

# Retinal and OCT Grand Rounds

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1

- ## OCT
- AMD
  - DR/DME
  - ERM/VMT
  - CSR
  - Macula edema from BRVO/CRVO
  - Macula Holes
  - Plaquenil screening
  - OTHER STUFF


2

- ## What's new in OCT?
- MORE SCANS PER SECOND
    - =70 k
  - WIDEFIELD
  - COMBO INSTRUMENTS
    - PHOTOS
    - FAF
    - ANTERIOR SEG
      - Pachmetry
      - Angles
  - GLAUCOMA
    - GCC Analysis


3

## OCT Angiography: the Next Chapter in Posterior Imaging

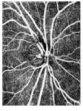
Images retinal microvasculature without dye injection  
Displays structure and function from a single imaging system



2002: Time Domain OCT



2006: Spectral Domain OCT



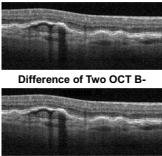
2014: OCTA

4

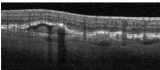
## Principles of AngioVue OCTA

OCTA uses motion contrast to detect flow from OCT data

- Rapidly acquires multiple cross-sectional images from a single location on the retina
- Flow is the difference in signal between two sequential B-scans



Difference of Two OCT B-scans

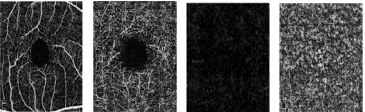


Flow Signal (Red) Overlay on OCT B-scan

5

## Vascular Imaging...No Referral Needed

- See retinal vasculature without referring patients out of the practice
- Visualize signs of disease earlier and make more intelligent referrals
- Manage more pathology to keep patients in the practice longer
- Elevate the practice with state-of-the-art imaging technology



6

### The Utility: Applications of OCTA in the Primary Eye Care Practice

- Observing dry AMD for conversion to wet
- Monitoring diabetic patients
- Visualizing vascularization in PEDs
- Identifying CNV in central serous
- Examining glaucoma patients for vascular changes

Images courtesy of Richard Rosen, MD, Pravin Dugel, MD & Alan Franklin, MD, PhD

Superficial & Deep Plexus in Diabetic Retinopathy      Outer Retinal Zone in Neovascular AMD      Outer Retinal Zone in PED Case

7

### A New Approach to Visualizing Blood Flow

- Patient Benefits
  - Reduces patient burden to allow more frequent imaging
  - Avoid potential side-effects of fluorescein injection
- Clinical Benefits
  - Faster than a dye-based procedure
  - Ultra-high resolution imaging of retinal microvasculature
  - 3D visualization: segments retinal vasculature into individual layers

8

### Comparison of Vascular Imaging Modalities

	FA	ICG	OCTA
Test Administration	Dye Injection Series of Photos	Dye Injection Series of Photos	Non-Invasive, Dye-Free, OCT Scan
Image Presentation	2-Dimensional	2-Dimensional	3-Dimensional, Individual Layers of Vasculature, Allows Localization of Abnormal Flow
Vasculature Imaged	Retinal Vessels	Choroidal Vessels	Retinal and Choroidal Vessels
Blood Flow Visualization	Dynamic, Leakage and Pooling Visible	Dynamic, Leakage and Pooling Visible	Static, Shows Flow Information at a Fixed Point in Time
Field of View	30° - 150°	30° - 150°	?
Procedure Time	30 Minutes	30 Minutes	30 Seconds

9

### Enface OCTA Generated from OCTA Volume Data

- Multiple motion-contrast frames create 3D OCTA volume
- Enface visualization of layers obtained by slicing and projecting slabs from 3D OCTA data

10

### Enface OCTA Slabs: Based on Retinal Anatomy

En Face Visualization of Layers Based on Retinal Anatomy

11

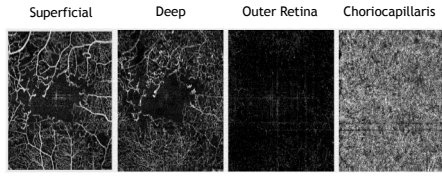
### Normal

Superficial Capillary Plexus      Deep Capillary Plexus      Outer Retinal Zone      Choriocapillaris

Larger Vessels Smaller FAZ than Deep Plexus      Network of Fine Capillaries Larger FAZ      Avascular      Homogeneous Flow

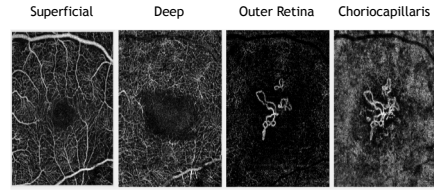
12

### Enface OCTA Overview: Pathology Examples (DR)



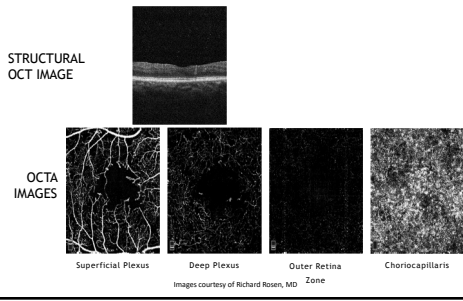
13

### Enface OCTA Overview: Pathology Examples (CNV)



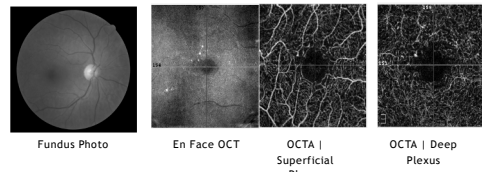
14

### Proliferative Diabetic Retinopathy



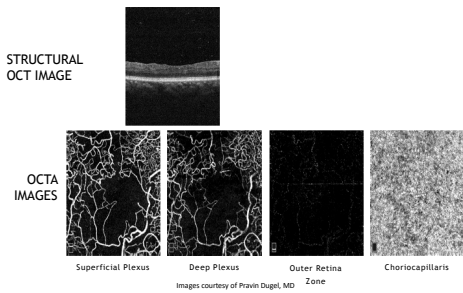
15

### Early Diabetic Retinopathy



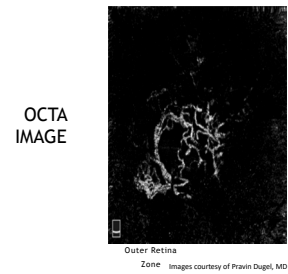
16

### Branch Retinal Vein Occlusion



17

### Choroidal Neovascularization in Age-Related Macular Degeneration



18

### OCTA Shows Reduced Blood Flow in Glaucoma

Normal  
ONH Flow Index = 0.159

Preperimetric Glaucoma  
ONH Flow Index = 0.125

\* J. Y. Moon, et al., Transl. Vis. Sci., 2013; 56(12): 3899-3906.  
 \*\* G. Chen, et al., Eye, 2013; 27(12): 2303-2310.  
 †† J. Y. Moon, et al., Invest. Ophthalmol. Vis. Sci., 2013; 54(12): 3899-3906.

19

### World's First OCTA Quantification of Optic Disc Vasculature

- OCT and OCTA analysis from the same scan:
  - Automatic detection of BMO
  - Rim and Cup area measured within BMO plane
  - Vessel density analysis based on RPC (ILM~NFL)
- Enables extensive analysis of disc structure and vasculature

20

### AngioDisc Trend Analysis

Image courtesy of Eric D. Hoffmann, MD and Michael R. Goldbaum, MD of Shiley Eye Institute, University of California at San Diego, La Jolla, CA

21

### RNFL Thickness Trend Analysis

Image courtesy of Eric D. Hoffmann, MD and Michael R. Goldbaum, MD of Shiley Eye Institute, University of California at San Diego, La Jolla, CA

22

### Overview Report Provides Disc Health at a Glance

One scan generates report showing:

- OCT Intensity
- RPC
- RPC Density
- RNFL
- Cup/Disc

Image courtesy of Eric D. Hoffmann, MD and Michael R. Goldbaum, MD of Shiley Eye Institute, University of California at San Diego, La Jolla, CA

23

### Disc Overview Report Brings New Information to Glaucoma Management

Image Courtesy of Drs. Wessley, Hoffmann, Goldbaum, Zangwill, USC, San Diego, CA USA

24

## Macular Hole

- Present as a circular to oval depression of varying degrees in the avascular area of the macula
  - May have surrounding cuff of edema
- Most common cause is idiopathic
  - other causes include blunt trauma, severe myopia, solar retinopathy, CME
- Highest incidence in 7<sup>th</sup> decade of life
- Women 2x as often as men

25

## Macular Hole

- Vision typically 20/80 to 20/200 with full-thickness hole
- If pt has macular hole in one eye, 28-44% chance of macular hole in other eye w/o a PVD
  - If PVD already, very little chance
- Watzke-Allen sign useful to differentiate true hole from similar appearance
- OCT very useful

26

## FTMH

- Definition: Full thickness macular hole that affects all macular layers from ILM to RPE
- Size
  - Small:  $\leq 250$   $\mu\text{m}$
  - Medium: 250 $\mu\text{m}$  to 400 $\mu\text{m}$
  - Large  $\geq 400$   $\mu\text{m}$
- Presence or absence of VMT
- By cause
  - Primary: Initiated by VMT (formerly idiopathic)
  - Secondary: from associated disease or trauma

27

## FTMH

- Small holes  $< 250$   $\mu\text{m}$ 
  - Small rate of spontaneous closure
  - Very high surgical closure rate (almost 100%)
  - Best response to pharmacologic vitreolysis
- Medium holes 250 $\mu\text{m}$  to 400 $\mu\text{m}$ 
  - High surgical closure rate ( $> 90\%$ )
  - Decent response to pharmacologic vitreolysis
- Large holes  $> 400$   $\mu\text{m}$ 
  - High surgical closure rate (75-90%)
  - No response to pharmacologic vitreolysis
  - $\frac{1}{2}$  of all holes are large at time of diagnosis

28

## LMH

- Lamellar Macula Hole OS
  - Also called partial thickness macular hole
- Pt ed.
- Monitor in 3 mos.
- Repeat OCT
- Consider retina referral if worsens

29

## VMT: Vitreomacular Traction

- VMT syndrome is characterized by a partial detachment of the posterior vitreous with persistent adherence to the macula
  - Can lead to CME, ERM, and macular hole formation
- Once thought to be relatively rare, with advent of OCT now being seen more and more
  - In one study, 8% of pts were thought to have VMT by clinical observation only, but 30% by OCT

30

### VAST STUDY

- 2,179 eyes, 1,120 asymptomatic pts >40 years of age
  - Mean age 59
  - 57% female
  - 57% hyperopes, 35% myopes, 8% emmetropes
- VMA in 31% of eyes
  - Peak age 50-59
  - Less common in AA and HA

31

### VMT

- More commonly encountered in older women
- Can occur in either sex, and age, no apparent racial predilection
- Aphakia and pseudophakia are protective, as these patient typically have a complete PVD
- Pts may report decreased vision, metamorphopsia and photopsia

32

### VMA vs. VMT: Duker

#### VMA

- Evidence of vitreous cortex detachment from retinal service
- Attachment of vitreous within 3 mm of fovea
- **No detectable change in foveal contour or underlying tissues**
- Focal: <1500 um

#### VMT

- Evidence of vitreous cortex detachment from retinal service
- Attachment of vitreous within 3 mm of fovea
- **Distortion of foveal surface, intraretinal structural changes, and/or elevation of fovea, but no full**

33

### VMT

- Clinically, very hard to diagnose
- PVD with adherence to macular area
- Can present as macular surface wrinkling/striae, similar to ERM, or loss of foveal reflex
- May also note a thickened posterior hyaloid membrane
- Retinal blood vessel distortion straightening may be present
- Retinal thickening /macular edema may be associated
- **OCT IS THE KEY!!!!**

34

### VMT

- Natural progression of disease is rather variable
- Slow progression possible with near normal acuity
- Approx 10% will have spontaneous PVD and resolution
- Therefore, close monitoring may be advised for some patients

35

### VMT

- In patients with poor vision, or symptomatic, a pars planar vitrectomy (PPV) may be considered
- Duration, severity should also be considered
- Literature reports up to a 75% success rate and improvement of vision following PPV

36

## Epi-retinal Membrane

- AKA macular pucker, cellophane maculopathy
- Can be secondary to peripheral retinal disease, such as detachment or tear; a retinal vascular disease such as BRVO; inflammation; trauma or idiopathic
- Idiopathic tend to be more mild and non-progressive vs. those after retinal tear

37

## Epi-retinal Membrane

- VA can range from 20/20 to 20/200 or worse
  - Studies show > 5% have worse than 20/200
- Often metamorphopsia is only complaint with idiopathic ERM
- Fewer than 20% of cases are bilateral
- Surgical removal is considered if severe vision loss or distortion

38

## ERM

AGE	INCIDENCE
< 60	1.7%
60-69	7.2%
70-79	11.6%
80+	9.3%

BLUE MOUNTAIN EYE STUDY, AUSTRALIA

39

## Epi-retinal Membrane

- Consider surgery if:
  - VA 20/40 or worse
  - Symptomatic
  - Visual need of patient
- 30 minute procedure
- Make sure you have an experienced surgeon!!

40

## Viagra and CSR

- Retina 2008: Fraunfelder and Fraunfelder
- 11 reported cases of CSR in men taking Viagra
  - In 8/11, pts stopped taking Viagra
  - In 6/8, vision improved with cessation
  - In 3 cases, CSR returned when started med again
  - 2 pts continued to have CSR after cessation
- Might consider recommending cessation of Viagra if active CSR, but relationship is unknown at this time

41

## Central Serous Retinopathy

- Common disorder of unknown etiology which typically affects men between age 20 and 45
  - Males to females 10:1
- Serous detachment of neurosensory retina due to leakage from small defect in RPE

42

## Central Serous Retinopathy

- Pt typically presents with fairly recent onset of blurred VA in one eye with a scotoma, micropsia, or metamorphopsia
  - VA typically 20/30-20/70
  - Often correctable with low hyperopic RX
  - Unilateral in 70% of cases

43

## Central Serous Retinopathy

- Appears as a shallow round or oval elevation of the sensory retina often outlined by a glistening reflex
- FA is helpful in providing definitive diagnosis
  - Classic Smoke stack appearance (occasionally)
  - Ink-blot appearance
- OCT shows marked elevation

44

## CSR: Risk Factors

### TRADITIONAL

- Male > Female 10:1
- Age: Peak 20-45
- Type A personality
- Stress
- Pregnancy

### OTHERS

- Steroid use
  - Oral
  - Topical?
  - Inhaled?
  - Injection?
- Choroidal Thickness
- Sleep apnea?
- Genes?
- Viagra?

45

## Central Serous Retinopathy

- 80-90% of pts will undergo spontaneous resolution and return to normal (or near normal) VA within 1-6 mos.
  - >60% resolve back to 20/20
  - Rare to have vision remain < 20/40
- Approx 40% will get recurrence
- CNVM is VERY rare occurrence, but possible

46

## CSR

- **When to worry/refer**
  - If VA worse than 20/70
  - If pt demographics do not support
  - If does not resolve in 6 mos
  - If gets worse rather than better
  - FA/ OCT does not support diagnosis
  - "Just doesn't feel right"
  - Pt is unable to accept vision/prognosis

47

## Treatment

- Observation
- PDT
- Anti-VEGF
- Anti-corticosteroids
  - Rifampin
  - Mifepristone
  - Ketoconazole
  - Spironolactone/eplerenone
  - Finasteride
- Acetazolamide
- Aspirin
- Metoprolol
- H.pylori treatment
- Methotrexate
- Behavior Modification!

48