

Introduction of basic hearing test



楊昆霖醫師/楊昭輝醫師

The Ear and Hearing

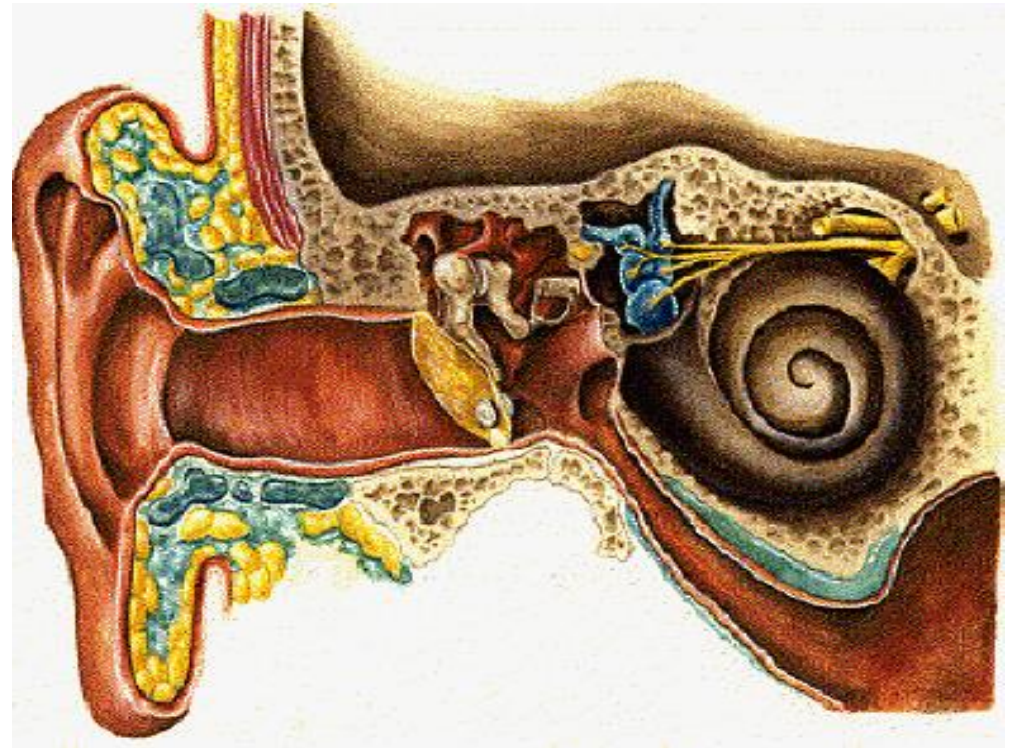
Sound and hearing

MECHANICAL

ELECTRICAL/SENSORY



Sound stimulation



Audiometry

Audiometry

- **Subjective** test – verbal or physical response
- Tests all parts of the ear
 - Pure Tone
 - Air conduction
 - Bone conduction
 - Speech testing
- Generate an Audiogram

Basic Pure-tone Audiometry

- Measures hearing sensitivity
 - **Air conduction** → measures sensitivity of entire pathway of auditory system, including outer, middle, and inner-ear.
 - **Bone conduction** → “by-passes” outer and middle-ear to measure sensitivity of inner ear directly.
- Determines type and severity of hearing loss
- Results are used to generate the audiogram

Conducting a Test

AIR CONDUCTION



- Place headset centered over ear canals and band snug on top of head
- **Red** on **Right** ear, **Blue** on **Left** ear

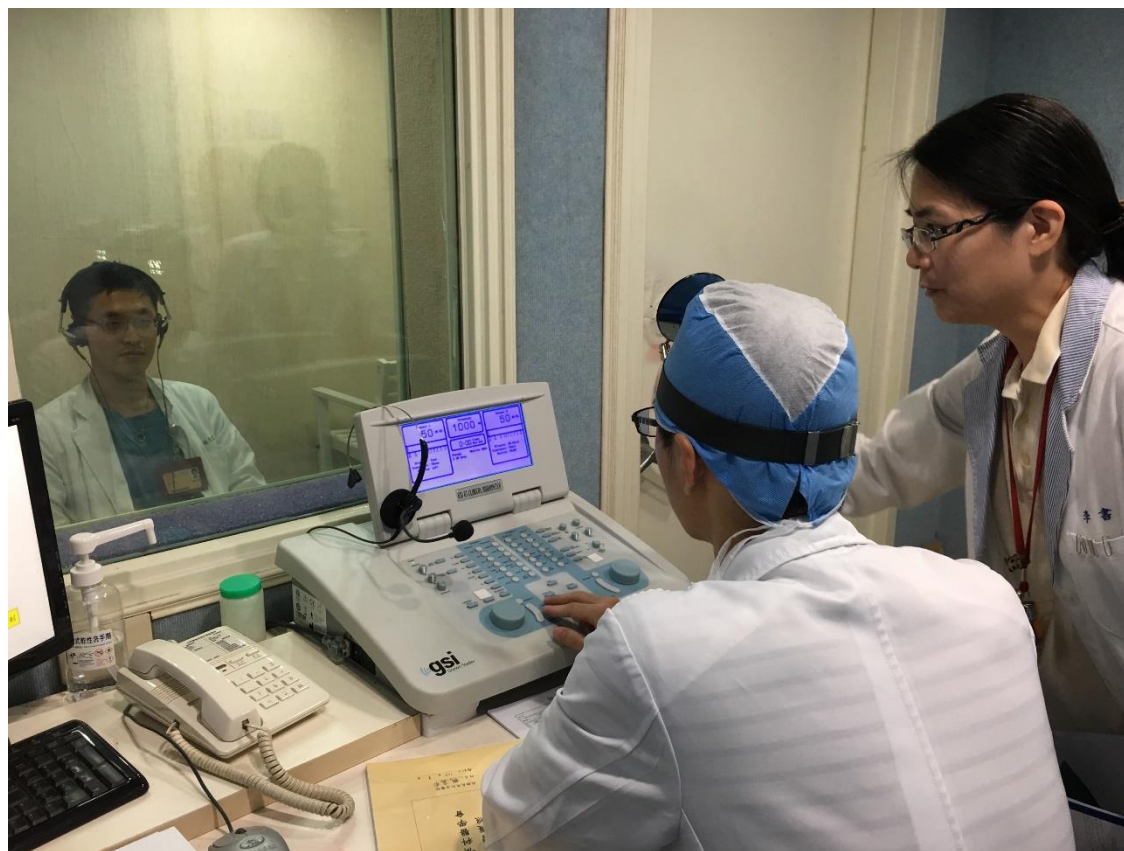
BONE CONDUCTION

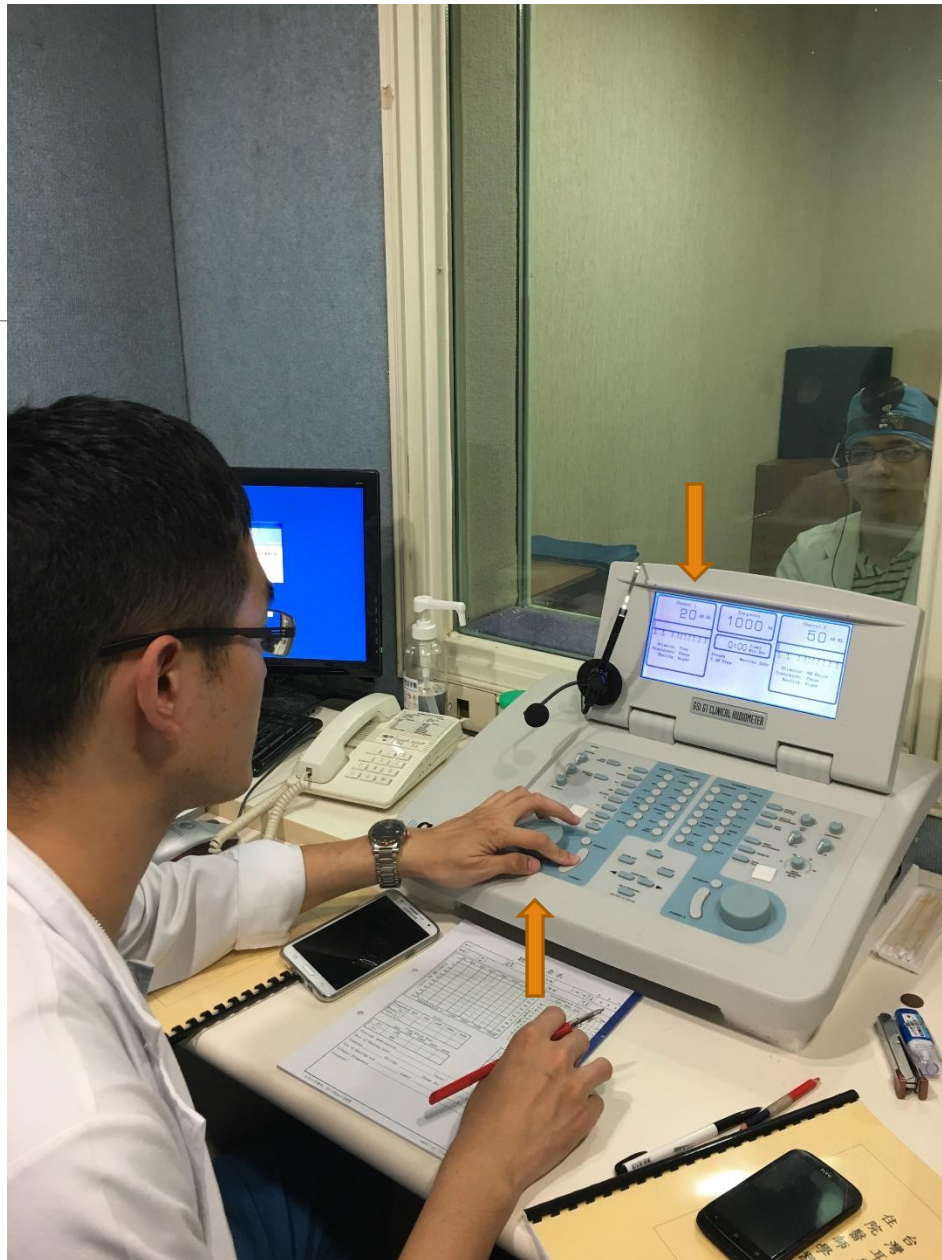


- Place bone oscillator on **mastoid bone** with other end of headband on opposite temple.
- Make sure oscillator does NOT touch the ear.
- Bone conduction stimulates **BOTH** ears.

Finding a Pure-Tone Threshold

- Start at **1000**Hz at 30dB (**50**dB) in better ear (or right ear) and present the tone.
- Follow “**Down 10, Up 5**” rule:
 - If patient responds, decrease 10dB
 - If patient does NOT respond, increase 5dB
 - Follow this pattern until **3** responses are obtained at the same level on the ascending run.
- Repeat this procedure for all test frequencies: 2000, 4000, 8000, 500, 250Hz.





Audiogram

● Mark Air and Bone thresholds on the chart

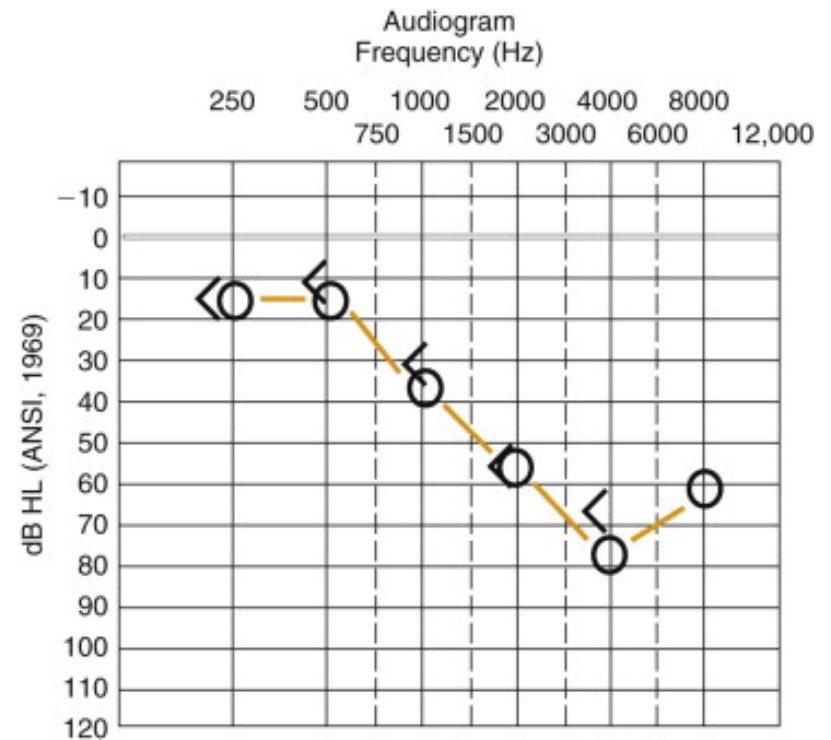
- Right ear △
- × Left ear □
- ◁ Right Bone ◻
- ▷ Left Bone ◻

● Behavioral response - cooperation of the patient is important

Soft

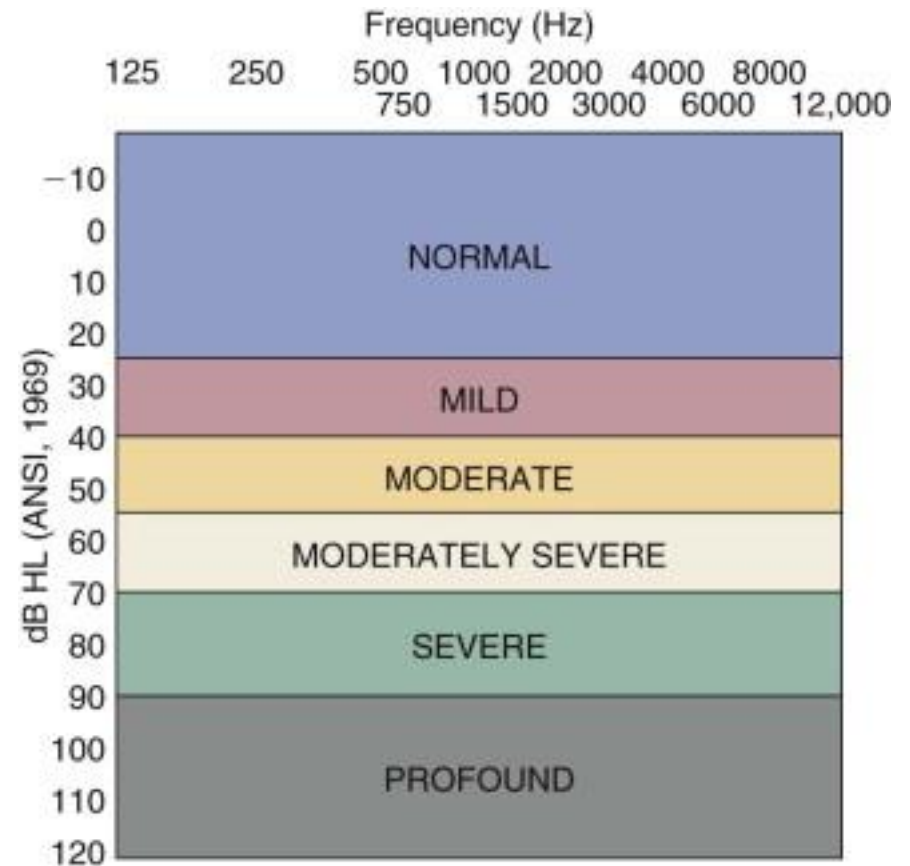


Loud



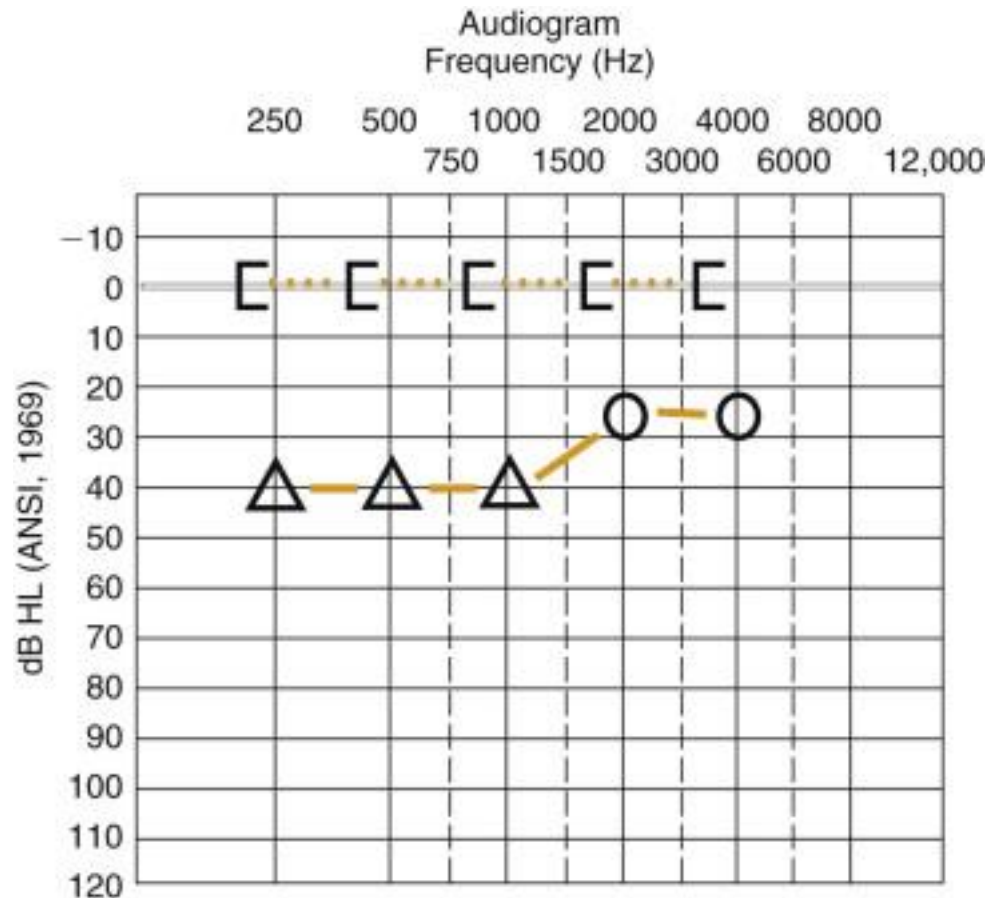
Severity of hearing loss

- Hearing Loss is described as a range
- Ranges from Mild through Profound



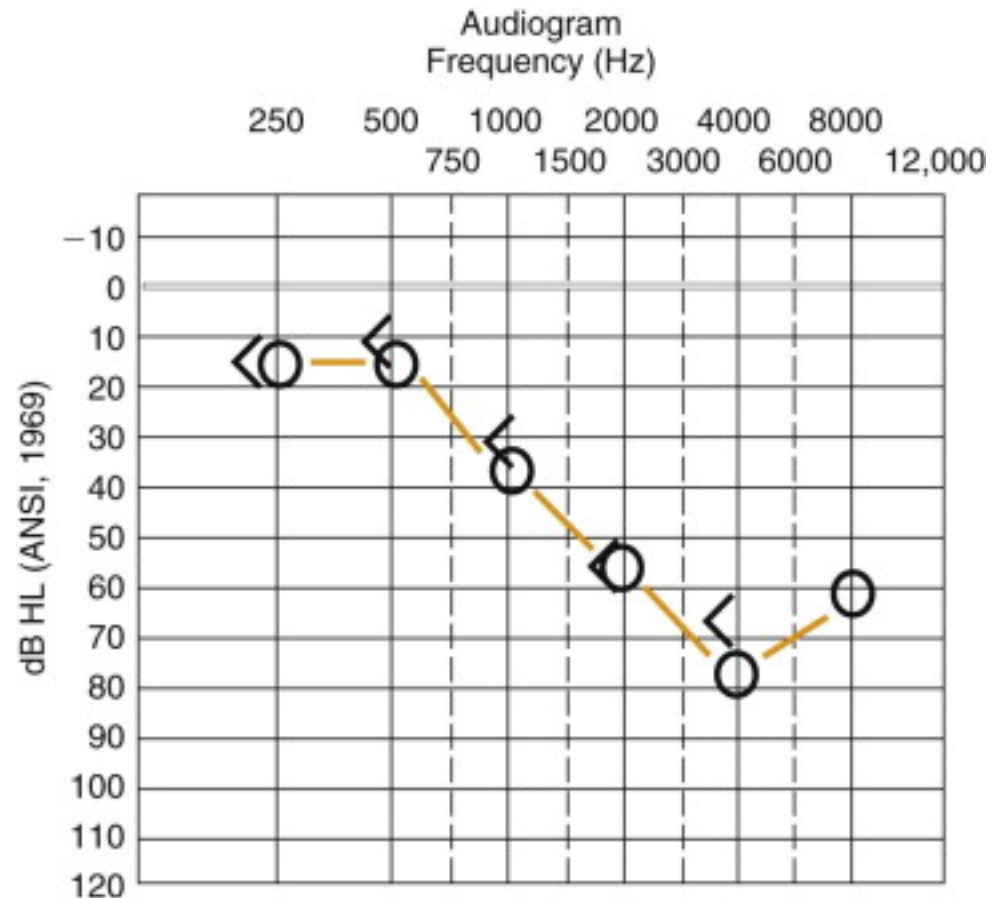
Types of Hearing Loss

- **Conductive** Hearing loss- Primarily caused by damage to the outer or middle ear
- Bone conduction is within the normal range, Air Conduction is not



Types of Hearing Loss

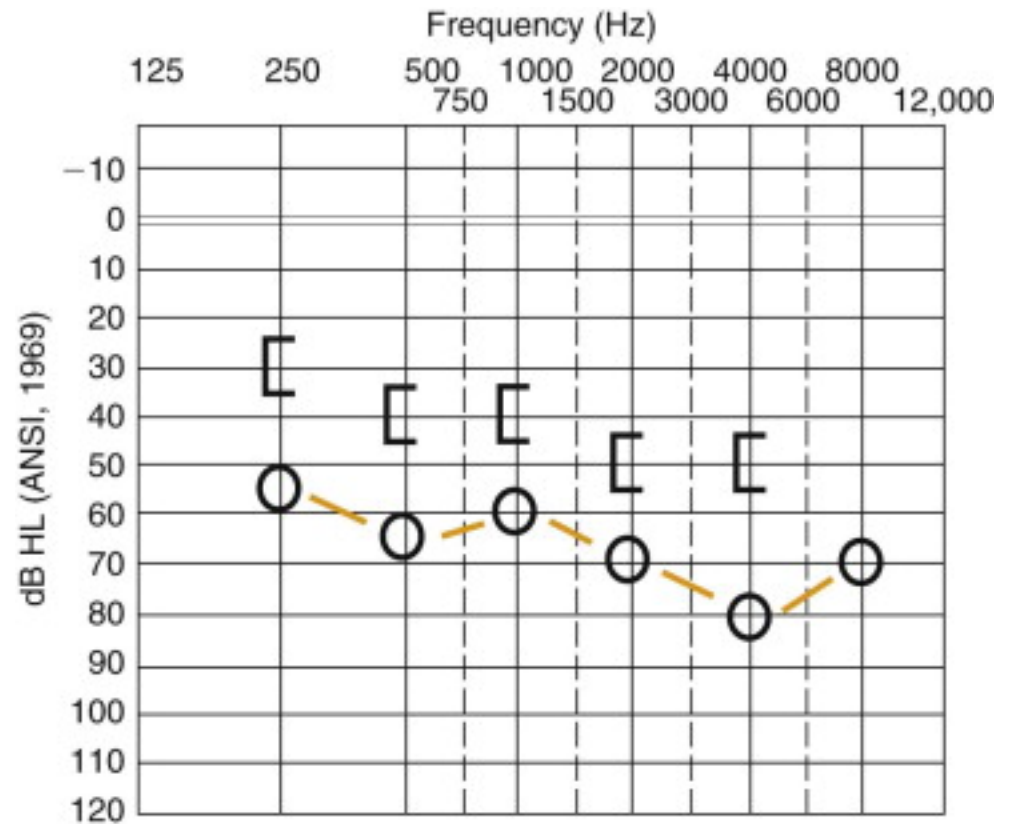
- **Sensorineural-**
Damage to the
Cochlea or beyond



Types of Hearing Loss

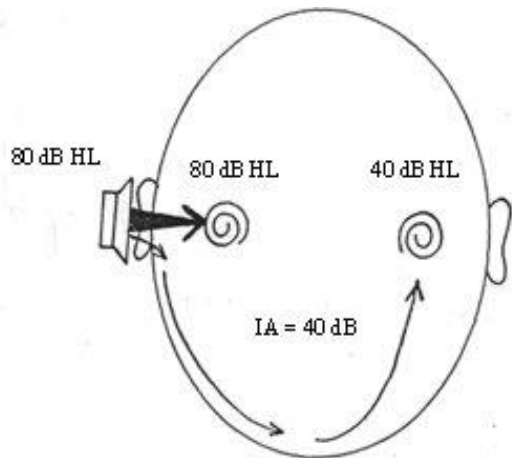
● Mixed Hearing Loss

- Has both conductive and sensorineural components

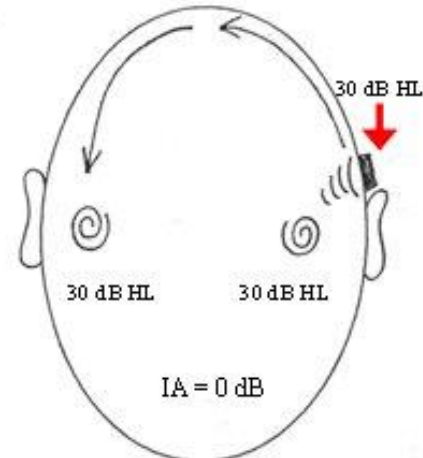


Masking

- **Why** - To prevent the non-testing ear from participating the test (**cross-over**)
- **Interaural attenuation** - reduction in sound when it crosses from one ear to the other



IA with air conduction (35 to 50 dB)



IA with bone conduction (0 to 10 dB)

Masking

● When

- Air conduction – 40dB or more difference between **air-conduction** threshold of the **bad ear** and **bone-conduction** thresholds of the **good ear**
- Bone conduction – **air-bone gap** of test ear more than 10dB

● How

- By presentation of a masking noise to the ipsilateral ear (Narrow-band noises in PTA)

Speech audiometry

● Speech detection threshold, SDT

- The intensity level at which a listener can barely discern the presence of a speech signal **50%** of the time

● Speech reception threshold, SRT

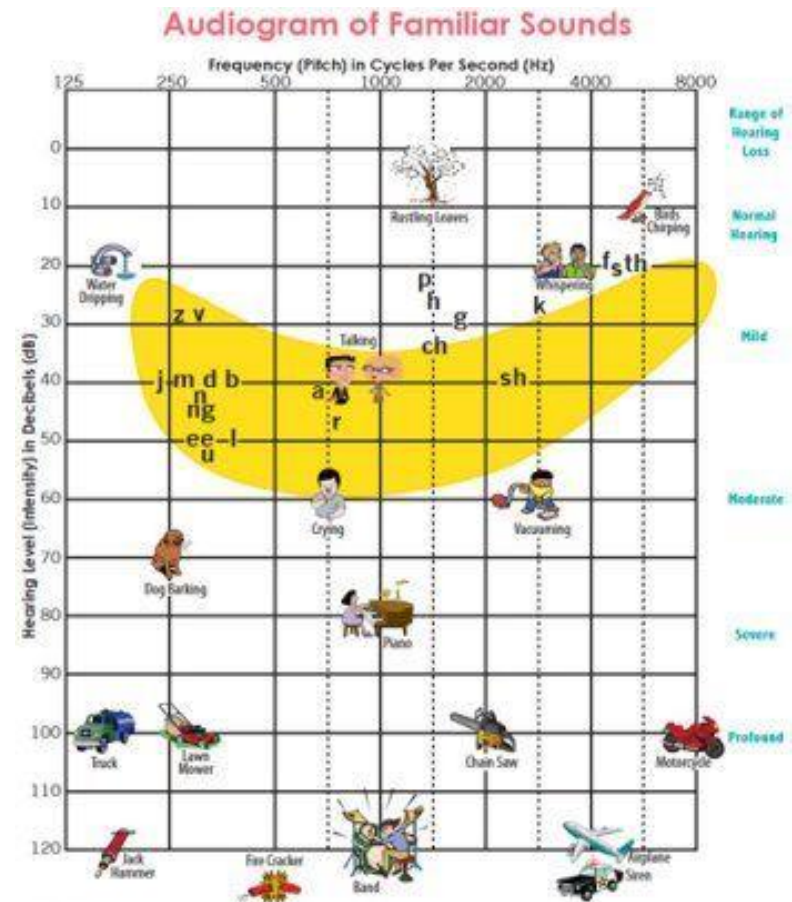
- Requires the listener to repeat the word
- SRT is usually 8 to 9 dB higher than the SDT

● Speech discrimination score, SDS

- Regarding the listener's ability to **recognize** speech under ideal listening conditions

Speech and the Audiogram

- Speech sounds in the English language can be plotted on the audiogram (**speech-banana**)
- This gives some insight into what sounds the patient is missing in everyday conversation.



Adapted from American Academy of Audiology, www.audiology.org and Northern, L.H. Downs, M. (2003). Audiogram of familiar sounds and Ling, S. & Ling, A. (1975). Aural Rehabilitation.

Summary--Audiometry

- Subjective evaluation to diagnose hearing loss
- Evaluates the entire auditory system
- Provides information on the most appropriate “next step”
 - Further diagnostic testing
 - Medical intervention
 - Hearing aids

Tympanometry

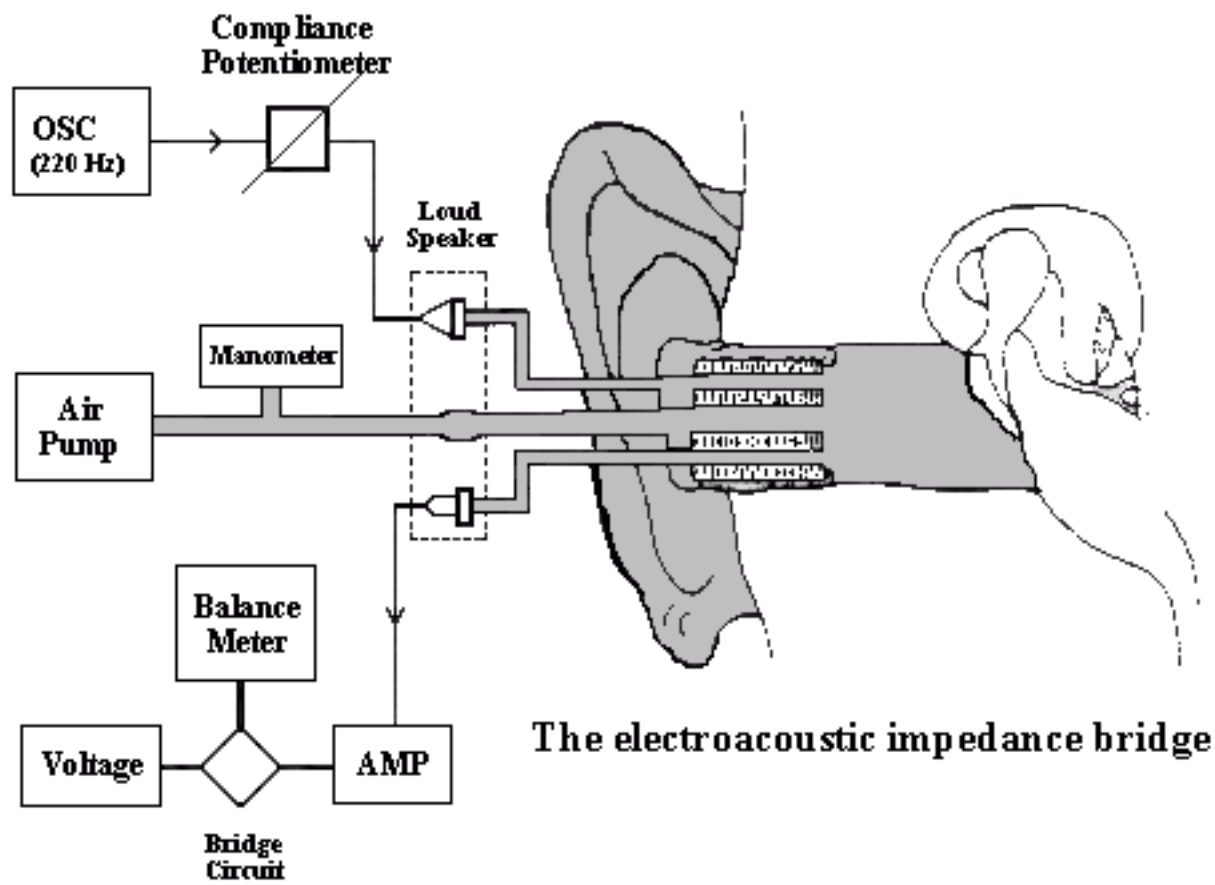
THE MIDDLE EAR

Tympanometry

- **Objective** measure of the middle-ear system
- “Not a hearing test”
- Graphic representation of ear compliance in relation to the pressurization of the ear canal

Tympanometry

- A probe is inserted in the ear canal that contains a **loudspeaker**, a **microphone**, and a **pump**.
- A tone (226Hz) is delivered into the ear while the pressure is changed within the sealed canal.
- Measurement taken at the probe - plots the flexibility of the ear drum and the ossicles.
- Plot is displayed in a graph called the tympanogram

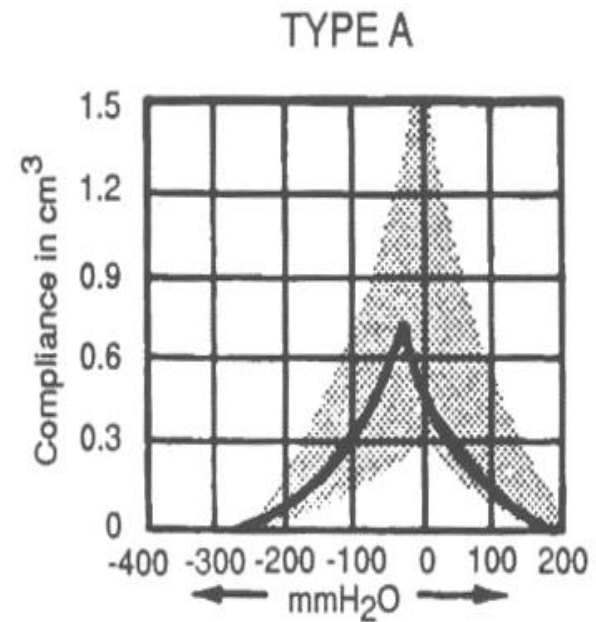


Refer: <https://dnhhelp.wordpress.com/otology/>



Tympanogram tells us

- Middle-ear pressure (normally equal to atmospheric pressure)
- “Compliance” of middle-ear system (eardrum movement)



Tympanogram

Types of Tympanograms

Type A

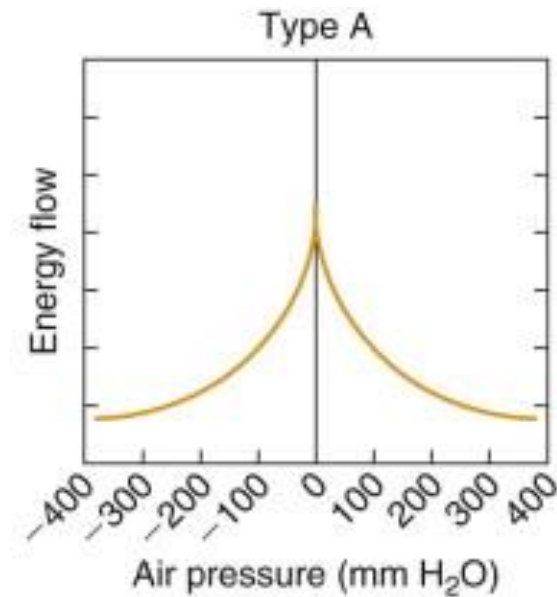


Figure 5.2 Normal tympanic membrane (Right)

- Normal middle ear pressure
- Normal eardrum movement
- Normal ear canal volume

Example:

- Normal middle ear



Type A_s

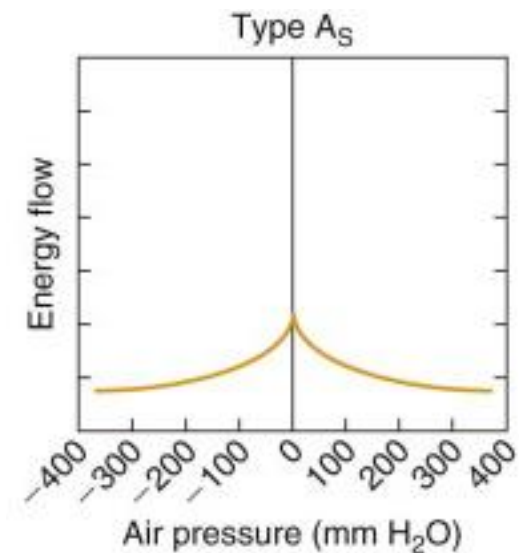
- Reduced Compliance
- Normal Middle-ear pressure
- Normal ear canal volume

Example:

- Fixation of ossicles
- Scarring on TM



Figure 5.24 Tympanosclerosis

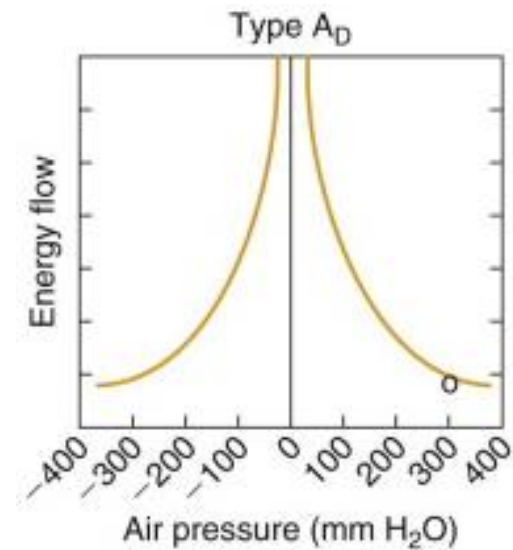


Type Ad

- Increased compliance
- Normal middle-ear pressure
- Normal ear canal volume

Example:

- Discontinuity of ossicles

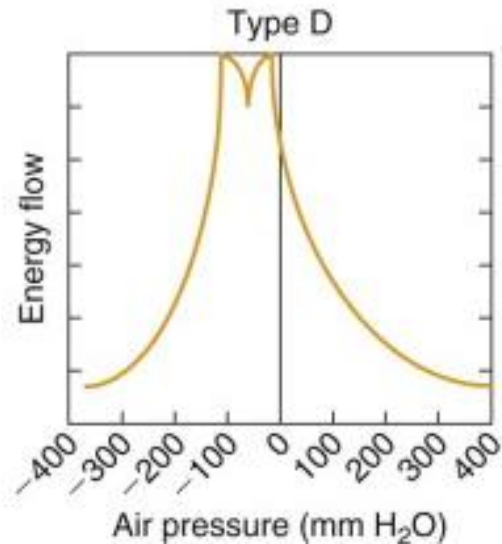


Type D

- Increased compliance
- Normal middle-ear pressure
- Normal ear canal volume

Example:

- Scarred eardrums or with normal, hypermobile eardrums.



Type B (normal volume)

- “Flat”
- No compliance or pressure peak indicated
- Normal ear canal volume

Example:

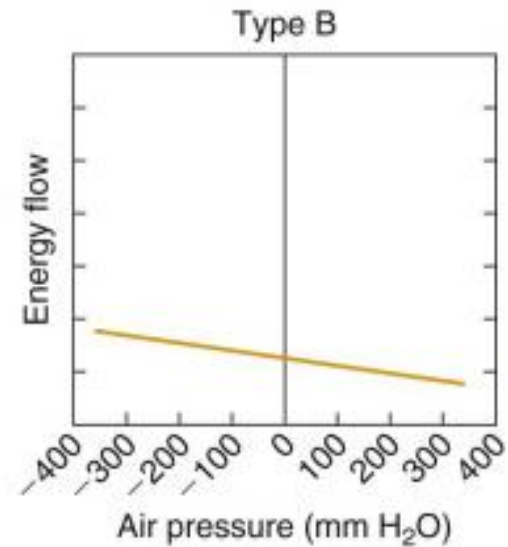
➤ Middle-ear fluid



Figure 5.8 Acute otitis media I



Figure 5.17 Serous otitis media



Type B (increased volume)

- “Flat”
- No compliance or pressure peak indicated
- Increased ear canal volume

Example:

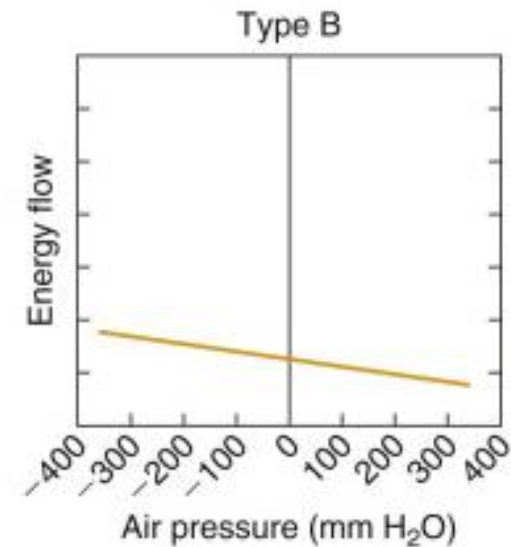
- Perforated TM
- Patent P.E. Tubes



Figure 5.19 ventilation tube



Figure 5.34 Perforation



Type B (decreased volume)

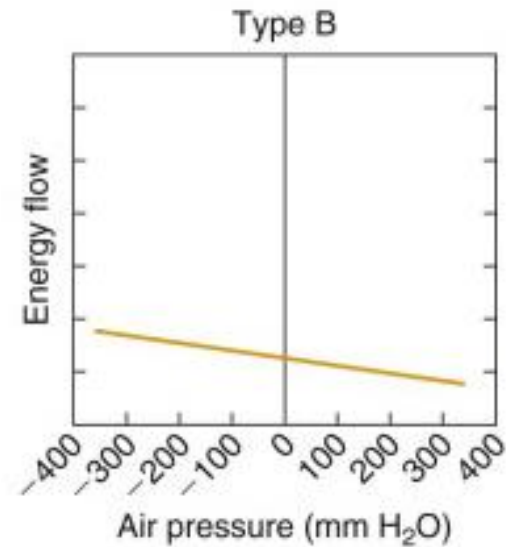


Figure 4.10 Earwax

- “Flat”
- No compliance or pressure peak indicated
- Decreased ear canal volume

Example:

- Occluding Wax
- Probe up against canal wall

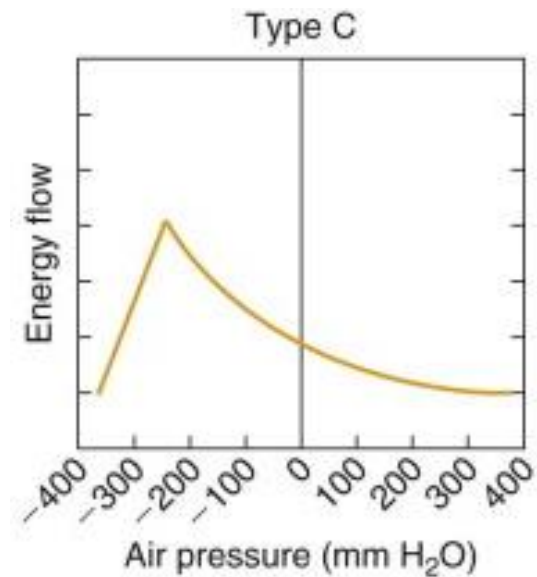


Type C

- Excessive negative middle-ear pressure
- Normal or reduced compliance
- Normal ear canal volume

Example:

- Eustachian tube dysfunction, initiation or resolution of middle-ear fluid



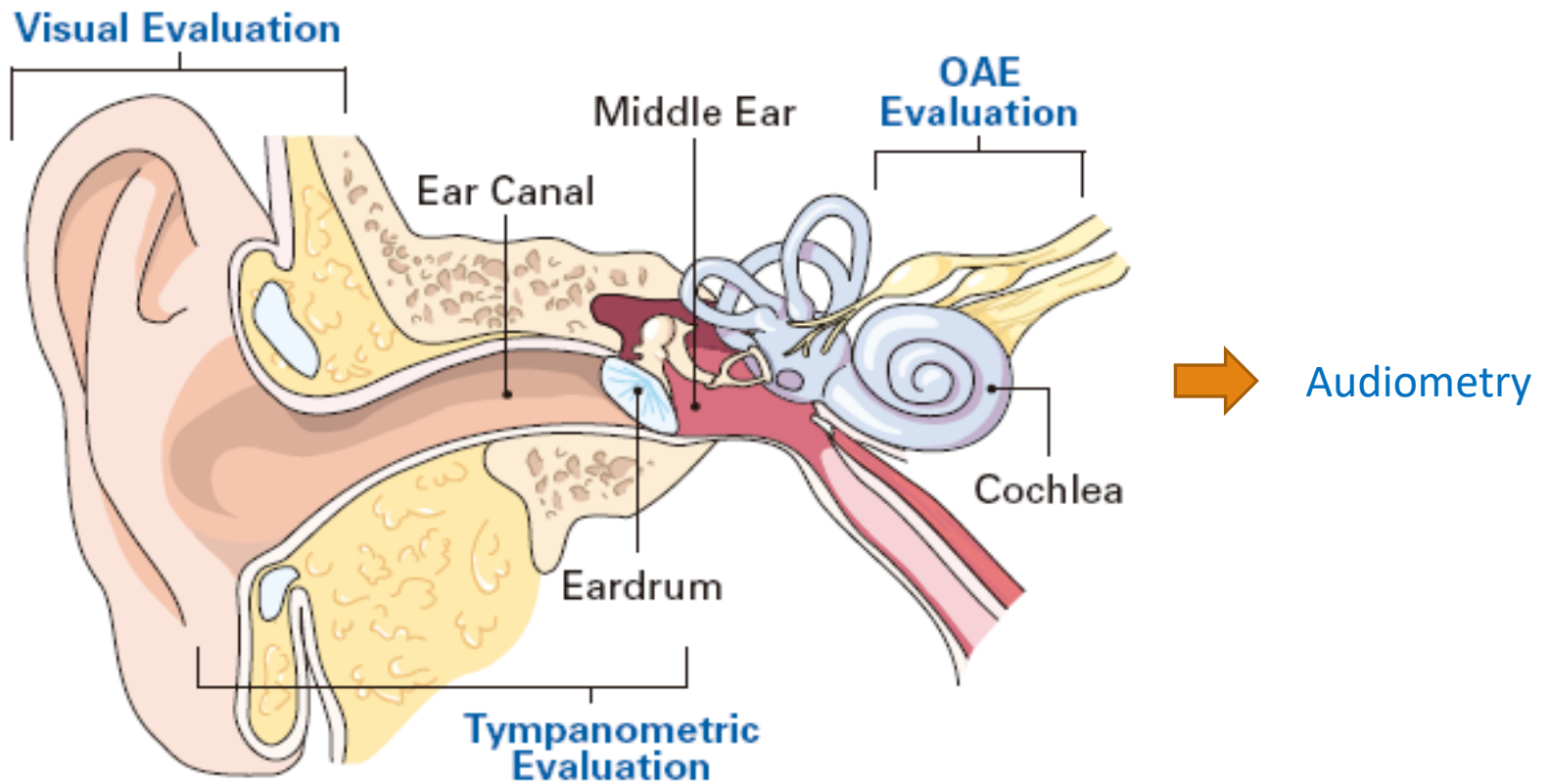
Advantages of Tympanometry

- Objective measure of middle-ear function
- Fast & Easy to perform
- Requires no response from the patient
- Can be performed on all ages, infant to adult

Why Use Tympanometry

- Objective documentation of reduced **eardrum** movement (ie: fluid, wax, etc.)
- Monitor chronic middle-ear fluid
- Confirm tympanic membrane perforation
- Monitor **Eustachian tube** function
- Correlate with audiogram to develop a more complete picture of hearing

Summary



Review



References

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Thanks for your listening
