

**Università degli Studi di Ferrara**  
**Dipartimento di Discipline Medico-Chirurgiche**  
**della Comunicazione e del Comportamento**  
**Sezione di Clinica Oculistica**  
**Direttore: Prof. Adolfo Sebastiani**

**LA DIAGNOSI DELLE MACULOPATIE**

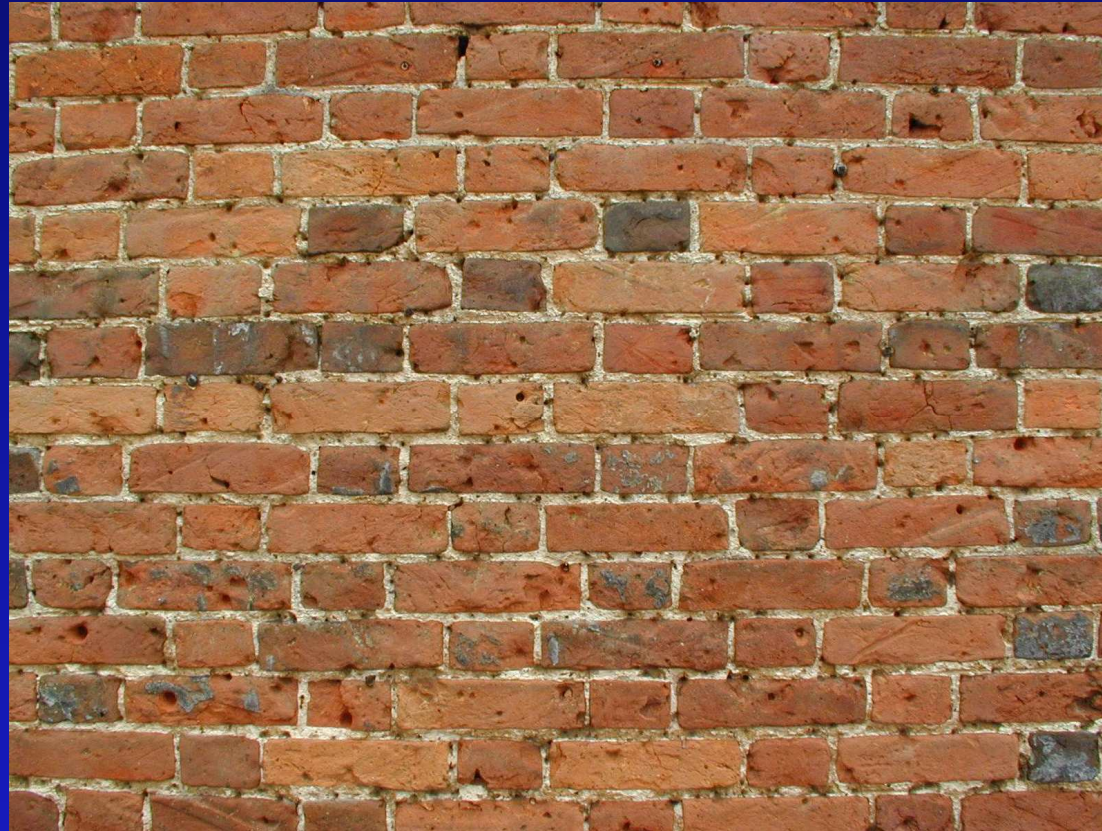
**SERGIO D'ANGELO**

Anamnesi

Esami  
funzionali

Esame del  
fundus oculi

Diagnostica  
strumentale

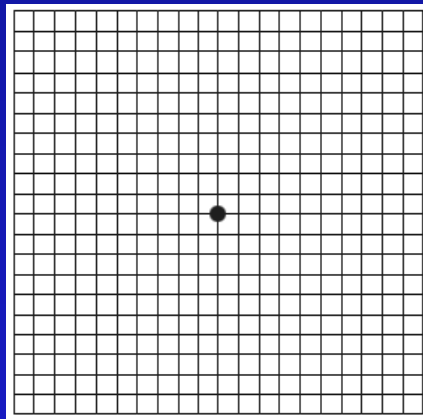


# Anamnesi

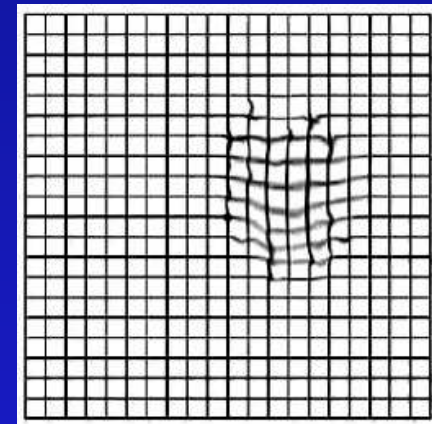
## METAMORFOPSIE



Presenza/assenza dello scotoma centrale



Test di Amsler (non sempre  
utile per la diagnosi precoce)





# Esami funzionali

## ACUITA' VISIVA

TABELLA V. — *Corrispondenza fra diverse espressioni dell'acutezza visiva e l'angolo di risoluzione.*

Frazione decimale	Frazione di Snellen		Valore decimale	Angolo di risoluzione in minuti primi
	in metri	in piedi		
10/10	6/6	20/20	1	1
9/10			0,90	1,1
8/10	6/75	20/25	0,80	1,3
7/10	6/9	20/30	0,70	1,4
6/10			0,60	1,6
5/10	6/12	20/40	0,50	2
4/10	6/15	20/50	0,40	2,5
	6/18	20/60	0,33	3
3/10	6/21	20/70	0,30	3,3
	6/24	20/80	0,25	4
2/10	6/30	20/100	0,20	5
	6/37,5	20/125	0,16	6,25
	6/45	20/150	0,12	7,5
1/10	6/60	20/200	0,10	10

# Esami funzionali

## ACUITA' VISIVA

### TAVOLE OTTOTIPICHE ETDRS

Ottotipi per lontano nei quali le dimensioni dei caratteri hanno una progressione **geometrica** con elevato contrasto. La variazione percentuale della dimensione del carattere tra lettere adiacenti è la stessa per tutti i livelli di acuità visiva



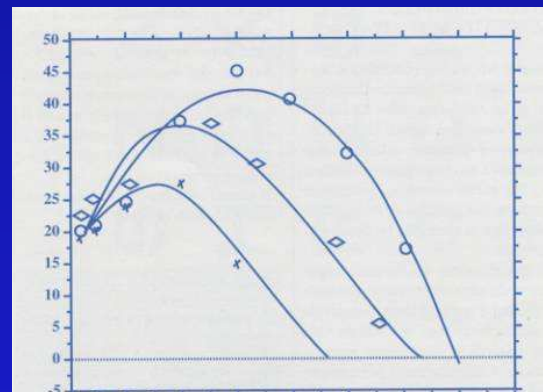
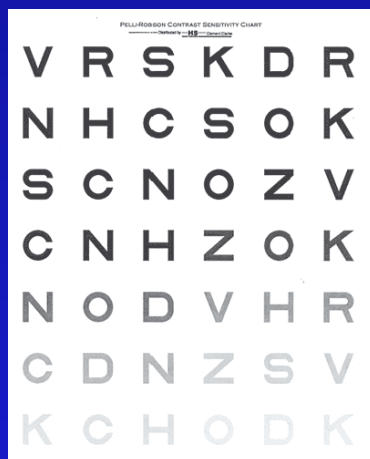
ETDRS "Chart 1" acuity chart

# Esami funzionali

## SENSIBILITA' AL CONTRASTO

### TAVOLE DI PELLI ROBSON

Ottotipo per la misurazione della sensibilità al contrasto. Presentando lettere della stessa dimensione in cui il contrasto, legato alla diversa luminanza del carattere rispetto allo sfondo, diminuisce progressivamente. Si esegue monocularmente alla distanza di 2 m, con illuminazione ambientale ed eventuali lenti correttive adeguate. Si misura la sensibilità al contrasto come % o in unità logaritmiche

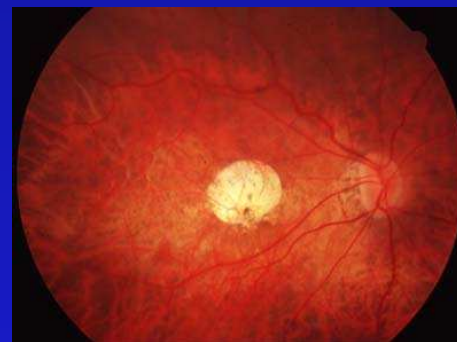
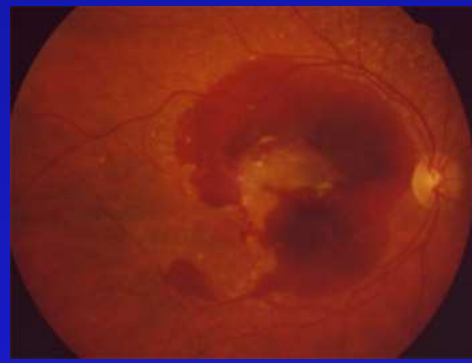
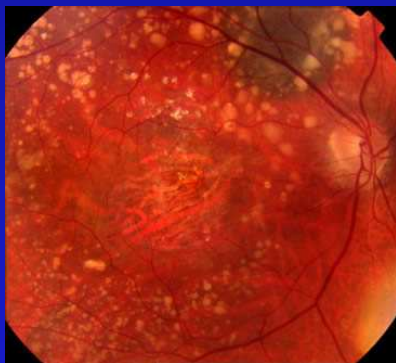


# FUNDUS OCULI

IMPRESCINDIBILE

BIOLAMPADA + LENTI OFTALMOSCOPIA INDIRECTA

- LOCALIZZAZIONE
- TIPOLOGIA
- GRADO DI ATTIVITA'
- SEGNI INDIRECTI DI CNV OCCULTA



# Diagnostica strumentale



# Diagnostica strumentale

Angiografia retino-coroideale

FAG = fluorangiografia

ICG-A = angiografia con verde indocianina

OCT (OPTICAL COHERENT TOMOGRAPHY)

Tomografia Ottica a Radiazione Coerente

# ANGIOGRAFIA RETINO COROIDEALE

L'ANGIOGRAFIA RETINO-COROIDEALE SI BASA SU UN'APPLICAZIONE DEL FENOMENO FISICO DELLA FLUORESCENZA: EMISSIONE LUMINESCENTE CHE CESSA IMMEDIATAMENTE AL CESSARE DELLA CAUSA DI ECCITAZIONE.

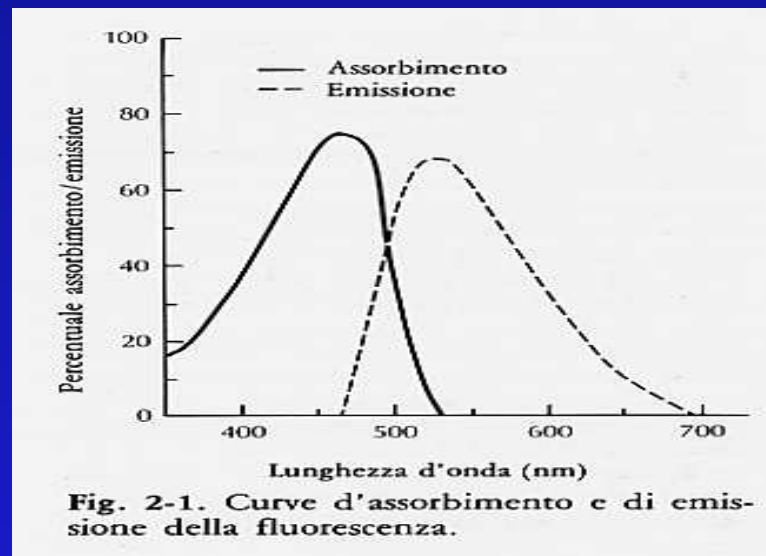


# ANGIOGRAFIA RETINO COROIDEALE

LE SOSTANZE UTILIZZATE NELL'ANGIOGRAFIA RETINO-COROIDEALE SONO FLUORESCENTI:

=> FLUORESCEINATO DI SODIO  
=> VERDE D'INDOCIANINA

IL TERMINE "MEZZO DI CONTRASTO" E' IMPROPRIO IN QUANTO ESSE NON SONO RADIOPACHE. VENGONO QUINDI DEFINITE TRACCIANTI



# ANGIOGRAFIA RETINO COROIDEALE

## Principles of fluorescein angiography.

There are two barriers between the blood and retina. One in the retinal circulation at the endothelial cell lining with its tight junctions in the retinal capillaries, and the second involving the choroidal circulation at the zonula occludens between adjacent retinal pigment epithelial cells. Damage to either of these barriers results in a leakage of fluid into or beneath the sensory retina. Serous detachment of the retinal pigment epithelium is a special situation in which both barriers remain intact but fluid accumulates in the space between the detached pigment epithelial cells and Bruch's membrane.

It is convenient to analyze the fluorescein angiographic findings in relation to these two barriers, as a large number of retinal disorders affect either the retinal vascular system or the choriocapillaris-Bruch's membrane-pigment epithelium layers.

Int Ophthalmol Clin. 1977 Summer;17(2):1-19.

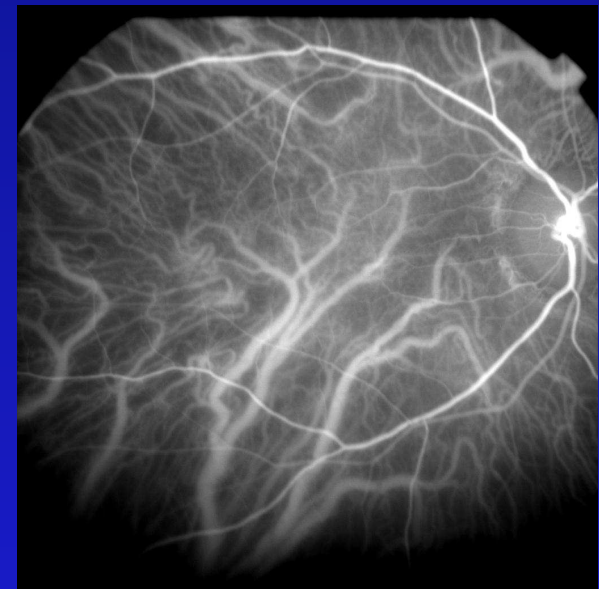
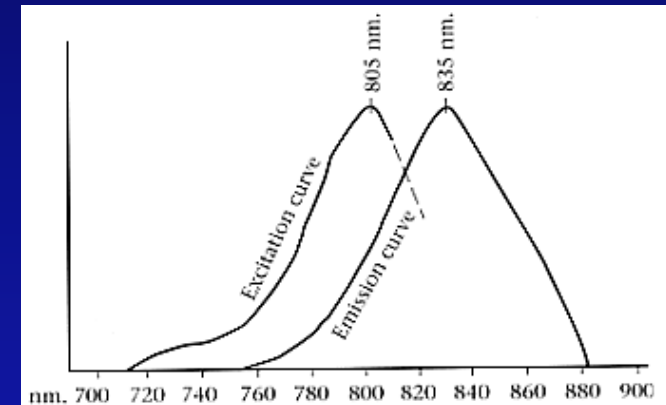
# ANGIOGRAFIA AL VERDE INDOCIANINA

L'epitelio pigmentato retinico e la coroide assorbono tra il 50 e il 75% della radiazione nello spettro blu-verde (circa 500 nm) e solo il 21-38% nello spettro dell'infrarosso (circa 800 nm).

Legame con le proteine plasmatiche = 98%

Trascurabile diffusione attraverso l'endotelio fenestrato della coriocapillare.

Migliore definizione dei vasi coroideali rispetto alla fluorangiografia

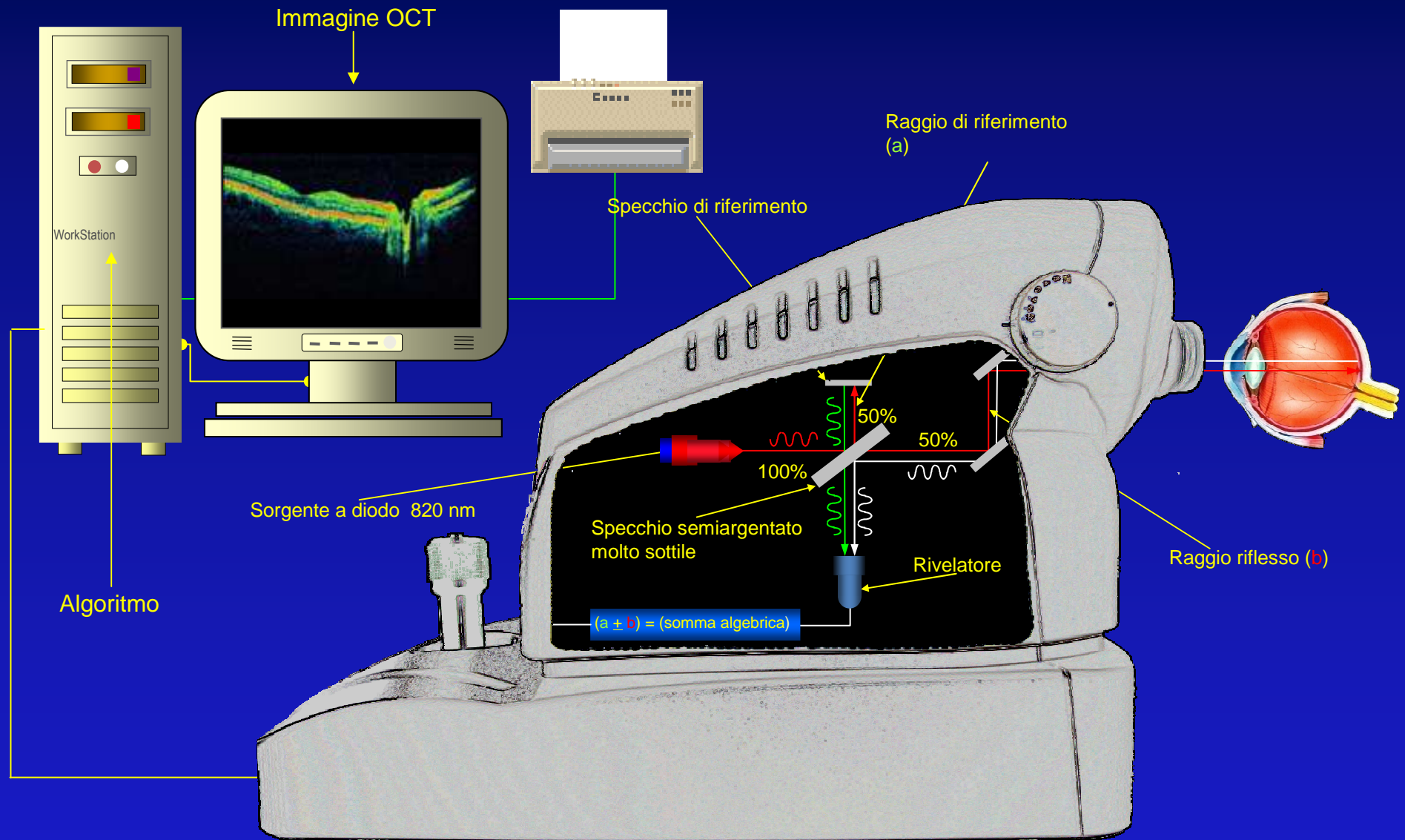


# ANGIOGRAFIA RETINO COROIDEALE

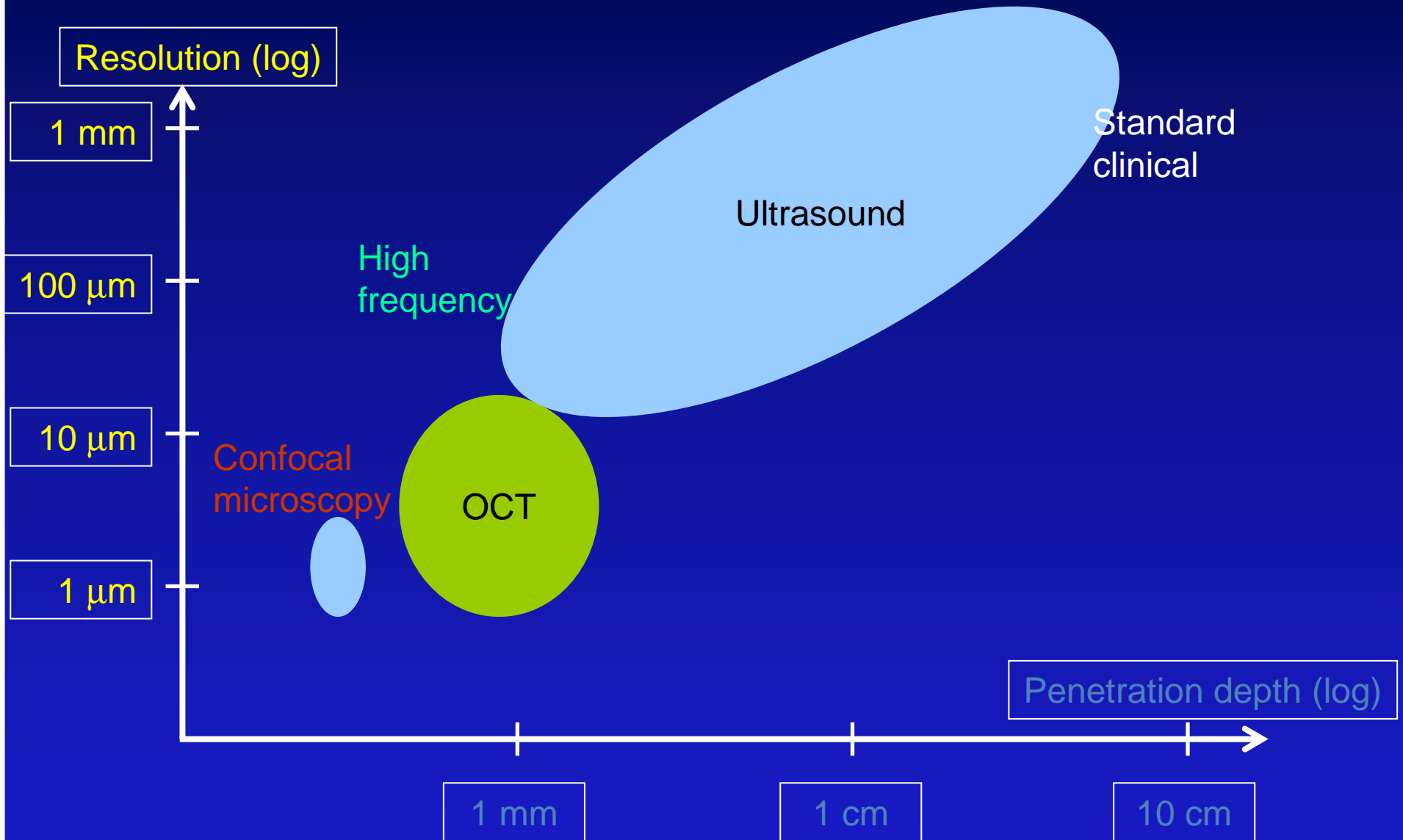
## COMPLICANZE

- NAUSEA, VOMITO
- FUORIUSCITA DEL COLORANTE DALLA VENA
  - Ematomi
  - Flebiti
  - Neuriti
- INIEZIONE ACCIDENTALE IN ARTERIA
- REAZIONI ALLERGICHE
  - Rush cutaneo
  - Broncospasmo
  - Edema della glottide
  - Shock

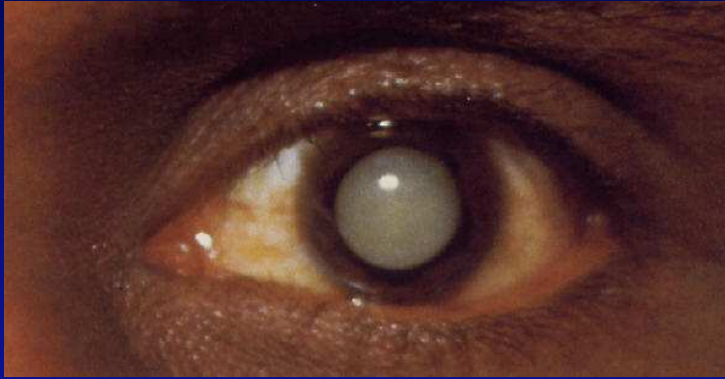
# OCT (Optical Coherence Tomography)



**OCT imaging is analogous to ultrasound B-mode imaging, except that it uses light instead of sound**



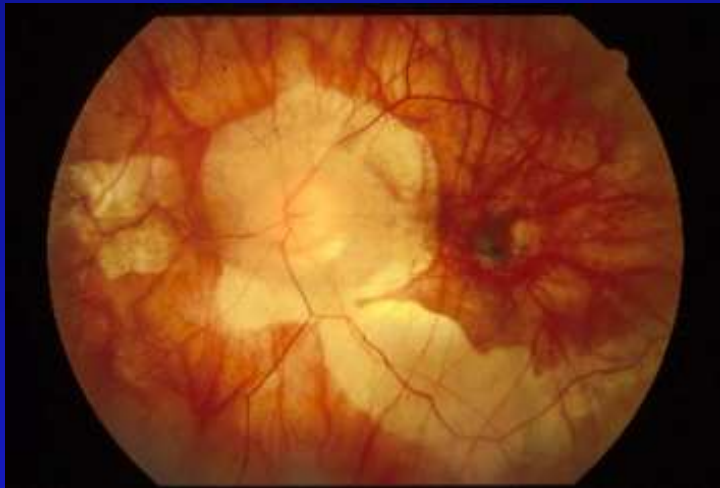
# LIMITI:



CATARATTA



LESIONI PAPILLARI,  
PERIPAPILLARE ED  
IUXTAPAPILLARI

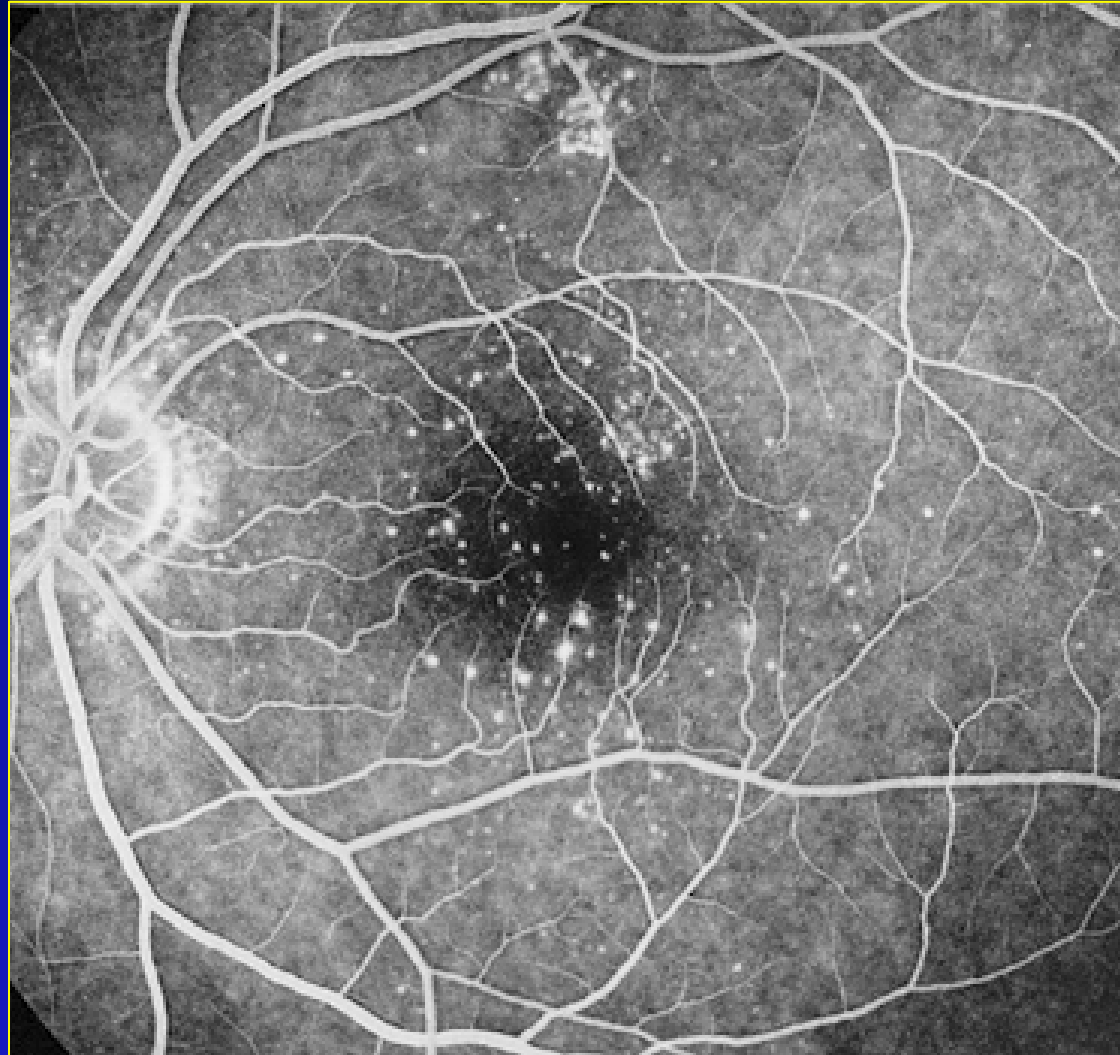


CRESCENTE MIOPICO



MANCANZA DI FISSAZIONE

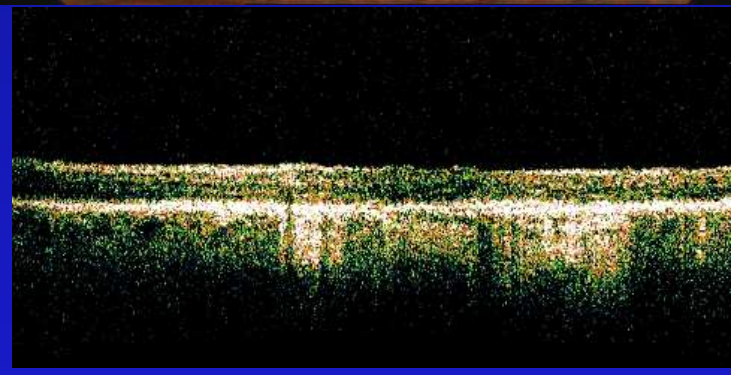
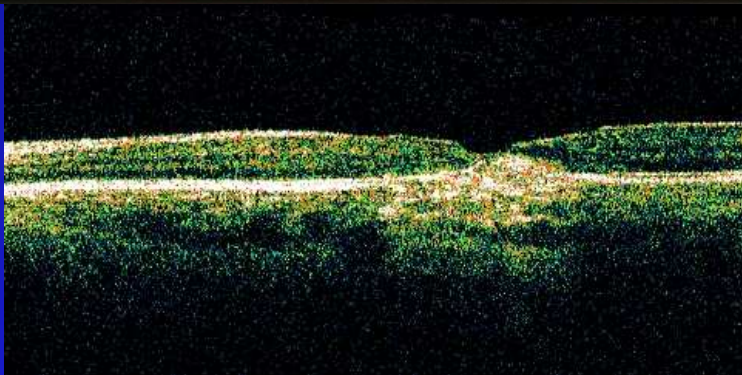
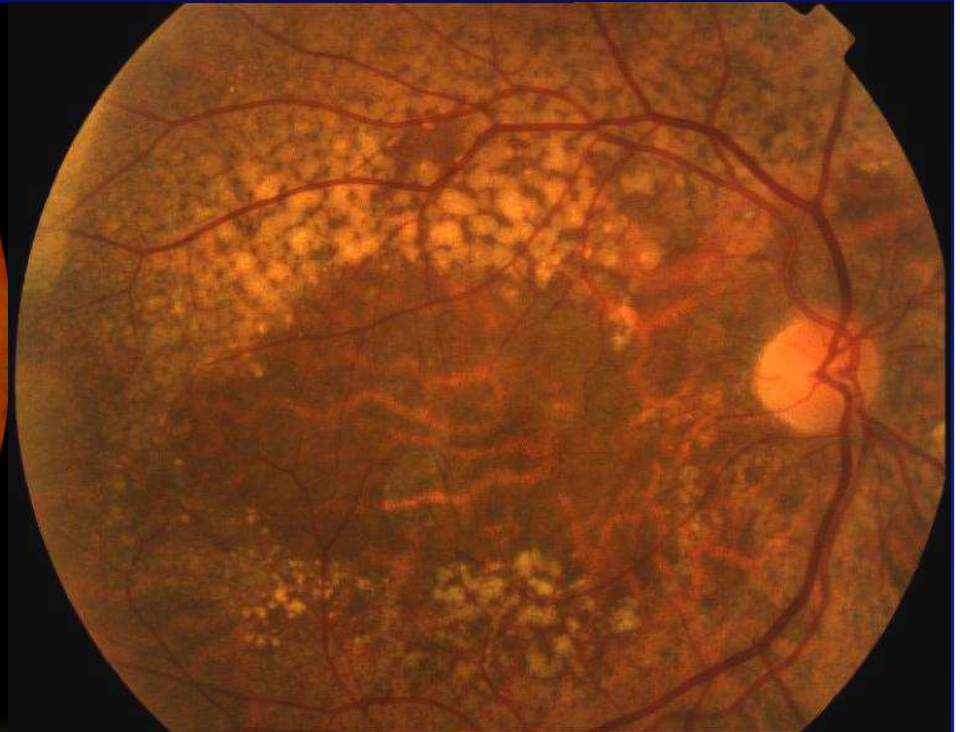
# Quando e cosa chiedere?



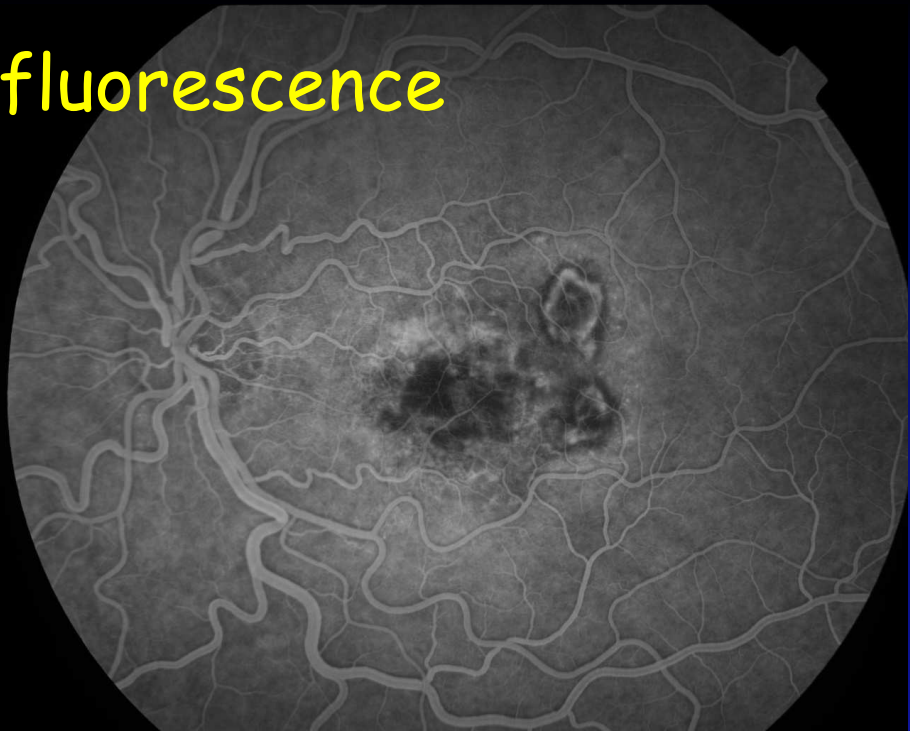
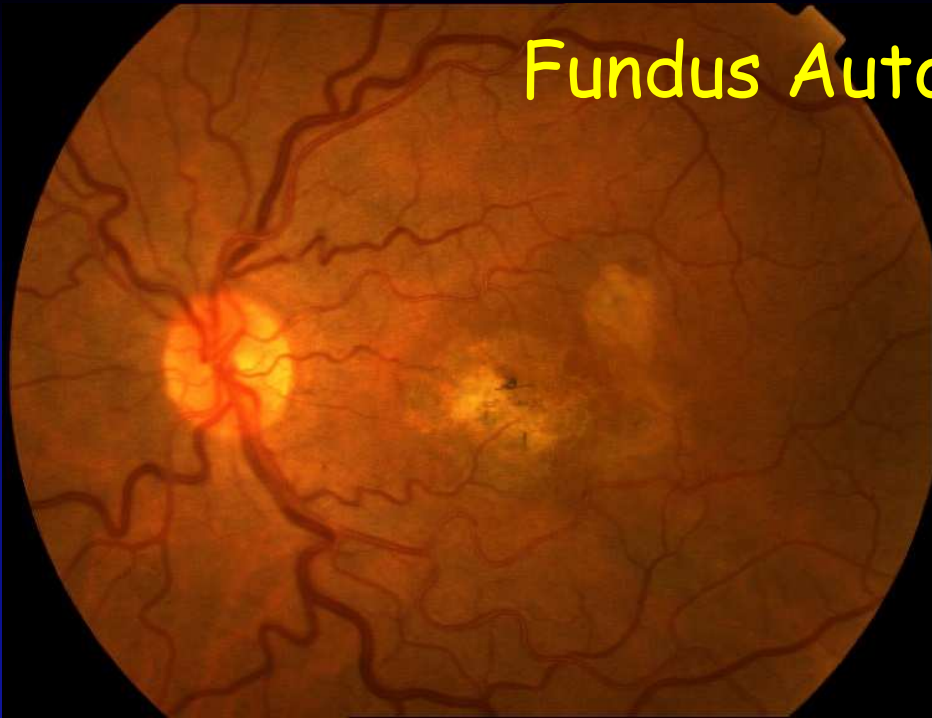
# Quando e cosa chiedere?

2009

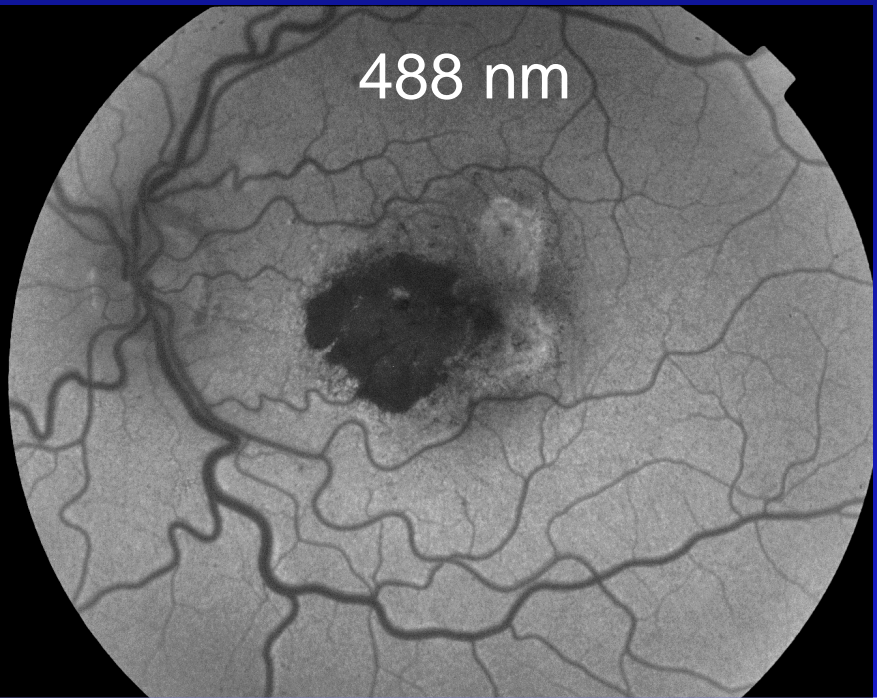
2012



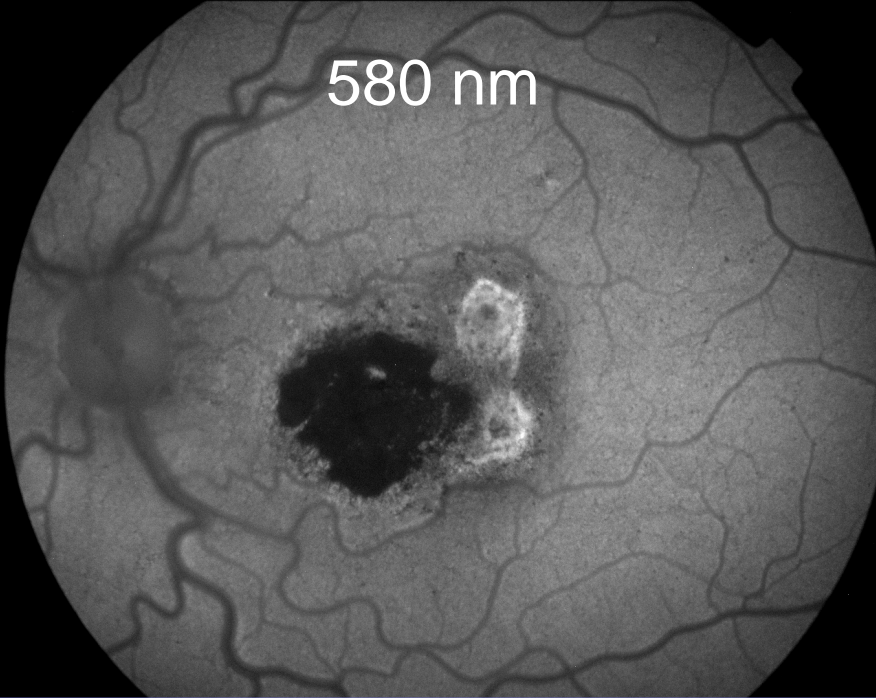
# Fundus Autofluorescence



488 nm



580 nm



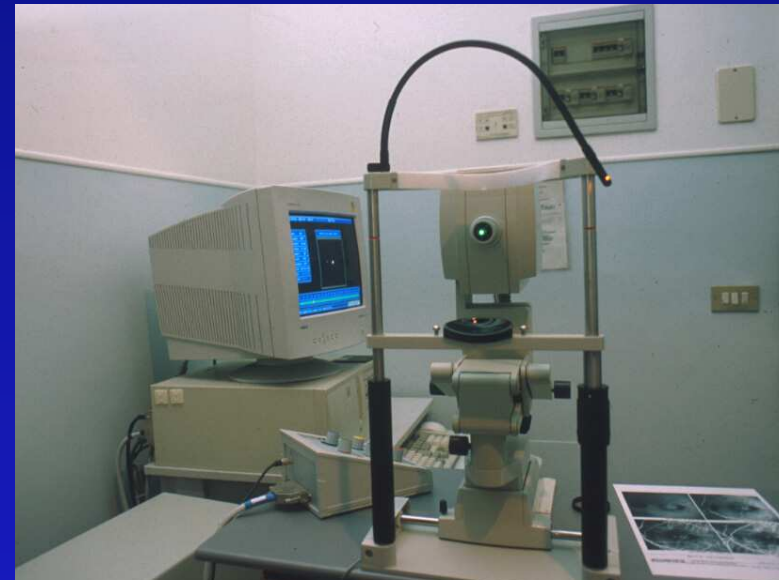
# L'evoluzione della specie

## *Angiografia Digitale*

- 2 sistemi base: DFC & SLO



Digital Fundus Camera

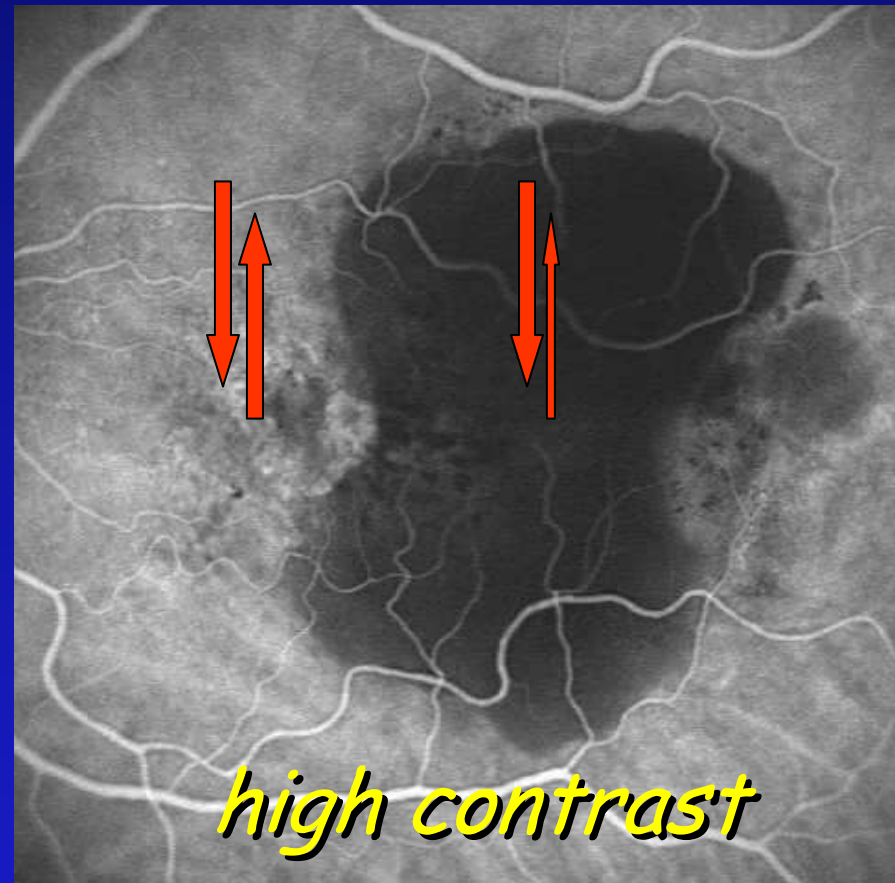
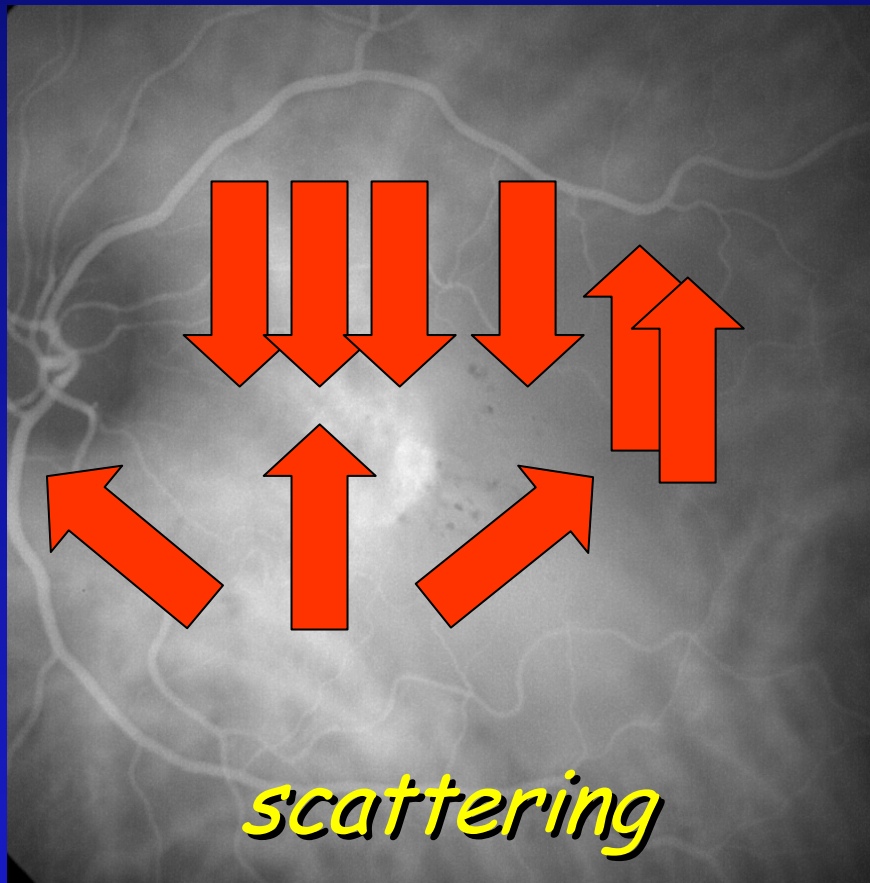


Scanning Laser Ophthalmoscope

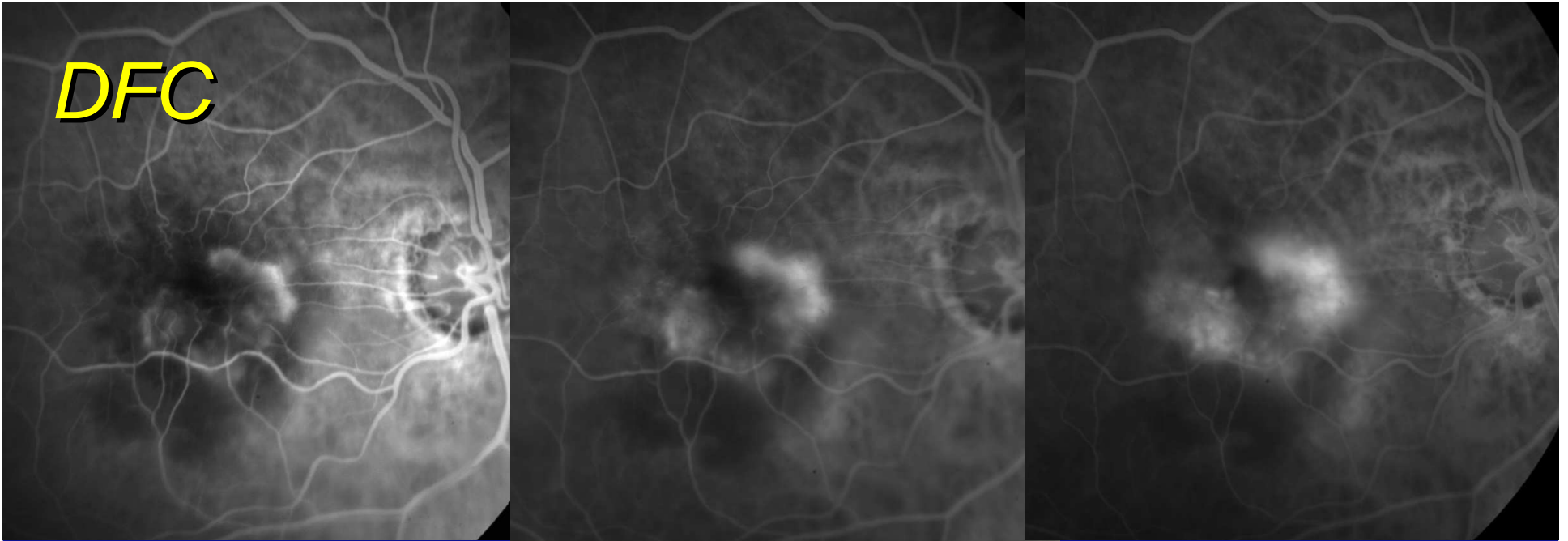
# Differences in DFC and SLO imaging

- DFC: illuminate the entire fundus area at once
- SLO: scan the area with a small spot
- DFC: emitted and scattered light: same route
- SLO: transmit only coaxial light
- DFC: great depth of field
- SLO: small depth of field

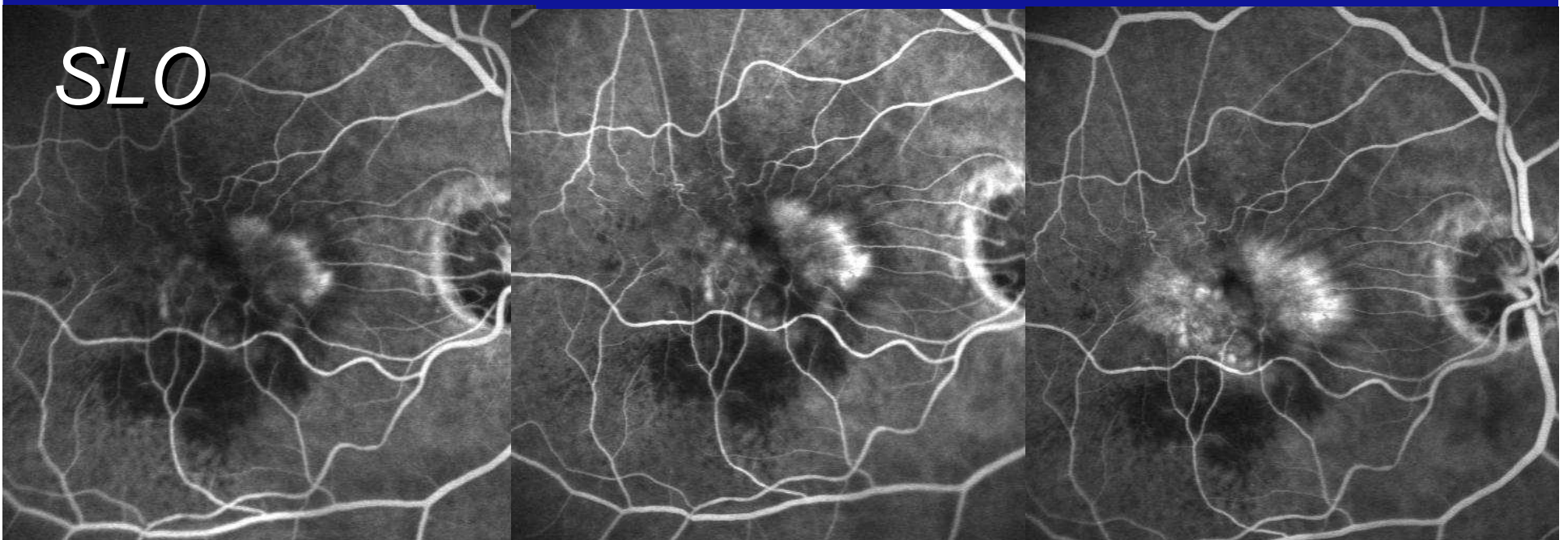
- DFC: illuminate the entire fundus area at once
- HRA: scan the area with a small spot



**DFC**



**SLO**



# DOMINIO DEL TEMPO

## VS

# DOMINIO DELLO SPETTRO

Crono



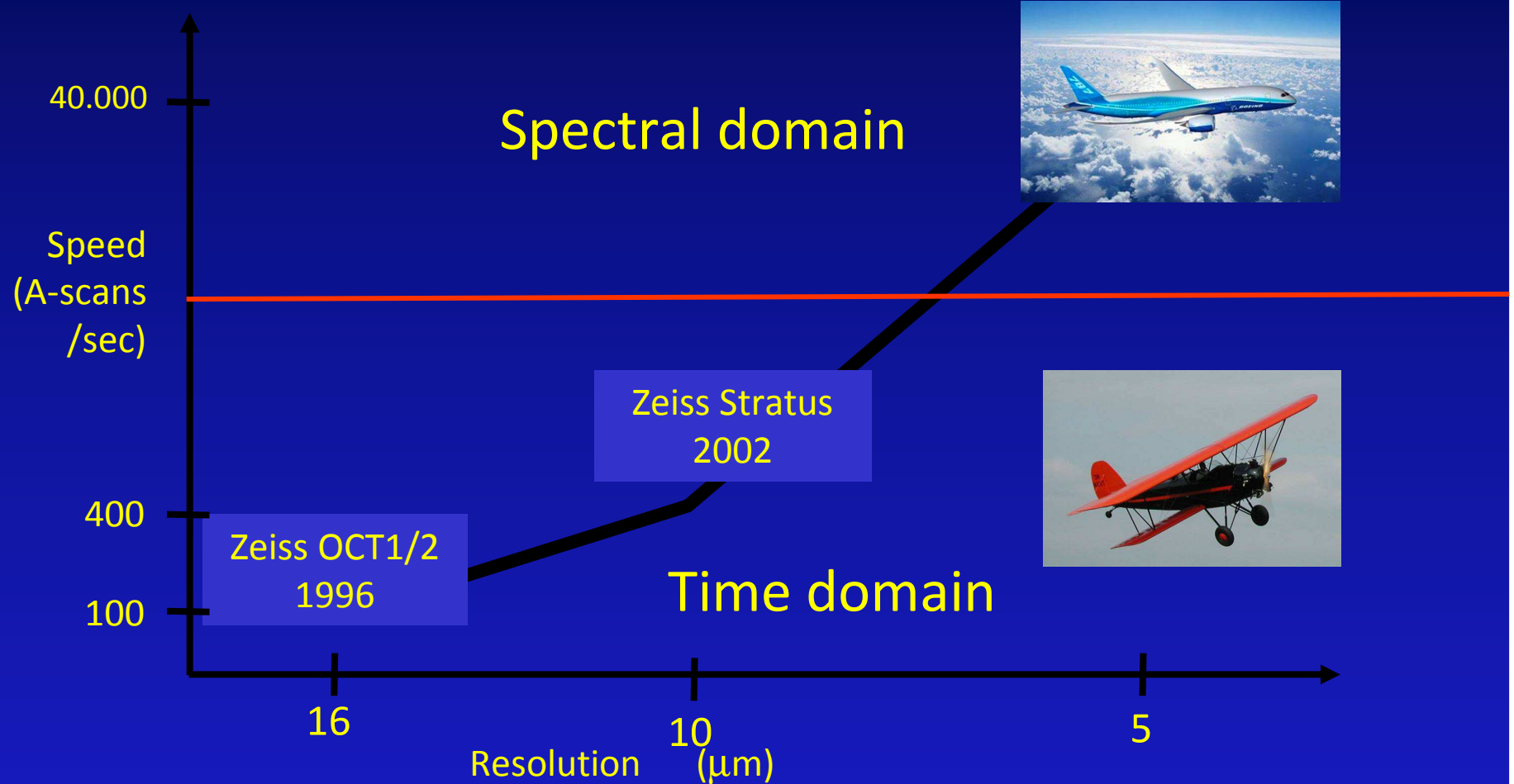
# TIME DOMAIN

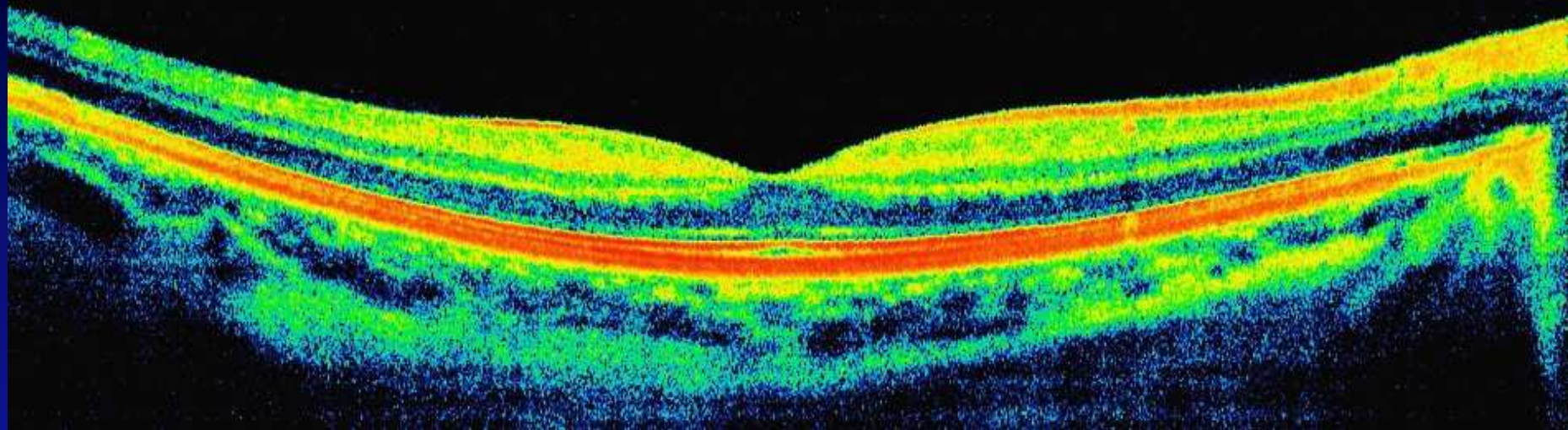
- Sul braccio dell'interferometro è montato uno specchio
- Lo specchio si muove fino ad individuare il ritardo di tempo nella riflessione del segnale luminoso da parte degli strati retinici
- I dati acquisiti vengono elaborati dal computer ed espressi come segnale A-Scan
- Lo specchio deve compiere un ciclo di movimento per ogni segnale A-scan
- La necessità di dover muovere meccanicamente lo specchio limita la velocità di acquisizione

## "Fourier (Spectral) Domain"

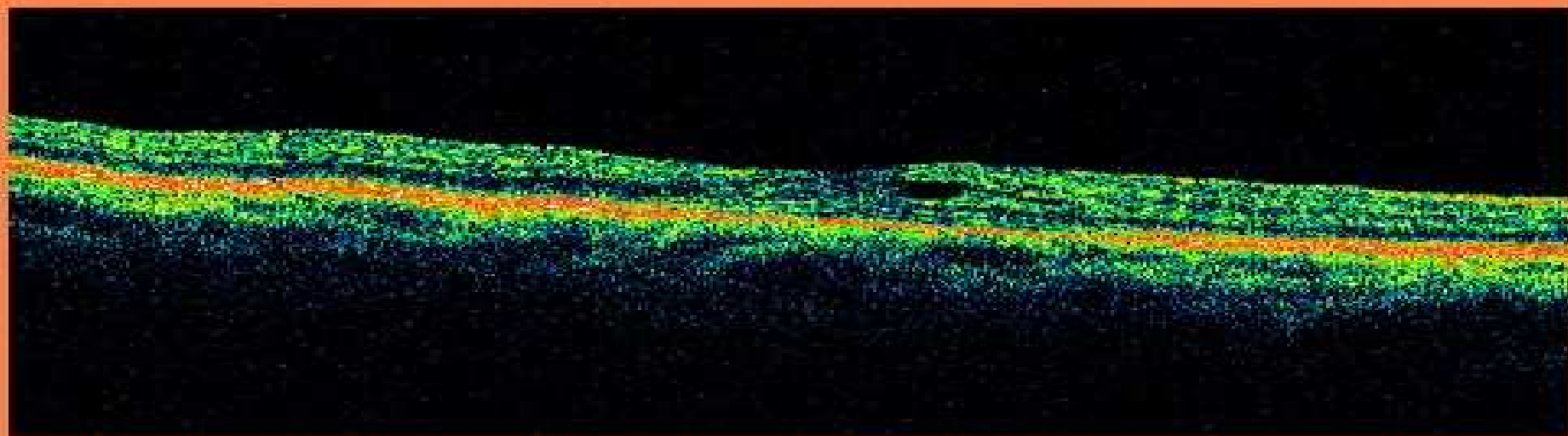
- Sul "reference arm" è montato uno spettrometro *CHE È FERMO*
- La differente riflettività tra il tessuto in esame e il riferimento viene scomposta in uno spettro
- Lo spettro viene catturato da una telecamera e convertito mediante analisi di Fourier in un segnale A-scan
- L'assenza di parti in movimento rende l'acquisizione particolarmente rapida
- L'immagine si forma tutta nello stesso momento

# L'evoluzione della specie

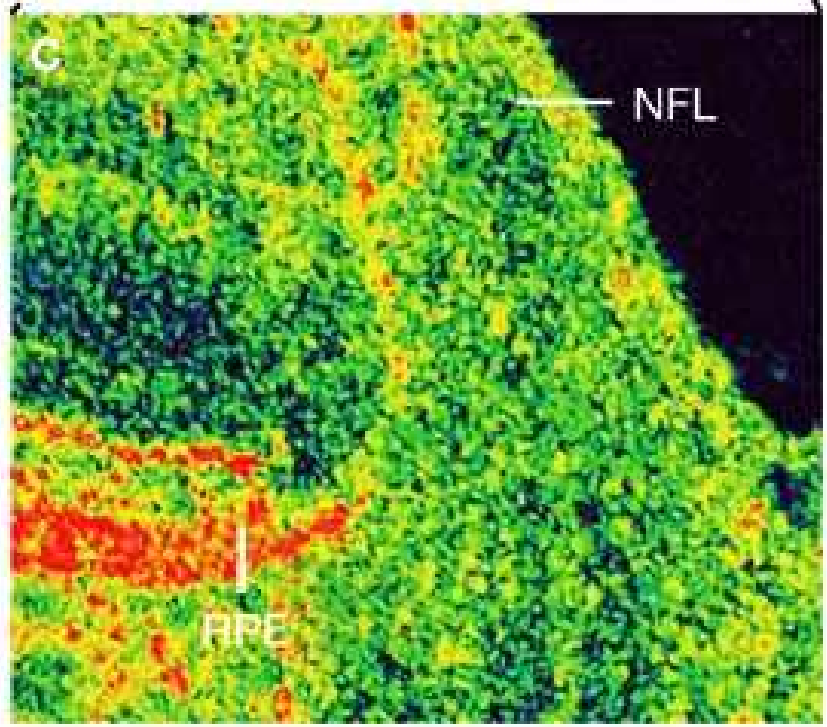
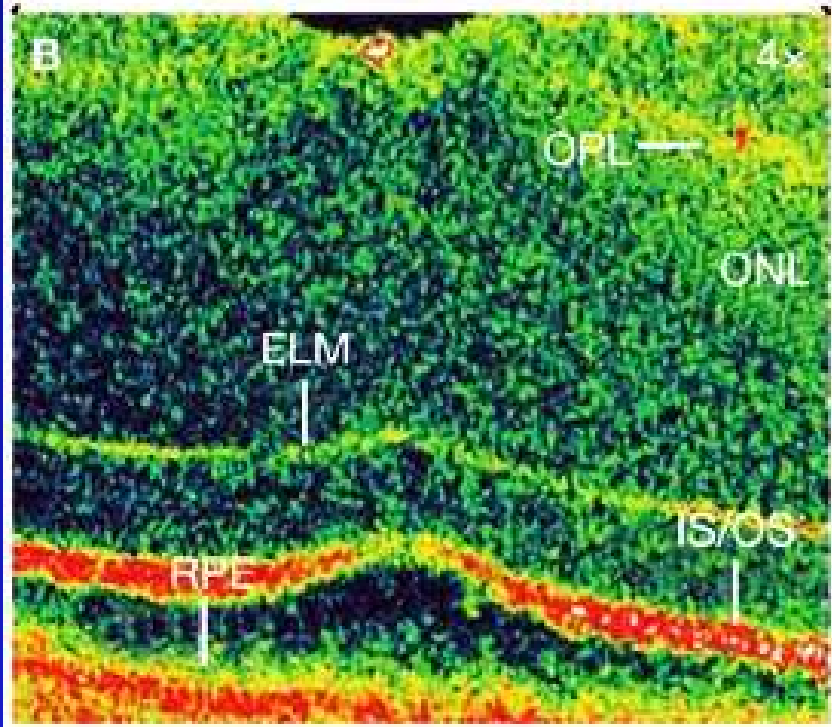
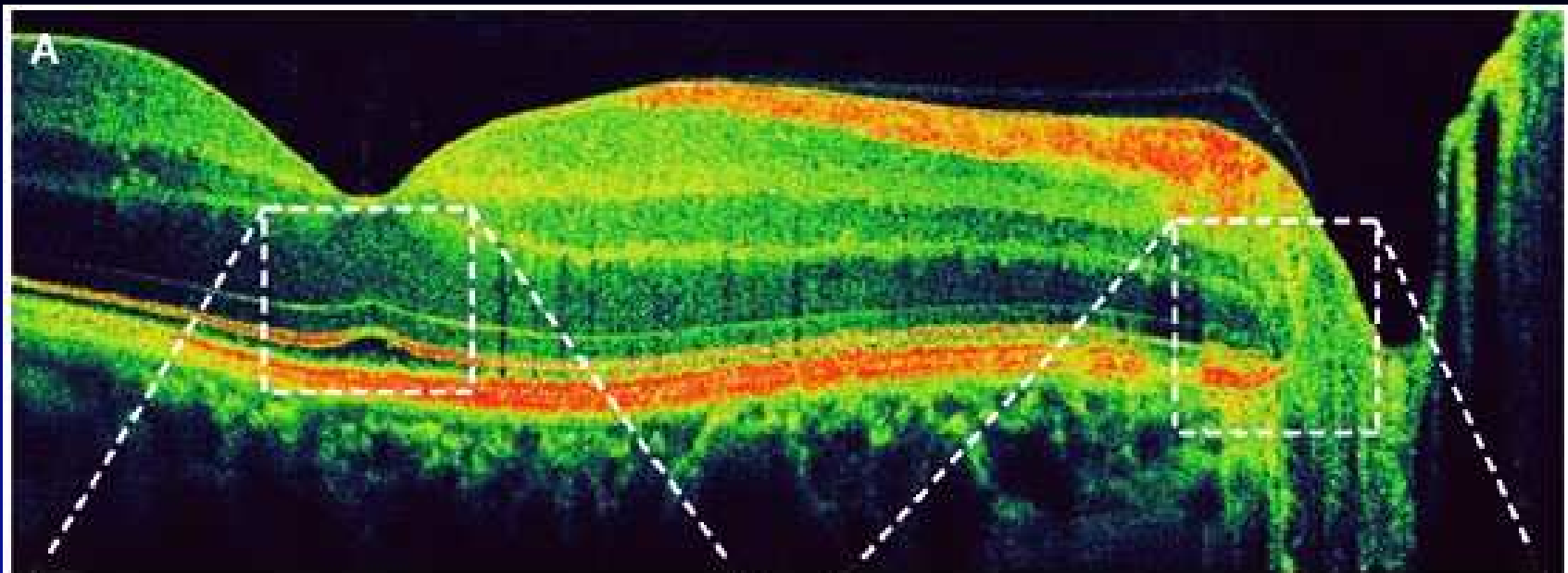




FOURIER DOMAIN OCT: RISOLUZIONE 3-5  $\mu\text{m}$  1024 A-scans in 0.04 sec

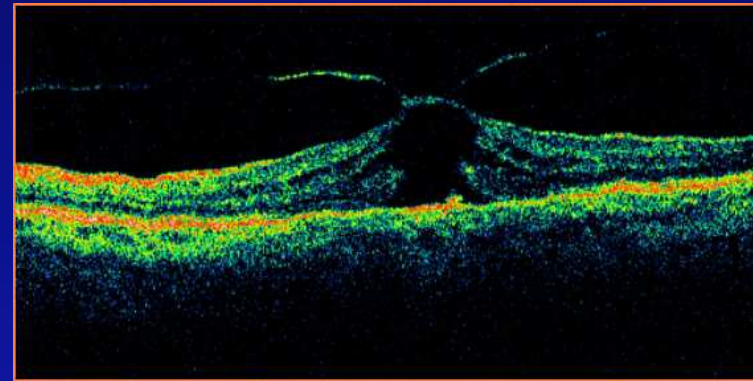
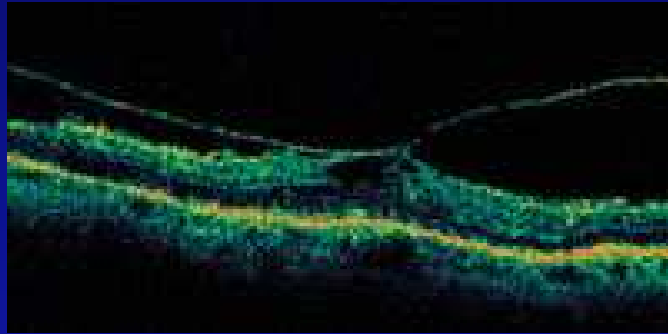


STRATUS (TIME-DOMAIN) OCT: RISOLUZIONE 10  $\mu\text{m}$  512 A-scans in 1.28''

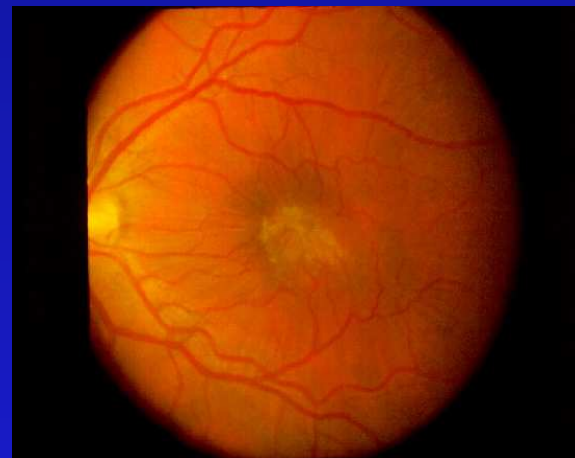
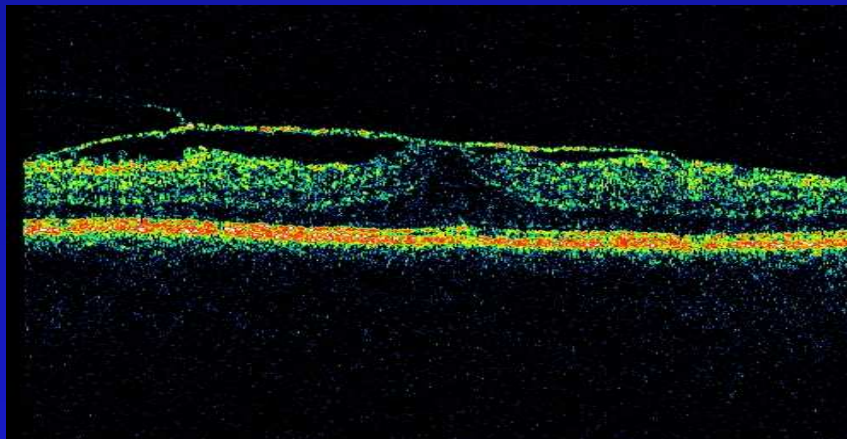


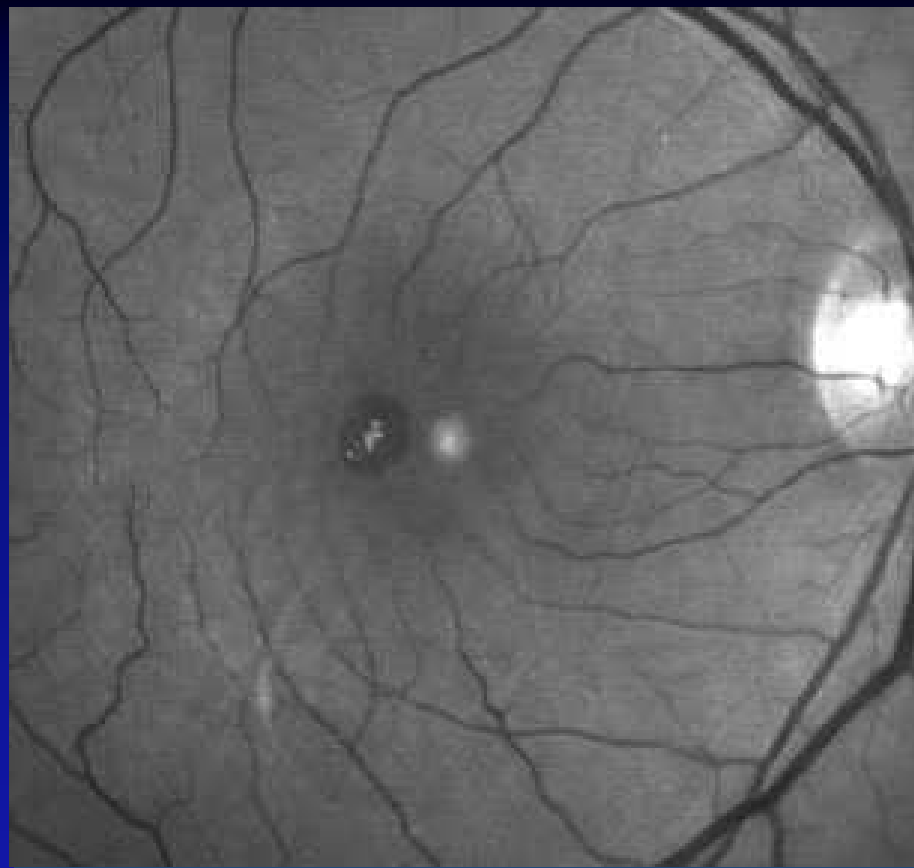
# PATOLOGIE DELL'INTERFACCIA VITREORETINICA

## 1) SINDROME DA TRAZIONE VITREOMACULARE (STVM)



## 2) PUCKER MACULARE

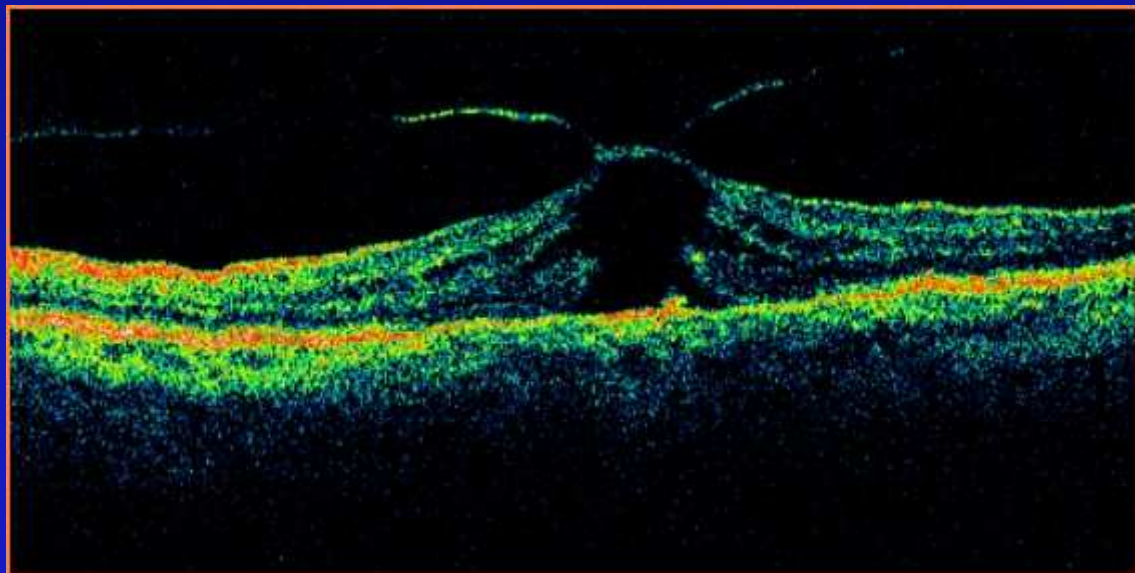
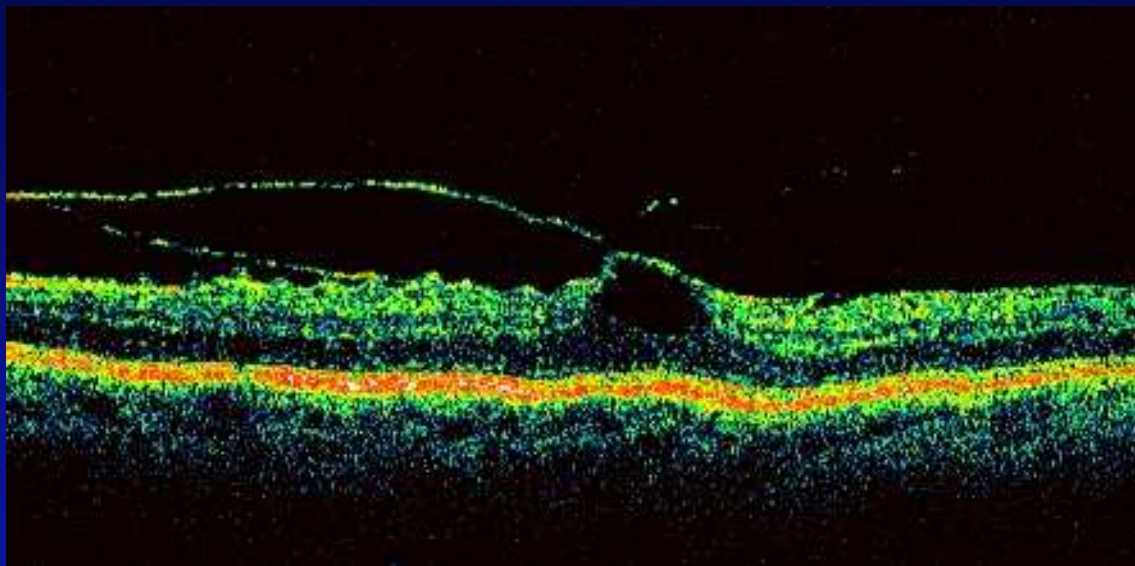




## Trazione tangenziale al neuroepitelio

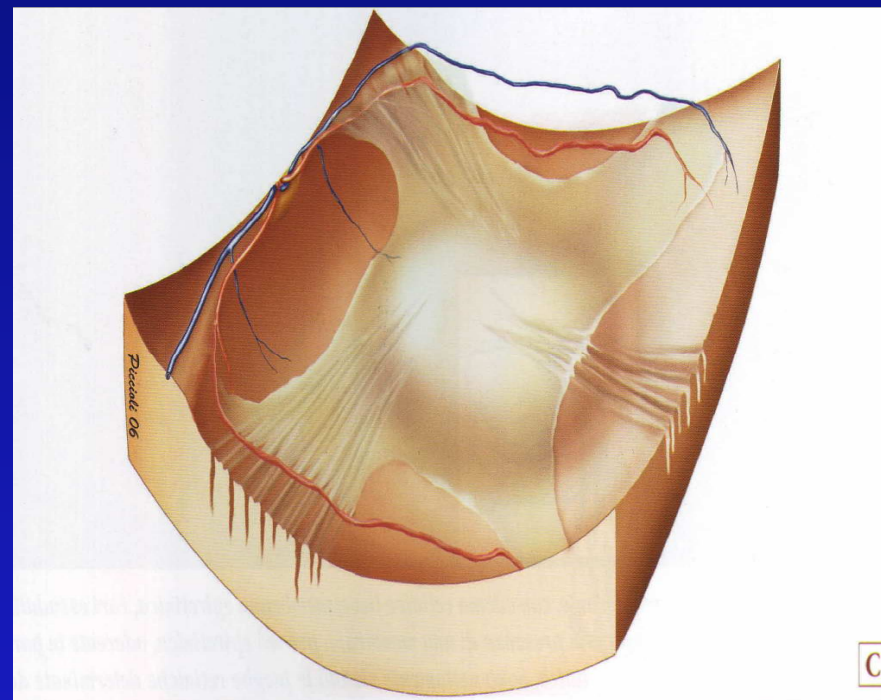
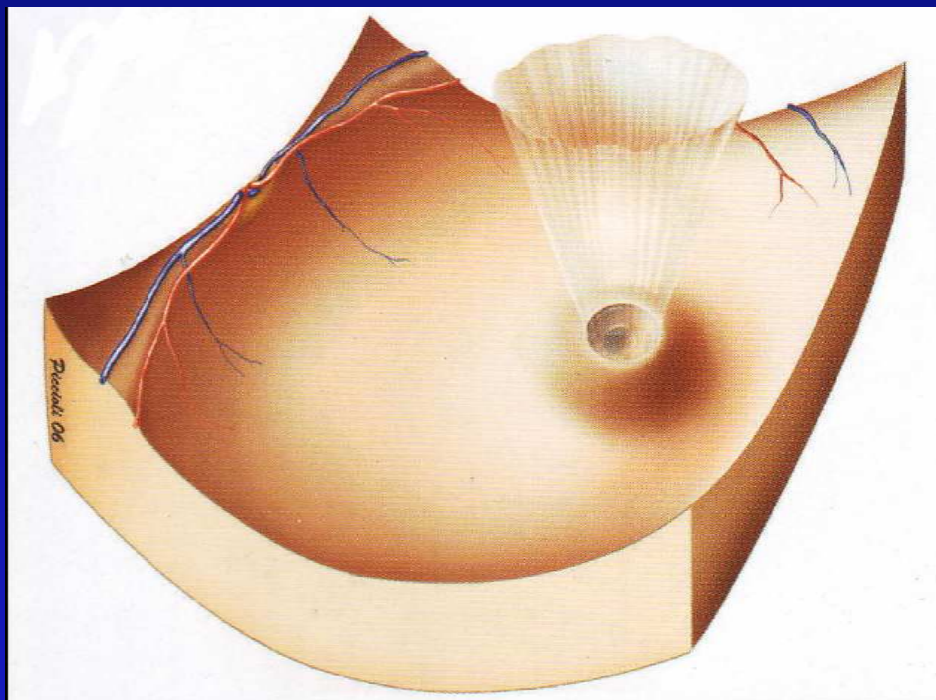


## Sindrome da Trazione Vitreo Maculare



# Considerare i vettori trazionali

- Antero-posteriori >>> SINDROME DA TRAZIONE VITREOMACULARE
- Tangenziali >>> CELLOPHANE, PUCKER

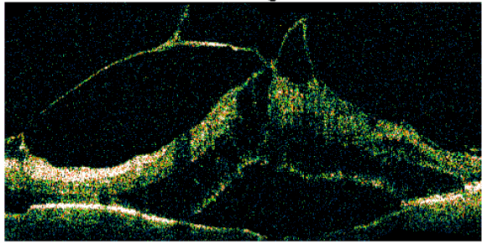


# LA CHIRURGIA

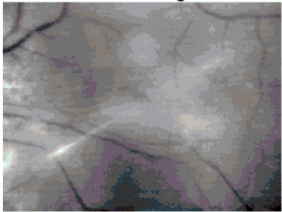
PRIMA

**NORMALIZE + ALIGN PROCESS**

OCT Image



Fundus Image



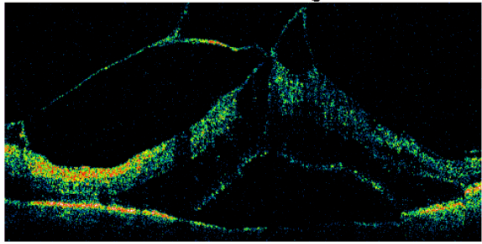
Gray

Brightness Contrast Zoom

Signal Strength (Max: 10) 3

Mirror Image

Scanned Image



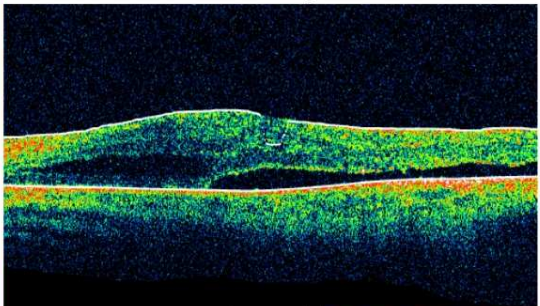
Patient/Scan Information

DOB:	1/23/1931, ID: NA, Male
Scan Type	Macular Thickness Map OS
Scan Date	1/12/2006
Scan Length	6.0 mm


DOPO

**RETINAL MAP ANALYSIS**

OCT Image



Fundus Image



Signal Strength (Max: 10) 8

Analysis Confidence Low

Log Reflection

Patient/Scan Information

DOB:	1/23/1931, ID: NA, Male
Scan Type	Macular Thickness Map OS
Scan Date	4/4/2006
Scan Length	6.0 mm

Center 462 +/- 72 microns

Total Volume 10.96 mm<sup>3</sup>

Microns

338	400
389	511
483	336
456	290
470	

Map Diameters

1.0 mm

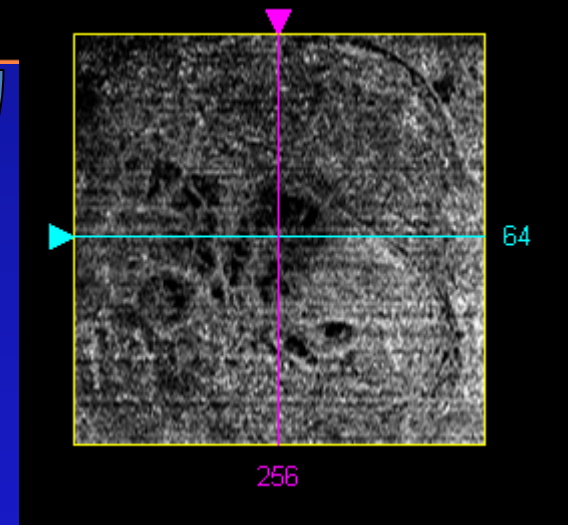
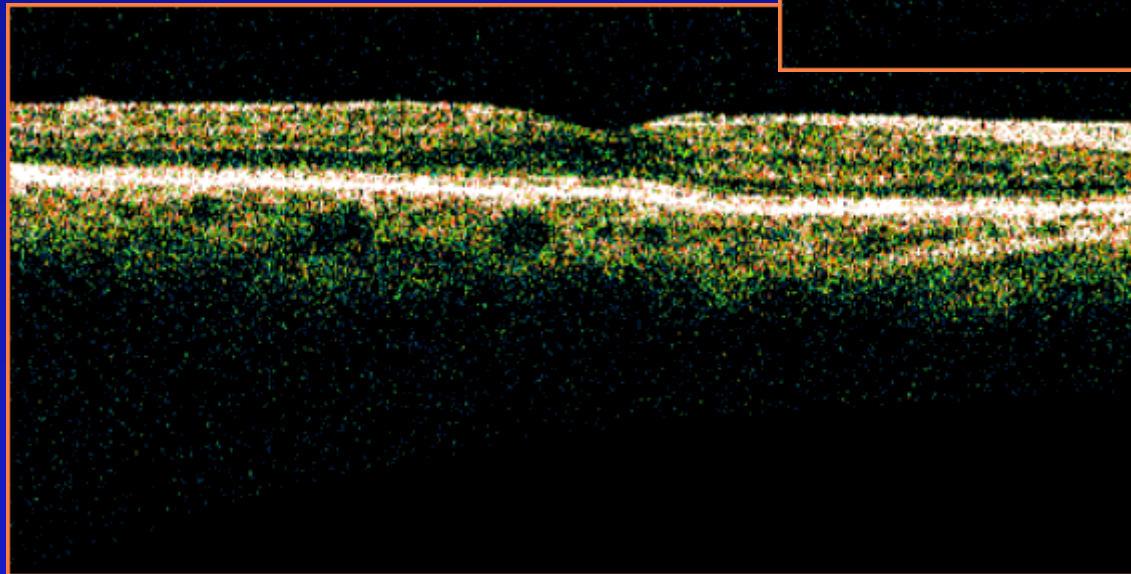
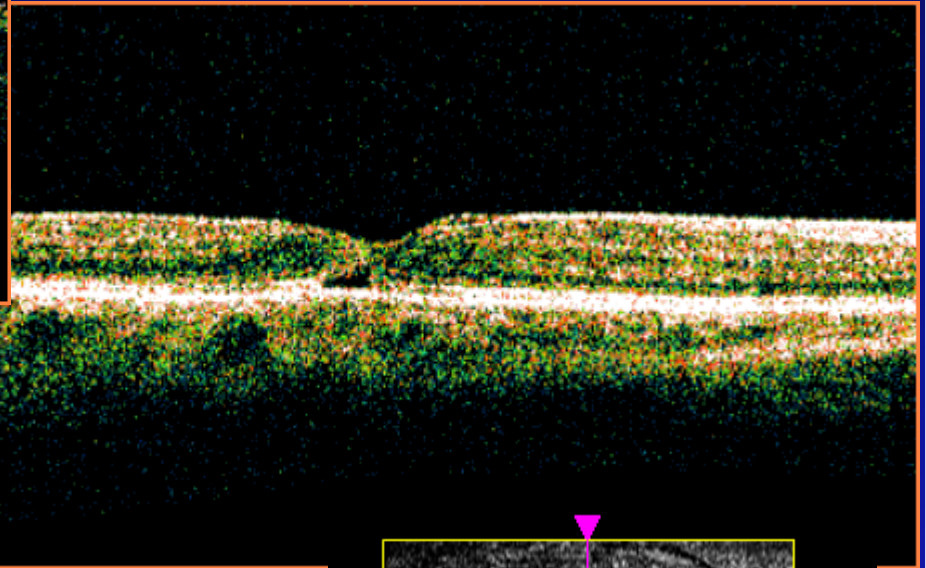
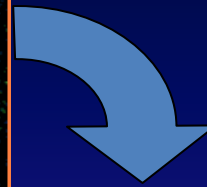
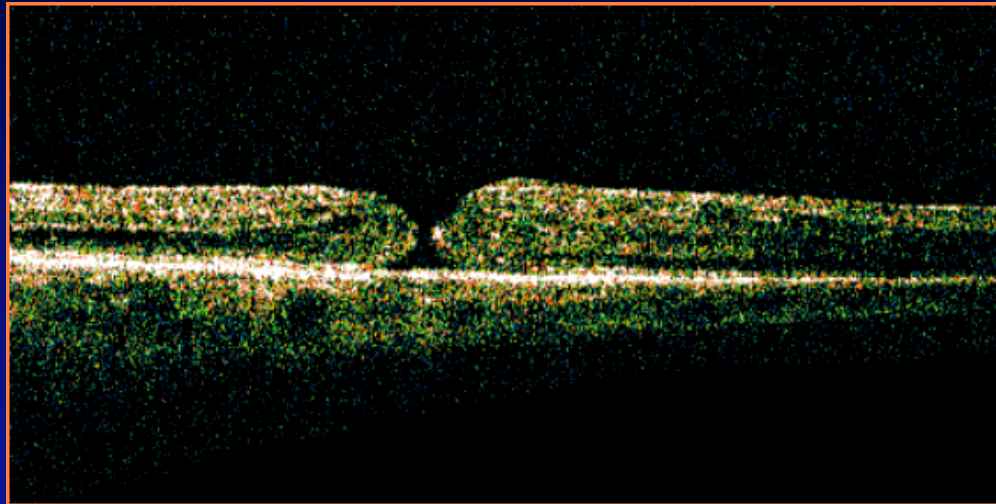
3.00 mm

6.00 mm

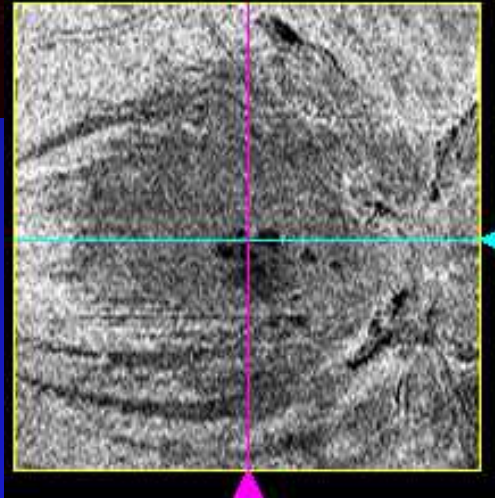
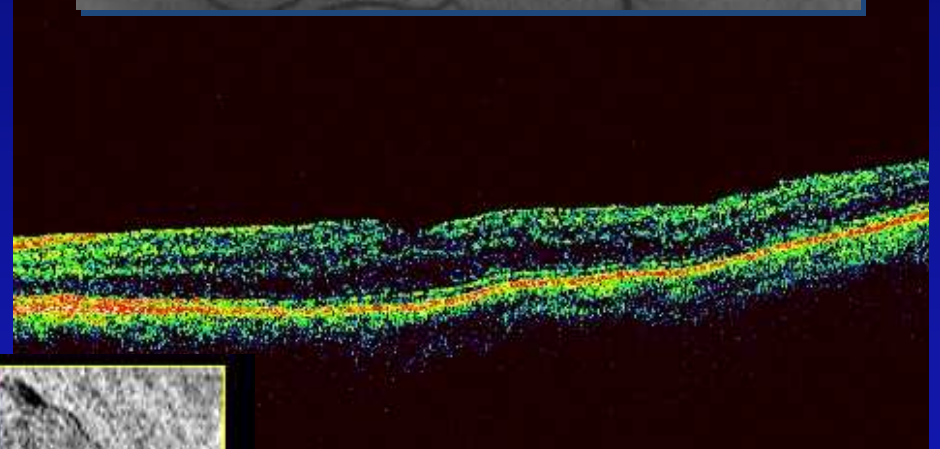
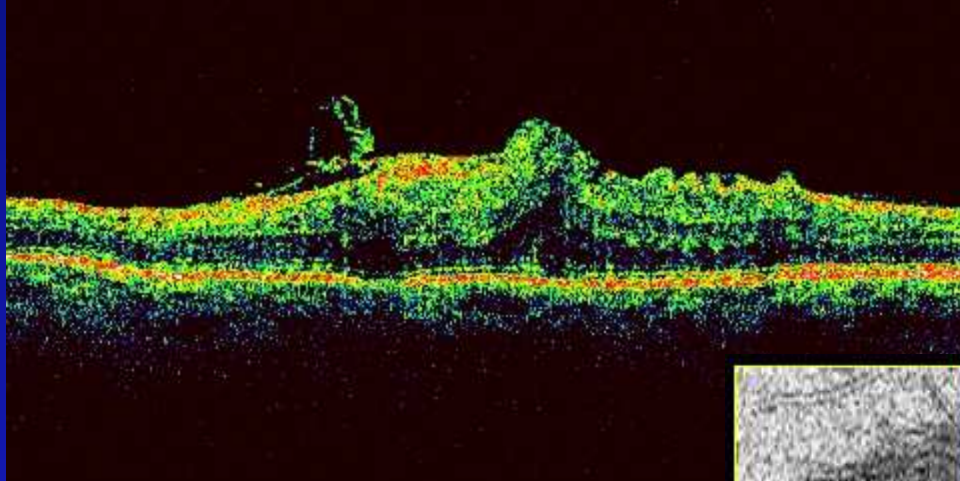
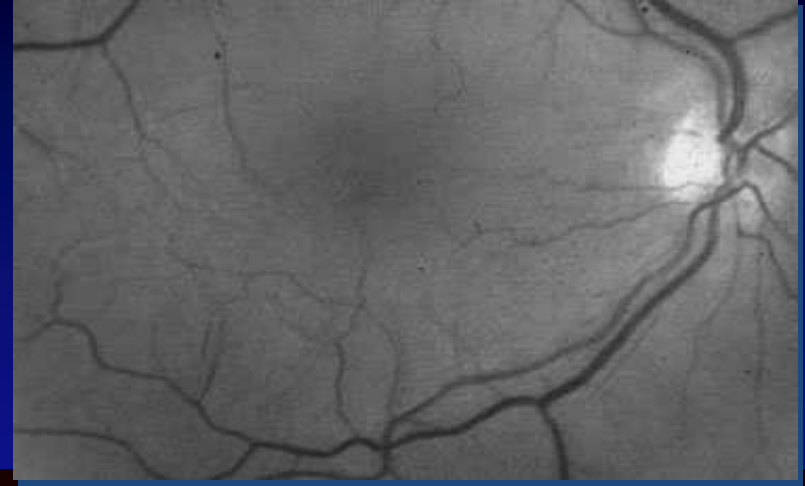
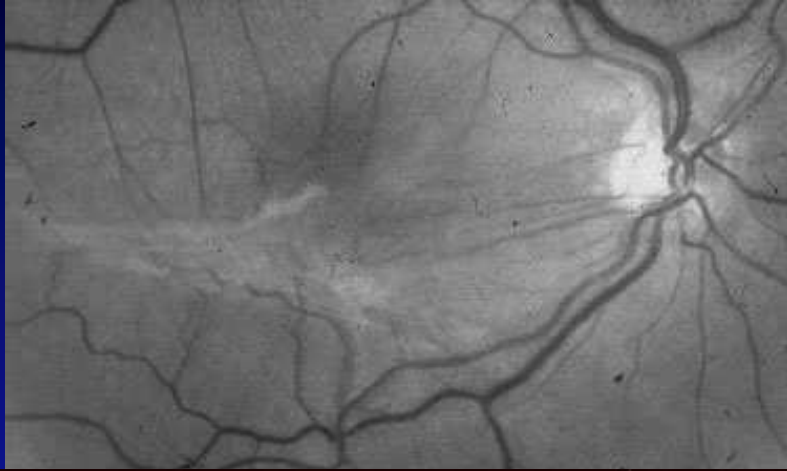
3.45 mm

6 mm

# LA CHIRURGIA

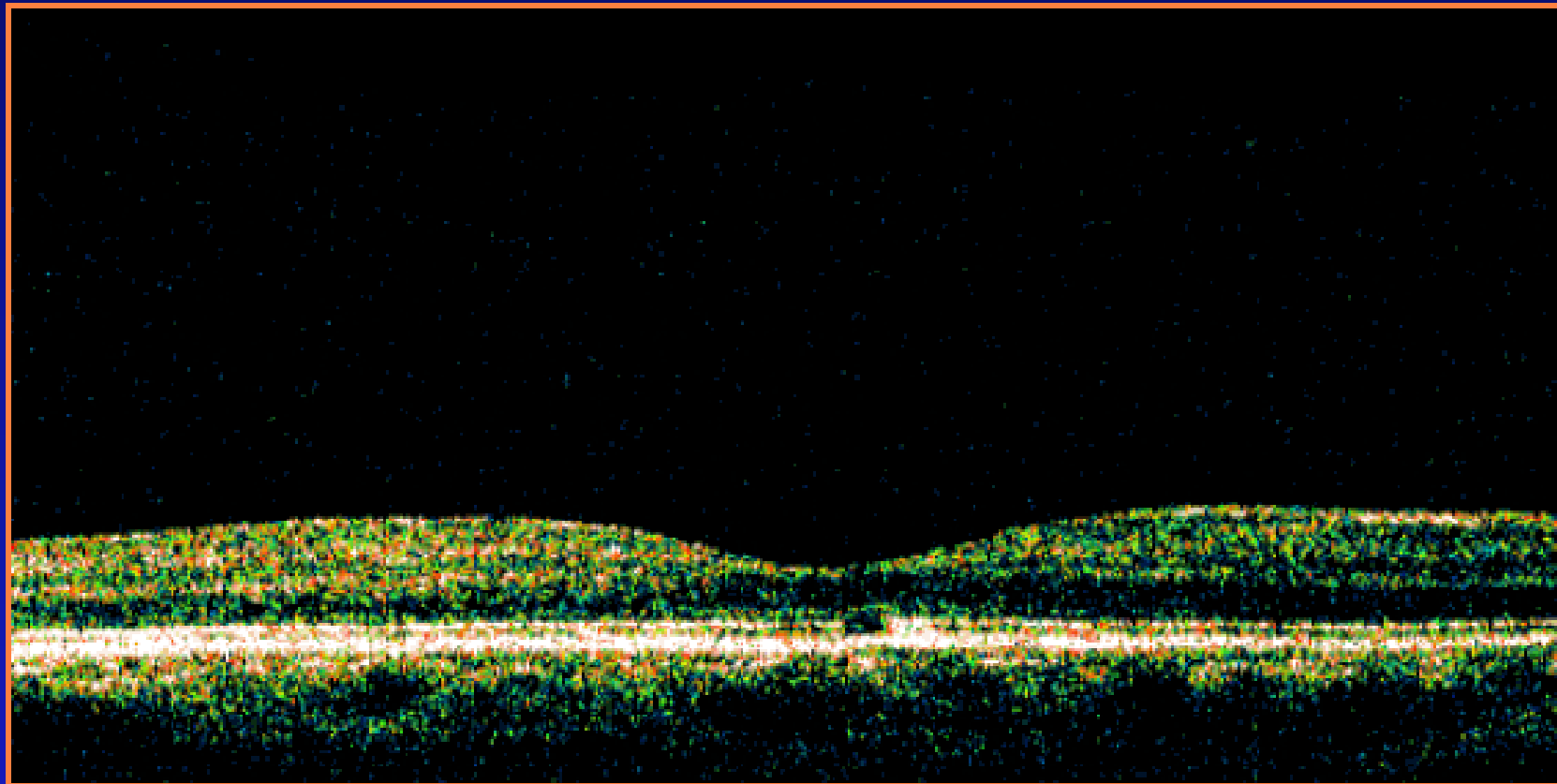


# LA CHIRURGIA



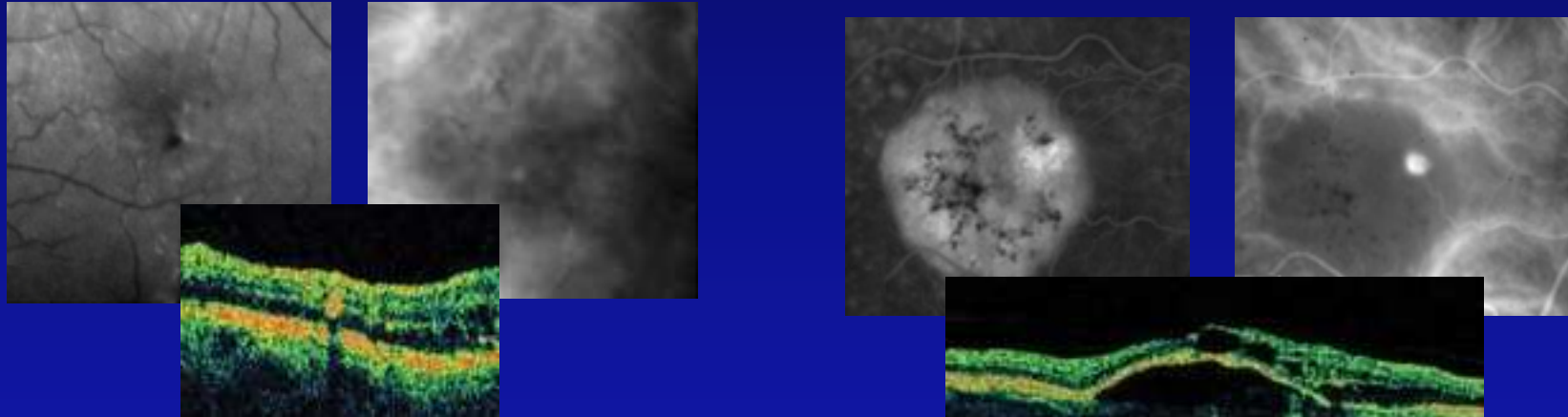
# Epitelio pigmentato retinico

## Fototraumatismi

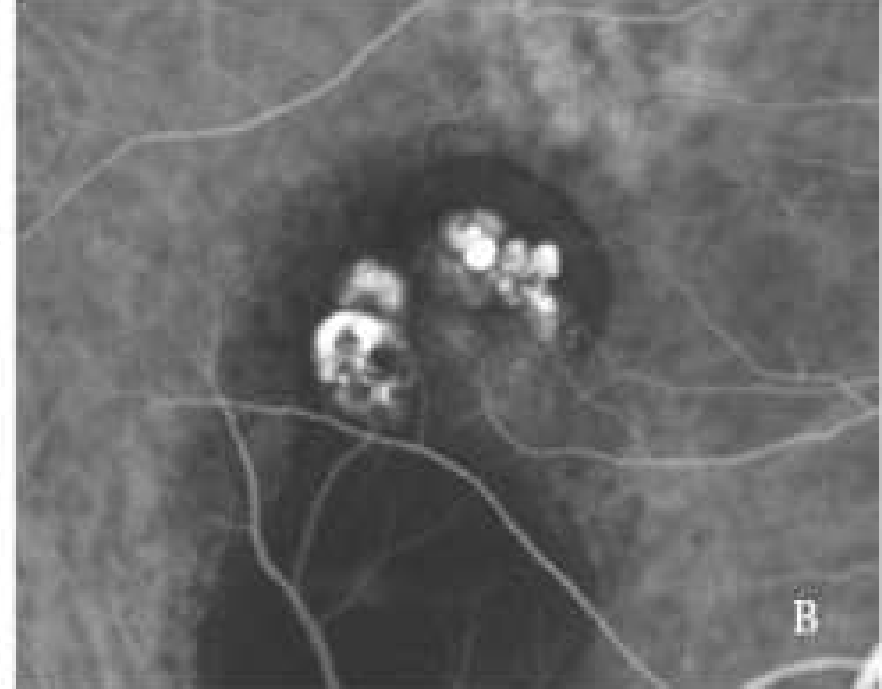
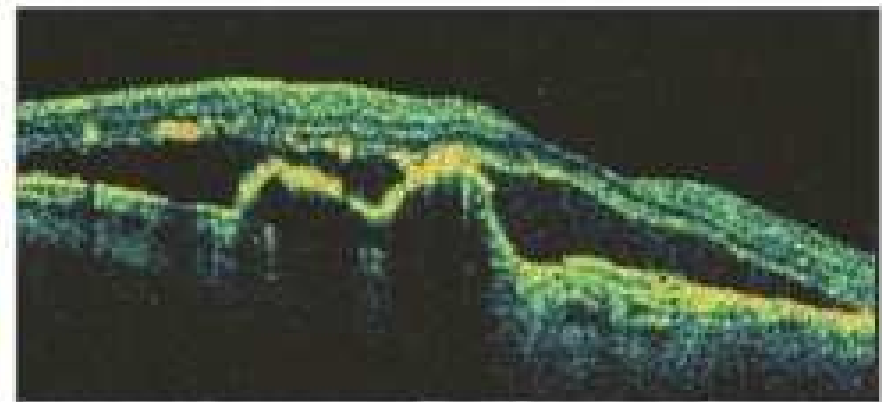
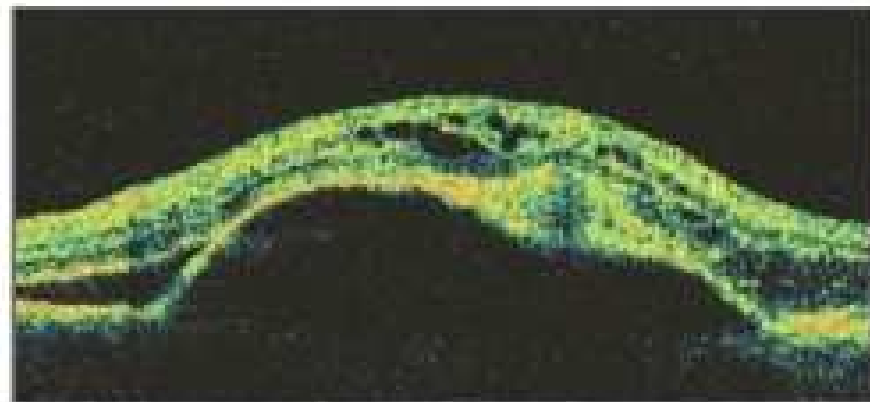


# ANGIOGRAFIA RETINO COROIDEALE

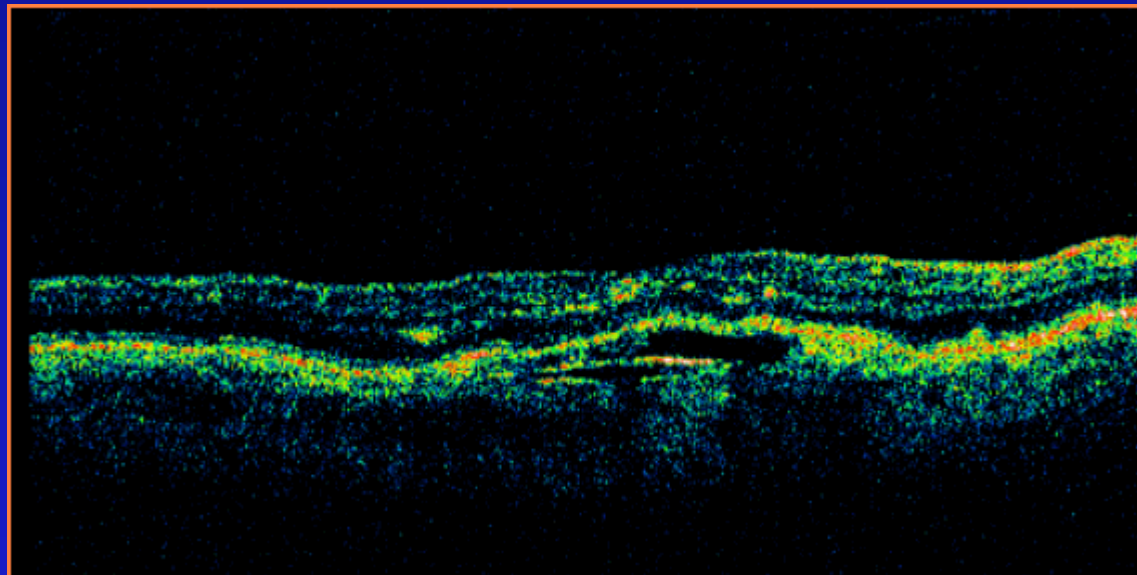
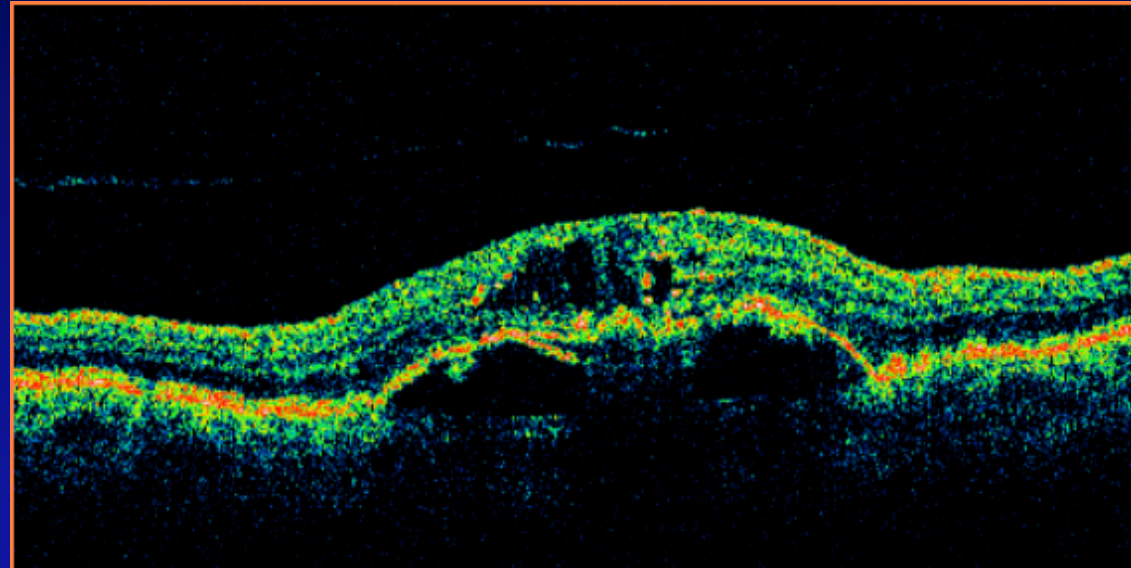
## Retinal Angiomatous Proliferation



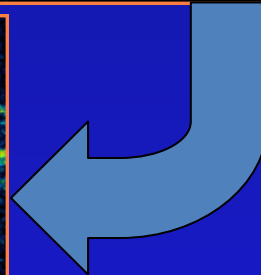
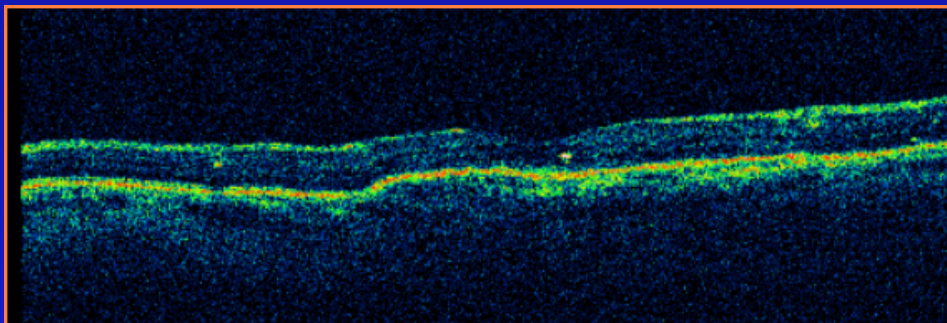
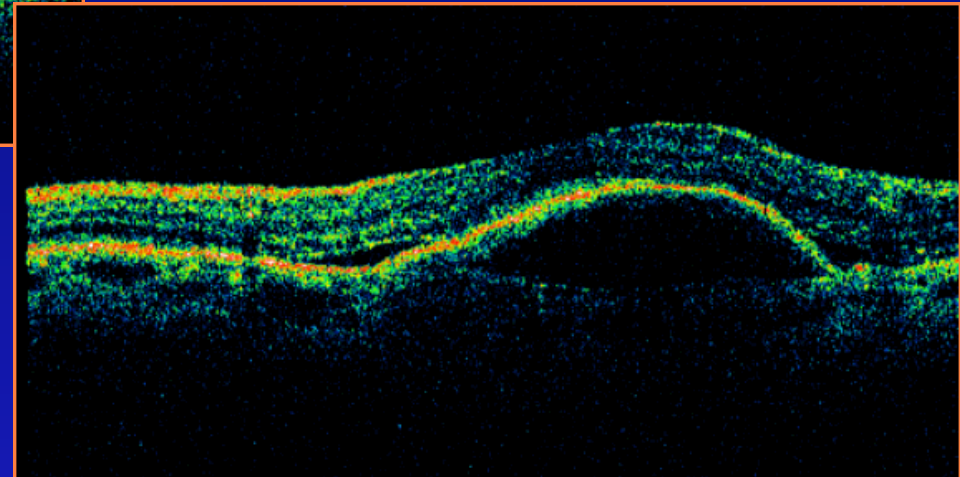
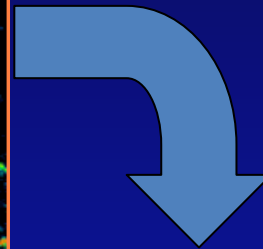
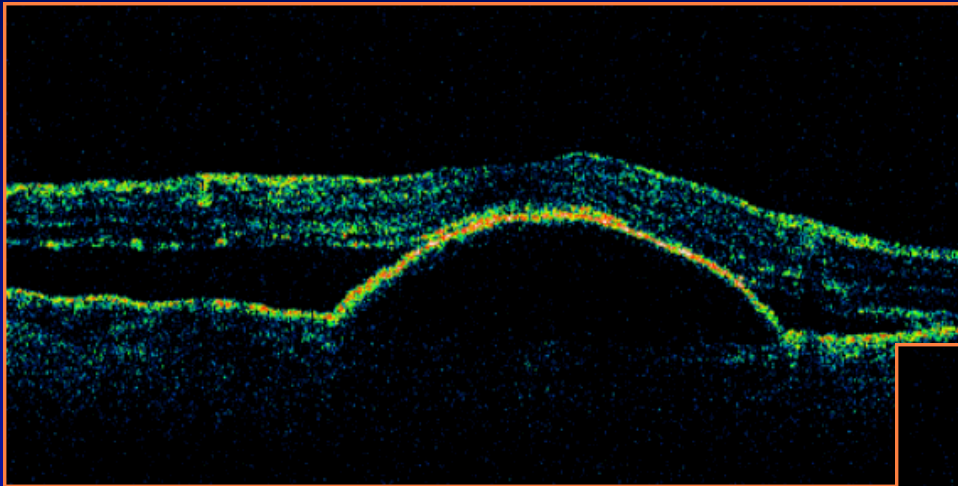
# *Vasculopatia Coroideale Polipoide*



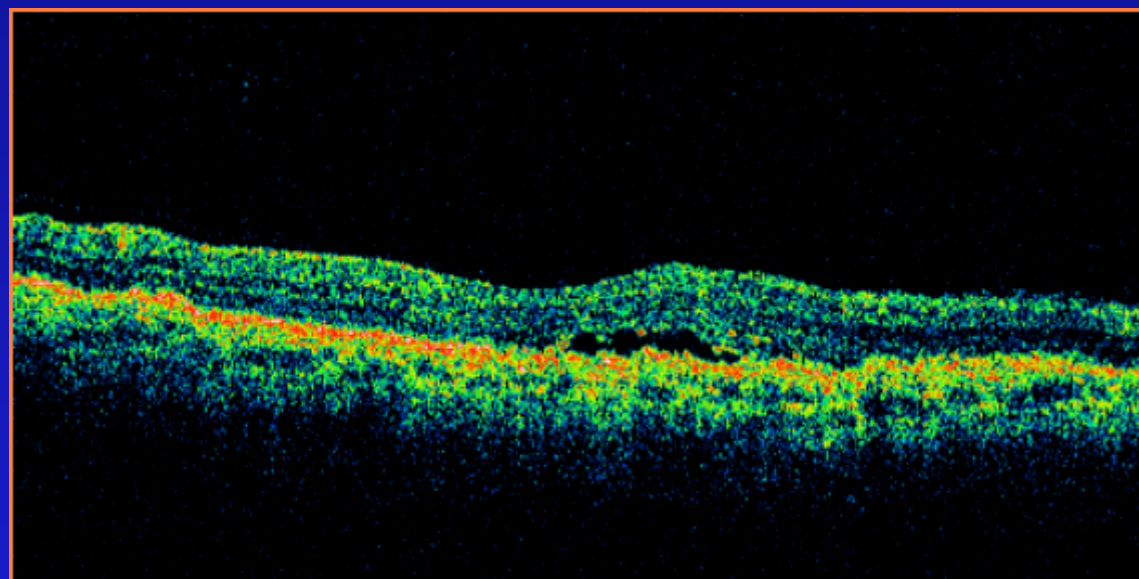
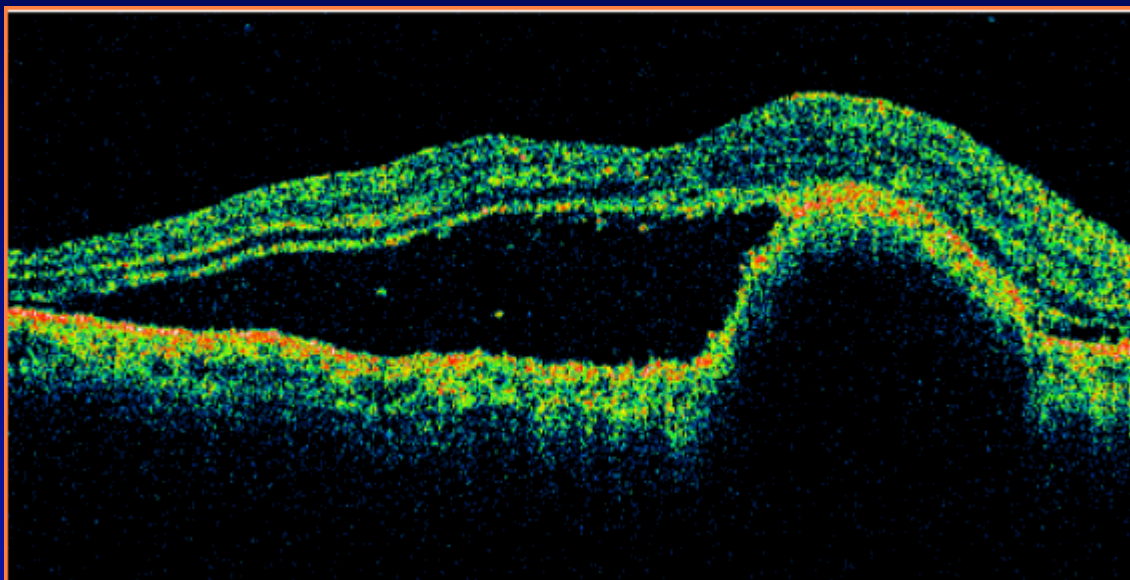
FOLLOW-UP NEOVASCOLARIZZAZIONE COROIDEALE TRATTATE  
ANTIANGIOGENICI



# FOLLOW-UP NEOVASCULARIZZAZIONE COROIDEALE TRATTATE ANTIANGIOGENICI



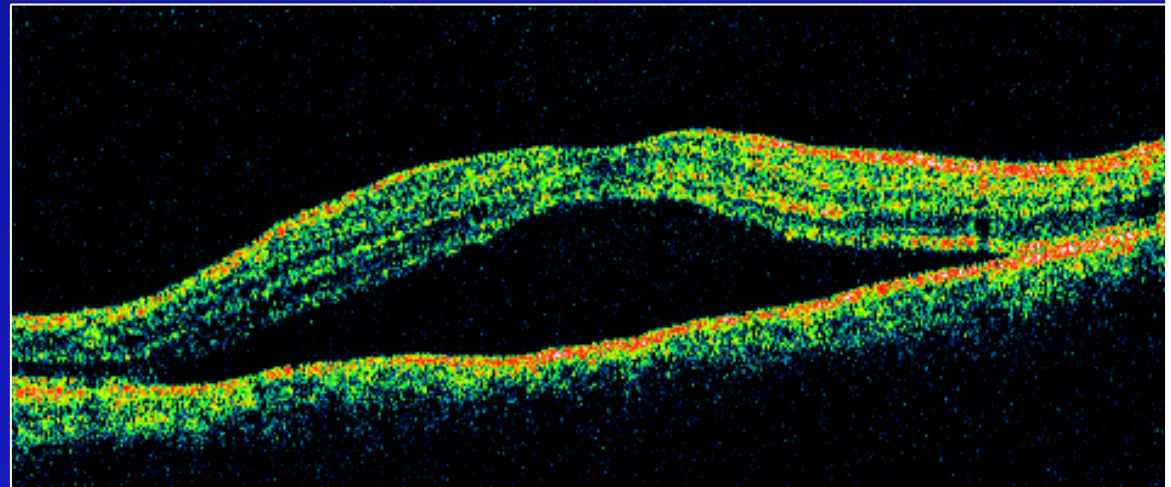
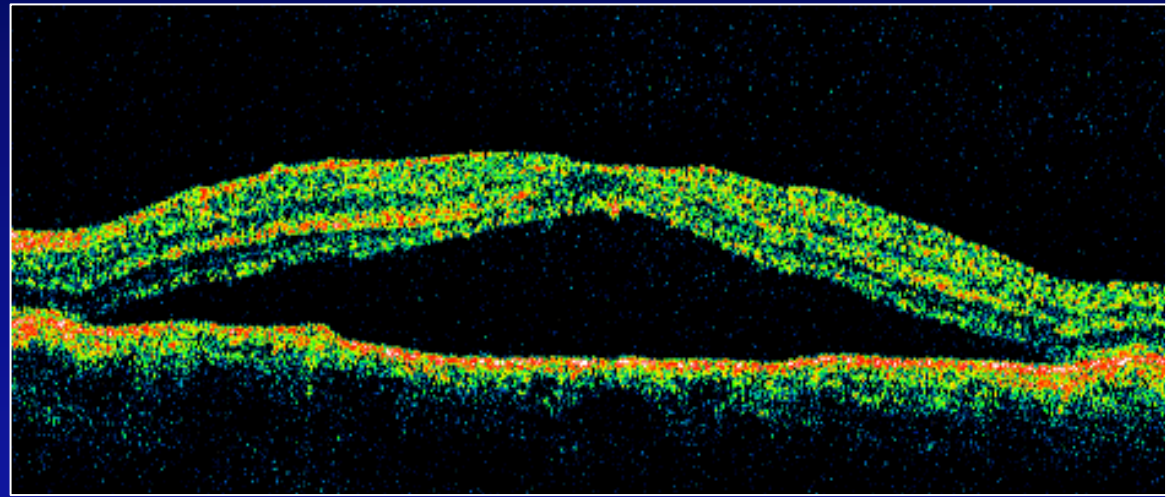
# FOLLOW-UP NEOVASCULARIZZAZIONE COROIDEALE TRATTATE ANTIANGIOGENICI



# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale



Preserved even PL



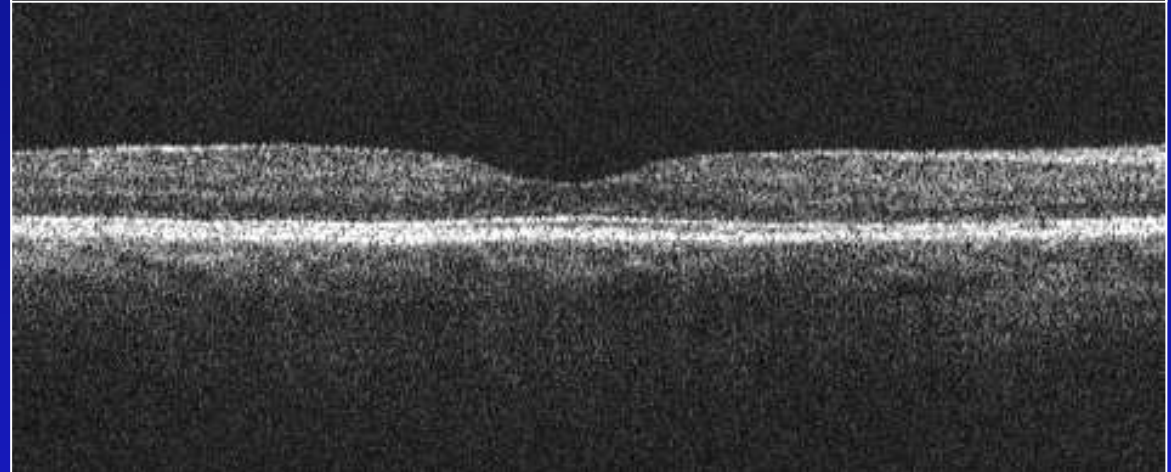
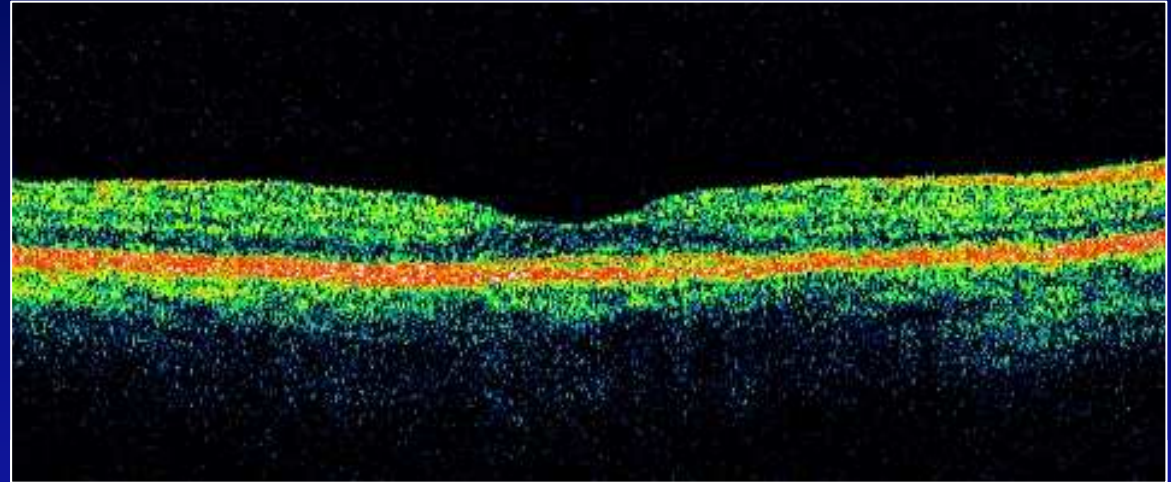
## CASE 1

Symptoms from 1  
month

V.A. 20/26

# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## Integrity of the PL



### CASE 1

4 months after resolution

V.A. 20/20

# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

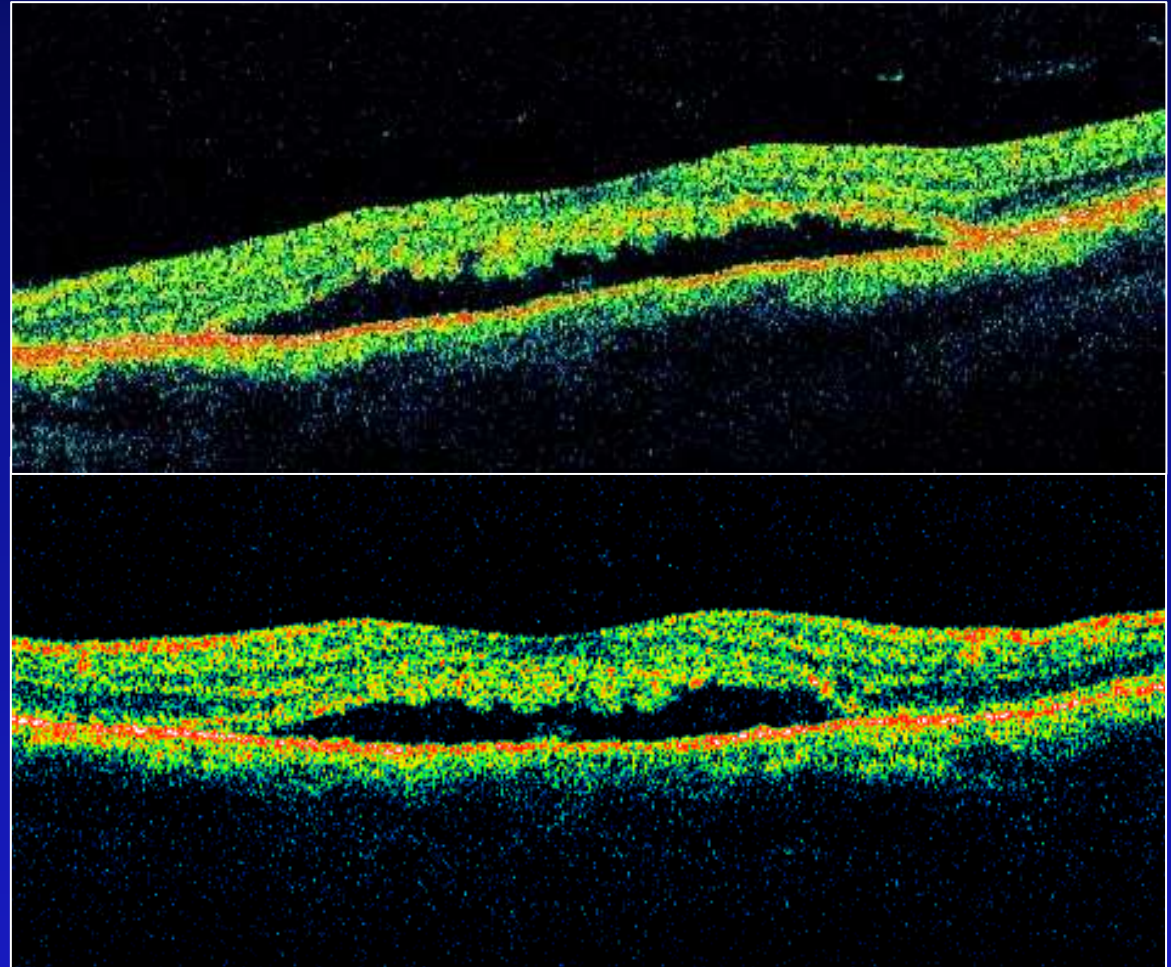
## Thickening and granulation of the PL



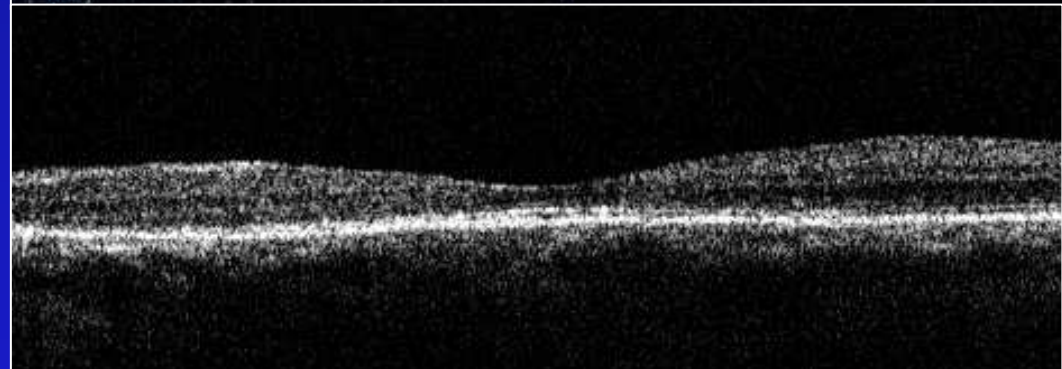
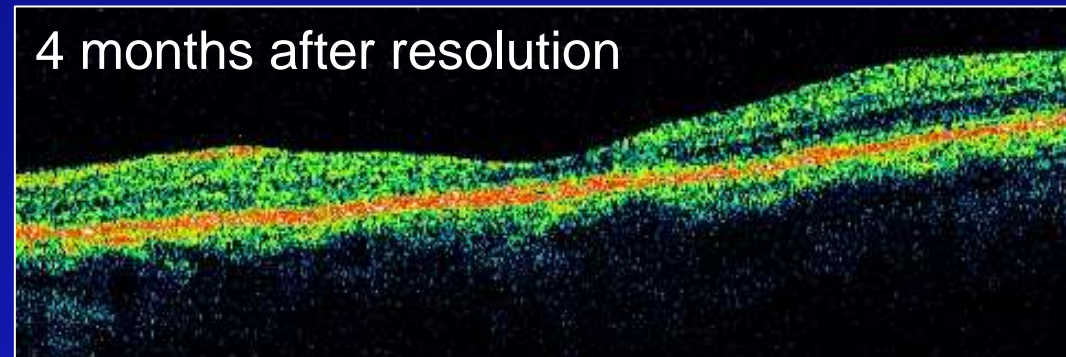
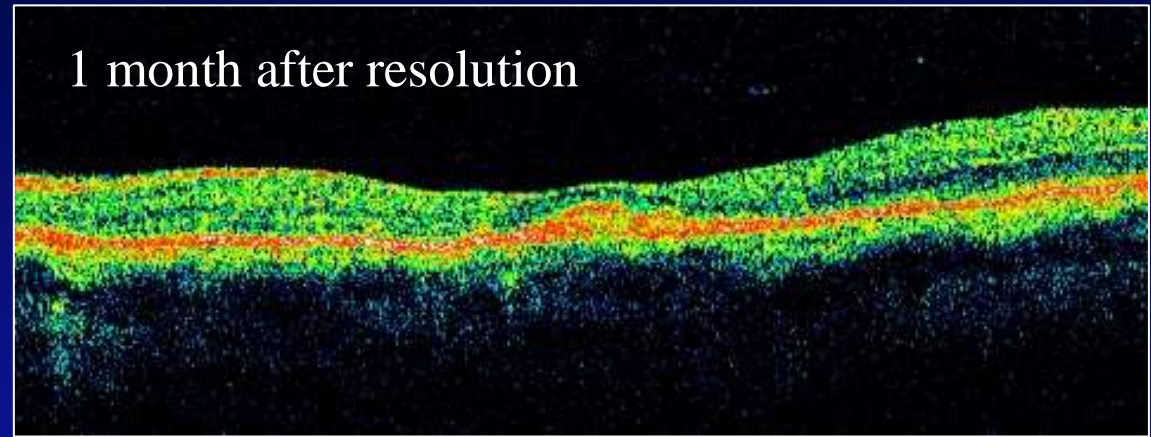
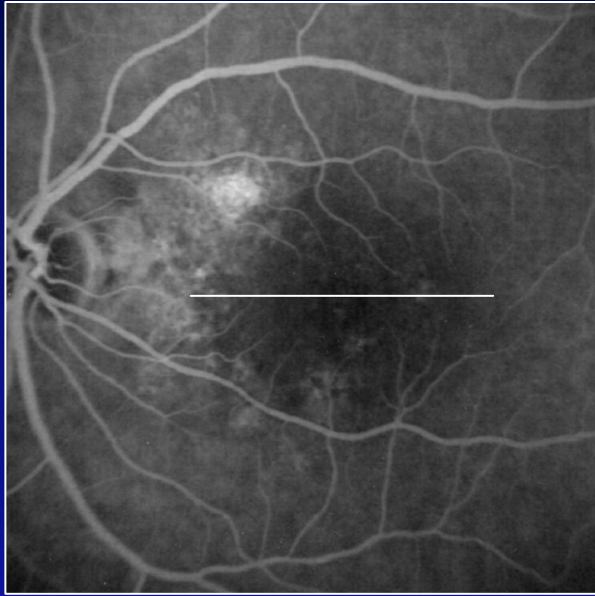
### CASE 2

Symptoms from 1 year

V.A. 20/50



# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale



**CASE 2**

V.A. 20/32

Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

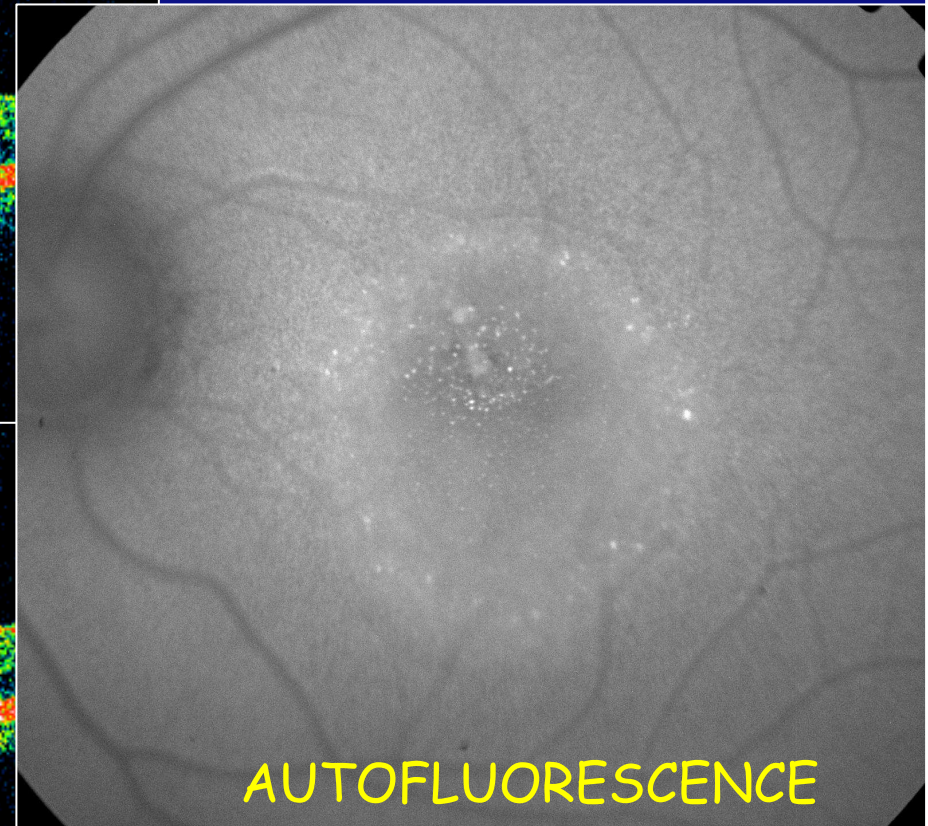
Thickening and  
granulation of the  
PL

*Outer segment disc  
dismantlement*

Symptoms from 4 months

Symptoms from 7 months

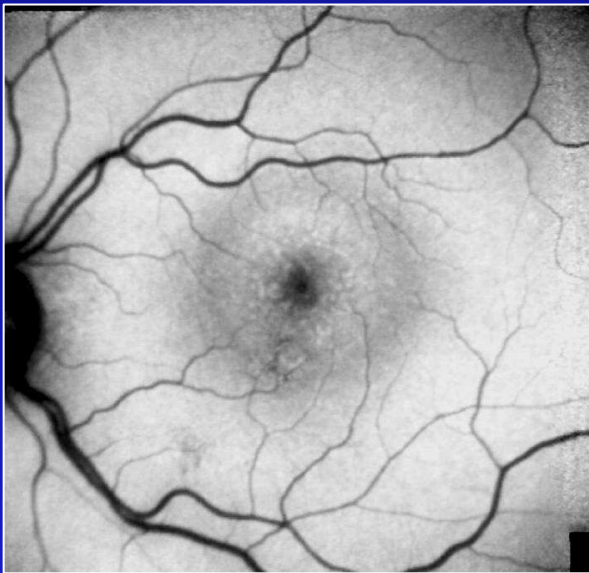
Symptoms from 9 months



AUTOFLUORESCENCE

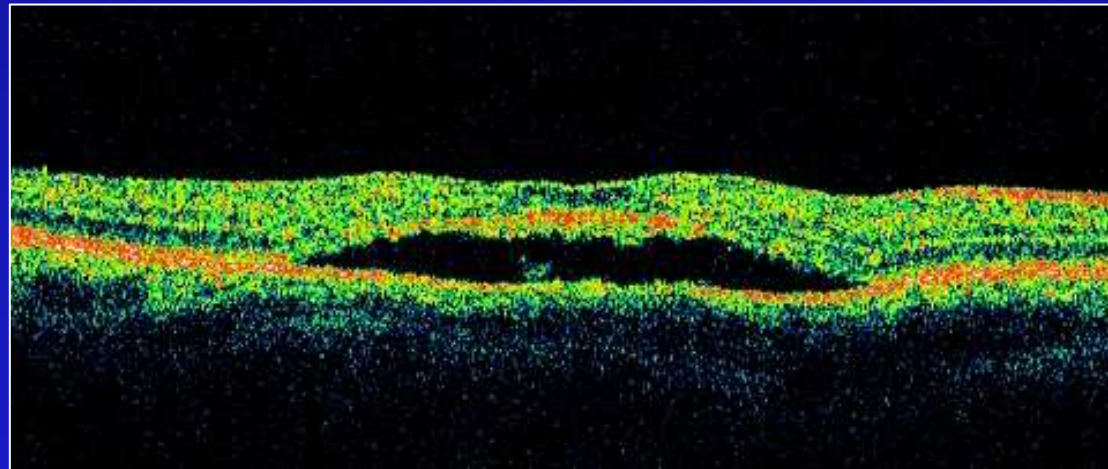
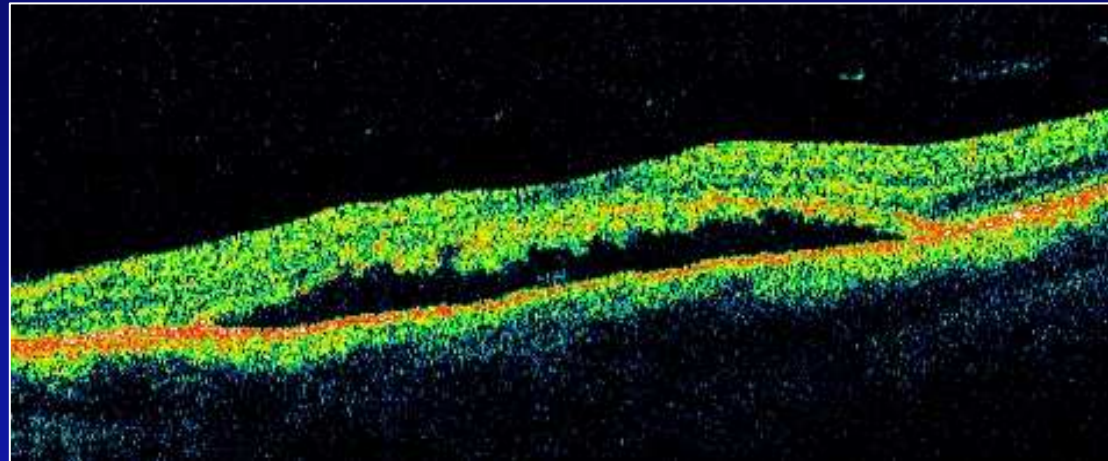
# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## AUTOFLUORESCENCE



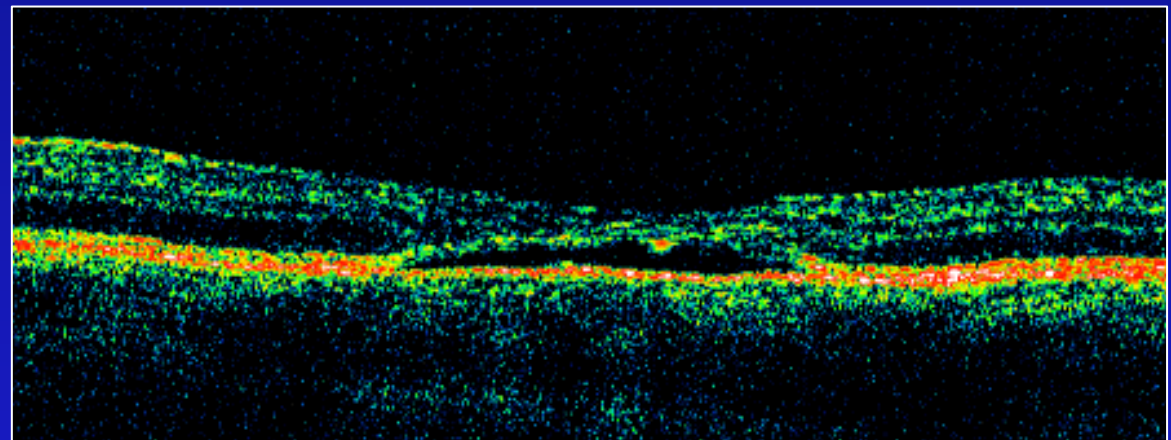
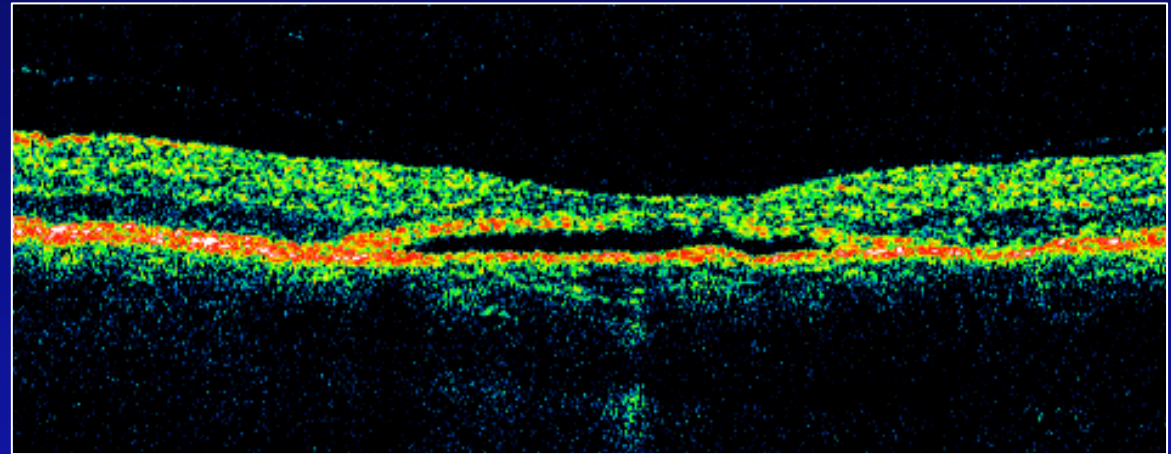
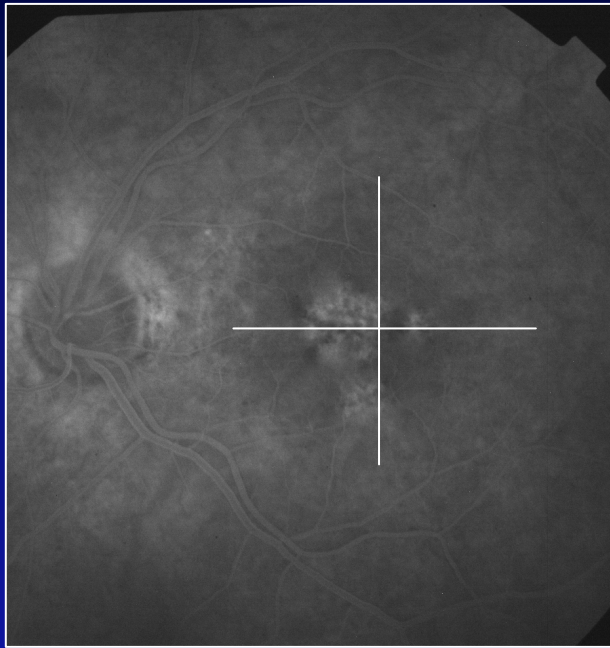
## Thickening and granulation of the PL

*Outer segment disc  
dismantlement*



# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## Atrophy of the PL



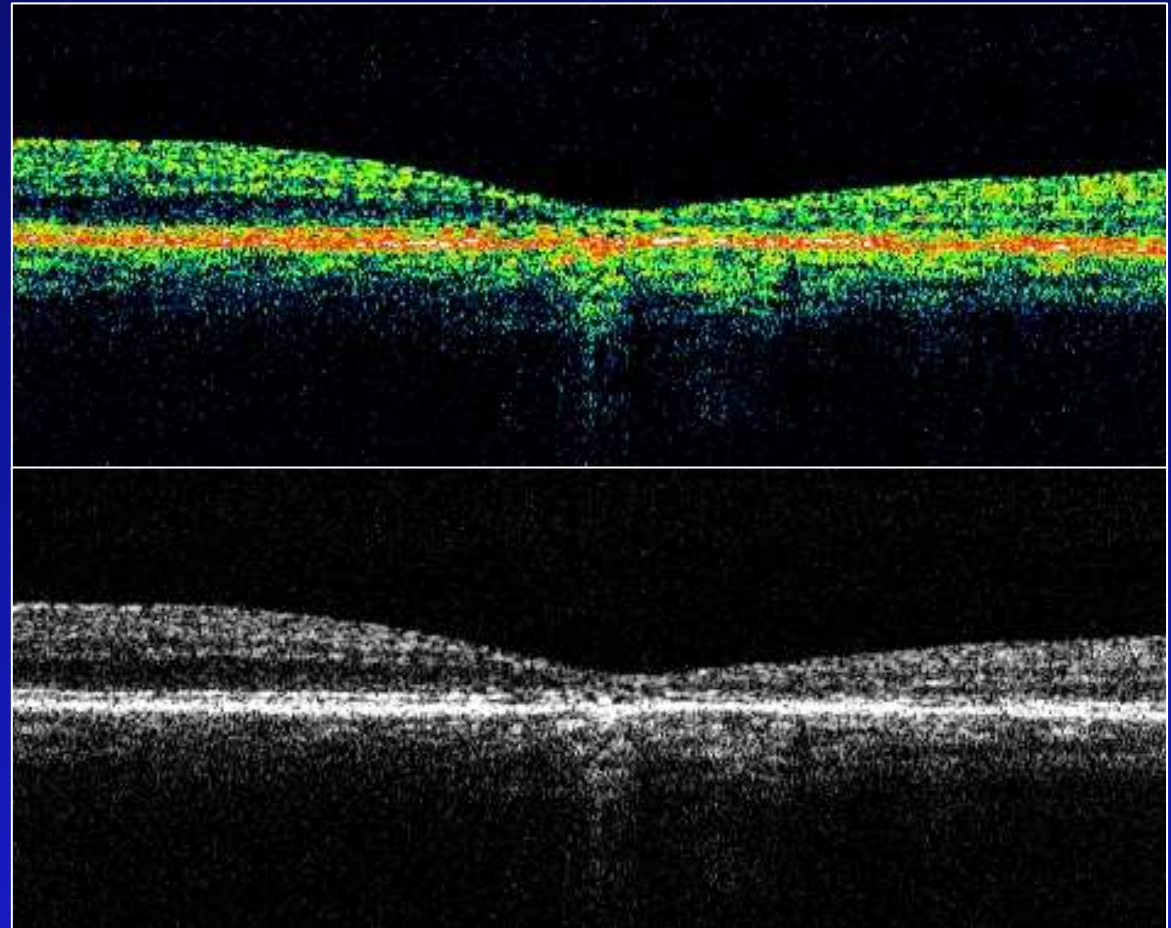
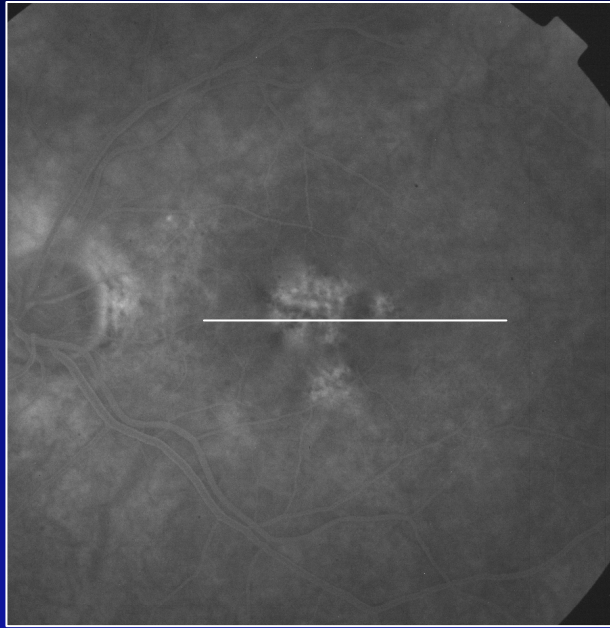
### CASE 3

Symptoms from 2 years

V.A. 20/60

# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## Atrophy of the PL



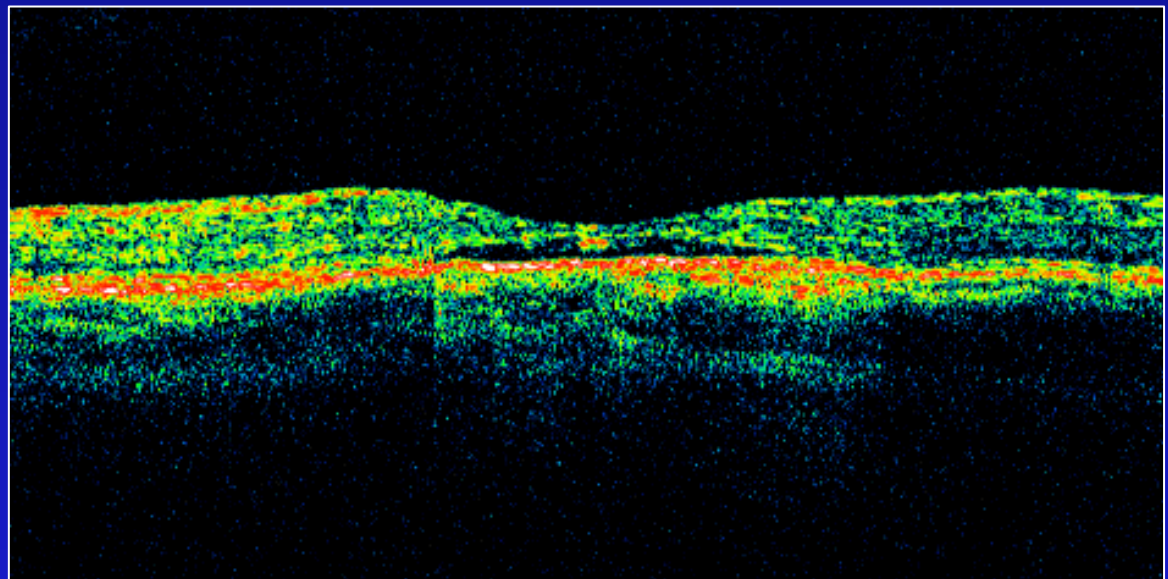
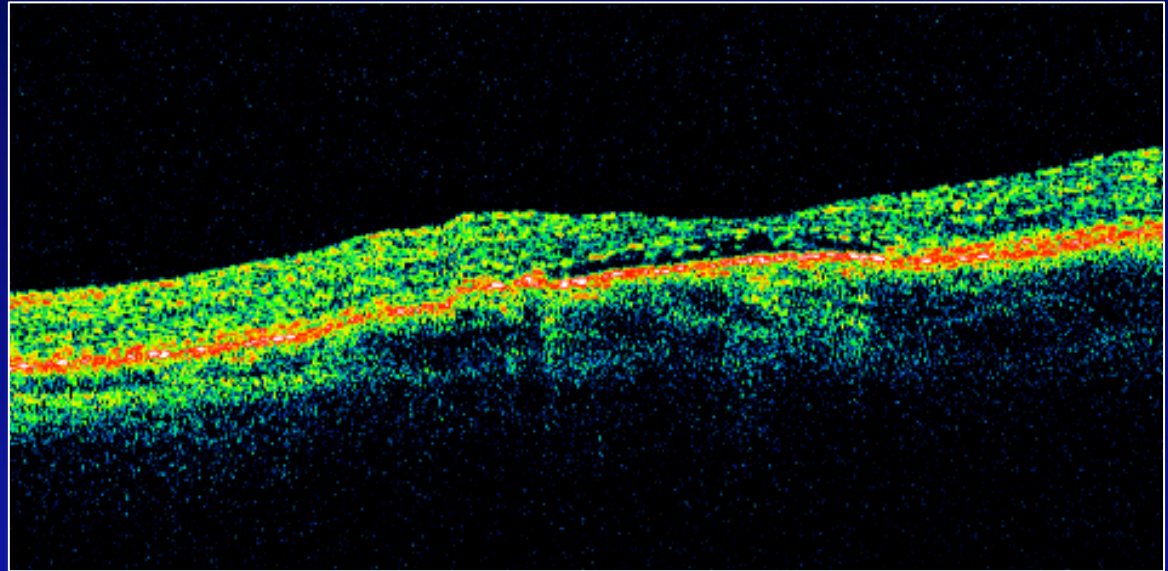
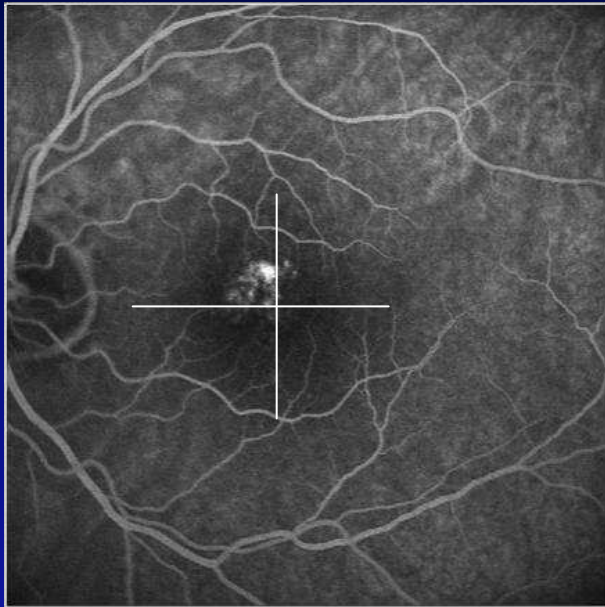
### CASE 3

4 months after resolution

V.A. 20/60

# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## Atrophy of the PL



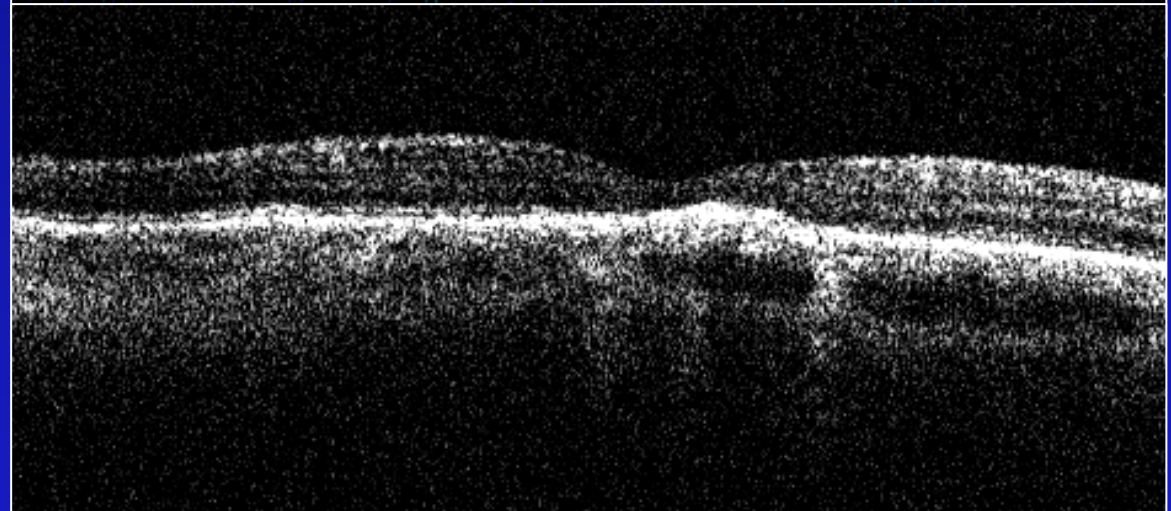
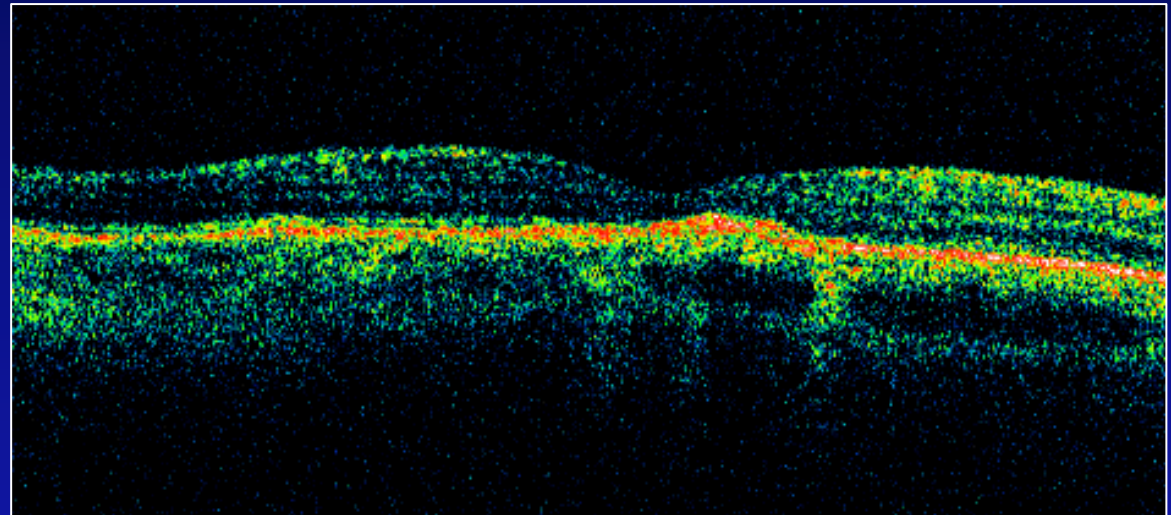
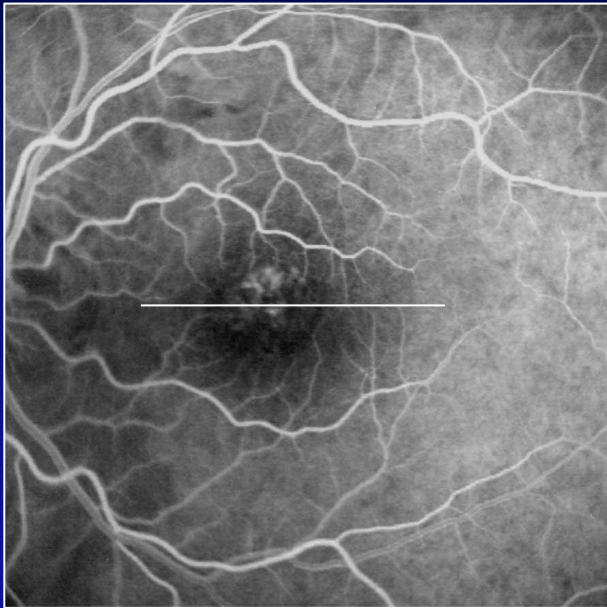
### CASE 4

Symptoms from 7 years

V.A. 20/200

# Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

## Atrophy of the PL



### CASE 4

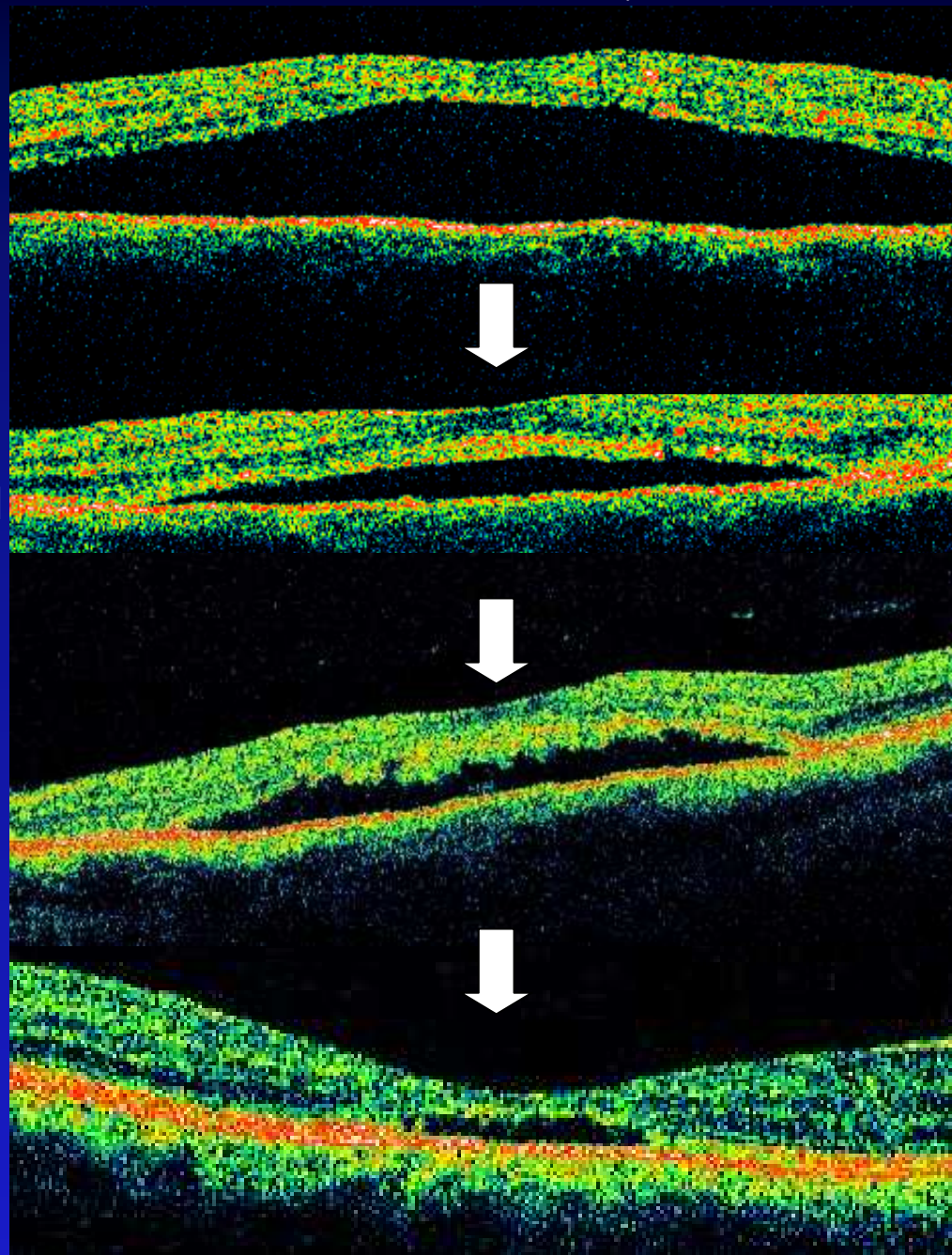
4 months after resolution

V.A. 20/200

## Studio dello strato dei fotorecettori nella corioretinopatia sierosa centrale

The condition of the PL was significantly correlated with the actual and the post-resolution V.A.

$p < 0.001$



*Complete V.A. recovery*

*Partial V.A. recovery*

*No V.A. recovery*

