OCT Mumbo Jumbo

Pearls and Pitfalls of OCT in Glaucoma
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Optical Coherence Tomograhpy(OCT)

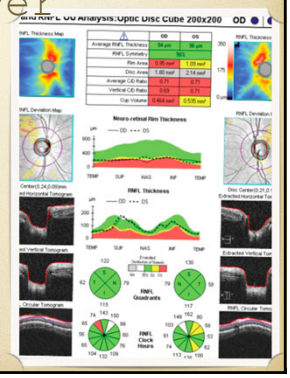
- Non-Contact, Non-invasive imaging device used to exam layers of the retina by looking that the interference patterns of reflected laser light from the individual tissues.
- Glaucoma (Retinal Nerve Fiber Layer, RNFL)

Types of OCT

- Time Domain OCT (TD-OCT)
  - Stratus OCT
- Spectral Domain OCT(SD-OCT)
  - Higher Resolution with faster image capture
  - Cirrus SD-OCT(Zeiss)
  - Spectralis OCT (Heidelburg)
  - RTVuve-100 (Optovue)
- Ultrahigh speed swept source, ultrahigh resolution, adaptive optics OCT

Retinal Nerve Fiber Layer

- 3.4mm circle of RNFL is scanned to create a TSNIT map.
- Compares patient thickness to a normative database (284 pts)
- Clocks and Quadrants



Pitfalls with RNFL

- **Look at Signal Strength (6+/10, Ideal 8+/10)**
  - **Poor due to Tech, patient(blink,movement) or media**
- The High Myope!! Split Inf/Sup NFL Bundle
  - Look for triple hump sign
- Testing Variability with Guided Progression Analysis
  - 3-5 um is considered normal average variability
  - Become suspicious for progression at 8-10um avg total loss(2 S.D./95% CI)
  - Become suspicious for progression at 5-6um in any single quad (Sup/Inf)
  - Pseudophakia (demonstrated to increase RNFL thickness up to 9% post CEIOL!!)
- Natural Progression of RNFL loss
  - 0.5-1um/year avg; 1-1.5um/year sup/inf avg

Signal Strength

- Always exam Signal Str of every scan (8+ ideal and 6+ is mandatory)
- Delete these scans from database esp for progression analysis.
- Look at image collected
  - Blinks miss inf half of RNFL
    - Black=0um measurement!!
  - PVDs block based on location
    - Thin RNFL
  - Cataracts reduce RNFL up to 9%
    - Cortical>PSC>NS
  - Asteroid Hylosis
    - DON'T GET ME STARTED!

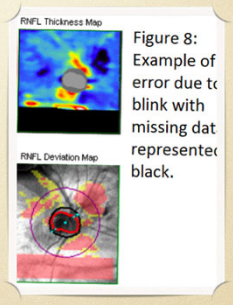


Figure 8: Example of error due to blink with missing dat represented black.

Segmentation Errors

- Deviation Map Centration
  - Confirm centration around the disk
- Segmentation Error (Look at Segmentation Lines)
  - Confirm scans are not in zero range (near top of image range)
  - Occurs in myopes with staphylomas/PPA and Optic Nerve Tilt
- SD-OCT has eye tracking feature which allows for more accurate measurements
  - Uses blood vessels for alignment
  - Make sure its on (Machine)

Segmentation Error

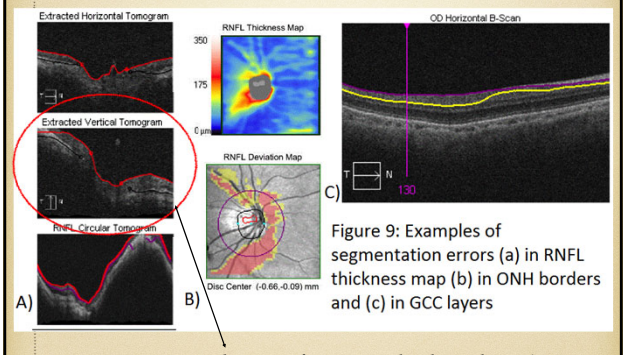


Figure 9: Examples of segmentation errors (a) in RNFL thickness map (b) in ONH borders and (c) in GCC layers

Large degree of Temporal Tilt with PPA

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  - Axial length, large C:D, Flooring Effect, Look for triple hump sign
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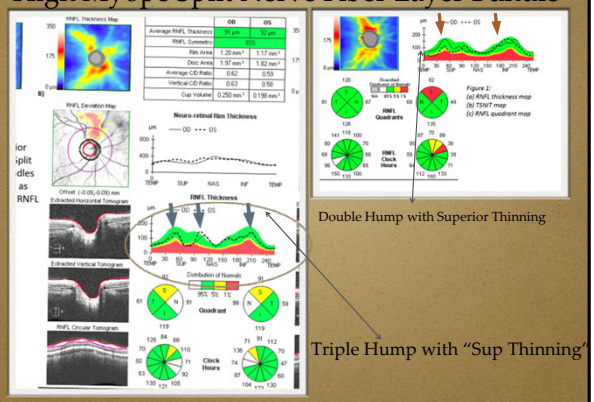
The Myope

- The Most Difficult Interpretation
- Normative Nomogram (284 patients)
  - Ranged from -12.0D to +8.0D (Handful of pts were >-6.0D)
  - Best comparison is usually the patient to themselves (serial scans 3+ to start)
- Axial Length Induced Magnification (>25.0mm)
  - Artificial thinning of NFL and poor estimations(shrinking) of neuroretinal rim
  - Larger C:D estimations and severe thinning estimates (Floor Effect)
  - Not currently accounted for on any OCT software/nomograms
  - Not due to refraction unless greater than -20.0D
- Temporal Tilt and Peripapillary Atrophy/Staphaloma (Segmentation Errors)
  - Split RNFL, Large Staphaloma or marked PPA make for reproducibility nightmares
- Best correlated with great 8/10 repeat scans, ignore the nomograms and serial FF and HVFs

High Myope Split Nerve Fiber Layer Bundle

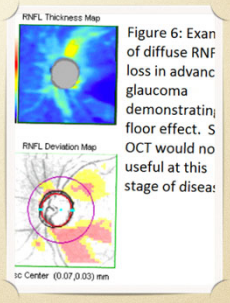


Double Hump with Superior Thinning

Triple Hump with "Sup Thinning"

Floor Effect

- Severe Thinning of RNFL
  - Seen in Myopes and Advanced Glaucoma
- Be suspicious for Floor Effect when
  - Scan quality is good(no black)
  - Rim is thin
  - Measurements are <45um
    - Glial cells +BV and connective tissue =40um.
- If scan cannot be improved, must rely on visual fields and fundus photos



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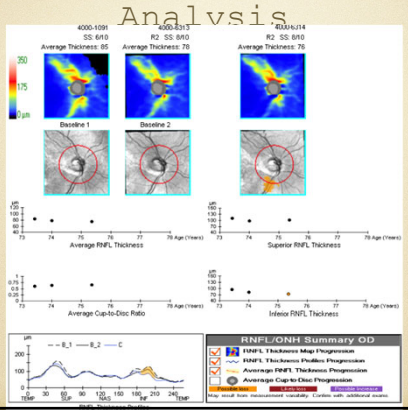
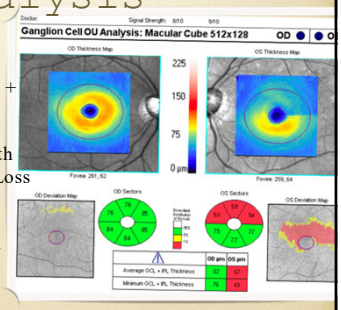
Guided Progression Analysis



Ganglion Cell Analysis

- Measurement of GCL + IPL of Macula
- Strong correlation with RNFL loss and GCL Loss
- GCL loss may detect earlier glaucoma than RNFL measurements



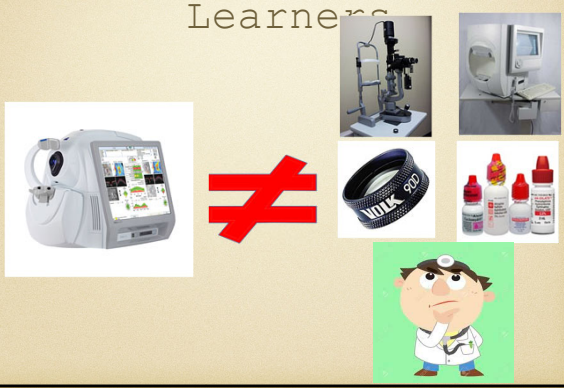
Pitfalls to GCA

- GCC of macula is about 50% of total RGCs at disc
- Anything that effects the macula will effect GCA accuracy/usability
  - ERMs, DME, CME, BRVO,BRAO,CNVM/ AMD and Myopic Degen

Conclusion

- OCT in any form is a useful test for monitoring and diagnosing glaucoma
- However it should NEVER be the sole means for diagnosis and monitoring of disease.
- Must be used in conjunction with other modalities and physician judgement/interpretation.

For the Visual Learners



Thank You