Ultrasonic Biomicroscopy (UBM)

Examining Techniques and Extending the Reach of Clinical Applications

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Ultrasound Biomicroscopy (UBM) of the eye

Visante™ OCT Anterior Segment Imaging and Biometry

Problems with traditional Shell & Gel examination method

- Worry about probe tip hitting the cornea
- Probe sterility issues
- Methodology concerns
  - Patient must recline
  - Gel often required
  - Shell must be inserted under the lids and (uncomfortable)
  - Likelihood of corneal abrasions from shell as posterior structures are examined

Problems with traditional examination method

- Consequently
  - More acceptance of HF ultrasound
  - If more convenient

Why must a shell be used in the first place?
Near Field Artifact Requires Standoff

- By physically moving the ultrasound probe tip back and forth via a motor, a sector of 120 degrees can be examined.
- The moving ultrasound probe/nub causes ultrasound waves to collide with one another creating interference which results in an acoustic dead zone.
- Structures contained within this dead zone can not be visualized and this is termed "near field artifact".

The ClearScan cover replaces the gel & shell technique

Safety-Sterility-Comfort

- Cover material becomes a balloon once probe inserted
- Creating positive pressure and resistance so nub stays away from the cornea

Safety

- ClearScan® patent pending is a disposable product
- Sterile bag/balloon surrounds probe

Sterility
**Sterility**

- Study* (in preparation) of patient-to-patient transfer of micro-organisms on the ClearScan after a single use in 34 patients
  - 80% of samples grew “bugs” associated with endophthalmitis, keratitis

  *Bell et al.

**Sterility**

- FDA requires sterility for any instrument that touches the eye
- The 5-10 sec alcohol wipe - ineffective
  - 90% of RNA still present
- Anything that touches the eye is a Class II device & must be approved by the FDA
  - Finger cot unacceptable and not FDA compliant

**Comfort & Measurement Accuracy**

**ClearScan Versus Shell**


**Methodology**

- Fill bag ½ with tap water for sealed probes
- Fill bag to bottom of collar with distilled water for open probes
- Add water slowly to minimize air bubbles

**Methodology - Probe Insertion**

- Clear silicone ring faces up
- Insert probe from this side only

Note recess

**Probe Insertion**

- Probe inserted into wrong side of ClearScan
Insertion c Open Probe

- Insert Probe
  - So barely protrudes under the ClearScan collar (no more than \( \frac{1}{4}'' \))

Probe Insertion Sealed Probe

- Insert Probe
  - Insert probe until white line shows
  - About \( \frac{1}{2}'' \)

Methodology

add drop of anesthesia
then BSS

two drops of BSS

Methodology

- Open eye c
  - Both hands
- Time-to-learn
  - About 20 minutes

Faux Speculum - sitting

note: once positioned
finger moves skin/probe up/down & left right

Methodology (Preferred)

Patient can be examined sitting
(ocular structures & dynamics same as when viewed with slit lamp)
What if eye slightly soft?

- ClearScan not covering cornea completely
- Internal bag pressure may be too high

To reduce internal bag pressure:
- Burp the bag and/or decrease water fill

Variables that affect bag pressure:
- Amount of fill
- Position of collar from probe end
- Presence of air bubble
- Preserve conical-bullet shape

Anterior Segment visualization with regular 10 MHz probes
Sterile B-scan exam
*as probe can not be sterilized*

Clinical Applications

Iris Cysts are Common!
Only look for them when angle is narrowed or closed

Chain of cysts closing angle
Cyst - 50 MHz vs 25 MHz

Subluxed lens

Haptic in Ciliary Body (iritis symptoms)

Haptics pushed forward IOL optic contacting iris
Subtle effusion
closed angle

Metallic IOFB

Synechia

Edematous & Opacified Cornea
adjunct to B-scan of posterior segment

Trauma with cells in AC
note different length of iris (nasal vs. temporal)
UBM in Glaucoma
- Narrow or closed angles (primary angle closure)
- Secondary angle closure
- Plateau iris

Occluded Angle in Glaucoma
(Examine with the LIGHTS OFF!)

50 MHz angle closed

If the scleral spur is hard to locate, how do you find it???

Scleral Spur in AC
important to estimate its location

Pupillary Block with Iris Bombé
convex bowing suggests pressure difference between AC and PC

Pupillary block
Phacomorphic lens changes

Plateau Iris

- **Configuration**
  - Angle narrow or closed gonioscopically
  - Flat iris plane (NOT bowed forward)
  - "Abrupt" posterior turn near iris insertion
  - Due, at least in part, to anteriorly positioned ciliary processes
  - Relative pupillary block
  - May be cured by peripheral iridotomy

Plateau Iris Syndrome

- **Syndrome** -- “True plateau iris mechanism”
  - Periph. iris bunches in angle when pupil dilated
  - Results from large or anteriorly positioned ciliary processes (or iris cysts) supporting peripheral iris
  - NOT due to pupillary block
  - Peripheral iridotomy NOT effective
  - Patent PI is (no longer) necessary to make the diagnosis; UBM can diagnose

Plateau Iris Syndrome

- **Treatment**
  - Pull iris away from angle
  - Pilocarpine (miotics)
  - Iridoplasty/gonioplasty
  - Effect may wear off with time
  - Regular follow-up every 4-6 months
    - Monitor gonioscopy
    - Repeat iridoplasty/UBM if necessary
Extending the reach of UBM

- Ability to visualize posterior and extraocular locations
- Examining during immediate post-op period
  - Delicate trabeculectomy filtering blebs
  - Tube shunts
- Can examine young children

Scleritis

- Negative for scleral nodule but can visualize over 10 mm from angle

membrane at end of tube shunt
20 mm from limbus functioning Ahmed valve implant

Encapsulated Filtering Bleb
Anterior Choroidal Effusion in an 8 y/o

MELANOMA

Conjunctival Melanomas

Iris melanoma
C2 = 1.72mm
C1 = 0.44mm
on 7-9 mm iris melanoma

Ciliar body melanoma
C2 = 3.99mm
C1 = 5.46mm

sclera
CB
melanoma enveloping the ciliary body
iris
Melanoma in CB

Extraocular Applications

Eyelid Lesions

UBM to locate punctal plugs

Other non-ophthalmic uses

Other clinical application include skin lesions on irregular surfaces e.g. basal cell
Conclusions

- The ClearScan®
  - Overcomes drawbacks associated with traditional shell and gel technique
  - Safety
  - Sterility
  - Comfort
  - Enhances the ability to exam
    - posterior ocular locations
    - delicate structures
    - young children
  - Non-ophthalmic applications

- This technology may promote greater use of high frequency ultrasound in ophthalmology and dermatology