Contemporary Tomography & Topography

- **Technology:**
  - OCT (Cirrus, OptoVue)
  - HRT III
  - GDx VCC
  - RTA IV

Cystoid degeneration

- Recent correlations between OCT, histology

Localized retinal detachment

- Recent correlations between OCT and histology
- Note retinal cysts, SRF, vitreous [in OCT image], sensory retina separated from RPE

Confocal Laser Scanning Retinal Topography

- Uses a **confocal laser scanning system** for acquisition and analysis of three dimensional images of the posterior segment of the eye.
- HRT

Confocal Laser Scanning Retinal Topography

- **Visible laser light** is focused on the retina and periodically deflected by oscillating mirrors.
- **Reflected light** at each point is measured using a light-sensitive detector.
- Light reflected outside of the focal plane is highly suppressed.
Confocal Laser Scanning Retinal Topography

- A two-dimensional confocal image is formed. It may be regarded as an optic section at any given focal plane.

Heidelberg Retina Topography

A three-dimensional image acquired with the HRT is a series of 32 optical section images at different depths from the initial focal plane, (e.g., of an optic nerve head)

HRT Imaging of CSME

Edema Value Thick 5.24 Edema Value Thin 1.38

Allows localization of edema

HRT Imaging of CSME

Reflectivity Image

CSME S/P 2 weeks

Edema Value Thick 2.52 Edema Value Thin 1.29

Edema reduced
Data acquisition algorithm

Normal tomographic sections

Ultrasound (Diagnostic Echography)

- Indications
  - Opaque Media
  - Following trauma with suspicious fundus findings / poorly visualized fundus
  - Monitoring suspicious pigmented/elevated fundus lesions
  - Axial length measurements

Ophthalmic Ultrasound

- "Sonar for the eye"
- Frequencies: 7.5 – 15 MHz
  - higher = better resolution
  - lower = deeper tissue penetration
- TRANSDUCER produces ultrasonic wavetrain and receives echoes
- "Echography"
**Ophthalmic Ultrasound**

**A–scan ultrasound (amplitude)**
- Echoes recorded as spikes on the time (X–) axis
- Position along the time axis corresponds to distance from the signal origin (probe/transducer)
- Most frequent application is axial–length measurement
- Probe is placed on the cornea (saline interface) and patient fixates a light to measure axial length corresponding to the fovea

**B–scan ultrasonography (brightness)**
- Stronger echoes are represented as brighter spots
- Scan can be dynamic (eye movements, probe movements)
- Can be used to simulate topographic information (*pseudo 3–D*)
- Corresponding A–scan may be displayed with the vector (tracer)
- Probe can be placed against cornea/sclera or closed lid

---

**Clinical procedure (B–scan)**

**Axial section**
- anteriorly, lens (gets in the way)
  - posteriorly, *shadow indicates optic nerve*
- with one eye fixating it is easier to direct the patient’s gaze to area of interest
  - aim for the item of interest

**Transverse section**
- Aim for the position of the fundus that is to be imaged (for superior, pt. looks up)
- Probe is placed on the limbus or against the lid and aimed toward the item of interest
- Advantages:
  - avoids the lens
  - allows pseudo 3–D [topographic] appreciation
Longitudinal section
- Similar in approach to axial but probe is held with the mark in the same position while the probe is moved nasally/temporally yielding a series of sections along the anterior–posterior axis of the globe
- The mark of the probe may be either upright (12 o’clock) or laterally placed giving a corresponding vertical or horizontal representation on the screen

A Screening examination sequence
- Axial section (probe is vertical or horizontal) imaging the optic nerve
- Transverse sections of the superior, inferior, nasal and temporal peripheries
- Longitudinal scans of any disorders encountered
- Dynamic transverse / longitudinal sections for mental topographic reconstruction / quantification

Interpretation
Reflectivity (B–scan)
- Useful in differentiating interfaces
- Will vary with “gain setting”
- Examples
  - highly reflective structures will remain bright with attenuation (reduced gain) [calcification – buried drusen]
  - homogeneous lesions will have high surface reflectivity but appear hollow (acoustically dark) on B–scan [malignant melanoma]
- Comparison to the A–scan information

Kinetic Ultrasound
- As the patient moves the eye, the contents' image may be viewed dynamically on the screen (not printout)
- Examples:
  - asteroid bodies
  - other vitreous opacities including PVD
  - retinal detachment
  - intraocular foreign bodies
  -

Practical Application
- A–scan
- axial length measurement
  - anisometropia
  - IOL calculation
-
Opaque media
- malignant choroidal melanoma
- vitreous hemorrhage
- what’s behind that cataract?
Clear media
- malignant choroidal melanoma
- penetrating ocular trauma
- buried optic nerve head drusen

28 M hit with baseball @ age 12
VA 20/XXXX
Angle recession
Constant R XT
Desires cataract surgery to improve VA

Based on these images, what is your diagnosis / advice?

71 M with non-contributory history and VA = 20/40
consistent with cataract and a pigmented elevated lesion
B–scan – Clinical Application

Indications

- A–scan in anisometropia, pre–cataract eval., etc.
- B–scan
  - opaque media (RD)
  - cloudy media
  - suspicious elevation

Vitreous floaters

Vitritis

Asteroid bodies

Vitreous hemorrhage
Vitreous hemorrhage

http://www.refindia.net/ref/activities/onlinelectures/

Long-standing vitreous heme.

http://www.refindia.net/ref/activities/onlinelectures/

PVD

http://www.refindia.net/ref/activities/onlinelectures/

PVD

http://www.refindia.net/ref/activities/onlinelectures/

Subhyaloid hemorrhage

http://www.refindia.net/ref/activities/onlinelectures/

Retinal detachment

http://www.refindia.net/ref/activities/onlinelectures/
RD vs. PVD appearance at disc

http://www.refindia.net/ref/activities/onlinedisorders/

Traction RD

http://www.refindia.net/ref/activities/onlinedisorders/

Intraocular mass (retinoblastoma)

http://www.refindia.net/ref/activities/onlinedisorders/

Choroidal Malignant Melanoma

http://www.refindia.net/ref/activities/onlinedisorders/

Choroidal detachment

http://www.refindia.net/ref/activities/onlinedisorders/

Intraocular foreign body

http://www.refindia.net/ref/activities/onlinedisorders/