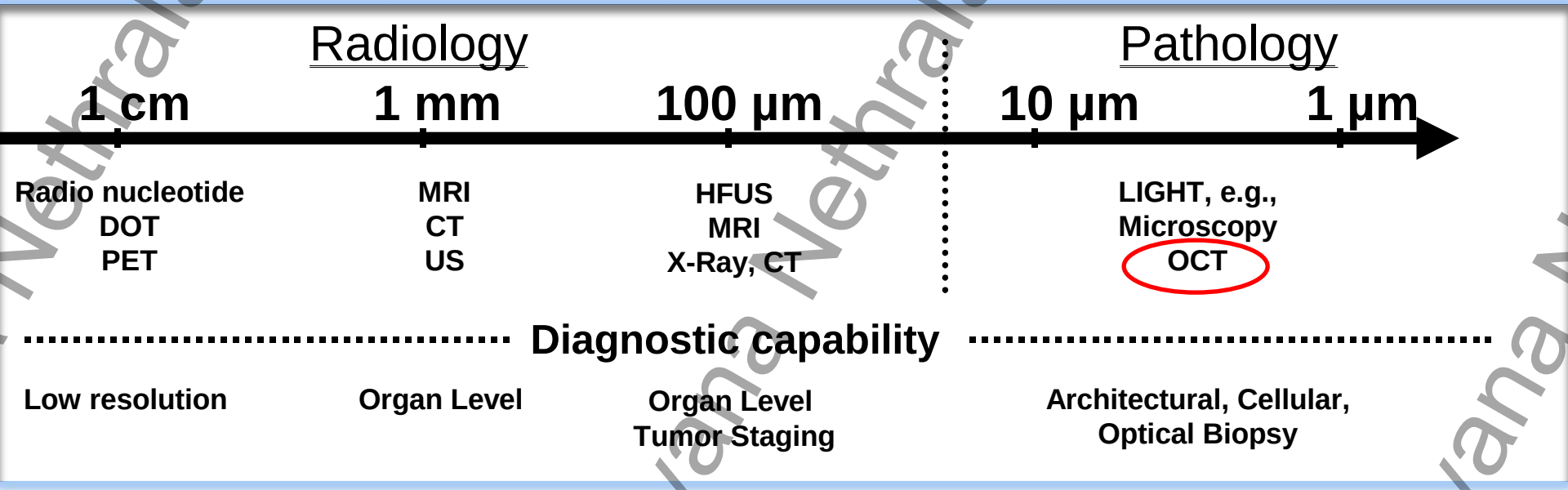
Optical coherence tomography

Dr Poornachandra B

Currently used medical imaging methods

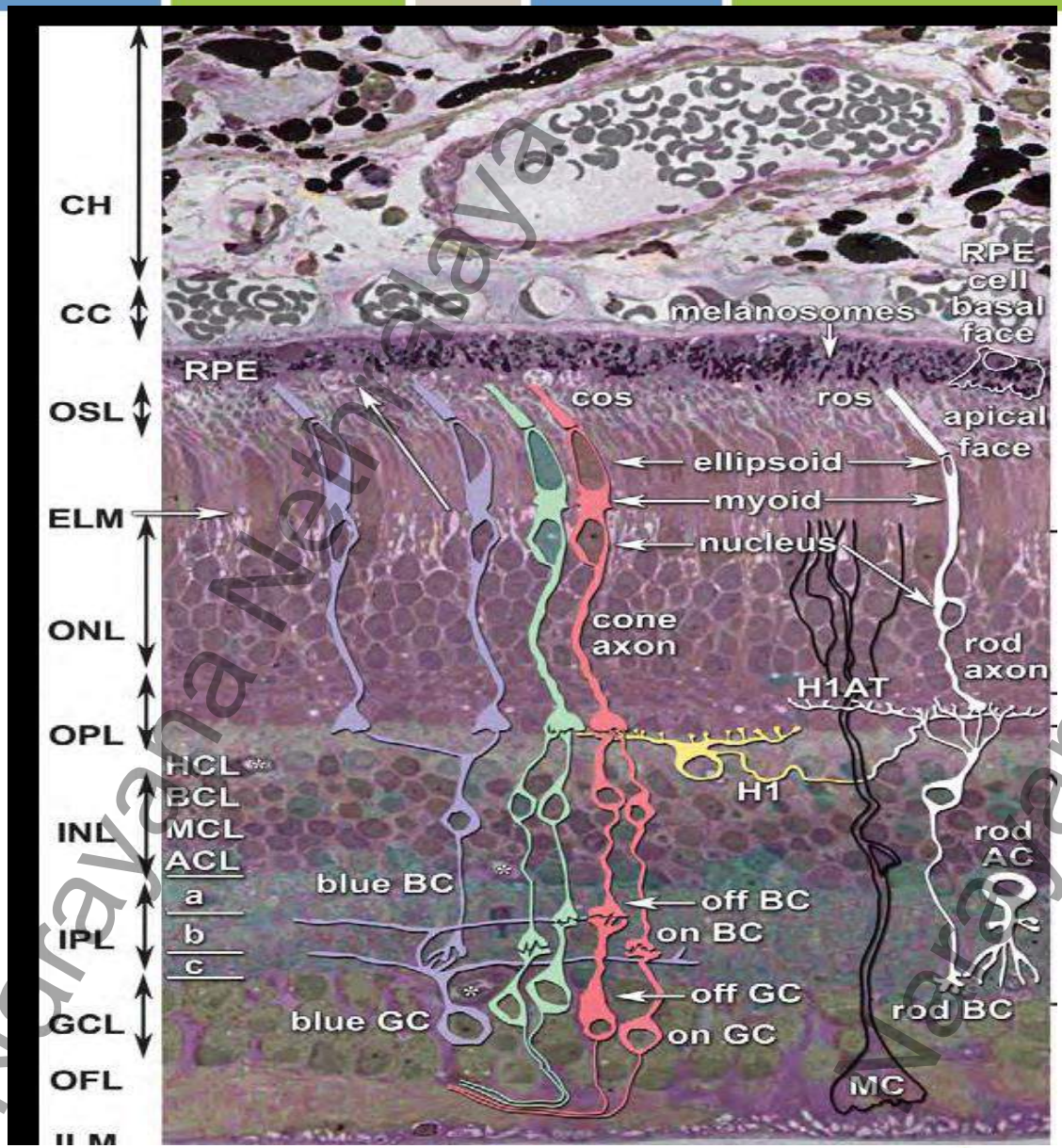


Histopathology is the gold standard especially for cellular level diagnosis

Histology

Choroid

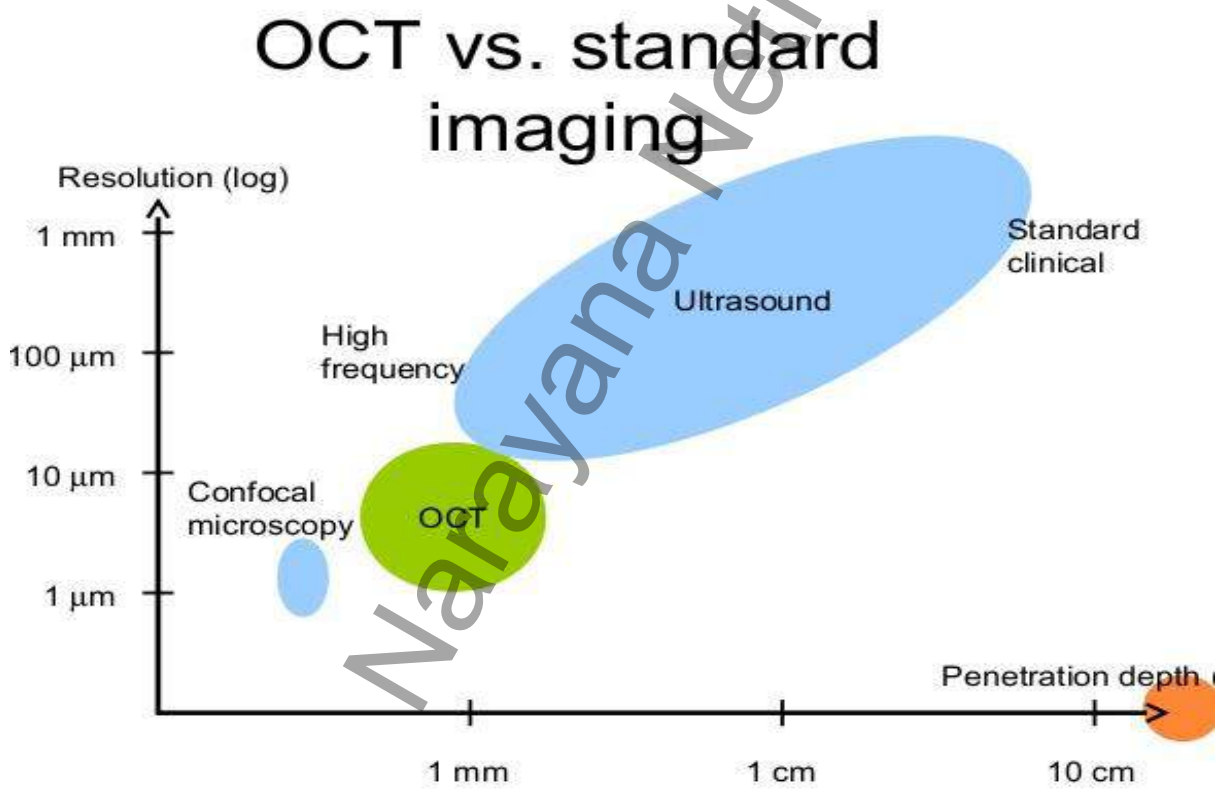
Retina



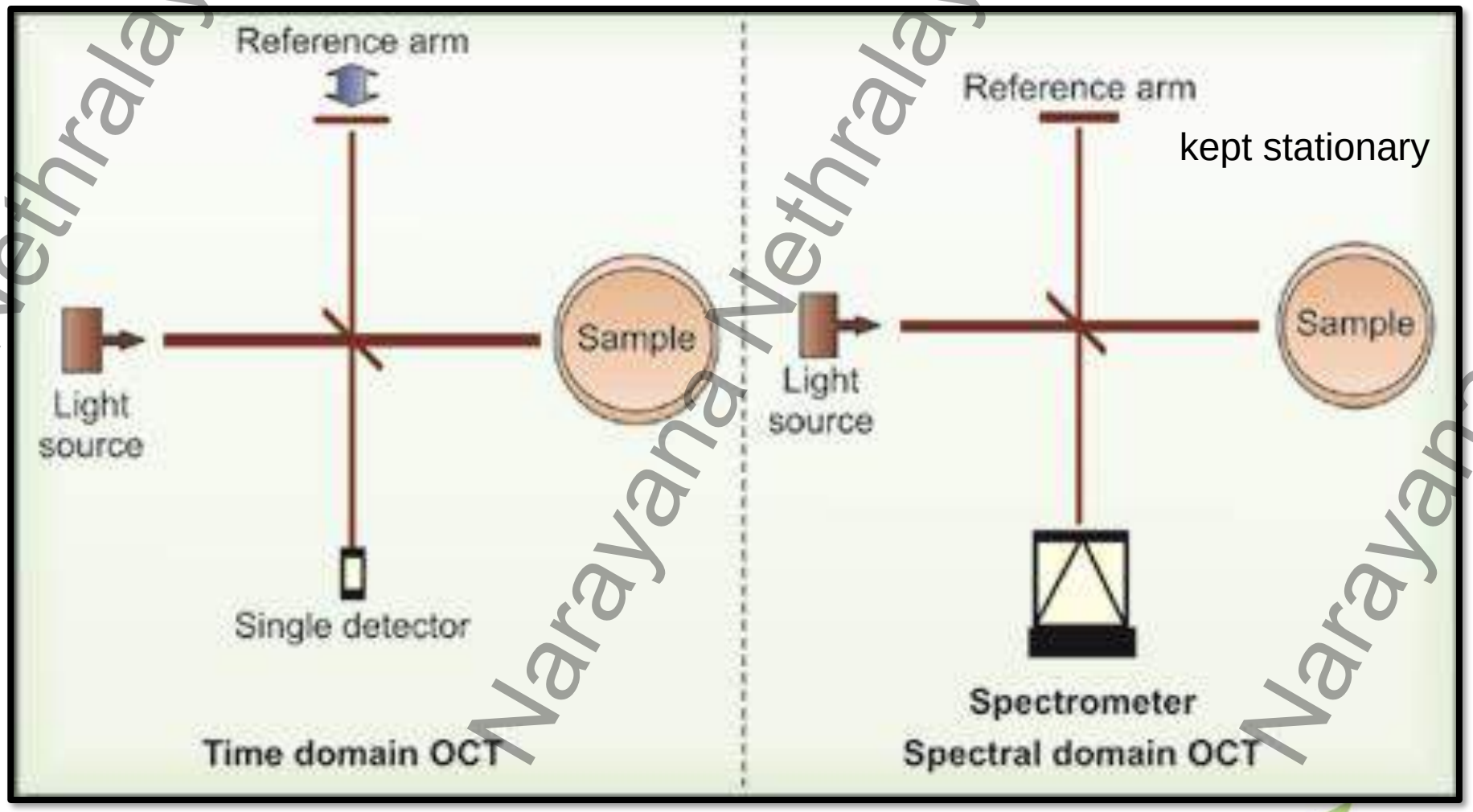
Jakobiec

OCT

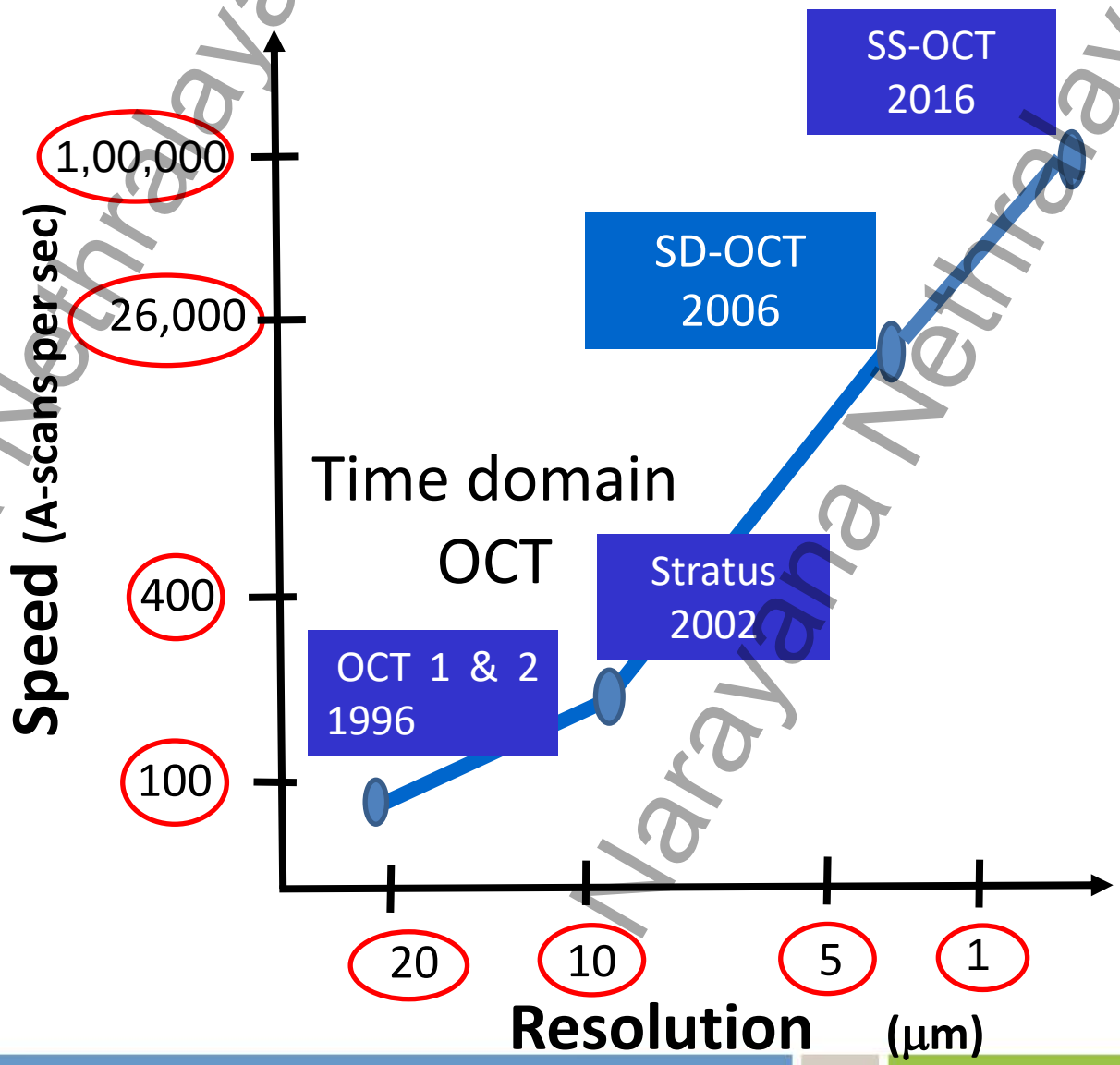
- OCT is analogous to ultrasound imaging
- Uses infrared light instead of sound

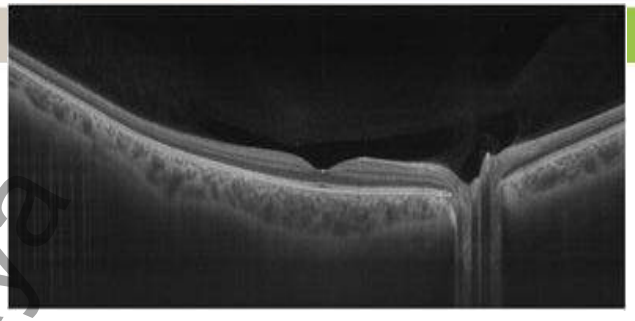


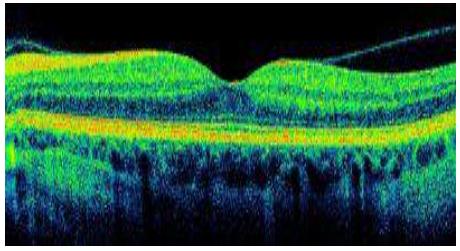
Principle of OCT – low coherence interferometry

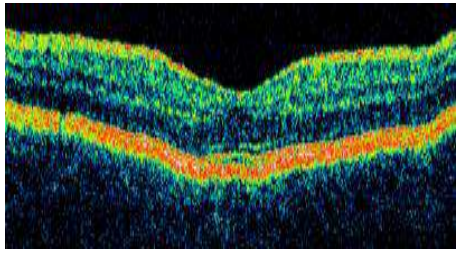


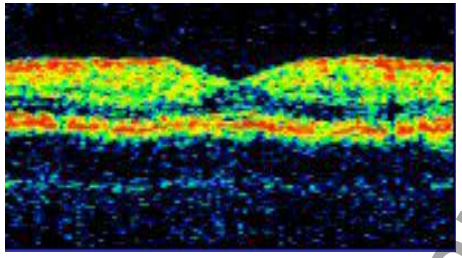
Evolution of OCT

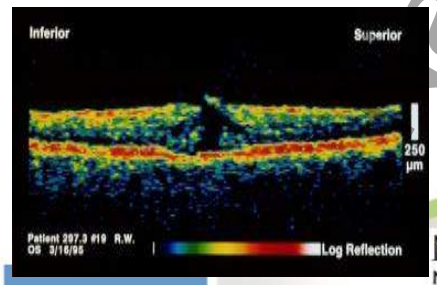












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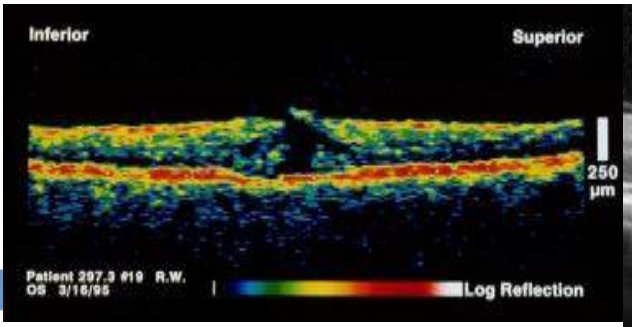
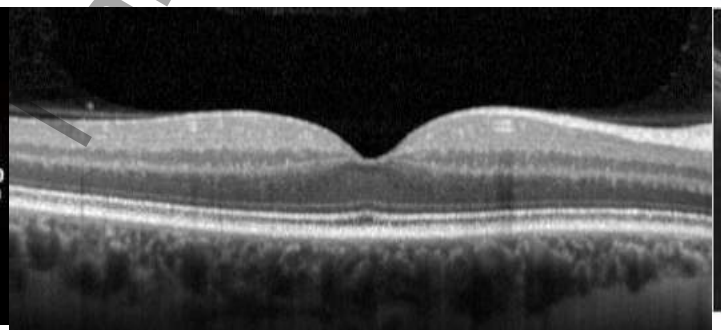
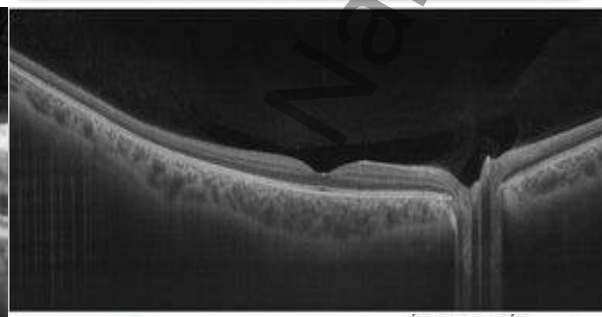
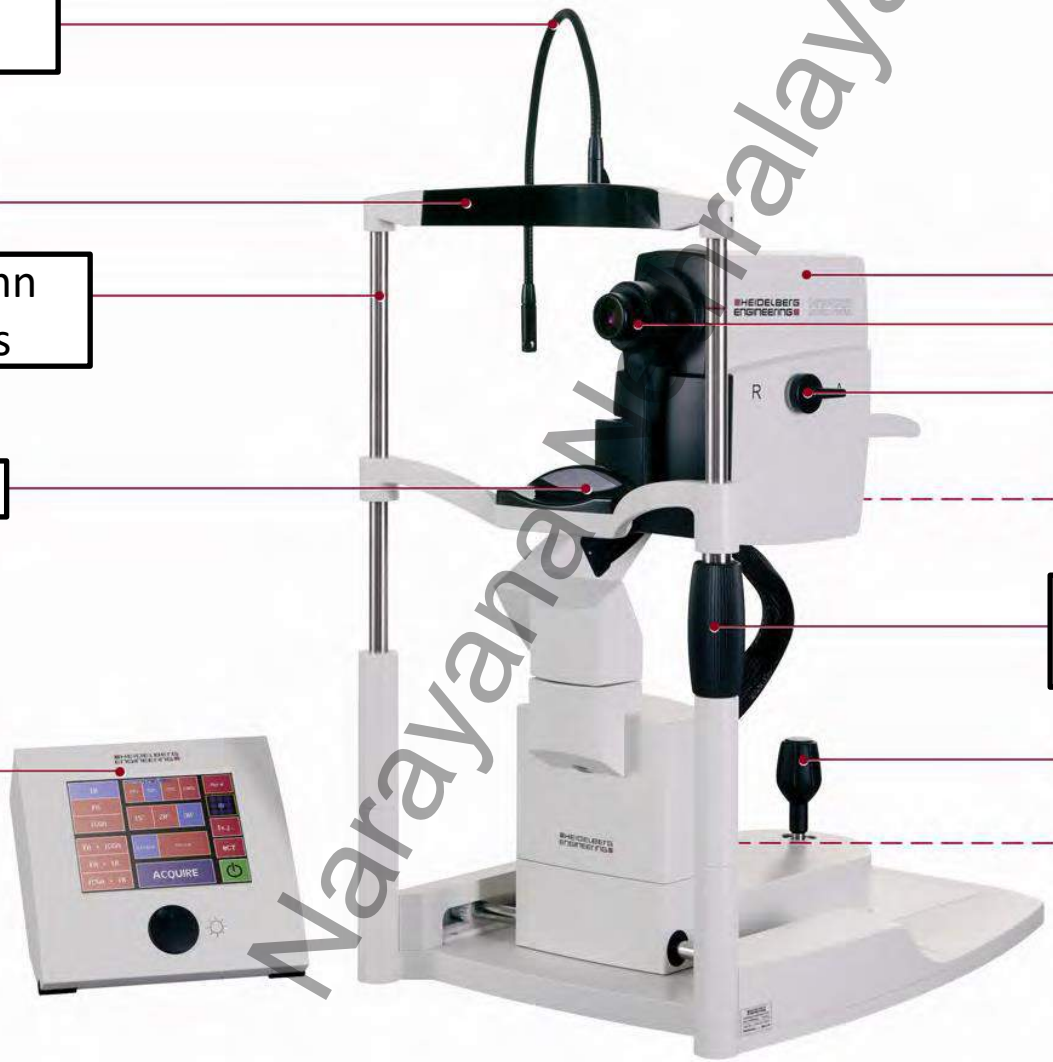
TDOCT	SD/FD OCT	SSOCT
400 ascans/sec	40,000 ascans/sec	1,00,000 ascans/sec
4-6mm scan	6-9 mm scan	12 mm scan
Resolution 10 µm	Resolution 4-7 µm	Resolution 1 µm
Single Detector	Spectrometer with CCD camera	Photodetectors
Light source 840 nm	Light source 840 nm	Light source 1050 nm







SD OCT



External fixation light

Forehead rest

Head rest column with red marks

Chin rest

Touch panel with ART/Sensitivity knob Joystick

Camera head

Objective lens

Filter wheel

Focus knob

Adjustment screw for chin rest

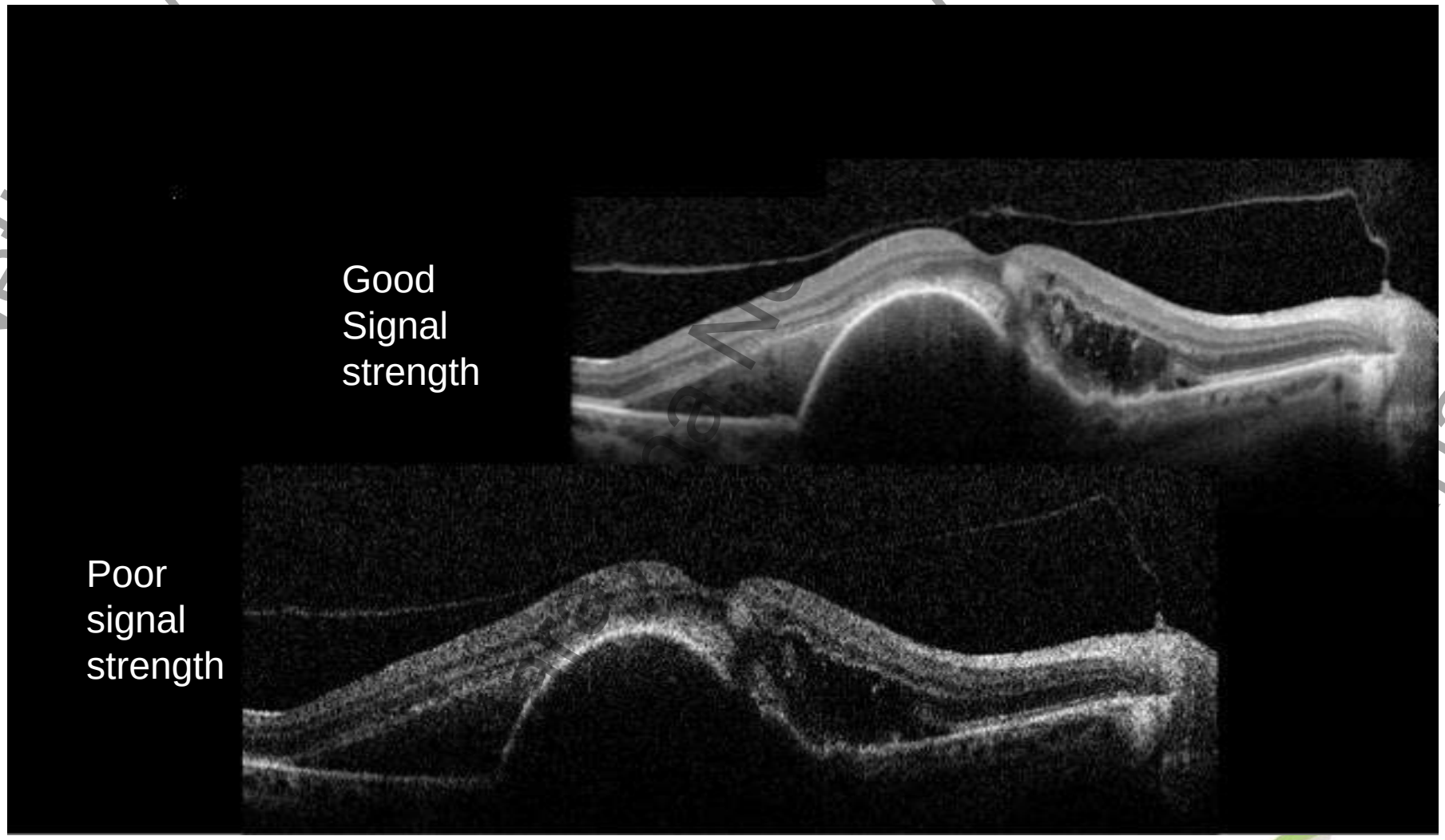
Joystick

Setscrew

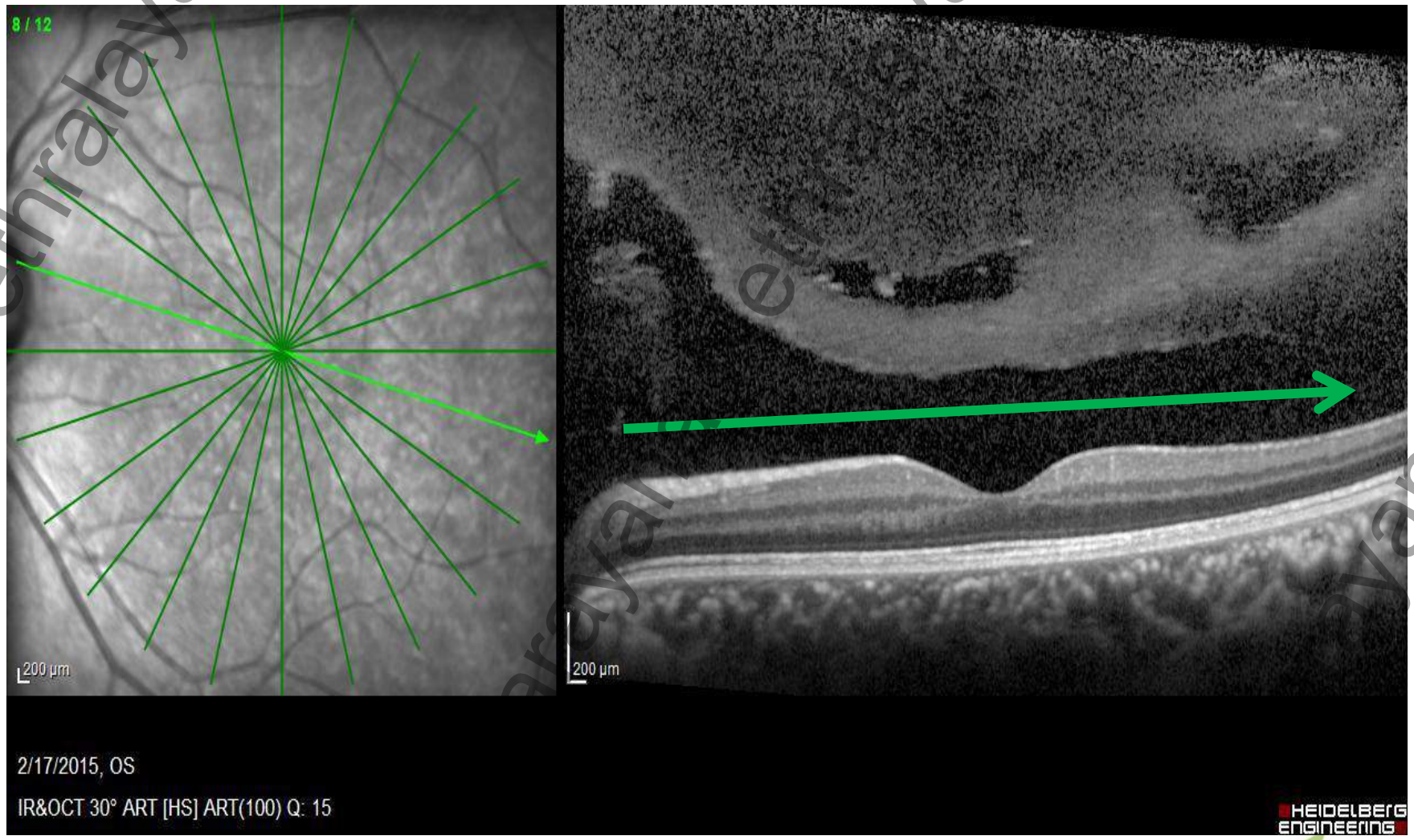
How to Read OCT Scan

- Identify Patients Name , Age, Sex ,Race,
- Identify Eye

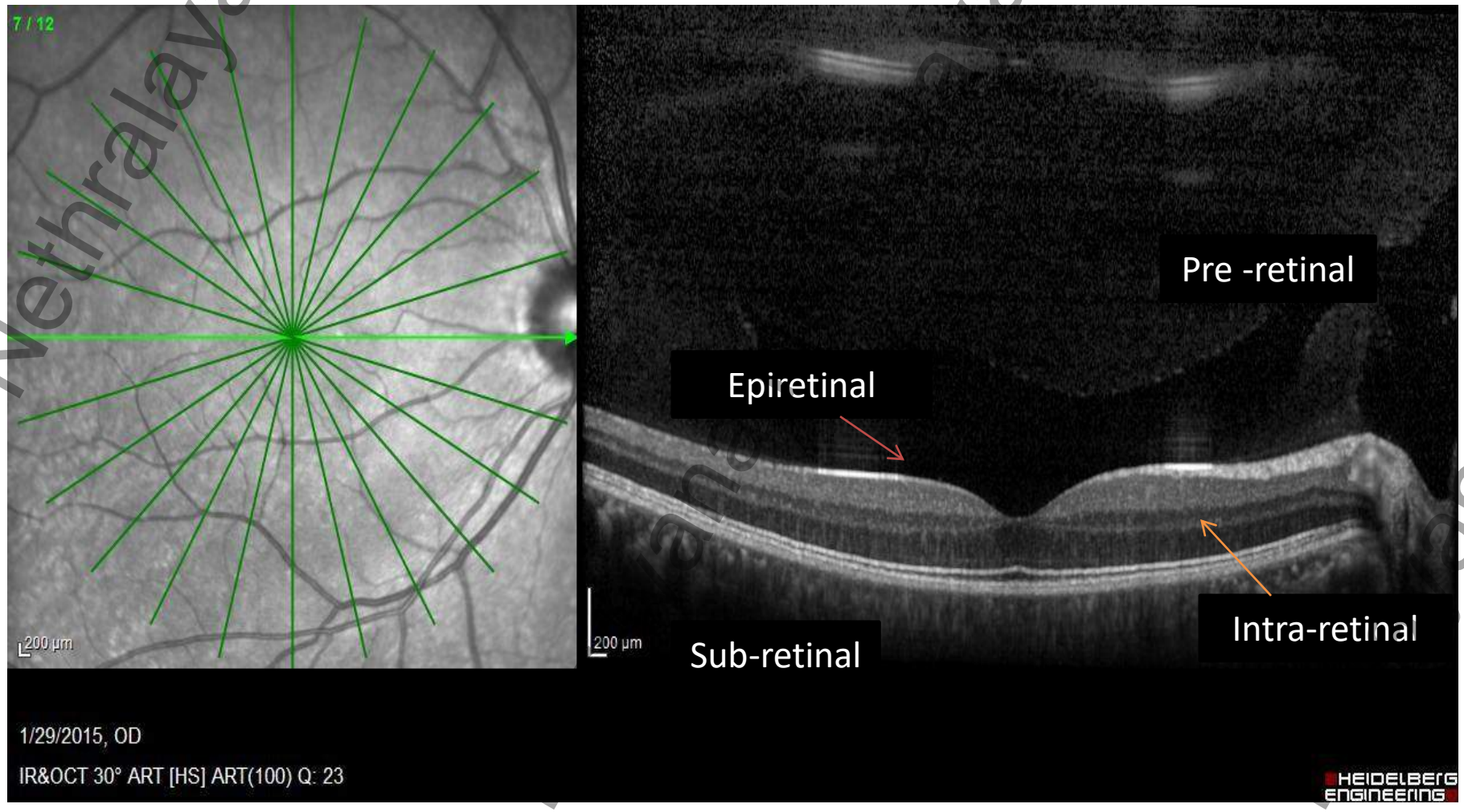
Signal Strength

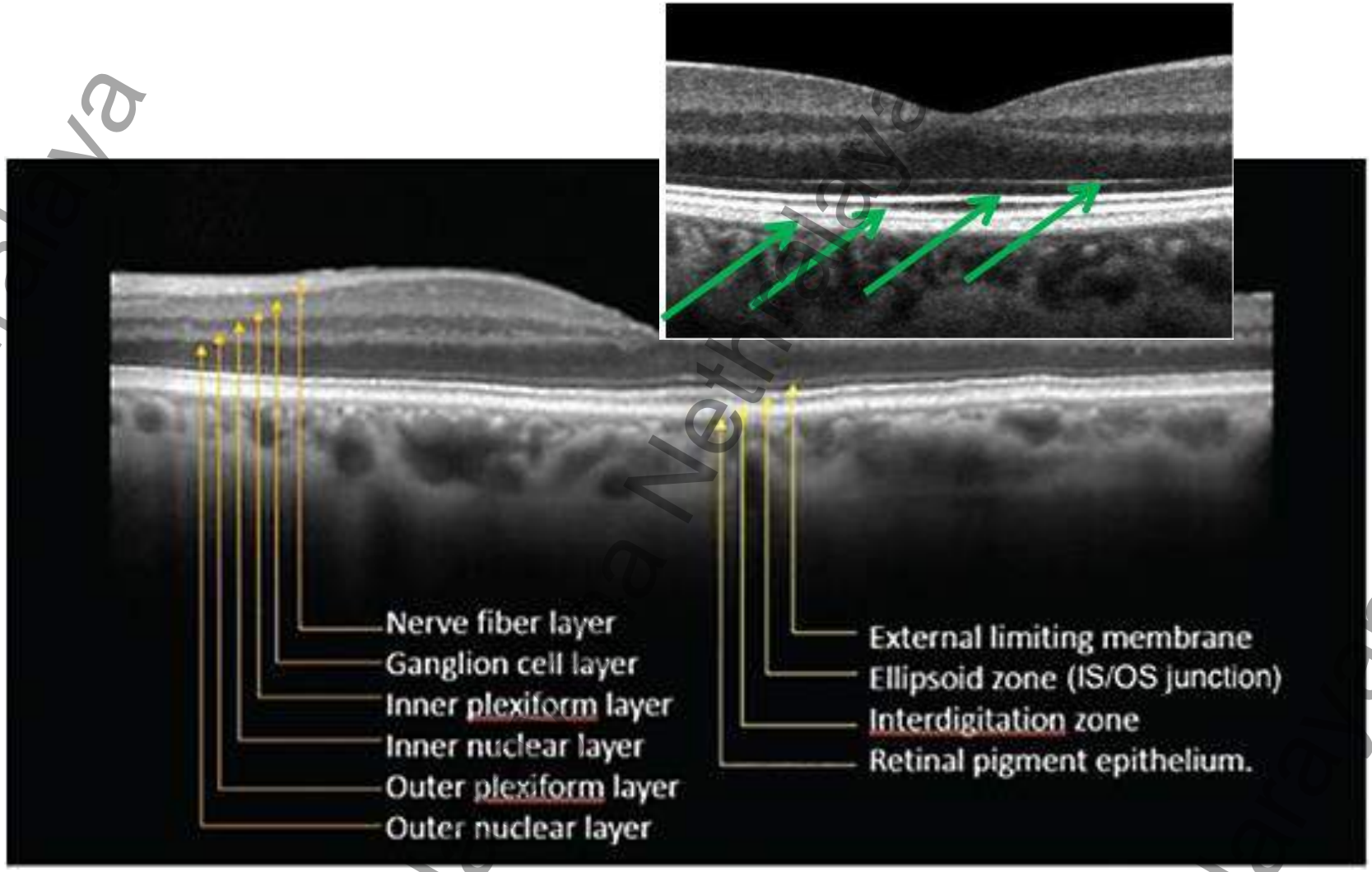


Direction Of Line

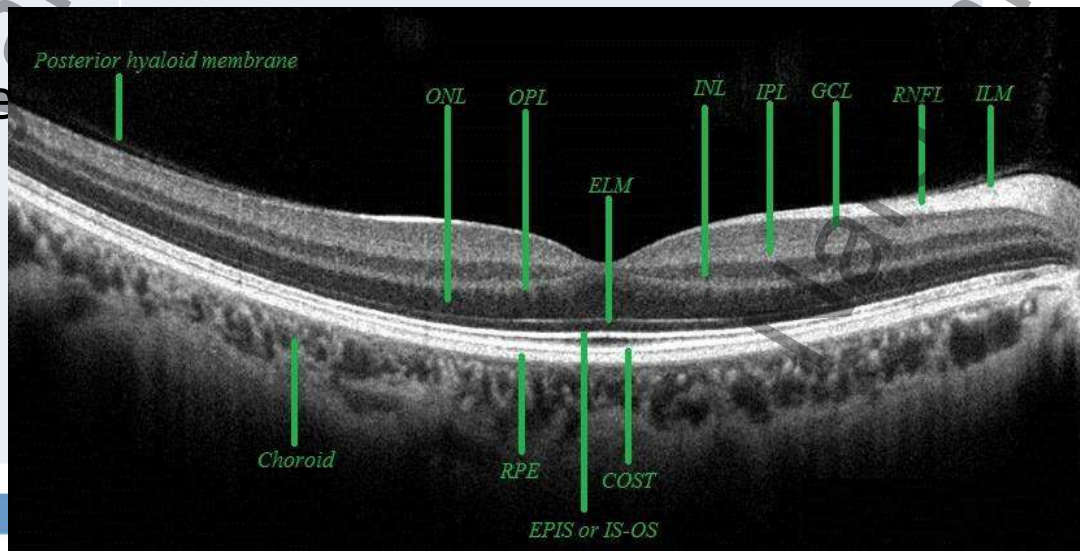


OCT interpretation



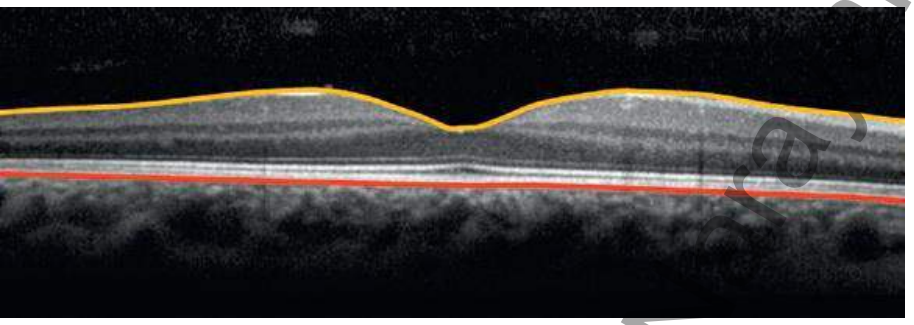


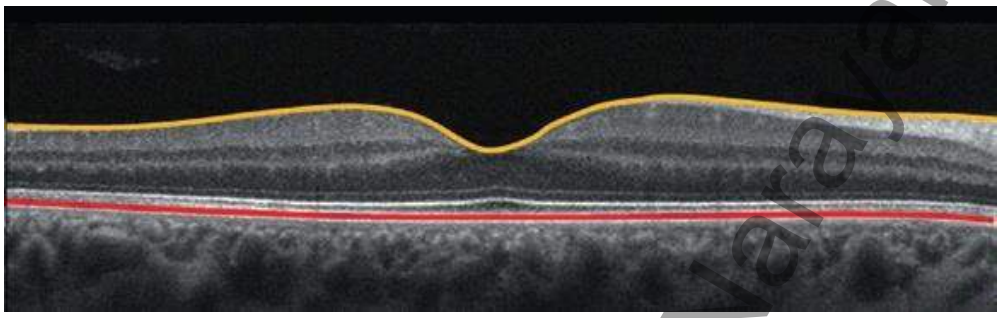
HYPER REFLECTIVE	HYPO REFLECTIVE
ILM RNFL IPL , OPL, ELM, IS-OS jn RPE RPE- choriocapillaries complex	Ganglionic cell layer Innernuclear layer Outer nuclear layer
Drusen ,PED Epiretinal membrane CNVM lesions Anterior face of hemorrhage Disciform scars Hard Exudates	Intraretinal/subretinal – fluid/blood



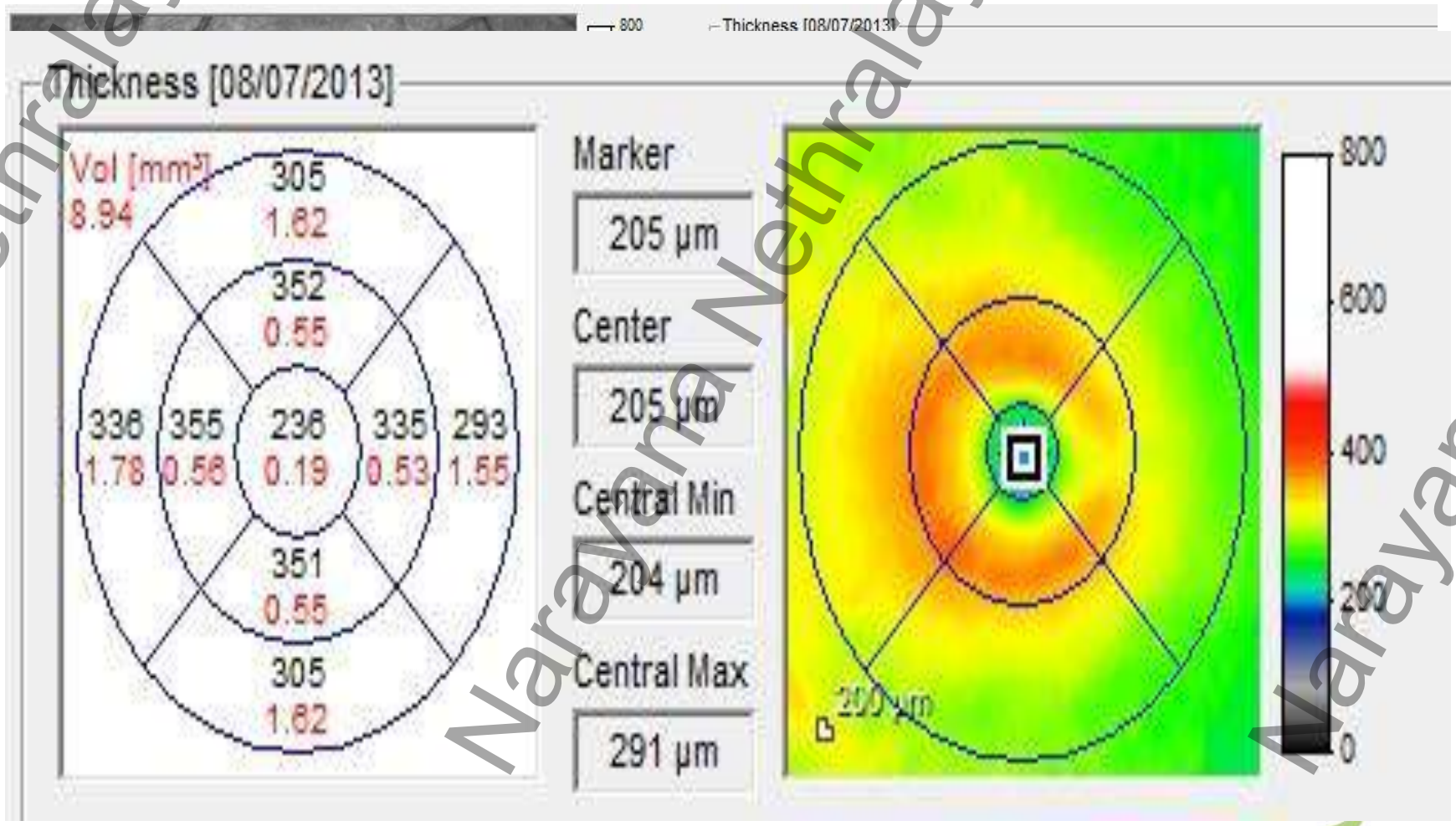
Quantitative analysis

- Retinal thickness
  - Different instruments – different segmentation algorithms
    - Spectralis –ILM to Posterior edge of RPE
    - Cirrus – ILM to anterior edge of RPE
    - Stratus – ILM to IS-OS (EZ)





Macular Thickness



Retinal vascular disorders

SD-OCT in retinal vascular disorders

- Retinal thickness assessment
- Patterns of DME
- Deciding Rx protocol in DME
- Quantification of CME in vein occlusion
- Monitoring response to treatment in DME, RVO
- Prognostic indicators – IS-OS(EZ), ELM integrity

DIABETIC MACULAR EDEMA

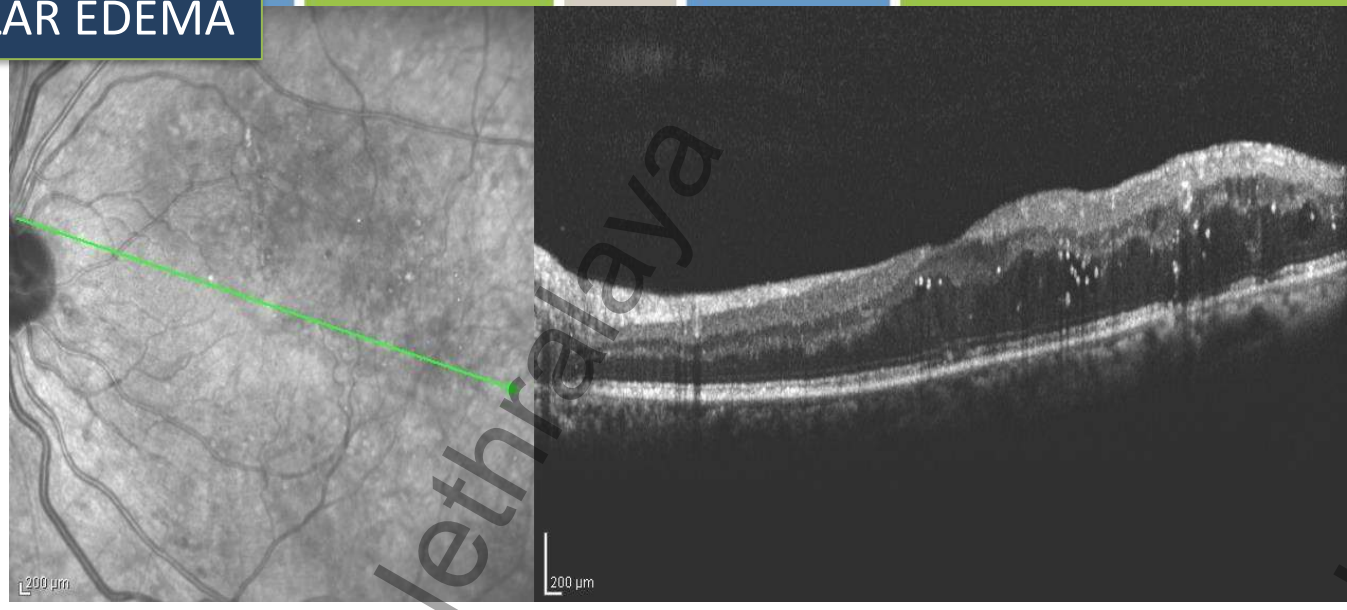
Patterns of DME on OCT

- Spongy/diffuse thickening
- Cystoid macular edema
- Serous retinal detachment(SRD) without PHT
- Posterior hyaloidal traction(PHT) without TRD
- PHT with TRD

•*Kim BY et al,. Optical coherence tomographic patterns of diabetic macular edema. Am J Ophthalmol. 2006 Sep;142(3):405-12.*

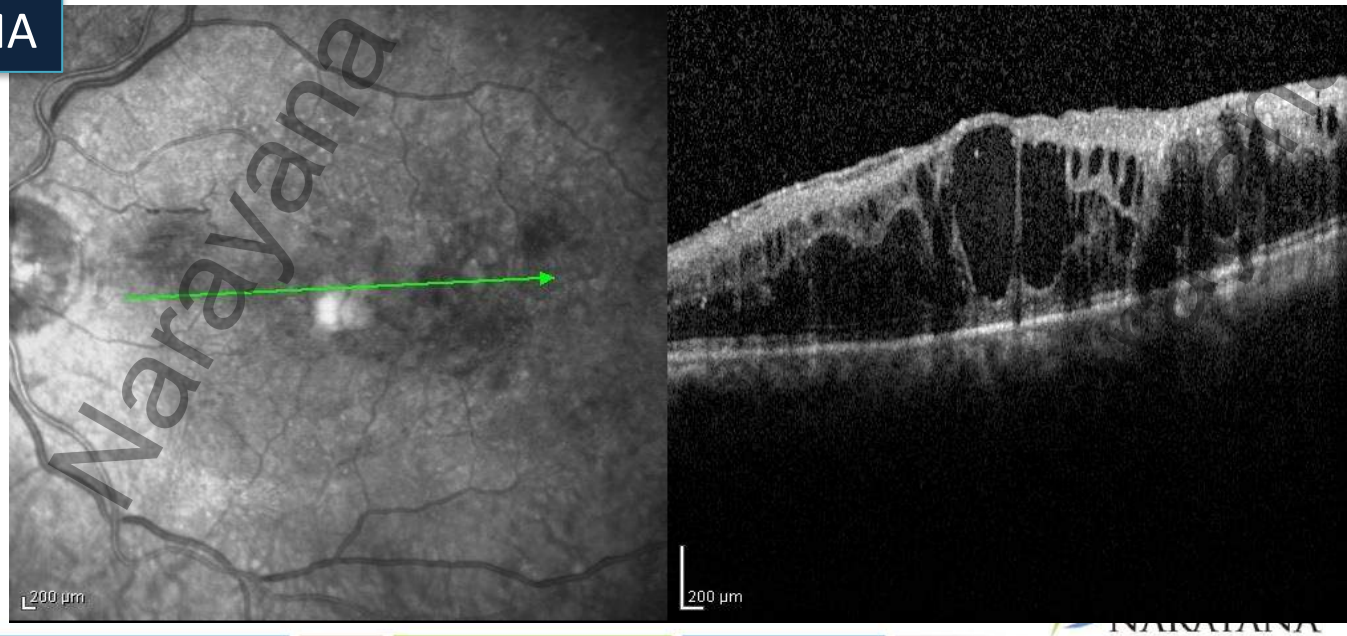
DIFFUSE/SPONGY MACULAR EDEMA

- Focal laser
- Intravitreal injections



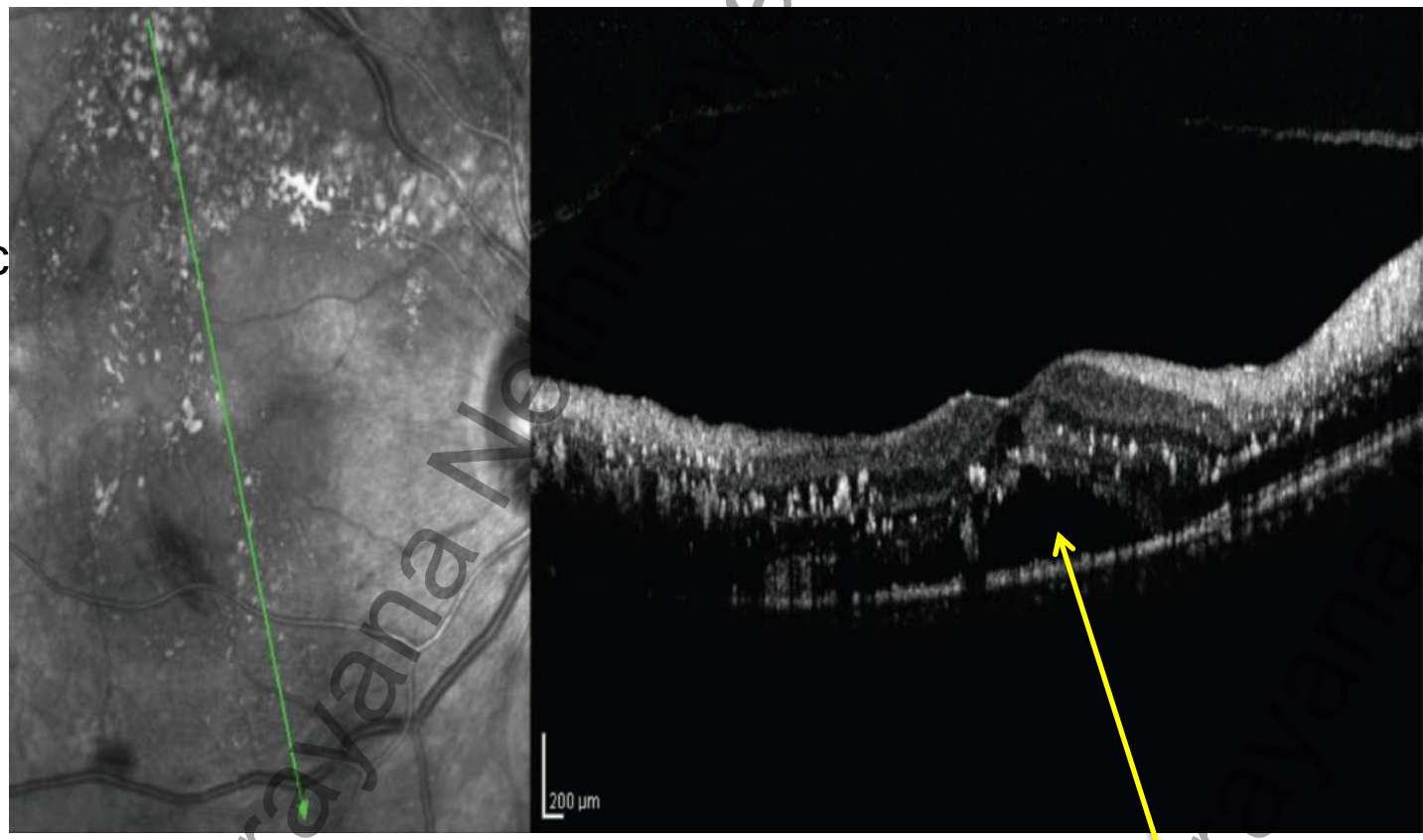
CYSTOID MACULAR EDEMA

- Intravitreal injections
- Can be followed up by focal/modified grid



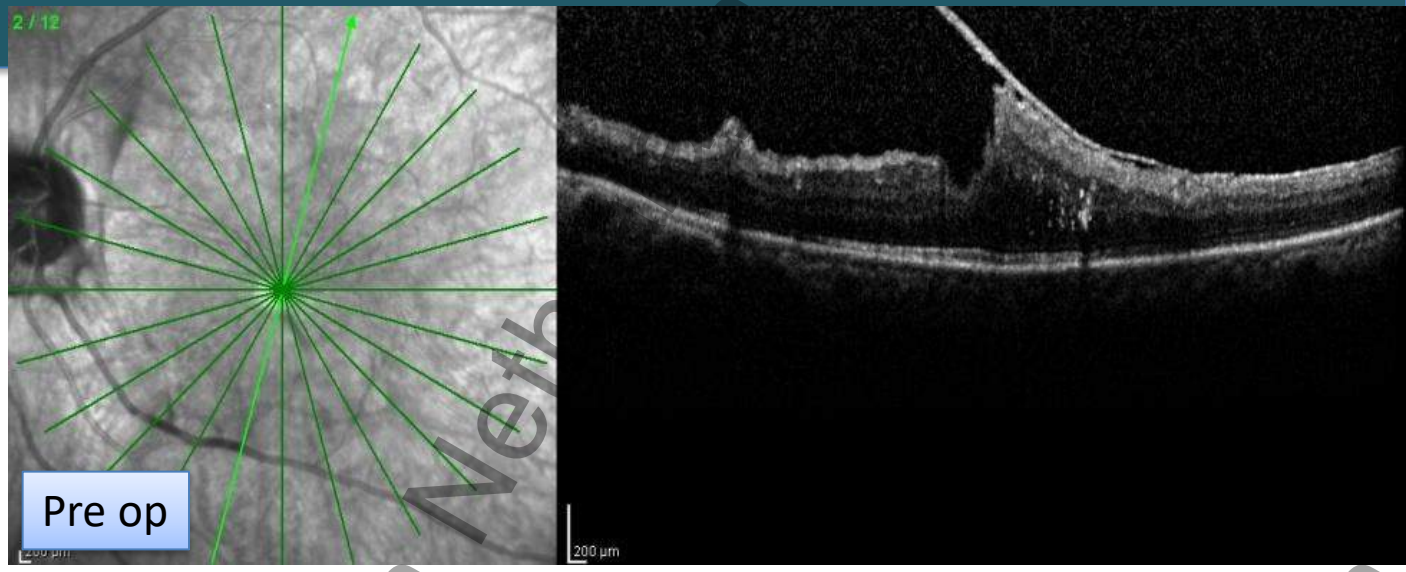
SEROUS RETINAL DETACHMENT WITHOUT PHT/VMT

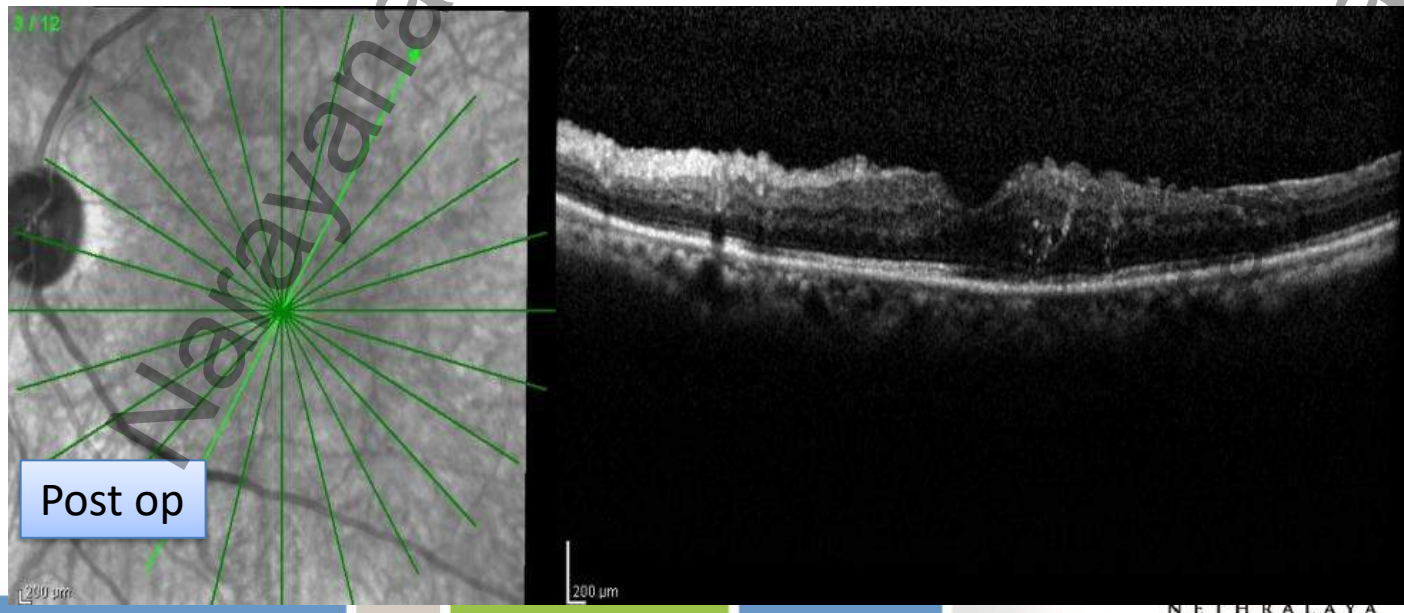
- More symptomatic
- Intravitreal injections



POSTERIOR HYALOIDAL TRACTION WITHOUT TRACTIONAL RETINAL DETACHMENT

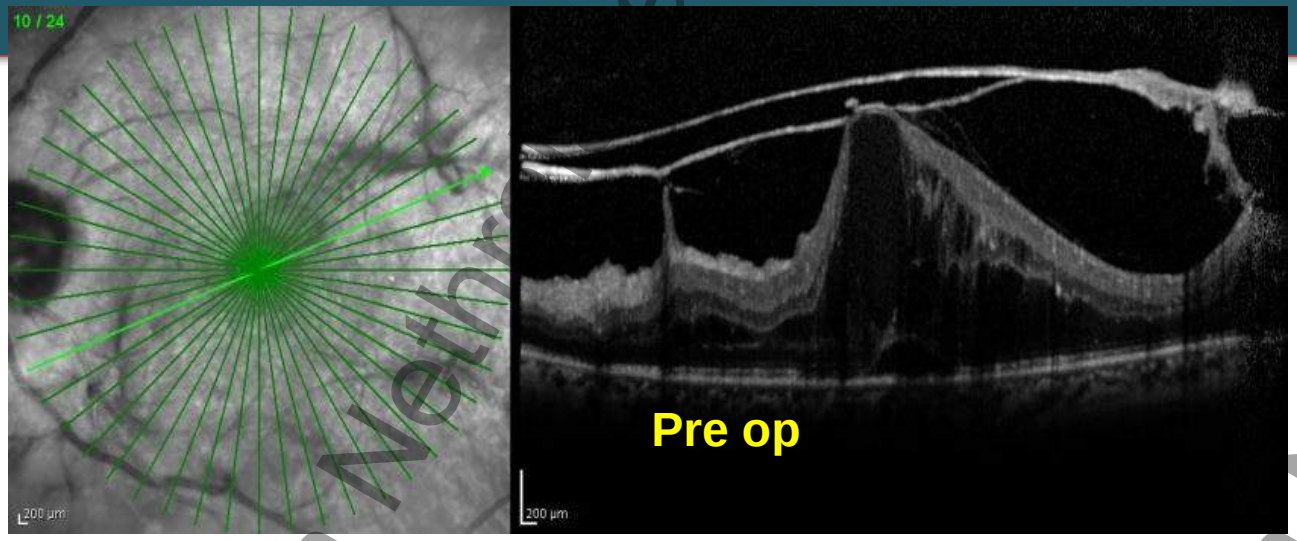
- Taut PHF
- Surgical intervention

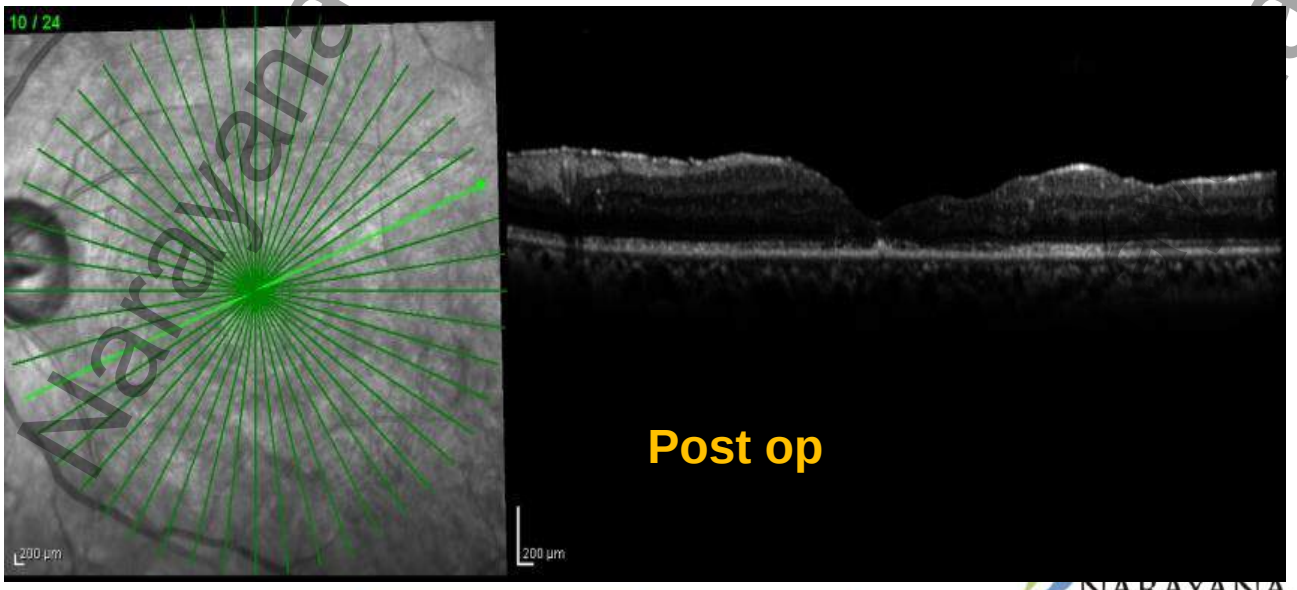




POSTERIOR HYALOIDAL TRACTION WITH TRACTIONAL RETINAL DETACHMENT

- Severe forms of PDR
- Surgical Intervention
- Can be a Combined or tractional alone





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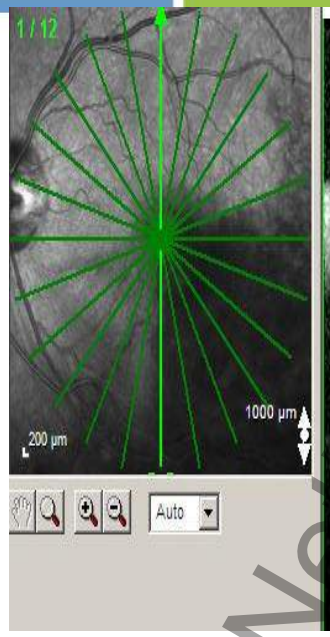
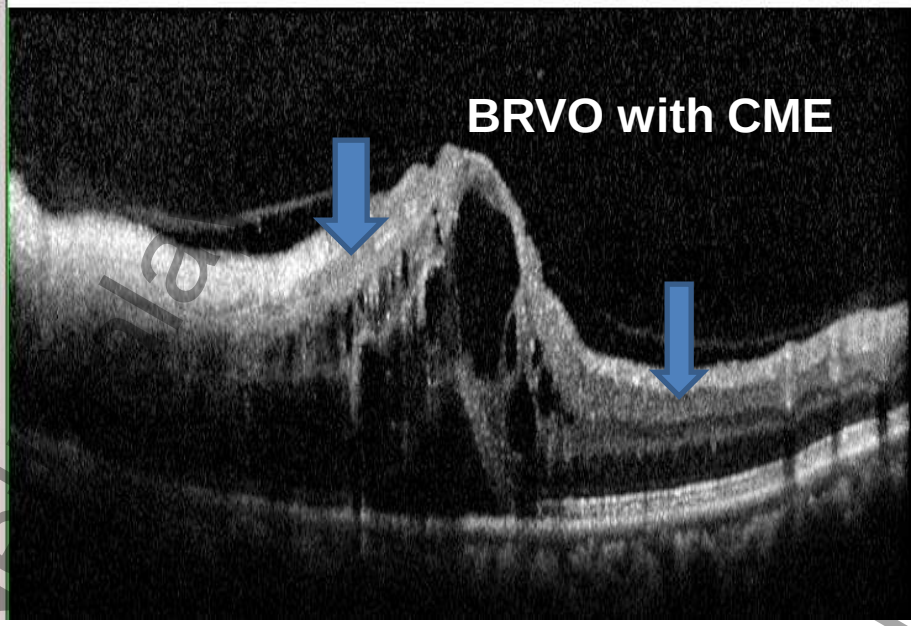
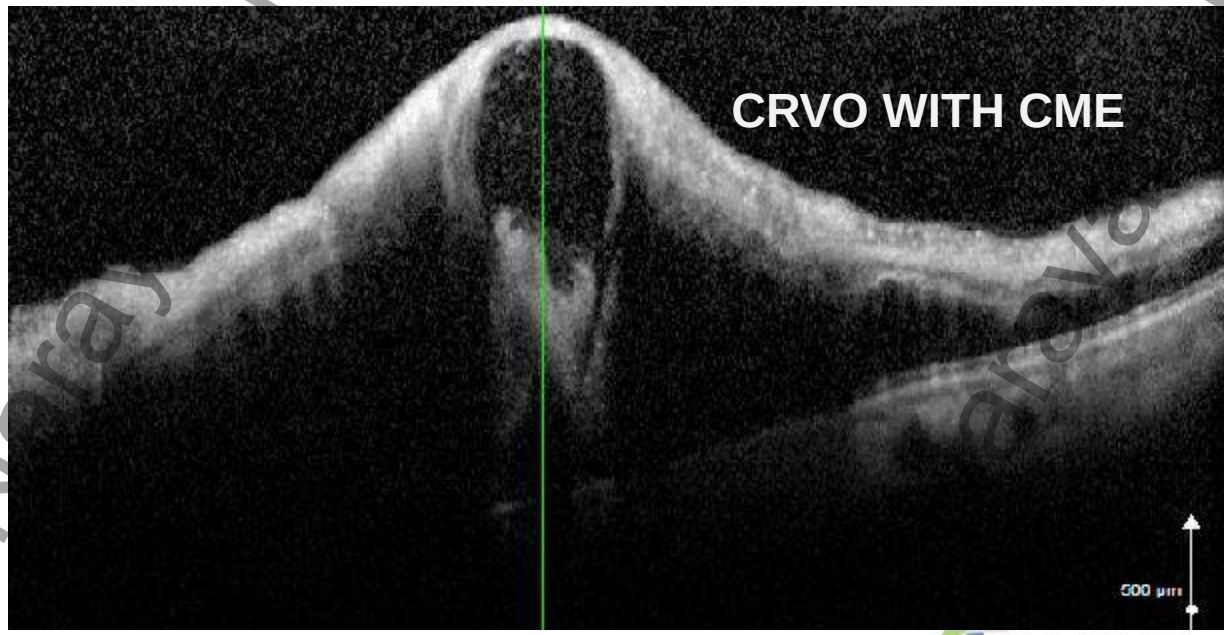
VEIN OCCLUSIONS

- CME,SRD
- EZ(IS/OS) and ELM-prognostic aid
- Great follow up tool
- Complications-ERM/lamellar hole/RPE changes



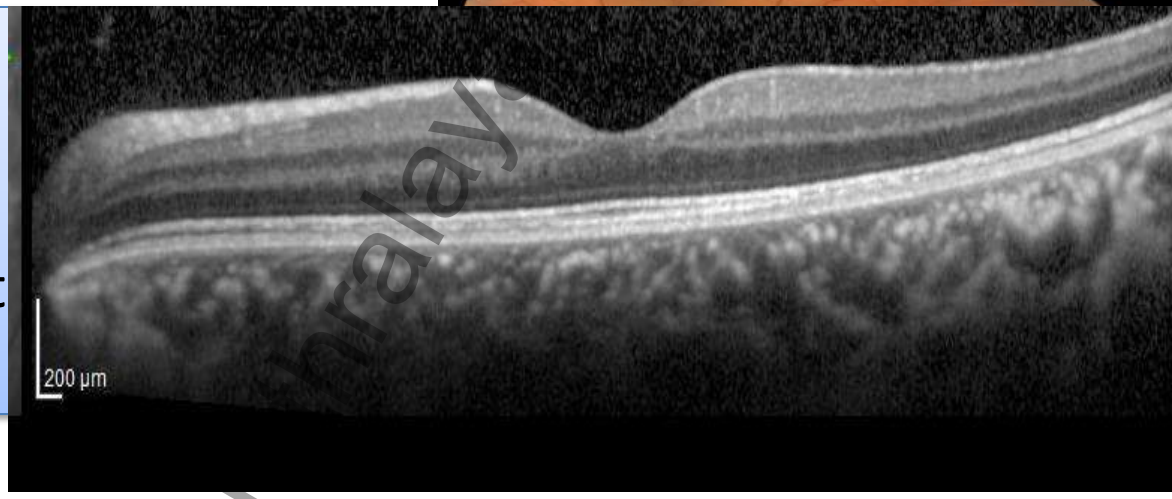


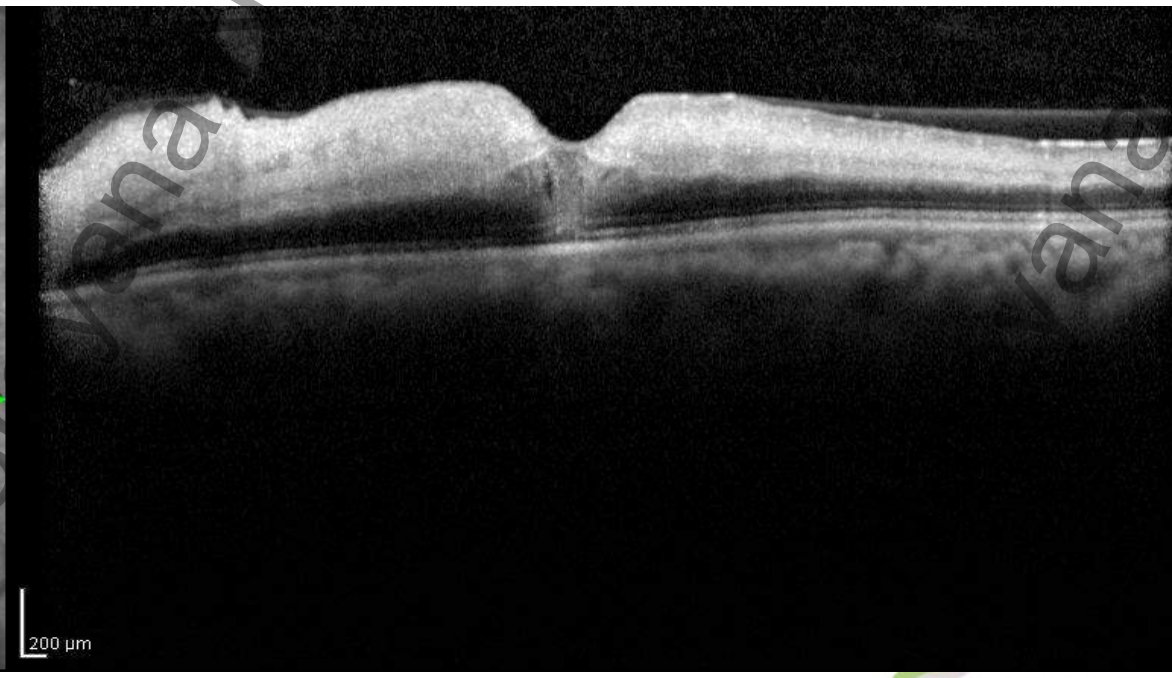


CENTRAL RETINAL ARTERY OCCLUSION

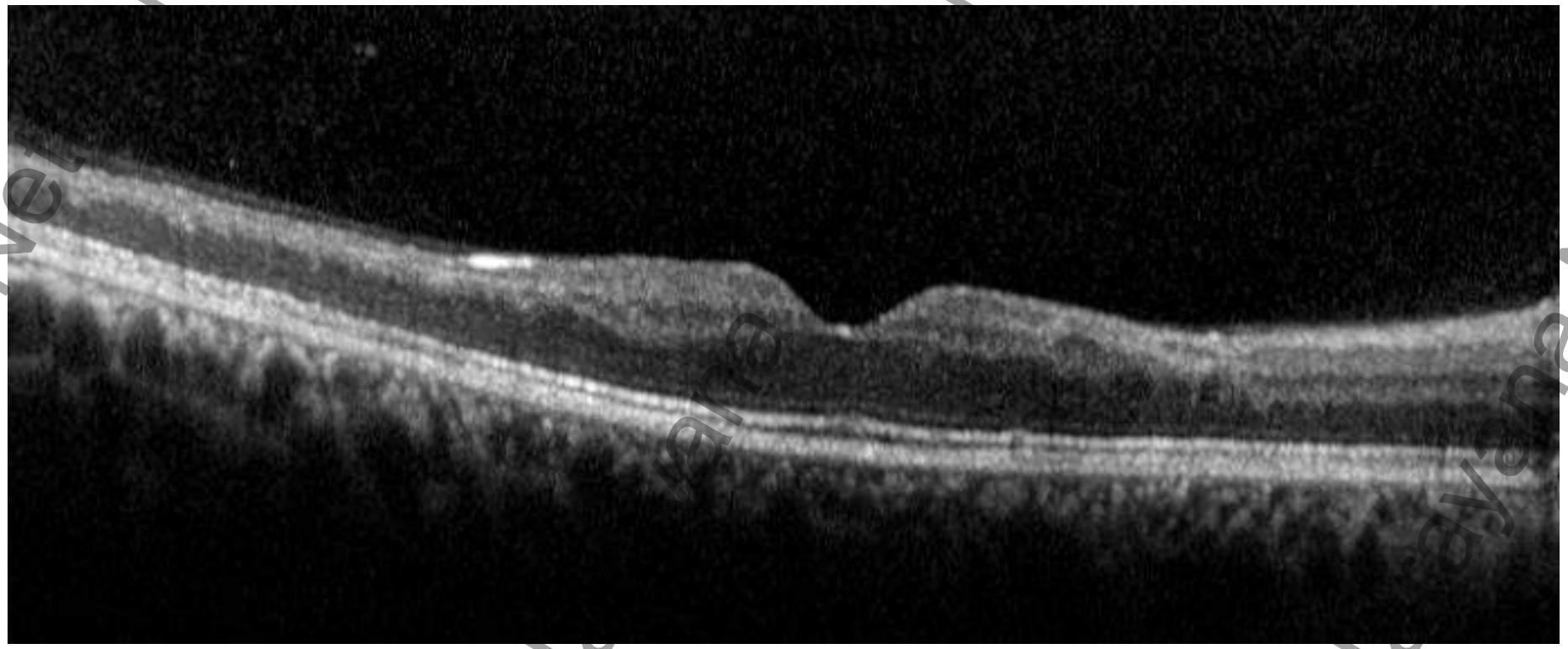
Acute phase

- Inner retinal thickening, hyperreflectivity
- Hyporeflectivity of the out retinal layers



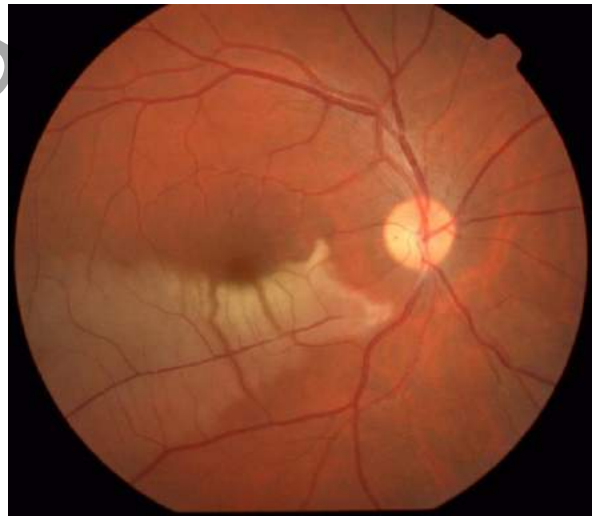


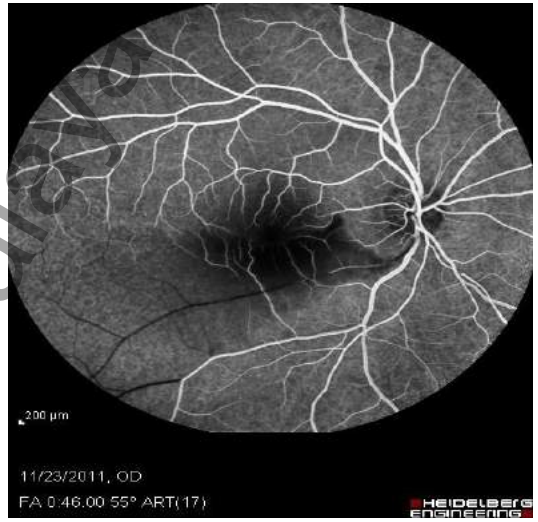
Arterial occlusions- chronic phase

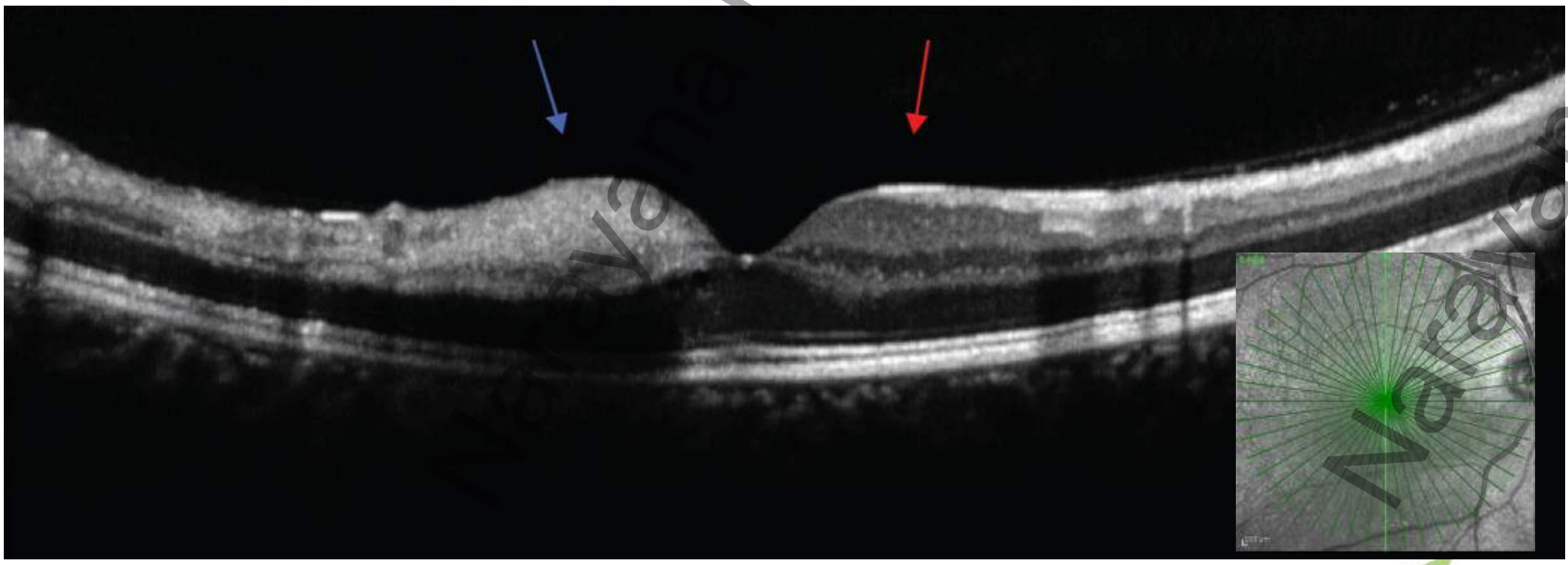


Thinning ,hypereflectivity of inner retinal layers

BRAO



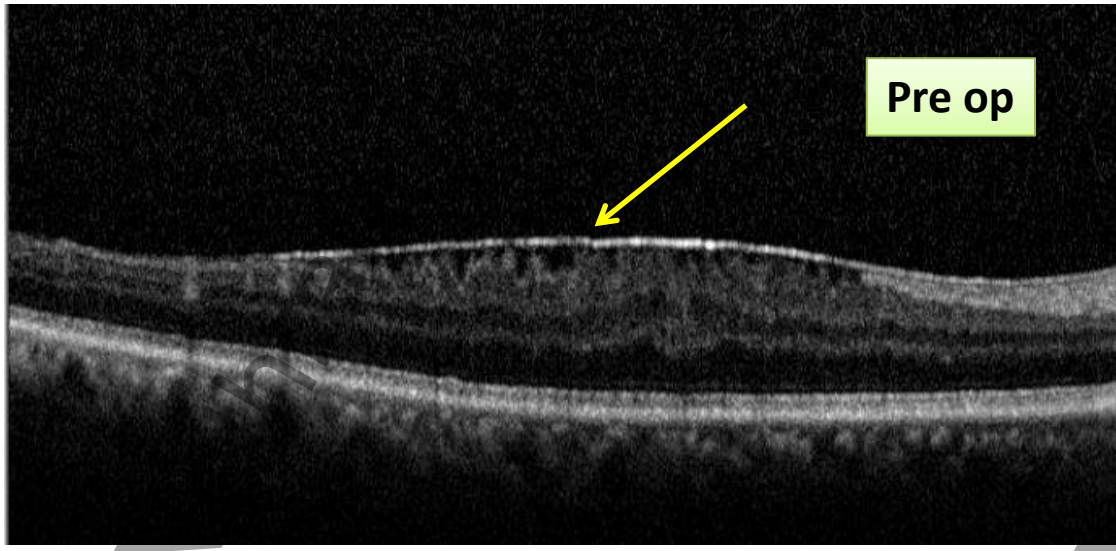


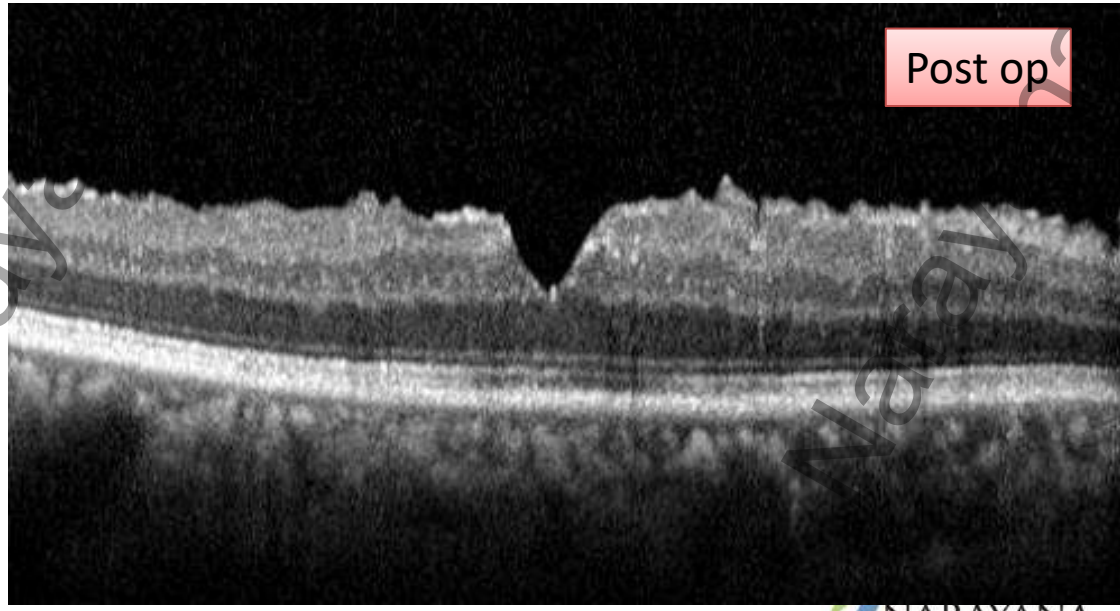


Vitreomacular interface disorders

EPIRETINAL MEMBRANE

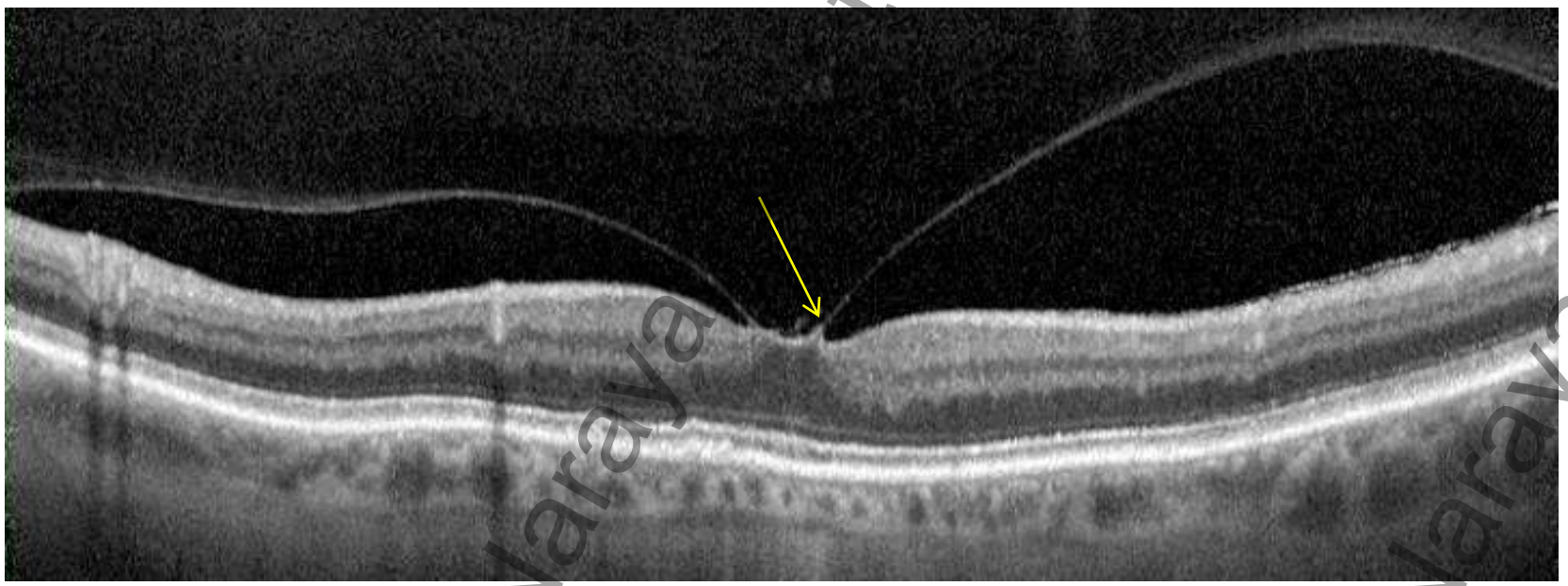
- CME, CMT ,distortion of retinal layers
- EZ (IS/OS) and ELM integrity for Visual Prognosis



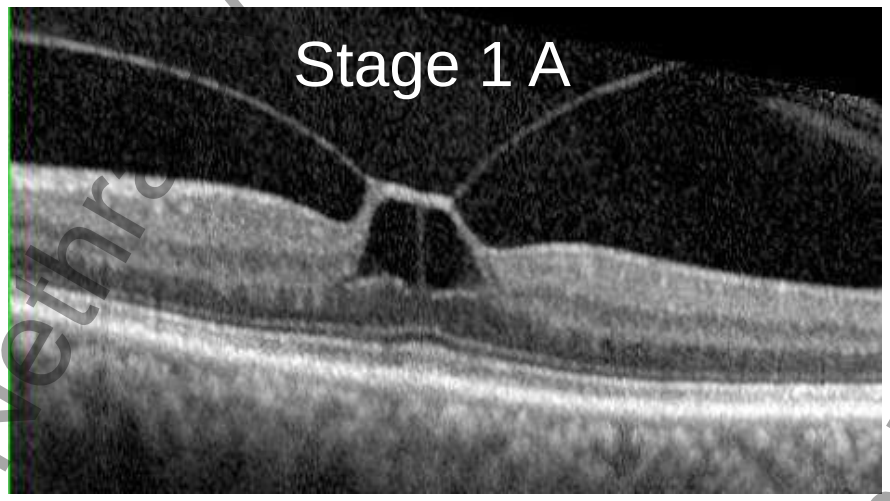


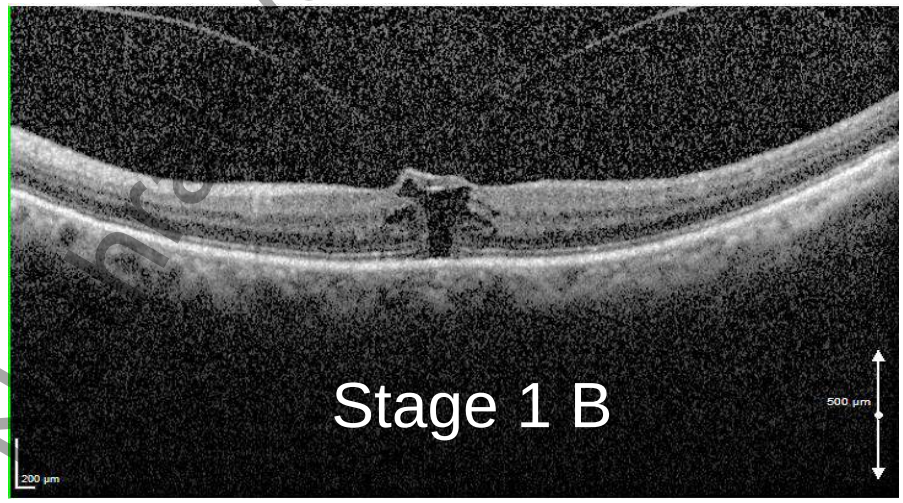
Macular hole

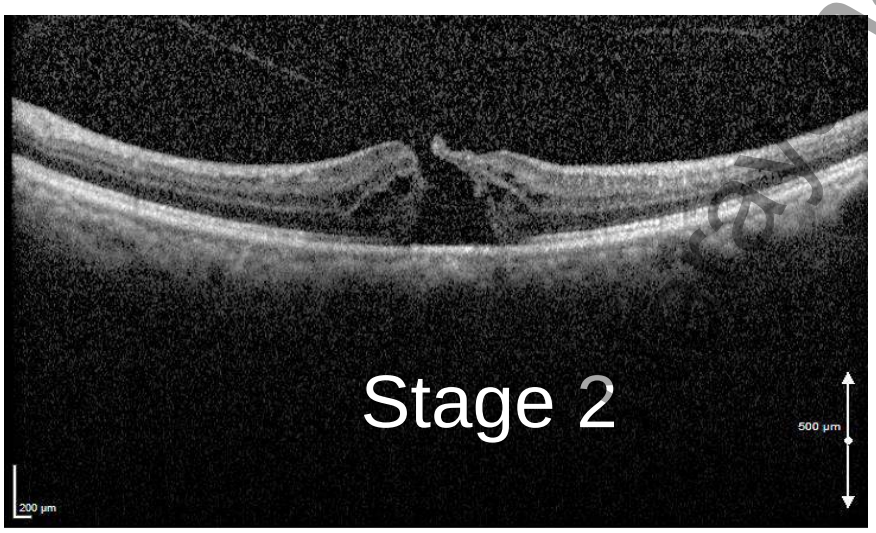
Stage 0 macular hole

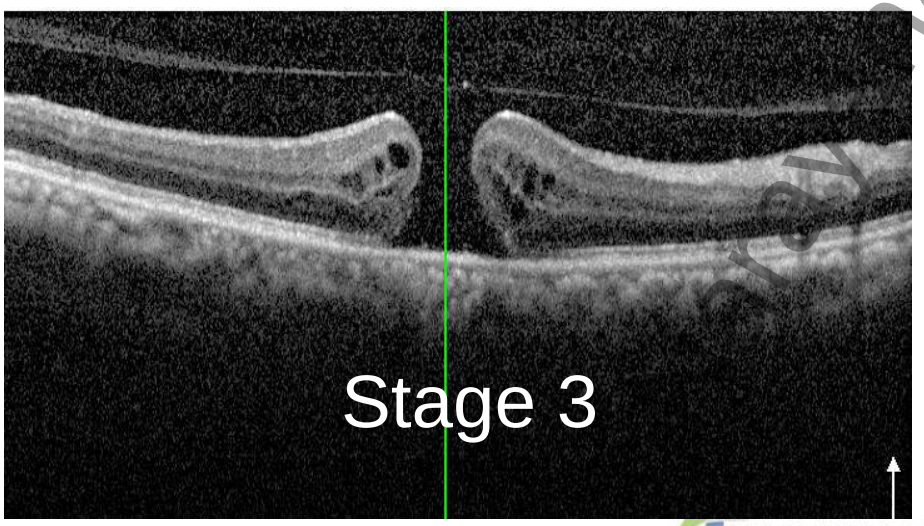


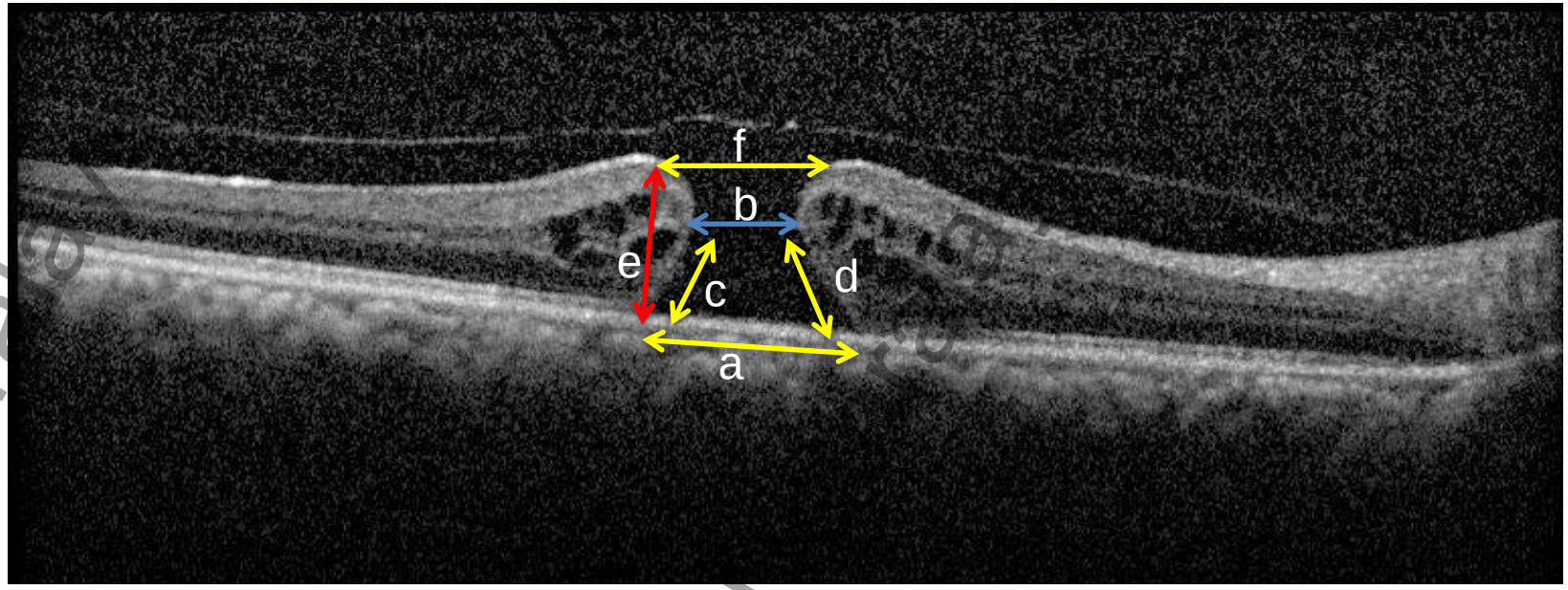
Macular hole











MACULAR HOLE INDEX

e/a-Ratio of hole height to base diameter

Better VA with MHI>0.5 than with MHI<0.5

TRACTIONAL HOLE INDEX

e/b - > 1.41 Good Visual Prognosis

HOLE FORMING FACTOR

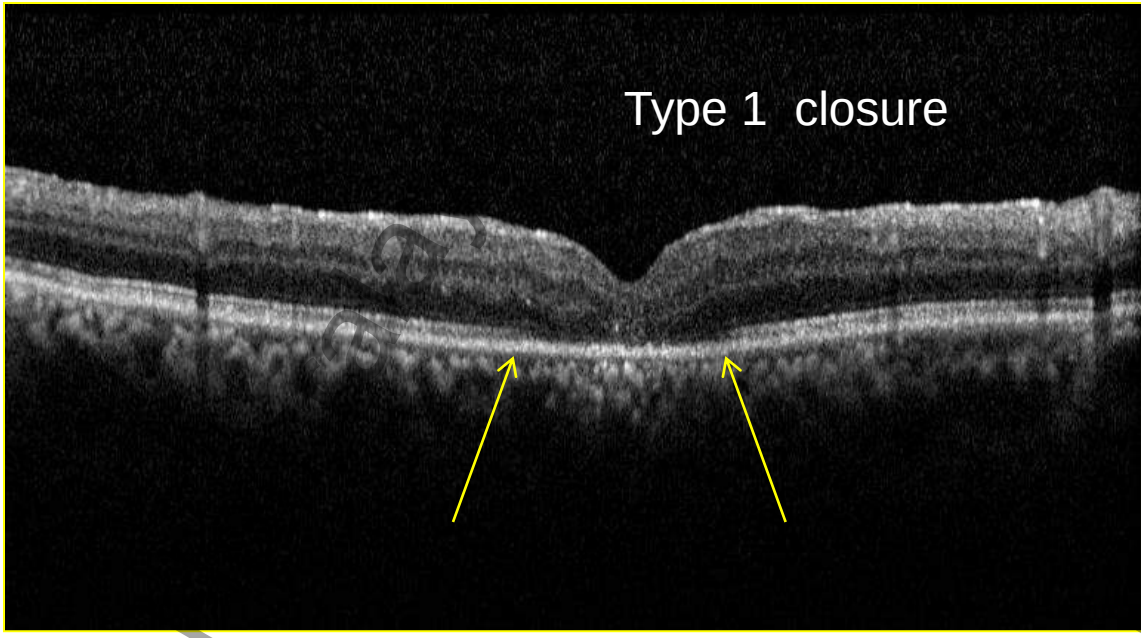
HFF – c+d/a

>0.9 Hole closure in one surgery
≤0.5 -67% anatomical success rate

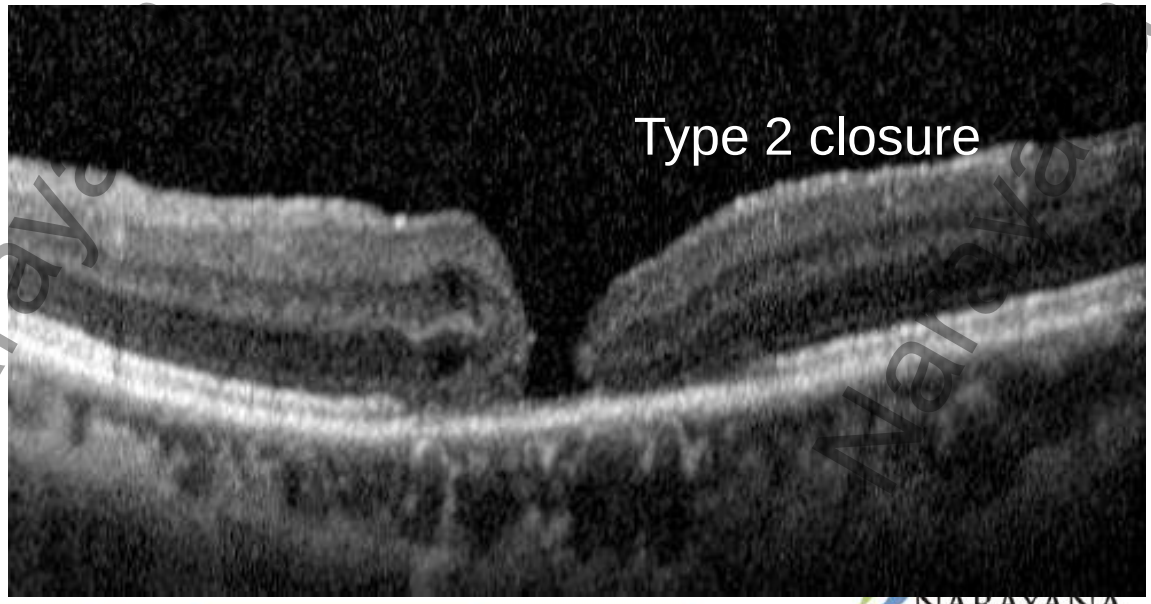
•*Ulrich et al ,. Br J Ophthalmol 2002;86:390–393*

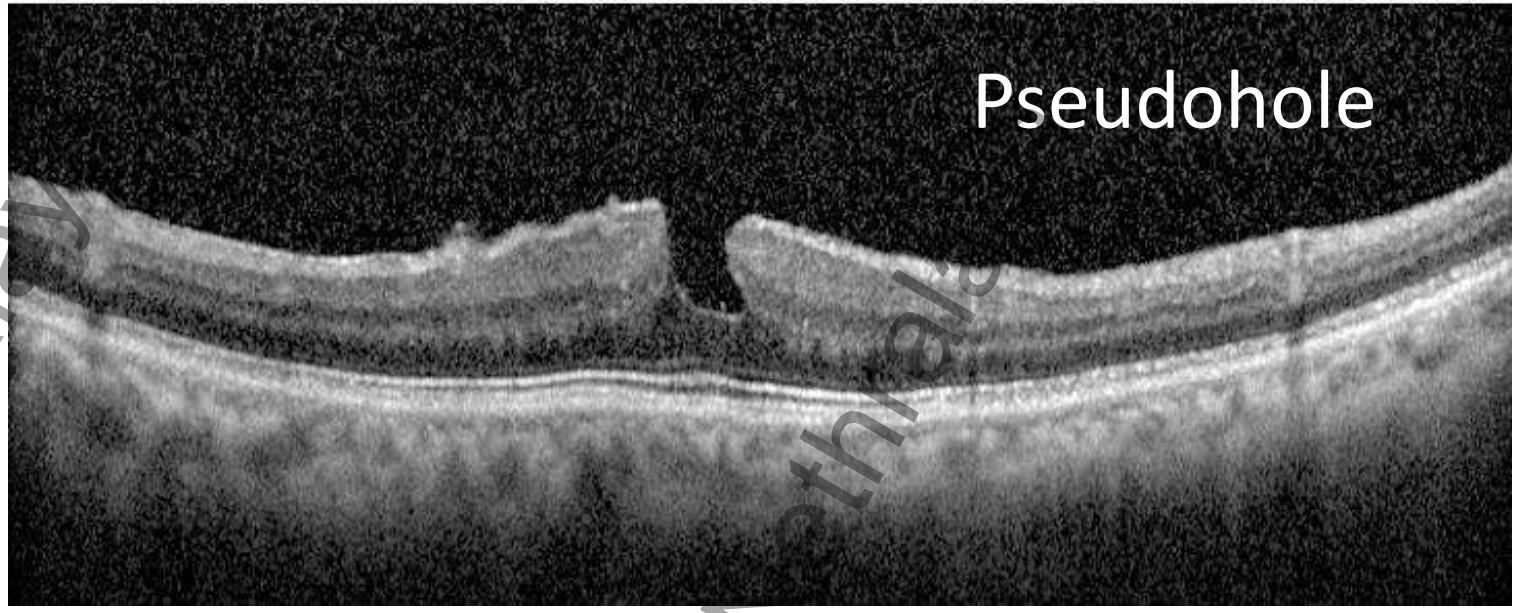
MACULAR HOLE CLOSURE

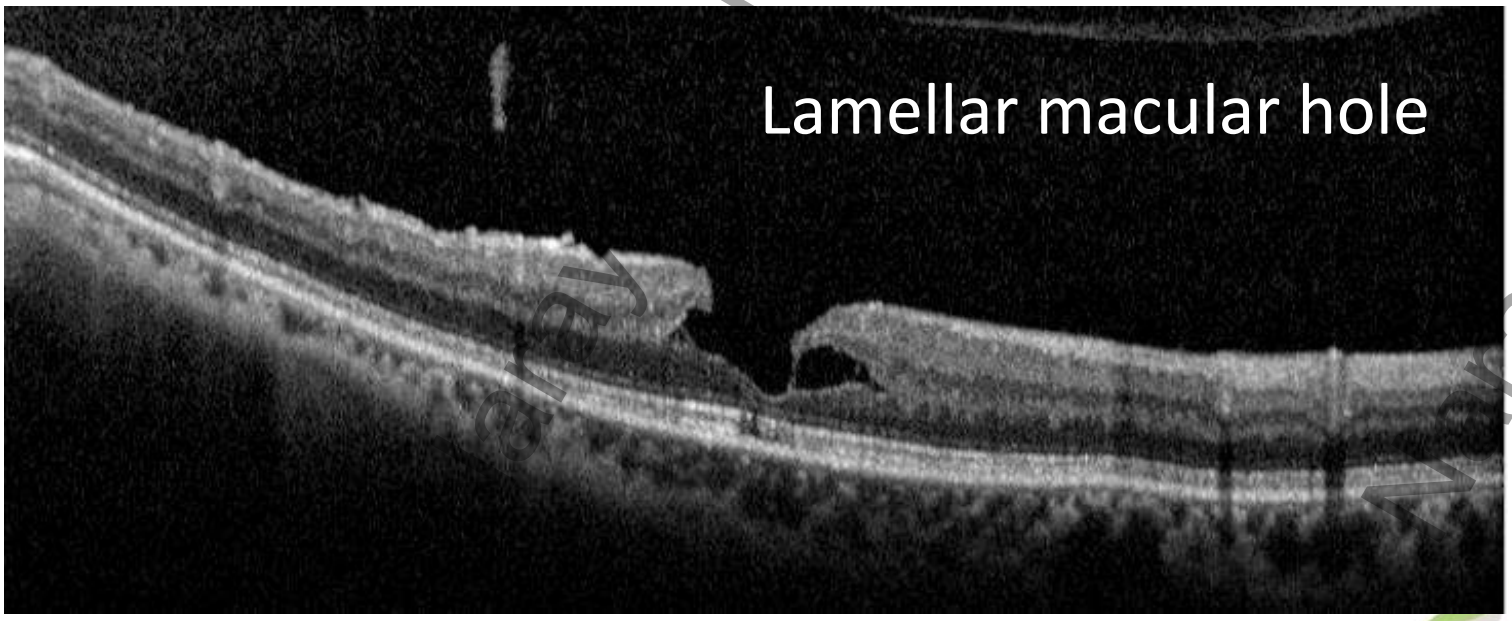
- ***Type 1*** closure
- No foveal defect of the neurosensory retina



- ***Type 2*** closure
- Foveal defect of the neurosensory retina

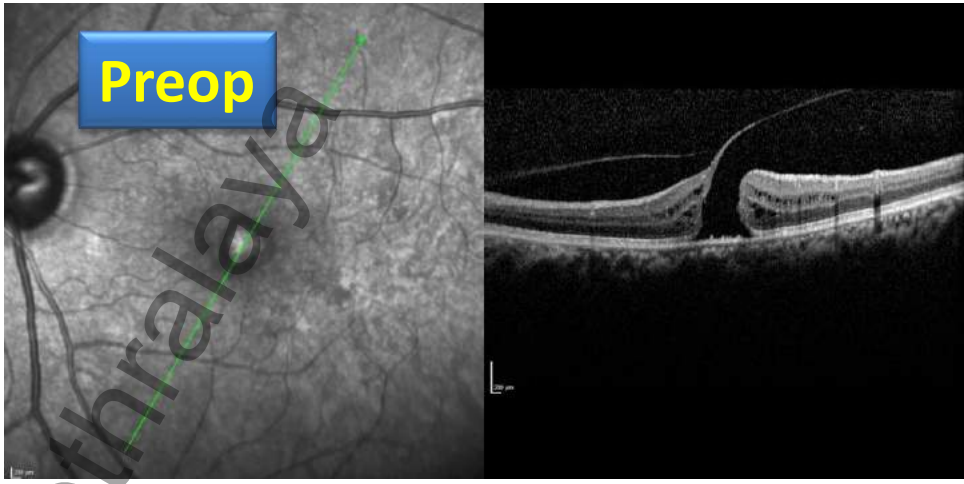


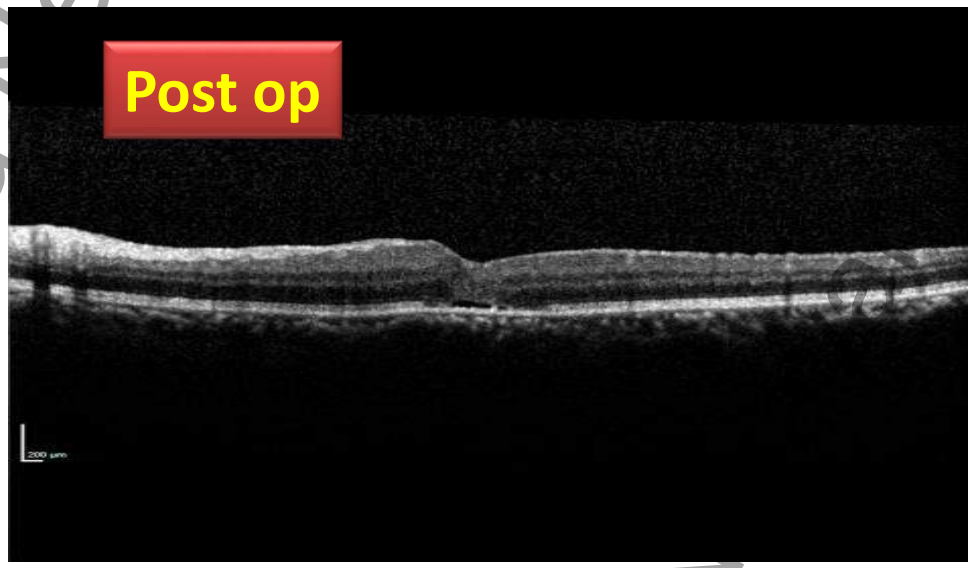




OCT in macular hole

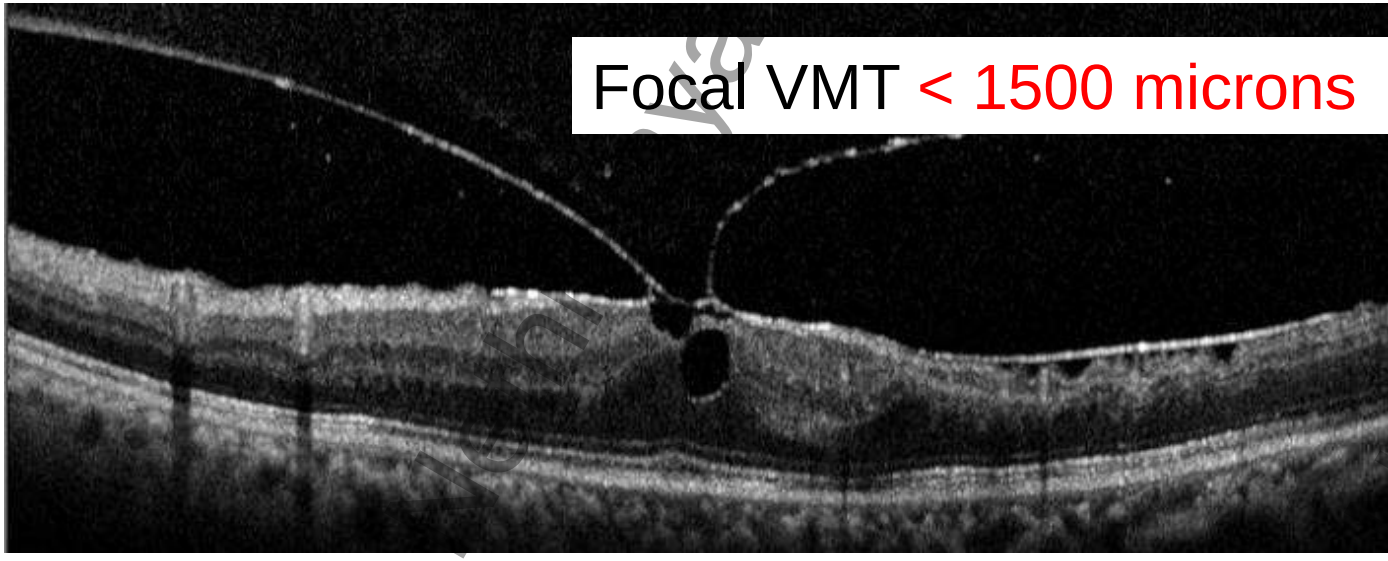
- Establish the diagnosis
- Staging of macular hole, chronicity
- Anatomical and visual prognosis
- ELM, EZ (IS/OS) – integrity
- Types of macular hole closure

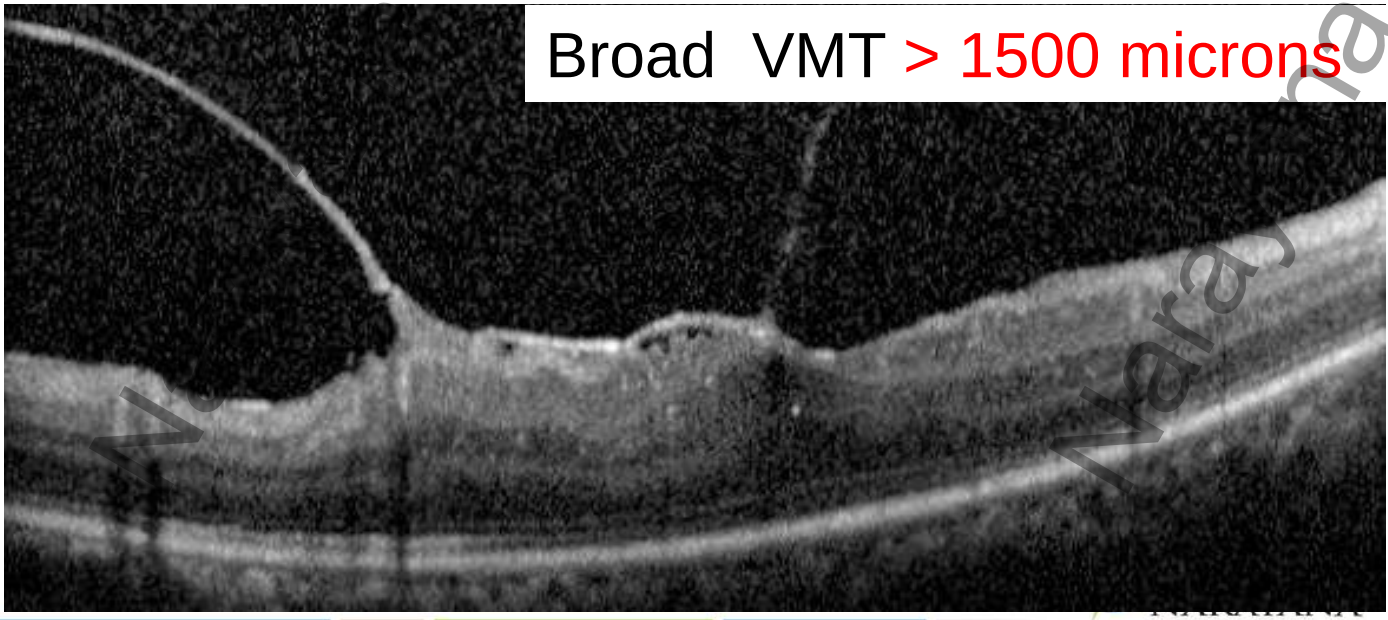




VITREOMACULAR TRACTION

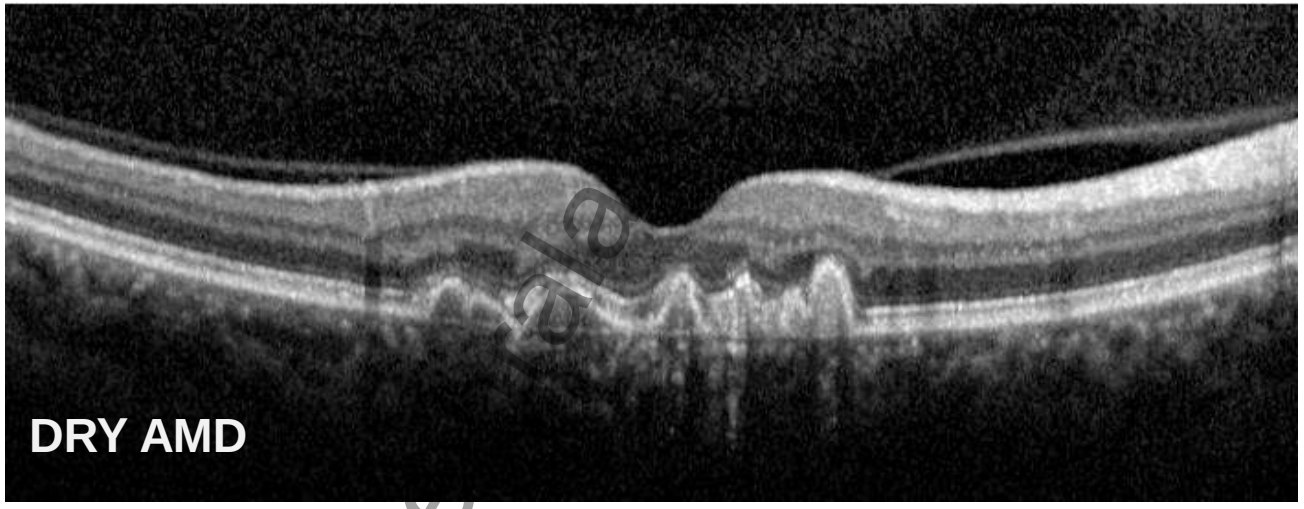
- Dull fovea
- Asymptomatic
- Metamorphopsia /DV
- CME/SRD
- Surgical Rx/observation

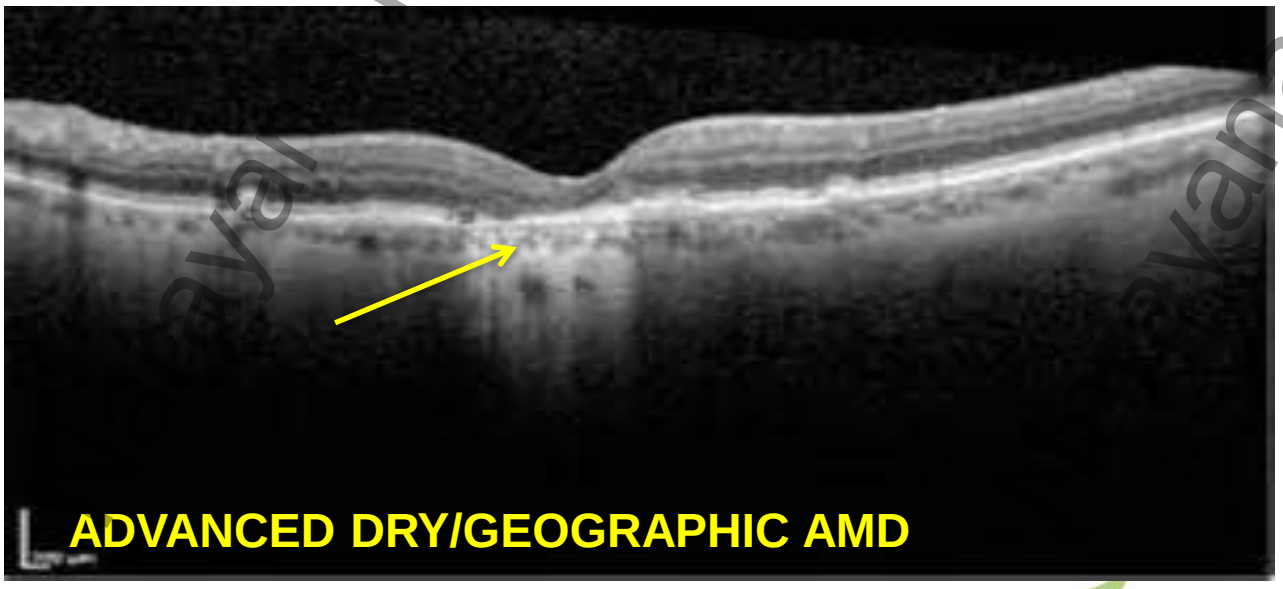




DRY AMD

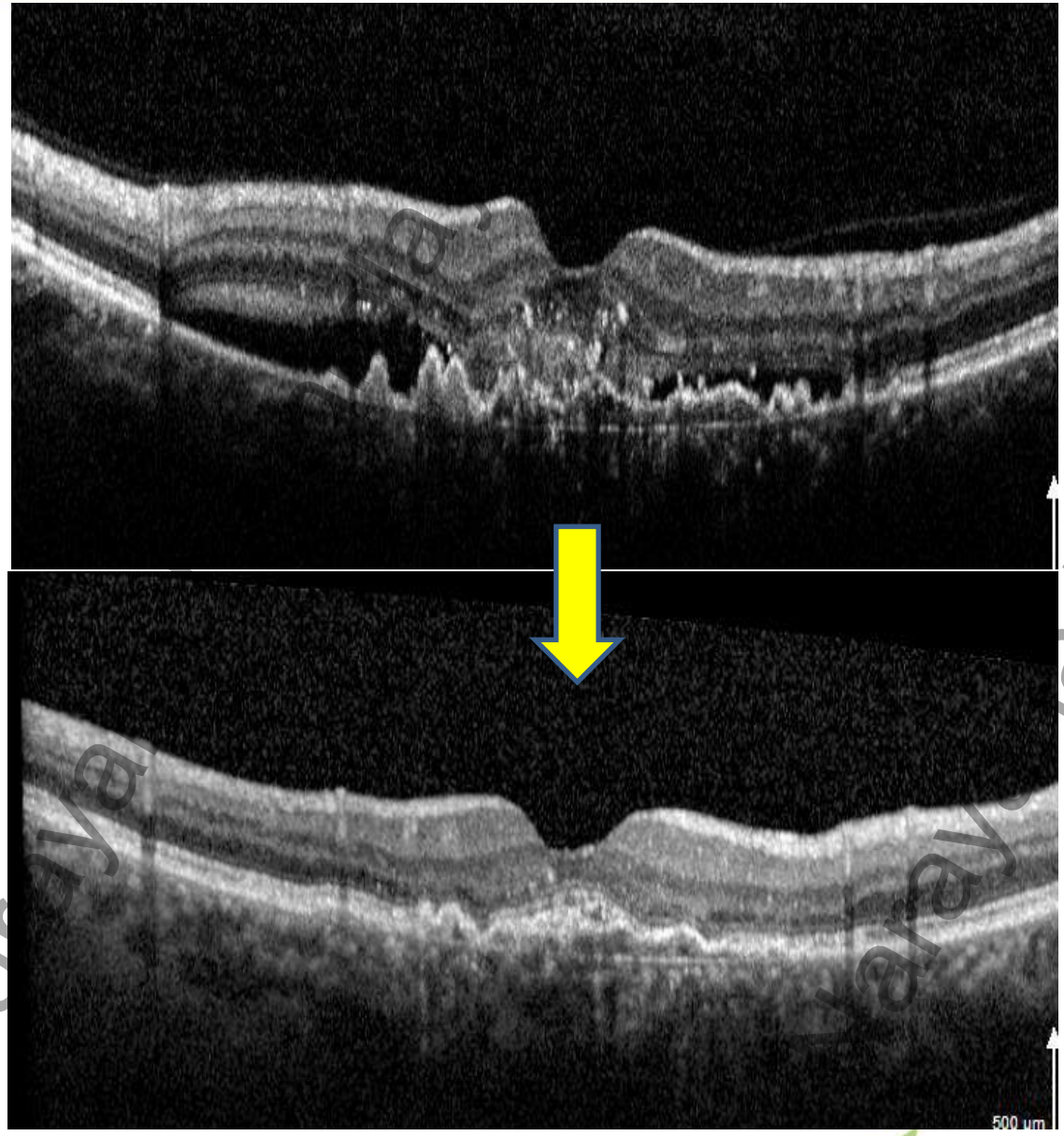
- Extent of the disease
- Monitoring of disease progression
- Staging and prognosis





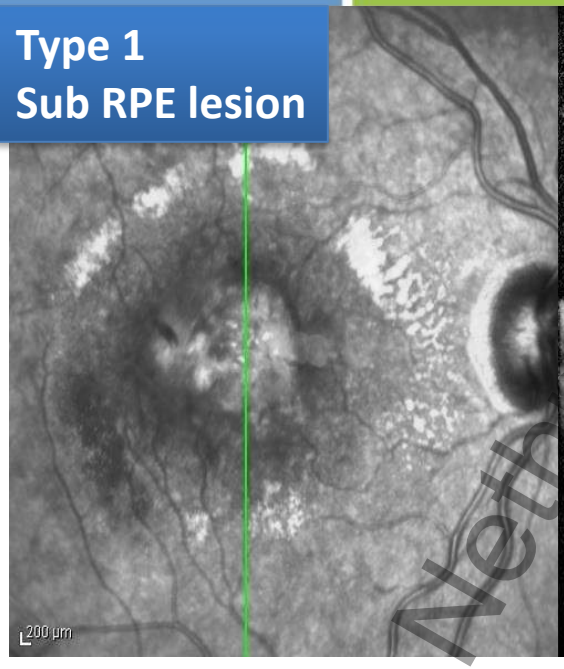
EXUDATIVE AMD

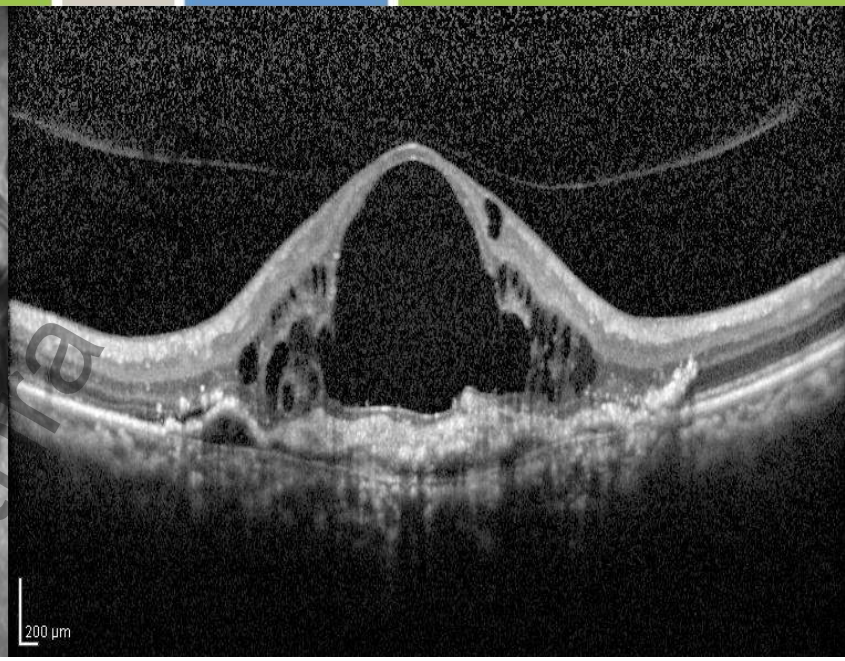
- CNVM lesion-type/location/extent
- FFA/ICG correlation
- Subretinal /intraretinal fluid
- PEDs-types
- Response to anti VEGFs



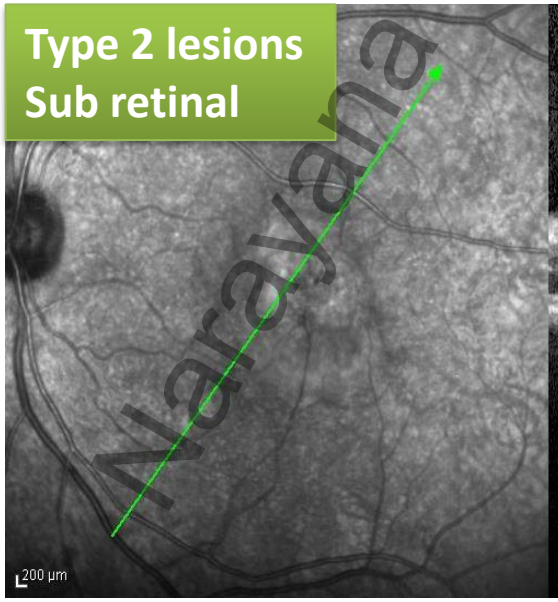
EXUDATIVE AMD cont..

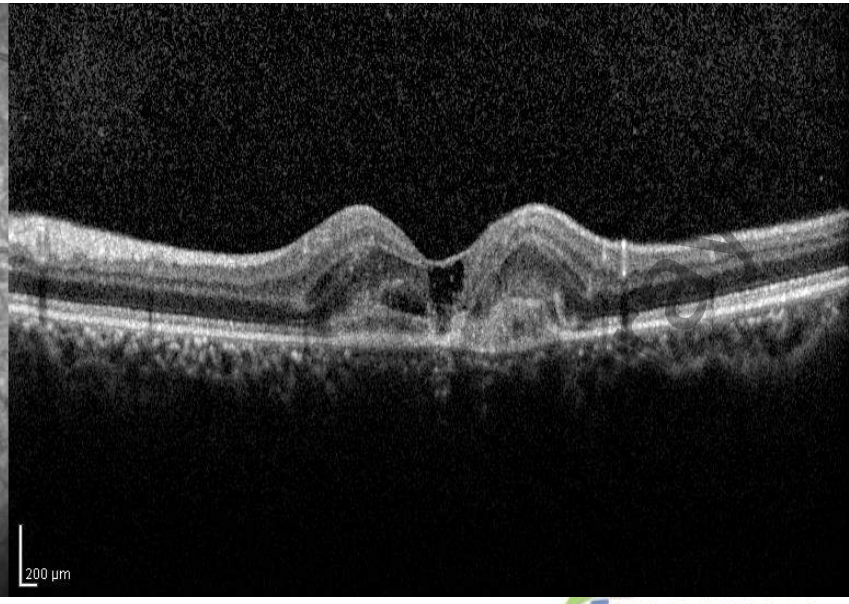
Type 1
Sub RPE lesion





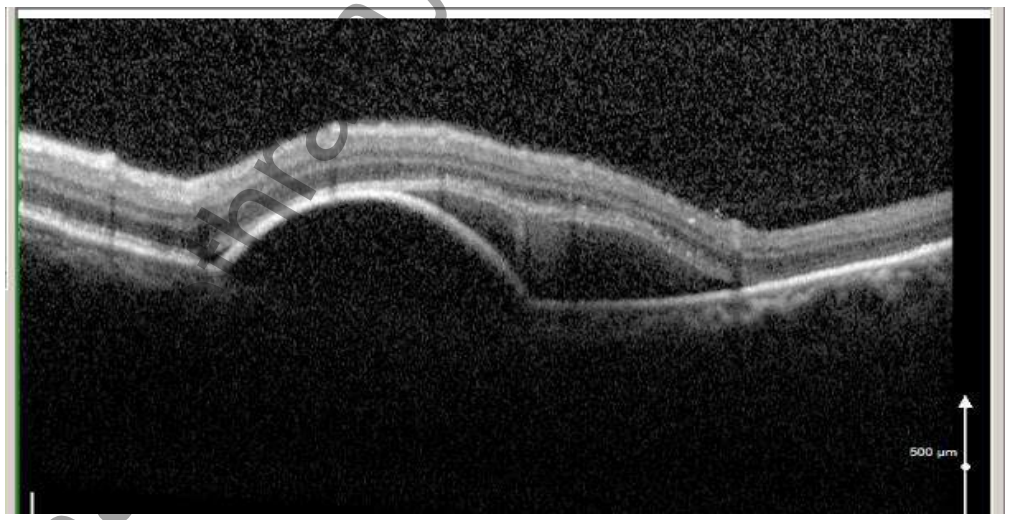
Type 2 lesions
Sub retinal



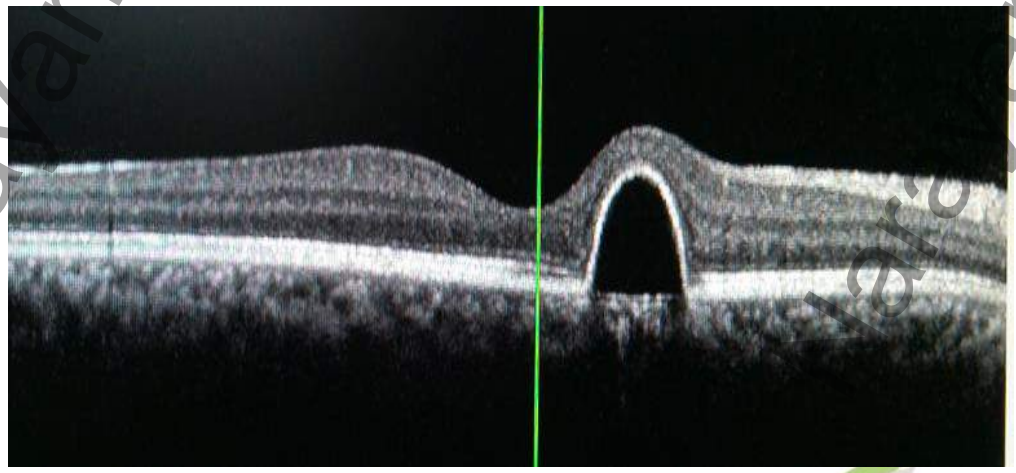


Types of PEDs

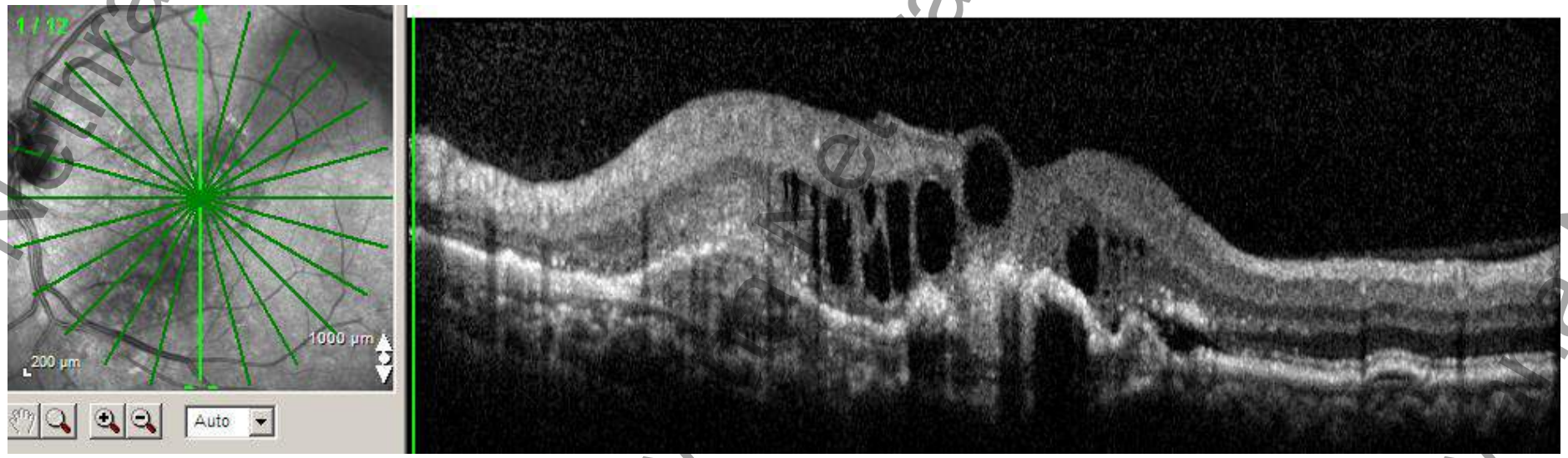
Hemorrhagic PED



Serous PED

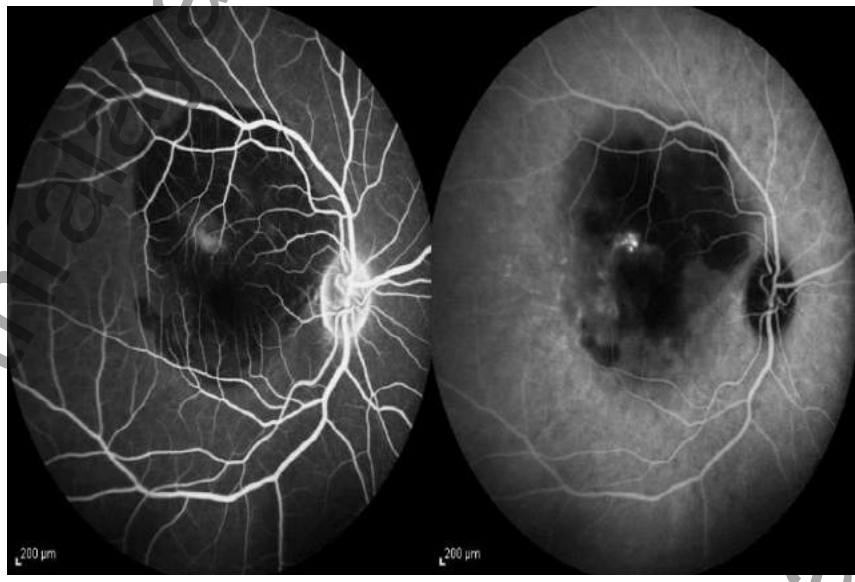


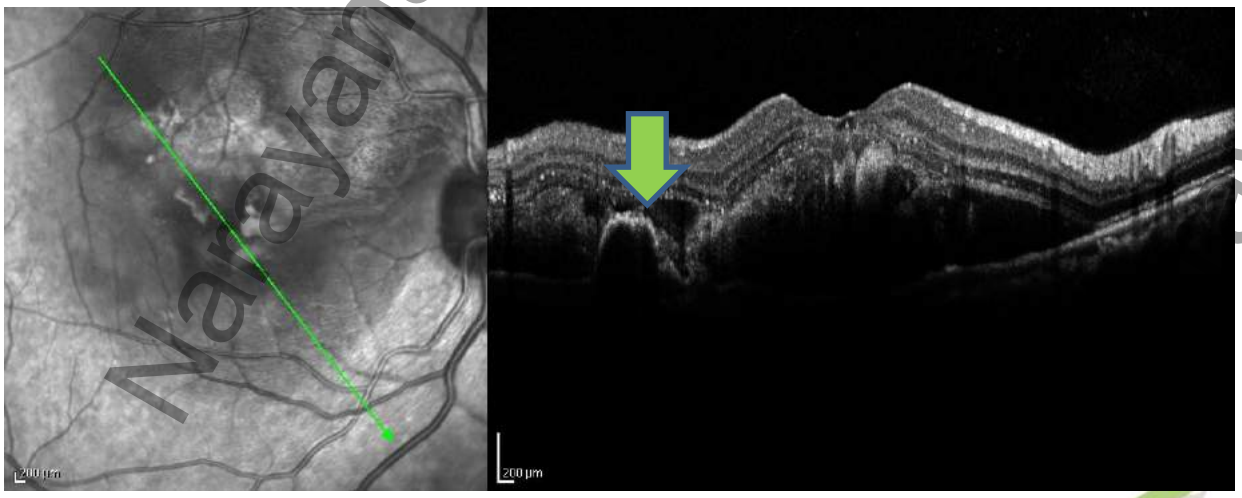
Fibrovascular PED



Polypoidal Choroidal Vasculopathy

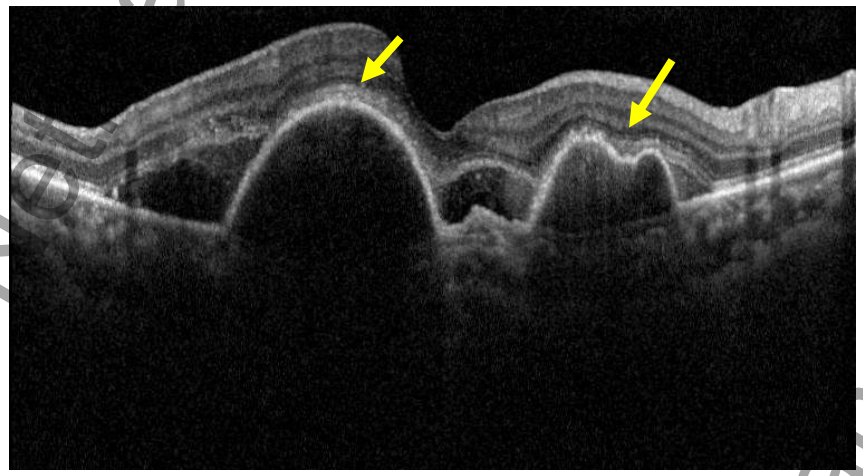
- Variant of occult CNVM
- Present with serosanguinous PEDs
- ICG is diagnostic



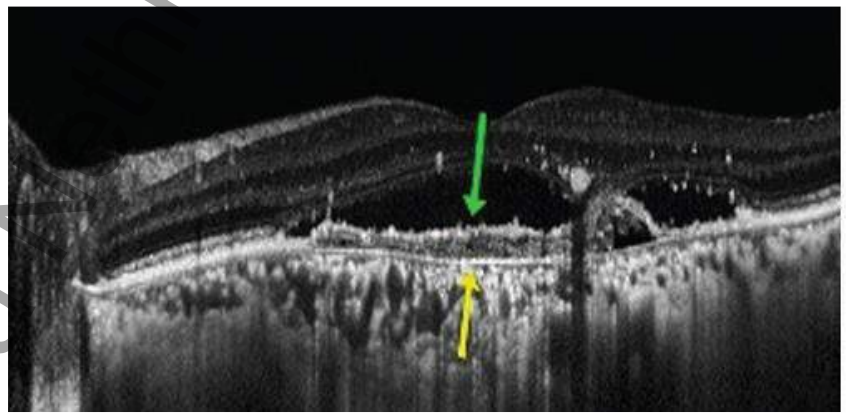


PCV – OCT FEATURES

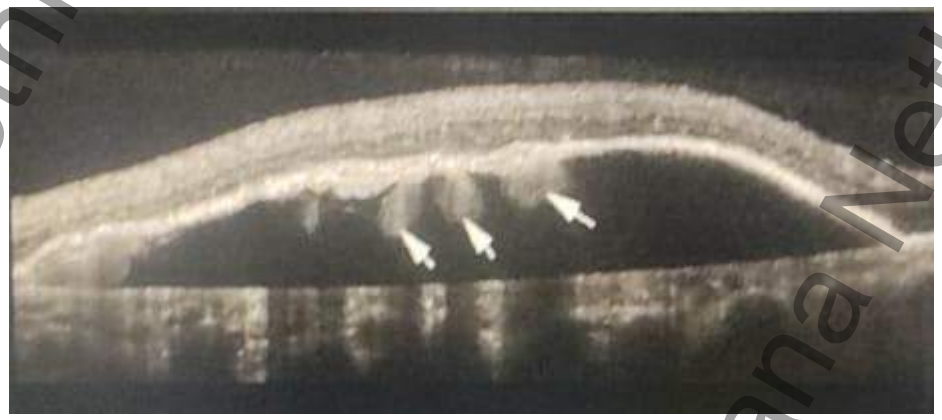
1. Thumb-like polyp (TLP)/Sharp-peaked PED
2. Notched PED: Signifies the polypoidal lesion at margin of PED
3. Hyporeflective lumen surrounded by hyperreflective ring attached to undersurface of RPE
4. Double-layer sign (DLS): representing shallow irregular RPE elevation and Bruch's membrane, signifying AVN



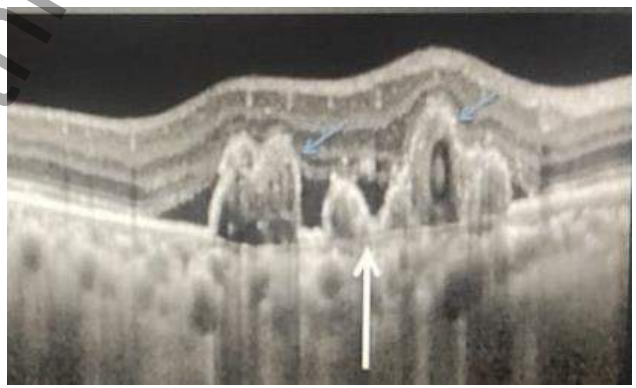
THUMB LIKE PED AND NOTCHED PED



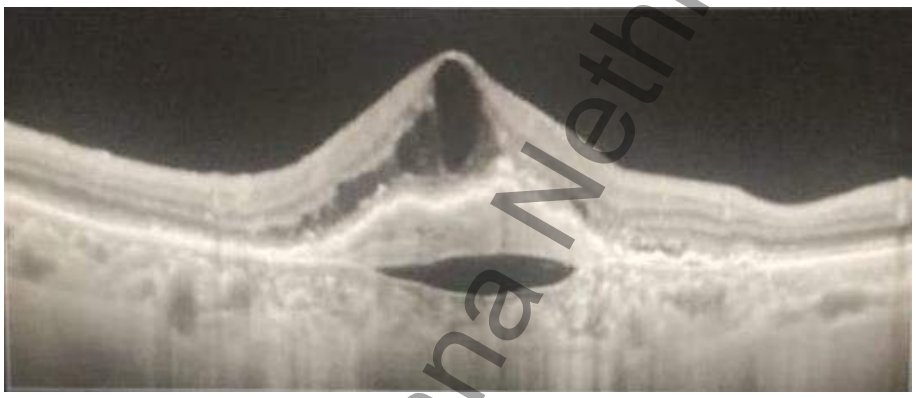
DOUBLE LAYER SIGN



STRING OF PEARLS : Multiple PCV adherent to under surface of RPE detachment

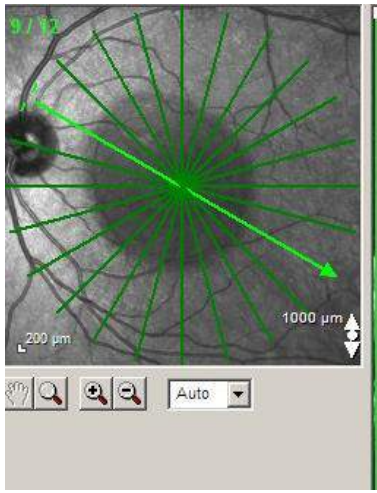


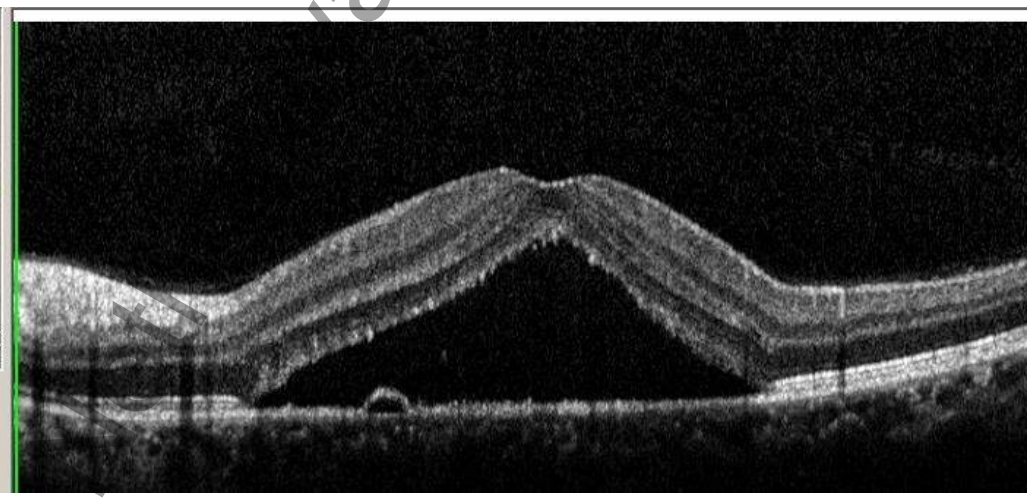
M SHAPED PED : well delineated, round-oval sub RPE cavities corresponding to polyps



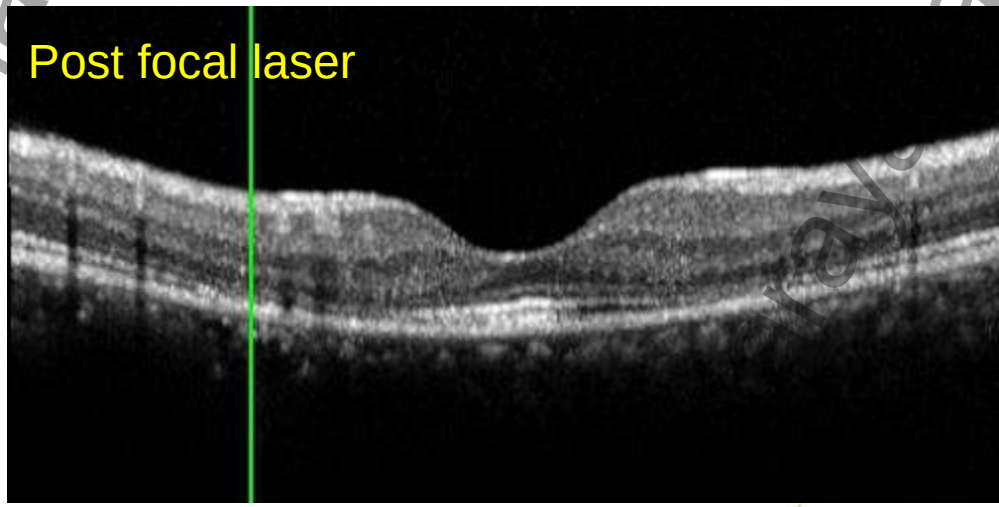
TRIPLE LAYER SIGN : hyporeflective space between sub RPE neovascular tissue (type 1 cnvm) and underlying choroid

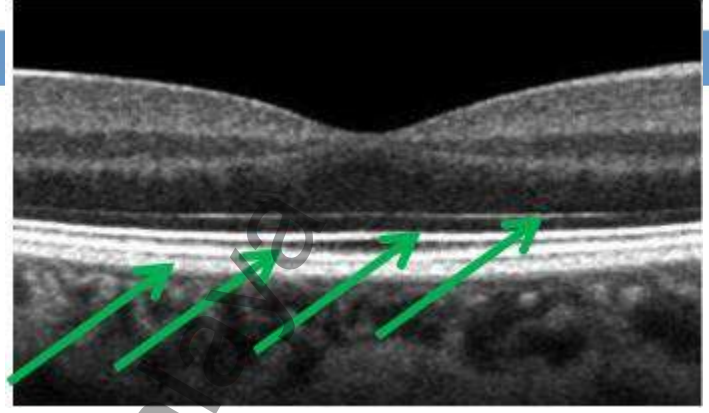
CENTRAL SEROUS CHORIO RETINOPATHY



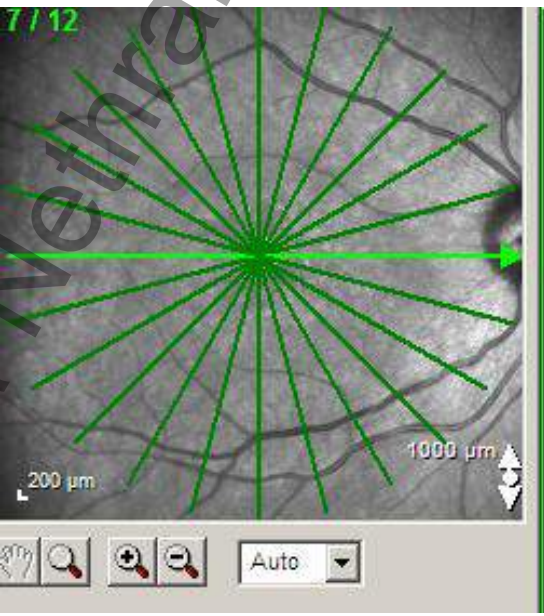


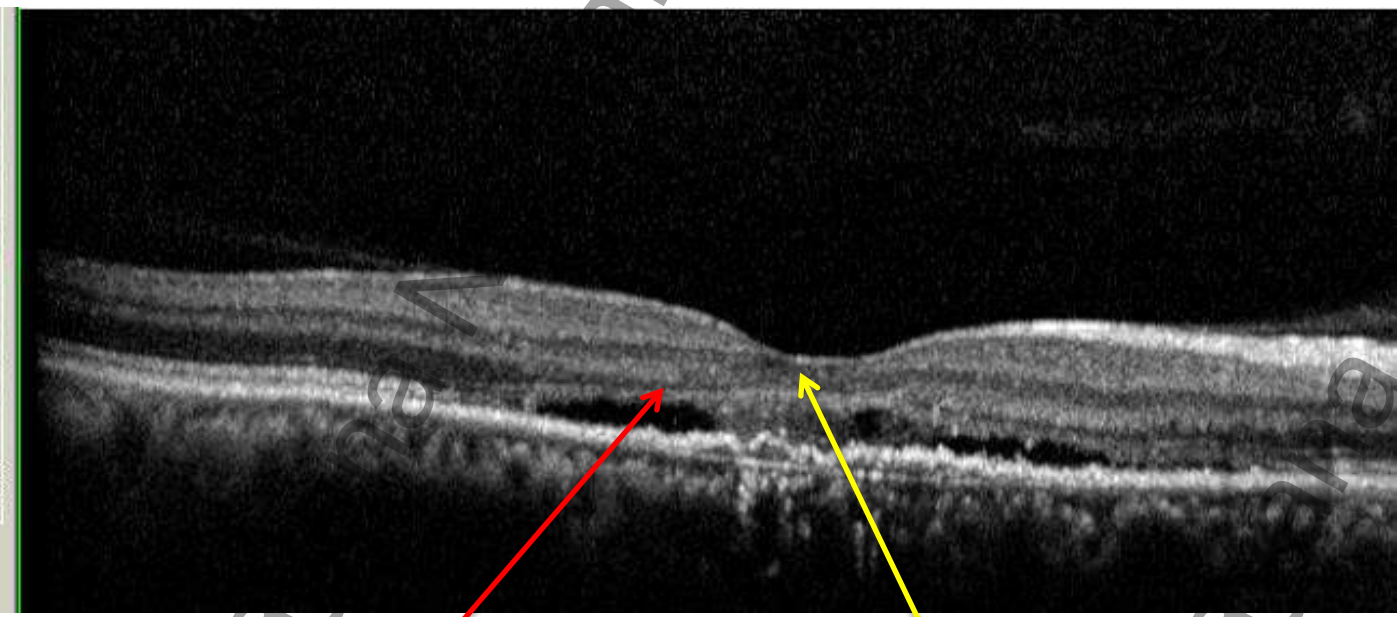
- Extent, nature of SRF
- PED
- Follow-up
- Response to treatment
- Complications
- Acute/chronic CSCR
- Prognostical aid- status of IS/OS, ONL





Chronic CSCR



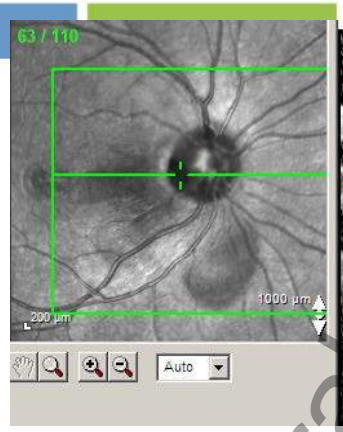


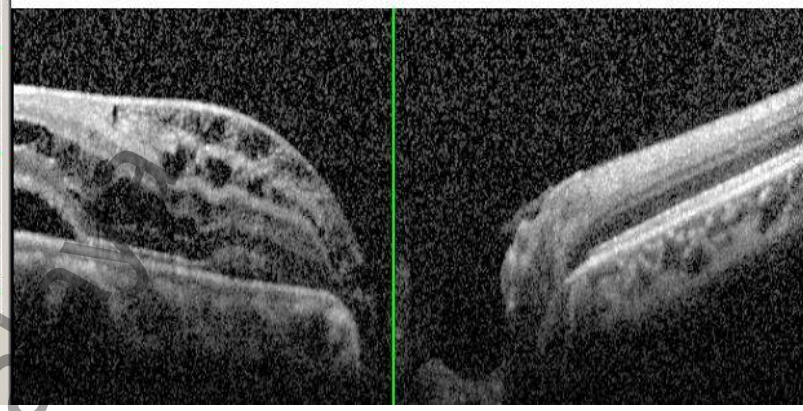
ONL thinning

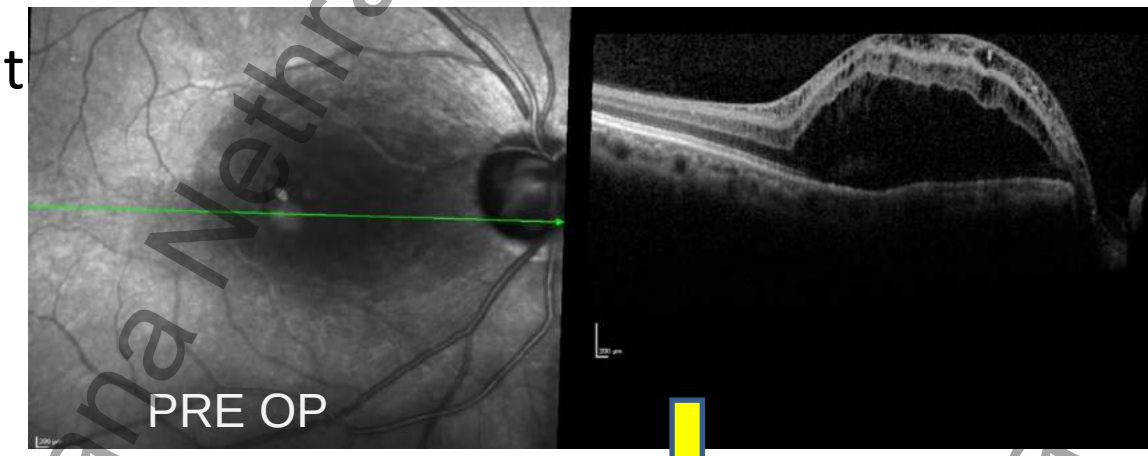
Foveal thinning

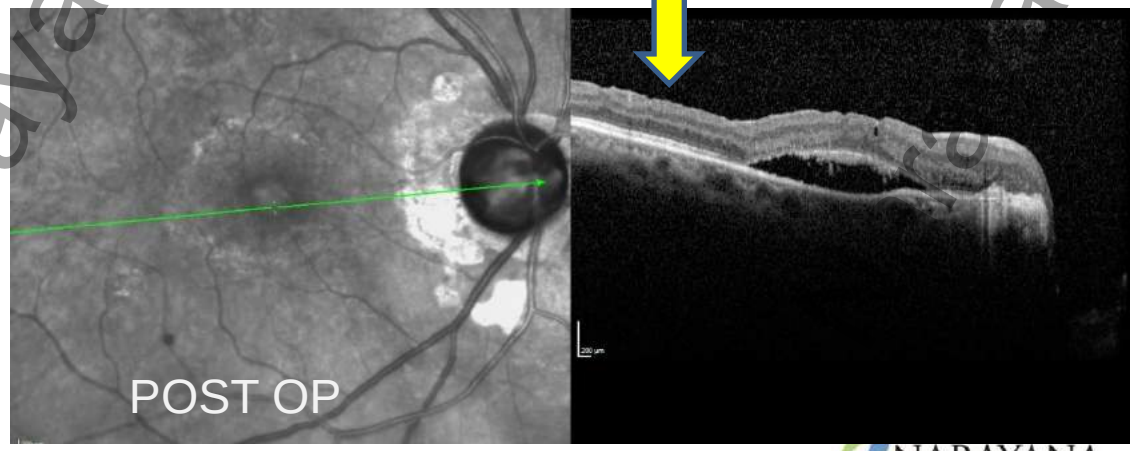
OPTIC DISC PIT

- Macular schisis, serous rd
- Communication with the pit
- Monitor response to laser and surgery

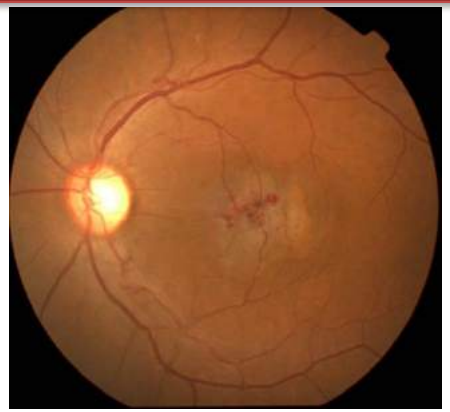


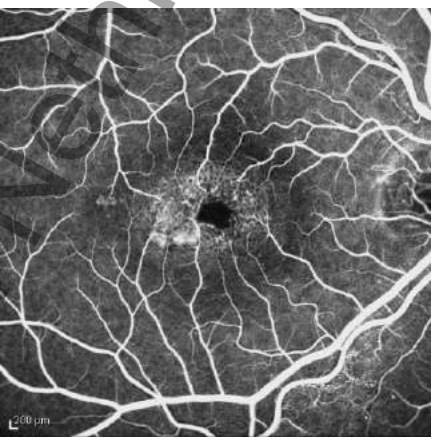




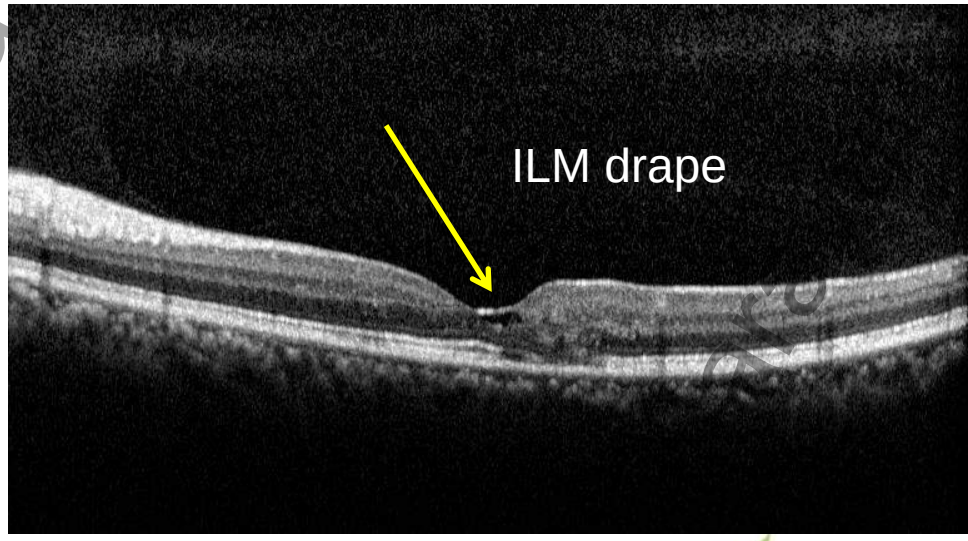


IDIOPATHIC PARA FOVEAL TELANGIECTASIA/ MACTEL

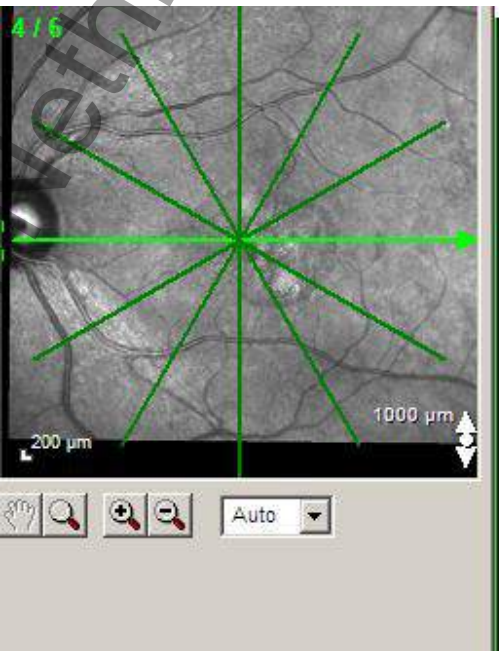


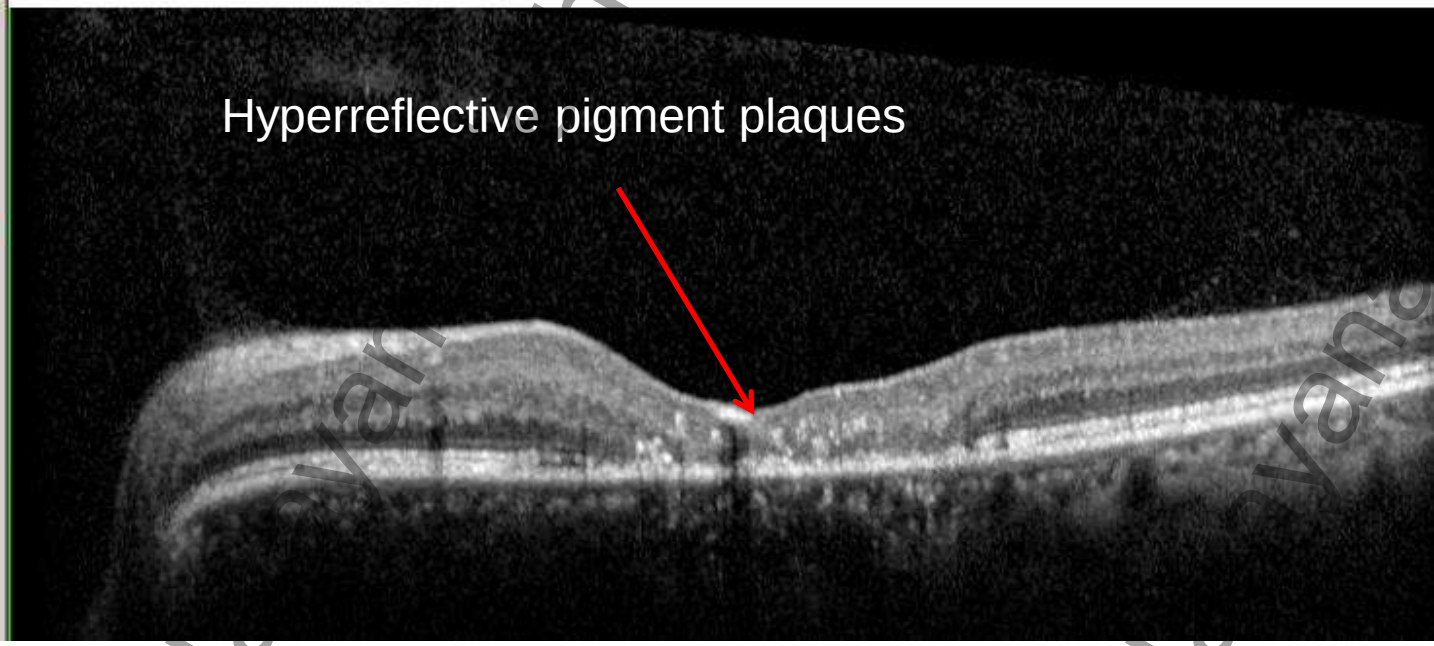


- ILM drape
- EZ (IS-OS) disruption
- Temporal enlargement of foveal pit
- Foveal atrophy



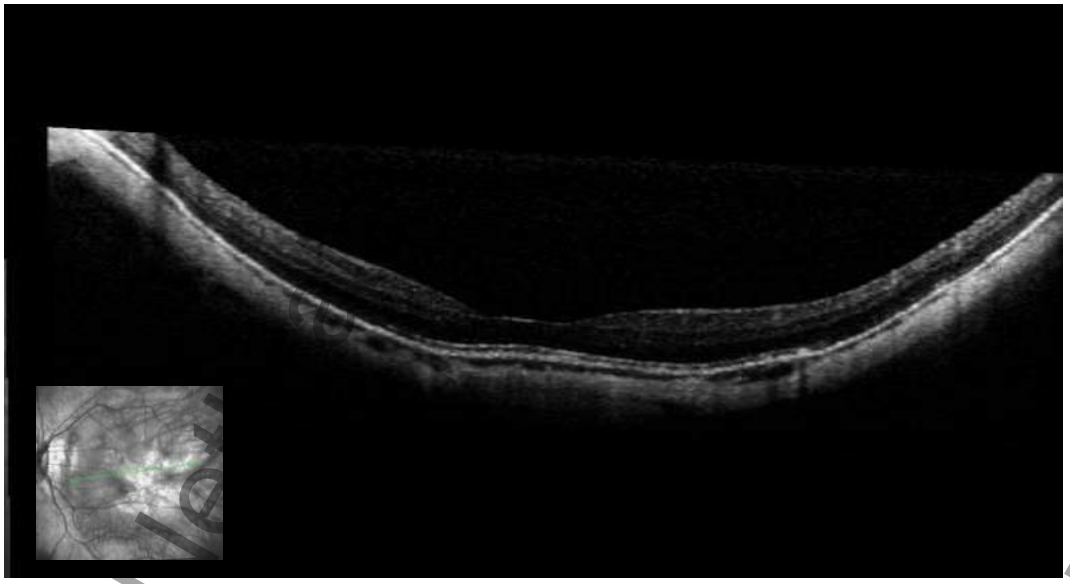
PFT

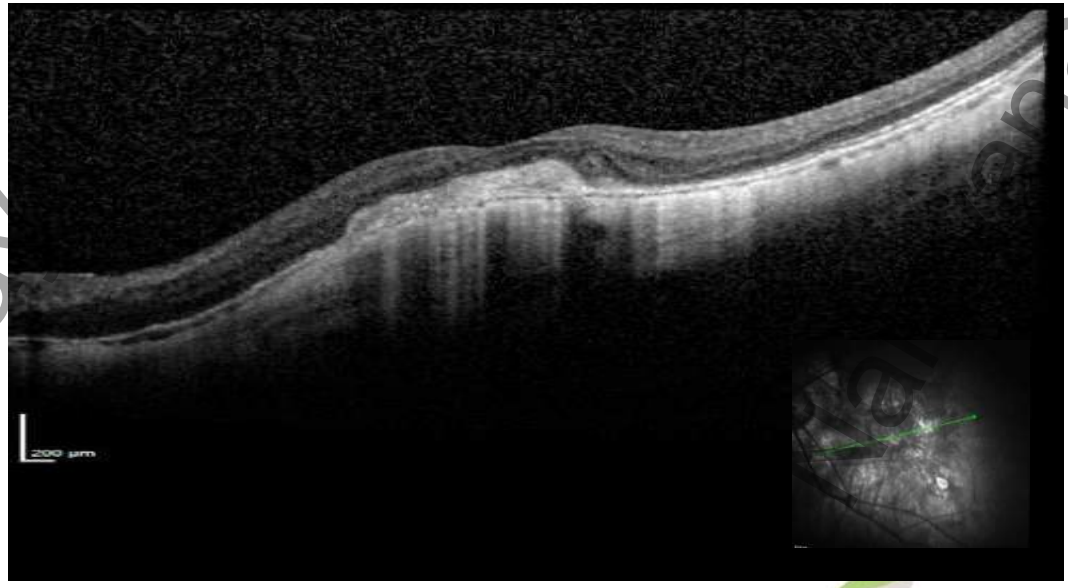




MYOPIA

- Staphylomas
- Haemorrhages and scars
- Myopic CNVMs
- Myopic foveoschisis
- Macular and lamellar holes
- ERMs



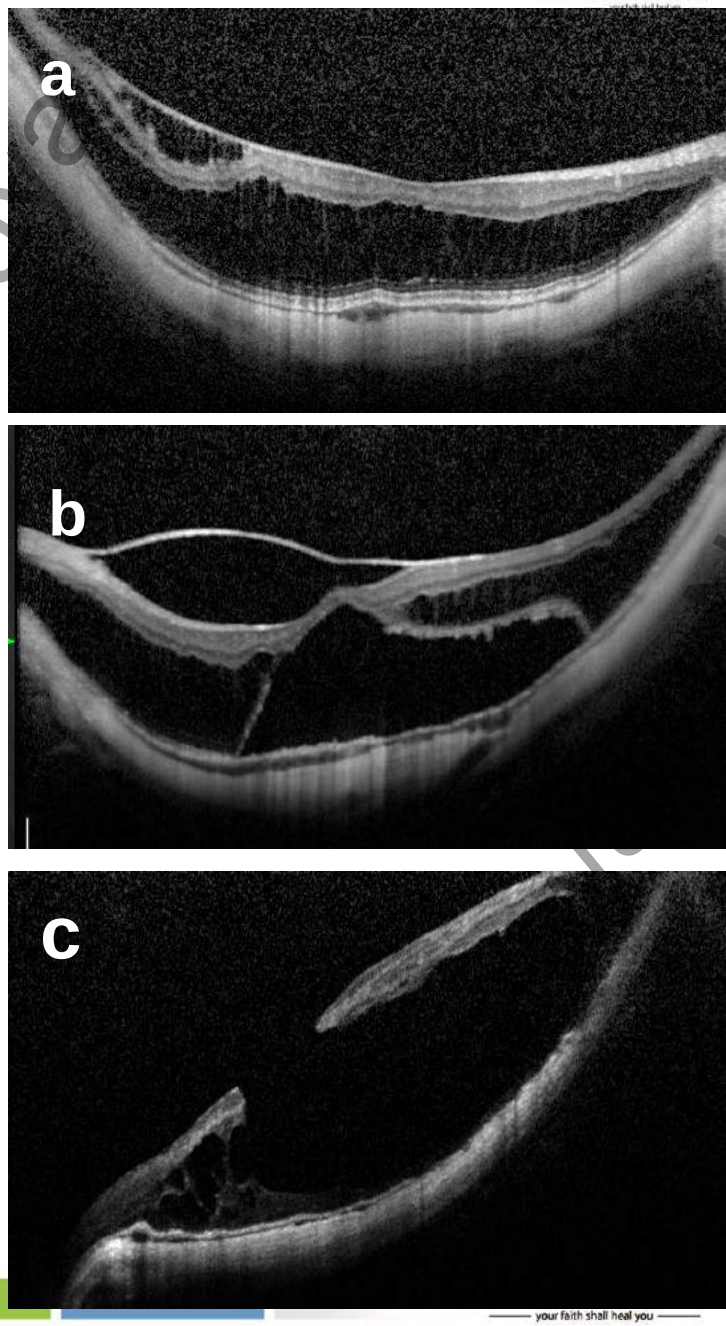


Myopic Foveoschisis

a. Retinoschisis type

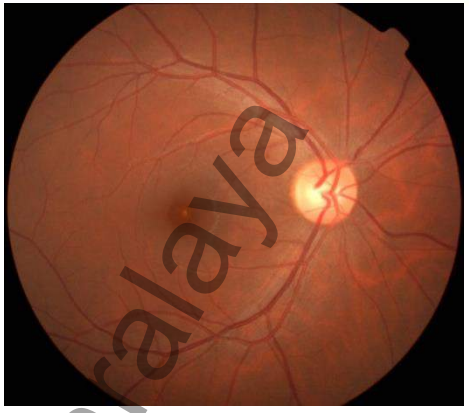
b. Foveal detachment type

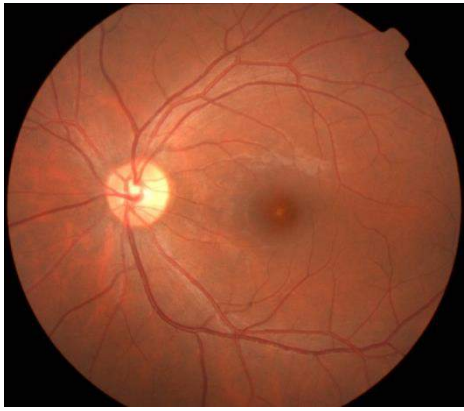
c. Macular hole type



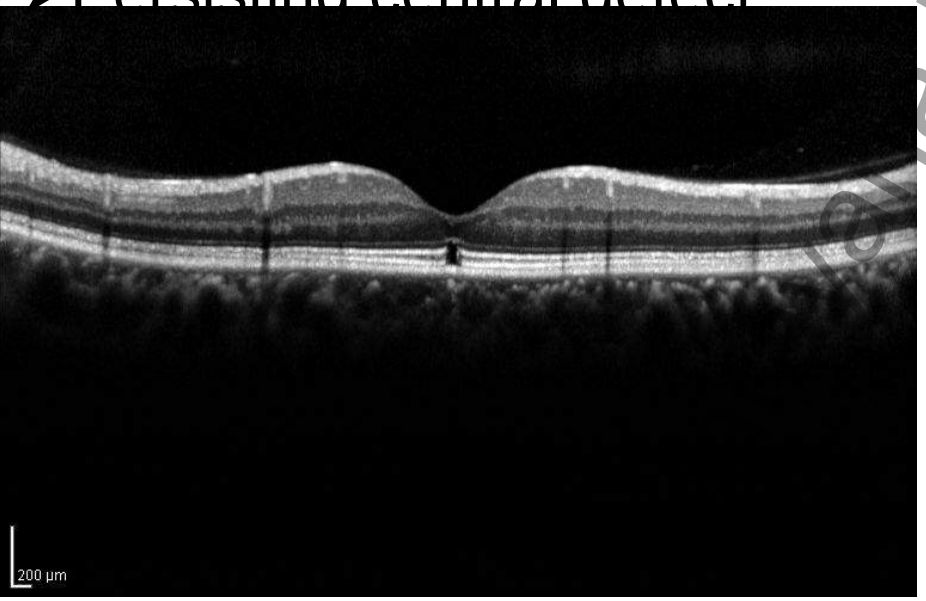
Gaucher D et al. Long-term Follow-up of High Myopic Foveoschisis: Natural Course and Surgical Outcome. Am J Ophthalmol 2007;143:455–462

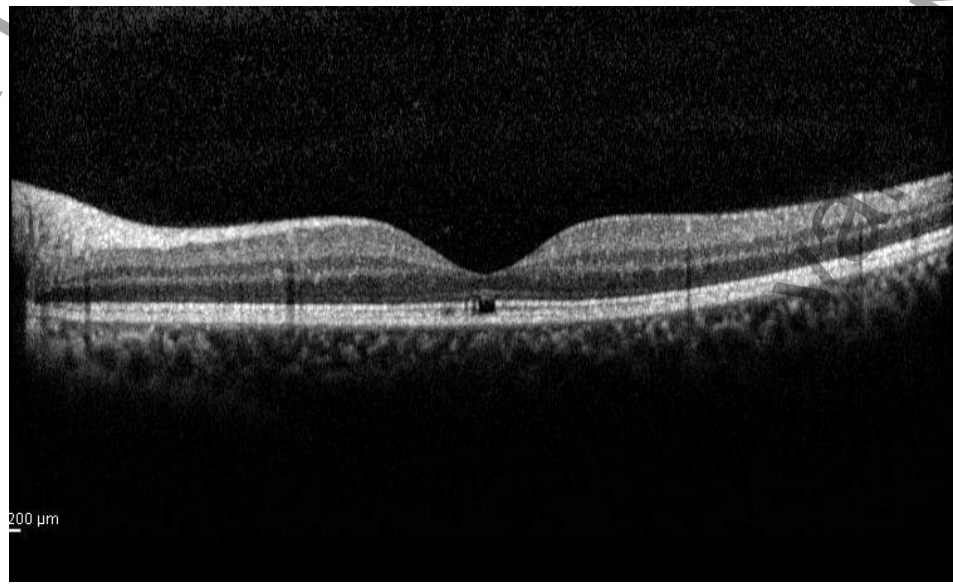
SOLAR RETINOPATHY



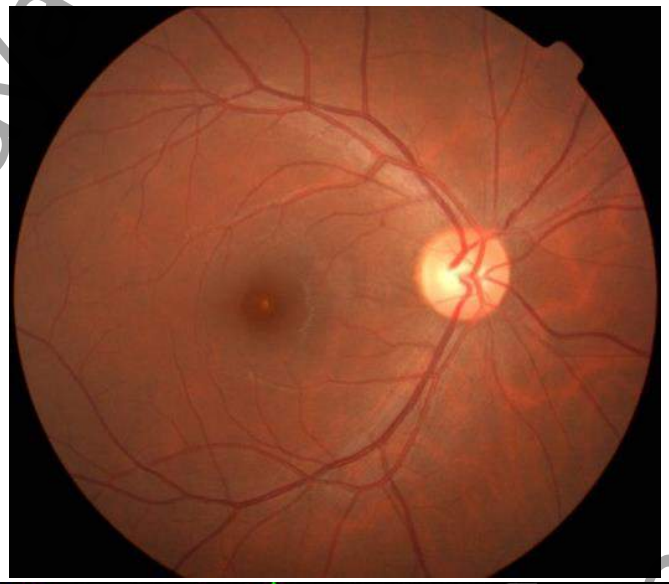


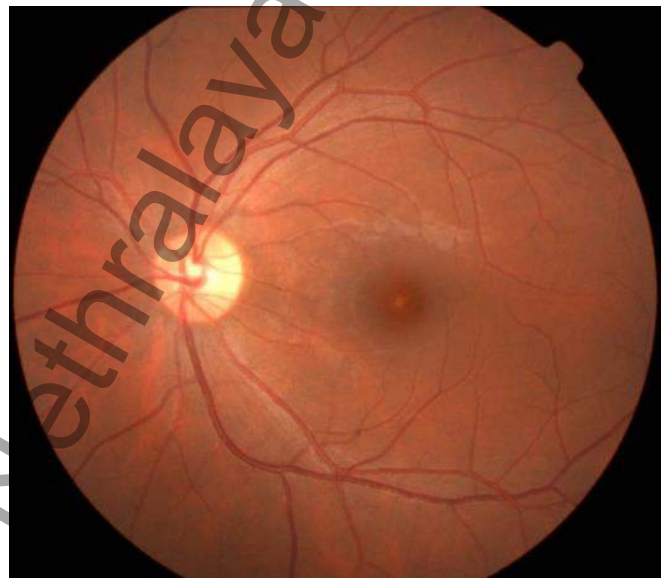
- Photoreceptor damage in early stages
- EZ (IS/OS) and RPE changes later
- Some improve
- Persisting central defect

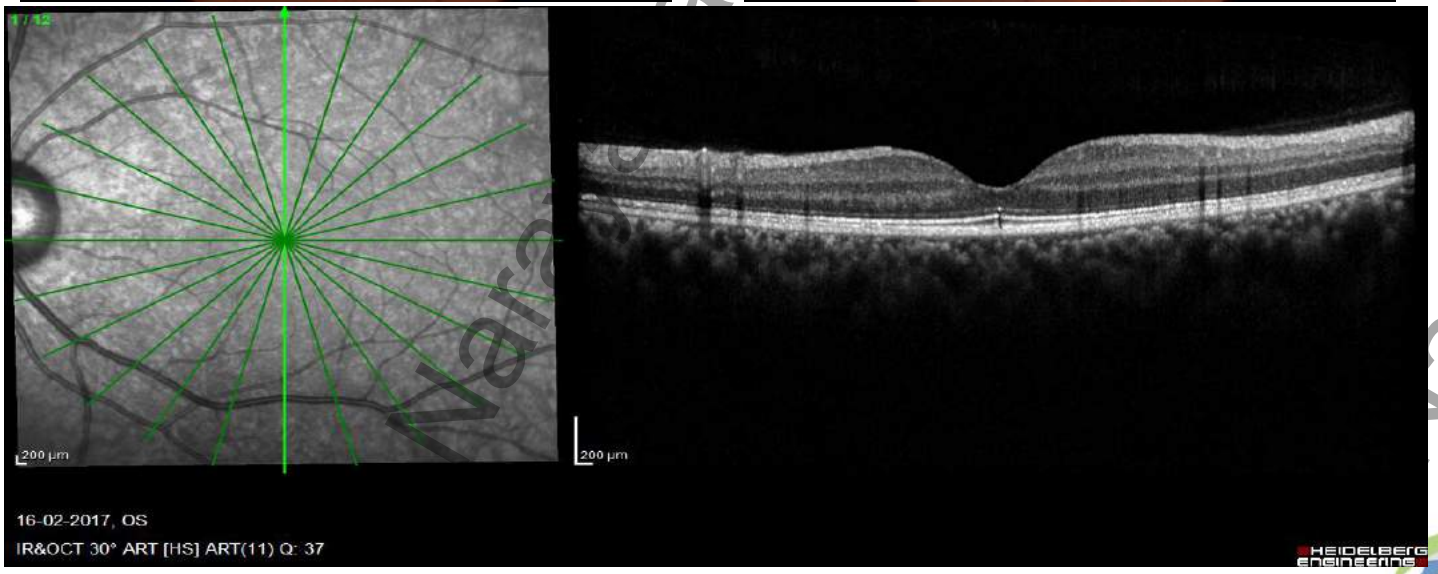




Kevin et al., open ophth journal 2012

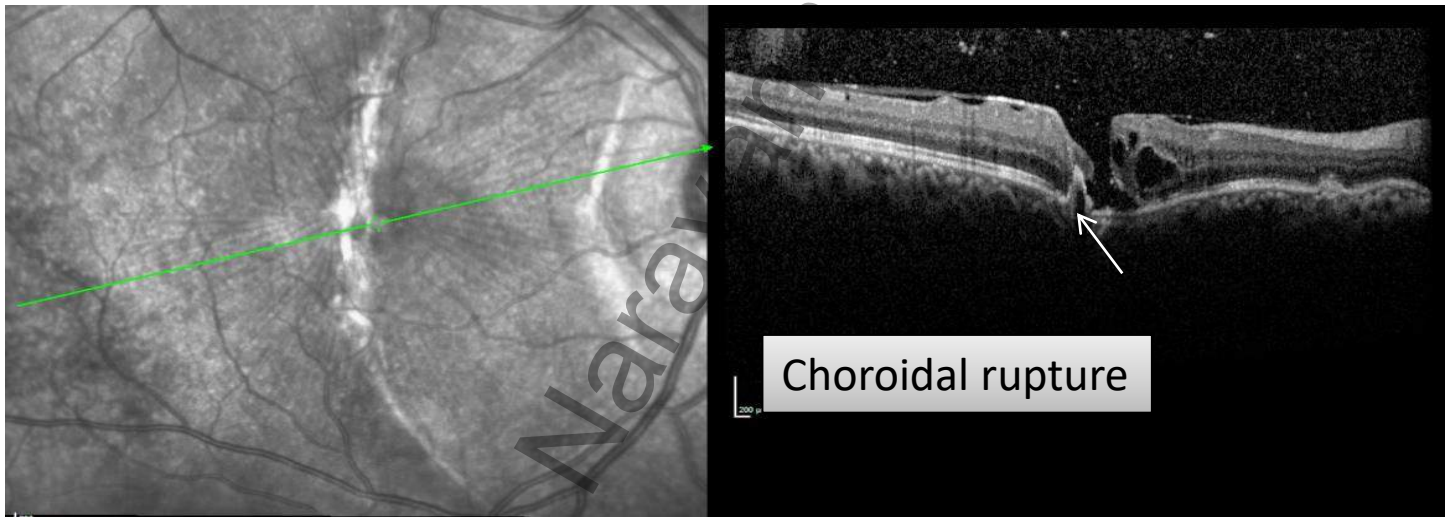




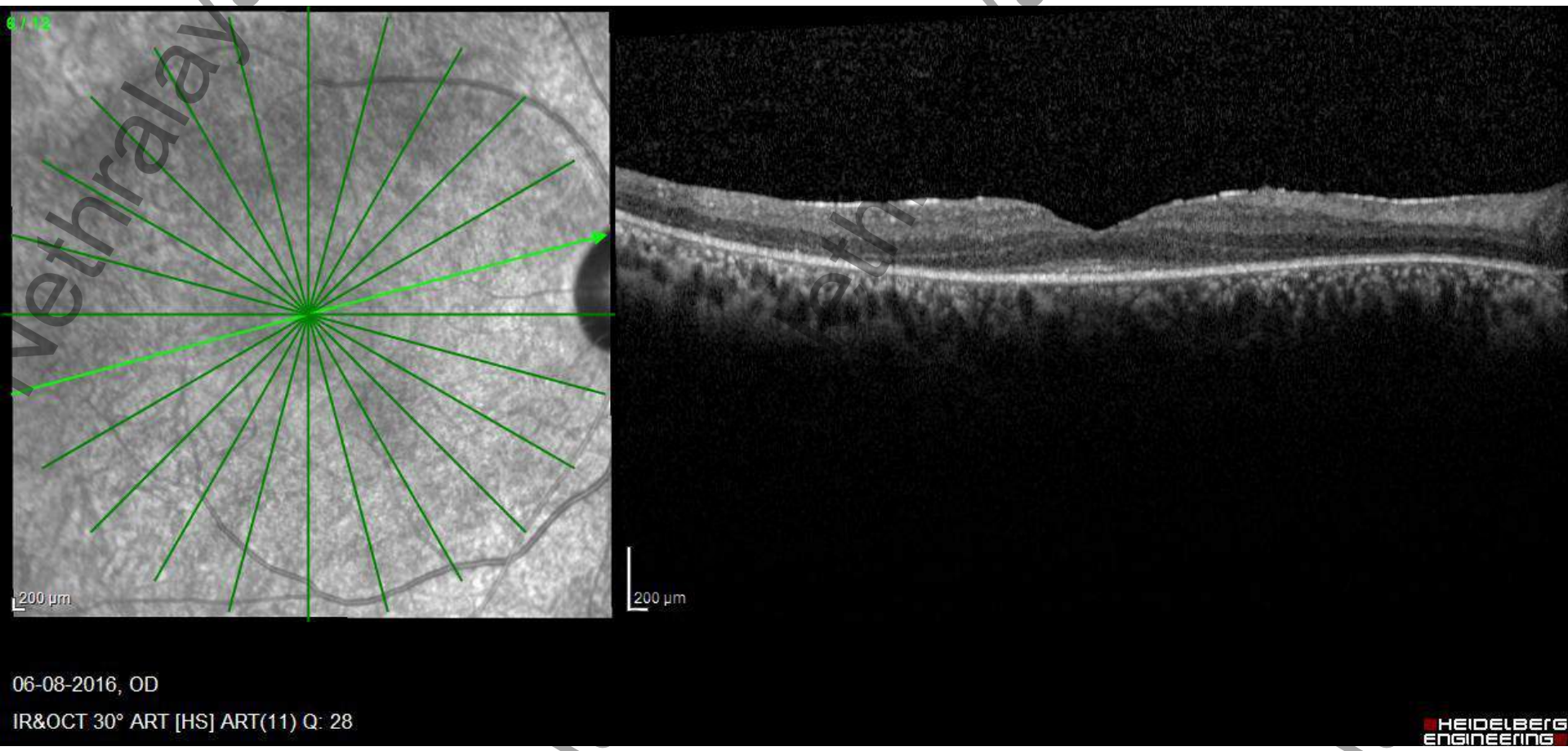


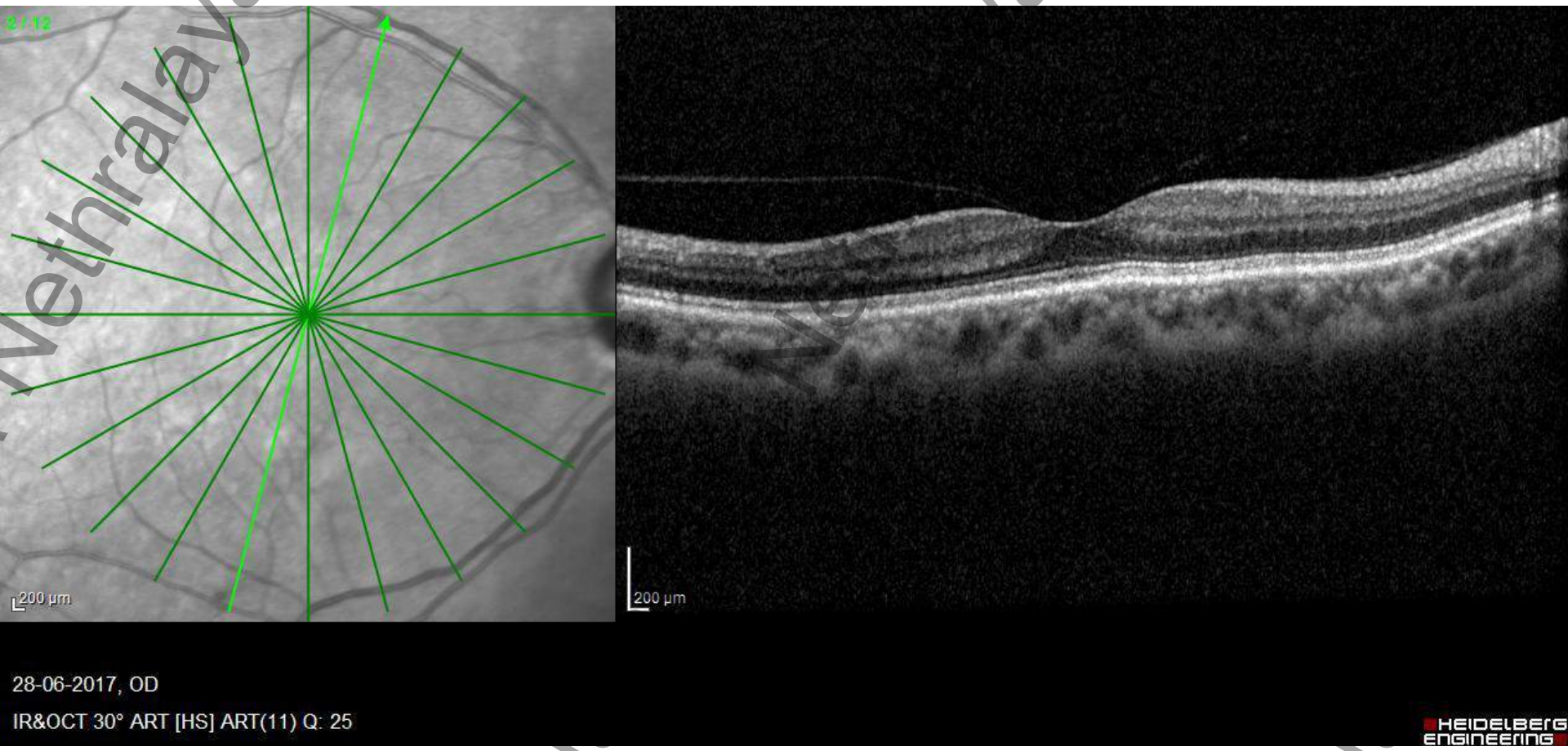
OCULAR TRAUMA

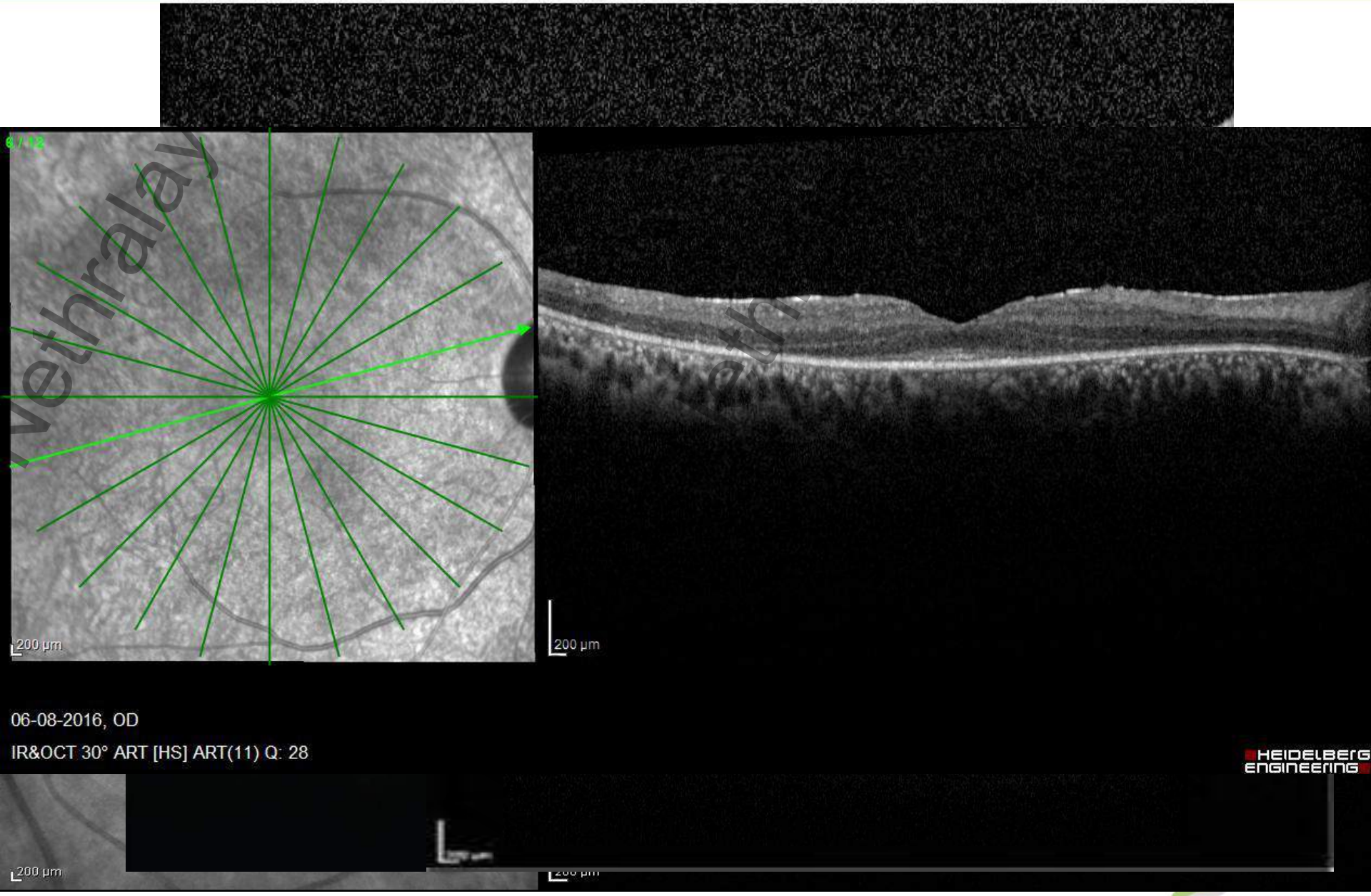
- Varying retinal injuries
  - Berlins edema, macular hole, RPE and IS/OS changes
  - Choroidal ruptures
- Progression and prognostic aid
- Decision making tool in traumatic macular holes



Retinitis Pigmentosa







THANK YOU

NARAYANA NETHRALAYA
your faith shall heal you