OCT: The Optometrist’s MREye

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OCT

- in vivo histology
- Working mechanism: similar to B scan (optical vs. acoustic reflectivity) but uses infrared light
- Resolution: 3-5 microns with SD technology
- Different optical reflectivity in various tissue structures

Spectral Domain OCT

- Time Domain.............then.....
- Spectral Domain..........now....
- Swept Source and OCT dyeless angiography

Swept Source OCT

- Twice as fast (twice as many A-scans / second) as SD OCT
- Allows for wide field imaging (12mm vs. 6-9 mm). Easily gets ONH and macula in the same scan
- Longer wavelength of light, so can image much more effectively through media opacities, and penetrates much better in to the choroid (2.6 mm depth vs. 2.3mm)
OCT angiography

Adaptive Optics (Images courtesy of Dr. Steve Burns)

Different Companies
- Carl Zeiss Meditech
- Heidelberg
- Optovue
- Topcon (Triton Swept Source)
- Others

Importance of normative database
- Typically take demographic factors into account, but not refractive error. This can be very important with high myopes, who will have thinner NFL than their counterparts with equal demographics
- Composition of normative database also very important

Cirrus normative database
- 284 individuals
- Age 18 to 84
- Refractive error +8.00 to -12.00
- 43% Caucasian
- 24% Asian
- 18% African American
- 12% Hispanic
- 1% Indian
- Small amount of others combined
**PIL**

- Line seen at junction of inner and outer segments of the photoreceptors
- Extremely useful for evaluating disease state and visual potential
- Ophthalmology calls it the “ellipsoid line” or “ellipsoid zone”

**Very important!**

**High Myopia with ICSC**

- Precise location of raster lines indicated on LSLO fundus image

**Diabetic Macular edema**

**AMD**

- LSLO fundus image with overlay of retinal thickness map
- 3D layer segmentation maps provide detailed visualization of histology and pathology

**High Myopia with ICSC**

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Pars planitis with chronic CME

Diamox!

What else is going on?

RP WITH CME

RP WITH CME OCT

Post-op CME

Vitreoretinal Interface Disorders

- Idiopathic Epiretinal Membrane
- Vitreomacular Traction Syndrome
- Idiopathic Macular Hole
- Full thickness Macular Hole
### Macular hole sizes
- Small \(\leq 250\) microns
- Medium 250-400 microns
- Large > 400 microns
- Horizontal diameter at narrowest point

### New grading system
- VMA with no change in foveal contour: Stage 0
- VMT with disruption of foveal contour: Stage 1
- VMT with small or medium FT hole: Stage 2
- VMT with medium or large full thickness hole: Stage 3
- Any full thickness hole without VMT: Stage 4
- Lamellar hole
- Psuedohole from ERM

### VAST study: How common is VMA / VMT?
- 1950 eyes
- Age 40-89 years
- Phakic
- No pre-existing maculopathy
- No history of vitrectomy or Jetrea
- VMA prevalence of 39%
- VMT prevalence of 1%
- Most common in 40’s and 50’s, then decreases with age (25% VMA & 2% VMT over age 63)

### VAST study
- Not significantly associated with sex, refractive error, or visual acuity status
- AA 55% less than Caucasians

### ERM
- Membranous growth of glial cells on retina surface
- Can be asymptomatic or very bothersome
- Metamorphopsia is common
- More common after PVD
- Tractional macular holes, cysts, CME, neurosensory RD’s; retinal and choroidal folds, etc.
ERM

ERM + Cystoid Edema

ERM with Macular Edema

“lemon drops”

Neurosensory RD

ILM fracture

ERM with pseudoholes 20/30

ERM with lamellar hole
Macular Holes: 70 Y/O female

- Full thickness macular hole & ERM - OS
  BCVA 20/400
- Pseudohole 20/25 - OD

OD Pseudohole

OS Full Thickness Macular Hole

Pseudohole

Macular hole repair
20/25!

VMA / ERM enface

VMA on an ERM

VMTS 3yrs later 20/20-
VFTS spontaneous resolution after 3 months

VMT / ERM / release with pseudohole

Jetrea (ocriplasmin)
- Effective at breaking VMA about 26% of the time in clinical trials
- Costs $3000-$4000 per injection, covered by some insurance carriers
- Reports of decreased visual function after injection, usually not permanent

Jetrea
- Factors that increase success in real world settings (Ophthalmology Times on-line) to about 50%....
  - VMA < 1500 microns in diameter
  - Age < 65
  - Full thickness macular hole present
  - Phakic eye
  - No ERM

Jetrea
- If PIL line disrupted at one week after injection (recovers by one month), then 75% chance of success
- This PIL disruption may correlate with reports of temporary reduction in visual function

Oasis study
- 2 year trial post approval
- 220 patients: 146 Jetrea, 74 sham injections
- VMA resolution at 28 days: 41.7% Jetrea, 6.2% sham
- Macular hole closure (if applicable) 30% Jetrea, 15.4% sham
- BCVA improvement of 2 lines or more: 50.5% Jetrea, 39.1% sham
Macular Hole Formation

- Full thickness hole OD, VMTS OS

- Attached Operculum

Macular Hole

- Posterior Hyaloid
- Operculum
- Cystic spaces
Macular Hole

Central Serous Retinopathy

CSR with PED

ICSC with “LEMON DROPS”

Old ICSC

ICSC has abnormally thick choroid on SD OCT. EDI: Normal is 250 microns.

ICSC FAF
ICSC FAF

“drops of water on a windshield”

SD-OCT

SD-OCT

SD-OCT

Macular Degeneration
Another Doyne’s Patient

- 73 year old with mild blurring & metamorphopsia OD X 1 month
- Longstanding history of dry AMD OU
- BCVA: OD 20/25- OS 20/20- + Amsler OD
- OCT: See slides
PED with 20/25

PED VA = 20/70

Subretinal fluid...or is there something else?

Same concept

CNVM

S/P Avastin injection- What's new?

Miscellaneous Retinal Conditions
Plaquenil Toxicity FAF

Plaquenil VF OU

Plaquenil toxicity: Flying Saucer Sign

Medullated Nerve Fibers

Retinal Detachment
S/P RD surgery 6 Mos. 20/40

Macula off RD

PDR with traction RD

Horseshoe tear

Development of Foveal Retinoschisis

Foveal Retinoschisis
Another Patient Foveal Retinoschisis

Mystery schisis

Peripapillary retinoschisis
- Underappreciated
- 3-5% of glaucoma patients
- Macula rarely involved
- Can have a visible laminar pit or not
- Can be affected by IOP
- Can affect RNFL readings
- Can resolve
- Also seen in .5% or so of normals

Mystery schisis case 2

hypoony
- Choroidal Folds
Solar maculopathy

Solar maculopathy (images courtesy Dr. Jerome Sherman)

Solar maculopathy vs. Achromatopsia

Adult Vitelliform

Also Adult Vitelliform

Adult Vitelliform Dystrophy
Best’s dystrophy

Cone dystrophy

IJXT with ILM drape
20/40
(Mac Tel II)

Choroidal folds and cyst
Optic nerve head and glaucoma

Granule Cell

Use of GCC analysis with glaucoma

GCC analysis

VF OU

GCC and VF Loss comparison
GCC loss in glaucoma

GCC loss in glaucoma VF

Stroke and GCC loss

Stroke and GCC loss #2

Stroke and GCC loss #2

Drance and wedge defect: are they all like this?
25Y/O female
Dg: IIH Diamox Tx

Resolving

23 y/o male - IIH

Resolution

ONH Drusen

ONH DRUSEN SD-OCT
Improved with EDI
ONH drusen detection with OCT

- Optic Disc Drusen Consortium Consensus……..
- Always use EDI
- Blood vessels are more solid, cast a shadow, and can show as figure 8
- Drusen always prelaminar
- Drusen always hyporeflective
- Drusen often have a hyperreflective border, especially superiorly

ONH drusen detection with OCT

- Drusen can conglomerate, and these areas can have some internal reflectivity from borders
- The old concept of a hypoflective fluid wedge at the edge of the nerve in true papilledema DOES NOT APPLY with SD-OCT. Was a time domain OCT artifact.

FAF ONH drusen
Anterior Segment OCT

- Many units available with anterior segment capability

Wide angle to angle

OCT pach

Plateau Iris
Wound leak with choroidals

Wound leak post repair

Scleral lens

Scleral lens

Scleral lens landing zone
Two for the price of one!

THE END!