IMMERSION
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Amplitude Scan

The **amplitude** of a periodic variable is a measure of its change over a single period, such as time or spatial period (Meters per second).
Immersion is Ultrasonography

Imaging of deep structures of the body by recording the echoes of pulses of ultrasonic waves directed into the tissues and reflected by tissue planes where there is a change in density.
Sound Travels Faster through Solids than through Liquids

Sound Travels . . . through . . . **solid** cornea . . . **liquid** aqueous . . . **solid** lens . . . **liquid** vitreous . . . then **solid** retina, choroid, sclera, and orbital tissue
Velocity of sound is determined by the density of the medium it passes through.
The Probe sends out a sound beam and that sound bounces back to the probe at contact with an interface and is converted to spikes

- **Taller/Stronger Spikes**
  Greater difference between the two interfaces (solid to liquid; cornea to aqueous)

- **Shorter/Weaker Spikes**
  Less difference between the two interfaces (liquid to semi-liquid; vitreous to vitreous floater)

- **No Spike**
  No difference between the two interfaces/Identical interface material
Angle of Incidence
Probe Orientation to the Visual Axis

• Probe situated perpendicularly to cornea, lens, and retina
• If situated correctly then it allows the echoes to go back to the probe
• Increased angle results in weaker signals and shorter spikes
Shape and Smoothness Affecting Spike Quality

Macular edema, ERM, and staphylomas may not be smooth and may not reflect the sound back to the probe
Image 1 Smooth
Image 2 Macular Edema or PED
Image 3 AMD or ERM
Blocked Spikes

Sound absorbs at each of the stops it makes along the way.

A dense cataract may cause a weaker shorter retina spike.
Gain

• Measured in decibels
• Affects amplification and resolution of spikes
• High Gain
  Increases spike sensitivity and the heights are maximized
  This allows visualization of weaker signals (i.e. retina spikes)
• A negative affect of high gain is a loss of resolution
Resolution

• Ability of two interfaces that lie in close proximity to be displayed (lens layers and retina to scleral)
• Technician should reduce the gain until the retinal and scleral surfaces are seen as separate spikes
When Gain is Turned Up
Result Differences

- Right and Left eyes should be within 0.3 mm of each other
  - Except with scleral buckling, anisometropia, corneal transplantation, keratoconus, & refractive surgery
- Readings of the same eye should be 0.1 mm from one another (5 readings minimum each eye)
Affects of Improper Axial Measurements

- **Average eye (ex: 23.5 mm)**
  1.0 mm error = 2.50 D miscalculation
  
  Another way to look at it: 0.1 mm error = 0.25D

- **Long eye (ex: 30 mm)**
  1.0 mm error = 1.75 D miscalculation

- **Small eye (ex: 22mm)**
  1.0 mm error = 3.75 D miscalculation
Refractive Generalizations

• Long eyes are typically myopic
• Short eyes are typically hyperopic
• Steep corneal curvature can result in myopia
• Flat corneal curvature can result in hyperopia

Conclusion: a patient can be myopic because of steep corneal curvature rather than long axial length, and a patient can be hyperopic because of flat corneal curvature rather than short axial length
Choosing Lens Material

Know the status of the eye: PMMA, acrylic, silicone, phakia, etc have different densities

Velocity pre-settings in machine according to lens status
Wrong lens material will result in incorrect results

• Example: If an eye with an acrylic IOL is measured on pseudophakic PMMA mode, a 0.2 mm error will occur. If an eye with some silicone IOLs is measured on PMMA mode, a 1.2 mm error will occur. (0.2 mm = 0.50 D average eye length)
Aviso Quantel
Aviso Quantel
Nidek
Accutome
Cleaning

• Follow Manufacturer’s Guidelines

Example: One model of Accutome has a recommended disinfection technique to clean the probe membrane and tip assemblies with isopropyl alcohol (and no other substance). It is imperative that the alcohol be given time to evaporate before applying a probe to the patient’s eye.
Getting Started

- Accutome A-Scan Plus instrument including display
- Ultrasonic Probe
- Power Supply
- Power Cord
- Footswitch
- Keyboard
Immersed Probe in Fluid
Scleral Shell Placed Between Eyelids
Saline Filled Shell
Shell and Probe Set Up
Display After Measurements
Using the Foot Pedal

1. When you are acquiring measurements, the footswitch will capture an image.
2. Will select one of the five images on the Measure Screen.
3. Will delete the current image on the Measure Screen.
Threshold and Gates
Threshold and Gates

• First Marker- Cornea Surface
• Second Marker- Anterior Lens
• Third Marker- Posterior Lens
• Fourth Marker- Retina
• Threshold must touch spikes

Note: some IOLs will not show a posterior lens marker
Visualize What You Are Measuring
Thank you

Sources

- http://d163axztg8am2h.cloudflare.net/static/doc/7f/e3/30c450cff38961b053a24e0067d3/24-4216_a.pdf
- https://www.google.com/search?q=Prager+Shell+in+the+eye