

Ultrasonic Biomicroscopy UBM

Examining Techniques and Extending the Reach of Clinical Applications

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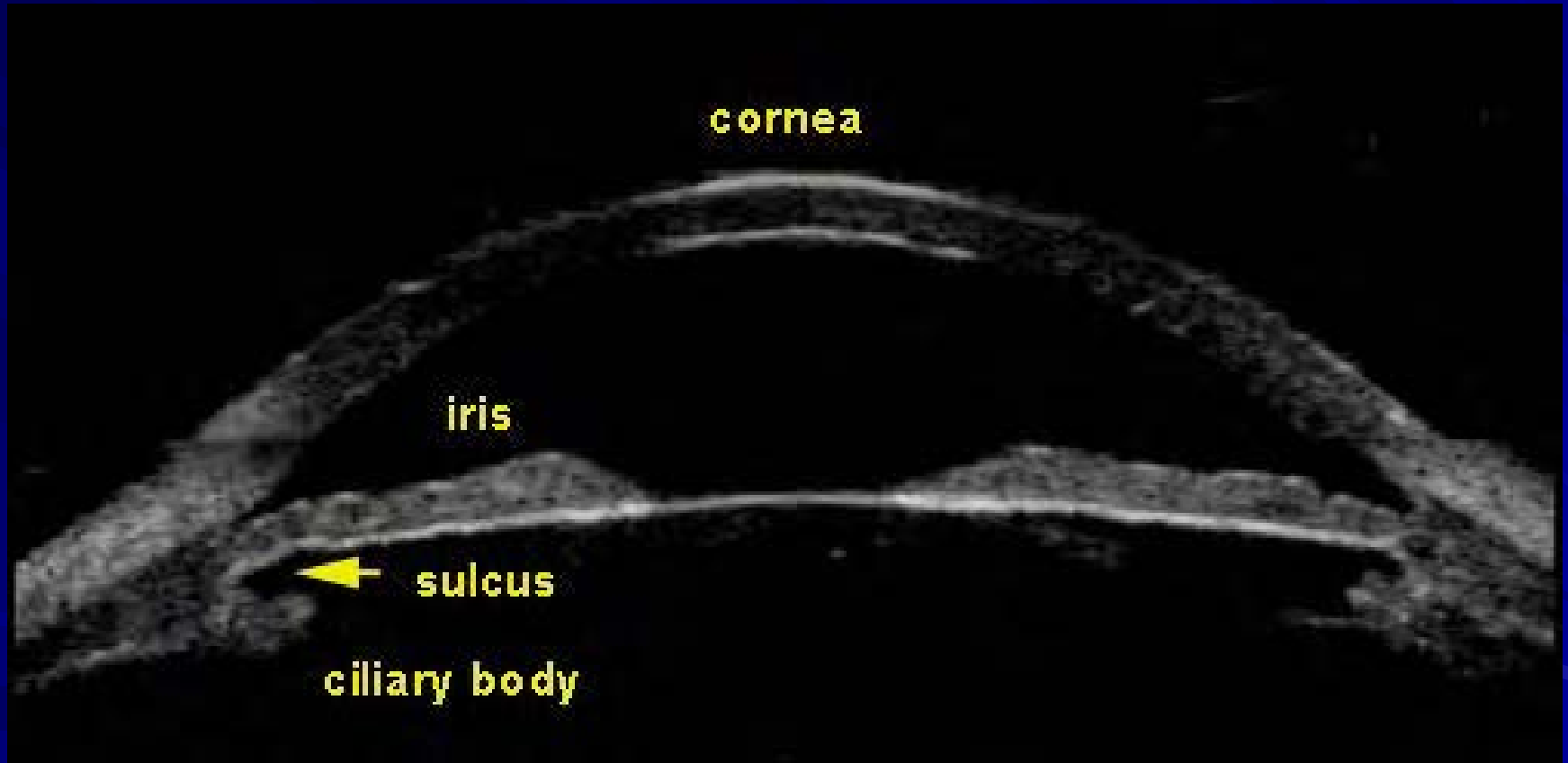
Consultant ESI

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Ophthalmology
University of Texas Medical School –
Houston

No Conflicts of Interest to Disclose

Ultrasound Biomicroscopy (UBM) of the eye



Visante™ OCT Anterior Segment Imaging and Biometry

- Not a topic of discussion today



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



Safety - "never allow the transducer to contact the eye....."

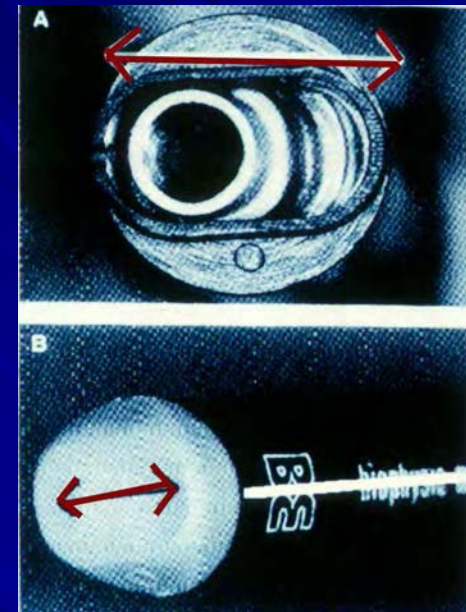
Sterility - "How to prevent patient-to-patient transfer of infection...."

Why must a shell be used in the first place?



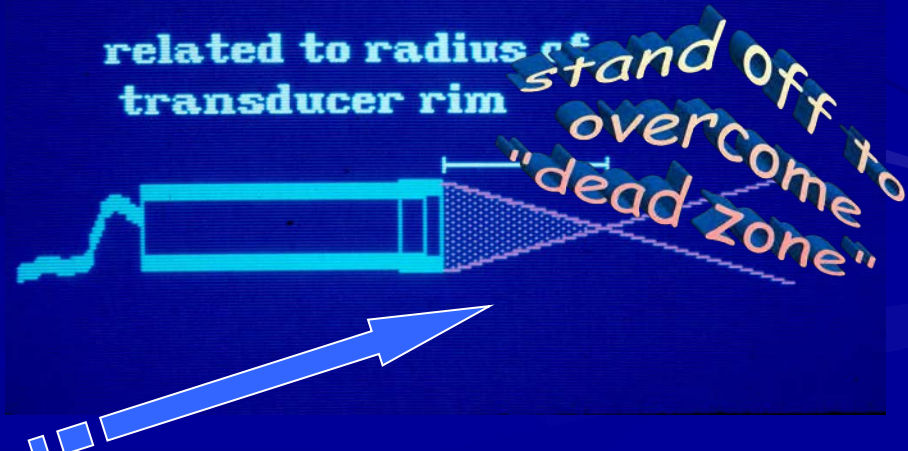
Near Field Artifact Requires Standoff

- 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"



Near field artifact

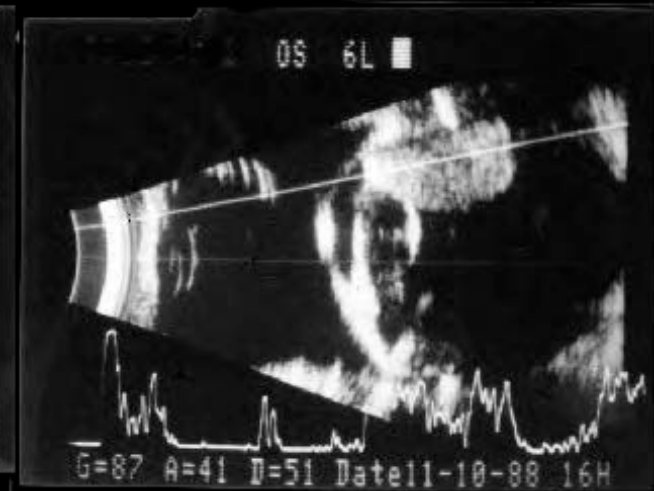
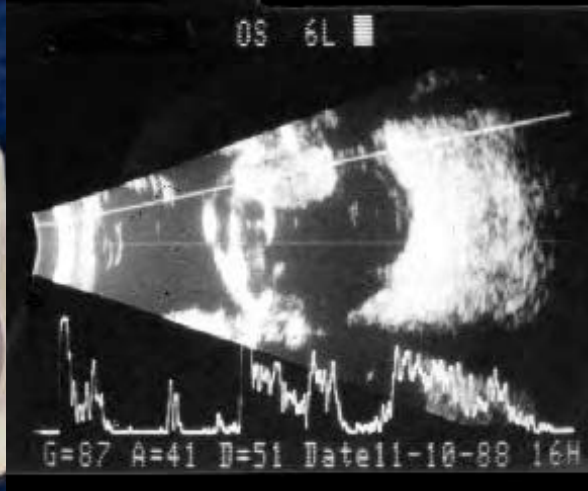
related to radius of
transducer rim



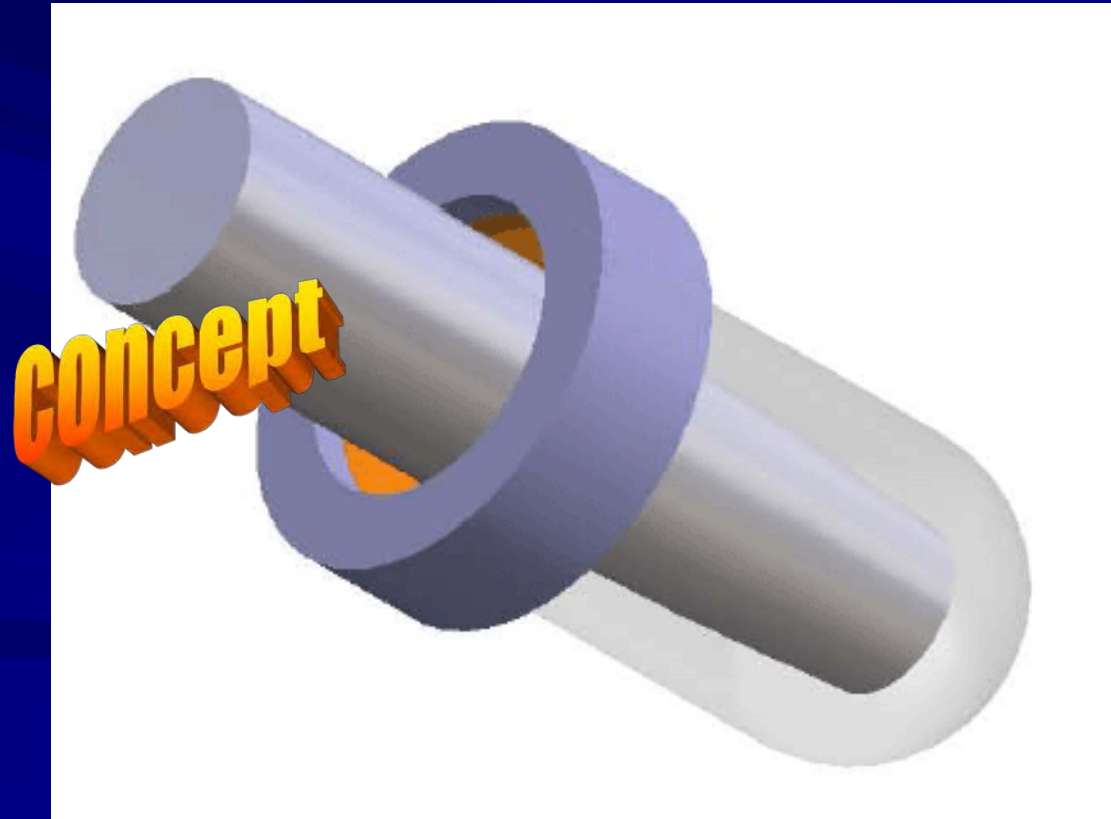
Near Field Artifact Requires Standoff



Longitudinal scan does not show
anterior segment



The ClearScan cover
replaces the gel & shell
technique



Safety-Sterility-Comfort



Safety

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



Sterility

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



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 NP, Anand A, Wanger A, Prager TC: Microbial Contamination of Ultrasound Biomicroscopy Probes: An Evaluation of Cross-infection Risk. J Cataract Refract Surg. 2012 Jan;38(1):174-5. Epub 2011 Nov 10.



Sterility

- FDA requires sterility for any instrument that touches the eye
 - CDC. MMWR. Vol. 47, 1998:1-39.
- 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

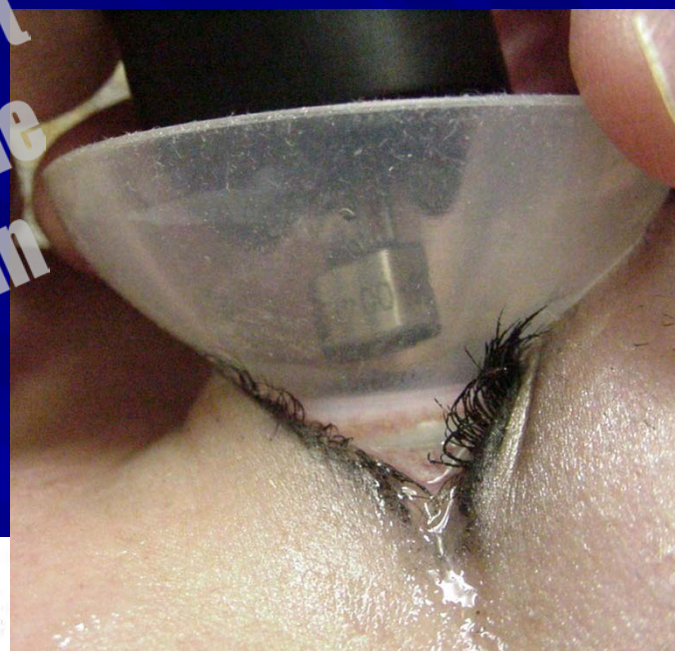


Comfort & Measurement Accuracy ClearScan Versus Shell

Bell NP, Feldman RM, et al.: A New Technology for Examining the Anterior Segment by Ultrasonic Biomicroscopy. The Journal of Cataract & Refractive Surgery, Jan;34(1):121-5, 2008.



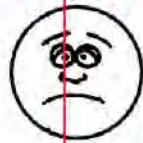
100% of cohort preferred the ClearScan



Comfort Scale

ClearScan™ = 0.40

Open Shell = 2.95



0
not uncomfortable
at all

1
uncomfortable
Little Bit

2
uncomfortable
Little More

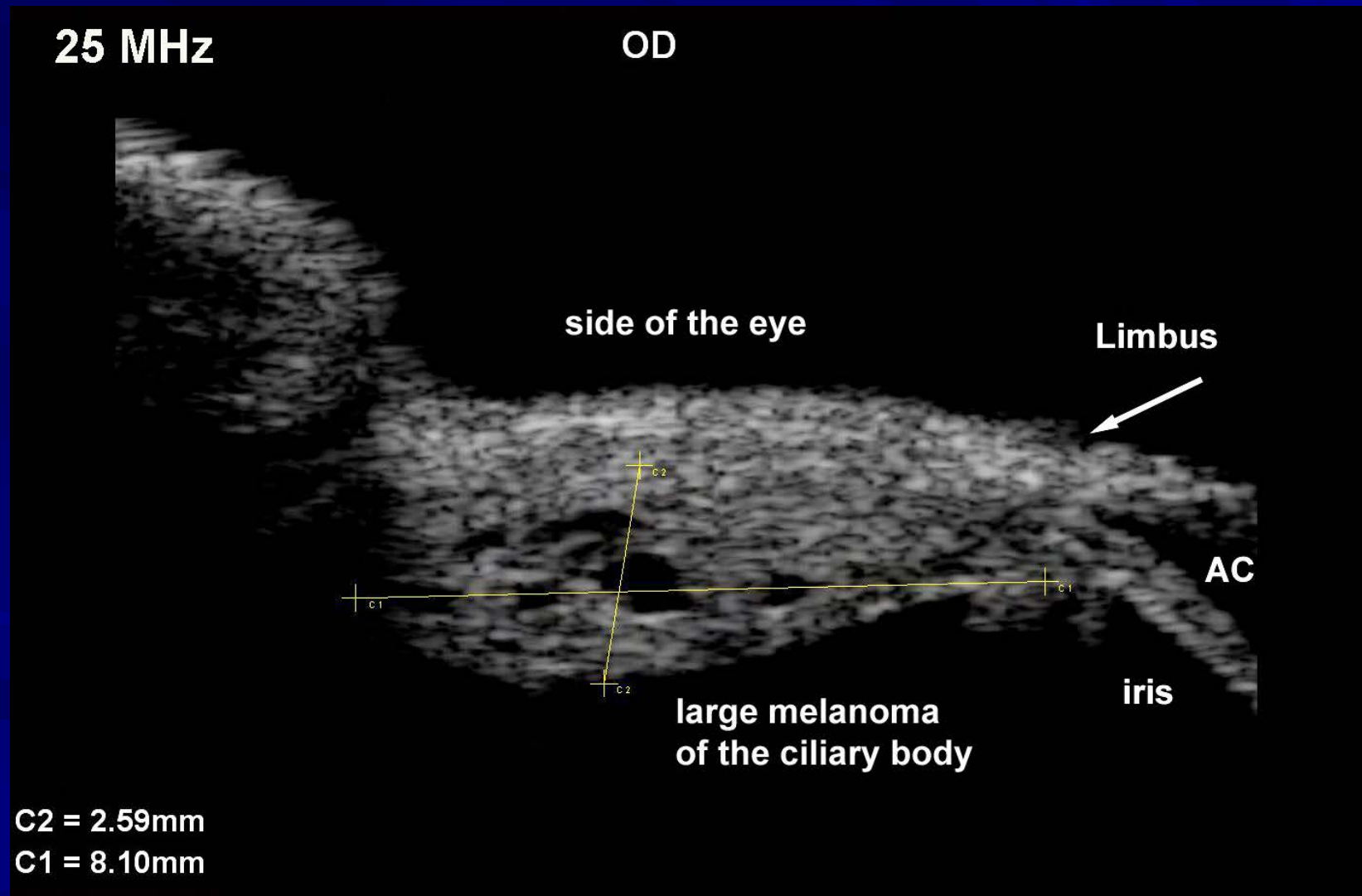
3
uncomfortable
Even More

4
uncomfortable
Whole Lot

5
uncomfortable
Worst

Added ClearScan advantage

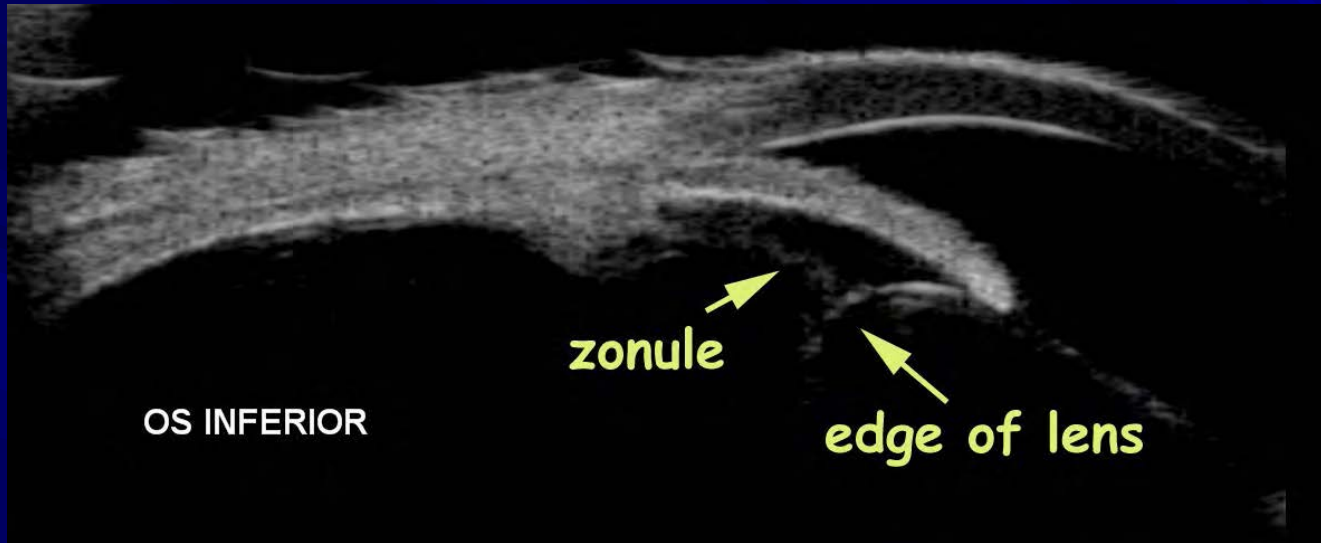
ID pathology on side of the eye



CB detachment extending 10 mm from iris



Visualizing zonules



Methodology

- Fill bag $\frac{3}{4}$ with **sterile 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

insertion side



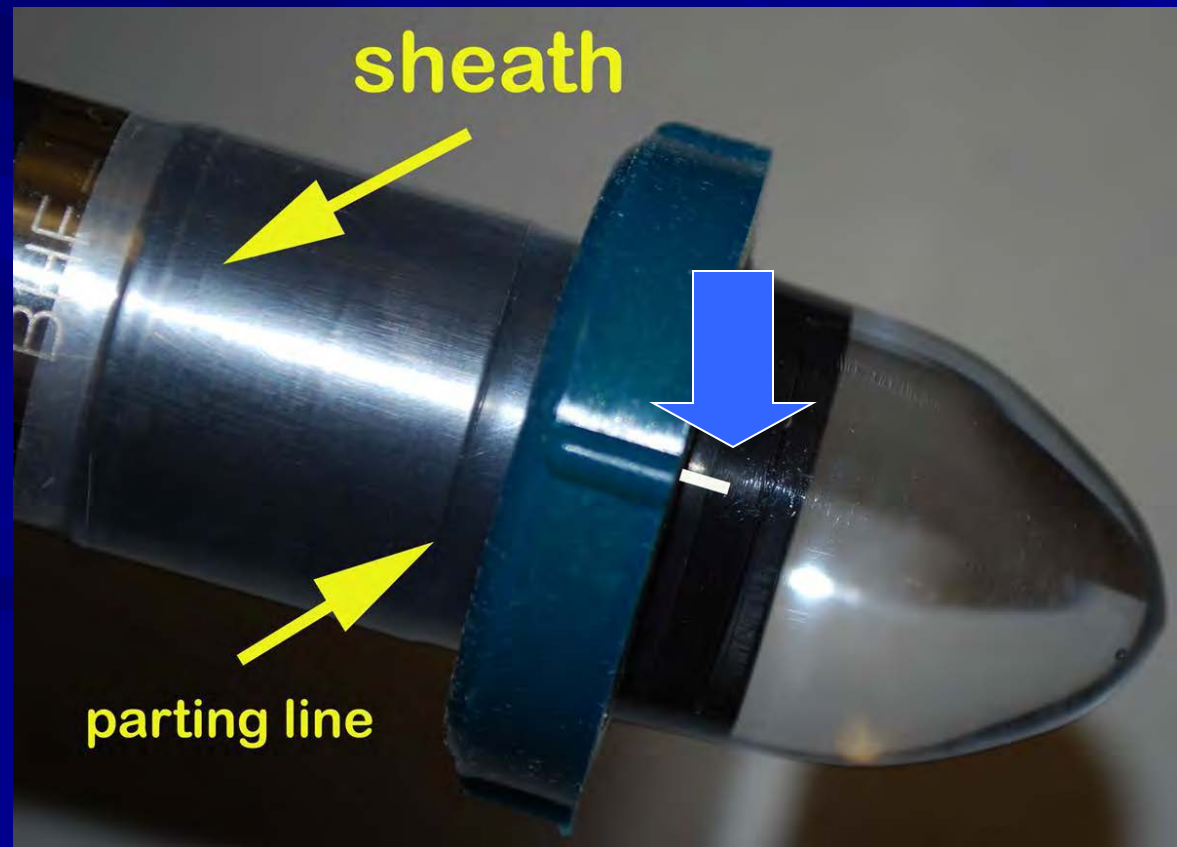
bottom
do not insert from this side



Insertion

■ Insert Probe

- So barely protrudes under the ClearScan collar (no more than $\frac{1}{4}$ "



Methodology

add drop of anesthesia
then BSS



Methodology

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



Faux Speculum

note: once probe positioned
finger **micro-movement** of skin/probe
up/down & left right



Methodology (Preferred-sitting)

Patient can be examined sitting
(ocular structures & dynamics same as when
viewed with slit lamp)



view conical bullet tip from side

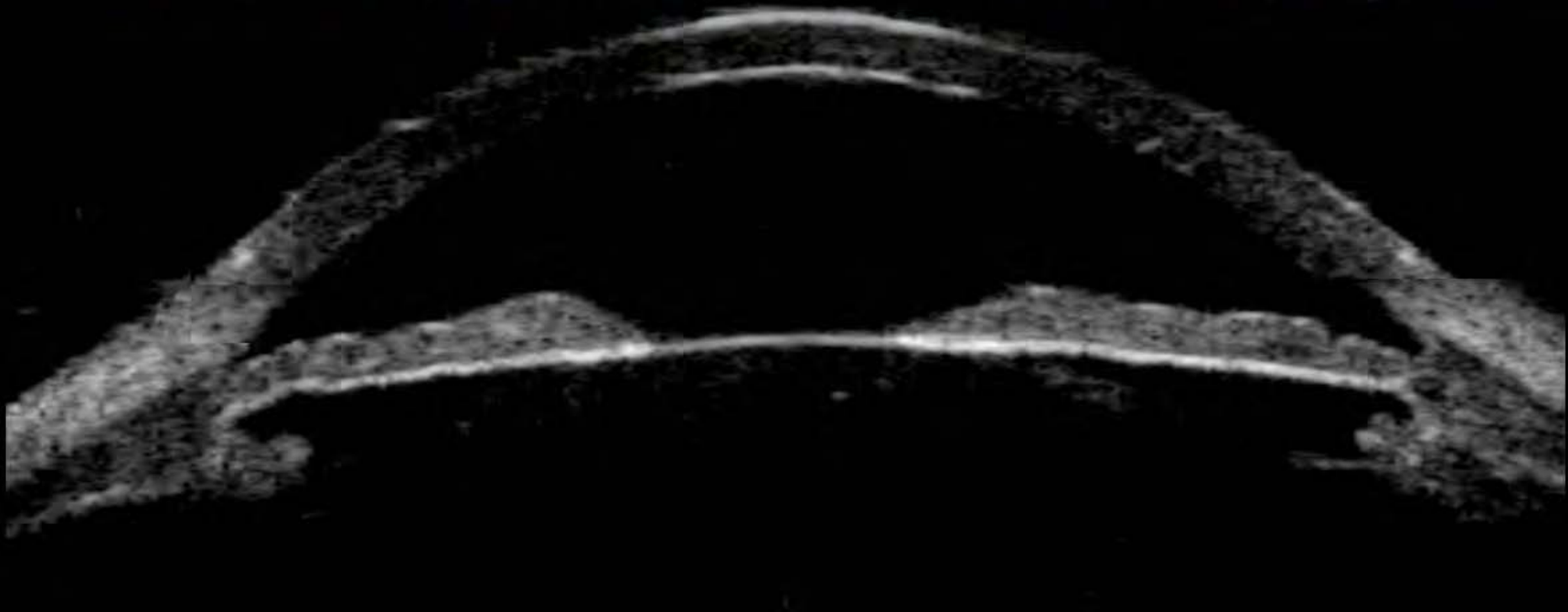
When supine

AC depth, angles, sulcus-to-sulcus measurements may change in older pts
harder to see around the green collar



Note smooth corneal surface

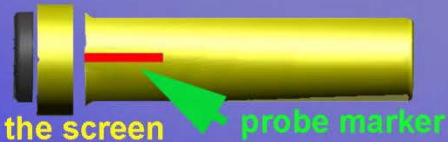
CS drapes evenly over the cornea indicating minimal pressure



Orientation

High Frequency Probe Orientation

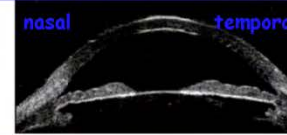
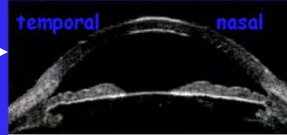
The structure the probe marker points toward is displayed on the right side of the screen



The probe marker faces:

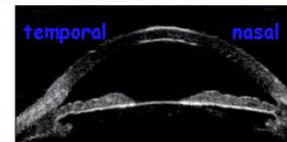
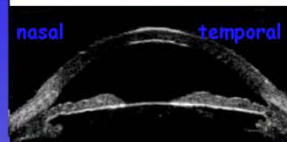
OD - nose

OS - ear



OD - ear

OS - nose



To examine angles, the probe marker always faces the cornea



**preferred:
same orientation
as viewing**

What if eye slightly soft?

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



cornea dented by ClearScan in
an eye with very low pressure



IOP = 0 mm Hg?
use open shell

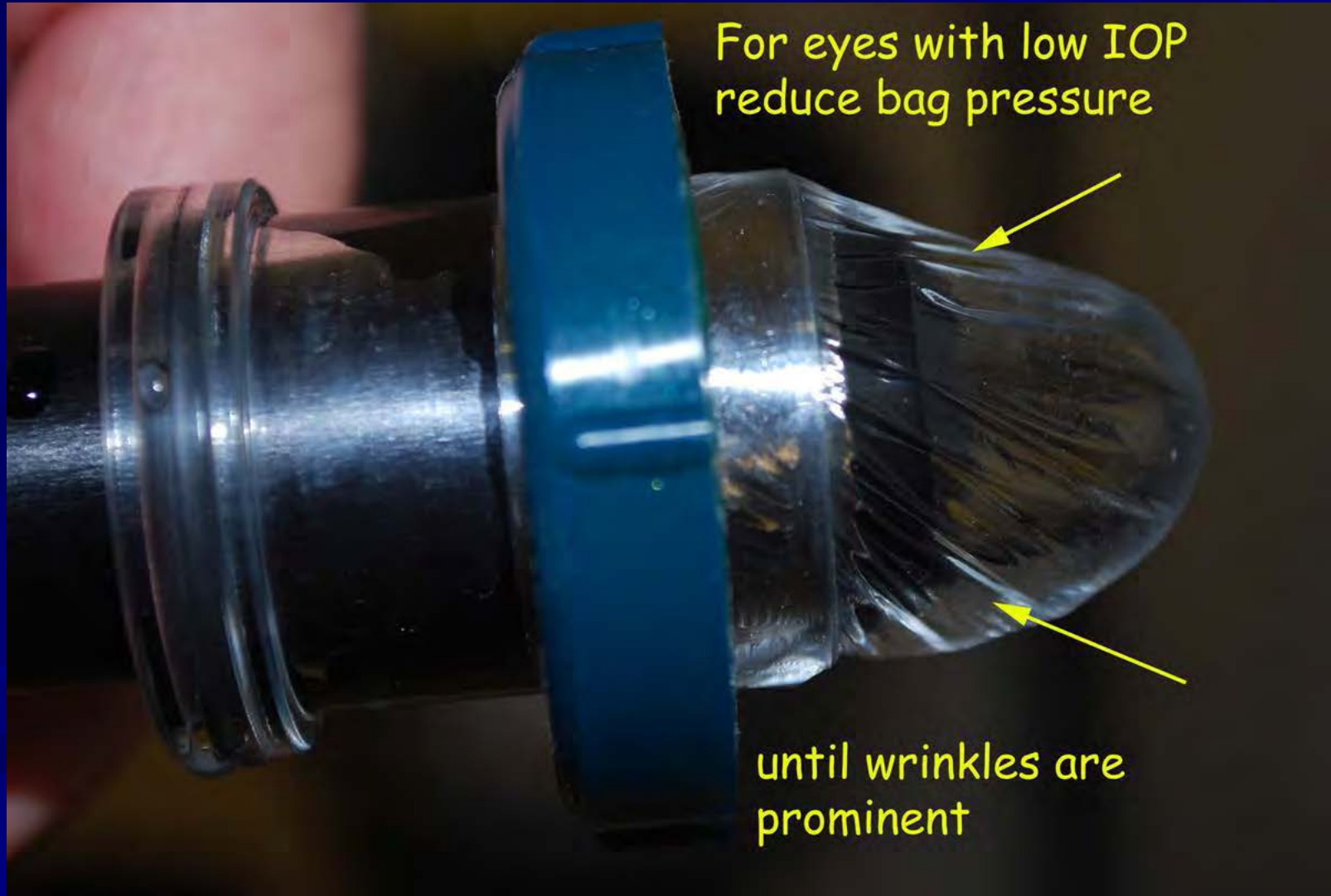
Soft eye (> 3 mm hg)
can be examined by
modifying internal
bag pressure

low IOP causes ClearScan to "dent" the cornea



3 ways to reduce internal bag pressure....

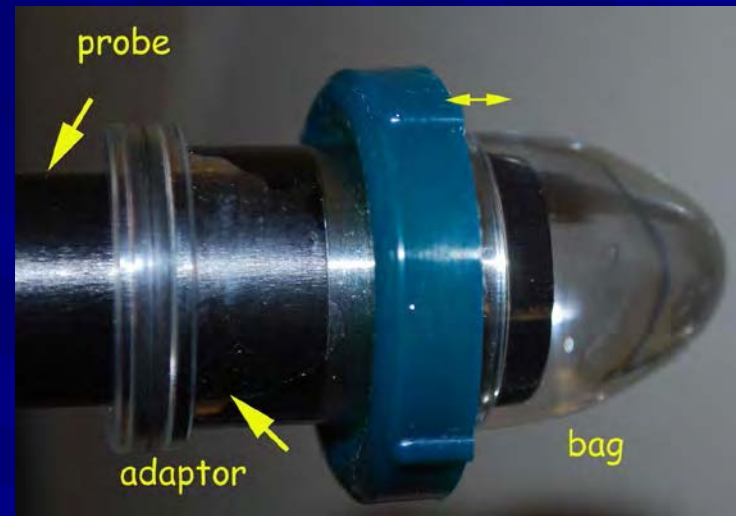
1) decrease water fill



3 ways to reduce internal bag pressure....

2) adjust position of collar

- Collar slid forward reduces pressure
- Collar slid backwards increases pressure
- Presence of small air bubble OK
- Preserve conical-bullet shape



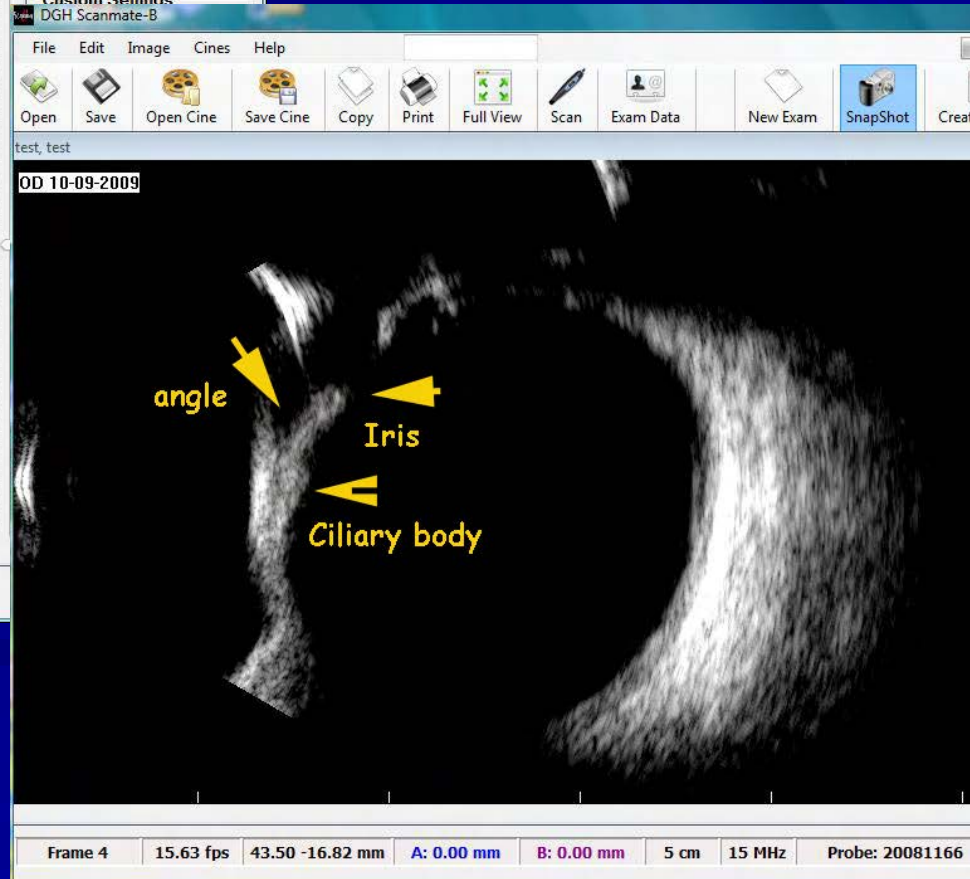
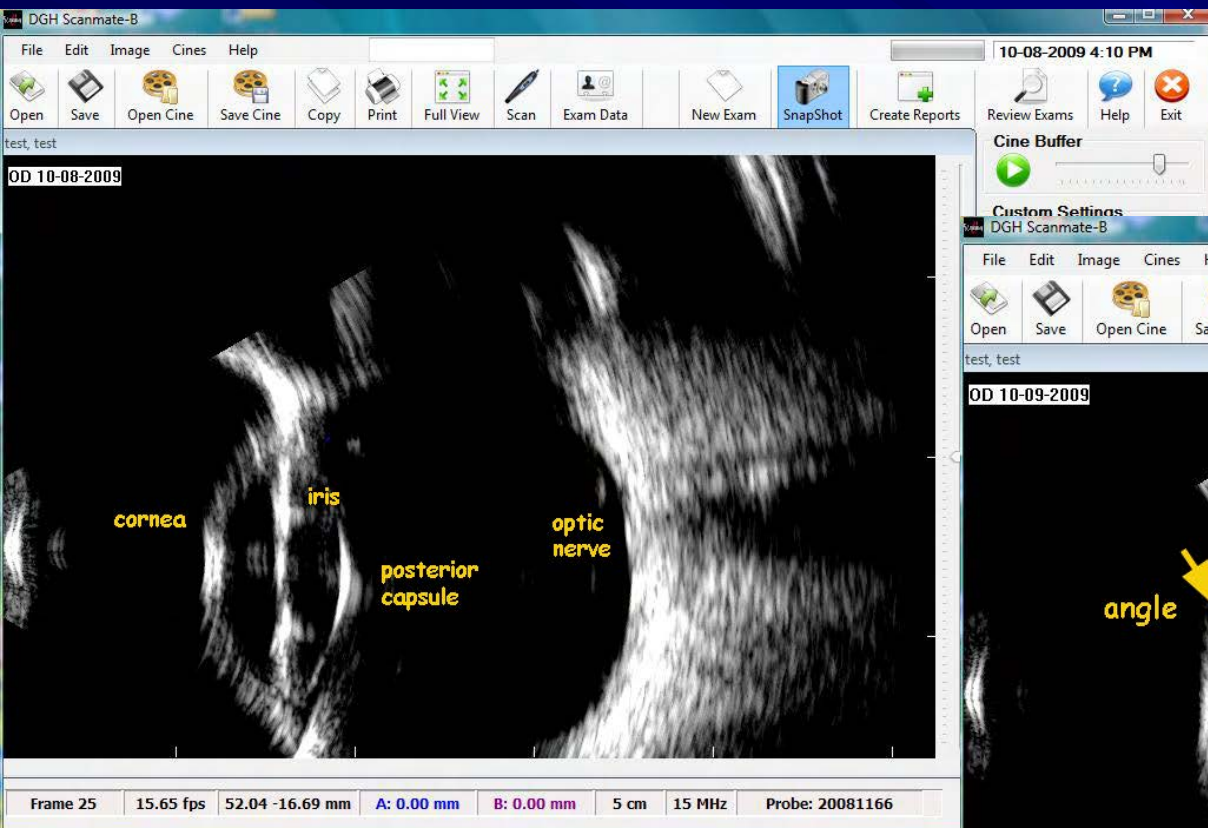
10 MHz B-Scan

3 ways to reduce internal bag pressure....

3) Lower bag pressure by pinching



Anterior Segment visualization with regular 10 MHz probes



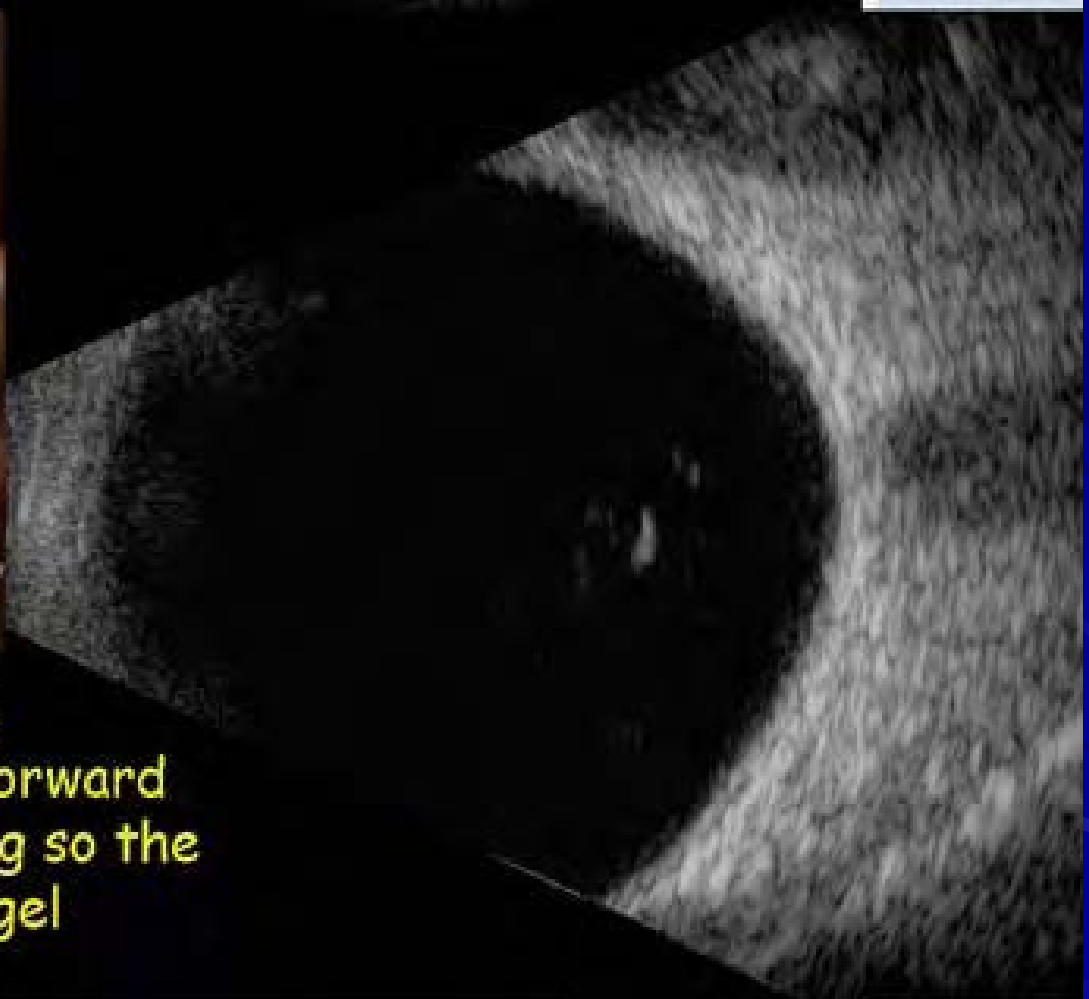
non-detailed examination

Sterile B-scan exam *as probe can **not** be sterilized*

Adapter for ClearScan

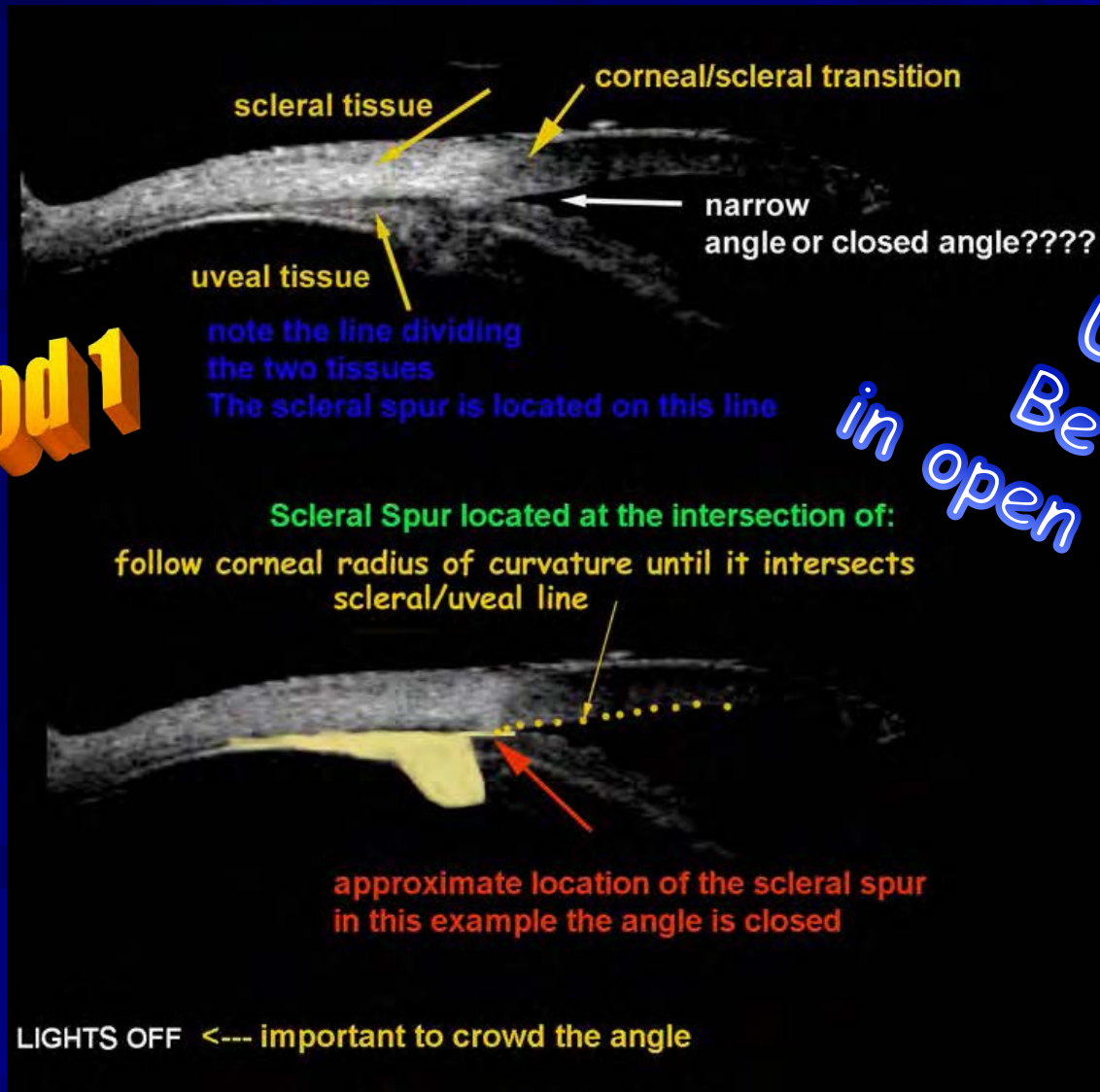


Place e.g. Goniosol inside of CS and push probe forward to the bottom of the bag so the probe tip is covered by gel



Scleral Spur in AC - often not visible

important to *estimate* its location -

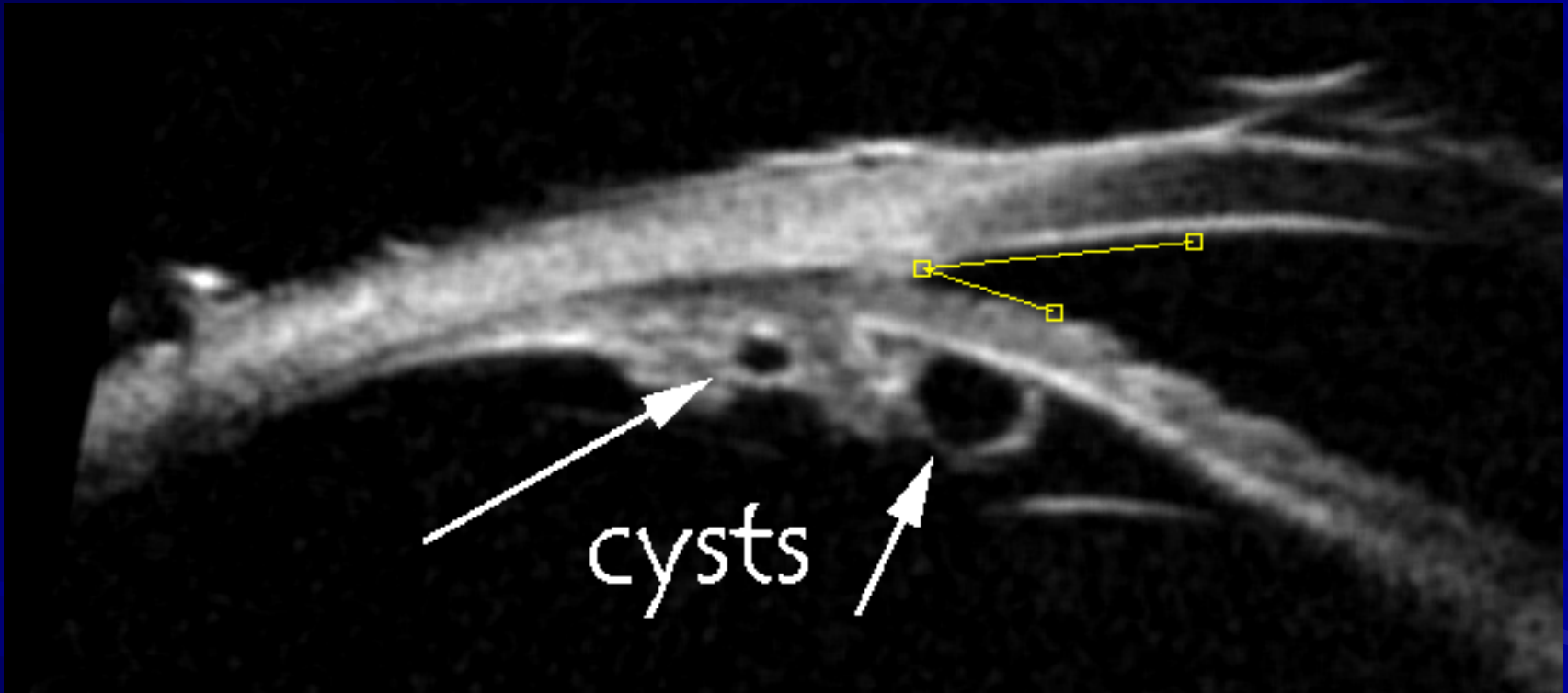


method 1

UBM may not be appropriate in open angle glaucoma

Clinical Applications

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



C1 = 2.07mm
OS CYST 8:00

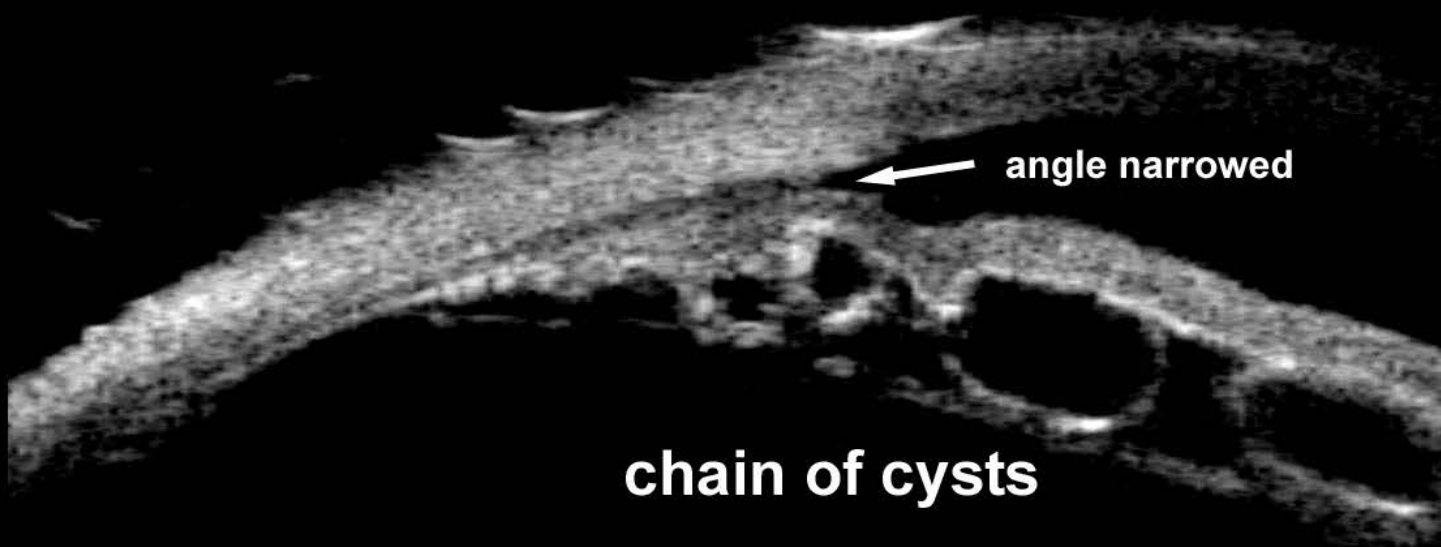
Cyst displacing
IOL

Cyst narrowing
the angle

Chain of cysts closing angle

50 MHz

OD

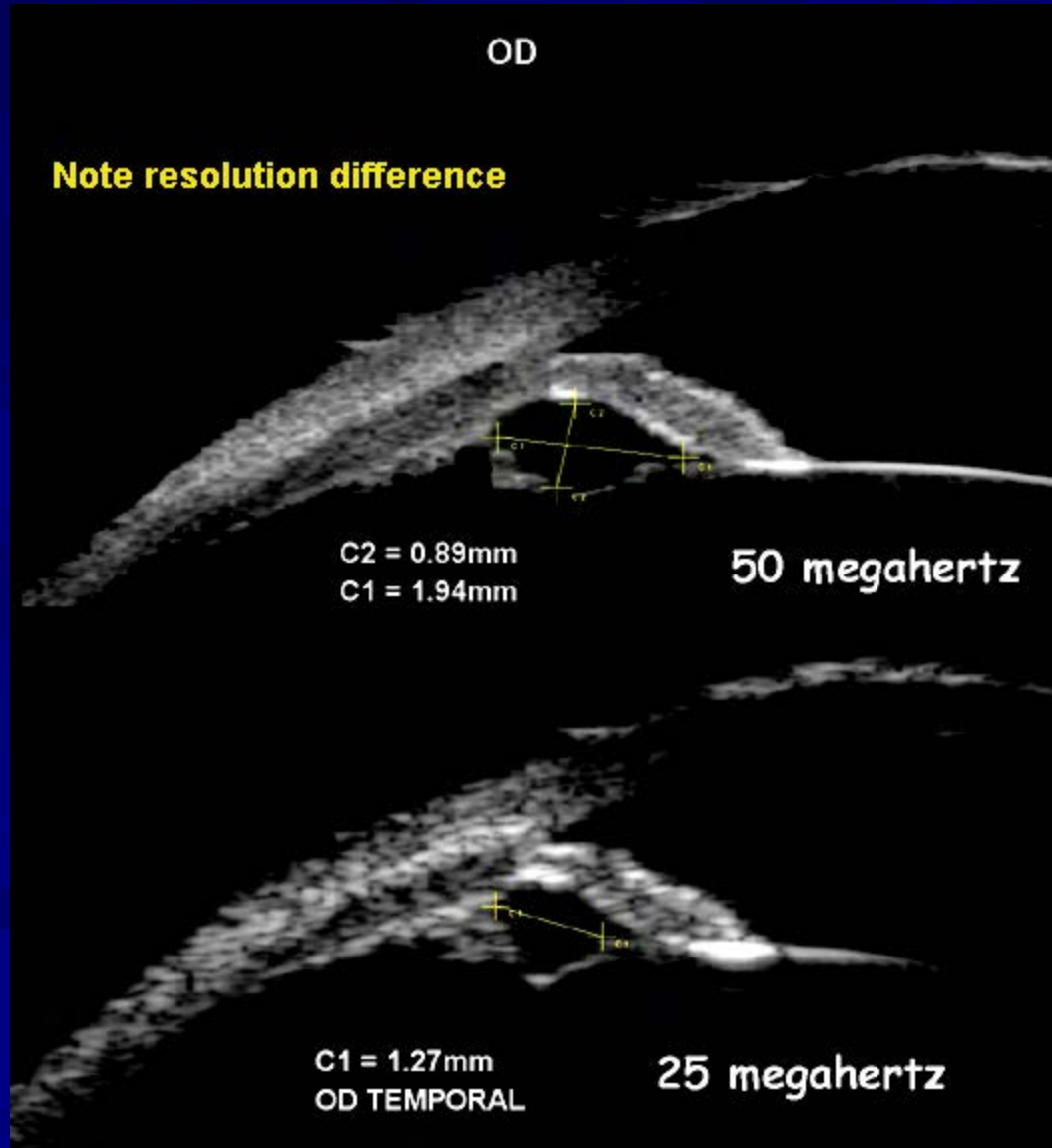


angle narrowed

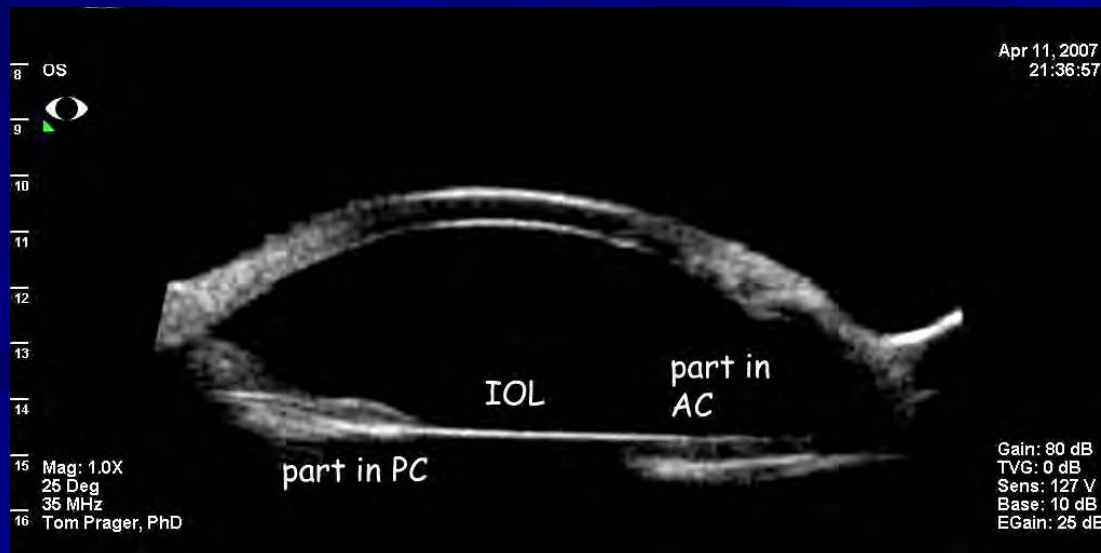
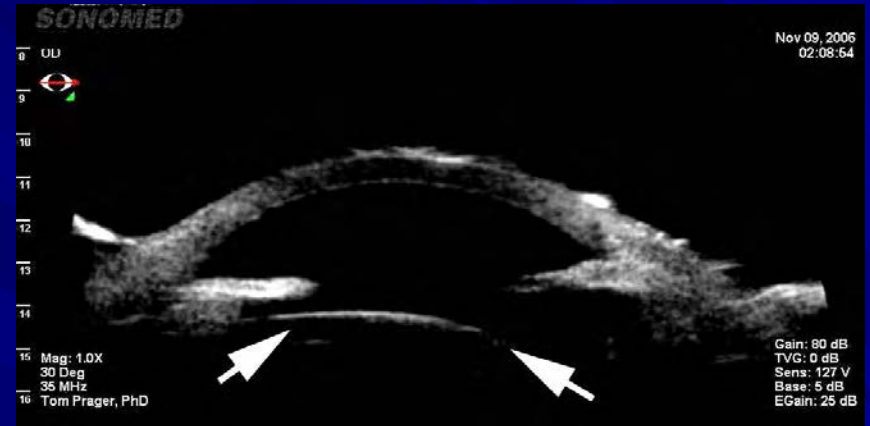
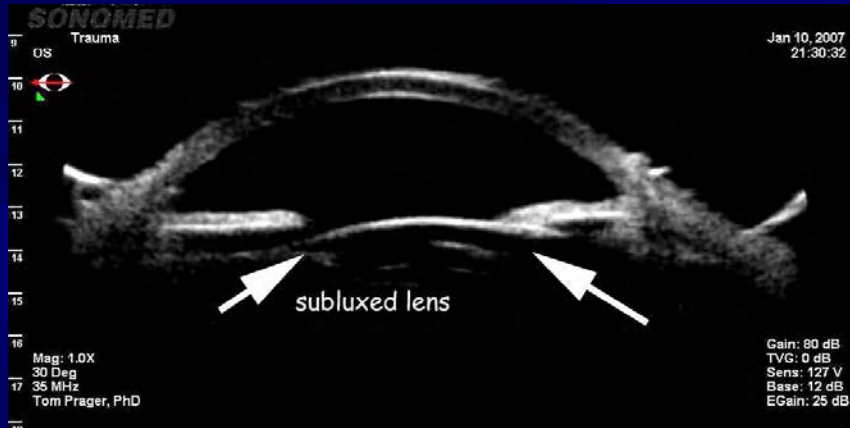
chain of cysts

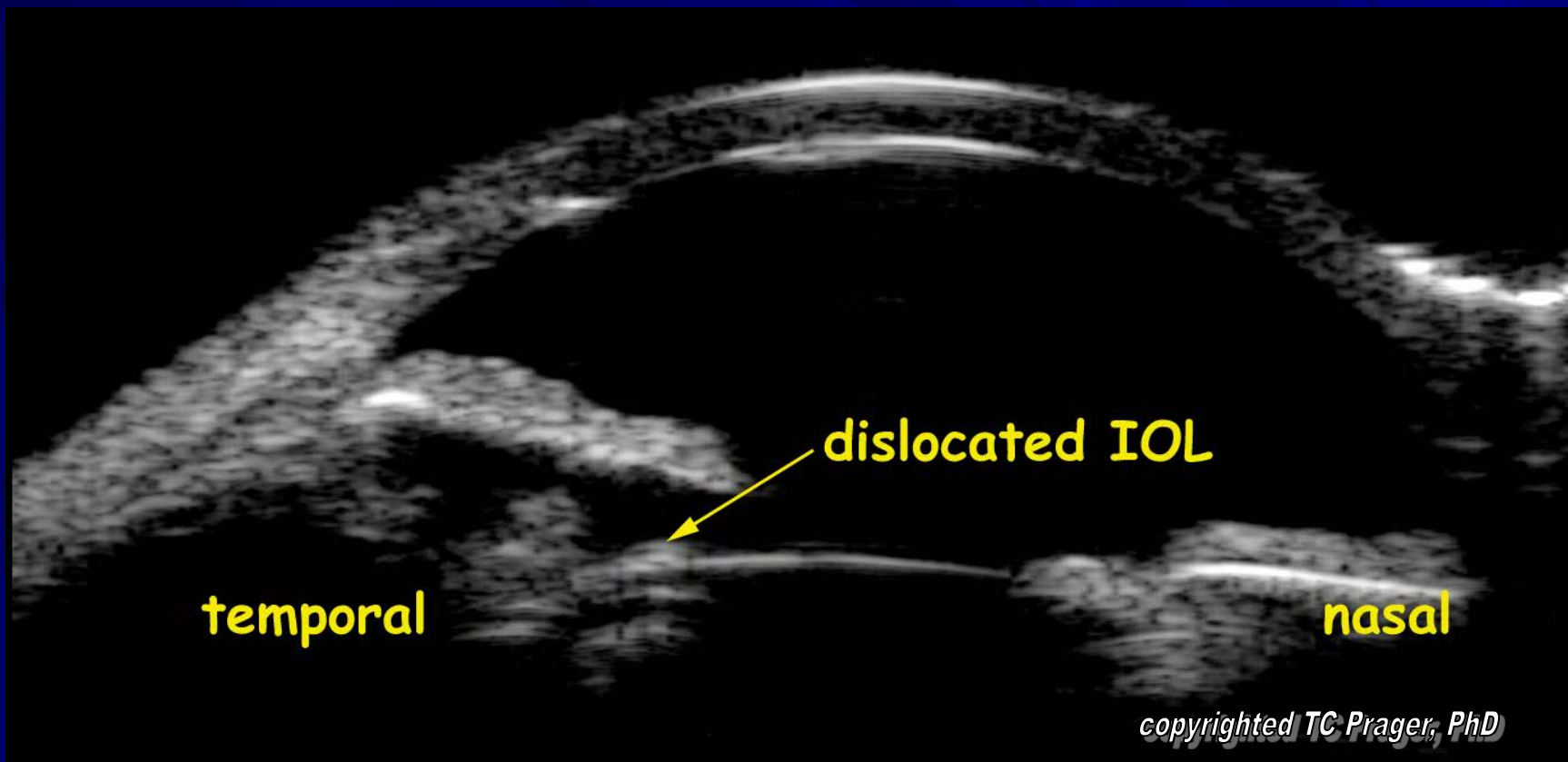
OD 7:00

Cyst - 50 MHz vs 25 MHz



Subluxed lens







lens subluxed

lens in place

copyrighted TC Prager, PhD

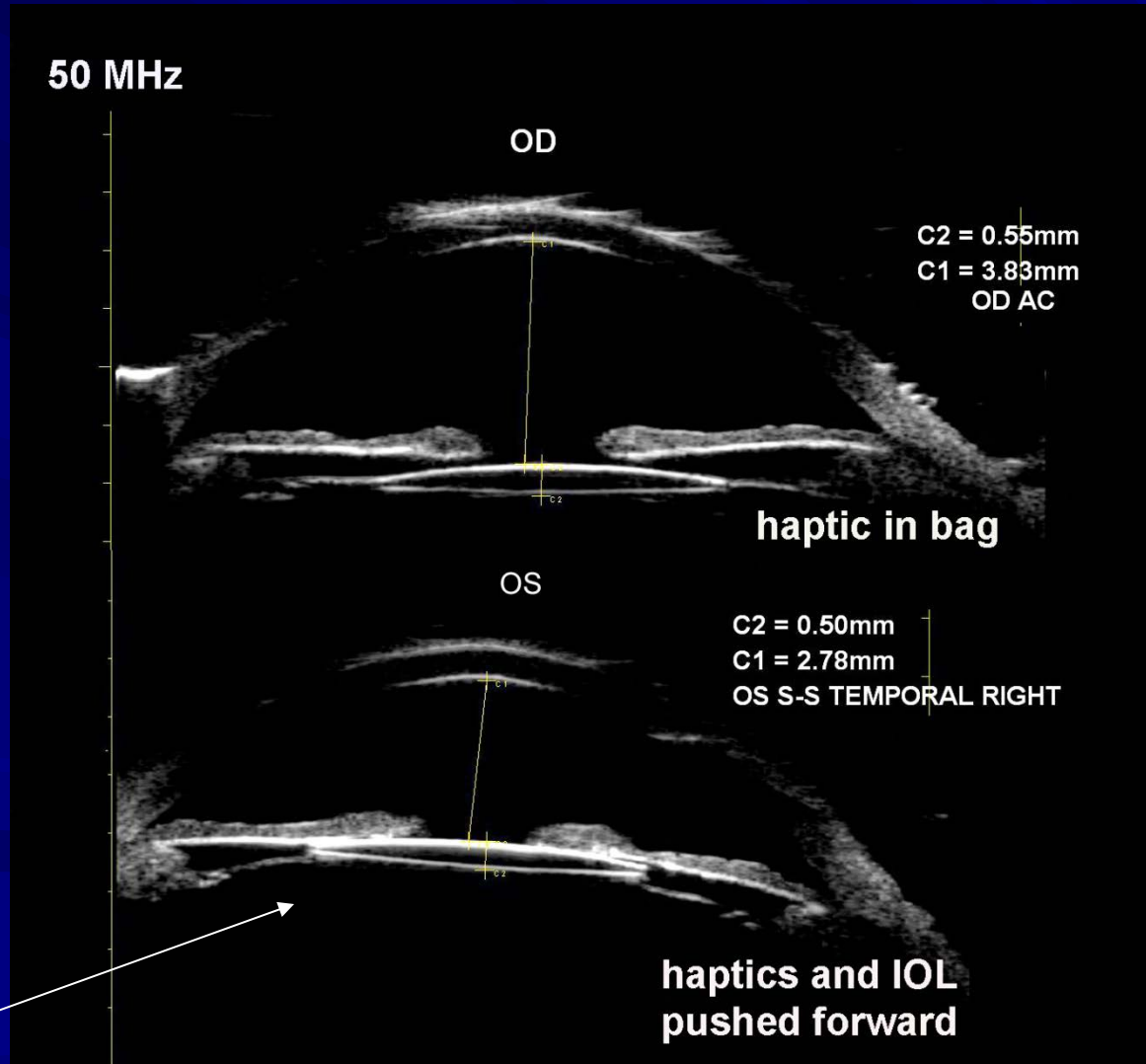
os 2:00

Haptic in Ciliary Body (iritis symptoms)

note wrinkling of endothelial layer and thickened cornea



Haptics pushed forward IOL optic contacting iris

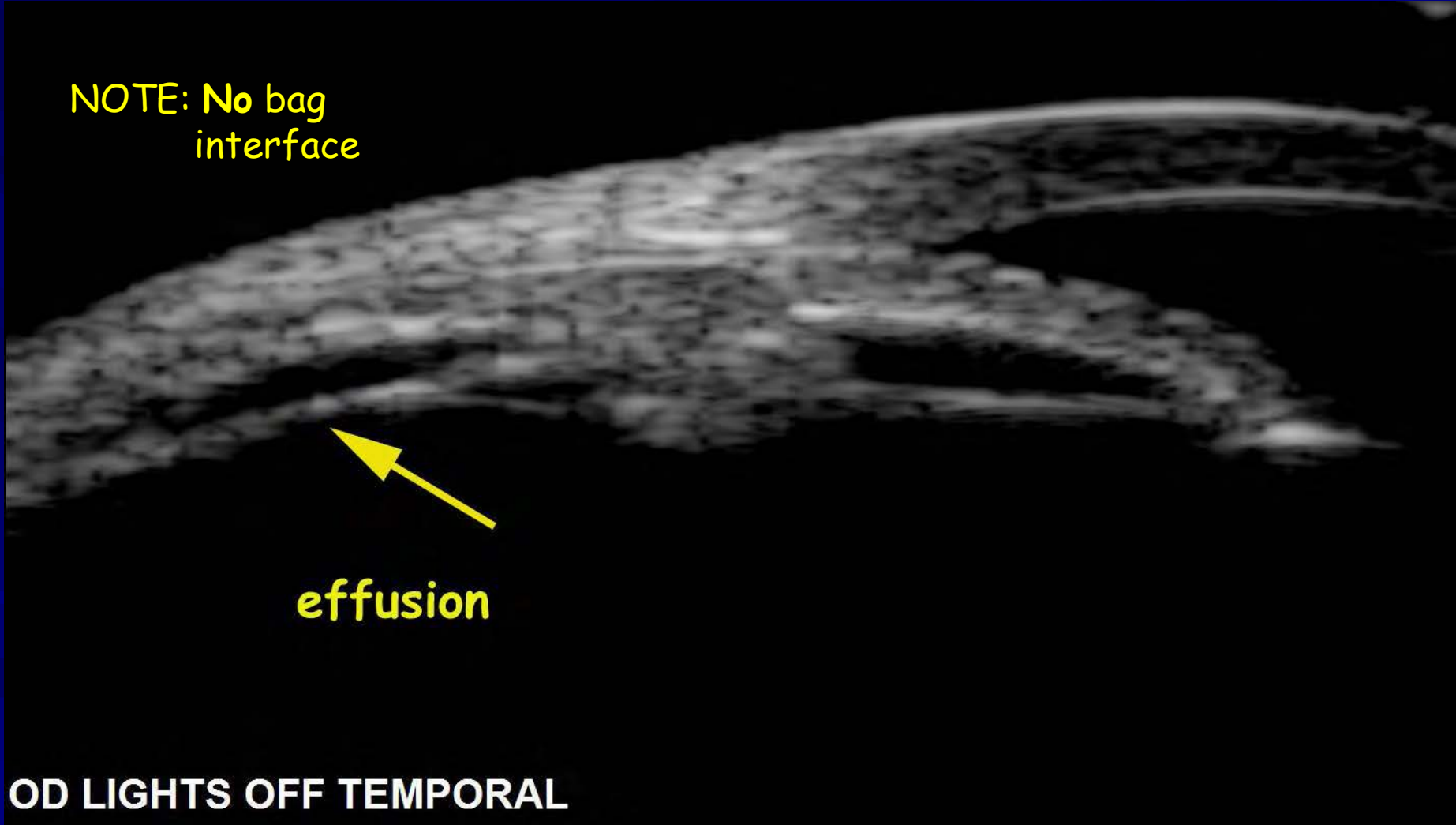


Subtle effusion closed angle

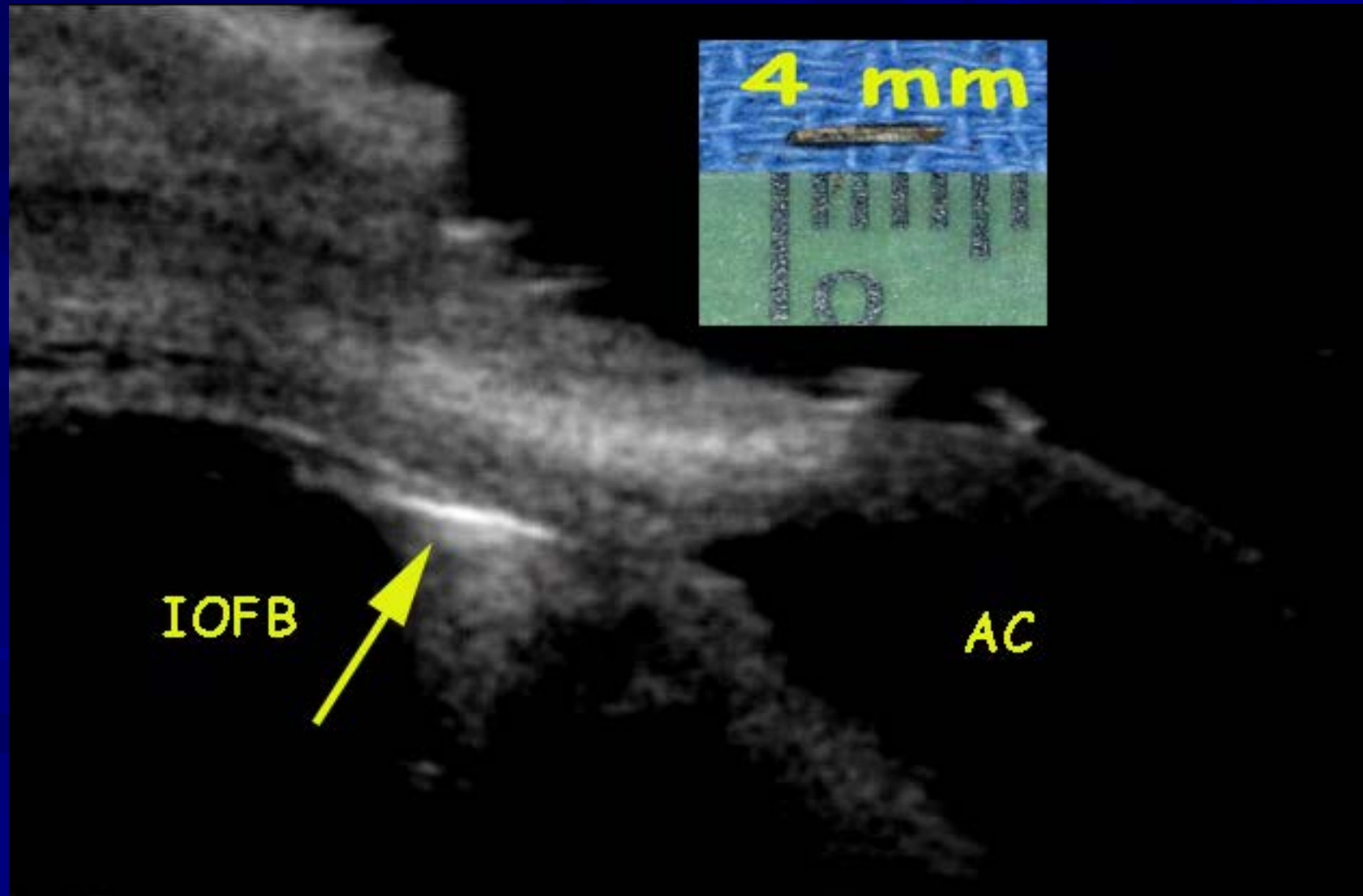
NOTE: No bag
interface

effusion

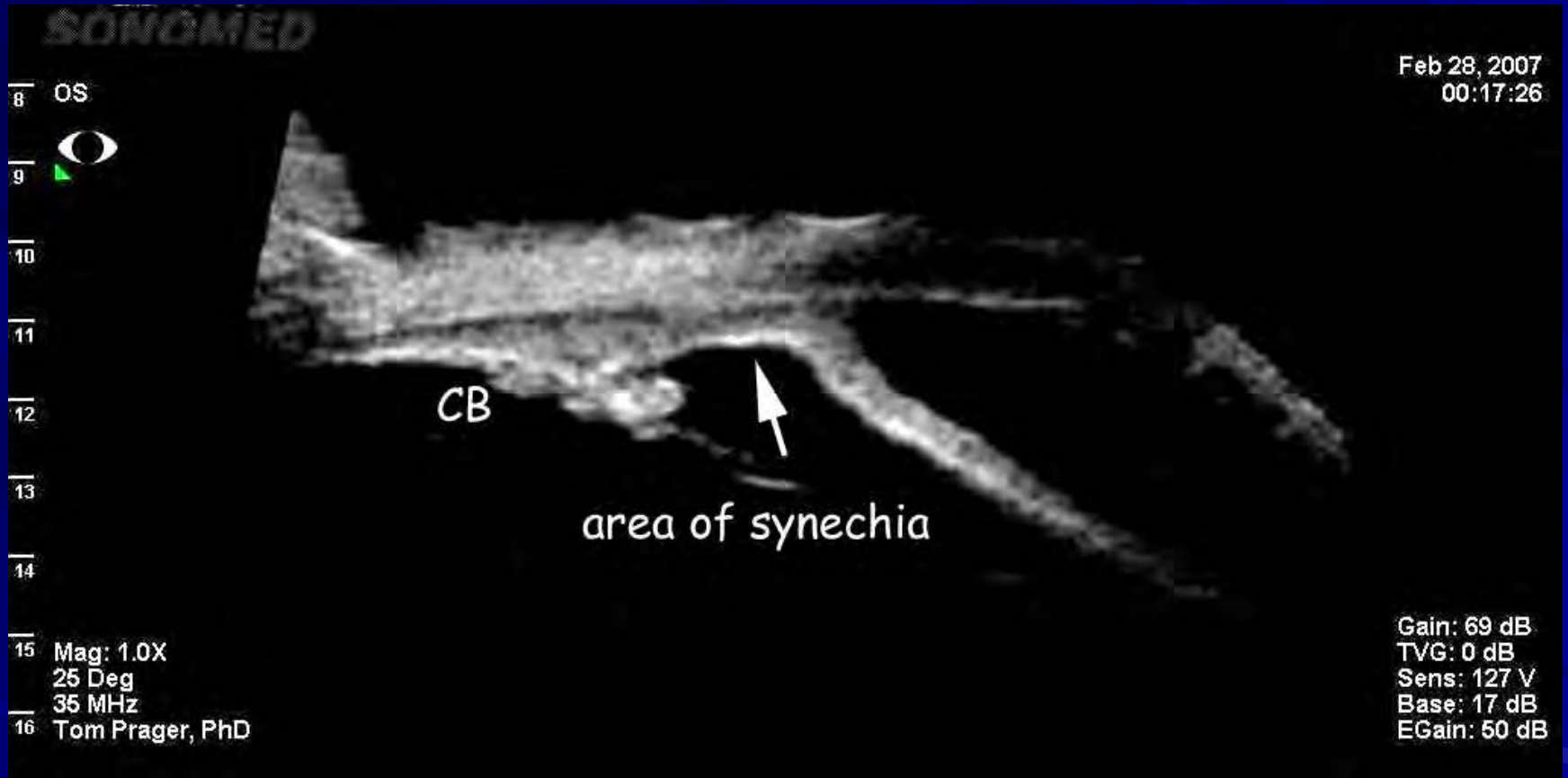
OD LIGHTS OFF TEMPORAL



Metallic IOFB

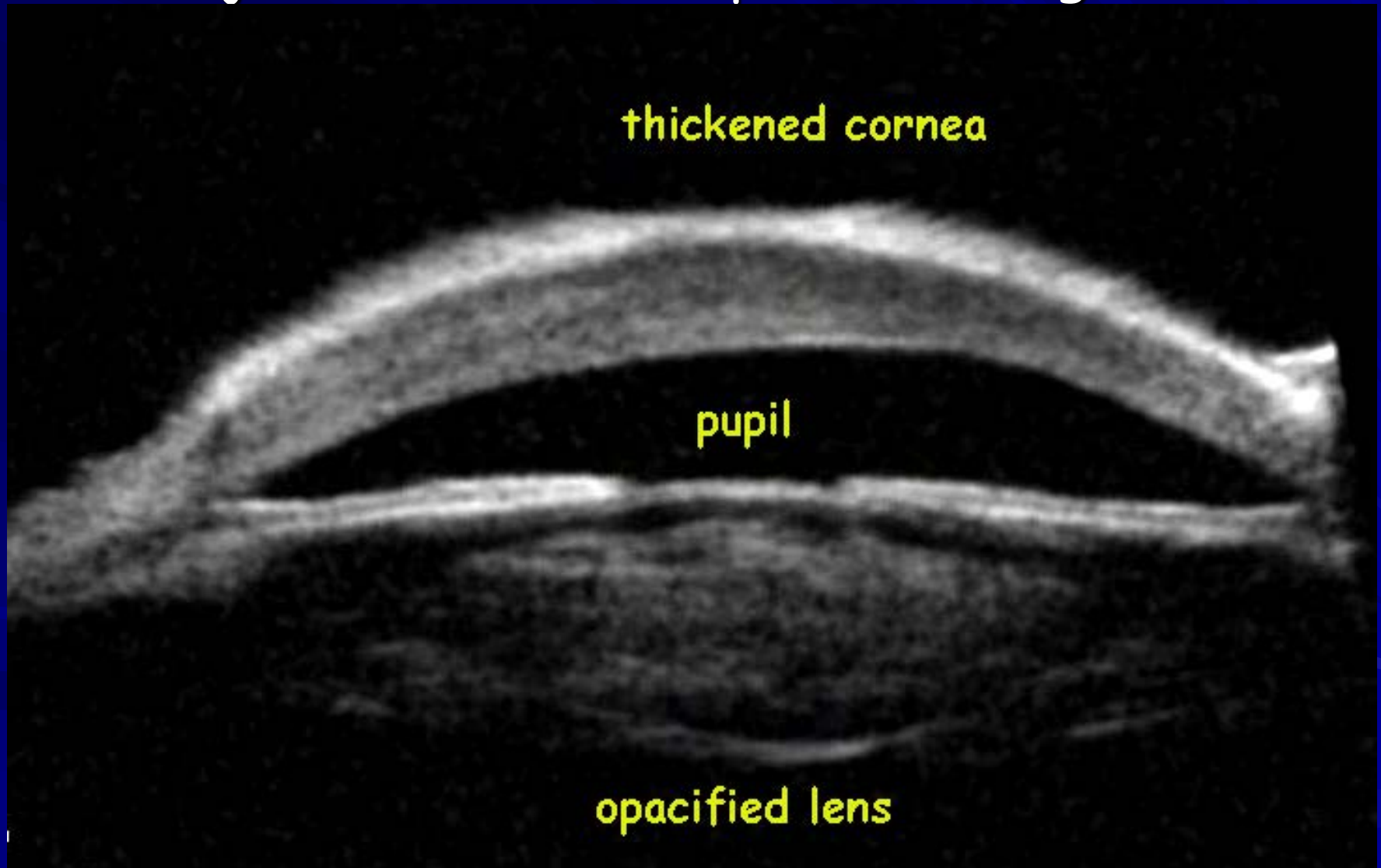


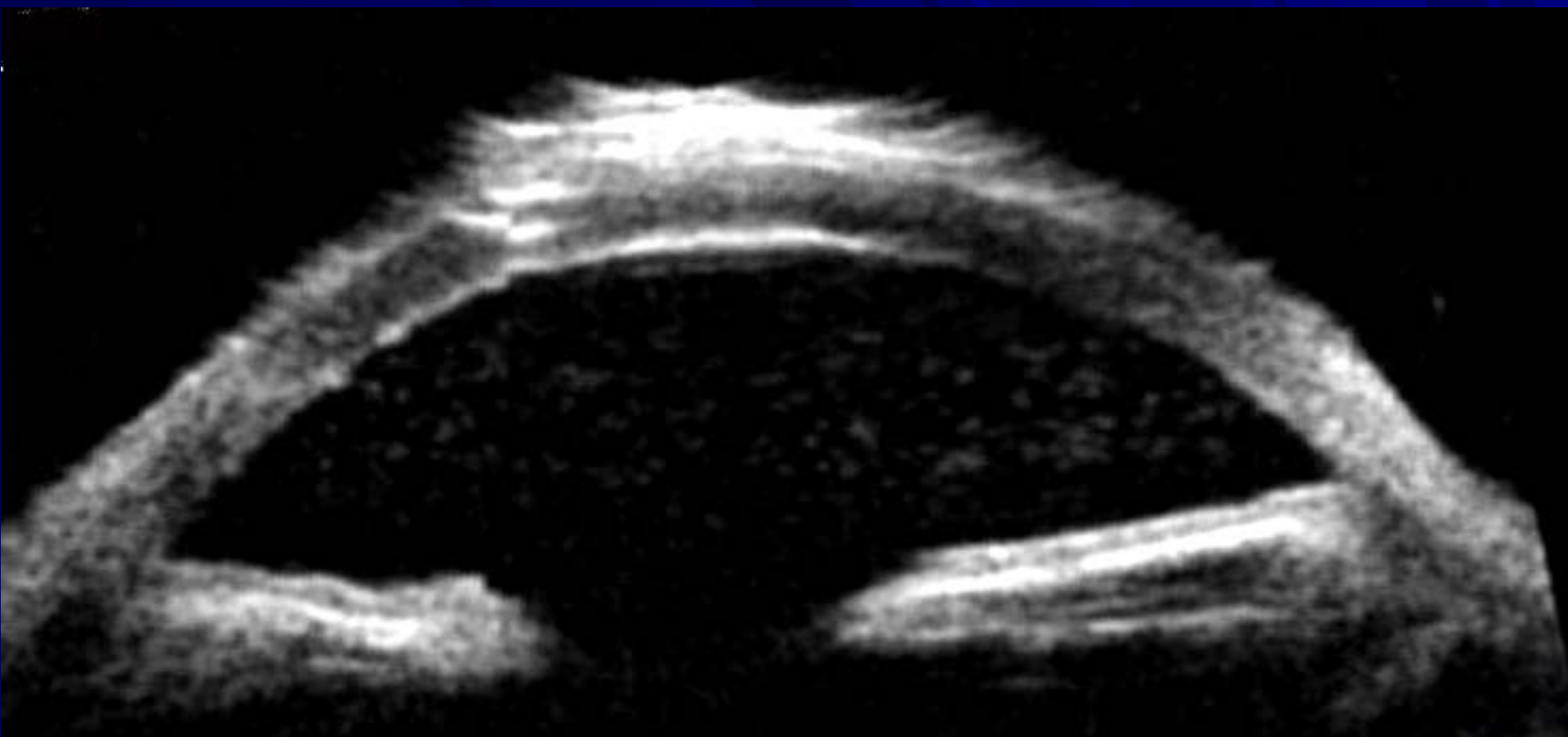
Synechia



Edematous & Opacified Cornea

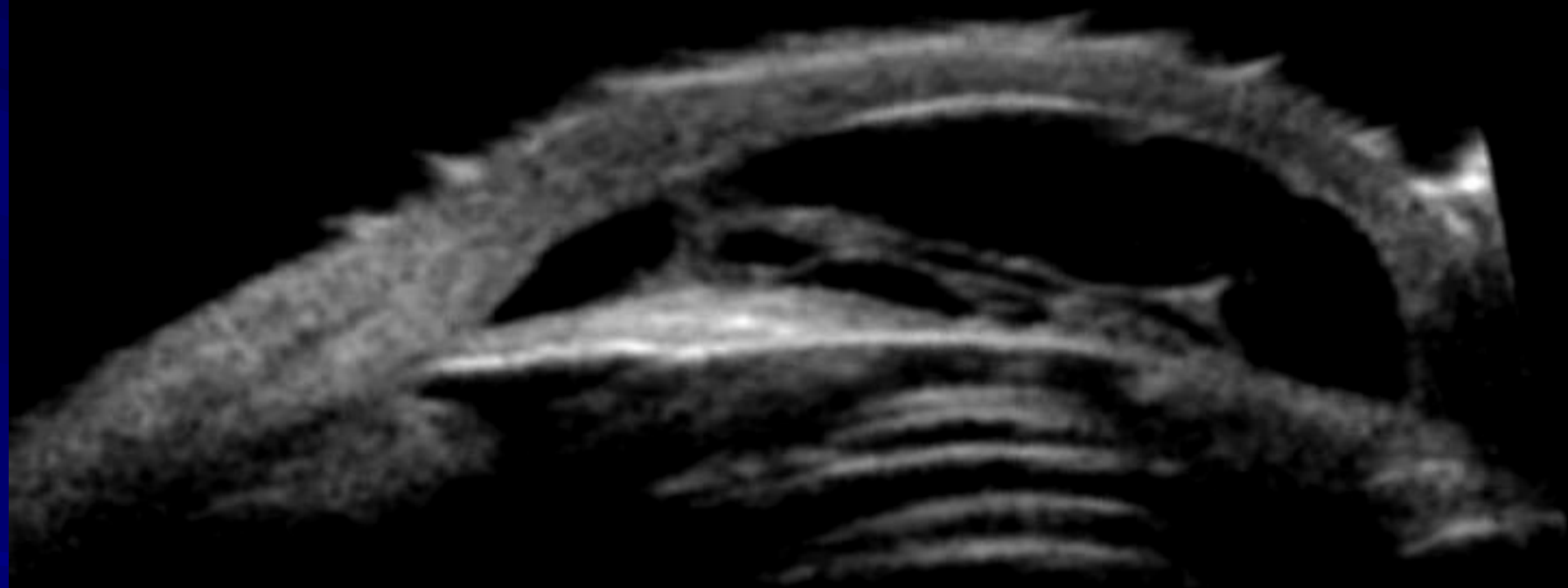
adjunct to B-scan of posterior segment

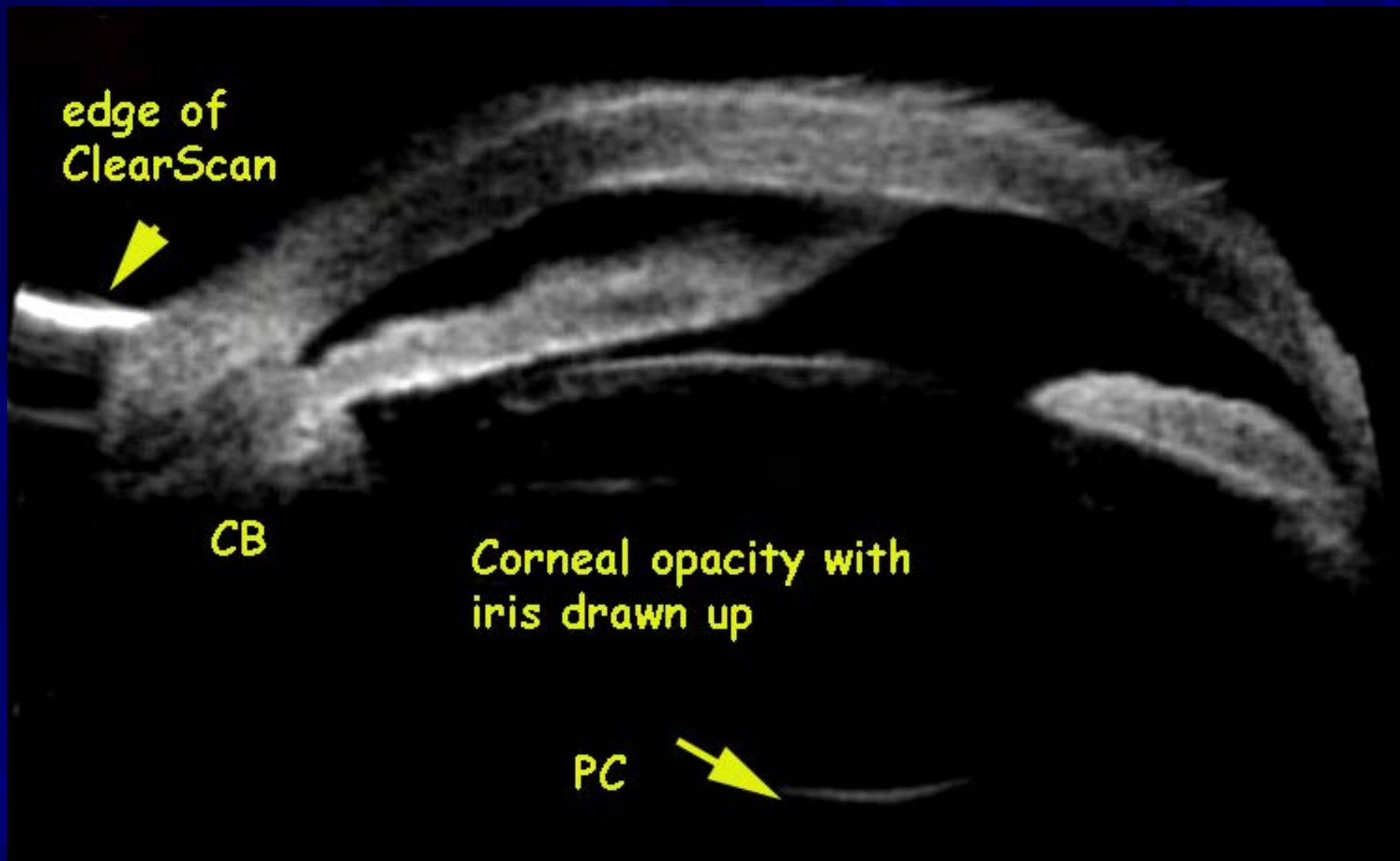




Trauma with cells in AC
note different length of iris (nasal vs. temporal)

membranes in AC





edge of
ClearScan



CB

Corneal opacity with
iris drawn up

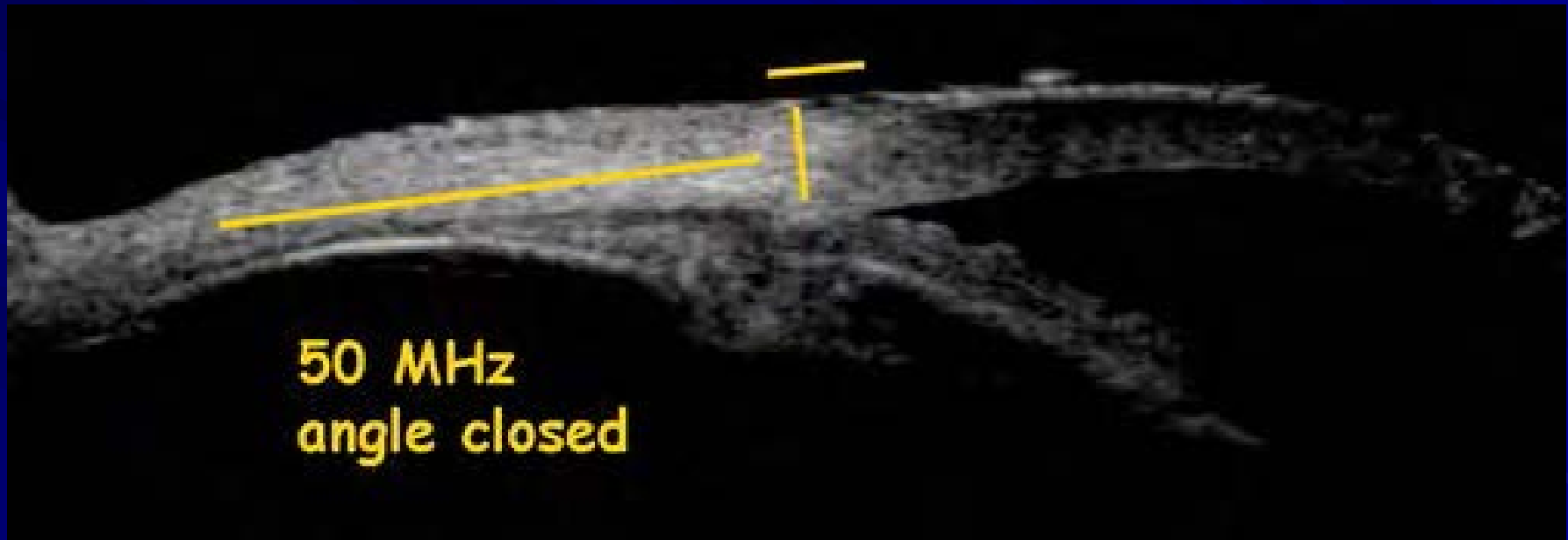
PC



UBM in Glaucoma

- Narrow or closed angles
(primary angle closure)
- Secondary angle closure
- Plateau iris

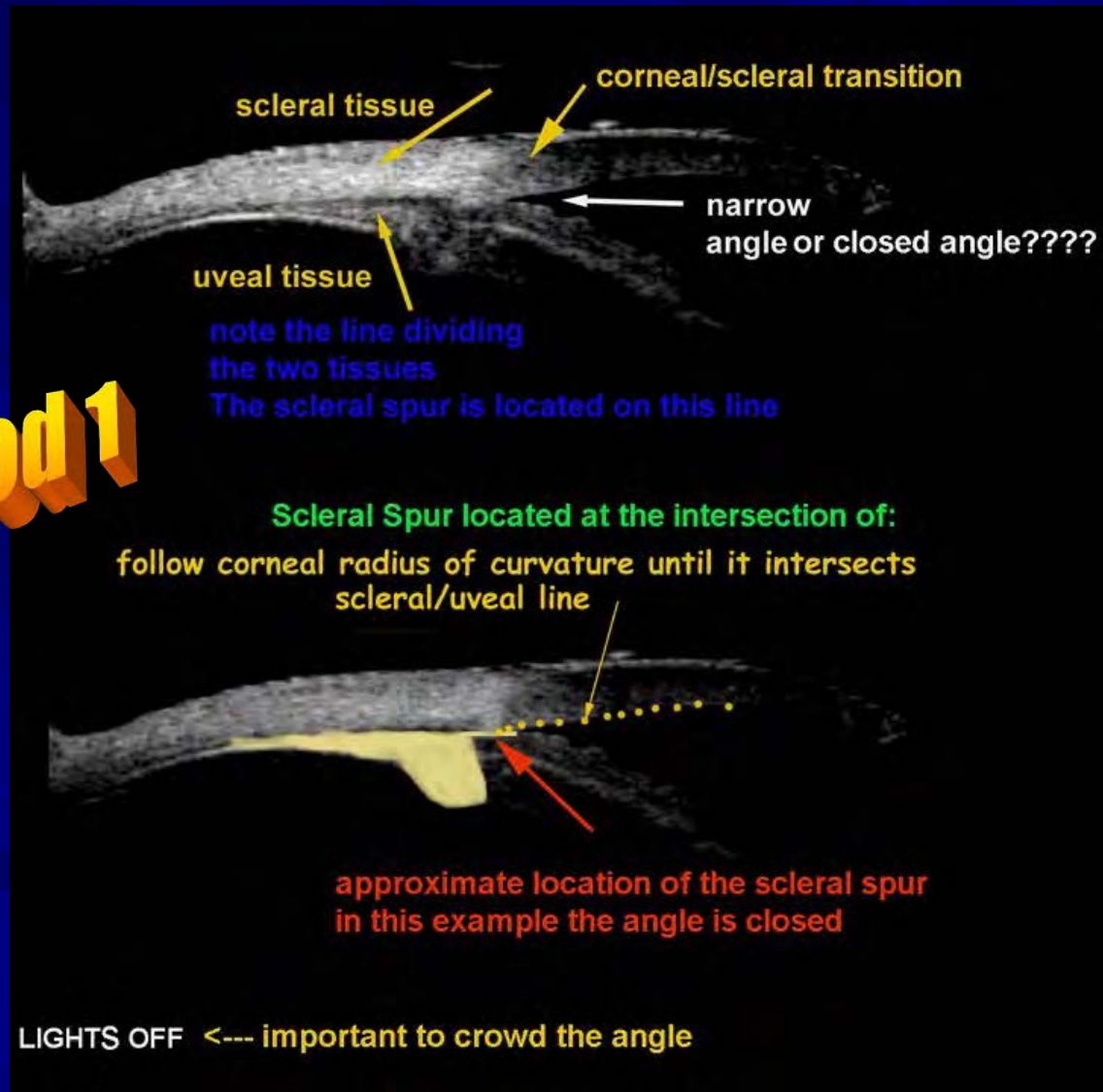
Occluded Angle in Glaucoma (Examine with the LIGHTS OFF!)



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

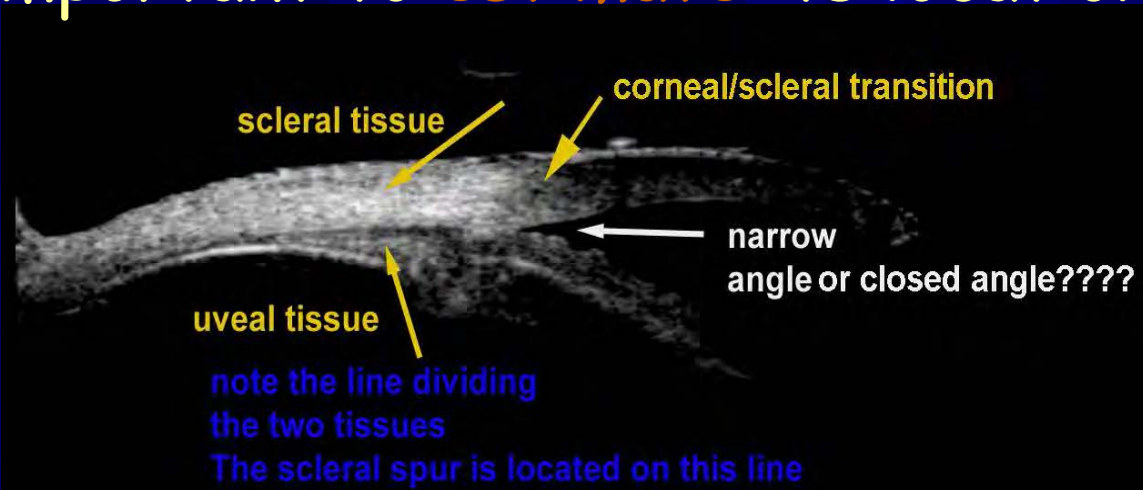
Scleral Spur in AC - often not visible

important to *estimate* its location -



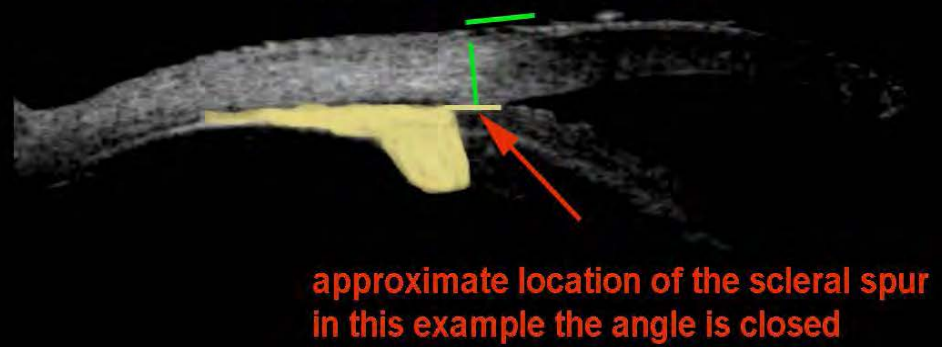
Scleral Spur in AC - often not visible

important to *estimate* its location -



method 2

Scleral Spur located at the intersection of:
1mm back from corneal scleral transition
and down to uveal scleral line



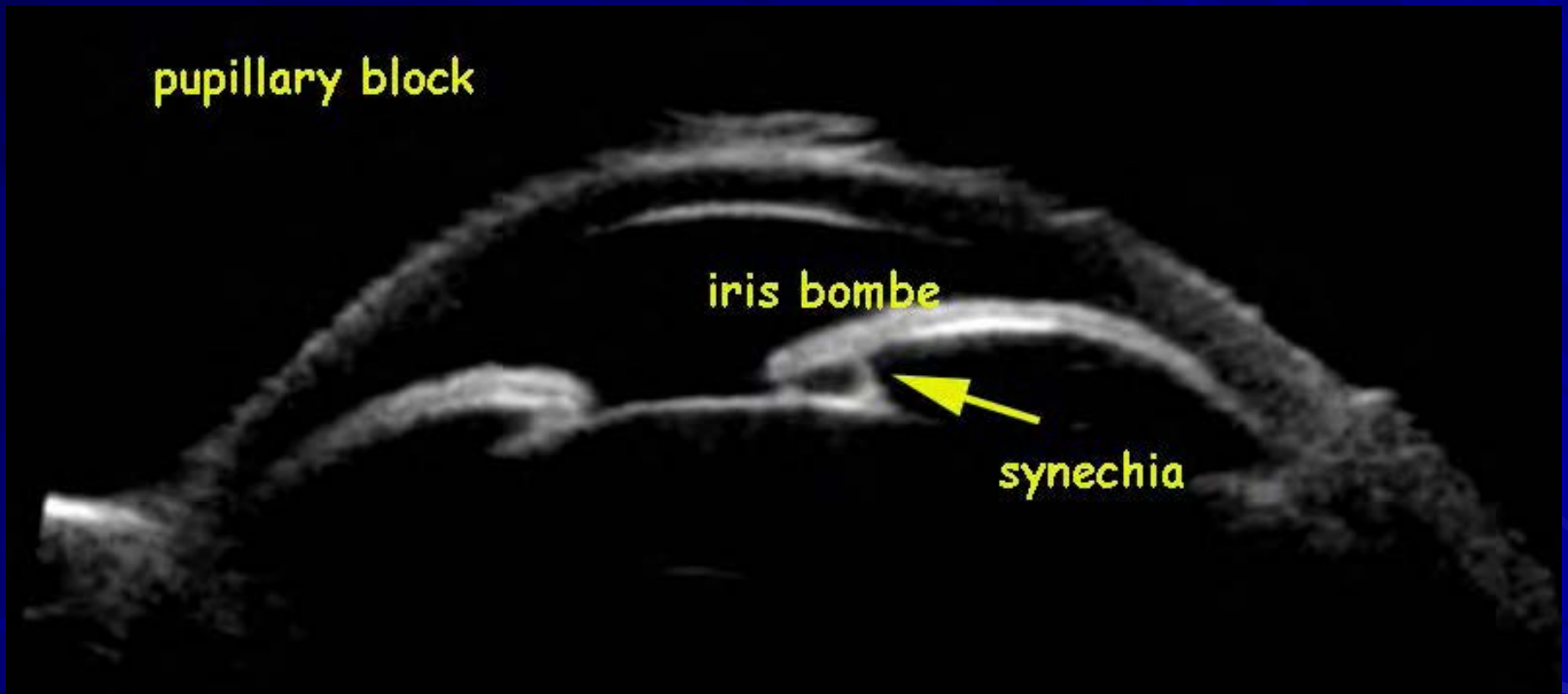
LIGHTS OFF <--- important to crowd the angle

Pupillary Block with Iris Bombé

convex bowing suggests pressure difference between AC and PC

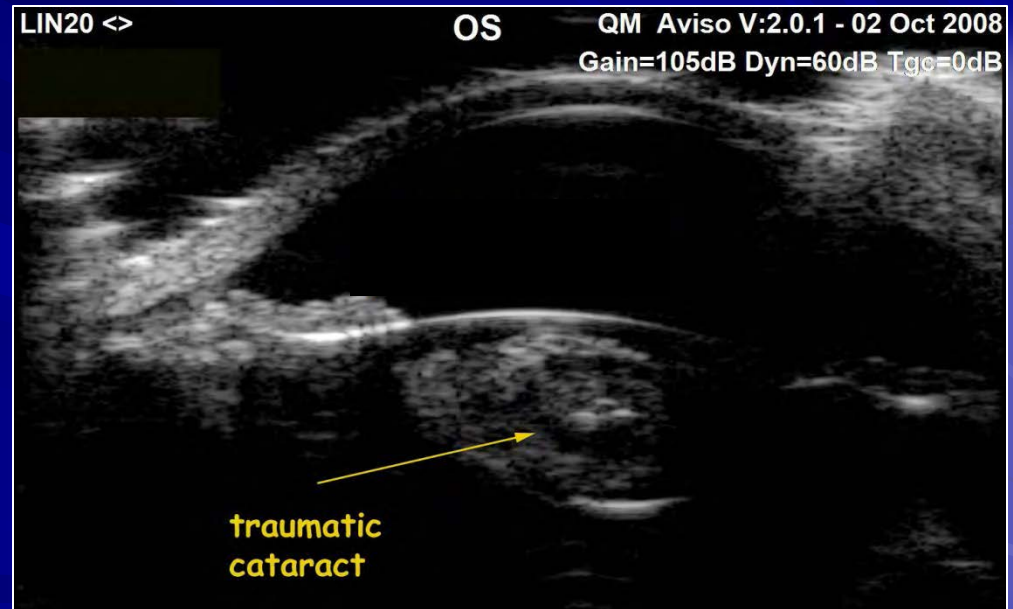
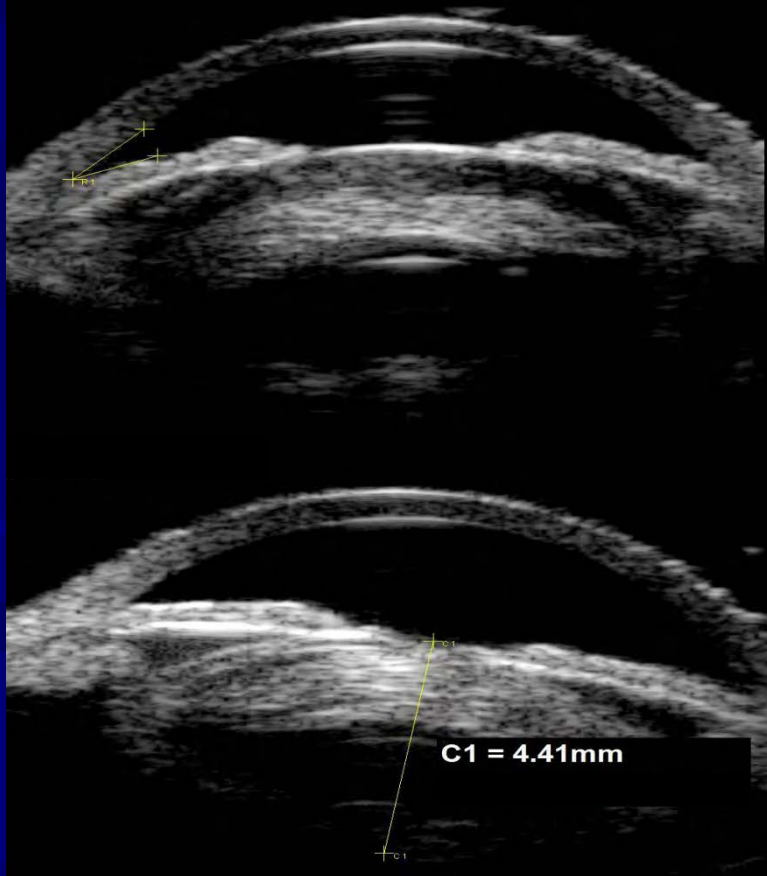


Pupillary block



Phacomorphic lens changes

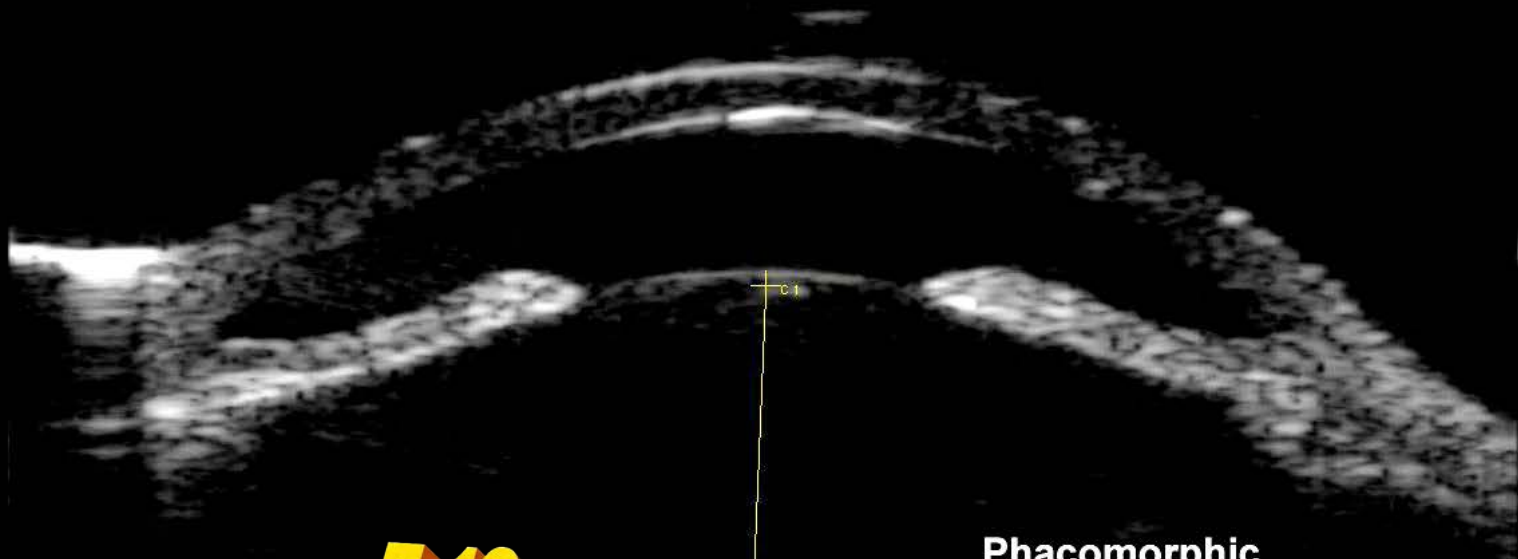
Enlarged phacomorphic lens touching cornea and pushing iris forward



Phacomorphic lens changes

25 MHz

OD



5.12 mm

Phacomorphic
lens closing the angle

C1 = 5.12mm

OD LIGHTS OFF S=S

PC

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

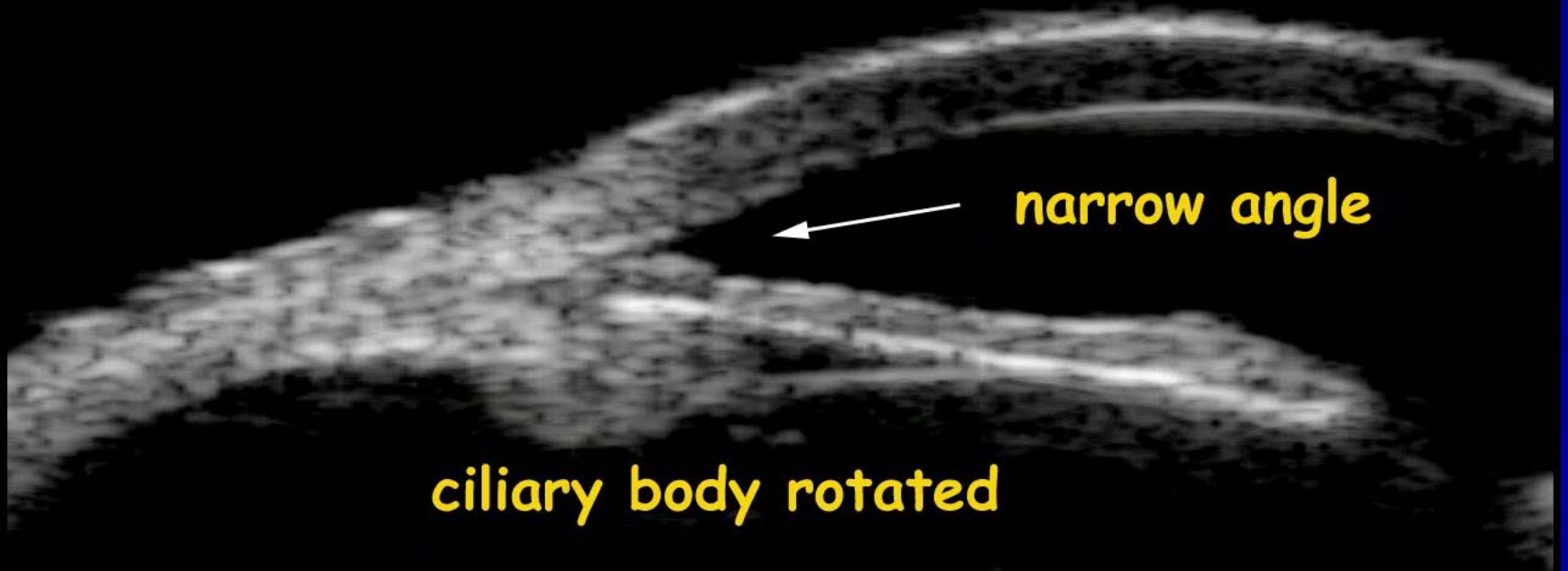
Plateau Iris

- Syndrome -- "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

LIN20 <>

OD

QM Aviso V:2.0.1 - 25 Sep 2008
Gain=100dB Dyn=60dB Tgc=0dB



narrow angle

ciliary body rotated

Plateau Iris



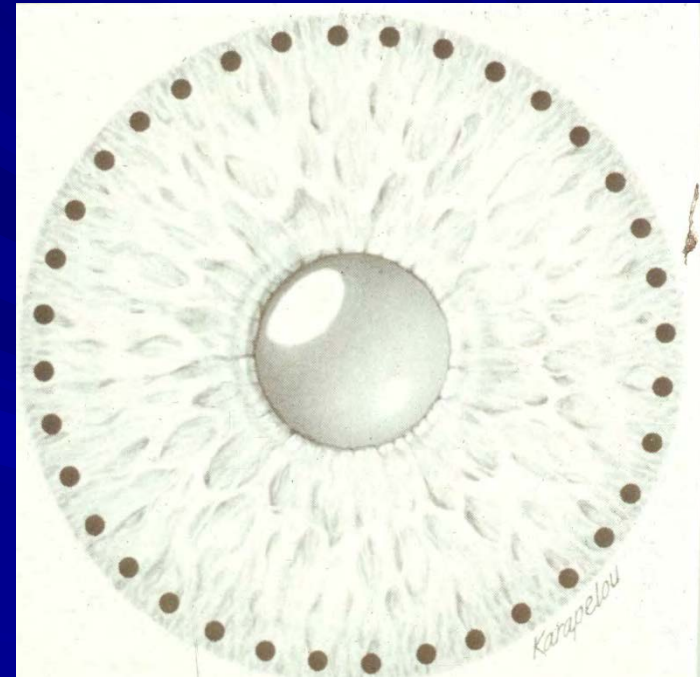
OD LIGHTS OFF TEMPORAL

copyrighted TC Prager, PhD

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



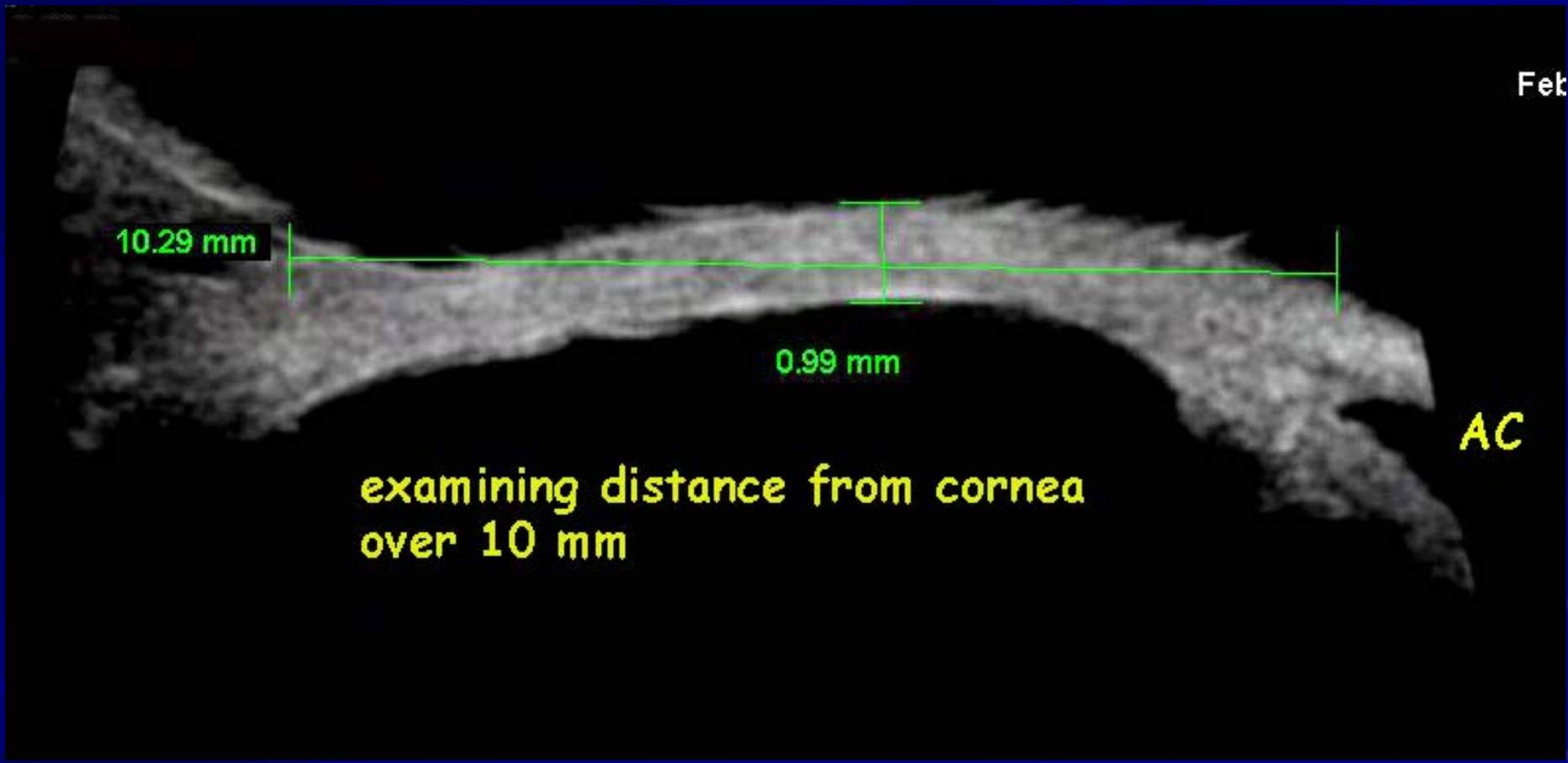
Fet

10.29 mm

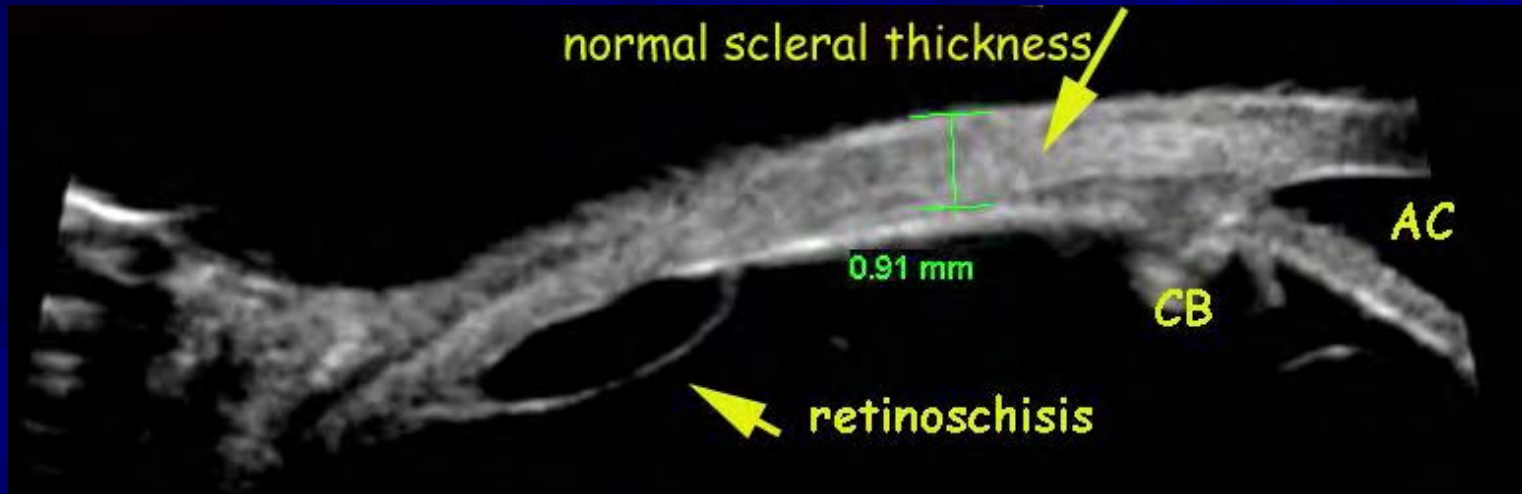
0.99 mm

AC

examining distance from cornea
over 10 mm



Scleritis



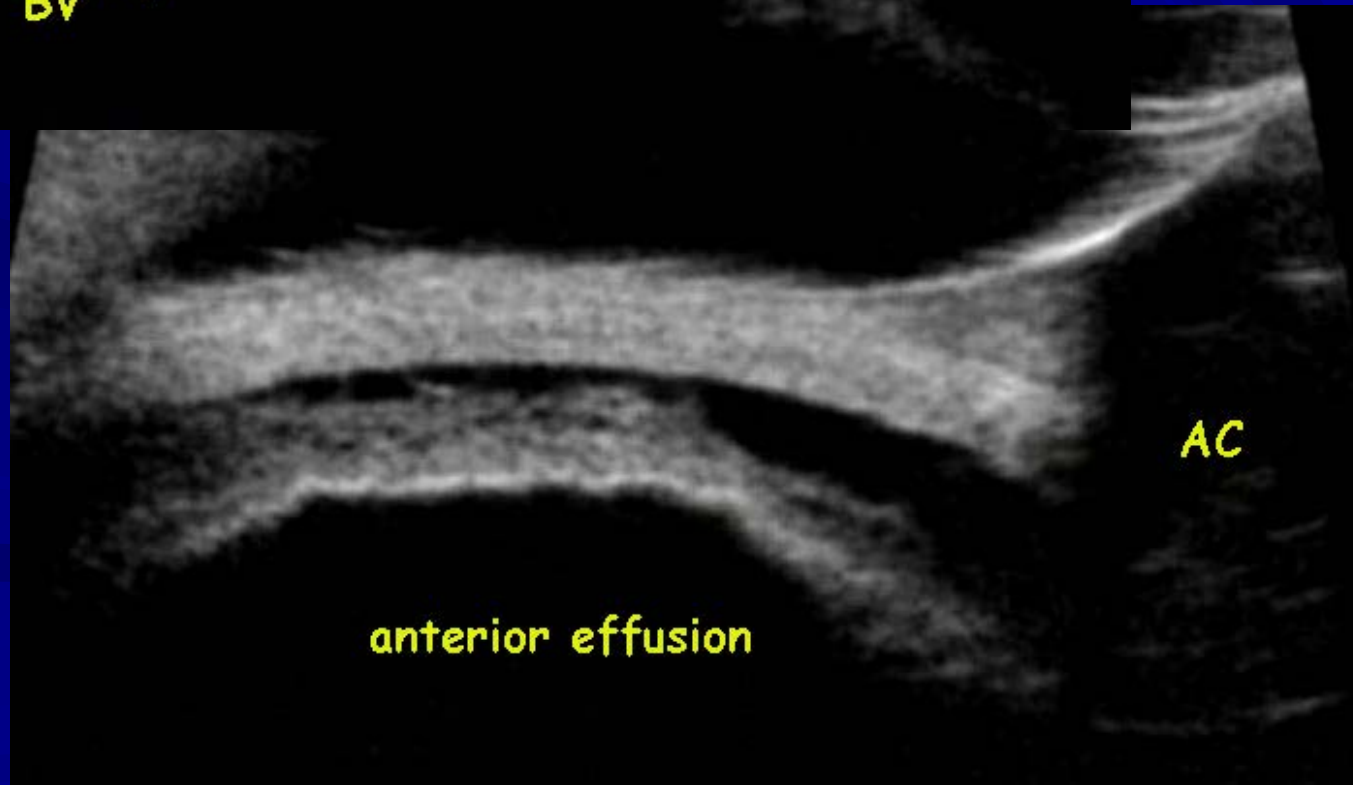
Hemangioma



anterior effusion

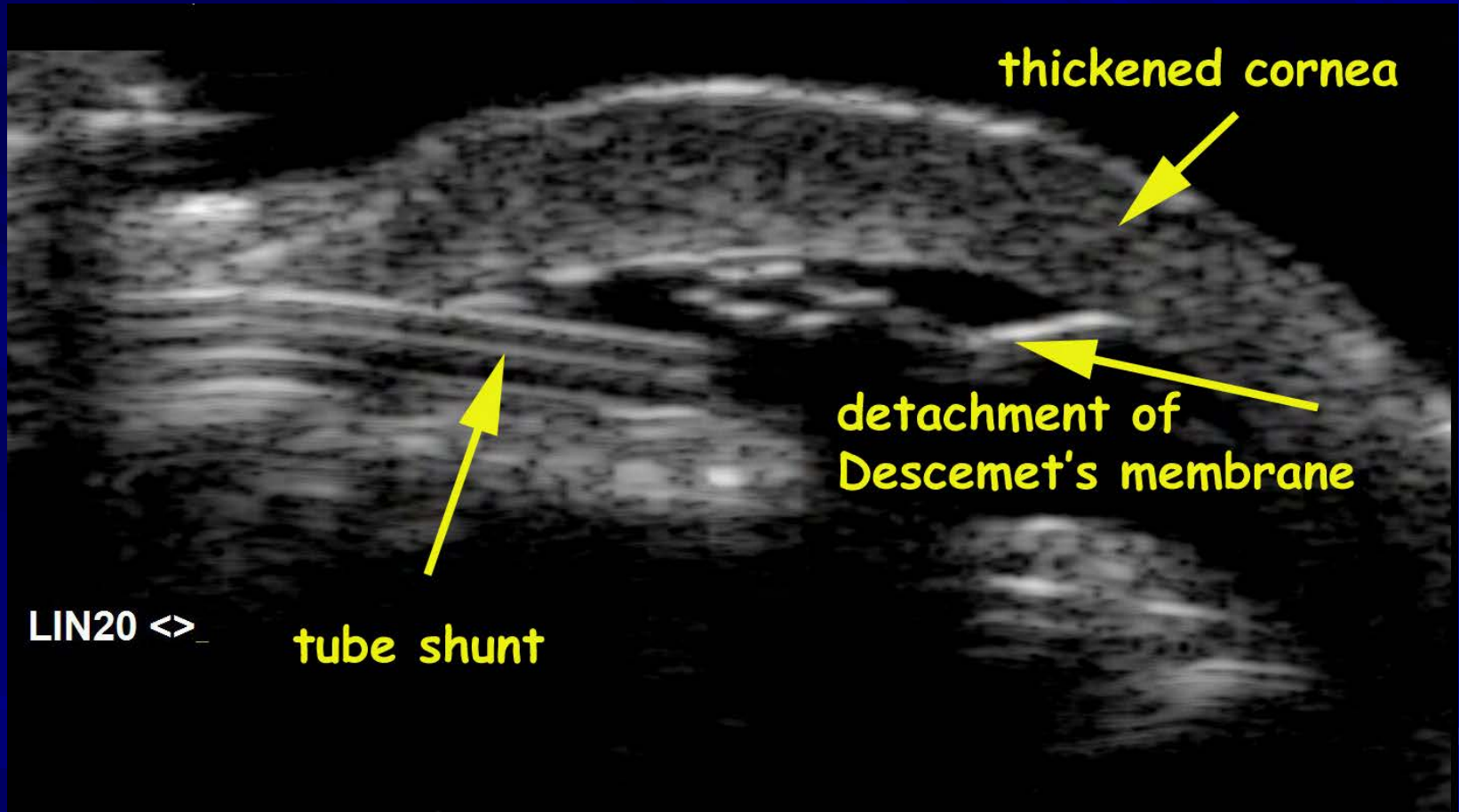
BV

AC



anterior effusion

AC



thickened cornea

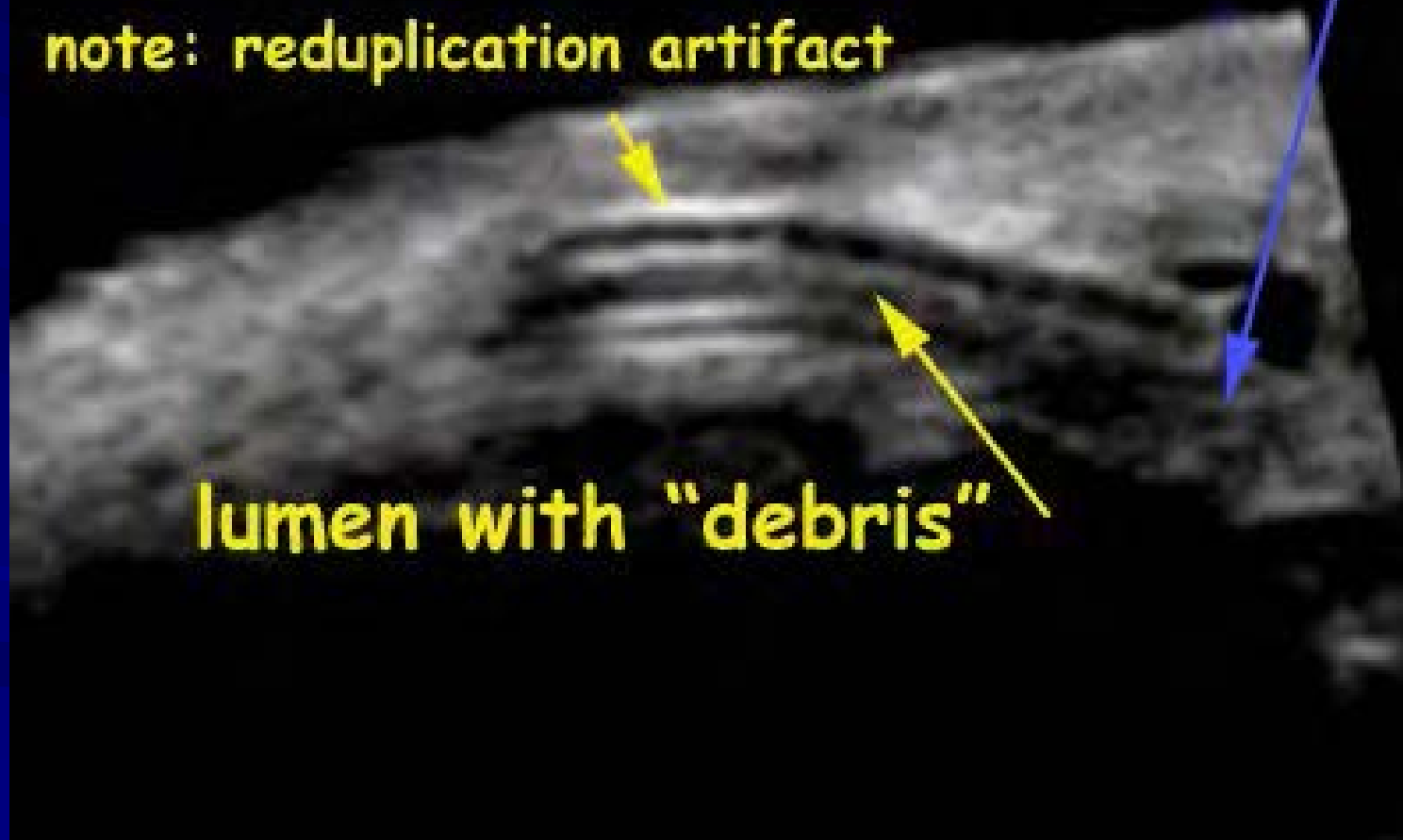
detachment of
Descemet's membrane

tube shunt

LIN20 <>

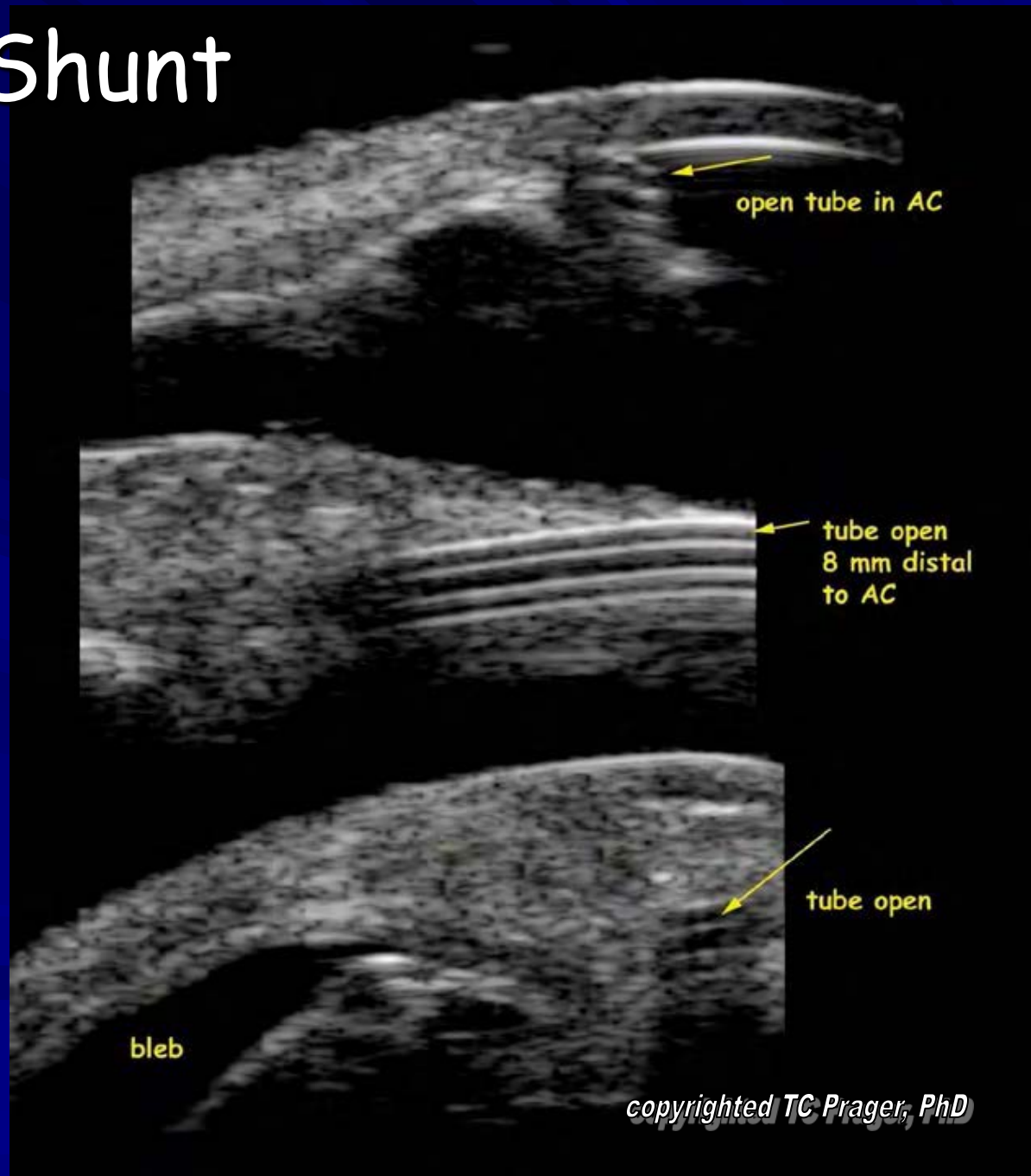
membrane at end of tube shunt

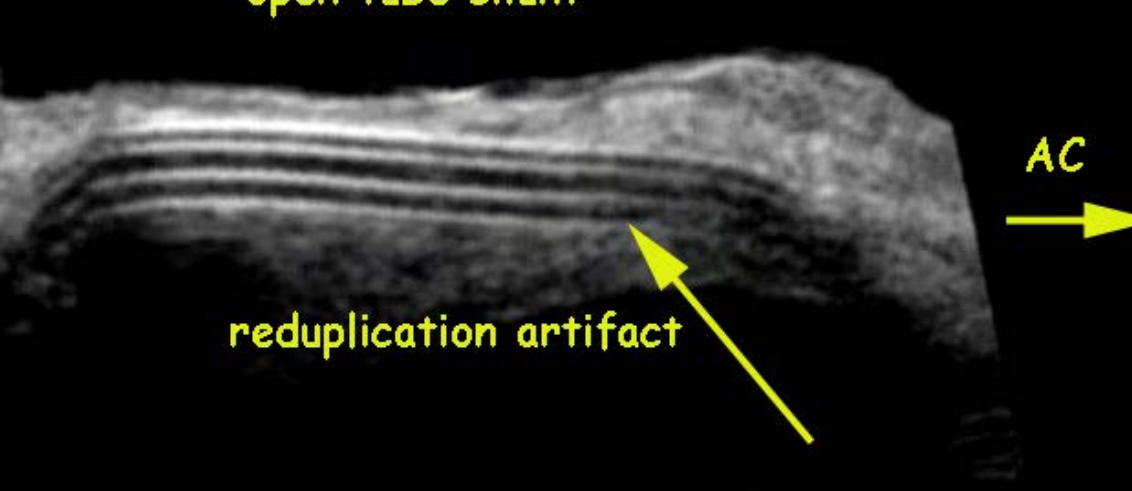
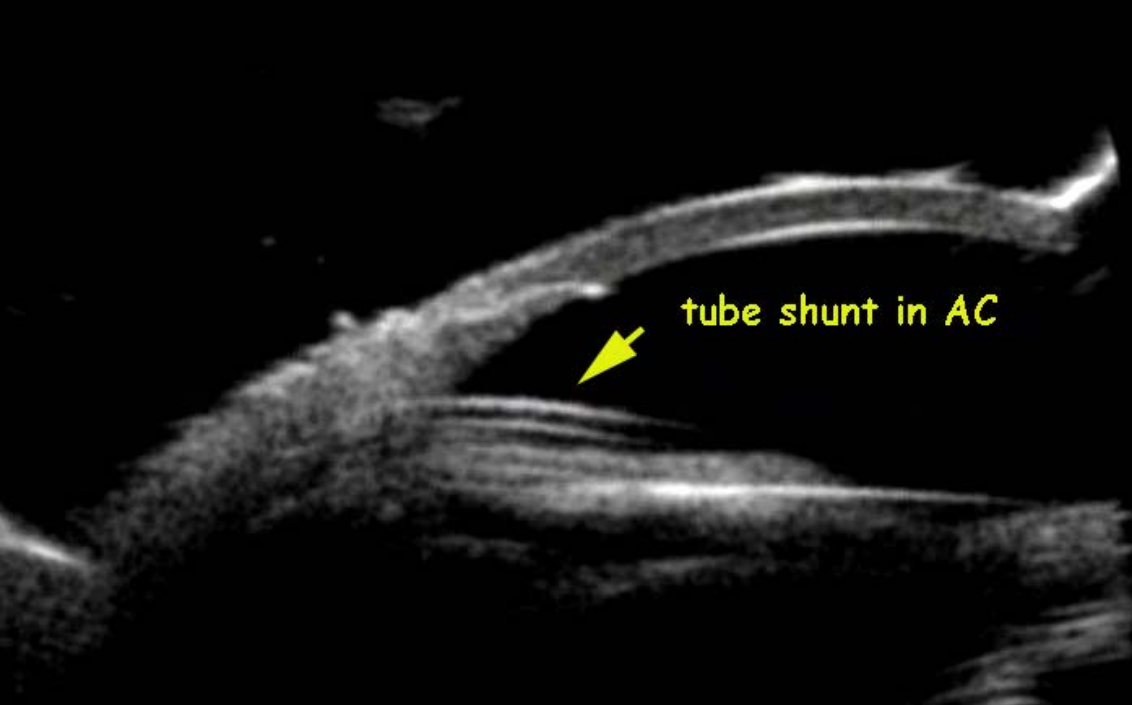
note: reduplication artifact



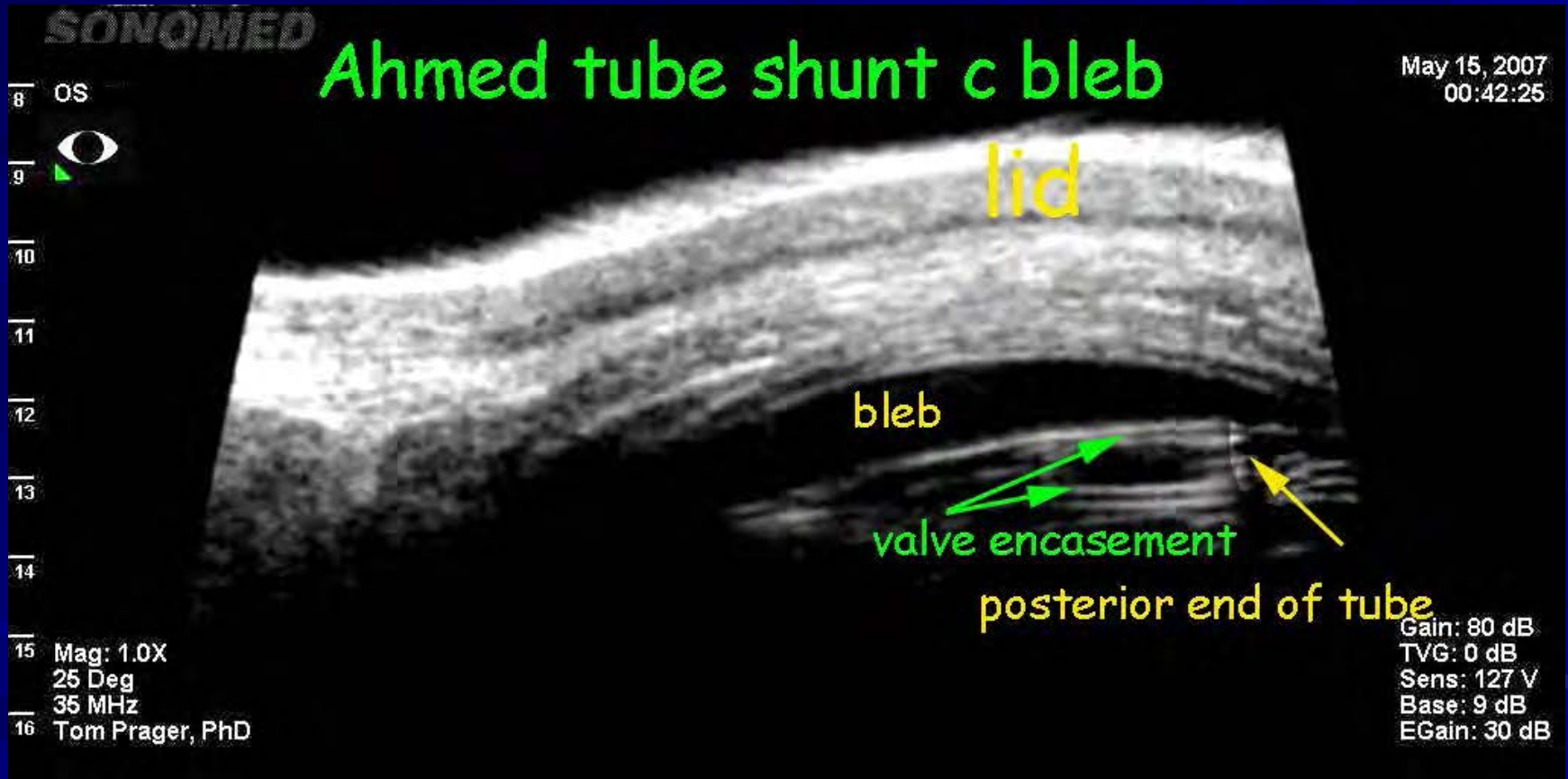
lumen with "debris"

Tube Shunt





20 mm from limbus functioning Ahmed valve implant



SONOMED

lid

May 15, 2007
02:46:35

8 OD
9 

Tenon's 

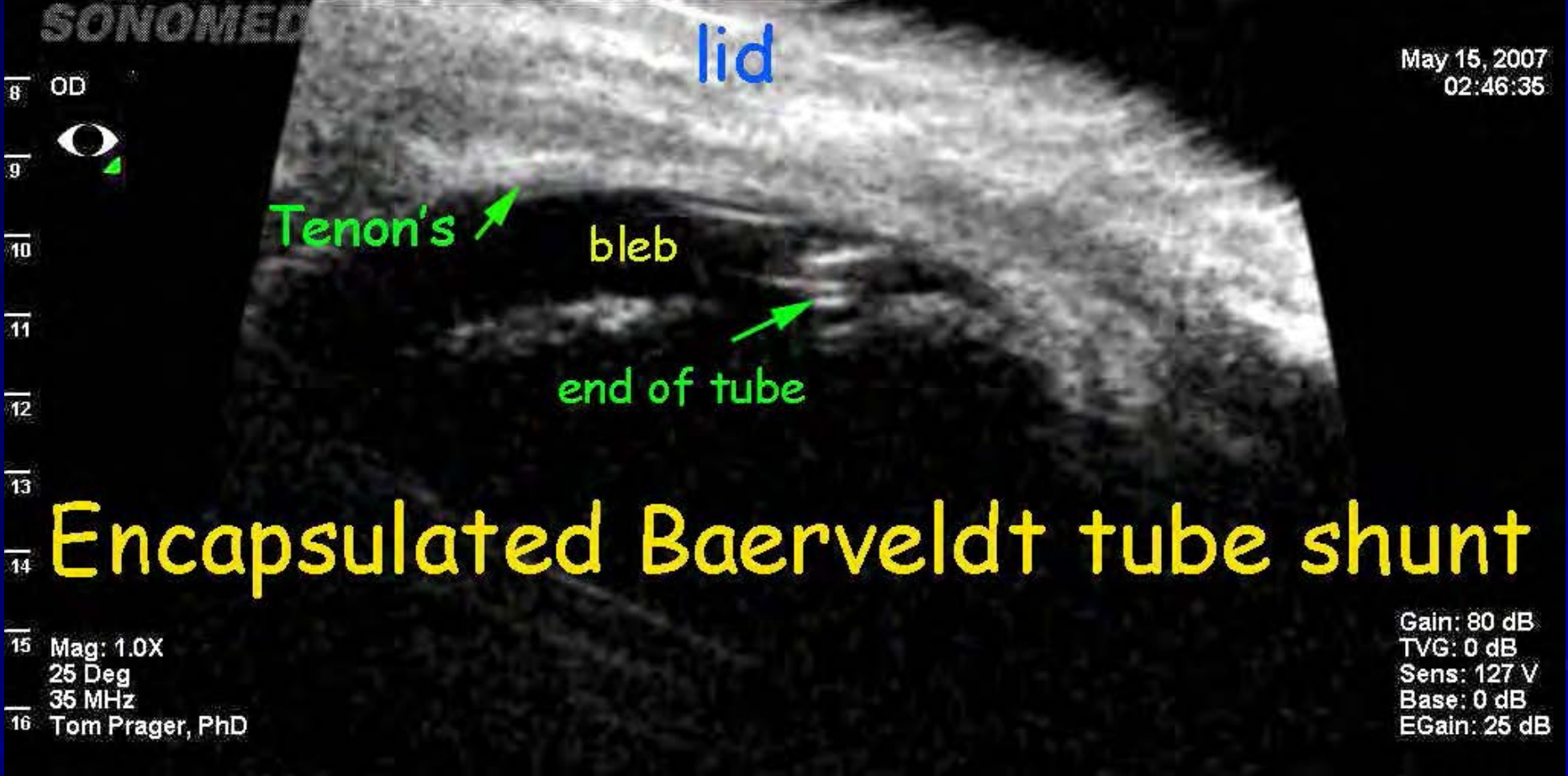
bleb

end of tube 

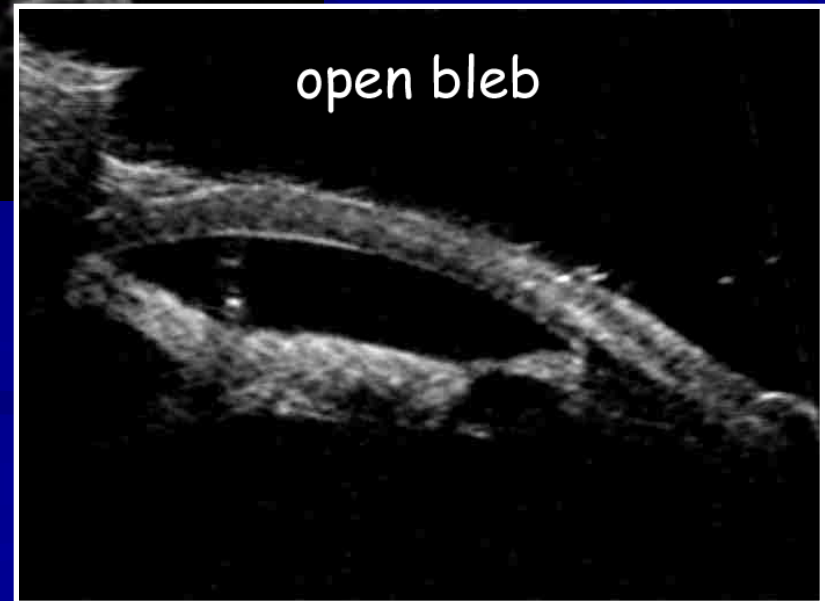
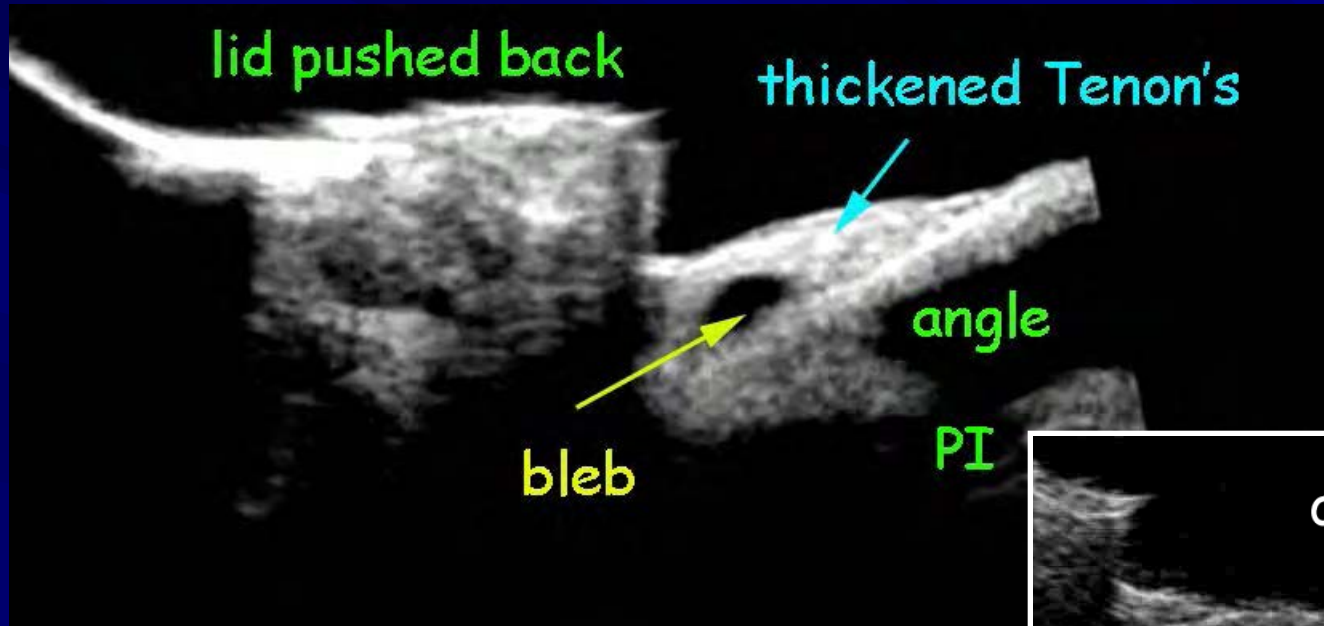
Encapsulated Baerveldt tube shunt

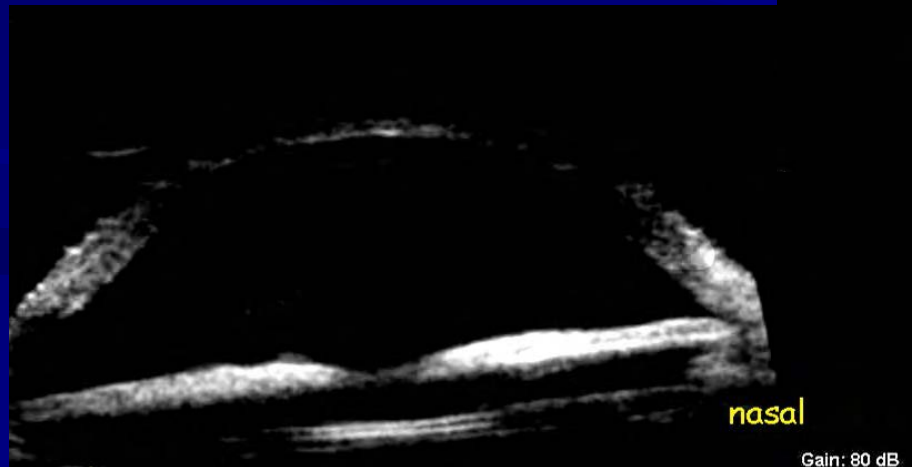
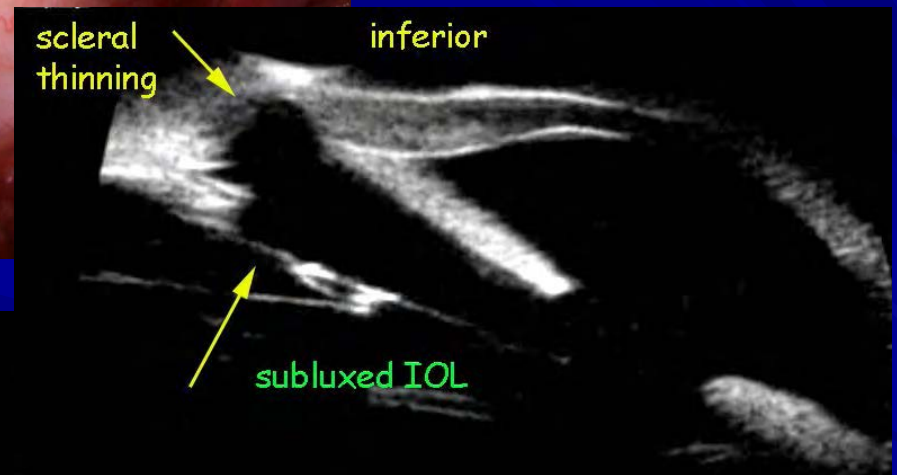
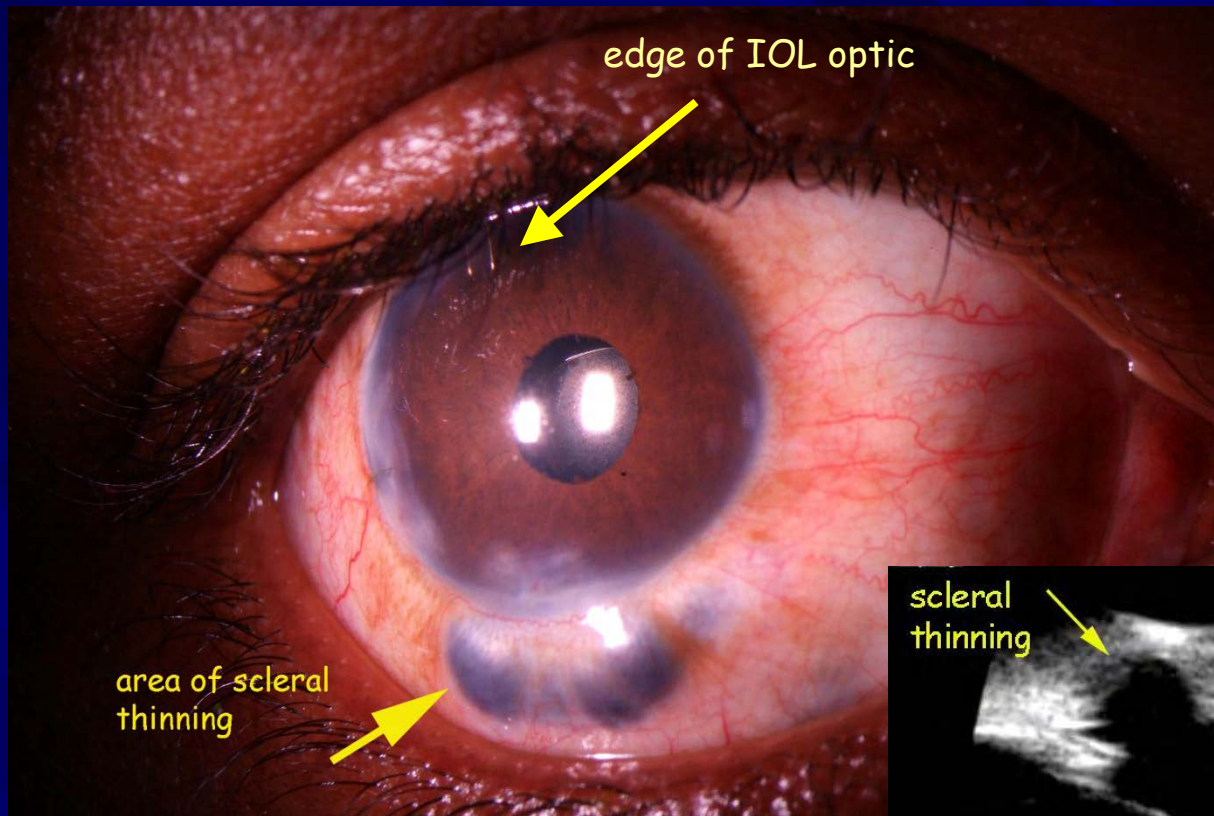
15 Mag: 1.0X
25 Deg
35 MHz
16 Tom Prager, PhD

Gain: 80 dB
TVG: 0 dB
Sens: 127 V
Base: 0 dB
EGain: 25 dB

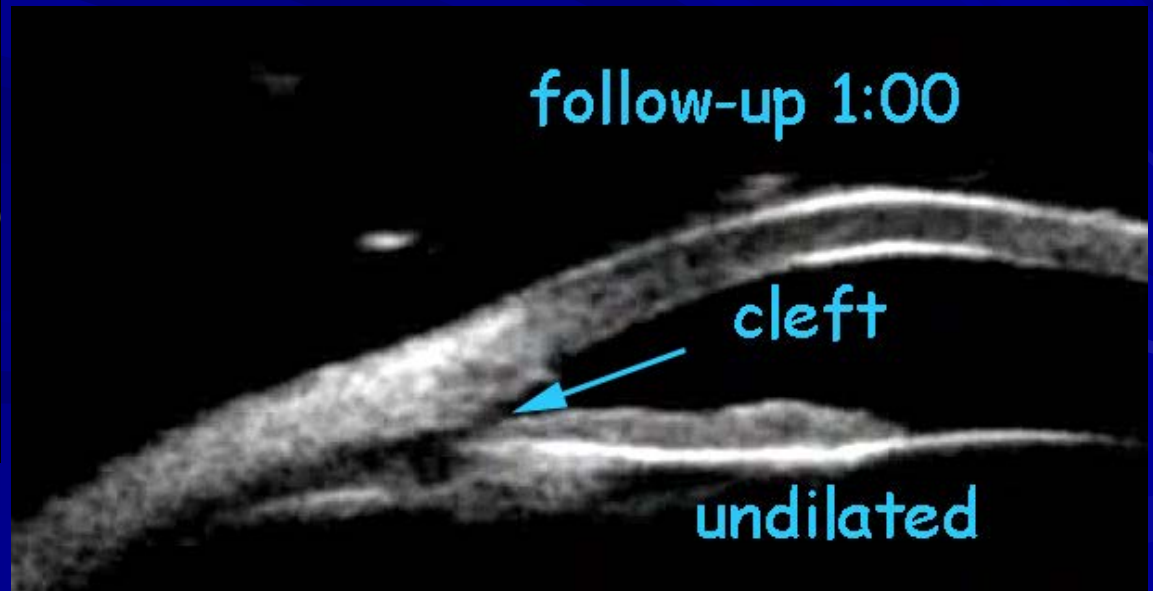
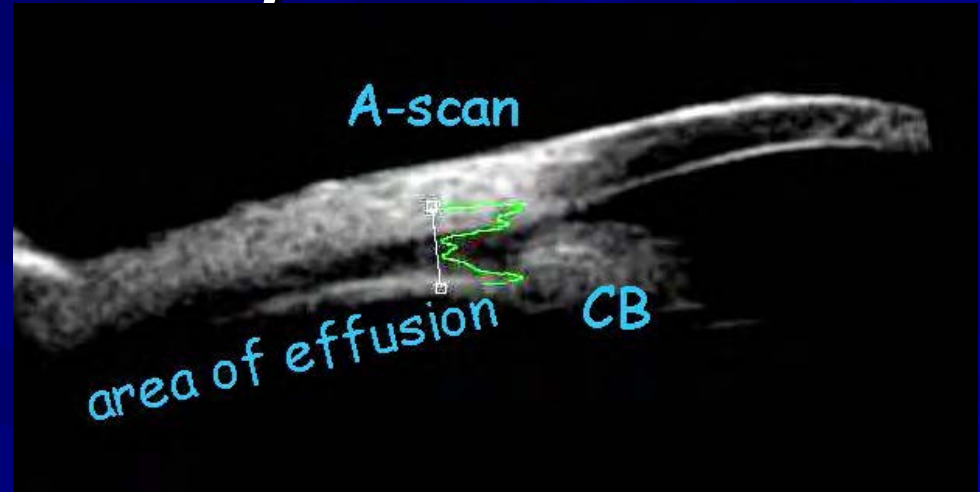


Encapsulated Filtering Bleb





Anterior Choroidal Effusion in an 8 y/o



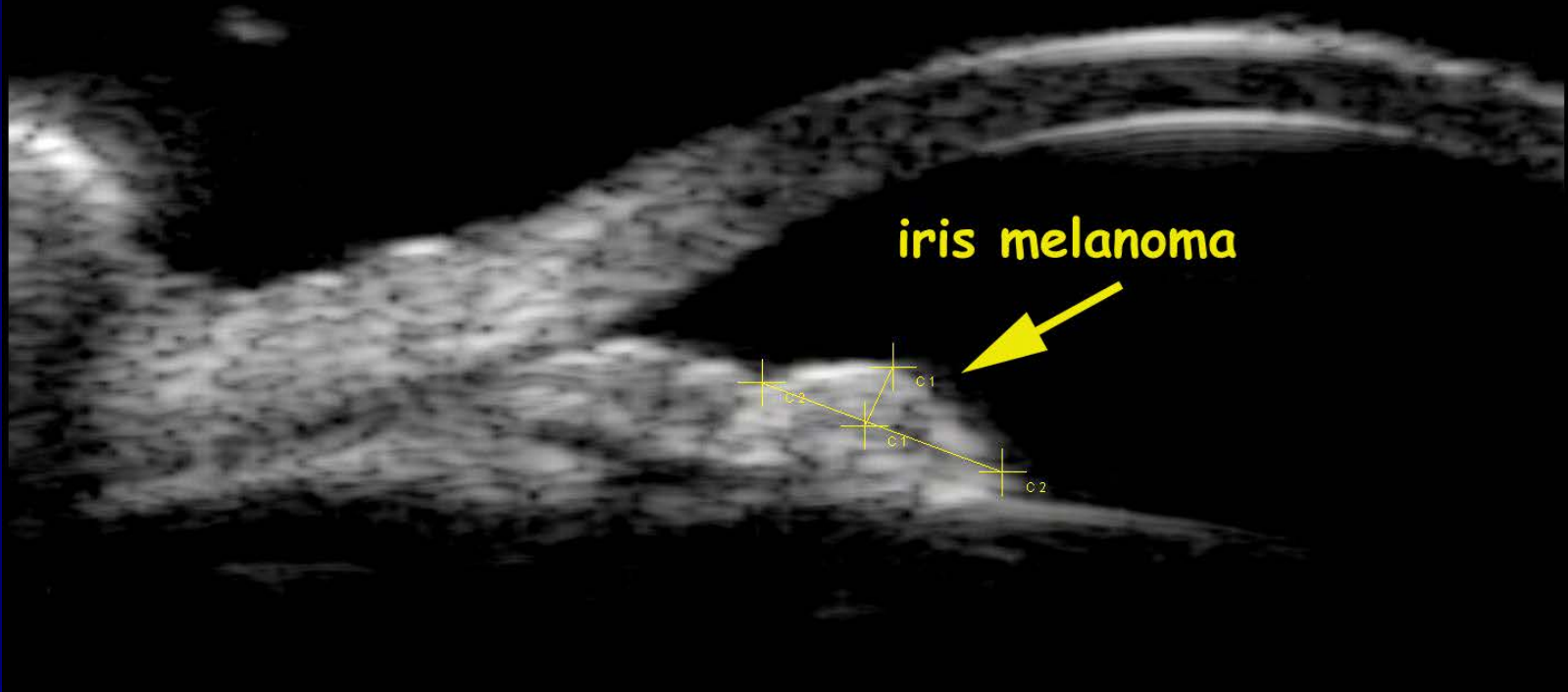
MELANOMA

LIN20 <>

OS

QM Aviso V:2.0.1 - 21 Oct 2008

Gain=100dB Dyn=60dB Tgc=0dB



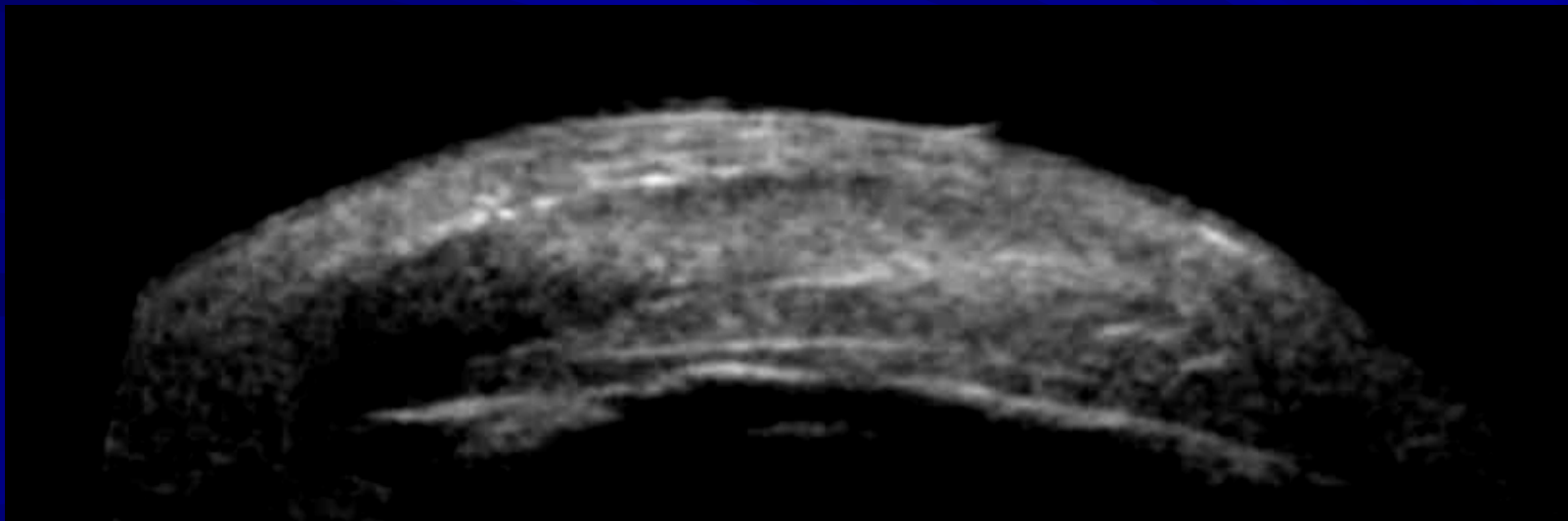
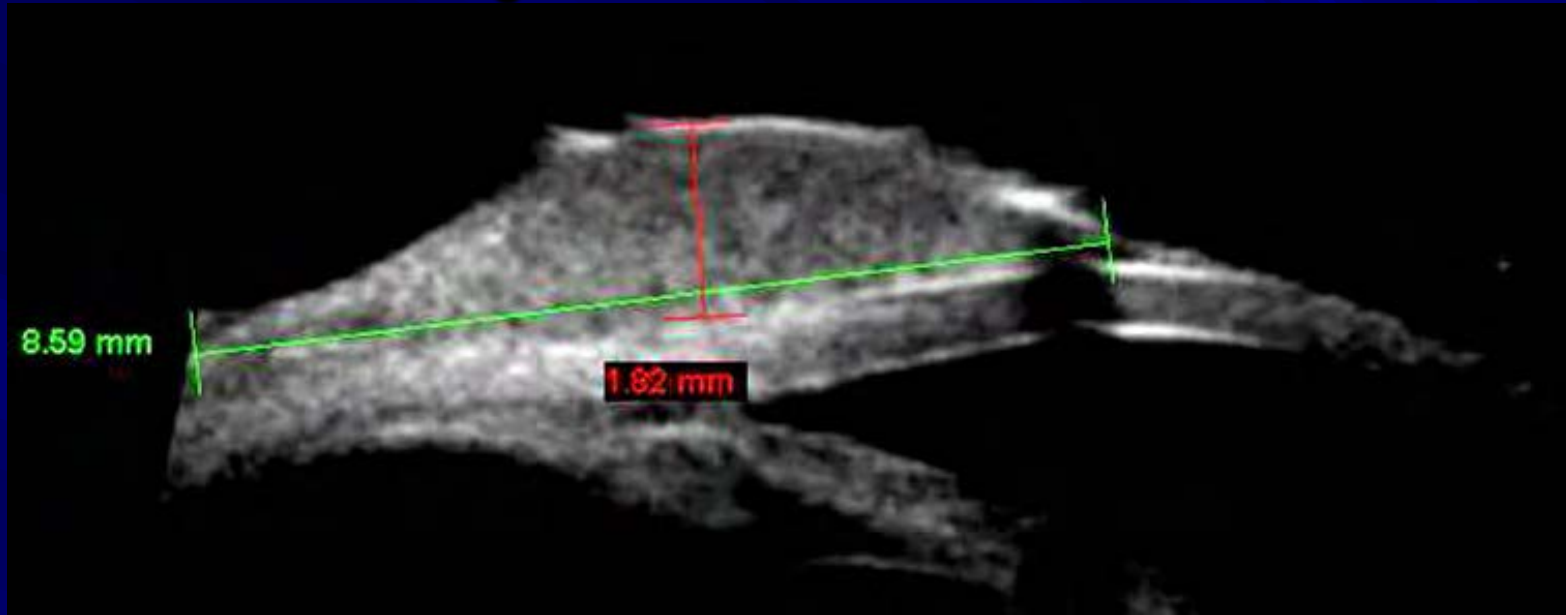
C2 = 1.72mm

C1 = 0.44mm

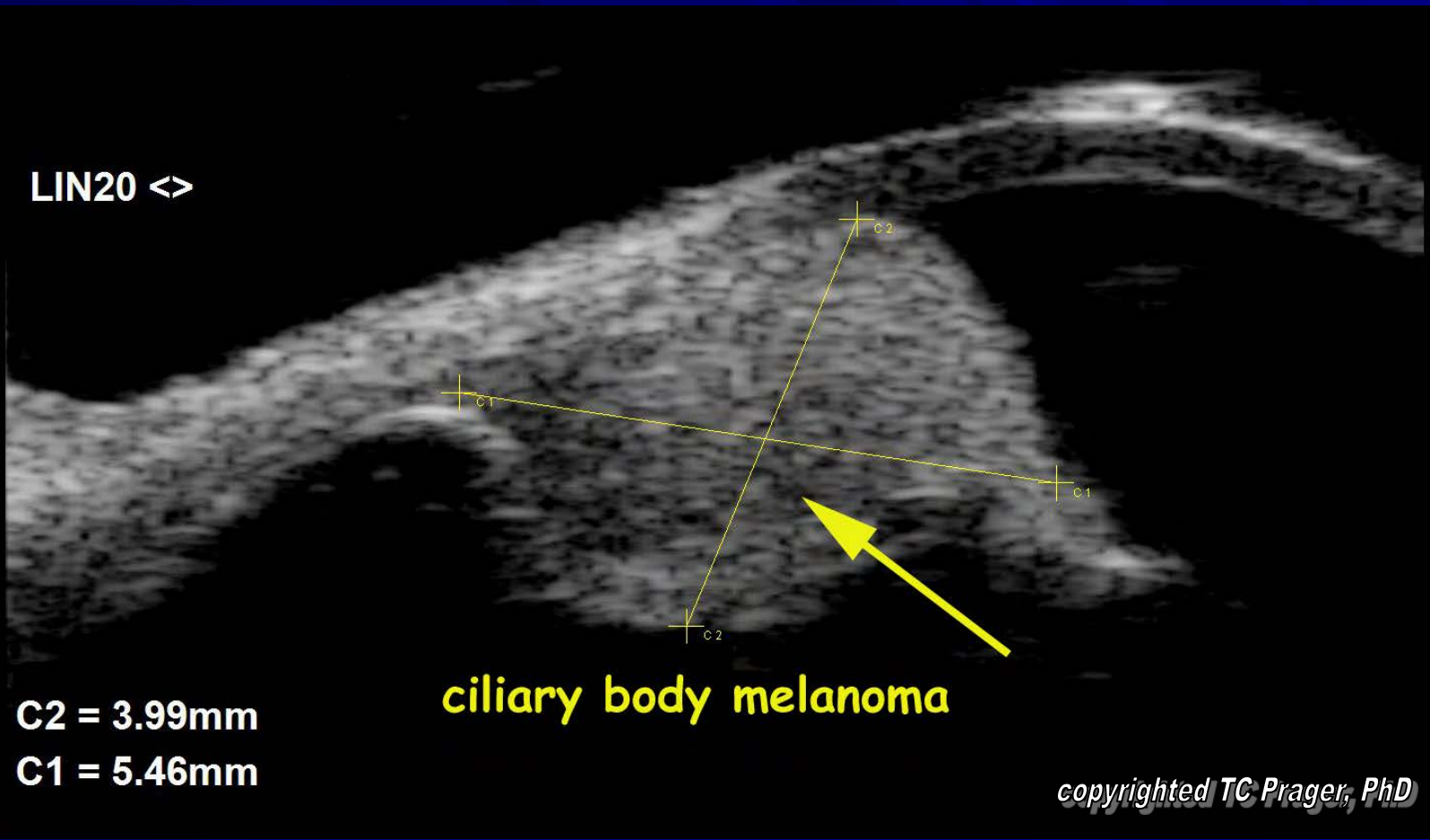
os 7:00 iris melanoma

copyrighted TC Prager, PhD

Conjunctival Melanomas



LIN20 <>

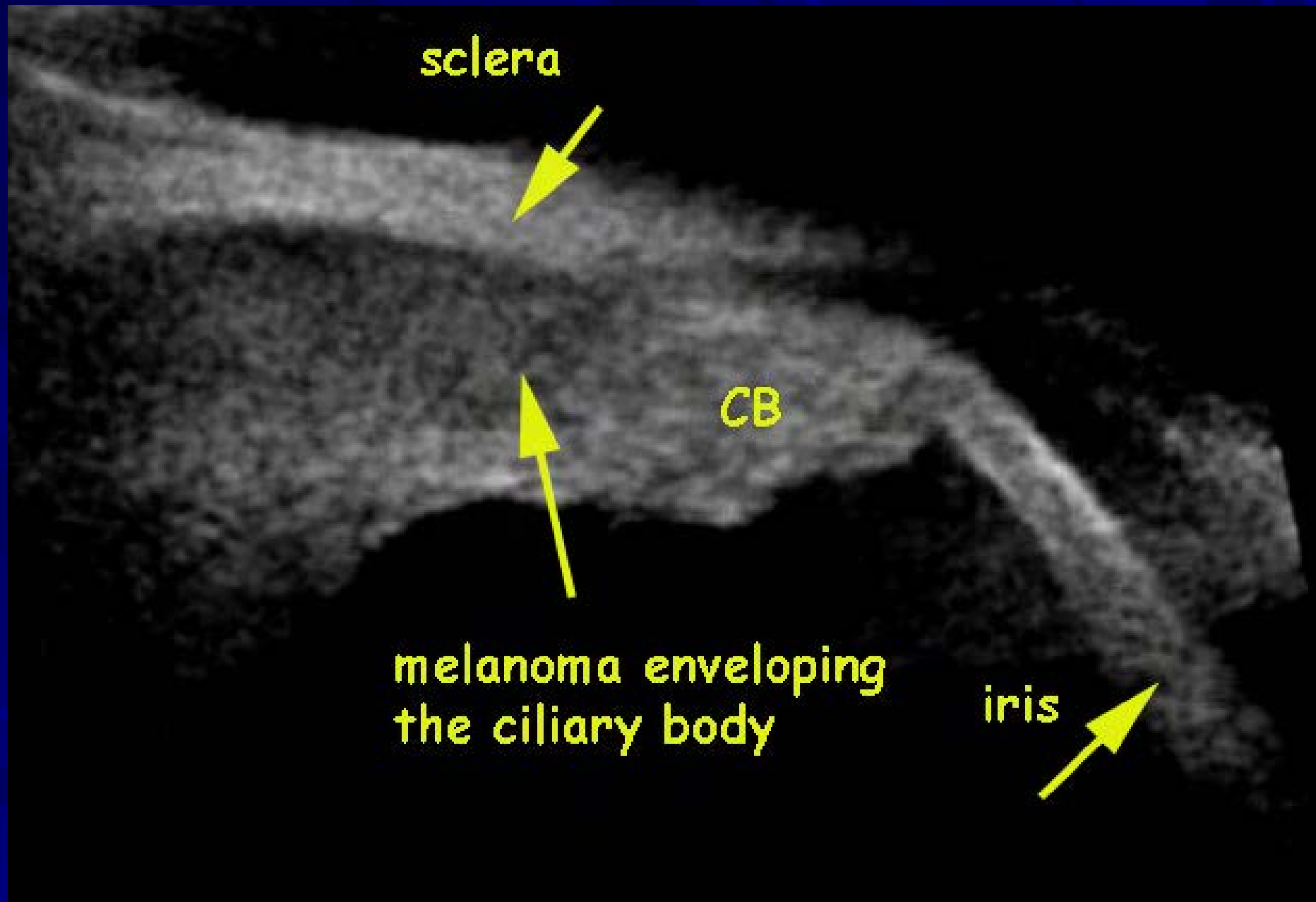


C2 = 3.99mm

C1 = 5.46mm

ciliary body melanoma

copyrighted TC Prager, PhD



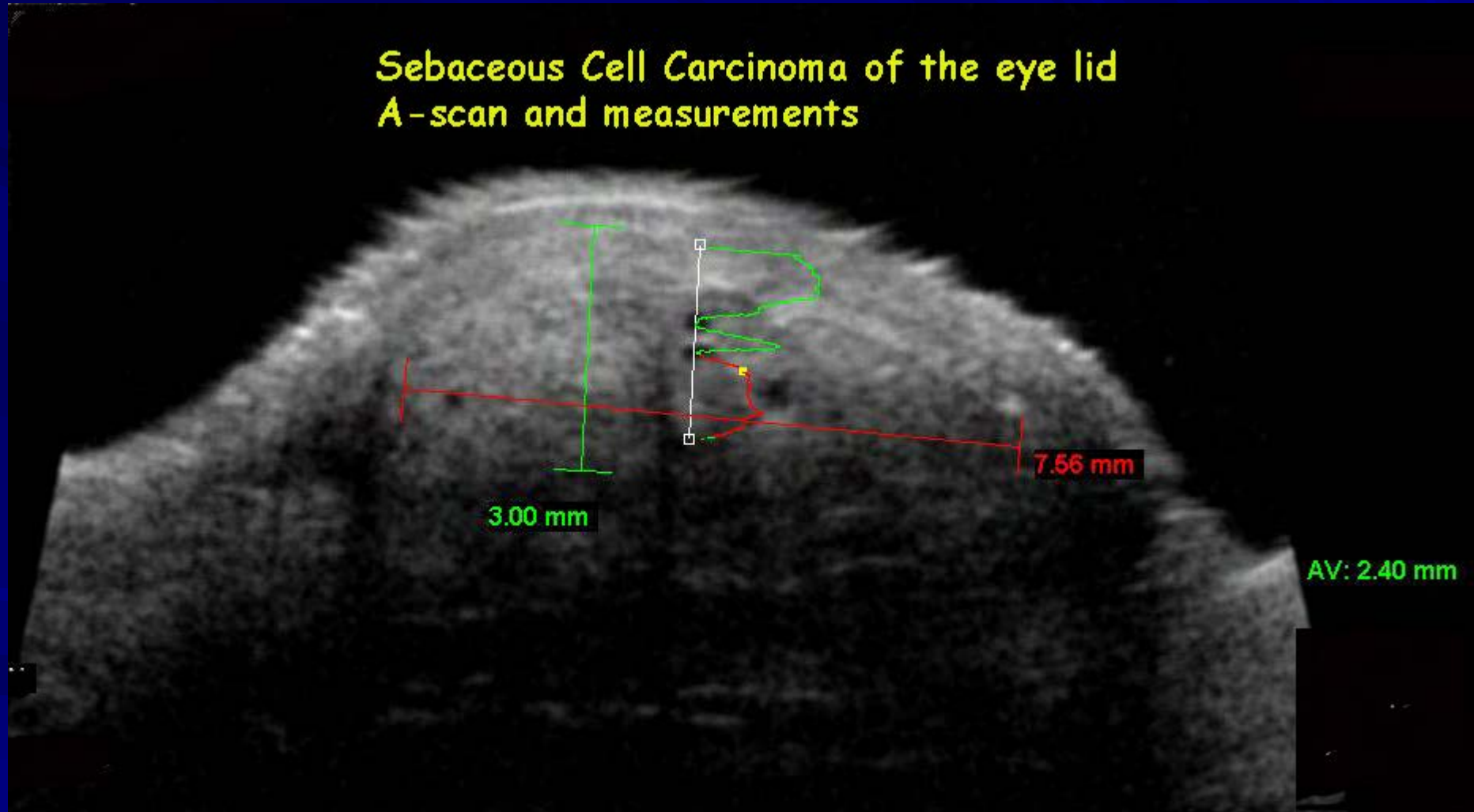
Melanoma in CB



Extraocular Applications

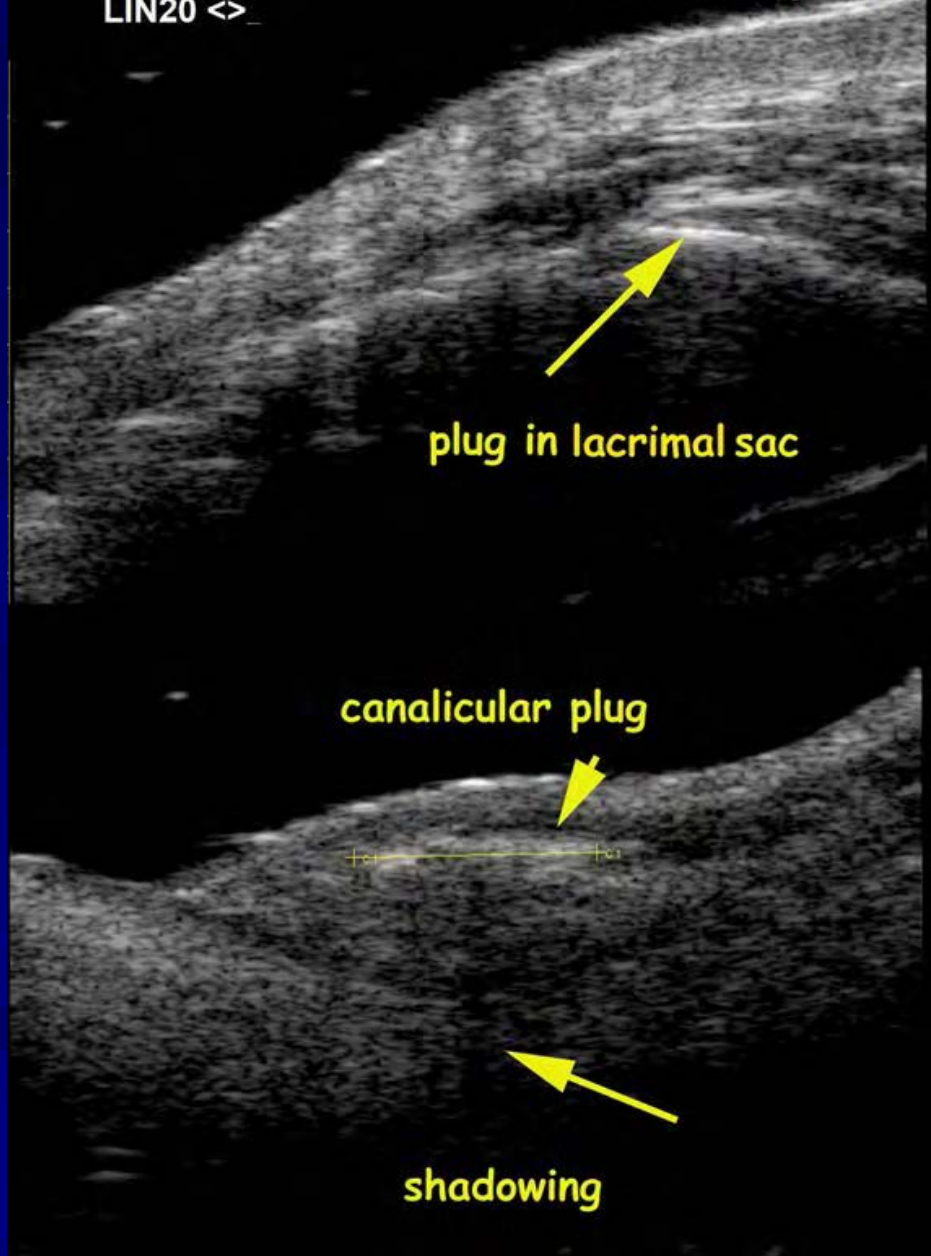
Eyelid Lesions

Sebaceous Cell Carcinoma of the eye lid
A-scan and measurements



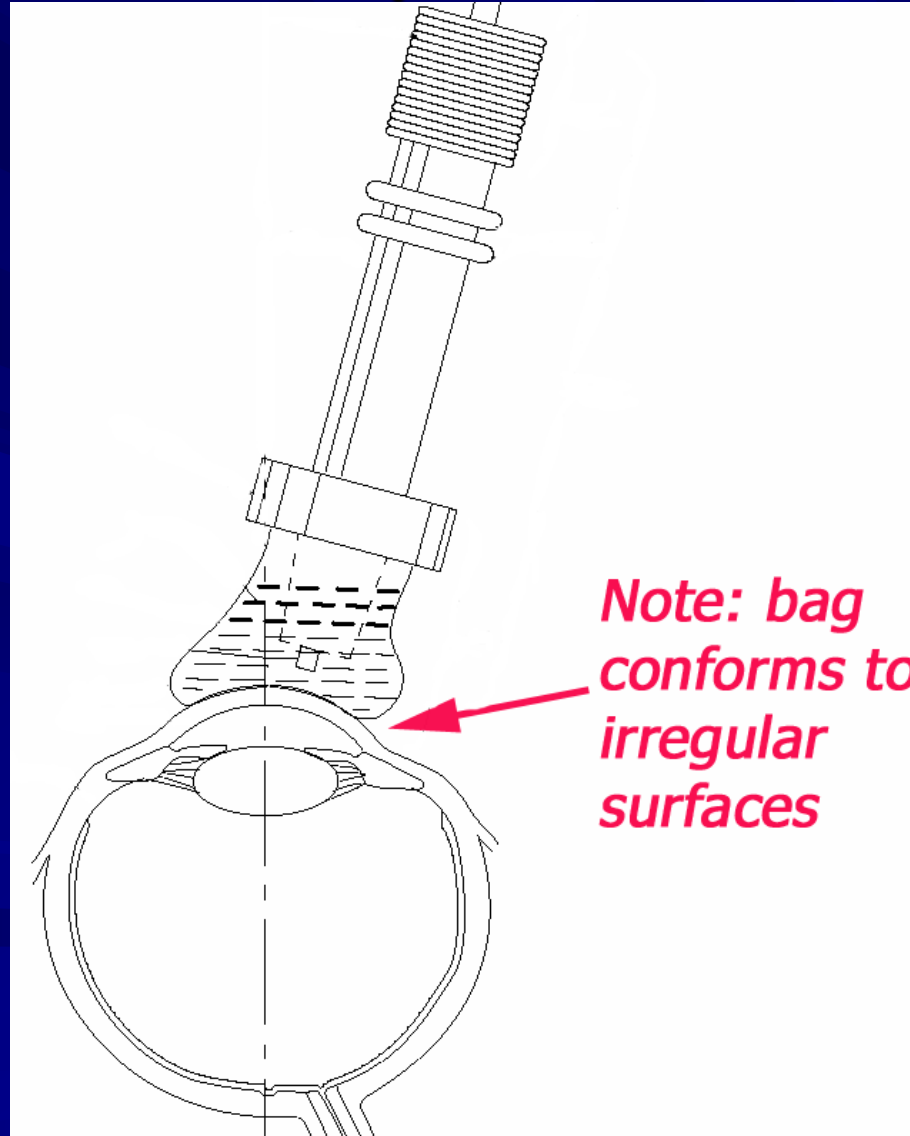
QM Aviso V:2.0.1 - 23
Gain=98dB Dyn=60dB

LIN20 <>

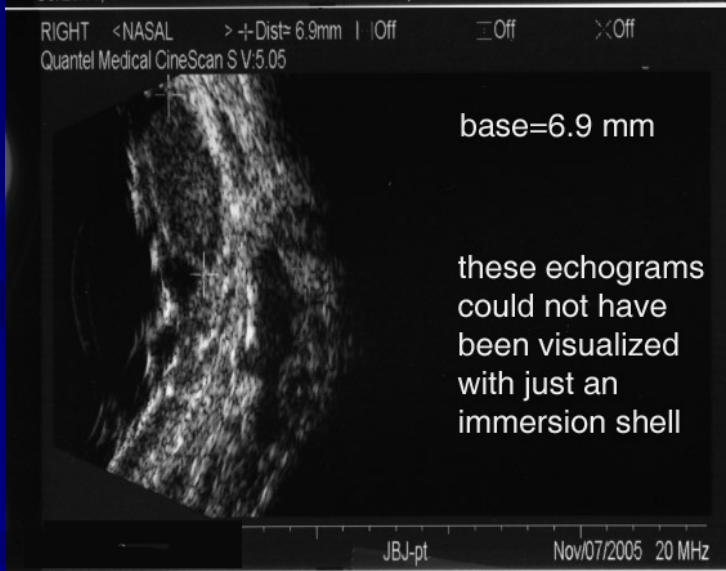
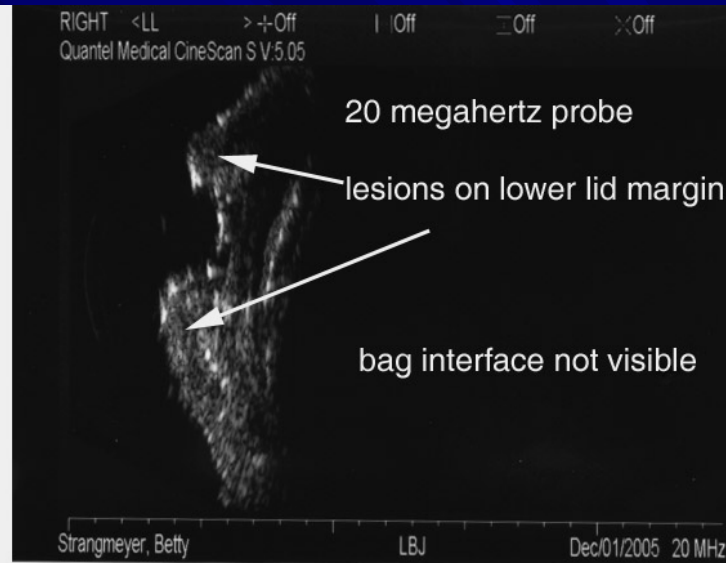
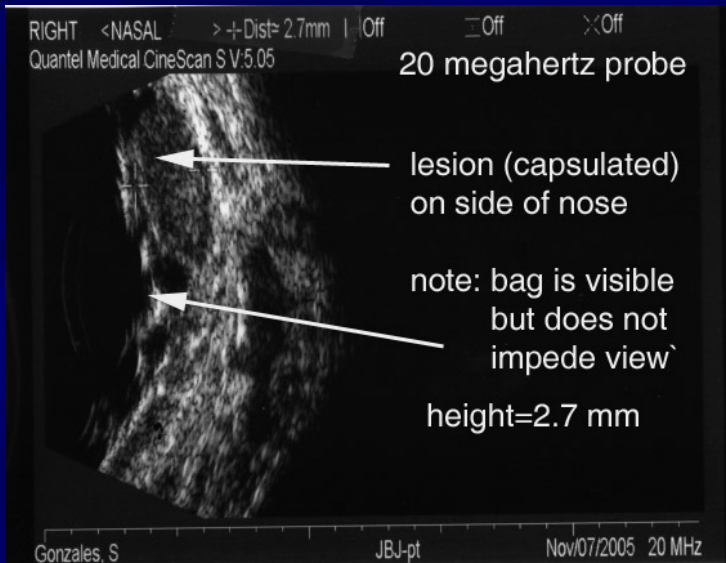


UBM to
locate
punctal
plugs

Other non-ophthalmic uses



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



Online resources - YouTube.com

search: ClearScan cover or

www.eyesurgin.com Go to "resources"

- B-Scan and ClearScan
- Intro to UBM
- Angle Exam
- Probe Orientation
- Probe Fill Technique
- ClearScan tips
- <http://www.eyesurgin.com/libvidpict.html>
- View Part 3 - the 12 minute version