may be unpredictable.

41 **Post op macular hole interpretation with OCT**

42 **Post op macular hole interpretation with OCT**

43 **ERM/Macular Pucker interpretation and management with**

macular thickness maps with OCT

- Epiretinal membrane (ERM) is a disorder of the vitreomacular interface characterized by symptoms of decreased visual acuity and metamorphopsia.
- OCT has proven to be more sensitive than clinical examination for the diagnosis of ERM.
- It has been estimated that 30 million people of advanced age in the US have an ERM in at least one eye.
- Most ERMs occur in individuals older than 50 years, and the prevalence of ERM increases as age increases

44 **ERM/Macular Pucker interpretation and management with macular thickness maps with OCT**

- Management
  - Vitrectomy
  - Epiretinal Membrane Peel
  - Internal Limiting Membrane Peel
- Complications
  - The most common complication, occurring in 12% to 68% of cases, is accelerated nuclear sclerosis of crystalline lens.
  - Recurrent ERM occurs in 3% to 12% of patients
  - Retinal detachment occurs in 3% to 14%. This may develop within 1 month postoperatively and may be related to intra-operative retinal breaks.

45 **ERM/Macular Pucker interpretation and management with macular thickness maps with OCT**

46 **ERM/Macular Pucker interpretation and management with macular thickness maps with OCT**

47 **ERM/Macular Pucker interpretation and management with macular thickness maps with OCT**

48 **ERM/Macular Pucker interpretation and management with macular thickness maps with OCT**

49 **Middle layer retina showing CME interpretation/ management with OCT**

- Diabetic Macular Edema (DME) versus Pseudophakic Cystoid Macular Edema (PCME)
- DME: More ONL cysts, no subretinal fluid, presence of hard exudates, microaneurysms, and ganglion cell layer and/or retinal nerve fiber layer cysts
- PCME: No ERM, solely INL cysts
- DME: PCME:

50 **Middle layer retina BVO interpretation/management with OCT**

- Vision loss from retinal vein occlusions is secondary to macular edema and if ischemic, has the risk to develop neovascularization and neovascular glaucoma.
- OCT can assist in detecting macular edema secondary to retinal vein occlusions and track response to treatment.
- Macular edema in retinal vein occlusions causes diffuse leakage, especially in CRVO.
- The macular edema is driven by ischemia and release of vascular endothelial growth factors (VEGF) that increases the inner retinal blood-brain barrier causing leakage of intraretinal fluid.

51 **Middle layer retina BVO interpretation/management with OCT**

- Macular edema secondary to branch retinal vein occlusion will respond to argon grid laser and anti-VEGF therapies (Lucentis, Eylea, avastin).
- Macular edema secondary to central retinal vein occlusion will respond to anti-VEGF therapies (Lucentis, Eyelea, and avastin) and intravitreal dexamethasone implant (Ozurdex).

52 **Middle layer retina BVO interpretation/management with OCT**

53 **Middle layer retina BVO interpretation/management with OCT**

54 **Review of the choroid complex anatomy.**

55 **Early stage dry ARMD interpretation/management**

- One in 10 people over the age of 60 have some form of AMD.
- That ratio increases to one in four people over 70.
- AMD is the leading cause of legal blindness for people over age 55 in the Western world — more than 5 million new cases a year reported in Europe and North America alone.

56 **Early stage dry ARMD interpretation/management**

- As defined by the AREDS, early AMD is characterized by small drusen (<63 µm), few medium drusen (63–125 µm), and/or minimally detected or no pigment epithelial abnormalities in the macula.
- Patients in this category have a low risk of progressing to advanced AMD after 5 years in either eye.

57 **Early stage dry ARMD interpretation/management**

58 **Early stage dry ARMD interpretation/management**

- Intermediate Dry ARMD
  - Defined by the AREDS as having extensive medium drusen (63–124 µm) or one or more large drusen (³125 µm in diameter) in one or both eyes.
  - The progression to advanced AMD at 5 years in this group is approximately 18% according to the original AREDS.
  - However, for patients with large drusen in one eye, the rate of development of advanced AMD at 5 years is 6.3%, whereas the rate for patients with multiple bilateral large drusen increases to 26% at 5 years.

59 **Early stage dry ARMD interpretation/management**

60 **Late stage geographic degeneration OCT interpretation/ management**

- Advanced ARMD
  - Geographic atrophy of the RPE involving the foveal center
  - Neovascular maculopathy that includes the following:
    - Choroidal neovascularization (CNV) defined as pathologic angiogenesis originating from the choroidal vasculature that extends through a defect in Bruch's membrane.
    - Serous and/or hemorrhagic detachment of the neurosensory retina or RPE
    - Retinal hard exudates (a secondary phenomenon resulting from chronic intravascular leakage)
    - Subretinal and sub-RPE fibrovascular proliferation
    - Disciform scar (subretinal fibrosis)

61 **Late stage geographic degeneration OCT interpretation/ management**

62 **Late stage geographic degeneration OCT interpretation/ management**

63 **Late stage geographic degeneration OCT interpretation/ management**

- Treating the wet form of macular degeneration may involve the use of anti-VEGF treatment, thermal laser treatment or photodynamic therapy (PDT).
- Treatment of wet macular degeneration generally reduces—but does not eliminate-- the risk of severe vision loss.
- It is important to remember that only about 10 percent of all macular degeneration cases are exudative, or wet form, and about 75 percent of these cases cannot be treated.

64 **Review histology of Wet ARMD (CNV)**

- New capillaries and fibroblasts originate from the choroid and grow through a defect in the Bruch membrane into the subretinal space or the sub-RPE space. Reactive hyperplastic RPE is present at the advancing edge of CNV.
- Specimens obtained from surgical excision of CNV reveal that the most common cellular components are vascular

endothelium and RPE. These were present in more than 85% of samples.

- Fibrocytes and macrophages also have been identified in more than 50% of specimens. Extracellular components include collagen and fibrin. VEGF has been identified in the specimens obtained during submacular surgery.

65 **Wet ARMD interpretation/management with OCT**

- Targeting VEGF allows a two-hit strategy: antiangiogenesis +antipermeability
  - Avastin (bevacizumab)
  - Lucentis (ranibizumab)
  - Eylea (aflibercept)
  - Macugen (pegaptanib)

66 **Wet ARMD interpretation/management with OCT**

- The Macular Photocoagulation Study (MPS) proved the efficacy of laser photocoagulation in the treatment of CNV secondary to ARMD.
- PDT uses light-activated drugs and nonthermal light to achieve selective destruction of CNV with minimal effects on the surrounding normal tissues.
- Uncontrolled studies have recommended surgical excision of subfoveal CNV via pars plana vitrectomy. The goal is to remove CNV but to leave the underlying RPE and choriocapillaris intact.

67 **Wet ARMD interpretation/management with OCT**

68 **CSR Interpretation/management with OCT**

- The disease classically affects men between the ages of 20 and 50 and has been associated with corticosteroid exposure, phosphodiesterase inhibitor use, obstructive sleep apnea and “type A” personality traits.
- The characteristic finding is a posterior neurosensory retinal detachment caused by leakage of fluid from the level of the retinal pigment epithelium.

69 **Retinal Detachment with OCT**

- Macula On RD with VA 20/20. Emergency surgery within 24 hours.

70 **Retinal Detachment with OCT**

71 **Anterior seg angles with OCT**

- Gonioscopy: If the posterior trabecular meshwork can't be seen for 180 degrees or more, that's considered to be an occludable angle and the patient should receive prophylactic laser.

72 **Pachymetry with OCT**

73 **Keratoconus using the OCT pachymetry**

74 **Normal RNFL interpretation with OCT**

75 **OHT interpretation/management with OCT**

- Ocular hypertension is a condition in which the following criteria are met:
  - An intraocular pressure greater than 21 mm Hg in one or both eyes, as measured by applanation tonometry on 2 or more occasions
  - Absence of glaucomatous defects on visual-field testing
  - Normal appearance of the optic disc and nerve fiber layer
  - Anatomically normal, open angles on gonioscopy
  - Absence of ocular conditions contributing to the elevation of pressure, such as narrow angles, neovascular conditions, and uveitis

76 **Early glaucoma interpretation/management with OCT**

- The advantage of OCT in early glaucoma is that it can detect damage that is not measurable with any other technology.
- Need to lose approximately 20 percent of her retinal nerve fiber layer before a visual field defect is likely to be present.
- Helpful to compare one eye to the other and look for asymmetry. Asymmetry, especially in the supero- or infero-

temporal regions, provides a clue that it could be early glaucoma.

77 ☐ **Late stage glaucoma interpretation/management with OCT**

- In the advanced stages of glaucoma, the standard 24-2 visual fields may no longer be very sensitive to subtle progression.
- Imaging technologies such as SD-OCT also encounter problems with advanced optic nerve damage. On the SD-OCT measurements of the RNFL, the so-called floor effect becomes relevant in eyes with severe thinning. RNFL thinning levels off at approximately 40 to 50 μm, perhaps due to residual glial tissue, blood vessels, or other nonneural tissue.

78 ☐ **MS interpretation/management with OCT**

79 ☐ **Brain trauma interpretation/management with OCT**

80 ☐ **Detecting PSC with OCT**

- Nuclear cataracts have less influence on OCT image quality relative posterior cataracts.

81 ☐ **My gold standard to practice with OCT**

Common Subclinical Retinal Diseases: Diagnosis and Management Utilizing OCT

Kenneth E Ekelund, O.D.
Ekelund Vision Center
2190 Larkspur Lane, Suite 200
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OCT History/Paradigm Shift

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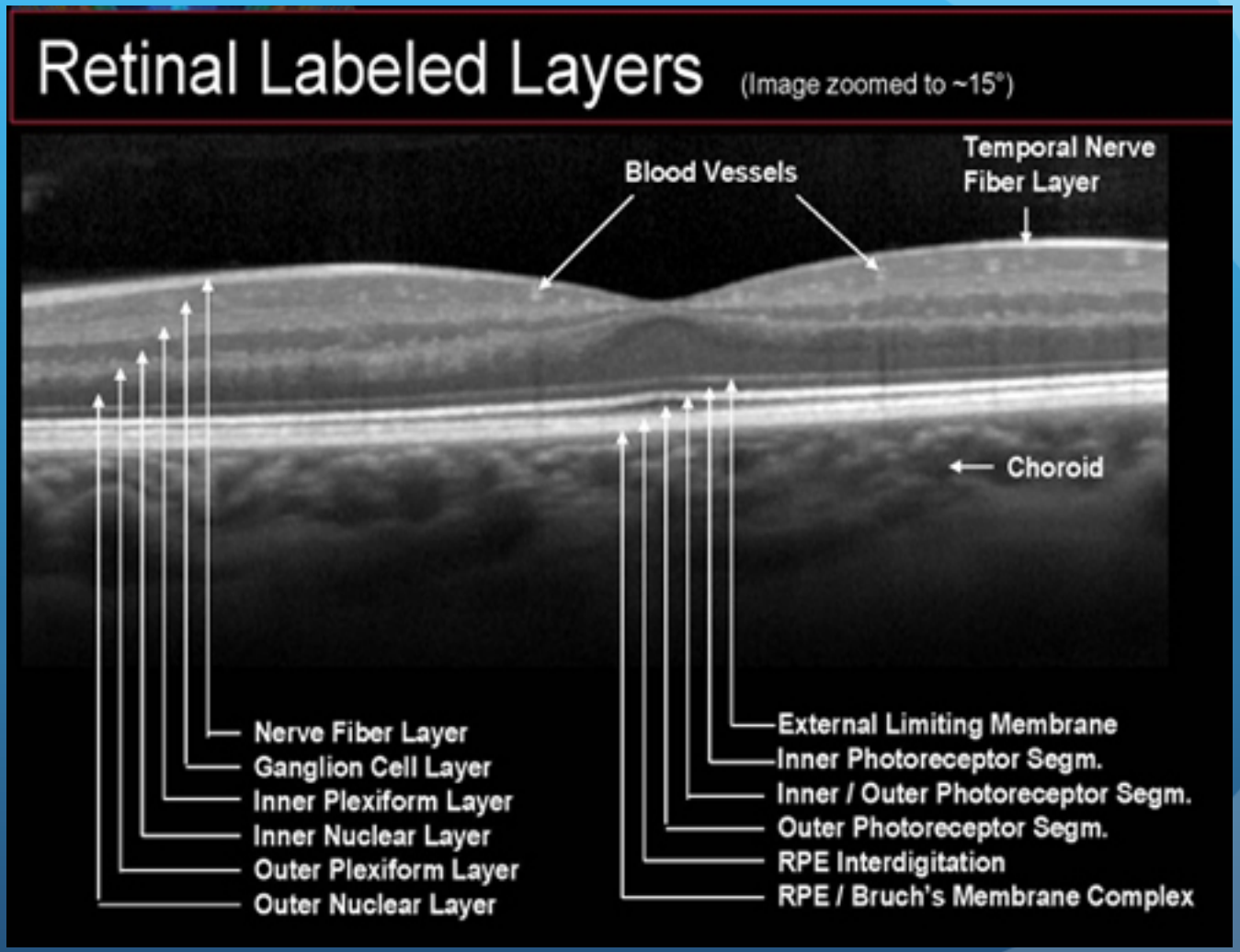

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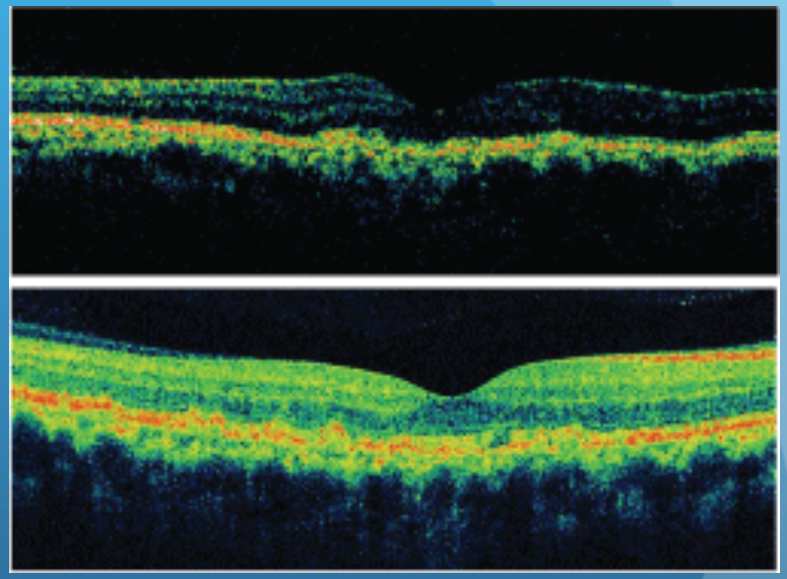

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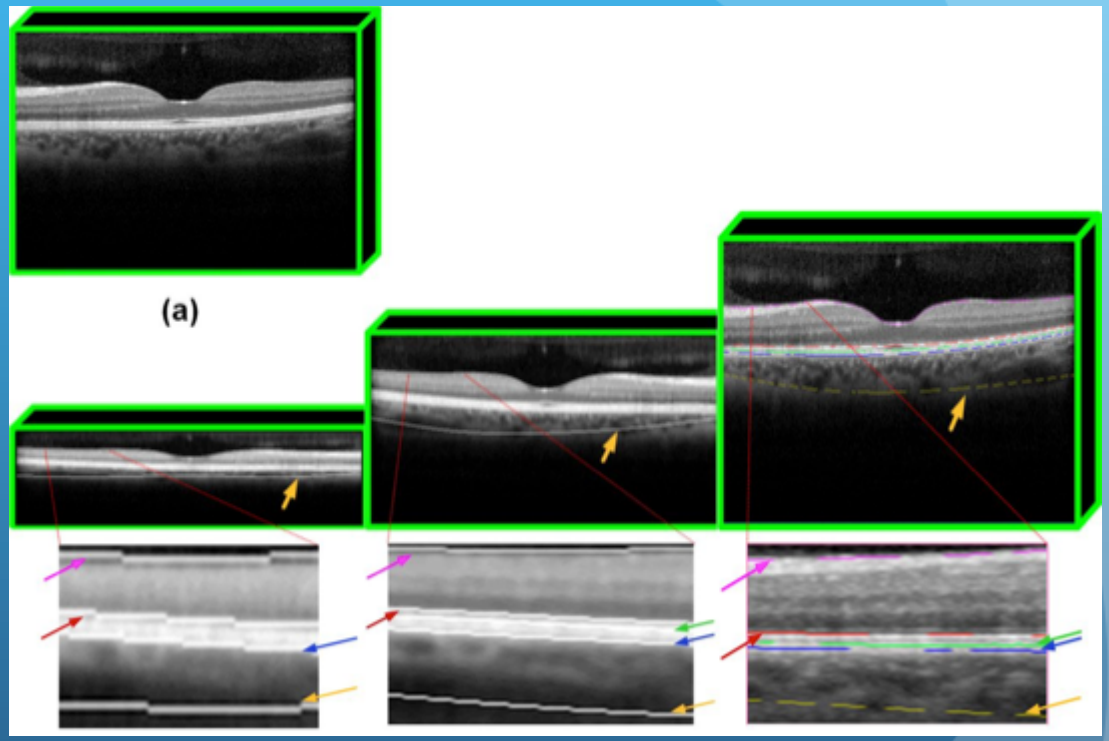

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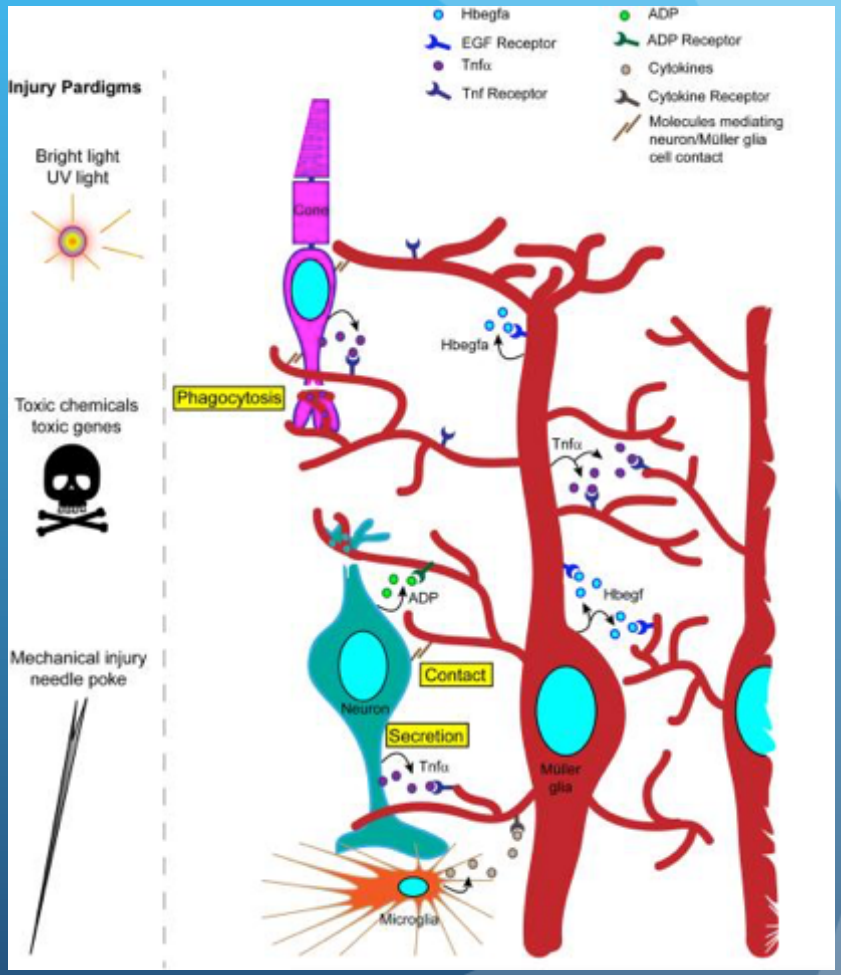

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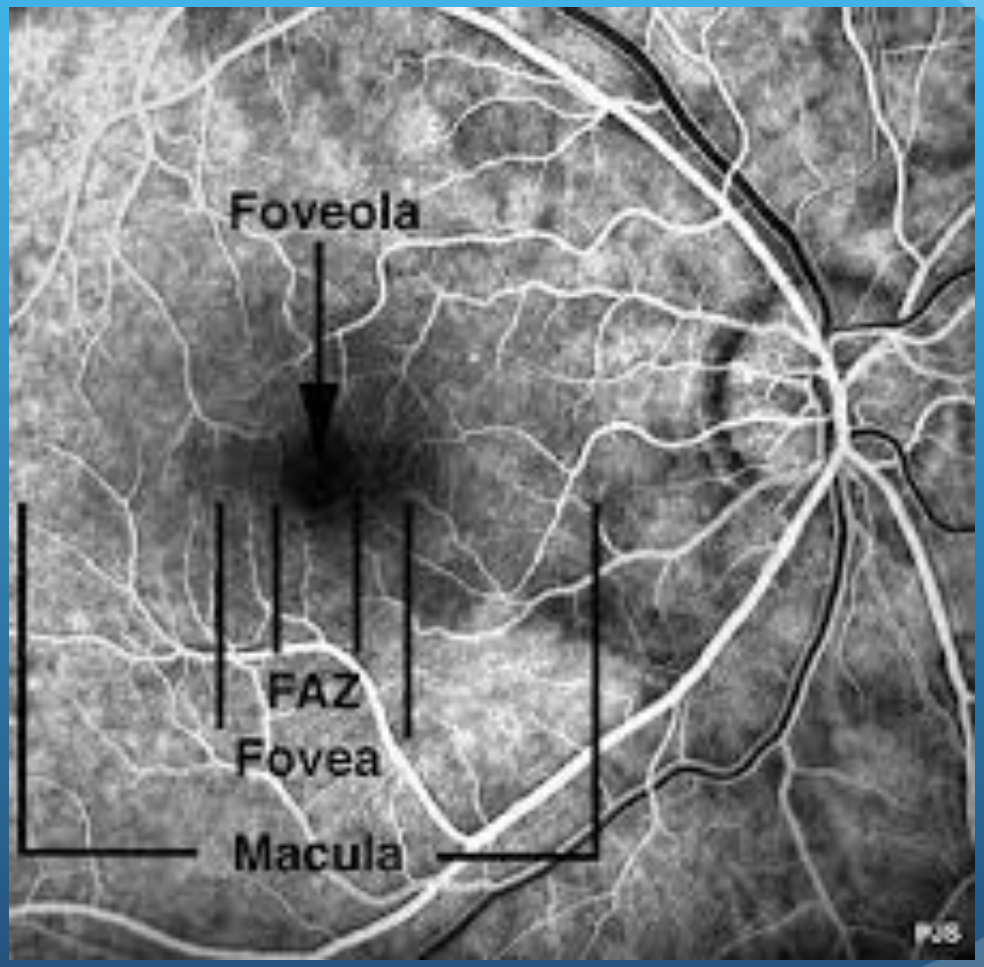
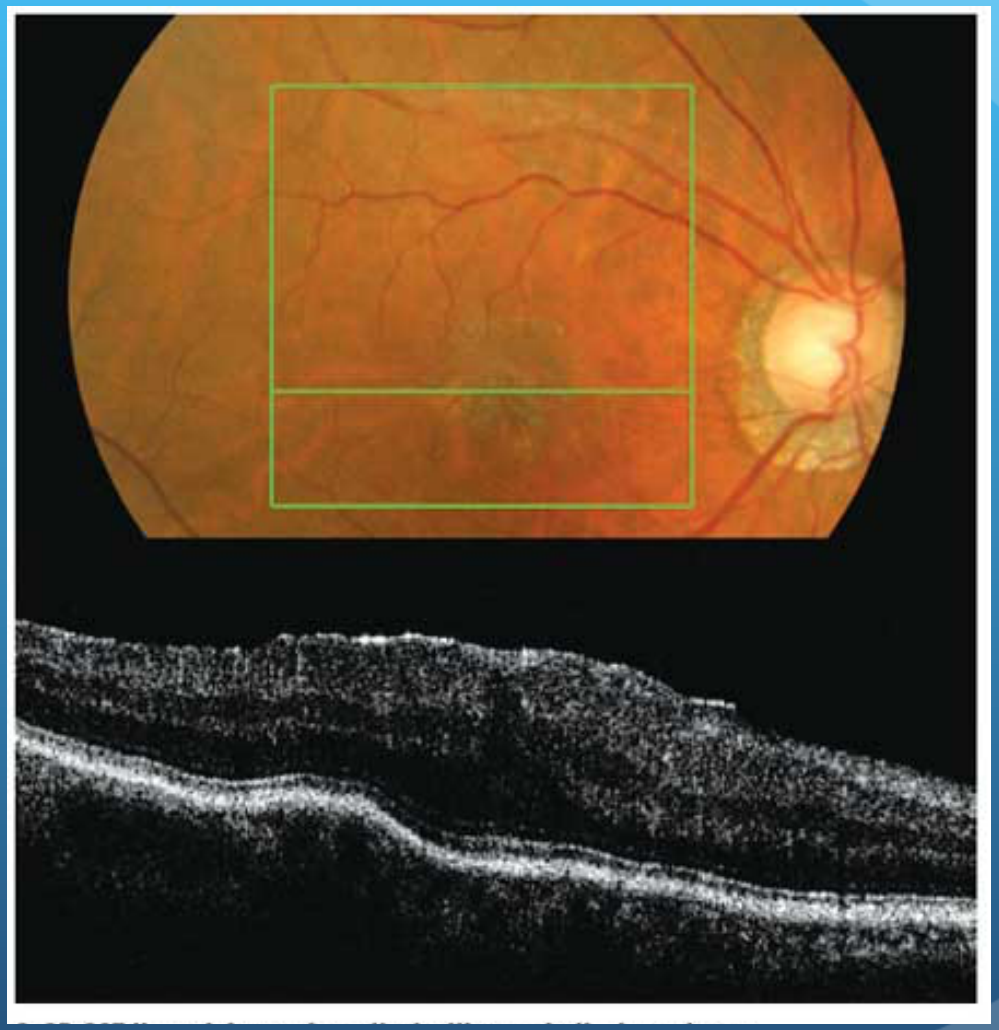
Diagram review of macula

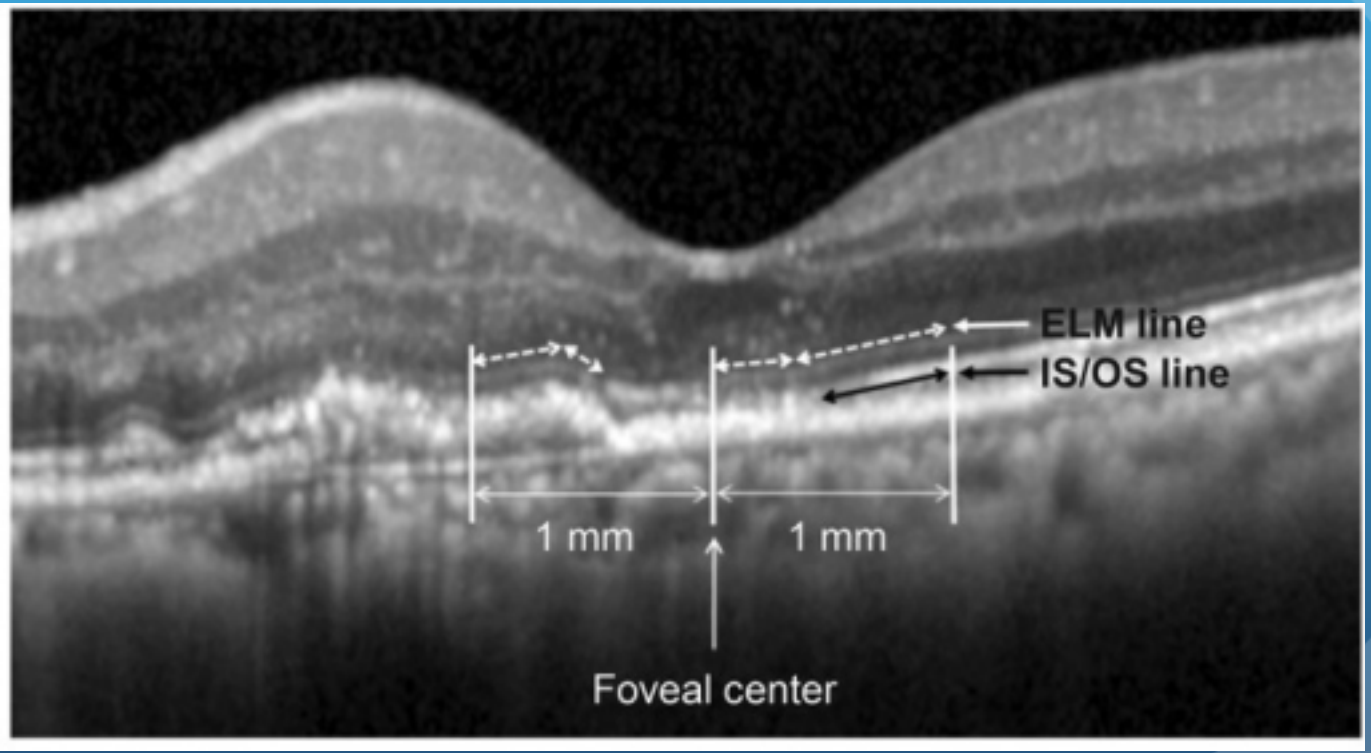


Comparison of fundus photo vs cross section OCT view of posterior pole



Outer layer retina view of cross section OCT IS/OS junction and its importance

OCT IS/OS Junction: important indicator of photoreceptor integrity



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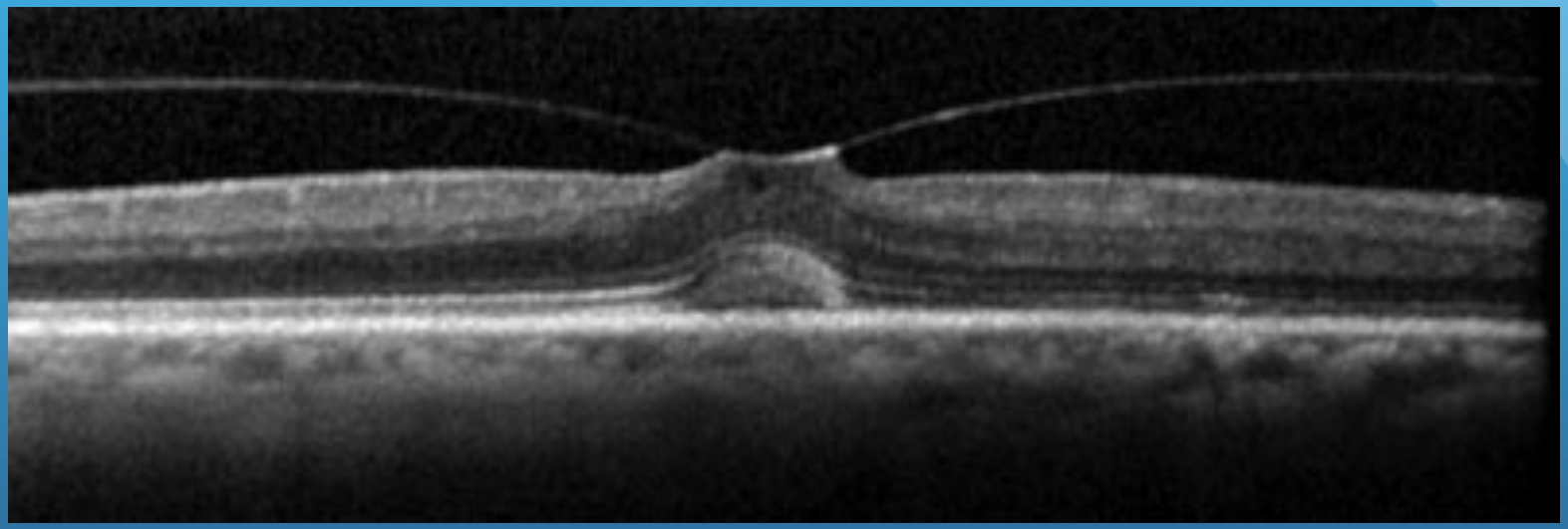

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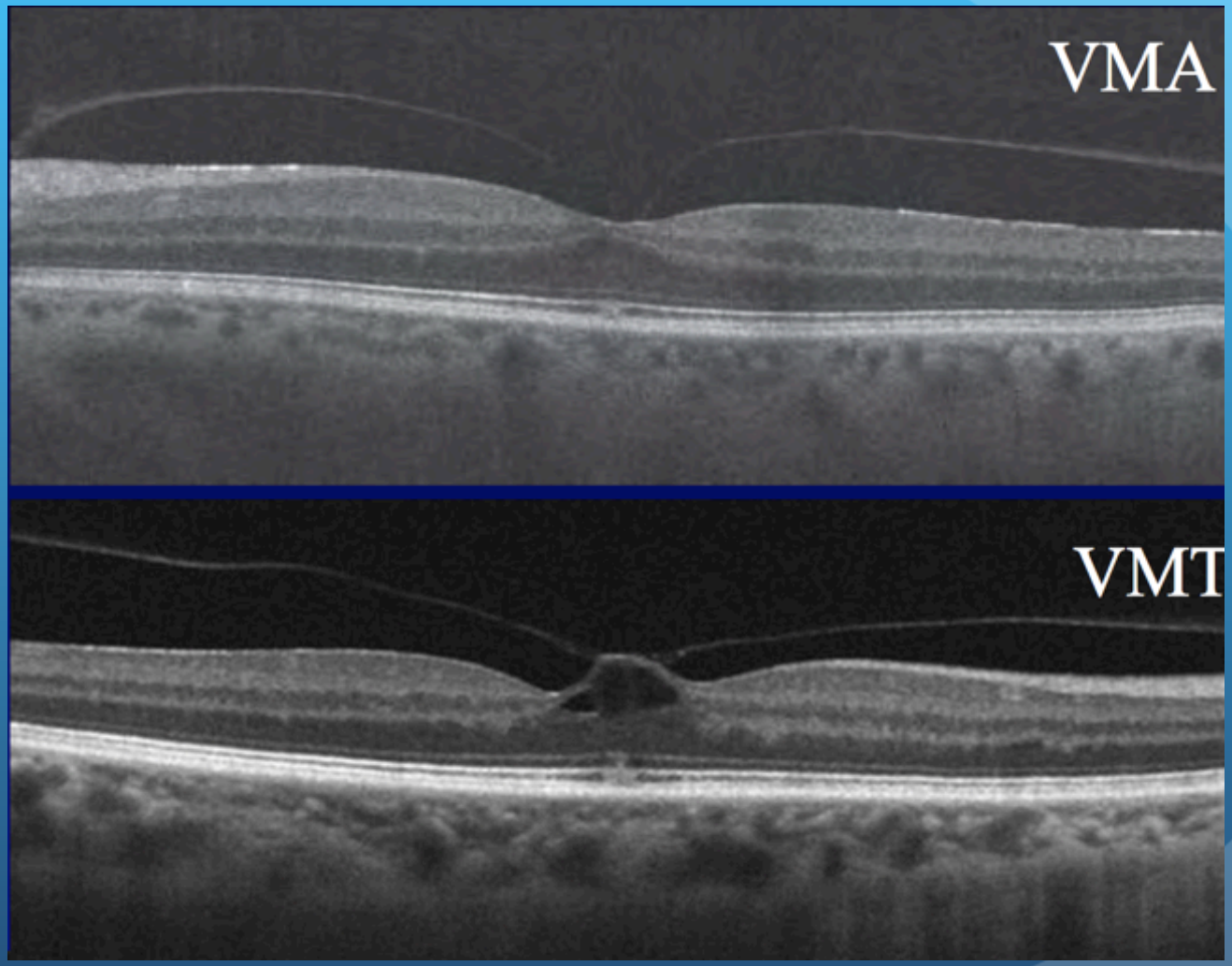


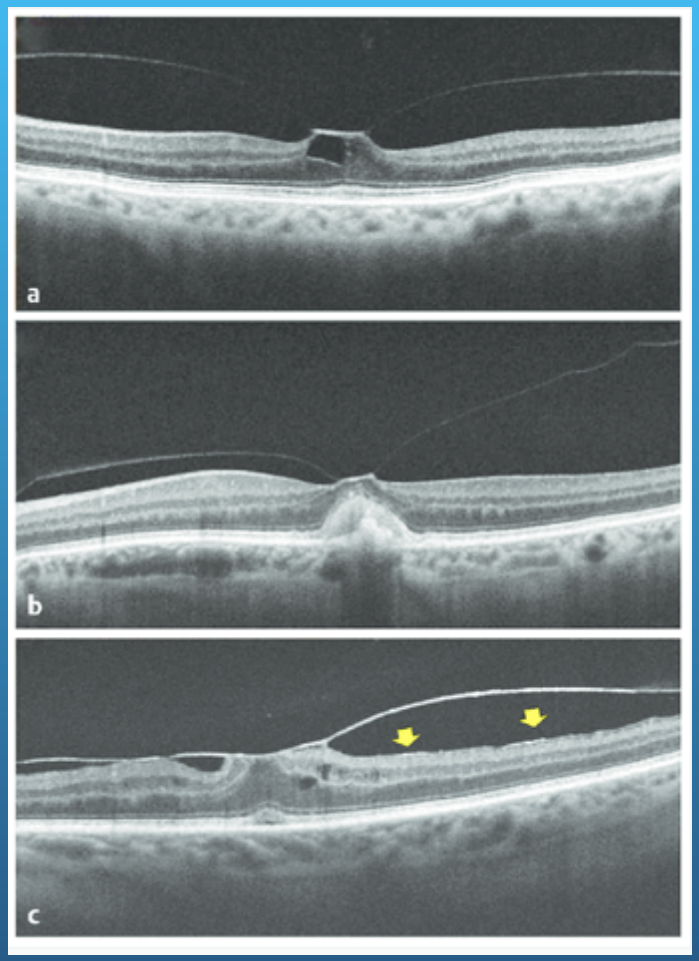
VMA/VMT types and new classification due to OCT

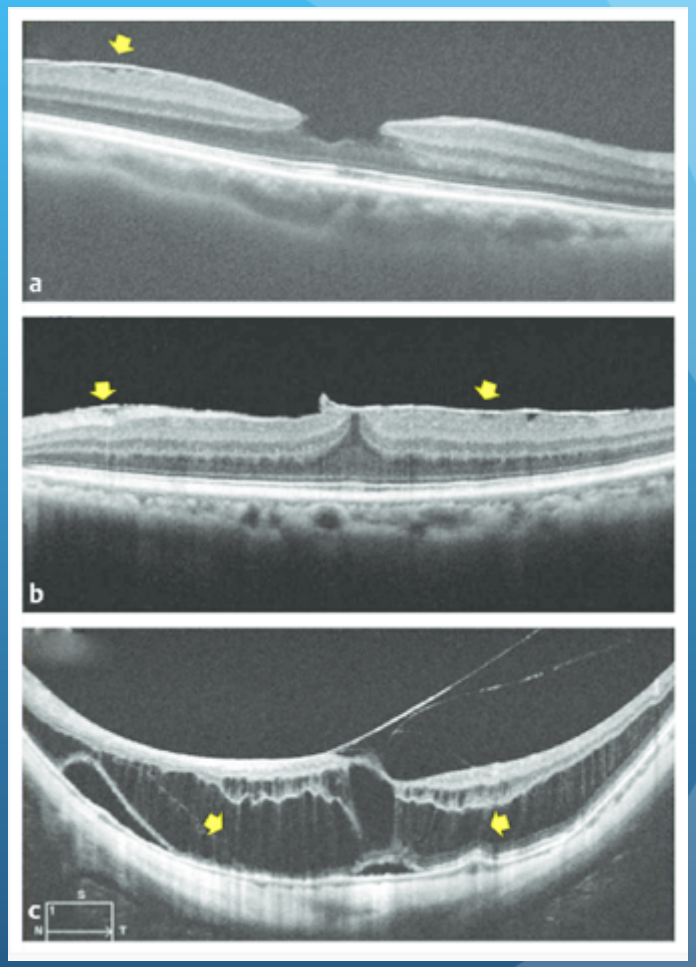
Anatomic State	Classification	Definition	Gass Classification
VMA	Size of attachment area Focal (≤ 1500 µm) Broad (> 1500 µm) Presence of associated macular abnormalities Isolated Concurrent	No detectable change in foveal contour	Stage 0
VMT	Size of attachment area Focal (≤ 1500 µm) Focal (≤ 1500 µm) Presence of associated macular abnormalities Isolated Concurrent	Absence of full-thickness interruption of all retinal layers and vitreous attachment associated with: • Distortion of foveal surface • Intraretinal structural changes Elevation of the fovea above the RPE	Stage 1

VMA/VMT types and new classification due to OCT

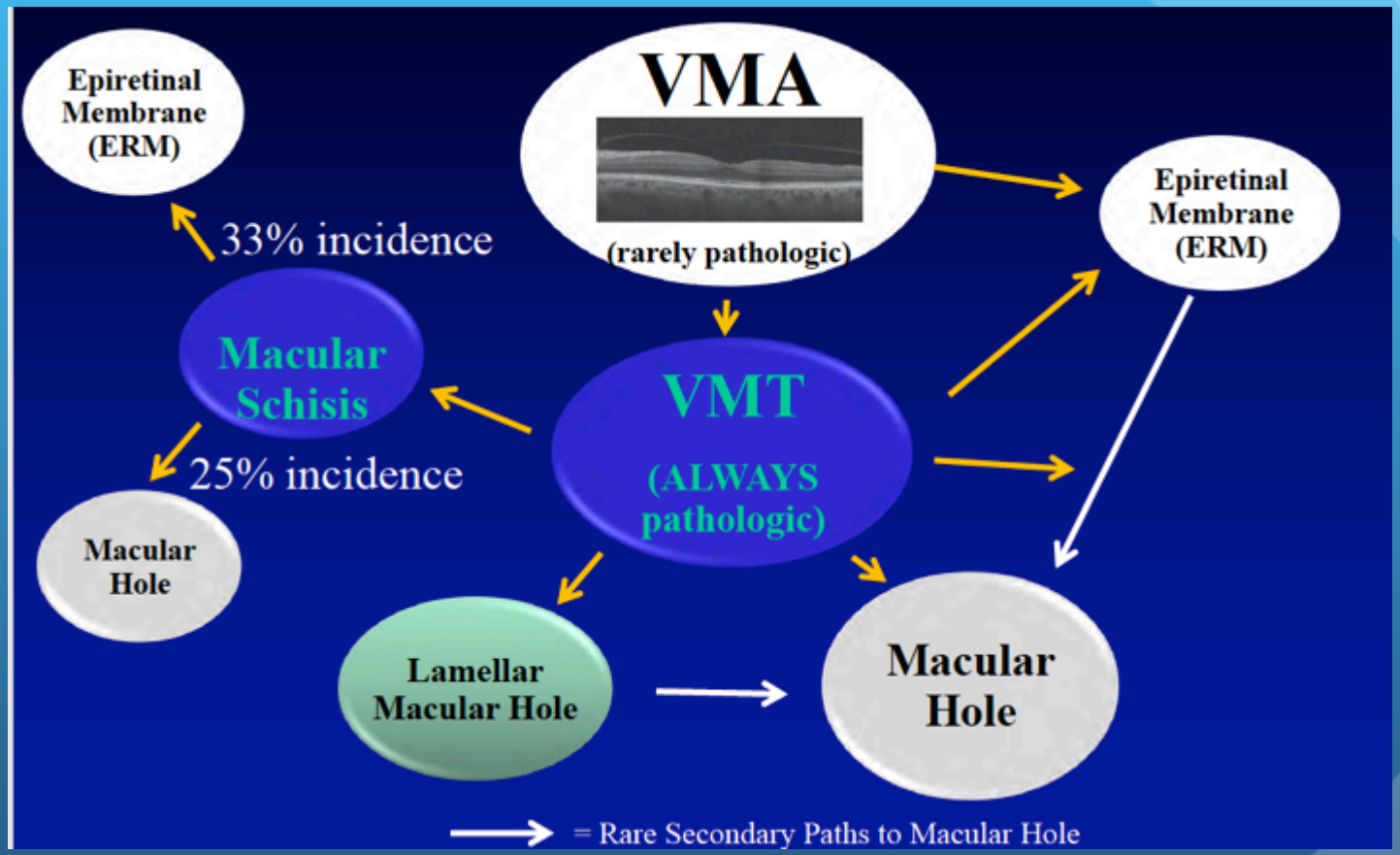
Full-thickness macular hole	Size -- horizontal diameter at narrowest point Small (≤ 250 µm) Medium (250-400 µm) Large (> 400 µm) Cause Primary Secondary* Presence or absence of VMT	Full-thickness foveal lesion from the ILM to the RPE	Stage 2: small or medium hole with VMT Stage 3: medium or large hole with VMT Stage 4: any size hole without VMT
Lamellar macular hole	—	Irregular foveal contour with defect in the inner fovea and an intact photoreceptor layer	
Macular pseudohole	—	Concomitant ERM with central opening and invaginated or heaped foveal edges without loss of retinal tissue	

VMA/VMT types and new classification due to OCT





Schematic flow chart of VRI pathology.



VMA/VMT broad vs focal adhesion with OCT

- VMA: VMA is a perifoveolar PVD
- VMA is considered stage 1 PVD by Johnson's classification

TABLE 1 STAGES* OF POSTERIOR VITREOUS DETACHMENT

Stage 1	Perifoveal separation with adhesion of vitreous to the fovea
Stage 2	Complete separation of vitreous from the macula
Stage 3	Extensive vitreous separation with adhesion of vitreous to the disc
Stage 4	Complete posterior vitreous detachment

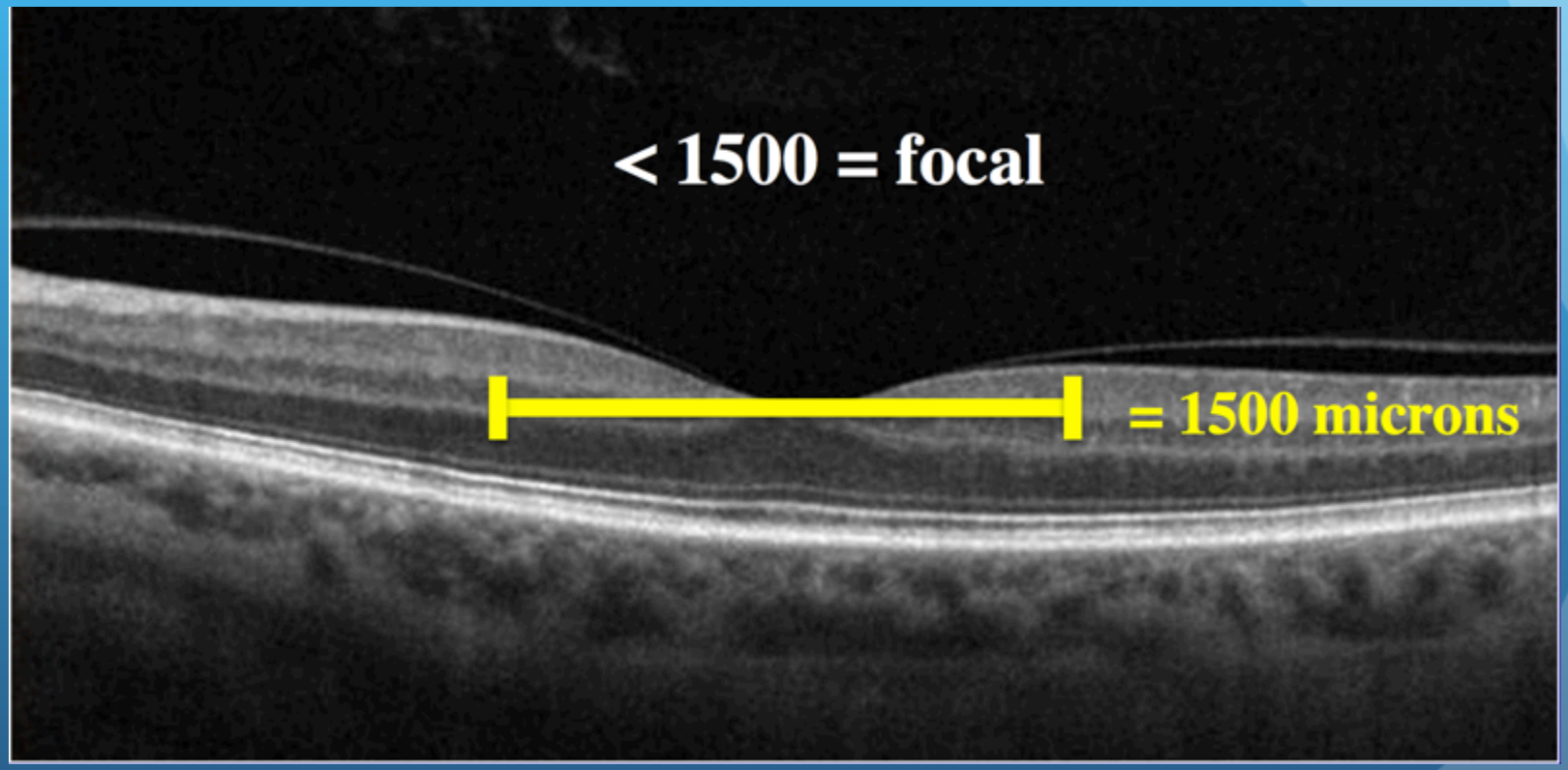
These stages can be studied with optical coherence tomography.[4,17]

* The proposed staging levels may not imply a linear, staged progression of a posterior vitreous detachment.

VMA/VMT broad vs focal adhesion with OCT

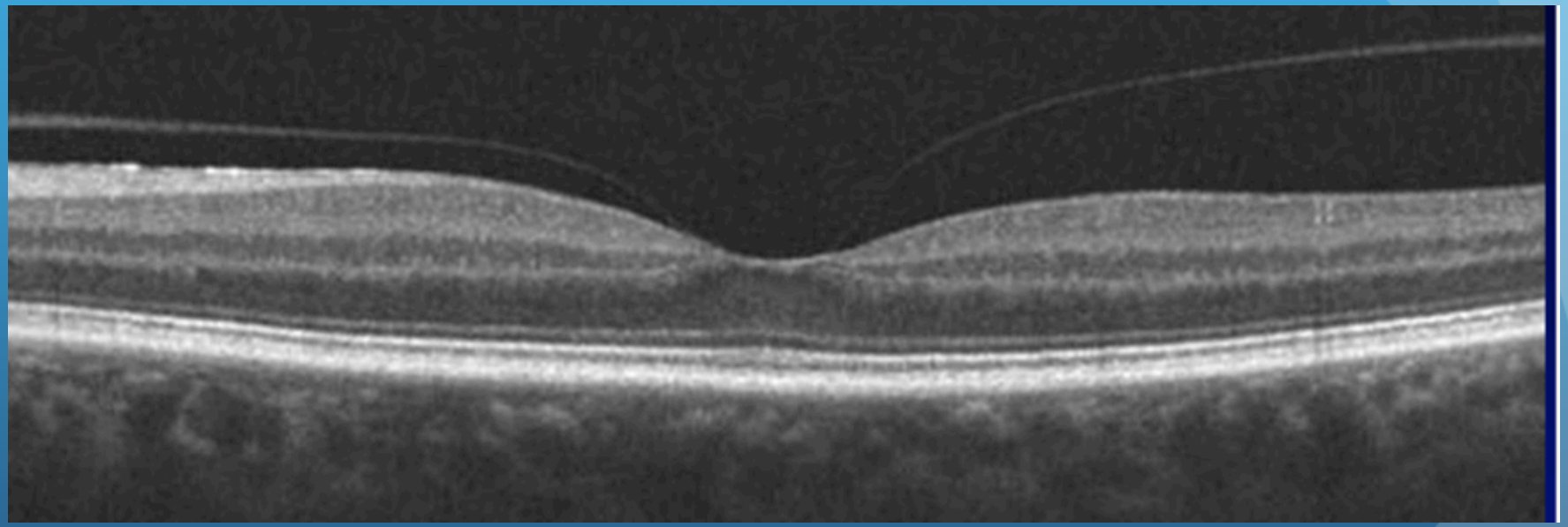
- Focal vs Broad
- Focal Attachment <1500 Microns
- Broad attachment >1500 microns
  - Broad VMA paralllel to the RPE

VMA/VMT broad vs focal adhesion with OCT



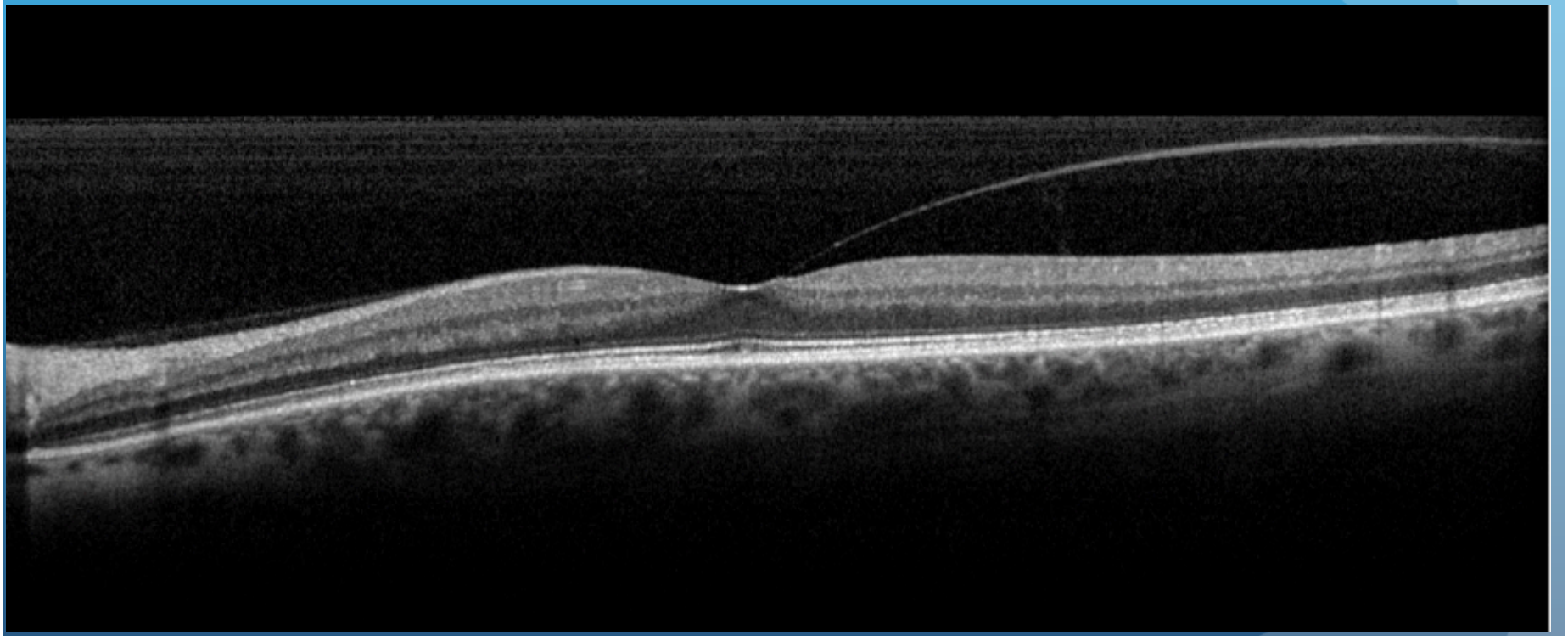
VMA/VMT broad vs focal adhesion with OCT

- Focal



VMA/VMT broad vs focal adhesion with OCT

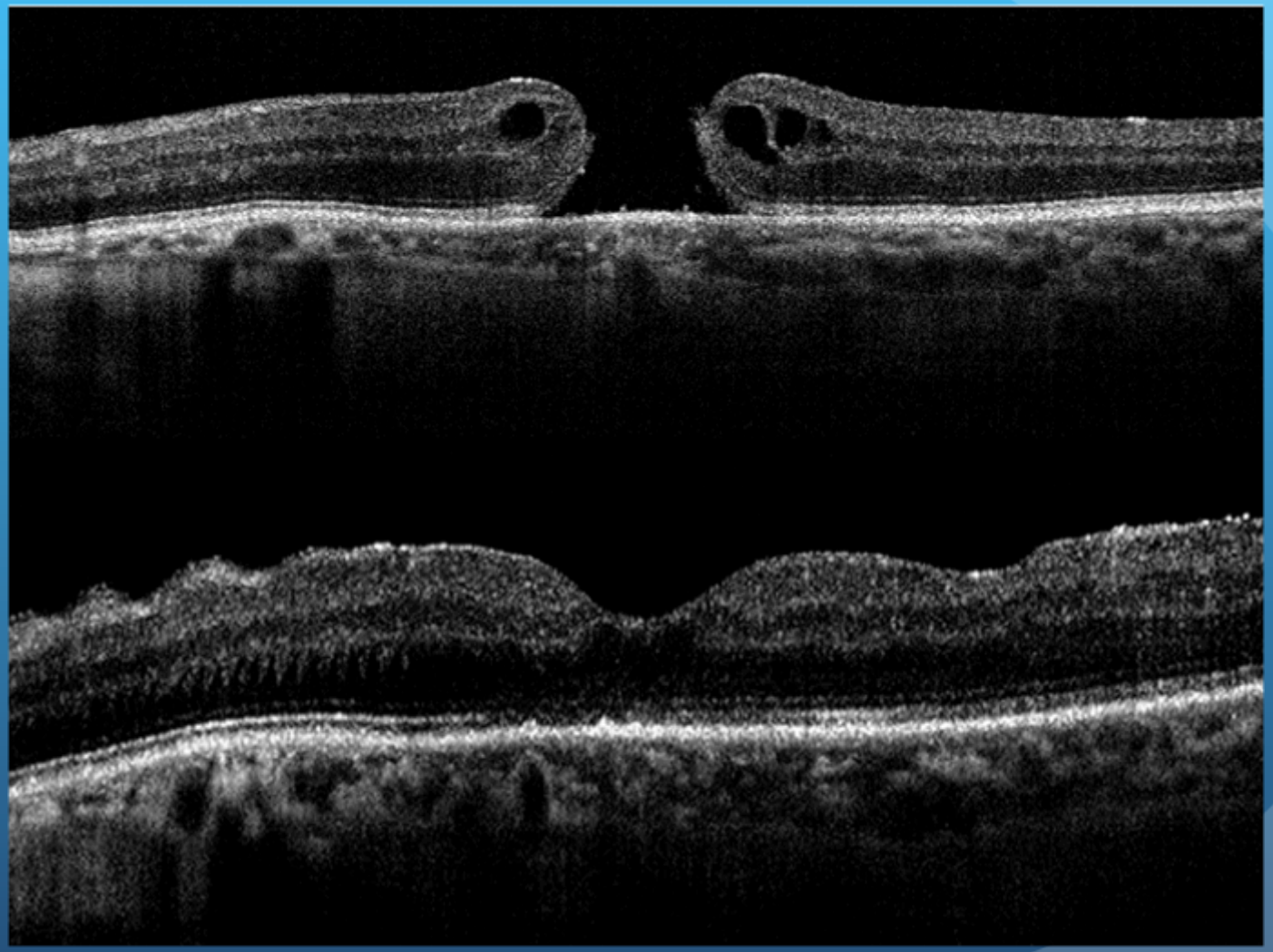
- Broad



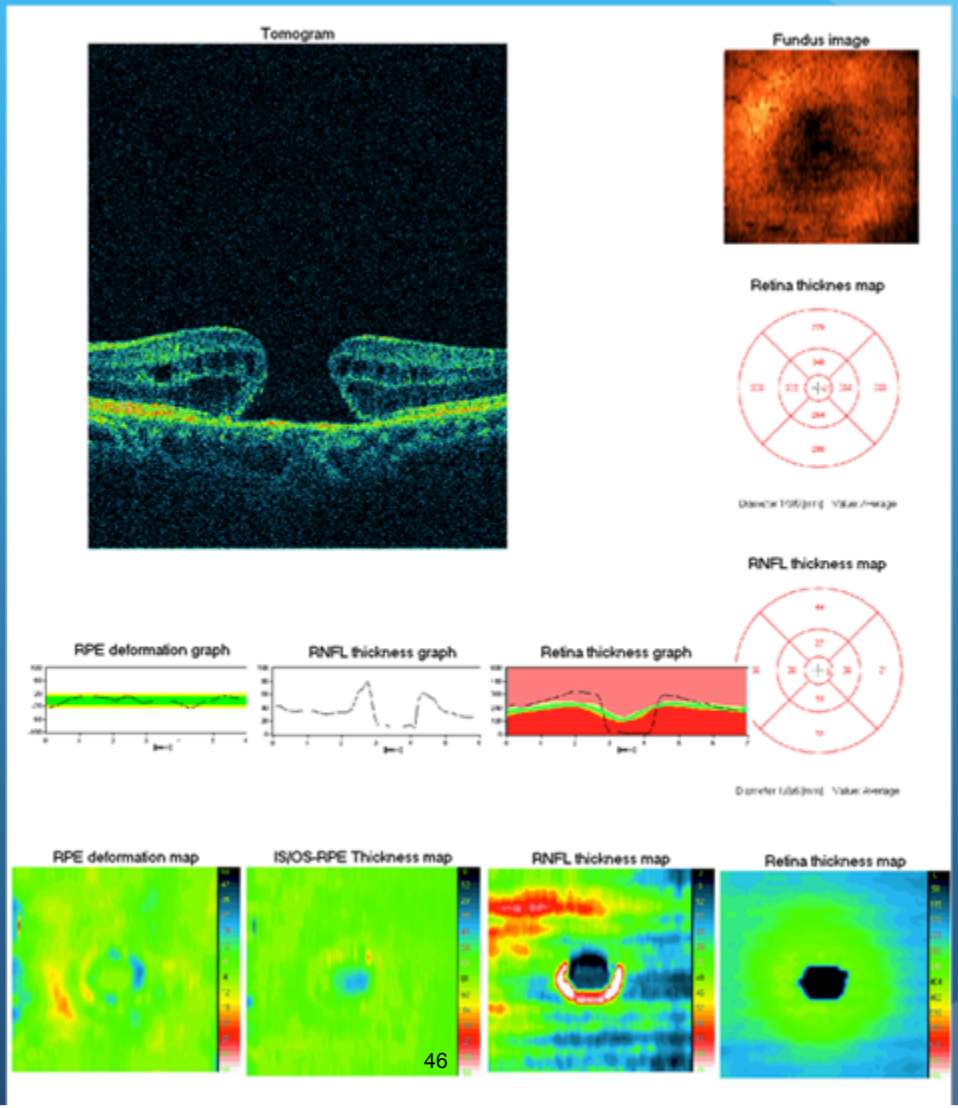
New Classification of macular holes due to OCT

Stage	Biomicroscopy (Gass)[12]	Interpretation (Gass)[12]	Optical coherence tomography[25,43,44,47]
Stage 0: MH			Perifoveolar detachment of posterior hyaloid with normal fovea or minor changes in the foveal contour and reflectivity[25,26]
Stage 1A: Impending MH	Central yellow spot, loss of foveolar depression, no vitreofoveal separation	Early serous detachment of foveolar retina	Perifoveolar detachment of posterior hyaloid. Foveal cyst in the inner foveola, and/or foveolar detachment of the cone outer segment tip line[26]
Stage 1B: Impending MH	Yellow ring with bridging interface, loss of foveolar depression, no vitreofoveal separation	Serous foveolar detachment with lateral displacement of xanthophyll *or* Central occult foveolar hole with bridging contracted prefoveolar cortex	Perifoveolar detachment of posterior hyaloid. Foveal cyst extending in the outer retina, causing a break in the photoreceptor layer. "Occult Macular Hole"
Stage 2: MH	Eccentric oval, crescent, or horseshoe retinal defect inside edge of yellow ring	Hole (tear) in contracted prefoveolar vitreous bridging round retinal hole, no loss of foveolar retina	Hole of various size. Partial opening of the roof of the cyst, the operculum staying still attached to the edge of the hole. Partial detachment of the posterior hyaloid, which is still attached at the operculum. The operculum contains retinal elements
	Central round retinal defect with rim of elevated retina, with or without prefoveolar opacity	Hole with pseudo-operculum, rim of retinal detachment	
Stage 3: MH	Central round ≥400 μm diameter retinal defect, no Weiss's ring, rim of elevated retina, with or without prefoveolar opacity	Hole with pseudo-operculum, no posterior vitreous detachment	Hole of various size. Posterior hyaloid detached from the macular surface, but still attached to the optic disc, most often containing an operculum
Stage 4: MH	Central round defect, rim of elevated retina. Weiss's ring with prefoveolar opacity	Hole with pseudo-operculum and posterior vitreous detachment from optic disc and macula	Hole of various size, with complete posterior vitreous detachment on biomicroscopy. The posterior hyaloid is not visible on OCT

Pre op OCT to create better post op outcomes and expectation with OCT



OCT thickness maps of macula importance for managing pre and post op retinal pathology



What makes a good candidate for VMT treatment with Jetrea

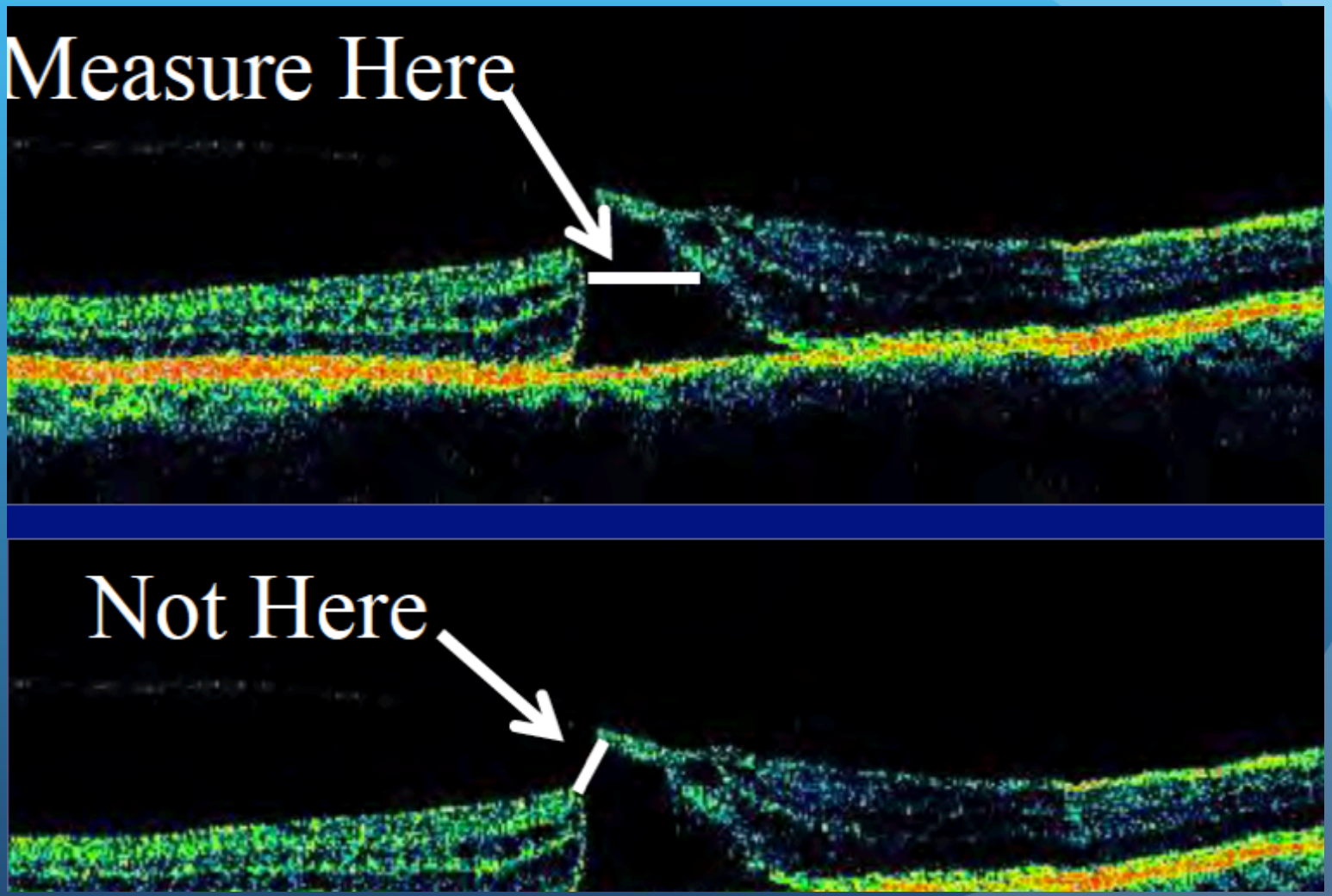
- FDA Approval of Jetra (Ocriplasmin) 2012
- Is the first and only FDA-approved nonsurgical treatment for symptomatic VMA.
- Jetrea has proteolytic activity against protein components of the vitreous body and the vitreoretinal interface (VRI) (e.g. laminin, fibronectin and collagen), thereby dissolving the protein matrix responsible for the vitreomacular adhesion (VMA).
- Success rates for release of traction within 28 days was 26.1% as compared to 10.1% in the placebo group

What makes a good candidate for VMT treatment with Jetrea

Best candidates for ocriplasmin injection	
1	Phakic eyes
2	Age ≤65 years
3	No previous surgeries
4	No diabetic retinopathy
5	No ERM
6	VMA <1,500 μm
7	No macular pucker
8	FTMH <250 μm

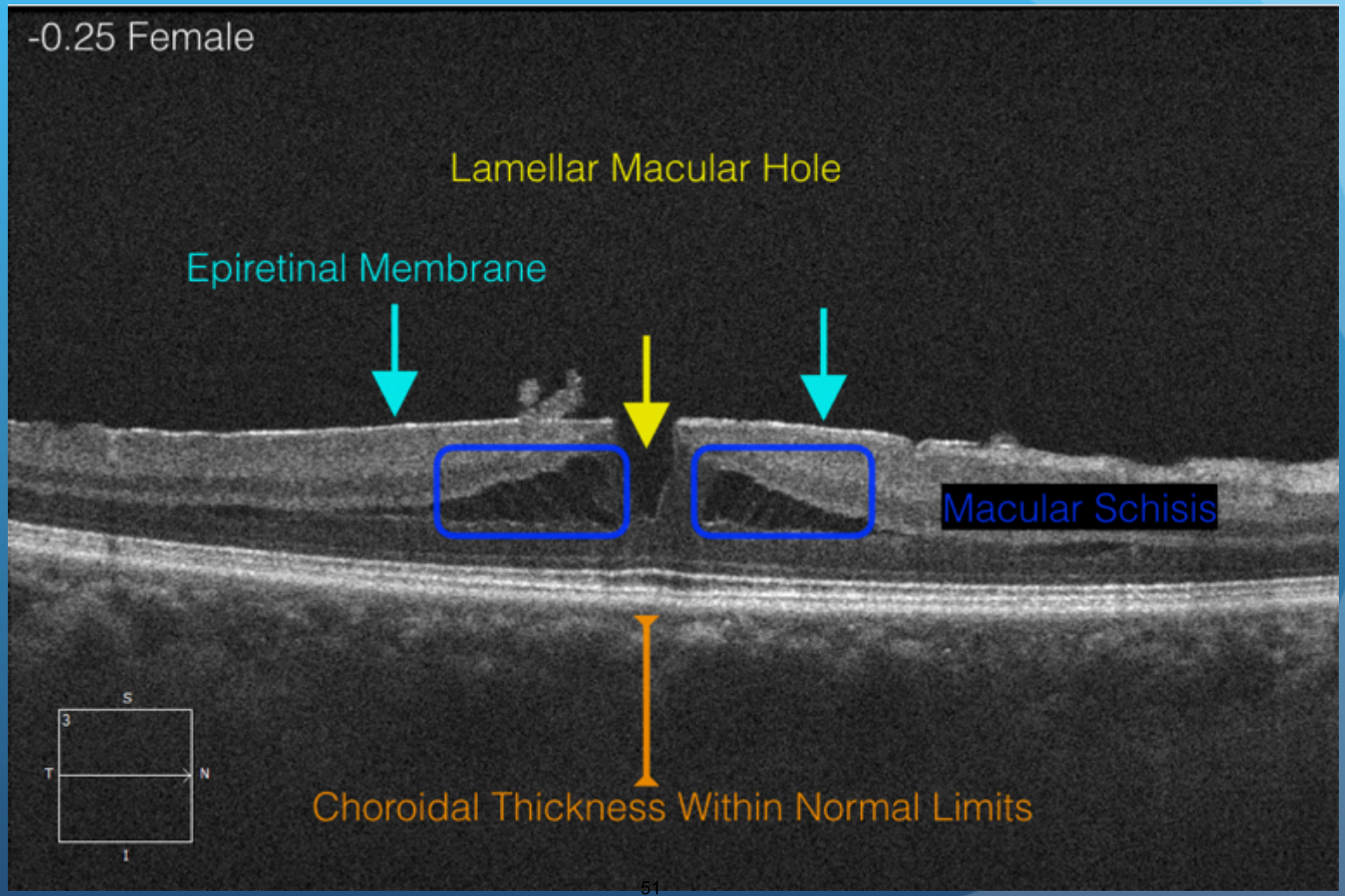
- Also patients who have mild to moderate symptomatic VMA, and also have good visual acuity. Patients may be experiencing metamorphopsia, but test 20/40 or better on a Snellen visual acuity chart.

Measurement for macula hole to determine Jetrea vs PPV

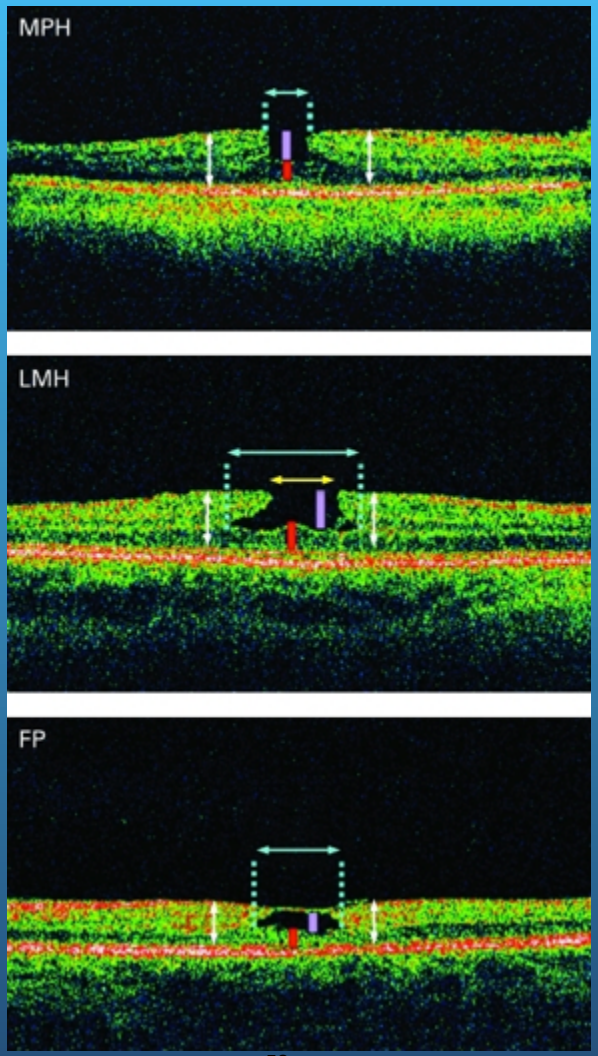


What makes a good candidate for VMT treatment with Jetrea

Types of Lamellar Holes interpretation and/management with OCT



Types of Lamellar Holes interpretation and/management with OCT



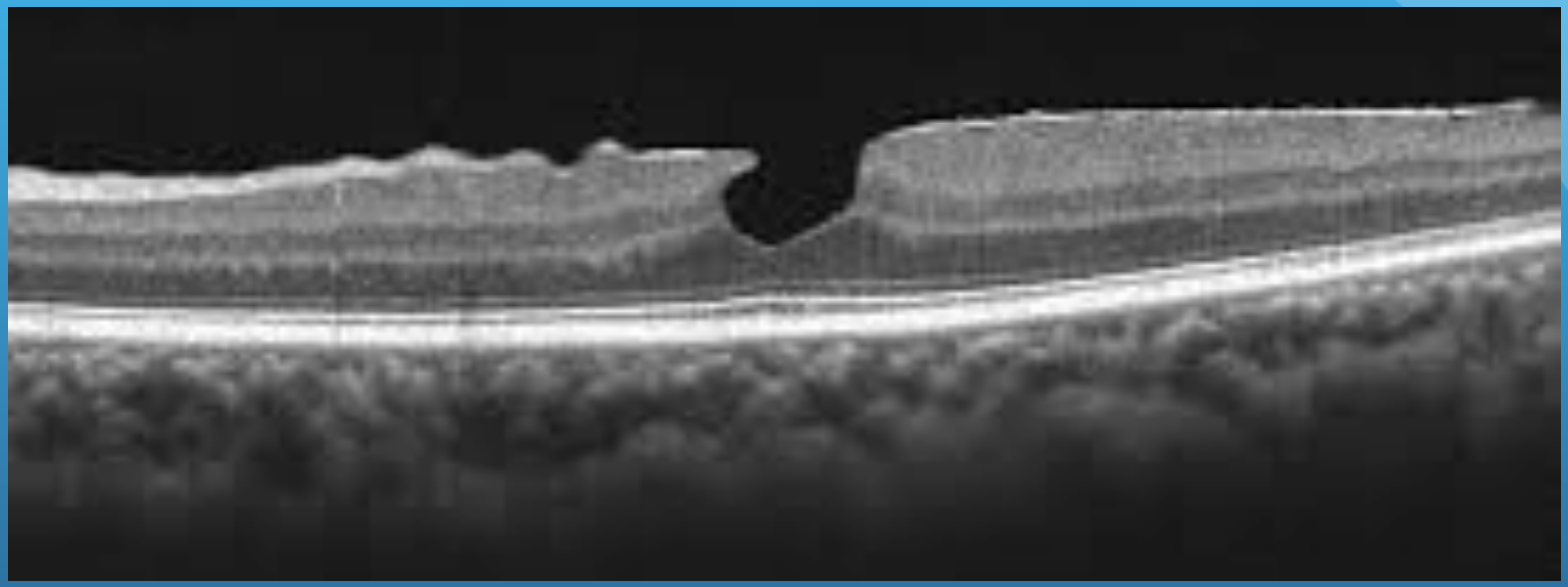
Pseudohole interpretation and management with OCT

- Retinal lesion that simulates macular hole without actual tissue loss.
- Clinical features: Altered light reflex and darker appearance of the fovea
- Optical coherent tomography (OCT) demonstrates:
  - Steepening of foveal contour
  - Full thickness retinal tissue is present
  - Reflective epiretinal membrane layer is present on the surface of the retina

Pseudohole interpretation and management with OCT

- Fluorescein angiography often reveals normal fluorescence except if traction-induced retinal vascular disruption present.
- Management:
  - Treatment of the underlying causes of epiretinal membrane.
  - Observation of progressive contraction, which may lead to macular edema.
  - Surgical vitrectomy to peel the epiretinal membrane may be indicated in patients with worsening vision of 20/80 or less.

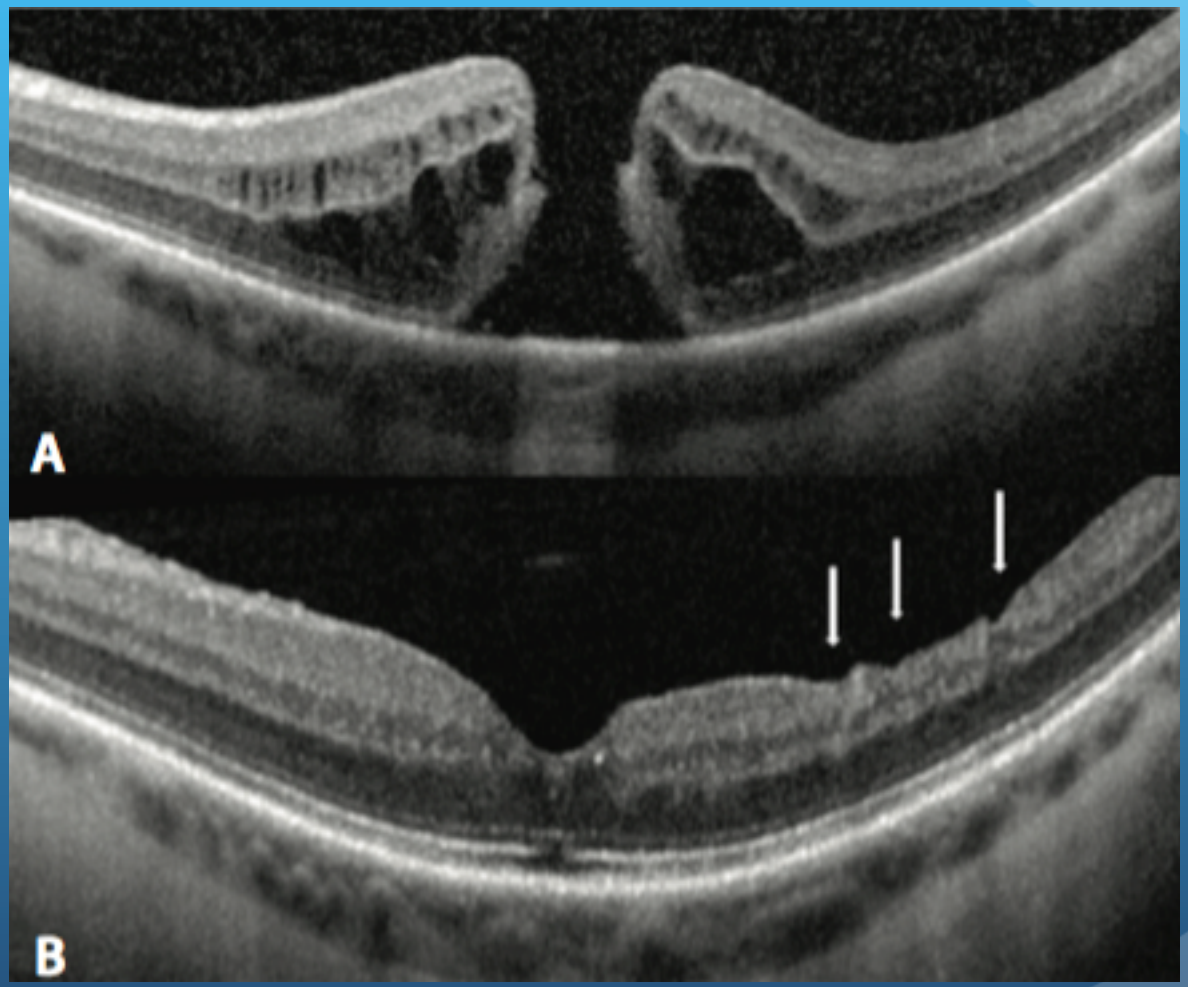
Pseudohole interpretation and management with OCT



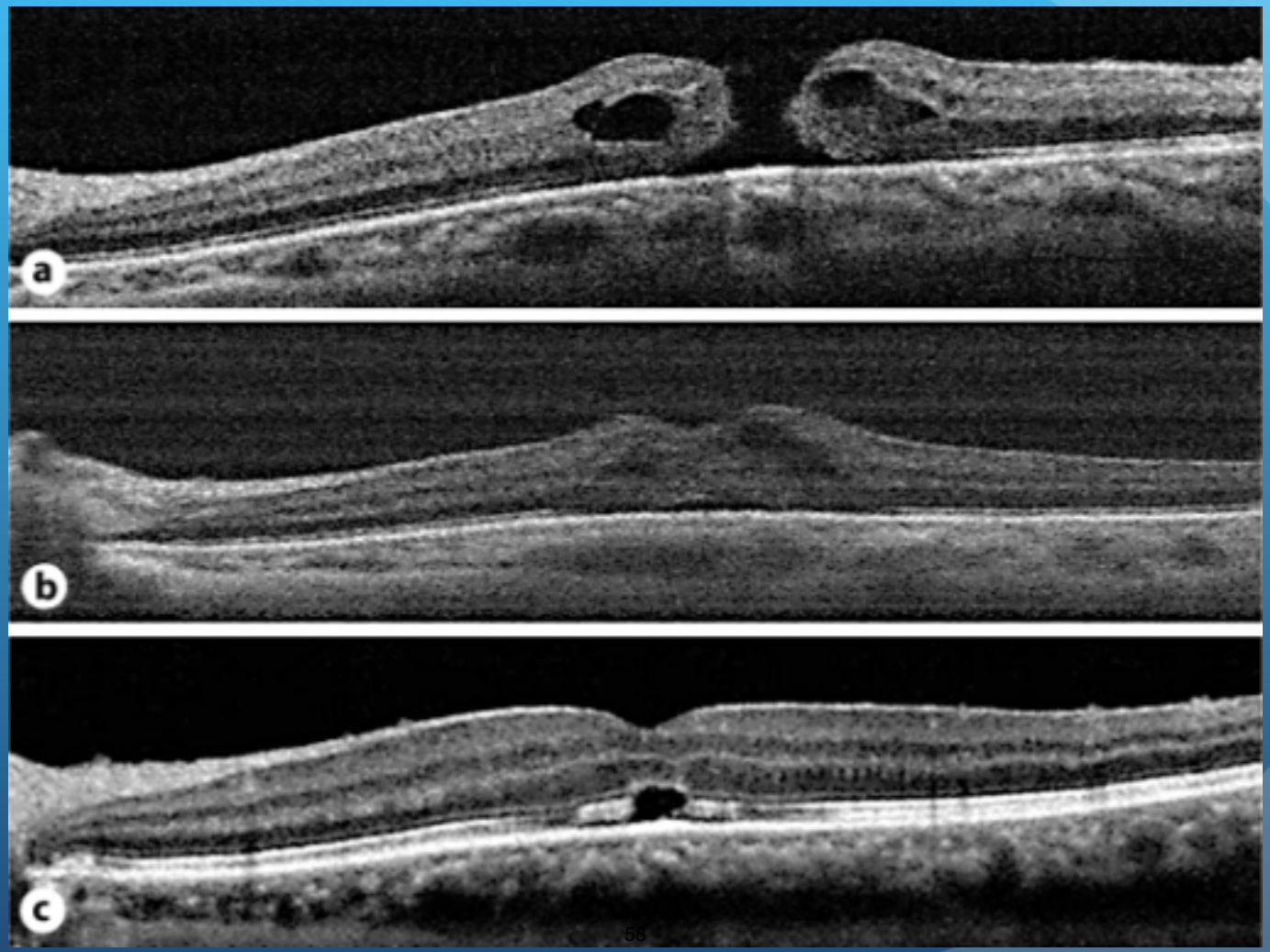
Post op macular hole interpretation with OCT

- The length of time a patient has experienced symptoms is key to predicting likelihood of visual improvement. Less than 6 months is an ideal duration.
- To facilitate macular hole closure, all tractional forces surrounding the open hole should be removed.
- Vitrectomy for macular hole repair has proven highly successful through a number of techniques. Pharmacologic vitreolysis with ocriplasmin is another treatment option, although the effects of ocriplasmin on visual acuity may be unpredictable.

Post op macular hole interpretation with OCT



Post op macular hole interpretation with OCT



ERM/Macular Pucker interpretation and management with macular thickness maps with OCT

- Epiretinal membrane (ERM) is a disorder of the vitreomacular interface characterized by symptoms of decreased visual acuity and metamorphopsia.
- OCT has proven to be more sensitive than clinical examination for the diagnosis of ERM.
- It has been estimated that 30 million people of advanced age in the US have an ERM in at least one eye.
- Most ERMs occur in individuals older than 50 years, and the prevalence of ERM increases as age increases

ERM/Macular Pucker interpretation and management with macular thickness maps with OCT

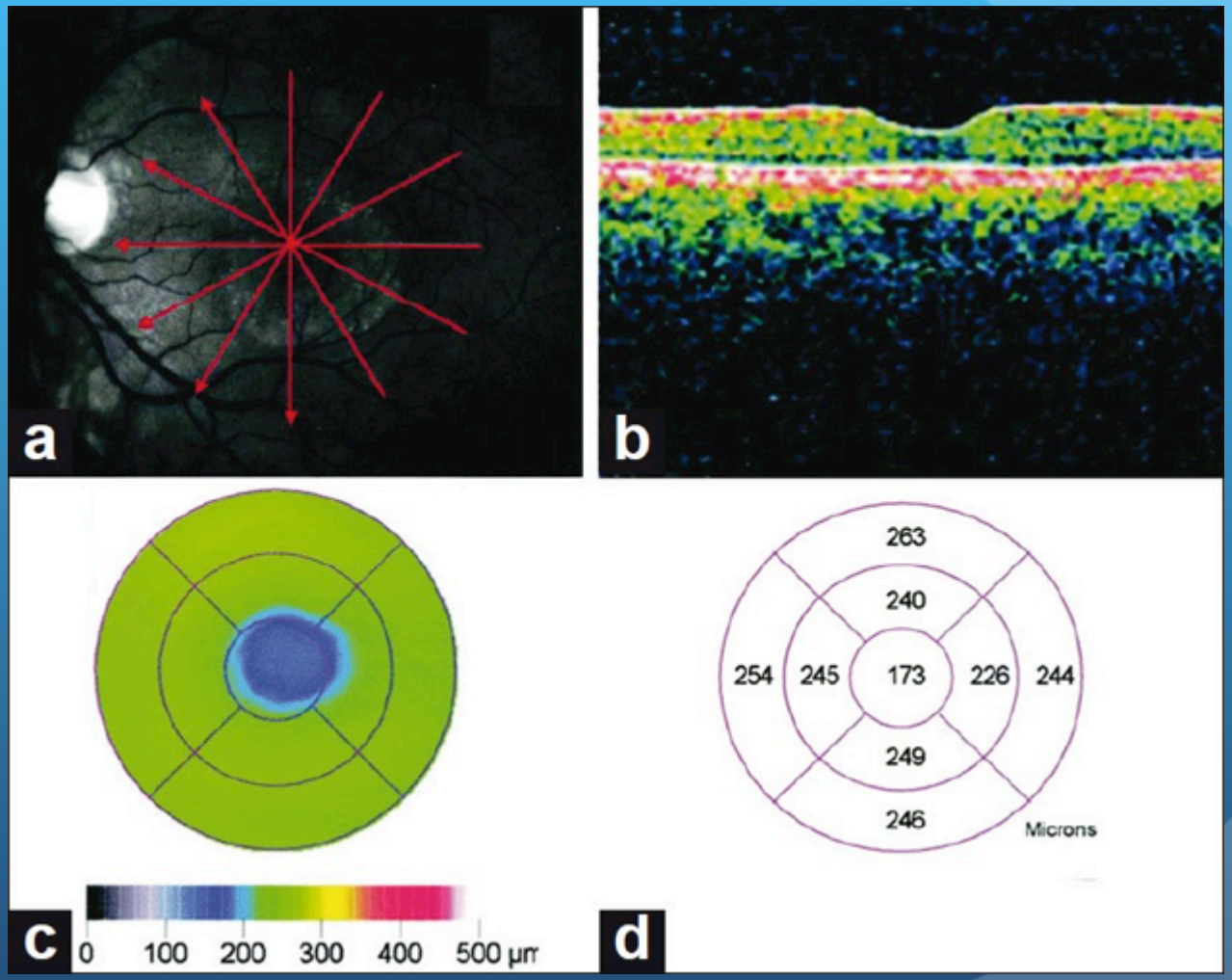
- Management
  - Vitrectomy
  - Epiretinal Membrane Peel
  - Internal Limiting Membrane Peel
- Complications
  - The most common complication, occurring in 12% to 68% of cases, is accelerated nuclear sclerosis of crystalline lens.
  - Recurrent ERM occurs in 3% to 12% of patients
  - Retinal detachment occurs in 3% to 14%. This may develop within 1 month postoperatively and may be related to intra-operative retinal breaks.

ERM/Macular Pucker interpretation and management with macular thickness maps with OCT

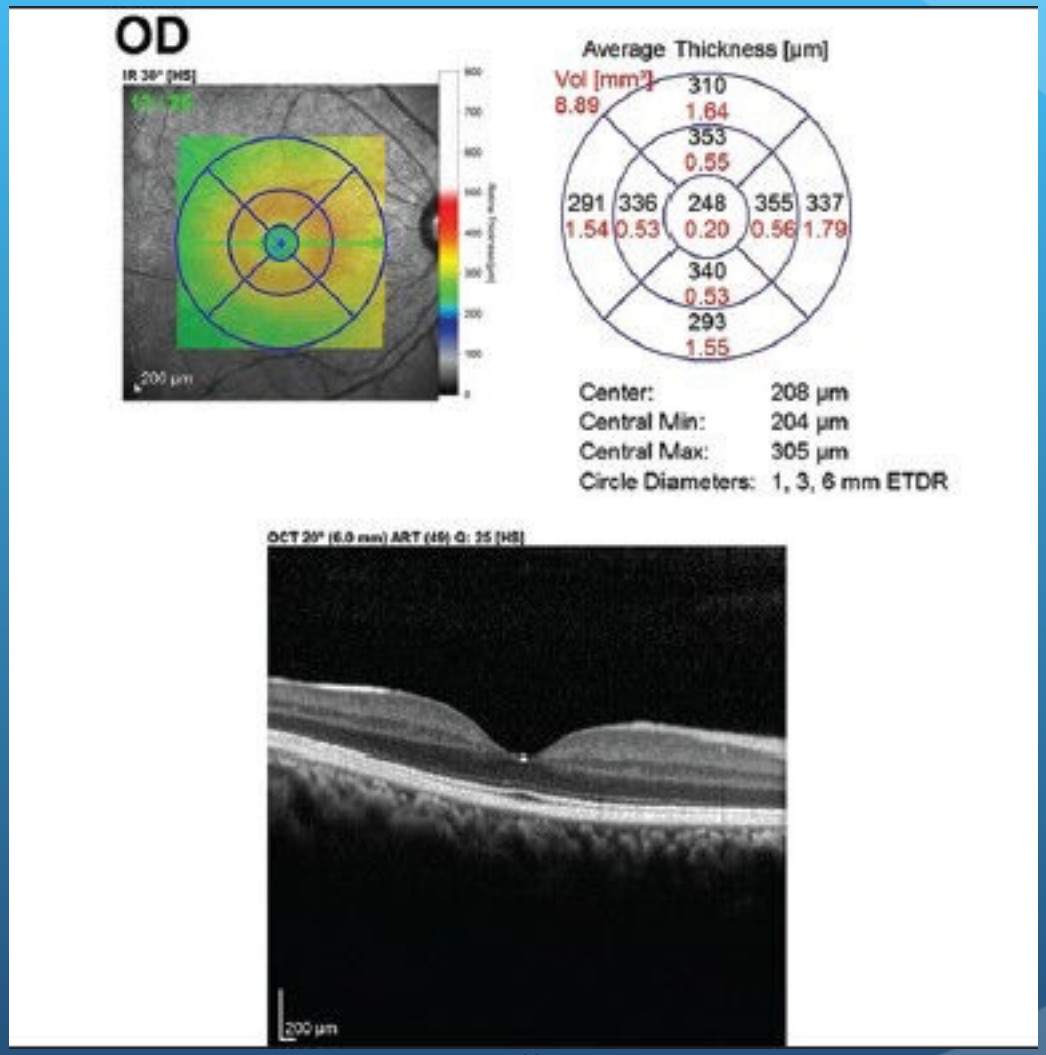
OCT-based morphologic classification of ERMs

Group A: with posterior vitreous detachment	
A1	No contraction
A2	Contraction
A2.1	With retinal folding
A2.2	With edema
A2.3	With cystoid macular edema
A2.4	With lamellar macular hole
Group B: with vitreous attachment	
B1	No traction
B2	Vitreomacular traction
B2.1	With edema

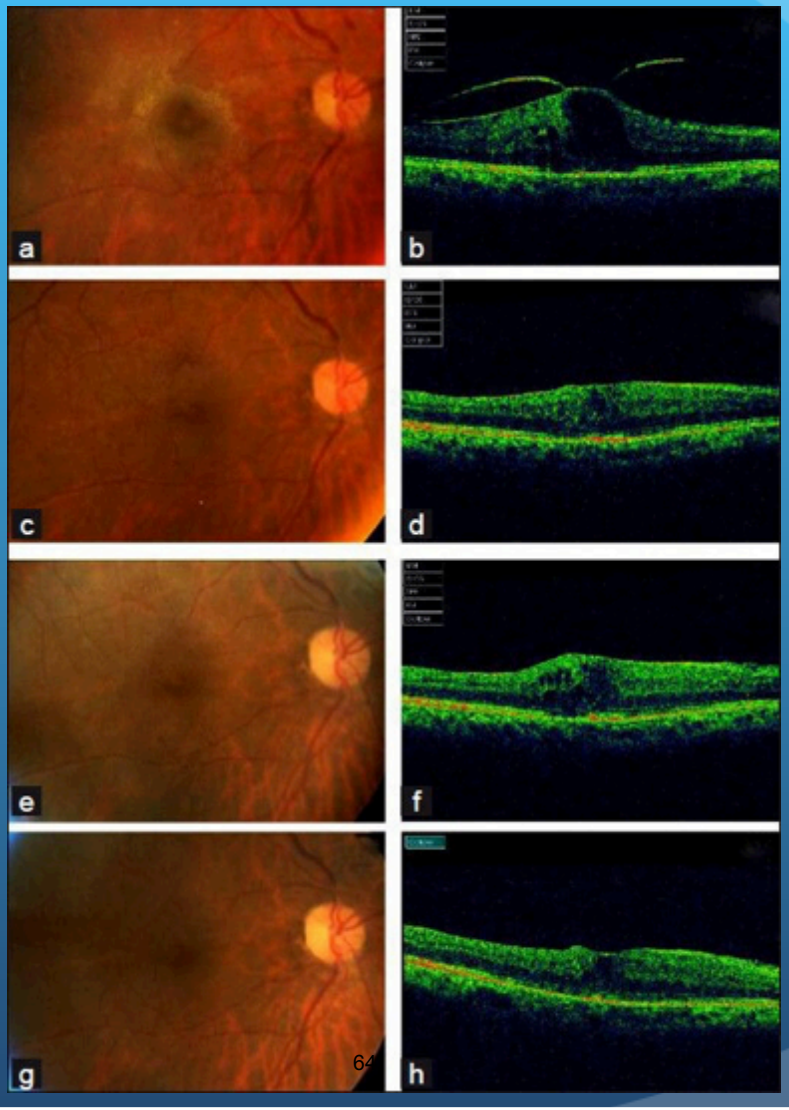
ERM/Macular Pucker interpretation and management with macular thickness maps with OCT



ERM/Macular Pucker interpretation and management with macular thickness maps with OCT

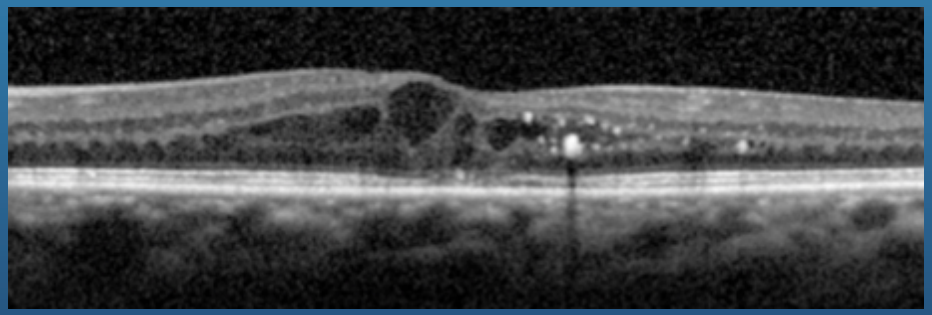


ERM/Macular Pucker interpretation and management with macular thickness maps with OCT

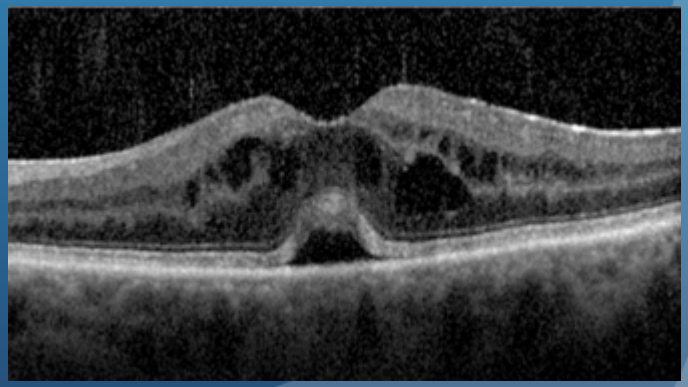


Middle layer retina showing CME interpretation/management with OCT

- Diabetic Macular Edema (DME) versus Pseudophakic Cystoid Macular Edema (PCME)
- DME: More ONL cysts, no subretinal fluid, presence of hard exudates, microaneurysms, and ganglion cell layer and/or retinal nerve fiber layer cysts
- PCME: No ERM, solely INL cysts
- DME:



PCME:



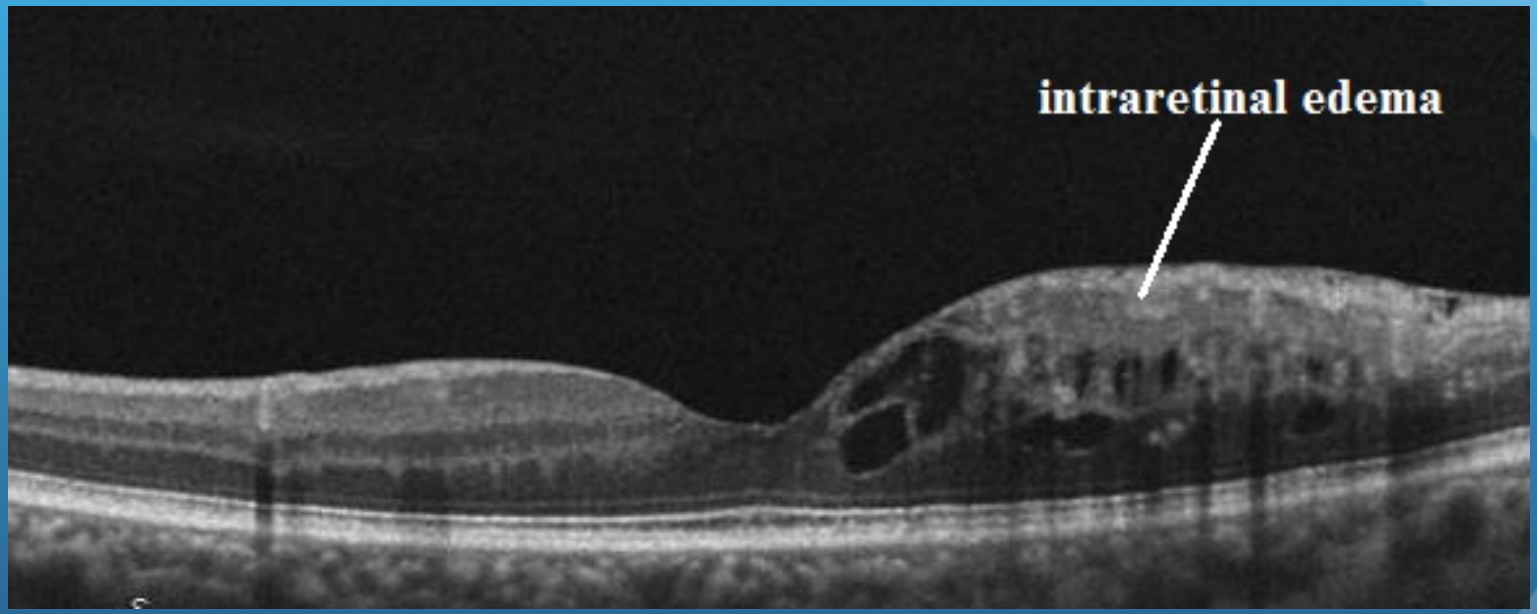
Middle layer retina BVO interpretation/ management with OCT

- Vision loss from retinal vein occlusions is secondary to macular edema and if ischemic, has the risk to develop neovascularization and neovascular glaucoma.
- OCT can assist in detecting macular edema secondary to retinal vein occlusions and track response to treatment.
- Macular edema in retinal vein occlusions causes diffuse leakage, especially in CRVO.
- The macular edema is driven by ischemia and release of vascular endothelial growth factors (VEGF) that increases the inner retinal blood-brain barrier causing leakage of intraretinal fluid.

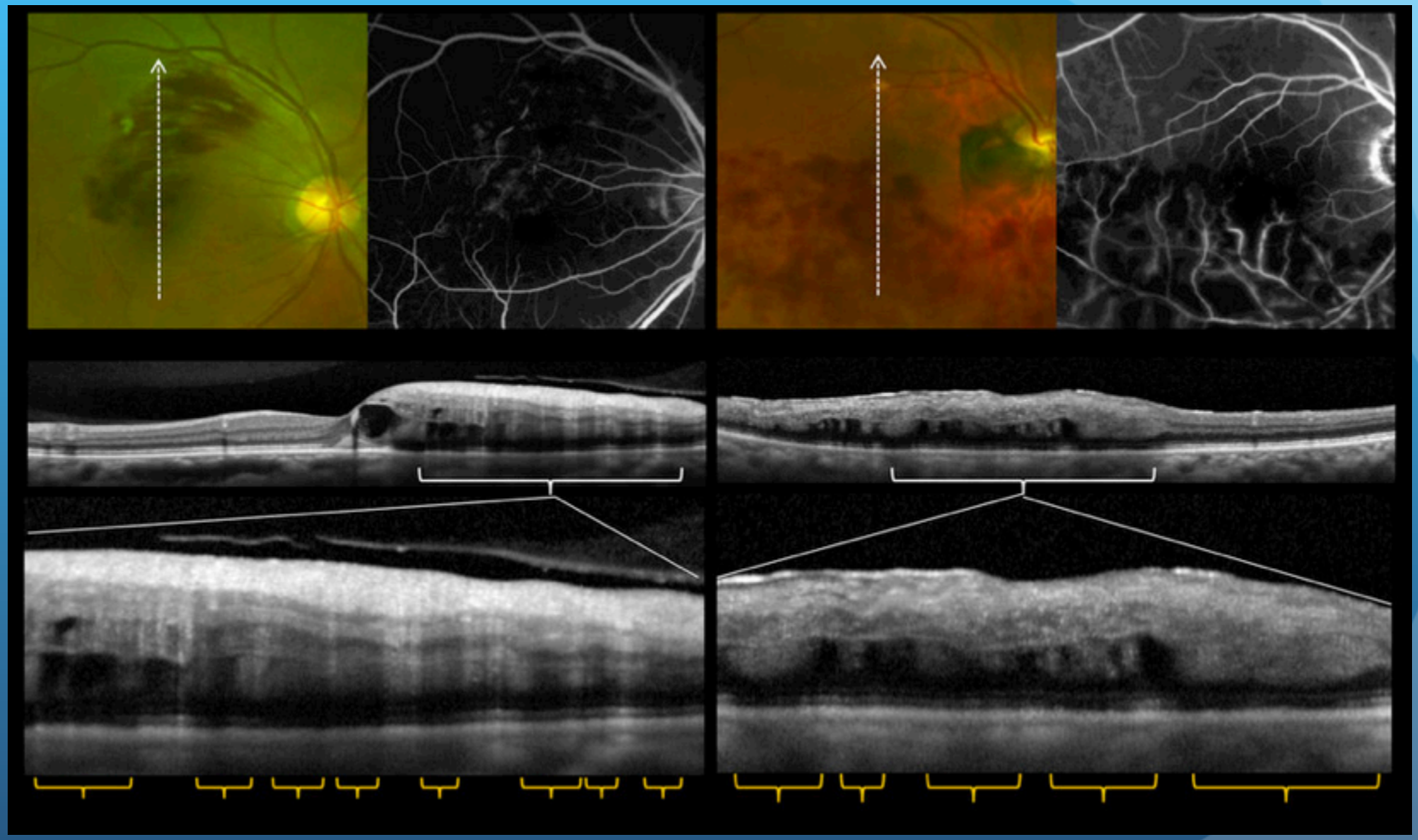
Middle layer retina BVO interpretation/ management with OCT

- Macular edema secondary to branch retinal vein occlusion will respond to argon grid laser and anti-VEGF therapies (Lucentis, Eylea, avastin).
- Macular edema secondary to central retinal vein occlusion will respond to anti-VEGF therapies (Lucentis, Eyelea, and avastin) and intravitreal dexamethasone implant (Ozurdex).

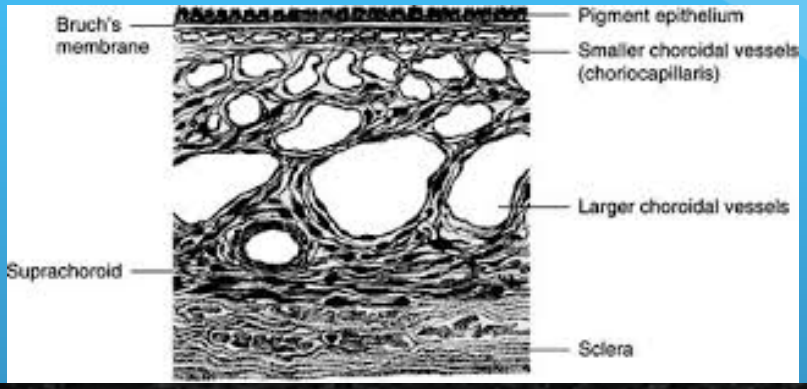
Middle layer retina BVO interpretation/ management with OCT

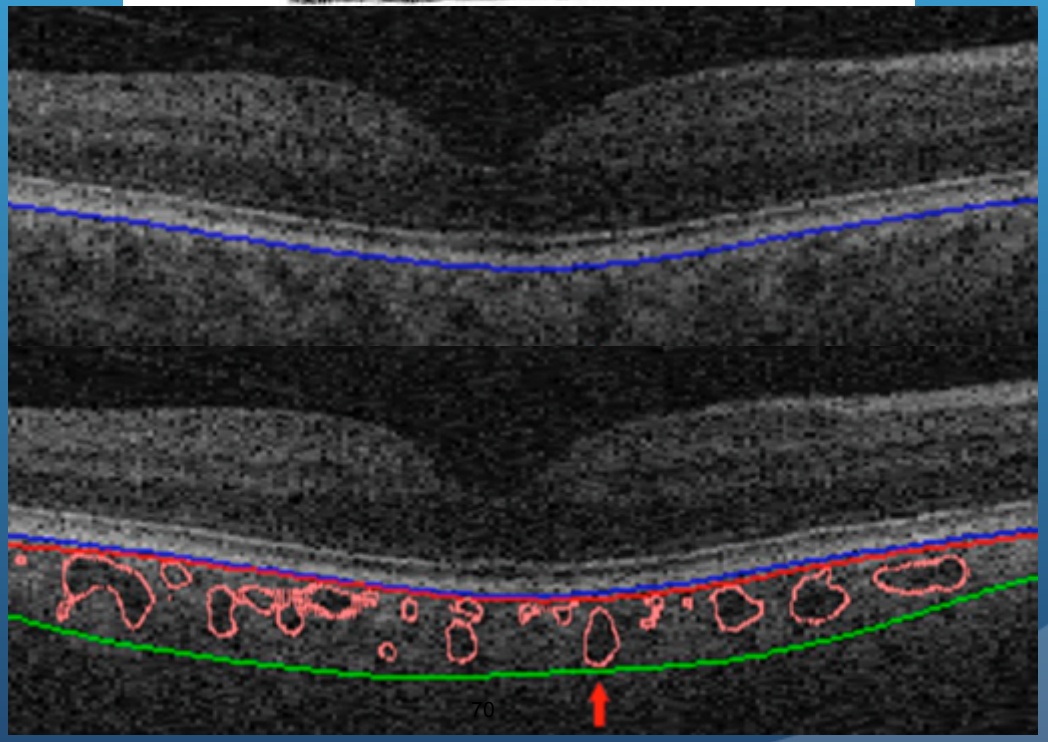


Middle layer retina BVO interpretation/ management with OCT



Review of the choroid complex anatomy.



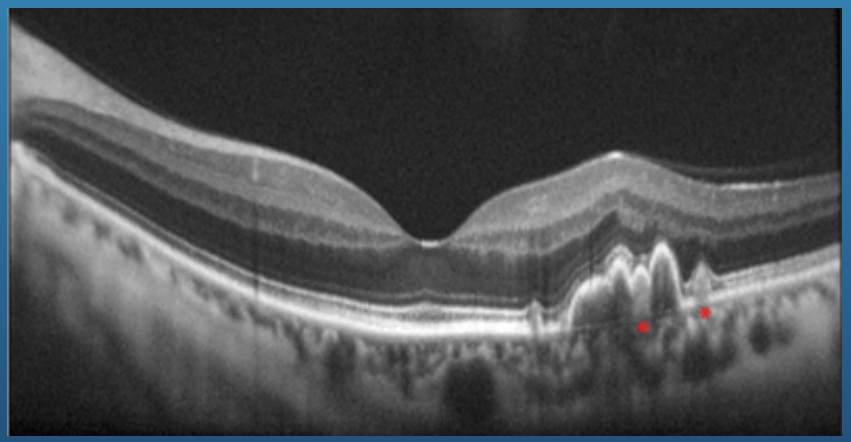


Early stage dry ARMD interpretation/management

- One in 10 people over the age of 60 have some form of AMD.
- That ratio increases to one in four people over 70.
- AMD is the leading cause of legal blindness for people over age 55 in the Western world — more than 5 million new cases a year reported in Europe and North America alone.

Early stage dry ARMD interpretation/management

- As defined by the AREDS, early AMD is characterized by small drusen (<63 μm), few medium drusen (63–125 μm), and/or minimally detected or no pigment epithelial abnormalities in the macula.
- Patients in this category have a low risk of progressing to advanced AMD after 5 years in either eye.



Early stage dry ARMD interpretation/management

Table 1. Recommendations for AMD

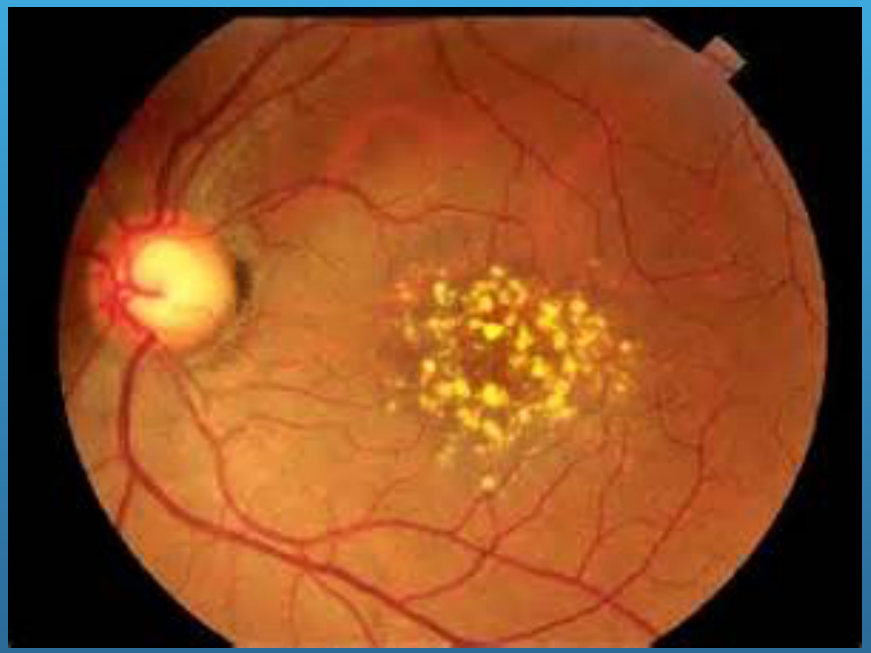
Type of AMD	Characteristics	Vitamin Recommendation(s)
Early dry	A few small/medium-sized drusen; normal vision, no symptoms	Not recommended
Intermediate dry	Many medium-sized drusen; drusen under the retina; possible visual blurring	Recommended
Advanced dry	Drusen as in intermediate stage, but also breakdown of light-sensitive cells and macular tissues; blurred central vision	Recommended if in one eye only
Wet	Abnormal vessels behind the retina; macula displacement; wavy appearance to straight lines	Recommended if in one eye only

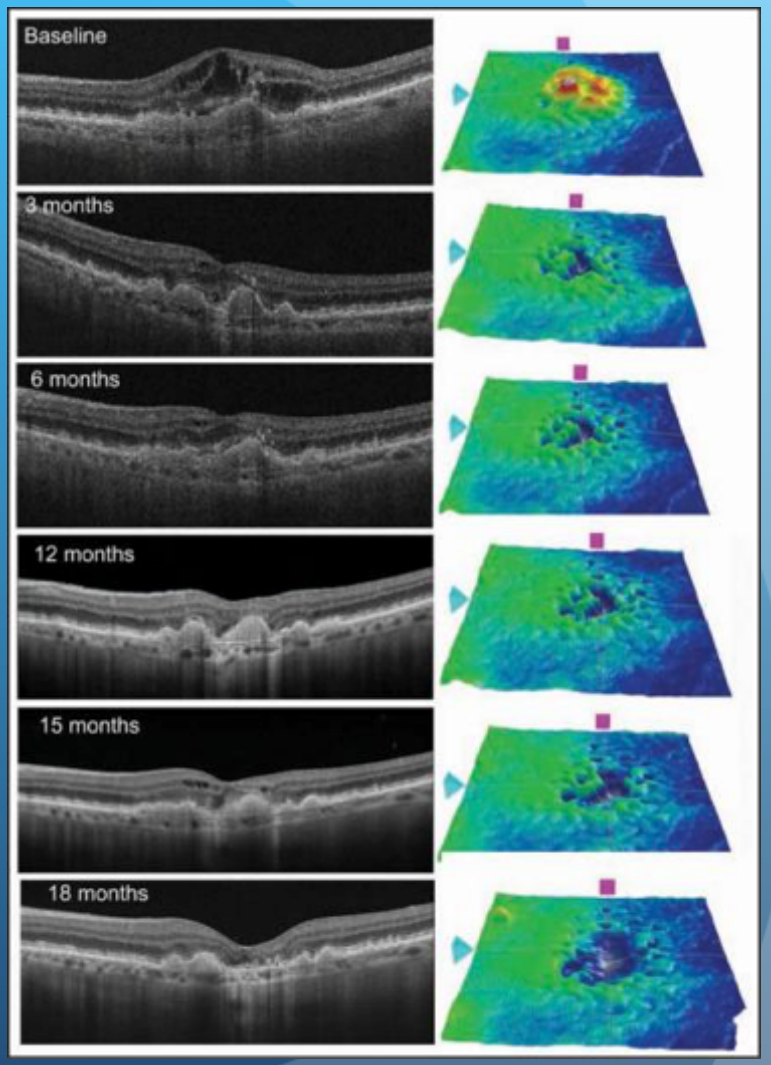
AMD: age-related macular degeneration. Source: References 5, 26.

Early stage dry ARMD interpretation/management

- Intermediate Dry ARMD
  - Defined by the AREDS as having extensive medium drusen (63–124 µm) or one or more large drusen (³125 µm in diameter) in one or both eyes.
  - The progression to advanced AMD at 5 years in this group is approximately 18% according to the original AREDS.
  - However, for patients with large drusen in one eye, the rate of development of advanced AMD at 5 years is 6.3%, whereas the rate for patients with multiple bilateral large drusen increases to 26% at 5 years.

Early stage dry ARMD interpretation/management

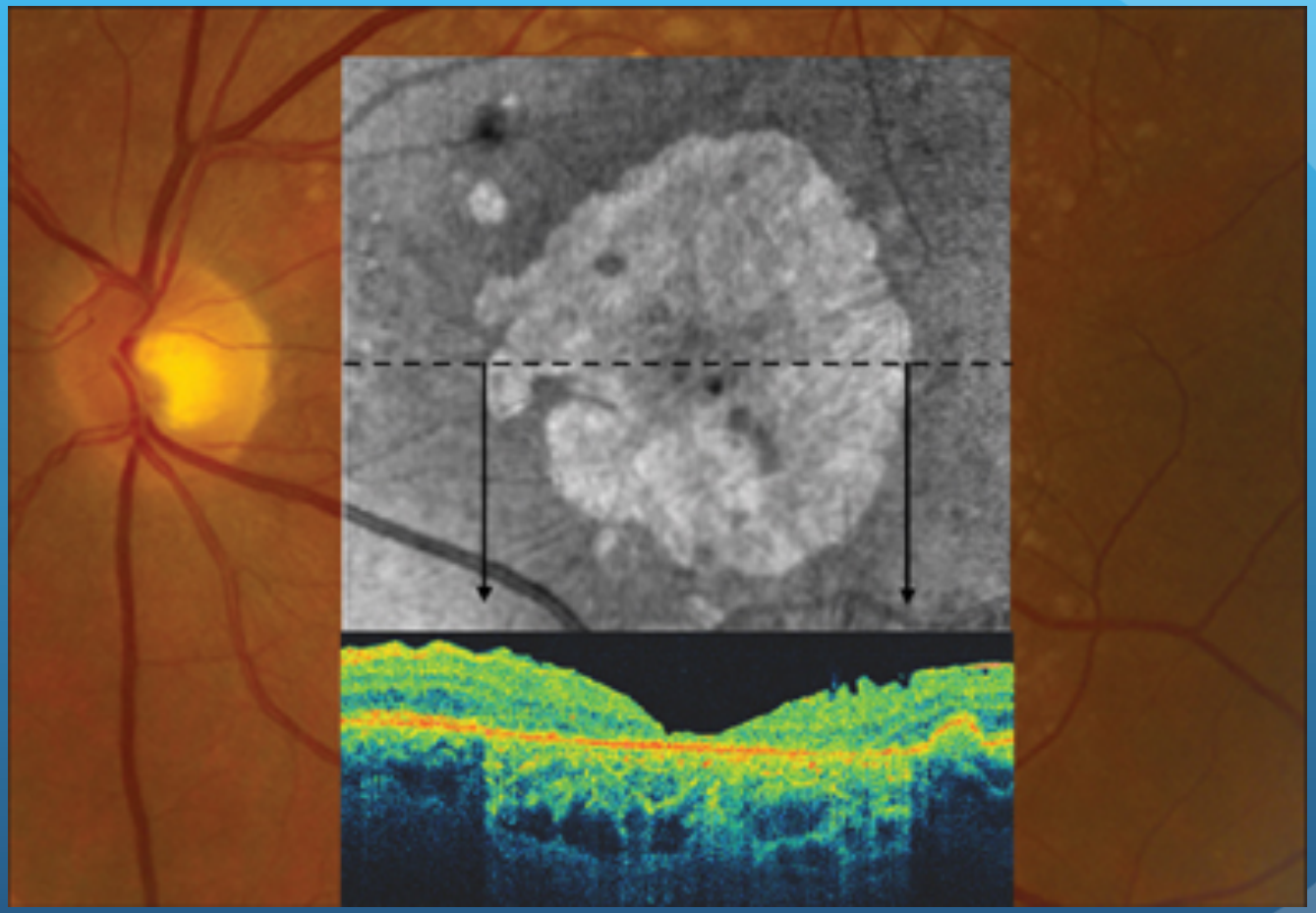




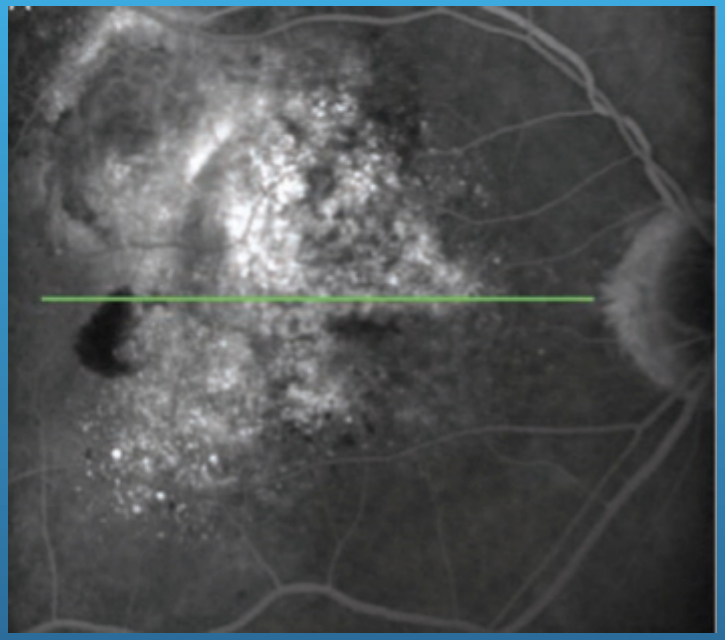
Late stage geographic degeneration OCT interpretation/management

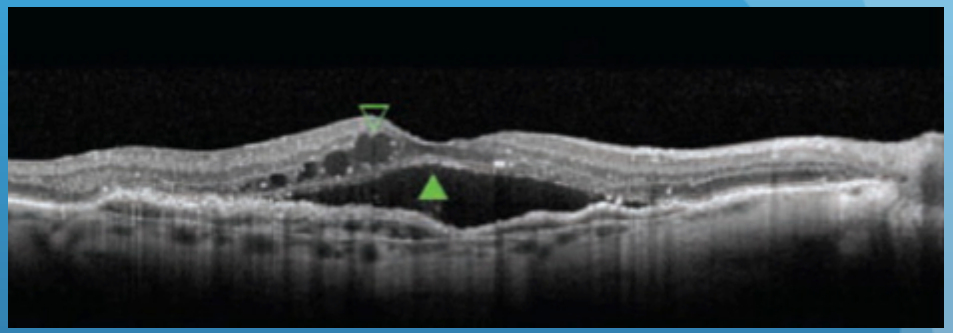
- Advanced ARMD
  - Geographic atrophy of the RPE involving the foveal center
  - Neovascular maculopathy that includes the following:
    - Choroidal neovascularization (CNV) defined as pathologic angiogenesis originating from the choroidal vasculature that extends through a defect in Bruch's membrane.
    - Serous and/or hemorrhagic detachment of the neurosensory retina or RPE
    - Retinal hard exudates (a secondary phenomenon resulting from chronic intravascular leakage)
    - Subretinal and sub-RPE fibrovascular proliferation
    - Disciform scar (subretinal fibrosis)

Late stage geographic degeneration OCT interpretation/management



Late stage geographic degeneration OCT interpretation/management





Late stage geographic degeneration OCT interpretation/management

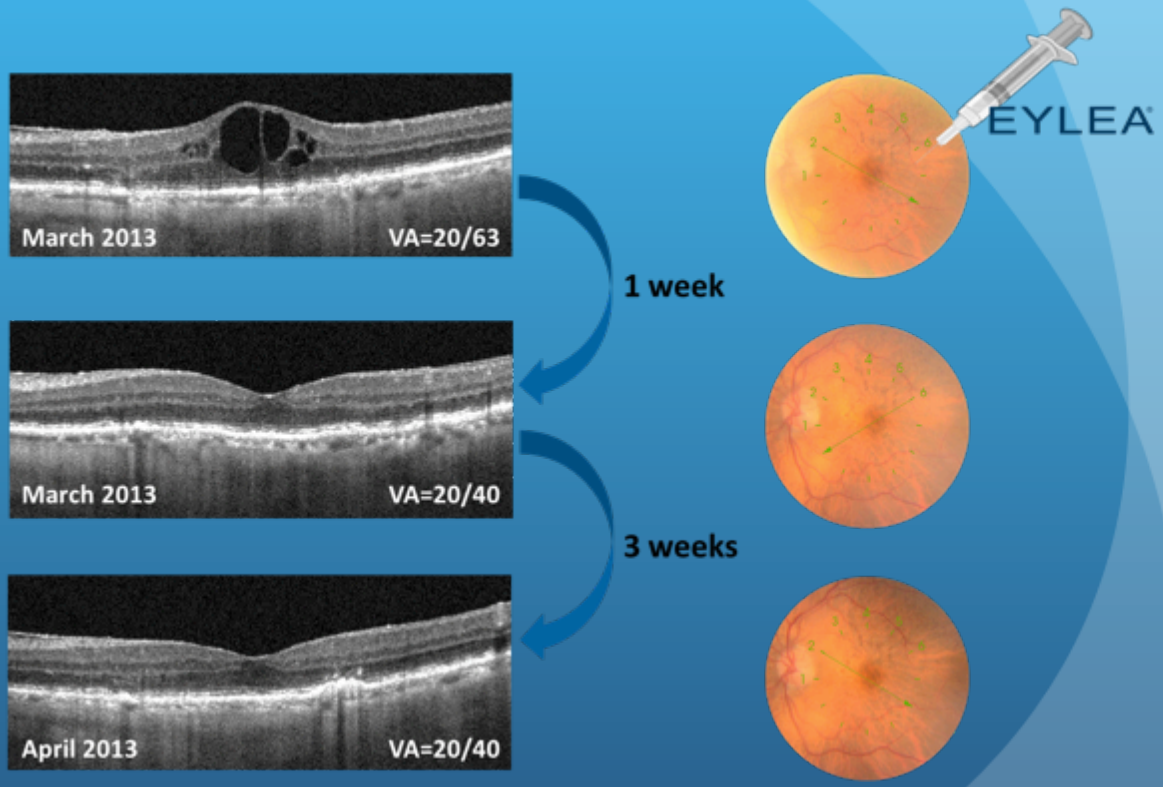
- Treating the wet form of macular degeneration may involve the use of anti-VEGF treatment, thermal laser treatment or photodynamic therapy (PDT).
- Treatment of wet macular degeneration generally reduces—but does not eliminate-- the risk of severe vision loss.
- It is important to remember that only about 10 percent of all macular degeneration cases are exudative, or wet form, and about 75 percent of these cases cannot be treated.

Review histology of Wet ARMD (CNV)

- New capillaries and fibroblasts originate from the choroid and grow through a defect in the Bruch membrane into the subretinal space or the sub-RPE space. Reactive hyperplastic RPE is present at the advancing edge of CNV.
- Specimens obtained from surgical excision of CNV reveal that the most common cellular components are vascular endothelium and RPE. These were present in more than 85% of samples.
- Fibrocytes and macrophages also have been identified in more than 50% of specimens. Extracellular components include collagen and fibrin. VEGF has been identified in the specimens obtained during submacular surgery.

Wet ARMD interpretation/ management with OCT

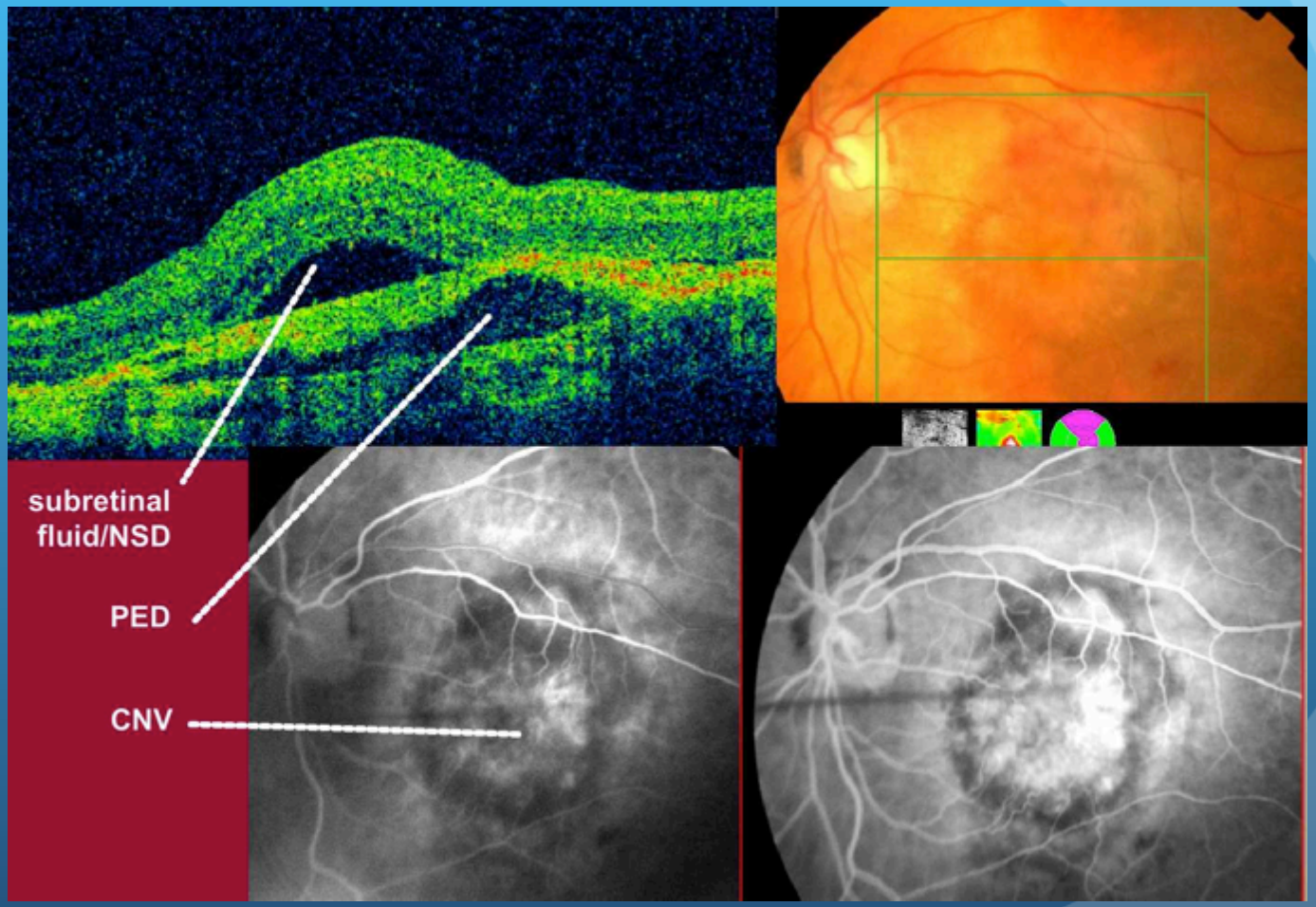
- Targeting VEGF allows a two-hit strategy: antiangiogenesis +antipermeability
  - Avastin (bevacizumab)
  - Lucentis (ranibizumab)
  - Eylea (aflibercept)
  - Macugen (pegaptanib)



Wet ARMD interpretation/ management with OCT

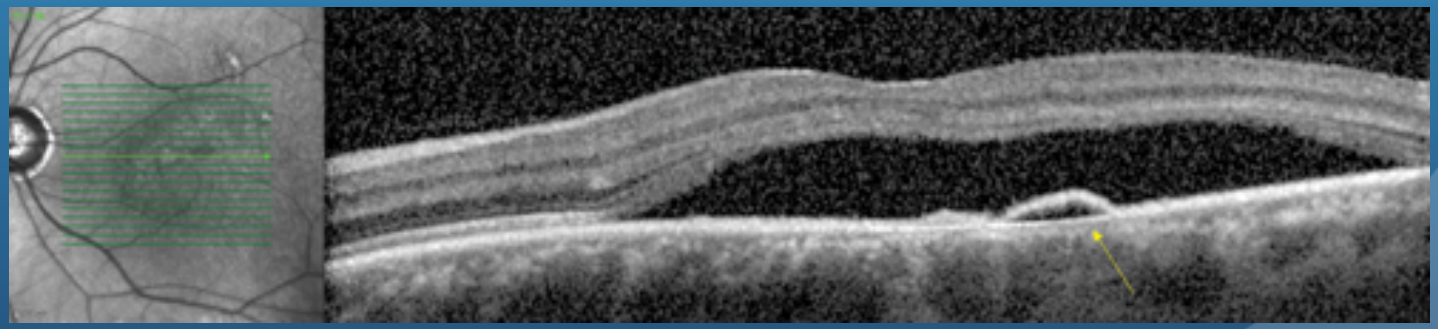
- The Macular Photocoagulation Study (MPS) proved the efficacy of laser photocoagulation in the treatment of CNV secondary to ARMD.
- PDT uses light-activated drugs and nonthermal light to achieve selective destruction of CNV with minimal effects on the surrounding normal tissues.
- Uncontrolled studies have recommended surgical excision of subfoveal CNV via pars plana vitrectomy. The goal is to remove CNV but to leave the underlying RPE and choriocapillaris intact.

Wet ARMD interpretation/ management with OCT



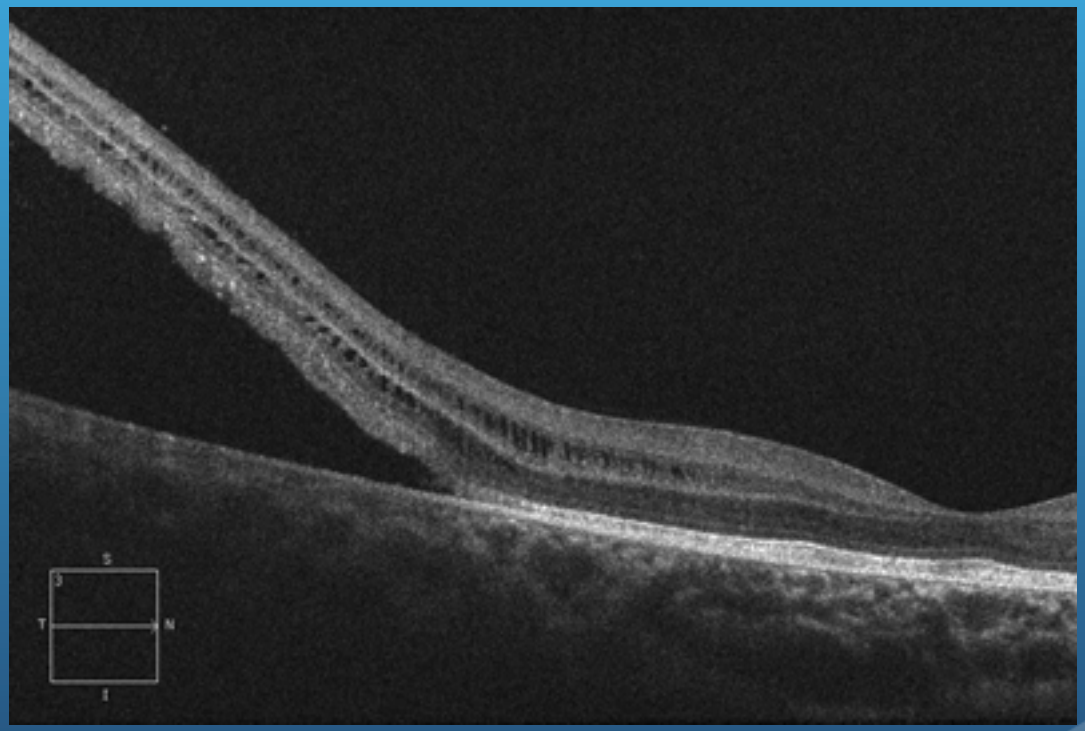
CSR Interpretation/management with OCT

- The disease classically affects men between the ages of 20 and 50 and has been associated with corticosteroid exposure, phosphodiesterase inhibitor use, obstructive sleep apnea and “type A” personality traits.
- The characteristic finding is a posterior neurosensory retinal detachment caused by leakage of fluid from the level of the retinal pigment epithelium.



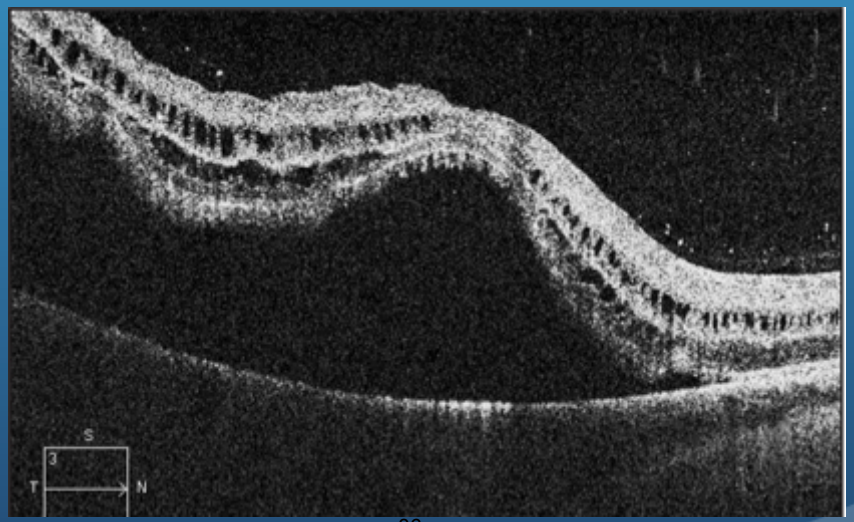
Retinal Detachment with OCT

- Macula On RD with VA 20/20. Emergency surgery within 24 hours.



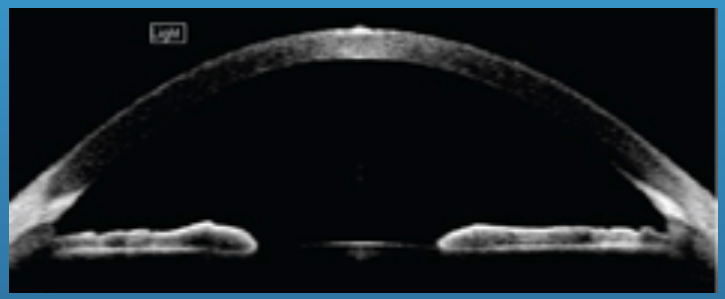
Retinal Detachment with OCT

If the macula has detached it is referred to as a “mac-off” retinal detachment and prognosis for recovery of central acuity is worse, and thus urgent treatment is less critical. Nonetheless, studies show visual recovery is best if the procedure is performed within 7-10 days.

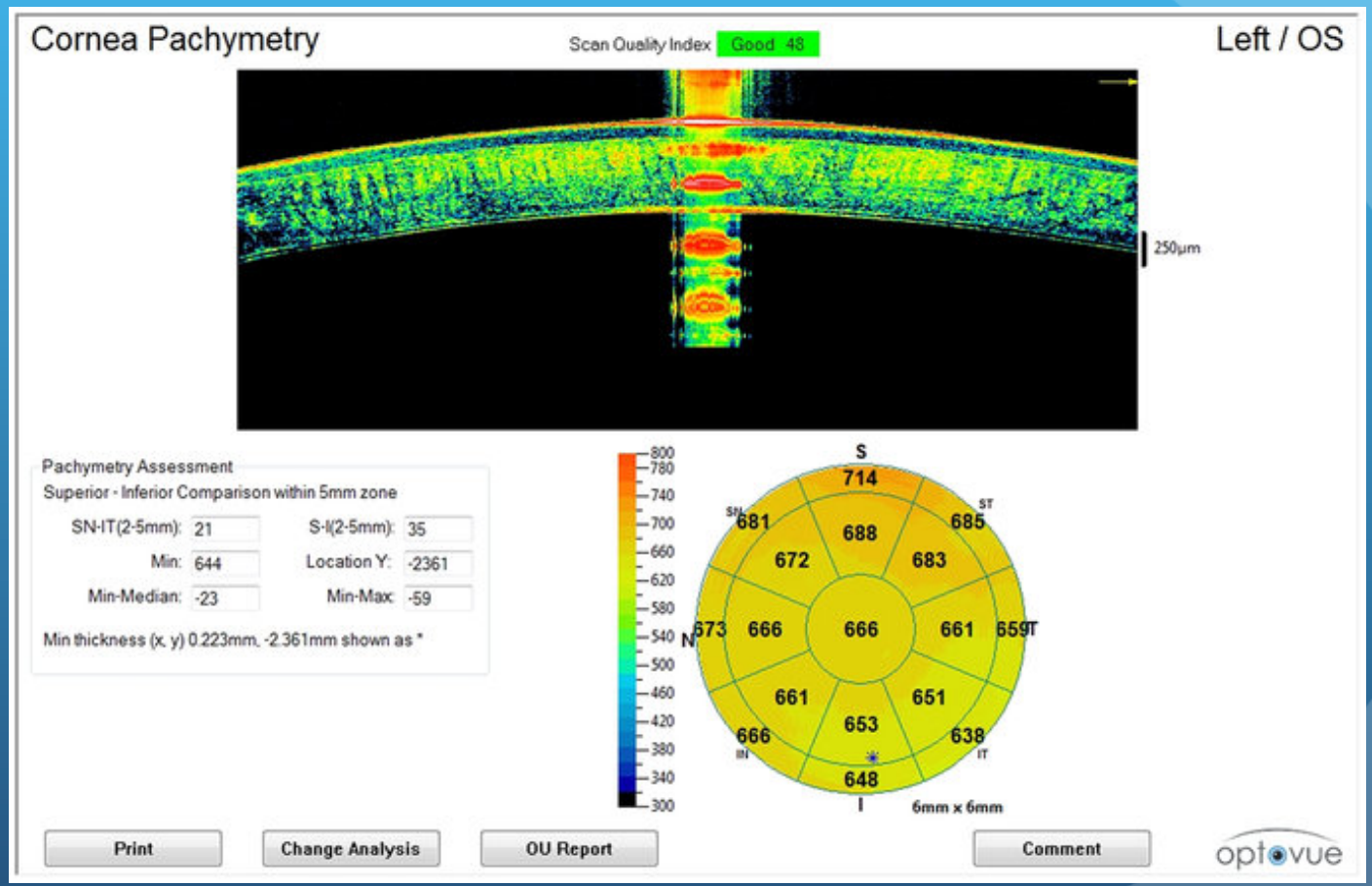


Anterior seg angles with OCT

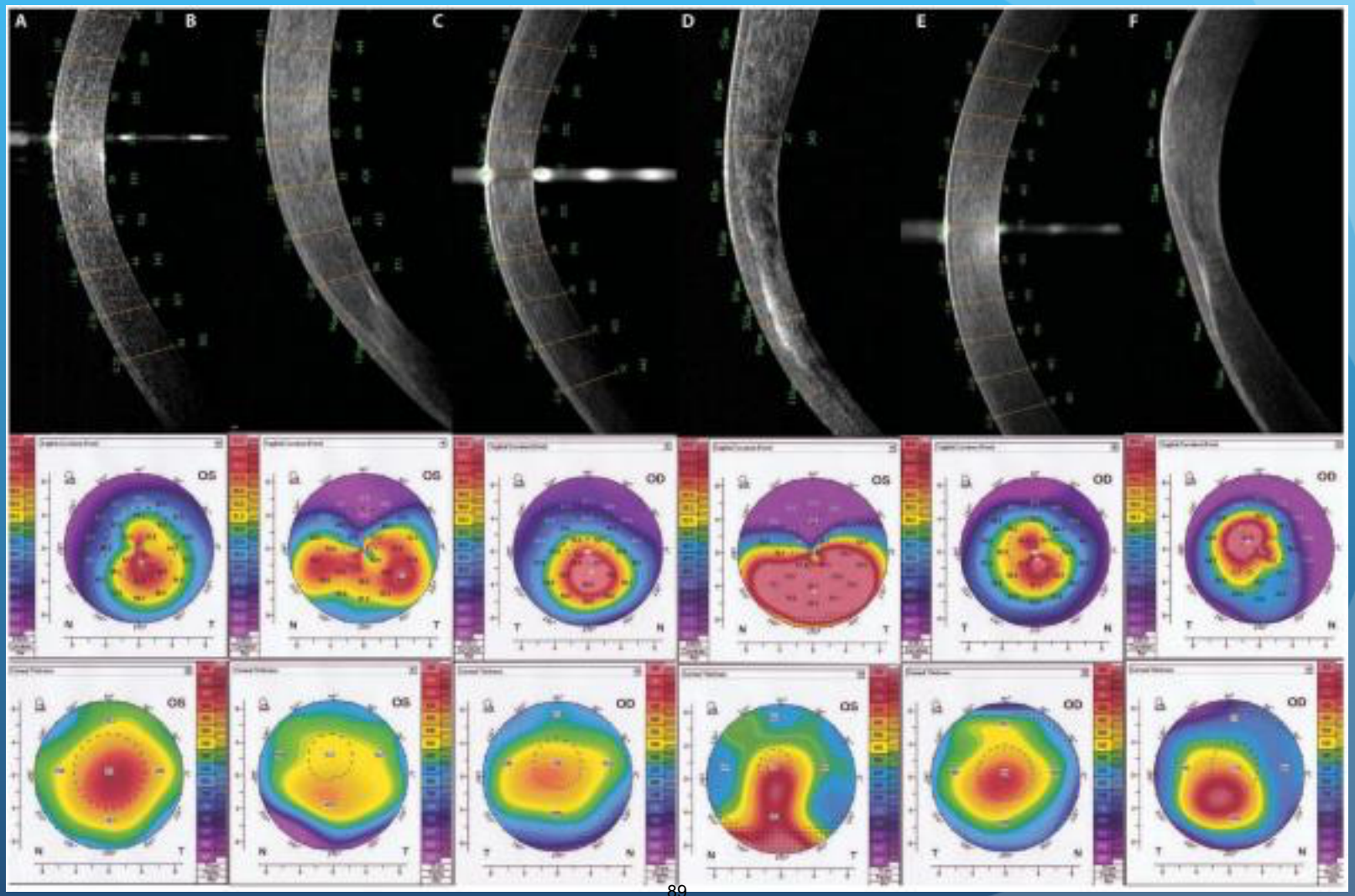
- Gonioscopy: If the posterior trabecular meshwork can't be seen for 180 degrees or more, that's considered to be an occludable angle and the patient should receive prophylactic laser.



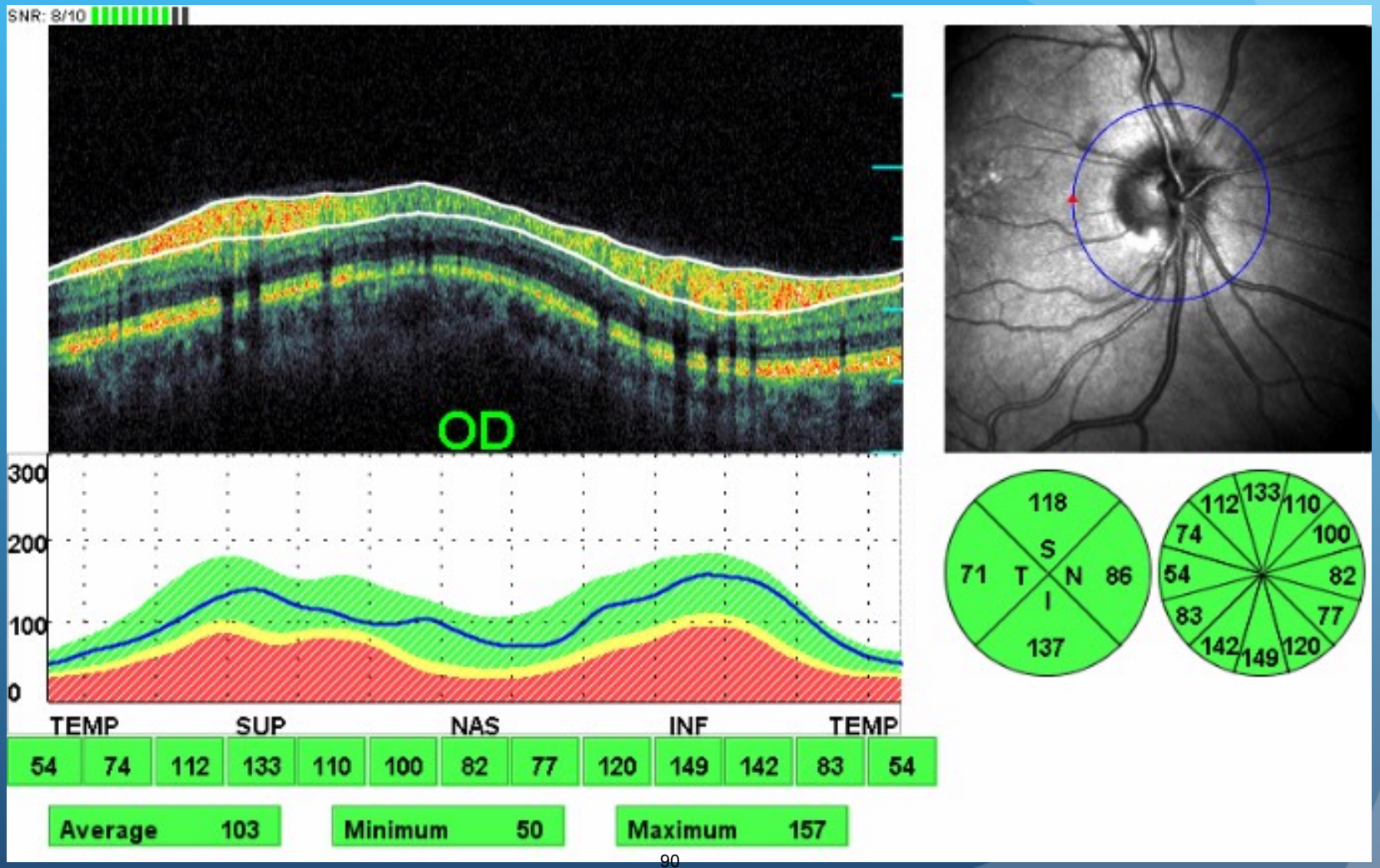
Pachymetry with OCT



Keratoconus using the OCT pachymetry



Normal RNFL interpretation with OCT

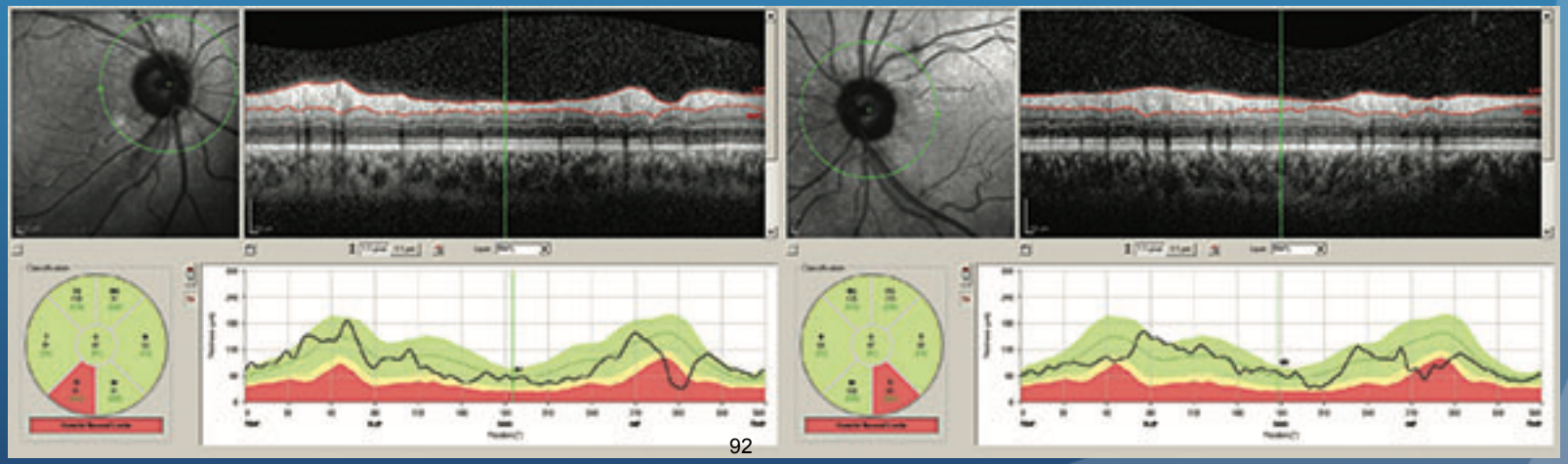


OHT interpretation/management with OCT

- Ocular hypertension is a condition in which the following criteria are met:
  - An intraocular pressure greater than 21 mm Hg in one or both eyes, as measured by applanation tonometry on 2 or more occasions
  - Absence of glaucomatous defects on visual-field testing
  - Normal appearance of the optic disc and nerve fiber layer
  - Anatomically normal, open angles on gonioscopy
  - Absence of ocular conditions contributing to the elevation of pressure, such as narrow angles, neovascular conditions, and uveitis

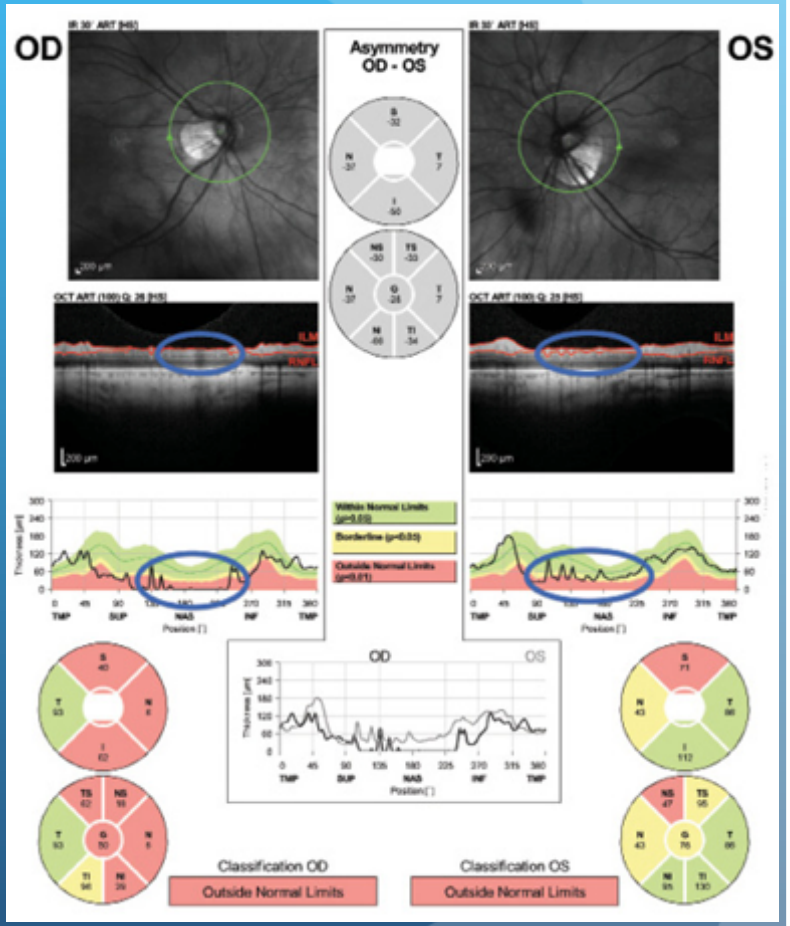
Early glaucoma interpretation/ management with OCT

- The advantage of OCT in early glaucoma is that it can detect damage that is not measurable with any other technology.
- Need to lose approximately 20 percent of her retinal nerve fiber layer before a visual field defect is likely to be present.
- Helpful to compare one eye to the other and look for asymmetry. Asymmetry, especially in the supero- or infero-temporal regions, provides a clue that it could be early glaucoma.

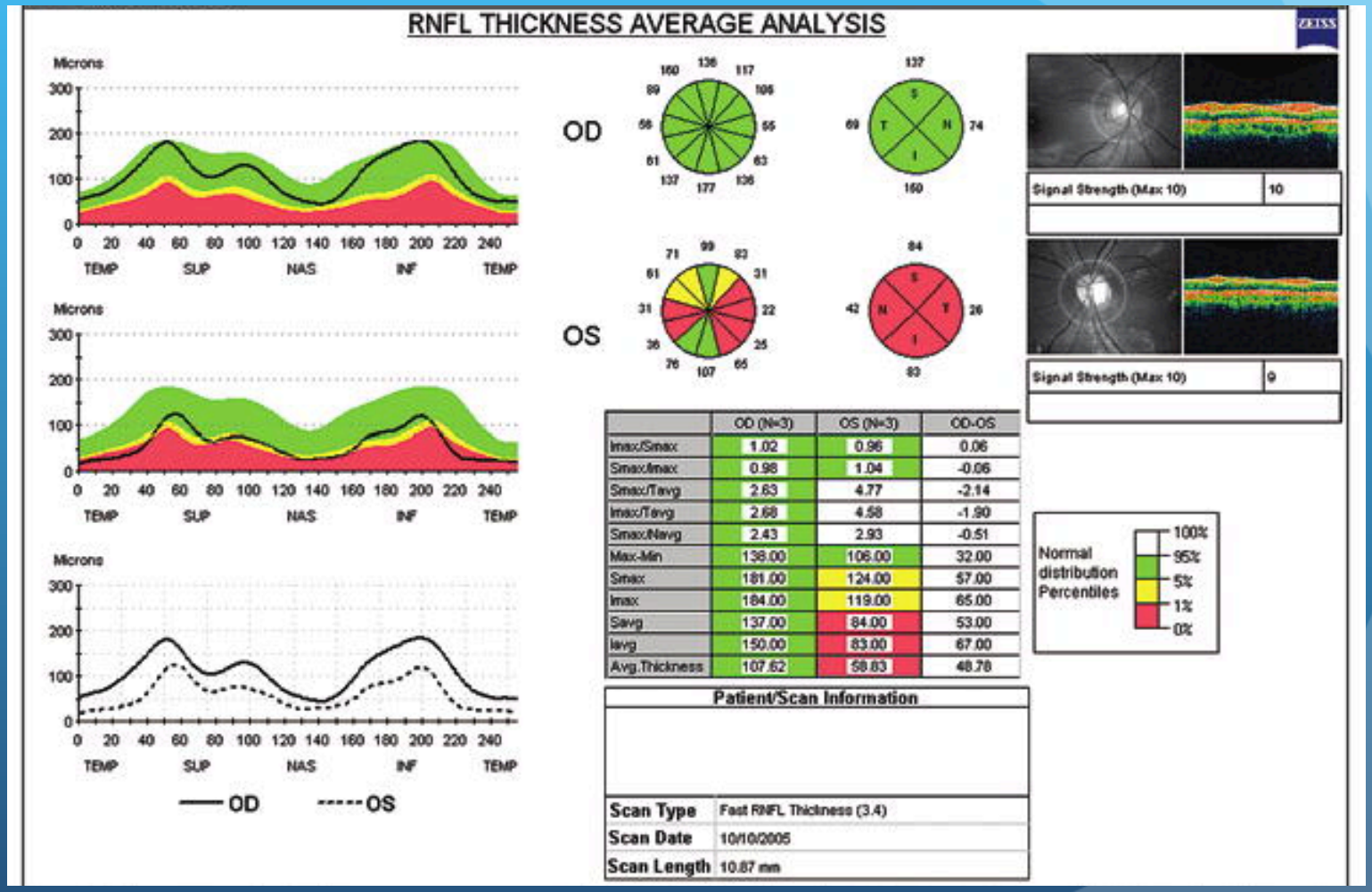


Late stage glaucoma interpretation/ management with OCT

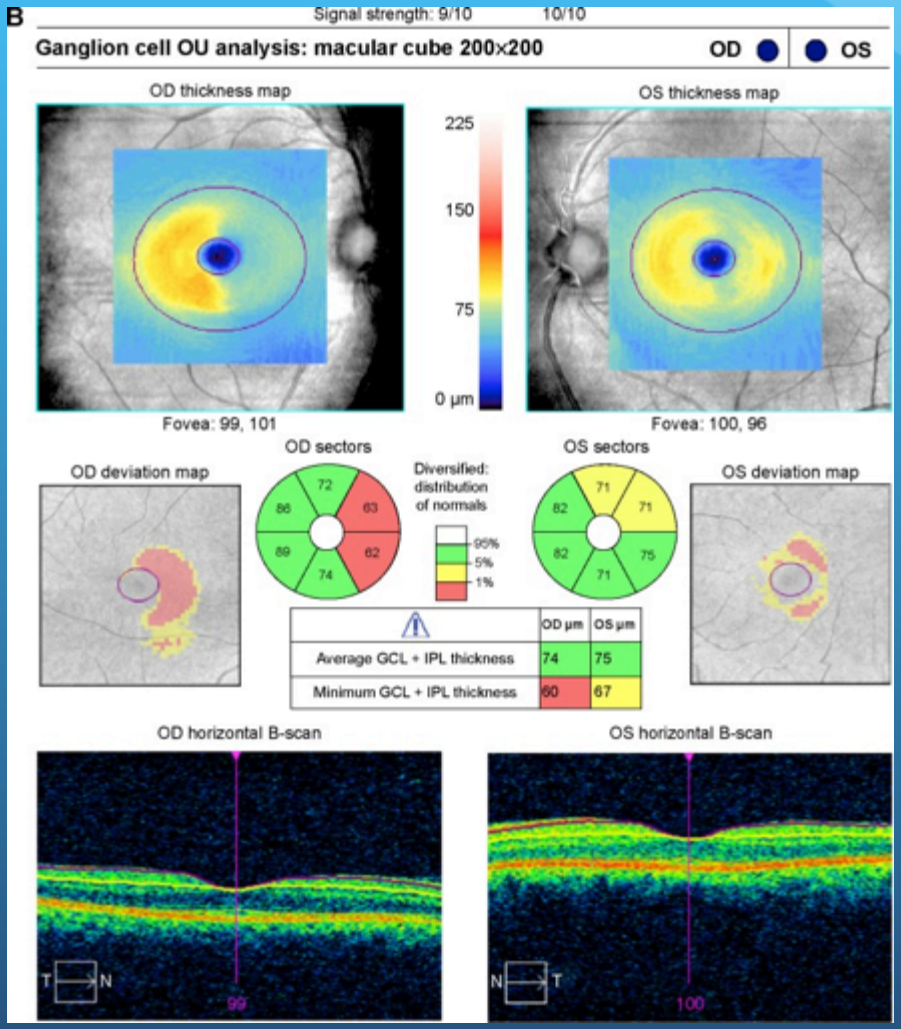
- In the advanced stages of glaucoma, the standard 24-2 visual fields may no longer be very sensitive to subtle progression.
- Imaging technologies such as SD-OCT also encounter problems with advanced optic nerve damage. On the SD-OCT measurements of the RNFL, the so-called floor effect becomes relevant in eyes with severe thinning. RNFL thinning levels off at approximately 40 to 50 µm, perhaps due to residual glial tissue, blood vessels, or other nonneural tissue.



MS interpretation/management with OCT

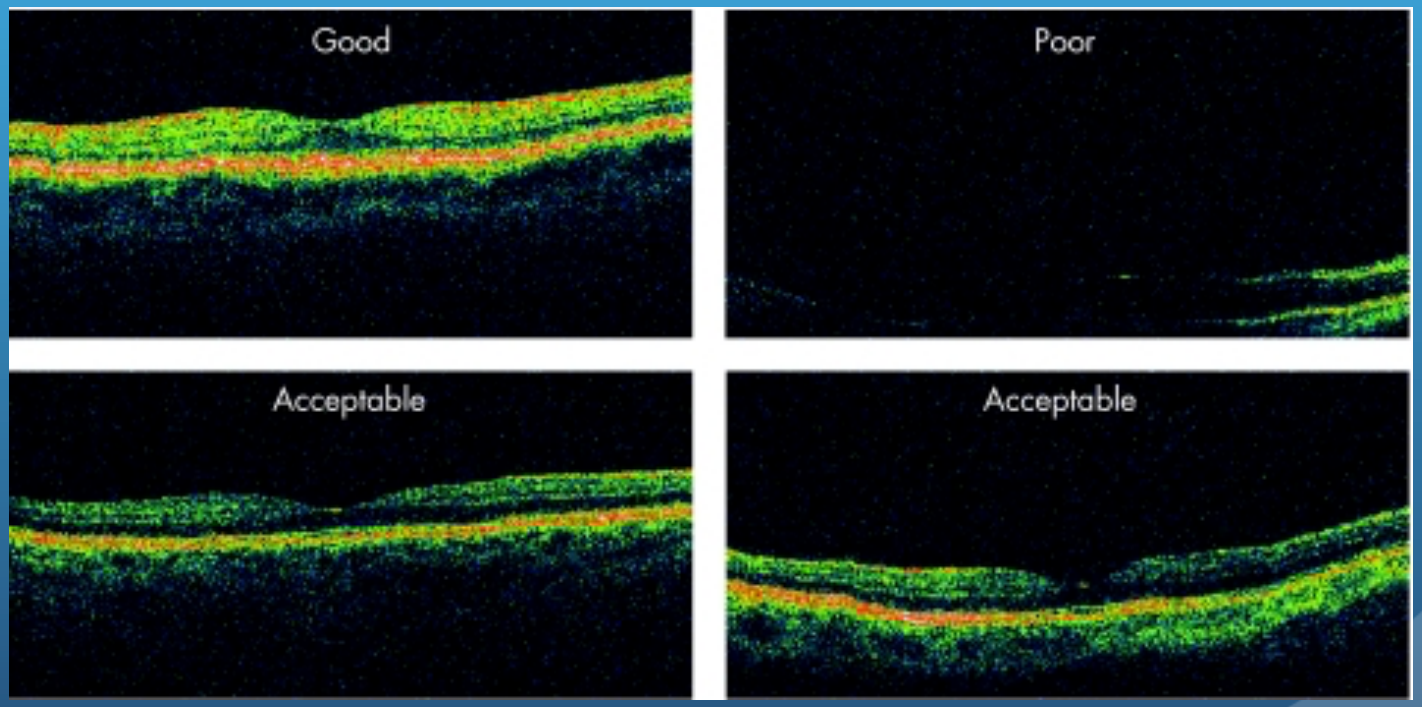


Brain trauma interpretation/ management with OCT



Detecting PSC with OCT

- Nuclear cataracts have less influence on OCT image quality relative posterior cataracts.



My gold standard to practice with OCT

Central California Optometric Society
&
Tulare-Kings Optometric Society
Cordially Invite You To Attend

The Inaugural Joint Society CE Program

"Common Subclinical Retinal Diseases.
Diagnosis & Management Utilizing OCT"
2-Hour CE Approval Pending

Guest Speaker:
Dr. Kenneth E. Ekelund, OD
Ekelund Vision Center
Redding, California

Dinner Program Sponsored by

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Thursday, September 8, 2016
6:00 PM – 8:30 PM
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TKCOS Members email your RSVP to TSuorsa@msn.com

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07/23/2015

Resume: Kenneth Errol Ekelund, O.D.

1975 Graduate of SCCO

1975-1987: Associate/Clinic Director with Carl Ebersole M.D.

1984-1997: Associate with Lee Nordan M.D., in refractive surgery (MKM, RK, ALK, PRK, Lasik)

1987-Present: Established solo private practice: General Optometry

1999-2008: Partnership/ clinic director, with Tom Tooma M.D., established lasik center in my private practice creating TLC Redding, Calif.

2013-2014: Optometry liaison with NVision/Tom Tooma M.D. NPB, Calif.

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Lecture Title: Common Subclinical Retinal Diseases. Diagnosis and Management Ulitizing OCT

Course Catagory: Ocular Disease

Slide 1: OCT History / 4 Paradigm Shift.
Slide 2: Review of Retinal Anatomy with gray scale retinal layers
Slide 3: OCT Importance in daily practice:
Slide 4: Review of Retinal History
Slide 5: Choroid Complex review:
Slide 6: Mueller/glia cell review and function
Slide 7: 4 Categories of Retinal Disease with OCT
Slide 8: Diagram review of macula fovea faz foveola dimensions
Slide 9: Comparsion of fundus photo vs cross section OCT view of posterior pole
Slide 10: Outer layer retina view of cross section OCT is/os junction and its importance
Slide 11/12/13/14/15/: Review of PVD Partial PVD (APVD) development and stats
Slide 16: APVD creating multiple VRI maculopathies
Slide 17: OCT scans of VMA/VMT
Slide 18/19/20/ : VMA/VMT types and new classification due to OCT
Slide 21: Schematic flow chart of VRI pathology.
Slide 22/22/23/24/25/: VMA/VMT broad vs focal adhesion with OCT
Slide 26: New Classification of macular holes due to OCT
Slide 27: Pre op OCT to create better post op outcomes and expection with OCT
Slide 28: OCT thickness maps of macula importance for managing pre and post op retinal pathology
Slide 29/30/31/: What makes a good candidate for VMT treatment with Jetrea
Slide 32: Measurement for macula hole to determine Jetrea vs PPV
Slide 33/34: Types of Lamellar Holes interpretation and/management with OCT
Slide 3536/37/: Pseudohole interpretation and management with OCT
Slide38/39/40: Post op macular hole interpretation with OCT
Slide 41/42/43/44/45/: ERM/Macular Pucker interpretation and management with macular thickness maps with OCT
Slide 46: Middle layer retina showing CME interpretation/management with OCT
Slide 47/48/49/50: Middle lalyer retina BVO interpretation/mangement with OCT
Slide: Review of the choroid complex anatomy.
Slide 49/50/51/52/53/: Early stage dry ARMD interpretation/management
Slide 54/55/56/57/: Late stage geographic degeneration OCT interpretation/management
Slide 58: Review histology of Wet ARMD (CNV)
Slide 59/60/61/: Wet ARMD interpretation/management with OCT
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Slide 73: Brain trauma interpretation/management with OCT
Slide 74: Detecting PSC with OCT
Slide75: My 4 th upgrade OCT and my gold standard to practice with OCT