INTERPRETING RETINAL OCT'S & INTRODUCING OCT-ANGIOGRAPHY

Nate Lighthizer, O.D., F.A.A.O.
Associate Professor
Assistant Dean for Clinical Care
Director of Continuing Education
Chief of Specialty Care Clinics
Oklahoma College of Optometry
lighthiz@nsuok.edu

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Disclosures

- Aerie Pharmaceuticals
- Biotissue
- Diopsys
- Ellex
- EyePromise
- Ivantis
- Lumenis
- Maculogix
- Nidek
- Nova Ocular
- Novartis
- Optovue
- Quantel
- Reichert
- RevolutionEHR
- Sight Sciences
- Shire
- Sun Pharma

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Overview

- Beyond (Retina) First
  - History/principles of the OCT
  - What does the normal retinal OCT look like
  - Vitreal disorders
  - Retinal/RPE disorders
  - Choroidal disorders
- Glaucoma
  - What does the normal ONH OCT look like
    - rNFL
    - GCA
  - ONH disorders

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History of OCT

- 1991: 1st scientific description of the OCT
  - Huang et al, Science. 1991; 254 (5035): 1178-1181.
- Original Founders:
  - David Huang, M.D., PhD
  - Dr. James Fujimoto, PhD
  - Eric Swanson, MS
  - Carmen Puliafito, M.D.
  - Joel Schulman, M.D.
- Introduced commercially in the mid-1990's

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The Beginning OCT

- 1995 OCT1 debuted at 100 axial scans per second with a resolution of 20 microns

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Evolving the OCT

- Stratus OCT – 2002
  - "Time domain"
  - 500 axial scans/second
  - 10 micron resolution

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Evolving the OCT

- "Spectral-Domain" OCT – 2007
  - "Fourier-Domain"
  - 27,000 – 40,000 axial scans/second
    - Analyzes data using a spectrometer
    - Does not use a moving mirror
    - Very fast acquisition speed
      - 65x greater acquisition speed
    - 3-D imaging

  *** 3.5 – 6 micron resolution ***

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Understanding and Interpretating the Retina OCT

- Choroid
- 10 layers of the retina
  - RPE
  - Photoreceptors
  - ELM
  - Outer nuclear layer
  - Outer plexiform layer
  - Inner nuclear layer
  - Inner plexiform layer
  - Ganglion cell layer
  - Nerve fiber layer
  - ILM
- Vitreous

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Posterior Vitreous Detachment (PVD)

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Vitreo-macular adhesion/traction (VMT)

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Vitreomacular traction

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Vitreomacular traction

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Macular hole

- Unilateral, decreased vision
  - Often in 60-80 year old women
  - Anyone w/ a history of trauma
- Symptoms:
  - Decreased vision, metamorphopsia
    - 20/200 for full thickness holes
- Signs:
  - Red hole in the macula
  - (+) Watzke-Allen sign

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Macular hole

- Stages
  - Stage 1a -> impending hole. Normal foveal depression with yellow spot/dot in fovea.
  - Stage 1b -> Abnormal foveal depression with yellow ring.

Stage 1b macular hole

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Macular hole

- Stages
  - Stage 2 -> Small full-thickness hole. 20/80 - 20/400.
  - Stage 3 -> Full-thickness hole w/ cuff of SRF. No PVD
  - Stage 4 -> Full-thickness hole with cuff of SRF, with complete PVD.

Stage 2 macular hole

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Macular hole

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  - Stage 3 -> Full-thickness hole w/ cuff of SRF. No PVD
  - Stage 4 -> Full-thickness hole with cuff of SRF, with complete PVD.

Stage 3 Macular hole

Stage 4 macular hole →

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Macular Hole

- Treatment:
  - Stage 2 holes or beyond (full thickness macular holes)
  - Vision 20/40 or worse
  - How long has the hole been there???
  - Vitrectomy & membrane peel
  - Face down???
- Prognosis:
  - 20/40 or better in up to 65% of cases

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Lamellar Macular hole

- "Partial thickness macular holes"
- Aborted macular holes

- "Upside down anvil" "anvil-like"
- VA -> usually 20/40 or better
- 4 characteristics
  1. Irregular foveal contour
  2. Break in inner fovea
  3. Intraretinal split
  4. Intact foveal photoreceptors

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Pseudohole

- "False hole"
- Simulates macular hole w/o actual tissue dehiscence
- Full thickness retinal tissue is still present
  - Not an anvil

- VA
  - Usually 20/20 – 20/30 unless significant ERM is present

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Cystoid Macular Edema (CME)

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Cystoid Macular Edema (CME)

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Diabetic macular edema (DME)

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CSME vs. CME???

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Central Serous Chorioretinopathy (CSR)

- Demographics
  - 25-50 year old men, stressed/Type A personalities
- Symptoms
  - Unilateral, blurred vision
    - VA -> usually 20/20 – 20/80
  - Metamorphopsia
- Signs
  - Localized serous detachment of the neurosensory retina in the macula

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Central Serous Chorioretinopathy

- DDx:
  - Optic disc pit
  - CNVM

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Central Serous Chorioretinopathy

- Med associations:
  - Steroids
    - Nasal sprays, steroid creams, oral, injectable
  - Ephedra
    - Ephedrine & pseudoephedrine
- Treatment:
  - Observation/lifestyle change
  - D/C steroid if possible
  - Possible laser therapy

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Plaquenil Toxicity

- Antimalerials:
  - Chloroquine
  - Hydroxychloroquine (Plaquenil)
- Now used for RA, SLE, Sjogren's, etc.
- Toxicity risk is low, but….
- Lots of different screening recommendations have been proposed

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Plaquenil Toxicity

- Risk Factors:
  - Cumulative dose**
    - 1000 gram cumulative dose for Plaquenil
    - 6.85 years to reach that
  - Daily dose
  - Age
  - Liver or kidney dysfunction
  - Pre-existing retinal disease or maculopathy

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Plaquenil Toxicity

- Symptoms:
  - Asymptomatic early
  - Paracentral visual field defects affecting reading
  - Color vision changes
- Signs:

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Plaquenil Toxicity

- Recommended Screening Guidelines:
  1. Baseline exam within the first year of starting Plaquenil
     - Biomicroscopy exam, 10-2 VF, Fundus photos, OCT
  - After 5 years, annual screening exams
    - SD-OCT or
    - mfERG or
    - Fundus autofluorescence

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Plaquenil Toxicity

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  1. Baseline exam within the first year of starting Plaquenil
     - Biomicroscopy exam, 10-2 VF, Fundus photos
     - SD-OCT or mfERG or fundus autofluorescence
  - After 5 years, annual screening exams
    - Biomicroscopy exam along with 10-2 VF and
    - **SD-OCT** or
    - **mfERG** or
    - **Fundus autofluorescence**

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Plaquenil toxicity "saucer sign"

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Plaquenil Toxicity

- Tests not recommended for screening
  - Fundus photography
  - Time-domain OCT
  - FA
  - Full-field ERG
  - EOG
  - Color vision testing
  - Amsler grid

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Plaquenil Toxicity

- Treatment:
  - No medical therapy is available to treat/cure the toxicity
  - D/C the med if possible
    - Work with the PCP

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Dry Age-related Macular Degeneration (AMD)

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Dry Age-related Macular Degeneration (AMD)

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Dry Age-related Macular Degeneration (AMD)

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Dry Age-related Macular Degeneration (AMD)

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Dry Age-related Macular Degeneration (AMD)

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Wet Age-related Macular Degeneration (AMD)

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Wet Age-related Macular Degeneration (AMD)

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OCT-ANGIOGRAPHY

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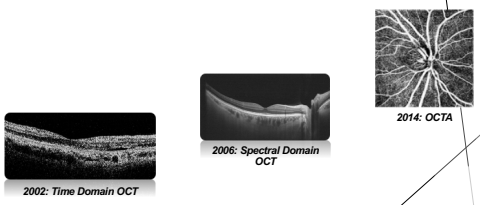
OCT Angiography: the Next Chapter in Posterior Imaging

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



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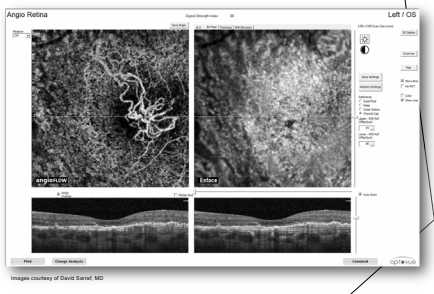
Structure & Function from One System



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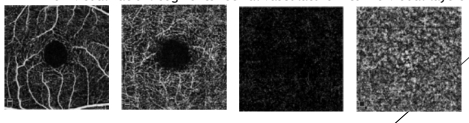
A New Approach to Visualizing Blood Flow

- 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



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OCT-Angiography

How Does it Work?

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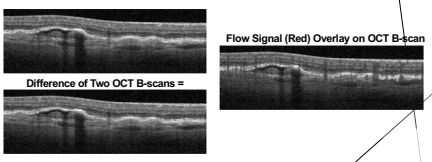
Principles of OCTA

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



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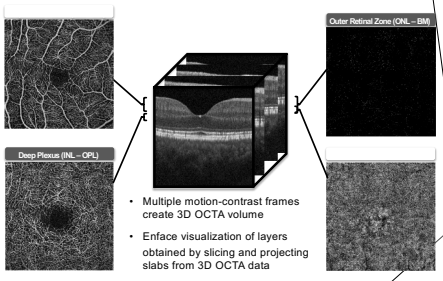
Enface OCTA Generated from OCTA Volume Data



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

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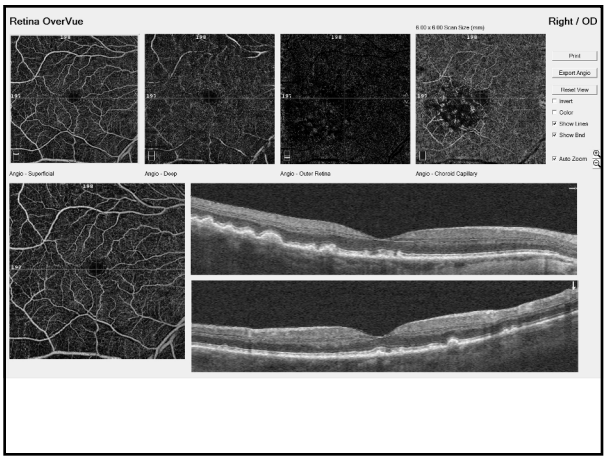

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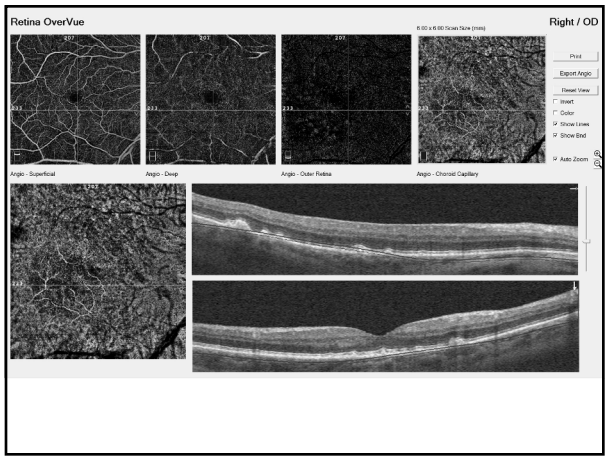

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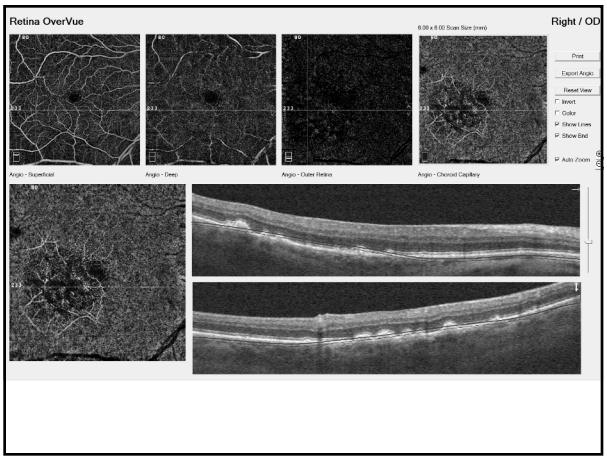

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OCT-ANGIOGRAPHY

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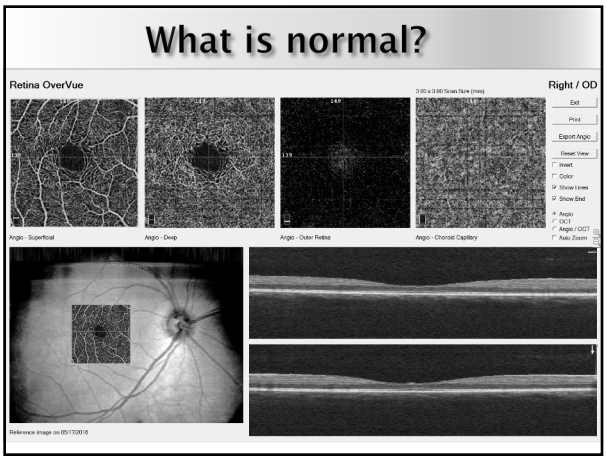

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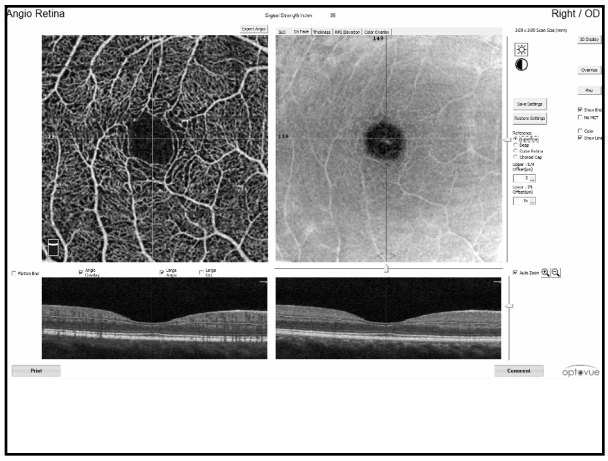

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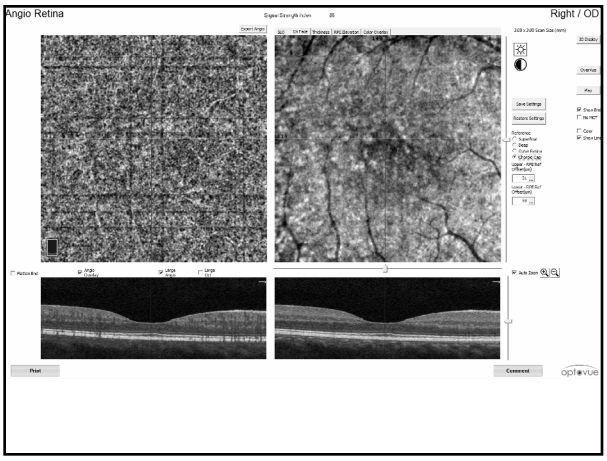

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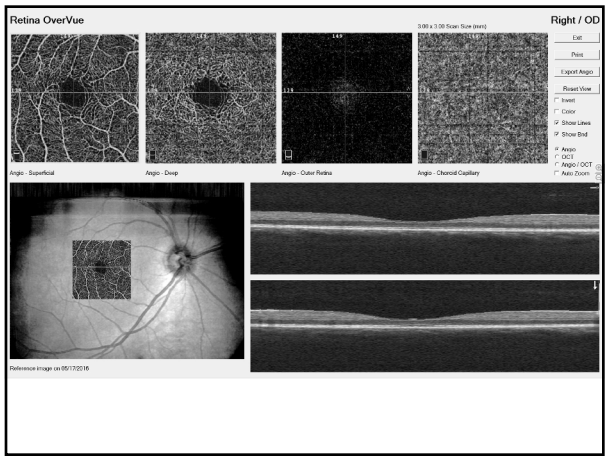

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OCT-A in our clinic

Indications:

AMD – dry vs. wet
Diabetics -
- is there neo?
- is their non-perfusion (capillary dropout)?

Vein Occlusions
Glaucoma patients
- nerve perfusion?

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