

OCT Bootcamp: The Basics of Retinal OCT

Optometry Symposium
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November 2, 2008

Question

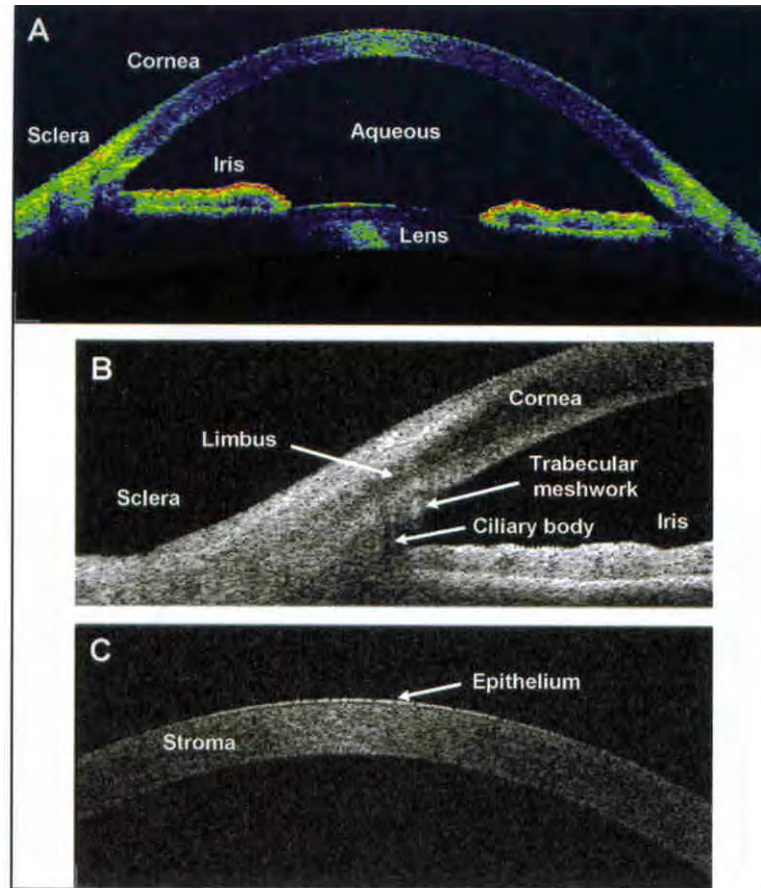
- How many ophthalmic imaging tests can claim the following?
 - Non-invasive
 - Non-contact
 - No radiation
 - Painless
 - Fast
 - Reliable and sensitive (to 10 microns)

Optical Coherence Tomography

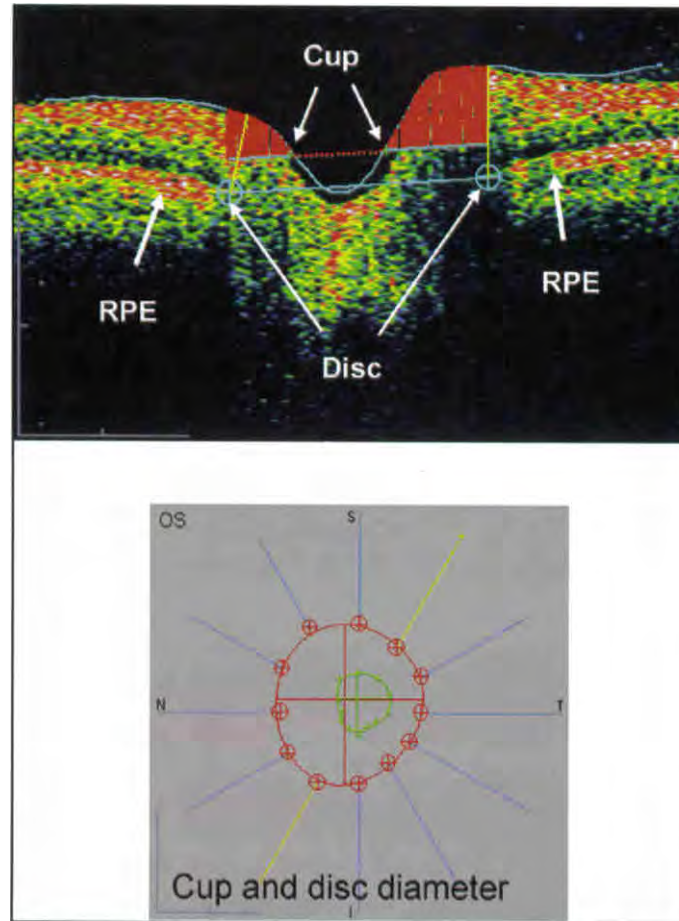
- Diagnostic test that allows for imaging and measurement of various ocular structures



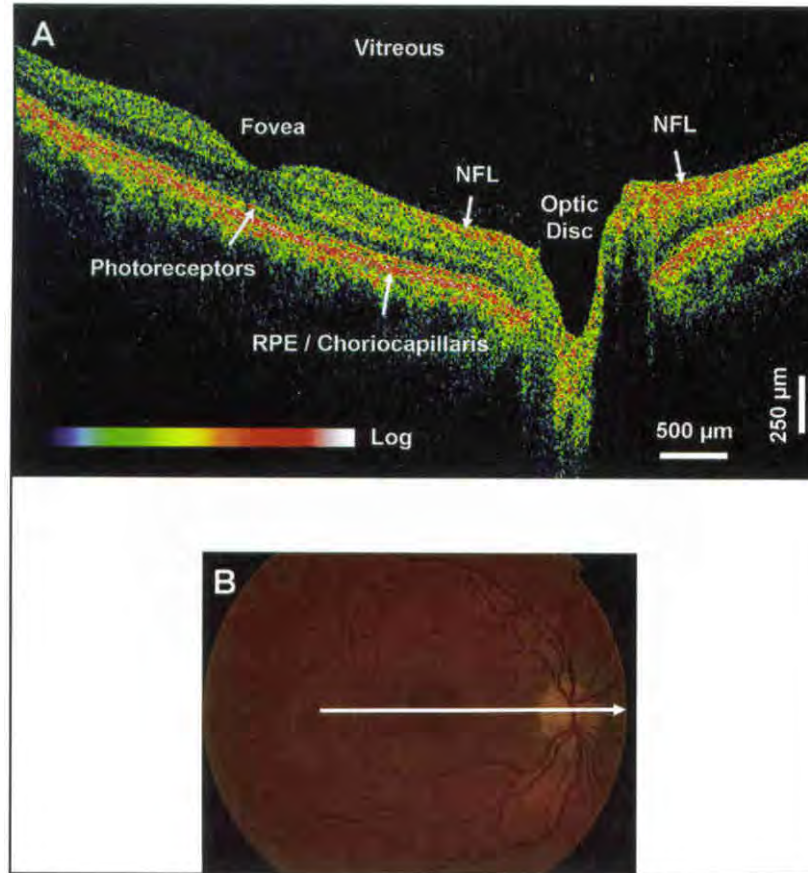
OCT: Anterior Segment



OCT: Optic Nerve



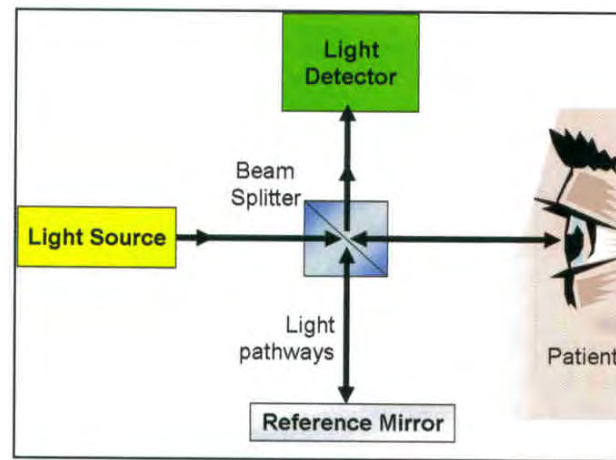
OCT: Retina



Goals

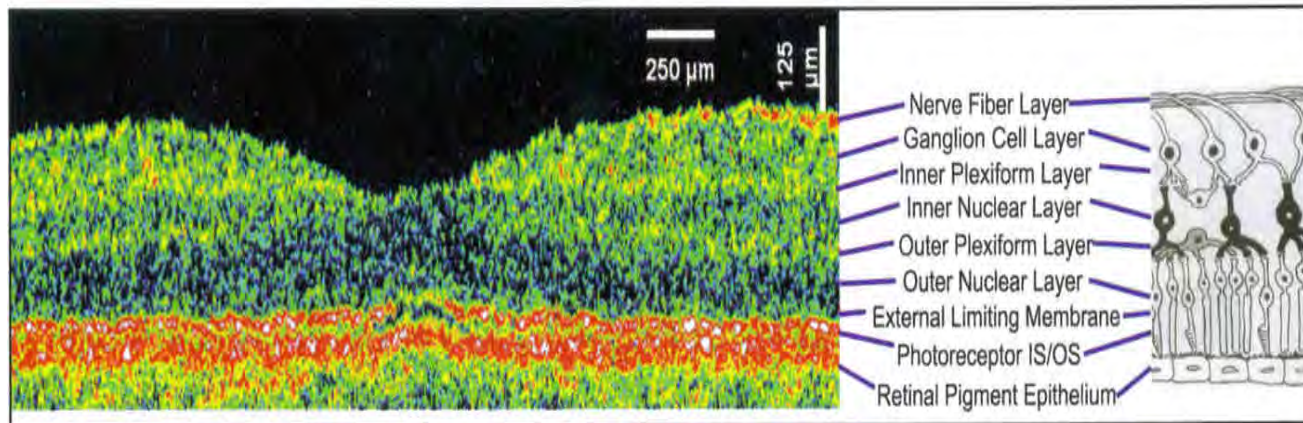
- Quick overview of OCT function
- Interpretation of macular OCT scan
- Define indications for macular OCT
- Practical examples

How does OCT work?



- Rays of light provide 2 and 3-dimensional imaging of tissues at histological level

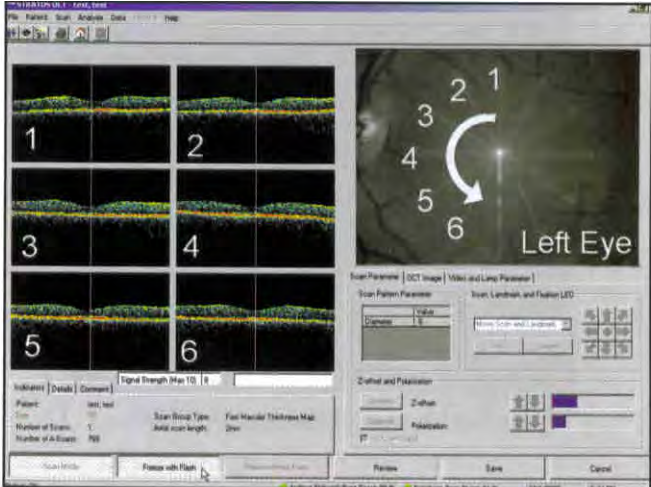
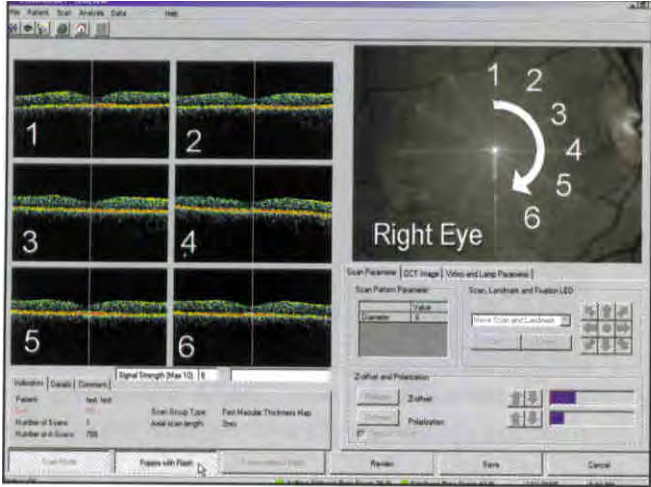
Optical Biopsy of Retinal Layers



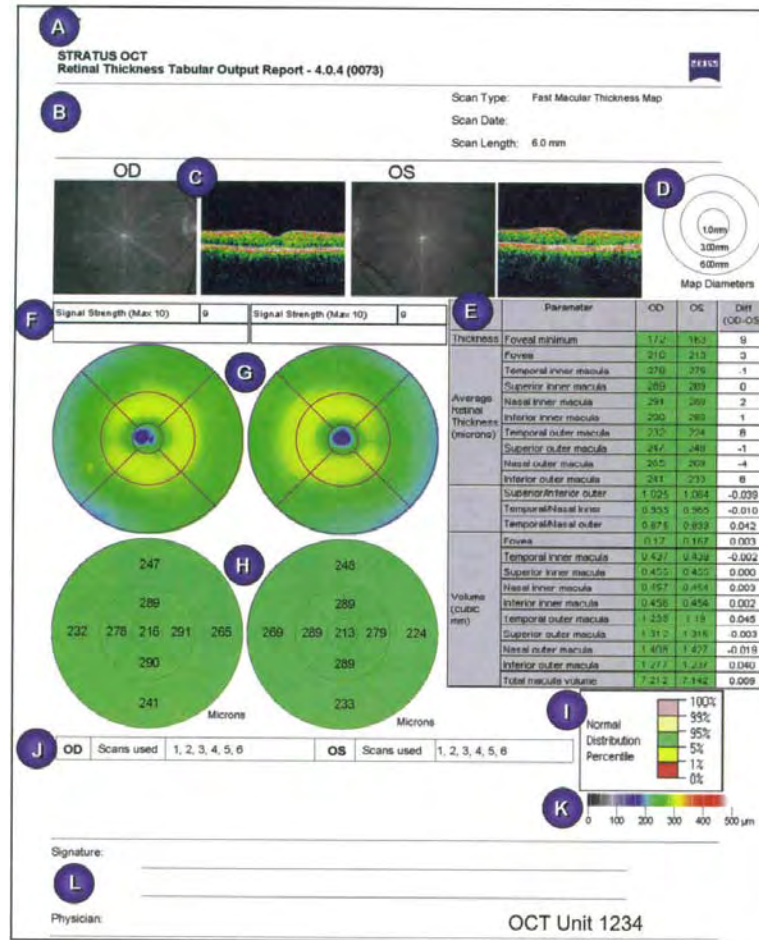
Limitations of Retinal OCT

- Mydriasis may sometimes be necessary
- Dioptric media must be somewhat transparent
- Exploration typically limited to posterior pole
- Good lacrimal film necessary

Obtaining A Macular Scan

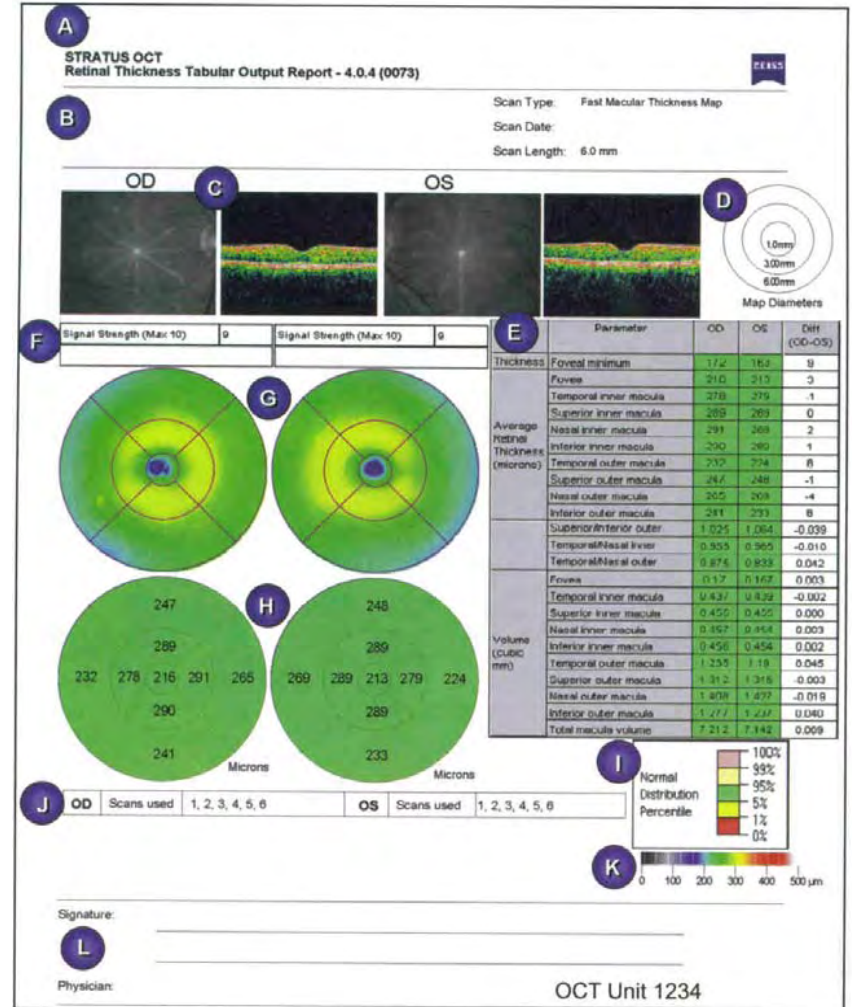


Composite Macular Scan

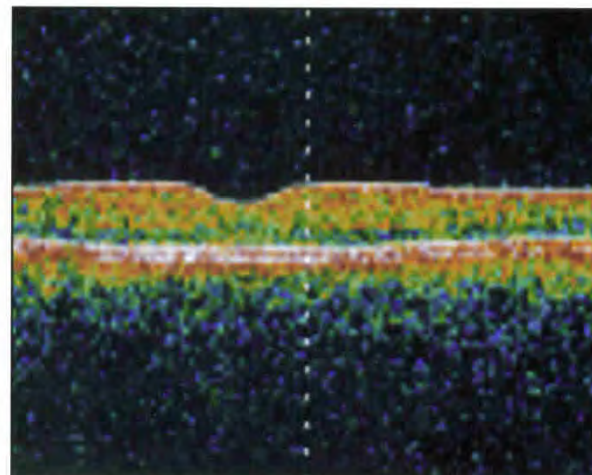
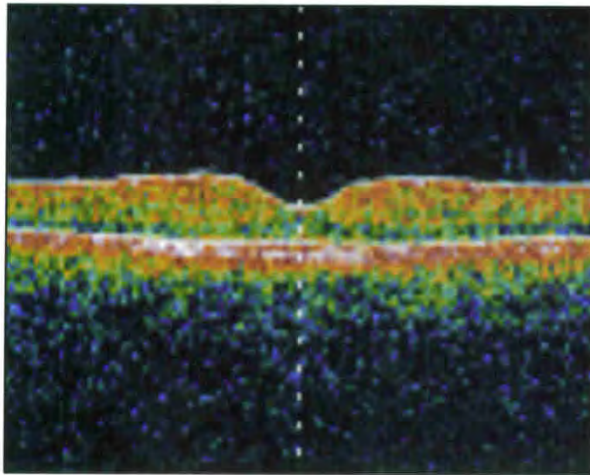
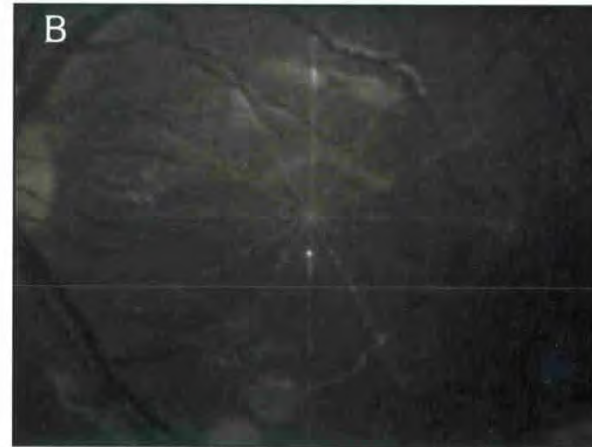
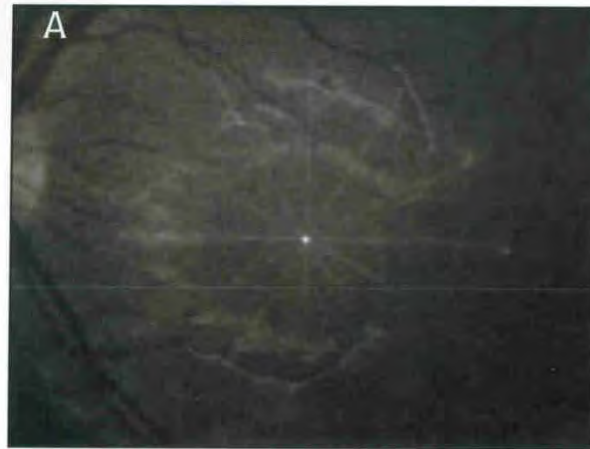


Interpretation of Macular OCT Printout

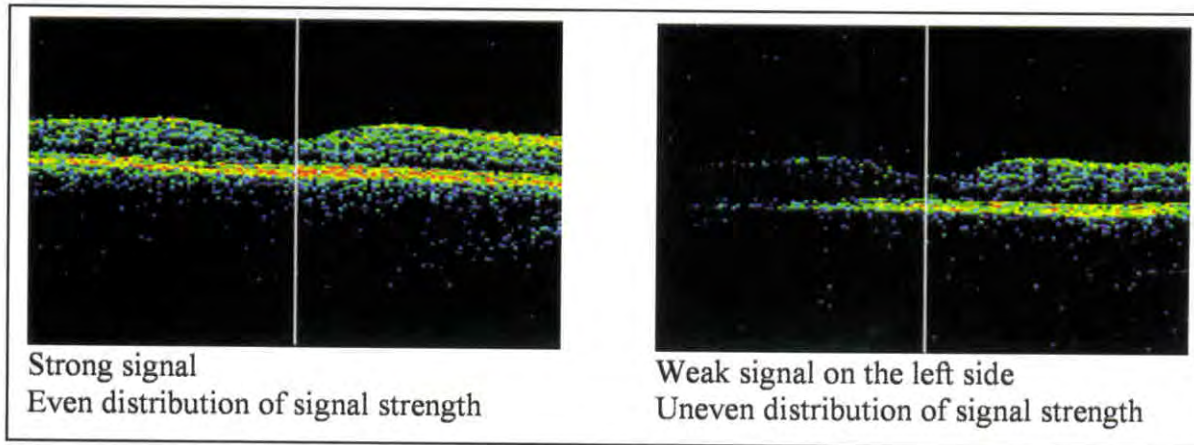
- Assessment of reliability
 - Scan placement
 - Signal strength
 - Algorithm performance



Scan Placement

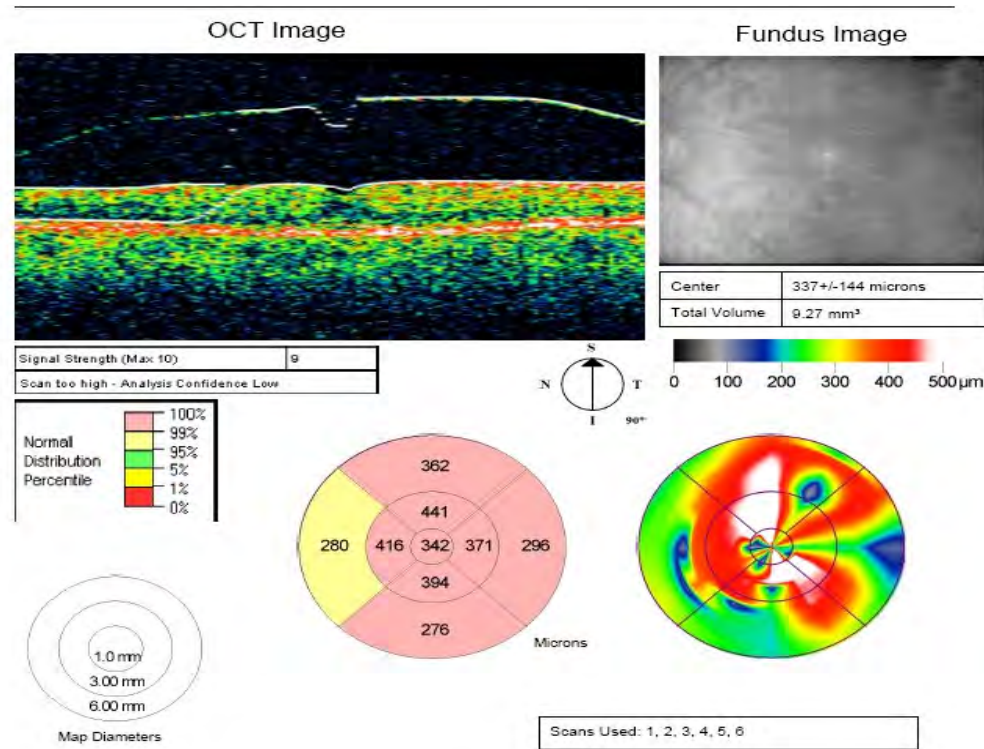


Signal Strength



- Signal strength 6 = adequate
- Signal strength 8 = very good

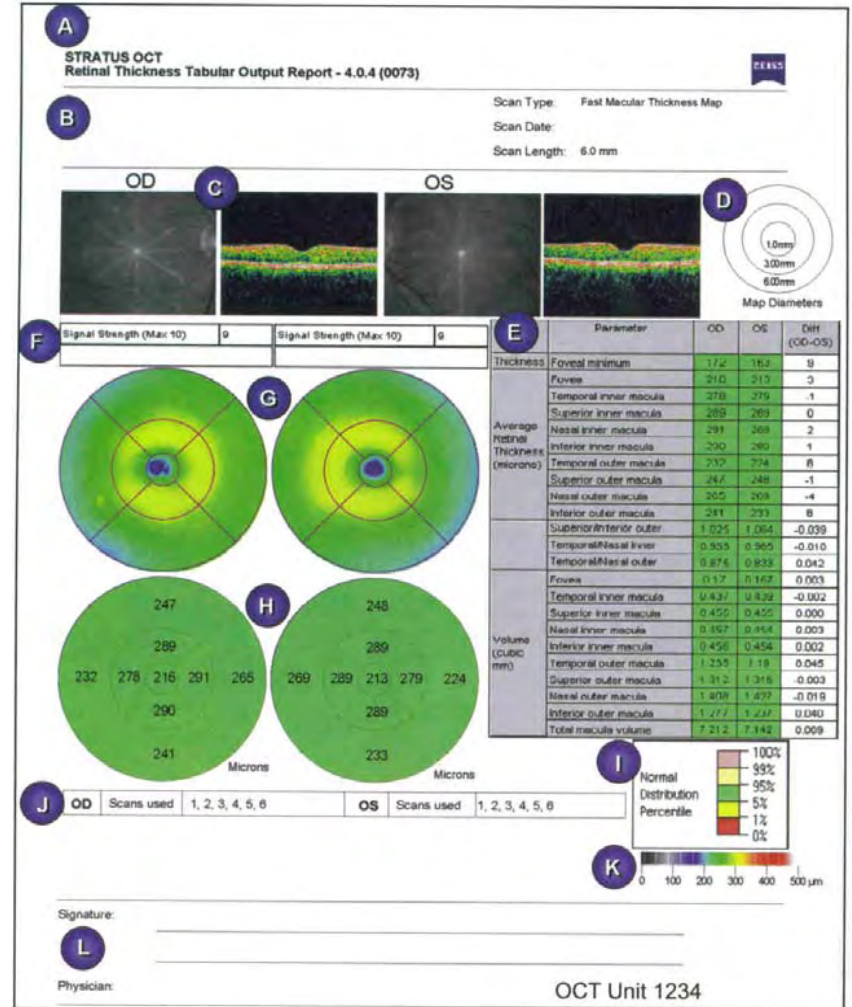
Algorithm Performance



- For macular scan, the borders of algorithm should fit to ILM and PR inner and outer segment
- If algorithm has failed, then the quantitative data should be disregarded

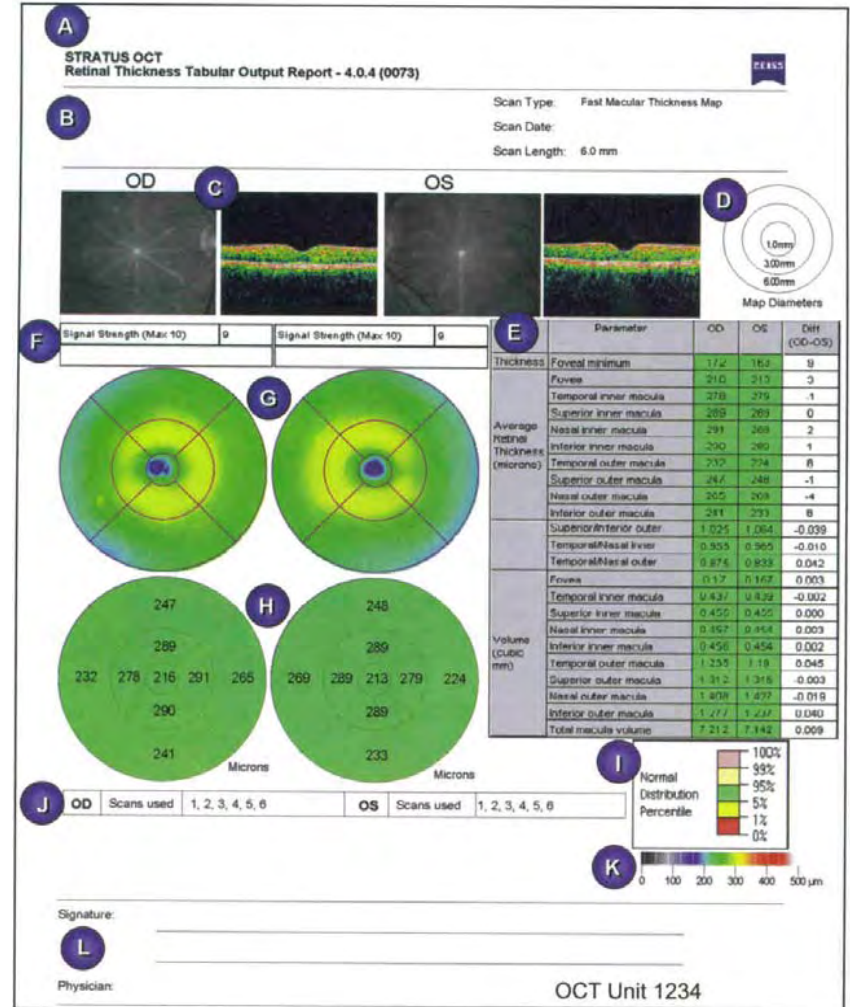
Interpretation of Macular OCT Printout

- Color-coded qualitative thickness map



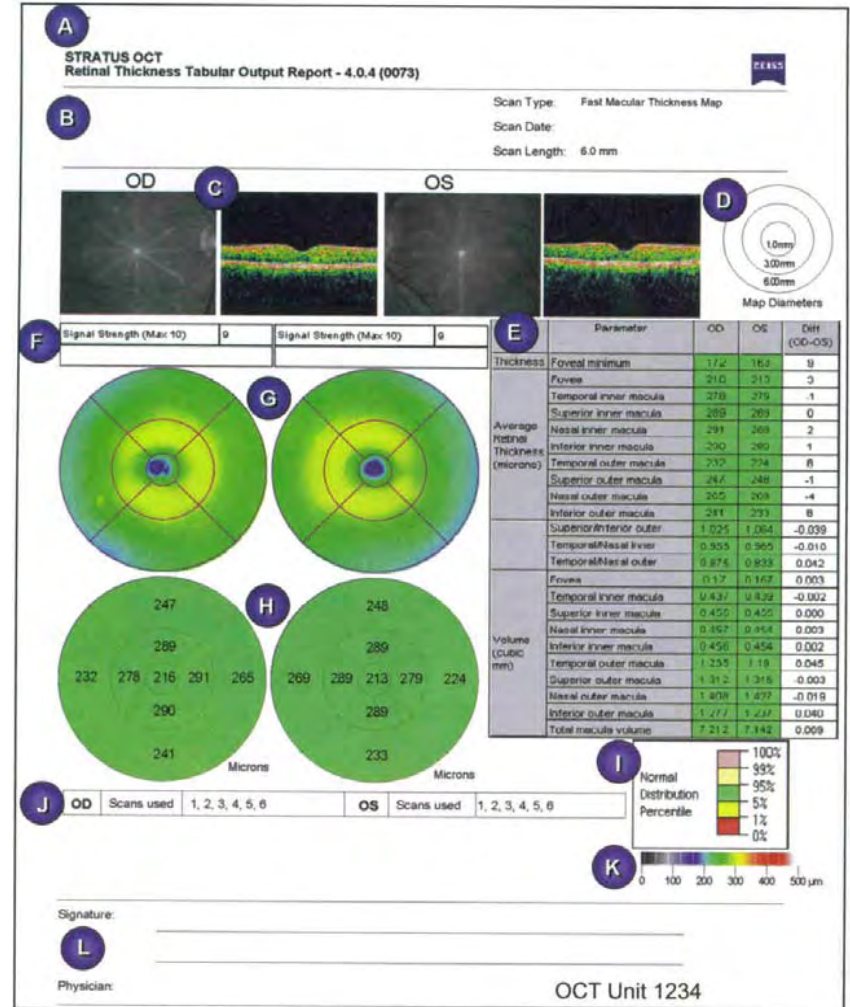
Interpretation of Macular OCT Printout

- Color-coded quantitative thickness map
 - Macula 150 to 250 μ
 - Foveola $\leq 200 \mu$



Interpretation of Macular OCT Printout

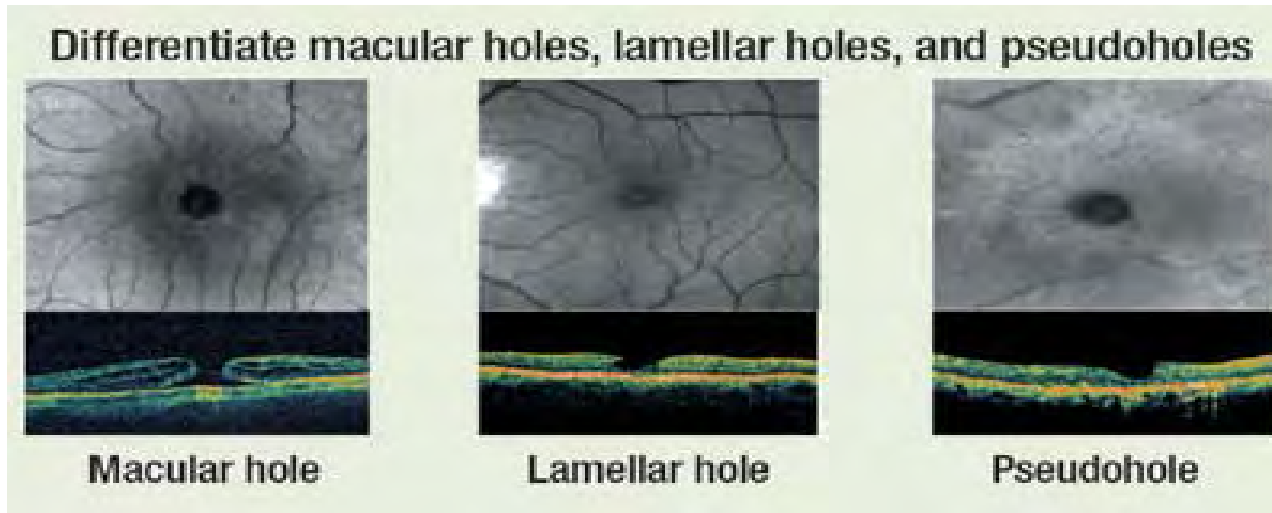
- Table of thickness and volume parameters



Indications for Retinal OCT

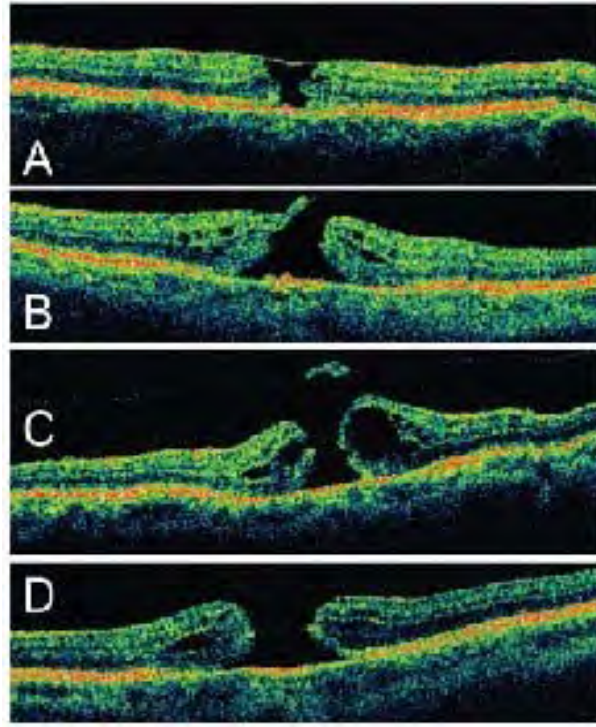
- To examine the retina and its sub-layers
 - Atrophy, Edema, Traction, Subretinal fluid, RPE irregularity
 - ARMD, CME, CSME, CSR
- To monitor progression
- To aid in treatment planning
- To monitor response to therapy

Indications for Retinal OCT



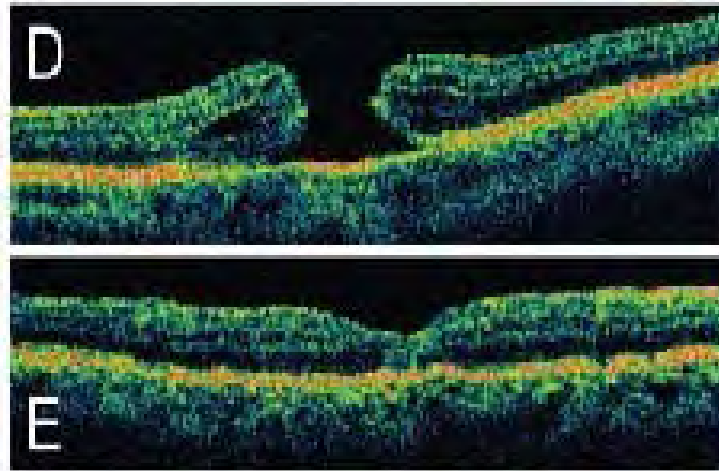
- To examine the retina and its sub-layers
 - Extent of retinal defects or abnormalities
 - Detailed measurements

Indications for Retinal OCT



- To monitor progression

Indications for Retinal OCT



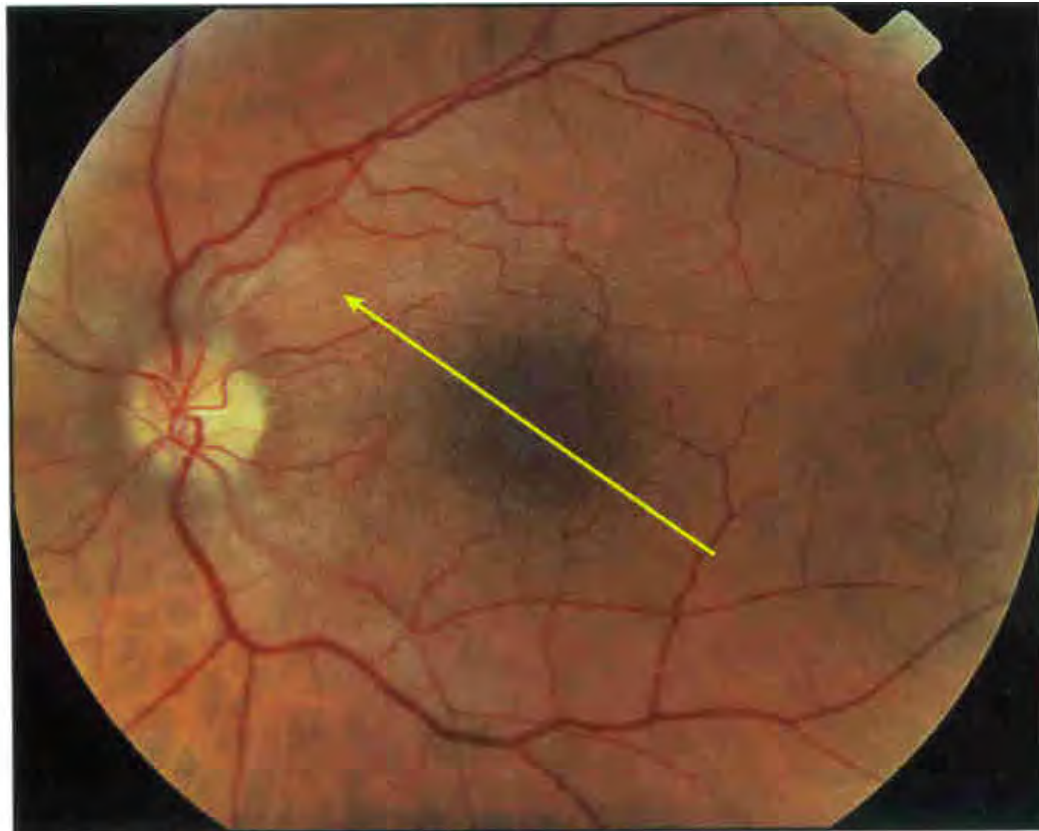
- To aid in treatment planning
- To monitor response to therapy

Case Studies: Vitreoretinal Interface Disorders

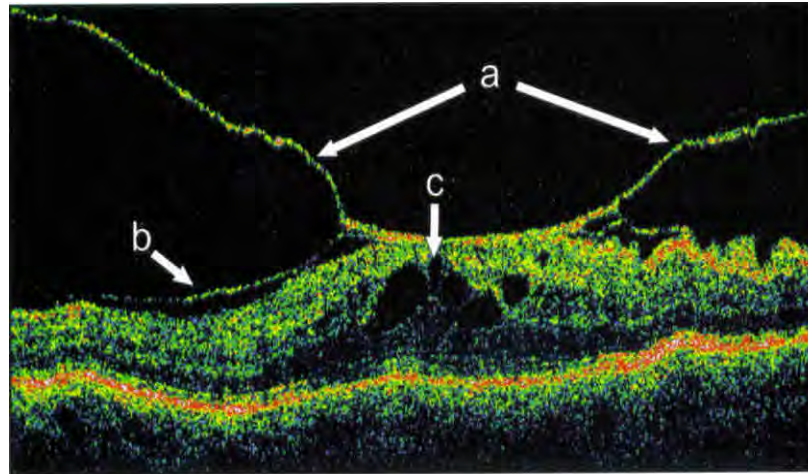
Case 1

- A 67 year-old man notes progressive decrease in vision OS x 6 mos
- VA 20/20 OD, 20/200 OS

Case 1 Fundus Photo

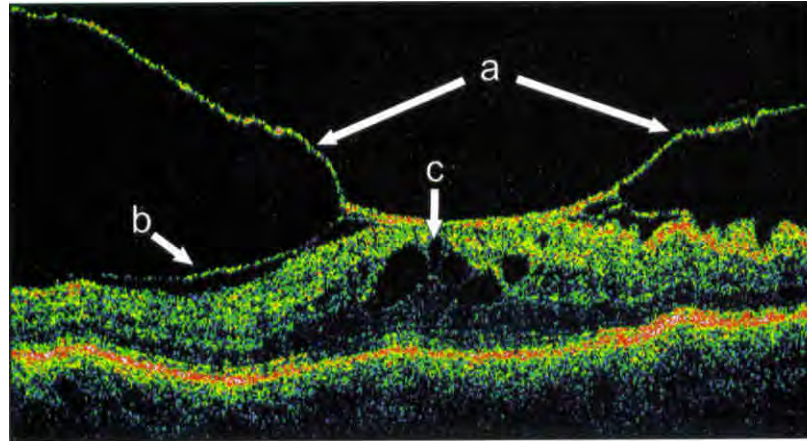


Case 1 OCT of Macula



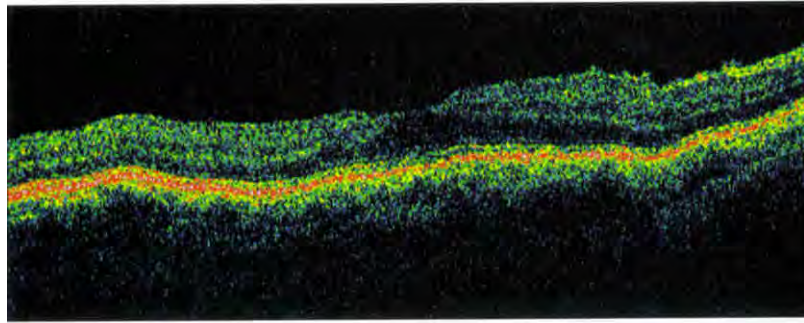
- Diagnosis?

Case 1 OCT Macular Scan



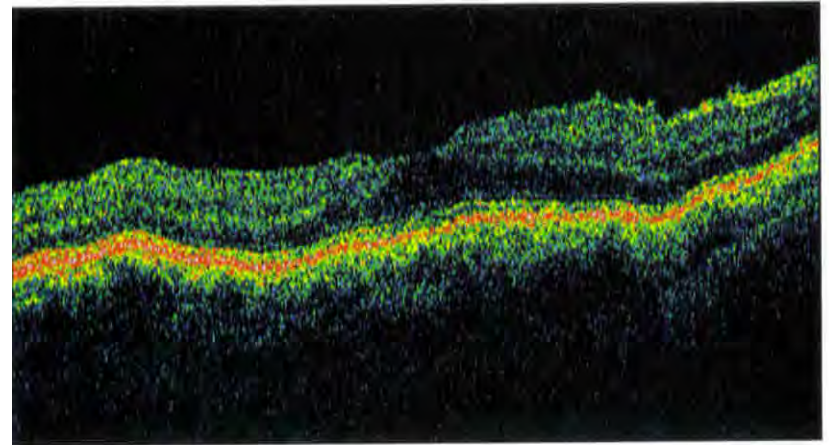
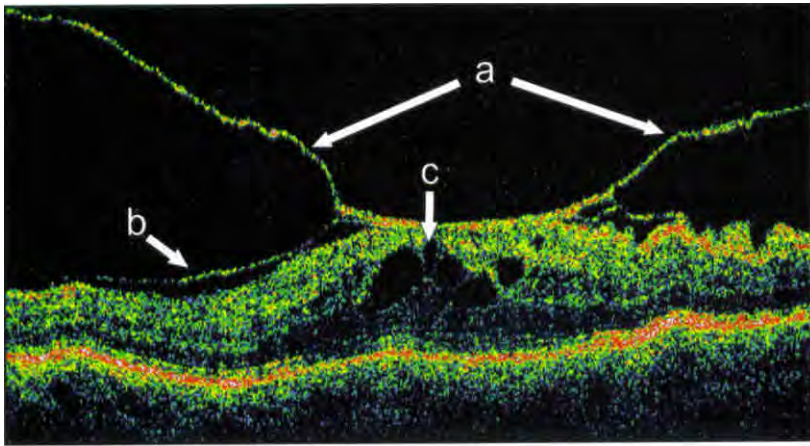
- Diagnosis: Vitreomacular traction
 - Epiretinal membrane
 - Cystoid macular edema

OCT Macular Scan: 3 Months Post-op



- No remaining ERM
- Macular edema resolved
- VA 20/40

Comparison OCT: Preop & Postop



OCT Advantage

- Enhanced visualization of pathological process
- Aided in determining optimal treatment
- Postoperative OCT showed resolution

Case Studies: Retinal Vascular Diseases

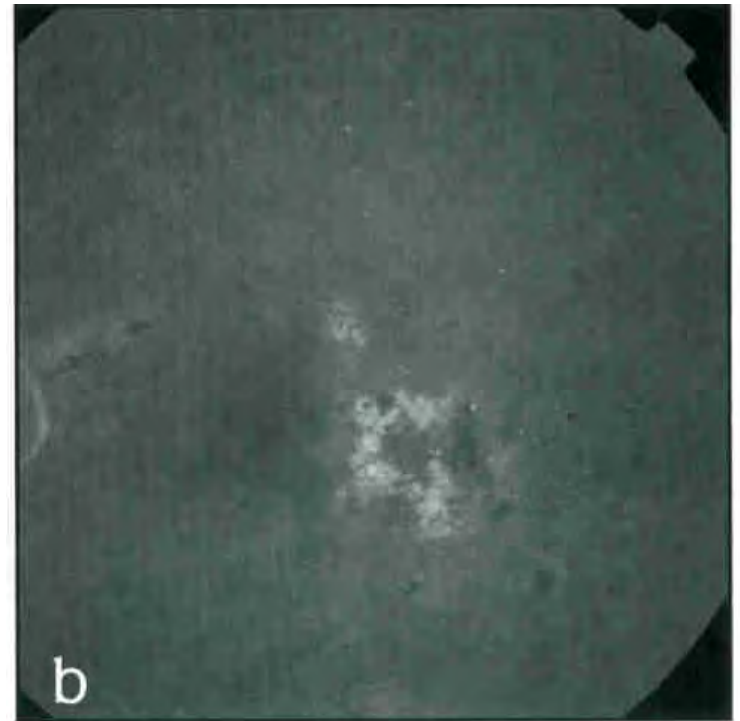
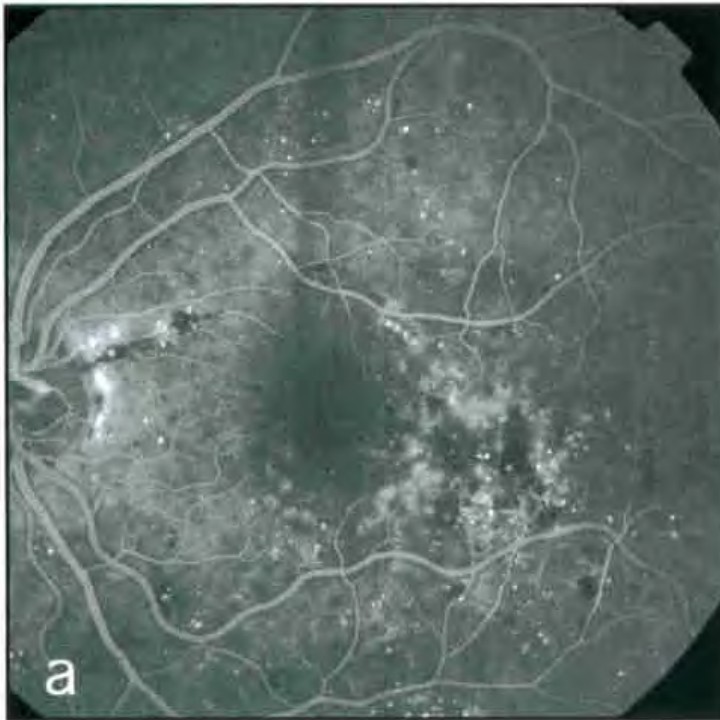
Case 2

- 66-yo woman with severe NPDR OS treated with focal laser photocoagulation complains of subsequent worsening vision OS x several months
- Her visual acuity 20/60 OD, 20/200 OS

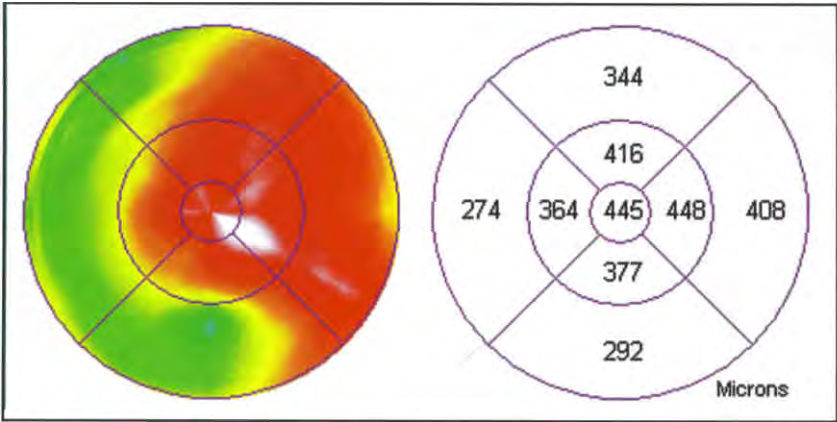
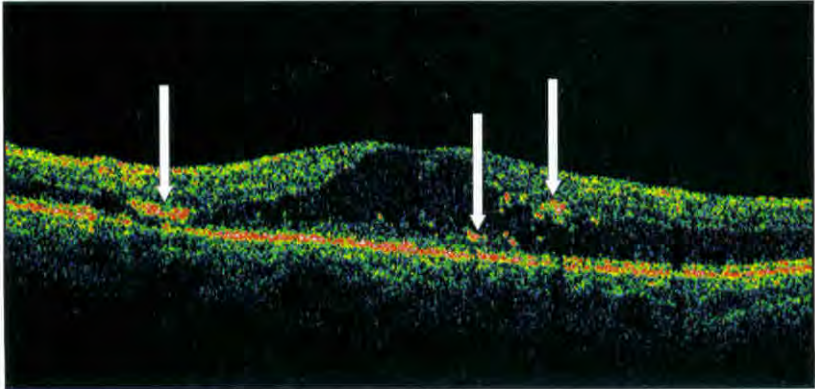
Case 2 Fundus Photo



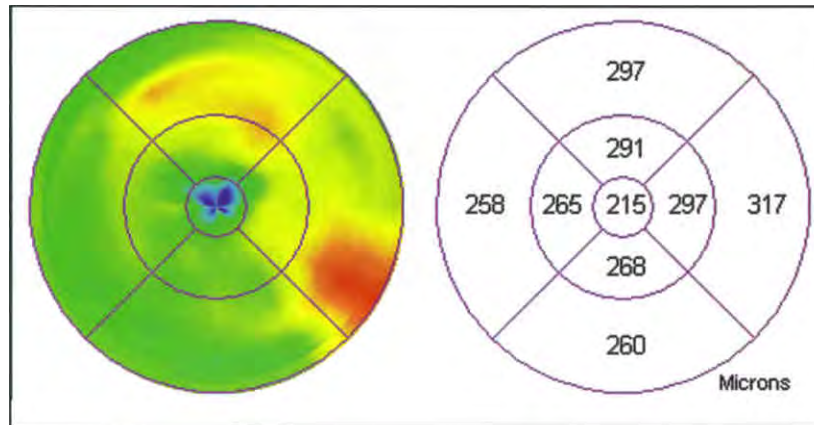
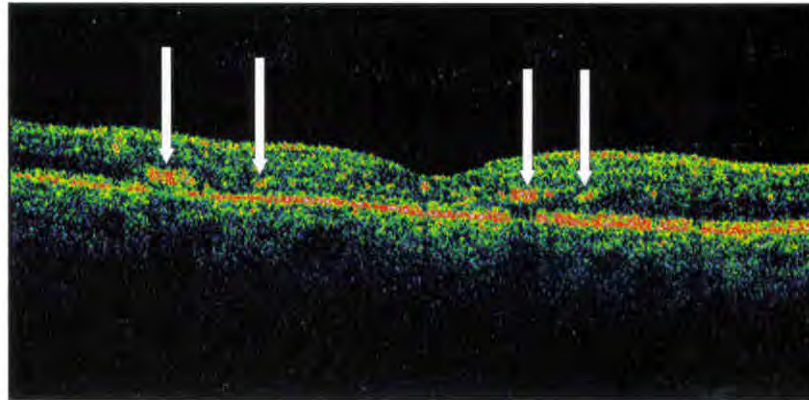
Case 2: FA Early and Late



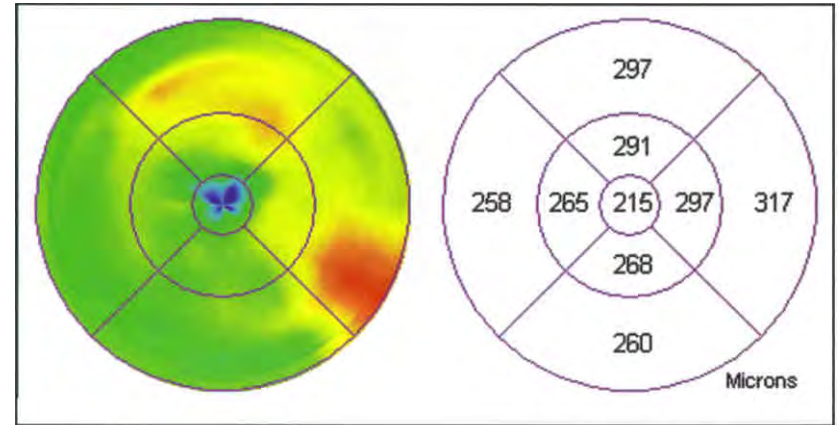
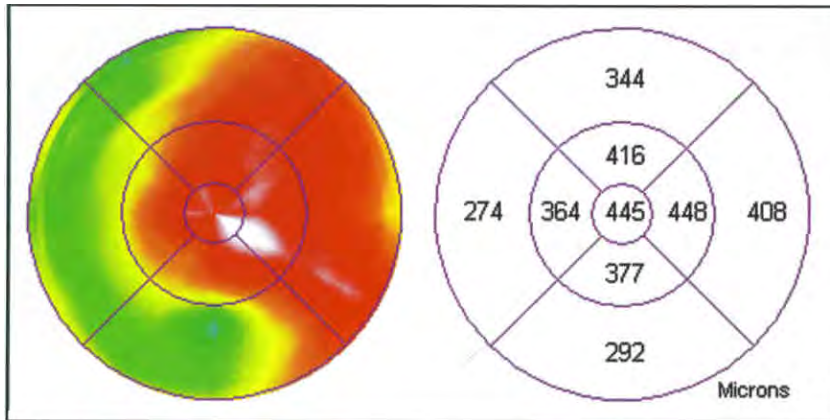
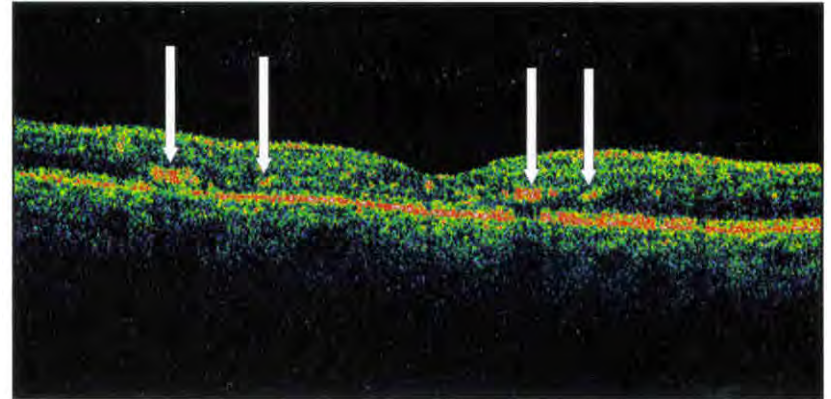
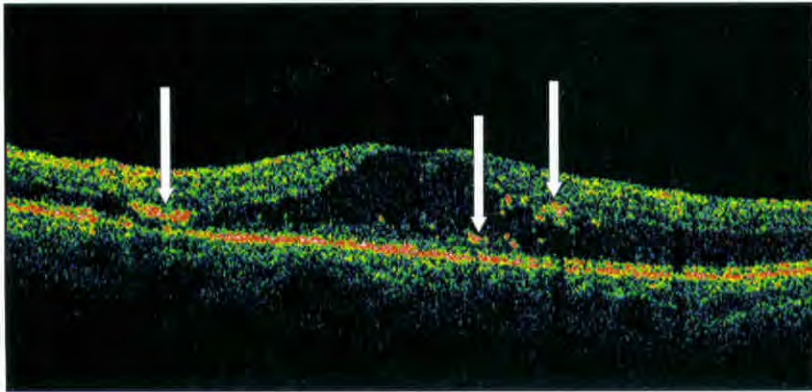
Case 2: Initial OCT - CSME



Case 2: OCT 6 wks post-IVK



Case 2: Pre- and Post-Treatment



Case 2 OCT Advantage

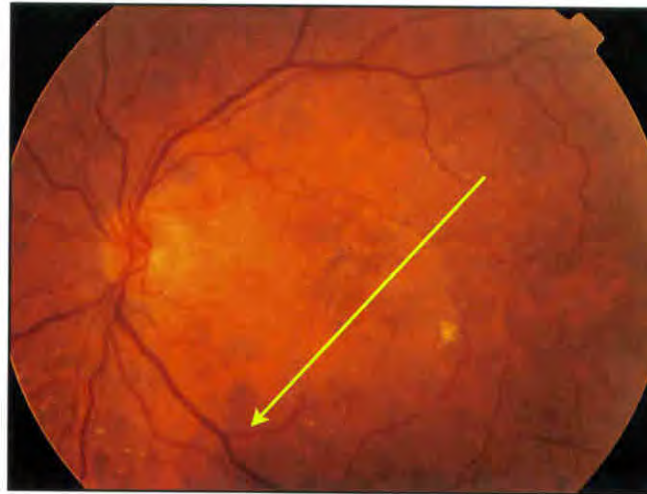
- Quantified morphological abnormality
- Showed failure to respond to original laser treatment
- Showed improvement with adjunctive intravitreal therapy

Case Studies: Other Retinal Entities

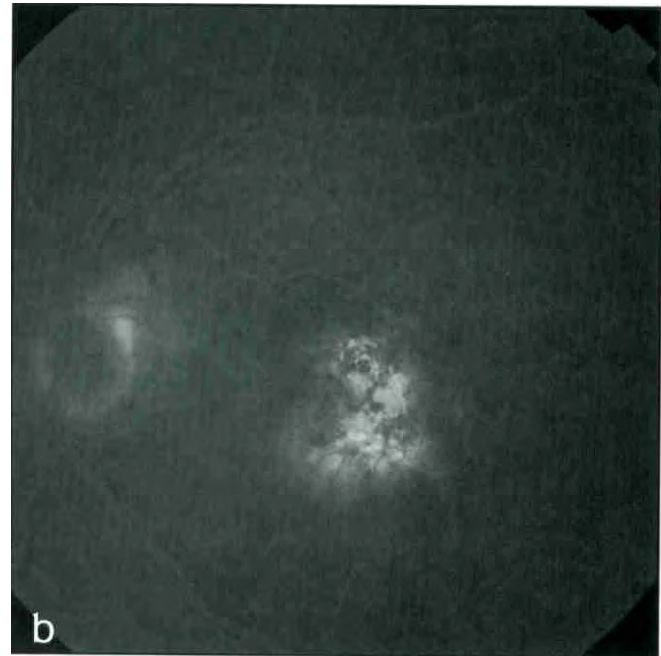
Case 3

- A 75-year-old woman complains of slowly deteriorating vision OS over 6 months
- VA 20/30 OD, 20/60 OS

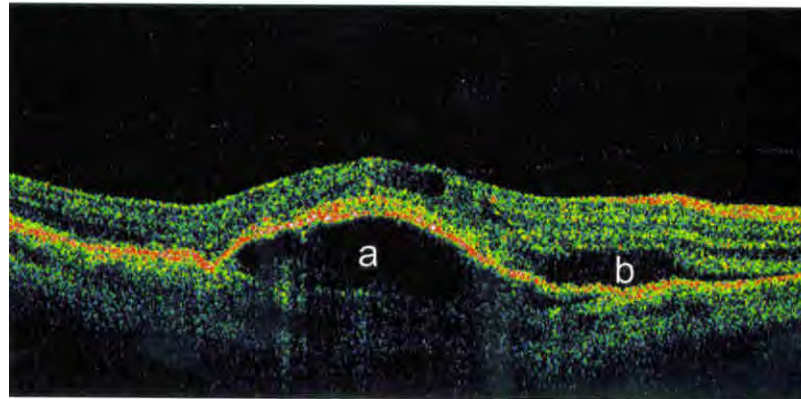
Case 3: Fundus Photo



Case 3: FA Early and Late

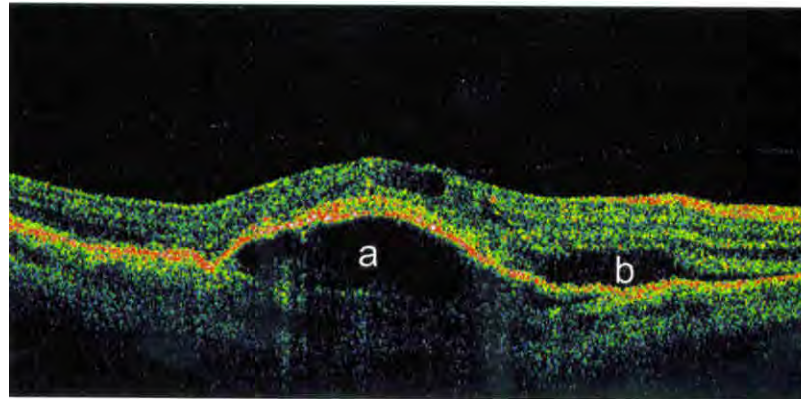


Case 3: OCT



- Diagnosis

Case 3: OCT



- Diagnosis: Wet ARMD with occult CNVM

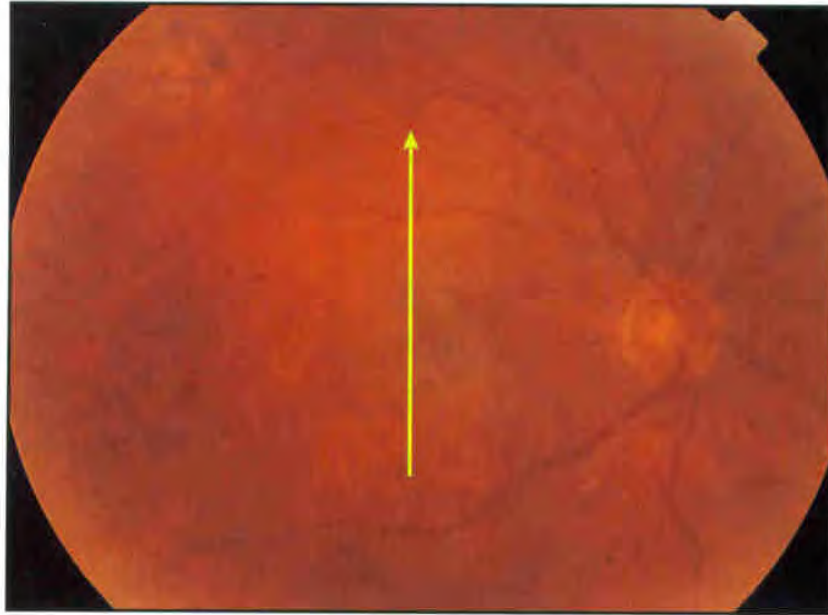
Case 3 OCT Advantage

- Effectively demonstrates the layers involved in the pathological process

Case 4

- A 70-year-old male was referred for evaluation of persistently decreased central visual acuity OD after retinal detachment repair 3 months earlier
- VA remained 20/200 OD

Case 4 Fundus Photo

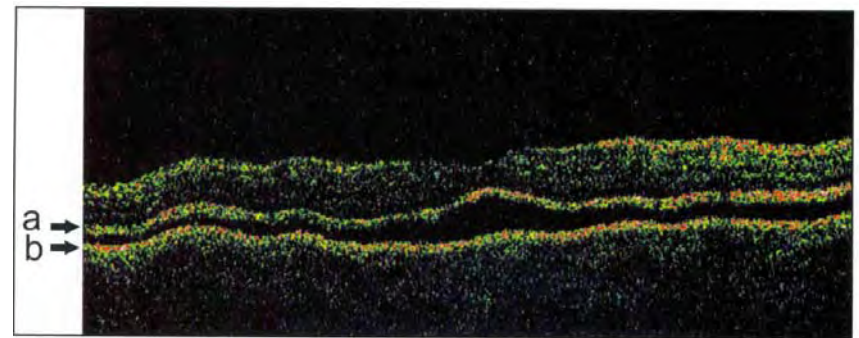
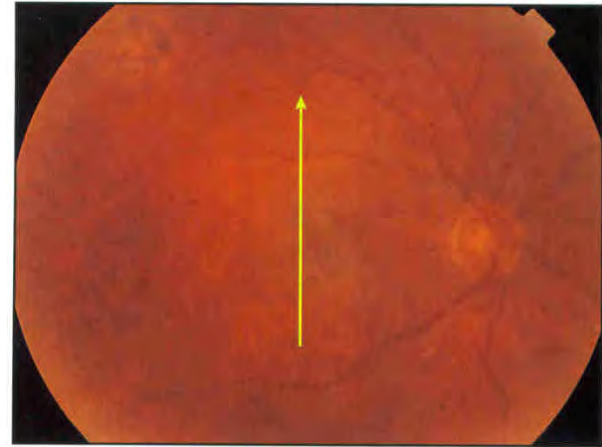


Case 4 OCT



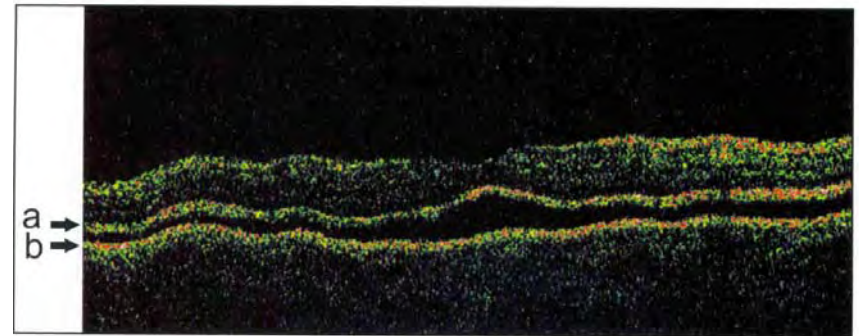
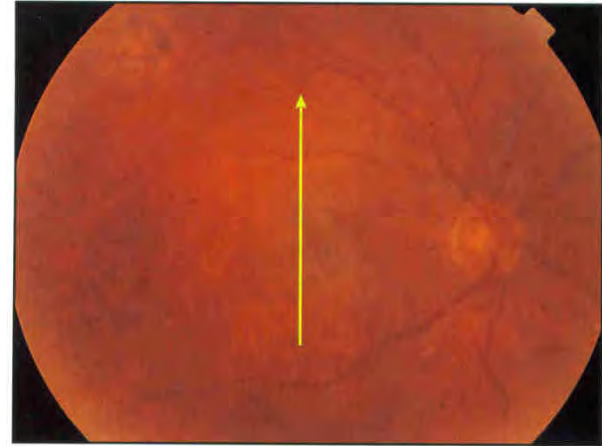
Case 9 OCT Advantage

- Diagnosis?



Case 9 OCT Advantage

- Persistent shallow RD

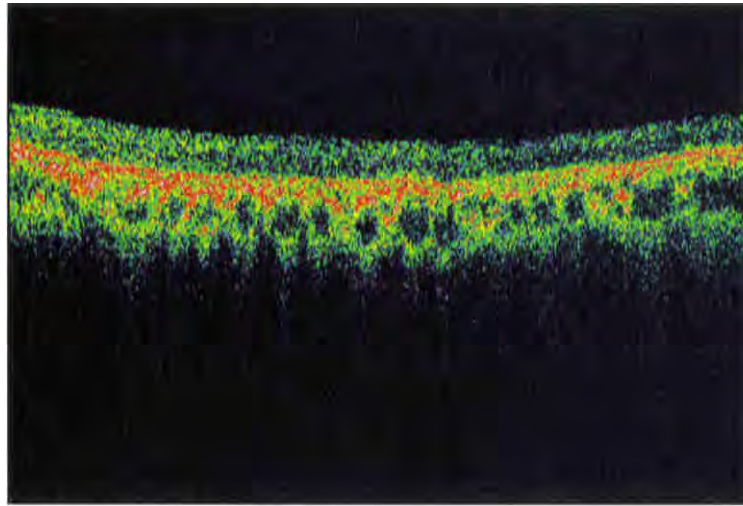


Case 4 OCT Advantage

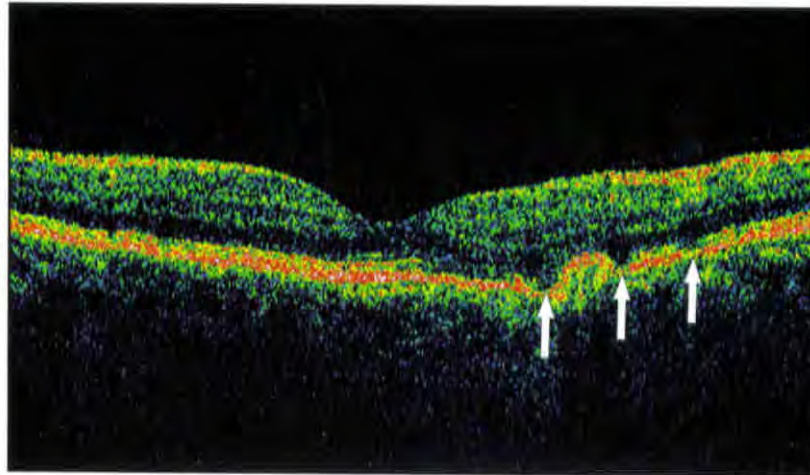
- Reveals structural defect that is difficult to identify ophthalmoscopically

Unexpected Uses

Retinitis Pigmentosa



Angioid Streaks



Summary

- Retinal OCT as useful diagnostic tool for:
 - Evaluating structural integrity of posterior pole
 - Decision making
 - Following sequential change

References

- Schuman, J, Puliafito, C. and Fujimoto, James. Everyday OCT. Slack. 2006.
- Nussenblatt, RB, Kaufman, SC, Palestine, AG, Davis, MD, Ferris, FL. (1987) Macular thickening and visual acuity *Ophthalmology* **94**,1134-1139
- Hee, MR, Puliafito, CA, Duker, JS, et al (1998) Topography of diabetic macular edema with optical coherence tomography *Ophthalmology* **105**,360-370
- Chauhan, DS, Marshall, J. (1999) The interpretation of optical coherence tomography images of the retina *Invest Ophthalmol Vis Sci* **40**,2332-2342
- Koozekanani, D, Roberts, C, Katz, SE, Herderick, ED. (2000) Intersession repeatability of macular thickness measurements with the Humphrey 2000 OCT *Invest Ophthalmol Vis Sci* **41**,1486-1491
- Munuera, JM, García-Layana, A, Maldonado, MJ, Aliseda, D, Moreno-Montañés, J. (1998) Optical coherence tomography in successful surgery of vitreomacular traction syndrome *Arch Ophthalmol* **116**,1388-1389
- Hee, MR, Puliafito, CA, Wong, C, et al (1995) Quantitative assessment of macular edema with optical coherence tomography *Arch Ophthalmol* **113**,1019-1029
- Otani, T, Kishi, S, Maruyama, Y. (1999) Patterns of diabetic macular edema with optical coherence tomography *Am J Ophthalmol* **127**,688-693
- . Early Treatment Diabetic Retinopathy Study Research Group (1991) ETDRS report number 7: Early Treatment Diabetic Retinopathy Study design and baseline patient characteristics *Ophthalmology* **98**,741-756
- Puliafito, CA, Hee, MR, Lin, CP, et al (1995) Imaging of macular diseases with optical coherence tomography *Ophthalmology* **102**,217-229

Thank You

Any Questions?