

LOC Meeting - 15.2.2022
Wakefield

Interpretation of OCT Macula

EA Luhishi

Eye Centre

Pinderfields Hospital

Wakefield

UK



Multimodal Images

- The approach to diagnose a single retinal disease by combining different imaging
- Includes
 - Colour photos
 - OCT
 - FAF
 - IR reflectance
 - OCTA
 - FFA
 - ICG

Aims

- Normal anatomy / histology of macula
- Correlating histology & OCT
- Disorders of vitreoretinal interface
- Inner / Outer retinal disorders
- Choroid
- Vitreopapillary interface disorders
- OCTA
- Interpreting OCT macula
- Cases

OCT posterior segment

☐ Macula

- OCT of vitreoretinal interface (VRI)
- OCT macular retinal NFL
- OCT of macular ganglion cell layer (GCL) and inner plexiform layer
- OCT of outer retinal layers
- OCT of choroid

☐ Optic disc

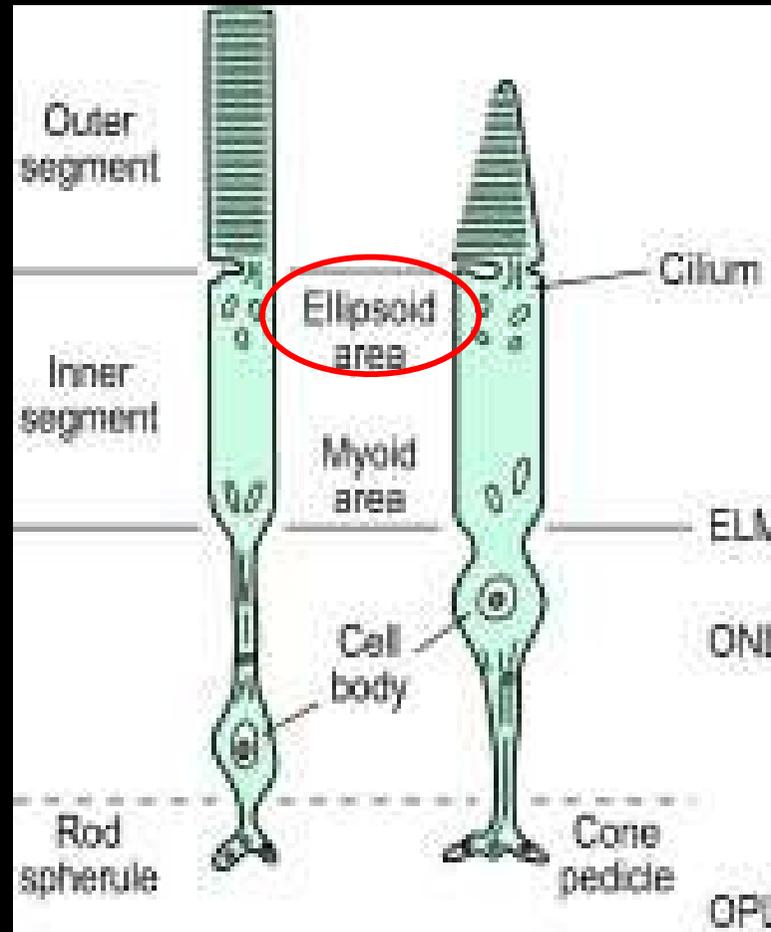
- Volume/cross sectional scan of optic disc
- OCT of peripapillary retinal NFL

☐ Other:

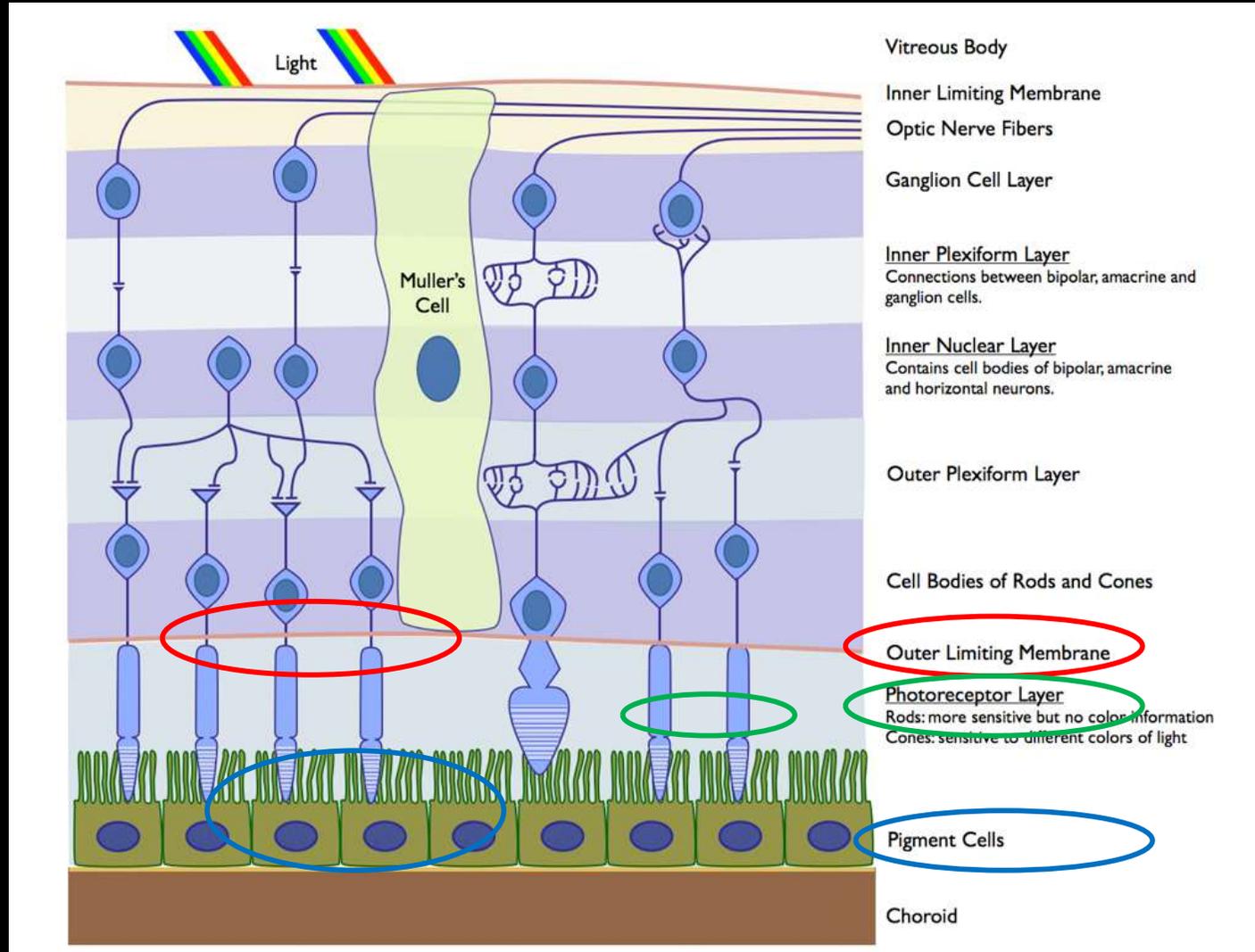
- Wide field OCT
- OCT angiography (OCTA)

Retinal Layers

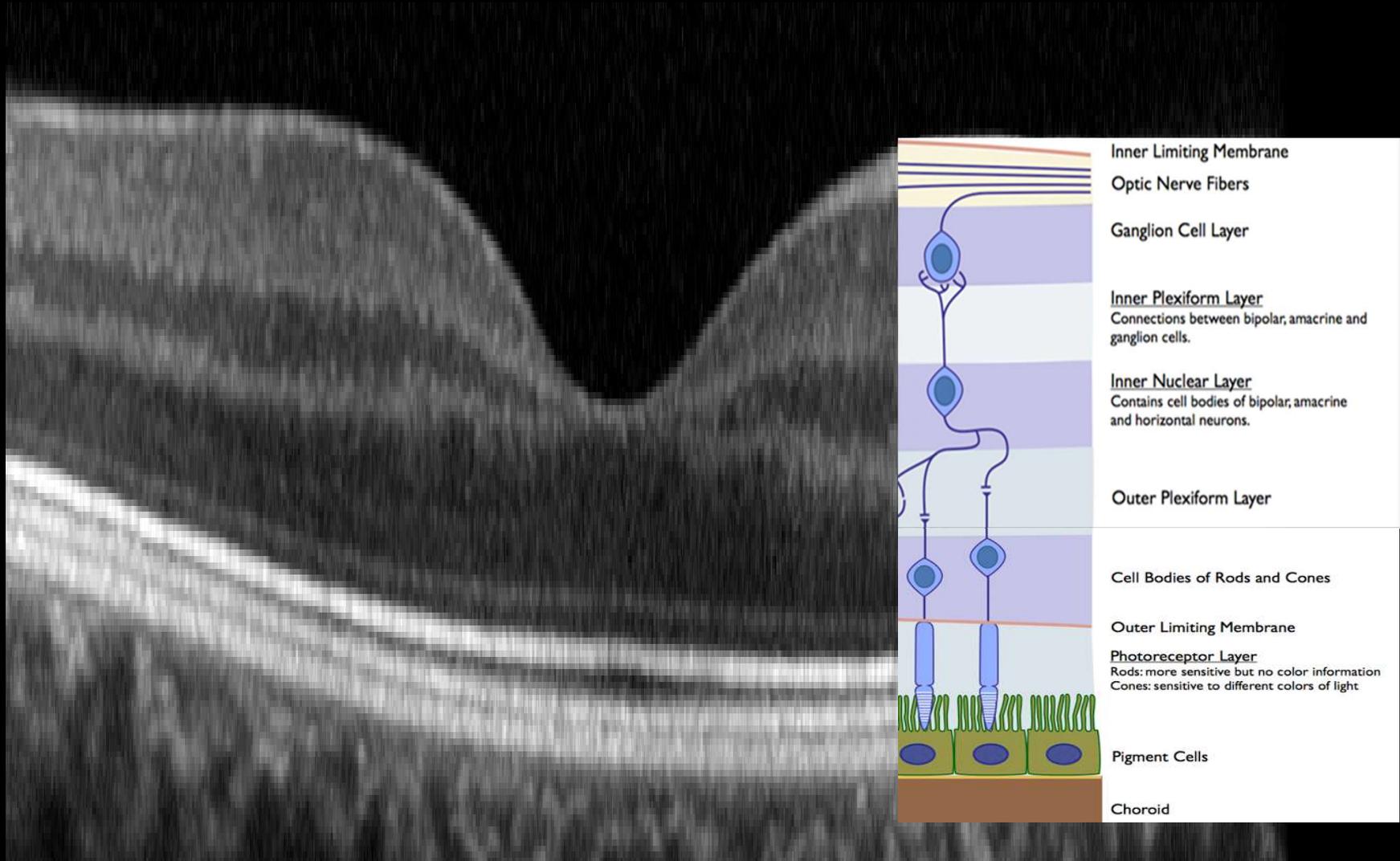
Retinal Photoreceptors



Normal Retinal Layers

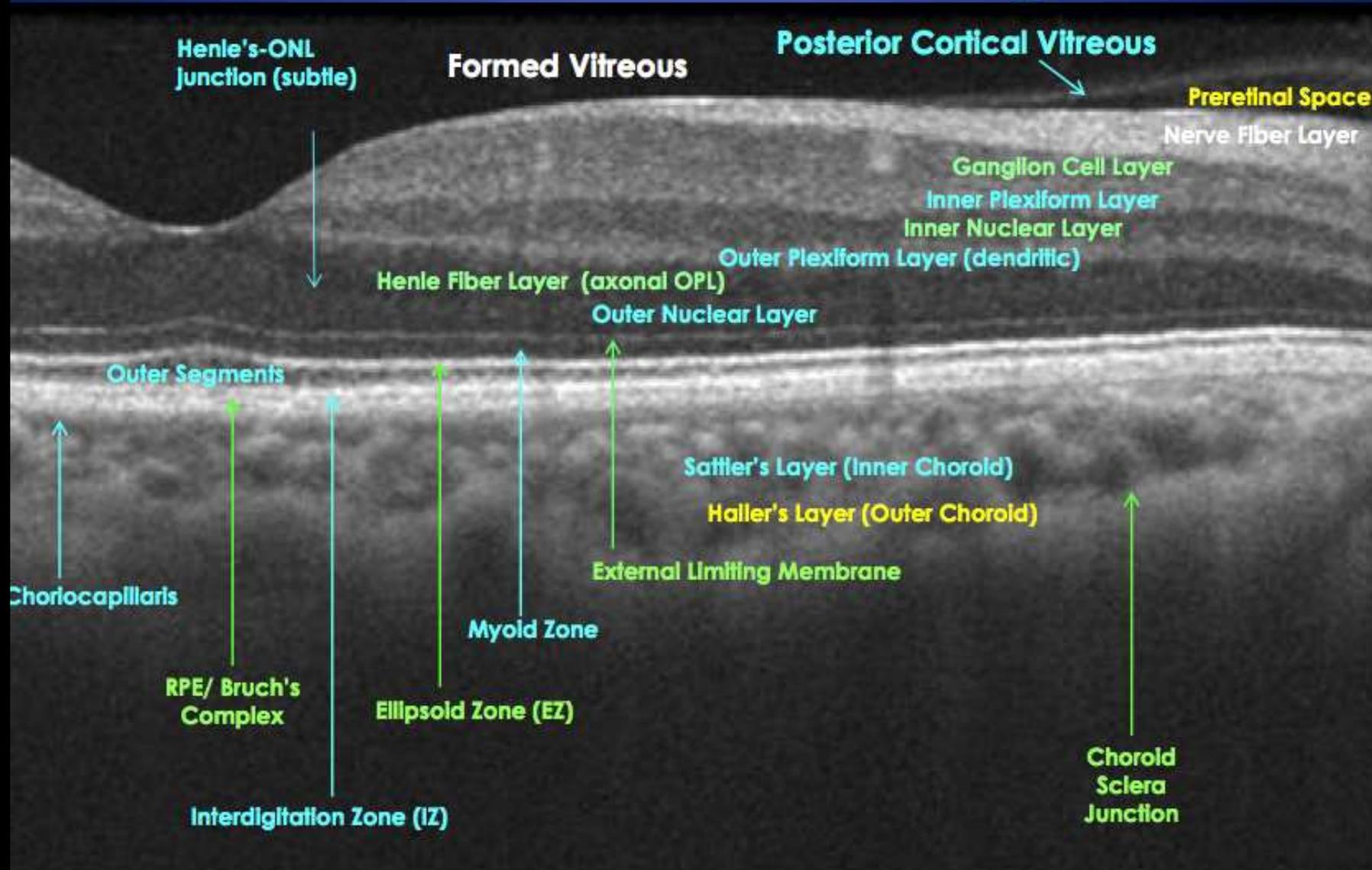


Normal OCT Macula – The Outer retinal Layers

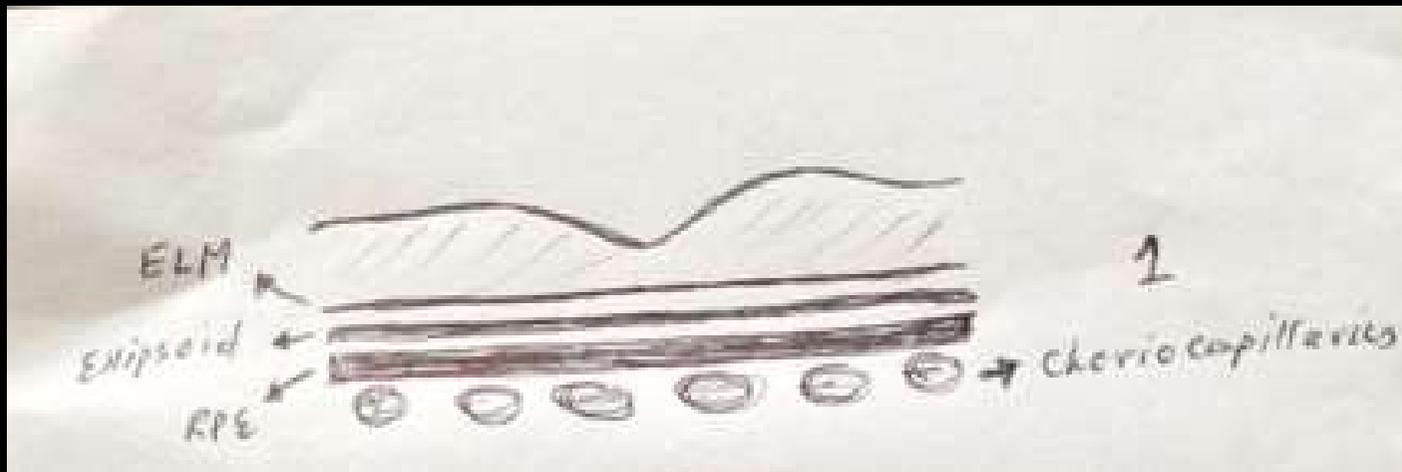
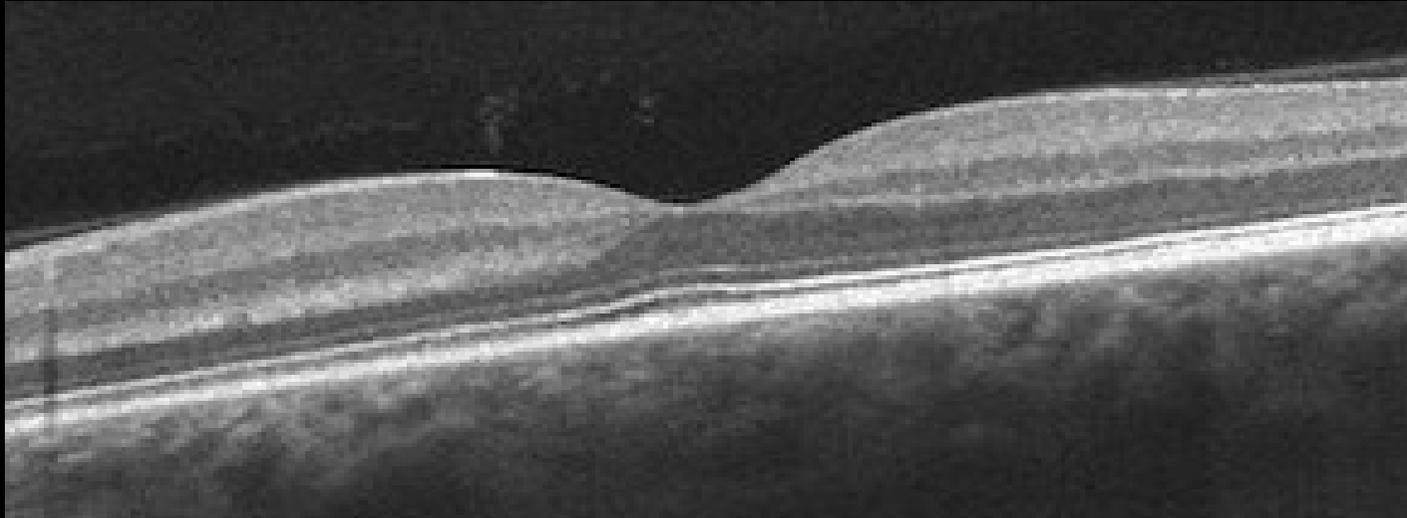


International Nomenclature for OCT Meeting

Consensus Normal OCT Terminology



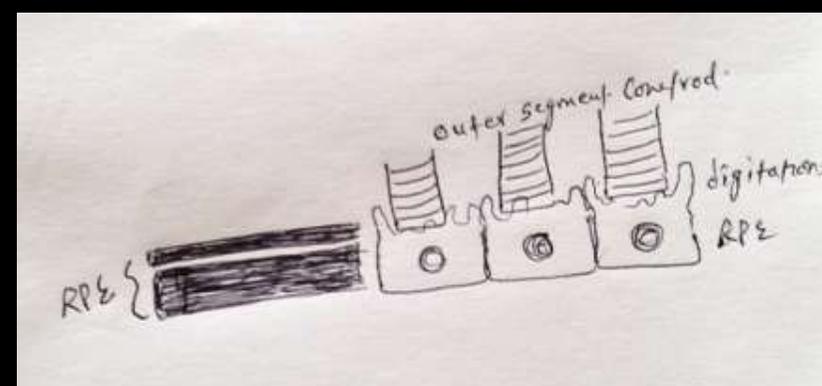
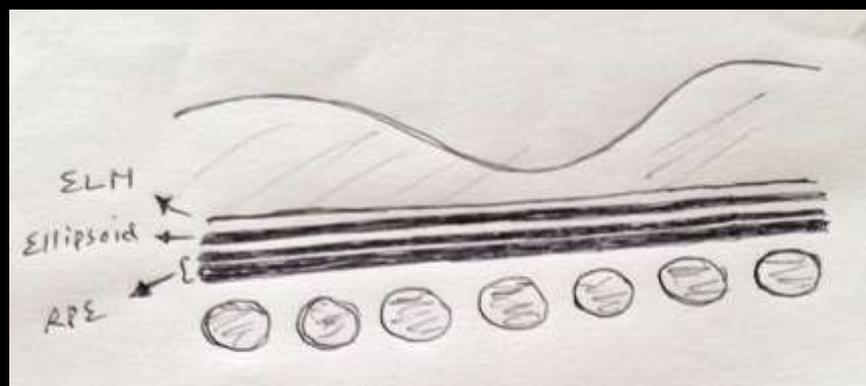
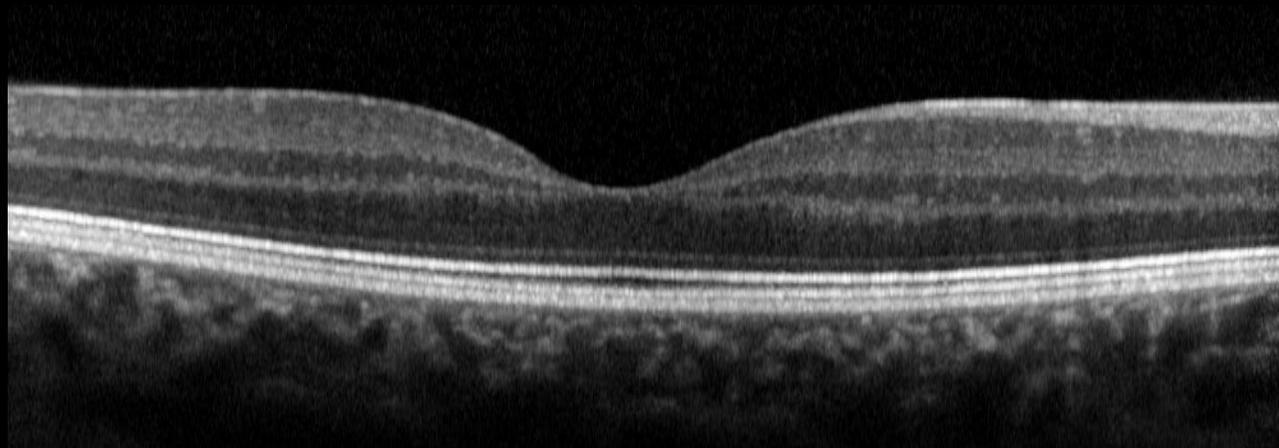
Normal OCT Macula – The Outer Retinal Layers



ELM: External Limiting Membrane

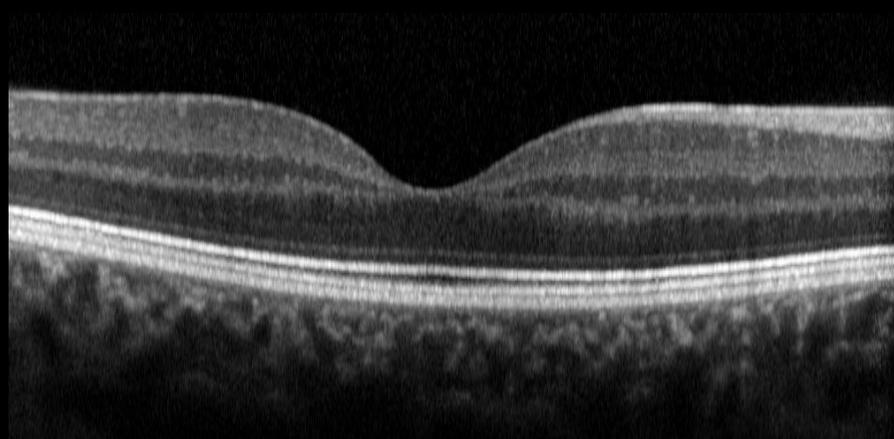
<http://www.northerneyesurgeons.com.au/oct-scanning>

Normal OCT Macula – The Layers

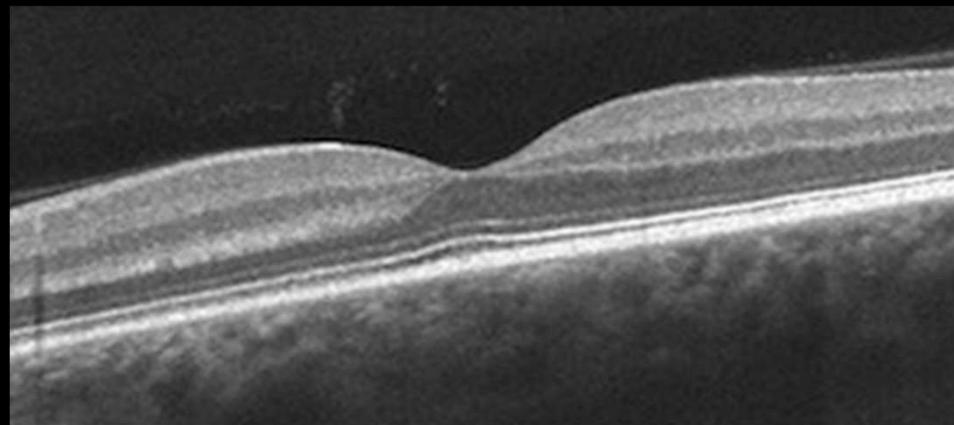


ELM: External Limiting Membrane

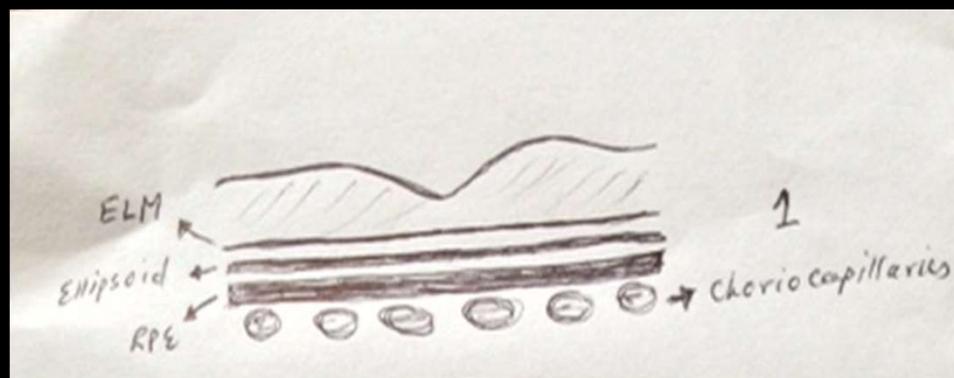
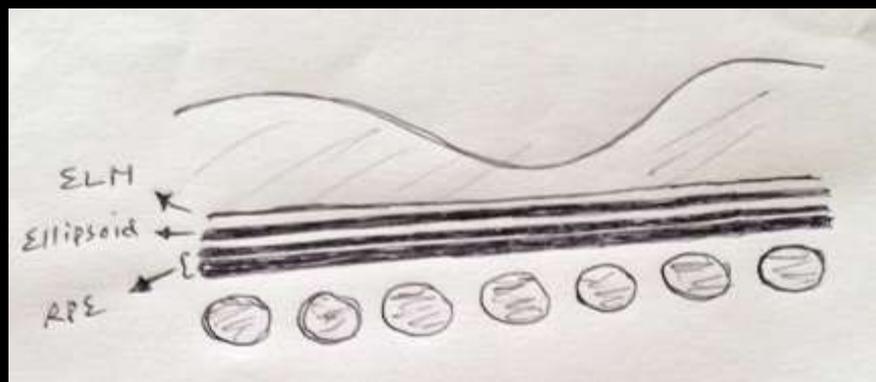
Normal OCT Macula – The RPE



2 Layers

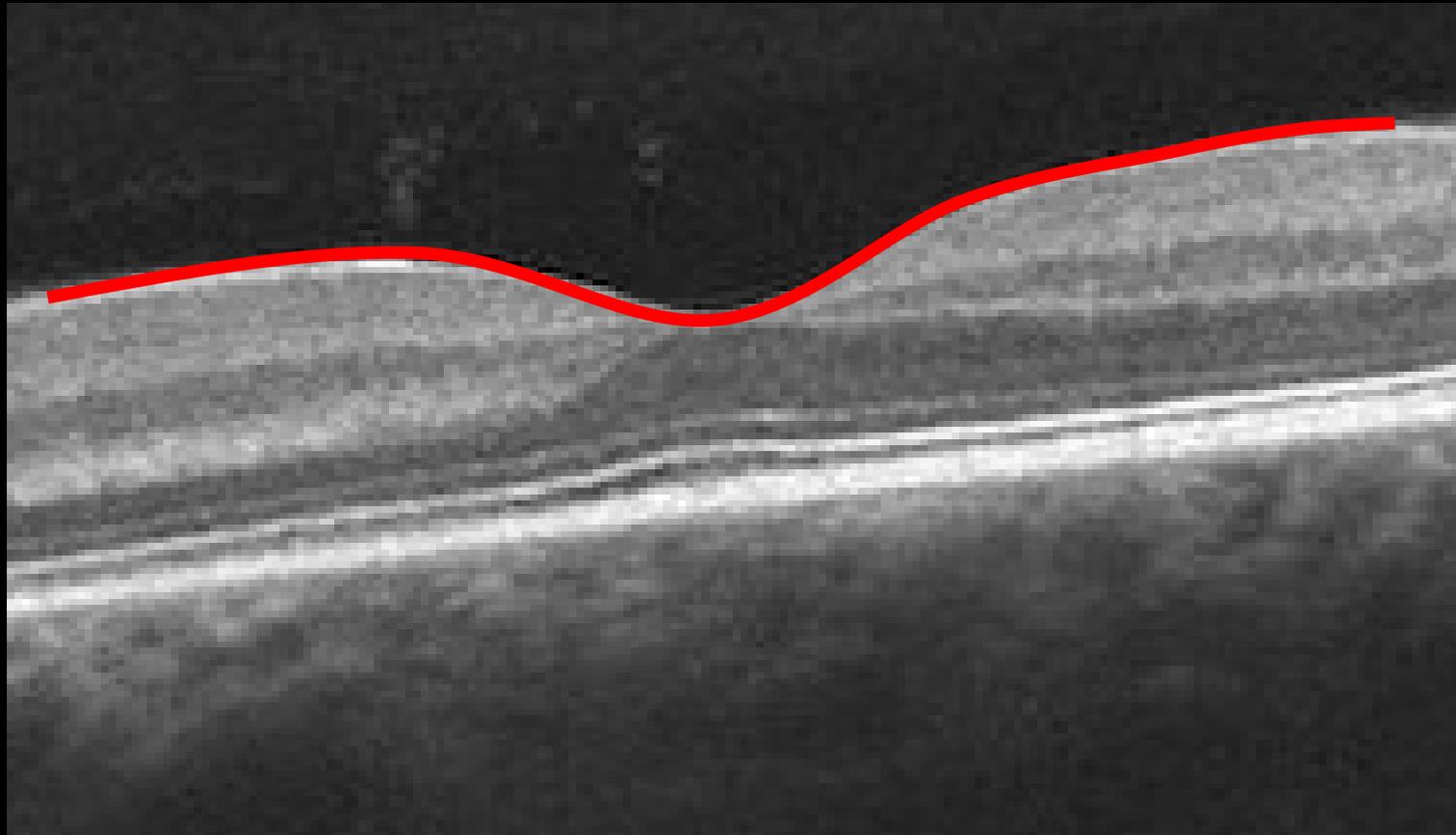


1 Layers



Disorders of Vitreomacular Interface

Vitreomacular Interface (VMI)



Evolution of PVD = Johnson Classification Scheme

- Stage 1
 - PVD begins in perifoveal macula
- Stage 2
 - Extends next into superior and temporal midperiphery then into fovea
- Stage 3
 - Then extends inferior midperiphery
- Stage 4
 - Finally the optic disc margin resulting in complete PVD – often with Weiss Ring

Johnson MW. *Trans Am Ophthalmol Soc.* 2005;103:537-67.

Vitreoretinal Interface (VRI) Disorders

- VMA = Vitreomacular adhesion
- APVD = anomalous PVD
- PVS = Posterior vitreoschisis
- PPVP = Posterior precortical vitreous pocket
- VMTS = vitreomacular traction syndrome
- VPTS = vitreopapillary traction syndrome
- TTPH = Taught thickened posterior hyaloid
- PTILM = Postvitrectomy taut ILM

Anomalous PVD

- Due to imbalance between the degree of gel liquefaction & weakening of vitreous adhesion
- If degree of vitreous liquefaction more than degree of weakening of vitreous → anomalous and strong vitreoretinal traction

Anomalous PVD

This may cause:

- Vitreomacular Traction Syndrome (VMTS)
- Retinal or intravitreal haemorrhage
- Macular pucker
- Posterior vitreous schisis (PVS)
- Myopic retinoschisis (MRS)
- peripheral retinal tears/ RD
- Vitreopapillary Traction Syndrome (VPTS)
- Wet AMD (nAMD)
- Aggravate NVD & NVE
- Retinal vascular occlusion

Anomalous PVD

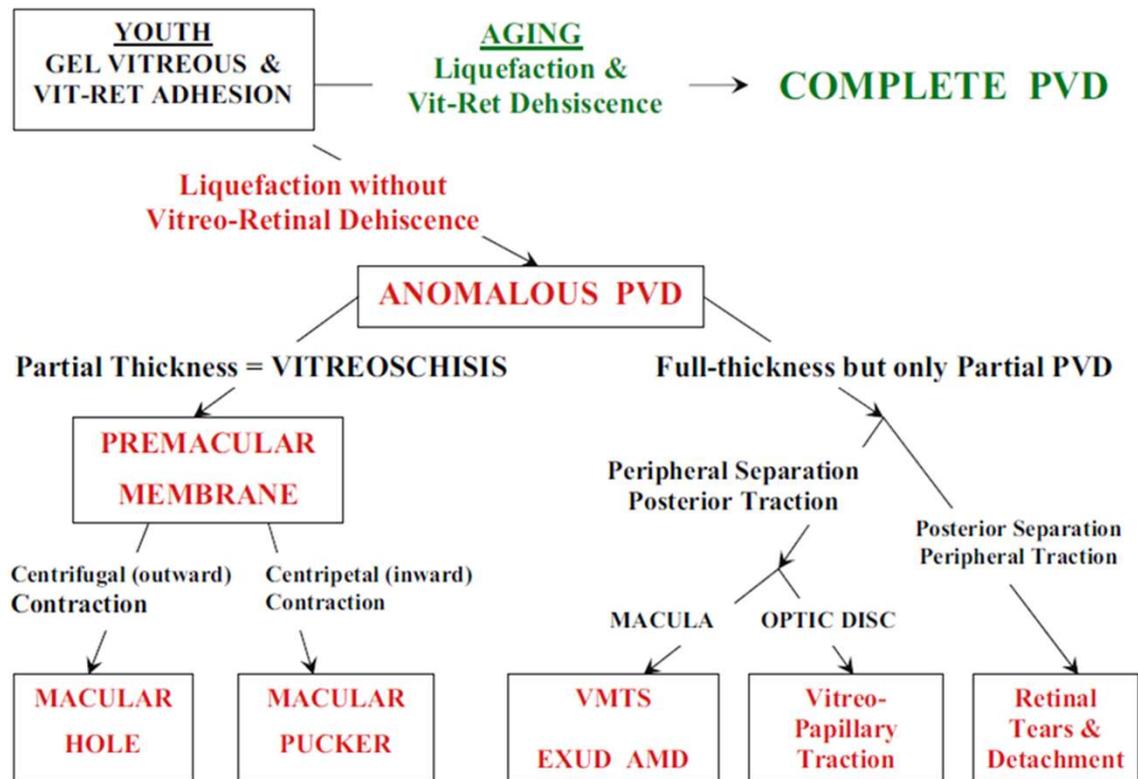
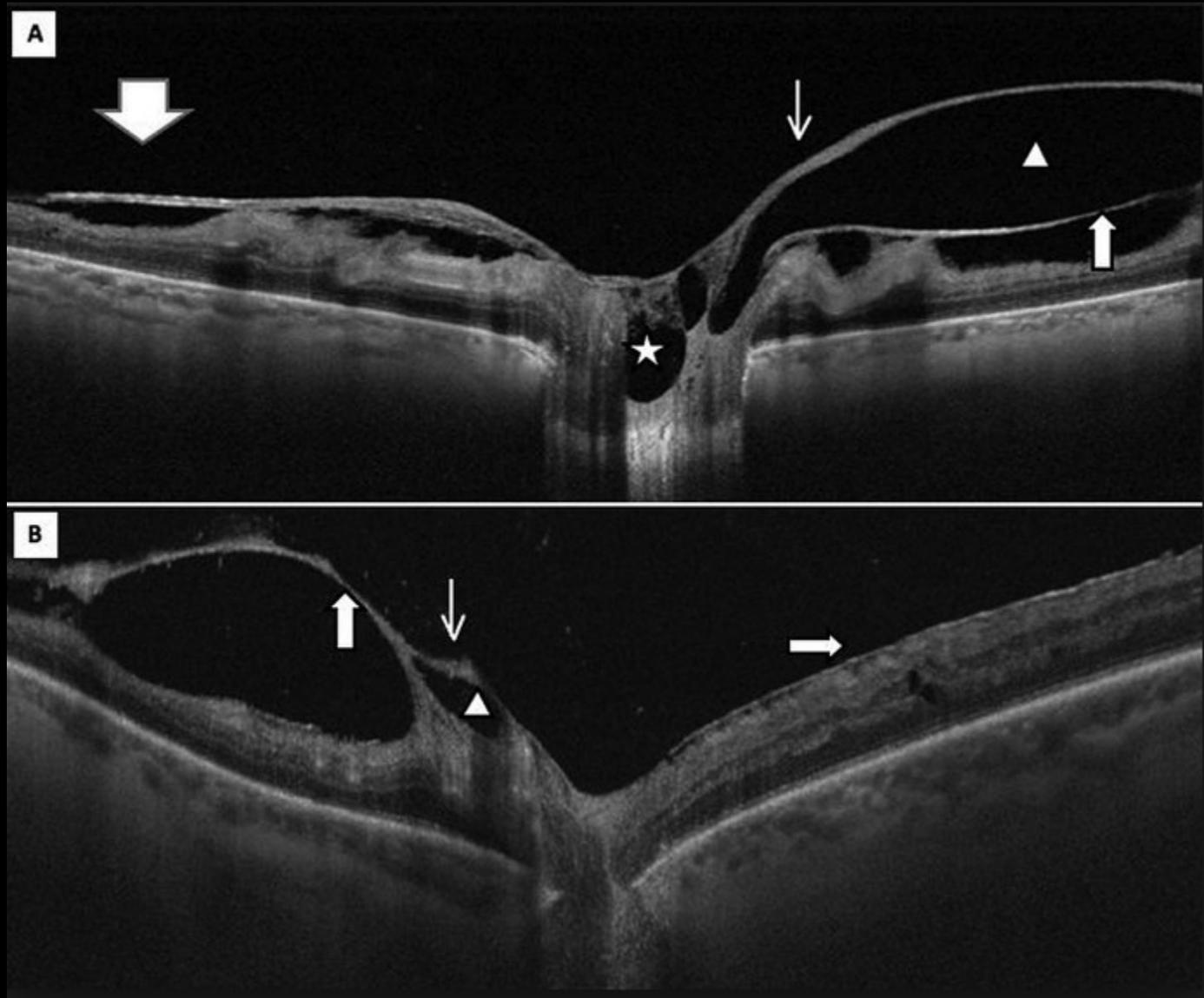


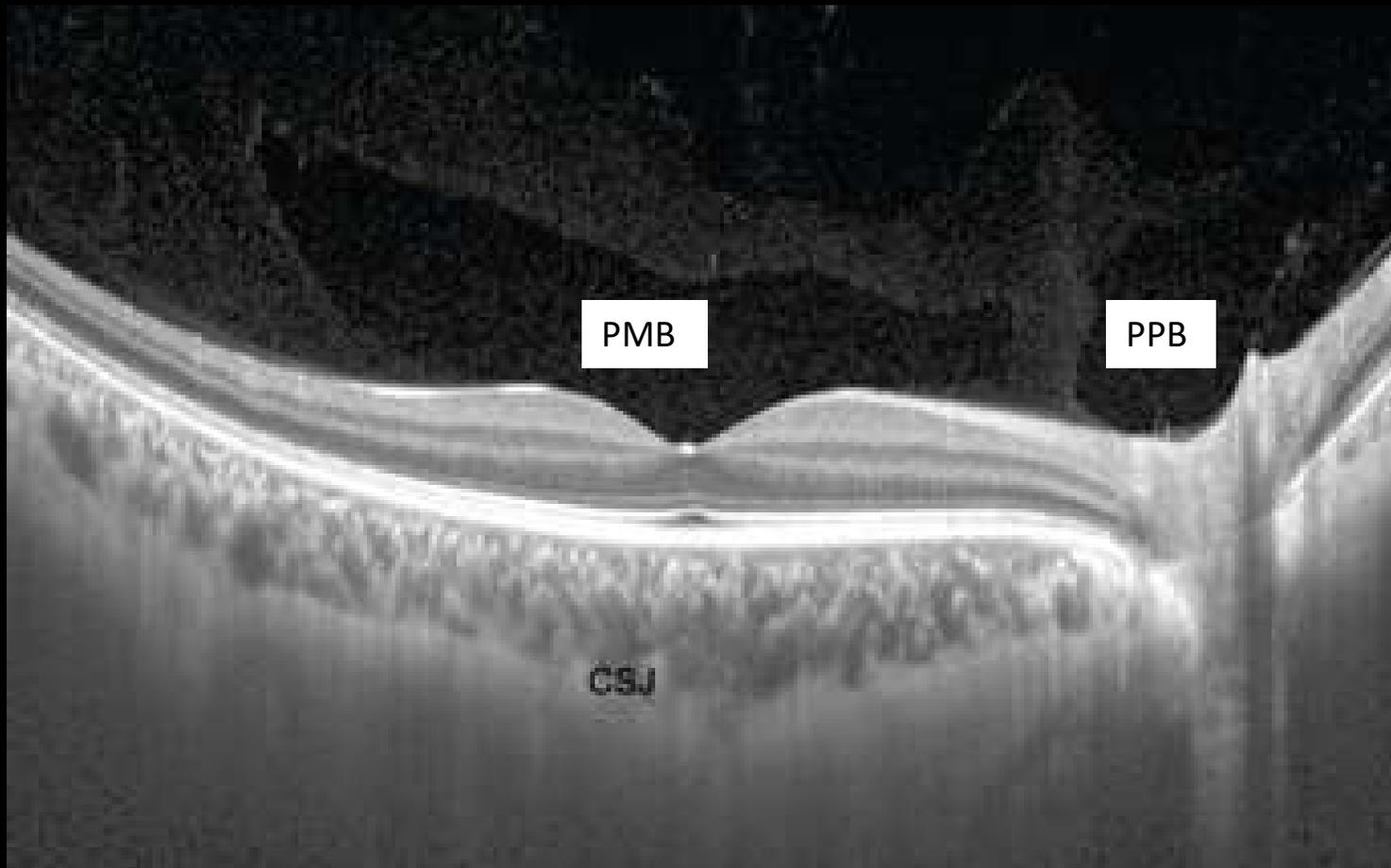
Fig. 3 Anomalous PVD. This schematic diagram demonstrates the various possible manifestations of anomalous PVD [10]. When gel liquefaction and weakening of vitreo-retinal adhesion occur concurrent-

to be highly associated with exudative AMD [11]. Persistent attachment to the optic disc can induce vitreo-papillopathies and also contribute to neovascularization and vitreous hemorrhage in ischemic retinopathies. If

Posterior Vitreoschisis (PVS)



Premacular Bursa / Prepapillary Bursa



VitreoPapillary Traction Syndrome (VPTS)



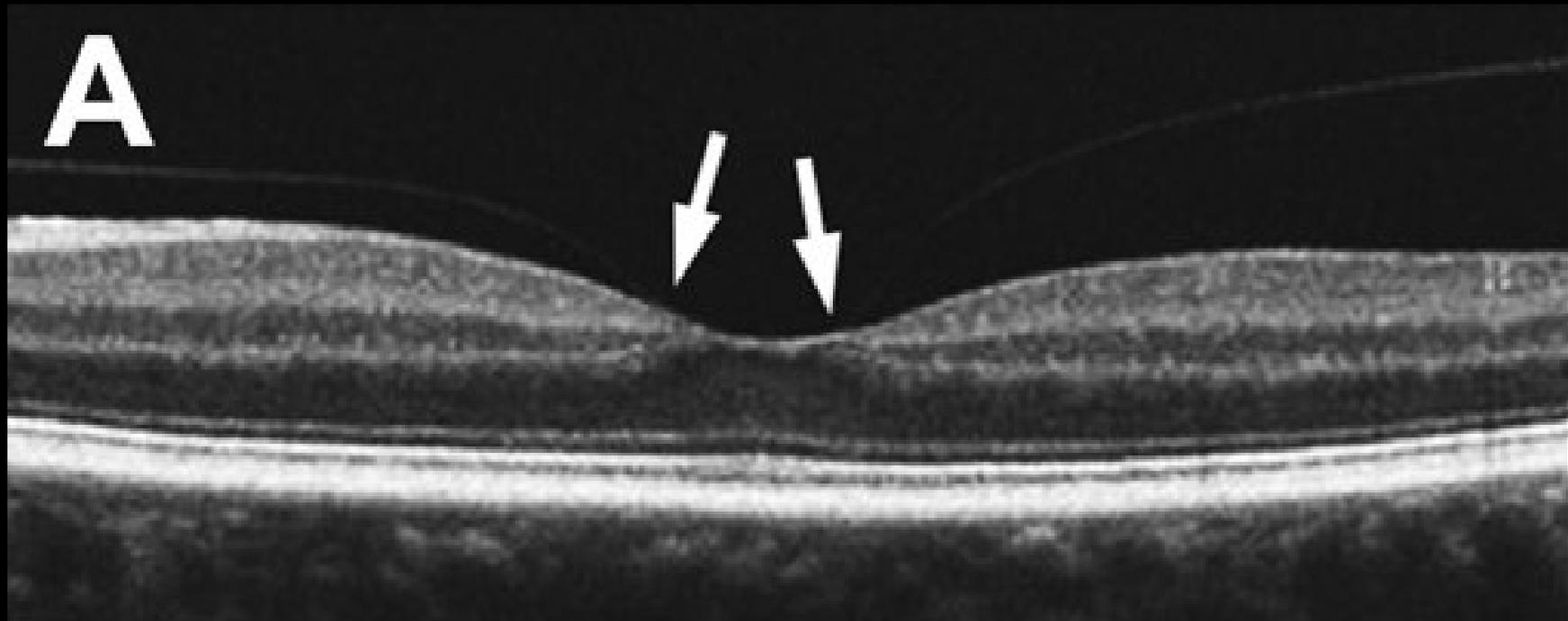
International Vitreomacular Traction Study (IVTS) Classification System

Table 1. The International Vitreomacular Traction Study Classification System for Vitreomacular Adhesion, Traction, and Macular Hole

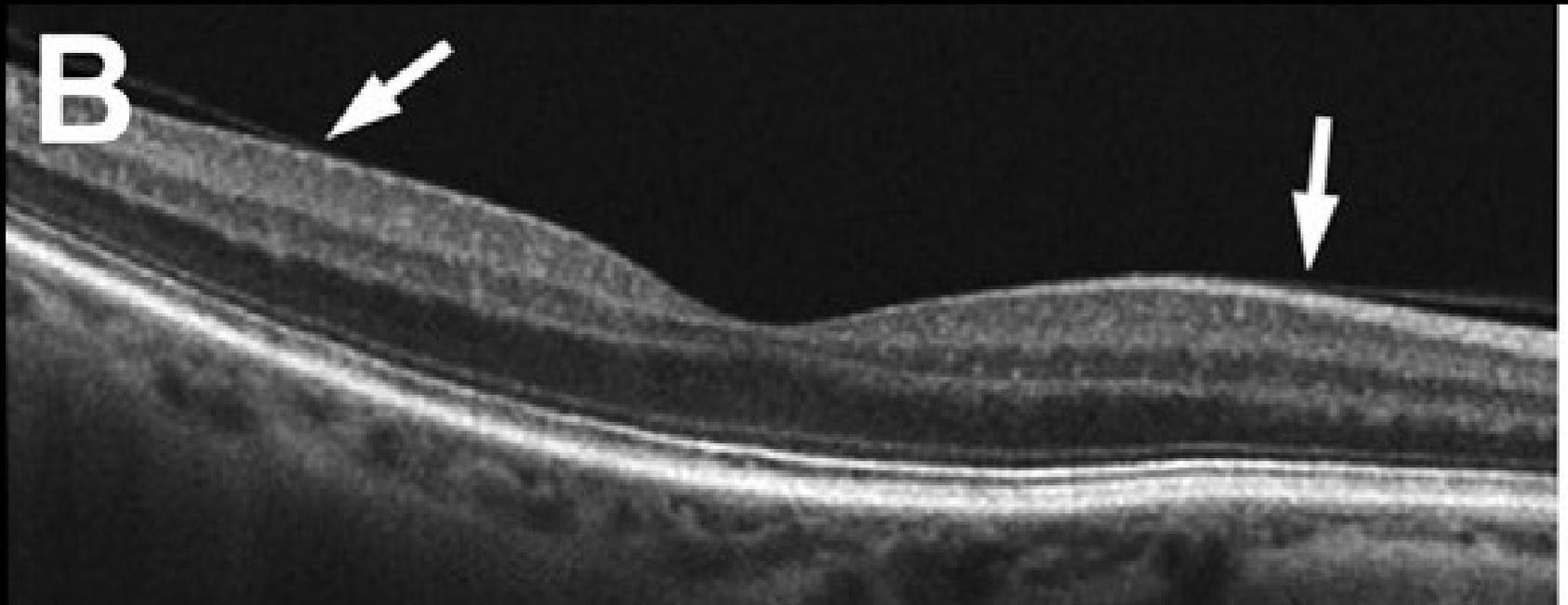
Classification	Subclassification
Vitreomacular adhesion	Size: focal ($\leq 1500 \mu\text{m}$) or broad ($> 1500 \mu\text{m}$) Isolated or concurrent
VMT	Size: focal ($\leq 1500 \mu\text{m}$) or broad ($> 1500 \mu\text{m}$) Isolated or concurrent
Full-thickness macular hole	Size: small ($\leq 250 \mu\text{m}$), medium ($> 250 - \leq 400 \mu\text{m}$), or large ($> 400 \mu\text{m}$) Status of vitreous: with or without VMT Cause: primary or secondary

VMT = vitreomacular traction.

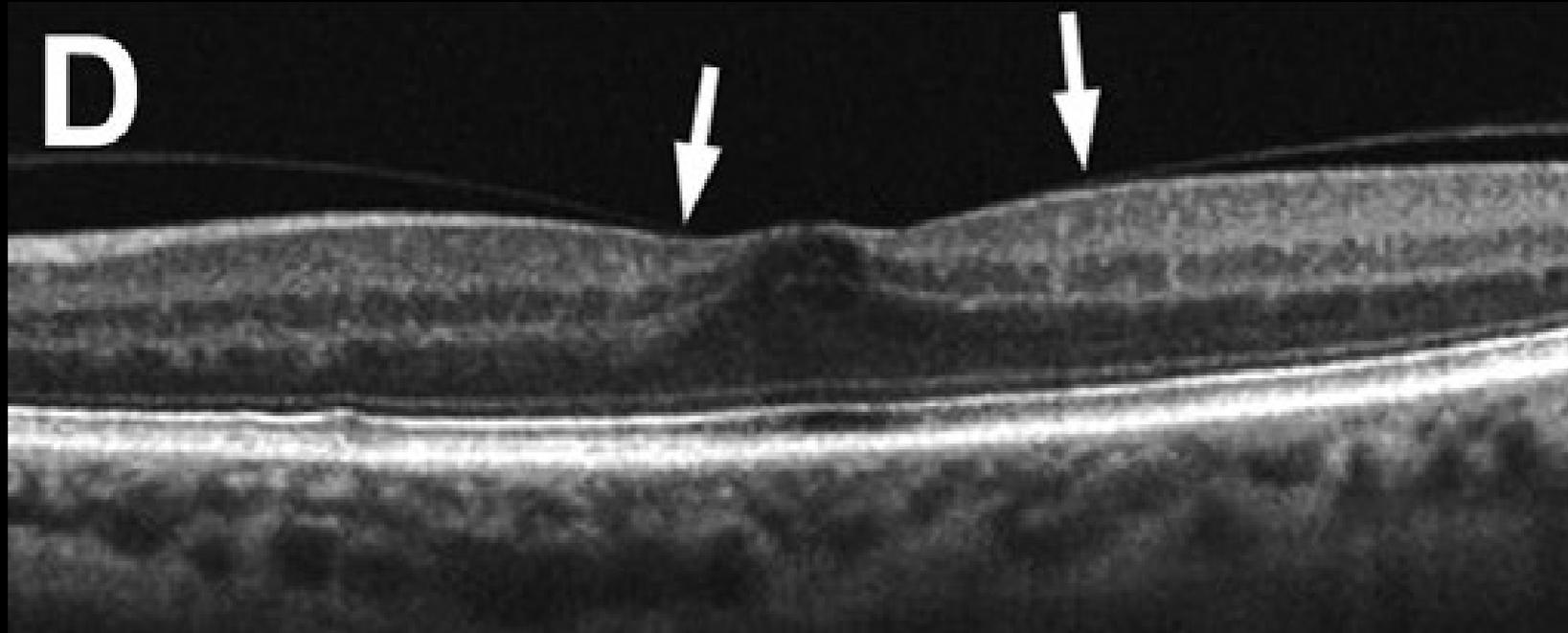
Focal Vitreomacular Adhesion (VMA)



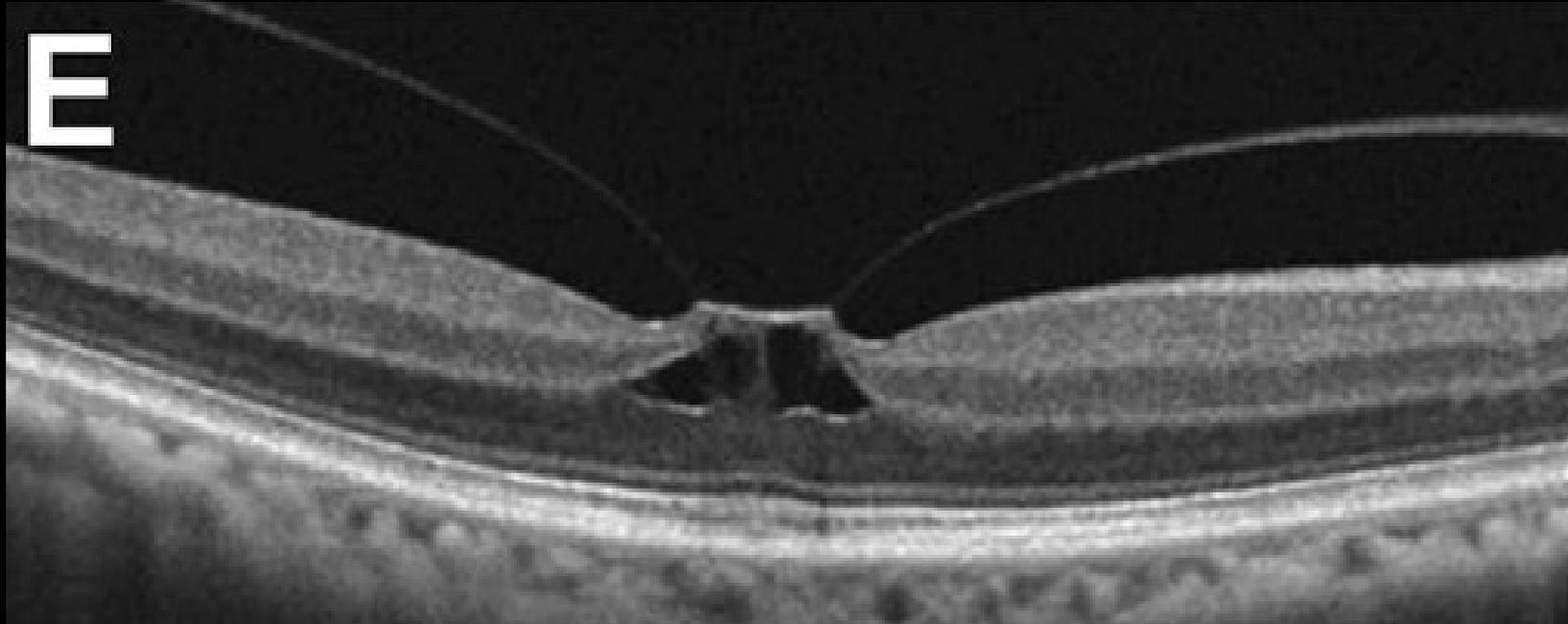
Broad Vitreomacular Adhesion (VMA)



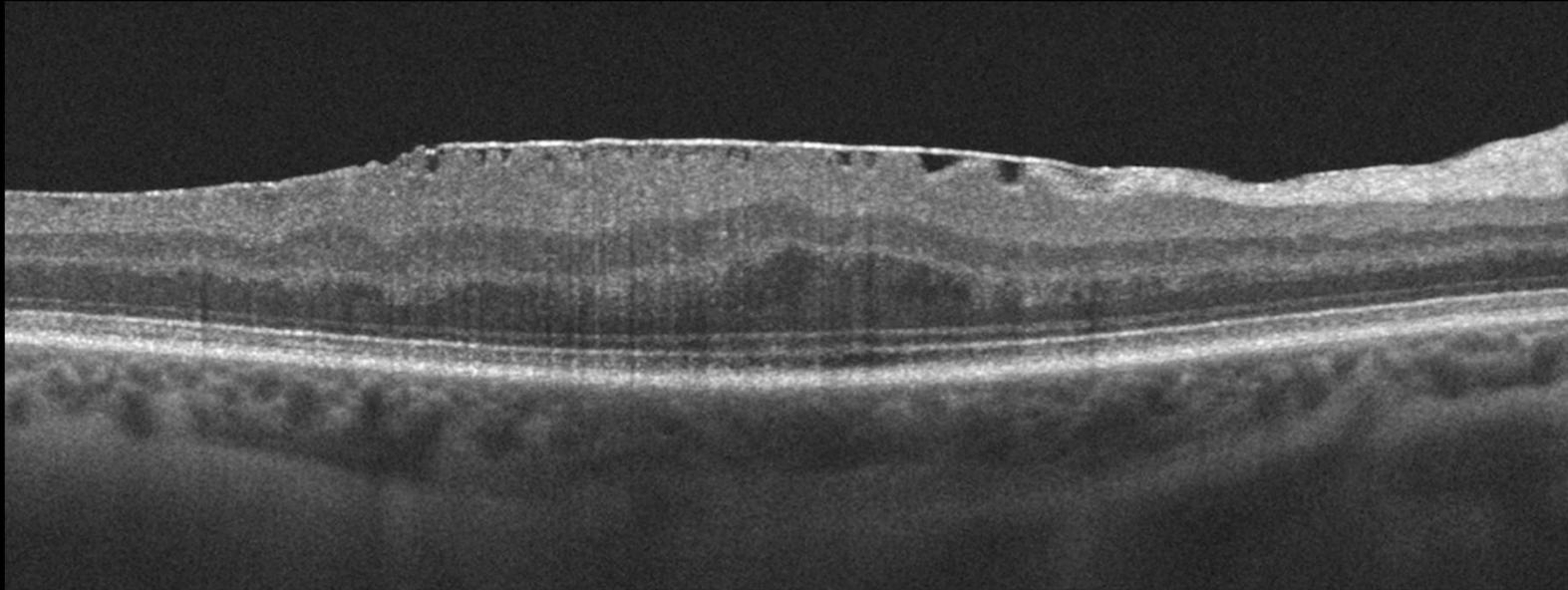
Focal Vitreomacular Traction (VMT)



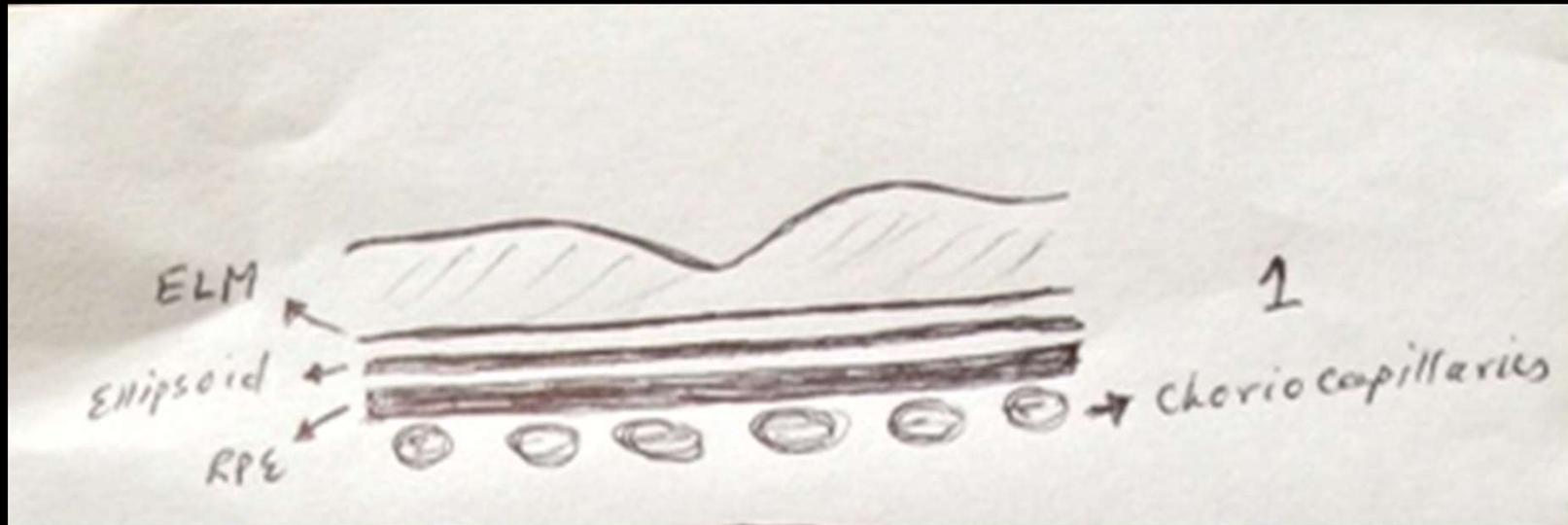
Focal Vitreomacular Traction (VMT) – with pseudocysts



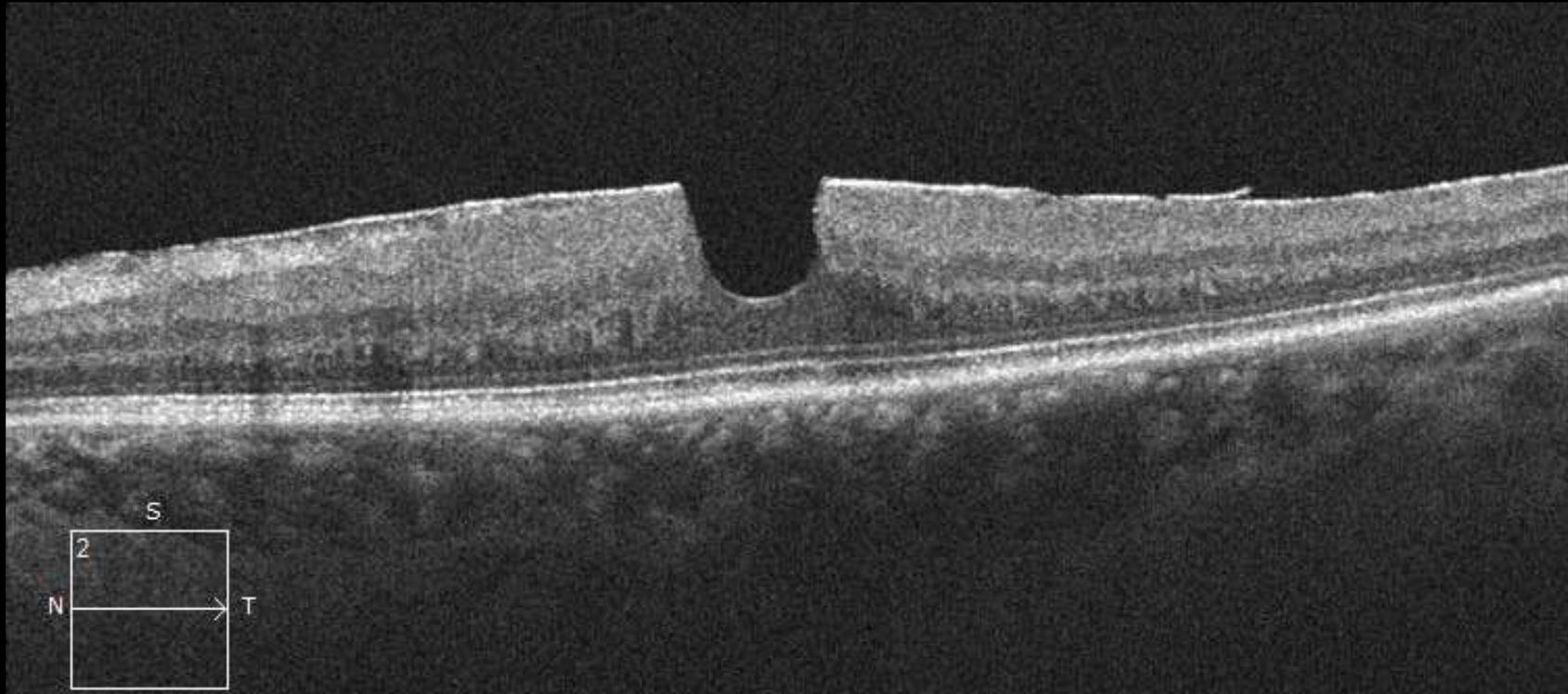
Macular Epiretinal membrane



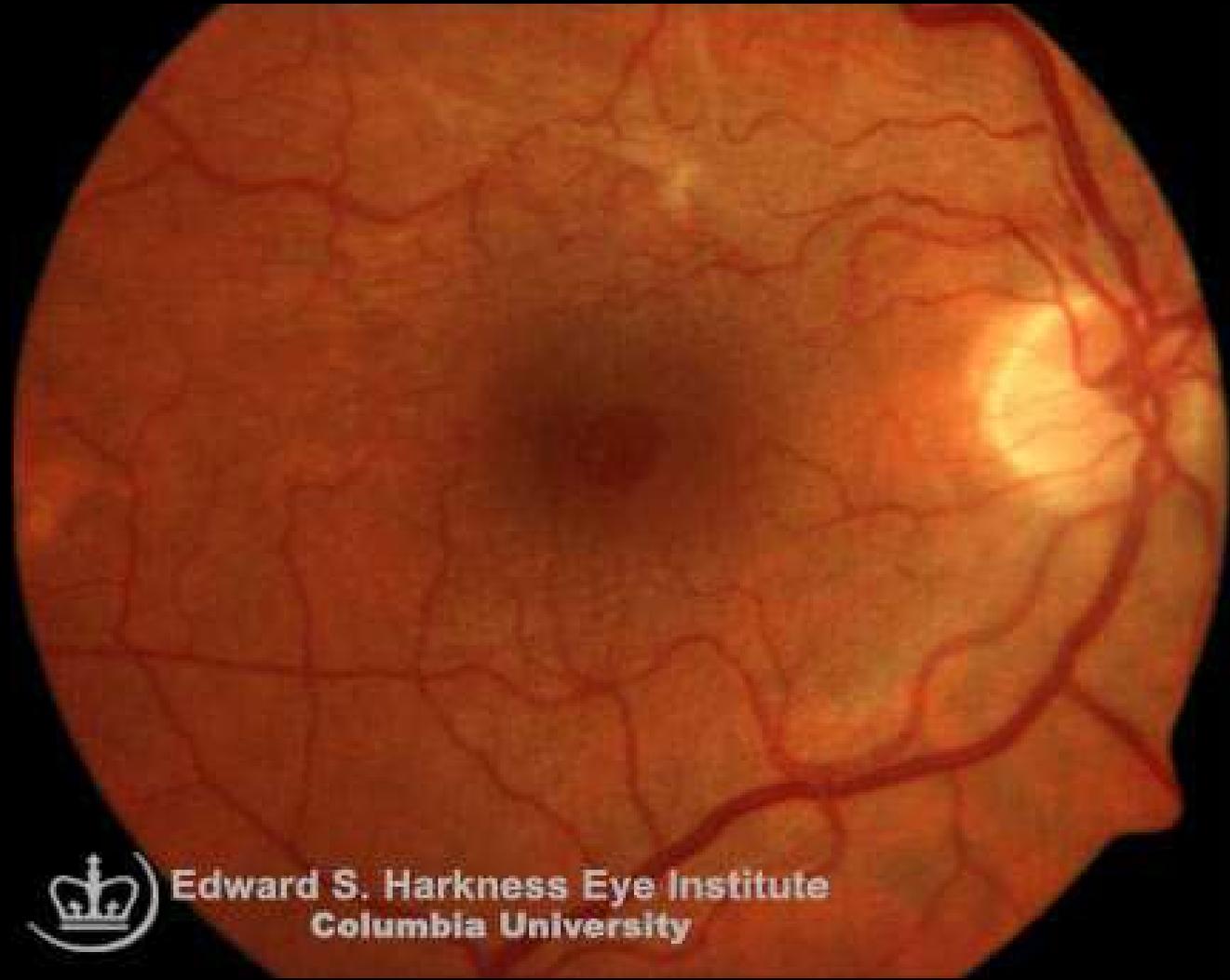
Lamellar Hole / Full Thickness Hole / Pseudohole



Epiretinal membrane with Macular Pseudohole

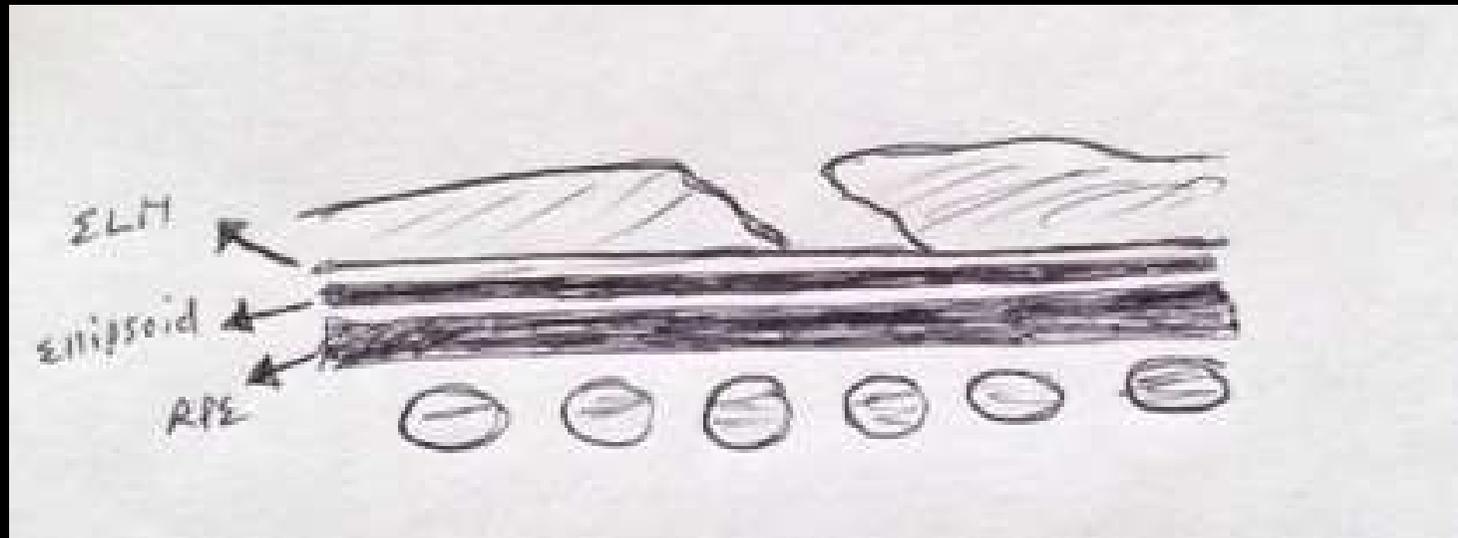


Epiretinal membrane with Macular Pseudohole

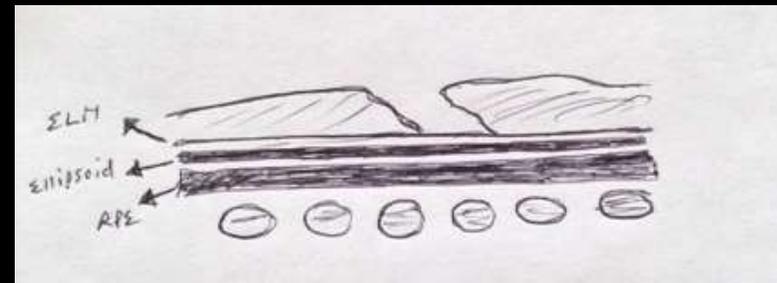
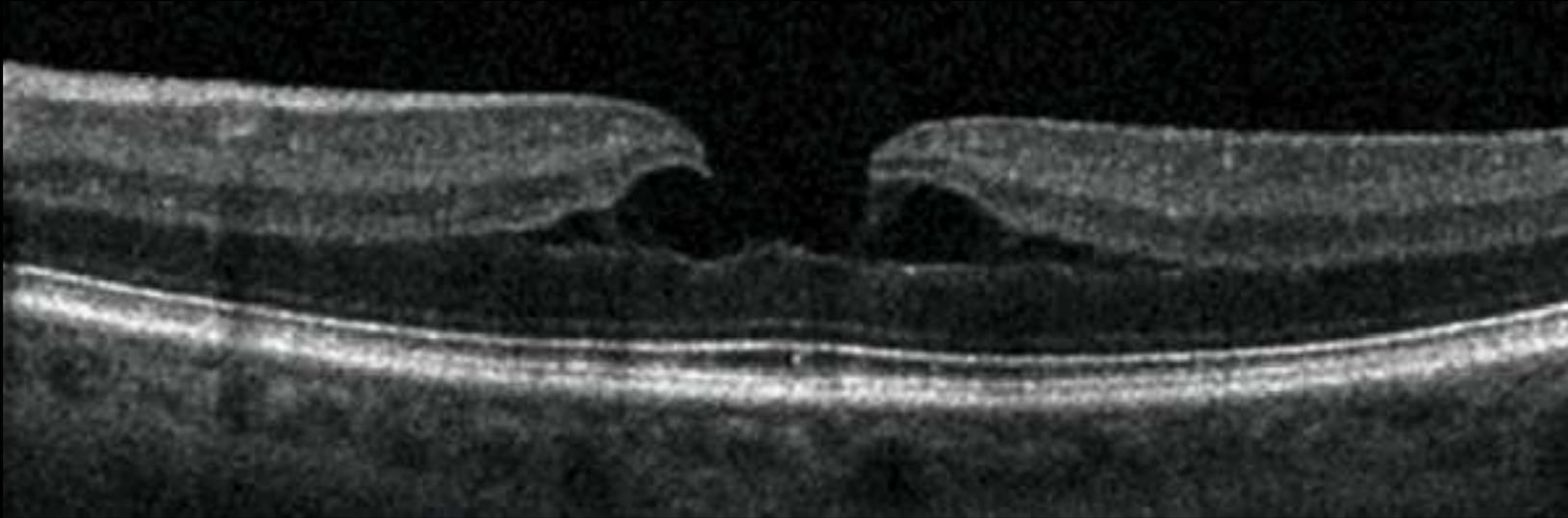


Edward S. Harkness Eye Institute
Columbia University

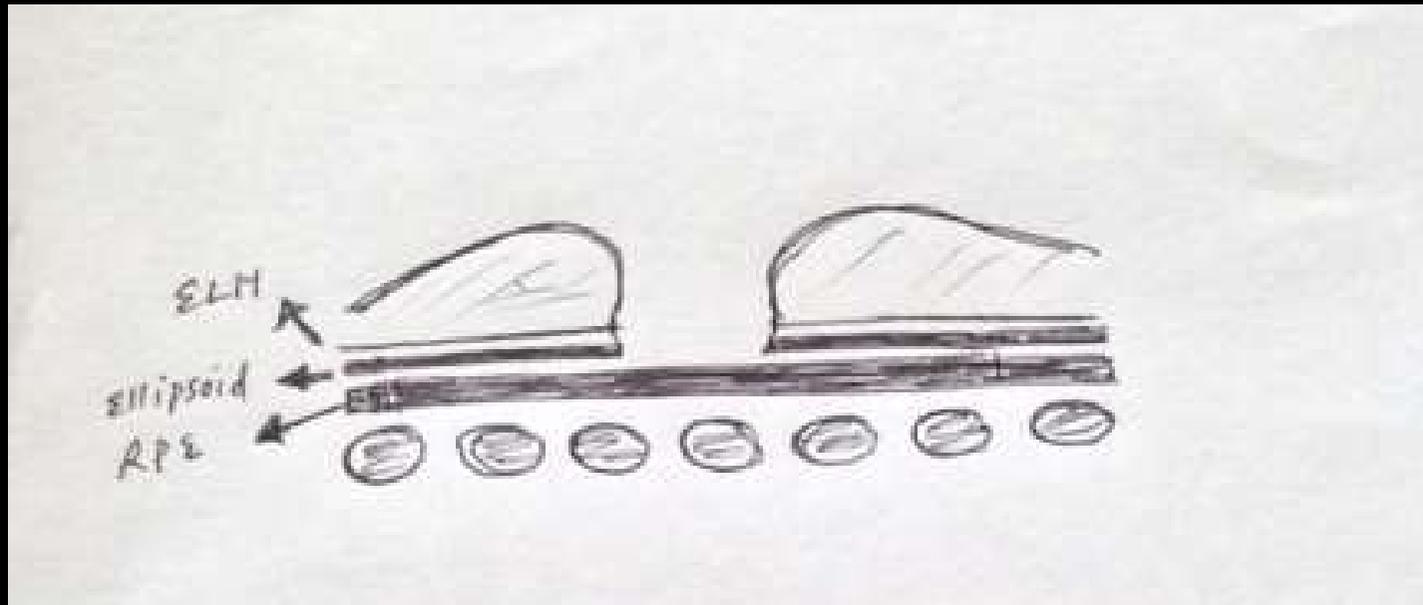
Lamellar Hole



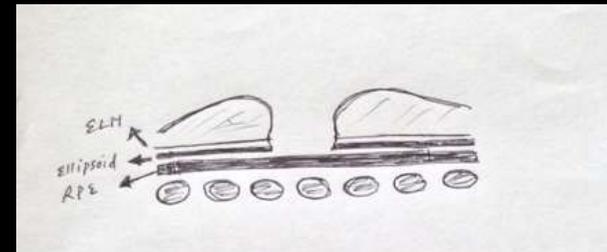
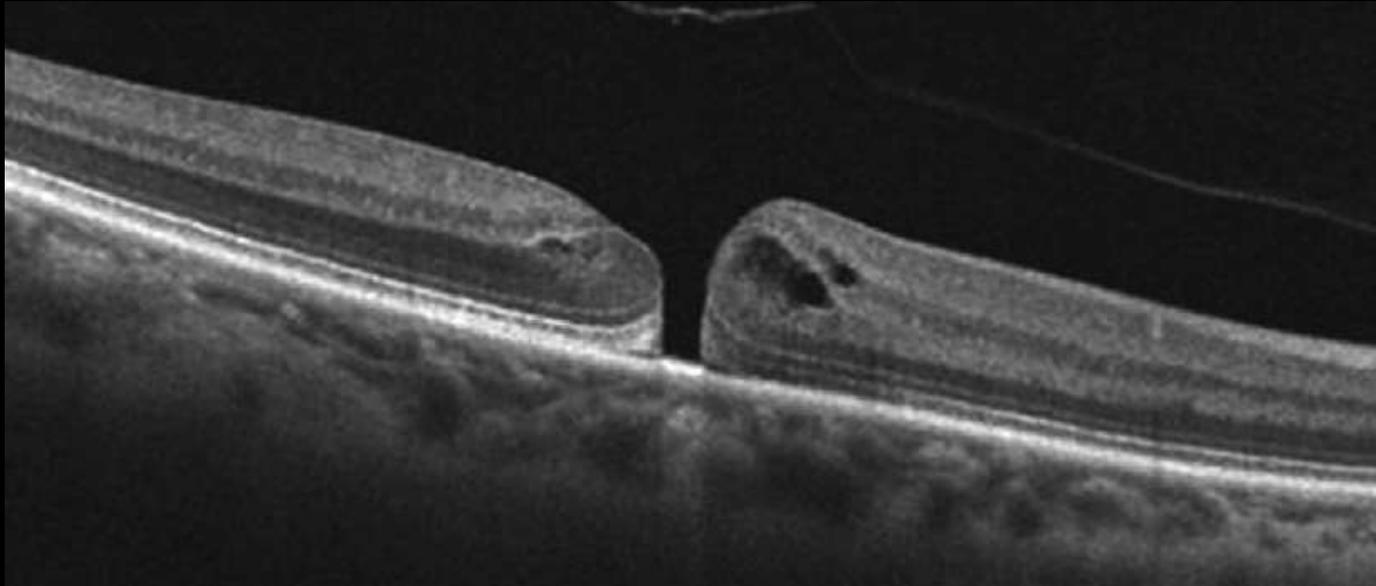
Lamellar Hole



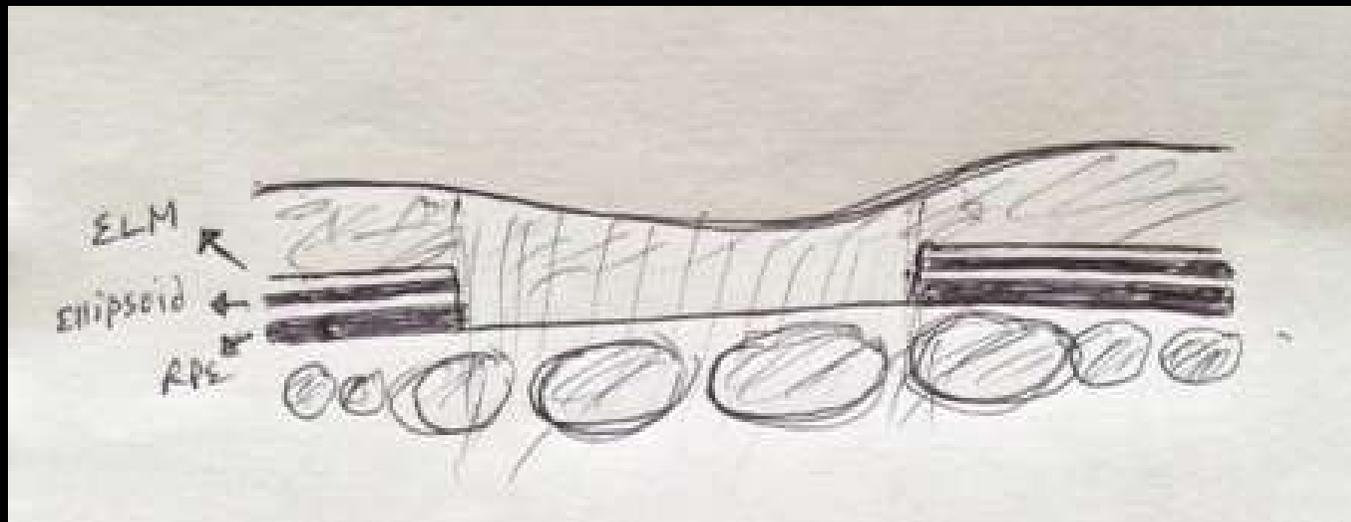
Full Thickness Macular Hole



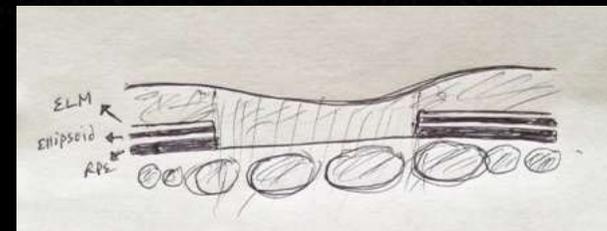
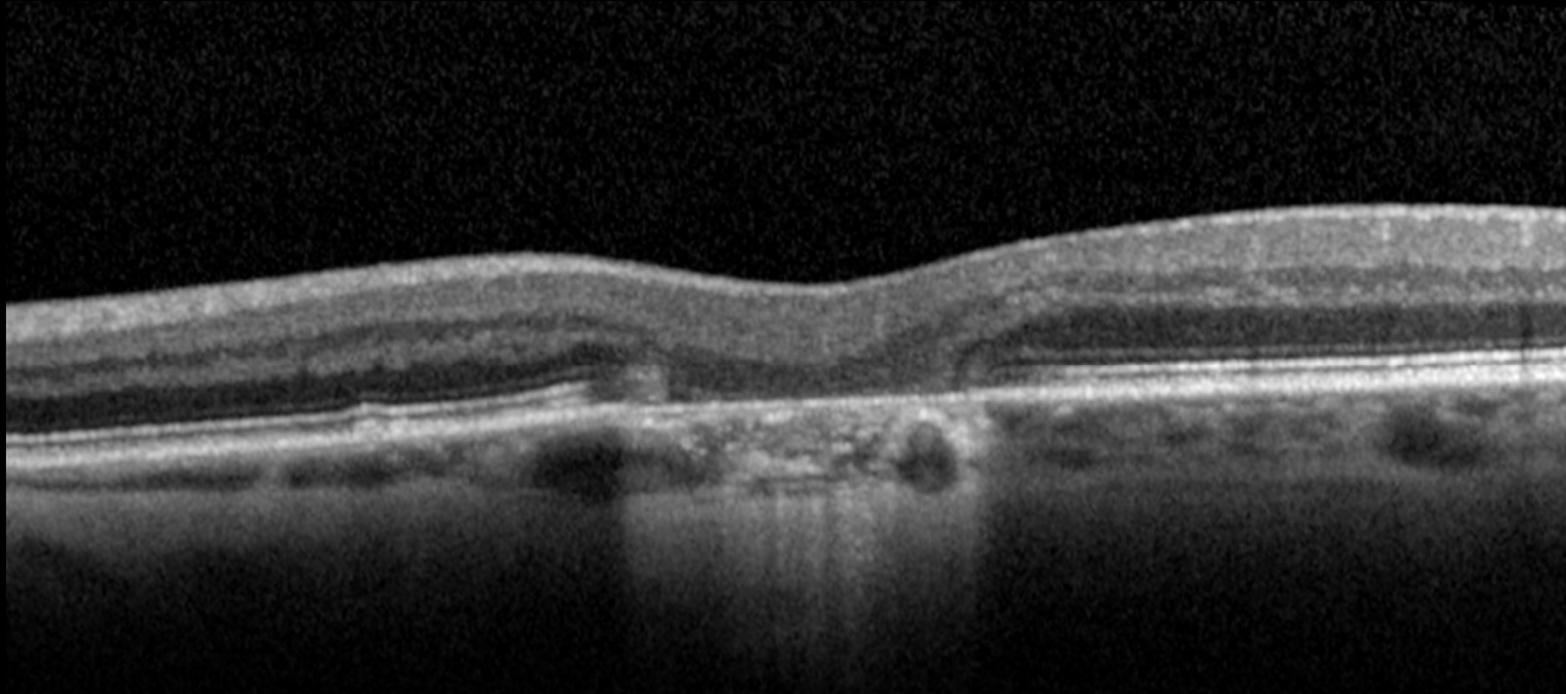
Full Thickness Macular Hole



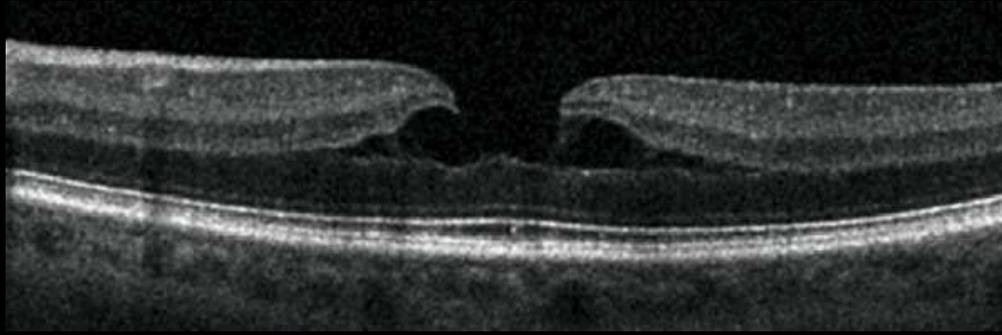
Geographic atrophy



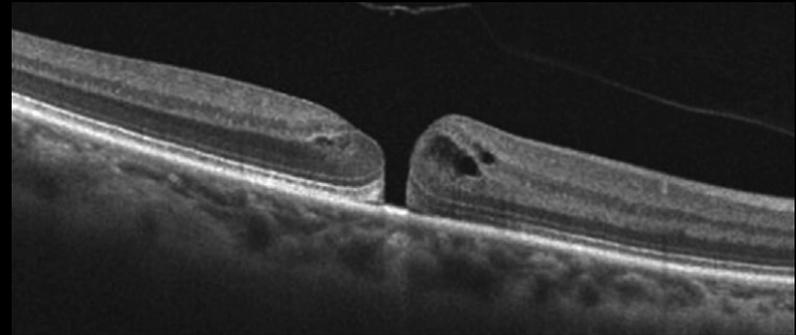
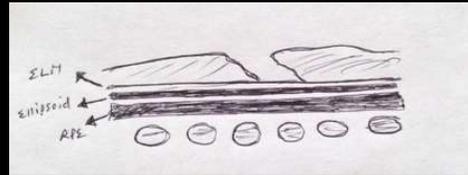
Geographic atrophy



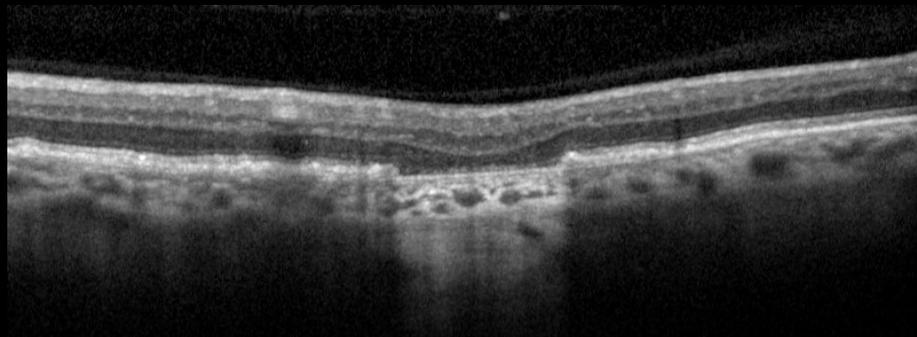
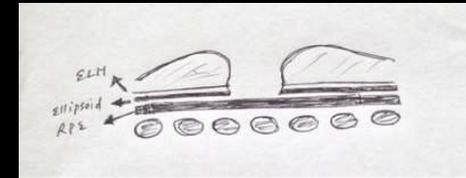
Holes / Atrophy



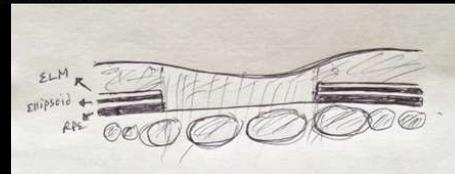
Lamellar Hole



Full Thickness Hole

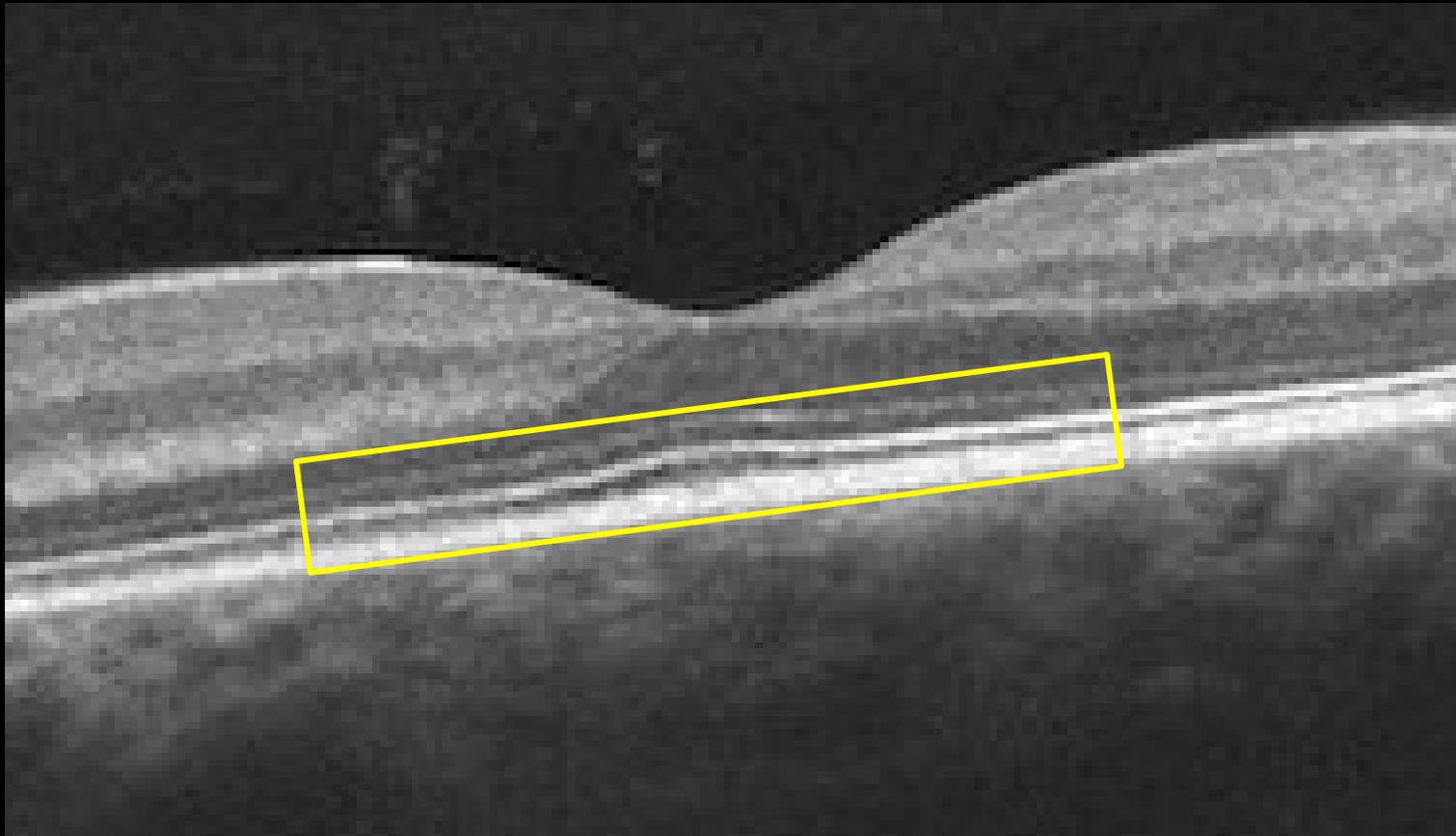


Geographic Atrophy



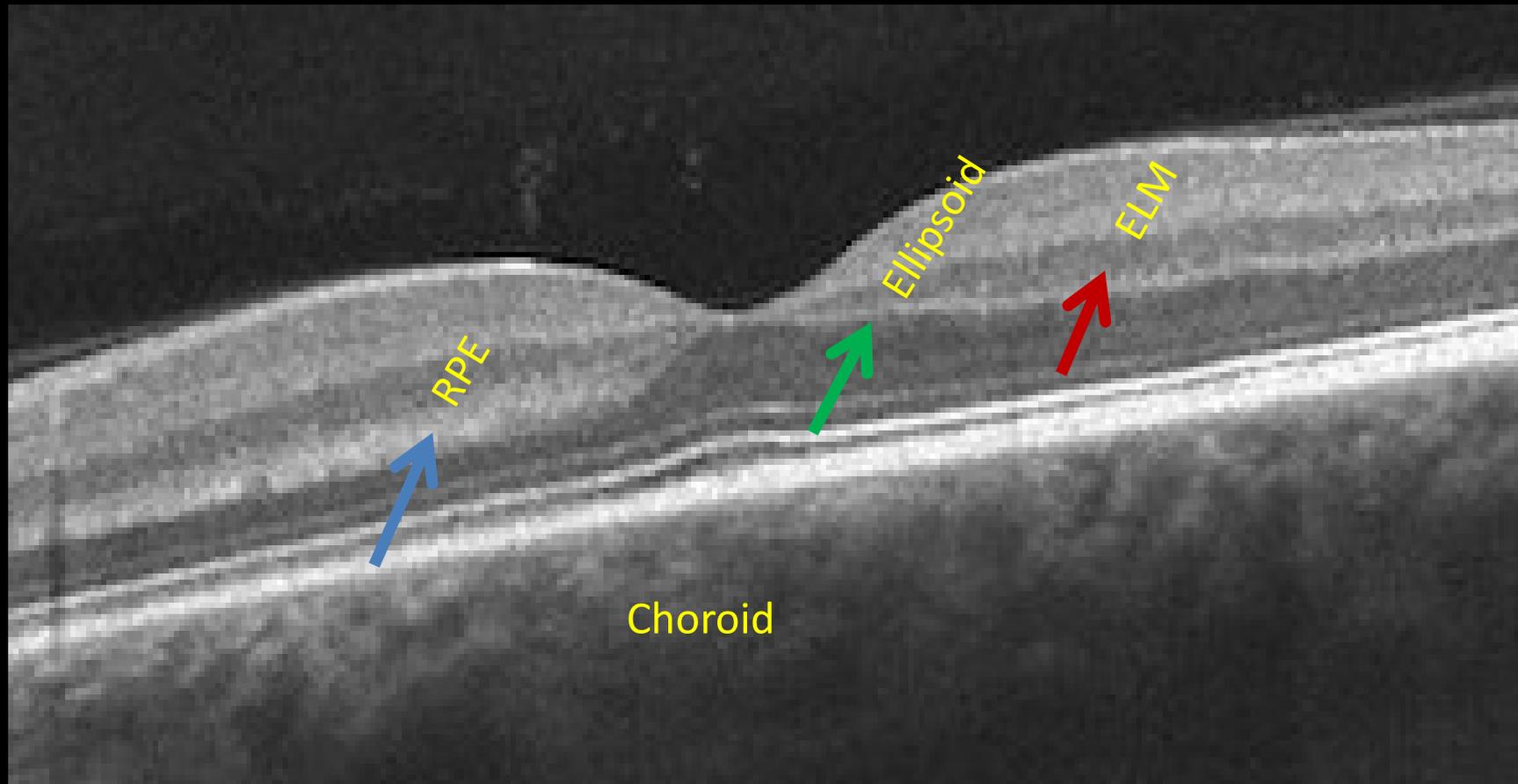
Disorders of Outer Retina

Outer Retinal Layers



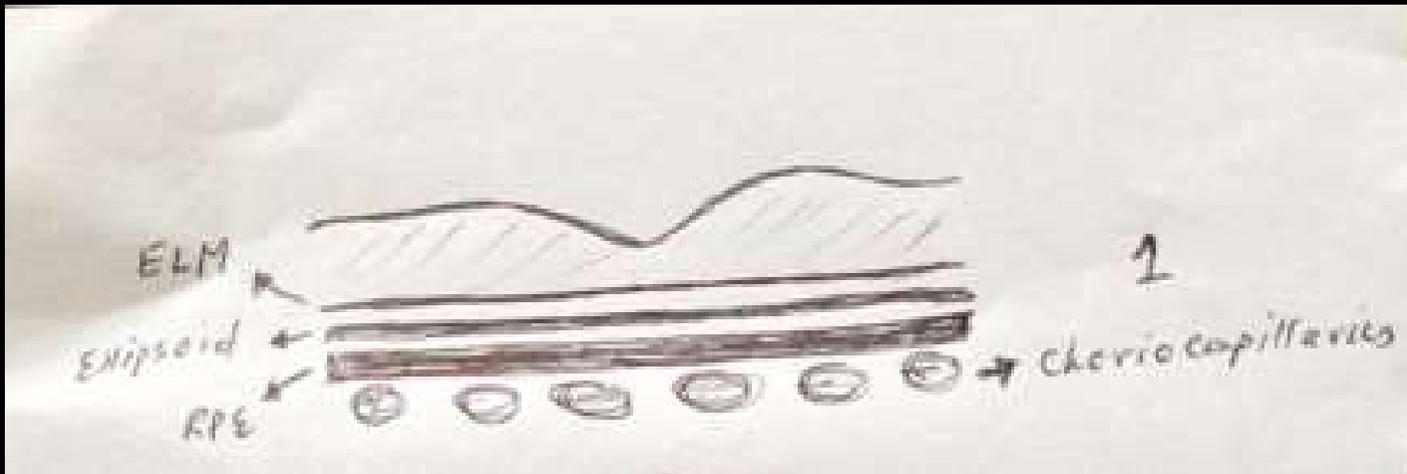
Normal OCT Macula

The Outer retinal Layers



3 Layers

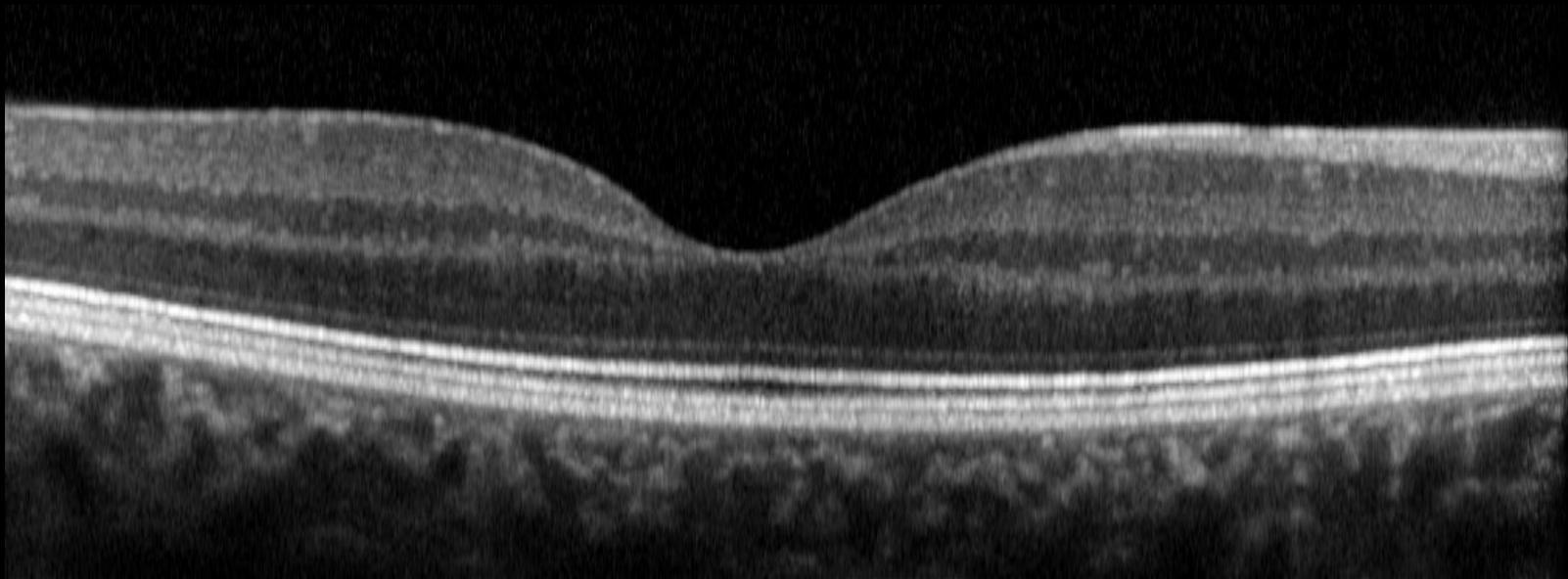
Normal OCT Macula – The Outer Retinal Layers



ELM: External Limiting Membrane

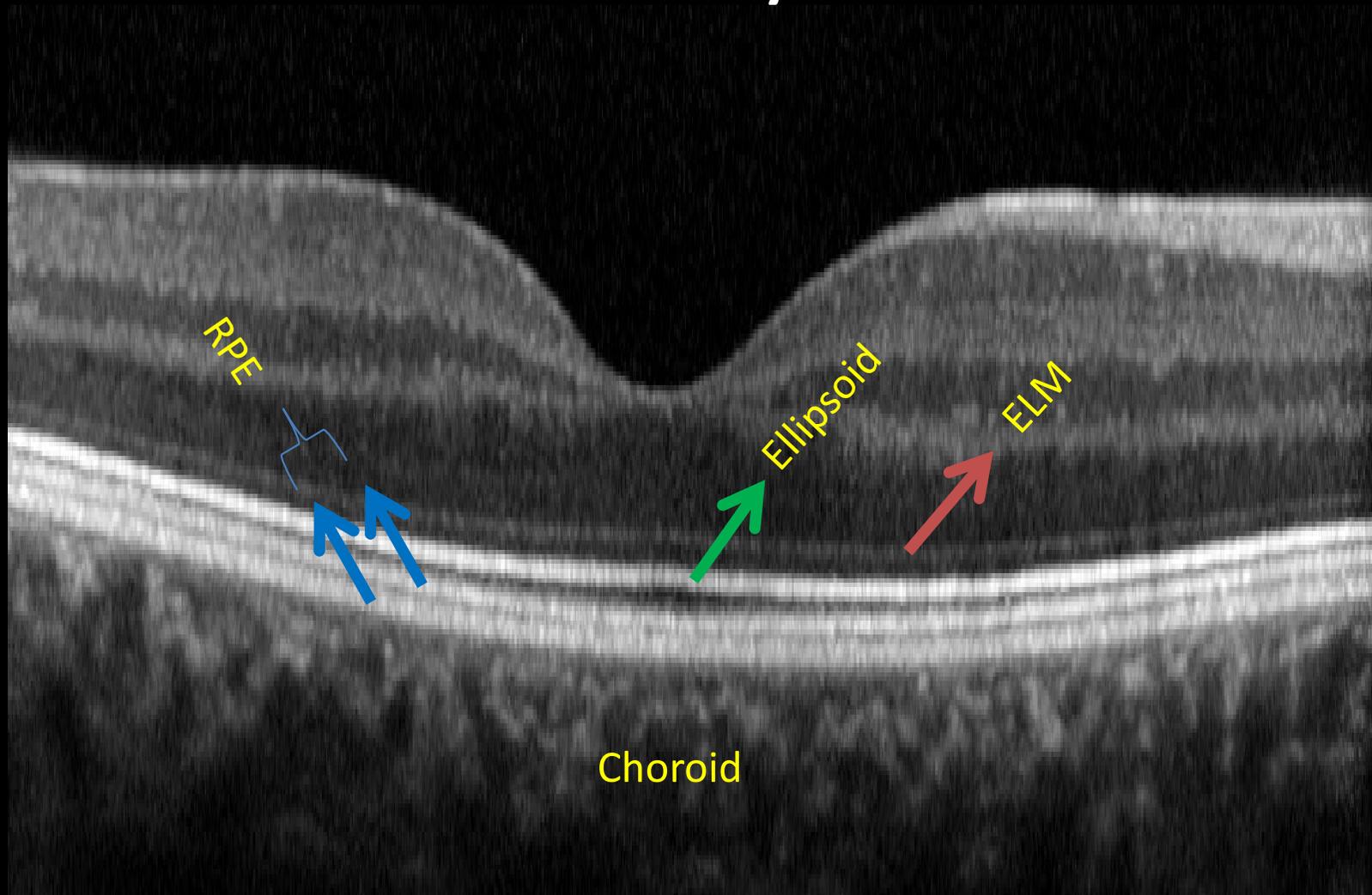
<http://www.northerneyesurgeons.com.au/oct-scanning>

Normal OCT Macula – The Outer retinal Layers

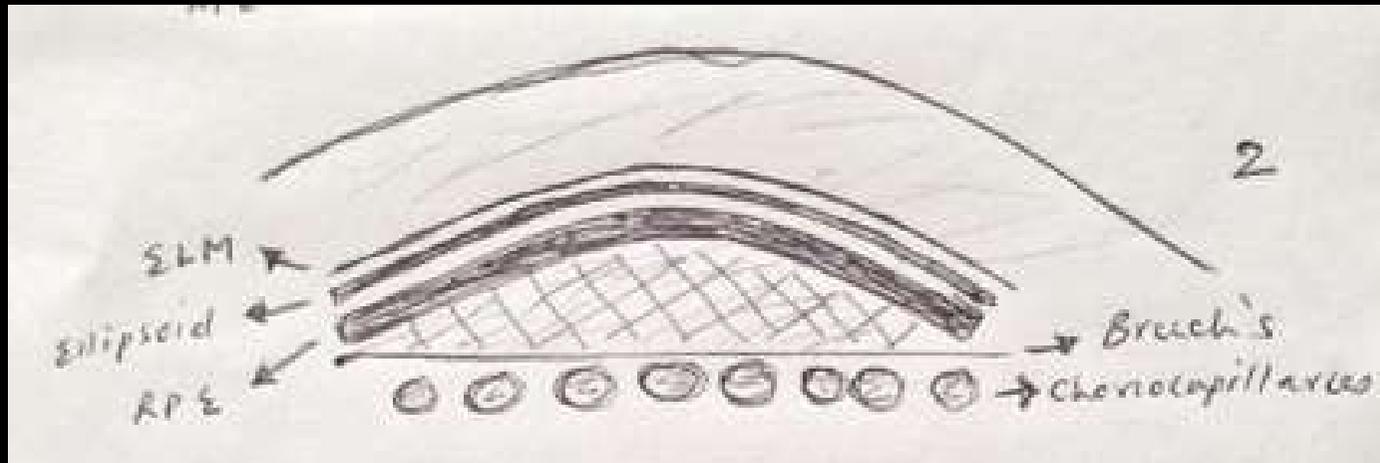


4 Layers

Normal OCT Macula – The Outer retinal Layers

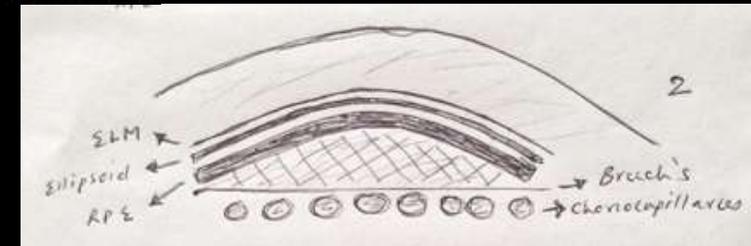
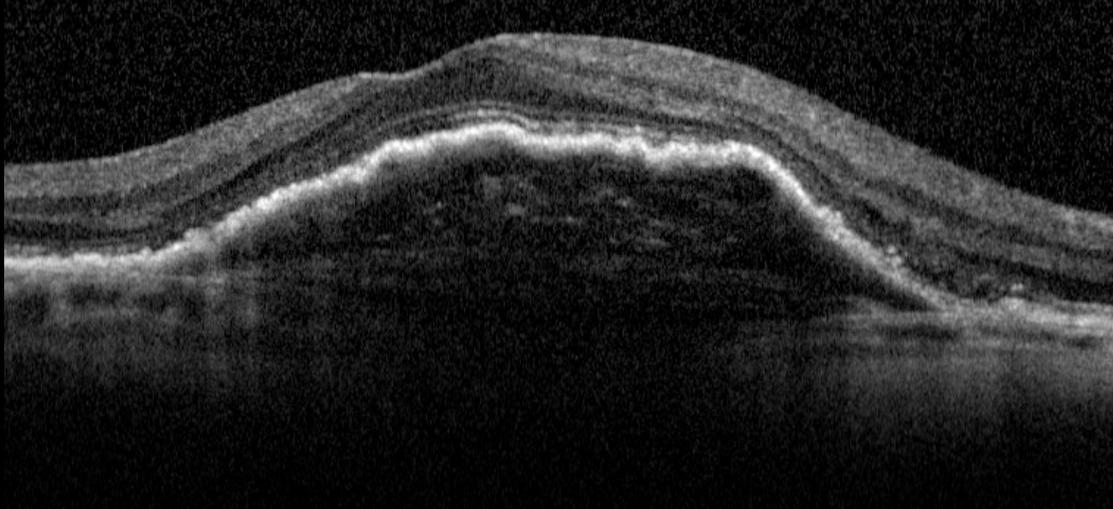


Pigment Epithelial Detachment (PED)



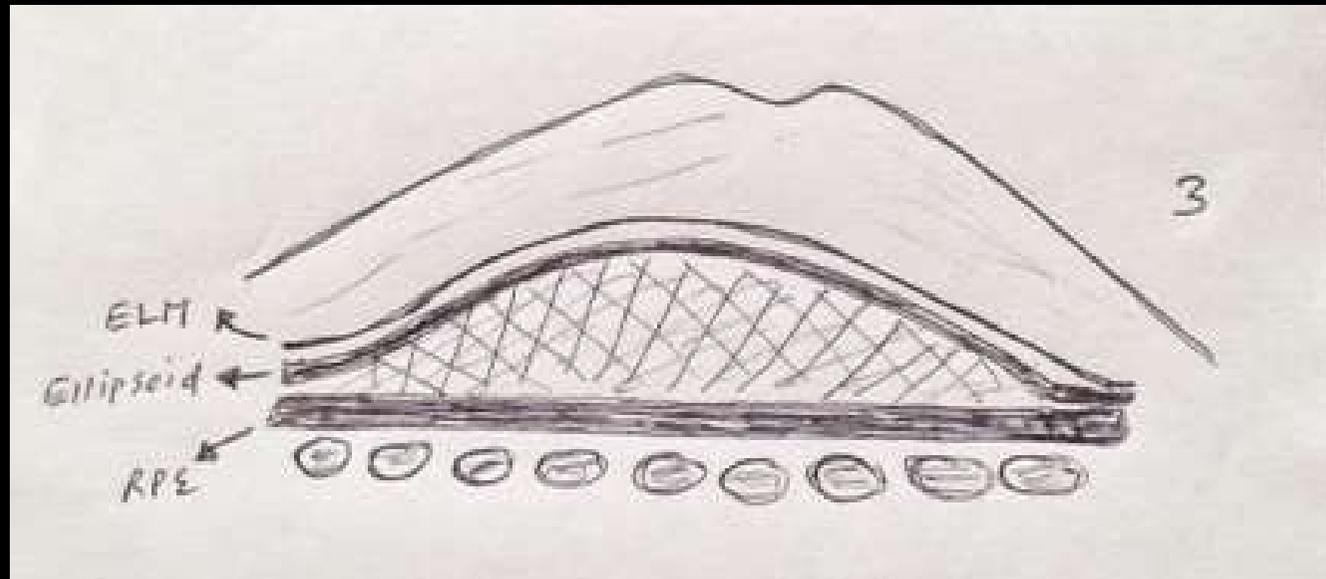
ELM: External Limiting Membrane

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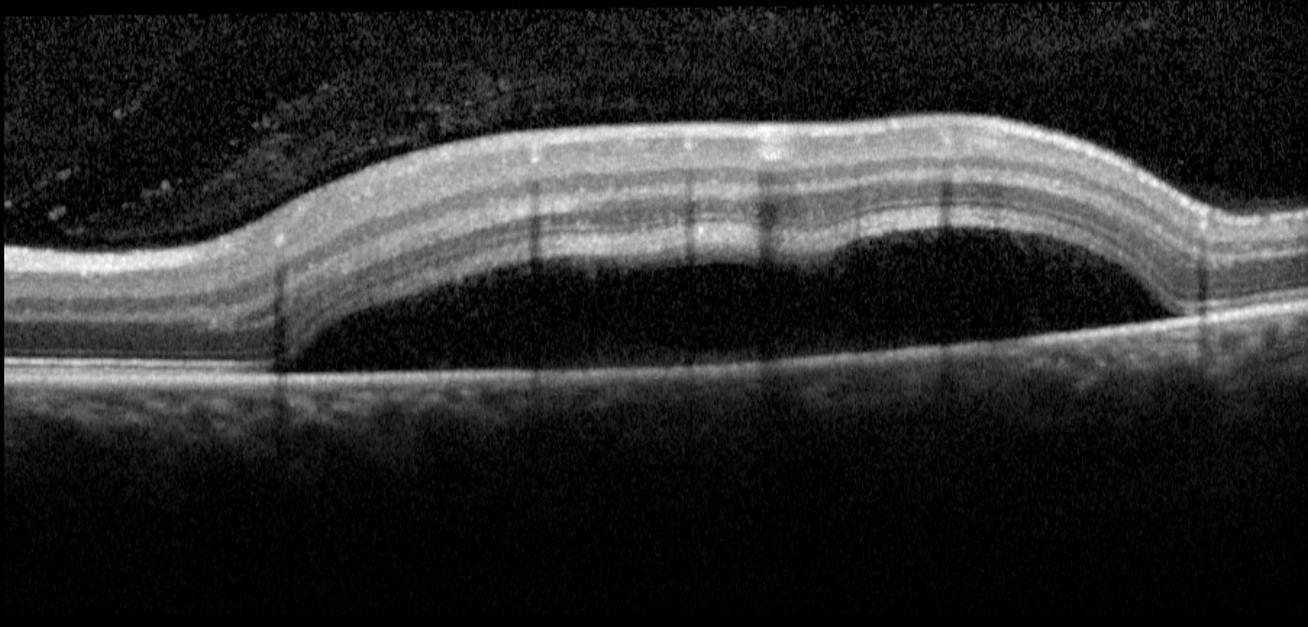
ELM: External Limiting Membrane

Subretinal Fluid (SRF)

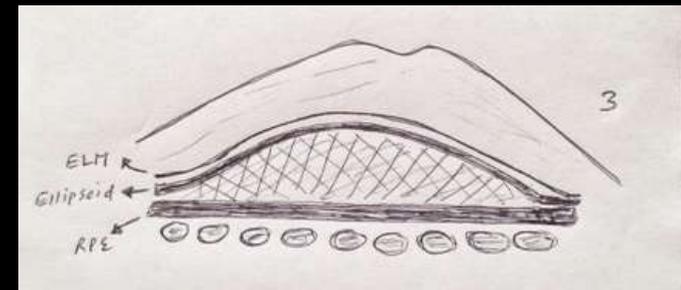


ELM: External Limiting Membrane

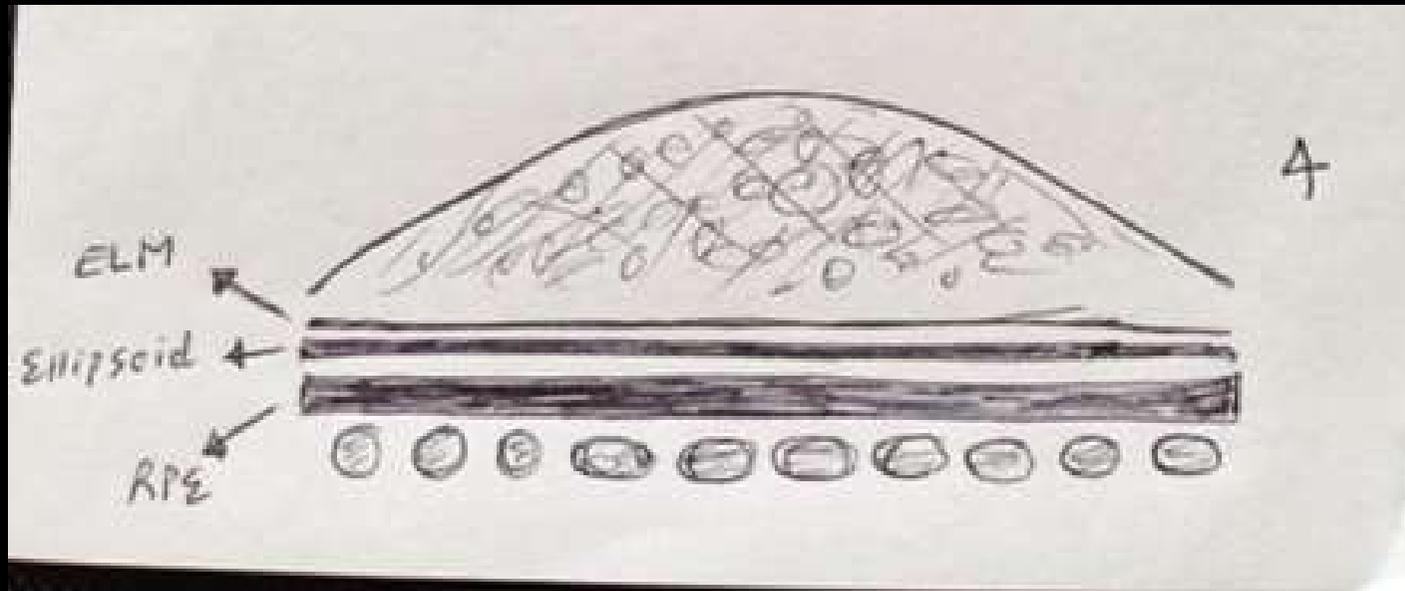
Subretinal Fluid (SRF)



ELM: External Limiting Membrane

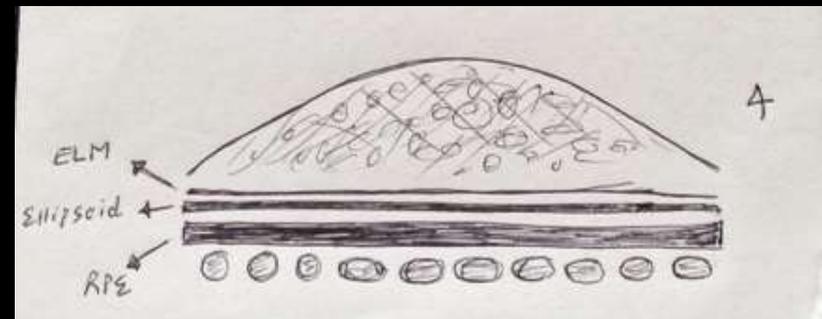
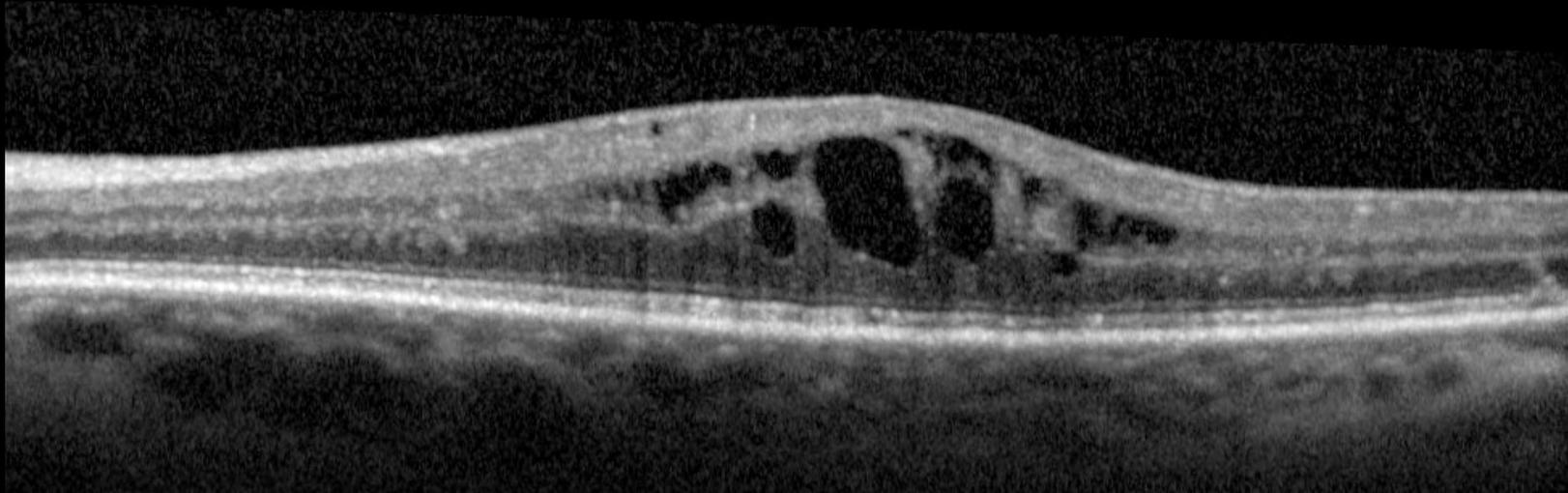


Intraretinal Fluid (IRF)



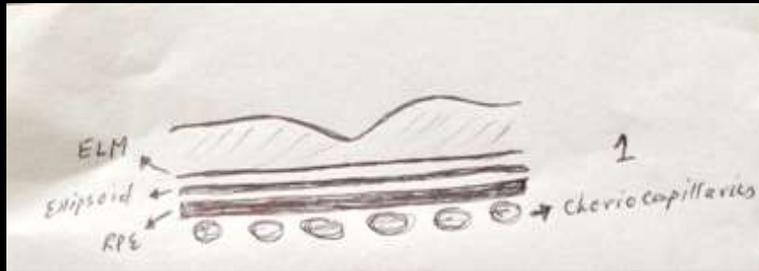
ELM: External Limiting Membrane

Intraretinal Fluid (IRF)

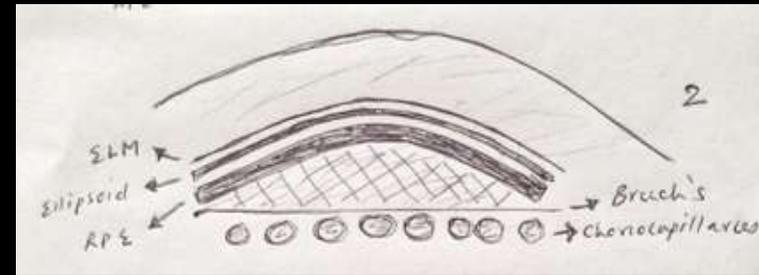


ELM: External Limiting Membrane

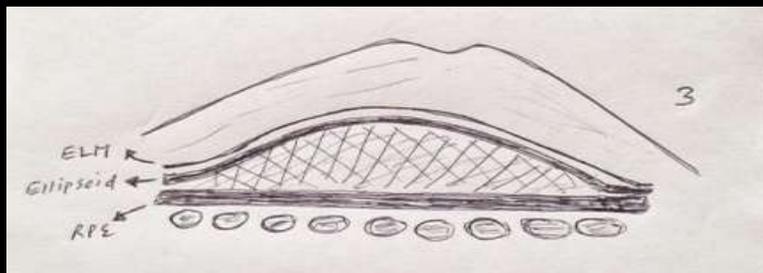
Macular Fluid



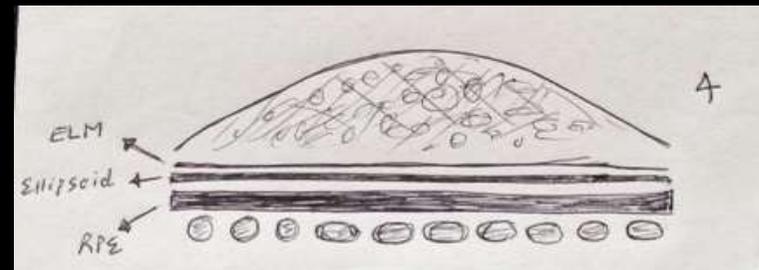
Normal



PED



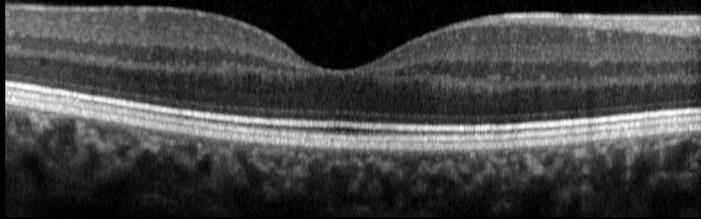
SRF



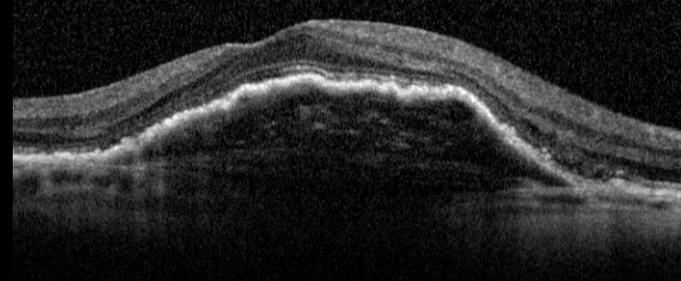
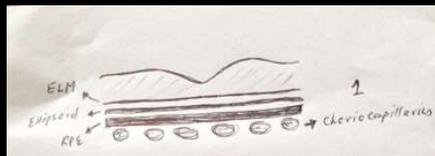
IRF

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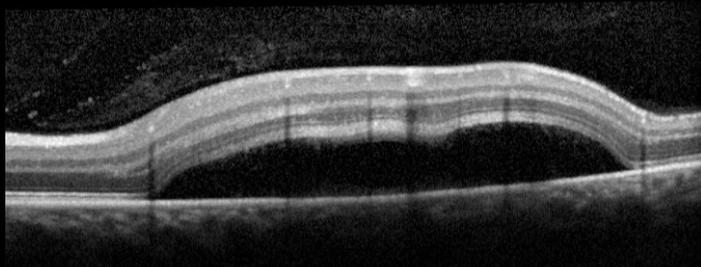
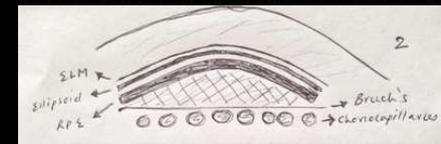
Macular Fluid



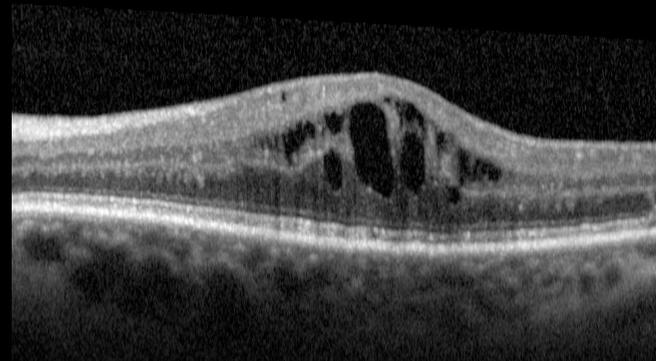
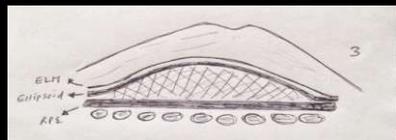
Normal



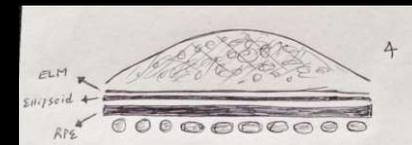
PED



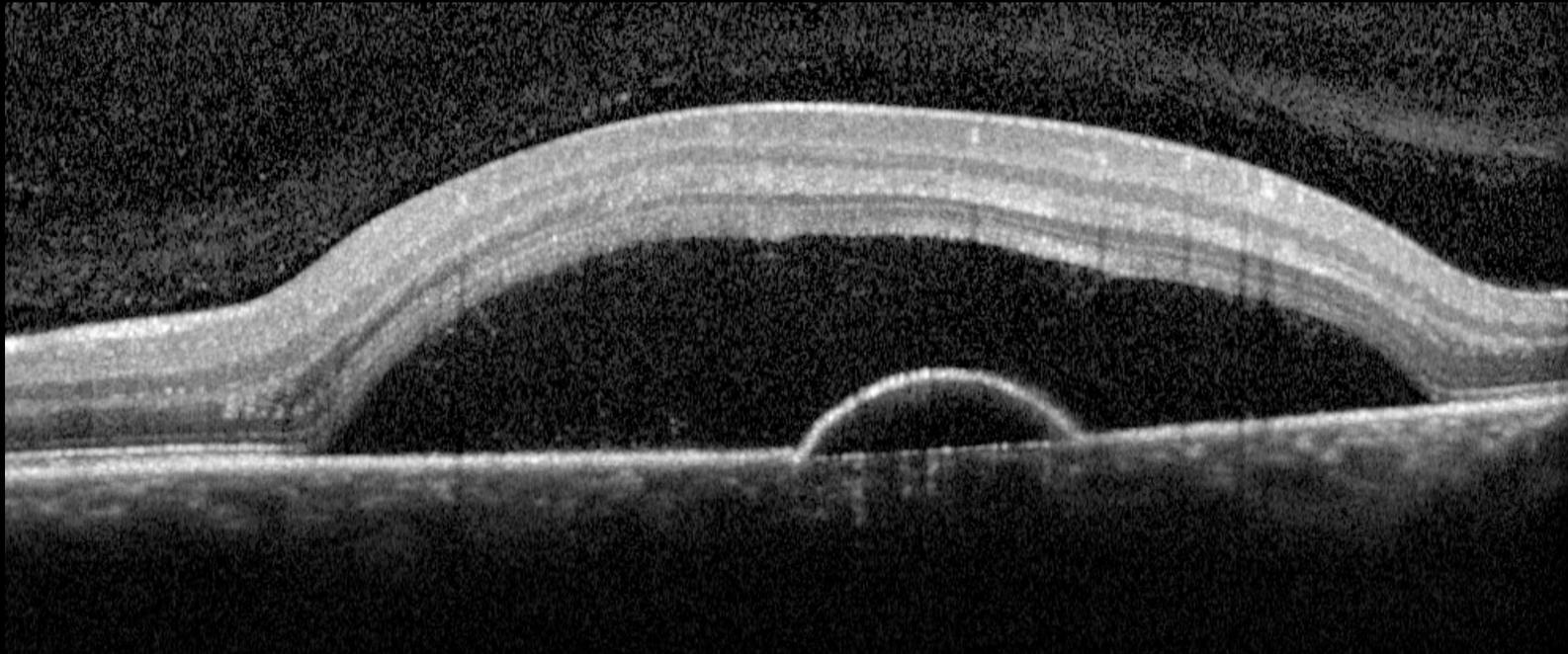
SRF



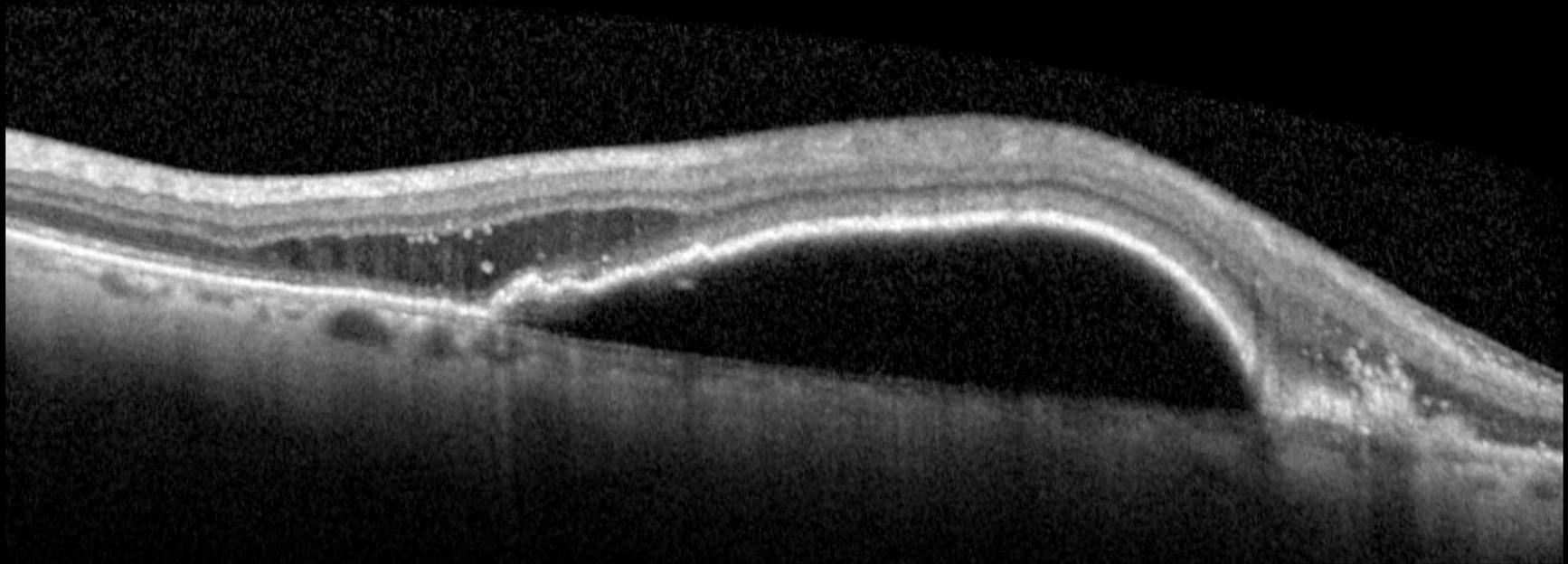
IRF



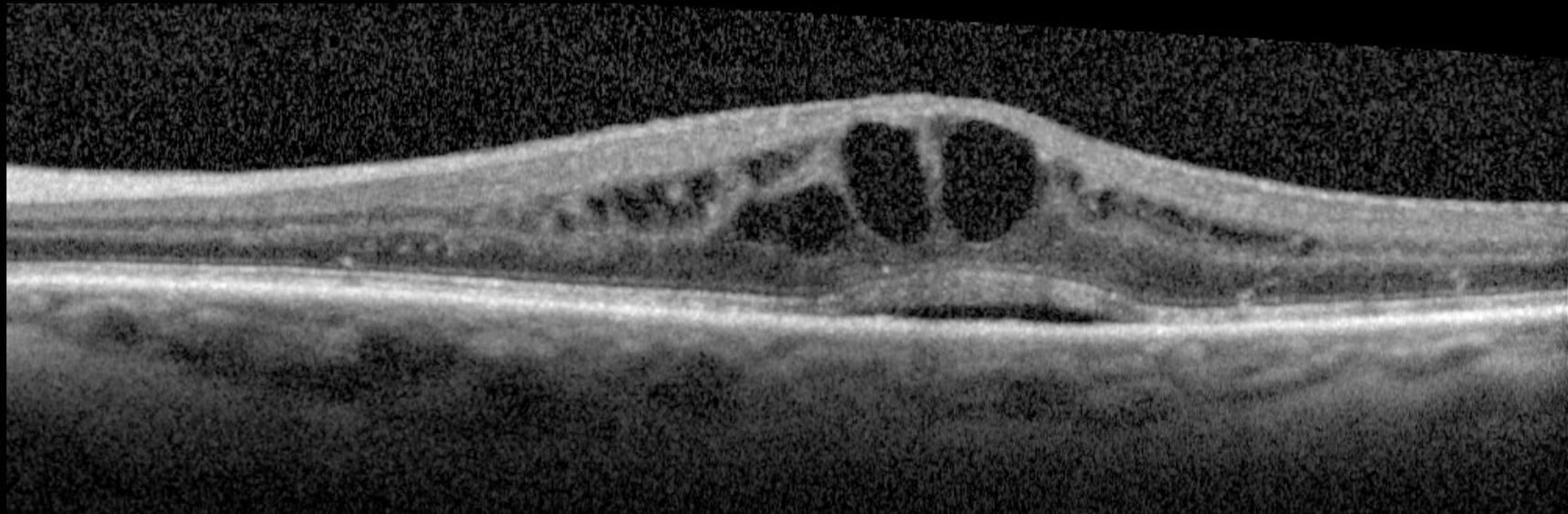
SRF & PED



IRF & PED

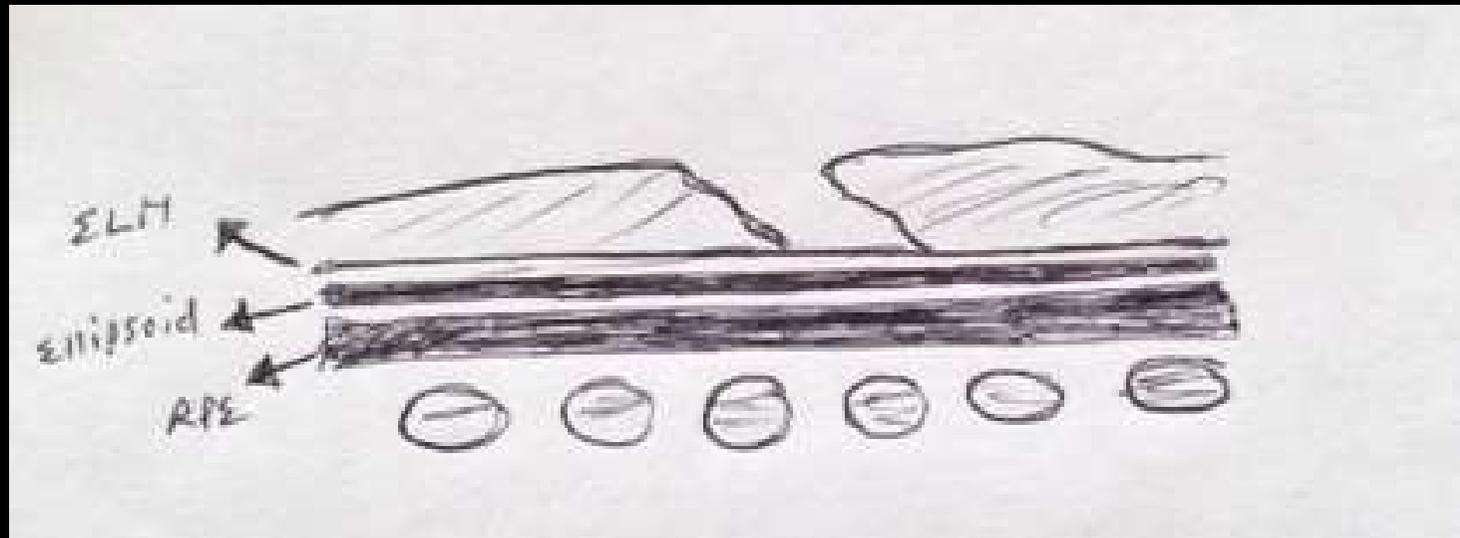


IRF & SRF

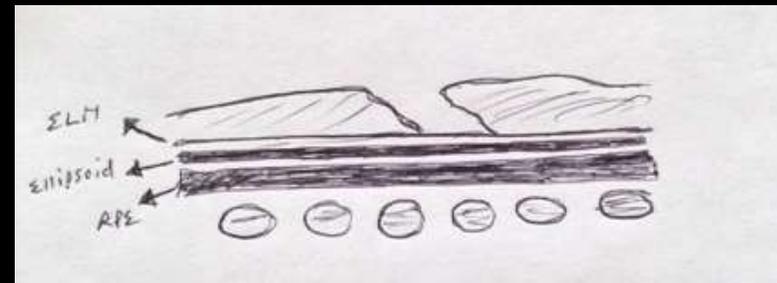
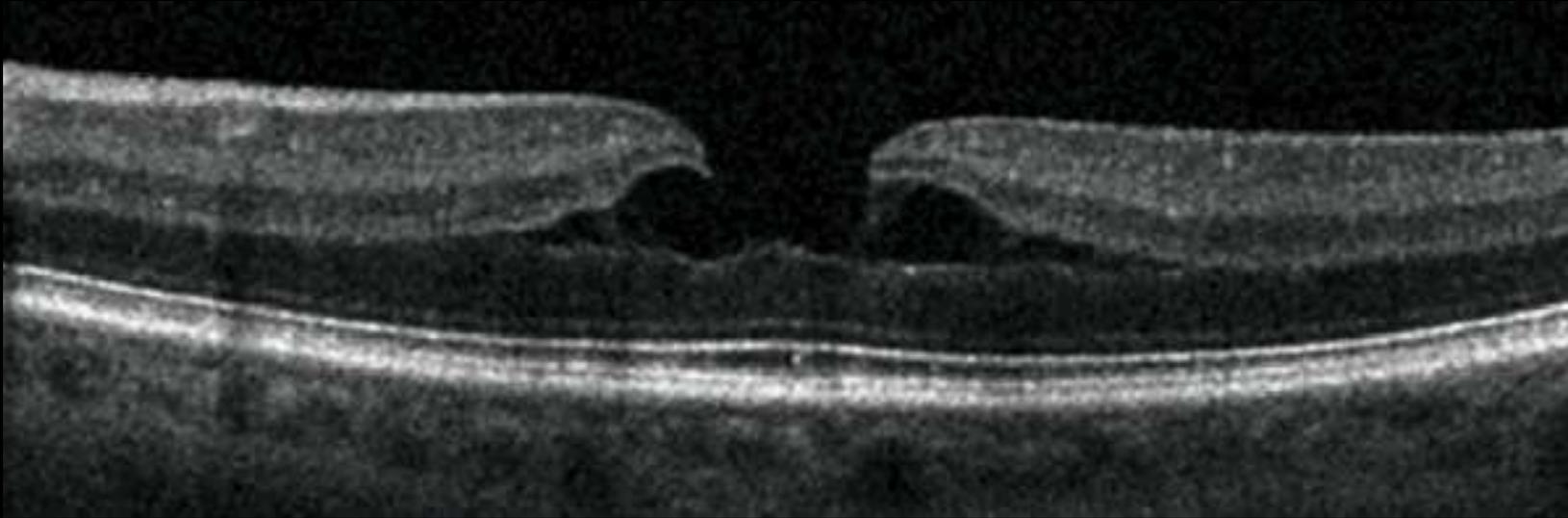


Holes / Atrophy

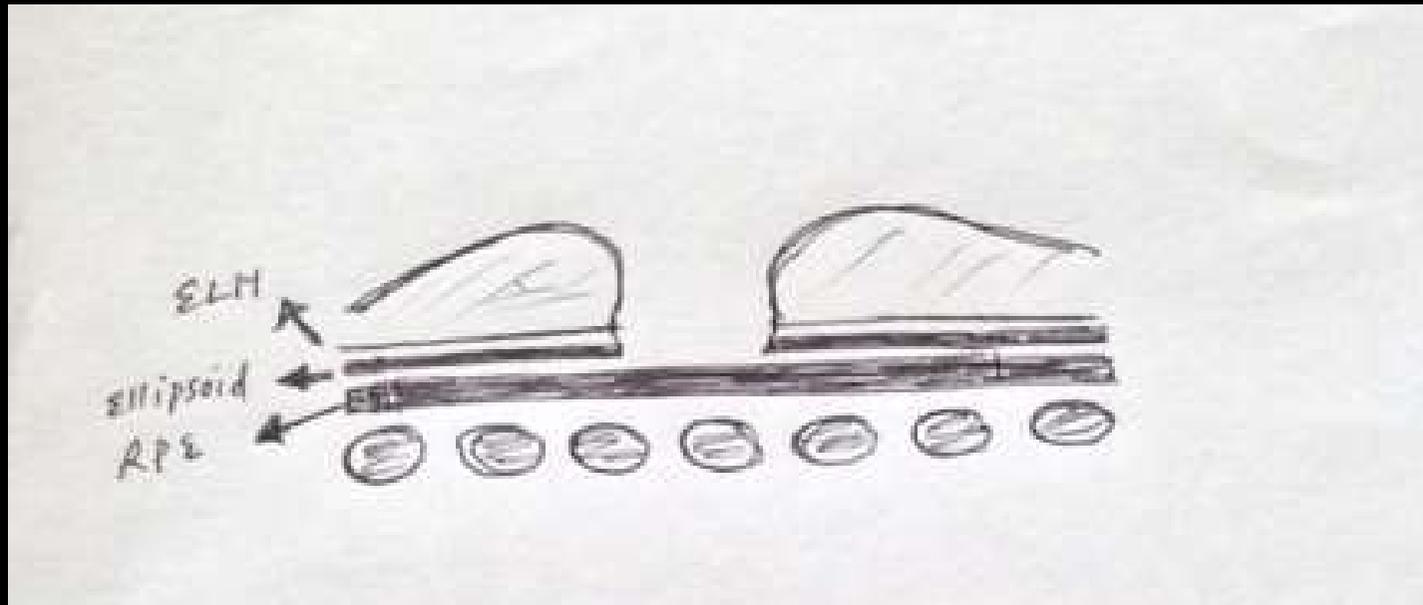
Lamellar Hole



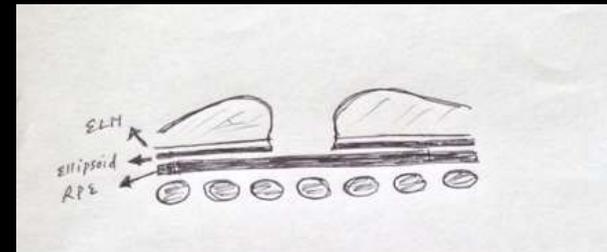
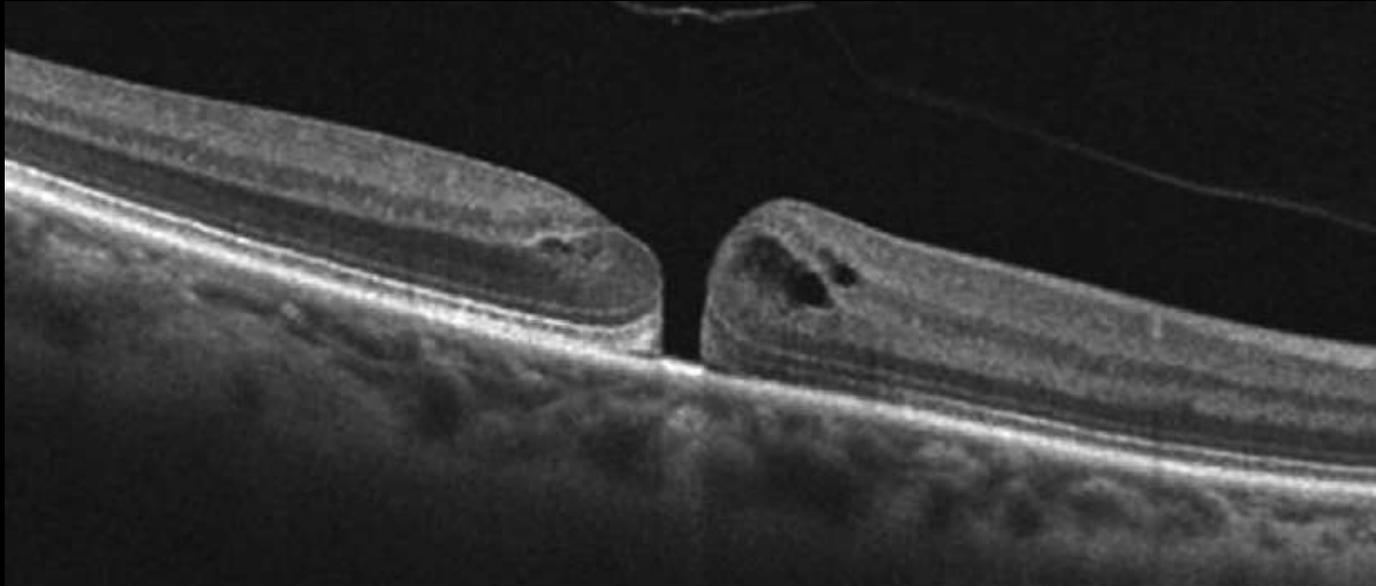
Lamellar Hole



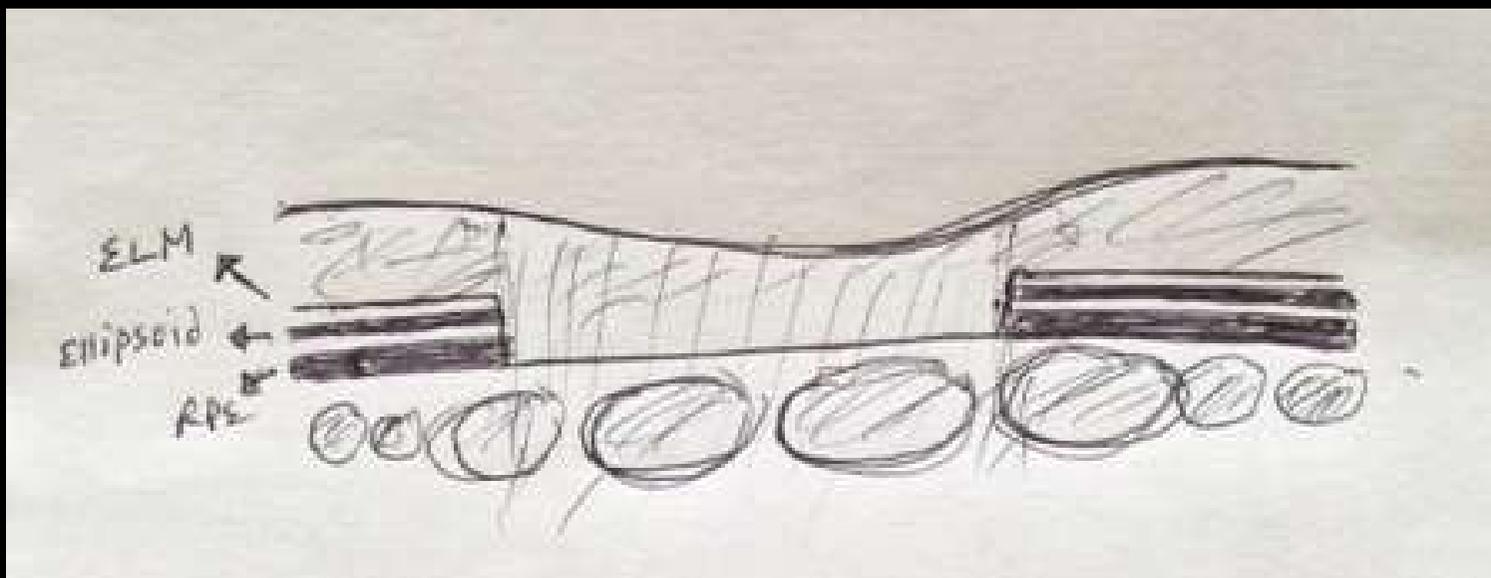
Full Thickness Macular Hole



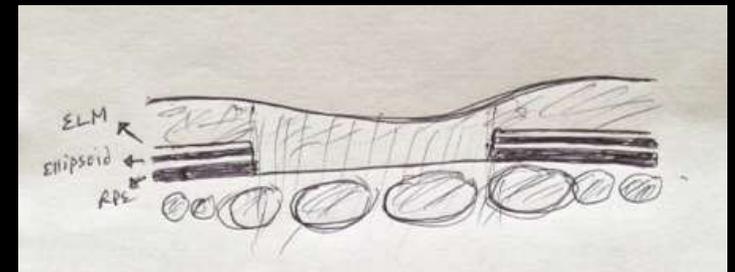
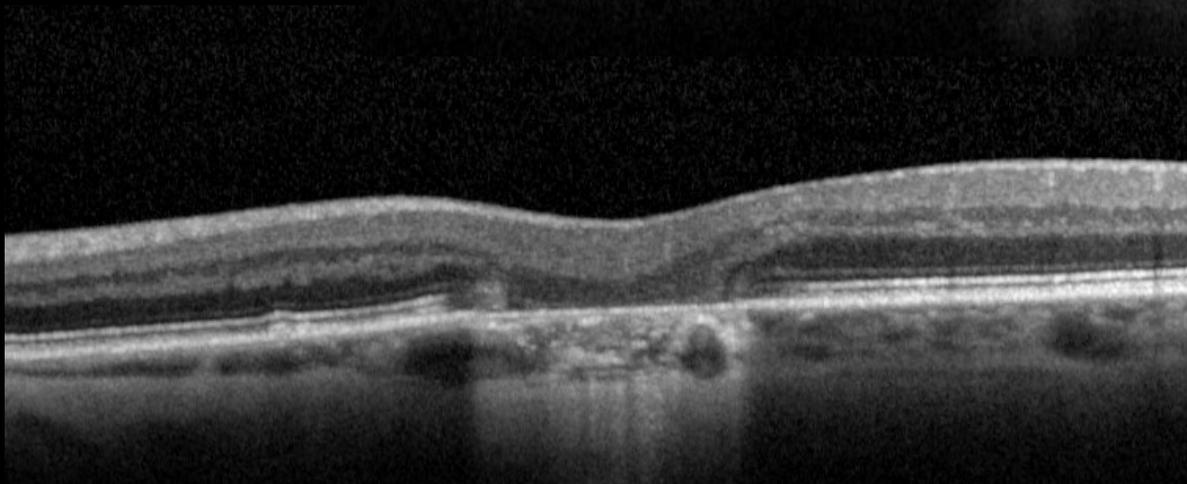
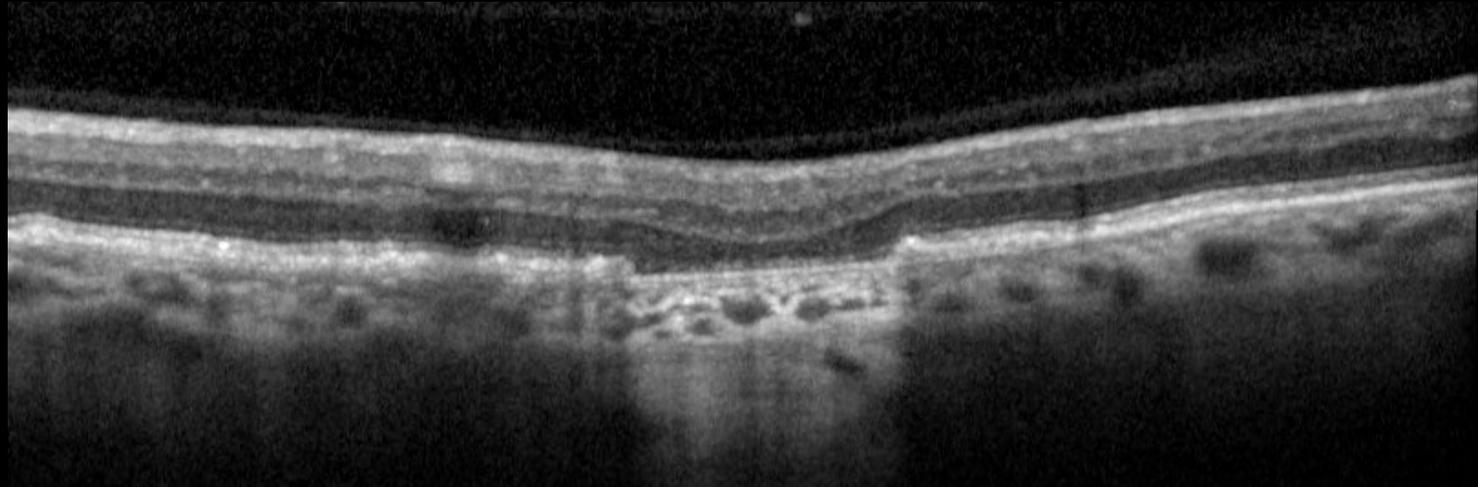
Full Thickness Macular Hole



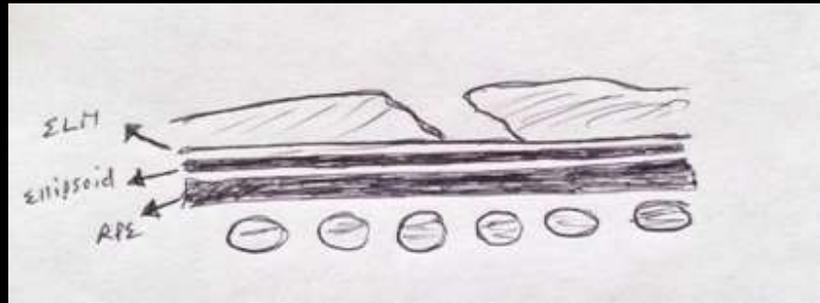
Geographic Atrophy



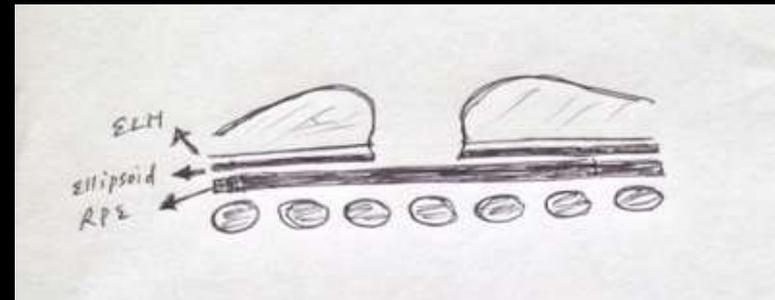
Geographic Atrophy



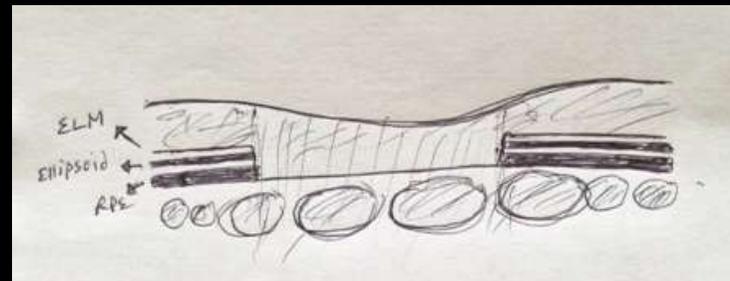
Holes / Atrophy



Lamellar Hole

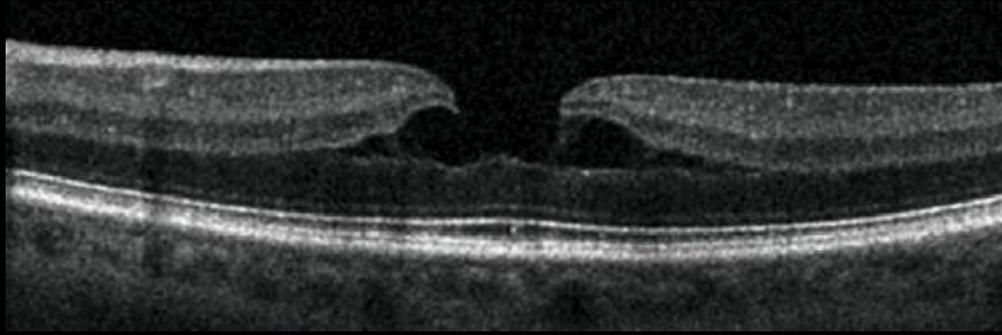


Full Thickness Hole

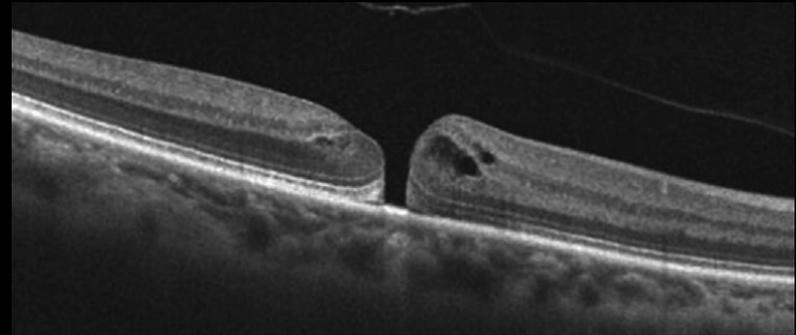
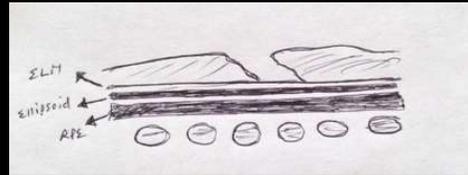


Geographic Atrophy

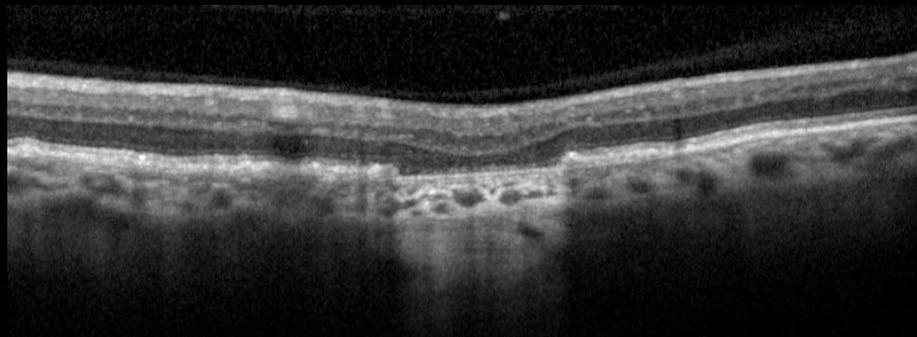
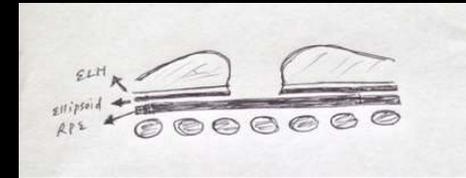
Holes / Atrophy



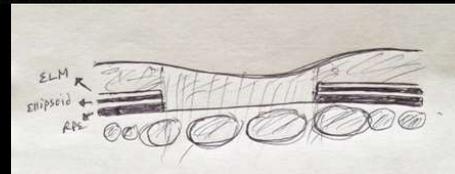
Lamellar Hole



Full Thickness Hole

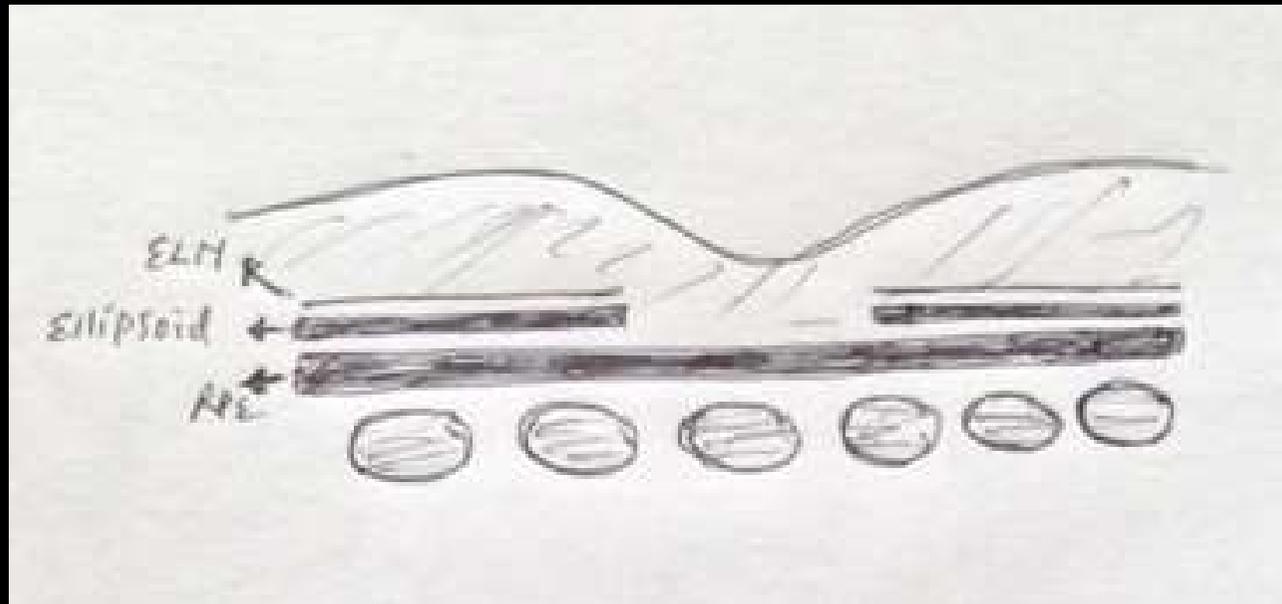


Geographic Atrophy

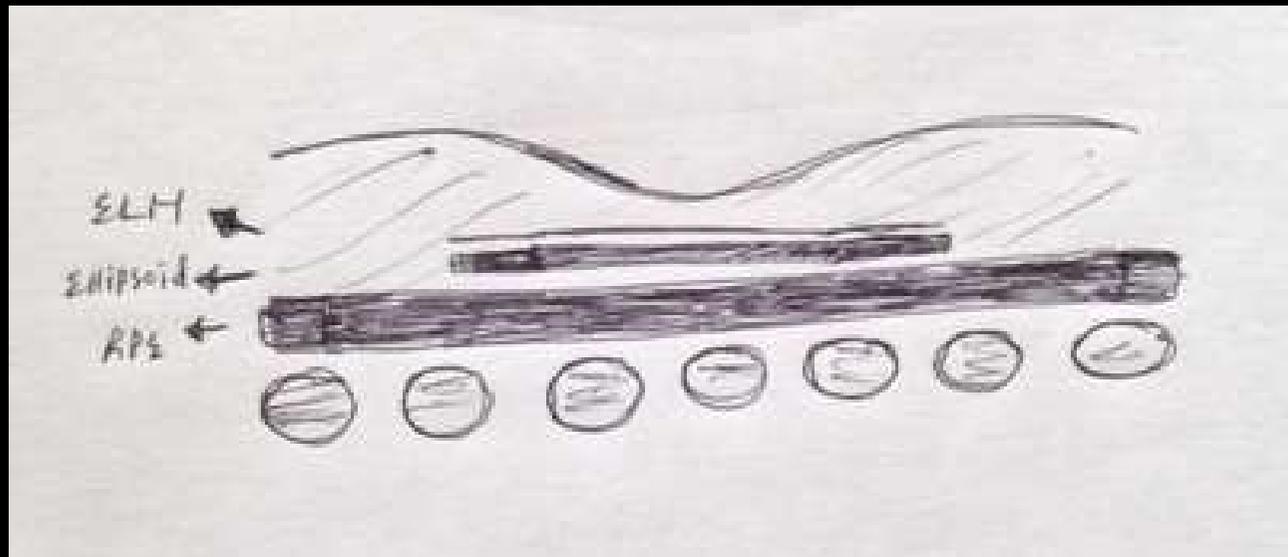


Photoreceptors

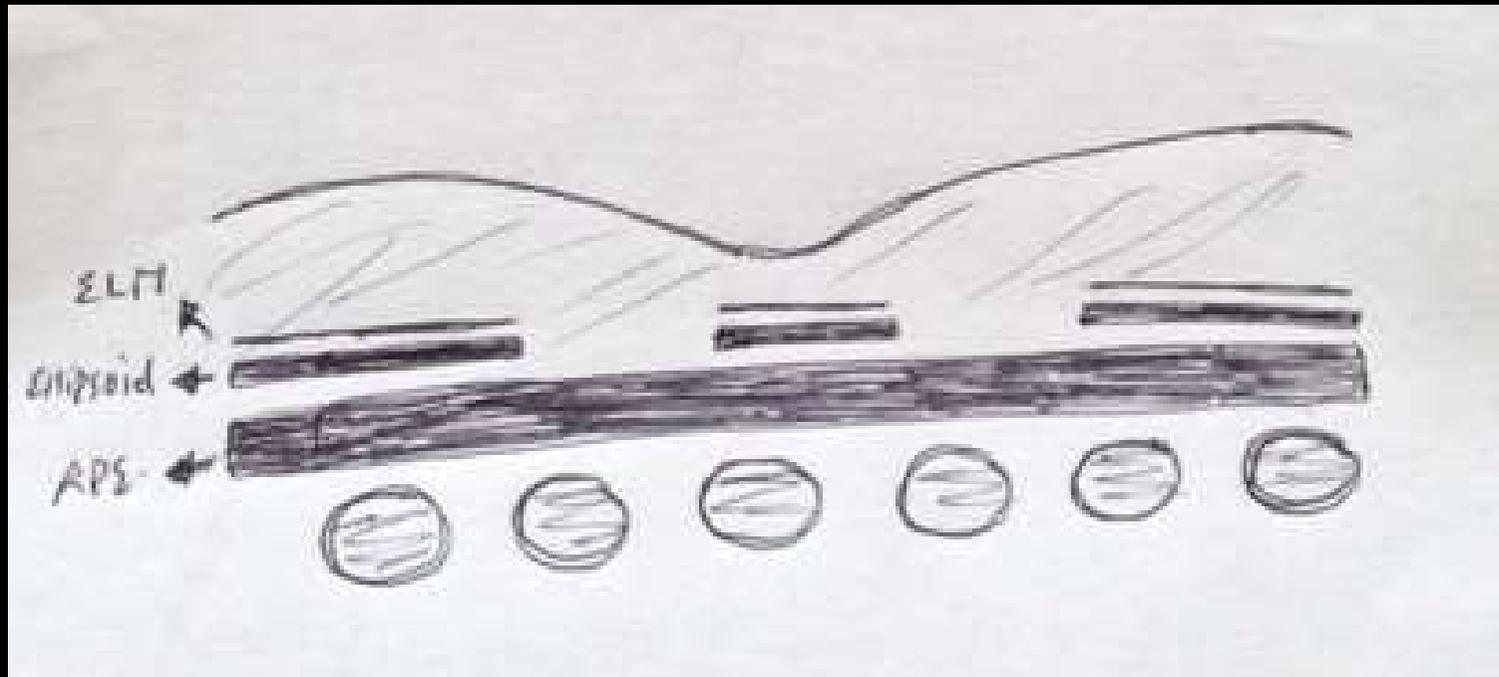
Central foveal loss of Photoreceptors



Peripheral / Extra-foveal loss of PR



Parafoveal loss of PR

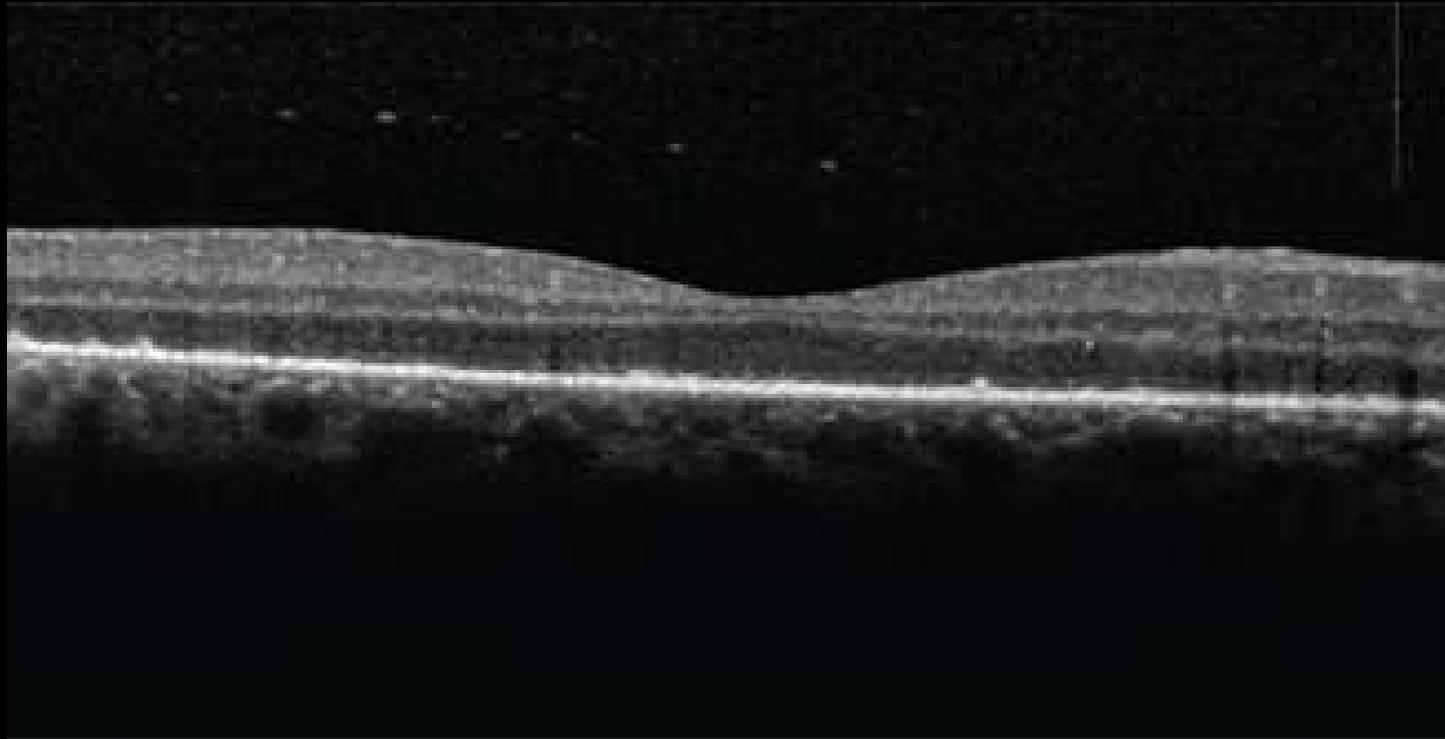


OCT - Choroid

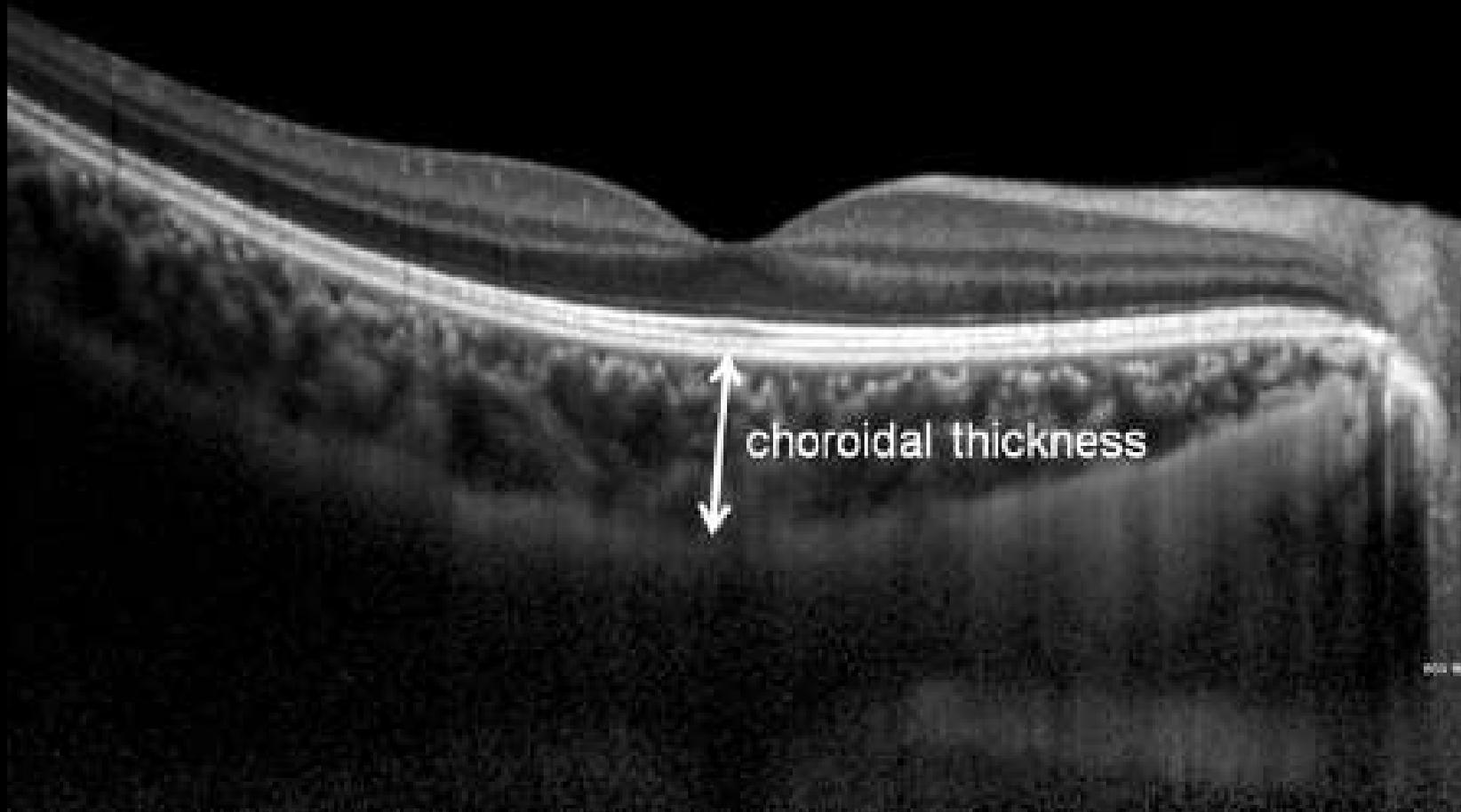
OCT - Choroid

- Enhanced Depth Imaging (EDI) OCT
- Swept Source OCT

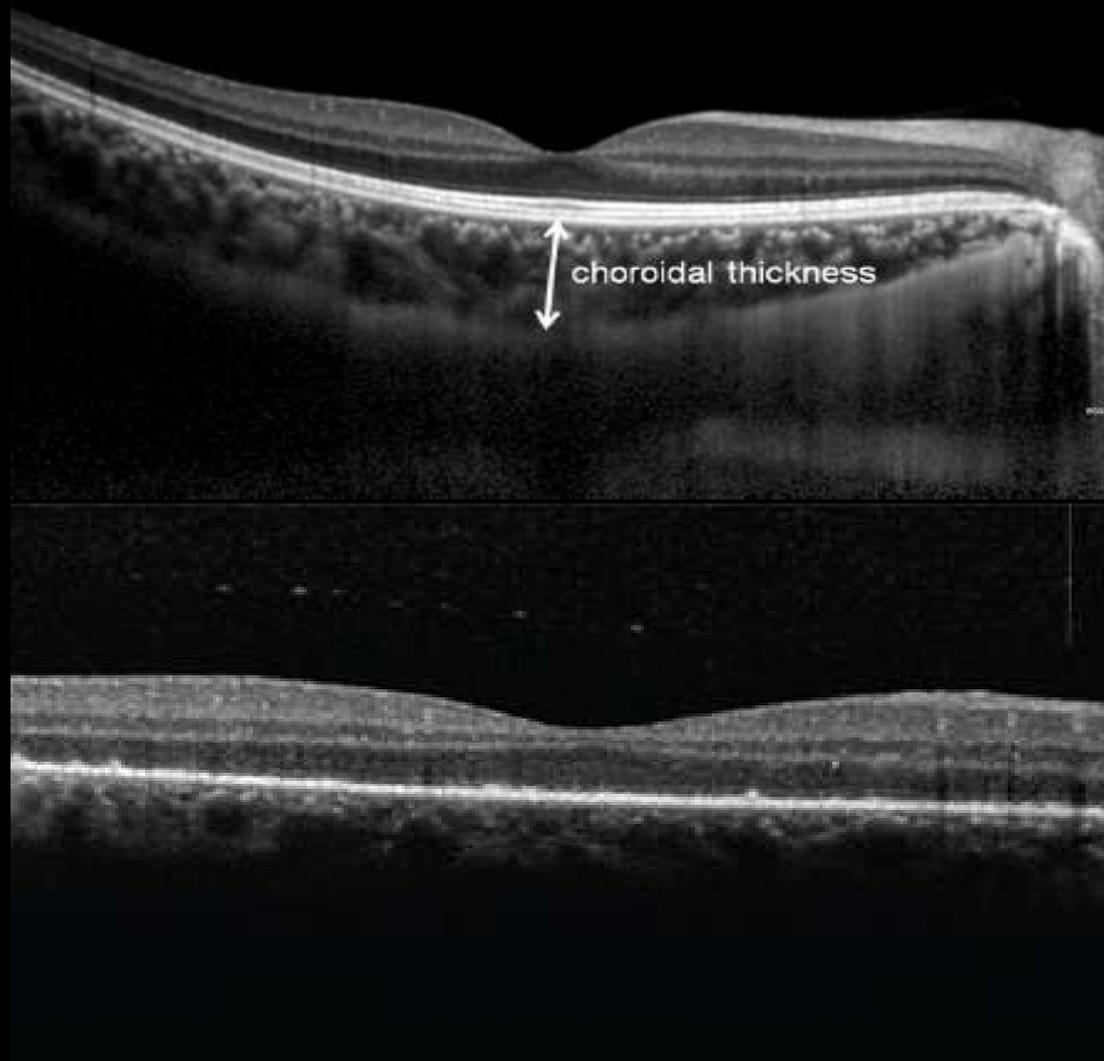
SD OCT



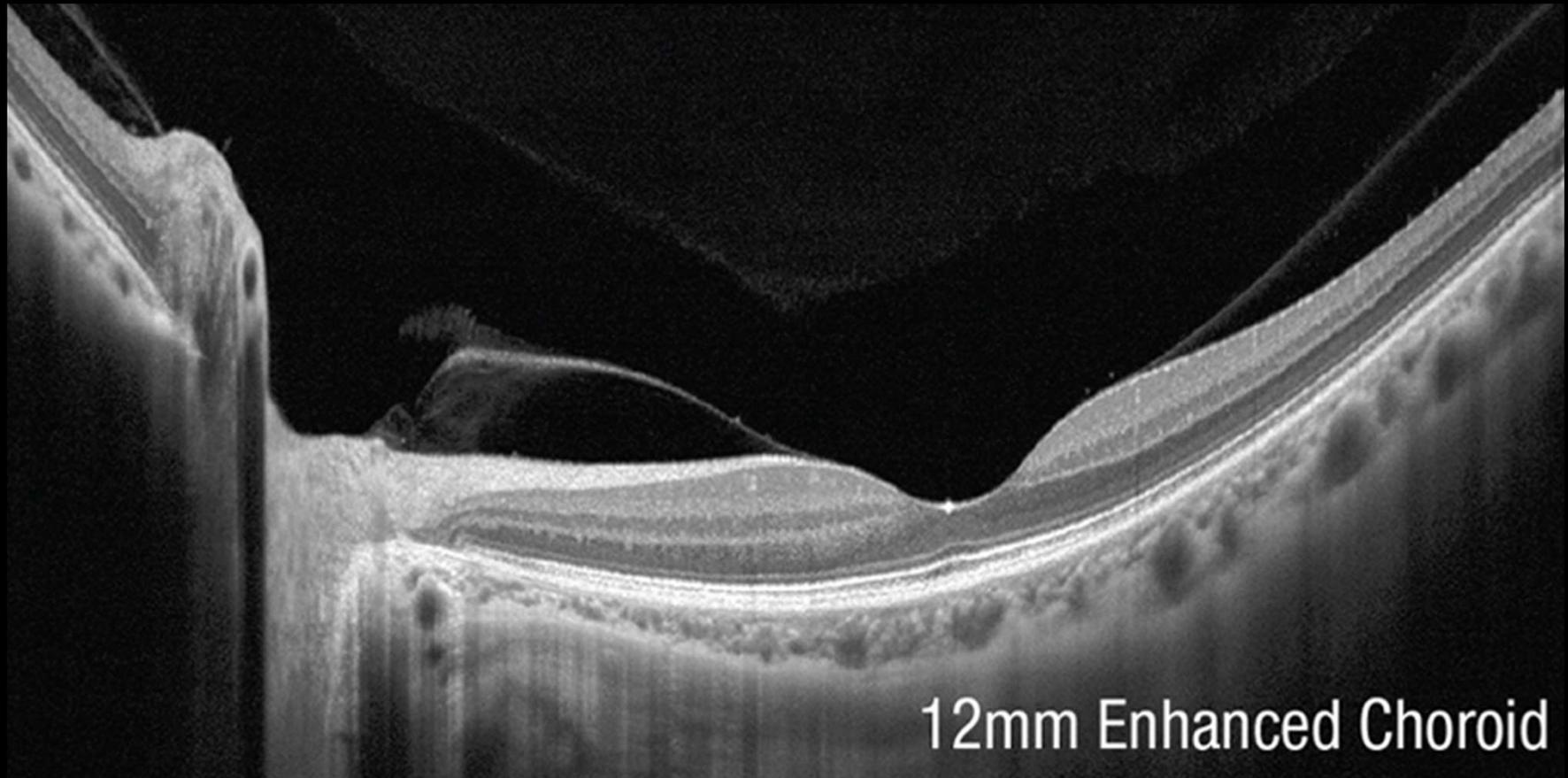
EDI OCT



EDI OCT versus SD OCT

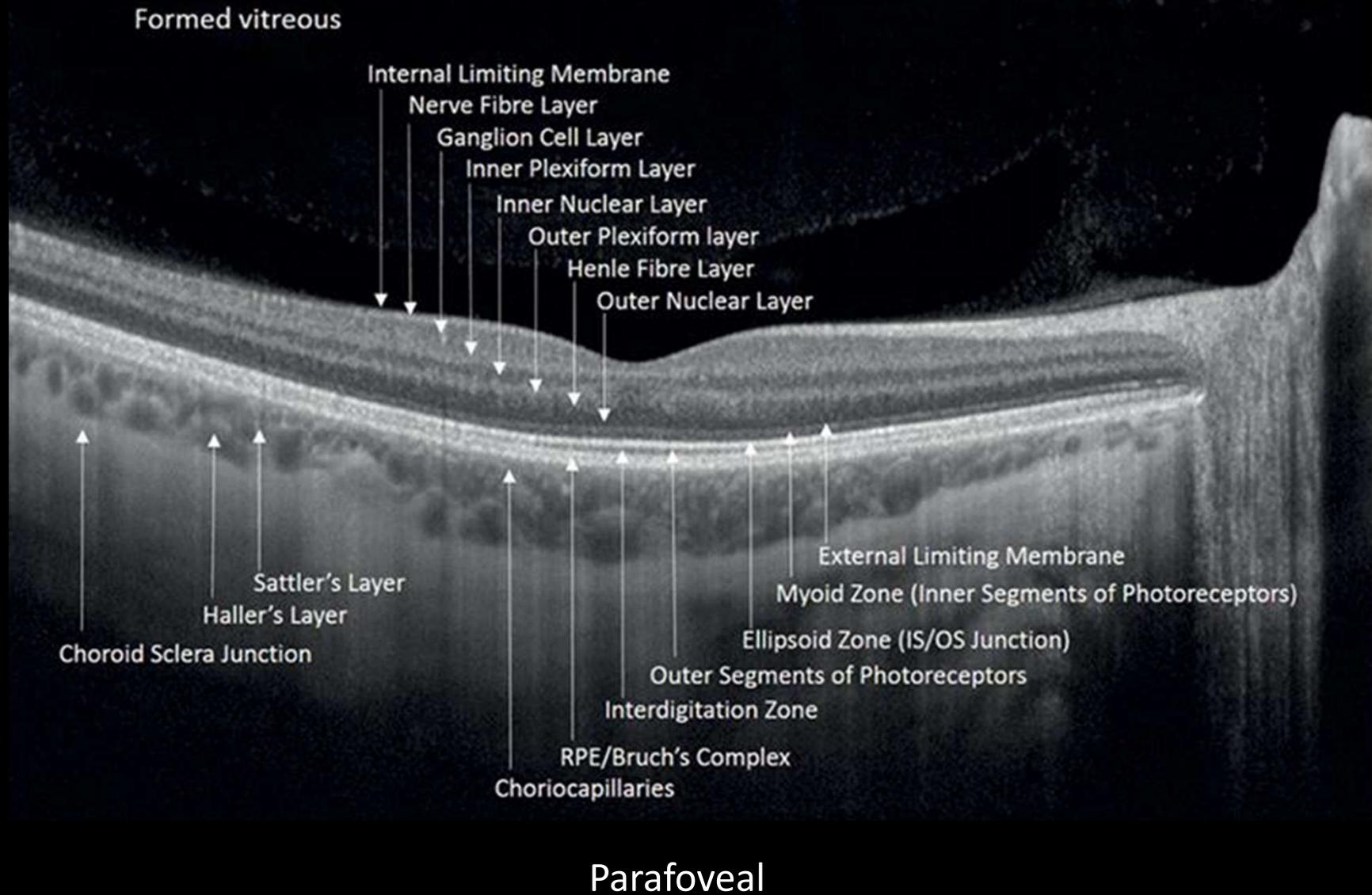


SS OCT



12mm Enhanced Choroid

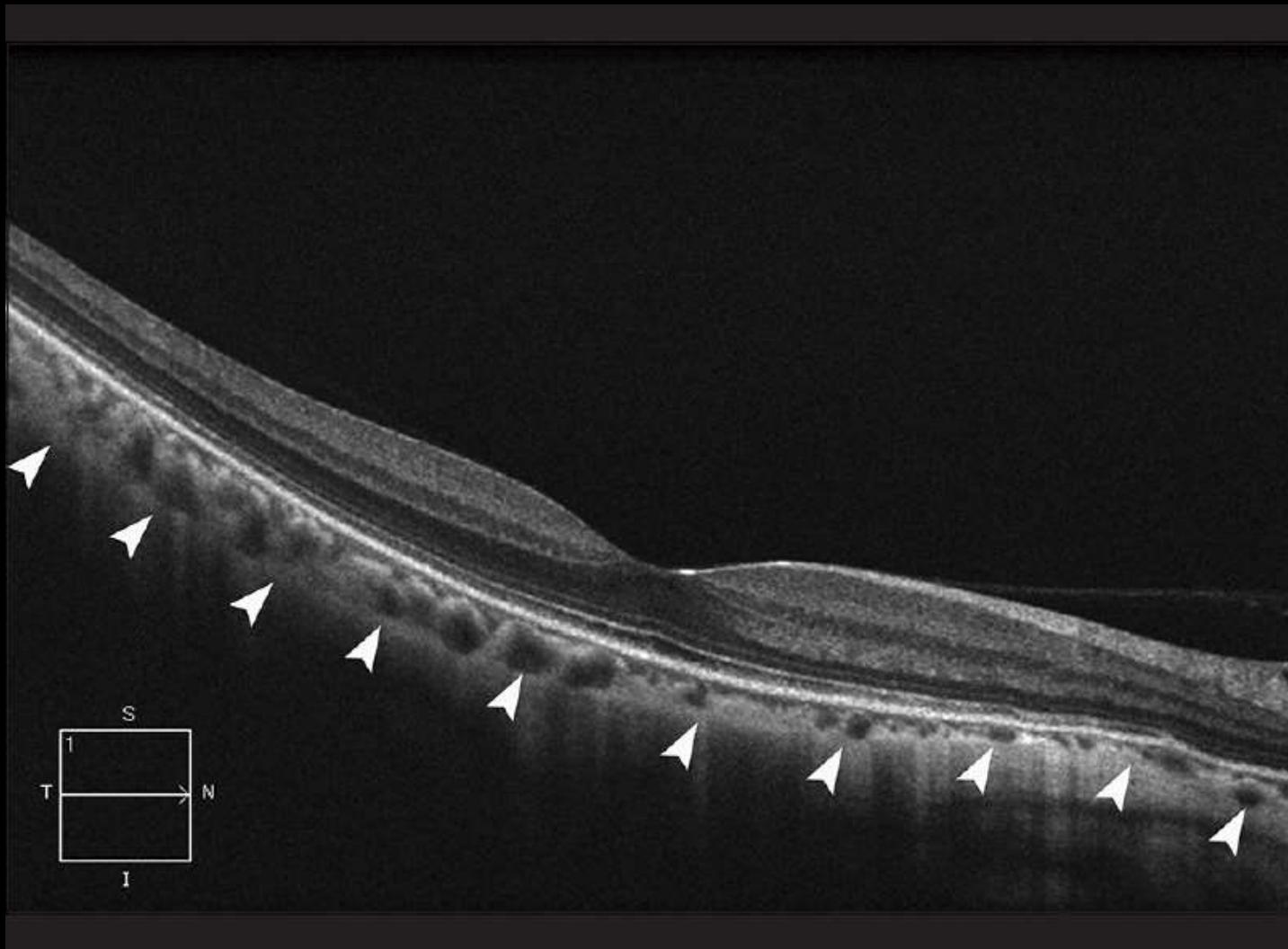
OCT - Choroid



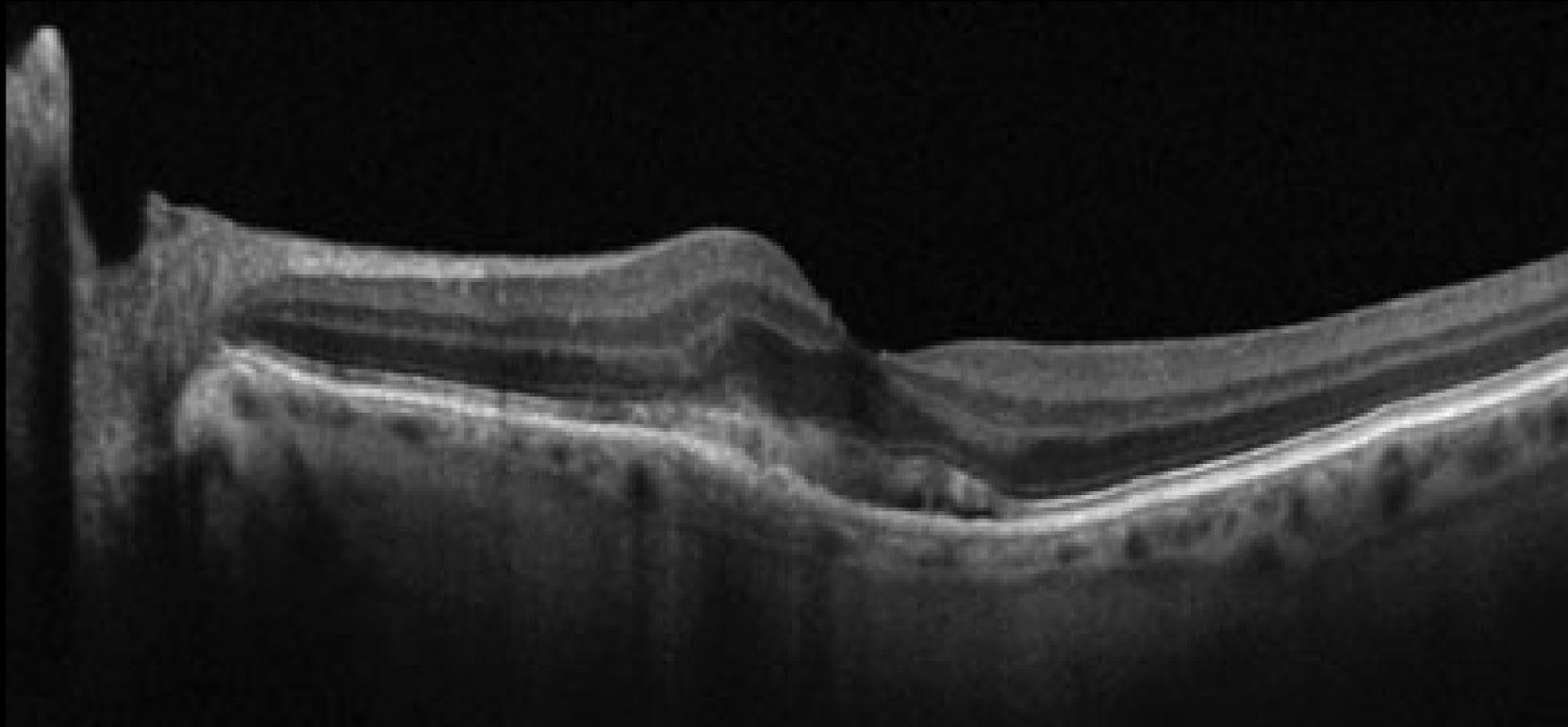
Choroid

- Choroid thickness decrease with
 - age
 - Increasing axial length
- Thin choroid
 - AMD
 - Myopia

Myopia – Thin Choroid



AMD – Thin Choroid



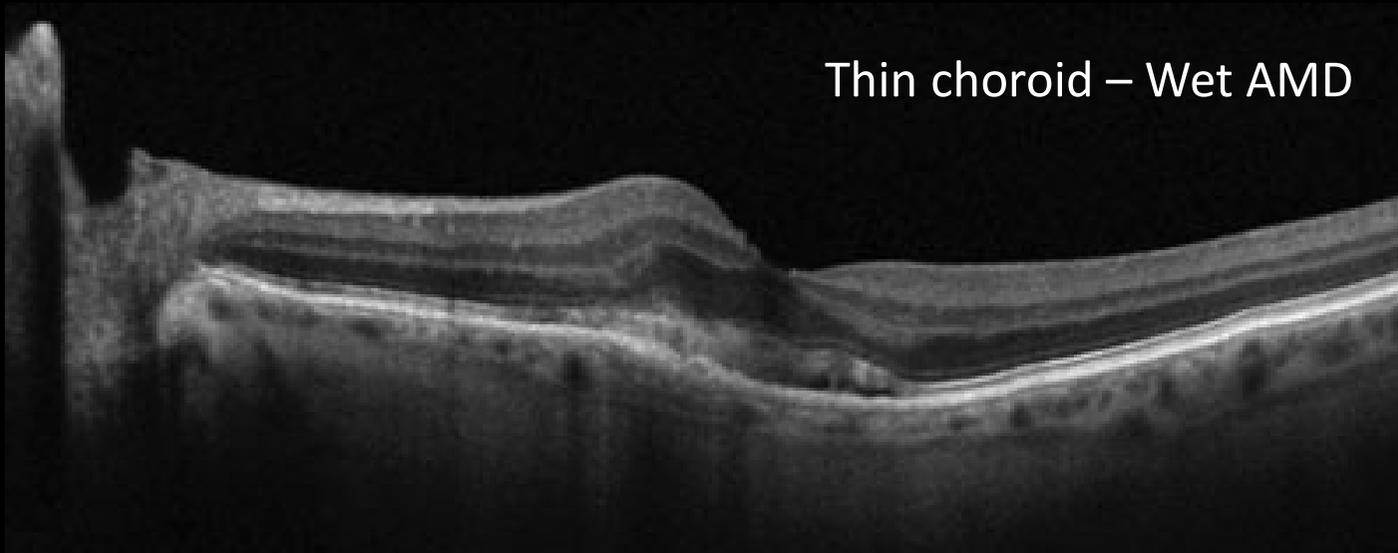
Pachychoroid

- Thickened choroid

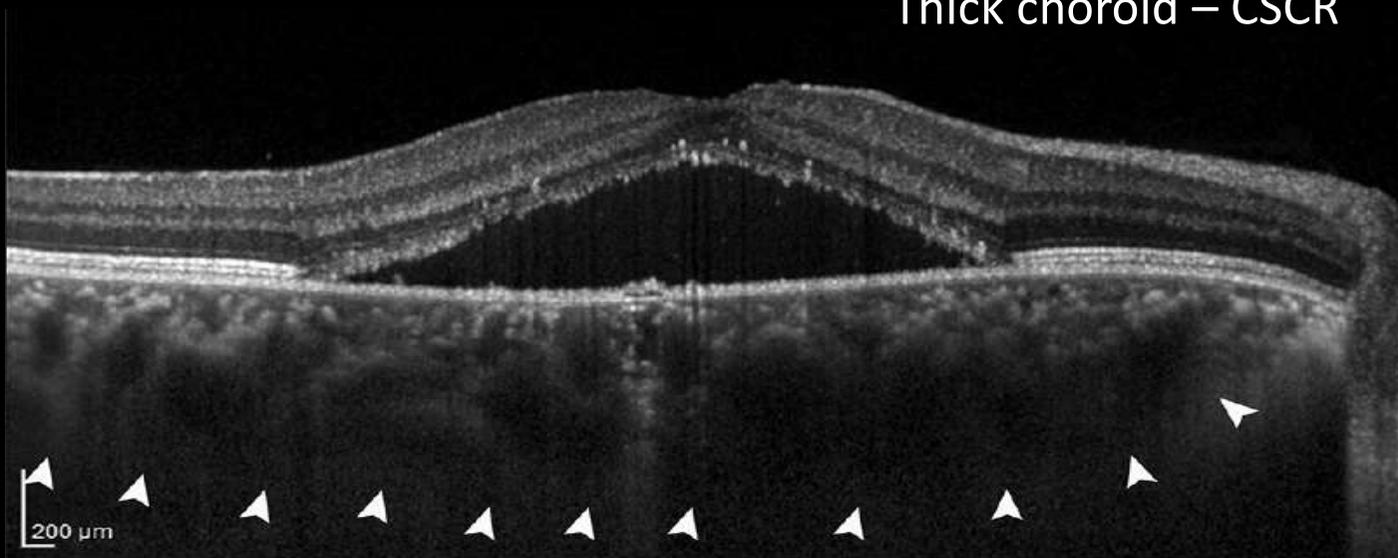
Pachychoroid Disease Spectrum

- 1) Pachychoroid Pigment epitheliopathy (PPE)
- 2) Central Serous ChorioRetinopathy (CSCR)
- 3) Polypoidal choroidal vasculopathy (PCV)
- 4) Pachychoroid neovascularopathy (PNV)

Thin choroid – Wet AMD



Thick choroid – CSCR



Summary

- OCT currently is the main tool for macula assessment – a necessity than a luxury
- Be familiar with the anatomy / histology of the macular region and its correlation with the OCT layers
- Use the latest accepted nomenclature and terminology
- Be aware of recent / evolving classifications / redefining of macular / retinal disorders
- Identify what scan protocol / type used - technology
- Assess the OCT macula systematically from inside out particularly looking at the
 - Vitreoretinal interface
 - ELM, Ellipsoid band and the RPE
- Identify the level of any macular fluid
- Try to correlate the OCT changes with the clinical picture

Case 1

- 27 years Male
- Optician
 - Visual phenomenon
 - Visual field defect
- Seeing flickering spots of light last 10 years
- Seen in Huddersfield 5 years ago
 - Machine broken down
 - DNA

Case 1

- Asthma
- Smoker
- On questioning
 - History of night vision problems

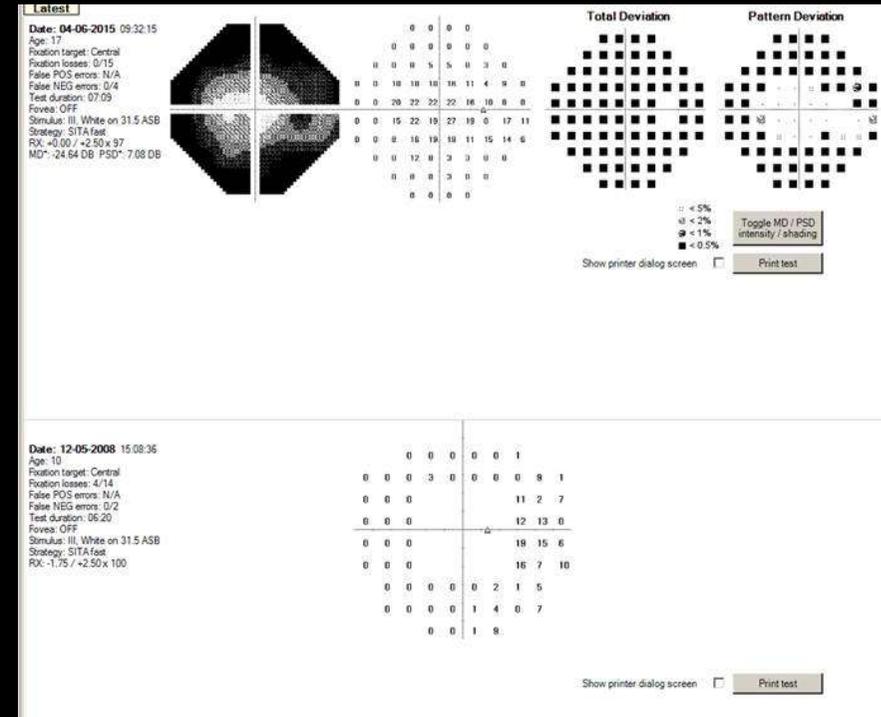
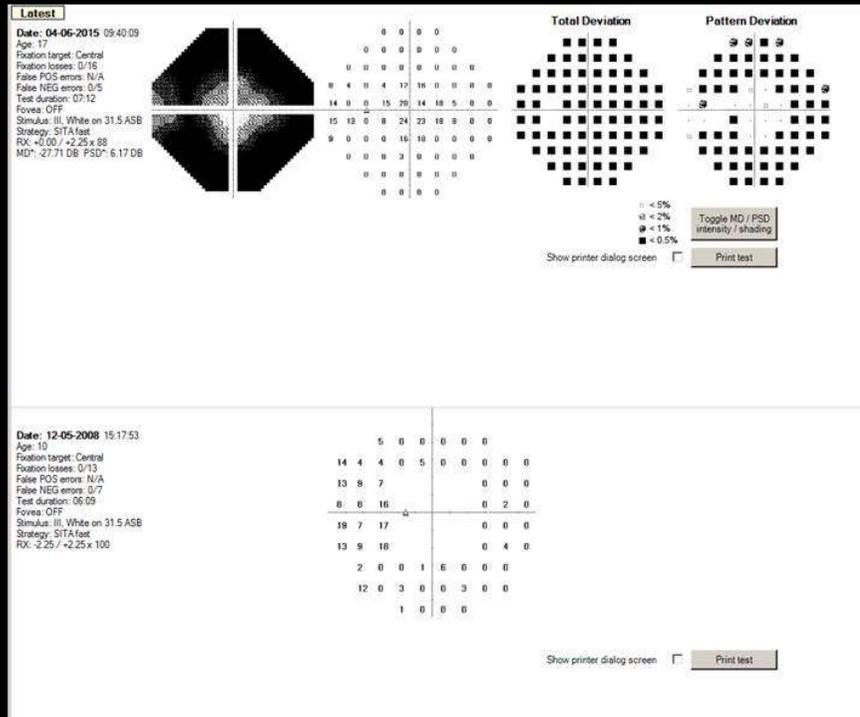
Case 1

- VA 0.2 (UA) 0.18 (PH)
- Colour vision: BE normal
- Anterior segment: BE normal
- Fundus: BE extensive retinal pigmentary changes

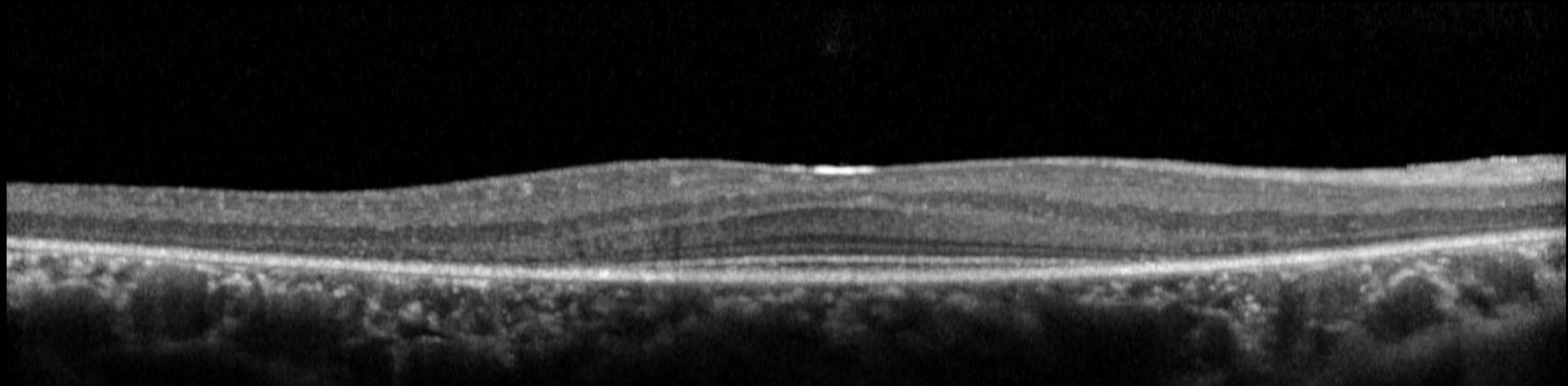
Case 1

- Visual fields: BE marked peripheral constriction

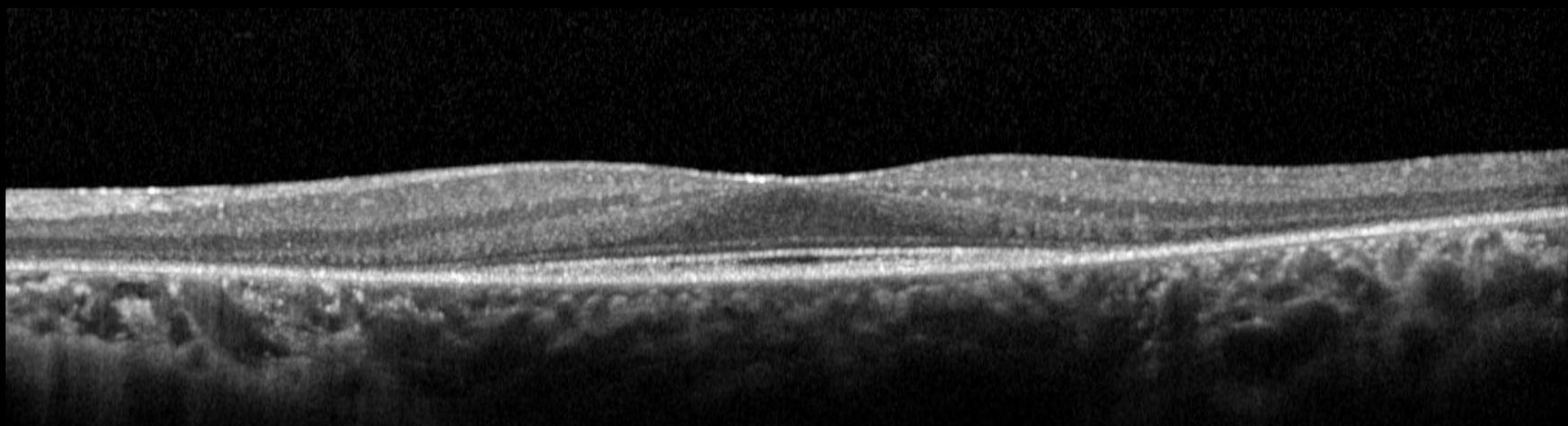
Case 1 – visual fields



Case 1 – OCT macula RE



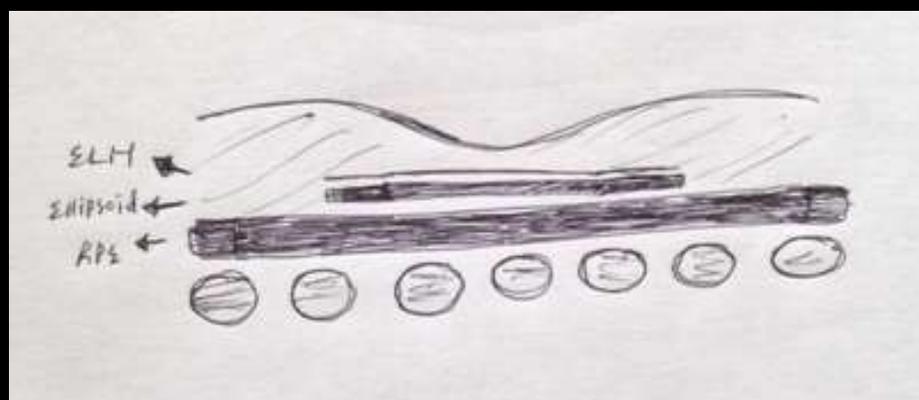
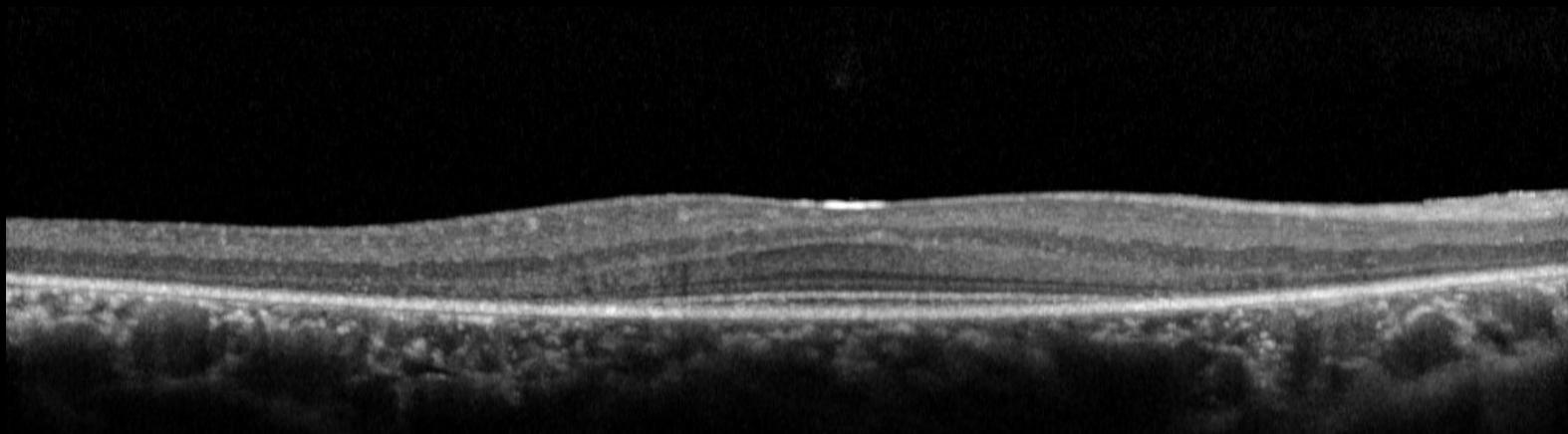
Case 1 – OCT macula LE



Case 1 - Questions

- What is the diagnosis?
- What is the OCT findings?

Case 1 – OCT macula RE



Case 1

- Rod dystrophy

Case 2

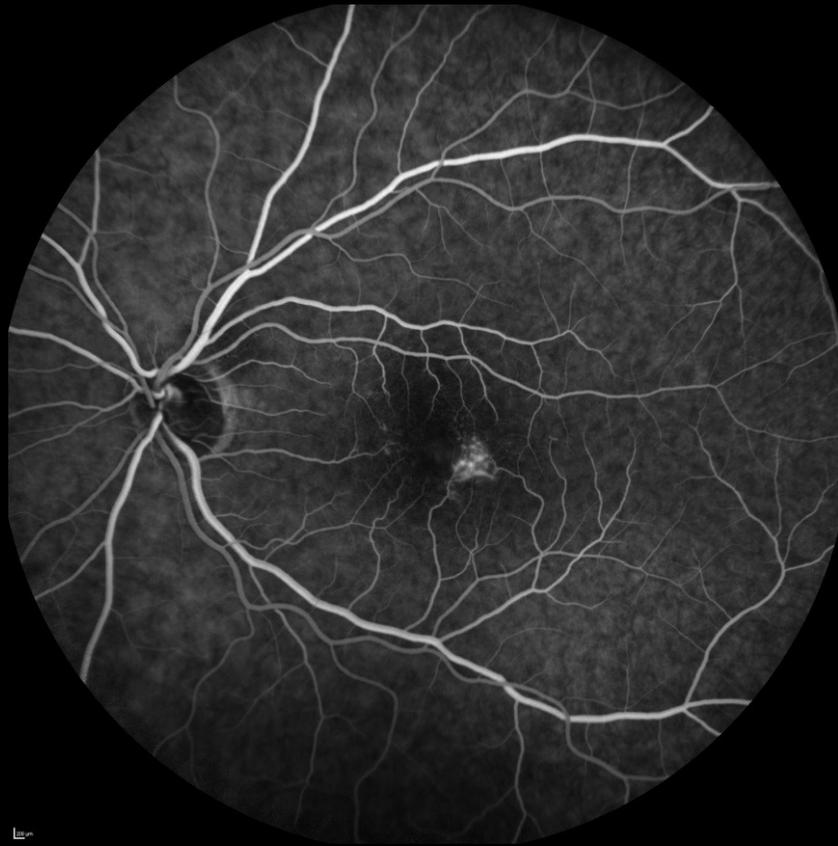
- 15.11.2013

– VA 0.4 0.0

Case 2 – FFA RE 2011



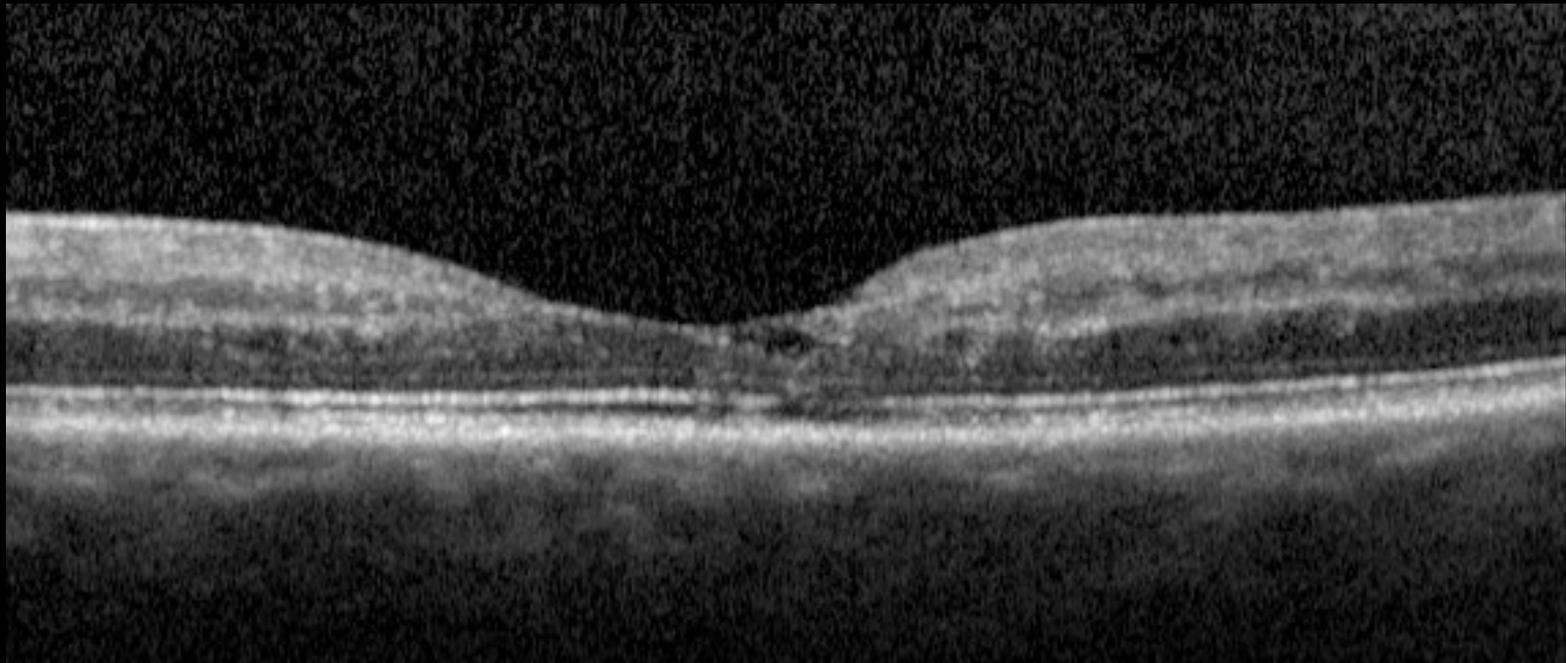
Case 2 – FFA LE 2011



Case 2 – OCT RE 2011



Case 2 – OCT LE 2011

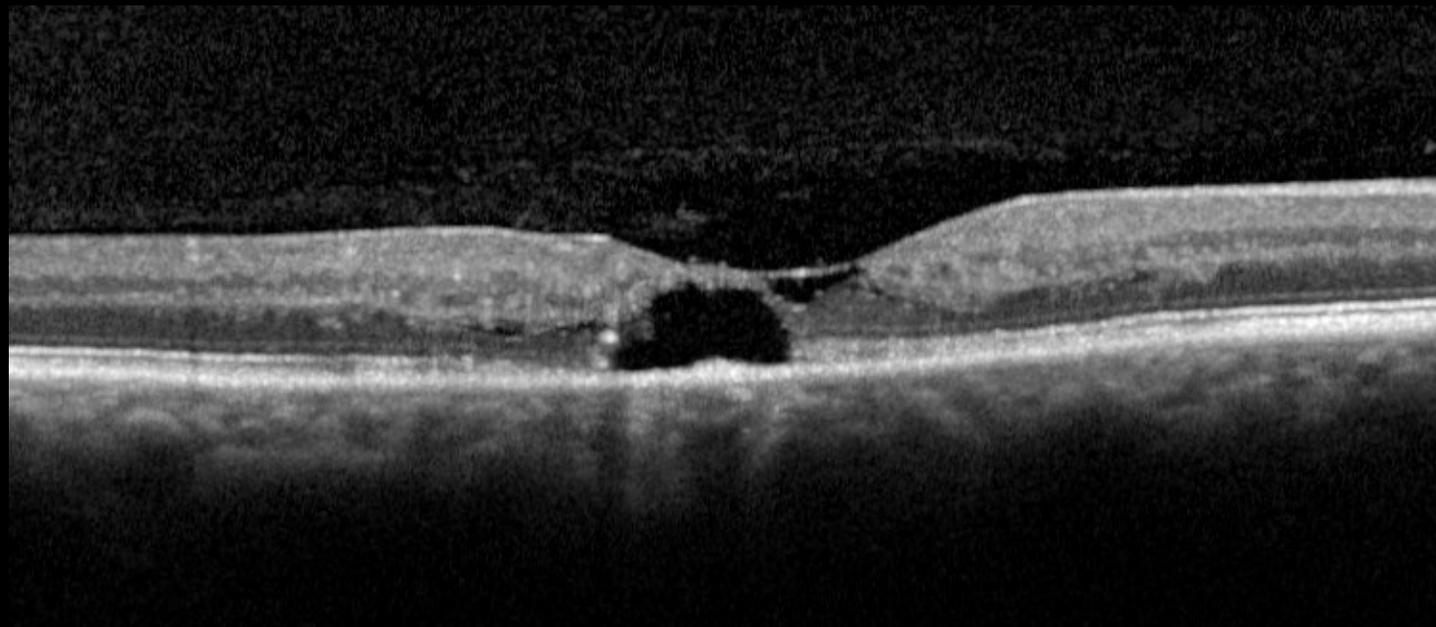


Case 2

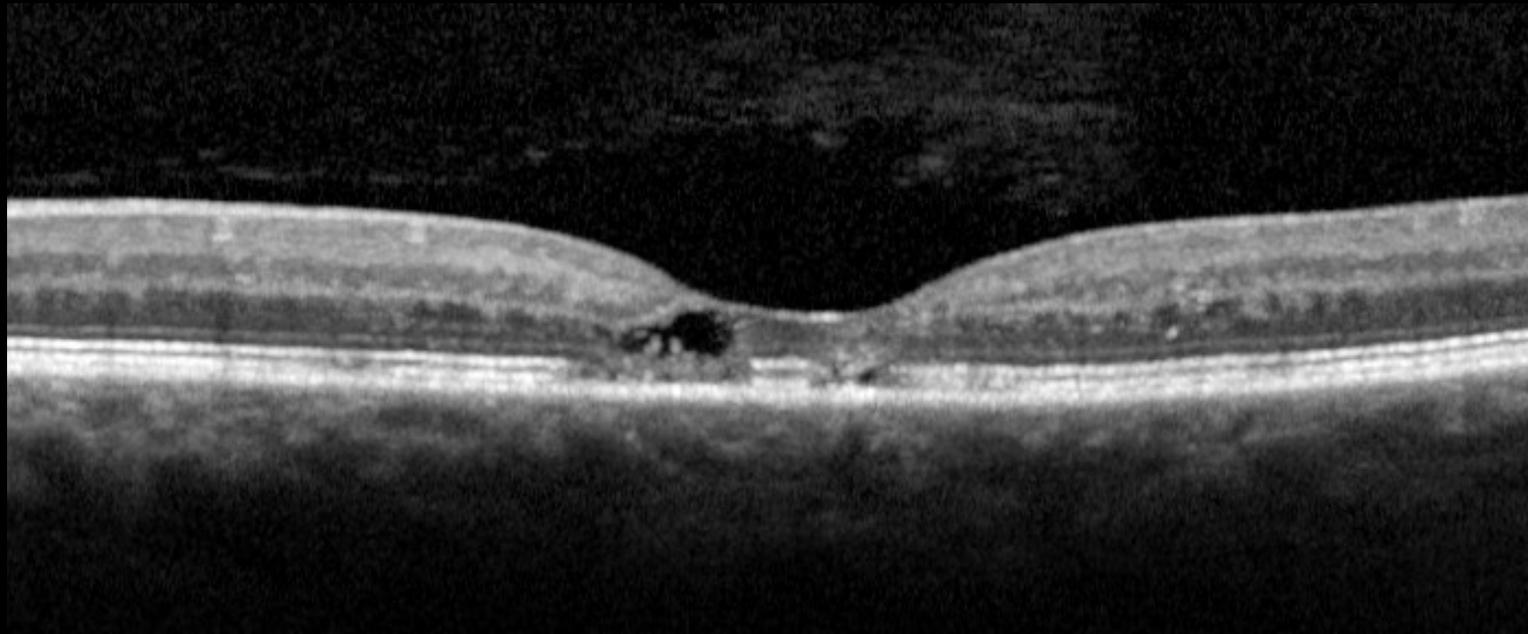
- 12.6.2015

– VA 0.5 0.1

Case 2 – OCT RE 2015



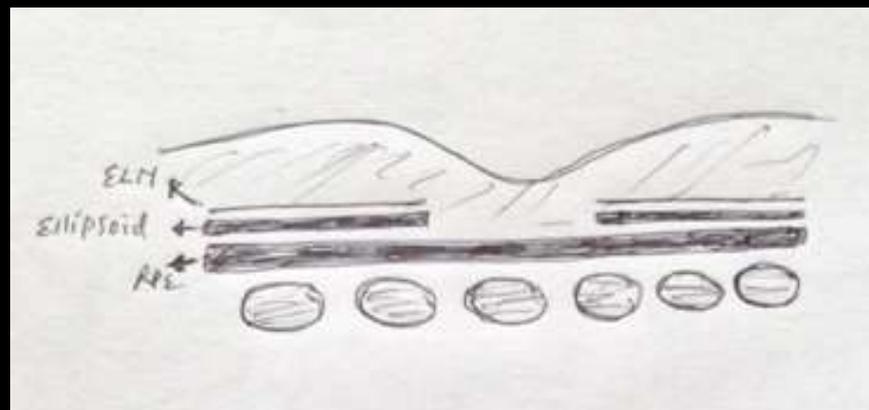
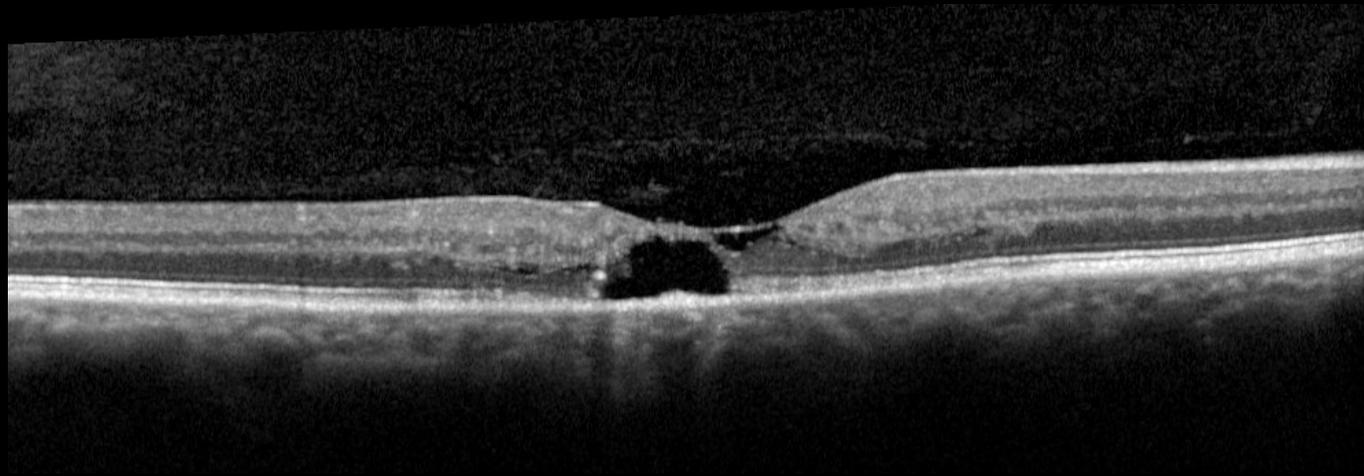
Case 2 – OCT LE 2015



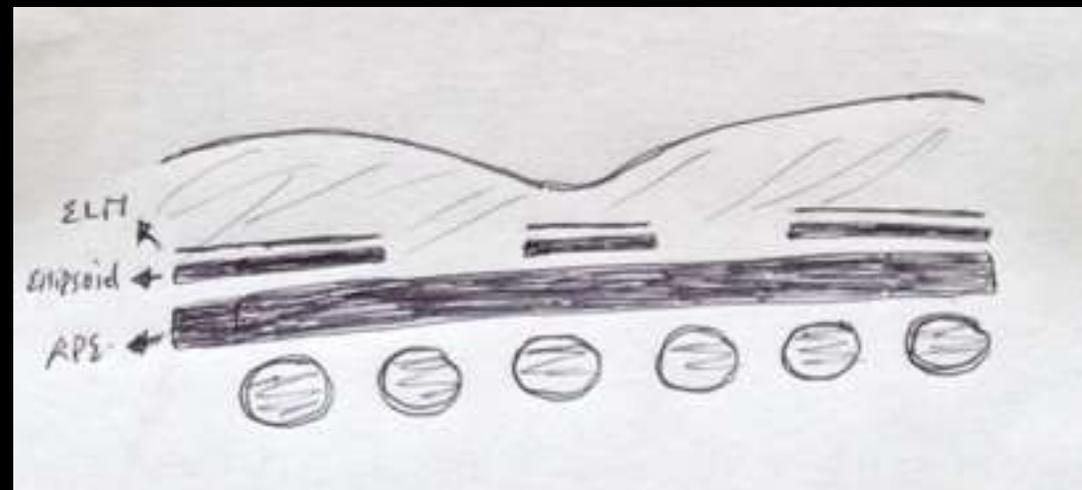
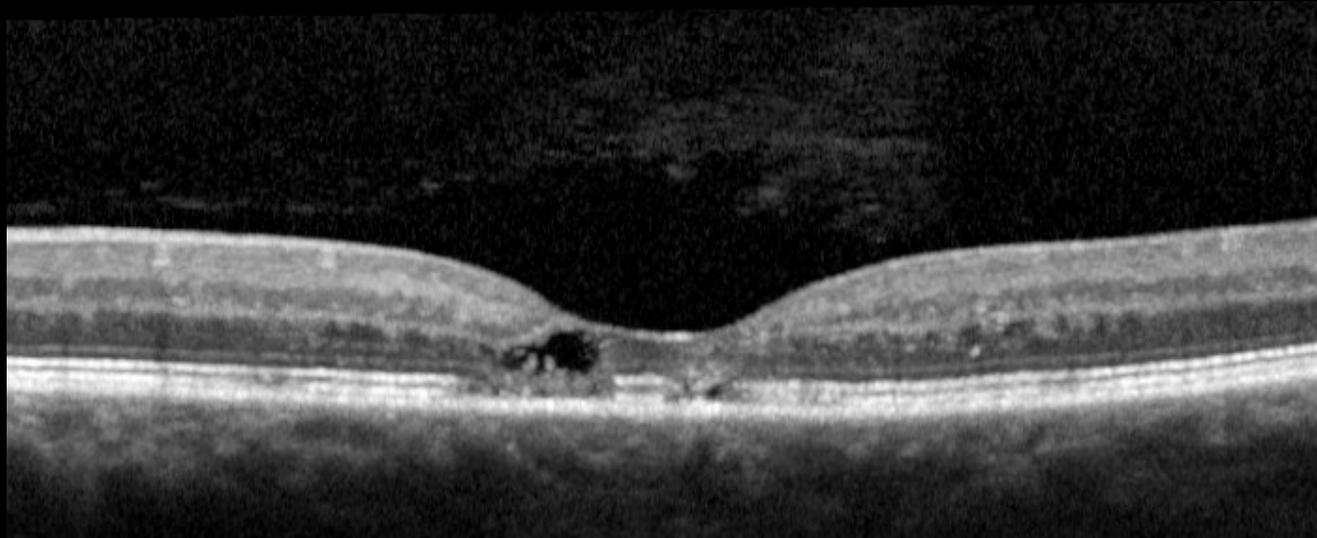
Case 2 - Questions

- What is the diagnosis?
- What are the OCT findings?

Case 2 – OCT RE 2015



Case 2 – OCT LE 2015



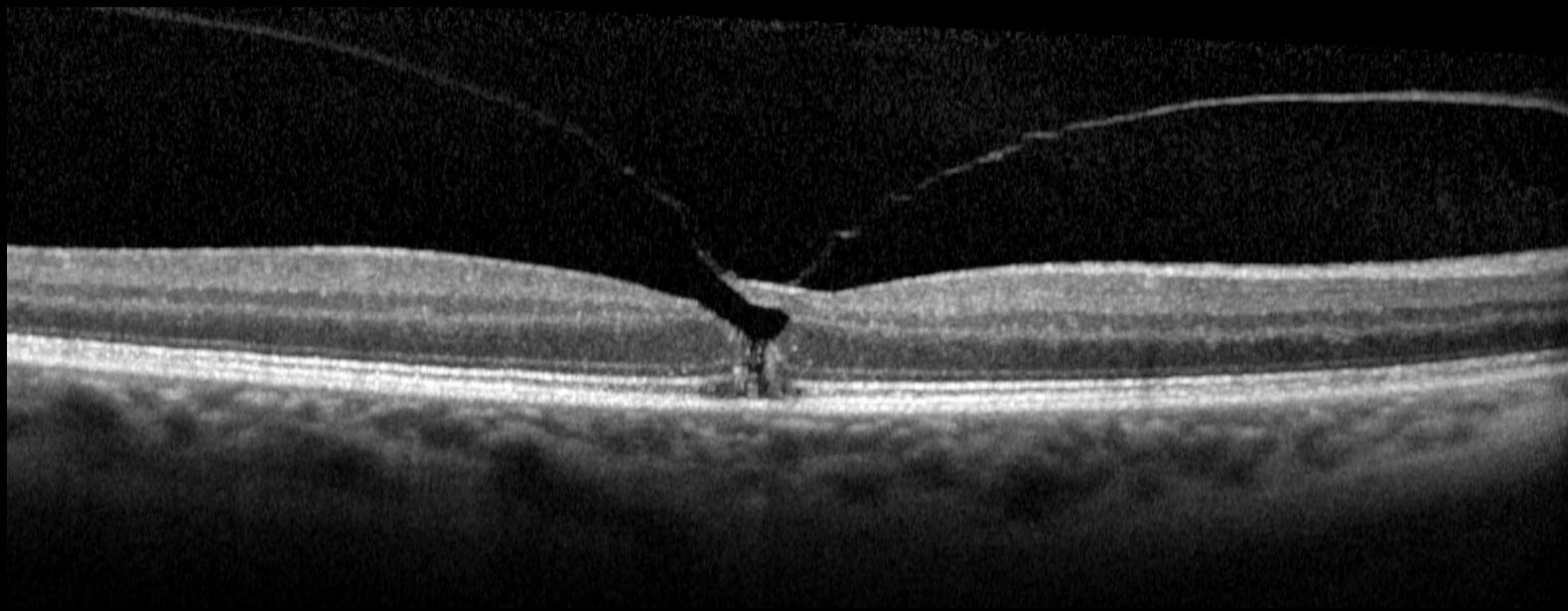
Case 2

- Mac Tel Type 2

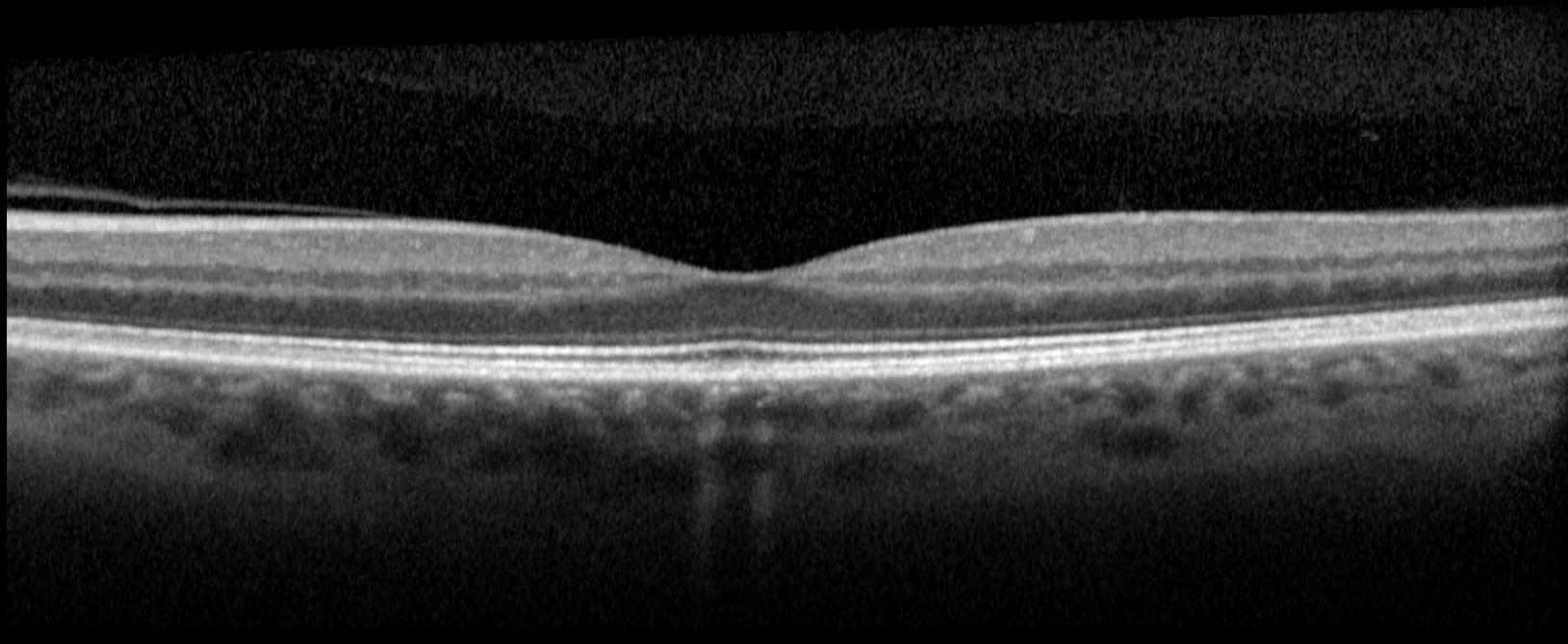
Case 3

- 18.6.2015
 - 70 years female
 - VA 0.6 0.3

Case 3 – OCT RE



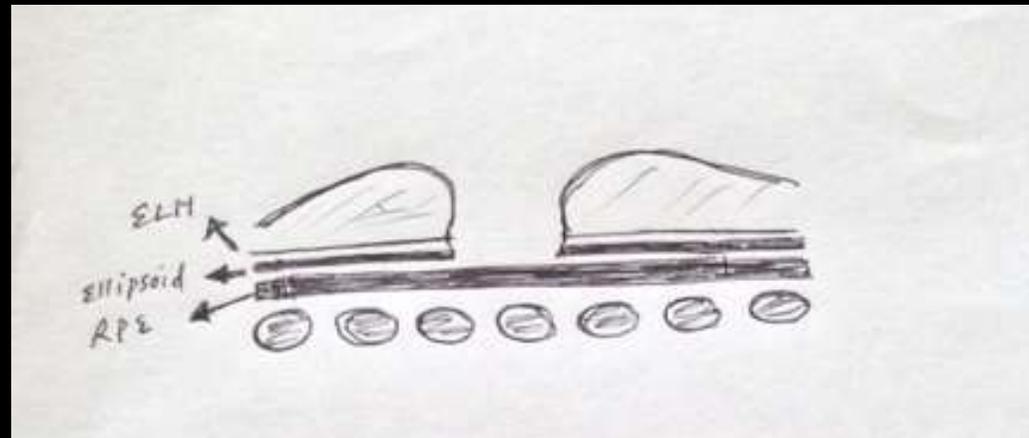
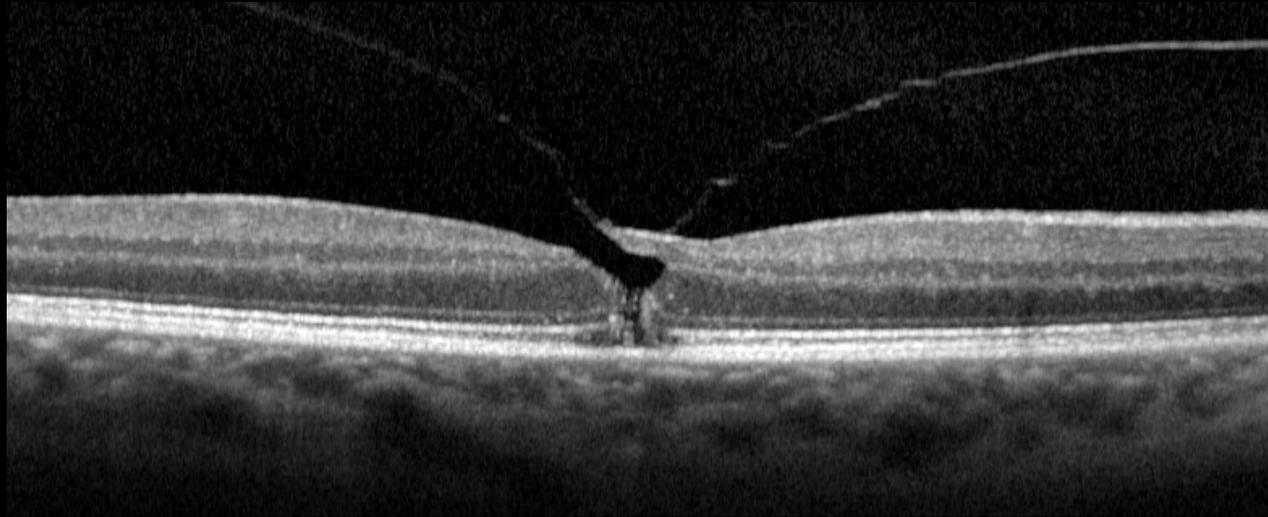
Case 3 – OCT LE



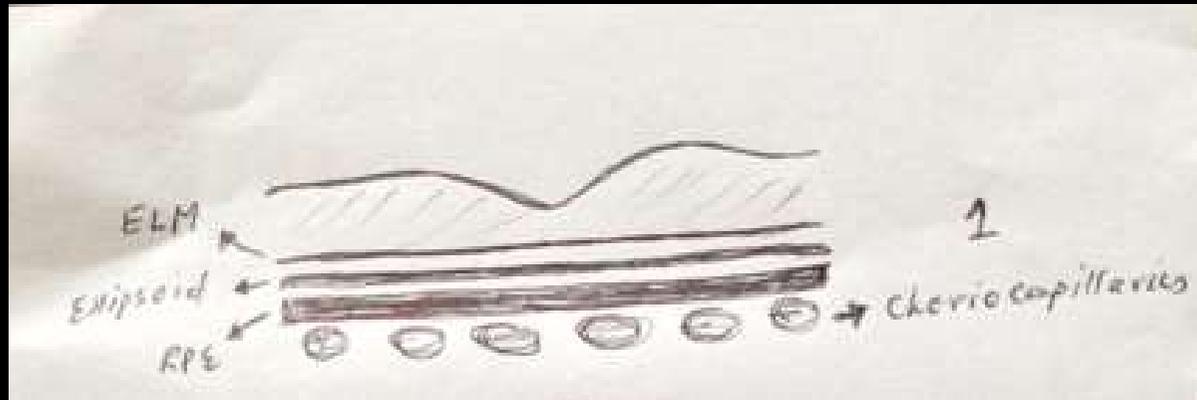
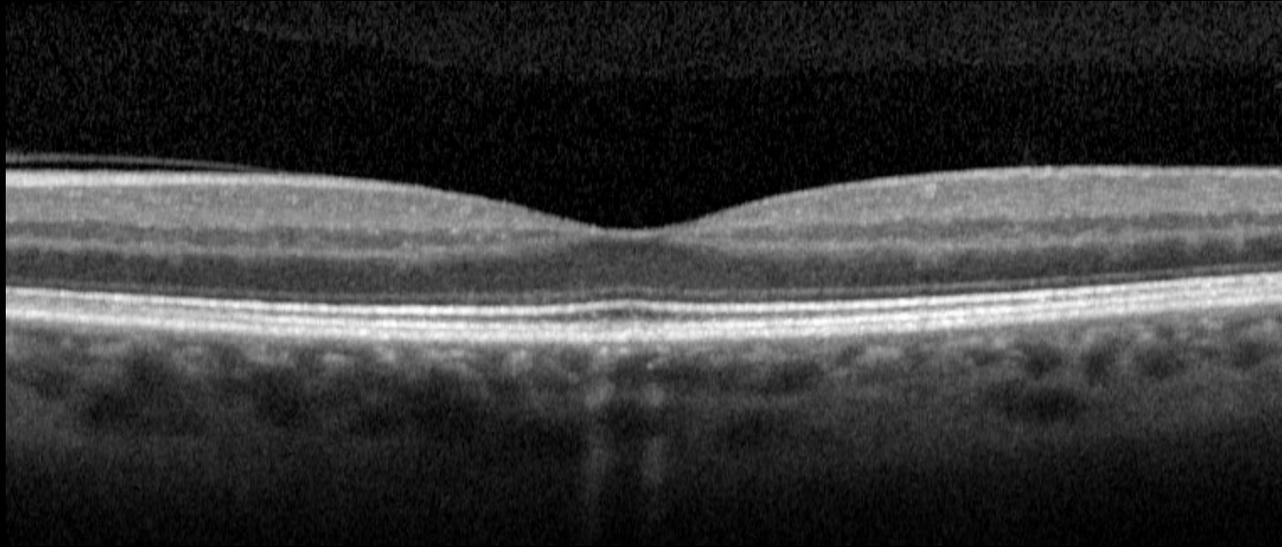
Case 3 - Questions

- What is the diagnosis?
- What is the OCT findings?

Case 3 – OCT RE



Case 3 – OCT LE



Case 3

- FT Macular Hole

Thank You