ALAN LOWELL SEMINARS INC.

State Laws

Rules & Regulations

ALAN LOWELL SEMINARS INC.

Licensing Exams

Science or Practice Based

Psychometric Practice Based Exams

(Based on a “Role Delineation”)

International Licensing Exam (ILE)

National Competency Exam (NCE)

ALAN LOWELL SEMINARS INC.

Testing Scales

(ILE) (NBC-HIS / NCE) & Other State Licensing Exams)

ILE

Based on 2015 updates) (Effective date: 5/2016)

Conduct Patient/Client Assessment (18-24%)

Interpret and Apply Assessment Results (25-31%)

Select Hearing Devices (18-20%)

Fit and Dispense Hearing Devices (16-22%)

Provide Continuing Care (11-17%)

Knowledge of Cerumen Management may be required. uestions about CM may appear on ILE or other exams.

NBC

(Based on 2012 Role Delineation study)

1. **Assess Patient Presenting Problem And Needs (19%)**
2. **Test And Analyze Patient Hearing (28%)**
3. **Prescribe And Analyze Hearing Instruments (13%)**
4. **Fit, Adjust, Program and Service Hearing Instruments and equipment (25%)**
5. **Counseling, rehabilitation and professional practice (15%)**

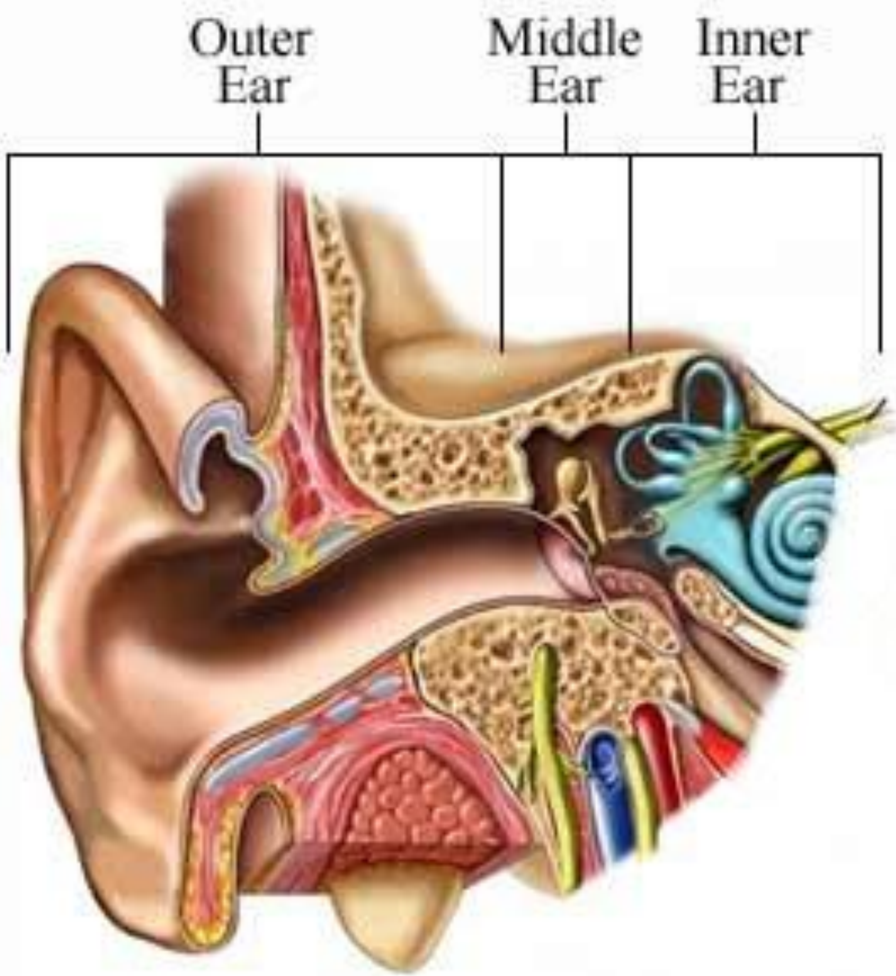
**** Knowledge of Cerumen Management may be required. Questions about CM may appear on Nation Competency Exam***

ALAN LOWELL SEMINARS INC.

Auditory System

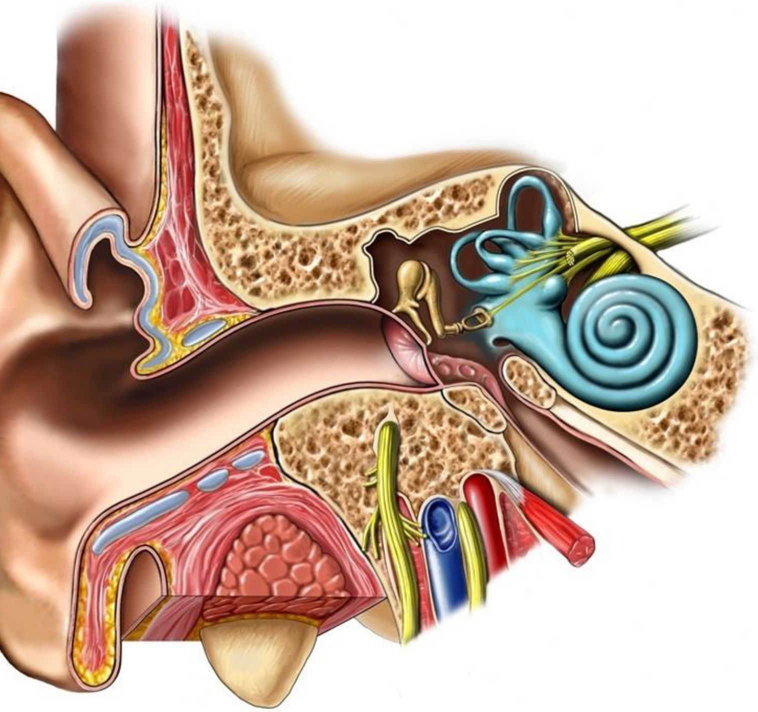
<u>Auditory System includes:</u>

- External ear
- Middle ear
- Inner ear



ALAN LOWELL SEMINARS INC.

Outer Ear

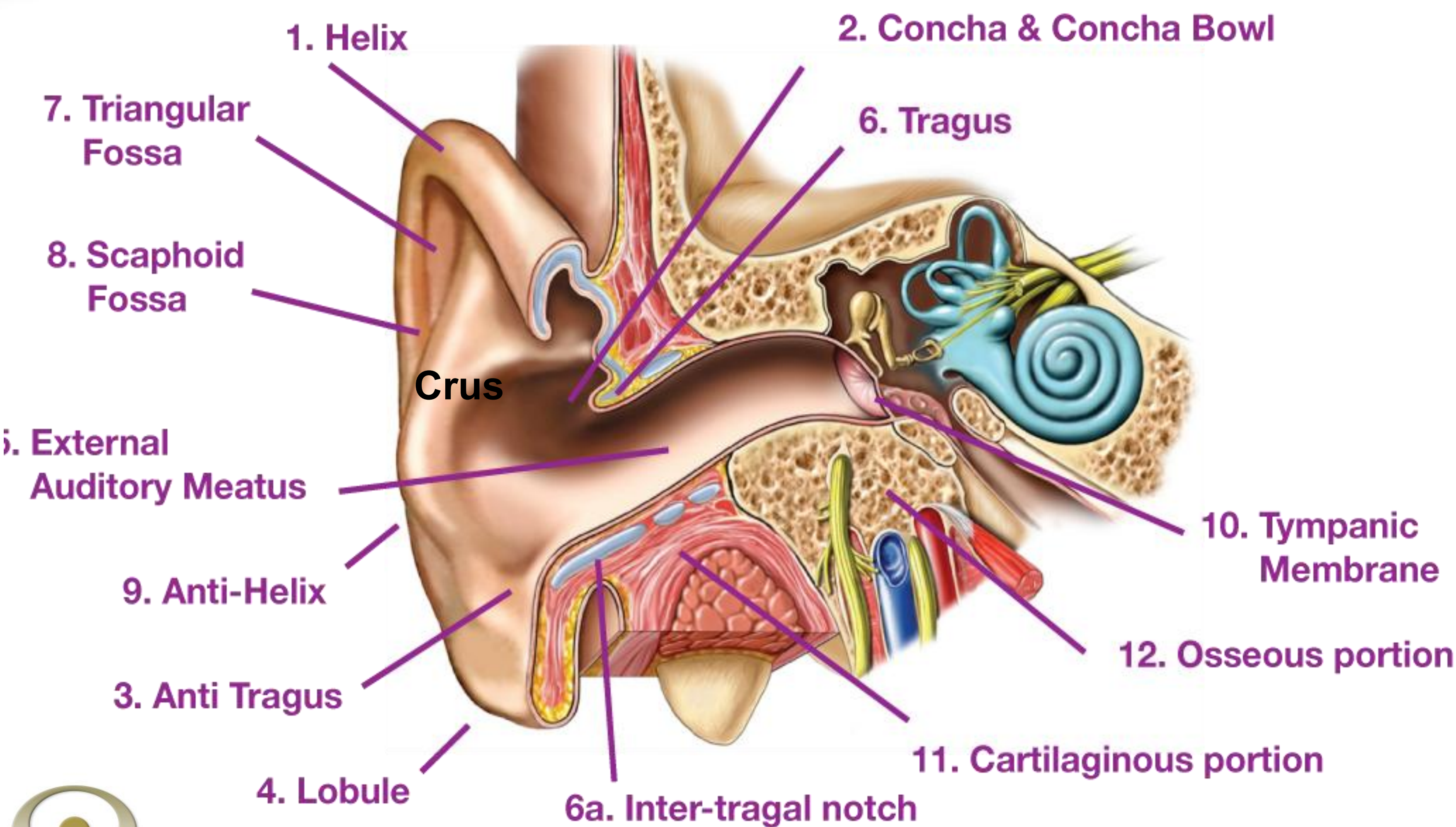


- Locates sounds & point of origin
- Funnels sounds
- Protects middle & inner ear
- **Sebaceous & Cerumen glands**

ALAN LOWELL SEMINARS INC.

Labeling the Outer Ear

Pinna (Auricle)

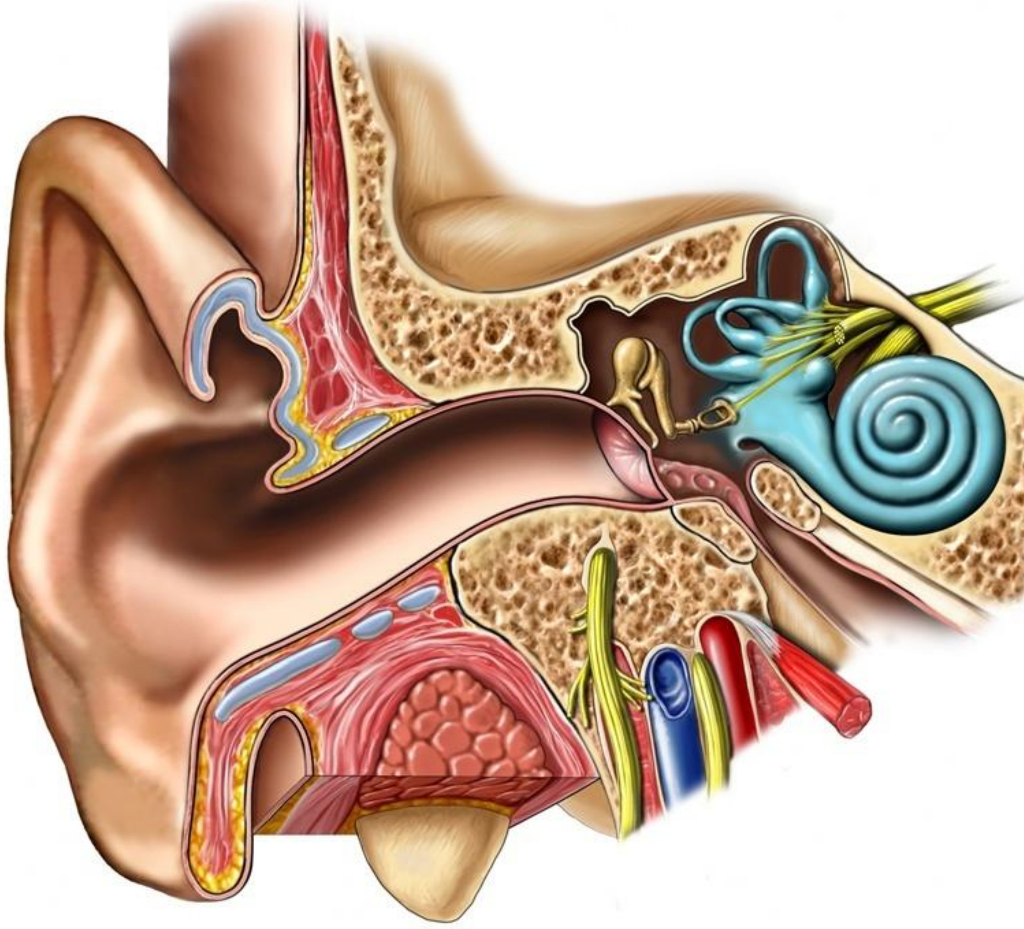


ALAN LOWELL SEMINARS INC.

External Auditory Meatus (Ear Canal)

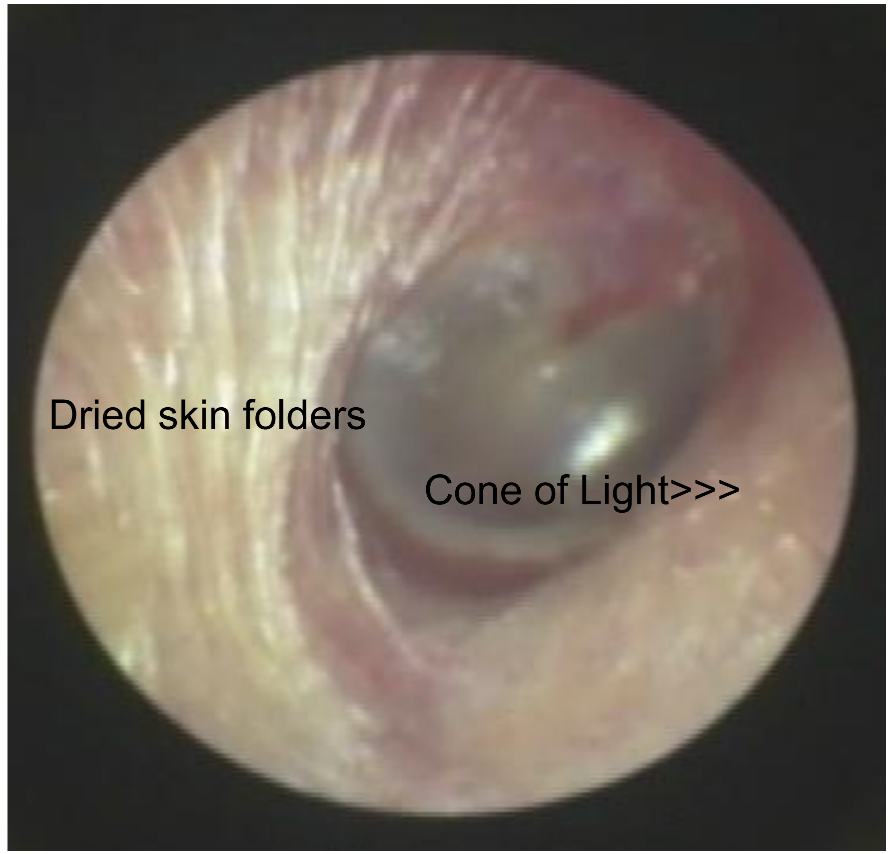
<u>External Auditory Meatus (Ear Canal)</u>

- Self cleaning
- Skin grows outward removing cerumen
- 2 1/2” (5cm) long
- Curves like figure “S”
- Rises slightly upward, forward & downward towards drum



Epithelial Migration

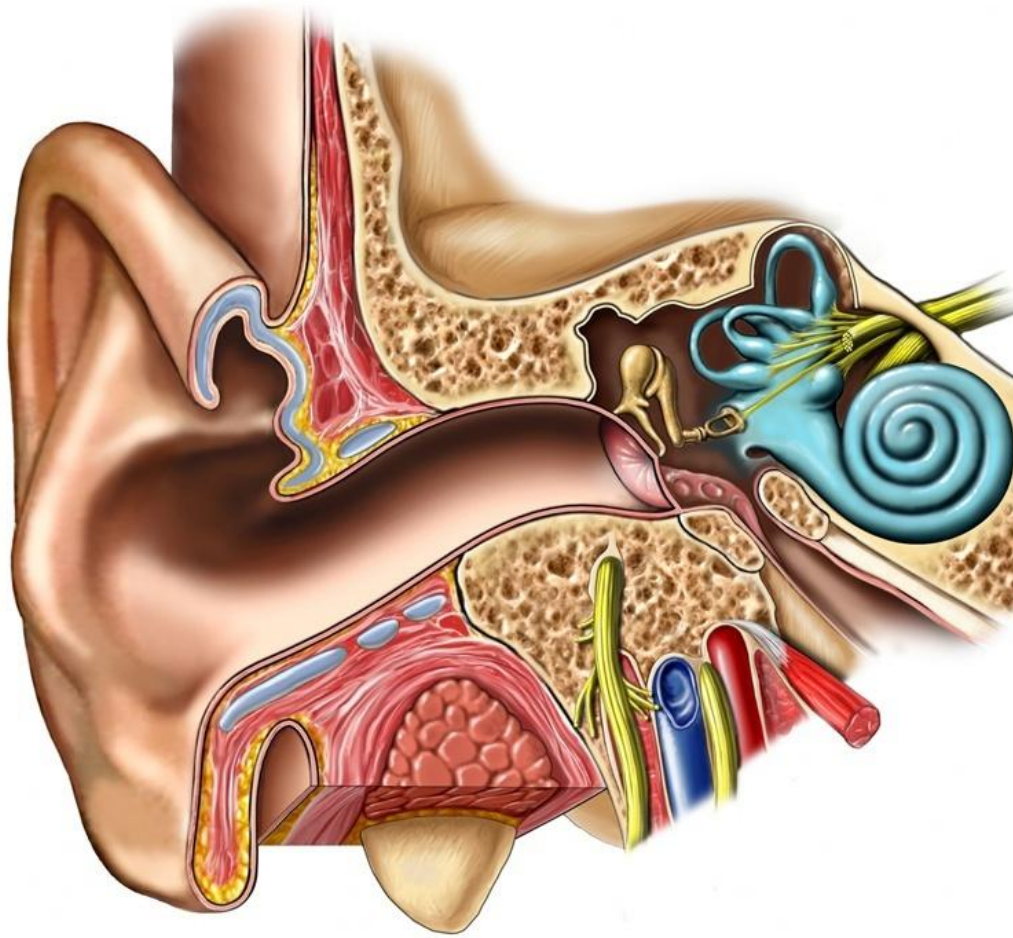
Self cleaning process of the ear canal



ALAN LOWELL SEMINARS INC.

Vagus Nerve

- Vagus Nerve
- X Cranial Nerve
- Arnolds Reflex
- Gag, cough
- **Meatus** = natural passage



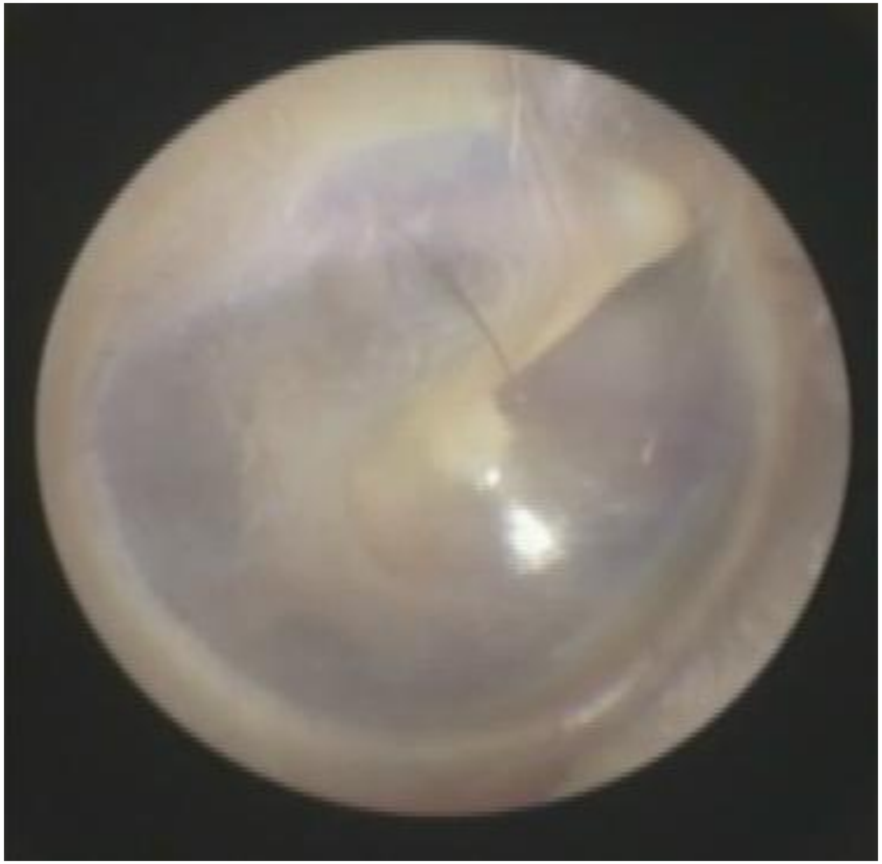
Tympanic Membrane

<u>Tympanic Membrane</u>

- 3/8” Diameter
- Thickness of parchment paper
- Concave/pearly white
- Comprised of 4 layers

ALAN LOWELL SEMINARS INC.

Tympanic Membrane - Layers



Tympanic Membrane

- 1st Layer = same skin that lines inner 1/3 of ear canal
- 2^{nd} & 3rd Layer = connecting tissue & muscle fibers
- 4th Layer = continuous with mucous membrane layer that lines middle ear

ALAN LOWELL SEMINARS INC.

Annular Ring

<u>Tympanic Membrane</u>

- <u>Annulus/Annular Rings</u>
- Holds TM in place
- Forms water tight seal
- Forms air tight seal

ALAN LOWELL SEMINARS INC.

Pars Tensa / Pars Flaccida

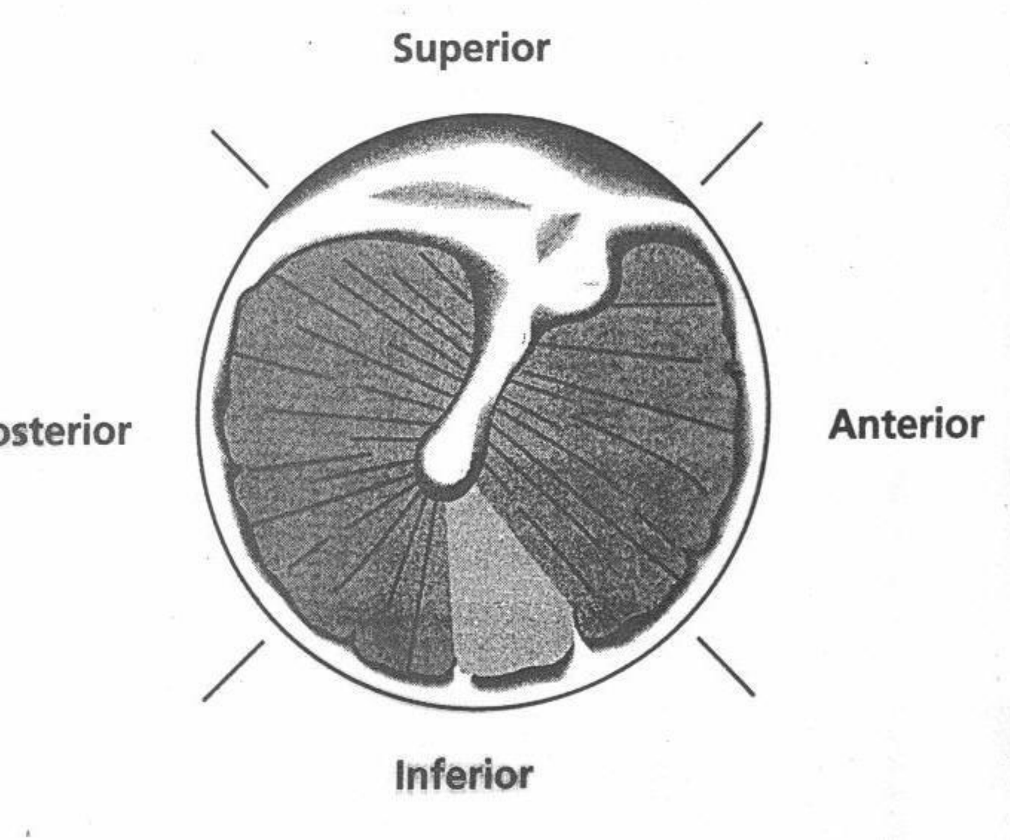
Tympanic Membrane

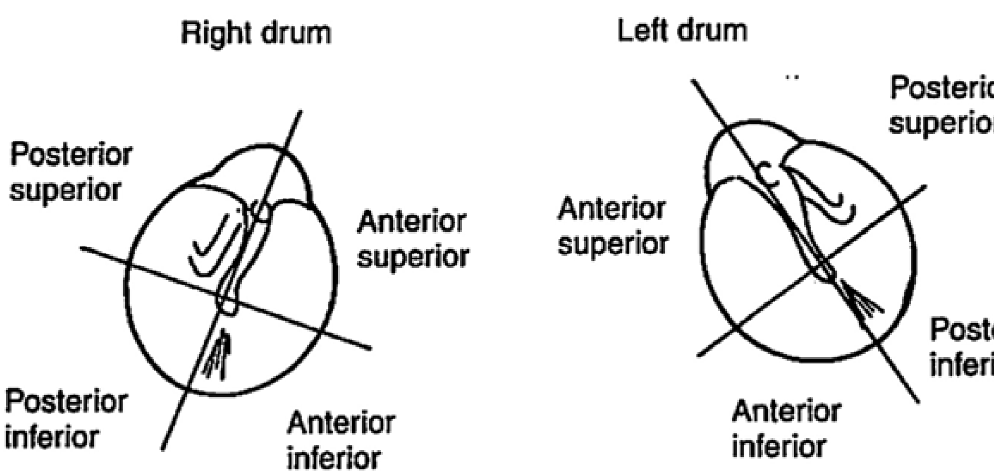
<Pars Flaccida (Shrapnell's Membrane)=1/5 smaller

<Pars Tensa = 4/5 larger

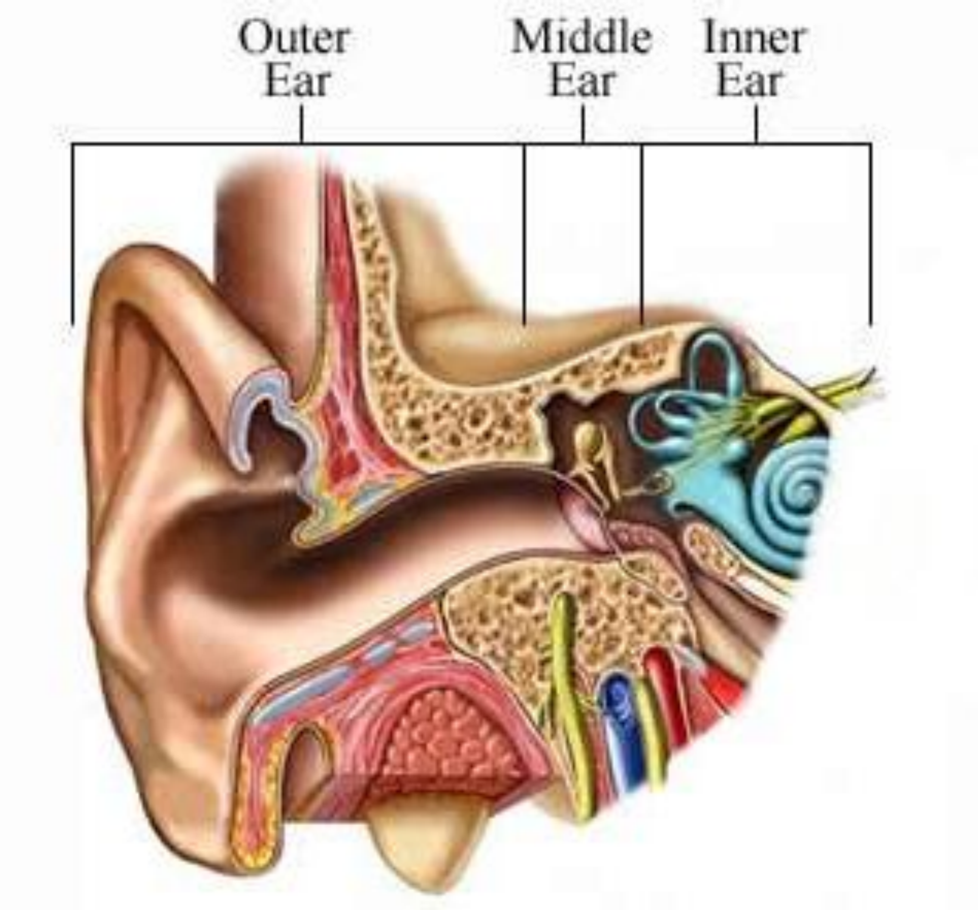
ALAN LOWELL SEMINARS INC.

Quadrants of the Ear Drum





Middle Ear



- Tympanic Cavity
- **<u>Ossicular Chain</u>**
- Malleus-Hammer
- Incus-Anvil
- Stapes-Stirrup

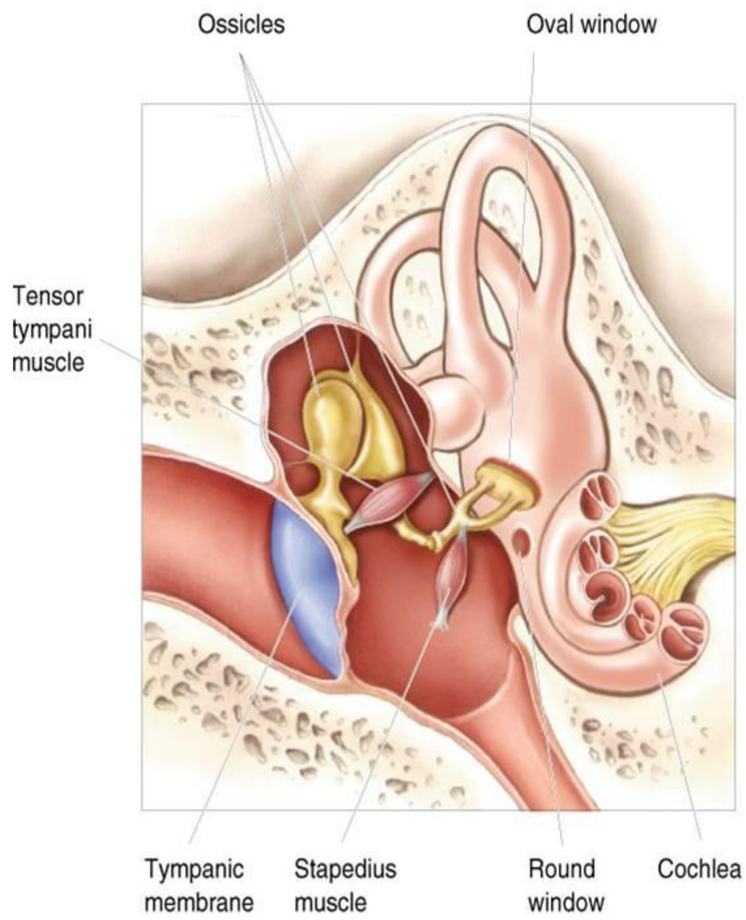
Function of Middle Ear

Conduct sound energy to the inner ear (immittance / impedance)

Mechanical energy

Ossicular chain is suspended in the middle ear cavity by ligaments

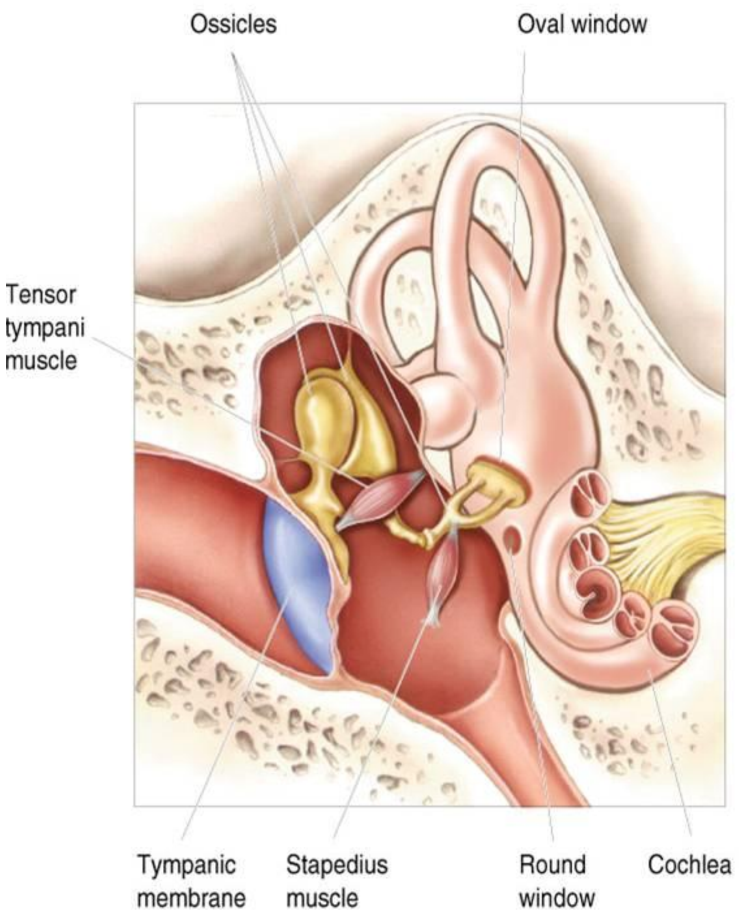
Tensor Tympani & Stapedius muscles
(Acoustic reflex)



ALAN LOWELL SEMINARS INC.

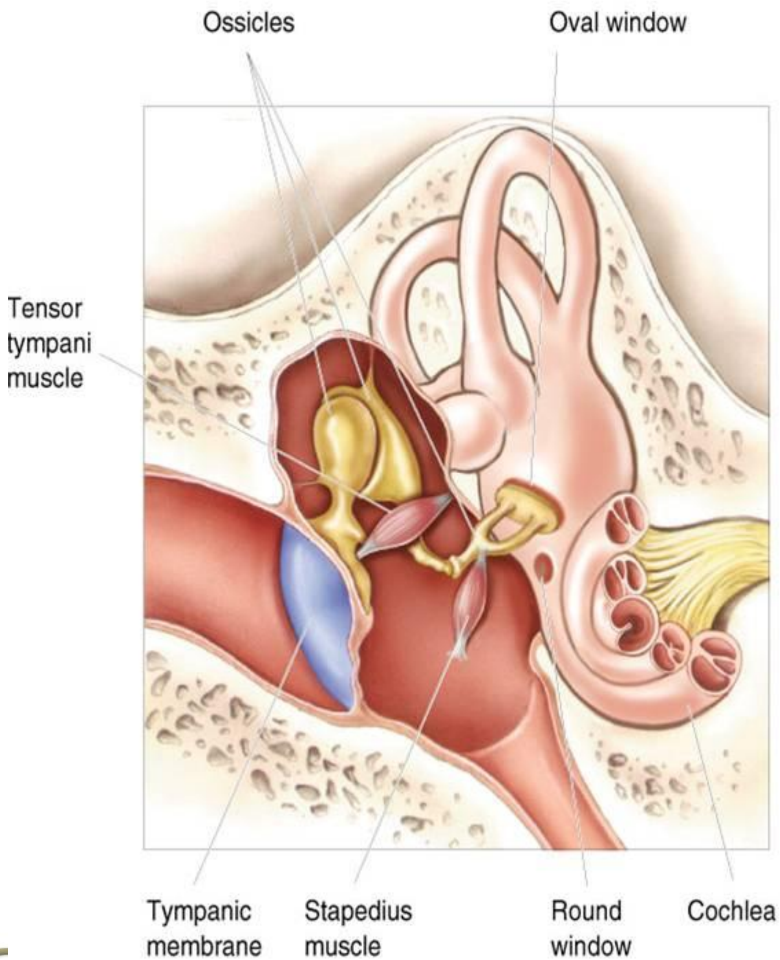
Middle Ear Cavity

- Air filled
- Water tight
- Sealed by TM
- Irregular shape
- Size of pea
- Lined w/mucous membrane
  (thin layer of tissue containing fluid secreting cells)



ALAN LOWELL SEMINARS INC.

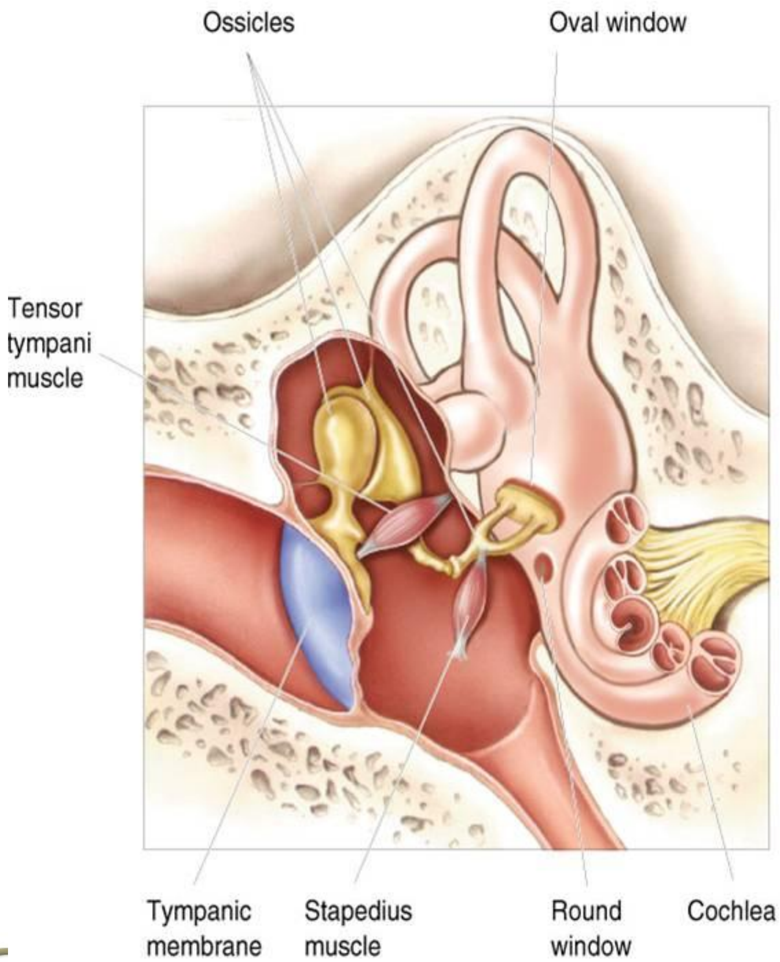
Incudostapedial Junction



- Top of Malleus articulates with top of Incus
- Bottom of Incus meets Stapes

ALAN LOWELL SEMINARS INC.

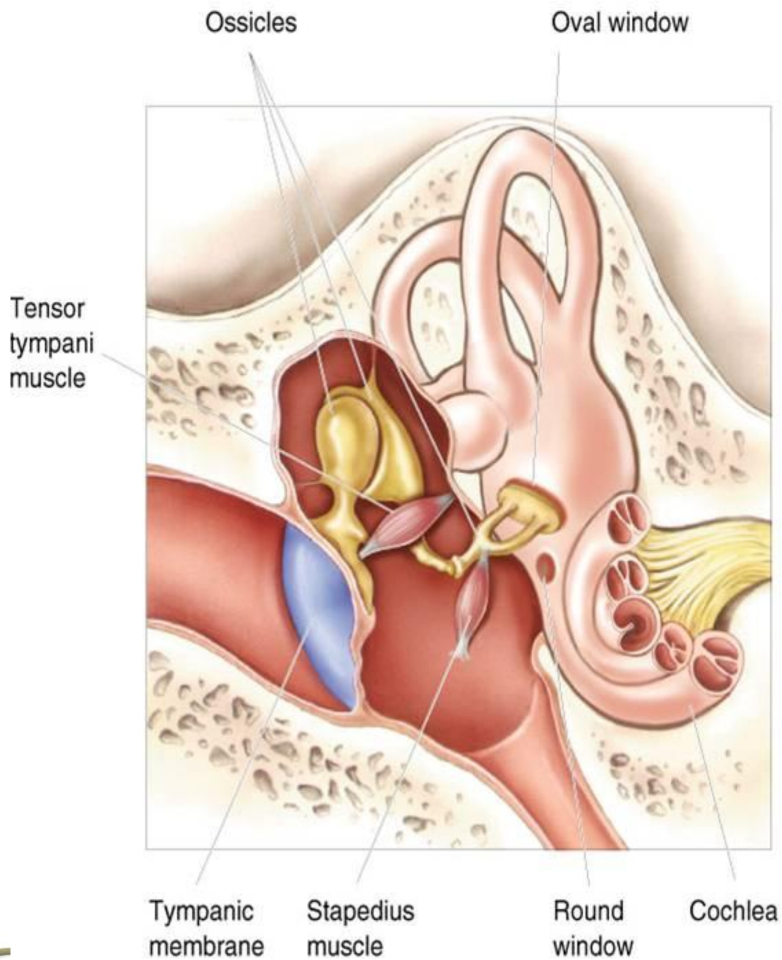
Middle Ear Muscles



Stapedius & Tensor Tympani Muscles

- Keeps ossicular chain taugh
- Responds to vibrations from TM
- Protects cochlea from dangerously loud sounds
- Acoustic reflex

Acoustic Reflex



<u>Transfer Function or Areal Ratio</u>

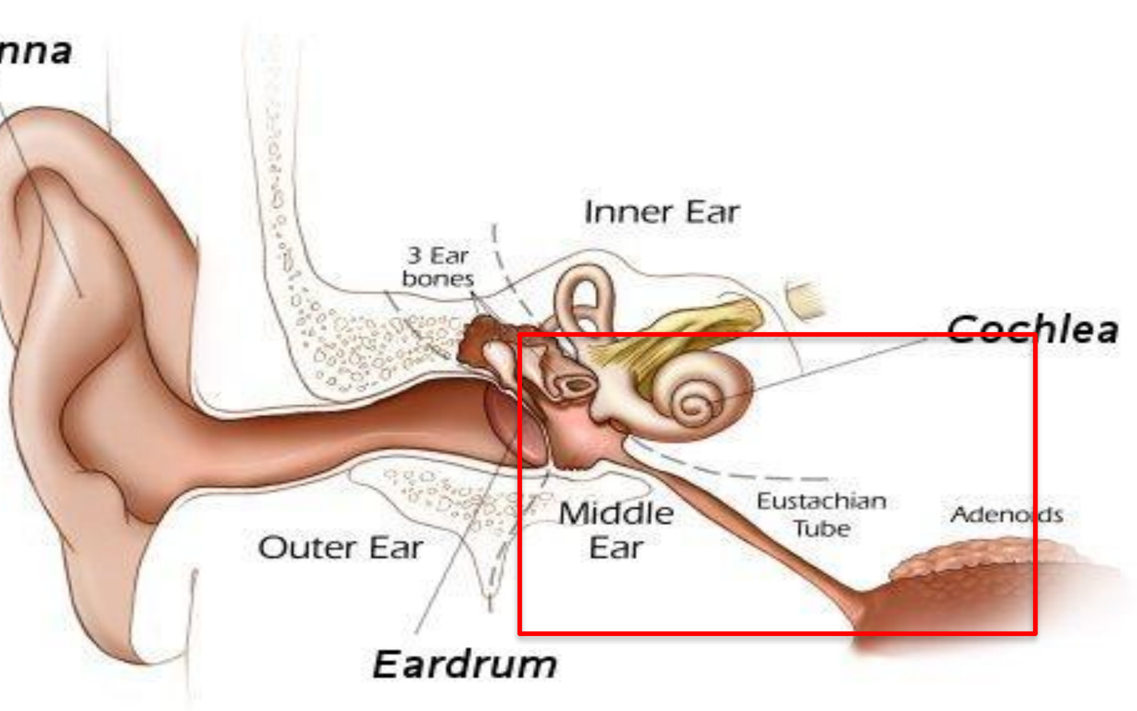
- 22:1 an increase of 27 dE

<u>Acoustic Reflex</u>

- Involuntary response
- Contraction of stapes
- Damper on system

ALAN LOWELL SEMINARS INC.

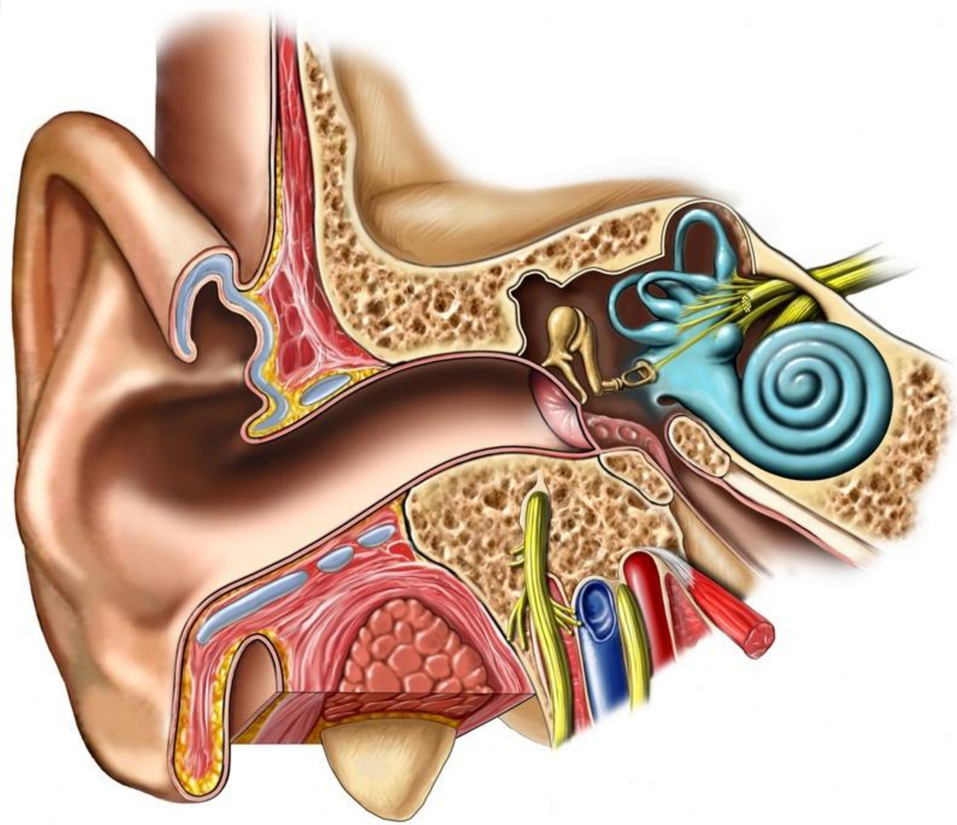
Eustachian Tube



Eustachian Tube

- Connects middle ear with naso-pharynx (back of throat)
- Equalizes ambient air pressure between middle & outer ear
- 1 1/2” long in adults (generally closed)

Epitympanic Cavity / Mastoid Cells



Mastoid Cells

- Air filled cavities in mastoid process of the temporal bone

Epitympanic Cavity

- Attic of middle ear
- Opening allows air
- Protected passage for nerves

ALAN LOWELL SEMINARS INC.

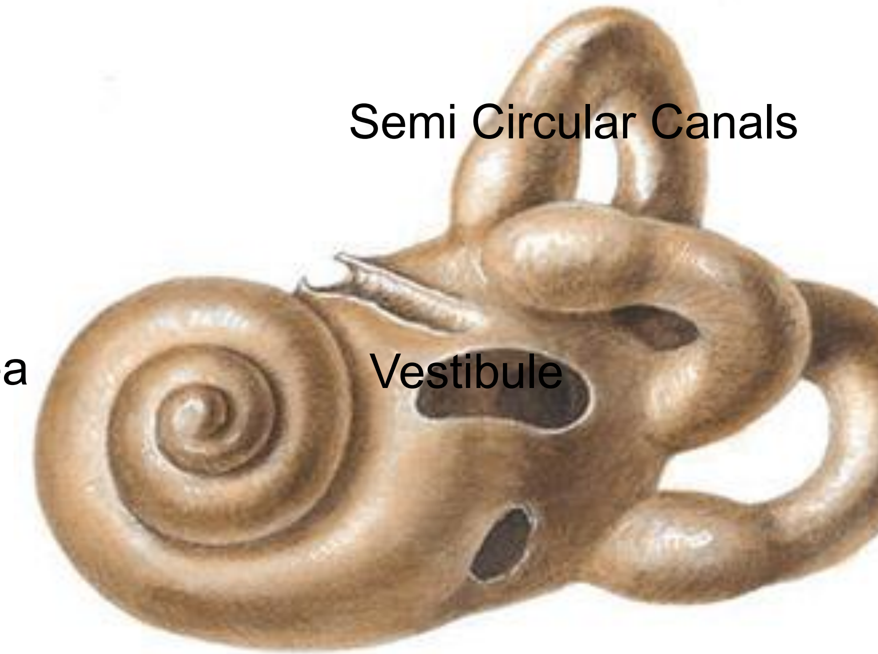
Inner Ear (Labyrinth)

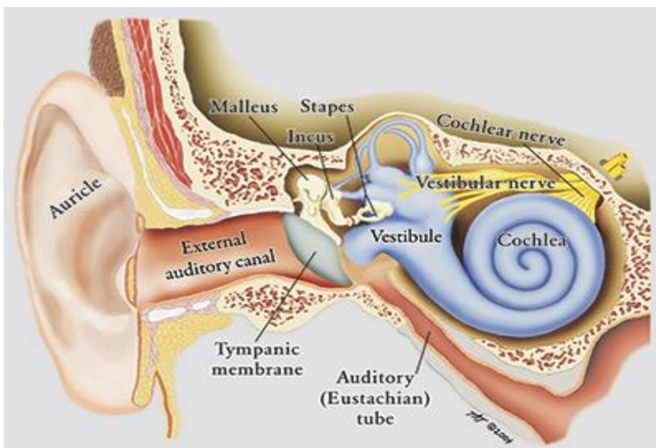
Three (3) major areas:

***Semi Circular Canals**

***Vestibule**

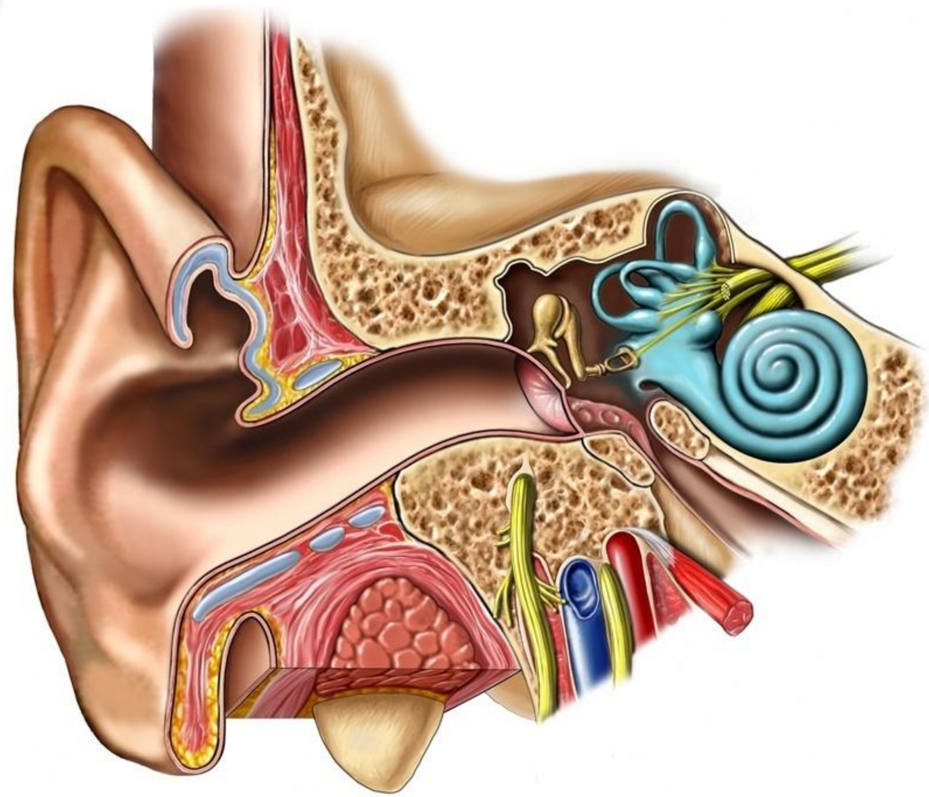
***Cochlea**





ALAN LOWELL SEMINARS INC.

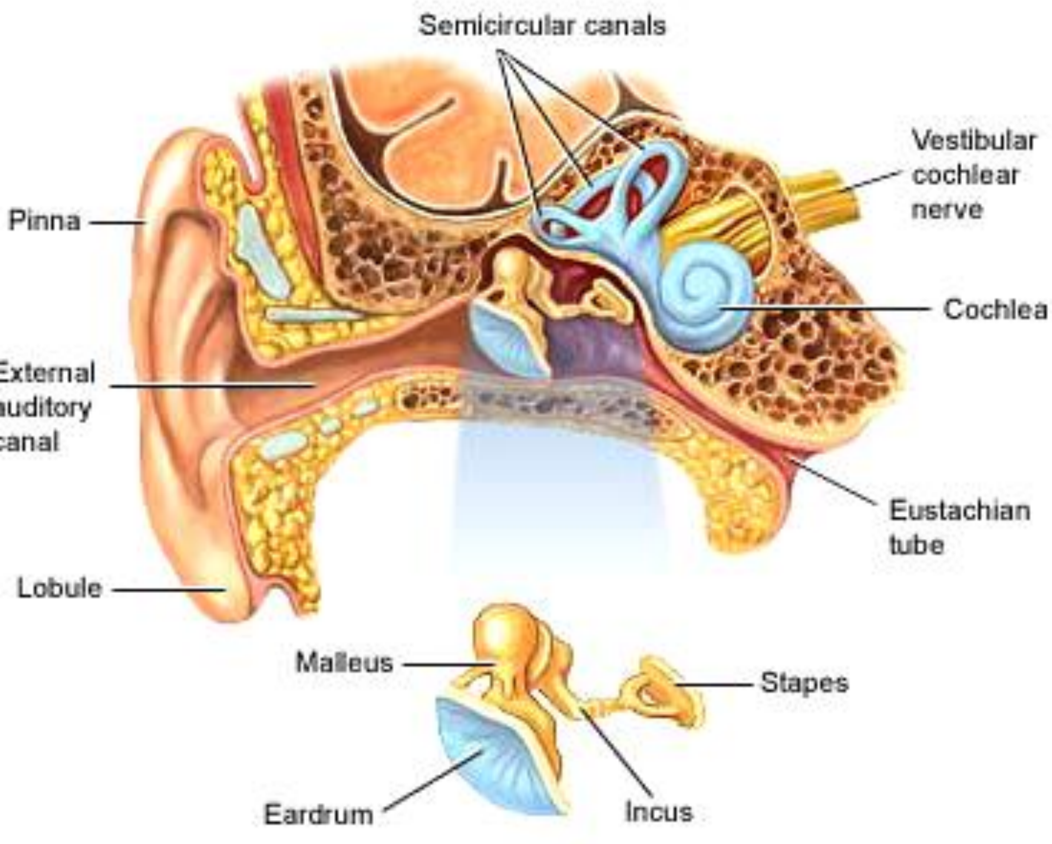
Vestibular System



Vestibular System

- Influences eye movement
- Body positioning
- Equilibrium & Balance

Semi Circular Canals

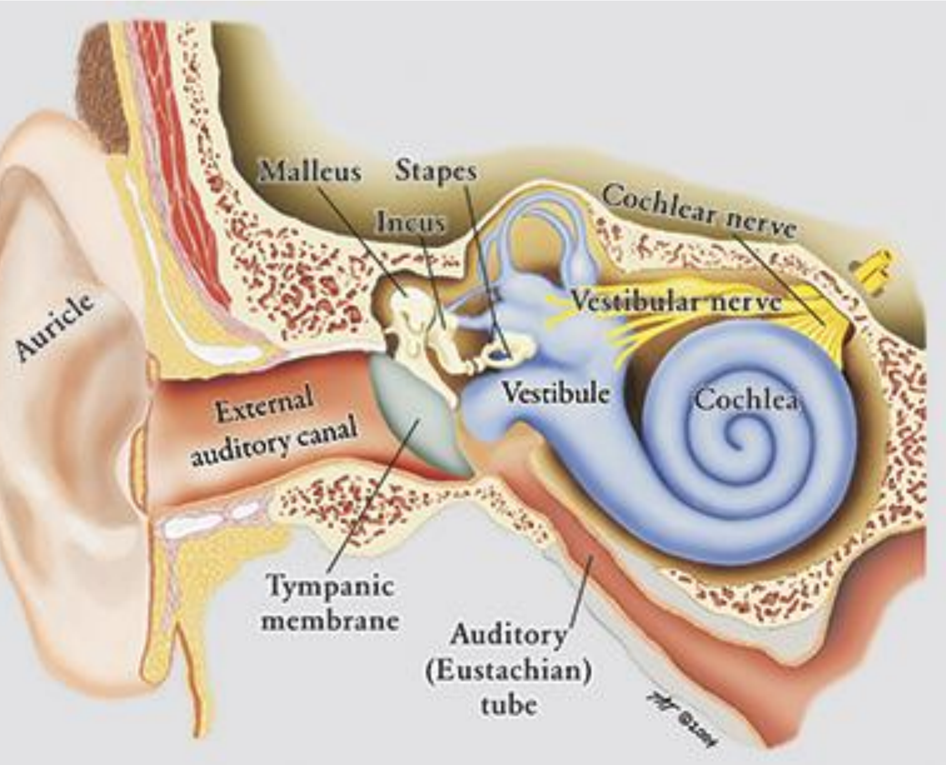


Semi Circular Canals

- Three (3) canals channeled through solid bone
- Endolymph & Perilymph fluids
- Sense of balance

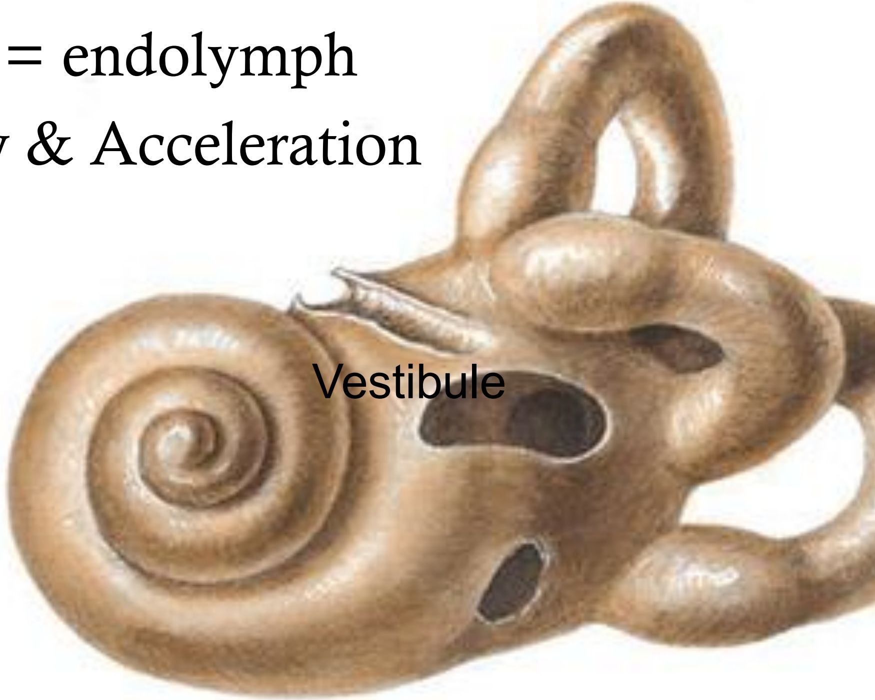
ALAN LOWELL SEMINARS INC.

Vestibule



<u>Vestibule</u>

- <u>Contains two (2) sacks:</u>
- Saccule = endolymph
- Utricle = endolymph
- Gravity & Acceleration



Cochlea

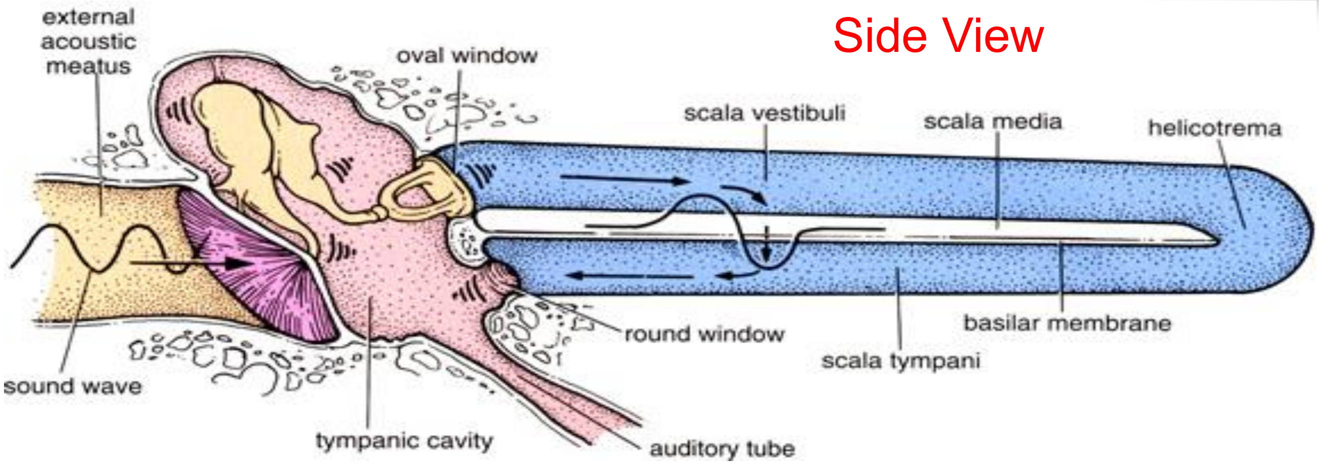
Cochlea

- Coiled like a snail
- Approx 2-2 1/2"long
- Approx 30,000 neural fibers
- Four (4) rows of hair cells
- Contains Organ of Corti

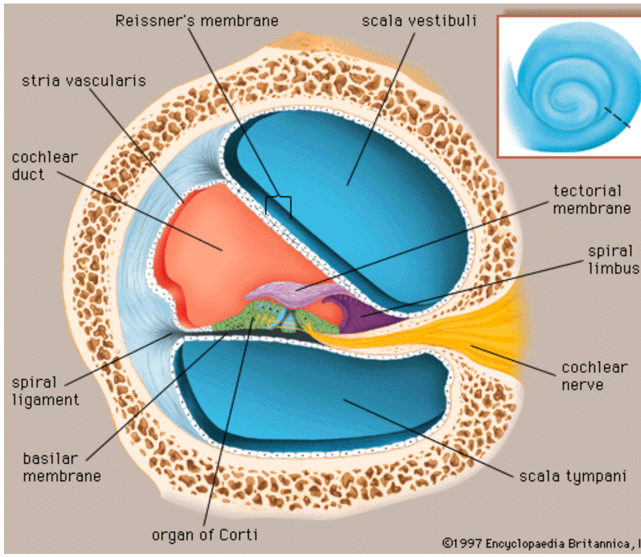
Key areas of the Cochlea

- Scala Vestibuli
- Scala Tympani
- Scala Media
- Reissner's Membrane
- Basilar Membrane
- Oval Window
- Round Window
- Promontory
- Base = highs
- Apex / Helicotrema = lows
- Stria Vascularis

Side View

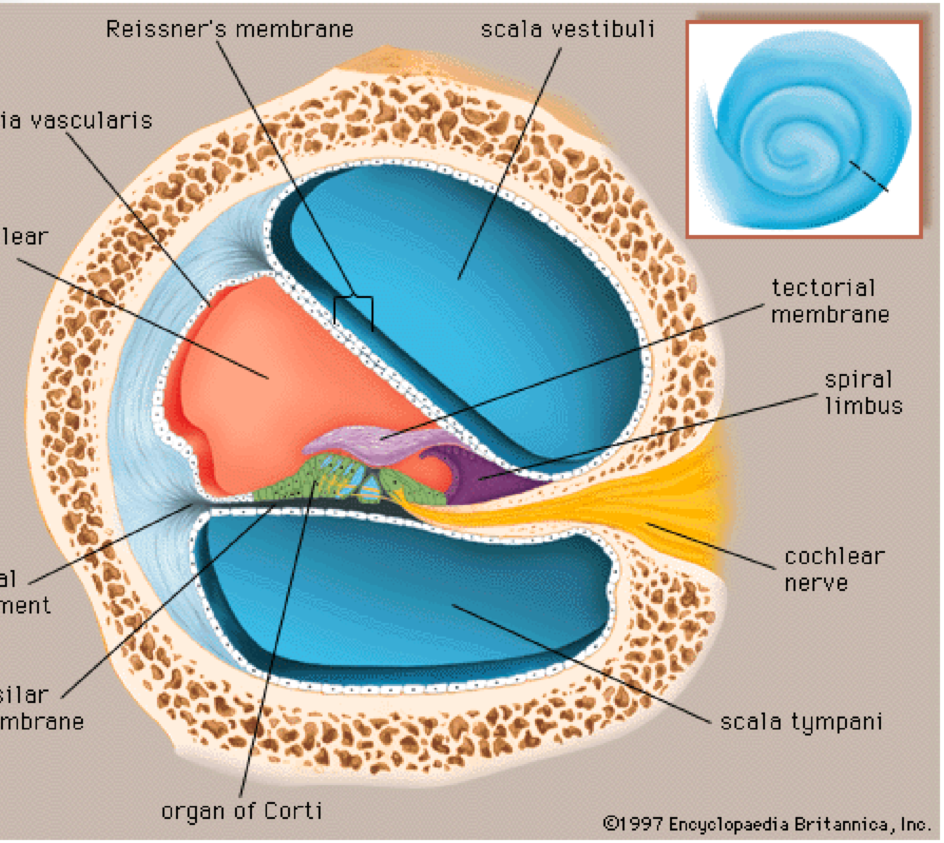


Top View >

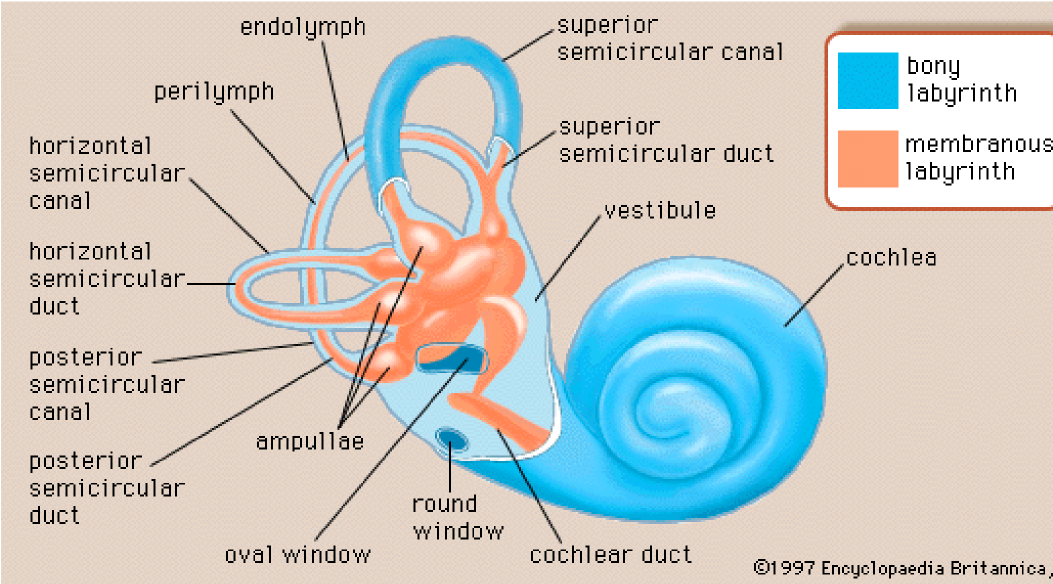


ALAN LOWELL SEMINARS INC.

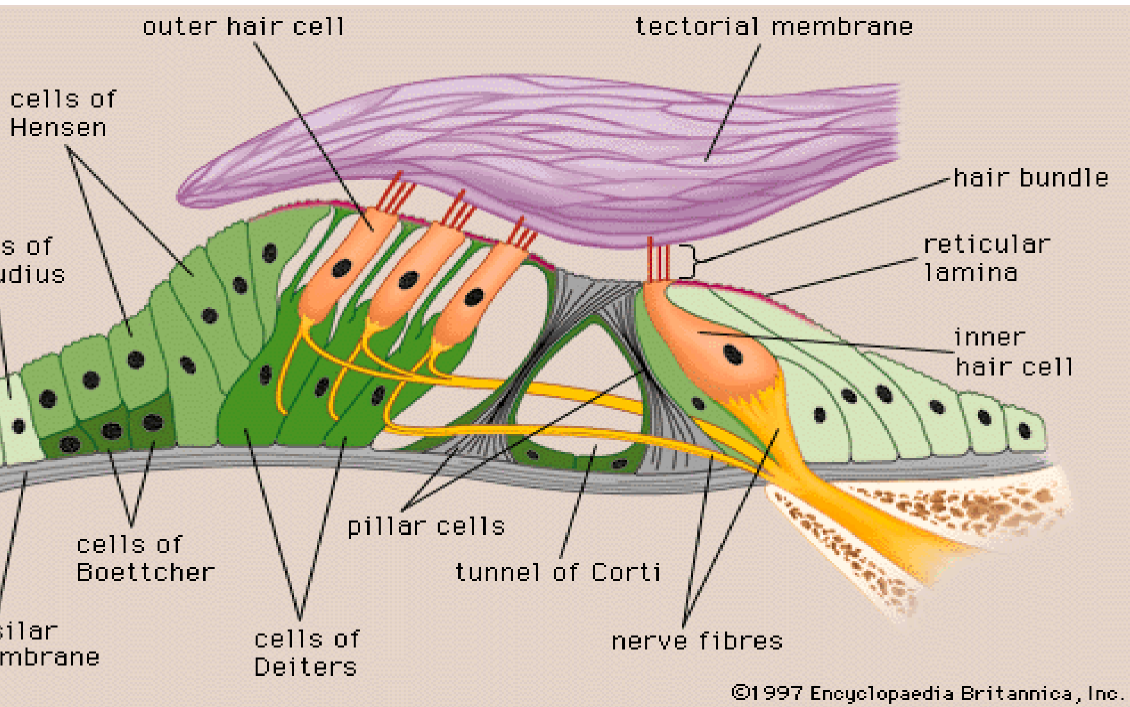
Terms Associated with Scala Media



- Cochlear Duct
- Canal of the Cochlea
- Membranous Labyrinth
- *Contains Organ of Corti*



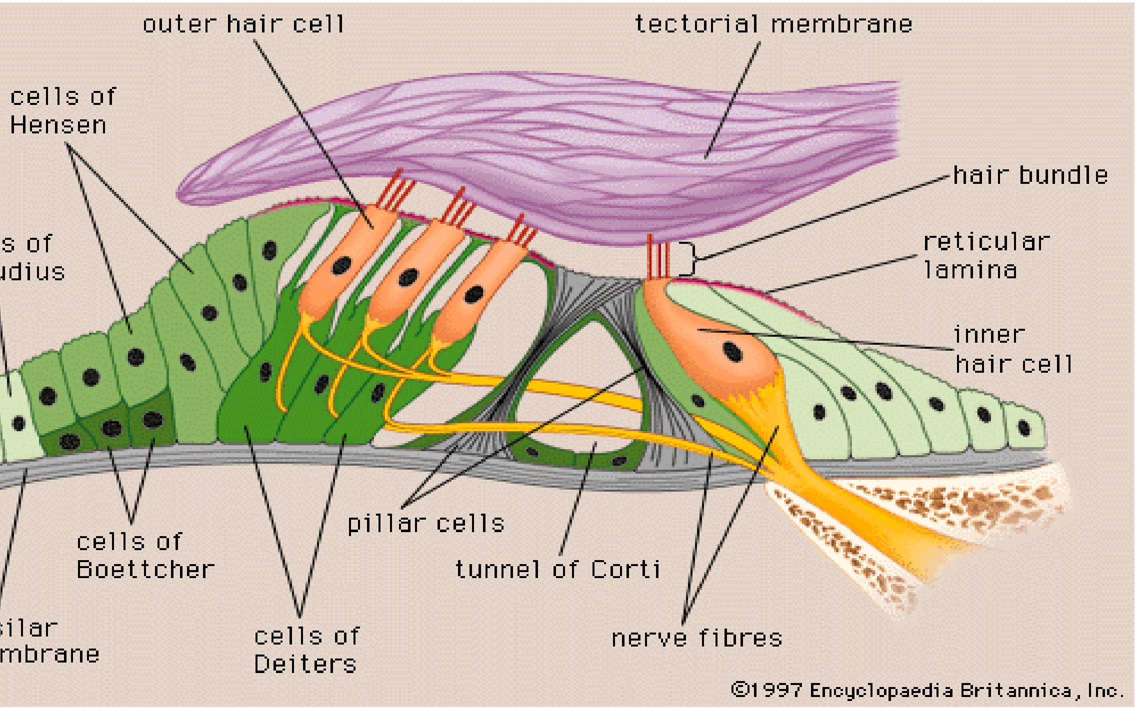
Organ of Corti



- Essential “Transducer”
- Sensory End Organ
- End Organ of Hearing
- Lays across the basilar membrane
- Base=Highs
- Apex=Lows

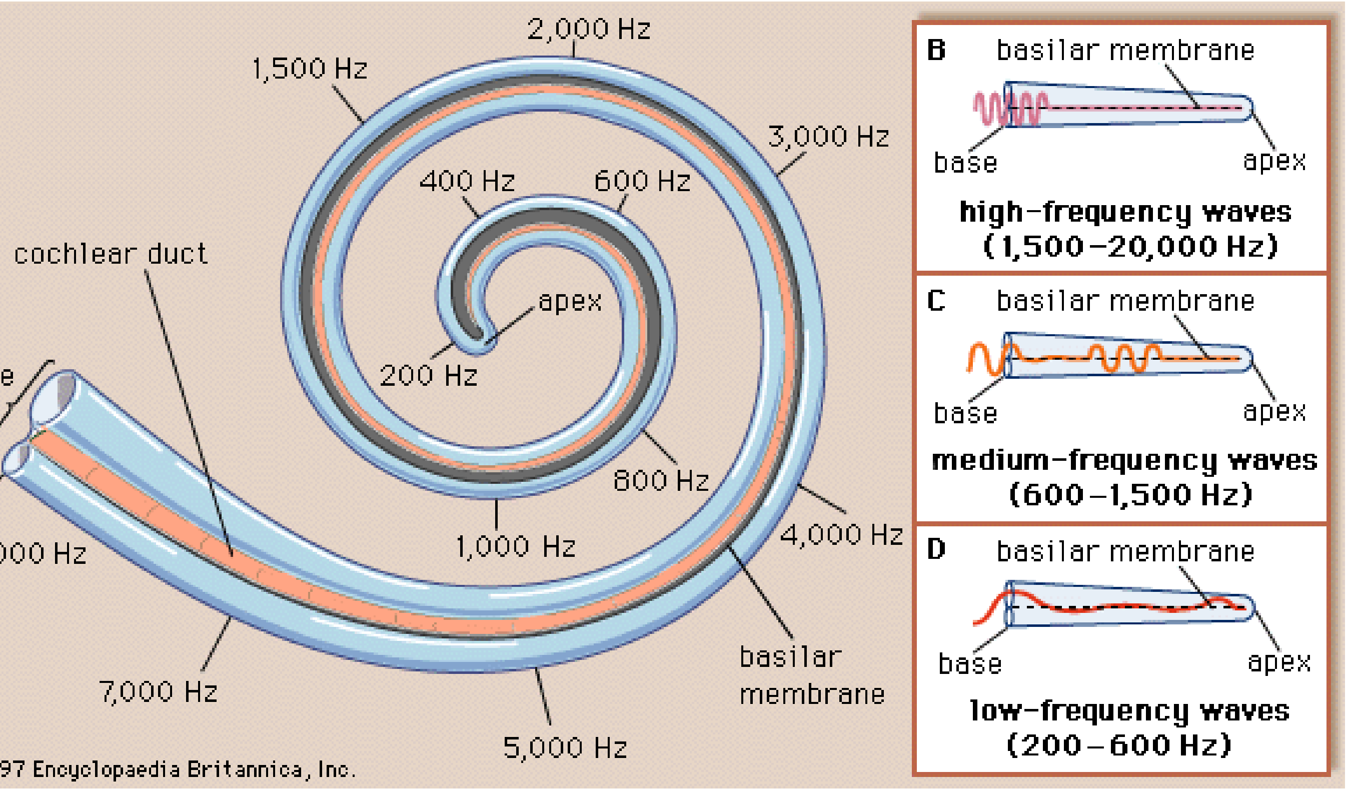
ALAN LOWELL SEMINARS INC.

Tectorial Membrane



- Hangs over neural fibers in Organ of Corti from base to apex
- Place Theory
- Place & Volley Theory
- *3000-3500 IHC*

Place Theory



Place Theory

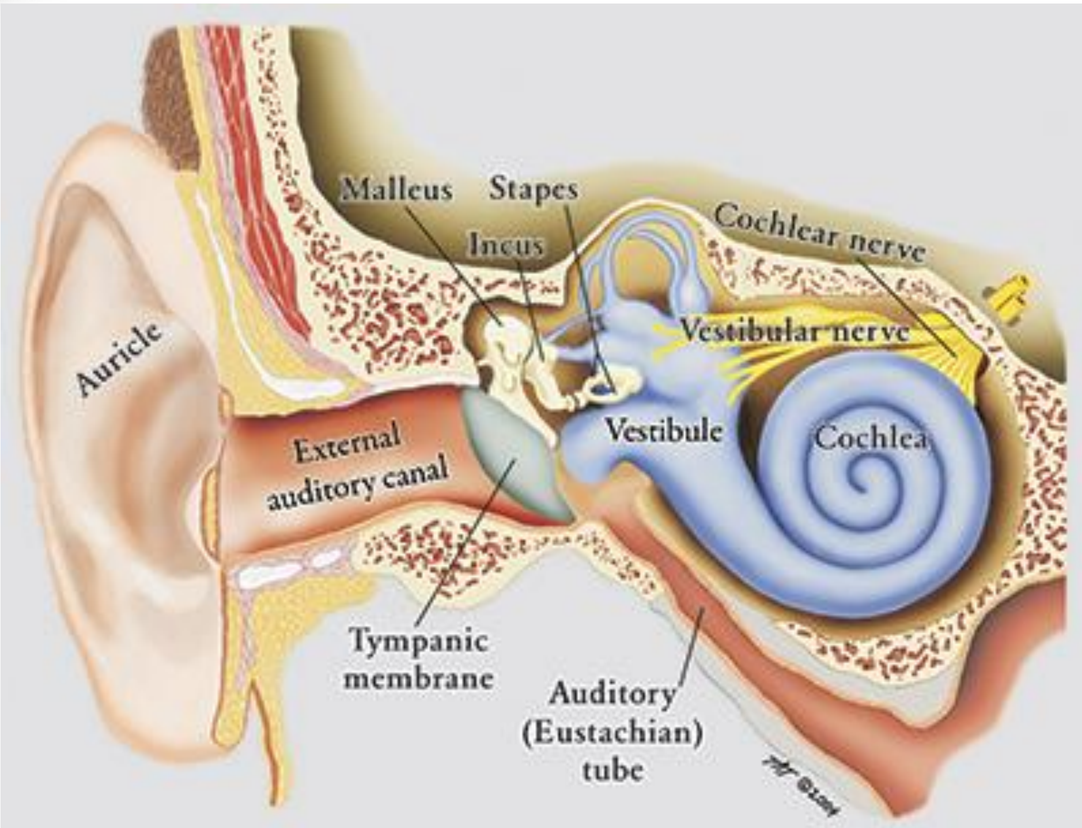
Neurons fire at a rate identical to stimulus below 1000 Hz

Place & Volley Theor

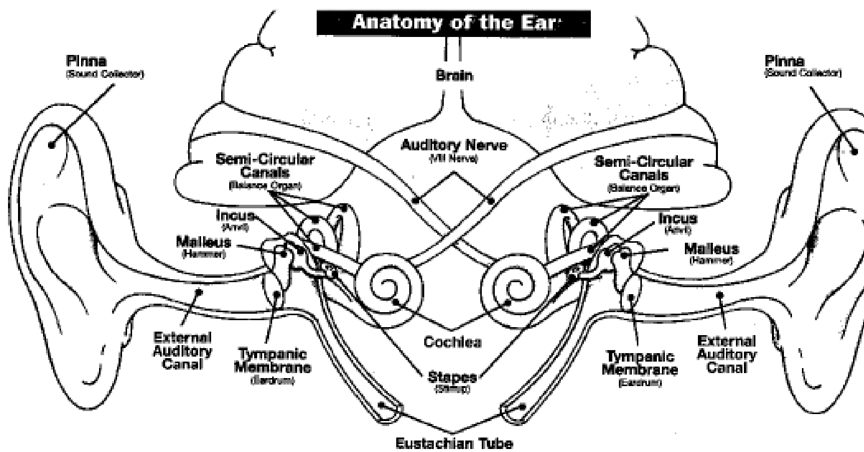
Stimulus beyond 1000 Hz are volleyed

ALAN LOWELL SEMINARS INC.

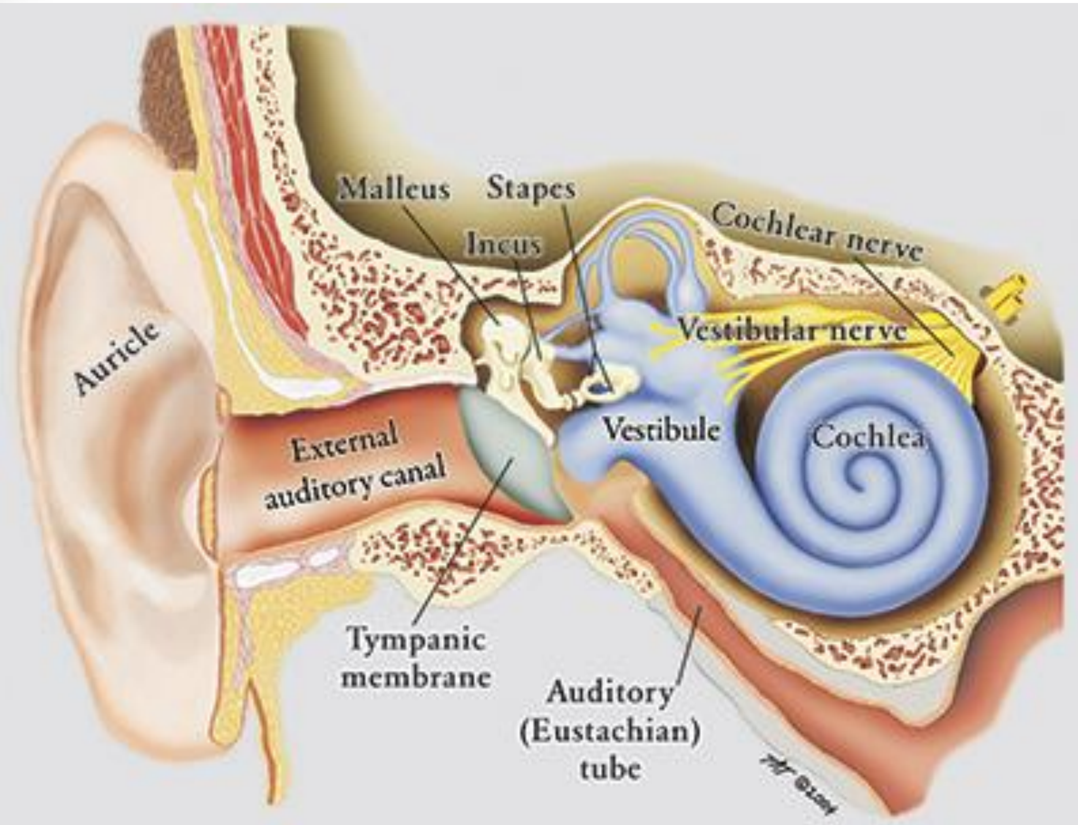
Auditory Nerve



- **Auditory Branch**
- **VIII Cranial Nerve**
- **Cochlear Branch**
- Sense of hearing to brain

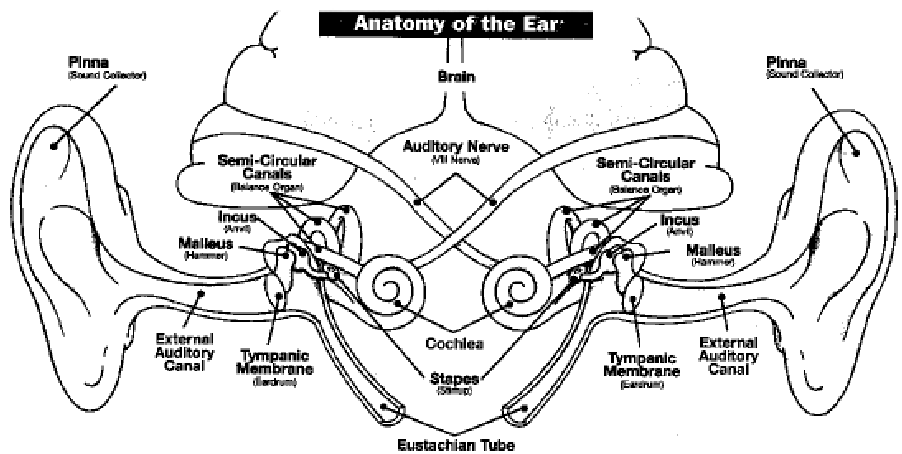


Vestibular Nerve Branch



Vestibular Branch

- Sense of balance & motion to brain
- Vestibular Branch becomes part of the auditory nerve

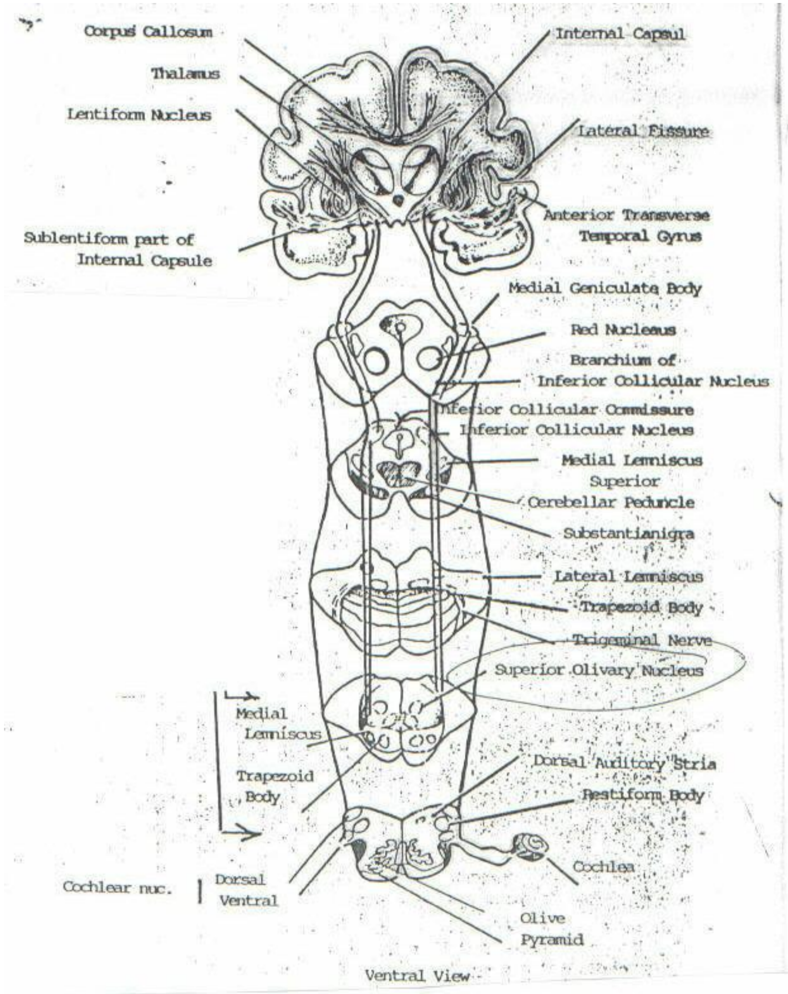


ALAN LOWELL SEMINARS INC.

Auditory Brainstem Response
(Evoked Potential Testing)

ABR

- Five-Seven Identifiable Locations up the Auditory Pathway
- Superior Olivary Complex



Auditory Nerve / Spiral Ganglion

Auditory Nerve

- 30,000 Neurons
- Afferent-transmits from cochlea to brain
- Efferent-transmits from brain to cochlea

Spiral Ganglion

- Formed and combined by nerve impulses traveling along nerve fibers

ALAN LOWELL SEMINARS INC.

Synaptic Junctions

Synaptic Junctions or Synapses

- Relay stations or transfer points for nerve fibers <u>changing electrical impulses to chemical</u>

Ascending Auditory Pathways

- Part of the central nervous system pathway composed of primarily afferent fibers
- Transmits from cochlea

Facts or Definitions

- **Binaural Fusion** (sounds presented to both ears come together as one single sound)
- **Binaural Summation** (6-10 dB increase)
- **Central Effect**
- **Binaural Localization** (two ears help locating sounds)

ALAN LOWELL SEMINARS INC.

Physics of Sound

ALAN LOWELL SEMINARS INC.

Frequency & Intensity

Frequency is related to pitch

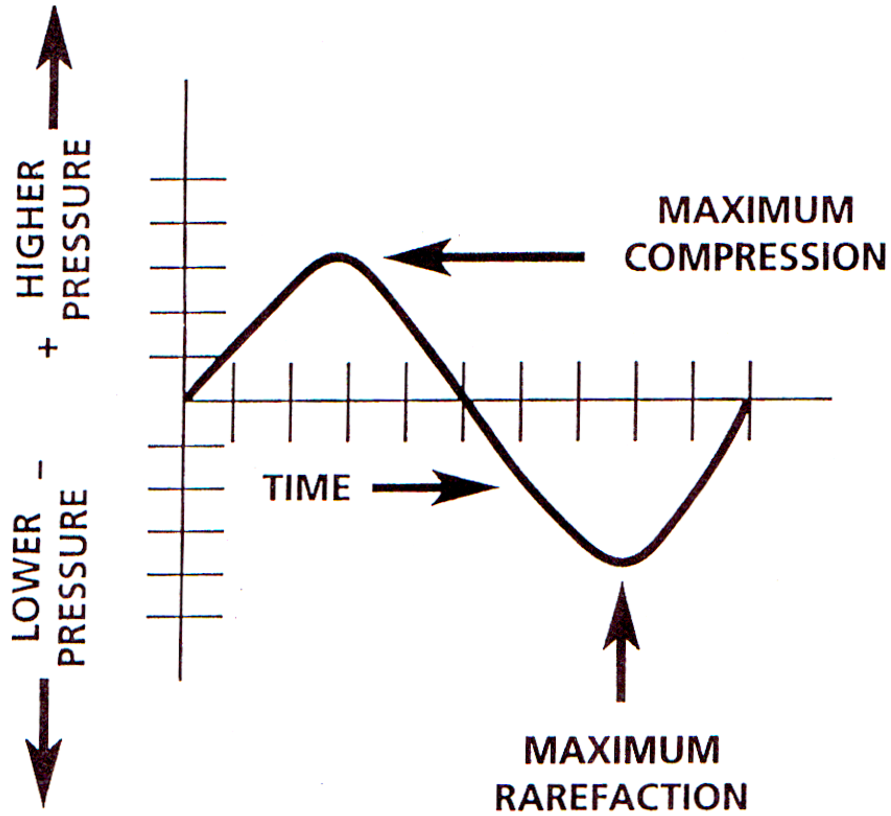
- Frequency = physical measurement
- Pitch = psychological aspect

Intensity is related to loudness

- Intensity = physical measurement
- Loudness = psychological aspect

ALAN LOWELL SEMINARS INC.

Sine Waves



One cycle contains (CPS)

- Compression-positive pressur
- Rarefaction-negative pressure
- Frequency consists of sine waves
- Frequency, Hertz, Kilohertz

ALAN LOWELL SEMINARS INC.

Diffraction

- Bending of sound waves around obstacles
- Lows bend more & travel further distances

ALAN LOWELL SEMINARS INC.

Phon / Sone

Phon

- Unit of loudness level measurement

- 40 dB SPL at 1000 Hz = 40 Phons (reference point)

Sone

- Unit of loudness level measurement relative to loudness level of 40 Phon

ALAN LOWELL SEMINARS INC.

Mels

<u>Mels</u>

- Measure pitch
- More Mels = Higher Pitch
- Less Mels = Lower Pitch

Sound Waves

Sound Waves

- Travel in ever expanding spheres in all directions away from their source
- Transmitted by small changes in air pressure
- Longitudinal Waves

Speed of Sound

- Air = 1100 ft per sec. **(340 Meters)**
- Liquid = 4x faster
- Solid = 14x faster
- Sound waves never travel through a vacuum

Pure / Complex Tones

Pure Tone

- Consists of only one frequency

Complex Sounds

- Mixtures of pure tones
- Fundamental frequency & overtones

Fundamental Frequency

Quality & Timbre

- Determined by the amount of pure tones and relative strength of each pure tone

Fundamental

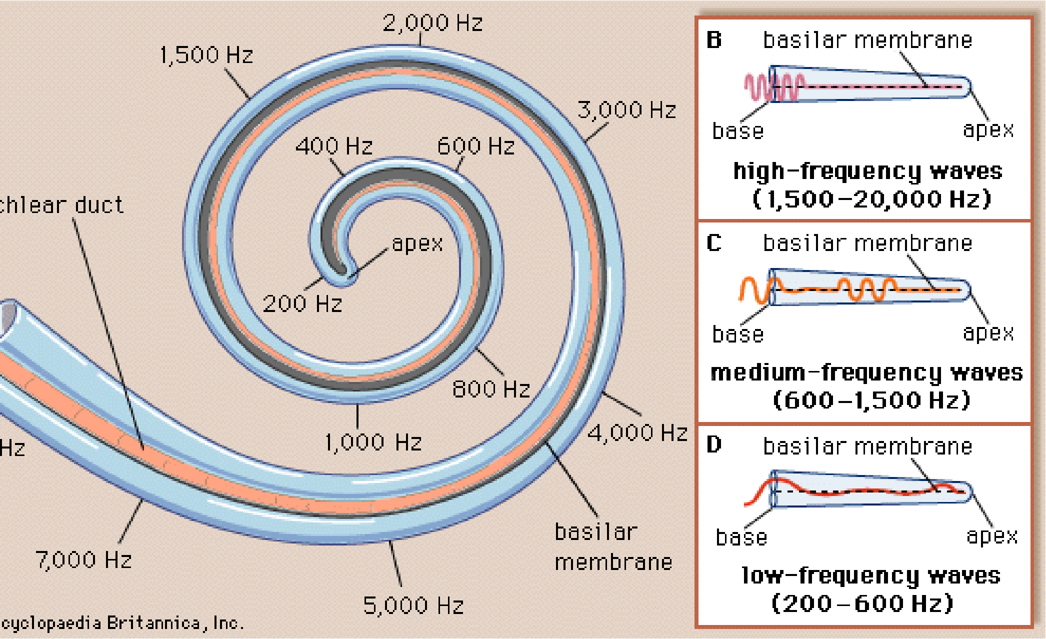
- Lowest frequency of a complex sound
- Predominate/Dominate

Relative Pitch

- Determined by fundamental frequency

ALAN LOWELL SEMINARS INC.

Fourier Spectral Analysis



Fourier Spectral Analysis

- Breaks down a complex sou
into individual frequencies

Phoneme

- Smallest Unit of Sound
- Differentiates meaning of words

Formants

Harmonics & Overtones

- Weaker frequency components
- Exact multiples of fundamental frequency

Formants

- Heavy concentration of energy important in recognition of speec
- Dominant characteristic of speec
- 2nd & 3rd formants most important for speech
- **Vowels** have more than (1) formant

ALAN LOWELL SEMINARS INC.

Reflection / Absorption

Absorption

- Termination of sound waves by material that prevents reflection or echo

Effective Sound Pressure

Effective Sound Pressure

- Physical measurement of sound
- Dyne/sq/cm
- .0002 Dyne/sq/cm weakest sound heard by the **BEST** human ear
- 1000 Dyne/sq/cm loudest sound that **NORMAL** ear can tolerate

Decibel

- Logarithmic syste
- Ratio 10:1
- 1/10 of a bel

Decibel

<u>Intensity range for measuring human hearing</u>

- 0-134 dB
- <u>0 dB</u> = Weakest sound heard by **<u>BEST</u>** human ear
- <u>134 dB</u> = Loudest sound tolerated by **<u>NORMAL</u>** human ear

Decibel Reference

Decibel

Not an absolute value

Always requires a reference

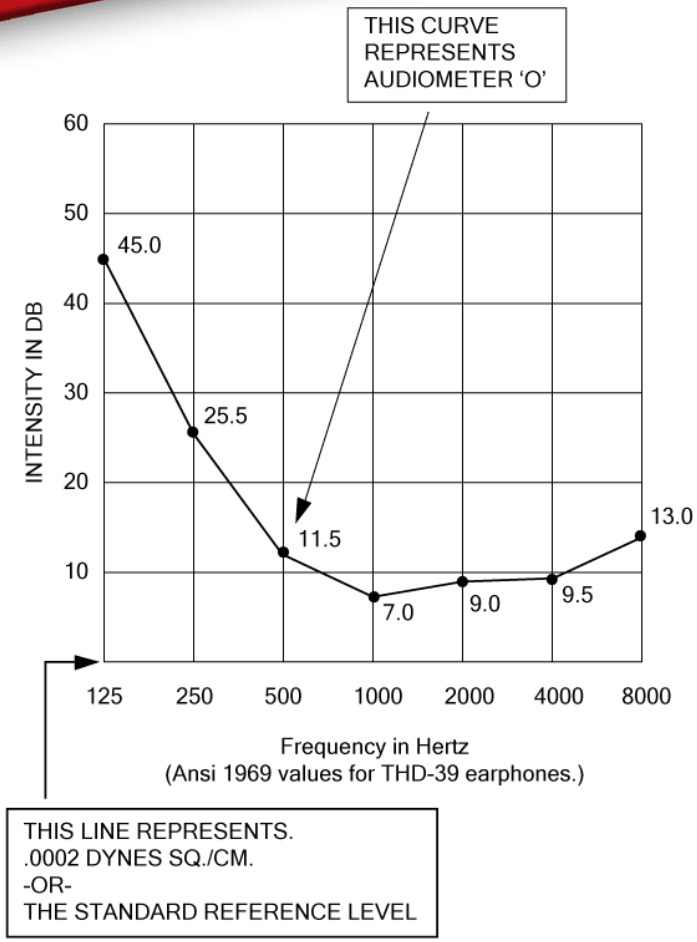
One (1dB) = smallest change in loudness that can be detected by the human ear

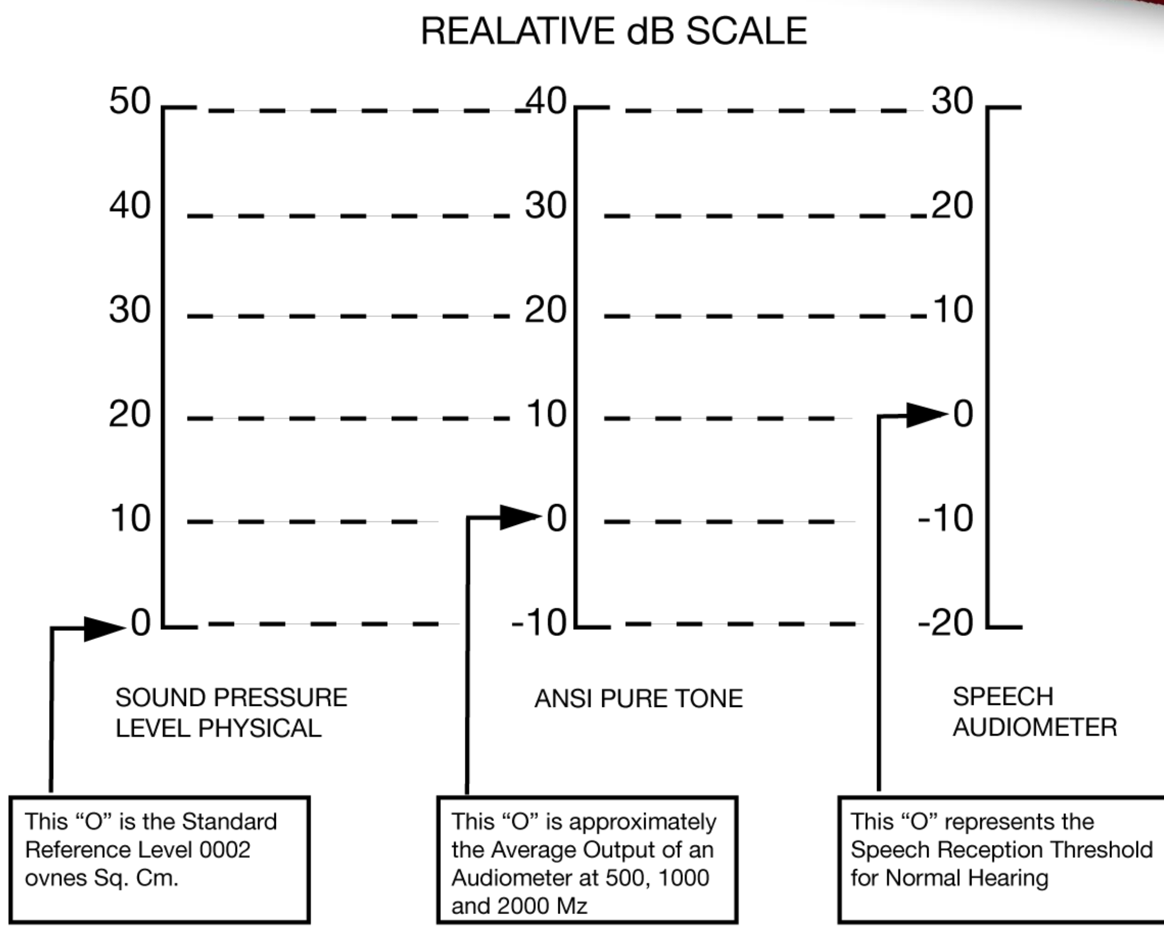
Sound Pressure Level (SPL)

- Thresholds reached by utilization of the Decibel system
- (See next slide for **reference** example)

ALAN LOWELL SEMINARS INC.

Decibel References





ALAN LOWELL SEMINARS INC.

Sound Pressure Comparisons

Less sound pressure is needed at lower intensity levels than at high intensity levels.

It takes <u>greater</u> sound pressure to make a *loud sound louder*.

- Doubling effective sound pressure increases intensity level 6 dB
- 120 dB 200 Dyne/sq/cm
- 126 dB 400 Dyne/sq/cm
- 132 dB 800 Dyne/sq/cm
- 138 dB 1600 Dyne/sq/cm
- *<u>134 db 1000 Dyne/sq/c</u>*

ALAN LOWELL SEMINARS INC.

Facts

Frequency & Pitch

- Synonyms used to describe sound

- Normal ear responds to sounds 20 Hz-20,000 Hz

Physiological Acoustics

- Associated with human hearing

- Most sensitive
- 3000 Hz - 4000 Hz

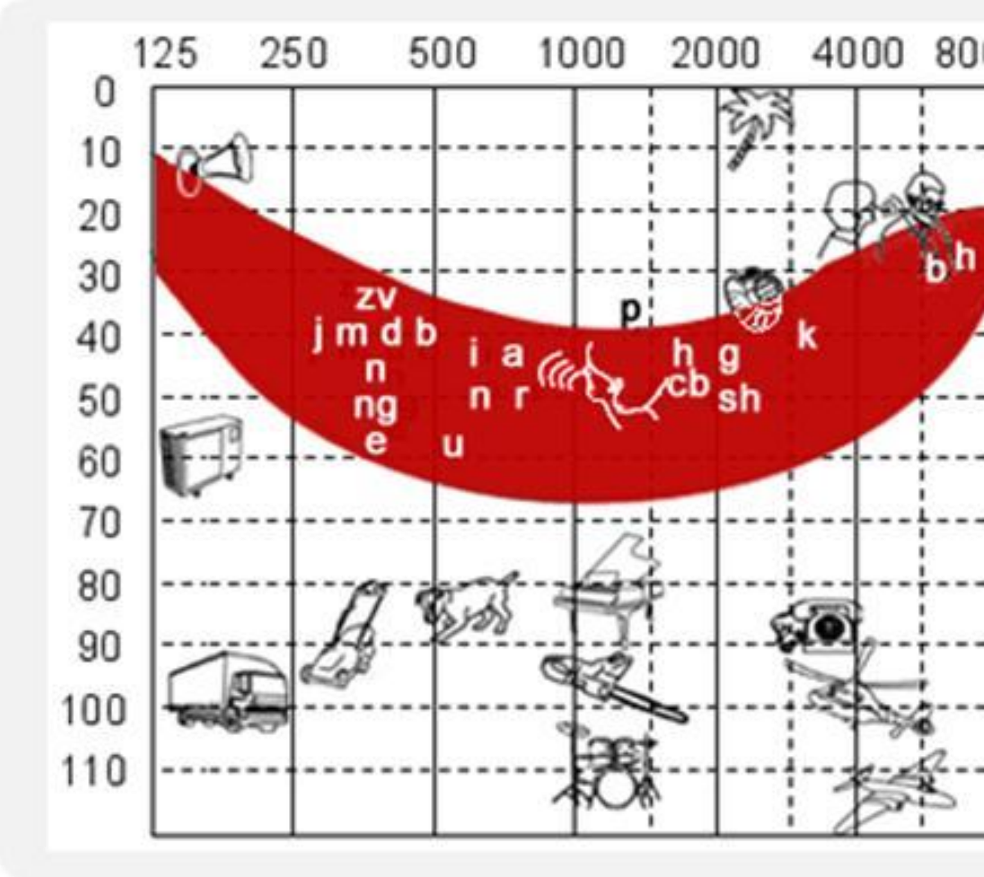
Facts

Vowels = stronger speech sounds

Consonants = weaker

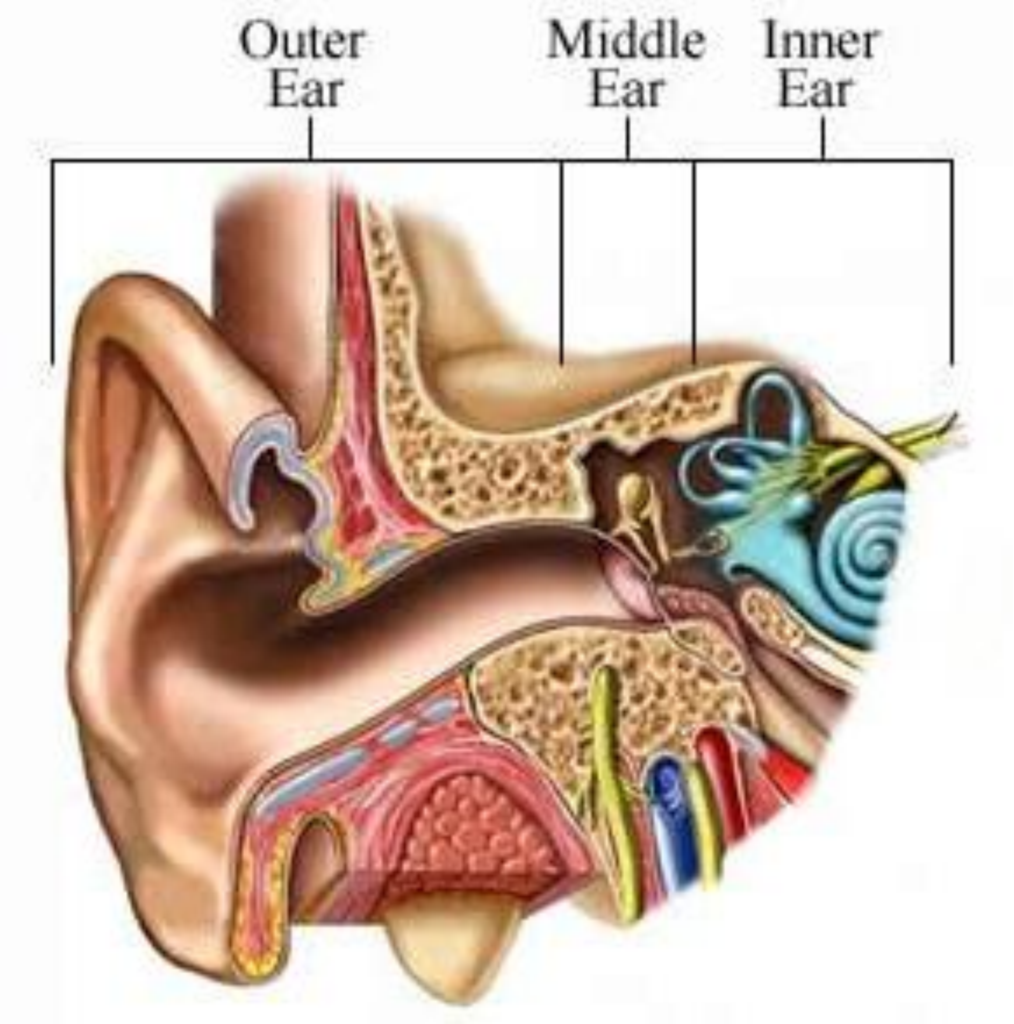
Normal conversational speech from a distance of **3 ft (1 Meter)**

65 dB SPL



Classification of Hearing Disorders

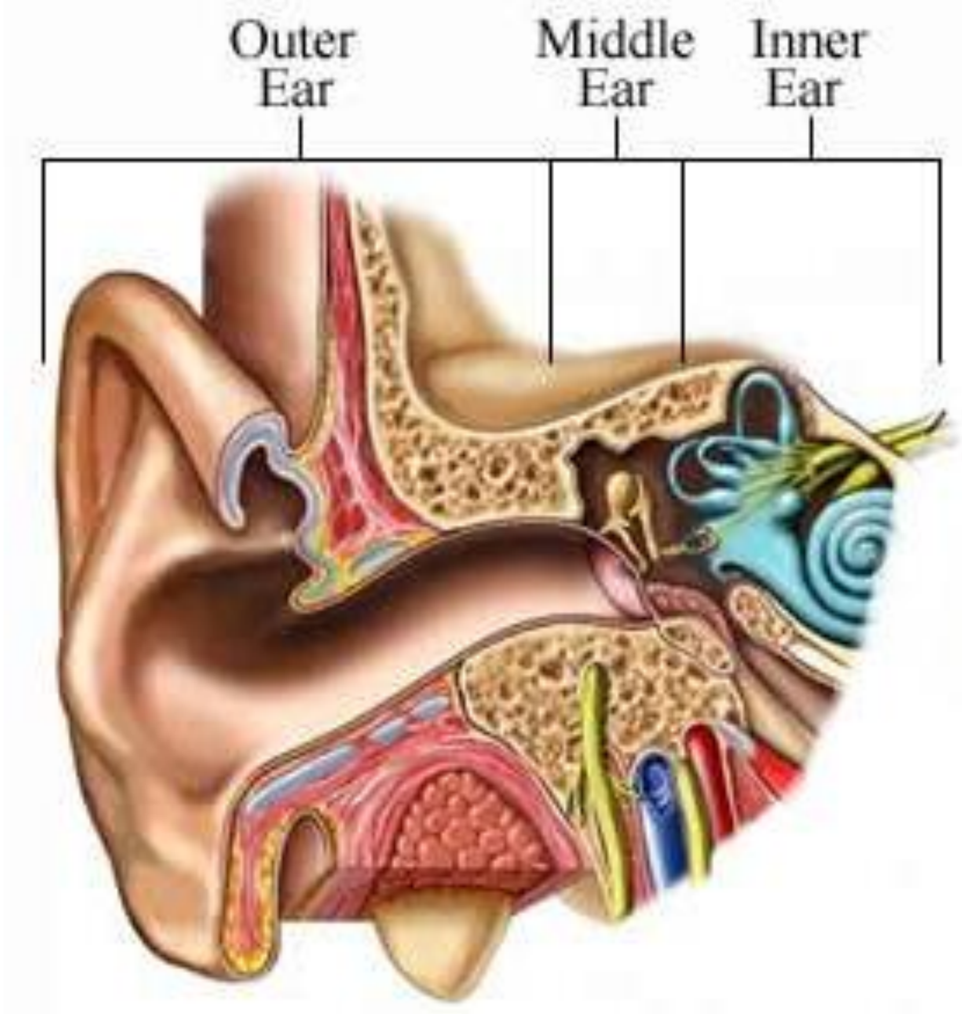
- Conductive
- Sensorineural
- Central Deafness
- Psychogenic



Conductive Hearing Loss

- Obstruction or breakdown in the outer and/or middle ear ……

- Wax impaction
- Perforated ear drum
- Otitis media
- Cholesteatoma
- Ossicular fixation (otoslcerosis)
- Ossicular discontinuity



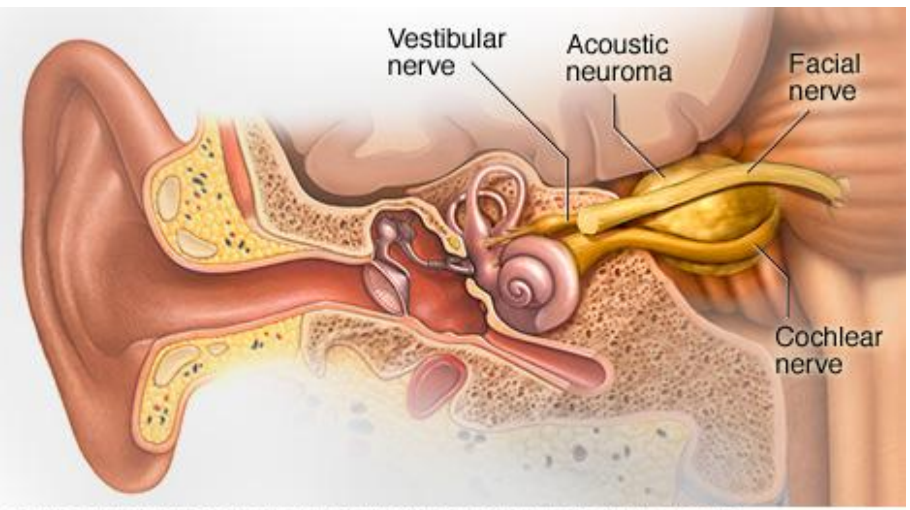
Sensorineural Hearing Loss

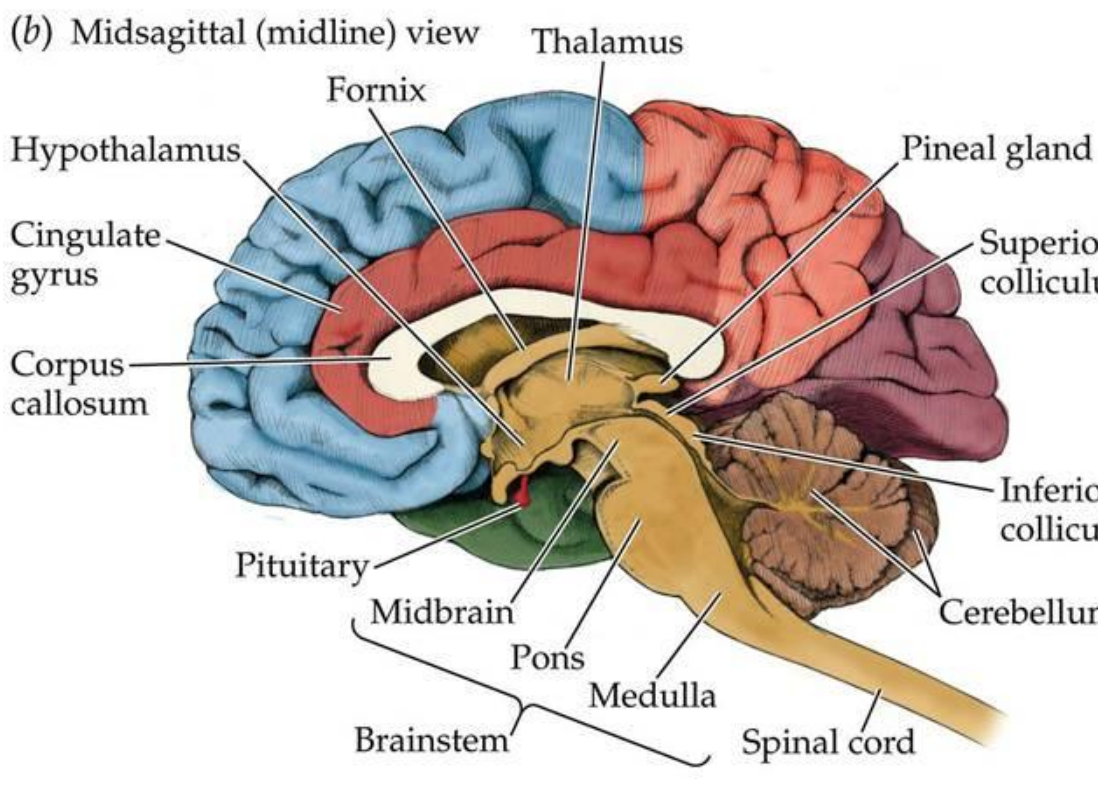
- Disorder of the inner ear or auditory nerve
- Sensory = Cochlea
- Neural = Auditory Nerve

ALAN LOWELL SEMINARS INC.

Central Deafness

- Retro cochlear condition
- i.e.: Brain Tumor
- Acoustic Neuroma





***Biological Psychology 6e*, Figure 2.12 (Part 2)**

Psychogenic Hearing Loss

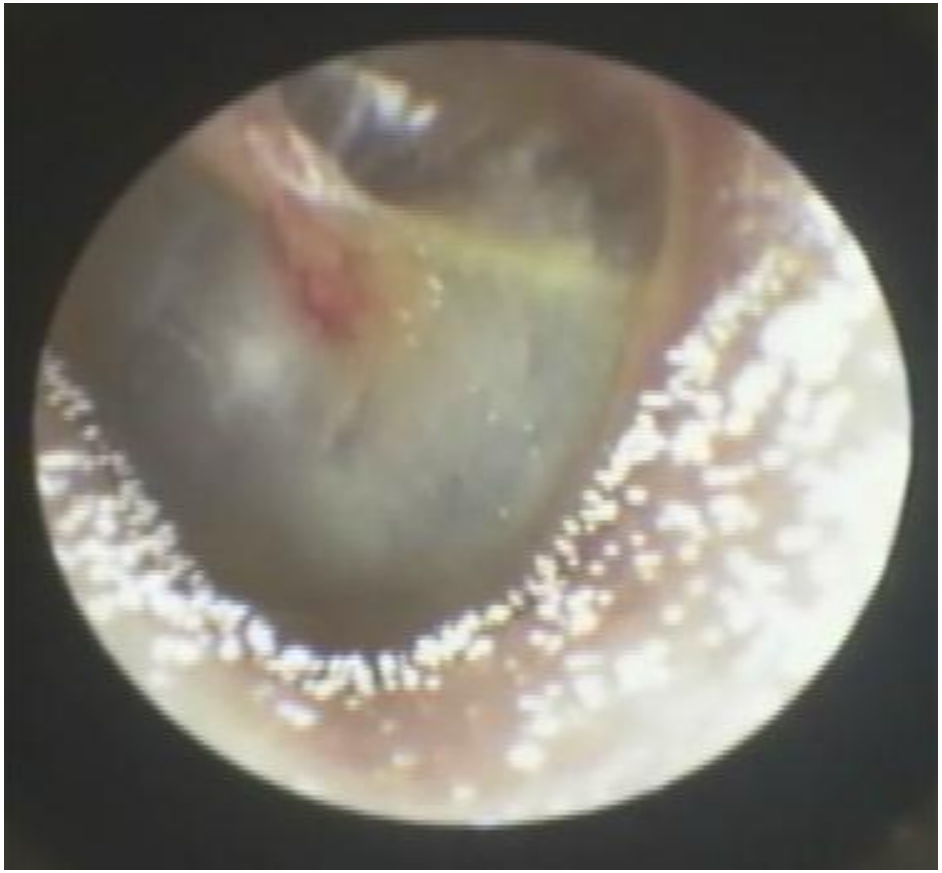
- All mechanisms normal
- Non Organic
- Functional

Ear Disorders

or Conditions

ALAN LOWELL SEMINARS INC.

Fungus Infection



- Candidas Albicans

ALAN LOWELL SEMINARS INC.

Exzema or Dermatitis

- Severe itching and pain
- Generally, no hearing loss

ALAN LOWELL SEMINARS INC.

Hematoma

- Blood collection under the keratin layer
- Between 6-9 o'clock
- Very painful

ALAN LOWELL SEMINARS INC.

Prolapsed Ear Canal vs. Atresia

- Breakdown of the cartilage
- May require tube insertion when testing
- May require extended receiver tube

- Atresia- Closed ear canal

ALAN LOWELL SEMINARS INC.

Cleft Palate

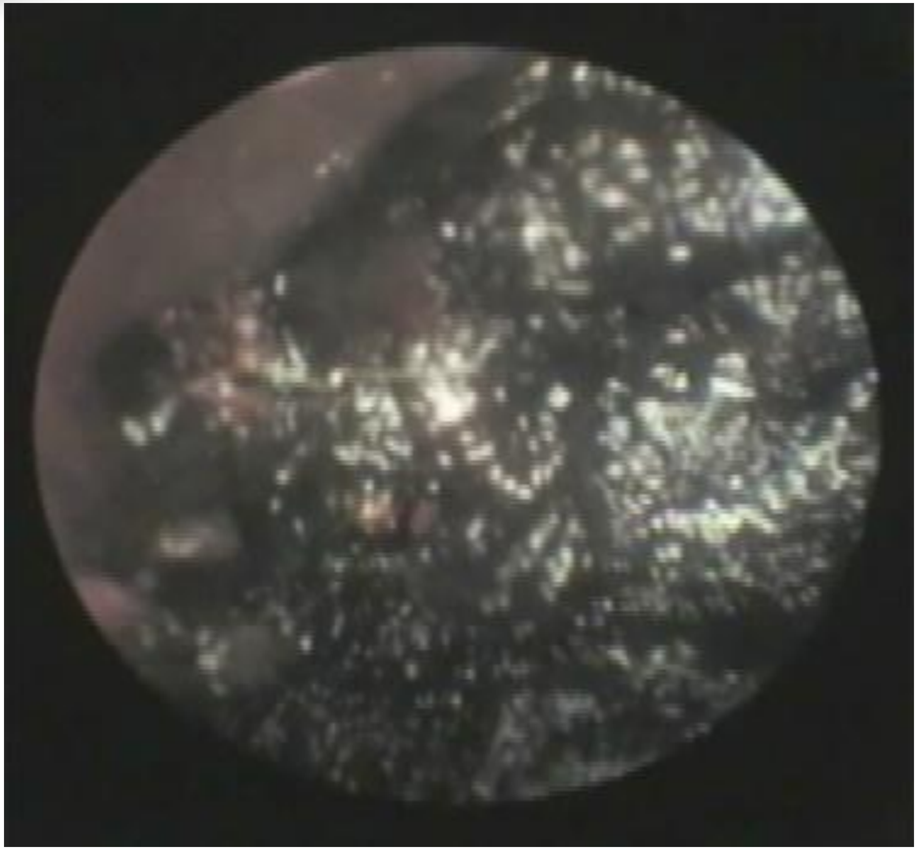
Congenital fissure (slit) in the palate (roof of mouth)

Hard or soft palate

Conductive Hearing Loss

ALAN LOWELL SEMINARS INC.

Impacted Cerumen



- Seen as yellowish or black mass in ear canal
- Partially occluded = NO LOSS
- Complete occlusion = up to a 25 dB hearing loss

ALAN LOWELL SEMINARS INC.

Otitis Externa

- Inflammation of canal walls
- Usually no hearing loss
- Redness
- Several causes & types of Otitis Externa

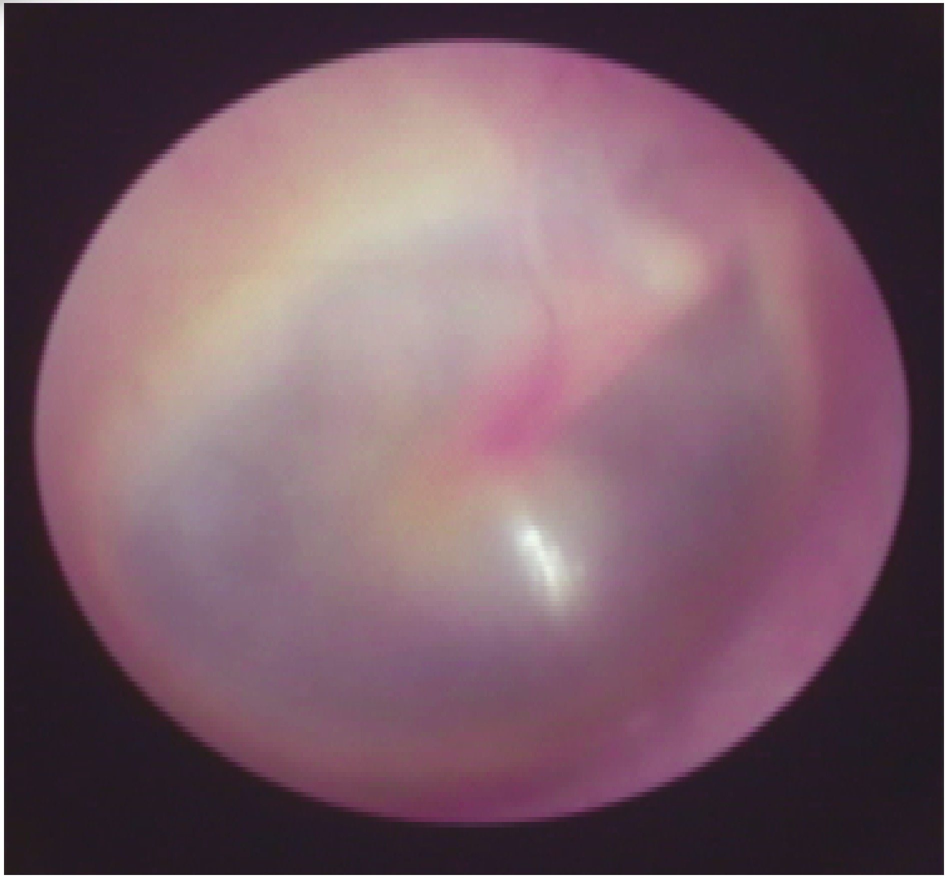
ALAN LOWELL SEMINARS INC.

Chronic Otitis Externa

- Chronic Infection with swelling & secretion from yellow to green.
- Treatment involves meticulous toilet & use of topical antibiotic, antifungal and steroid combinations.

ALAN LOWELL SEMINARS INC.

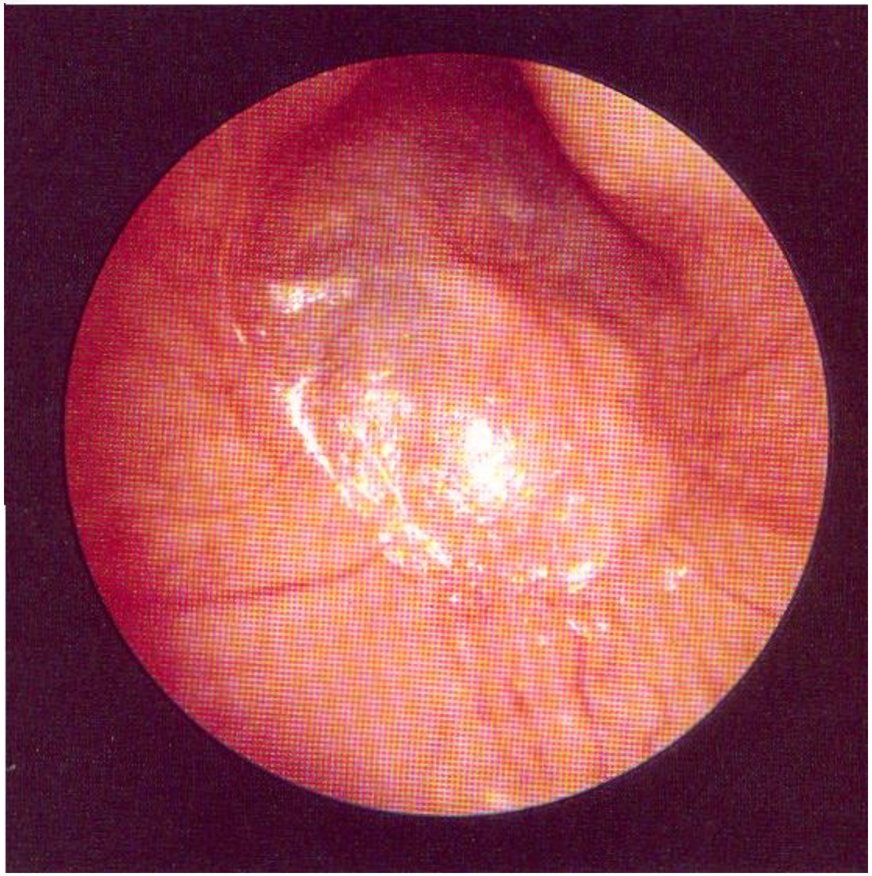
Non-Suppurative Otitis Media



- Non-bacterial
- Less painful
- Less serious

This photo has been altered to illustrate a non-Suppurative Otitis Media. It is not an actual photo. (photo not available)

Otitis Media (Suppurative)



- Middle Ear Infection (bacterial)
- TM red
- Drainage
- Odor
- Myringotomy
- Type B tympanogram

Myringotomy (PE tube)

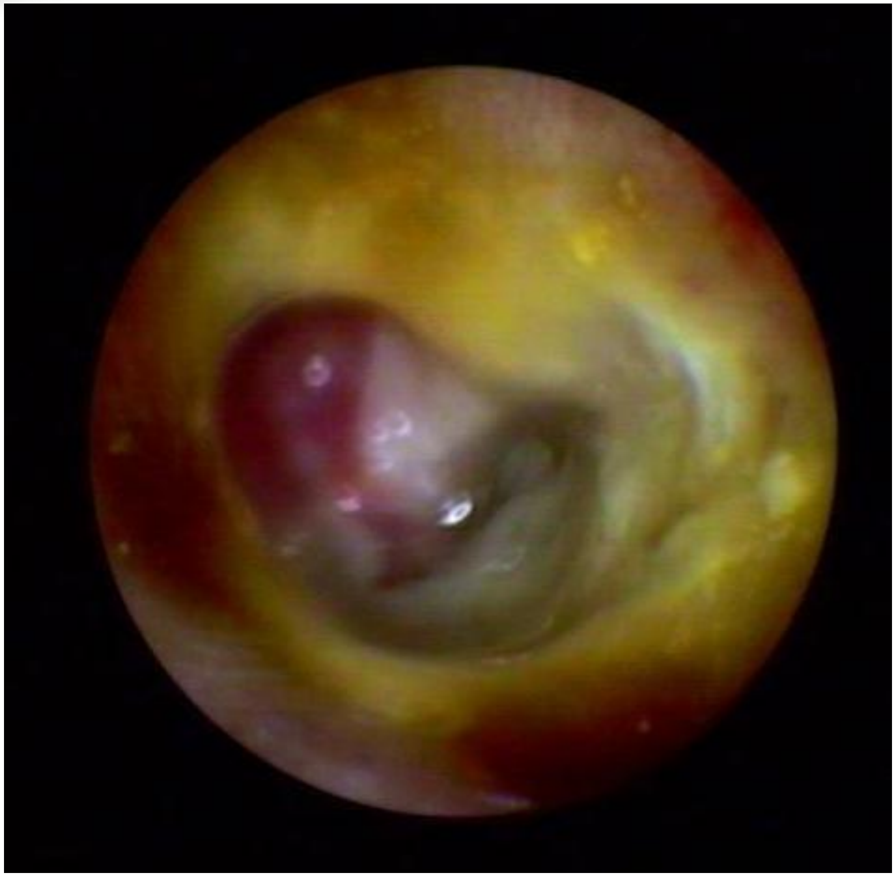
- Insertion of a ventilation tube (PE tube) pressure equalizer
- Allows fluid to drain from the middle ear cavity
- Surgically implanted to fal out by itself after a period of time

ALAN LOWELL SEMINARS INC.

Ruptured or Perforated Ear Drum

- May cause up to a
- 5-10 dB hearing loss
- Tympanoplasty
- Myringoplasty

Large Perforation (Tympanoplasty)

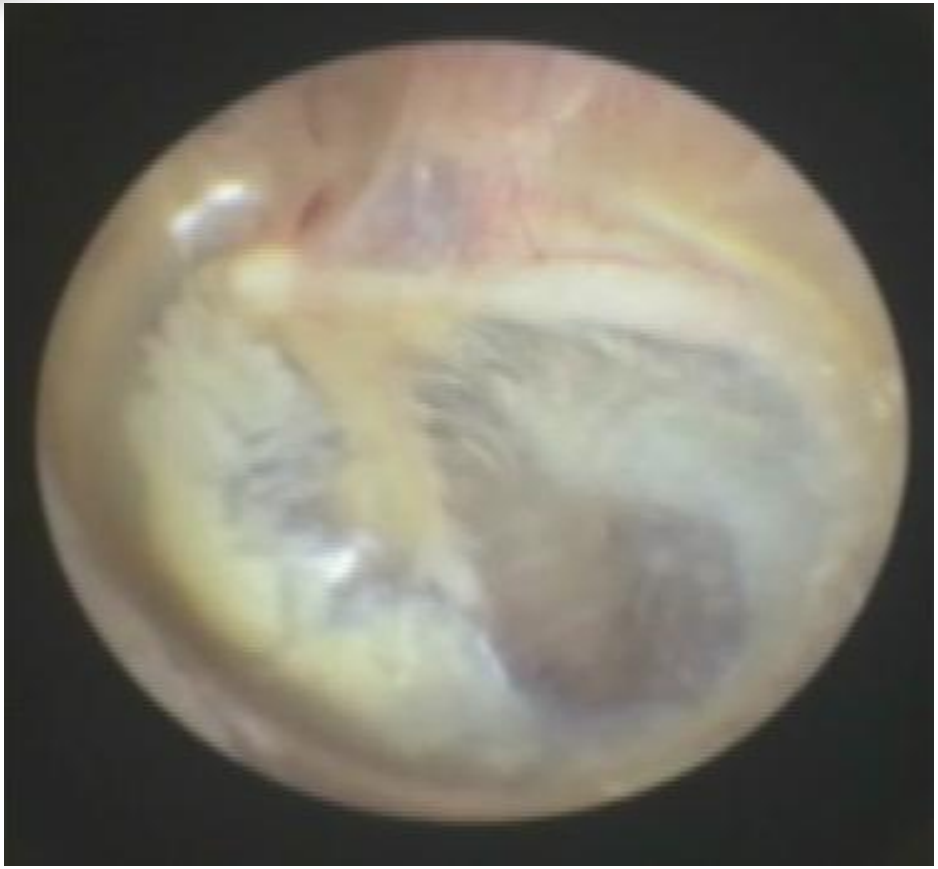


Tympanoplasty

- Removal of diseased tissue & reforming the middle ea for the best transmission o energy to the Oval Window through the remaining ossicles

ALAN LOWELL SEMINARS INC.

Tympanosclerosis



- White chalky calcium deposits
- Degeneration of TM tissue

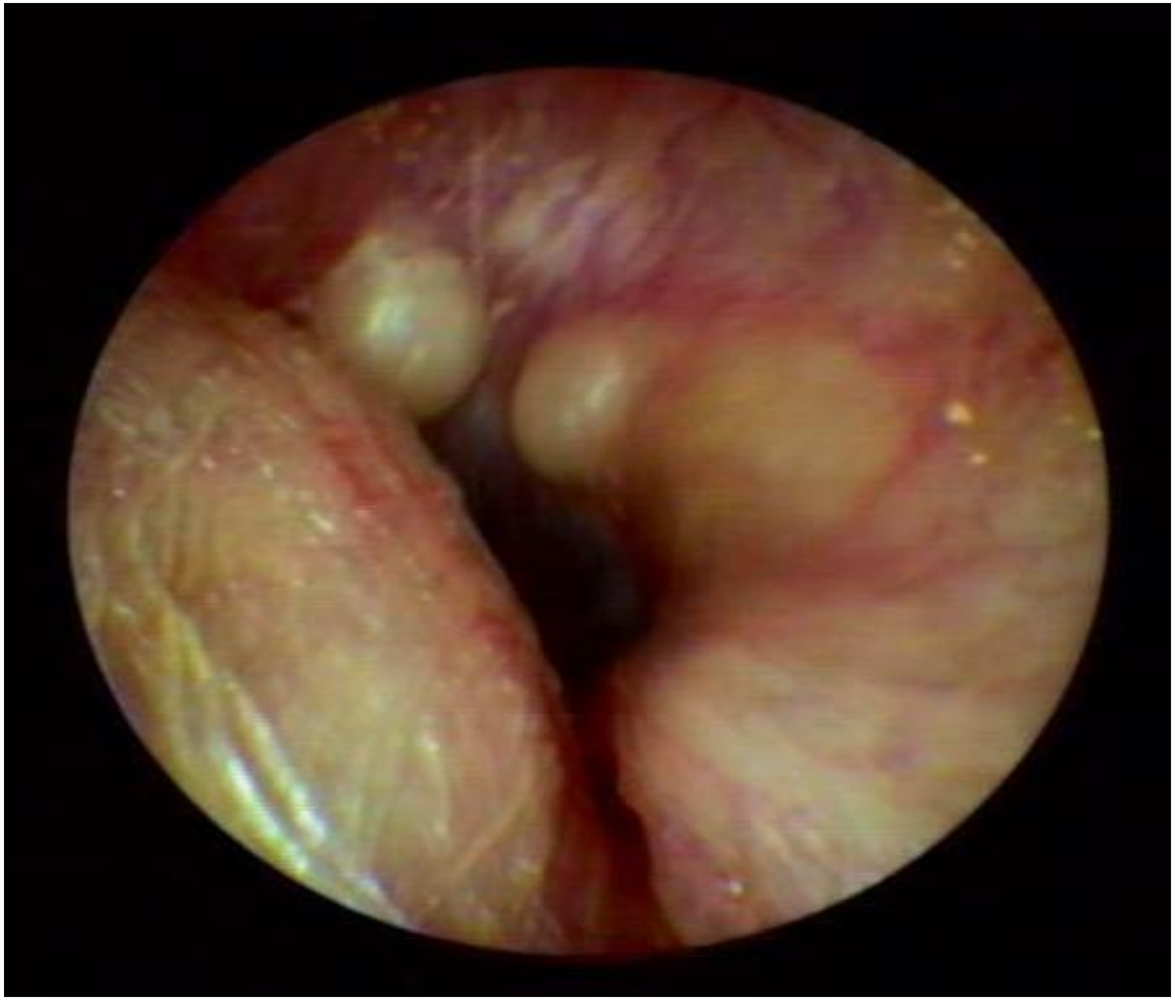
ALAN LOWELL SEMINARS INC.

Exostosis

- Rounded hard bony nodule
- Sometimes associated with cold water exposure

ALAN LOWELL SEMINARS INC.

Severe Bony Exostosis



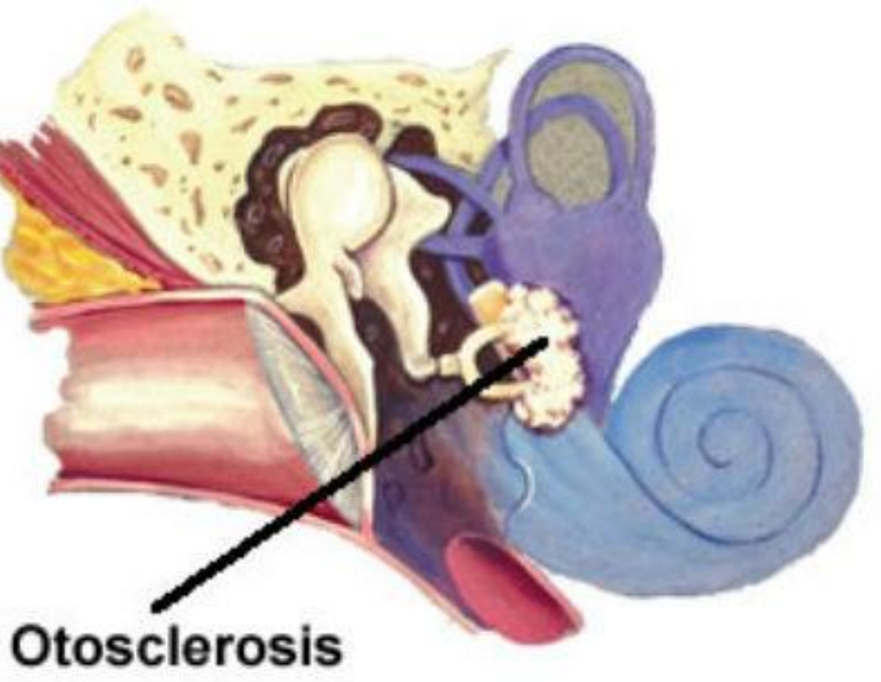
ALAN LOWELL SEMINARS INC.

Monomeric Spots

- Healed hole in eardrum (TM)
- Mirror Membranes
- Generally, no loss

Otosclerosis

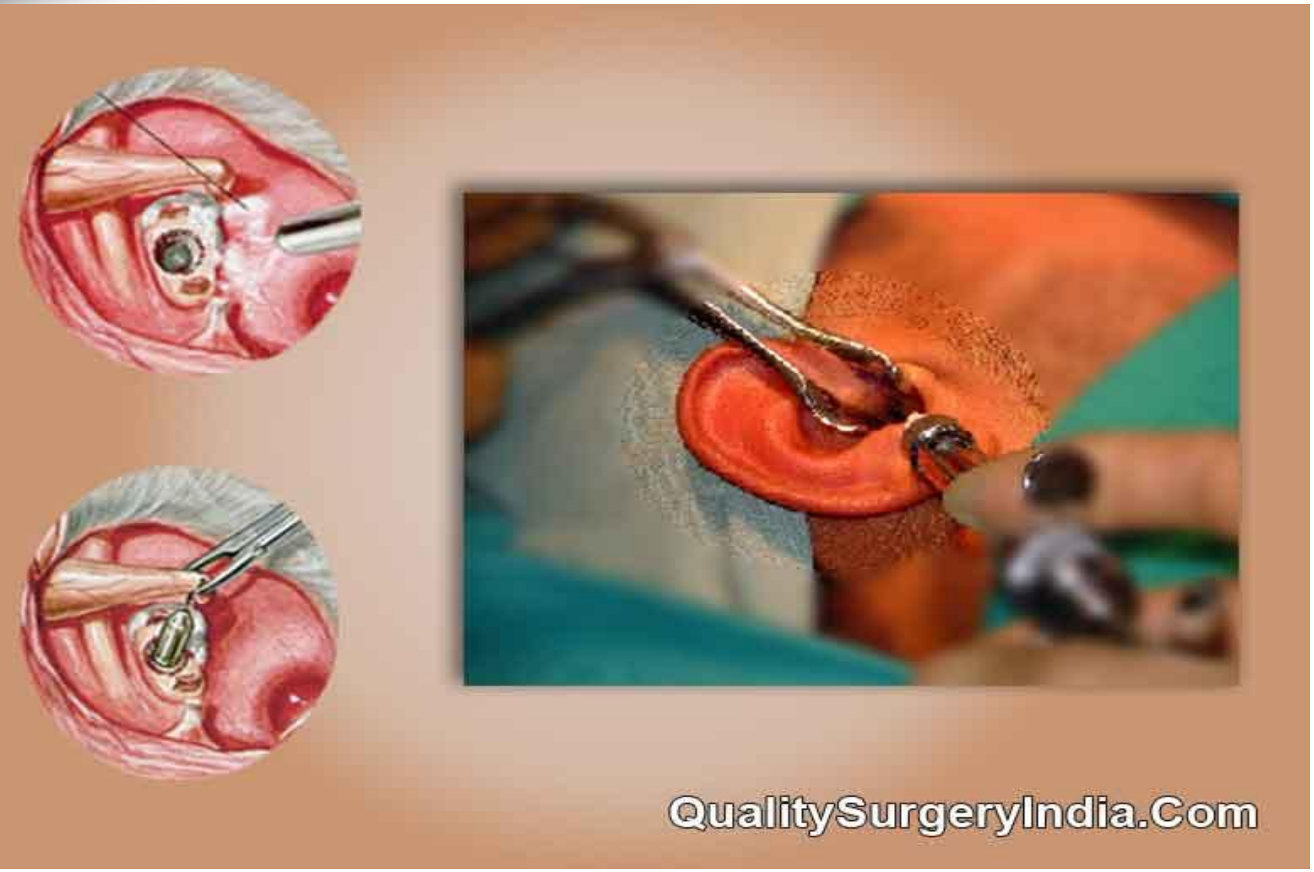
(Ossicular Fixation)



- Spongy growth around stapes
- Complete fixation 50-70 dB
- Mostly affects Caucasian women, mid age, after child birth
- Stapedectomy, Stapes Mobilizatio
- Type As tympanogram

ALAN LOWELL SEMINARS INC.

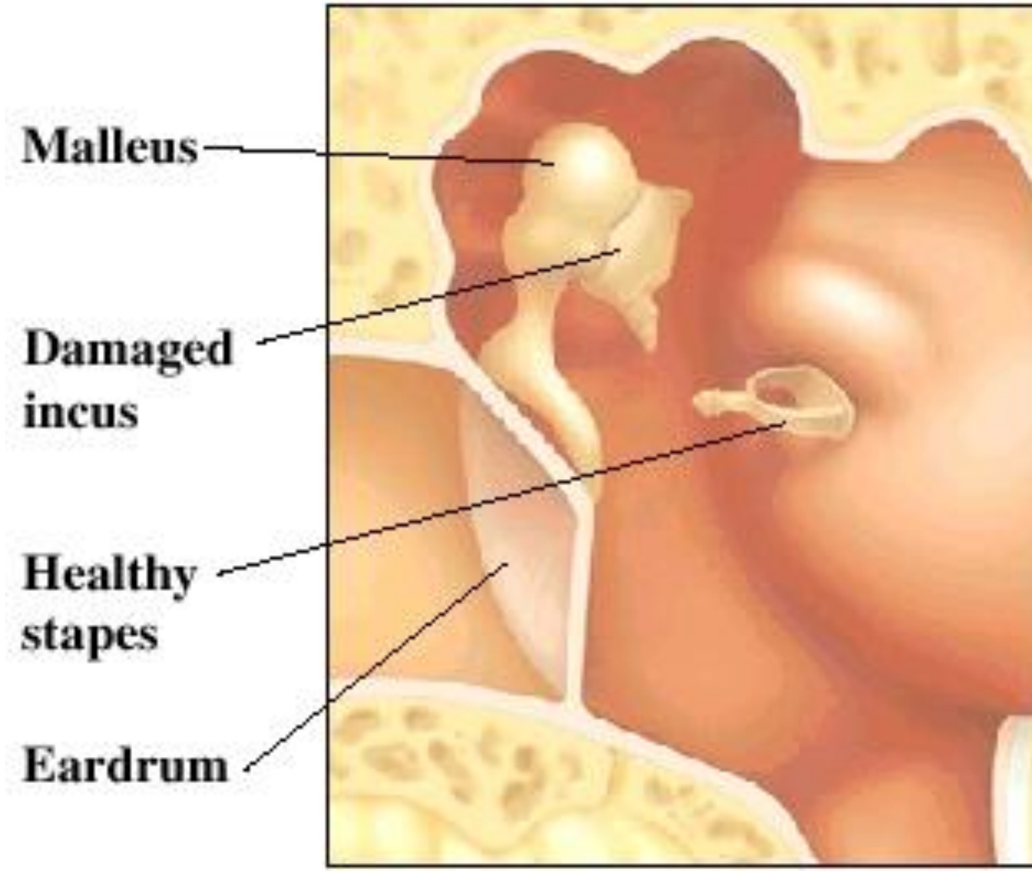
Stapedectomy



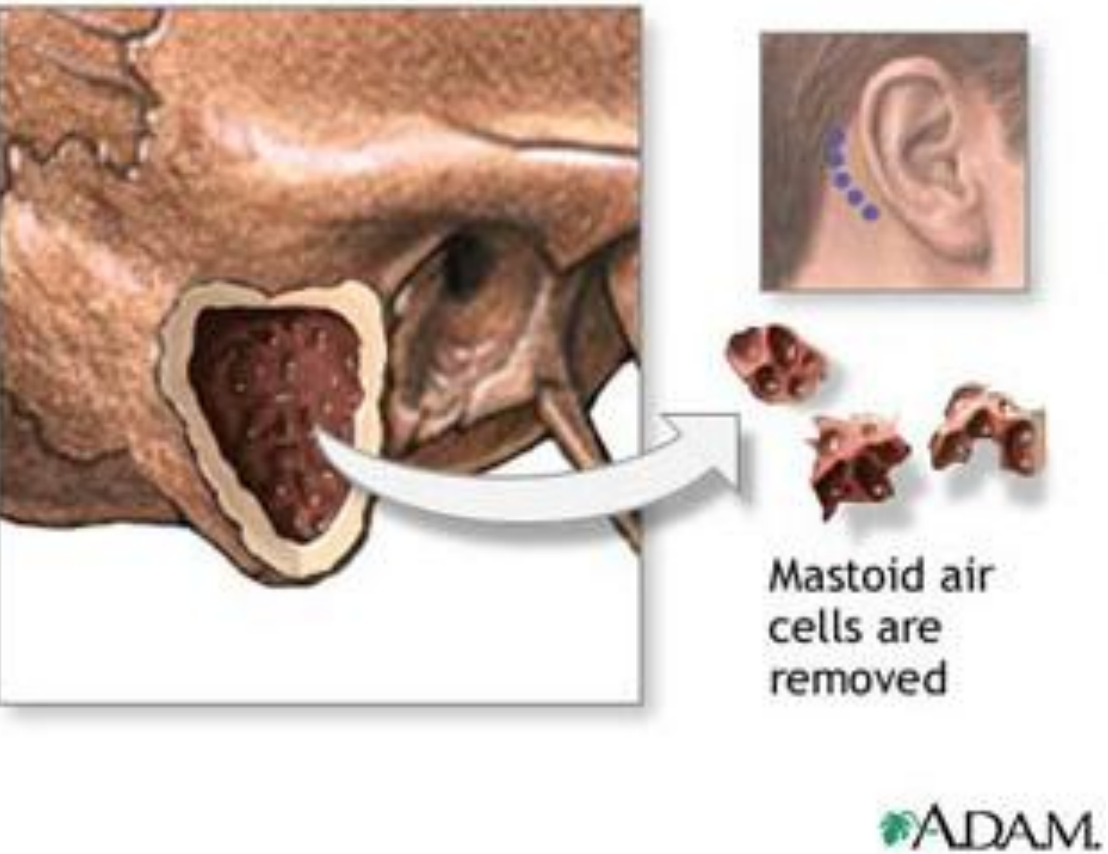
- Removal of stapes and replacing with a prosthetic

Ossicular Discontinuity

- Dislodged ossicular chain
- Altered lever capability
- Type Ad tympanogram



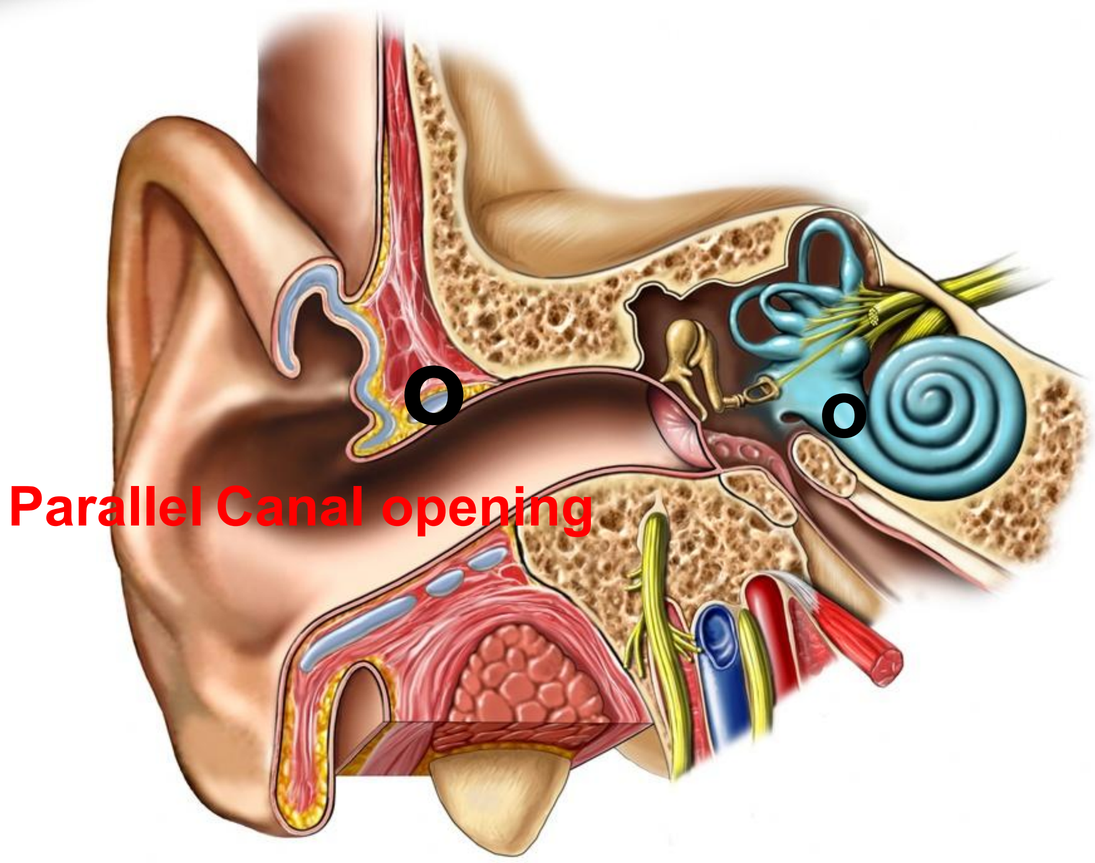
Radical Mastoidectomy



- Resulting from chronic Mastoiditis
- Scraping away diseased bone in the mastoid process of the temporal bone
- Possible removal of diseased components of the ossicular chain

ALAN LOWELL SEMINARS INC.

Fenestration (Early procedure & rarely performed)



- Removal of TM & most of the ossicular chain
- Construction of a new window in the cochlea

Cholesteatoma

- Tumor in the middle ear
- May perforate TM into external ear canal
- May result from poor Eustachian Tube function*

*Air in the middle ear may be absorbed by the body creating a vacuum in the middle ear. The vacuum pressure sucks in a pouch or sac by stretching the eardrum. This can develop into a Cholesteatoma

ALAN LOWELL SEMINARS INC.

Aero Otitis Media - Barotrauma

- Injury resulting from changes in ambient air pressure between outer & middle ear.
- Eustachian Tube Dysfunction(ETD)
- Valsalva method helps to equalize ambient pressure

ALAN LOWELL SEMINARS INC.

Paget's Disease

- Disease of the bones
- Causes a thickening of the temporal bone and ossicular chain
- May cause a conductive hearing loss
- Generally affects patients over 40 yrs old

Diseases & Hearing Loss

- Diabetes (disorder of the body's metabolism which controls blood sugar)
- Autoimmune Ear Disease (AIED) Antibodies that attack the inner ear
- HIV (Virus that attacks the bodies immune system)
- Multiple Sclerosis (may cause vision & cognitive & hearing issues)
- Polyarteritis Nodosa (blood vessel disease / can affect the nervous system)
- Cogan's syndrome (inflammation in the cornea / hearing loss)
- Lupus (autoimmune disease / can affect any organ in the body)
- Wegener's granulomatosus (inflammation that can affect upper body)
- Sjogren's syndrome (autoimmune inflammation in the body's glands)
- Behcet's disease (inflammation of the blood vessels)
- Lyme disease (infection due to being bitten by an infected tick)

ALAN LOWELL SEMINARS INC.

Autoimmune Ear Disease (AIED)

- Fluctuating unilateral or bilateral hearing loss
- May experience unilateral facial stiffness or paralysis
- With or without vestibular involvement
- May be rapid and progressive

HIV

- 29% of patients have hearing loss
- 26% of patients have tinnitus
- 32% of patients have dizziness
- 23% of patients have otalgia (ear pain)

Type 1 Diabetes
(Diabetes Mellitus)

- Juvenile Diabetes
- Insulin dependent
- Special precautions should be taken when operating in the ear canal to prevent bleeding

Type 2 Diabetes
(Non-Insulin Dependent Diabetes Mellitus) (NIDDM)

- Adult Onset Diabetes
- Associated with obesity
- Lack of exercise
- Diet control, exercise & oral medications (hypoglycemic agents) may control blood sugar levels
- Special precautions should be taken when operating in the ear canal to prevent bleeding

Sensorineural Hearing Loss

- Perceptive
- Nerve Loss
- Sensory=Cochlea
- Neural=Auditory Nerve & Ascending Pathways

ALAN LOWELL SEMINARS INC.

Sensorineural Hearing Loss

- Most often affects high frequencies
- Difficulty understanding consonants
- Sounds like people are mumbling
- Difficulty understanding in noise

ALAN LOWELL SEMINARS INC.

Sensorineural Hearing Loss

- Sensorineural = speaks louder
- Conductive = speaks softer

Hyperacusis

- A painful sensitivity to loud sound not necessarily discomforting to the normal listening person

ALAN LOWELL SEMINARS INC.

Sensorineural Hearing Loss

Recruitment

- Small increase in sound intensity is perceived as a rapid increase in loudness

Tinnitus

- Ringing
- Buzzing
- Clicking
- Rushing sound
- Any type of head noise

ALAN LOWELL SEMINARS INC.

Tinnitus

70 Million + Americans
uffer from head noise

70% have hearing loss

70% with hearing loss have
nnitus!

ALAN LOWELL SEMINARS INC.

Objective / Subjective Tinnitus

bjective Tinnitus

ead noises that can be heard
nd measured externally

Subjective Tinnitus

Head noises only evident to
the patient

Unable to be heard externall

ALAN LOWELL SEMINARS INC.

Common Causes of Tinnitus

Sudden exposure to loud noise

Long time exposure to high levels of low frequency sounds

Medications (250+)

Physical trauma to head or neck

Hypertension

Acoustic Neuroma

Thyroid disease

Vascular disorders (pulsing)

TMJ disorder

Ear infection, impacted cerumen

Nutritional deficiency

Treatments

*Conventional hearing devices

*Conventional hearing devices w programmed tinnitus management

*Tinnitus Retraining Therapy (TRT) (Auditory Habituation)

*Stress reduction therapy (Bio Feedback)

*Acupuncture

*Chiropractic treatments (around head & neck disc compressions)

*Over-the-counter supplements & products

*Drug treatment therapy (see next slide)

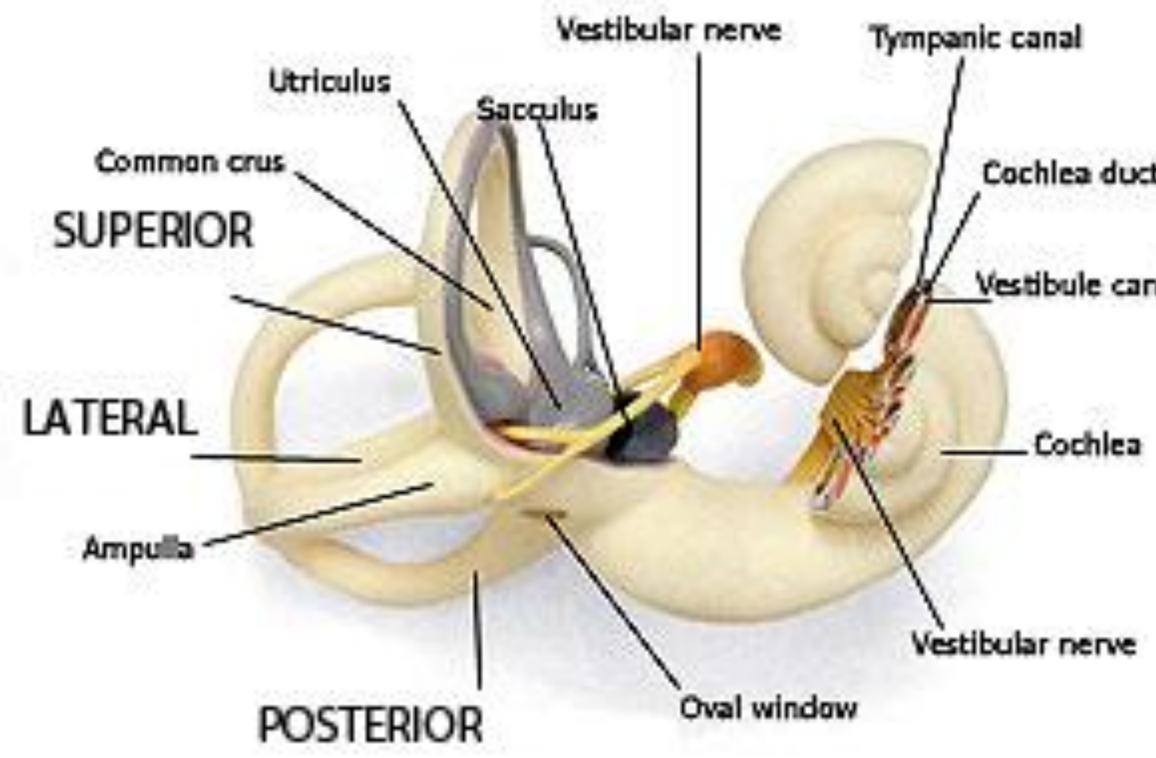
Drug Therapy

- Anesthetics
- Antidepressants
- Anticonvulsants
- Anti-anxiety agents
- Antihistamines
- Lasix
- Xanax

ALAN LOWELL SEMINARS INC.

Vestibular Disorders

The vestibular system works in conjunction with the ocular system (cranial nerve II) which controls our pattern of eye movement



ALAN LOWELL SEMINARS INC.

Common Causes of Vertigo

- Nystagmus (pattern of eye movements in opposite directions)
- Acoustic Neuritis (inflammation of the VIII Cranial nerve)
- Vestibular Neuritis (inflammation of the VIII Cranial nerve)
- Positional Vertigo
- Benign Paroxysmal Positional Vertigo (BPPV)
- Meniere's Disease (Endolymphatic Hydrops)

ALAN LOWELL SEMINARS INC.

Objective / Subjective Vertigo

Objective Vertigo

- Sensation of external objects spinning around the person

Subjective Vertigo

- Sensation that one is spinning or whirling

Treatment Maneuvers for Positional Vertigo

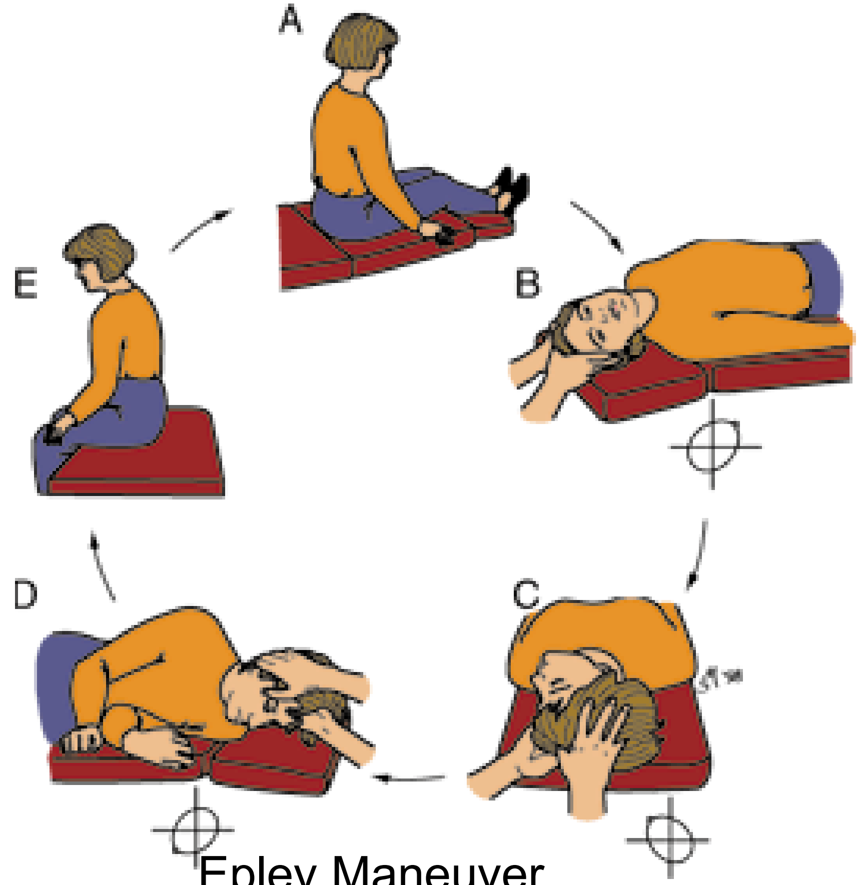
Hallpike

Modified Hallpike

Roll Test

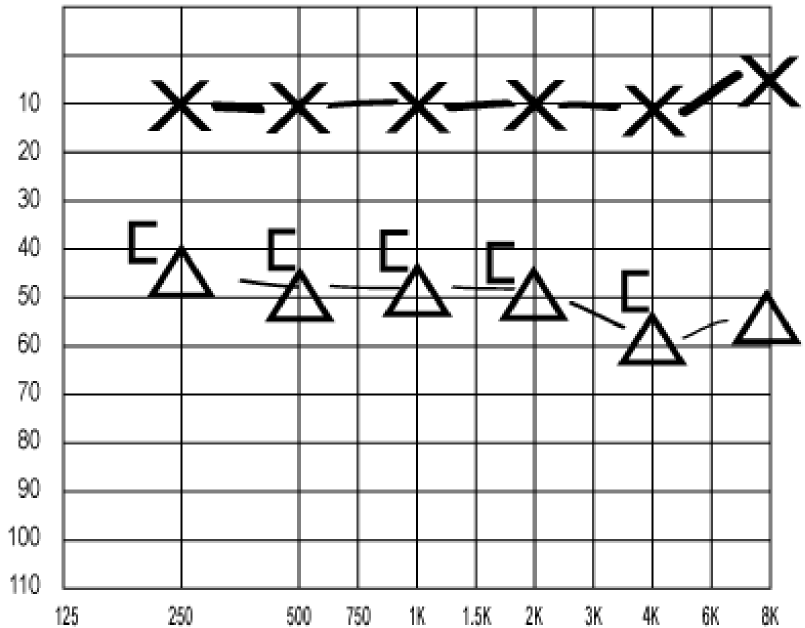
Semont Liberatory Maneuver

Epley Maneuver



Epley Maneuver

Meniere's
(Endolymphatic Hydrops)

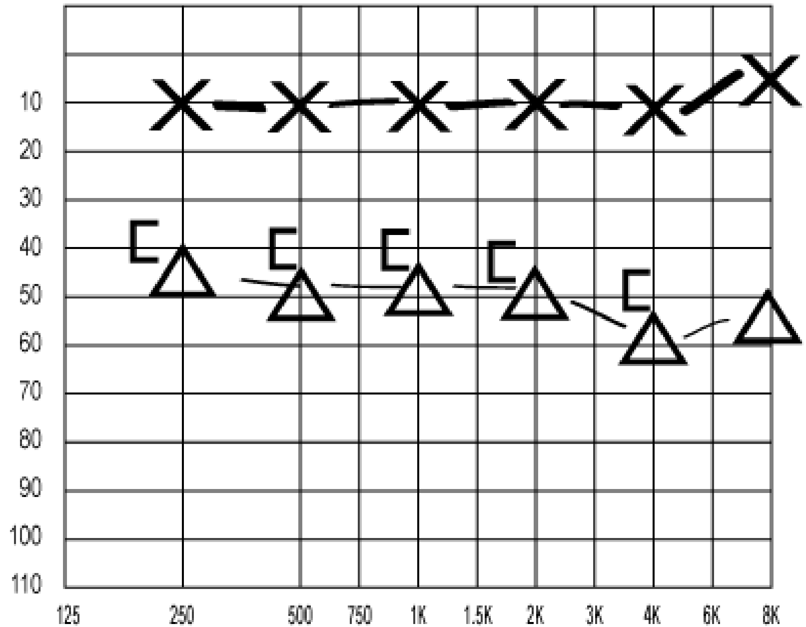


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Descrim. %	100 %	76 %	

- **Cochlear** = affects hearing (atypical)
- **Vestibular** = affects balanc & motion (atypical)
- **Meniere's Syndrome** = a little of both (most common)

ALAN LOWELL SEMINARS INC.

Meniere's Symptoms

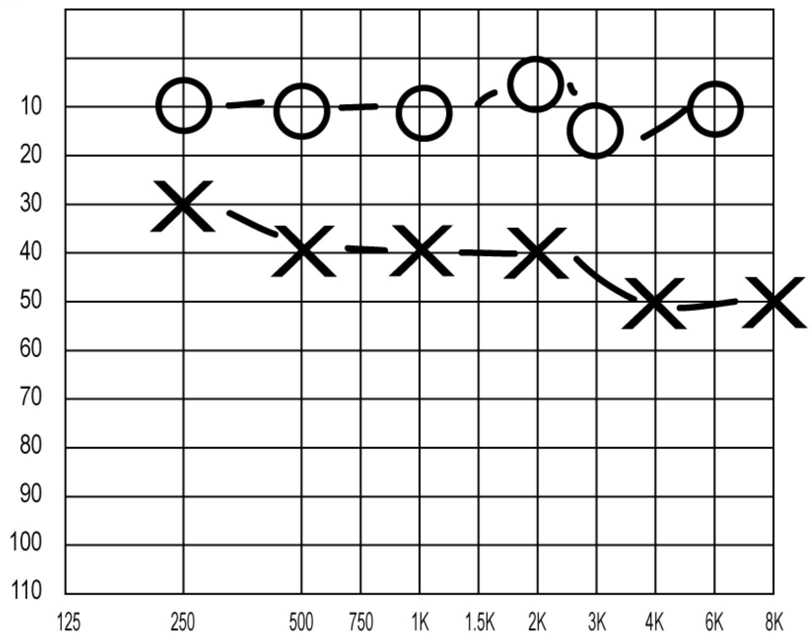


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Descrim. %	100 %	76 %	

- Fluctuating loss
- Tinnitus
- Vertigo

ALAN LOWELL SEMINARS INC.

Acoustic Neuroma



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Tumor on the VIII Nerve
- Unilateral loss
- Facial stiffness
- atypical poor SRT's
- atypical poor discrimination scores
- Vertigo / Tinnitus

ALAN LOWELL SEMINARS INC.

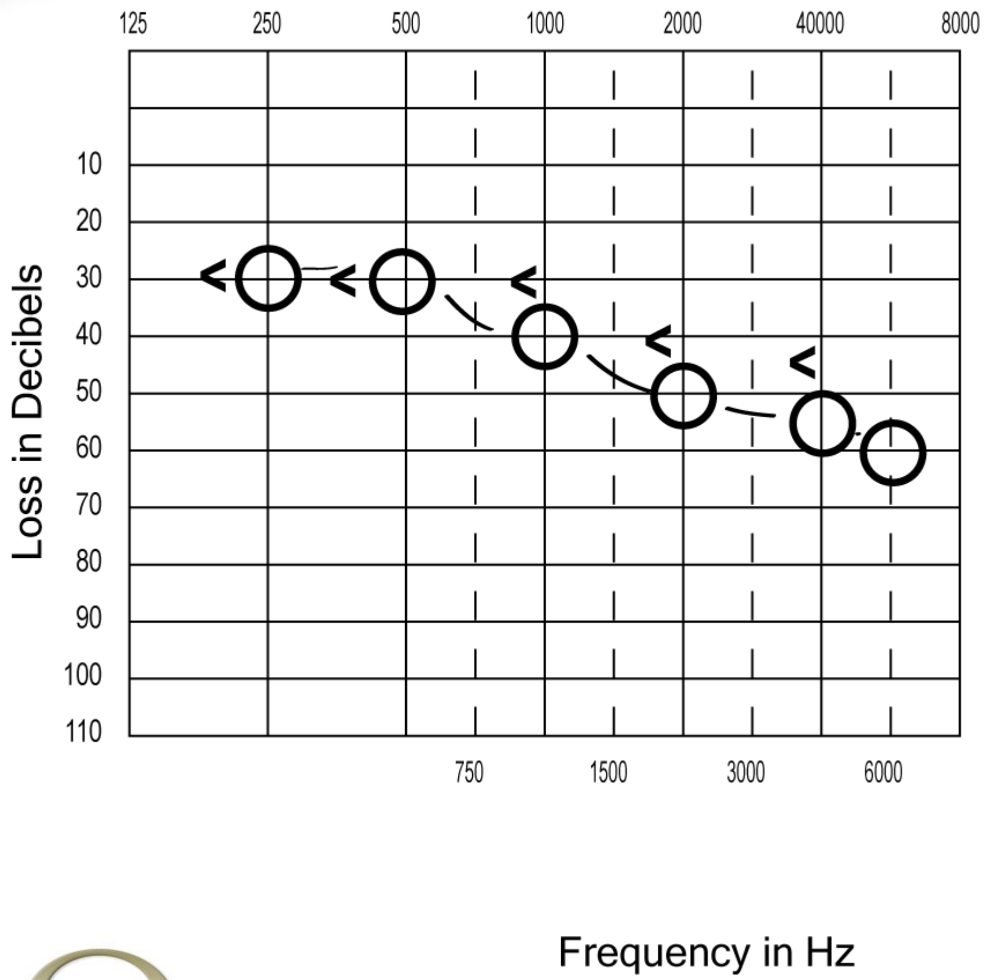
Tone Decay
(Common in retro-cochlear conditions)

- Perstimulatory Fatigue
- Common among Meniere's patients
- Acoustic Neuroma
- Inability to hold a tone at threshold for more than 60 seconds

Labyrinthitis

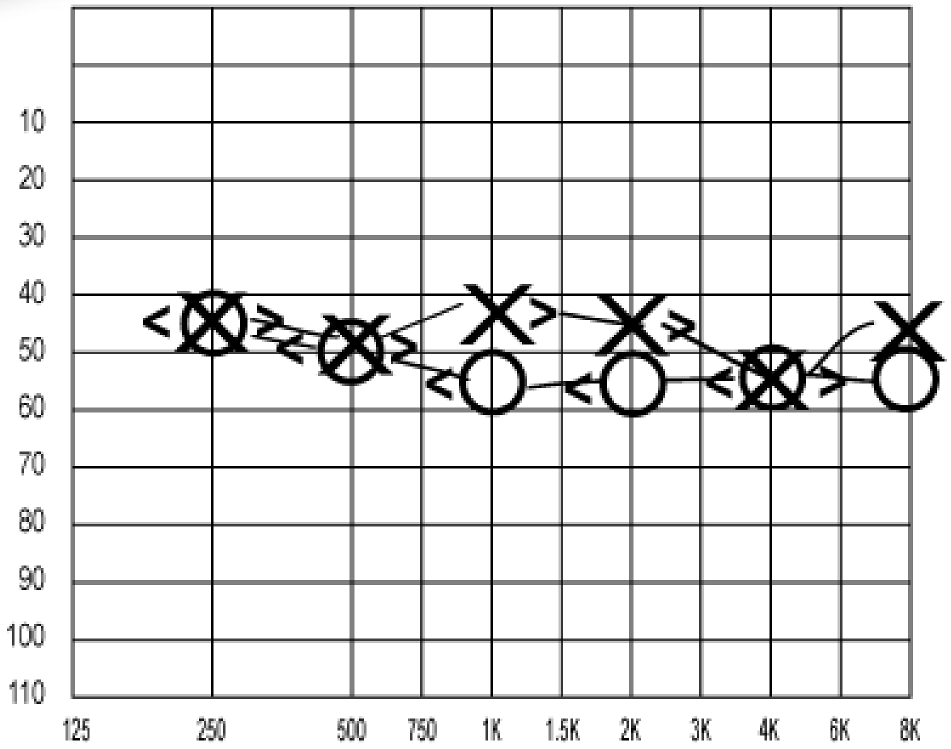
- Infection in the inner ear
- May involve cochlea
- May cause rapid deterioration

Typical Presbycusis



- Gradual hearing loss due to increasing age
- Typical Presbycusis loss

Central Presbycusis
(Phonemic Regression)



Generally, broader loss configuration

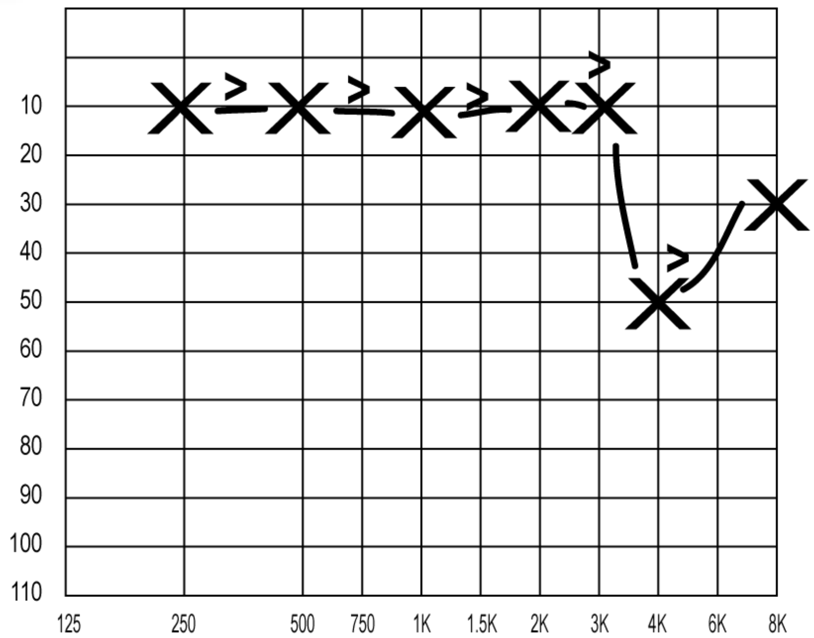
Characteristic for patients with phonemic regression

Atypically poor speech discrimination

ALAN LOWELL SEMINARS INC.

Noise Induced Hearing Loss

(4000 Hz Notch)



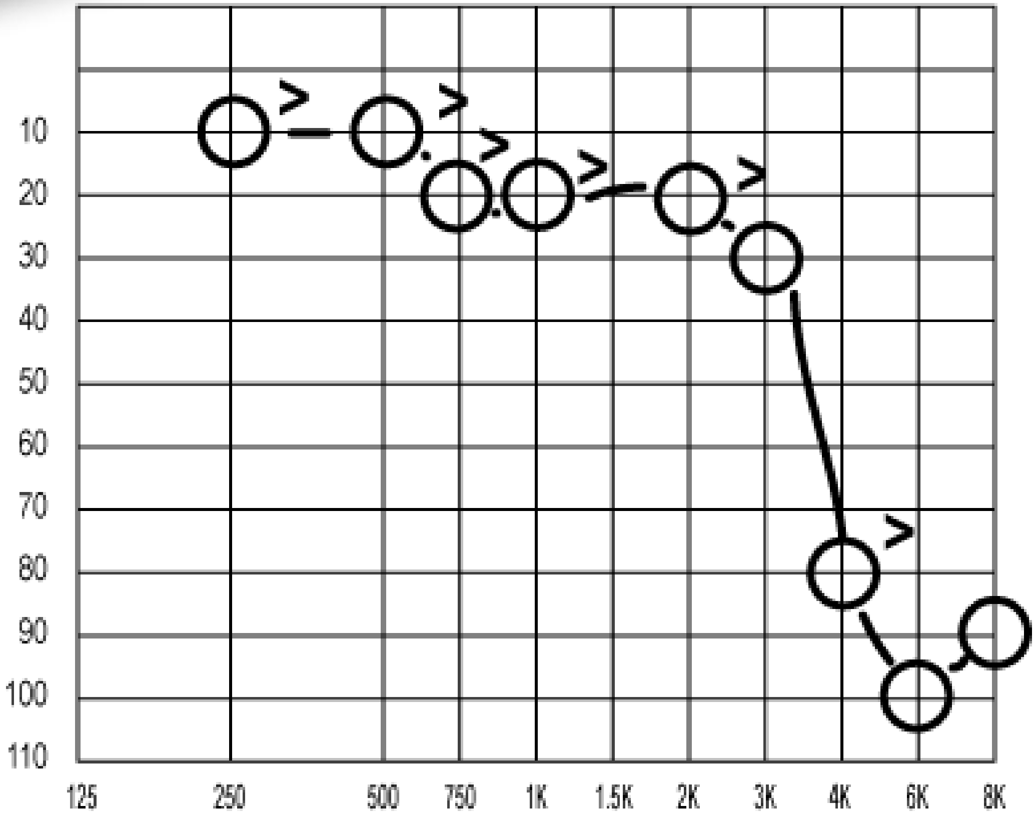
Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
DIscrim. %	%	%	

- Long time exposure to low frequencies over long periods of time
- Assembly line worker
- Airline pilot
- Heavy machinery operator
- Etc.

- *Straight line vector from the stapes & oval window to 4000 Hz*

ALAN LOWELL SEMINARS INC.

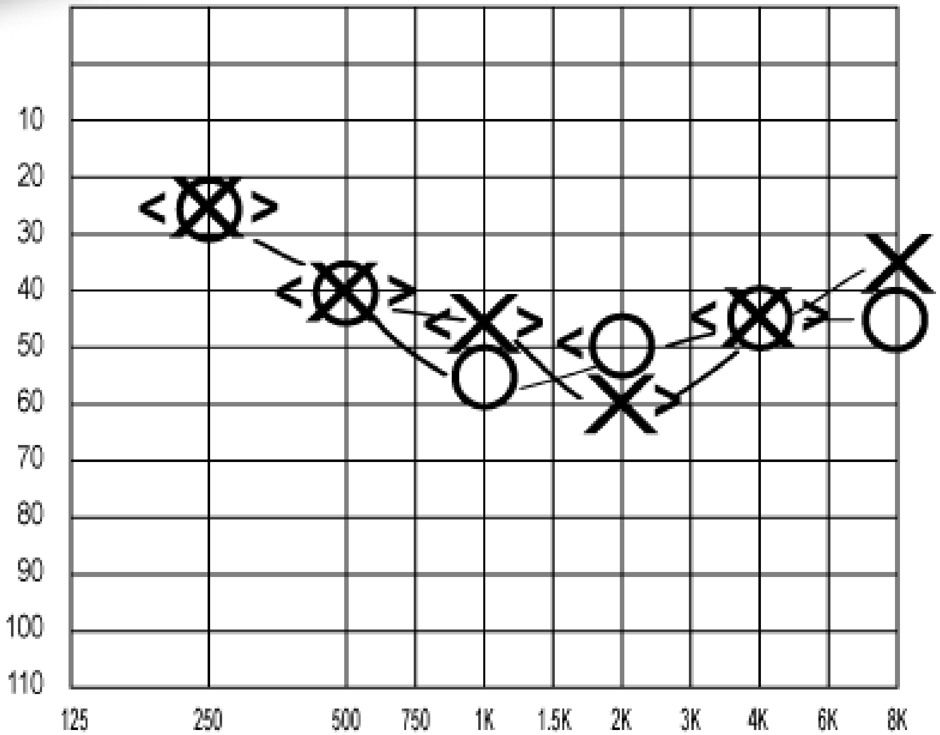
Acoustic Trauma



- Exposed to a single intense burst of sound
- Explosion

ALAN LOWELL SEMINARS INC.

Congenital Sensorineural



- Present at birth
- May be inherited
- Mother may have suffered flu or measles during pregnancy
- Most probably will progress over time (acquired congenital hearing loss)

Hearing Analysis
Various Audiometric configurations

Reference

Supplemental Course Book
Tab 3

ALAN LOWELL SEMINARS INC.

Oto - Toxic Drugs
(May cause rapid, progressive sensorineural hearing loss)

- **Salicylates** (Aspirin)
- **Anti-inflammatory drugs** (Advil, Aleve, etc.)
- **Antibiotics** (Streptomycin, Biaxin, etc.)
- **Loop Diuretics** (Lasix, Edecrin, Bumex)
  (treats certain heart & kidney disease)
- **Chemotherapeutic Agents** (Cisplatin, etc.)
- **Quinine** (Aralen, Altabrine, Legatrin, (treats malaria)
  O-Vel Muscle Relaxant

Fistula
(Pressure related trauma to the cochlea)

Oval Window Fistula

Round Window Fistula

ALAN LOWELL SEMINARS INC.

Temporal Bone Trauma

- Blow to head

Temporary Threshold Shift

Temporary sensorineural loss

Heavy equipment operator

Attended rock concert

Long time exposure may result in a permanent sensorineural loss

PB Rollover / Articulation Curve

- Common in cochlear & retro-cochlear loss
- Loss of ability to discriminate as words are presented at incrementally higher intensity levels
- More prevalent in patients absent *acoustic reflex*
- Early indicator in patients with *eight-nerve* disorder

ALAN LOWELL SEMINARS INC.

Cerebral Vascular Accidents (Stroke)

- Stroke
- Brain hemorrhage
- Skull fractures

<u>Aphasia</u>

Communication problem with both **receptive and / or expressive** capabilities

ALAN LOWELL SEMINARS INC.

Psychogenic Hearing Loss

- Functional
- Non Organic
- **Functional or Psychogenic Overlay**
- Some organic loss

Organic Hearing Loss

- Sensorineural
- Conductive
- Mixed
- Central

Malingering

Stenger's test
Doerffler Stewart test
Erhardt's test
Others…

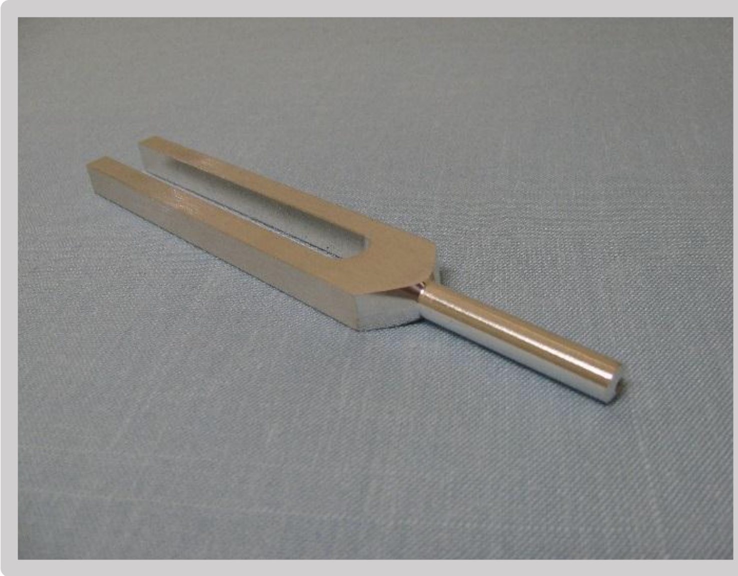
ALAN LOWELL SEMINARS INC.

Weber Test

n Tuning fork 512 Hz *(Unlikely to appear on a Practical Exa*

Heard mid-line = assume both ears equal

Lateralizes = assume greater conductive ear & must mask that ear when testing bone on opposite ear



ALAN LOWELL SEMINARS INC.

RINNE

ning fork test *(Most likely will not appear on a Practical Exa*

Rinne' Positive

- Sensorineural loss
- Normal hearing

Rinne' Negative

- Conductive loss

ALAN LOWELL SEMINARS INC.

Tympanometry / Impedance

Immittance Audiometry

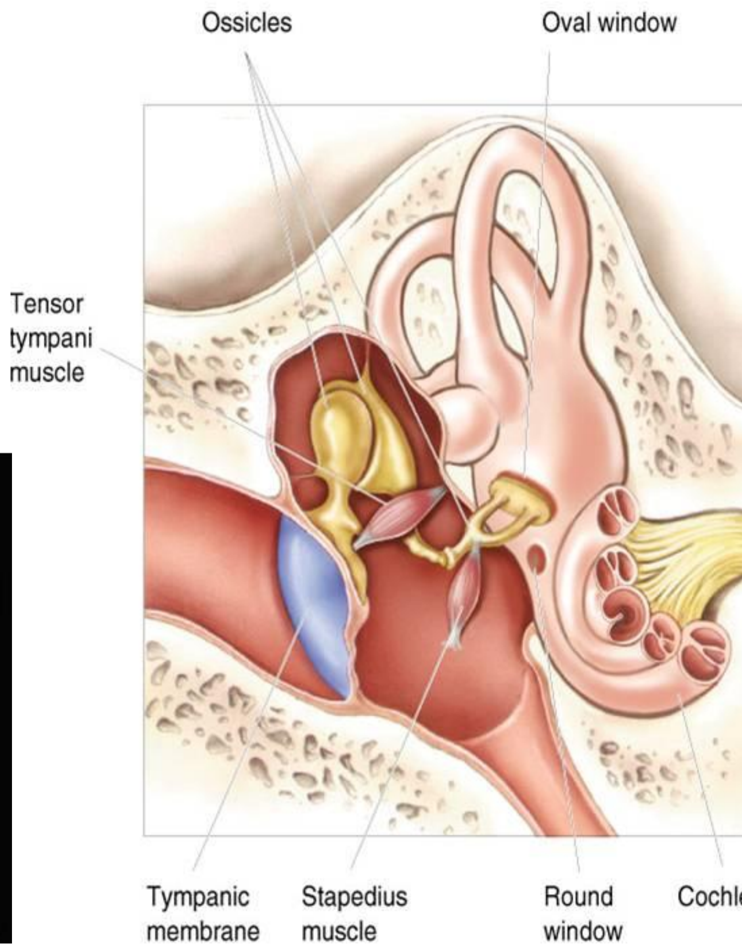
Photo provided by Med Rx

Photo provided by
GN Otometrics North America

Impedance / Immittance

Designed to assess middle ear function

- Lever action & capability of the ossicular chain based on the systems natural characteristics



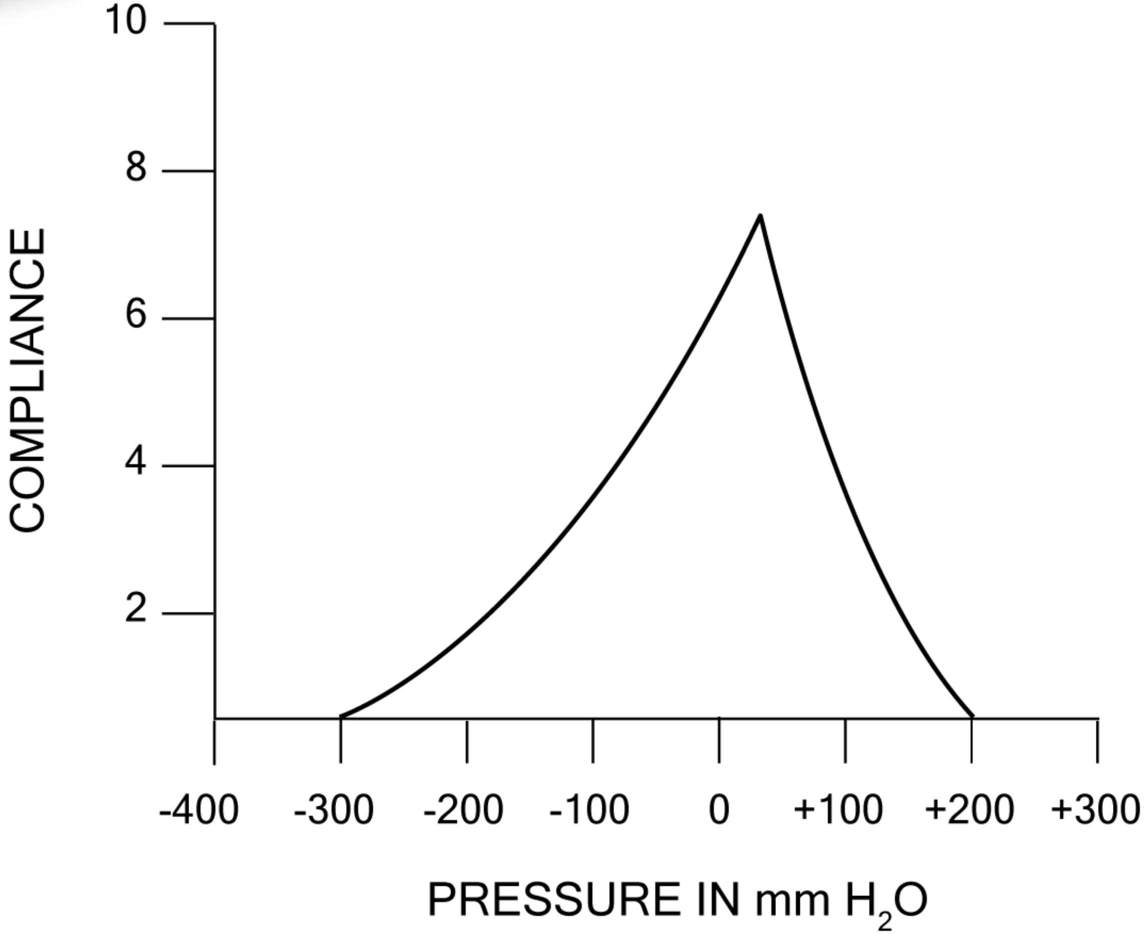
ALAN LOWELL SEMINARS INC.

Tymp Exam

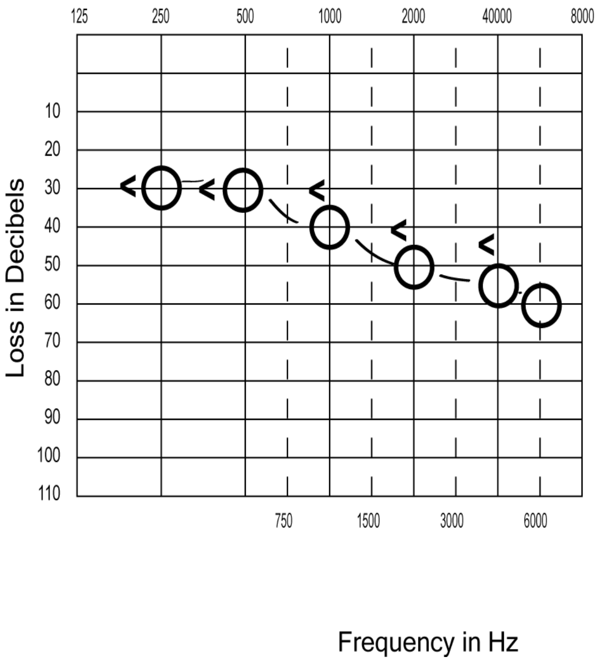
ALS-Five Day “ Hands-on” Training Class

ALAN LOWELL SEMINARS INC.

Type A Tympanogram

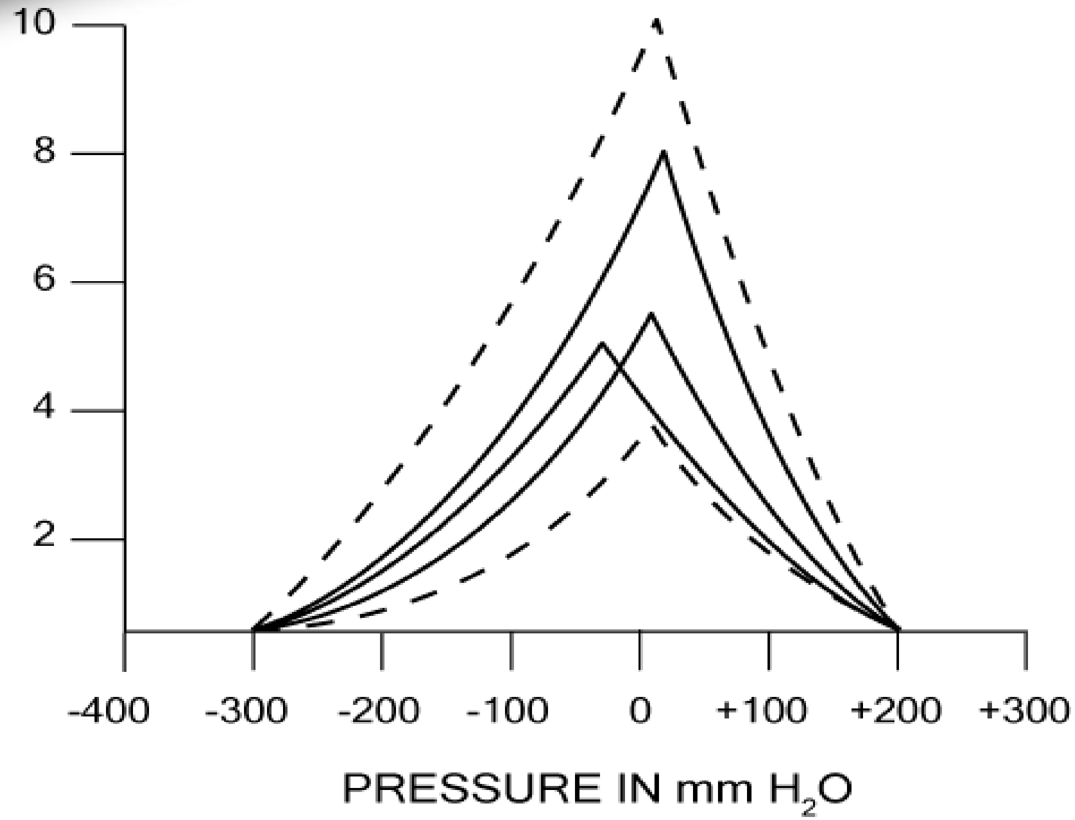


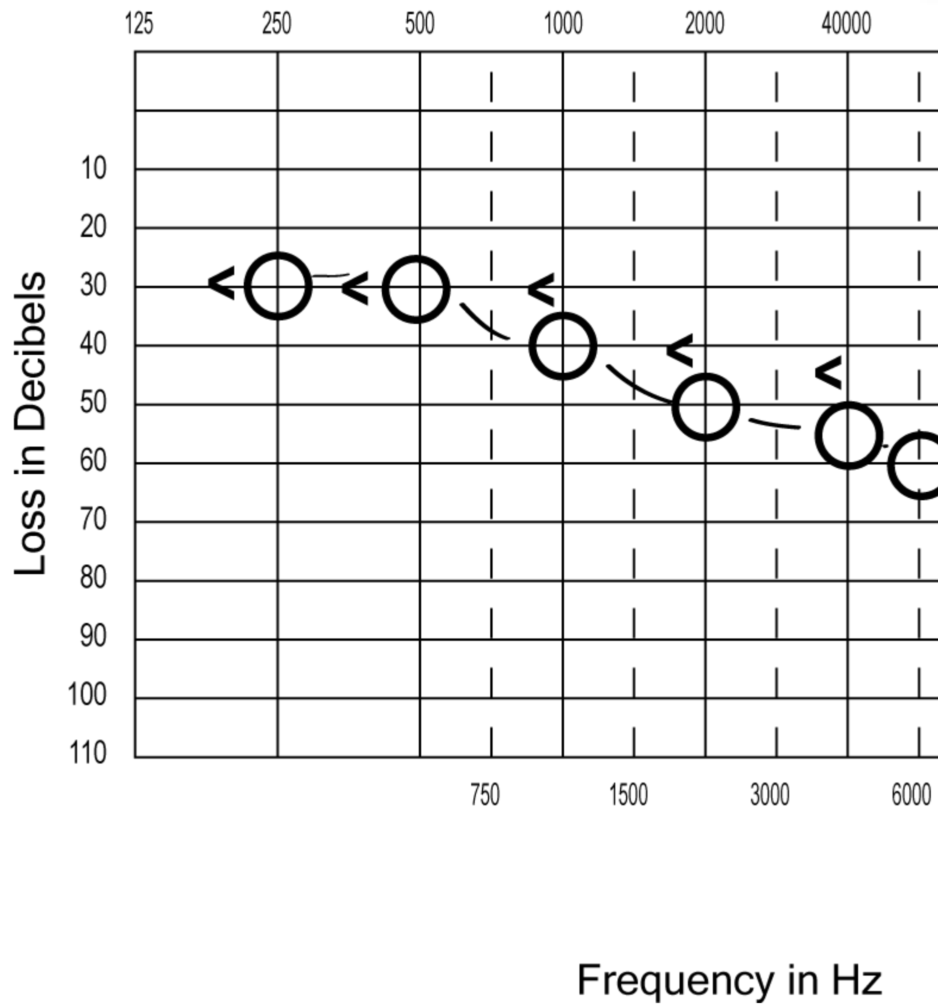
- Normal Hearing
- Sensorineural Loss



ALAN LOWELL SEMINARS INC.

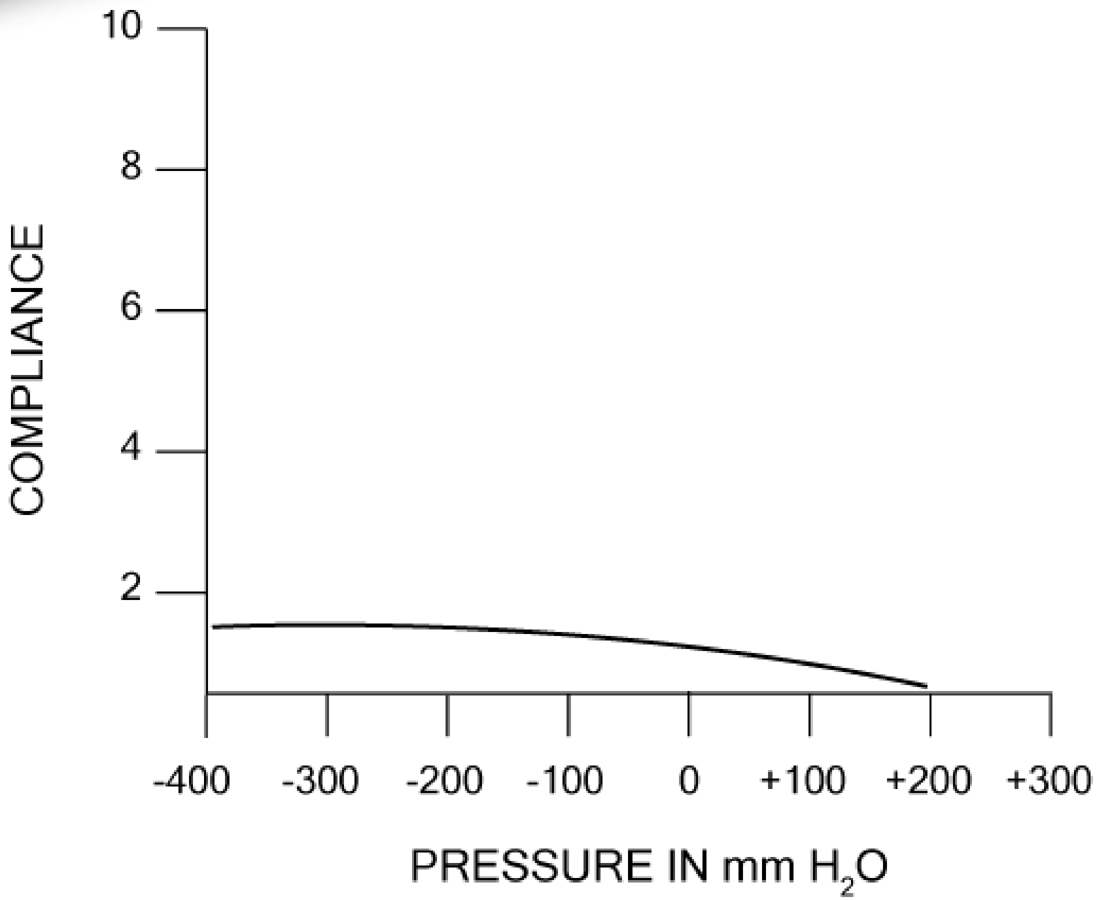
Acceptable Type A’s

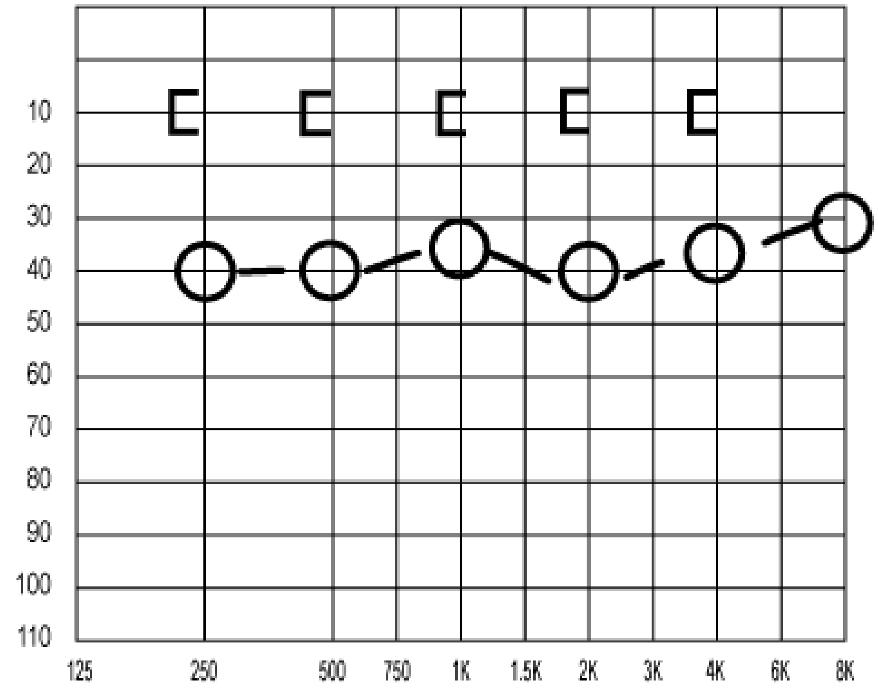




ALAN LOWELL SEMINARS INC.

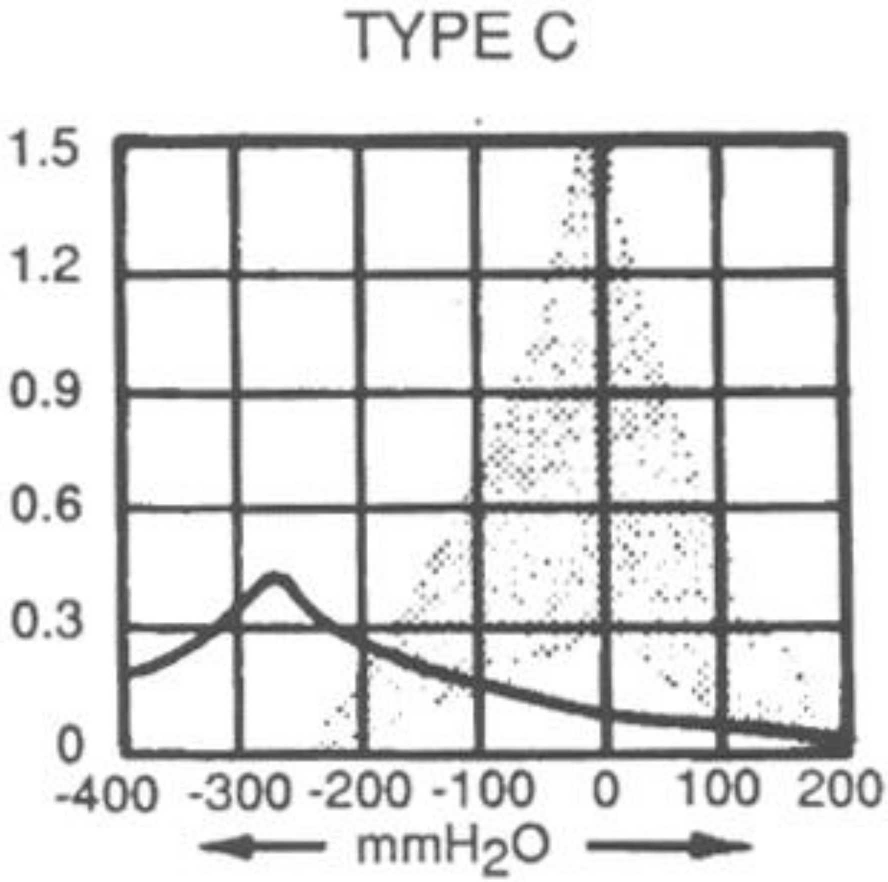
Type B Tympanogram (Conductive Loss) Otitis Media – Cholesteatoma - Middle Ear Mass



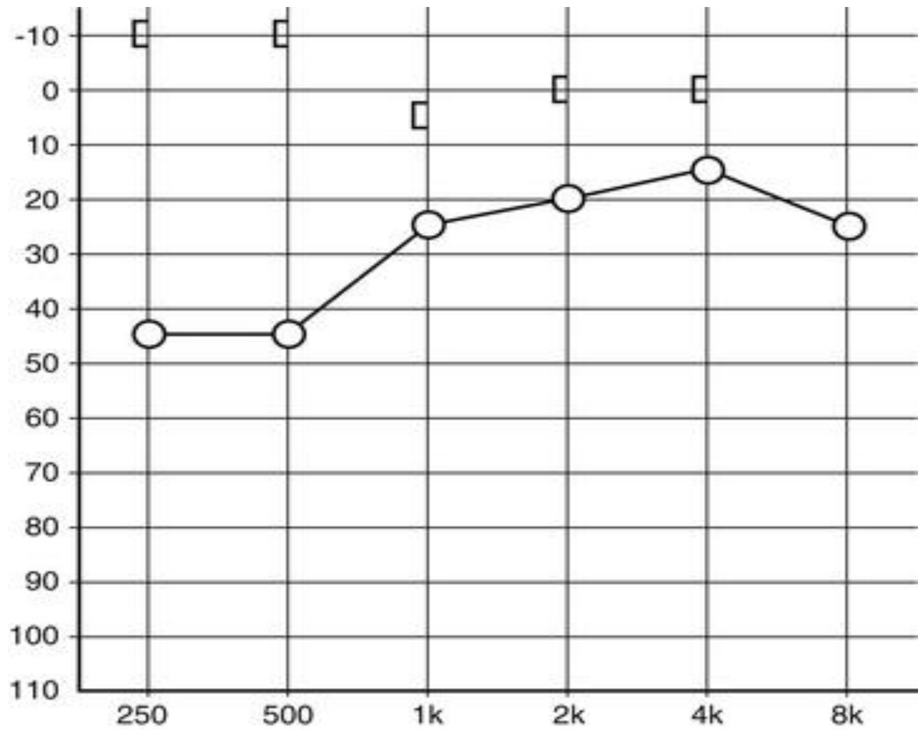


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

Type C Tympanogram

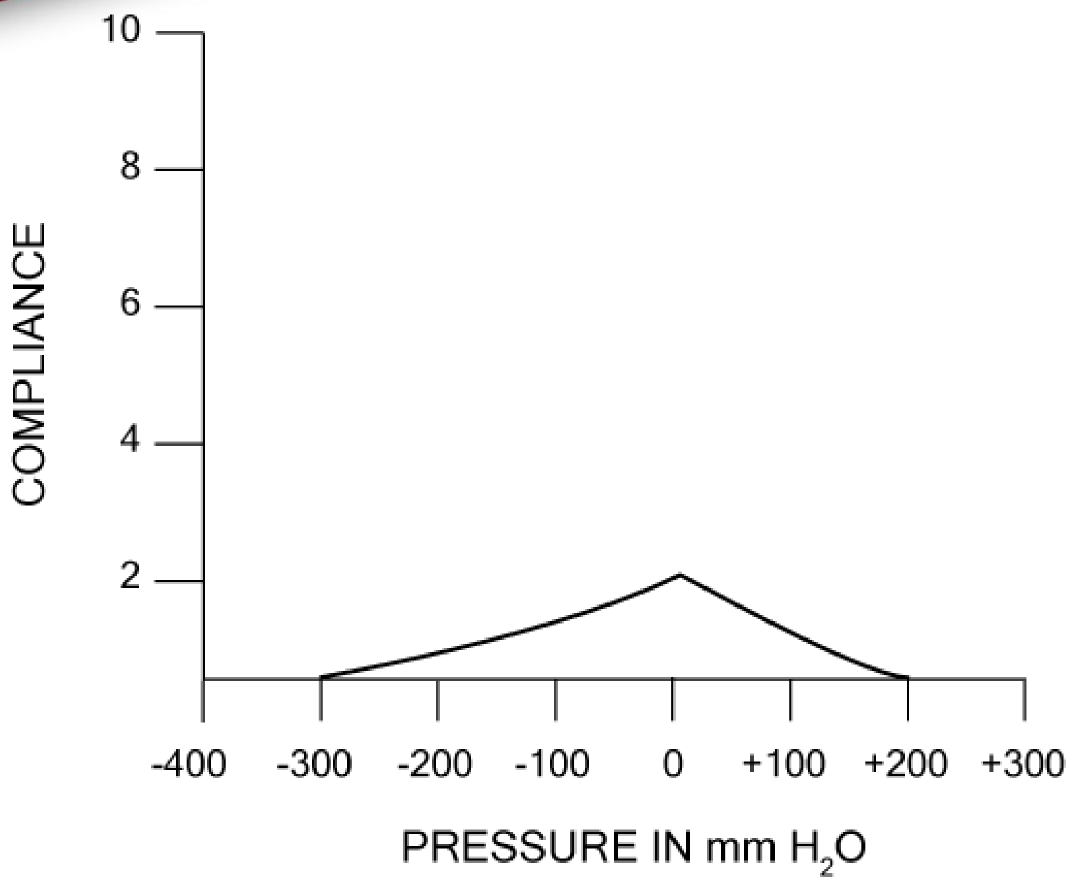


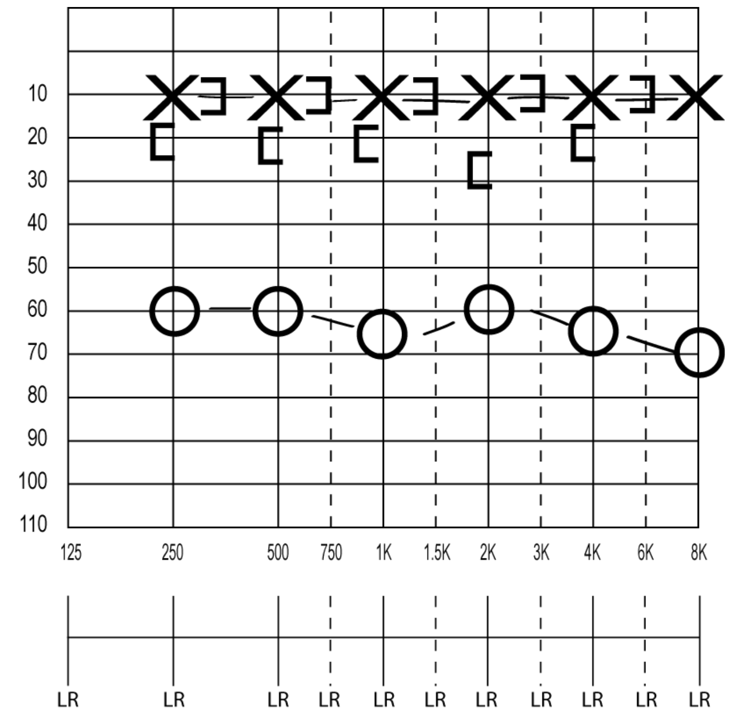
Eustachian tube dysfunction (ED)



ALAN LOWELL SEMINARS INC.

Type As Tympanogram (Ossicular Fixation) Otosclerosis - Tympanosclerosis





Ear Fitted	Left	Right	Binaural
SRT	10 dB	60 dB	
MCL	50 dB	90 dB	
UCL	105 dB	110 dB	
Discrim. %	100 %	96 %	

ALAN LOWELL SEMINARS INC.

Type Ad Tympanogram

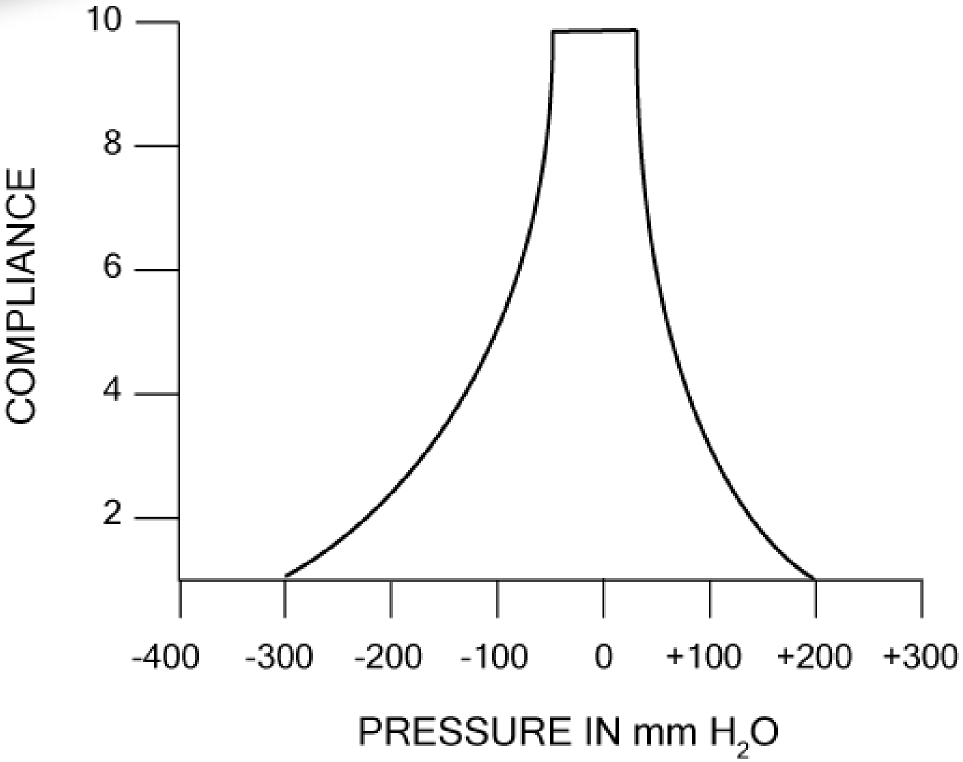
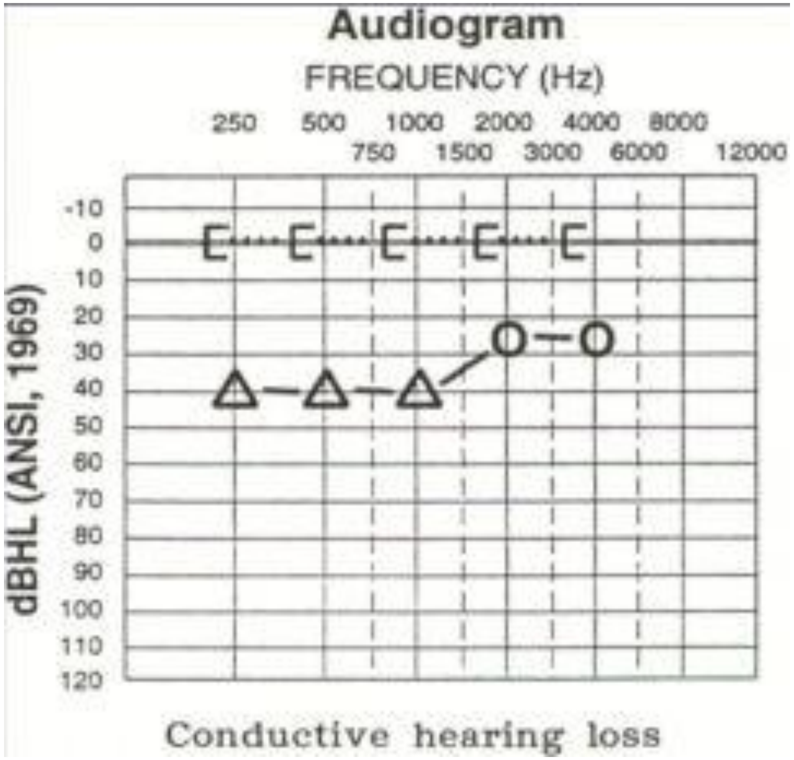


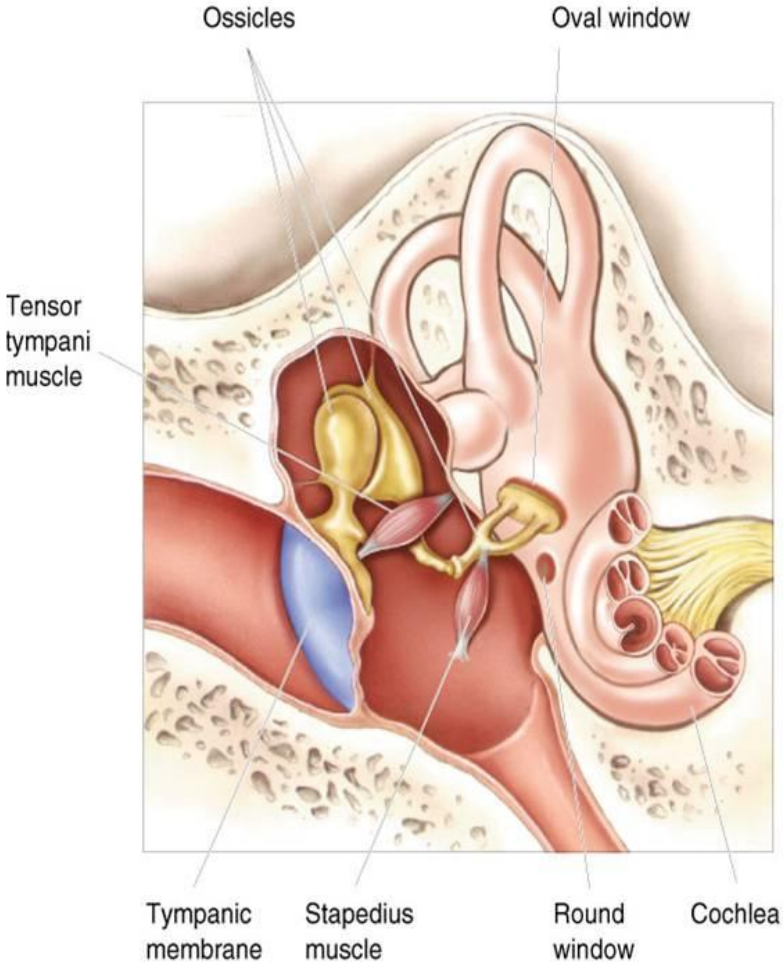
Figure 6 Tympanogram showing normal pressure with abnormally increase compliance.

- Ossicular Disarticulation



ALAN LOWELL SEMINARS INC.

Acoustic Reflex (Ipsilateral / Contra-lateral)



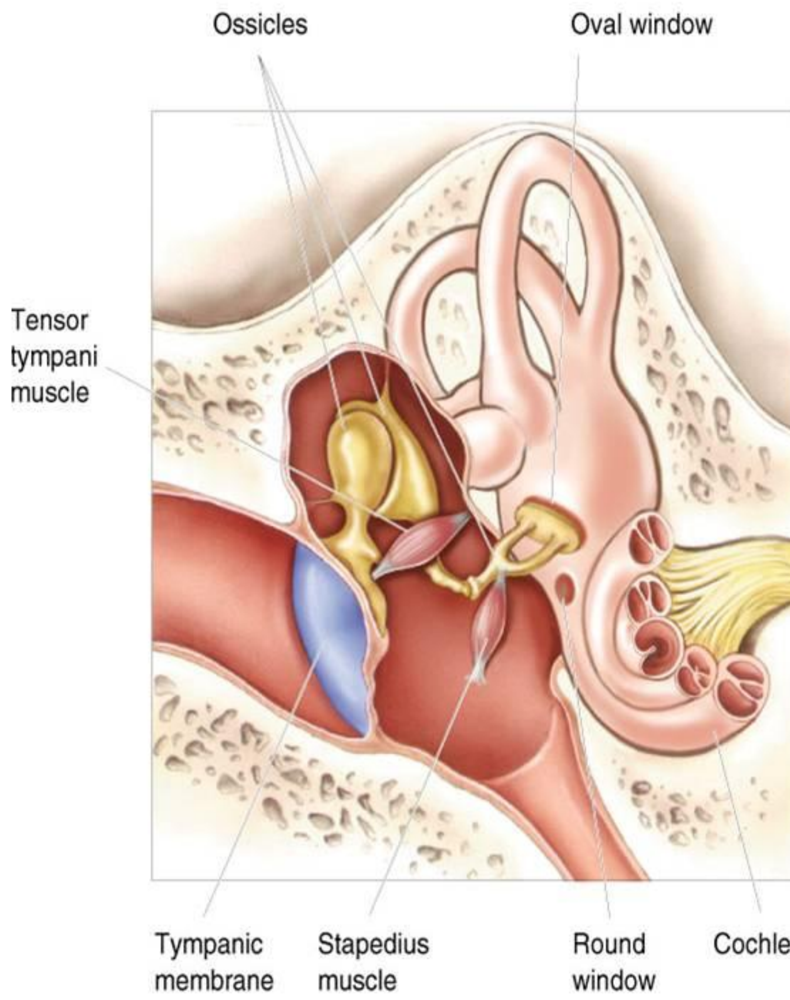
Acoustic Reflex Facts

he acoustic reflex results from a contraction of the tensor mpani and to a lesser degree the stapedius muscle when ound is present at approx. 80 dB above threshold

enerally, any loss above 20-25 dB at frequency will result in higher threshold reflex

he greater the hearing loss, the greater the possibility of an osent reflex

eflex decay most often is an indicator of retro-cochlea VIII erve involvement (ie: acoustic neuroma); Diagnostic reflex imulus is presented for 10 seconds as opposed to acoustic flex screening where stimulus is presented for 1.5 seconds



ALAN LOWELL SEMINARS INC.

Acoustic Reflex Present us

Measurements-typical

stimulus is most often presented for 1.5 seconds @80-95 dB or higher

Infection Control Protocols

- Always sanitize hands
- Keep work surfaces & equipment clean using solutions that contain **Bactericide, Viruscide and Fungiside ie: Sani-wipes**
- Take **Universal Precautions** to protect yourself, your staff and your patients…wear gloves, safety glasses, mask & lab coat
- Prevent the spread of germs through the eyes, nose & mouth
- Prevent cross contamination!

Infection Control – Personal Barriers

(Excerpts from Julie Purdy, PhD, CCC-A article on Infection Control Practice in The Hearing Professional)

reventing the spread or transmission of bacteria, ruses, fungi and other pathogenic icroorganisms:

- Avoid direct contact with hearing aids from a patient
- Accept devices from a patient in a separate container
- Use appropriate use of hand hygiene
- Use of personal protective equipment
- Use of appropriate medical waste disposal
- Use of proper procedures for repurposing reusable equipment

Properly fitted gloves should be worn for the following tasks:

- When ear drainage, blood, sores or lesion (on scalp) are evident
- Handling earmolds or hearing aids direct from the patient
- During removal or handling of ear impressions
- Performing cerumen management
- Cleaning or disinfecting instruments contaminated with cerumen
- Dealing with immuno-compromised clie

ALAN LOWELL SEMINARS INC.

Disinfection / Sterilization

Occupational Safety and Health Administration (OSHA)

Requires every dispensing practice to maintain a readily available written infection control plan

Disinfection

A process whereby germs are killed

- Cloths/towelettes
- Counter tops
- Hearing Aids
- Circumaural Headphones
- Bone Oscillator

Excerpts from an article in The Hearing Professional written by A.U. Bankatis, PhD and Robert J. Kemp, MBA

Sterilization

A process where ALL germs are killed each and every time including endospores

- Requires use of specific techniques or products
- Cold sterilization most widely used
- Soaking instruments in liquid chemicals for specified number of hours according to manufacturer's instructions
- Instruments or objects which make contact with mucous membranes or bodily fluids (cerumen, blood,)

ALAN LOWELL SEMINARS INC.

Items Requiring Disinfection & Sterilization

Disinfection

- Counter tops
- Hearing Aids
- Circumaural Headphones
- Bone Oscillator

Sterilization

Reusable specula
Oto-lights
Cerumen management instruments
Syringe / Tympanometer tips

Single and Multi use Items

Single use items

Insert phone tips
Disposable specula
Oto-blocks
Impression material / mixing tips
Fitted gloves
Polypropylene headphone covers
Real ear probe microphones*
**Maintain for use with same patient*

Multi use items

Cirumaural headset
Bone Oscillator
Reusable specula
Oto-lights
Otoscope
Cerumen management instruments
Syringe / impression gun
Tympanometer tips

ALAN LOWELL SEMINARS INC.

Patient Interrogatory

- Health history
- Medications
- Ear surgeries
- History of wax build-ups or prior wax removal
- Tinnitus history
- Communication history
- Experiential history
- FDA Otologic Warning Signs

ALAN LOWELL SEMINARS INC.

Otoscopy

- Traditional Otoscopy
- Video Otoscopy
- Direct Video Otoscope Inspection (DVOI)
- Direct Video Otoscope Guidance (DVOG)

Traditional Hand Held Otoscopy

Always use fresh batteries

Keep spare bulbs on hand

Always sterilize specula

ALAN LOWELL SEMINARS INC.

Bracing Technique

- Video Otoscopy
- Traditional Otoscopy
- Use of Oto-lights
- Impressions-Syringe method
- Impressions-Gun method

ALAN LOWELL SEMINARS INC.

Bracing for Otoscopy
(Bridge & Brace Technique)

Video Otoscopy - Proper Handling

ALAN LOWELL SEMINARS INC.

Cerumen Management

Caution! Do not perform Cerumen Management unless you…

- Have in-depth knowledge
- Developed and fine tuned skills
- Checked legality in your state or province
- Have properly sanitized equipment & instruments
- Have a medical referral source
- Professional liability insurance

Clinical Protocol Blueprint - Cerumen Management

- Patient Interrogatory
- Visual Clinical Evaluation
- Outer Ear Palpation
- **Direct Video Otoscopic Inspection (DVOI)**
- Determining Appropriate Method
- Always start with the less affected ear (healthy anatomy reference)
- Need for Medical Referral
- Recommend before & after photos

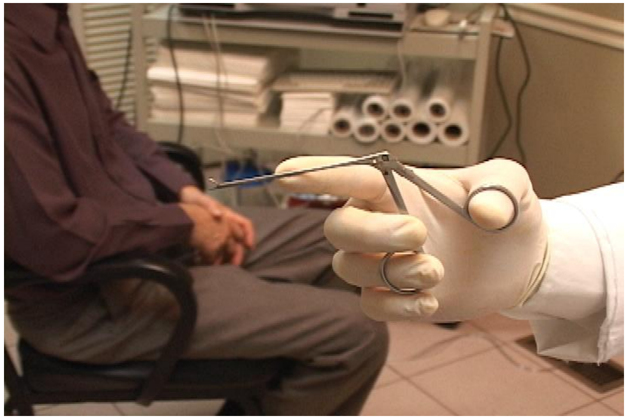
ALAN LOWELL SEMINARS INC.

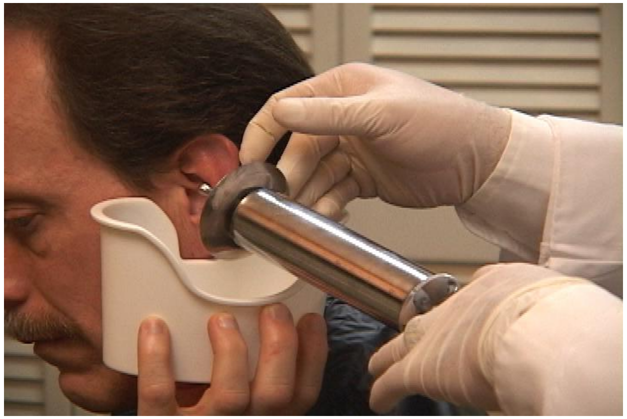
Required Equipment

- Video Otoscope
- Traditional Otoscope
- Direct Video Otoscopic Inspection (DVOI)
- Direct Video Otoscopic Guidance (DVOG)

Five Basic Cerumen Management Methods

- Q-tip
- Curette
- Instrument (forceps)
- Suction / Vacuum
- Flushing-Lavage-Irrigation





ALAN LOWELL SEMINARS INC.

Q - Tip Method

(when a minor amount of wax is located in pinna & outer 1/3 of ear canal)

- Follow anti-contamination & hygiene protocols
- Provide Direct Video Otoscopic Inspection (DVOI)
- Provide Direct Video Otoscopic Guidance (DVOG)
- Saturate Q-Tip in Miracell which will soften and loosen earwax from the Keratin layer (outer surface of the skin)
- Allow several minutes to soak
- Insert tip of Q-tip over & beyond wax mass
- Gently grab and slide wax out
- Repeat as necessary to clear wax
- Close procedure with DVOI & documentary photo

Curette (Instrumental) Method

Intended to create a gap between canal wall and wax

Quick way to clear ear in one scoop

Requires skillful handling of curette based on touch & sensitivity

Curette should float between fingers to slide backwards or out from the ear rather than into the ear which can
cause injury

Wax should be located in outer 2/3 of
ear canal

ALAN LOWELL SEMINARS INC.

Forceps (Instrumental) Method

Follow anti-contamination & hygiene protocols

Provide DVOI

Proper positioning of forceps

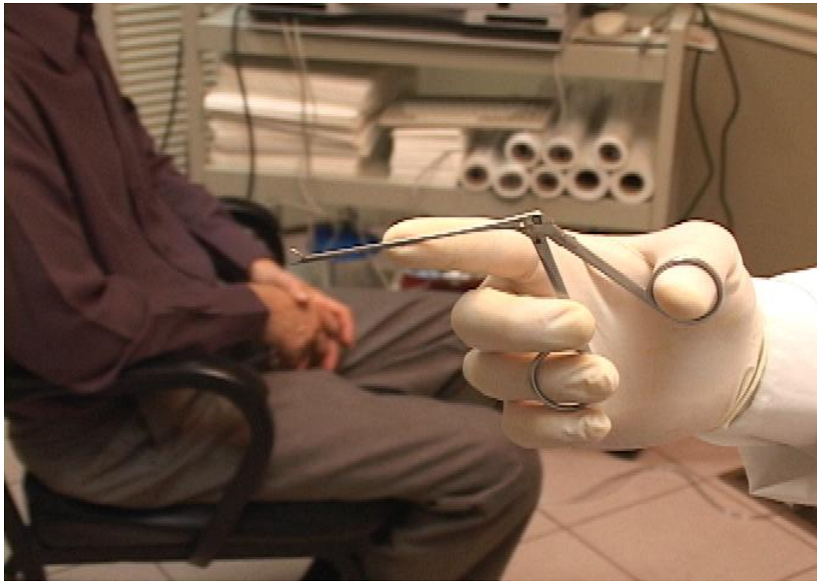
Provide DVOG

Position forceps on a flap (extended piece) on the wax mass

Grab flap or entire mass if possible and gently remove

Repeat procedure as many times as needed

Close procedure with DVOI & documentary photo



Vacuum / Suction

Prepare and instruct patient for procedure

Follow anti contamination and hygiene protocols

Provide Direct Video Otoscopic Inspection (DVOI)

Provide Direct Video Otoscopic Guidance (DVOG)

Using a suction tube connected to a suction pump gently apply tube tip to surface of wax mass

Using graduated negative pressure levels suction wax mass

Repeat as necessary to clear wax

ALAN LOWELL SEMINARS INC.

Audiometric Testing

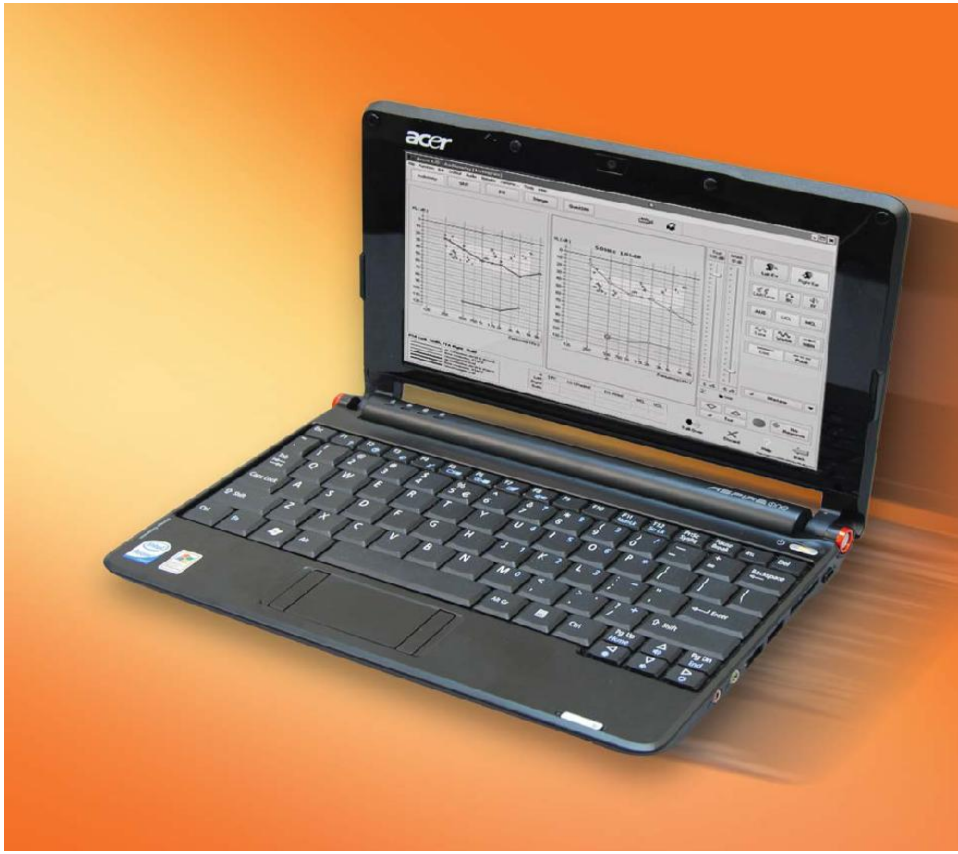
Sometimes referred to as

Suprathreshold Testing

ALAN LOWELL SEMINARS INC.

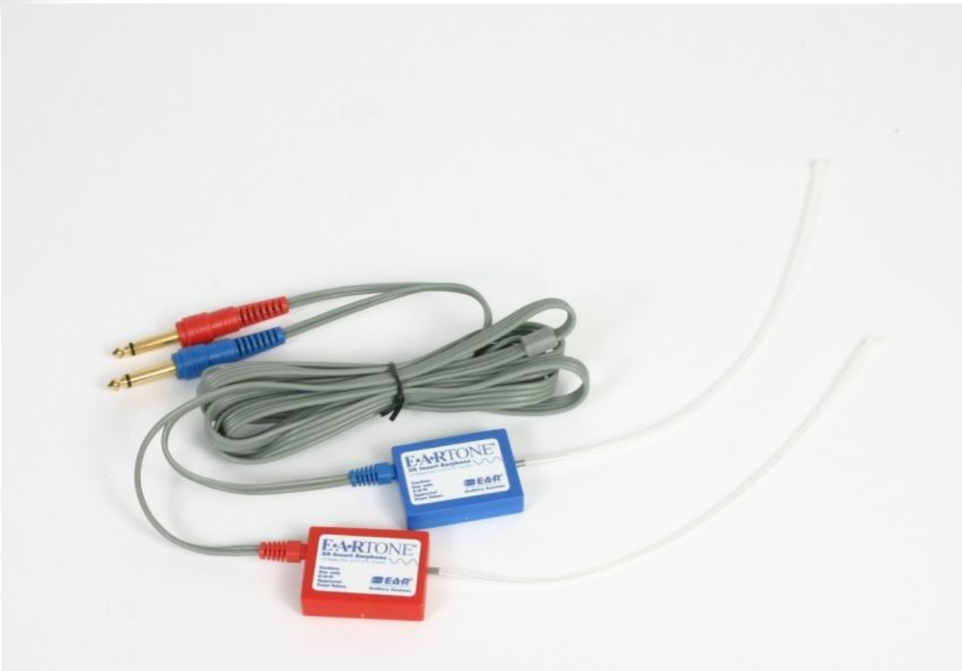
Audiometers

Photo provided by Frye Electronics, Inc.



ALAN LOWELL SEMINARS INC.

Circumaural Headsets & Insert Phones



Telephonic Dynamic Headset (TDH)

*Insert phones provide better test reliability
*Reduces low frequency ambient noise

Preparation for Hearing Evaluation

1. Test in quiet room
2. Position patient to avoid visual cues
3. Proper placement of insert or Circumaural headphones
4. Avoid establishing any test patterns for pure tone tests
5. Give your patient clear and precise instructions
6. Execute proper test protocols

Sound Level Meter (SPL)

ALAN LOWELL SEMINARS INC.

Patient Instructions & Explanations

1. Explain the type stimulus a patient will hear
2. Tell your patient how you would like them to respond
3. Briefly explain the purpose of the test
4. Confirm that patient understands the instructions
5. Properly execute the test

Always follow the same steps!

1. Select appropriate test function
2. Patient Instructions
3. Proper execution

ALAN LOWELL SEMINARS INC.

Descending / Ascending Method

- Set attenuator to easy to hear intensity level (20-30 dB) (40-50 dB)
- Start at higher Intensity level if necessary
- Present tone several times
- Decrease in **10 dB** steps presenting tone at each intensity level until not audible
- Increase in **5 dB** increments until heard 50% of time = Threshold of Hearing
- Bracket as necessary
- *Be mindful of the Ascending / Descending Method*

ALAN LOWELL SEMINARS INC.

Ascending / Descending Method

(Some states require use of Ascending/Descending Method

- Begin testing each test frequency below estimated threshold until patient hears tone…. or………..
- Begin at an intensity level at or slightly above estimated threshold (10-20 dB)
- Decrease in 10 dB steps presenting tones at each level until not audible
- Increase in 5 dB steps until tone is heard 50% of the time
- Bracket as necessary

Frequency Test Sequence
(Air Conduction)

Carhart

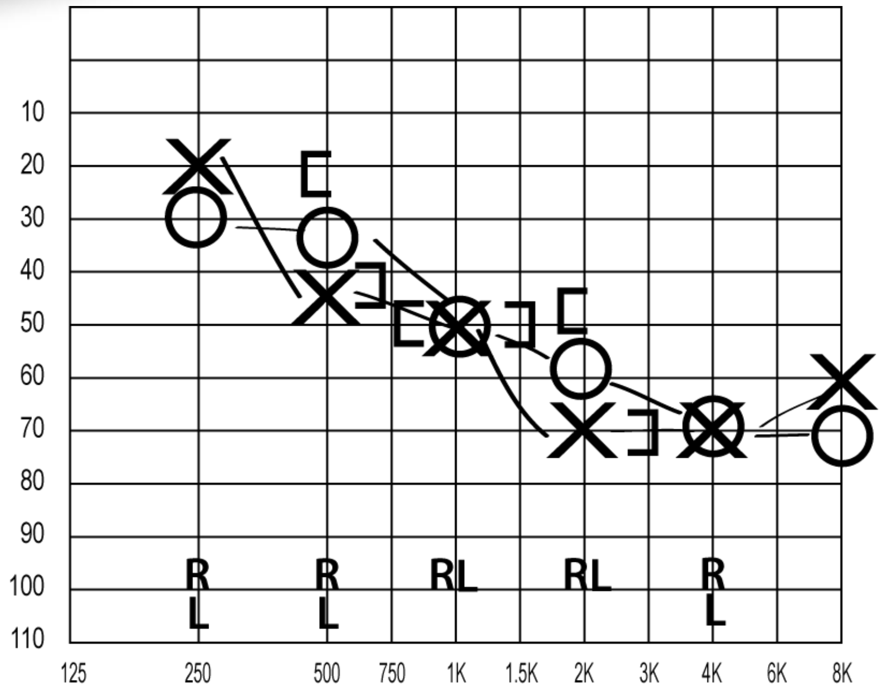
- 1000 Hz
- 500 Hz
- 250 Hz
- 1000 Hz (to validate)
- 1500 Hz
- 2000 Hz
- **3000 Hz**
- 4000 Hz
- 6000 Hz
- 8000 Hz

Classic

- 1000 Hz
- 1500 Hz
- 2000 Hz
- **3000 Hz**
- 4000 Hz
- 6000 Hz
- 8000 Hz
- 1000 Hz (to validate)
- 500 Hz
- 250 Hz

ALAN LOWELL SEMINARS INC.

Discrete UCL's

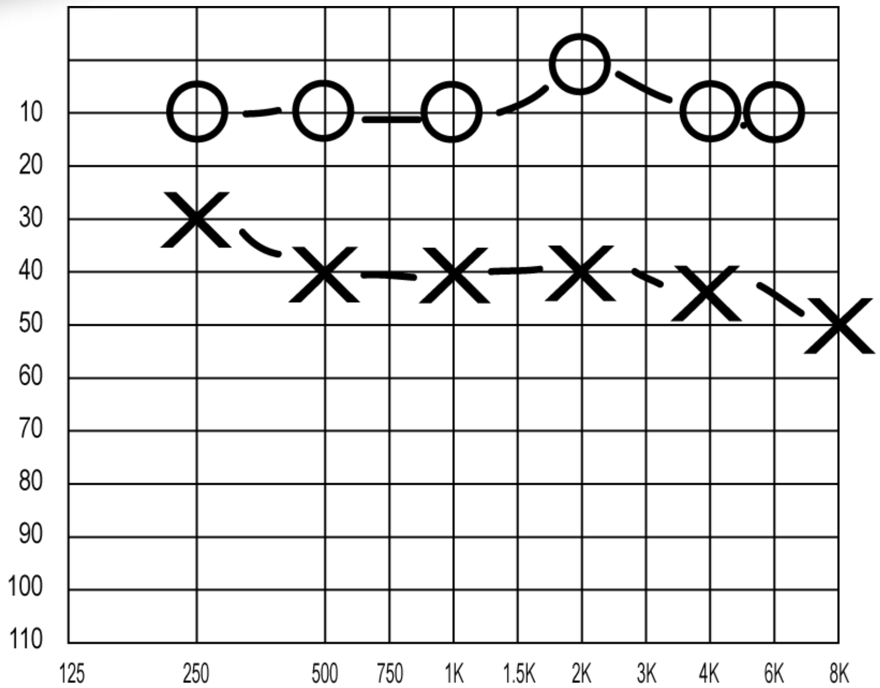


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Used when fitting Hi-Tech
- More accurate
- More comfortable

ALAN LOWELL SEMINARS INC.

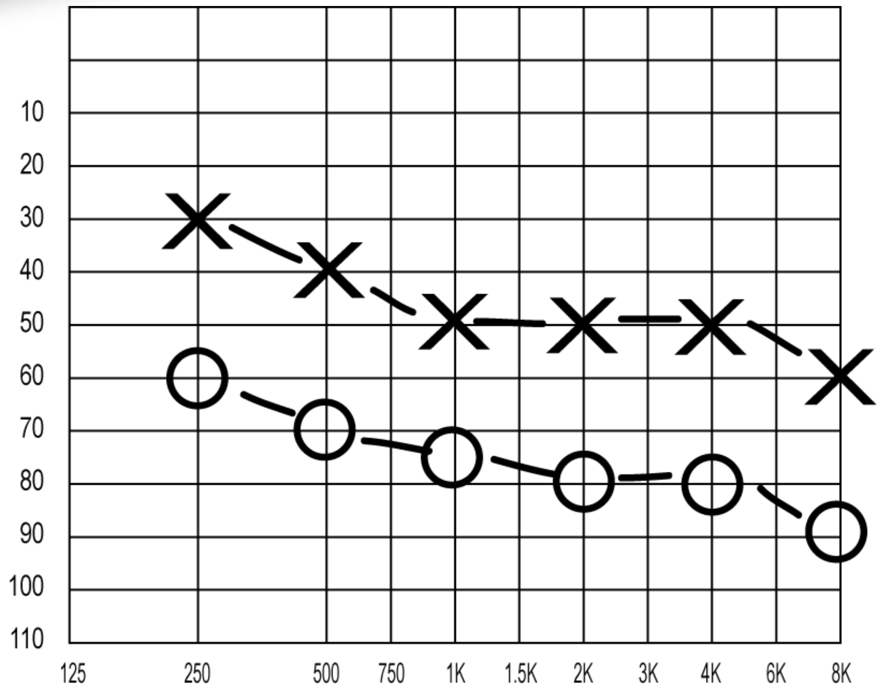
Unilateral Hearing Loss



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Loss in (one) ear
- One ear NORMAL

Asymmetrical Hearing Loss

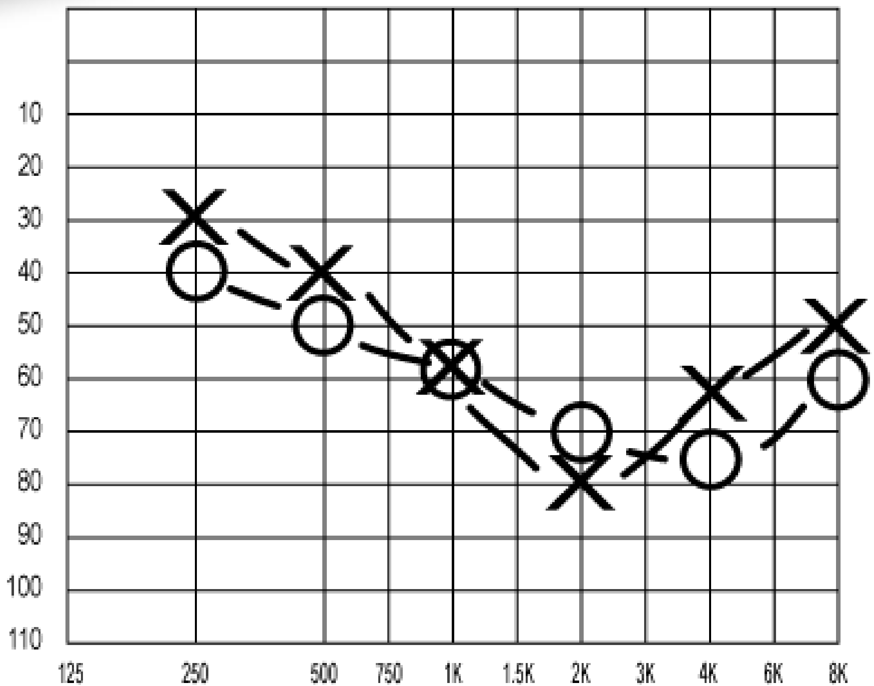


Ear Fitted	Left	Right	Binaural
SRT	50 dB	75 dB	
MCL	75 dB	95 dB	
UCL	100 dB	100 dB	
Discrim. %	76 %	56 %	

- Both ears have hearing loss
- Greater than **15 dB** difference between ears

ALAN LOWELL SEMINARS INC.

Symmetrical Hearing Loss



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Both ears have hearing loss within **15 dB** of each other

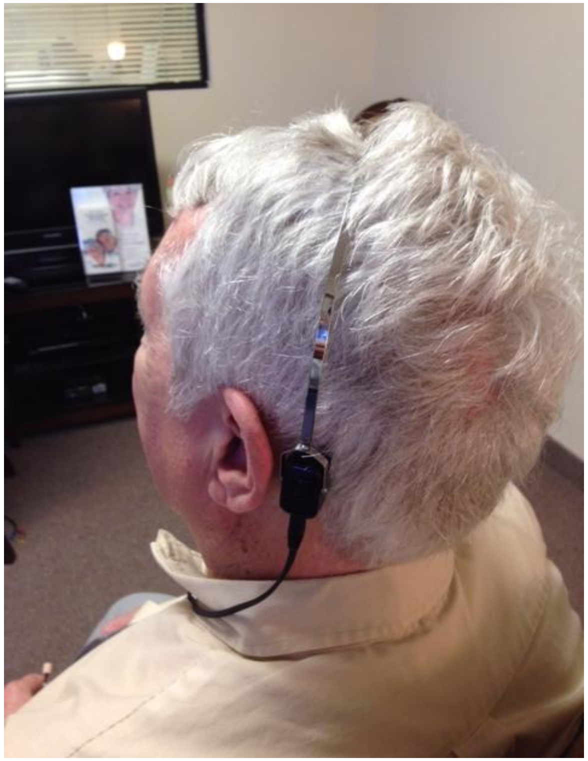
ALAN LOWELL SEMINARS INC.

Frequency Test Sequence
(Bone Conduction) (Relative utilized in US)

Carhart
- 1000 Hz
- 500 Hz
- 250 Hz
- 2000 Hz
- 4000 Hz

Classic
- 1000 Hz
- 2000 Hz
- 4000 Hz
- 500 Hz
- 250 Hz

Bone Oscillator - Proper placement on the mastoid



Bone Oscillator

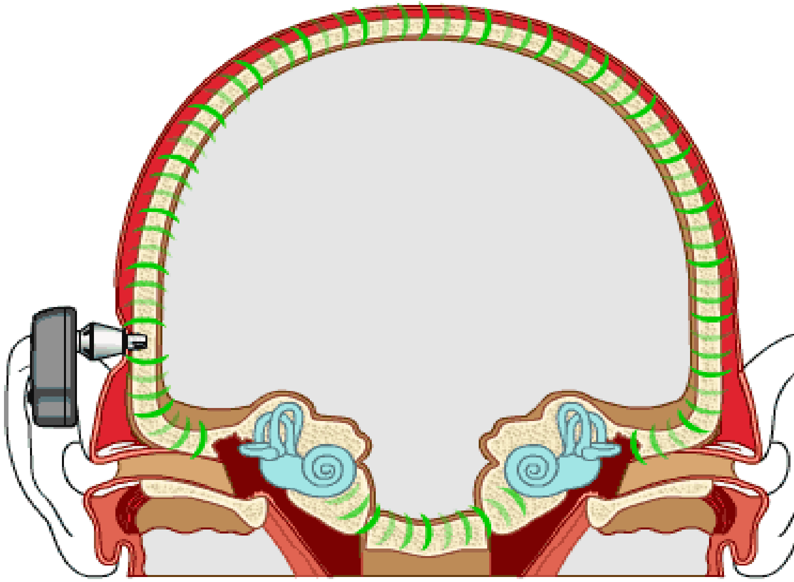
ALAN LOWELL SEMINARS INC.

y is it a good idea to always mask the oppos
(non test ear) for Bone Conduction?

Answer……..

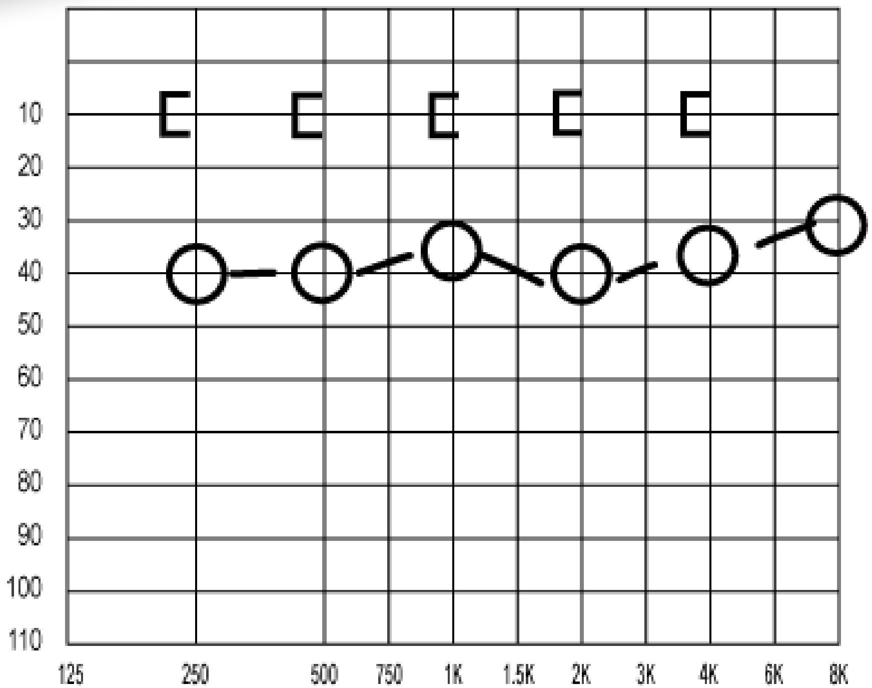
To prevent a cross-over!

(Interaural attenuation can be as low as 0 dB for bone)



ALAN LOWELL SEMINARS INC.

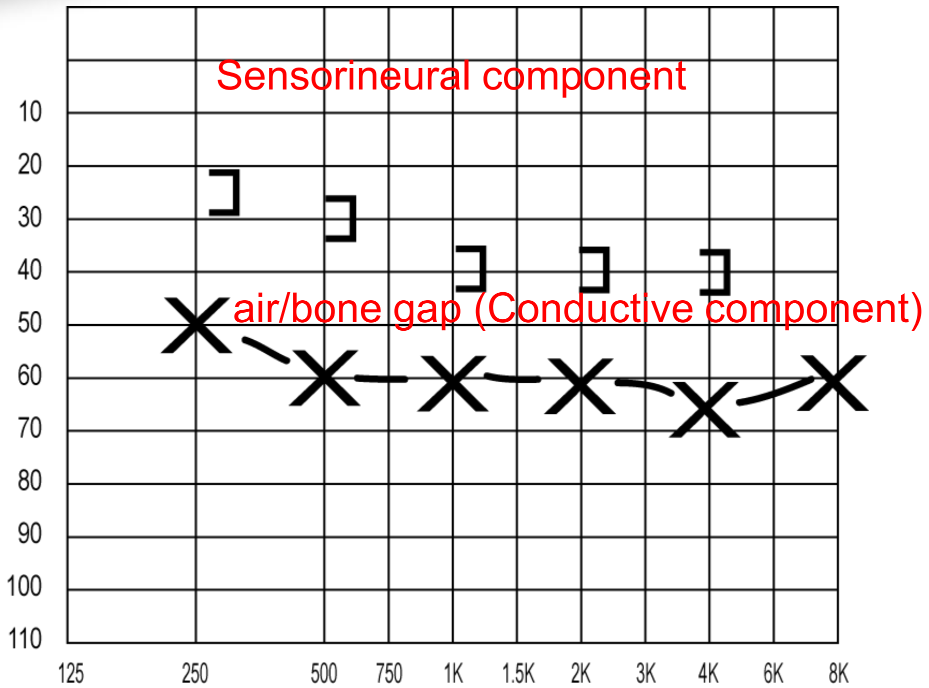
Pure Conductive Loss



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Bone scores all within NORMAL limits

Mixed Hearing Loss

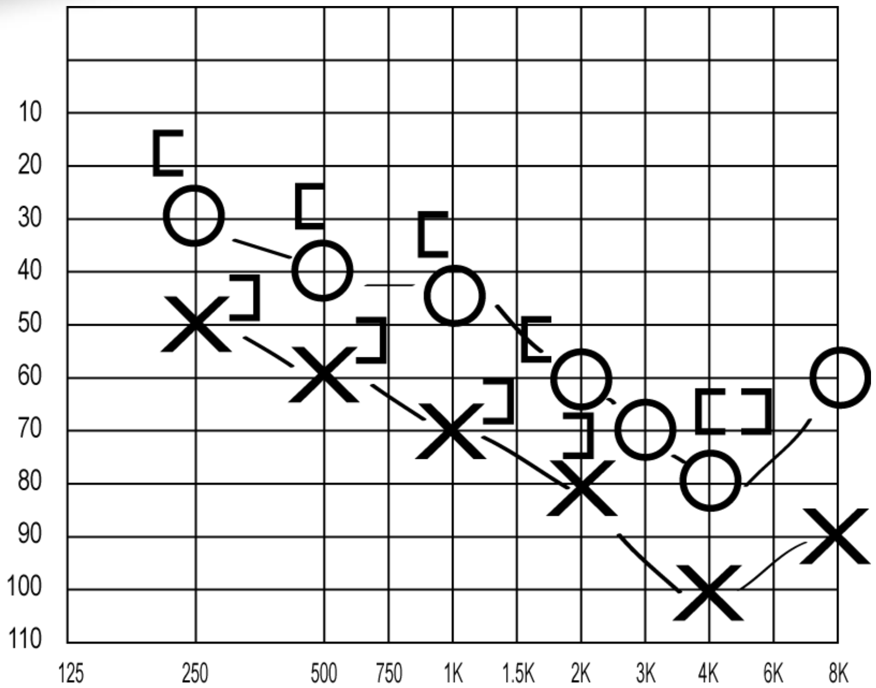


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Conductive Componen
- Sensorineural Component

ALAN LOWELL SEMINARS INC.

Pure Tone Audiogram



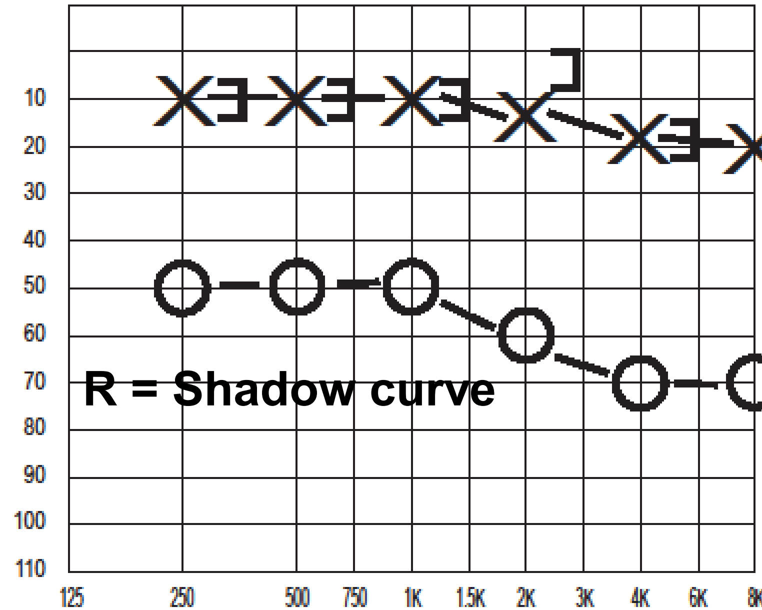
Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Configuration
- Severity
- R&L Comparison
- Guide to shell design
- Masking?
- Expectations for other tests

ALAN LOWELL SEMINARS INC.

Shadow curve?... Mask

- Procedure that prevents the non-test ear from hearing a stimulus presented to the test ear
- Enables a more accurate fitting in the poorer ear
- May reveal an unaidable ear



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

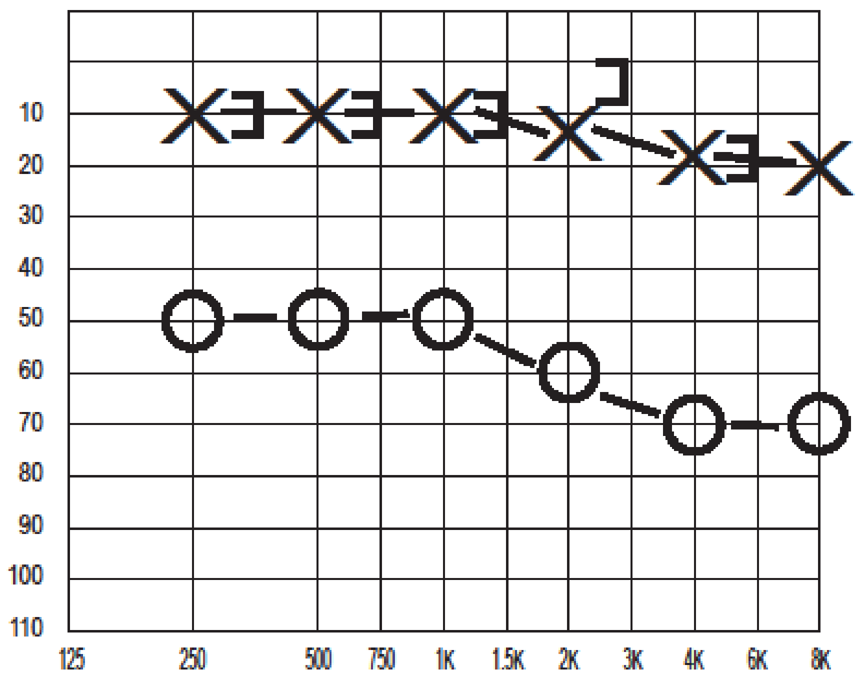
ALAN LOWELL SEMINARS INC.

Understanding Interaural Attenuation

- Reduction in sound energy of a signal as it is transmitted by bone conduction from one side of the head to the opposite ear
- Air Conduction = 40 dB difference*
- Bone Conduction = 0 dB difference
  - Early research suggests 35-40 dB (With use of TDH-39 Headphones)
  - 70-90 dB (With use of insert phones)

ALAN LOWELL SEMINARS INC.

Masking Air - Rule



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- The non-test ear (NTE) should b masked when the poorer ear (tes ear) displays thresholds 40 dB or greater than the bone conductior of the non-test or (better ear)

- **B test + 40**
- *Any frequency with a 40 dB+ difference must be masked*

ALAN LOWELL SEMINARS INC.

Masking Sounds

- **White noise**
- Broad band white noise or speech shaped
- Narrow Band (restricted bandwidth) (most desirable)

White noise by definition is broad band noise having similar energy at all frequencies.

Pink Noise by definition is random noise with equal energy per octave. Therefore, pink noise has more low frequency components and sounds “less hissy” than white noise.

Pink n

- **Pink noise is also an option with tinnitus masking technology**

ALAN LOWELL SEMINARS INC.

ER - 3 Insert Earphones

- Interaural attenuation levels and test reliability *increase* with the use of ER-3 insert earphones
- Reduces the probability of error
- Permits testing in areas of higher ambient noise
- Better attenuation of low frequency ambient noise

ALAN LOWELL SEMINARS INC.

Effective Masking

- ***Under masking*** = too little masking; a crossover may occur
- ***Over masking*** = too much masking; may prevent obtaining accurate threshold in the test ear
- ***Effective masking*** = just enough to prevent crossover

ALAN LOWELL SEMINARS INC.

Effective Masking

- Starting from 0 dB, increase intensity of masking in NTE until it just becomes audible (threshold)…. or….
- Using a diagnostic audiometer, introduce masking @ threshold
- Add 10-20 dB (to overcome occlusion effect)
- Begin retesting poorer or test ear via Plateau Method

Offsetting ***Occlusion Effect***

Circumaural headsets-correction factor: 30 dB @ 250 Hz
20 dB @ 500 Hz
10 dB @ 1000 Hz

Insert phones-correction factor 10 dB @ 250 Hz

ALAN LOWELL SEMINARS INC.

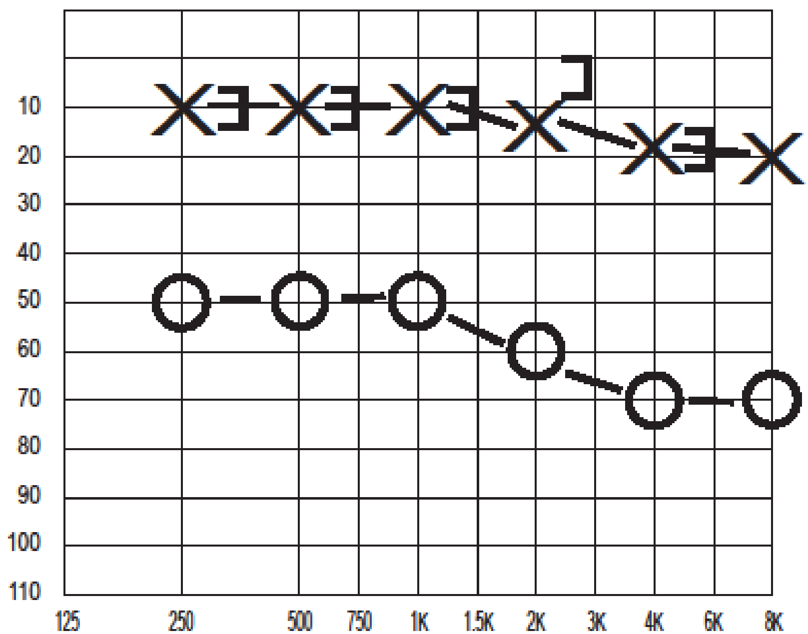
Plateau Method

(Hood's plateau method)

- A method whereby the tone presented to the test ear and the noise presented to the non-test ear (NTE) are increased in 5 dB increments until the noise can be raised or lowered 15 dB without any shift in threshold of the test ear.

“The Plateau Method”

(Example @ 1000 Hz)

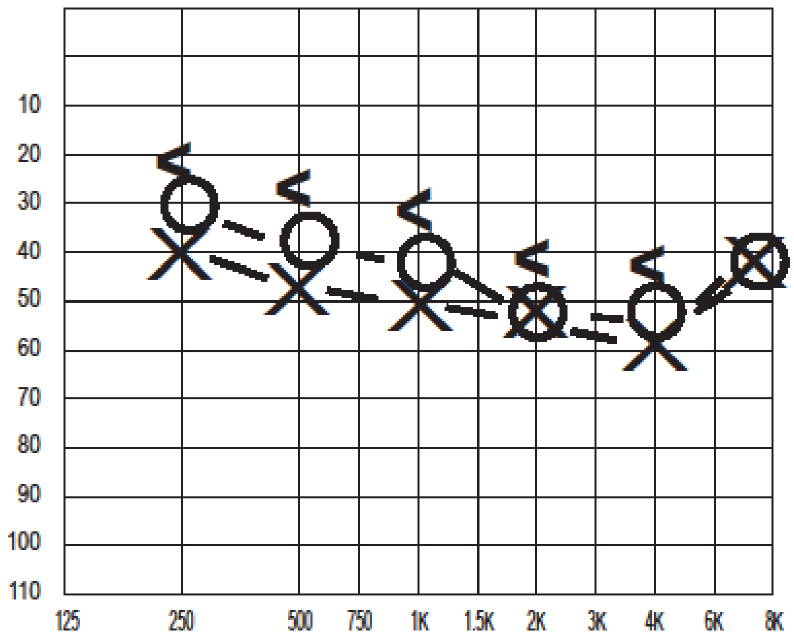


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

Masking=**L**	Tone=**R**	Respons
30 dB	50 dB	Hears to
35 dB	50 dB	No Resp
35 dB	55 dB	Hears tone
40 dB	55 dB	No Resp
40 dB	60 dB	Hears tone
45 dB	60 dB	No Resp
45 dB	65 dB	Hears tone
50 dB	65 dB	No Resp
50 dB	70 dB	Hears tone
55 dB	70 dB	Hears tone
60 dB	70 dB	Hears tone
65 dB	70 dB	Hears tone

ALAN LOWELL SEMINARS INC.

Masking Bone - Rule



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

Rule 1

Anytime the non-test ear displays an air-bone gap, should be masked when testing the test ear.

Rule 2

Mask for bone conduction when a 15 dB or more difference occurs between the bone conduction of better ear and the air conduction of the poorer ear

A good idea to always mask for bone conduction

Masking Dilemma

It may become difficult to obtain accurate bone scores with moderate-to-severe bilateral conductiv loss

ALAN LOWELL SEMINARS INC.

Masking - Definitions

Upward Spread of Masking

- Occurs whenever a low frequency sound masks out a higher frequency sound
- Background Noise

Backward Spread of Maski

- Louder sound occurs immediately after a soft sound
- Makes softer sound inaudible

ALAN LOWELL SEMINARS INC.

Masking - Definitions

<u>Forward Masking</u>

- One sound follows another closely
- Reduces sensitivity of first sound

<u>Lombard Effect</u>

- Increased volume of voice when masking is introduced to the better ear

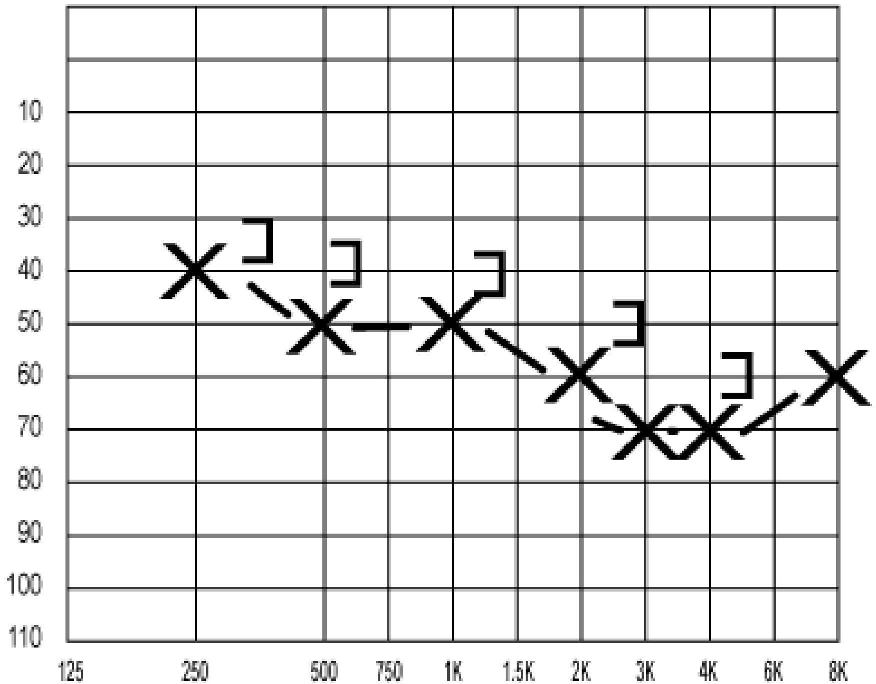
<u>Central Masking</u>

- When noise is presented to the non-test ear (NTE) it may cause a shift in the test ear

Speech Audiometry

- Most Comfortable Listening Level (MCL)
- Speech Reception Threshold (SRT)
- Uncomfortable Listening Level (UCL)
- Speech Discrimination (WRS)

Most Comfortable Listening Level (MCL)
(Some states may require use of recorded sentences)



Ear Fitted	Left	Right	Binaural
SRT	55 dB	dB	
MCL	80 dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Determine most comfortable level
- Cold running speech
- Unemotional live voice
- Recorded speech
- Calibrate VU meter
- 25 dB-40 dB above SRT (Avg. 30 dB)

ALAN LOWELL SEMINARS INC.

Speech Reception Threshold (SRT)

- Determine level speech is understood 50% of time
- Some states may require use of the Ascending/Descending Method
- Spondaic words (equal stress placed on both syllables; Inkwell, Armchair, Northwest)
- Easy words to understand
- Calibrate VU meter

ALAN LOWELL SEMINARS INC.

SAT - SDT

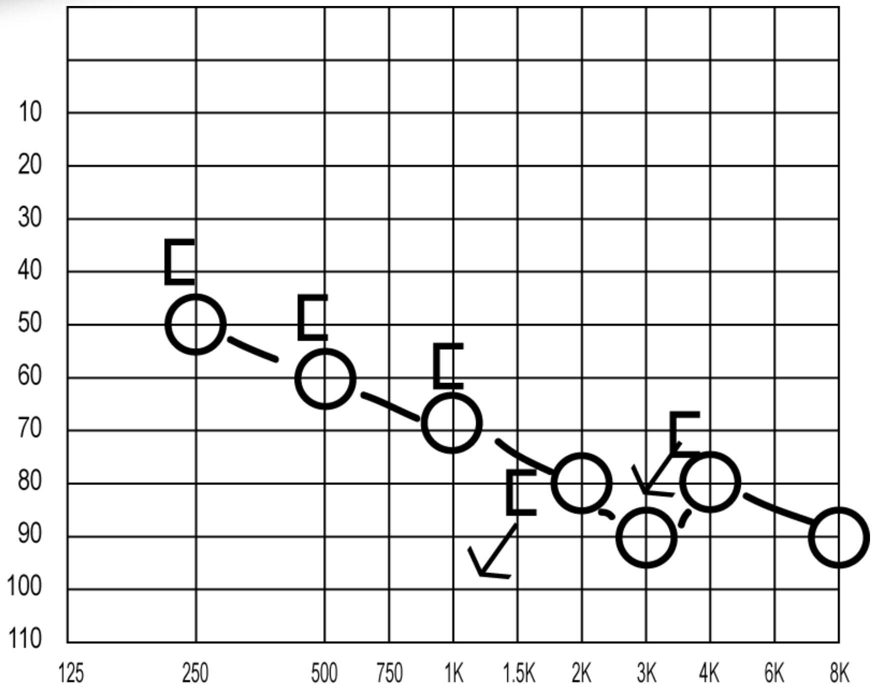
SAT (Speech Awareness Threshold)

SDT (Speech Detection Threshold)

Lowest level that speech is audible

ALAN LOWELL SEMINARS INC.

SRT



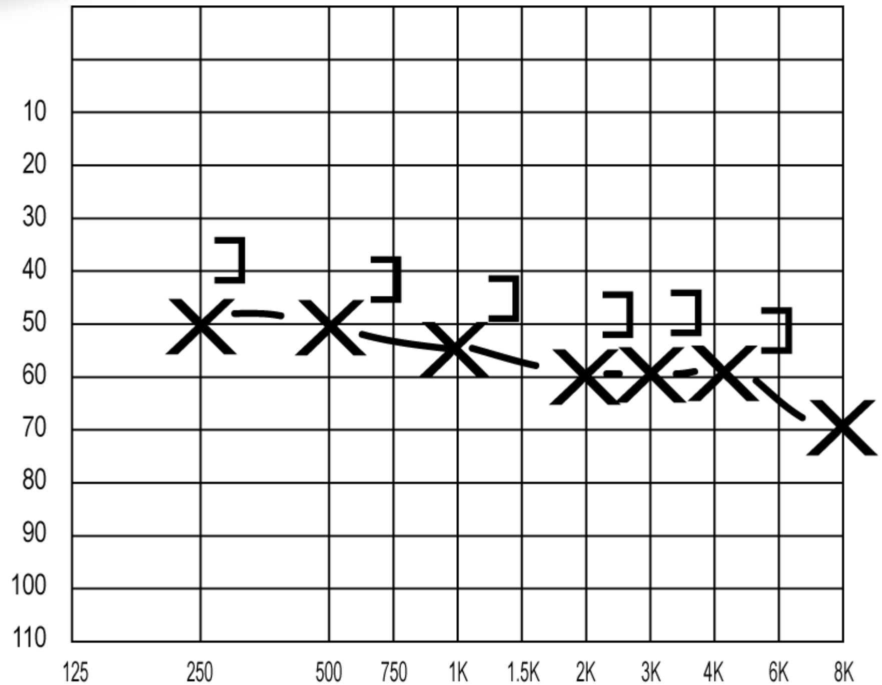
Ear Fitted	Left	Right	Binaural
SRT	70 dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Unemotional live voice
- Recorded speech
- Should agree +- 10 dB PTA
- Ski-slope loss (exception)
- Early indication of Acoustic Neuroma

ALAN LOWELL SEMINARS INC.

Uncomfortable Listening Level (UCL)

(Some states may require use of recorded sentences)



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	105 dB	dB	
Discrim. %	%	%	

- Threshold of Discomfort (TD)
- Loudness Discomfort Level (LDL)
- Determine discomfort level
- Calibrate VU meter
- Cold running speech
- Be careful!

Dynamic Range

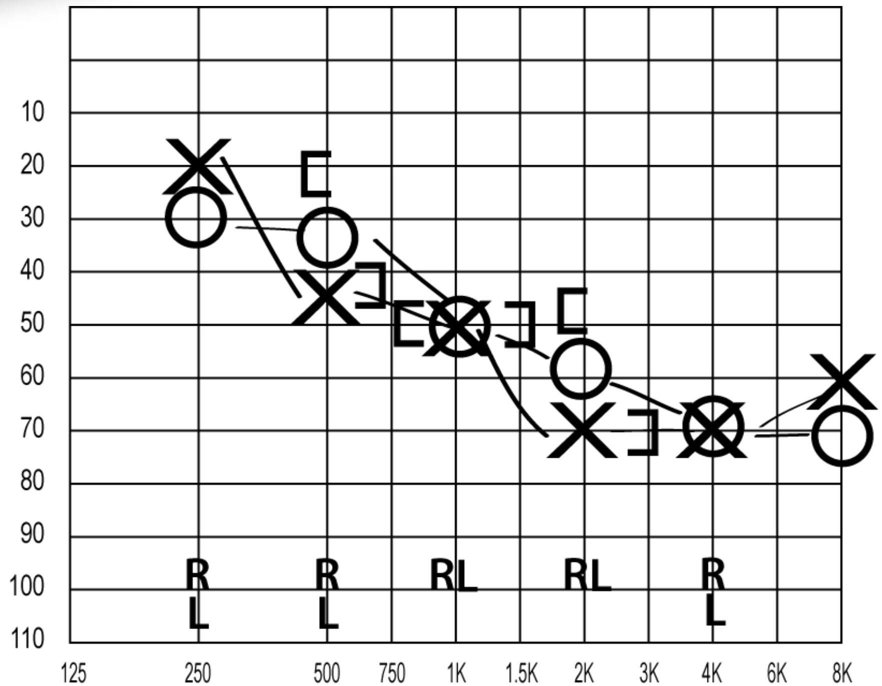
UCL

\- <u>SRT</u>

= DR (Dynamic Range)

(Auditory Area)

Discrete UCL's

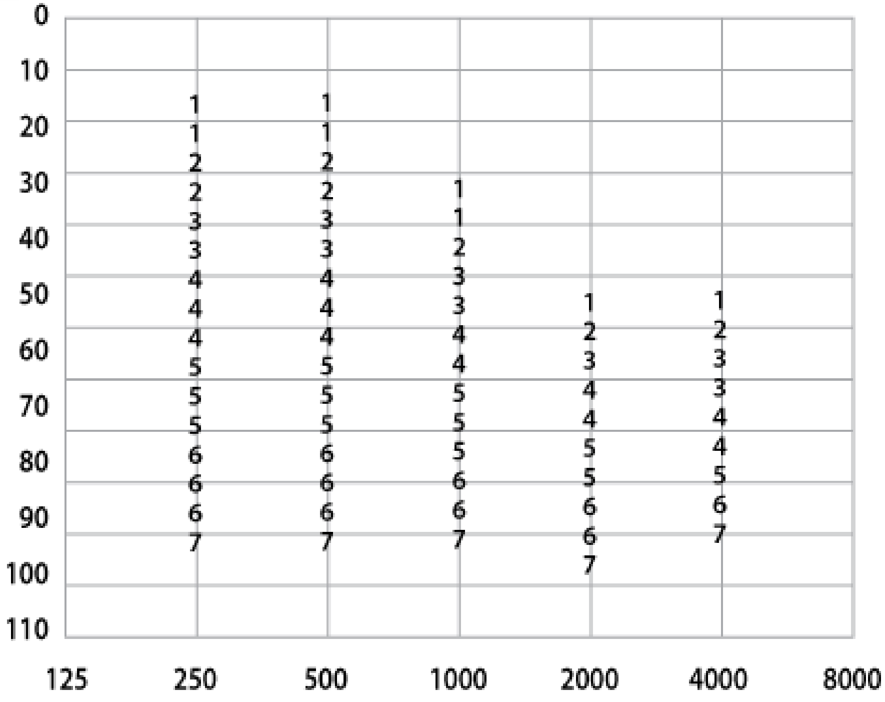


Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Used when fitting Hi-Tech
- More accurate
- More comfortable

ALAN LOWELL SEMINARS INC.

Loudness Growth Measurements



DYNAMIC RANGE PATIENT DESCRIPTIONS
1 = Very Soft
2 = Soft
3 = Comfortable, but Slightly Soft
4 = Comfortable
5 = Comfortable, but Slightly Loud
6 = Loud but OK
7 = Uncomfortably Loud

- Hi-Tech fittings
- More information

ALAN LOWELL SEMINARS INC.

Speech Discrimination (PB Max 50)

- Phonetically balanced word list
- Must present 25 words minimum
- Present words at MCL
- Unemotional live voice
- Recorded speech
- Calibrate VU meter
- 25 words = 4% correct

ALAN LOWELL SEMINARS INC.

Discrimination Word Lists
(Word Recognition Lists)

- NU #6 half-lists
- Frequency Weighted Word Lists
- CID-W22
- PB Max (50)
- Other acceptable word lists

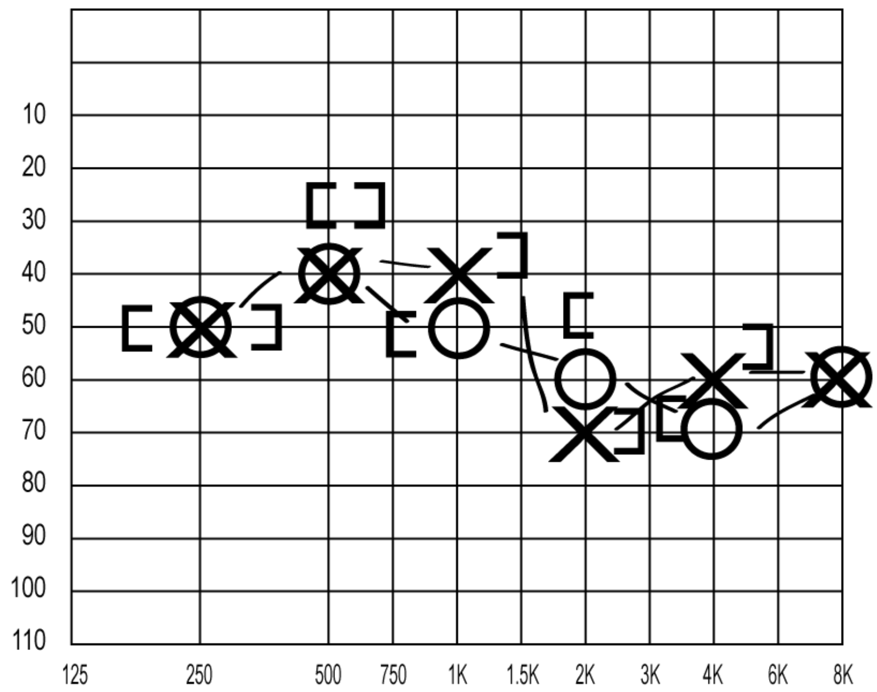
Modified Rhyme

- Reach
  - Teach
  - Peach
- Rat
  - Bat
  - Sat

- Multi- lists of words
- Not phonetically balanced
- Reasonable phonemic similarity
- Used by hearing impaired professionals
- Method to involve patient & family

ALAN LOWELL SEMINARS INC.

Complete Audiogram



Ear Fitted	Left	Right	Binaural
SRT	60 dB	55 dB	
MCL	80 dB	80 dB	
UCL	95 dB	100 dB	
Discrim. %	72 %	88 %	

- Pure tone Air
- Pure tone Bone
- Masking as indicated
- MCL
- SRT
- UCL
- Discrimination, right, left & binaural

QuickSIN

- Measures understanding capability at various signal to noise ratio levels
- Signal-to-noise ratio hearing loss (SNRHL)

- QuickSIN Example Audio

25 dB

20 dB

15 dB

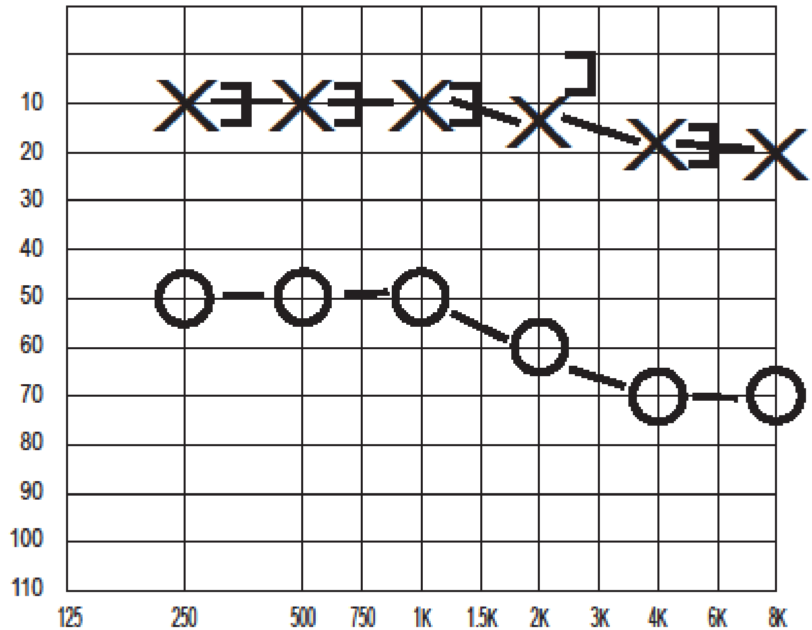
10 dB

5 dB

0 dB

ALAN LOWELL SEMINARS INC.

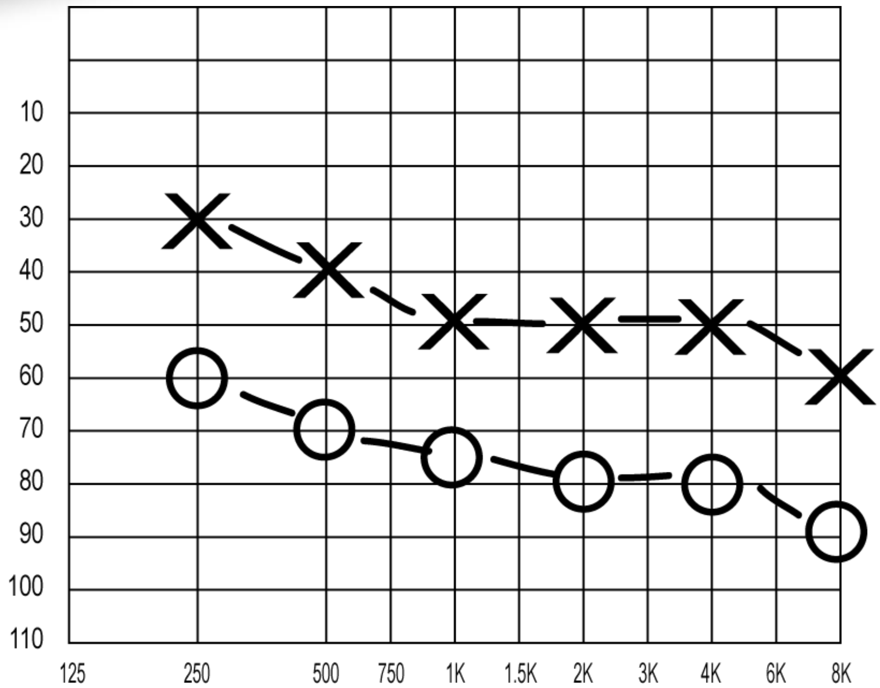
Masking for Speech Audiometry



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Mask for air conduction then…
- Mask for SRT
- Mask for Speech Discrimination
- MCL & UCL (optional

Masking for Speech Audiometry

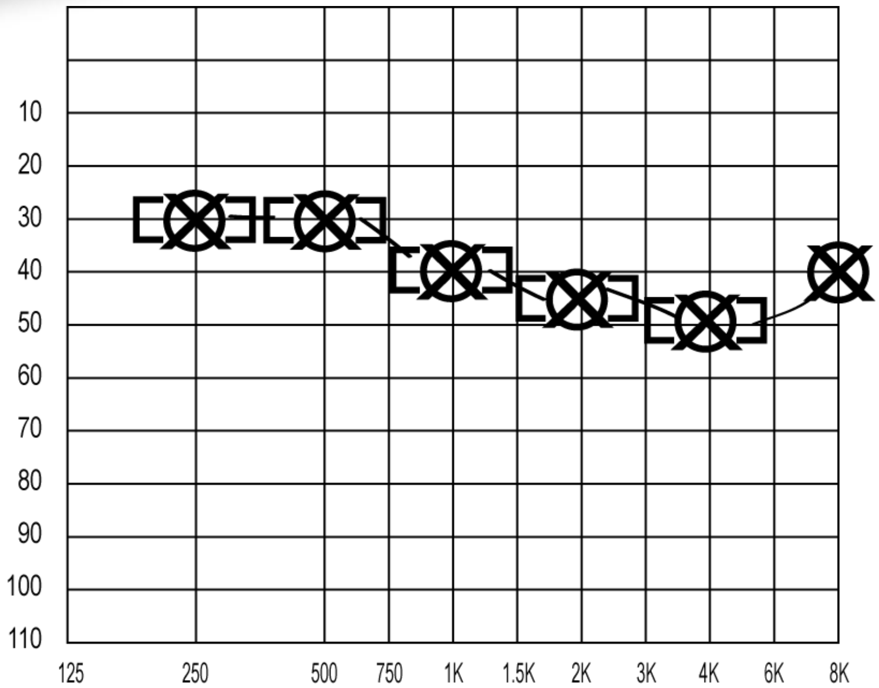


Ear Fitted	Left	Right	Binaural
SRT	50 dB	75 dB	
MCL	75 dB	95 dB	
UCL	100 dB	100 dB	
Discrim. %	76 %	56 %	

- When do we <u>ONLY</u> mask for Speech Discrimination?
- When the MCL in the poorer ear exceeds the thresholds (SRT) in better ear by 40 dB or more!

ALAN LOWELL SEMINARS INC.

Determining Which Ear to Fit

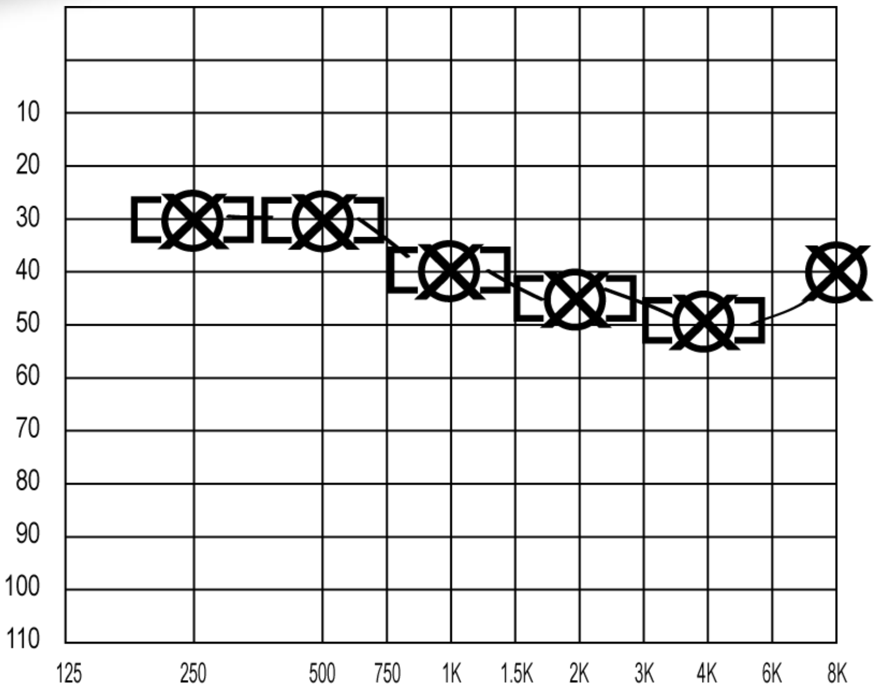


Ear Fitted	Left	Right	Binaural
SRT	40 dB	40 dB	
MCL	65 dB	65 dB	
UCL	90 dB	105 dB	
Discrim. %	92 %	92 %	

- Step#1
- **Better speech discrimination**
- Less than 8% go to step #2

ALAN LOWELL SEMINARS INC.

Step #2



Ear Fitted	Left	Right	Binaural
SRT	40 dB	40 dB	
MCL	65 dB	65 dB	
UCL	90 dB	105 dB	
Discrim. %	92 %	92 %	

- If speech discrimination is the same for both ears
- Fit ear with wider Dynamic Range

UCL

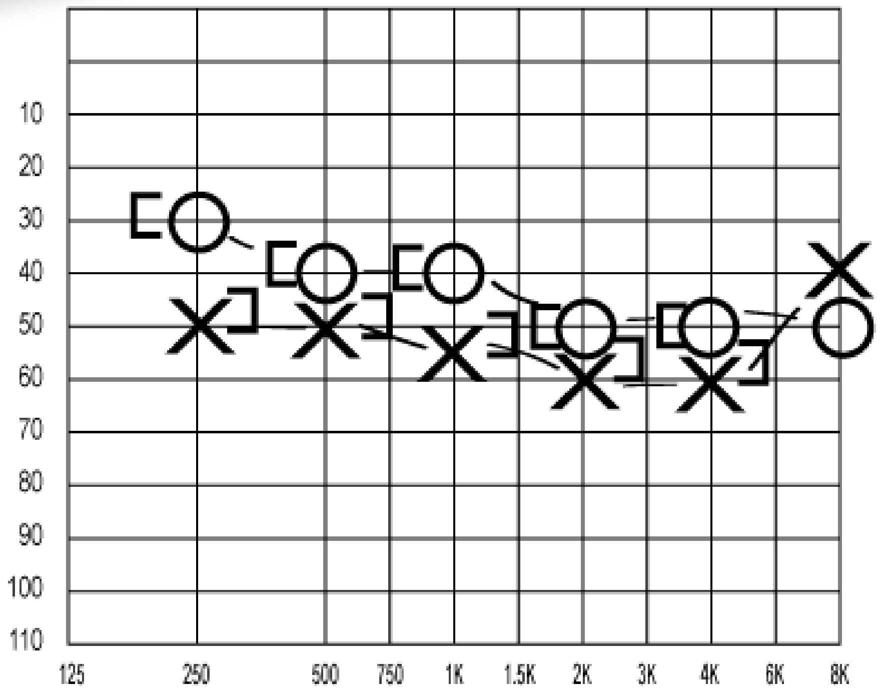
- <u>SRT</u>

= DR

(Auditory Area)

ALAN LOWELL SEMINARS INC.

Step #3

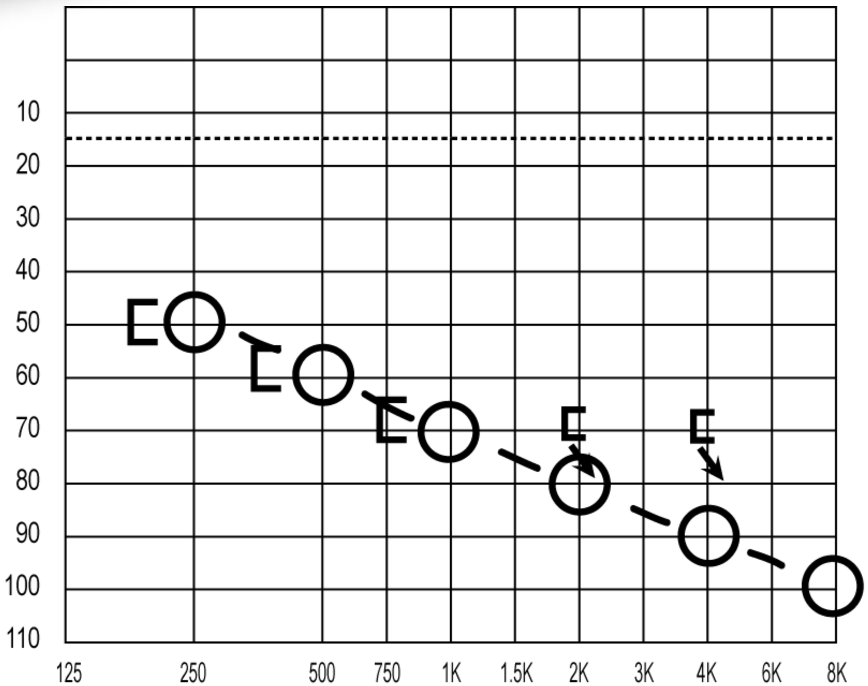


Ear Fitted	Left	Right	Binaural
SRT	40 dB	40 dB	
MCL	65 dB	65 dB	
UCL	105 dB	105 dB	
Discrim. %	92 %	92 %	

- If discrimination is same for both ears & DR's are same for both ears…
- Fit ear with PTA's closest to 60 dB
- **Both ears better than 60 dB - Fit <u>poorer</u> ear**
- **Both ears poorer than**
- **60 dB –Fit <u>better</u> ear**

ALAN LOWELL SEMINARS INC.

Determining Gain Rule #1
(early method)

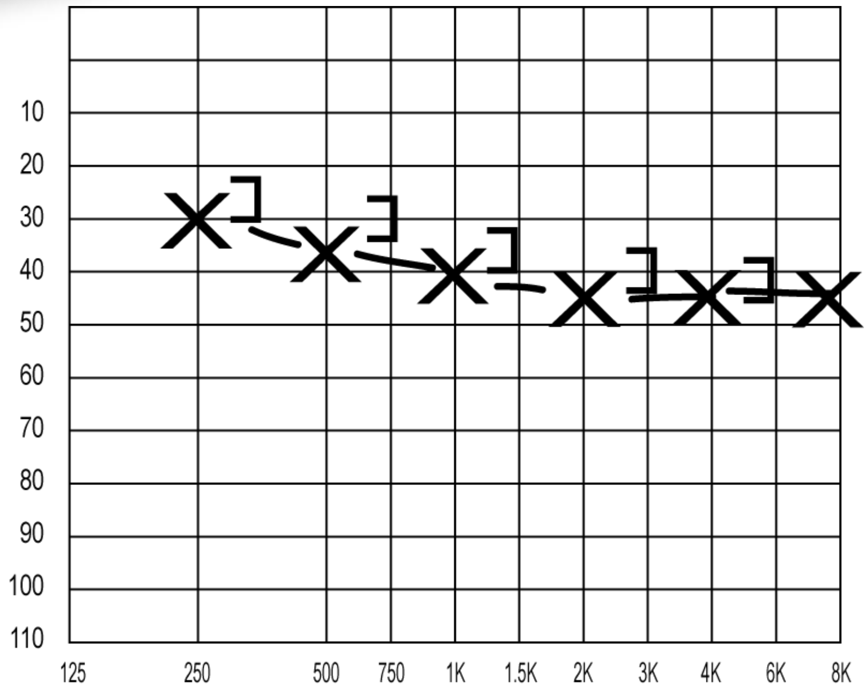


Ear Fitted	Left	Right	Binaural
SRT	dB	70 dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

- Select sufficient gain to achieve an aided SRT as close to 15 dB
- 15 dB represents <u>NORMAL</u> limits
- Must consider configuration of loss & where gain is needed

ALAN LOWELL SEMINARS INC.

Determining Gain Rule #2
(early method)



Ear Fitted	Left	Right	Binaural
SRT	40 dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

Useable Gain

- Divide SRT by 2
- Add 10 dB for reserve gain
- Must consider configuration of loss & where gain is needed

ALAN LOWELL SEMINARS INC.

Prescriptive Formulas to Determine Gain & Frequency Response

- Half Gain Rule
- Libby Procedure
- Lybarger Method
- Pogo
- Pogo II
- Fig 6
- NAL (R); NAL-RM; NAL NL1; NAL-NL2; *(other variations of NAL)*
- DSL-I/O
- IHAFF (International Hearing Instrument Fitting Formula
- *Other manufacturers proprietary formulas / variations of the above*

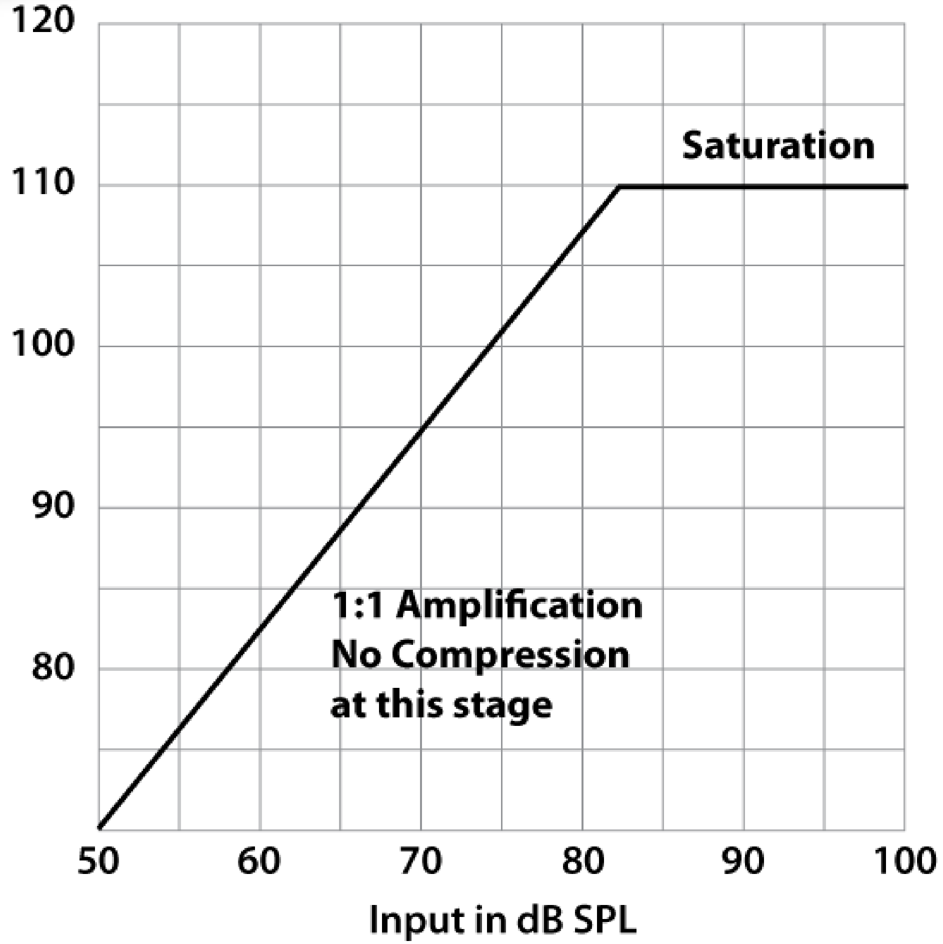
ALAN LOWELL SEMINARS INC.

Linearity

INPUT	+	GAIN	=	OUTPUT
40		40		80
50		40		90
60		40		100
70		40		110
80		40		120
90		40		130

ALAN LOWELL SEMINARS INC.

Linear Technology



- What proportionally goes in comes out!
- Clear-Crisp-Precise

Non - Linear Technology
(Output Limiting Systems)

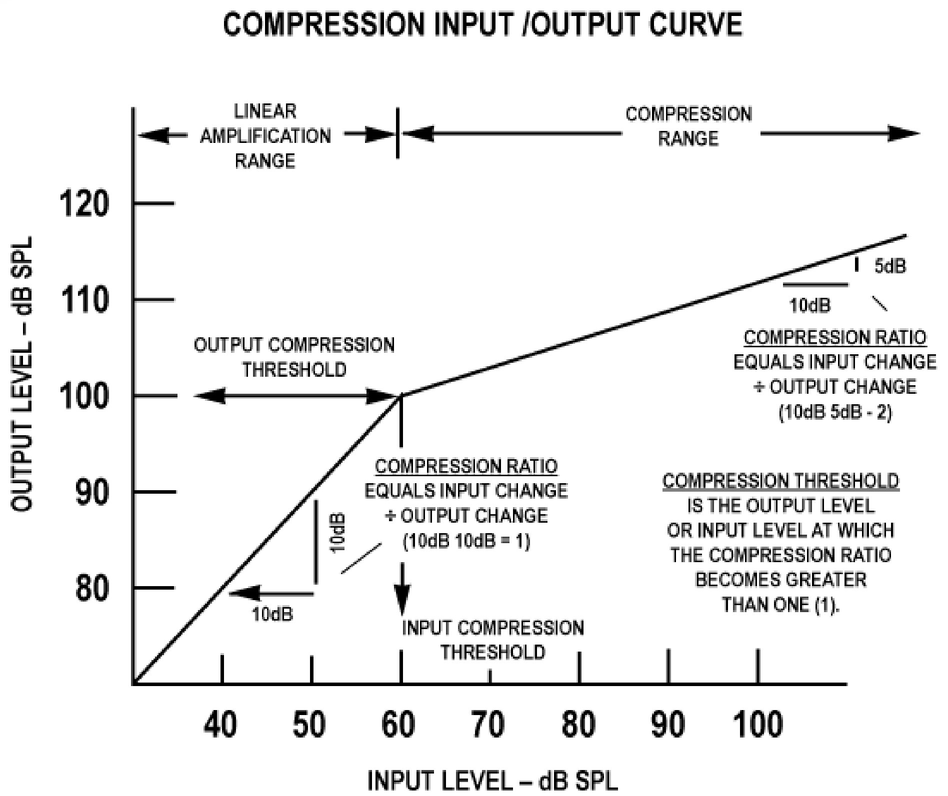
Automatic Gain Control (AGC)

Automatic Volume Control (AVC)

Automatic Signal Processing (ASP)

ALAN LOWELL SEMINARS INC.

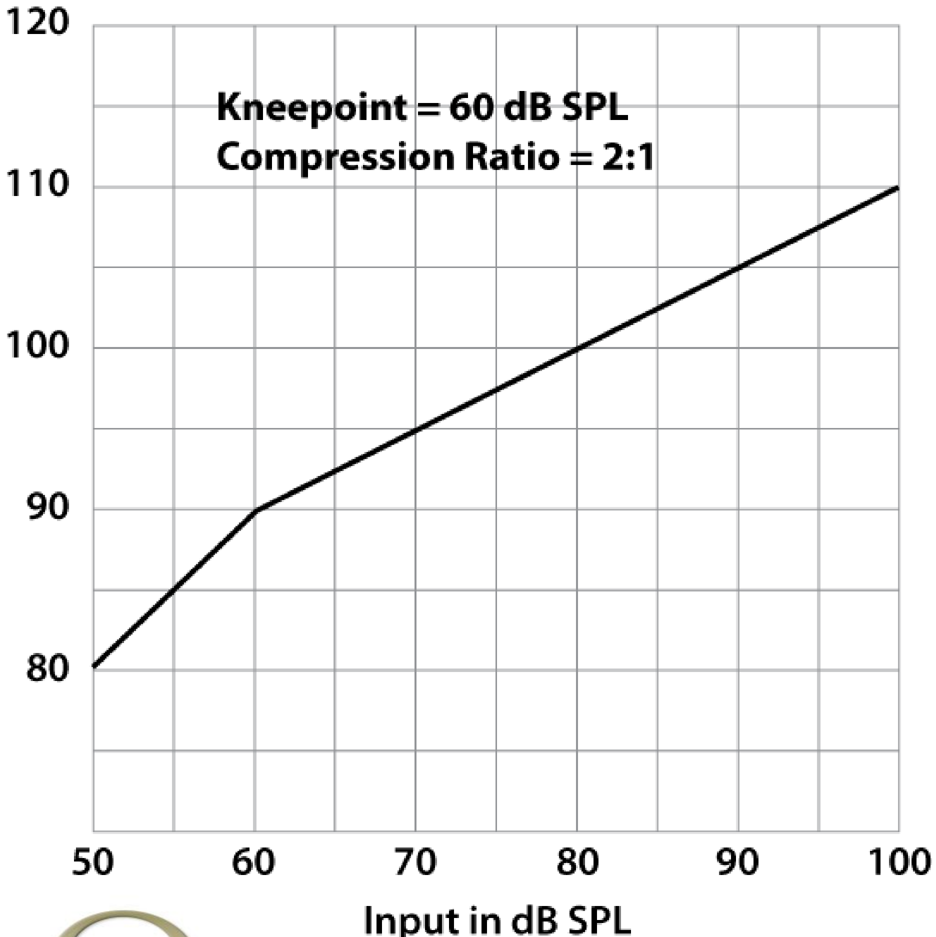
Compression (Basic)

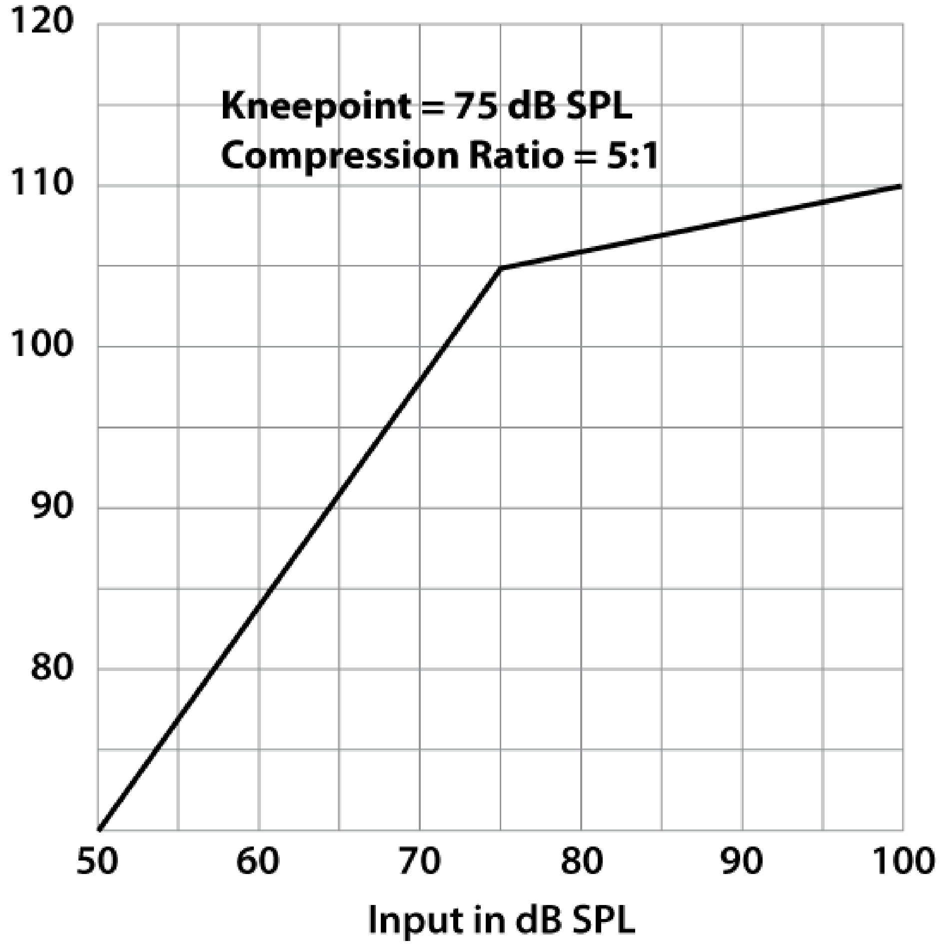


Key Elements

- Attack & Release time measured in milliseconds
- Threshold knee point
- Compression ratio
- Compression method (input, output, etc.)

Compression Ratio





ALAN LOWELL SEMINARS INC.

Various Compression Circuits

Linear Compression

Soft Peak Clipping Compression

Syllabic Compression

Dual Compression

Wide Dynamic Range Compression (WDRC)

Input Compression

Output Compression

Adaptive Compression

Directional Microphone Systems

ALAN LOWELL SEMINARS INC.

Omnidirectional Microphone

Same sensitivity regardless of
the direction of the incoming sound

ALAN LOWELL SEMINARS INC.

Why Directional?

- Multiple microphones used to improve hearing speech signals while reducing noise
- Improves signal-to-noise ratio (SNR)
- Improves hearing in reverberant environments
- Incorporates Automatic Speech Recognition (ASR) which recognizes speech & noise and re-synthesizes the speech with minimal background noise

Microphone Activation

- Manually
- Remote
- Program button
- Automatically

Adaptive Directional Systems

- The microphone is automatically activated utilizing adaptive compression circuits with automatically variable release times

ALAN LOWELL SEMINARS INC.

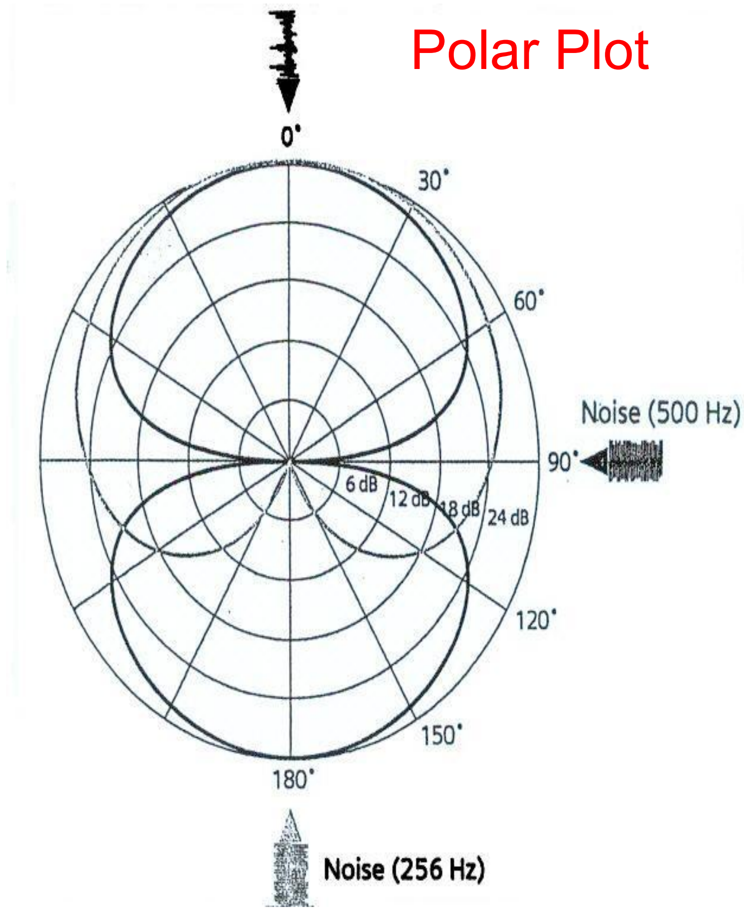
Polar Plot

Polar Plot

lots the performance (reduction of
oise) of a directional microphone on
n azimuth based on
ne angle of the noise.

Directivity Index

xpressed as the decibel improvement
n signal-to-noise ratio over that of an
mnidirectional microphone



American National Standards Institute

- OSPL 90 (SSPL 90)
- HF Average OSPL 90 (SSPL 90)
- Full-on Gain
- HF Average Full-on Gain
- Reference Test Gain (position)
- Harmonic Distortion
- Frequency Response Curve

ALAN LOWELL SEMINARS INC.

ectroacoustic Hearing Aid Analyzer FA

Photo provided by
Frye Electronics, Inc.

Hearing Instrument Test Chamber

- Electroacoustic analysis of any type of hearing instrument
- Directional capability
- Plots polar patterns

ALAN LOWELL SEMINARS INC.

2 - cc Couplers

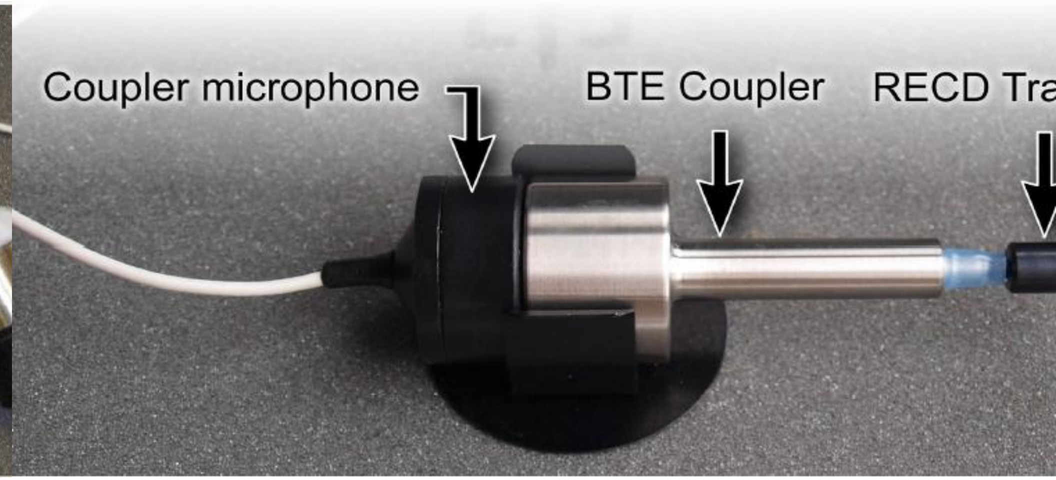
RIC; RITE; SIE o; SIA o

Customs

BTE>>>

ALAN LOWELL SEMINARS INC.

Electroacoustic Analysis Components



HA - 1 Direct Access 2cc Coupler

- Used for ITC-ITE

ITE (In-the Ear) —Full shell

HA - 2 2cc Coupler

- Utilized with a standard #13 size tube when testing BTE's

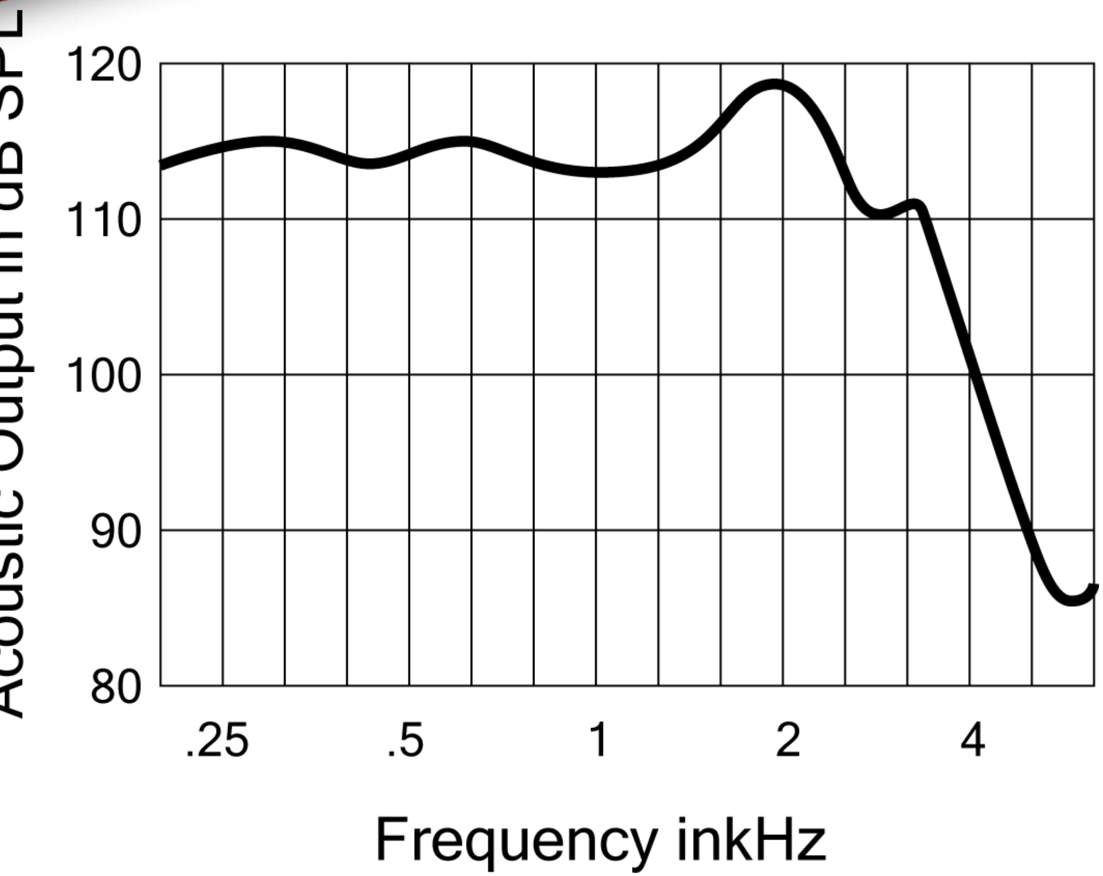
ALAN LOWELL SEMINARS INC.

Zwislocki Coupler

- Utilized with an ear simulator
- KEMAR (**K**nowles **E**lectronics **M**annequin for **A**coustic **R**esearch)
- 2cc coupler

ALAN LOWELL SEMINARS INC.

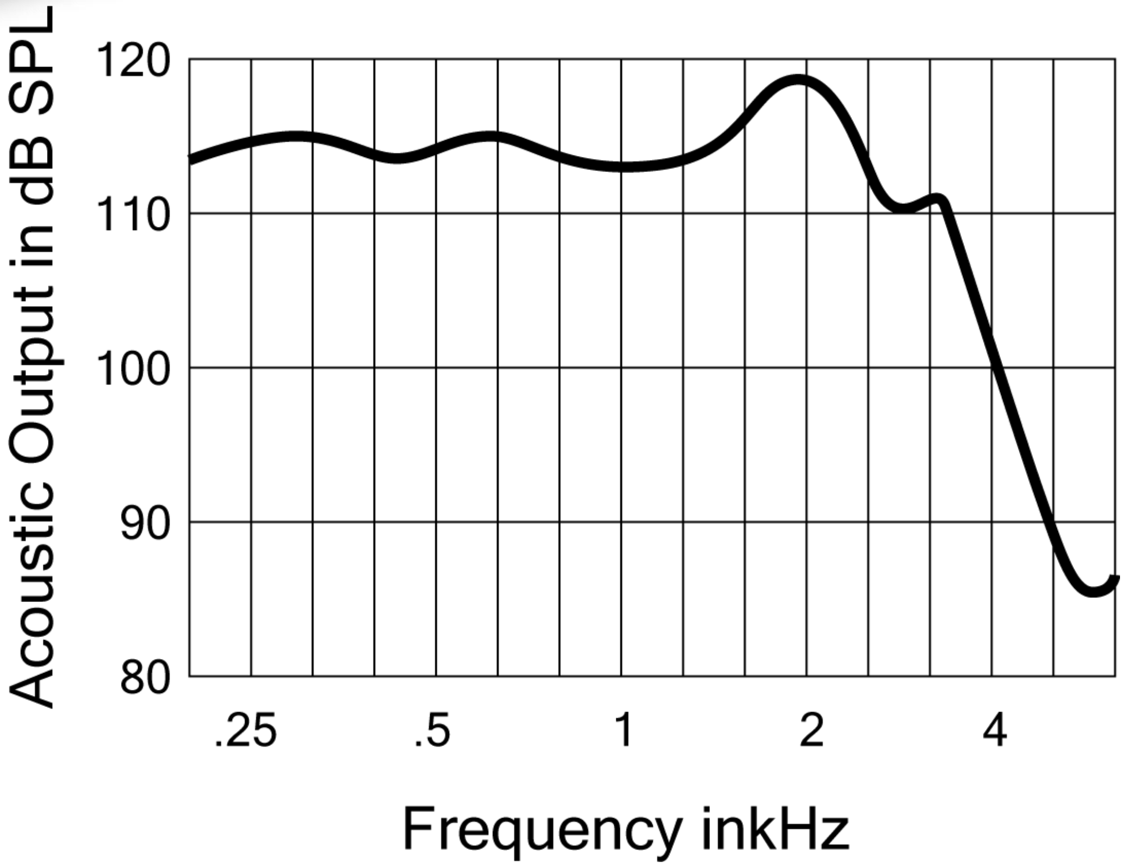
OSPL 90 (MPO) (SSPL 90)



- Connect to 2cc coupler
- VC full on
- 90 dB input
- Record curve between 200 Hz-5000Hz

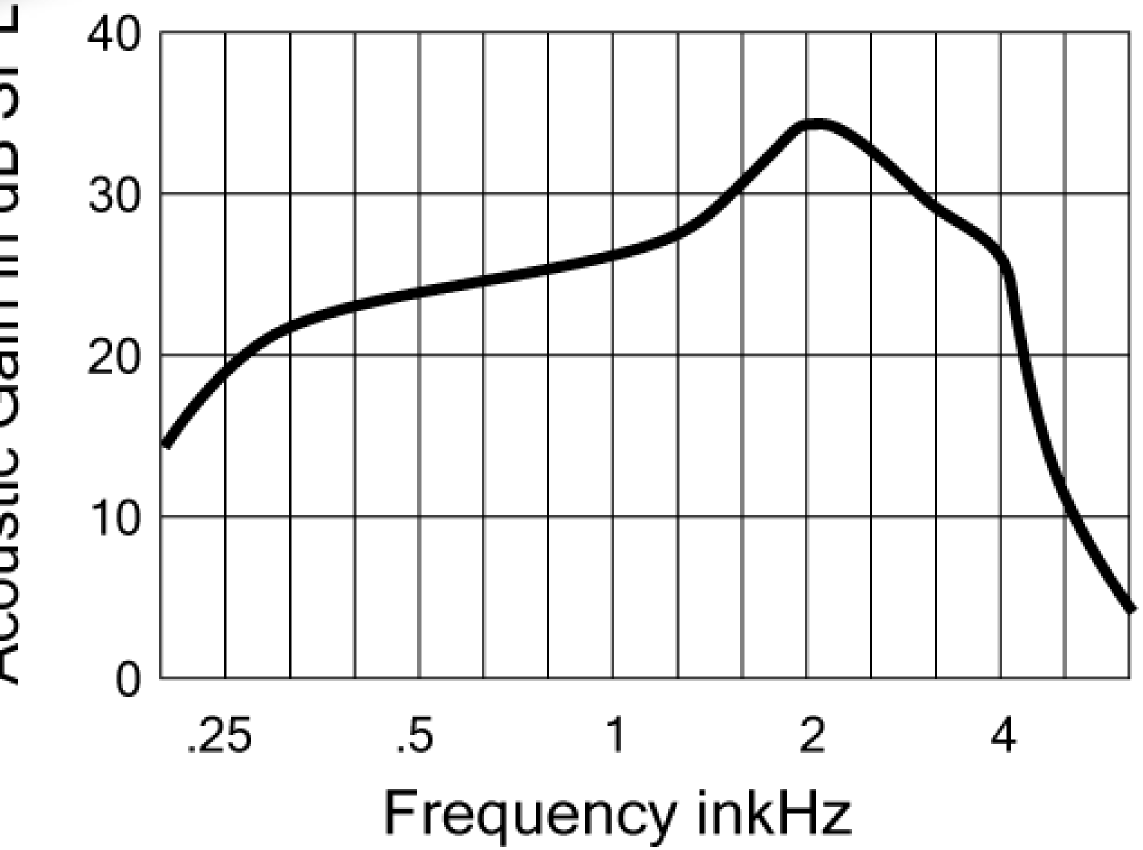
ALAN LOWELL SEMINARS INC.

HF - Average OSPL 90 (SSPL90) Special Purpose Average (SPA)



- Average 1000 Hz-1600 Hz & 2500 Hz

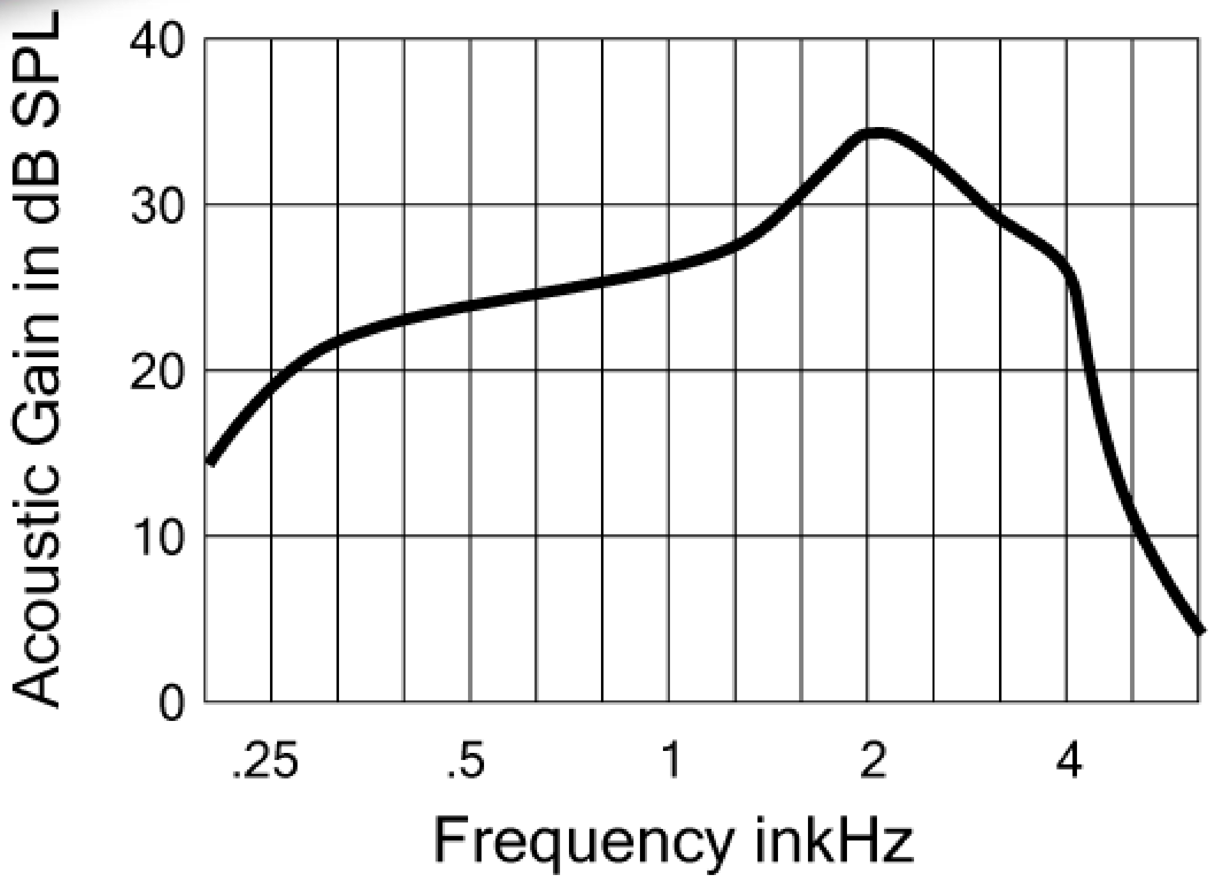
Full - on gain



- Connect to 2cc coupler
- VC full-on
- 50 dB input (AGC)*
- Record curve between 200 Hz- 5000 Hz

*60 dB for Linear

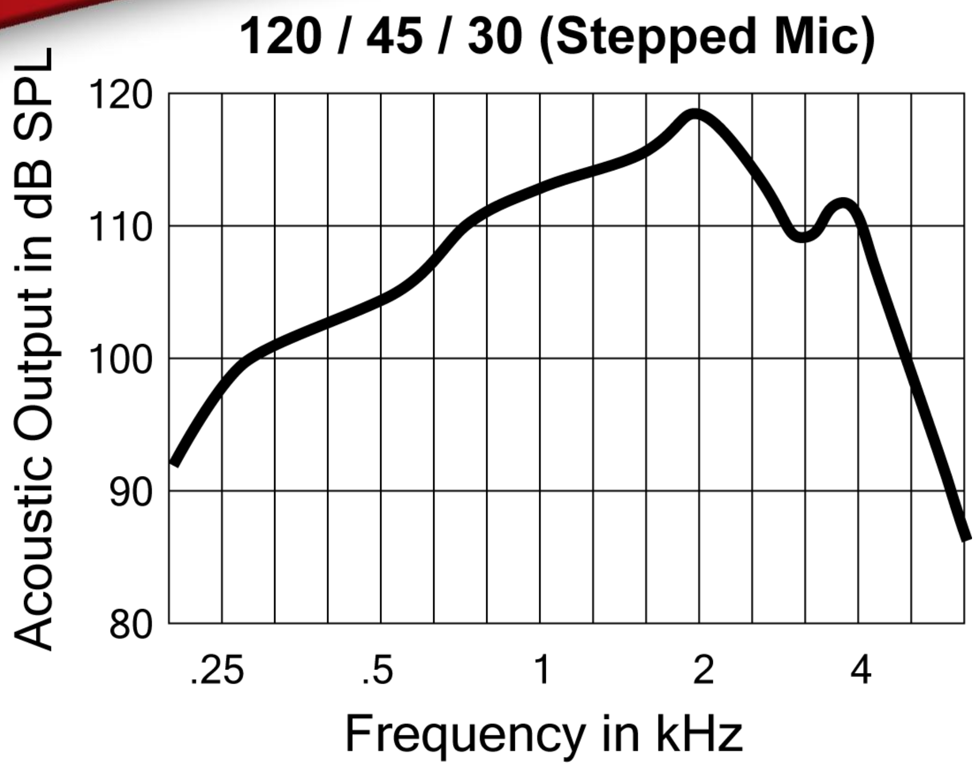
HF-Average Full - on gain Special Purpose Average (SPA)



- Average 1000 Hz-1600 Hz & 2500 Hz

ALAN LOWELL SEMINARS INC.

Reference Test Gain (position)



114 dB – 17 dB = 97 dB

Reference Test Position (RTP)

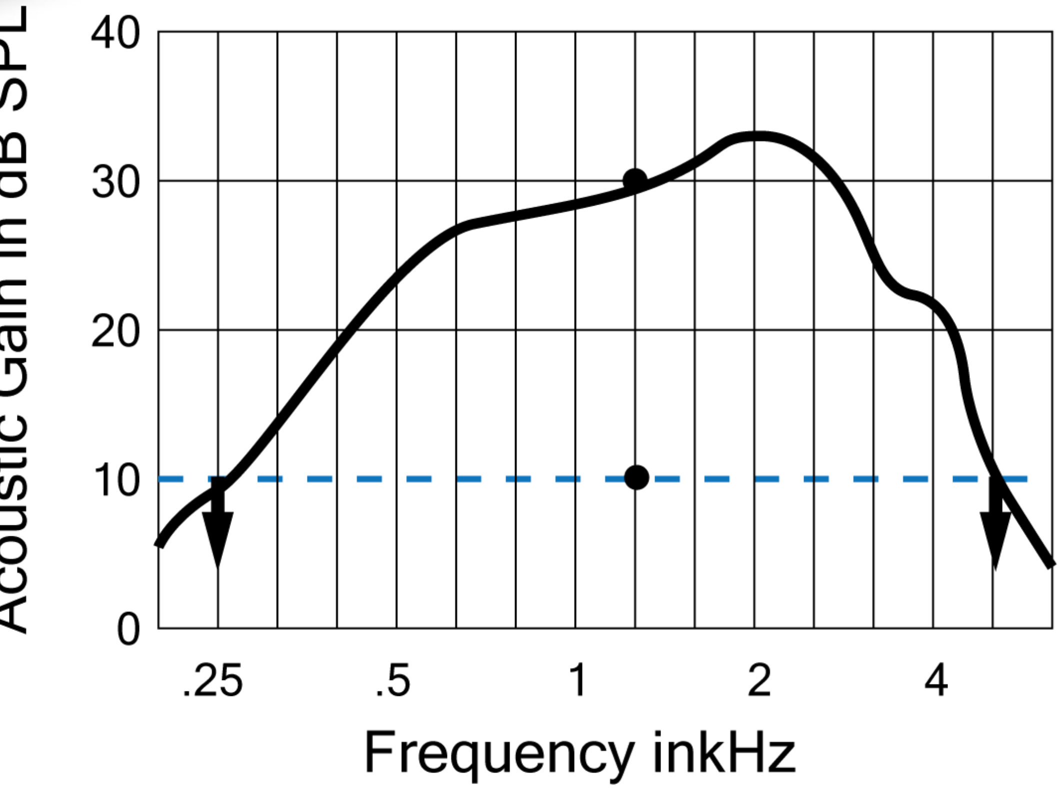
- Connect to 2cc coupler
- 60 dB input
- Rotate VC to a setting tha
  is 17 dB less than
  the HF-Average SSPL 90
- RTG/RTP

ALAN LOWELL SEMINARS INC.

Harmonic Distortion

- Connect to 2cc coupler
- VC set in RTP/RTG position
- 70 dB input
- Record % of harmonic distortion at 500 Hz, 800 Hz & 1600 Hz

Frequency Response Curve

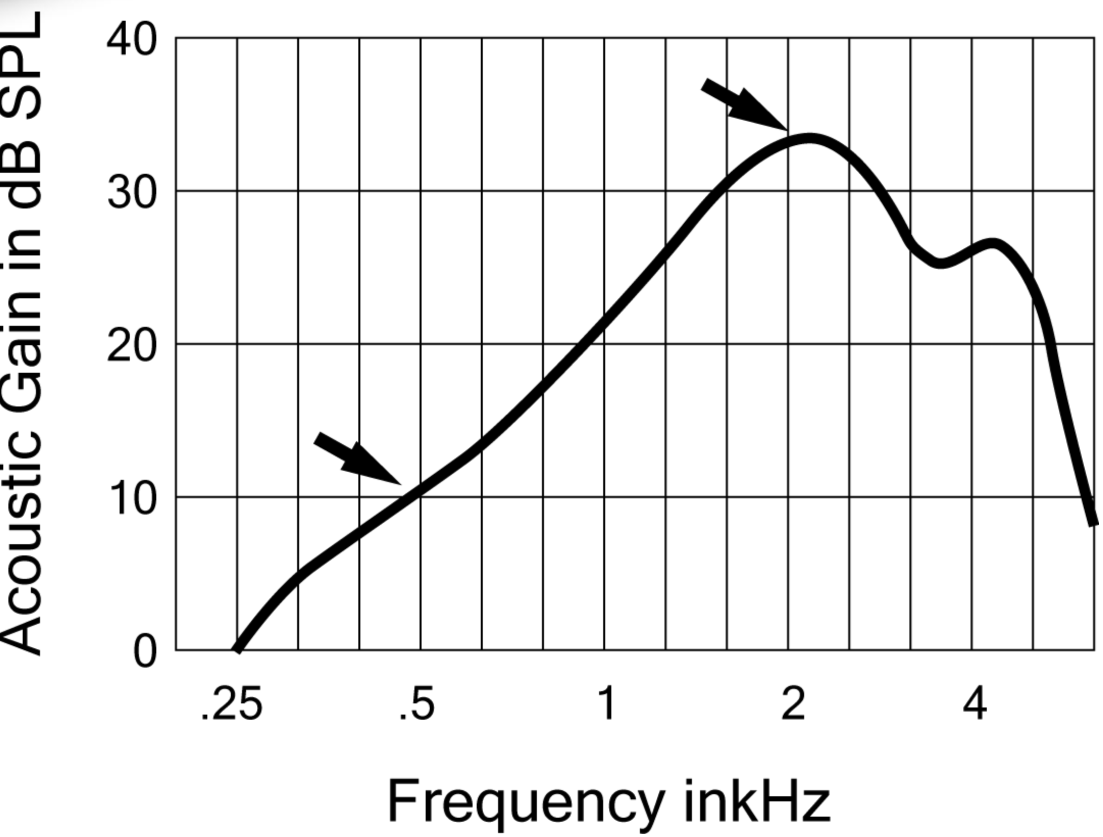


Reference Test Curve

- Determined from RTG curve
- Average 1000 Hz-1600 Hz & 2500 Hz
- Plot average on 1600 Hz line
- Subtract 20 dB
- Draw line intersecting both ends of curve = Frequency Response Curve

ALAN LOWELL SEMINARS INC.

Rise Characteristic (dB per octave rise)



- Locate peak of highest prominent frequency
- Count down 2 octaves
- Draw line connecting points
- Subtract & divide by 2

Prescriptive Formulas – Linear Early 1980's

- First introduced in the 1980's for linear technology that included:

- NAL-R *(National Acoustic Laboratories Revised)*
- POGO *(Prescription of gain and output)*
- Berger
- All specified gain requirements regardless of the intensity of the input signal level based on normal conversational speech between 65-75 dB SPL

ALAN LOWELL SEMINARS INC.

Prescriptive Formulas

(Specify gain requirements for soft-moderate & loud sounds)

- Fig 6 — Used w WDRC *wide dynamic range comp*
- Pogo — Moderate-Moderate Severe
- Pogo II — Severe-Profound
- NAL (R) Revised — Mild-Moderate Sloping
- NAL (M) Modified — Mild-Moderate Sloping
- Berger — Flat Loss Configurations
- DSL I/O* — Analog / Programmable

Early fitting formula for children

ALAN LOWELL SEMINARS INC.

Matrix

- 103/25/ Prog.= mild/mod
- 103/40/ Prog.= mod
- 125/55/ Prog.= mod/sev
- 136/74/ Prog.= power
- 112/45/ Prog.= mod
- 102/20/ Prog.= mild
- 110/35/ Prog.= mild/mod
- 125/60/ Prog.= severe
- 130/65/ Prog.= severe
- 138/80/ Prog.= profoun
- 115/45/ Prog.= mod

Hearing Aid Styles & Products

ALAN LOWELL SEMINARS INC.

Microphone & Receiver (speaker) (Transducers)

Microphone converts acoustic energy into electrical energy

Receiver converts electrical energy into acoustic energy

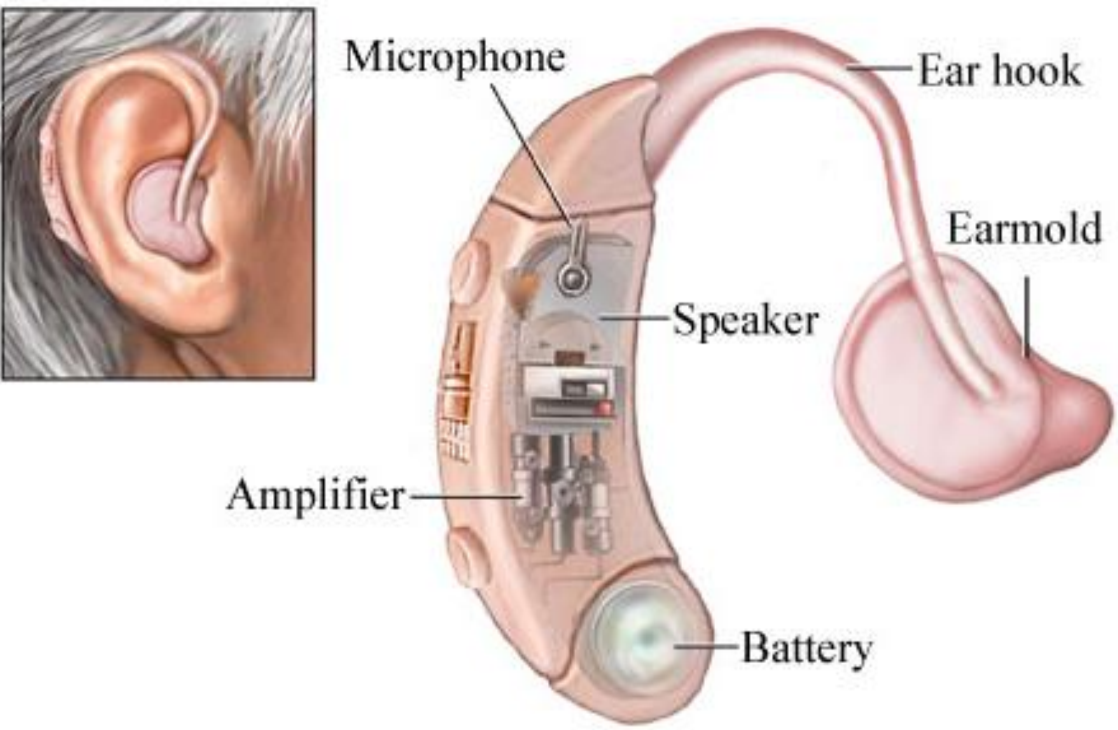
Electret Mic

- Broader range
- Smallest
- Quieter
- Shock resistant

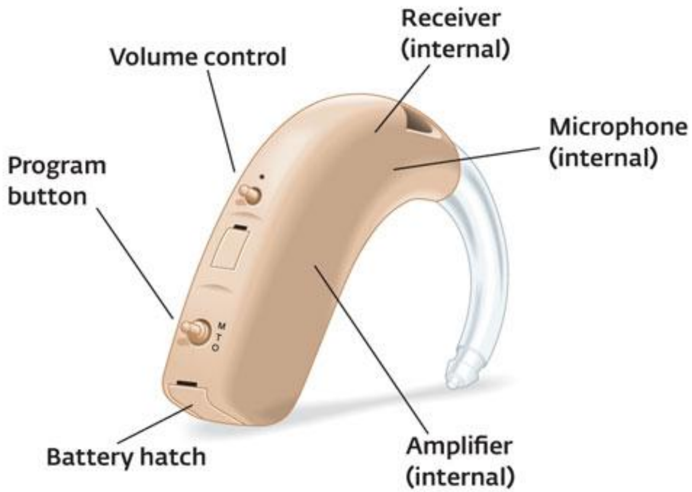
ALAN LOWELL SEMINARS INC.

Behind the Ear (BTE)

Post Auricular



- Requires ear mold
- Appropriate for any hearing loss
- Necessary for severe / severe profound hearing loss
- Directional capability



ALAN LOWELL SEMINARS INC.

In the Ear - (ITE)

- Requires an ear impression
- Designed to fit into the entire area of the outer ear
- Appropriate for mild to severe hearing loss
- Directional capability

ITE (In-the Ear)
—Full shell

Photo provided by ReSou

In the Ear - Half Shell (ITE)

- Requires an ear impression
- Designed to fit into outer 1/3 cartilaginous portion of the ear canal and concha area of the pinna
- Appropriate for moderate / severe hearing loss
- Directional capability

ITE (In-the Ear)
—Half shell

Photo provided by ReSou

ALAN LOWELL SEMINARS INC.

In the Canal (ITC)

Requires an ear impression

Designed to fit into the outer 1/3 cartilaginous portion of the ear canal

Most appropriate for moderate / moderate severe hearing loss

Directional capability

ITE (In-the Ear)
—Half shell

Photo provided by ReSou

Completely in the Canal (CIC)

Requires an ear impression

Designed to fit into the bony portion of the ear canal

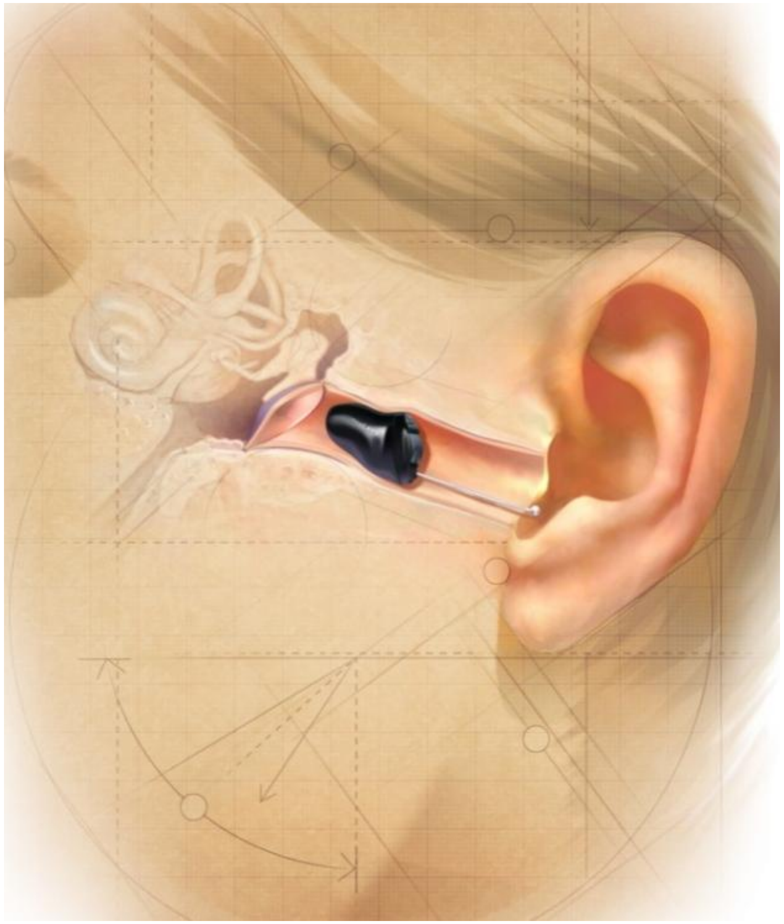
Most appropriate for moderate sloping hearing loss

Photo provided by ReSou

IIC

Invisible In-the-Canal

- Soundlens
- Photo furnished by Starkey Laboratories, Inc.



ALAN LOWELL SEMINARS INC.

Open Fit (OTE)
(SIA o)

- Requires slim tube
- Canal dome
- Appropriate for mild/ moderate sloping HF hearing loss
- Directional capability

Actual size shown.

Photo provided by ReSou

ALAN LOWELL SEMINARS INC.

Receiver in the Canal

(RIC) (RITE) (SIE o)

Requires slim tube

Canal dome w/ receiver

Appropriate for mild to severe HL in most loss configurations

May require custom canal dome

Directional capability

Photo provided by ReSo

ALAN LOWELL SEMINARS INC.

ade for Smart Phone Hearing Devic

- Bluetooth phone calls
- 20+ environmental settings
- Remote control for hearing aids
- Audio streaming
- Live mic in phone-streams to aids
- Misplaced aid feature
- Sound space which enables up to 20 saved locations

ALAN LOWELL SEMINARS INC.

Wireless / Streaming Technology

Lyric - Extended Wear

First 100% Invisible, *<u>Extended Wear</u>* Hearing Device

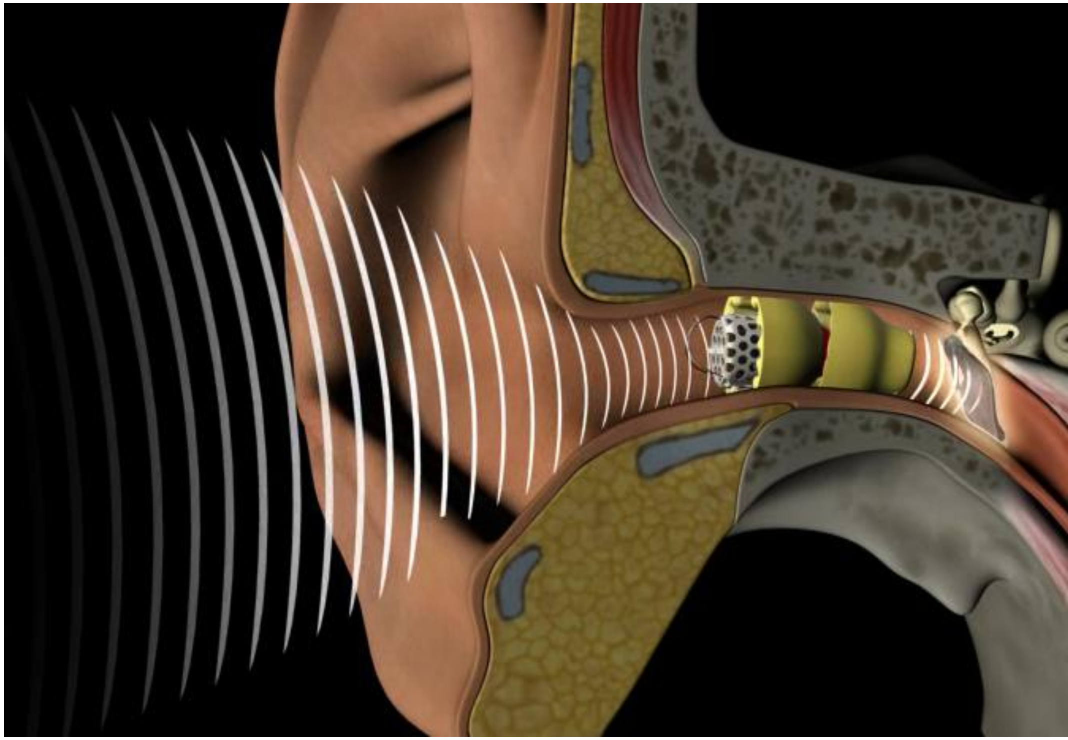
Placed by Lyric trained hearing professional

- No surgery or anesthesia required
- Placed ~4mm from the TM
- Same day fitting

Replaced as needed

- Can be worn up to 120 days
- Approximately six 10-15min replacement visits per year

Patients purchase one year of Lyric Hearing at a time



ALAN LOWELL SEMINARS INC.

Lyric Device

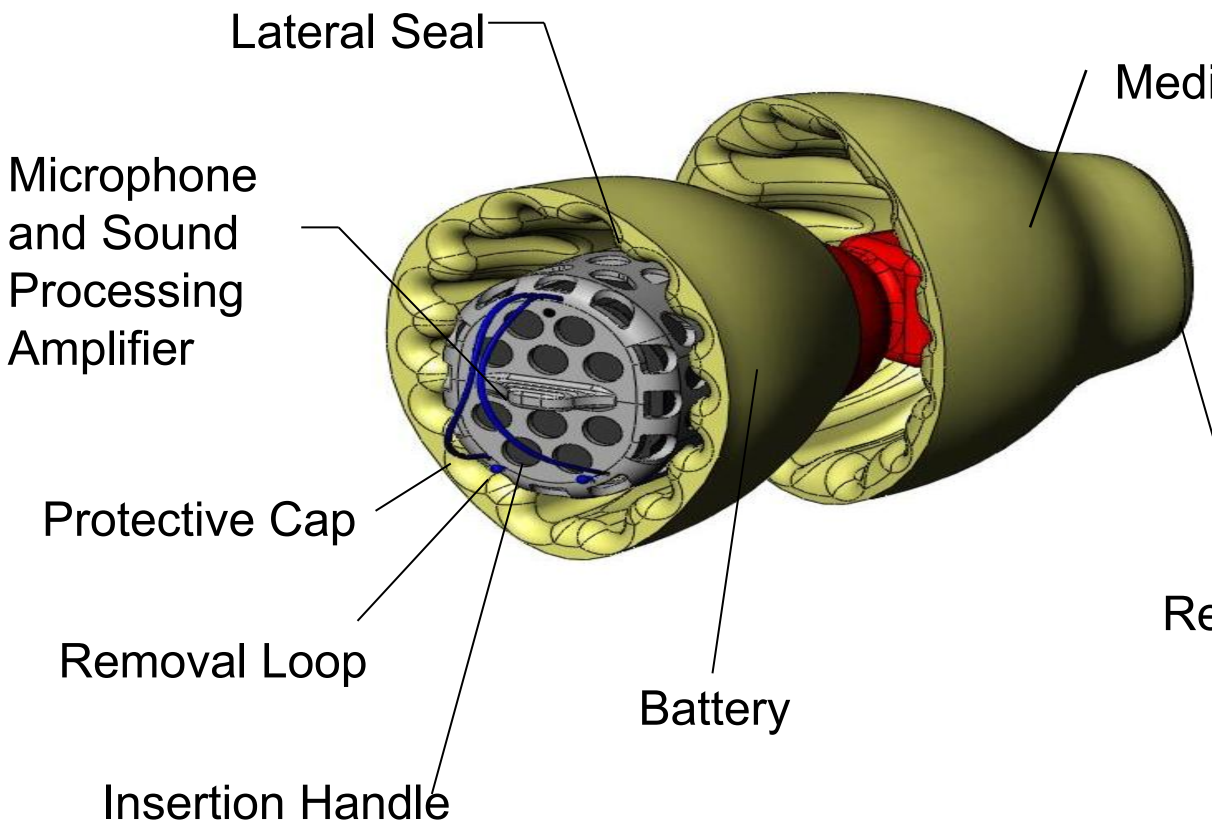
Key Technology Features

Anti-microbial seals engineered to contour to the ear canal

Proprietary coating and design technology is designed to protect device from moisture and cerumen

Proprietary battery designed to last up to 120 days

Insertion handle and removal loop provided for ease of placement and removal



 ALAN LOWELL SEMINARS INC.

Tel - Coil

- Magnetic pick-up
- Amplifies speech frequencies
- Magnetic Induction Coil
- Utilized with ALD's
- Assistive Listening Devices
- Programmable (latest)

ALD = Assistive Listening Device

LD’s refer to devices that
sist with hearing

Hearing impaired individuals may benefit from devices that enable them to hear & communicate better.

They also may be used to provide a greater awareness of the environment, especially in the case of the more severely impaired.

Examples

Vibrating alarm clocks

- TV listening systems such as Infrared, FM
- Magnetic loop systems
- Door bells that light when engag
- Listening systems in theaters, churches and concert halls
- Bluetooth technology

ALAN LOWELL SEMINARS INC.

Severe/Profound Hearing Loss

"Hearing Aids are of little or no help"

Cochlear Implants?

ALAN LOWELL SEMINARS INC.

Cochlear Implants - Candidacy

- Severe and Profoundly impaired adults or children unable to hear sufficiently with traditional hearing aids
- Children as young as 12 months old
- Severe -profound post linguistic adults with as much as 40%- 50% speech recognition
- No medical contraindications
- Highly motivated patients & or family members
- Desire to be part of the hearing world
- Broader indicators & candidacy parameters than in the early years (70's & 80's)

ALAN LOWELL SEMINARS INC.

The Hardware - External

The Hardware - External

- ESPrit (Nucleus Implants)
- First multichannel ear level speech processor

Two user selectable programs

Powered by two 675 high power zinc air cells (80 hrs operation)

ALAN LOWELL SEMINARS INC.

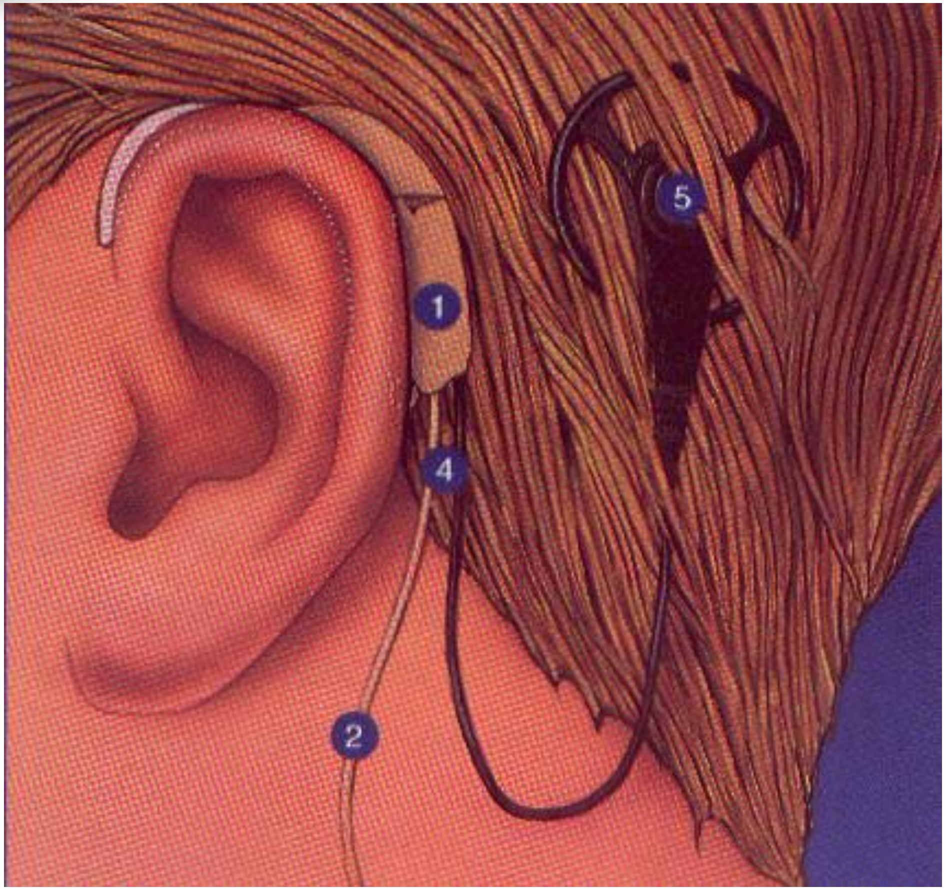
Internal Implant

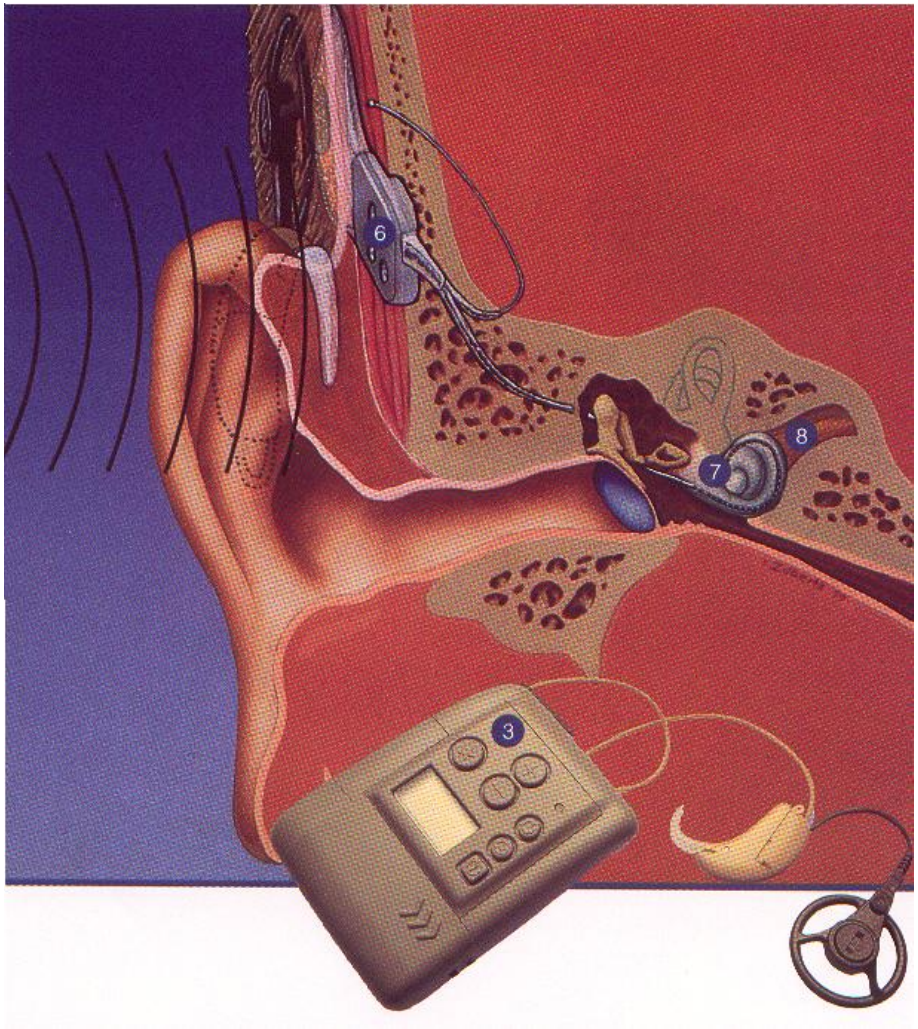
- Receiver implanted under skin in a carved out bed in the mastoid
- Made of thin rugged titanium case covered by a silicone capsule
- Includes advanced telemetry functions

Internal Hardware

- Electrode Array
- Nucleus 24
- Up to 22 sites of stimulation
- 22 channels
- 2 Grounds

The System





ntroducing the Cochlear™ Baha® 3P100

\ state-of-the-art Sound Processor
leveloped exclusively to meet the needs
of people with a conductive hearing loss,
nixed hearing loss or SSD.

- **Clarity in sound**
- **Brilliance in design**
- **Simplicity in use**

Hear now. And always

Cochlear™ Baha® System

BP100 SOUND PROCESSOR

ABUTMENT

IMPLANT

The Baha System has three components:

1. SOUND PROCESSOR - picks up sound and converts to vibration
2. ABUTMENT - transfers vibrations from Sound Processor to Implant
3. IMPLANT - titanium, placed in bone behind ear where it osseointegrates and transfers vibrations directly to cochlea via bone conduction

ALAN LOWELL SEMINARS INC.

Cochlear™ Baha® System basics

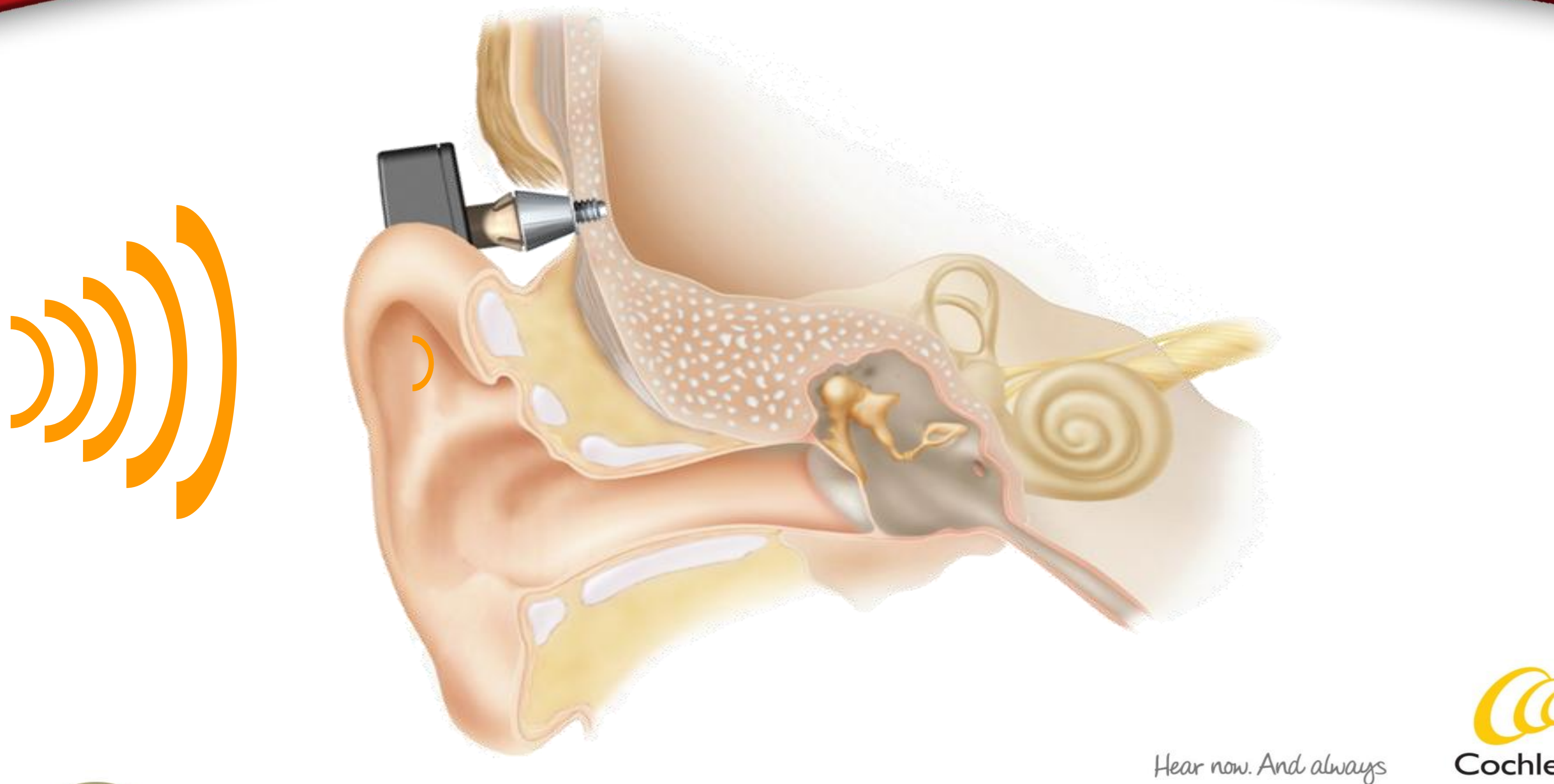
Components of the Baha System:

1. **Titanium implant** placed in the bone just behind the ear

2. **External Sound Processor** which connects to the implant via an abutment

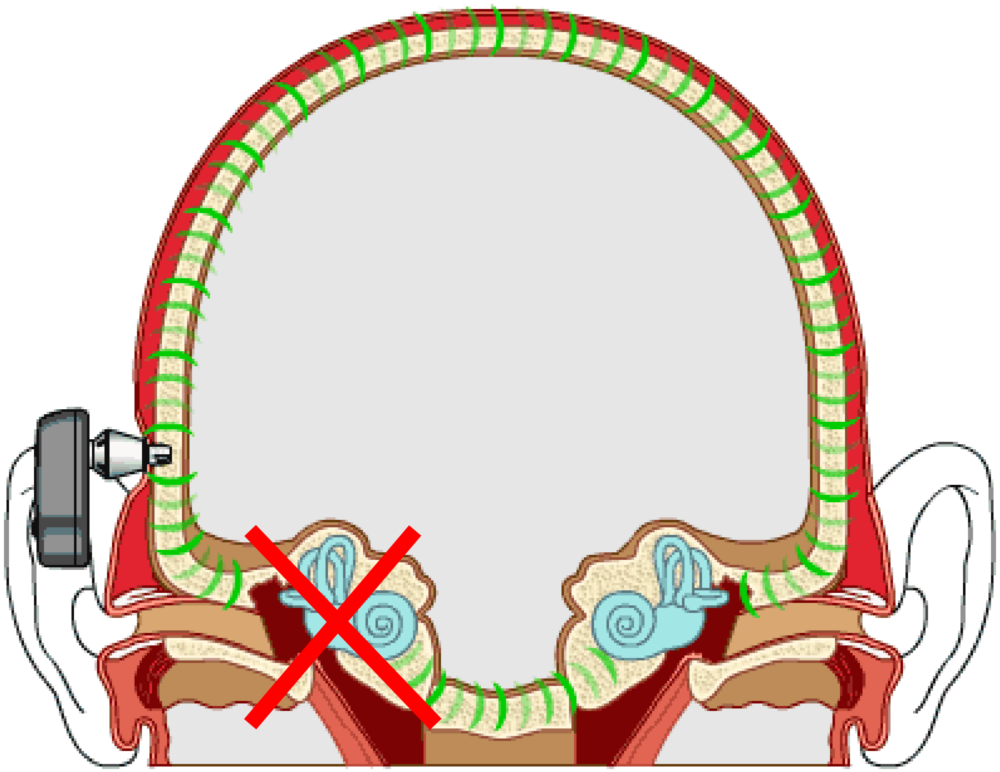
ALAN LOWELL SEMINARS INC.

How The Baha® System works



Baha® Indications

Single Sided Deafness (SSD)



One ear = profound sensorineural hearing loss (thresholds $\geq$ 90 dB HL)

Other ear = normal (PTA AC threshold $\leq$ 20 dB HL across .5, 1, 2, and 3 kH

ALAN LOWELL SEMINARS INC.

Occlusion

- **Natural increase in loudness by bone conduction when a blockage is present**
- Hearing aids or ear molds may cause occlusion

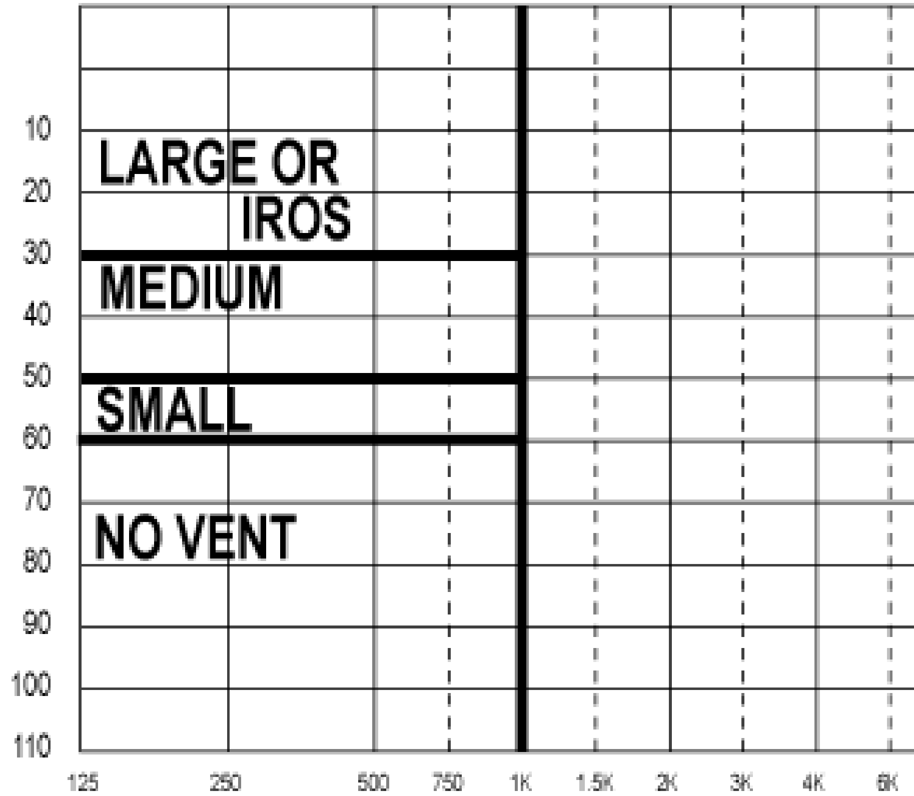
ALAN LOWELL SEMINARS INC.

Venting (Rule of Thumb)

Thresholds between 125 Hz & 1000 Hz determine Vent Diameter Size

Greater the loss in the lows…..the more narrow the vent diameter & deeper the length of shell or canal

Closer to normal the thresholds in the lows….the wider the vent diameter & shorter canal or shell length



ALAN LOWELL SEMINARS INC.

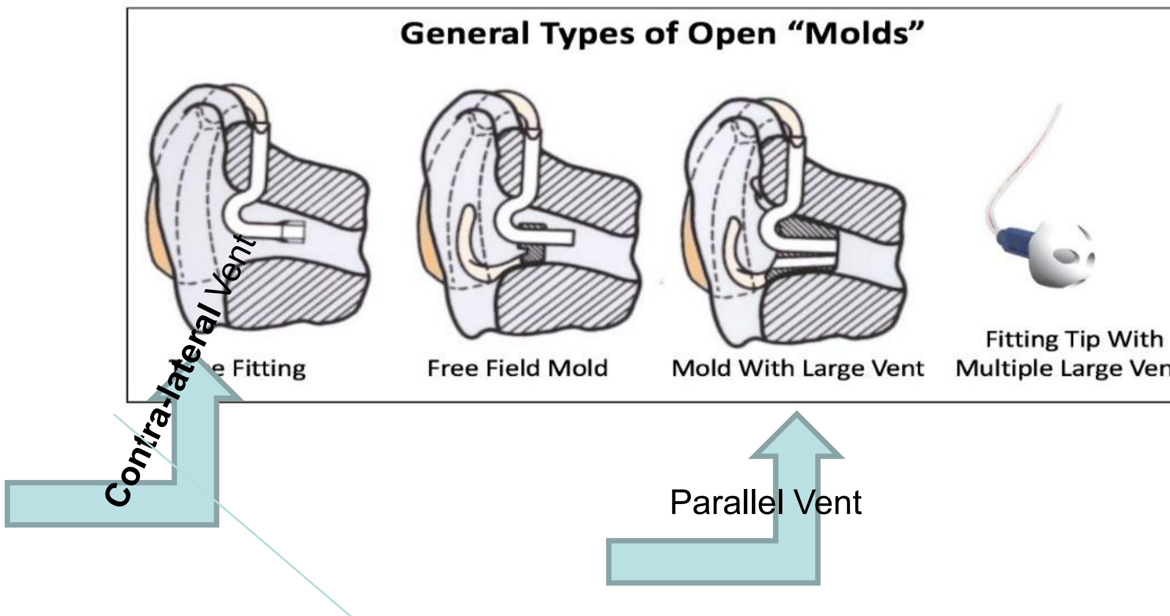
Venting

Parallel Vent

- Parallels transmission line
- Changes frequency response
- Cavity Vents
- IROS Vents
- Channel Vent
- Select -a- Vent (SAV)

Contra-lateral Vent

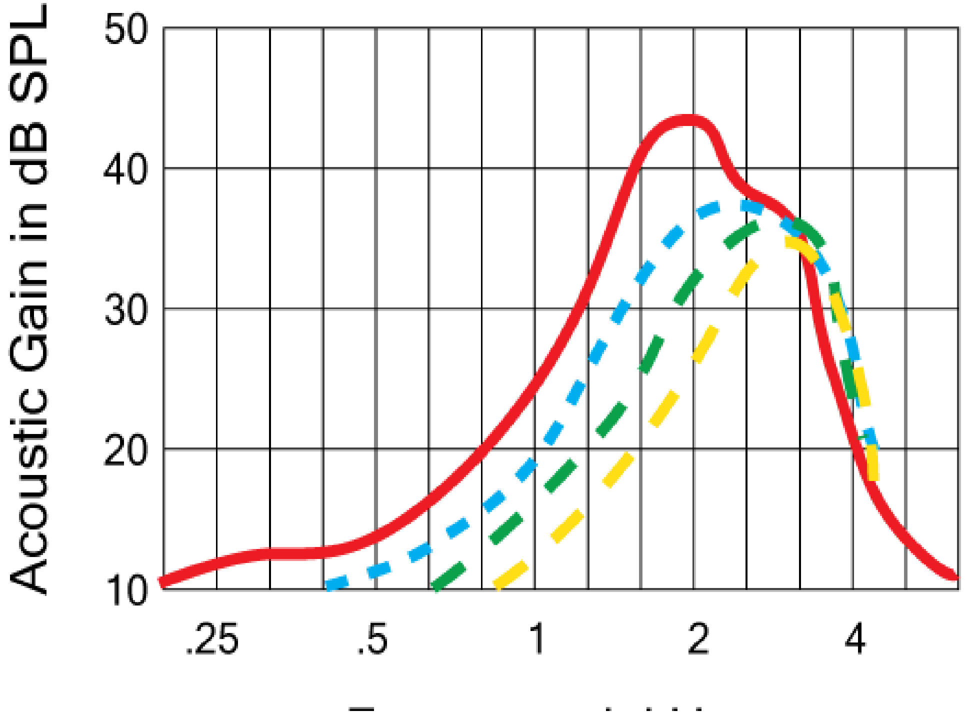
- Intersects transmission line
- Pressure release
- Used with BTE's

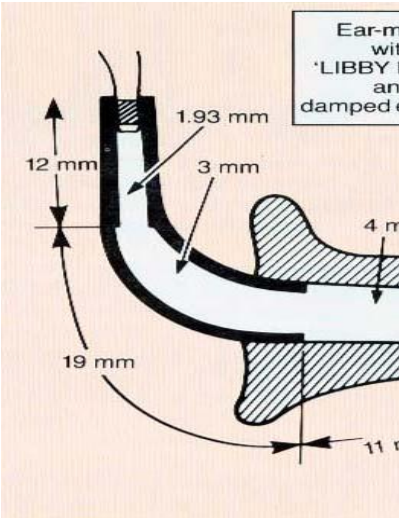


ALAN LOWELL SEMINARS INC.

Attenuators & Acoustic Dampers

- Smooth response in low's
- Dampen peaks
- Reduces gain in low's
- Reduces *Barrel Effect*
- Enhances high's
- Improves sound quality & speech discrimination





Libby Horn

Shell & Ear mold Measurements

• Standard canal length	0.710”
• Standard bore diameter	0.120”
• Shorter canal length	less lows
• Longer canal length	more lows
• Smaller bore diameter	less highs
• Larger bore diameter	less lows
• Standard tube size	Size #13
• Thick Wall	Size #13 (Thick Wall)

(Helps to control acoustic feedback)

ALAN LOWELL SEMINARS INC.

Ear Molds - Styles

Standard - Body Aid
Full Shell - High Gain
Skeleton – Moderate
Half Skeleton-Mild / Moderate
Half Shell – Moderate / Severe
Canal Lock – Mod / Mild
Canal - Mild
CROS Mold
(Jansen; Free Field)

Full Shell

Half Skeleton

CROS

Skeleton

ALAN LOWELL SEMINARS INC.

Earmold Materials

<u>Hard Materials</u>

- Acrylic resin (lucite)
- Ultra violet (photo-polymerization resin)
- Polyethlene

<u>Soft Materials</u>

- Soft-acrylic
- Soft ultra-violet
- Vinyl (PVC)
- Medical grade silicone

Special Earmolds

- Hypoallergenic
- Clear ultra-violet
- Polyethylene
- Clear silicone
- Thin layer of gold

Ear Impressions

Bracing technique

ALAN LOWELL SEMINARS INC.

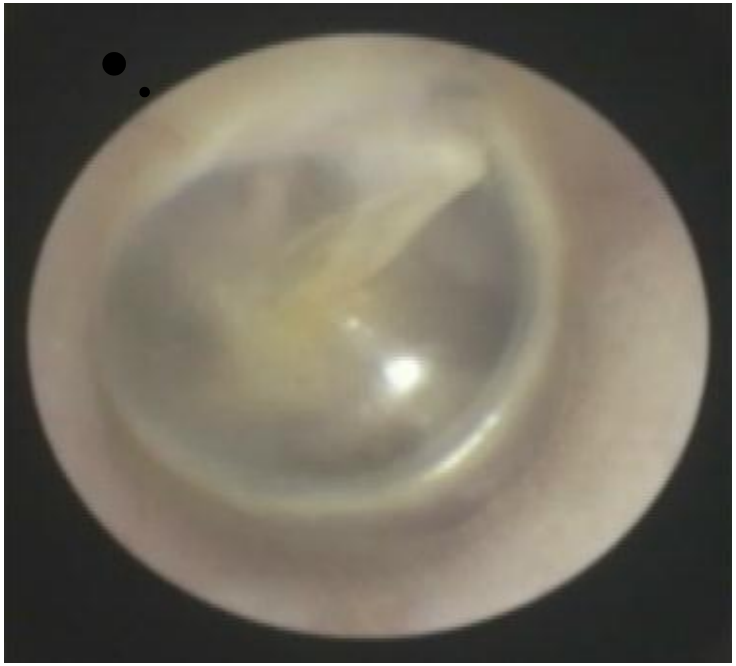
Task Sequence for Impressions

Never allow anyone in your operating space from sides to back of patient

- Otoscopy w/ bracing
- Oto-block placement w/ bracing
- Repeat otoscopy w/ bracing
- Prepare material for insertion
- Impression technique w/ bracing
- Impression removal
- Repeat otoscopy immediately w/ bracing
- Check impression for accuracy

ALAN LOWELL SEMINARS INC.

Otoscopy w bracing prior to taking an Ear Impression



ALAN LOWELL SEMINARS INC.

Oto-block Placement w Bracing

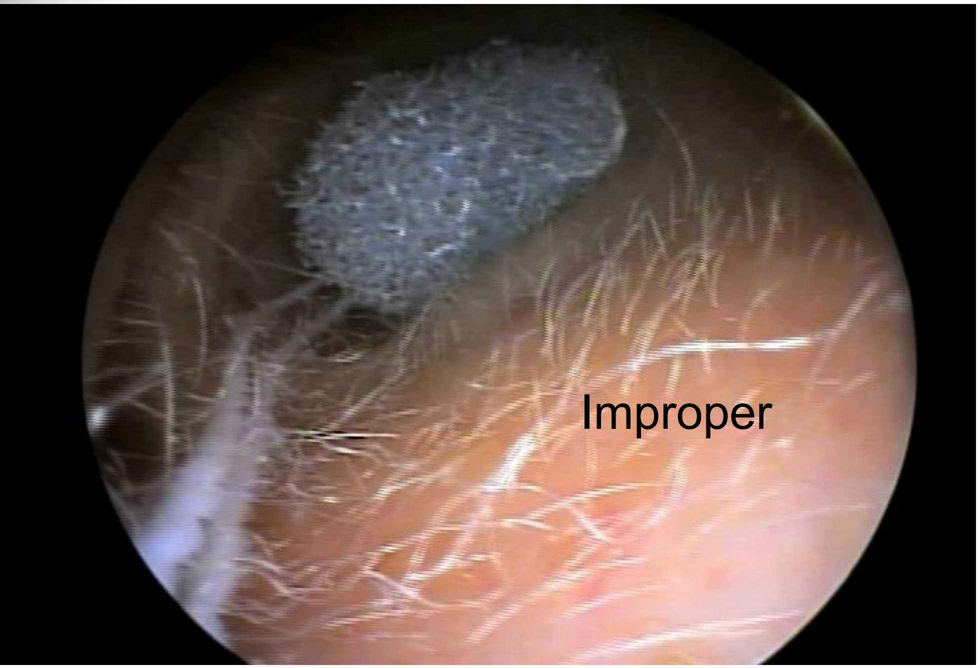
Select proper size oto-block and insert beyond the 2nd bend

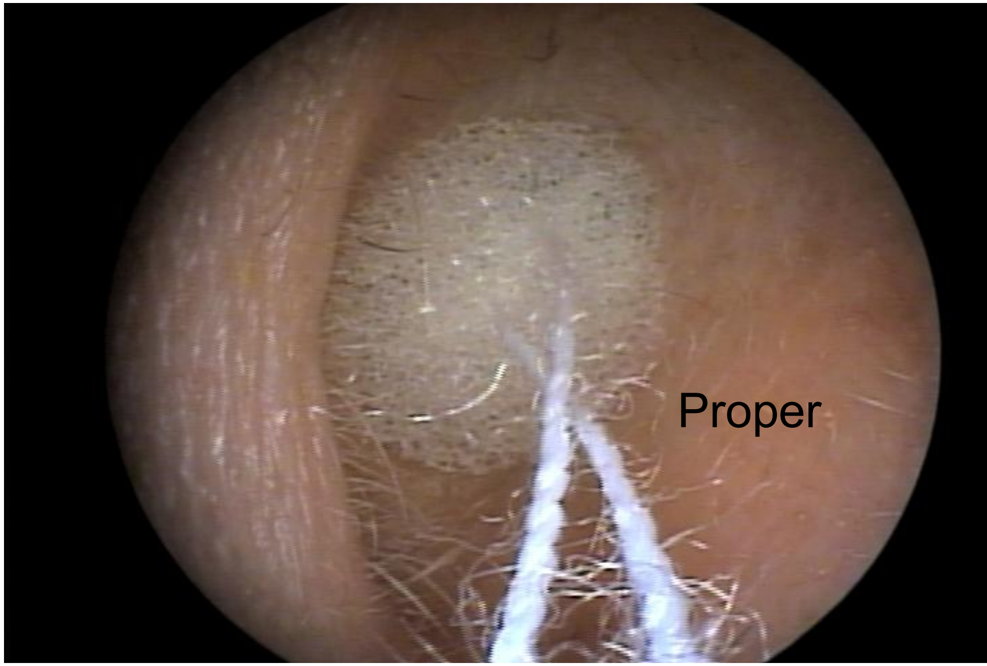
Oto-block must be set to provide a seal in the ear canal and be positioned to avoid "blow-by"

Perform otoscopy to check positioning

ALAN LOWELL SEMINARS INC.

Oto-block placement
(Proper Positioning)





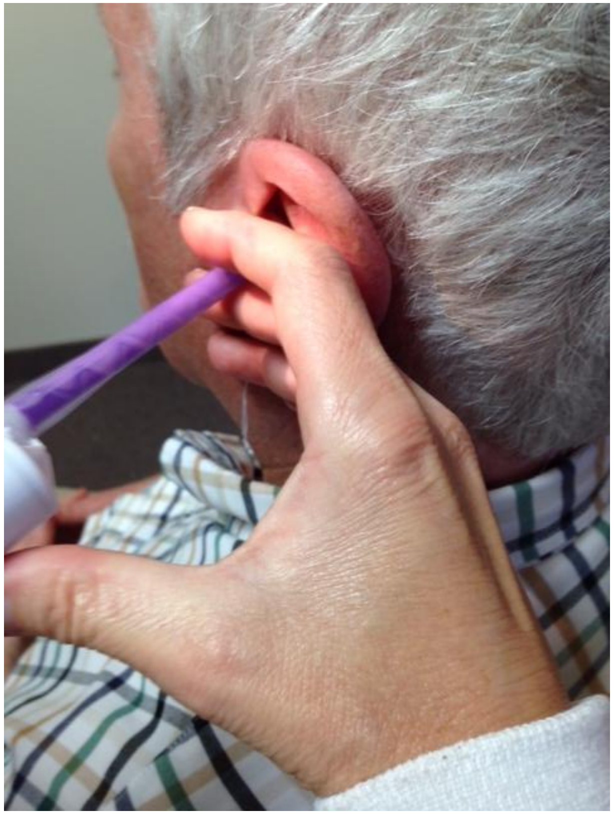
Bridge & Brace Technique
(Impression Gun)

Medical Gloves

ALAN LOWELL SEMINARS INC.

Bridge & Brace Technique
(Syringe)

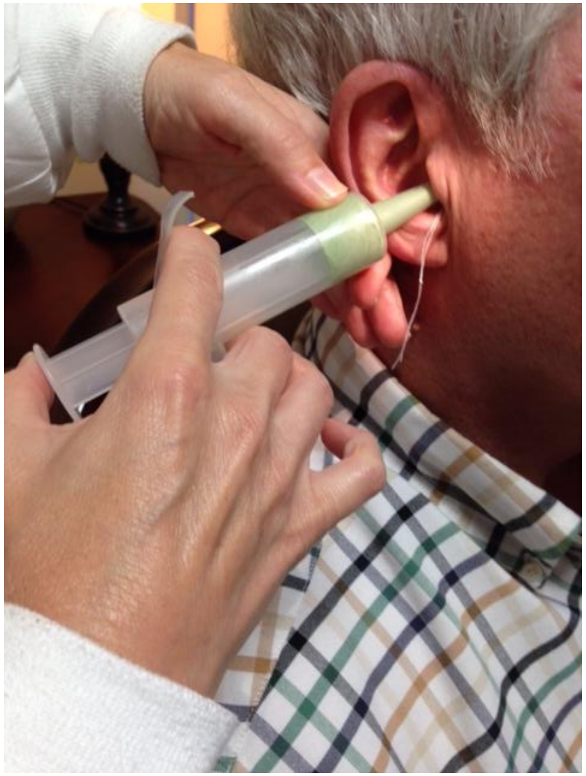
Impressions w various bracing techniques using gun method-Left ear



Medical Gloves should always be worn when taking impressions

ALAN LOWELL SEMINARS INC.

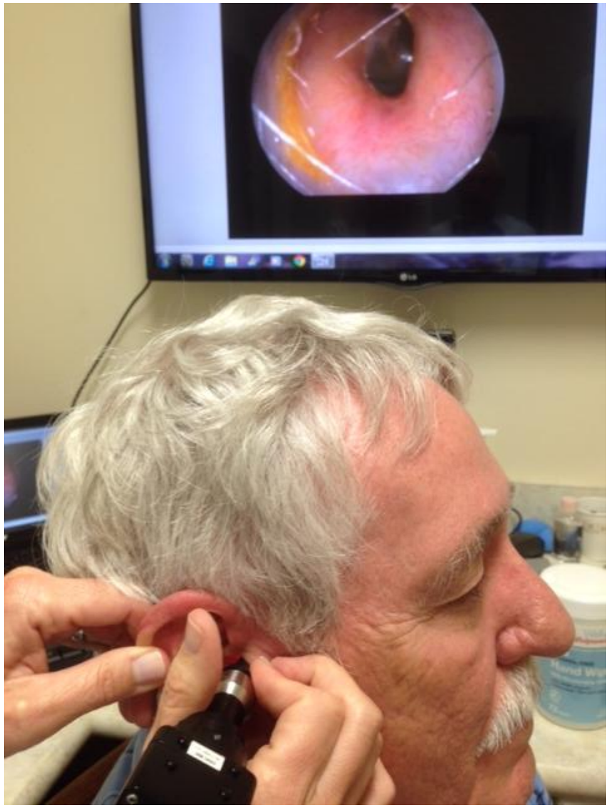
Impressions with various bracing techniques using a syringe method-Right ear



Medical gloves should always be worn when taking impressions

ALAN LOWELL SEMINARS INC.

Repeat Otoscopy

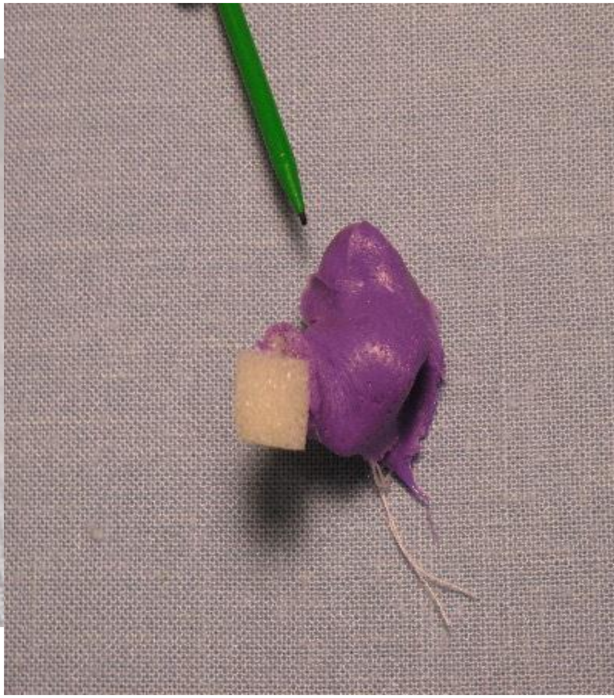


ALAN LOWELL SEMINARS INC.

Check impression for accuracy

Accurate impression”

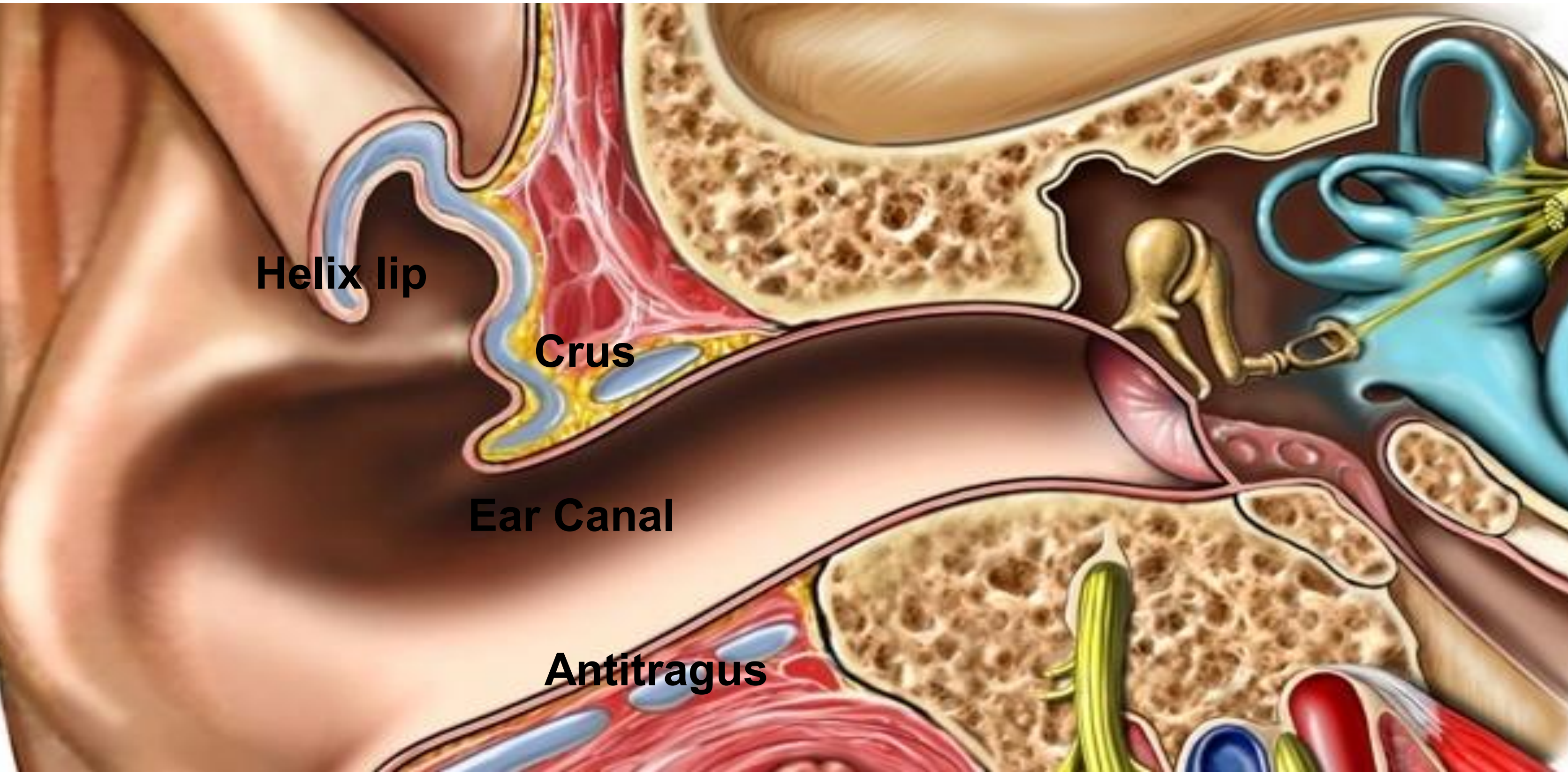
Angled oto-block placement



ALAN LOWELL SEMINARS INC.

Poor Fitting Earmolds / Custom Devices

May cause discomfort, sores & infections

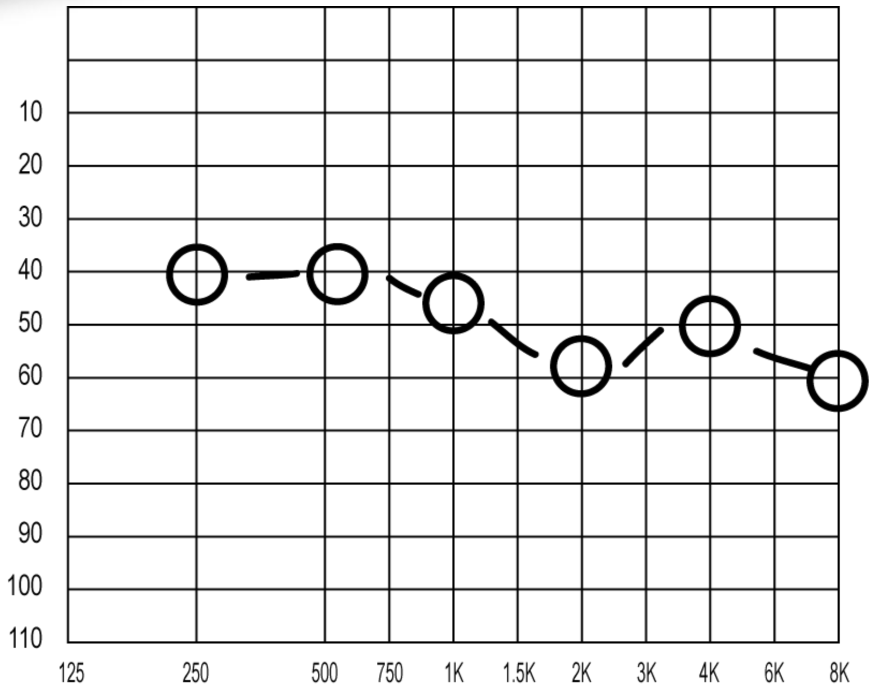


Audiogram Vs. Matrix

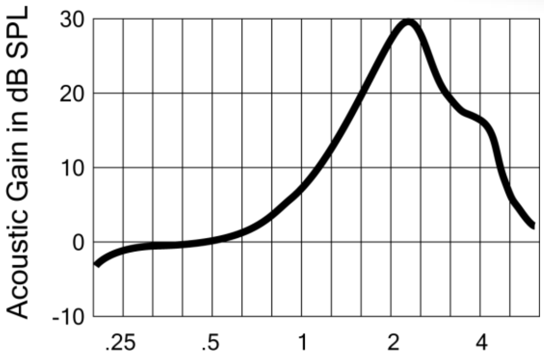
Application & Selection

ALAN LOWELL SEMINARS INC.

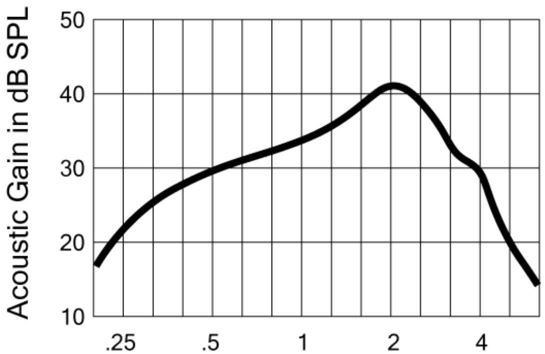
Audiogram Vs. Matrix #1



Ear Fitted	Left	Right	Binaural
SRT	dB	**50** dB	
MCL	dB	**80** dB	
UCL	dB	**95** dB	
Discrim. %	%	%	



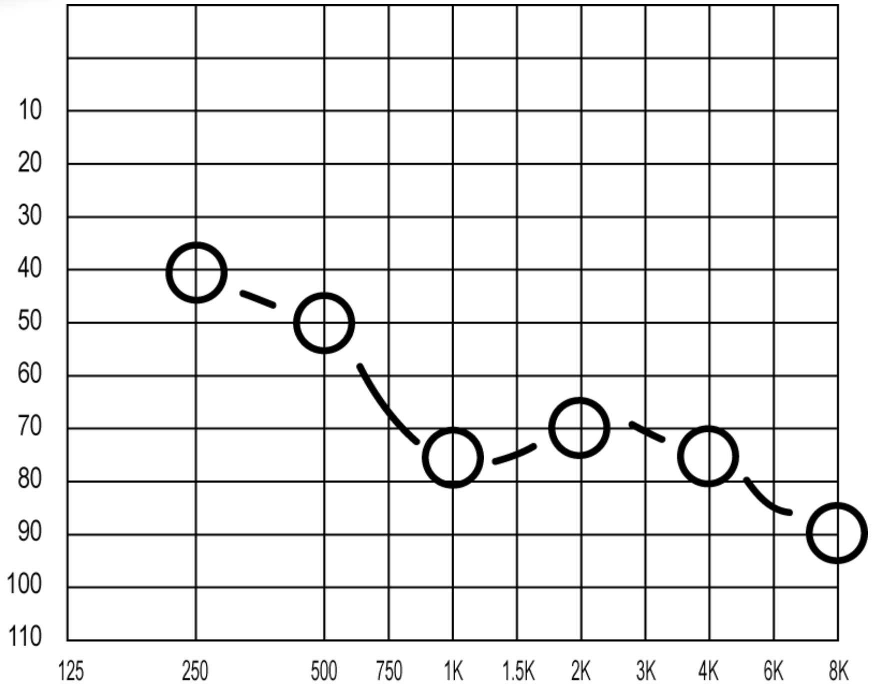
H.F. Avg. Full-on-Gain = 19 dB
H.F. Avg. SSPL90 = 103 dB



H.F. Avg. Full-on-Gain = 36 dB
H.F. Avg. SSPL90 = 110 dB

ALAN LOWELL SEMINARS INC.

Audiogram Vs. Matrix #2



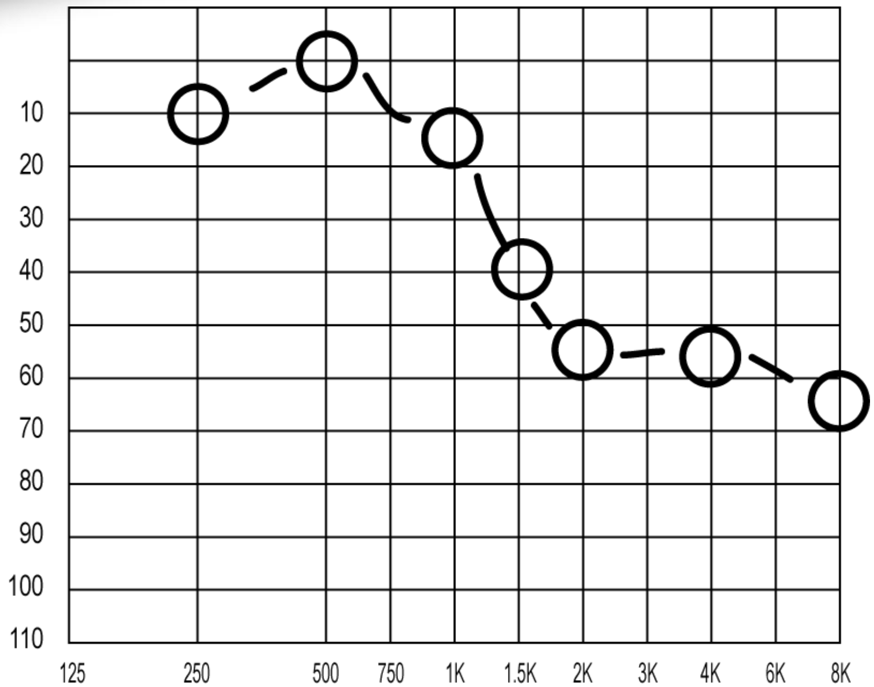
Ear Fitted	Left	Right	Binaural
SRT	dB	75 dB	
MCL	dB	95 dB	
UCL	dB	105 dB	
Discrim. %	%	%	

- 125 / 60 / Prog.
- H.F. Avg. 55 dB

- 103 / 25 / Prog.
- H.F. Avg. 17 dB

ALAN LOWELL SEMINARS INC.

Audiogram Vs. Matrix #3



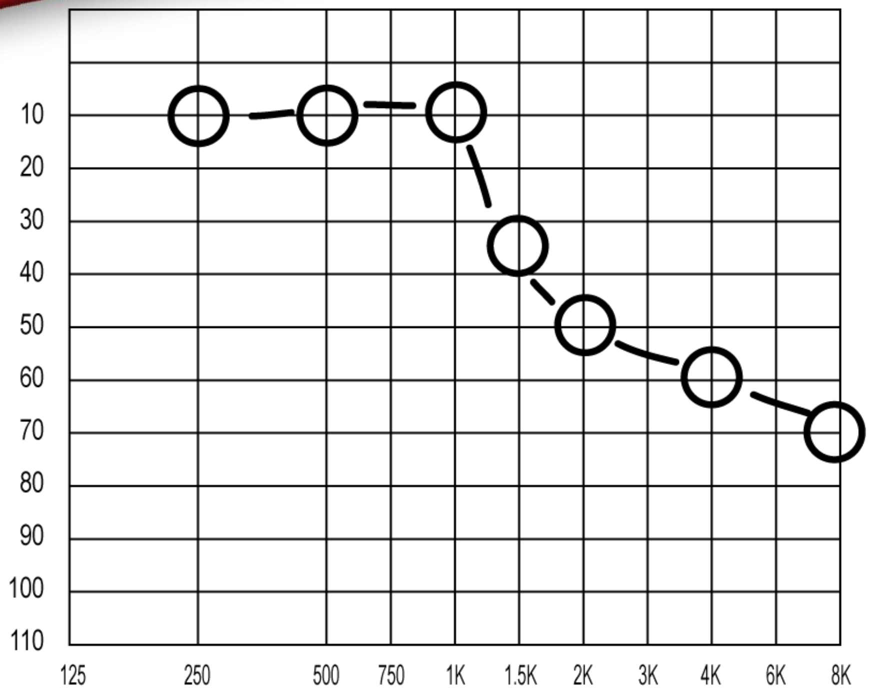
Ear Fitted	Left	Right	Binaural
SRT	dB	35 dB	
MCL	dB	75 dB	
UCL	dB	95 dB	
Discrim. %	%	%	

- 120 / 45 / Prog.
- H.F. Avg. 38 dB

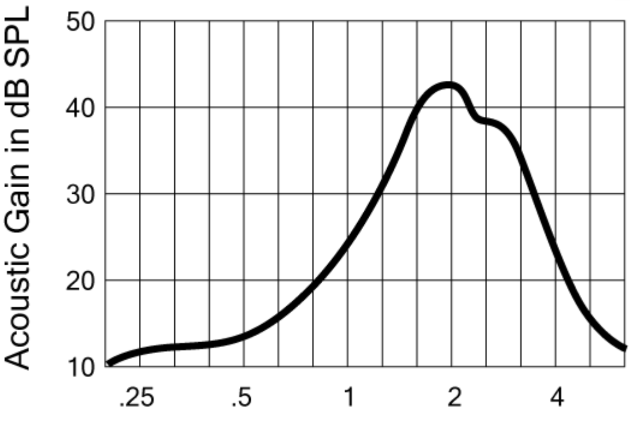
- 97 / 25 / Prog.
- H.F. Avg. 15 dB

ALAN LOWELL SEMINARS INC.

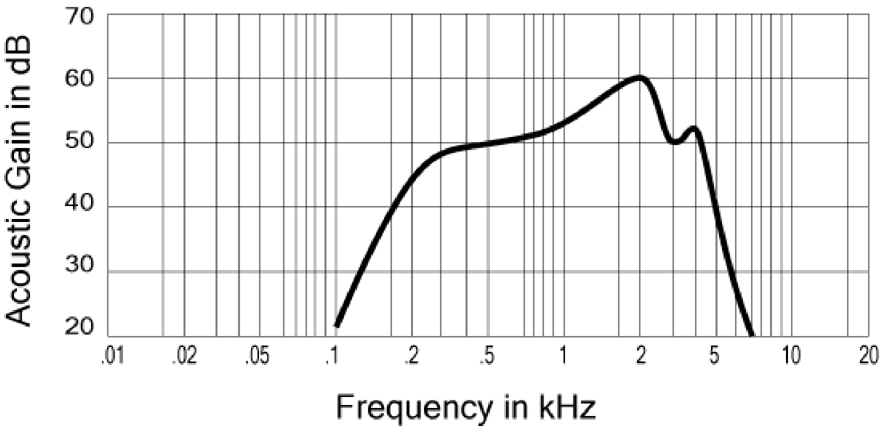
Audiogram Vs. Matrix #4



Ear Fitted	Left	Right	Binaural
SRT	dB	**0** dB	
MCL	dB	**70** dB	
UCL	dB	**100** dB	
DIscrim. %	%	%	



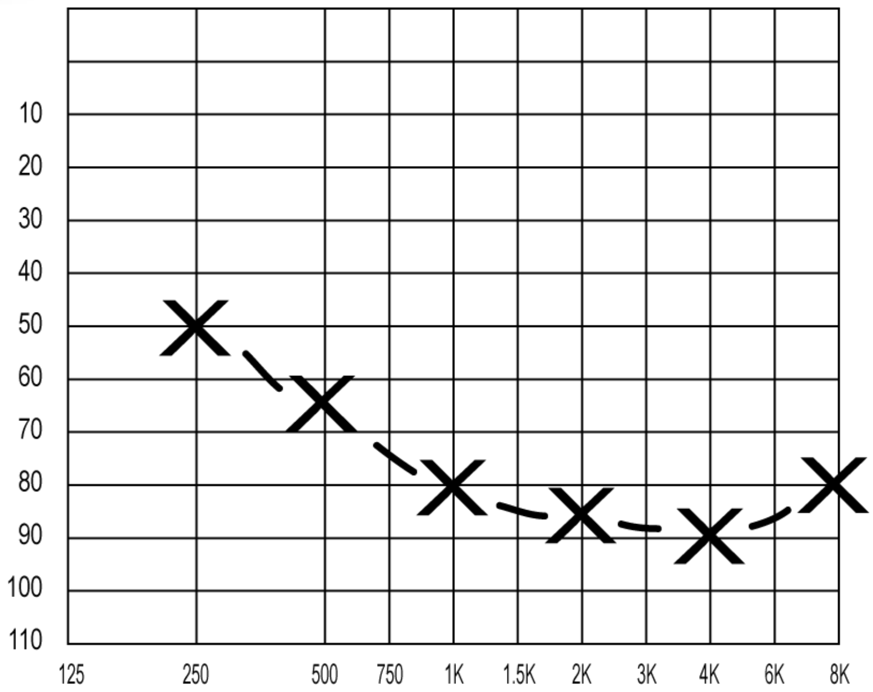
H.F. Avg. Full-on-Gain = 35 dB
H.F. Avg. SSPL90 = 114 dB



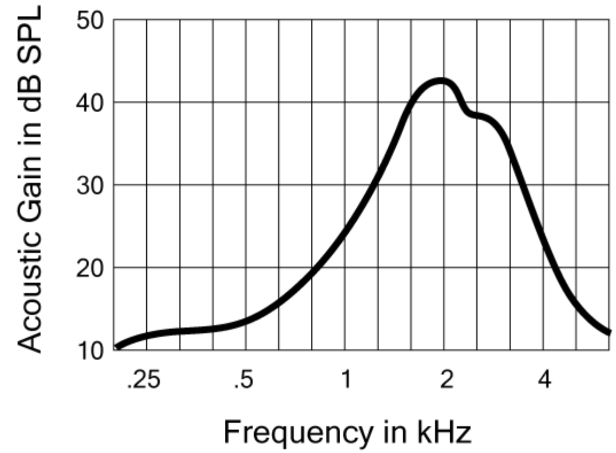
H.F. Avg. Full-on-Gain = 52 dB
H.F. Avg. SSPL90 = 123 dB

ALAN LOWELL SEMINARS INC.

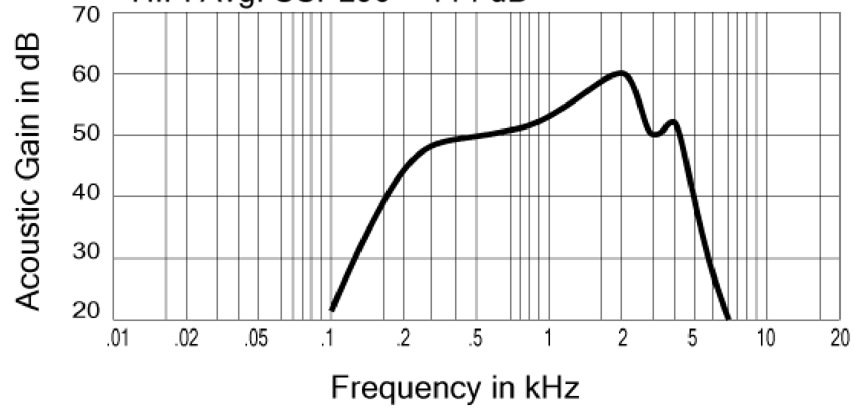
Audiogram Vs. Matrix #5



Ear Fitted	Left	Right	Binaural
SRT	**85** dB	dB	
MCL	**105** dB	dB	
UCL	**110** dB	dB	
Discrim. %	%	%	



H.F. Avg. Full-on-Gain = 35 dB
H.F. Avg. SSPL90 = 114 dB



H.F. Avg. Full-on-Gain = 52 dB
H.F. Avg. SSPL90 = 123 dB

ALAN LOWELL SEMINARS INC.

Circuitry

- Class A
- Class B
- Class D
- LDFR
- BILL
- TILL
- PILL
- ASP
- Analog
- Digital Programmable
- DSP

Channel Vs. Band

- **Channel**: refers to a frequency region that is processed separately & independently. A clear division between channels and independent processing for each channel.
- **Band**: refers to frequency region that is filtered. (Single channel circuits may have multiple regions that are filtered)

Digital Signal Processing (DSP)

- Multi-channel
- Numerous compression options
- Numerous fitting algorithms
- Digital clarity
- Sampling Rate*
- High resolution-less distortion-less error Vs. analog*
- Cleaner sound
- Multiple user programs
- Maximum audibility & comfort
- More resistant to wear & tear

ALAN LOWELL SEMINARS INC.

What makes digital digital?

Two step Process known as ***sampling and quantization (bits)***

High resolution modulator that incorporates:

- High level input compression
- Analog-Digital Converter
- Sampling rate (measured in Hz@ twice the highest frequency of the device)
- Binary Coding System (numerical representation -quantization)
- Digital Noise Reduction (DNR) technology (recognizes and automatically reduces noise levels)
- Digital Feedback Reduction (DFR) technology (automatically controls feedback using phase cancelling technology)

ALAN LOWELL SEMINARS INC.

Analog Signals

- Continuously vary over time and, therefore, are subjected to more noise, error, distortion and
wear & tear….*Less life!*

ALAN LOWELL SEMINARS INC.

Hearing devices that communicate with each other

Synchronization

ALAN LOWELL SEMINARS INC.

Benefits of Synchronization

Improved SNR hearing

Auditory localization

Loudness summation

Reduction of head shadow effect (6-7 dB)

Improved sound quality

Programming

ALAN LOWELL SEMINARS INC.

NOAH

Input Patient Info & Audiometric Data

- Registered name of a computer program for hearing aid fitting, developed to serve as an industry standard platform for programming hearing devices

- Universally used to program all programmable hearing aids

Key Elements

- Checking for proper hook-up & cables
- Use fresh batteries (if applicable)
- Selecting desired Rx formula for targets
- Program without patient present before delivery
- Select target gain screen in Output or Gain
- Set all user programs
- Replace battery after programming

ALAN LOWELL SEMINARS INC.

Programming Key Elements-continued

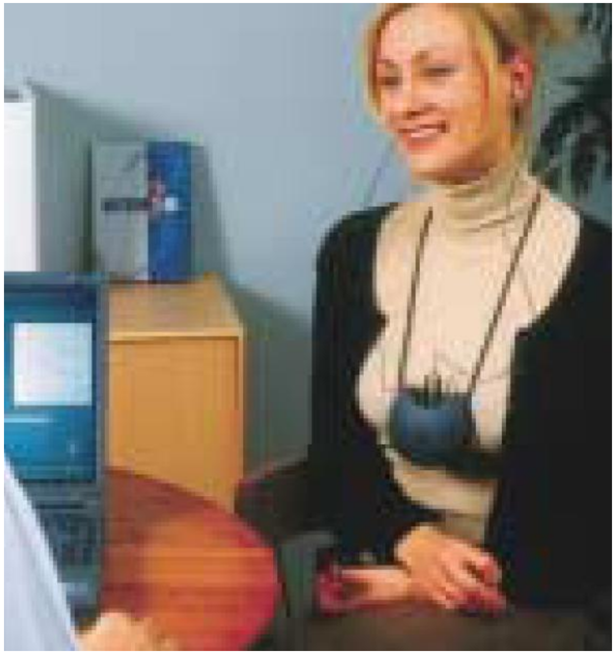
- Compression options
- Threshold knee points
- Compression ratios
- Fitting assistance tools
- Feedback management options
- Tinnitus options

ALAN LOWELL SEMINARS INC.

Hi-Pro Box


HI-PRO USB – proven technology
designed for the future
HI-PRO USB
Left
Right
PC Com
Power
HI-PRO USB

NOAH Link



ompletely Wireless Programming Devic

Rx Fitting Formulas

- Fitting targets are determined by selecting an appropriate fitting formula (software specific):

- Pogo II — Severe-Profound
- NAL (R) Revised — Mild-Moderate
- Berger — Flat Loss Configurations
- DSL I/O — Analog (originally developed for infants & children)
- *Other manufacturers proprietary fitting formulas…*

ALAN LOWELL SEMINARS INC.

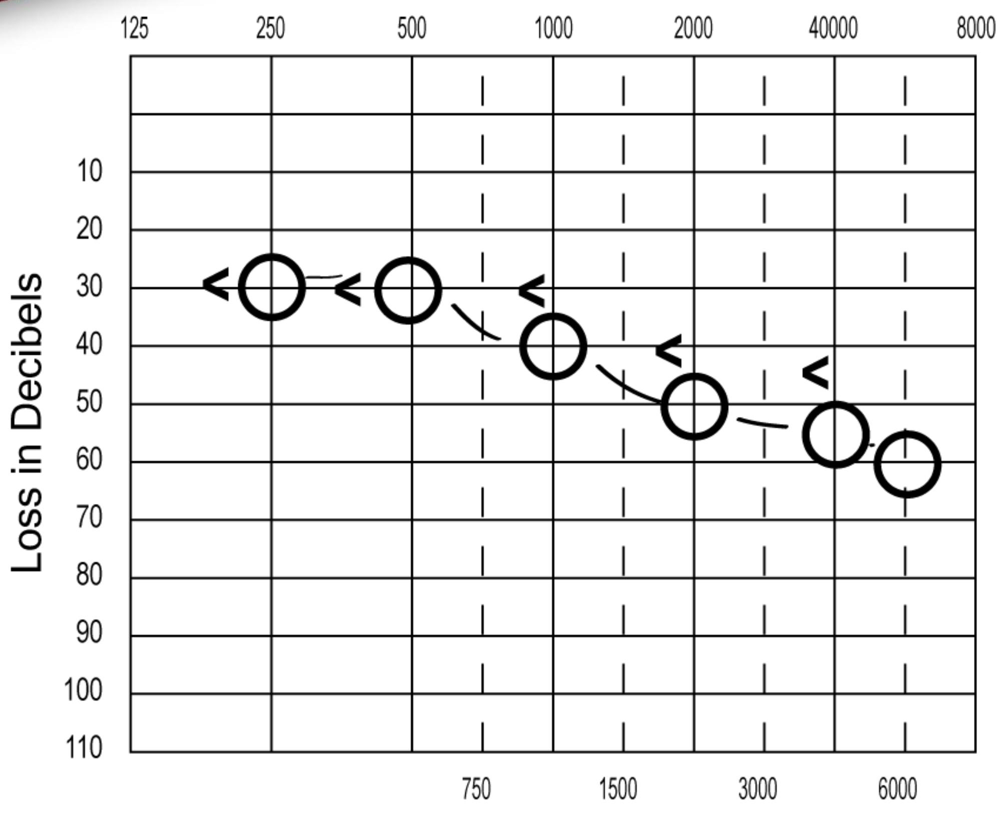
Program “by the steps”

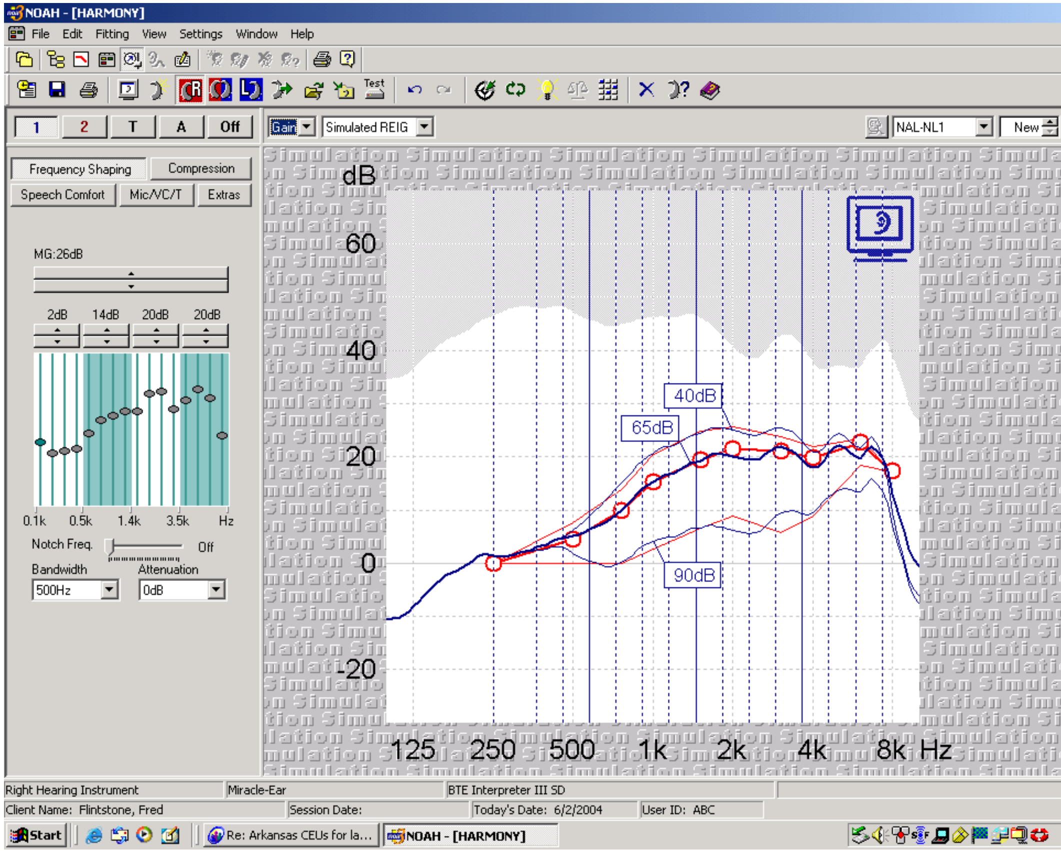
1. Input pure tone air thresholds & discrete UCL’s into software
2. Select Rx formula or accept software default
3. Insert fresh batteries (if applicable)*
4. Connect devices
5. Perform biological check & program “Best Fit” clinical settings
6. Schedule fitting appointment
7. Tweak fitting

* Always replace batteries(if applicable) after every programming session

Gain Screen

(On Target)

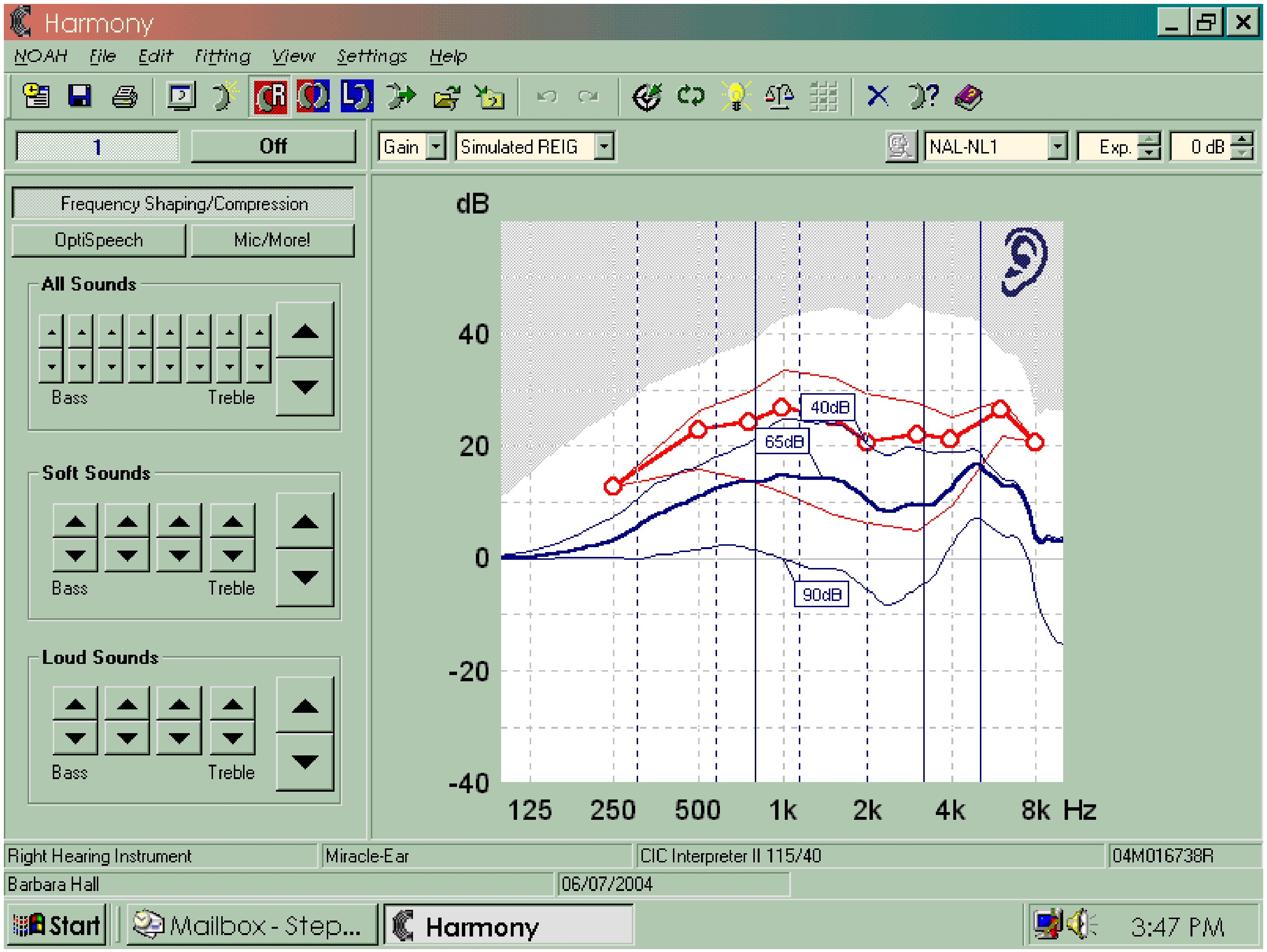




Frequency in Hz

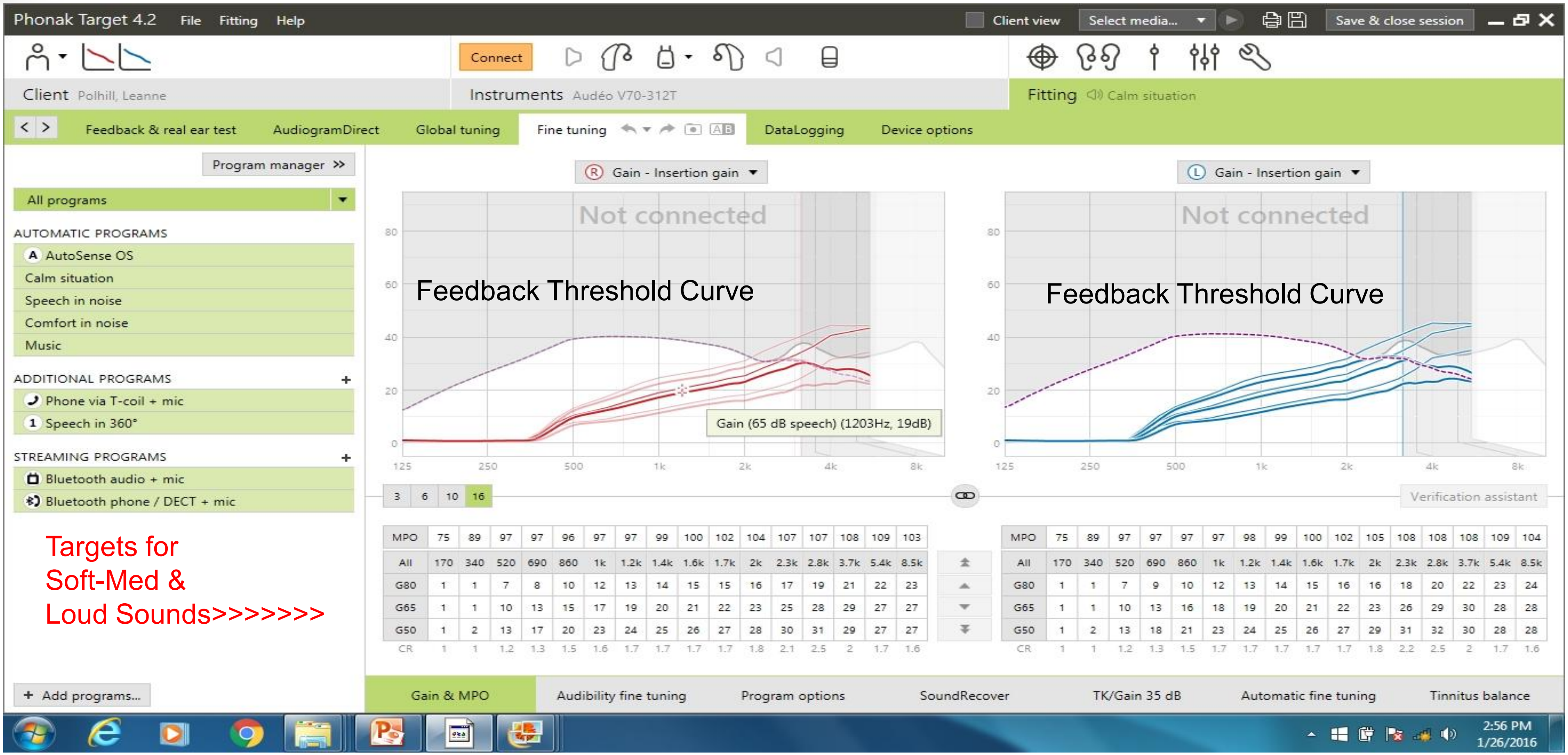
ALAN LOWELL SEMINARS INC.

Gain Screen
(Under Target)



ALAN LOWELL SEMINARS INC.

Target for Normal speech 65dB



MPO	75	89	97	97	96	97	97	99	100	102	104	107	107	108	109	103
All	170	340	520	690	860	1k	1.2k	1.4k	1.6k	1.7k	2k	2.3k	2.8k	3.7k	5.4k	8.5k
G80	1	1	7	8	10	12	13	14	15	15	16	17	19	21	22	23
G65	1	1	10	13	15	17	19	20	21	22	23	25	28	29	27	27
G50	1	2	13	17	20	23	24	25	26	27	28	30	31	29	27	27
CR	1	1	1.2	1.3	1.5	1.6	1.7	1.7	1.7	1.7	1.8	2.1	2.5	2	1.7	1.6

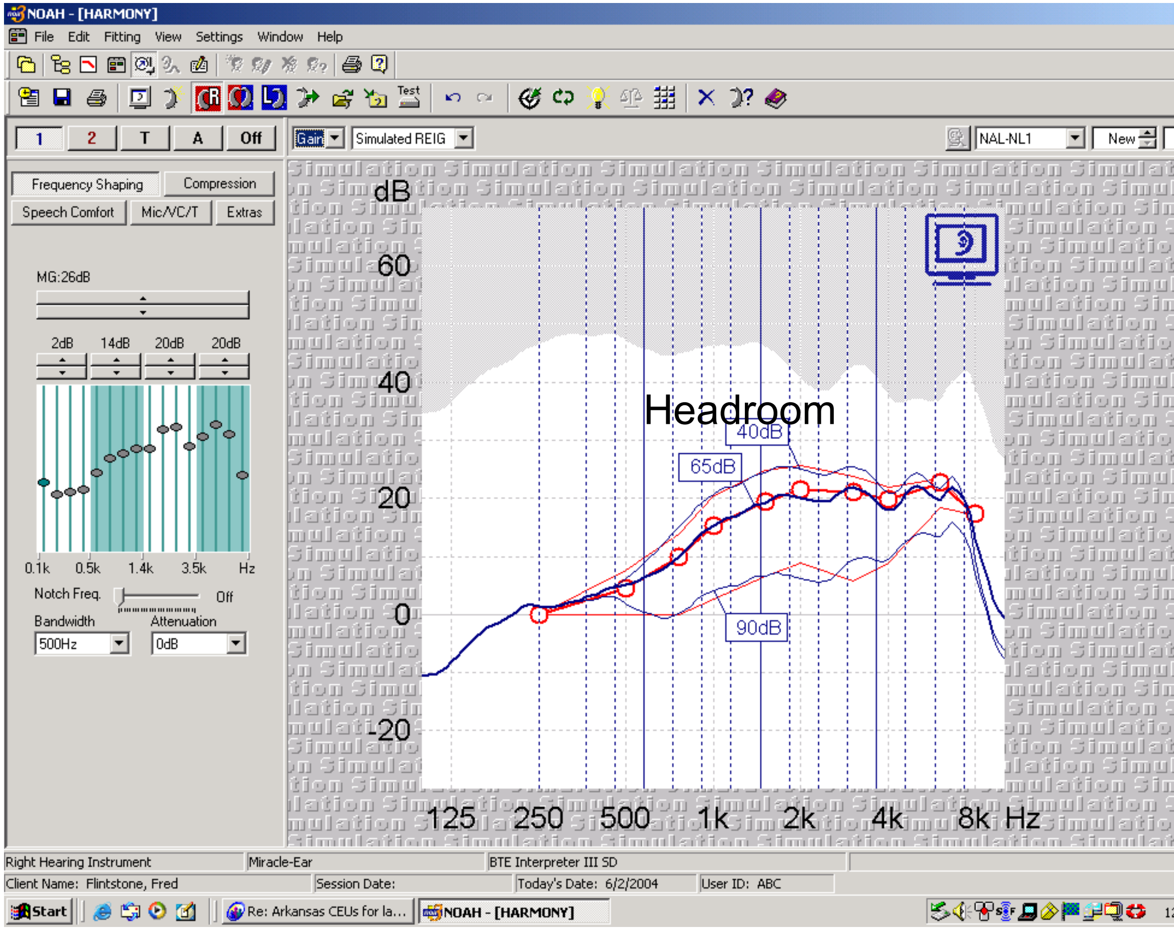
MPO	75	89	97	97	97	97	98	99	100	102	105	108	108	108	109	104
All	170	340	520	690	860	1k	1.2k	1.4k	1.6k	1.7k	2k	2.3k	2.8k	3.7k	5.4k	8.5k
G80	1	1	7	9	10	12	13	14	15	16	16	18	20	22	23	24
G65	1	1	10	13	16	18	19	20	21	22	23	26	29	30	28	28
G50	1	2	13	18	21	23	24	25	26	27	29	31	32	30	28	28
CR	1	1	1.2	1.3	1.5	1.7	1.7	1.7	1.7	1.7	1.8	2.2	2.5	2	1.7	1.6

ALAN LOWELL SEMINARS INC.

Headroom

(On Target)

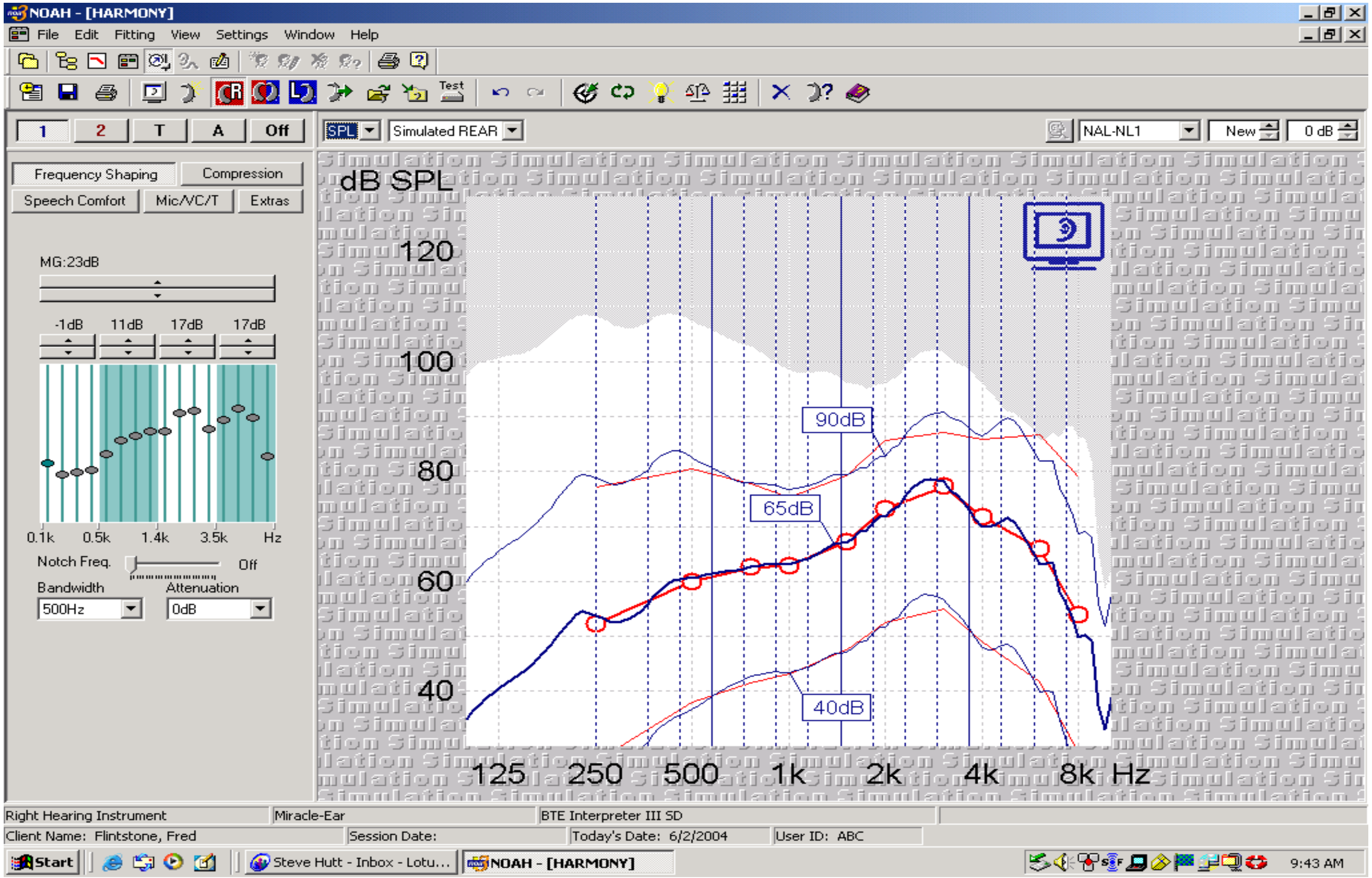
Residual dynamic range of a hearing aid based on a given output such as gain worn at MCL and the saturation of the device



ALAN LOWELL SEMINARS INC.

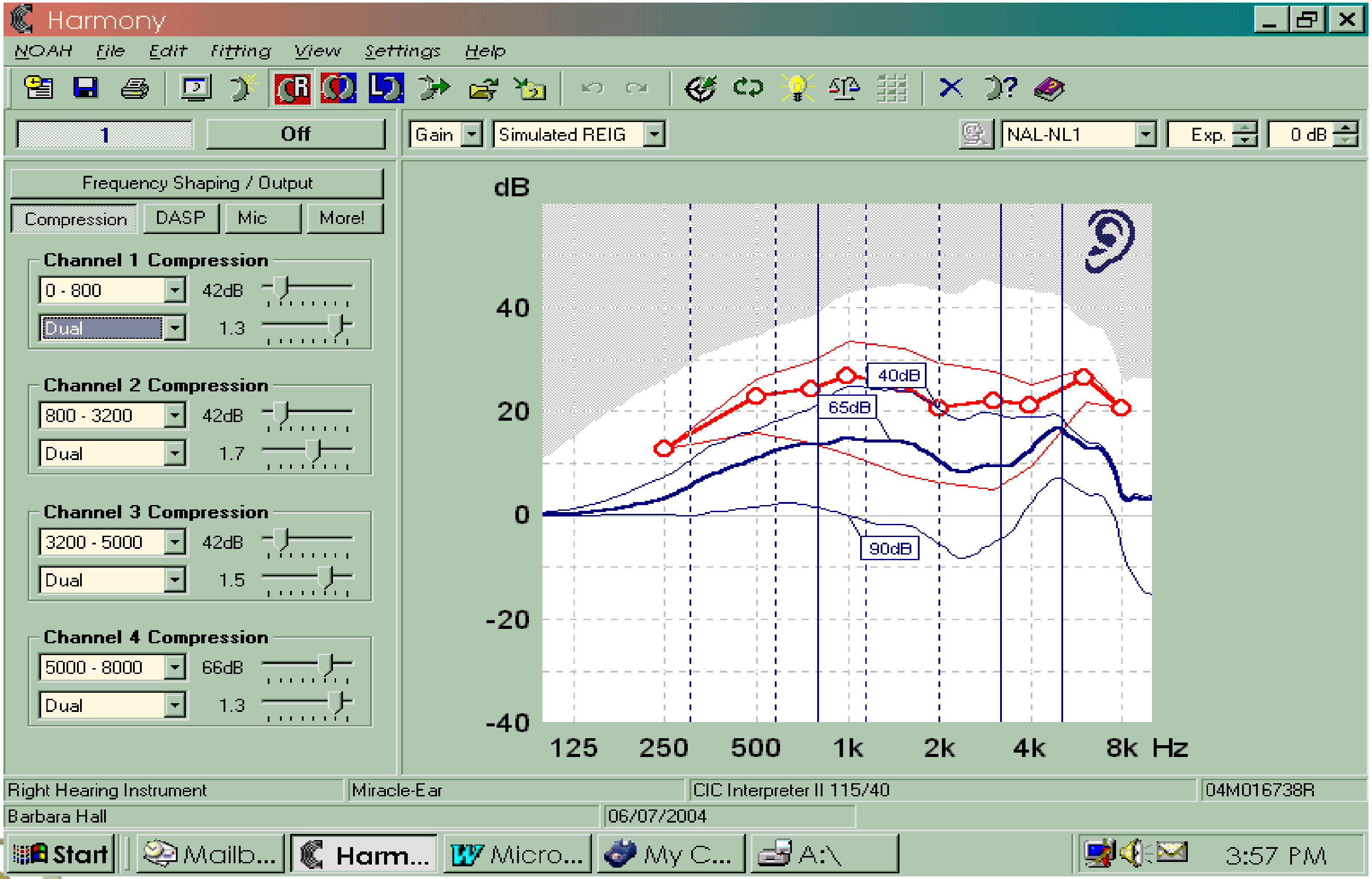
SPL Output Screen

(On Target)



ALAN LOWELL SEMINARS INC.

Compression Screen
(Under Target)



ALAN LOWELL SEMINARS INC.

Programming Options

Prescriptive Formulas

Device & Receiver Selection based n Degree of Hearing Loss

Compression Options (TK-Ratio)

Multiple Program Settings

Whistle Block

Noise Block

Sound Relax

*Echo Block

*Feedback Check

*Accessory Pairing & Streaming

*Frequency Transposition

*Tinnitus Management Features

*Device Signals & Alerts

*Percentage of Targets based on Experience-Age & Degree of Hearing Loss

ALAN LOWELL SEMINARS INC.

Frequency Transposition

ALAN LOWELL SEMINARS INC.

Program Fitting Assistant Applications

Refer to Course Additions study materials

ALAN LOWELL SEMINARS INC.

Fitting Verification & Validation

ALAN LOWELL SEMINARS INC.

Sound Field Testing

An Objective - *Fitting Verification*

Aided Vs Unaided

A measure of functional gain

ALAN LOWELL SEMINARS INC.

Sound Field

A room or area where sound occurs that may contain furniture or materials

A room where a hearing test is given

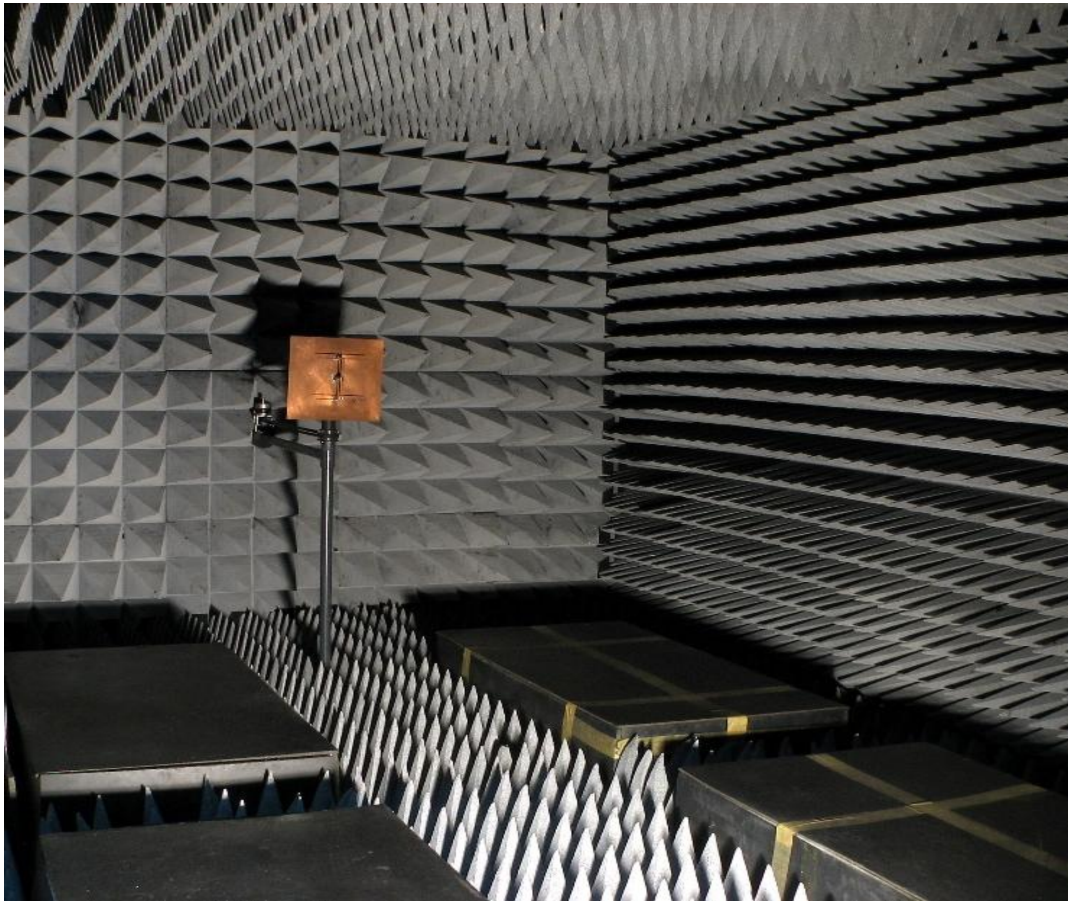
A sound booth

ALAN LOWELL SEMINARS INC.

Free Field
(Anechoic Chamber)

A field free of any materials or objects that will result in absorption or reflection of sound

Anechoic Chamber



ALAN LOWELL SEMINARS INC.

Why Do Sound Field Testing?

- Sound field testing provides an **unbiased** measure of improvement a patient receives with and without hearing aid(s) worn

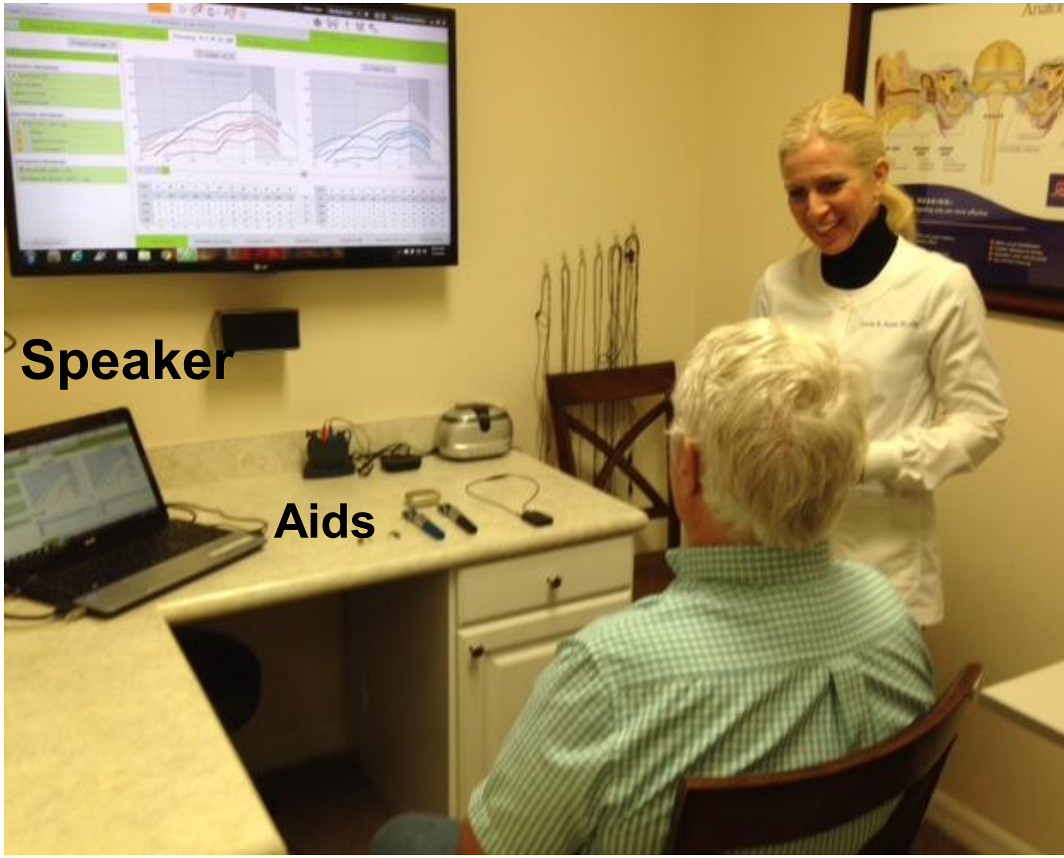
- Aided Vs Unaided Sound Field Testing….

Unaided Sound Field Testing in Quiet

Position speaker **3 ft (1 meter)** in front or back of patient

Present 25 phonetically balanced words at **65 dB SPL**

Score % of words repeated correctly = **Unaided Sound Field Score**



ALAN LOWELL SEMINARS INC.

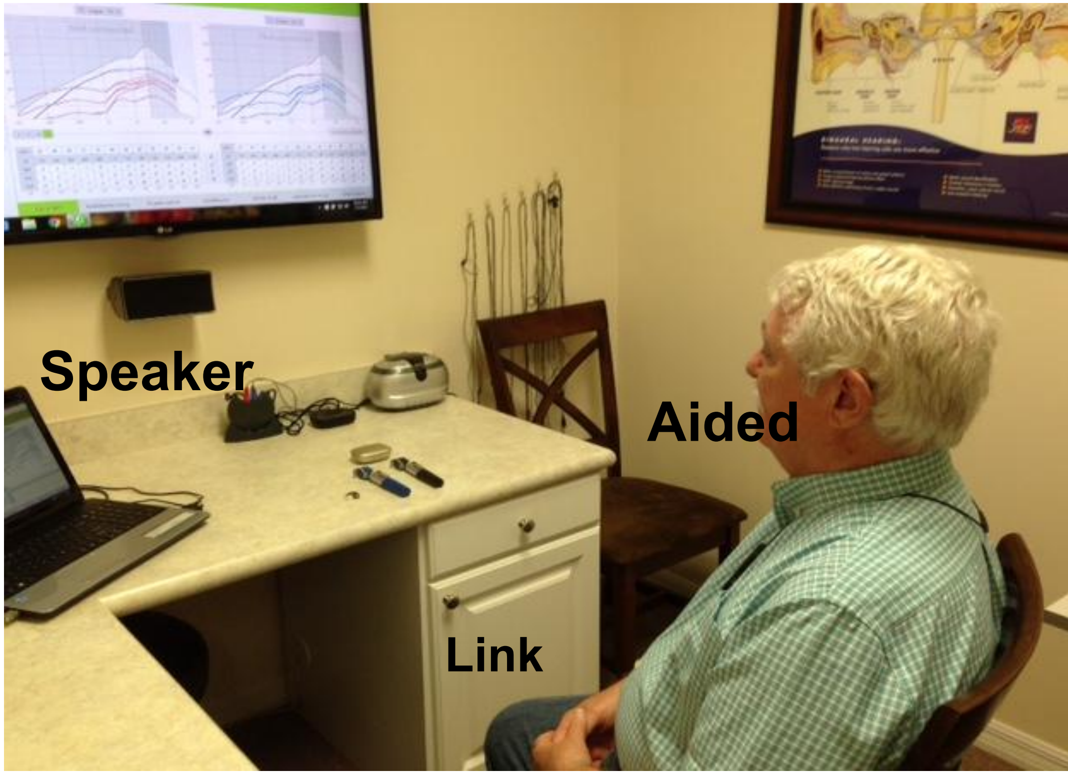
Aided Sound Field Testing in Quiet

Position speaker **3 ft (1 meter)** in front or back of patient (speaker must remain in same position as unaided test)

Set hearing aid(s) worn at **<u>MCL</u>**

Present 25 phonetically balanced words at **<u>65 dB SPL</u>**

Score % of words repeated correctly = **<u>Aided Sound Field Score</u>**



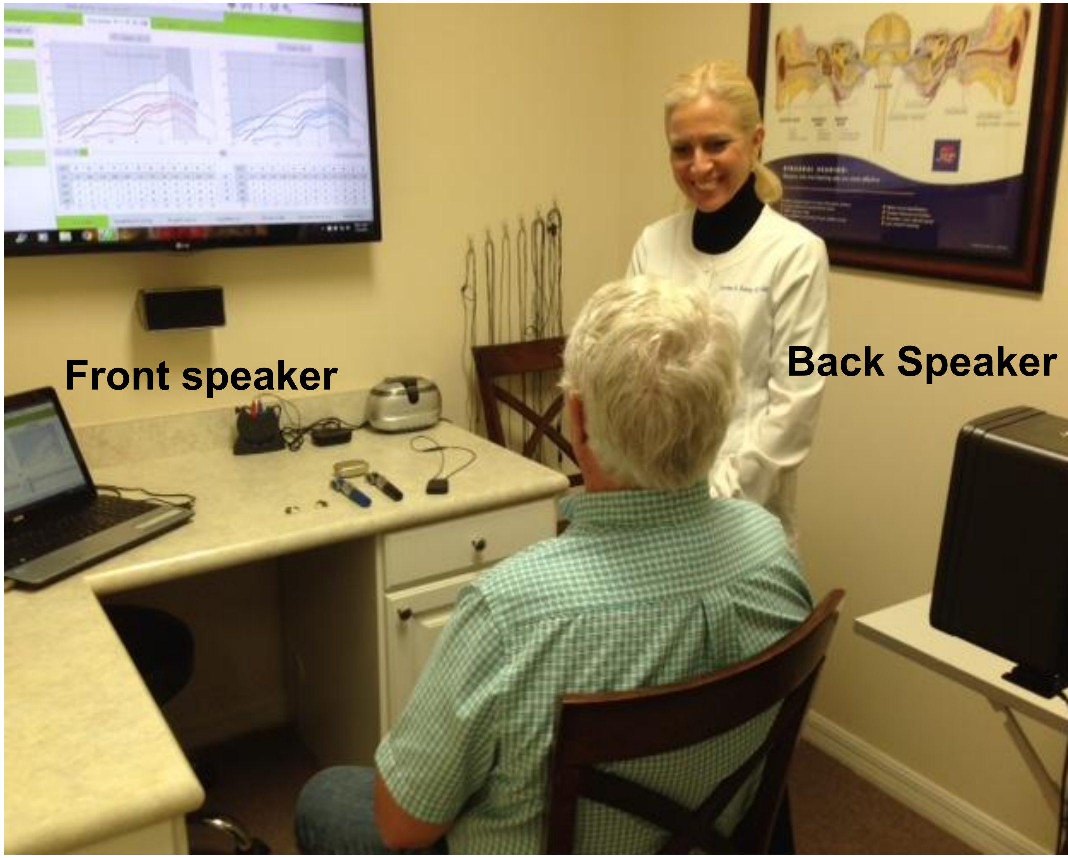
ALAN LOWELL SEMINARS INC.

Aided Vs. Unaided Sound Field in Noise

Repeat all steps exactly the same way

Place second speaker **3 ft (1 meter)** in front or back of patient

Present noise (white noise, restaurant noise, etc.)
<u>10 dB lower than signal</u> = <u>Unaided Vs. Aided Sound Field in Noise</u>



ALAN LOWELL SEMINARS INC.

Aided Vs. Unaided Sound Field

Quiet

- Unaided = 32%
- Aided = 88%

Noise

- Unaided = 28%
- Aided = 84%

ALAN LOWELL SEMINARS INC.

Real Ear Measurements / Live Speech Mapping

An Objective - *Fitting Verification*

Probe Mic & Reference Mic

In-situ (on site, aid worn)

Target gain via prescriptive method

REUR Real Ear Unaided Response

REAR Real Ear Aided Response

REIR Real Ear Insertion Response

REOR Real Ear Occluded Response

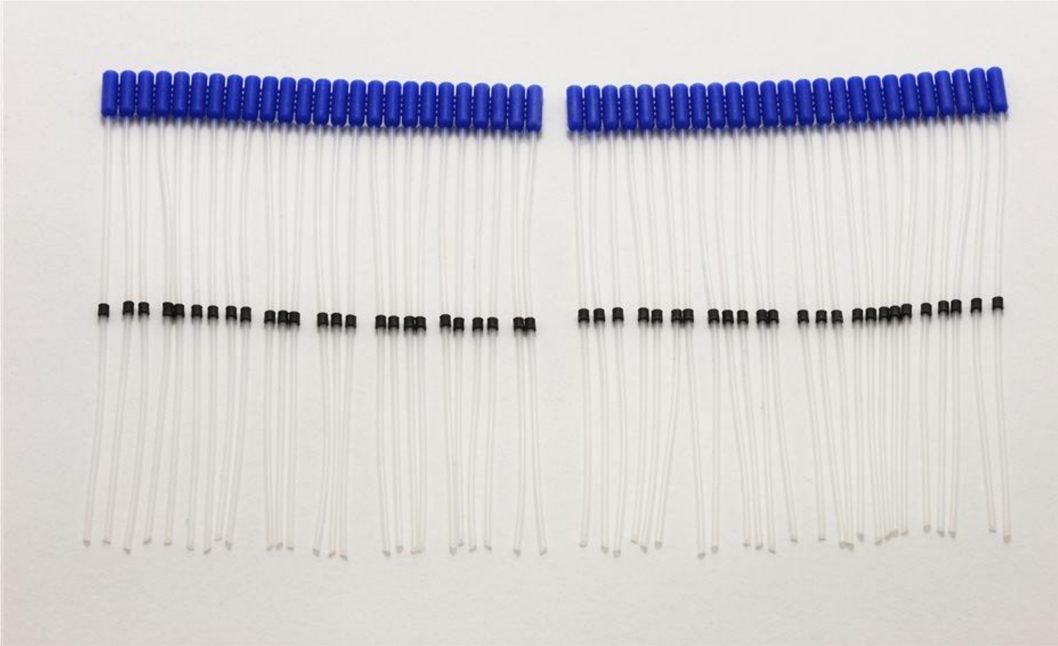
RESR Real Ear Saturation Response

Functional Gain = REAR - REUR

ALAN LOWELL SEMINARS INC.

Calibrate Before Use

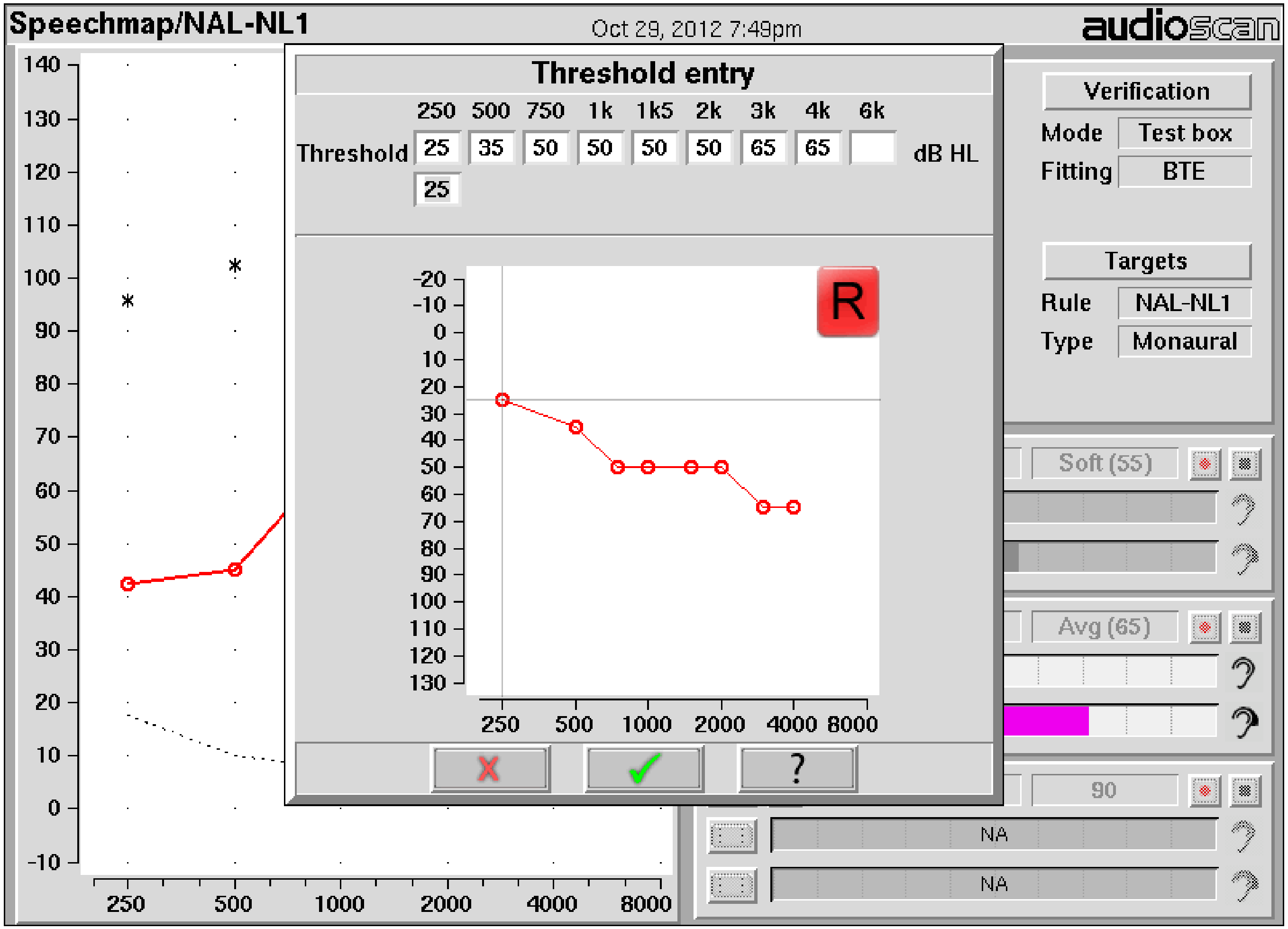
Reference Mic



Probe mic-one time use or retain in patient file

ALAN LOWELL SEMINARS INC.

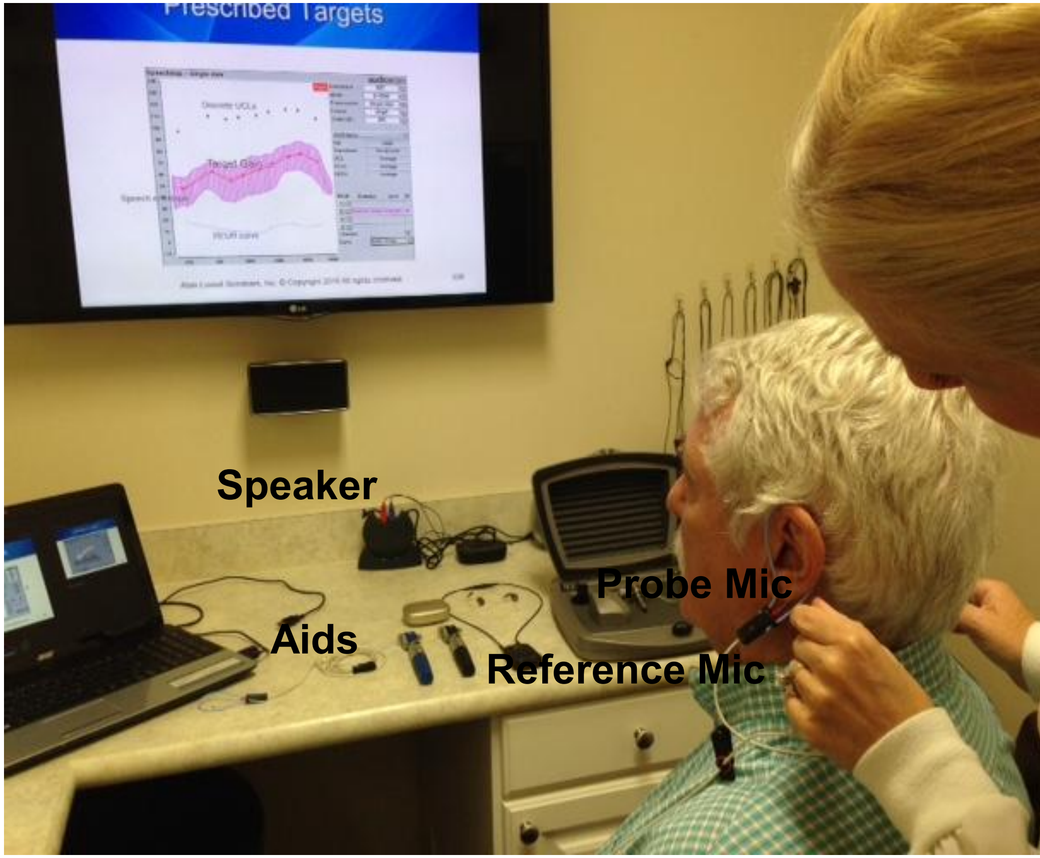
Audiogram Entry



Phase One-Unaided

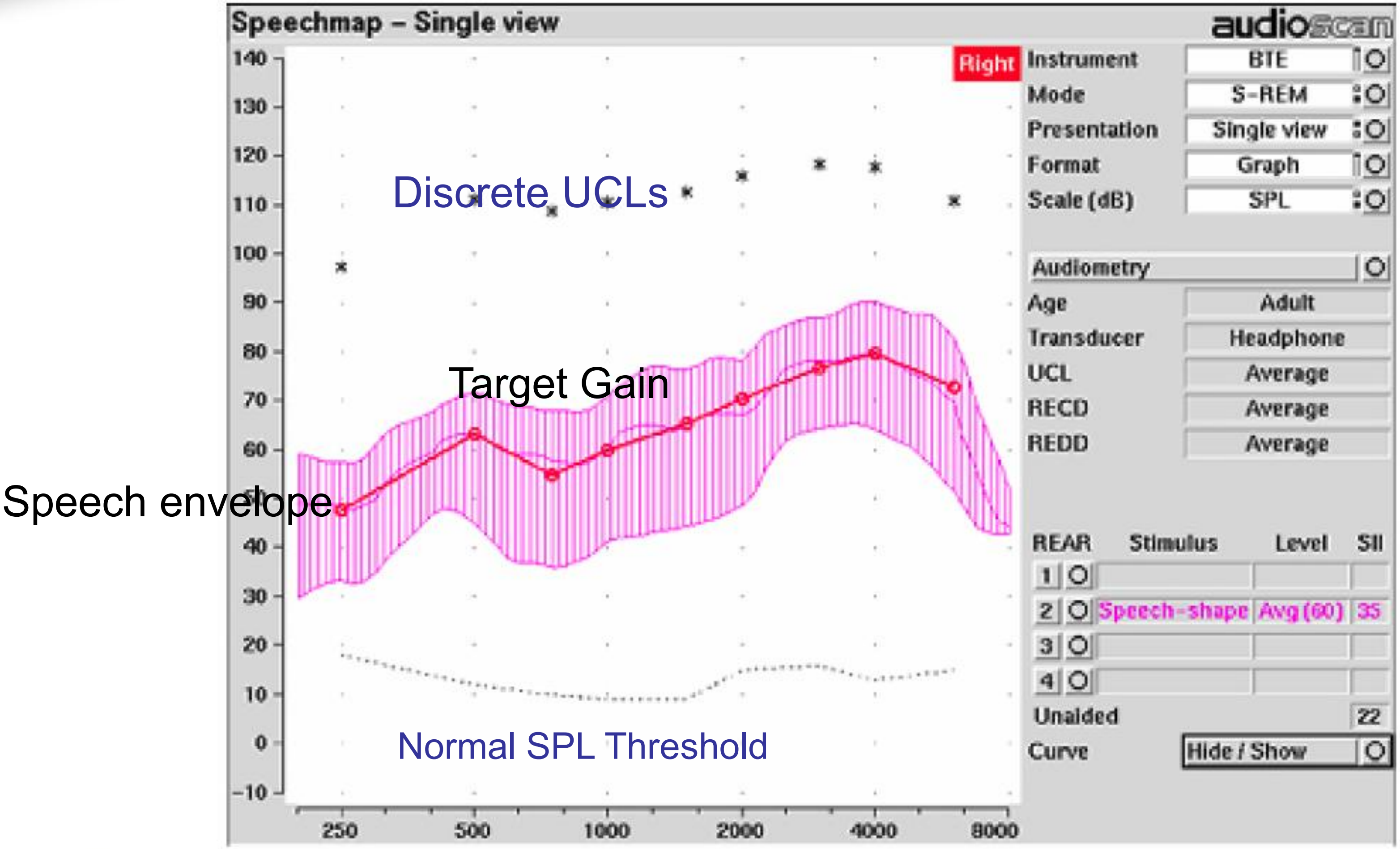
Phase One-Unaided Measurements

1. Input audiometric data & UCL’s
2. Calibrate reference & probe mic
3. Position patient 1 meter from speaker
4. Insert Probe mic 5-6 mm form TM
5. Place reference mic outside the ear
6. Present “normal” speech or pure tone sweep
7. **Establish REUR**



ALAN LOWELL SEMINARS INC.

Prescribed Targets



ALAN LOWELL SEMINARS INC.

Phase Two-Aided

<u>Phase Two-Aided Measurements</u>

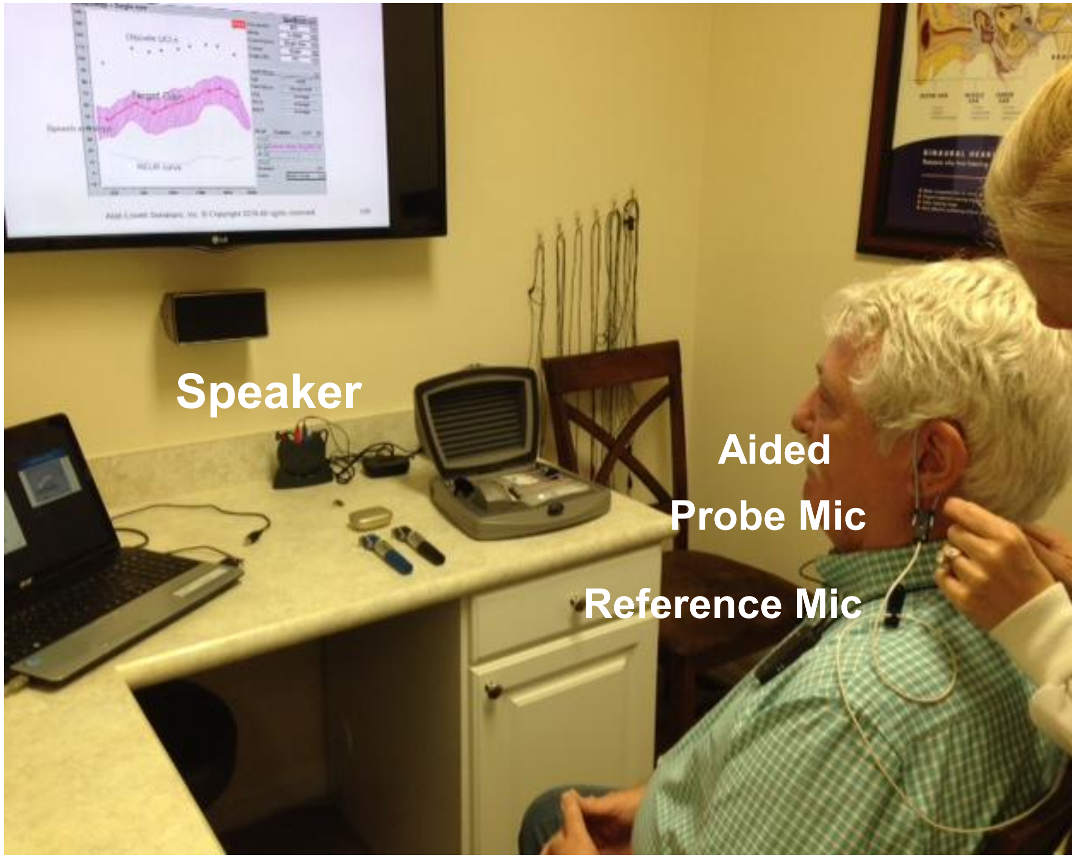
Insert aid

Maintain equipment same as for unaided measurements

Present "normal" speech or pure tone sweep

Illustrate target area showing accuracy of fitting

Establish REAR (REIR – REIG)

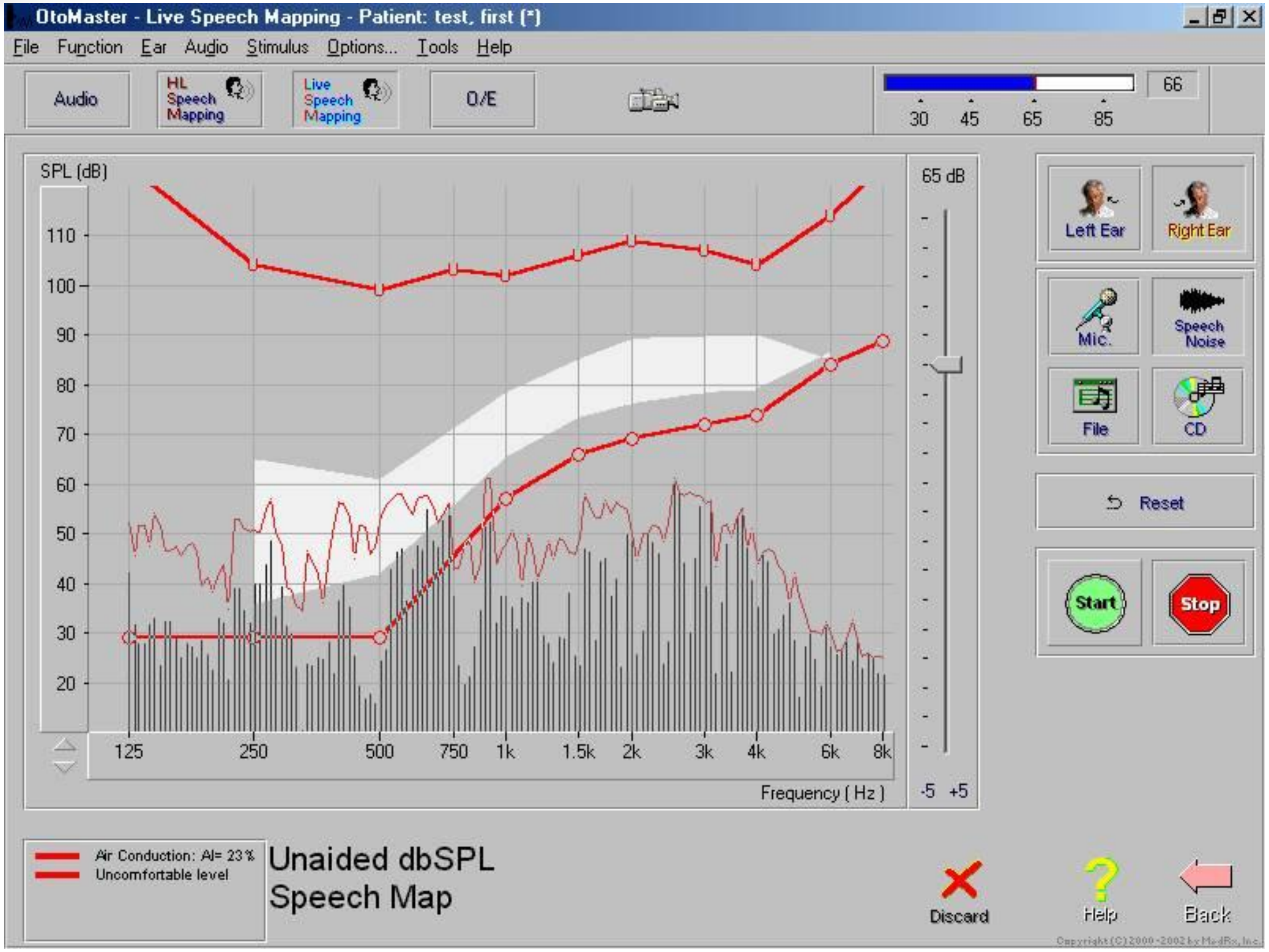


ALAN LOWELL SEMINARS INC.

Binaural Real Ear Measurements

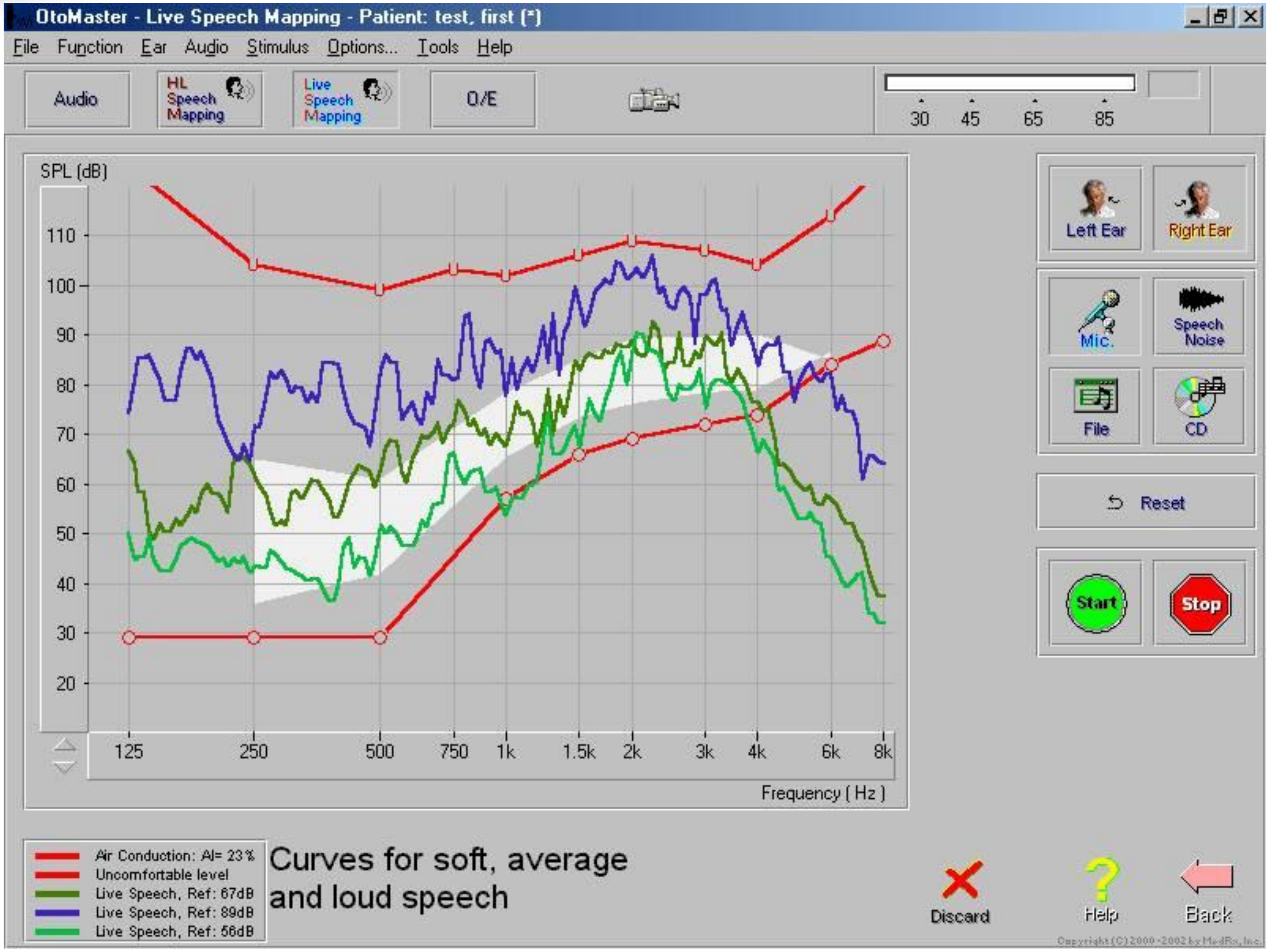
ALAN LOWELL SEMINARS INC.

Unaided in SPL



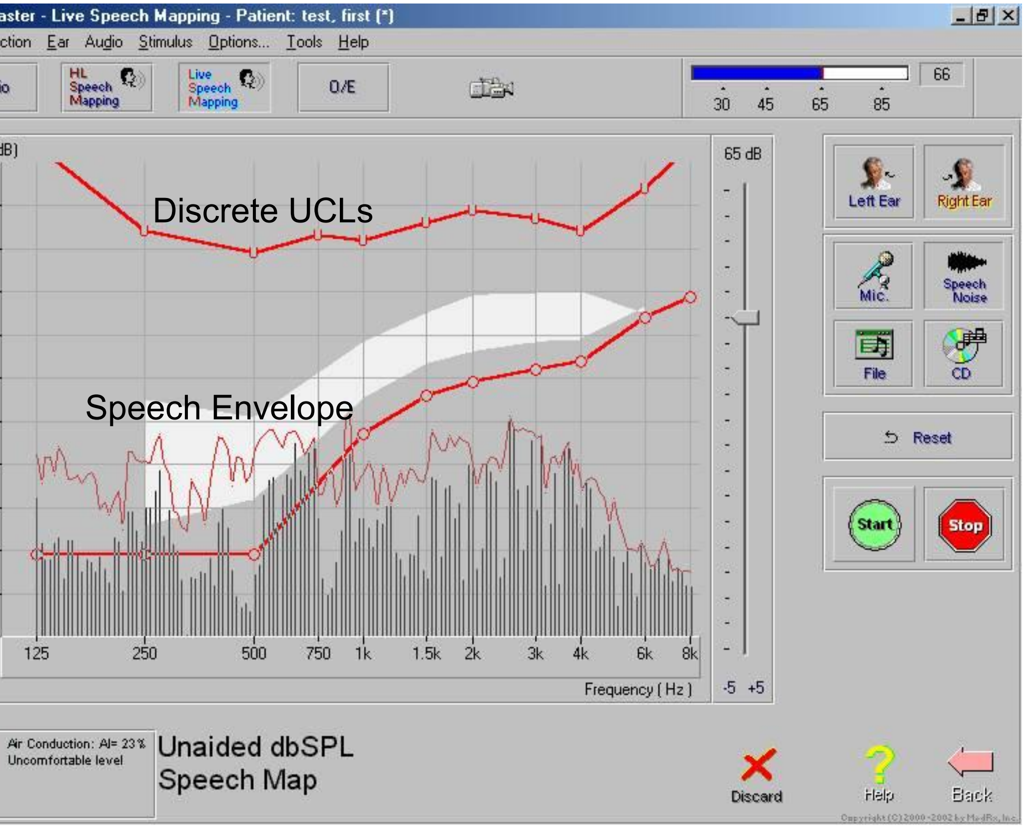
ALAN LOWELL SEMINARS INC.

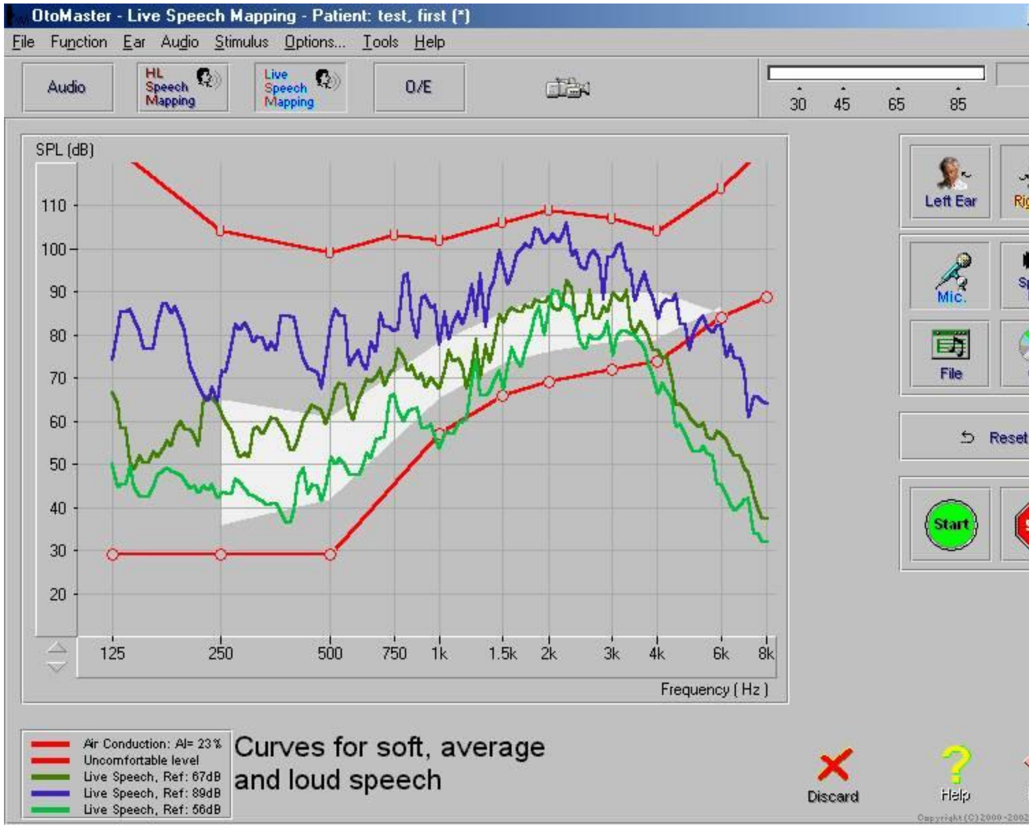
Aided Speech Mapping



ALAN LOWELL SEMINARS INC.

Unaided vs Aided





ALAN LOWELL SEMINARS INC.

Audioscan NOAH Module

S/N: 9111

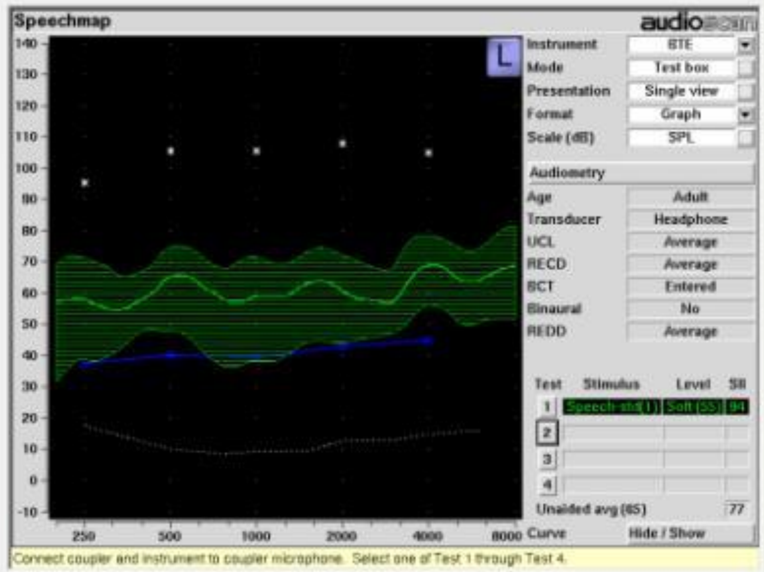
12/5/2012 12:28:02 PM	Audioscan AUD | Speechmap (left)
12/5/2012 12:04:04 PM	Audioscan AUD | Speechmap (left)
12/5/2012 12:03:18 PM	Audioscan AUD | Speechmap (left)
12/5/2012 11:56:23 AM	Audioscan AUD | Speechmap (left)
11/29/2012 10:17:43 AM	New Audiogram

Unmeasurable, Mr.

12/5/2012 12:03:18 PM

Audioscan AUD | Speechmap (left)

HL	L	20	30		30		30		30	
	R	20	30		30		30		30	
UCL	L									
	R									
BCT	L	10								30
	R	10								
RECD	L									
	R									
Hz		250	500	750	1000	1500	2000	3000	4000	6000



Version 2.1.4

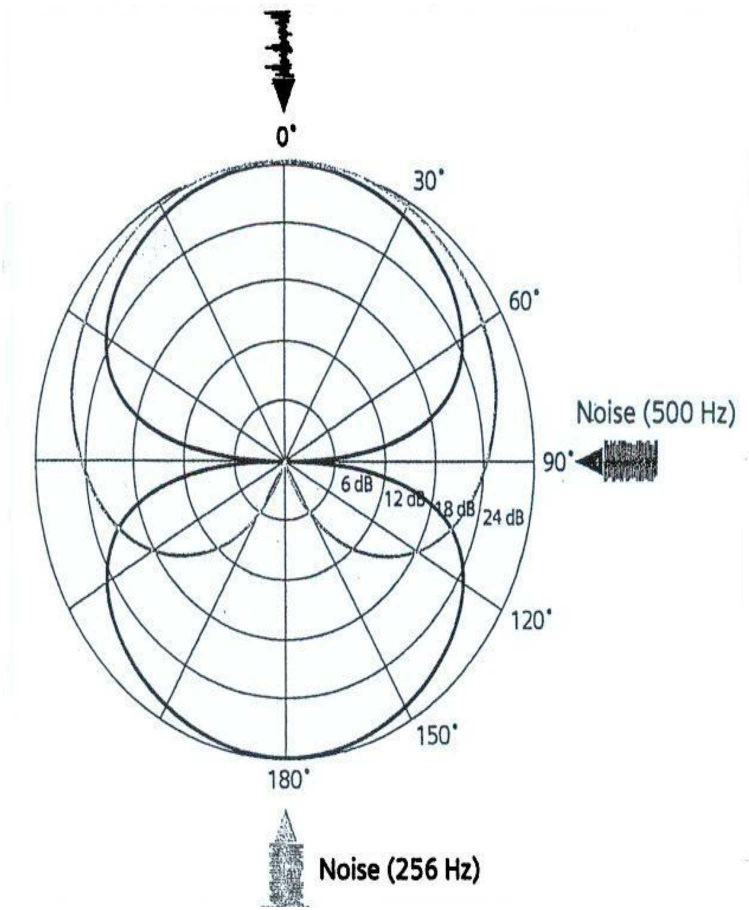
© 2012 EDI

ALAN LOWELL SEMINARS INC.

Additional Benefits

Illustrates Directional Microphone Technology

Illustrates hearing in various program settings



ALAN LOWELL SEMINARS INC.

In-Situ

- On-Site
- In-Place
- Real Time
- Real Ear
- = Invaluable patient & dispenser benefit

Otoacoustic Emissions

<u>OAE's</u>

A method to help detect hearing loss in…

Hard to Test Population

Infants

Stroke Victims

Etc.

ALAN LOWELL SEMINARS INC.

APHAB

Self Assessment Questionnaire *(A Subjective - Fitting Validation)*

Abbreviated Profile of Hearing Aid Benefit

self assessment questionnaire consisting of four subscales used for evaluating benefit received from amplification

APHAB

A Always (99%)
B Almost Always (87%)
C Generally (75%)
D Half-the-time (50%)
E Occasionally (25%)
F Seldom (12%)
G Never (1%)

	Without Hearing Aids	With Hearing Aids
13. The sounds of running water, such as a toilet or shower, are uncomfortably loud.	A B C D E F G	A B C D E F G
14. When a speaker is addressing a small group, and everyone is listening quietly, I have to strain to understand.	A B C D E F G	A B C D E F G
15. When I'm in a quiet conversation with my doctor in an examination room, it is hard to follow the conversation.	A B C D E F G	A B C D E F G
16. I can understand conversations even when several people are talking.	A B C D E F G	A B C D E F G
17. The sounds of construction work are uncomfortably loud.	A B C D E F G	A B C D E F G
18. It's hard for me to understand what is being said at lectures or church services.	A B C D E F G	A B C D E F G
19. I can communicate with others when we are in a crowd.	A B C D E F G	A B C D E F G

ALAN LOWELL SEMINARS INC.

COSI

Client Oriented Scale of Improvement *(A Subjective - Fittin Validation)*

irst phase

he wearer identifies listening situations that he/she would like o improve

econd phase

fter the hearing aid(s) are fit, the change in hearing function for e identified listening situation is recorded

ALAN LOWELL SEMINARS INC.

Objective vs. Subjective

Objective

Tympanometry
ABR (Auditory Brainstem Response)
Real Ear Measurements (fitting verification)
Live Speech Mapping (fitting verification)
Otoscopy
Tinnitus (objective)
Vertigo (objective)
Acoustic Reflex
Aided / Unaided Sound Field*
* Measure of *functional gain*

Subjective

Programming
Audiometry
Self Assessment Questionnaires
APHAB (fitting validation)
COSI (fitting validation)
Sound Field Testing
Tinnitus (subjective)
Vertigo (subjective)

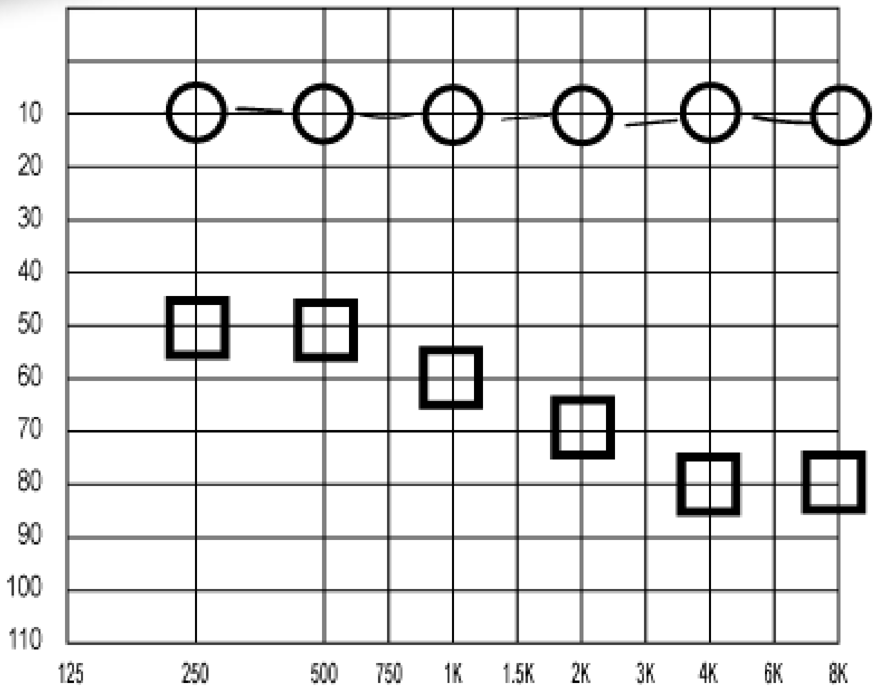
ALAN LOWELL SEMINARS INC.

CROS

Contra-lateral Routing Of Off Side Signal

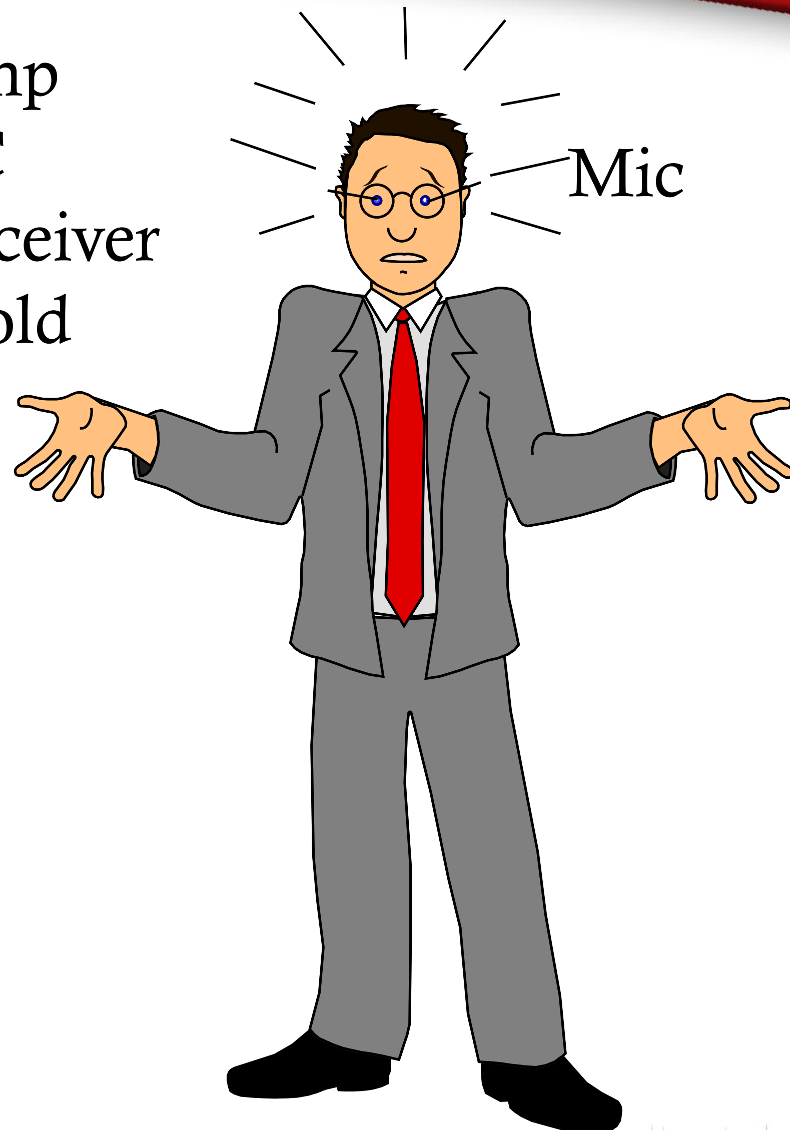
ALAN LOWELL SEMINARS INC.

Right Cros



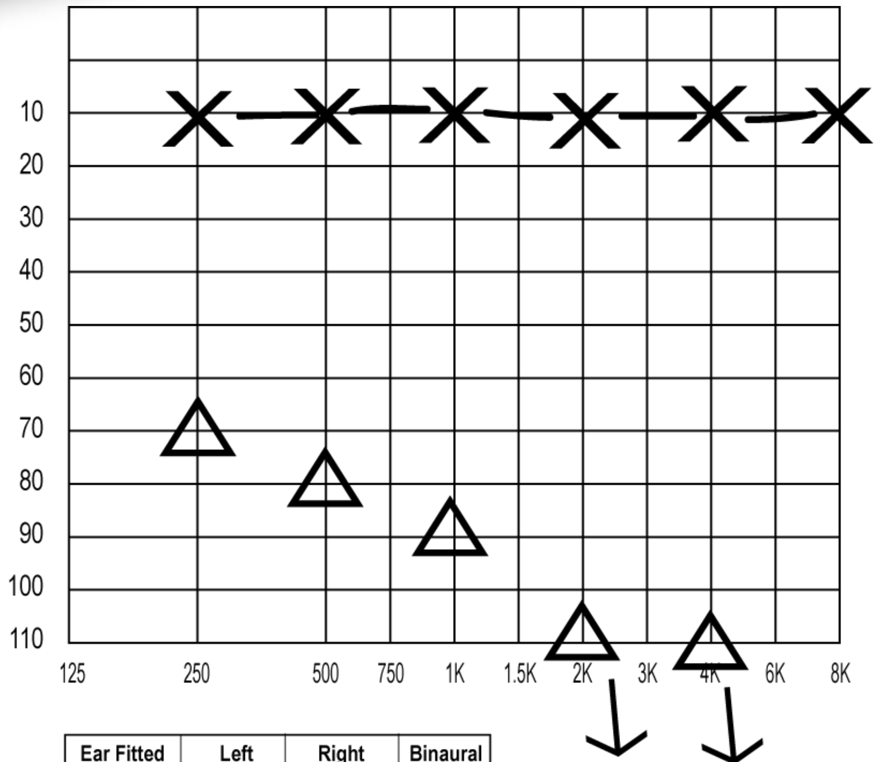
Ear Fitted	Left	Right	Binaural
SRT	NR dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	24 %	%	

Amp
VC
Receiver
Mold



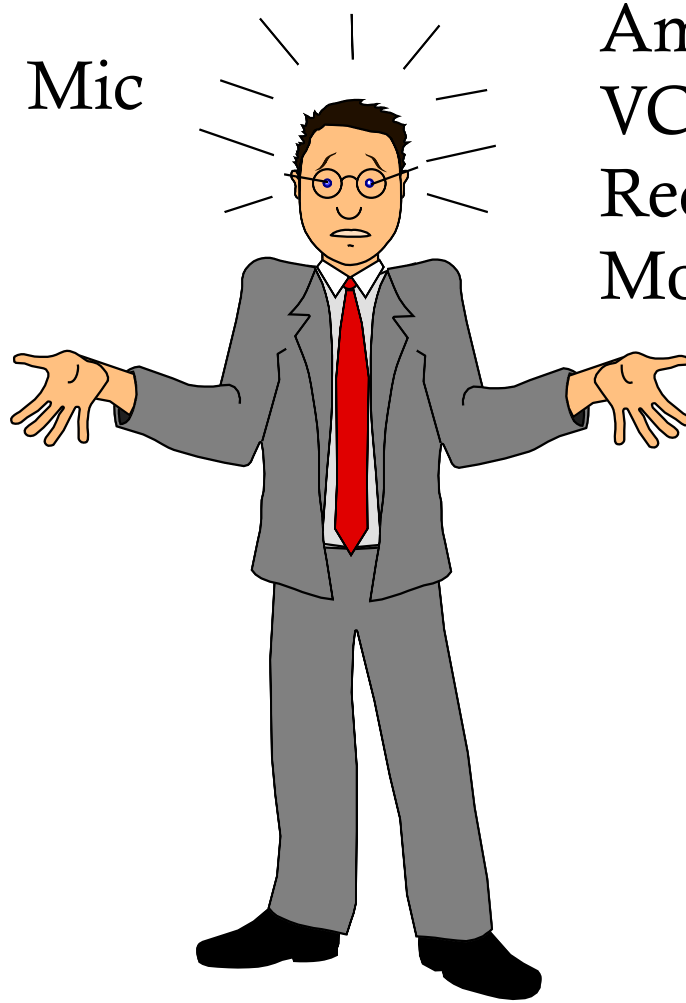
ALAN LOWELL SEMINARS INC.

Left Cros



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

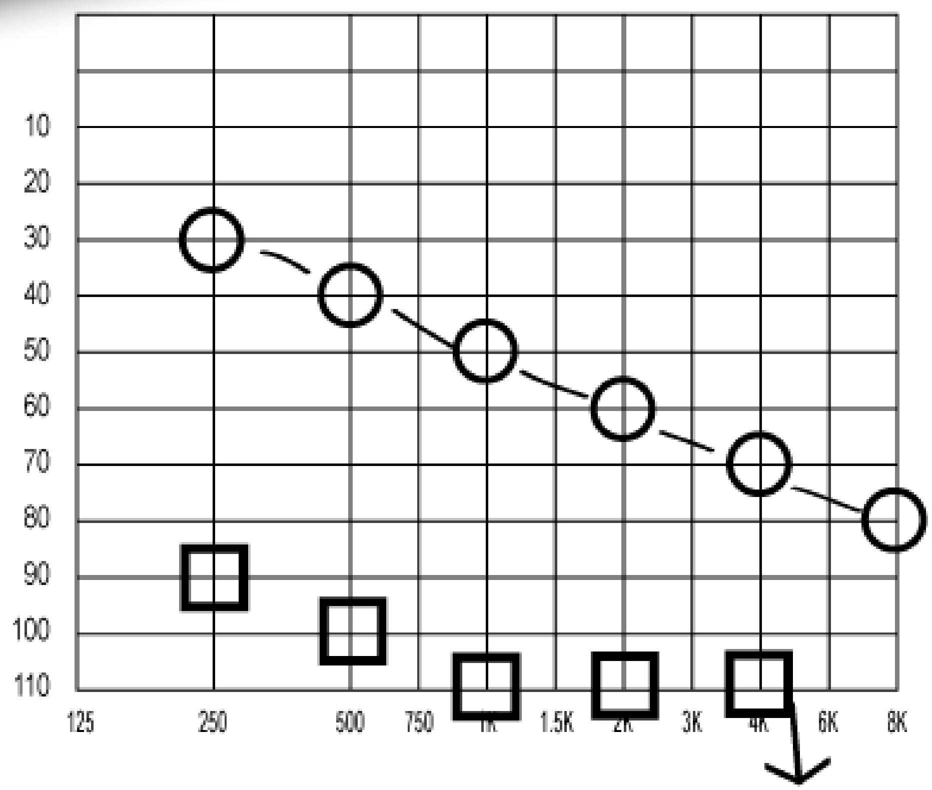
Mic



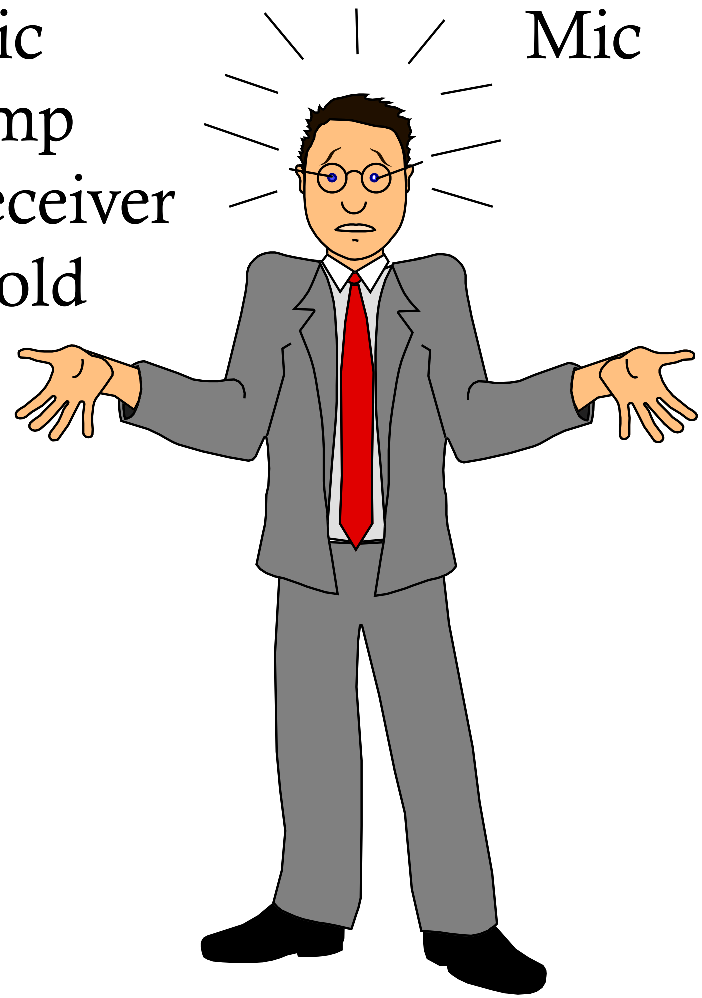
Amp
VC
Receiver
Mold

ALAN LOWELL SEMINARS INC.

Right BiCROS

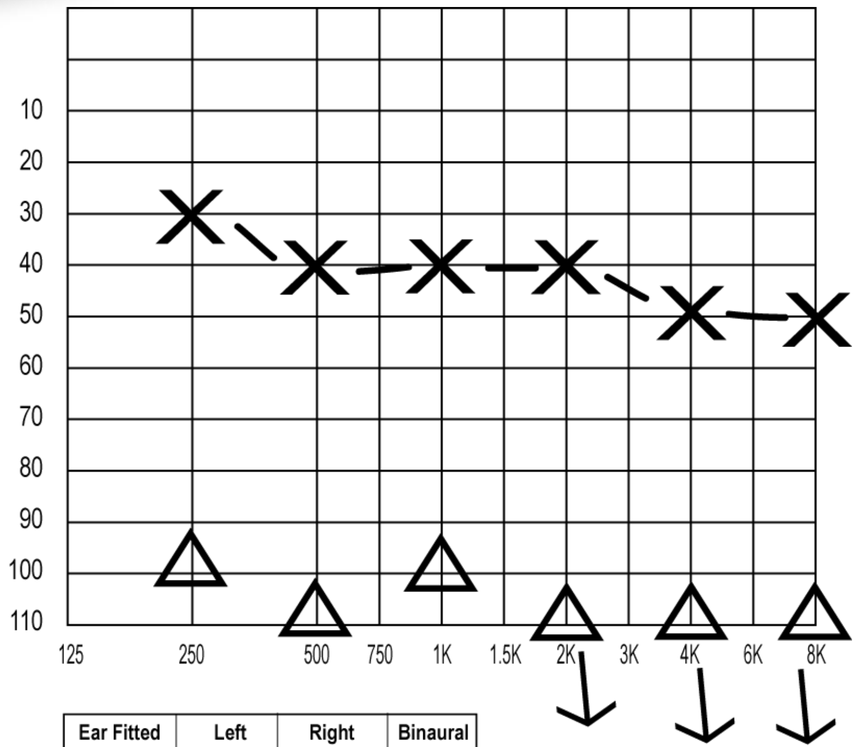


Mic
Amp
Receiver
Mold



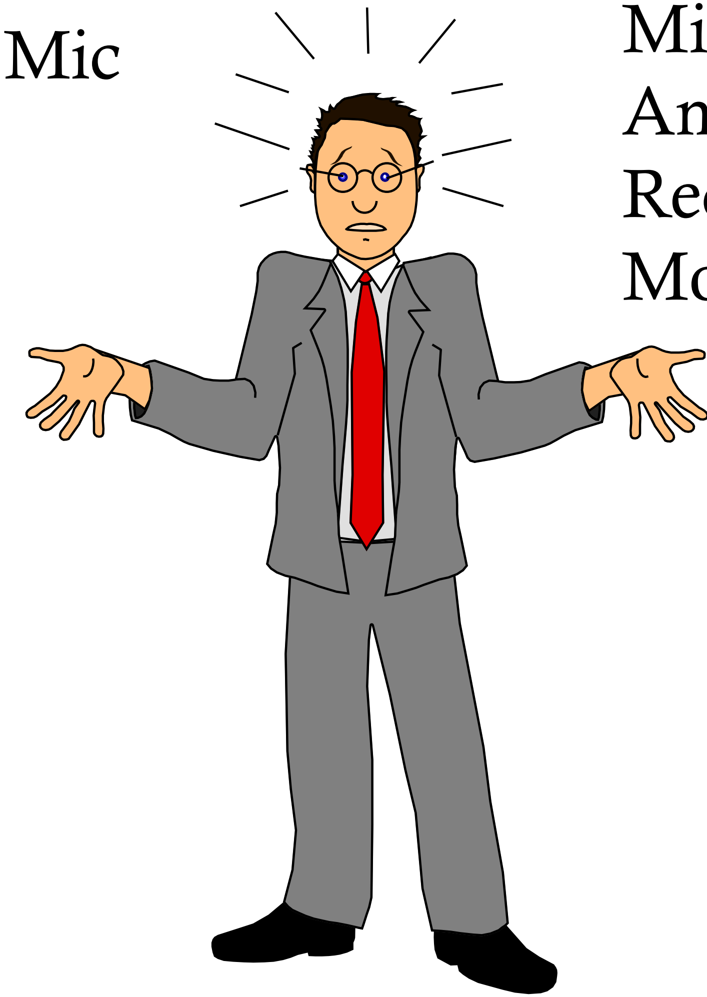
Mic

Left BiCROS



Ear Fitted	Left	Right	Binaural
SRT	dB	dB	
MCL	dB	dB	
UCL	dB	dB	
Discrim. %	%	%	

Mic



Mic
Amp
Receiver
Mold

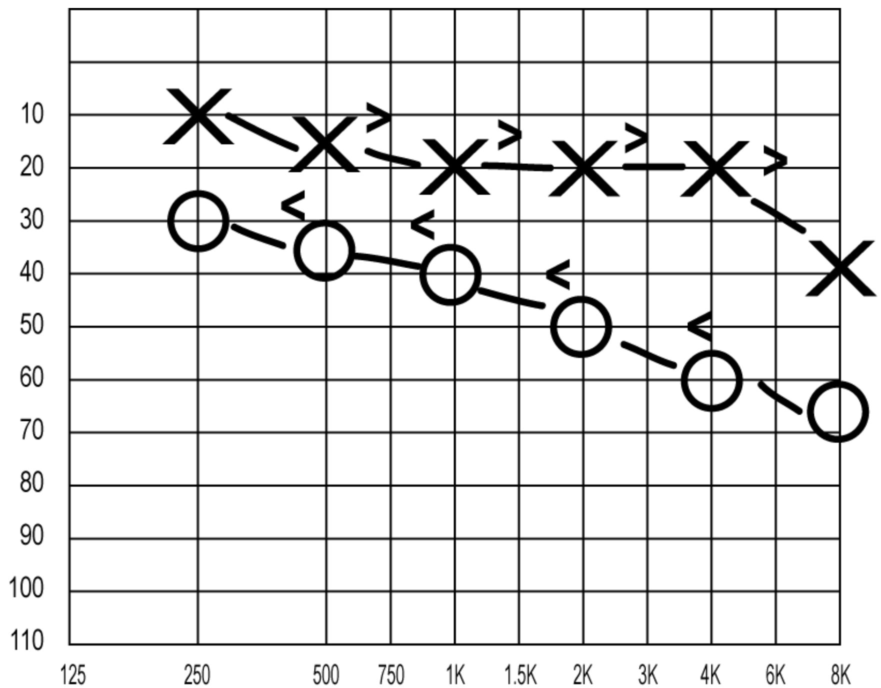
Audiogram Analysis

ectly answering the following questions when analyzing audiograms will enable you to be better prep

1. Unilateral, Symmetrical or Asymmetrical?
2. Conductive, Sensorineural or Mixed?
3. Mild, Moderate, Severe or Profound?
4. Monaural or Binaural fitting?
5. Masking indicated or recommended?
6. Appropriate device style?
7. Approximate gain & frequency required?
8. Shell design?
9. Patient limitations?

ALAN LOWELL SEMINARS INC.

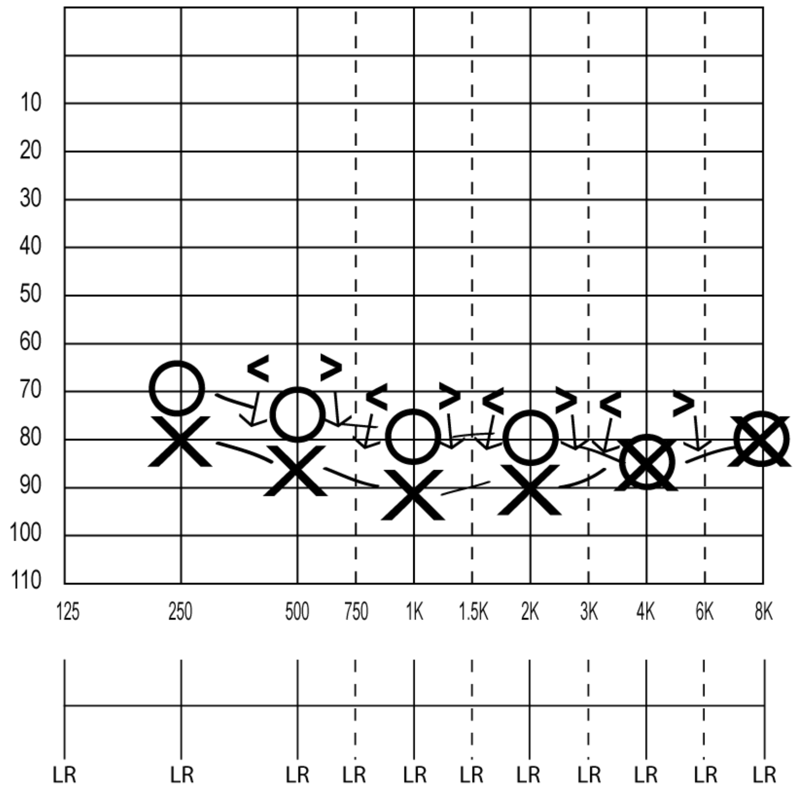
Case #1



Ear Fitted	Left	Right	Binaural
SRT	20 dB	40 dB	
MCL	60 dB	70 dB	
UCL	105 dB	100 dB	
Descrim. %	100 %	84 %	

ALAN LOWELL SEMINARS INC.

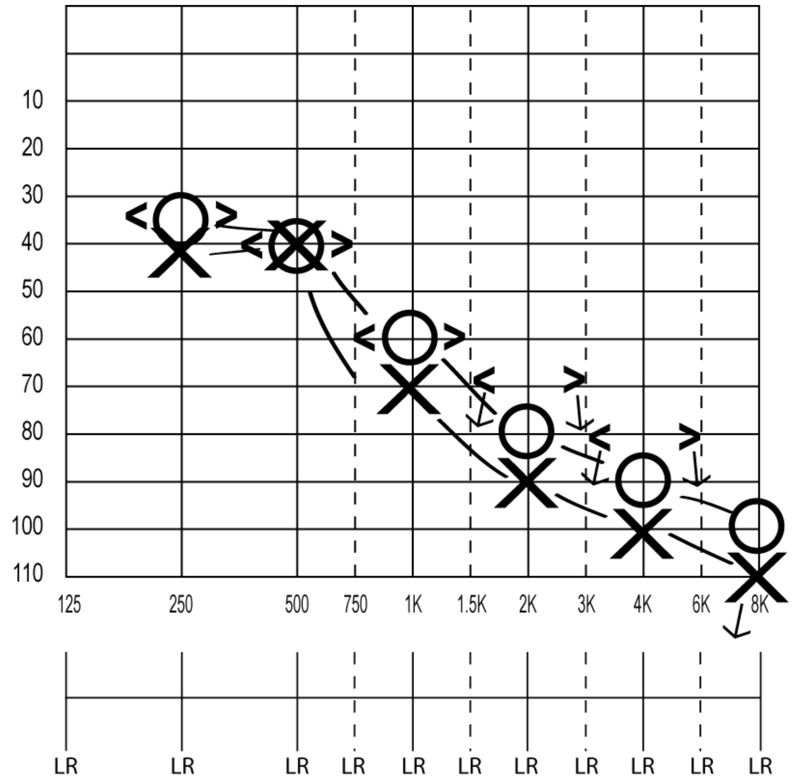
Case #2



Ear Fitted	Left	Right	Binaural
SRT	95 dB	80 dB	
MCL	100 dB	90 dB	
UCL	105 dB	105 dB	
Discrim. %	44 %	72 %	

ALAN LOWELL SEMINARS INC.

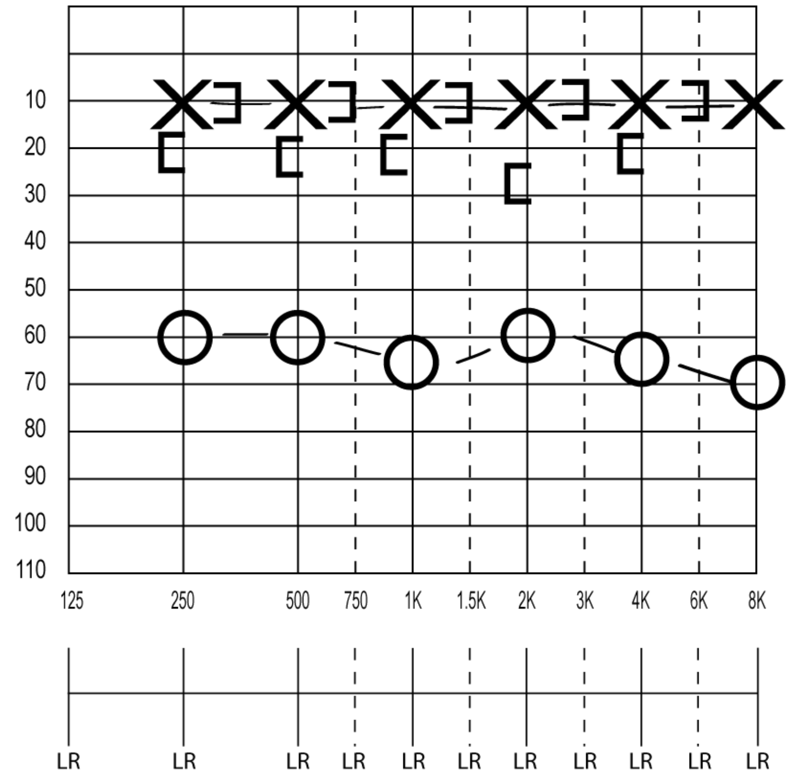
Case #3



Ear Fitted	Left	Right	Binaural
SRT	60 dB	55 dB	
MCL	85 dB	75 dB	
UCL	105 dB	90 dB	
Discrim. %	72 %	72 %	

ALAN LOWELL SEMINARS INC.

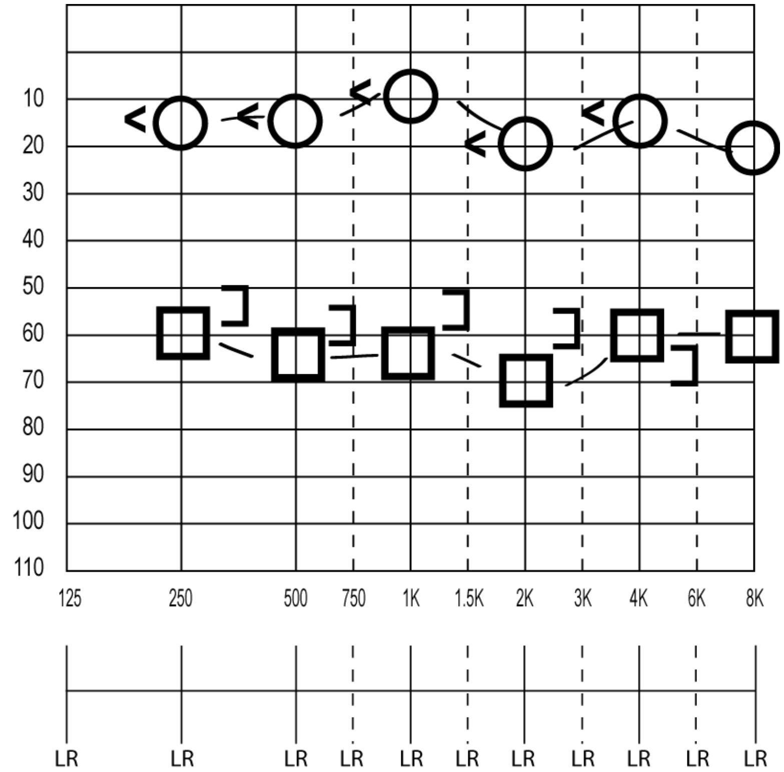
Case #4



Ear Fitted	Left	Right	Binaural
SRT	10 dB	60 dB	
MCL	50 dB	90 dB	
UCL	105 dB	110 dB	
Discrim. %	100 %	96 %	

ALAN LOWELL SEMINARS INC.

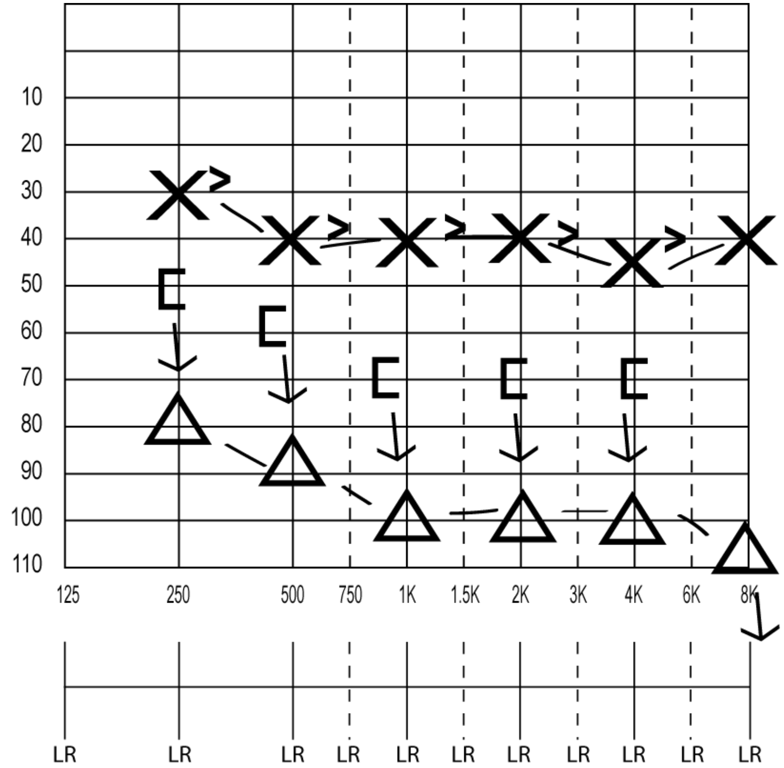
Case #5



Ear Fitted	Left	Right	Binaural
SRT	65 dB	10 dB	
MCL	80 dB	55 dB	
UCL	95 dB	110 dB	
Discrim. %	44 %	100 %	

ALAN LOWELL SEMINARS INC.

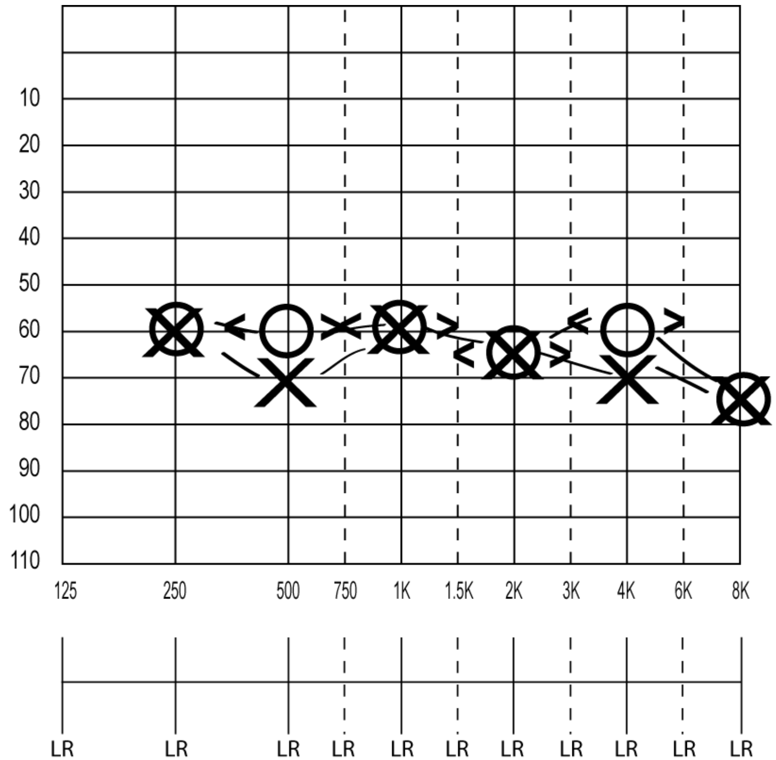
Case #6



Ear Fitted	Left	Right	Binaural
SRT	40 dB	CNT dB	
MCL	70 dB	CNT dB	
UCL	100 dB	CNT dB	
Discrim. %	96 %	CNT %	

ALAN LOWELL SEMINARS INC.

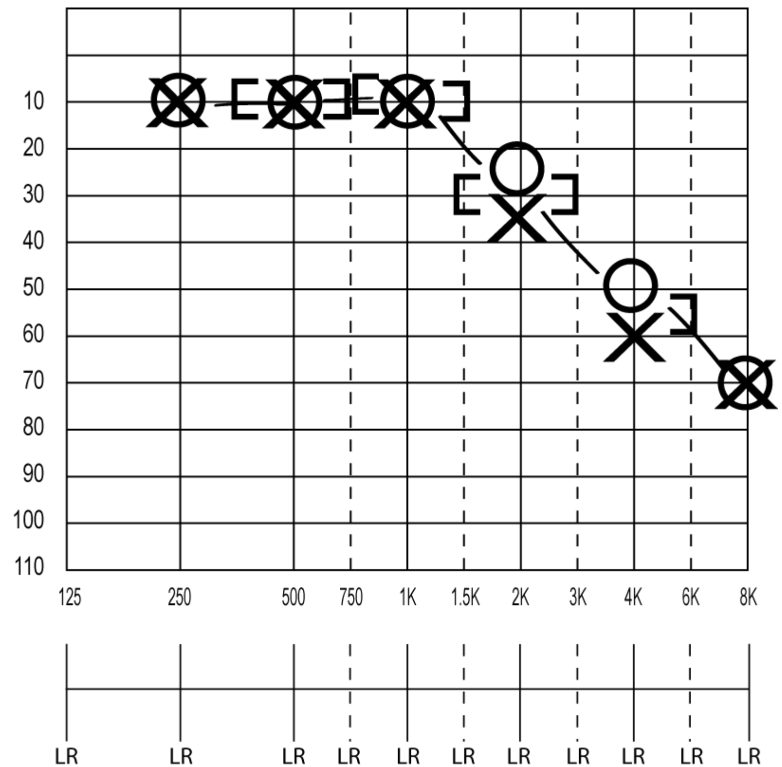
Case #7



Ear Fitted	Left	Right	Binaural
SRT	60 dB	65 dB	
MCL	90 dB	90 dB	
UCL	105 dB	105 dB	
Discrim. %	88 %	96 %	

ALAN LOWELL SEMINARS INC.

Case #8



Ear Fitted	Left	Right	Binaural
SRT	30 dB	30 dB	
MCL	60 dB	55 dB	
UCL	115 dB	90 dB	
Discrim. %	92 %	72 %	

ALAN LOWELL SEMINARS INC.

Hearing Aid

Service & Performance

ALAN LOWELL SEMINARS INC.

Sanitize

Ingredients:
Bactericide
Virucide
Fungicide

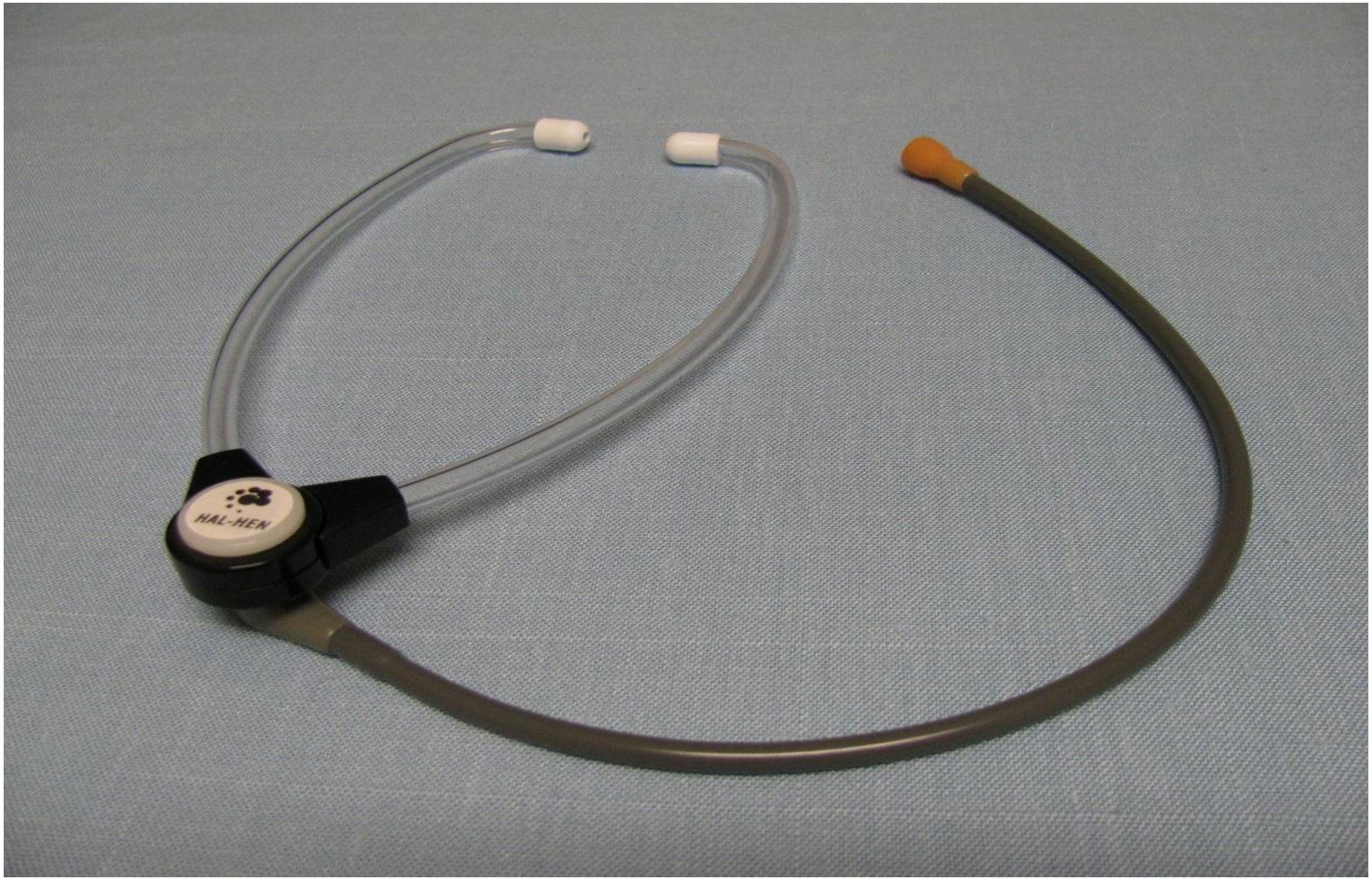
Products:

Pursue

Sani-Cloth Plus >

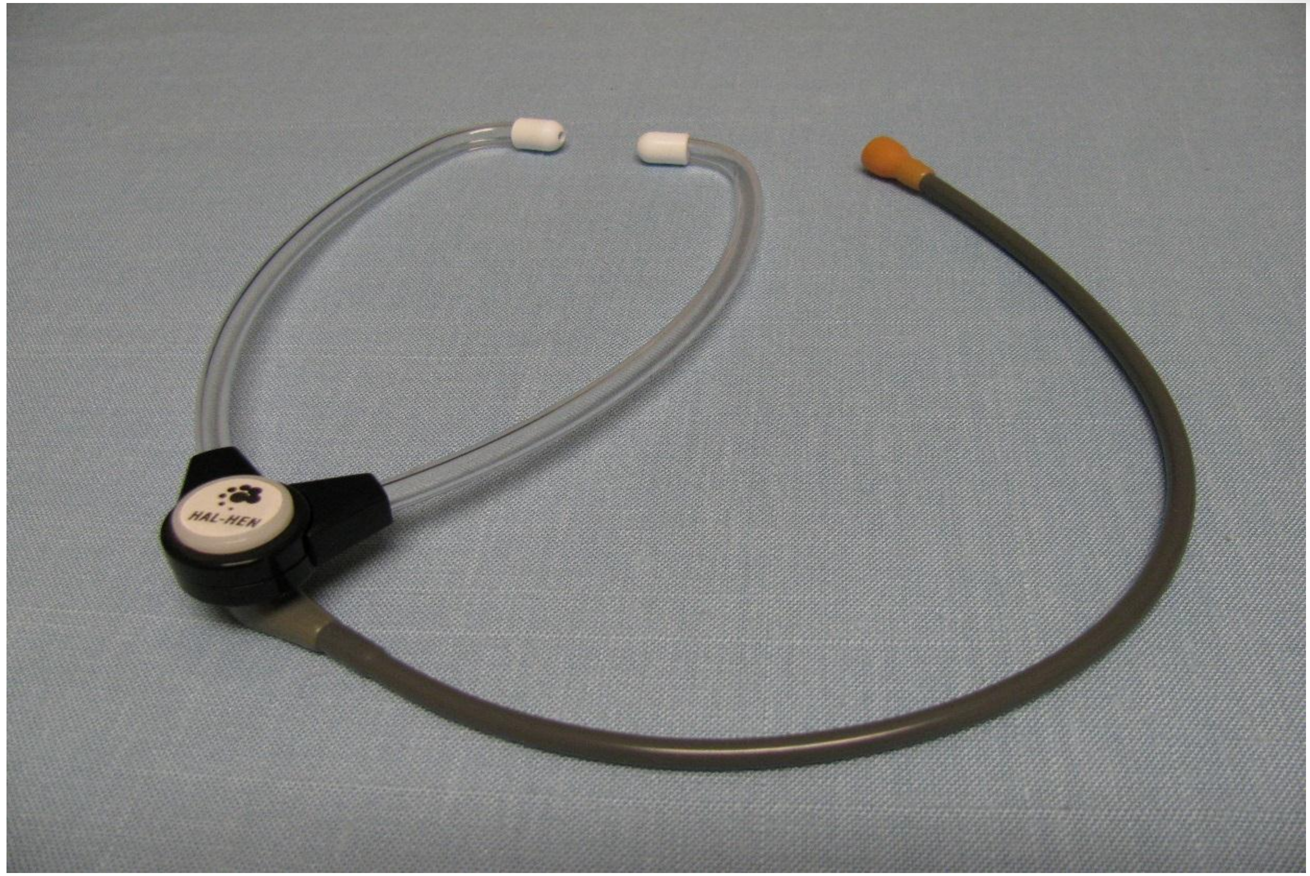
Stethoscope / Listening Tube

ffice evaluation of hearing aid performance & operation (biological che



ological check for the following conditio

- Acoustic feedback
- Internal feedback
- Distortion
- Weak
- Intermittent
- Dead
- Motor-boating
- VC taper (analog)
- VC taper (digital)
- Battery contacts
- High battery drain



ALAN LOWELL SEMINARS INC.

Over-all inspection of device

Check for the following observable conditions:

Brittle, loose or cracked tubing (BTE only)

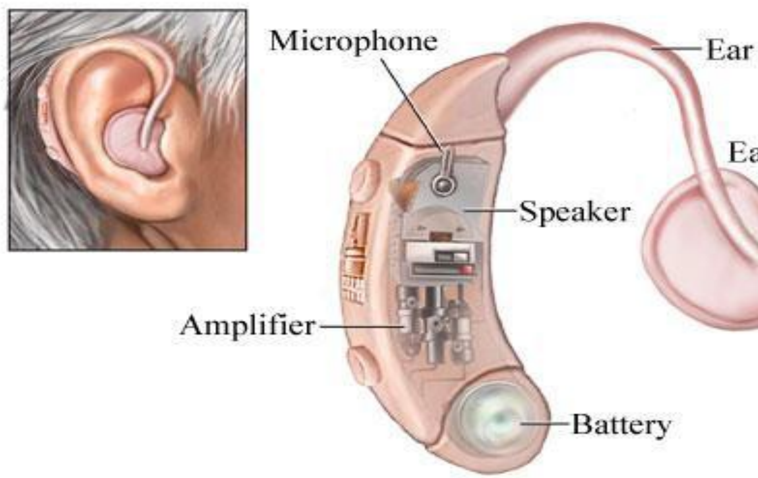
In-tact ear mold, unplugged sound bore (BTE)

In-tact, clear opening to microphone

In-tact, clear opening to receiver (speaker)

Battery contacts clear of corrosion (gently squeeze sides of device to listen for intermittence)

Check VC for proper taper or dead spots (manual VC only)



Tube change on a standard size BTE

Remove old tube

Clean earmold

Insert standard #13 or thick wall tubing

Measure tube to BTE

Cut tube & check for accuracy

ALAN LOWELL SEMINARS INC.

Measuring tube for proper fit

Place BTE on ear

Insert earmold w uncut quilled tube

Measure spot on tube to cut

Spot should be cut at point where tube can be slipped over lower portion of the earhook

Tube spreader may be used to spread tube so it easily slips onto earhook

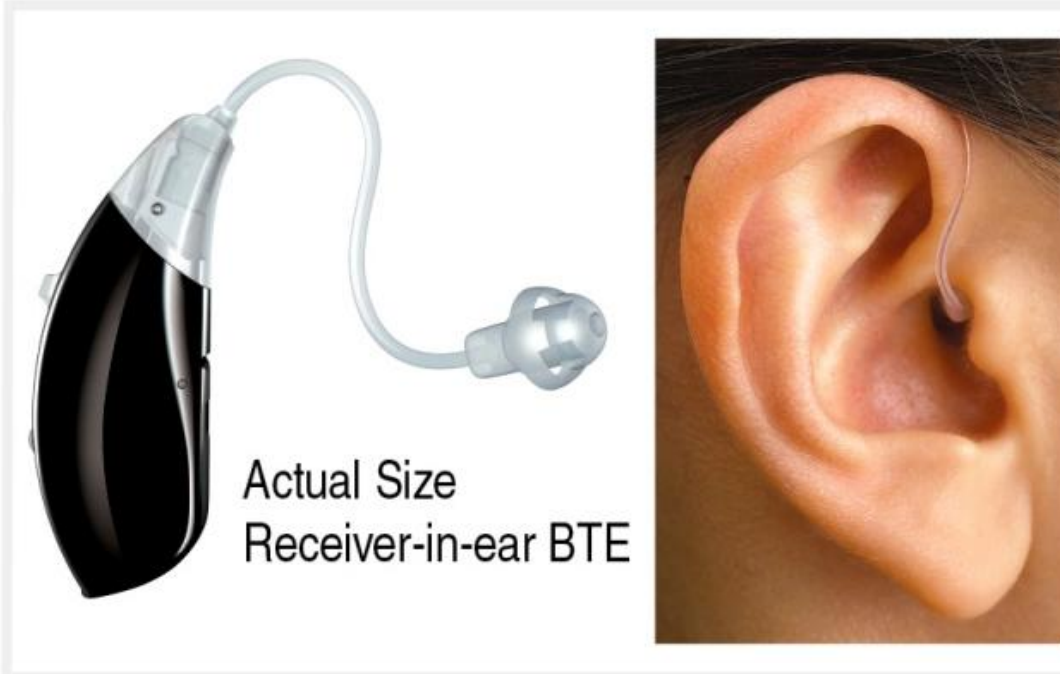
Check tube length to ensure device is sitting on ear securely (not too long or short)

ALAN LOWELL SEMINARS INC.

Receiver (Speaker) (Transducer)

Converts electrical energy into acoustic energy

Determines frequency range & power options

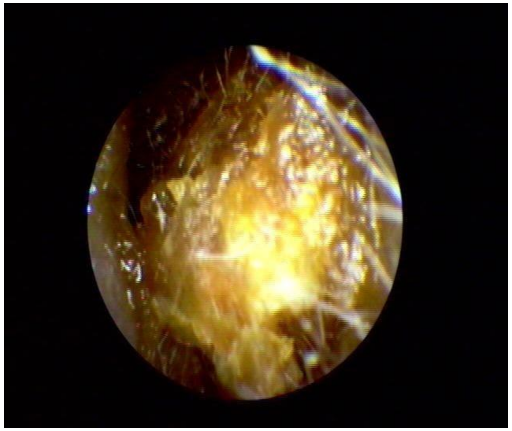


Acoustic Feedback

"My hearing aid whistles when I open my mouth or smile, turn the volume louder, bend down, hug someone, etc."

Possible causes:

- Excessive wax in ear >>>>>>
- Vent diameter is too large
- Shell or earmold is too loose in ear
- Canal length may be too short, or angled
- Part of the ear is covering microphone
- Device amplifies excessive HF peaks
- VC setting turned too loud
- TMJ
- Canal length may be too long & angled towards canal wall >>>>>>
- Need for binaural if only wearing monaural



ALAN LOWELL SEMINARS INC.

Internal Feedback

"The moment I place my hearing aid in my ear it whistles no matter where I set the volume"

ossible Causes:

- Dislodged receiver (speaker)
- Dislodged microphone
- Loose wire in circuit
- Hole in tube or earmold BTE)
- Hole or crack in the shell custom)

Checking for feedback:

1. VC in full on position
2. Cover receiver & vent
3. Remove tubing & earhook (for BTE)
4. Cover Receiver Opening (for BTE)
5. If feedback is present = internal feedback
6. If feedback is not present = acoustic feedback

ALAN LOWELL SEMINARS INC.

Distortion

"My hearing aid sounds distorted or noisy."

Possible causes:

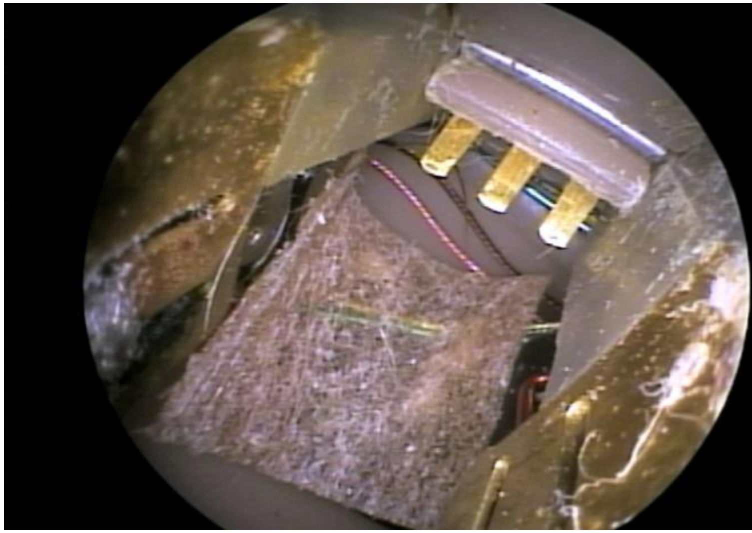
- Defective microphone
- Defective amplifier (circuit)
- Defective receiver (speaker)
- Moisture

ALAN LOWELL SEMINARS INC.

Weak

"My hearing aid sounds weak, even when I turn the volume louder. It doesn't sound the the way it did."

Possible causes:



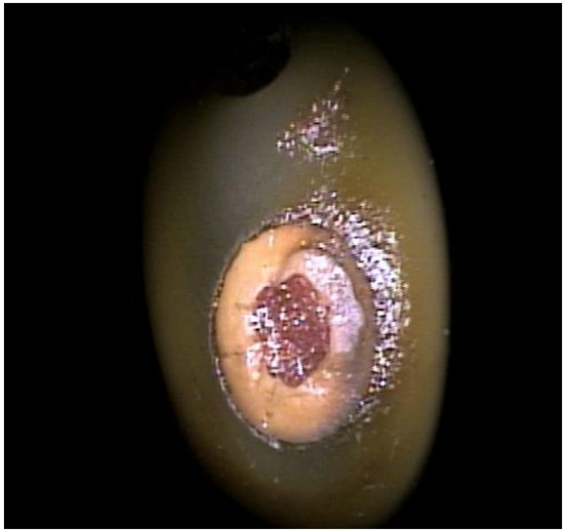
- Weak or dead battery (patient can't tell if its working since it didn't whistle when inserting)
- Wax in microphone or receiver (speaker)
- Moisture
- Corrosion or dirt on the battery contacts
- Hairspray in microphone
- Hole or crack in the receiver tube or housing
- Defective components

Dead

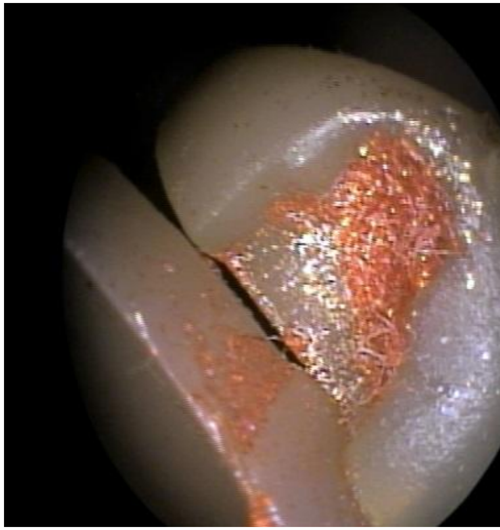
"My hearing aid is dead / not working."

ossible causes:

- Dead battery
- Wax plug in receiver (speaker)
- Wax smothering microphone
- Defective circuit
- Defective transducers (mic & receiver)



Plugged Receiver



Plugged Mic

Intermittent

"My hearing aid cuts in and out."

Possible causes:

- Defective VC (if manual) >>>
- Defective battery contacts (squeeze device to check)
- Wax in receiver (speaker)
- Wax in microphone
- Weak battery

Poor VC taper (manual only)

Possible causes:

Dirt or moisture in VC

Defective VC

ALAN LOWELL SEMINARS INC.

High Battery Drain

"My hearing aid is eating up batteries"
"I have to replace batteries every couple of days."

Possible causes:

- High current drain
- Defective batteries

Battery Life

Key Elements

- MAH Rating
- Current Drain
- Formula
- MAH Rating divided by current drain = usable hours
- Battery Voltage: 1.45V

MAH Ratings

- Zinc 13 300 hr
- Zinc 675 630 hr
- Zinc 312 175 hr
- Zinc 10 100 hrs

ALAN LOWELL SEMINARS INC.

Battery Life Calculation

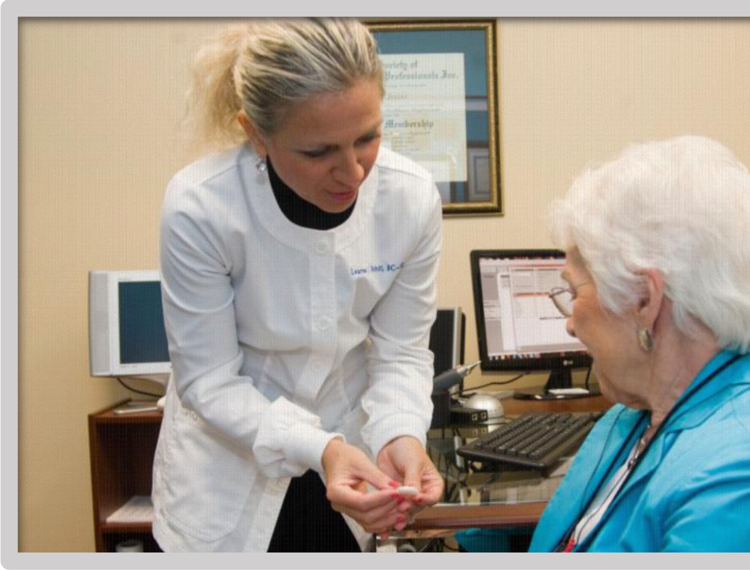
Circuit 1.2 current drain

Battery #312 175 hrs

175 divided by 1.2 = 146 hrs

146 hrs divided by 16 hrs per day = 9 days

Counseling & Delivery



Device Orientation (insertion & removal) R & L
Battery insertion & removal; storing batteries
Warning device indicator signals
User adjustable controls & operation
Use of wireless devices
Operation manual
Warranty, Loss & Damage
Wearing schedule; Realistic expectations
Telephone use including t-coil
engagement & benefits
Cleaning, care and storage
Aural Rehabilitation

ALAN LOWELL SEMINARS INC.

Aural Rehab
(Patient suggestions)

*Keep notes on progress

*Read aloud for 30 minutes each day

*Family member should read aloud for 30 minutes each day

*Recommend self-help groups for patients with poor WRS

*Recommend lip reading classes for patients with poor WRS

ALAN LOWELL SEMINARS INC.

Follow-up Scheduling

Initial fitting:

Once a week for 4 weeks

Routine check-ups:

Once every 3-4 months

Necessary visits:

Anytime

ALAN LOWELL SEMINARS INC.