UNC SCHOOL OF MEDICINE

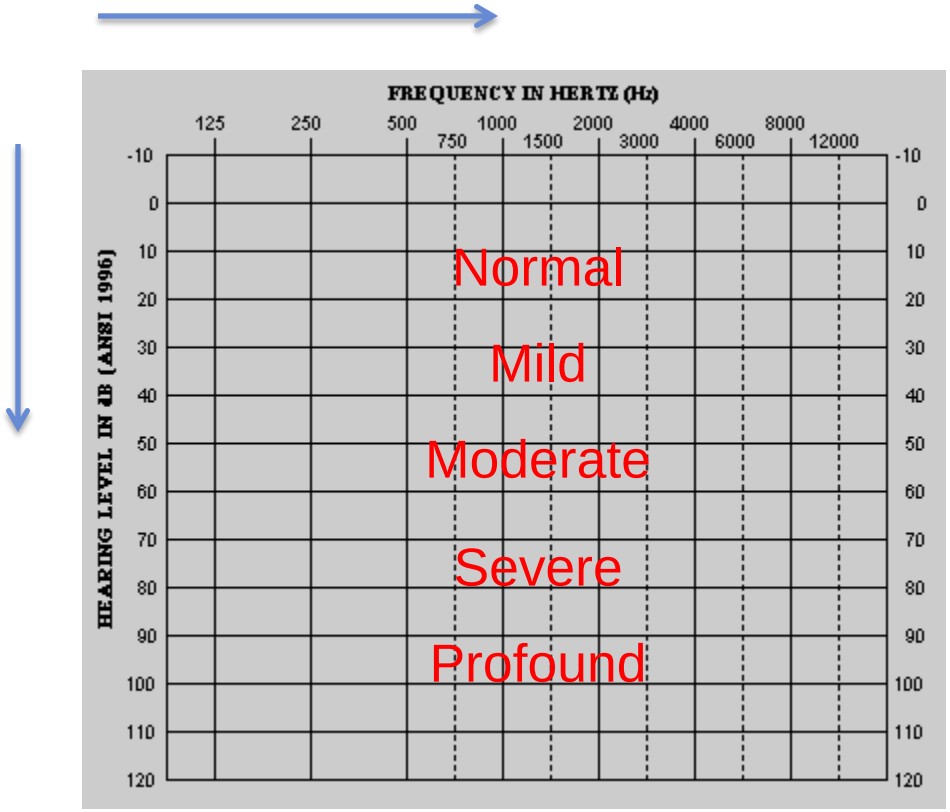
Implantable Treatments for Different Types of Hearing Loss

Margaret Dillon, AuD
Marcia Adunka, AuD

Implantable Technologies

- Types of hearing loss
- Bone-anchored devices
- Middle ear implantation
- Cochlear implantation

Audiogram



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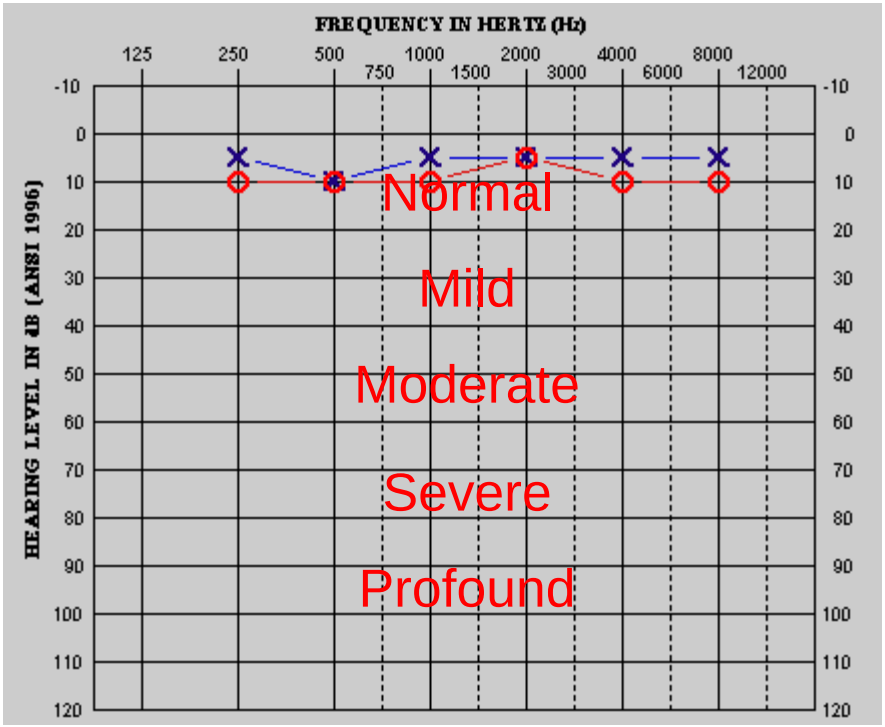
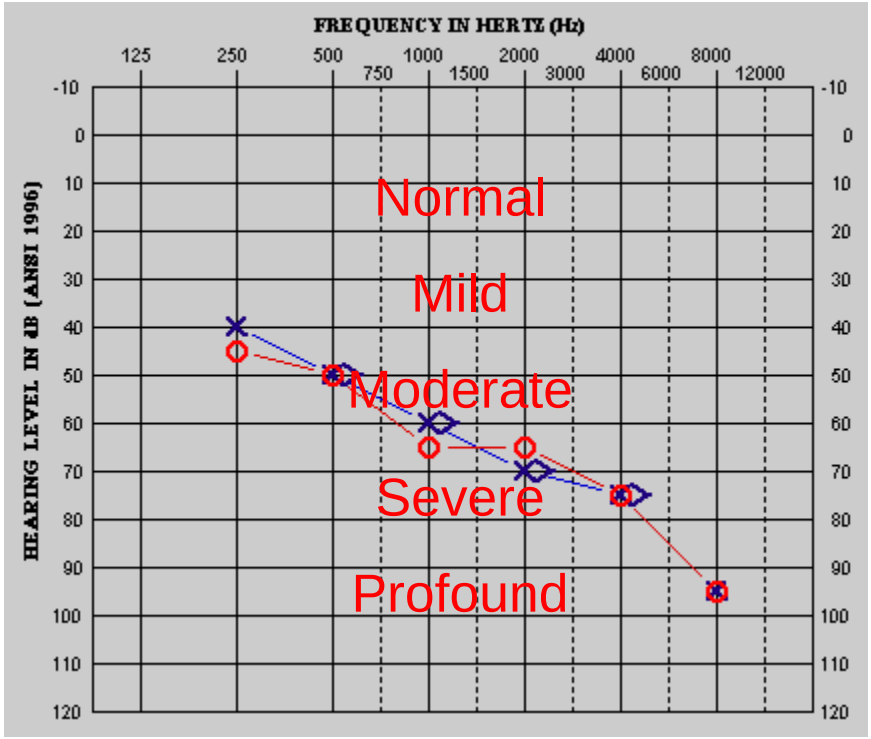
Audiogram


FREQUENCY IN HERTZ (Hz)
125
250
500
750
1000
1500
2000
3000
4000
6000
8000
12000
HEARING LEVEL IN dB (ANSI 1996)
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
Normal
Mild
Moderate
Severe
Profound

Audiogram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Types of Hearing Loss

- Conductive
  - » Dysfunction in the conduction of sound by the outer ear, tympanic membrane, and/or middle ear
- Sensorineural
  - » Dysfunction within the inner ear (cochlea) and/or auditory nerve
- Mixed
  - » Conductive + Sensorineural

Types of Hearing Loss

- Conductive
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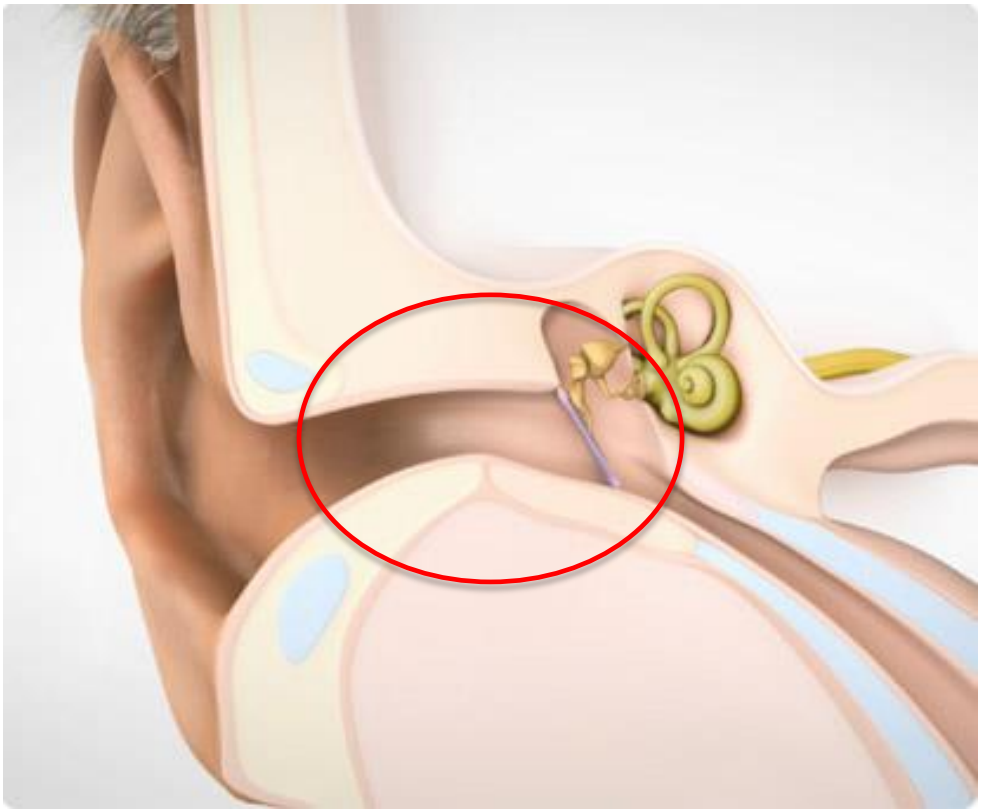

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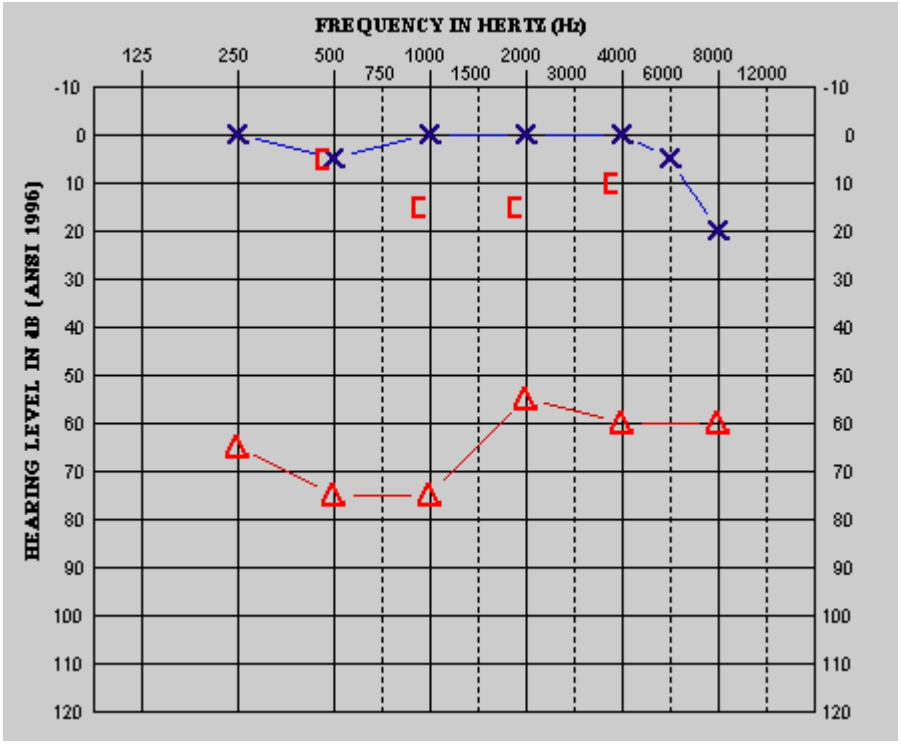
Types of Hearing Loss: Conductive



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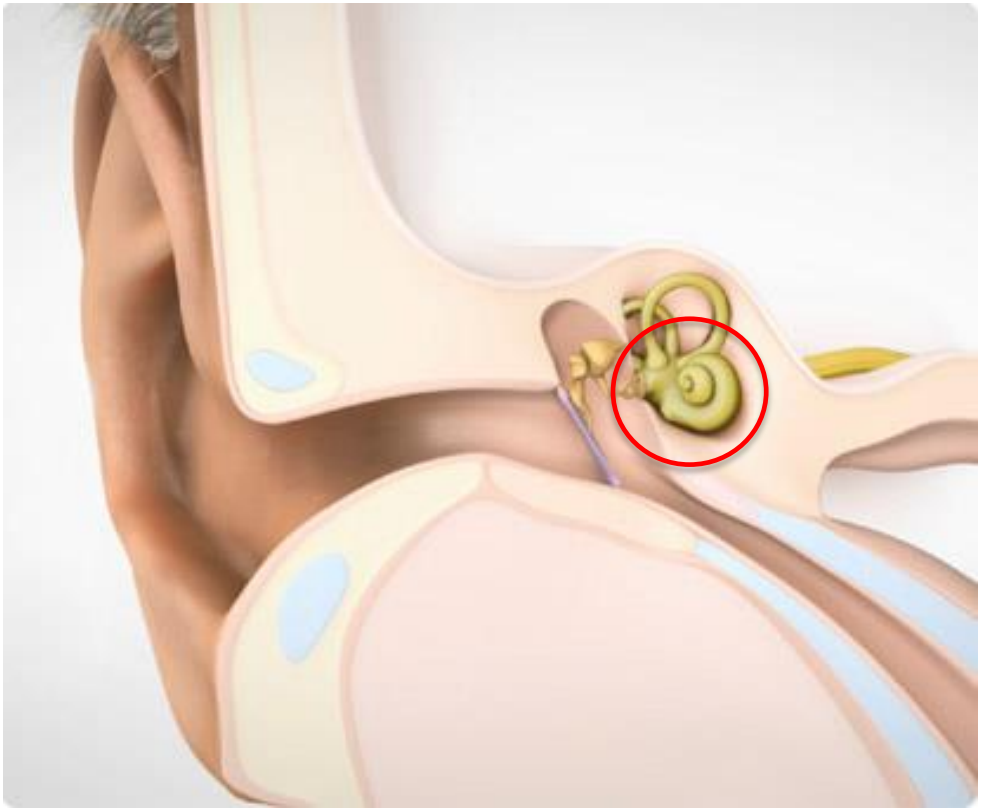
Types of Hearing Loss

- Sensorineural
  - » Dysfunction within the inner ear (cochlea) and/or auditory nerve



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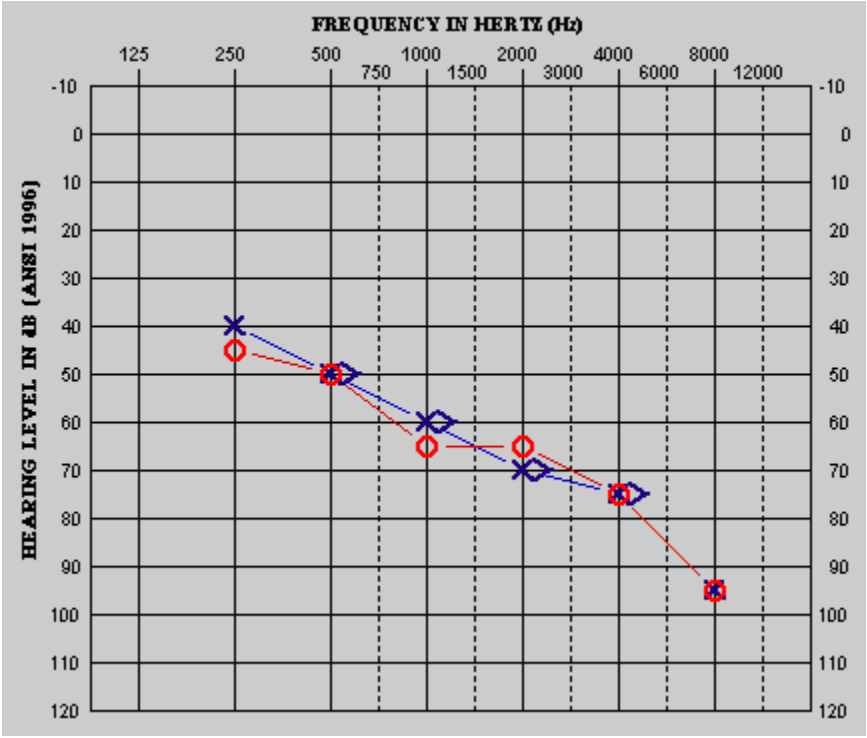
Types of Hearing Loss: Sensorineural



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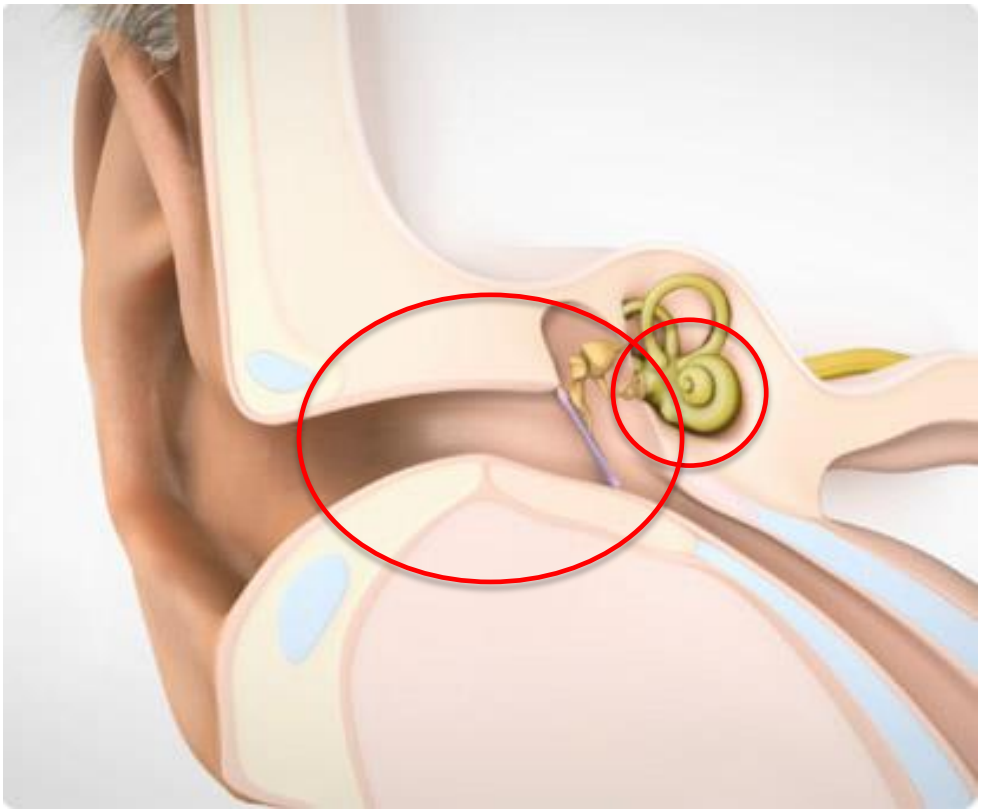
Types of Hearing Loss

- Mixed
  - » Conductive + Sensorineural



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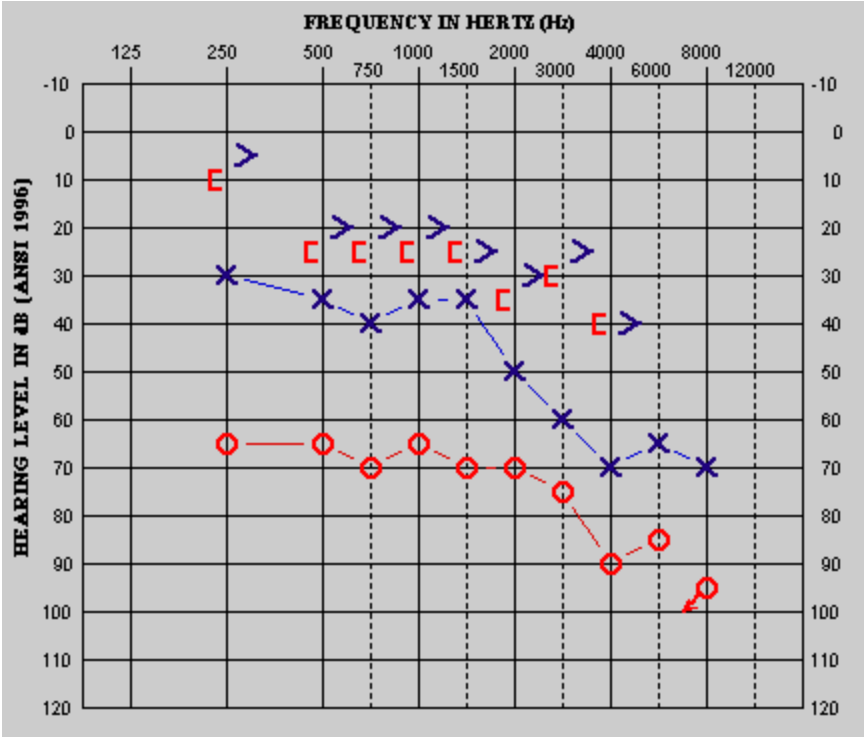
Types of Hearing Loss: Mixed



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Hearing Aids

- Amplify the acoustic signal

Phonak

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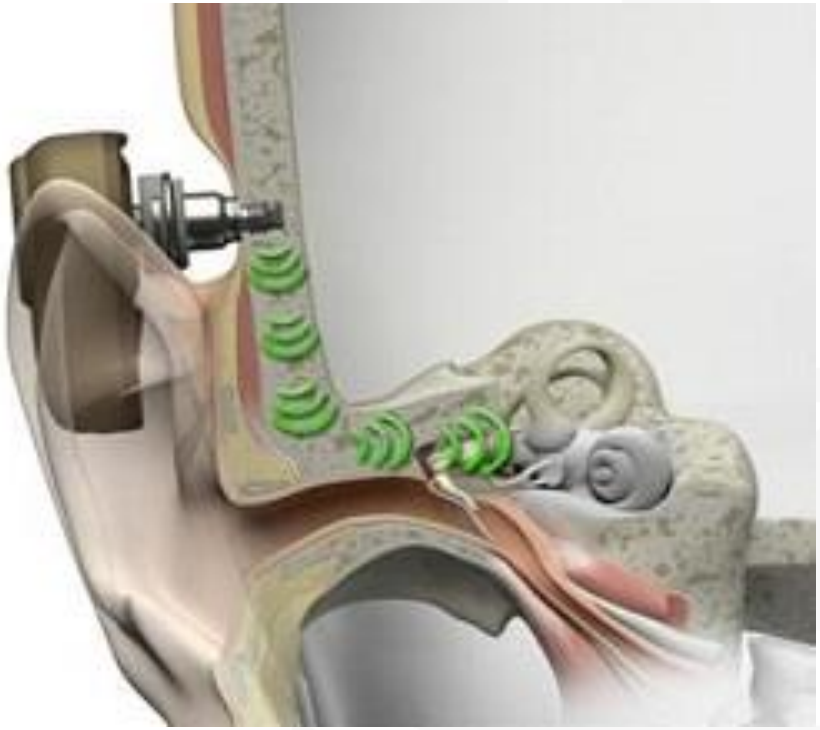
Implantable Treatments

- Bone-anchored devices
  - » Transmission of sound via bone conduction
- Middle ear implants
  - » Transmission of sound via vibratory stimulation
- Cochlear implants
  - » Transmission of sound via electric stimulation of the auditory nerve

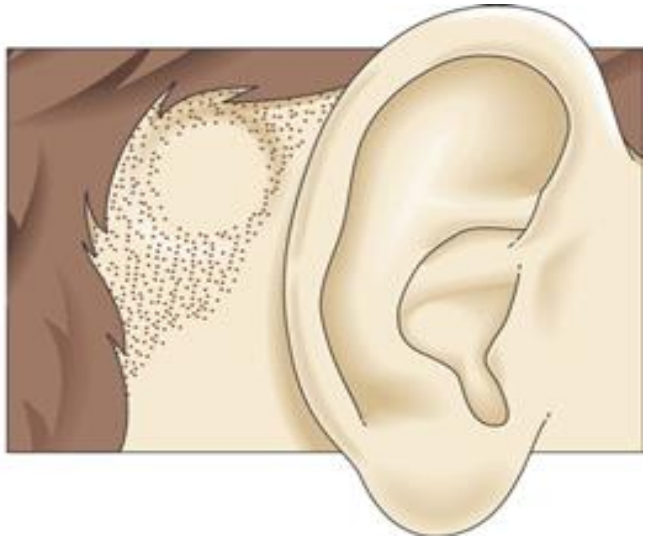
Bone-Anchored Devices

- Stimulation of the acoustic signal via bone conduction



Bone-Anchored Devices

- Three Part System:
  - » **Titanium Screw** surgically implanted into mastoid
    - Approximately 2 month osseointegration
  - » **External Abutment** transfers the sound vibrations
  - » **Sound Processor**



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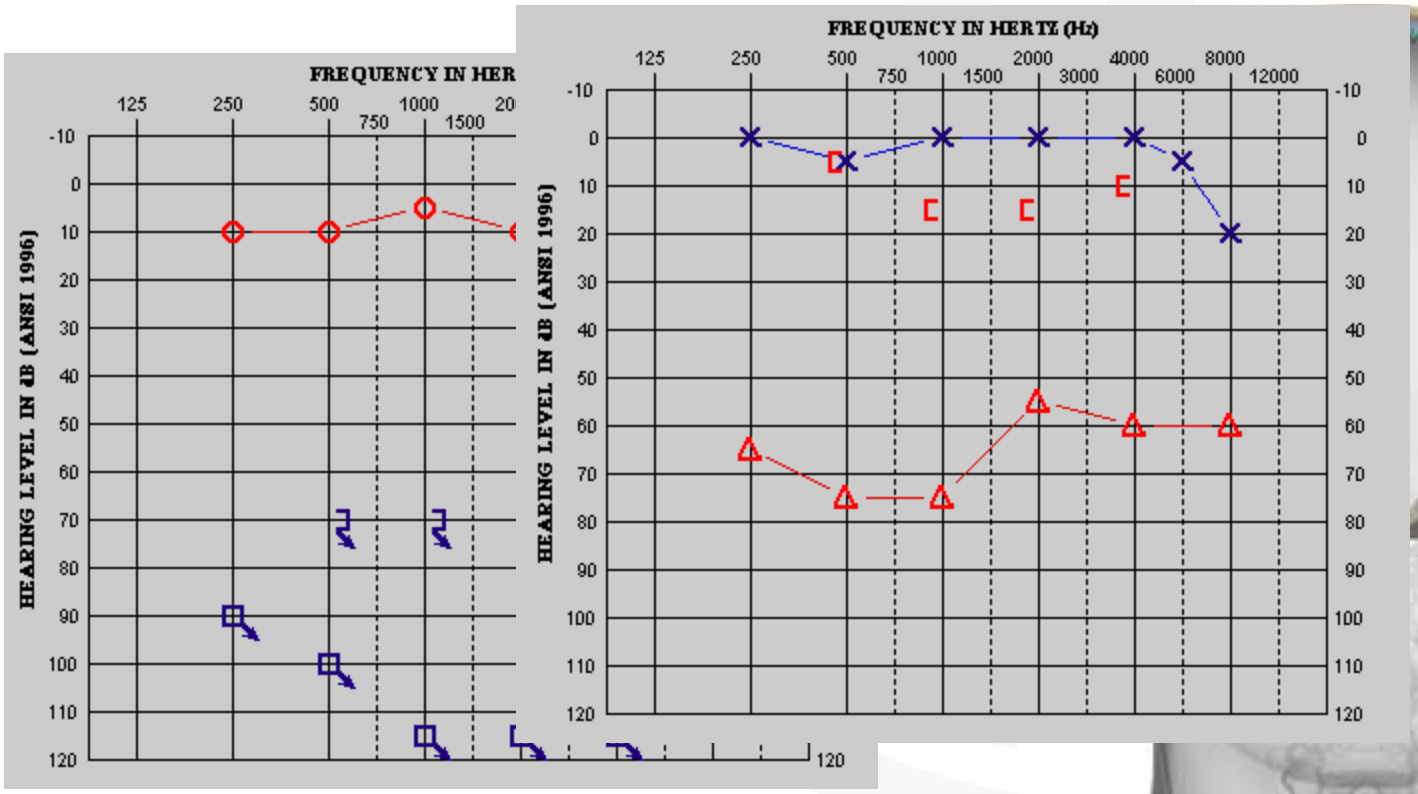
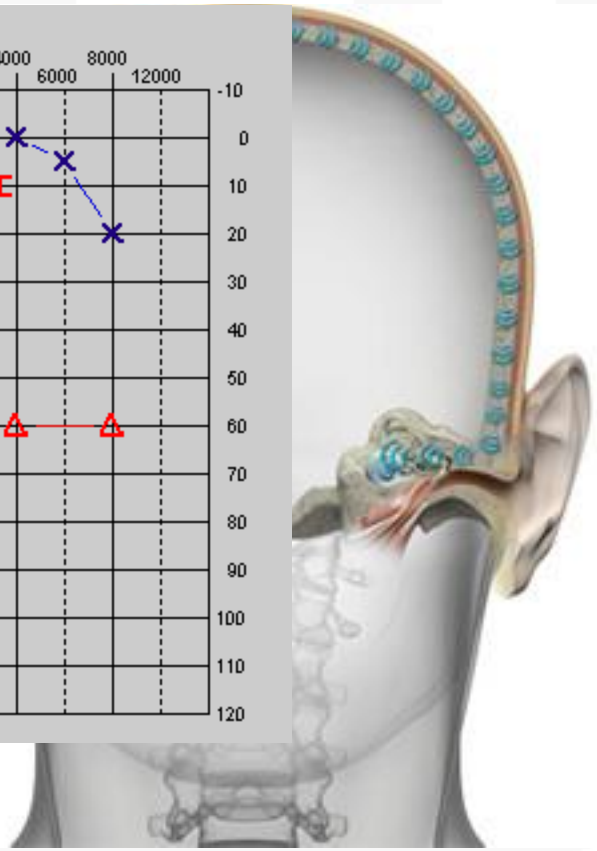
Bone-Anchored Devices

- Indications (FDA approvals)
  - » CHL and Mixed HL (1996)
  - » Single-Sided Deafness (SSD; 2002)





Oticon

Middle Ear Implants

- Esteem
  - » Envoy Medical
- Maxum
  - » Ototronix
- Vibrant Soundbridge (VSB)
  - » MED-EL Corporation

Vibrant Soundbridge (VSB)

- Converts sound into controlled, amplified vibrations
- Direct drive stimulation of the middle ear structures

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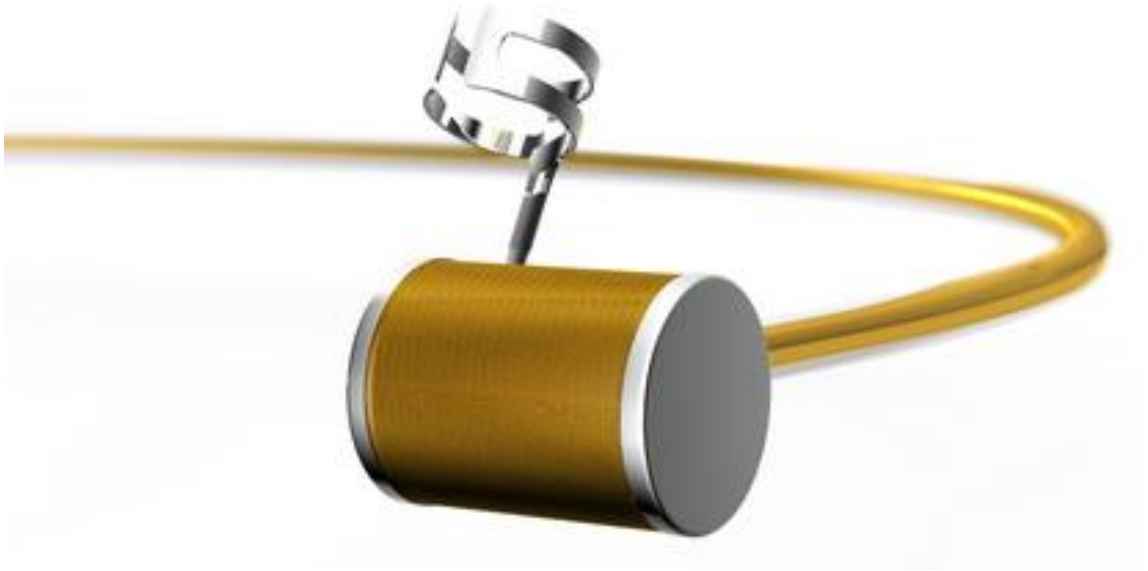
Vibrant Soundbridge (VSB)

- Two Part System:
  - » Internal
    - Vibrating Ossicular Prosthesis (VORP)



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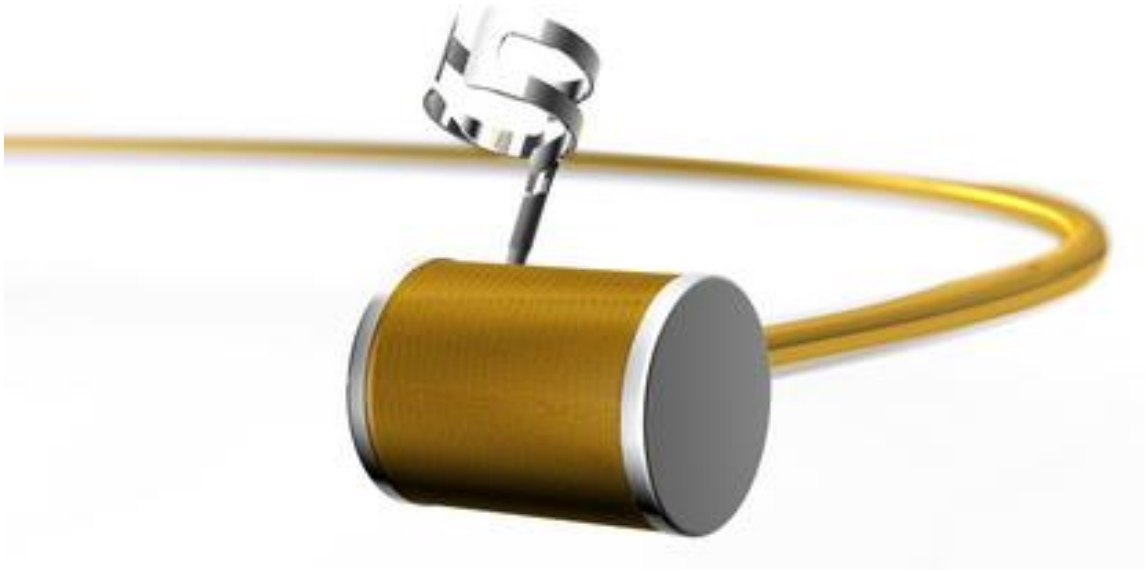
Vibrant Soundbridge (VSB)

- Vibrating Ossicular Prosthesis (VORP) with Floating Mass Transducer (FMT)
  - » Wide frequency range up to 8 kHz
  - » Preservation of residual hearing



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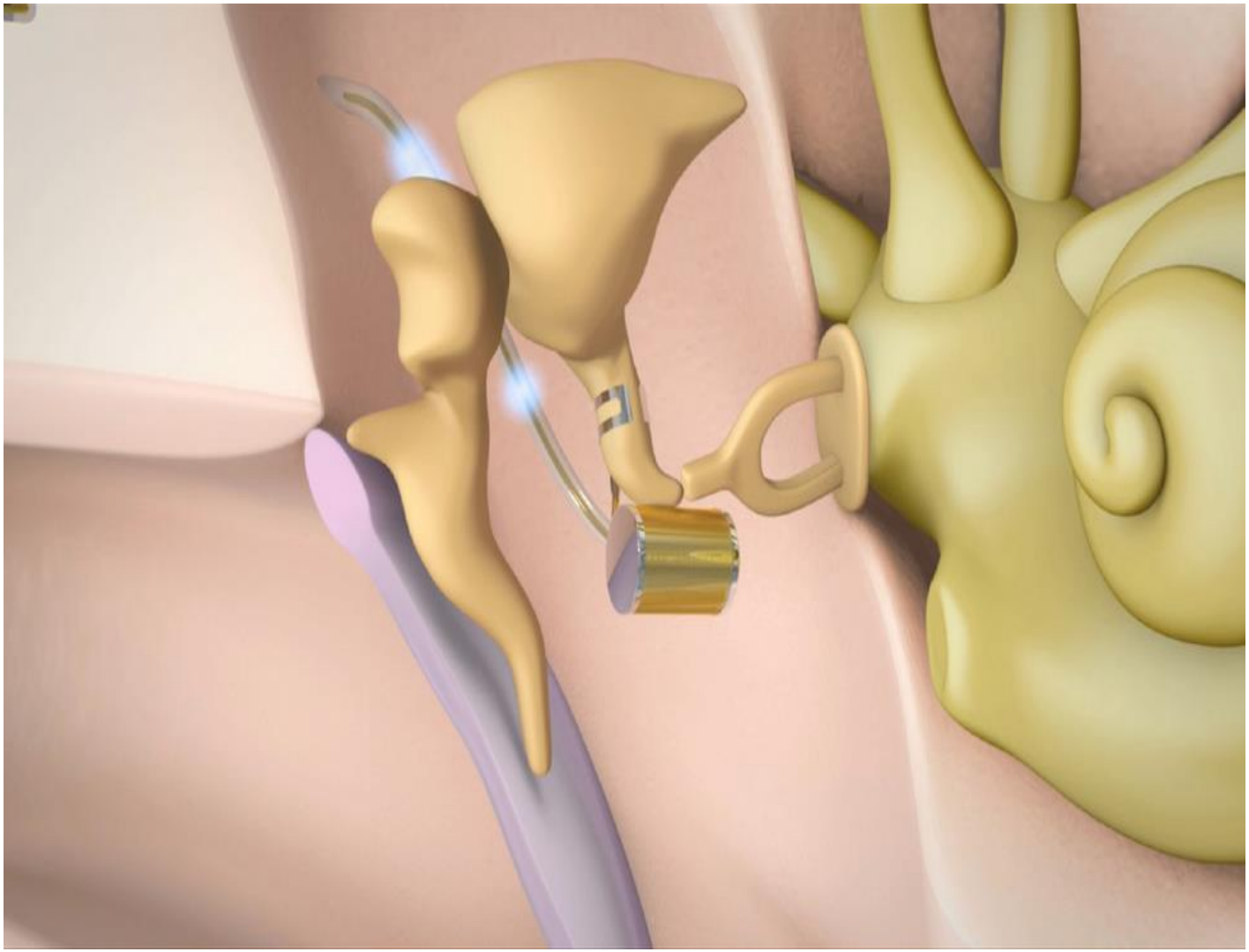
Vibrant Soundbridge (VSB)



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Vibrant Soundbridge (VSB)

- Two Part System:
  - » External
    - Audio Processor

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Vibrant Soundbridge (VSB)

- Magnetic connection between internal and external components

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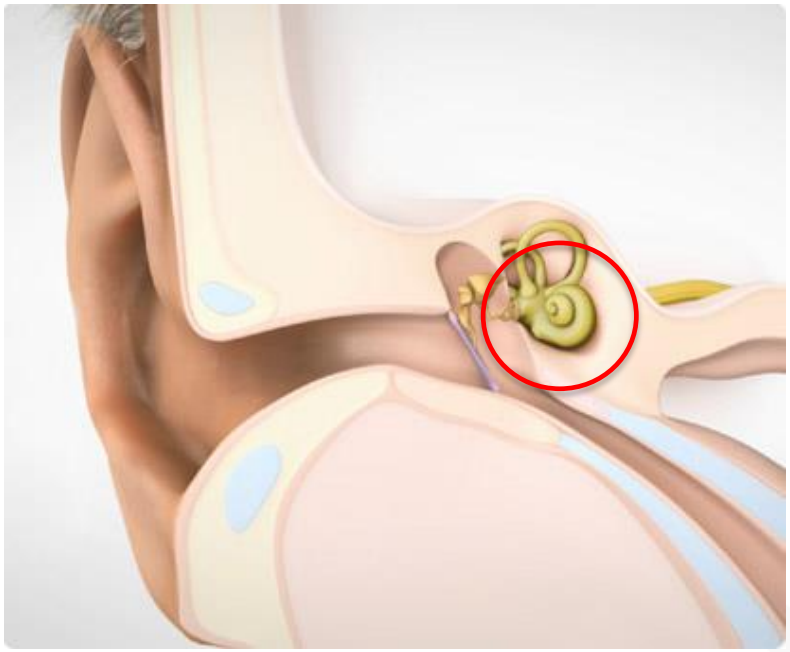
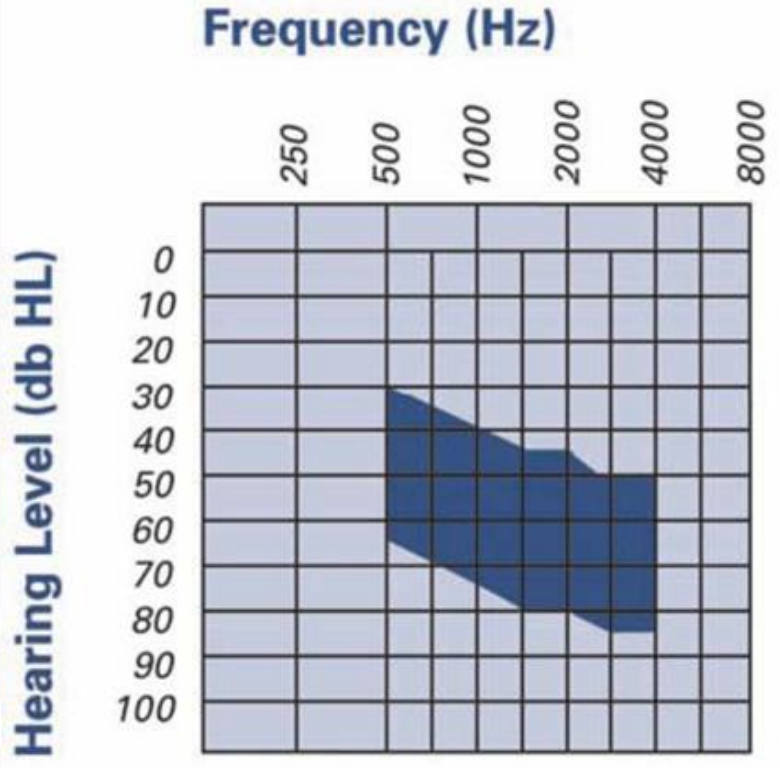
Vibrant Soundbridge (VSB)

- Approved Indications
  - » Adults
  - » Bilateral moderate-to-severe sensorineural hearing loss
  - » Word Rec > 50%





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VSB Clinical Trial

- Clinical Trial of the Vibrant Soundbridge as a Treatment for Conductive and Mixed Hearing Loss, Using Direct Round Window Cochlear Stimulation
  - » Multi-center clinical trial to evaluate VSB in a new population
  - » Sponsored MED-EL Corporation

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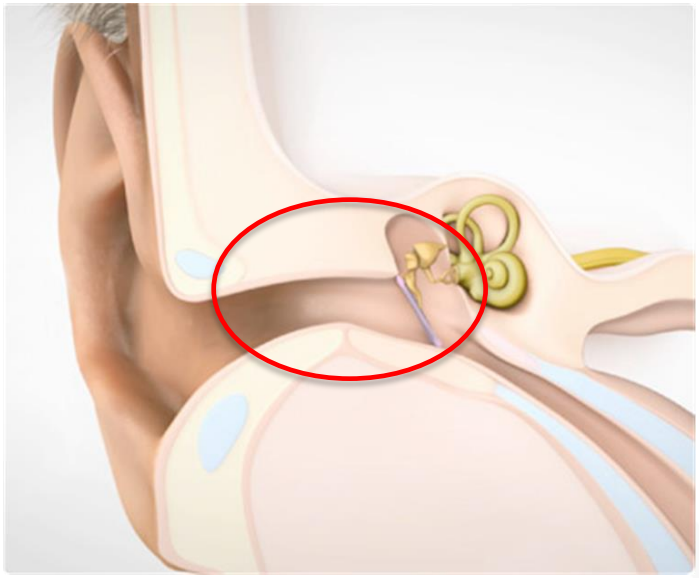
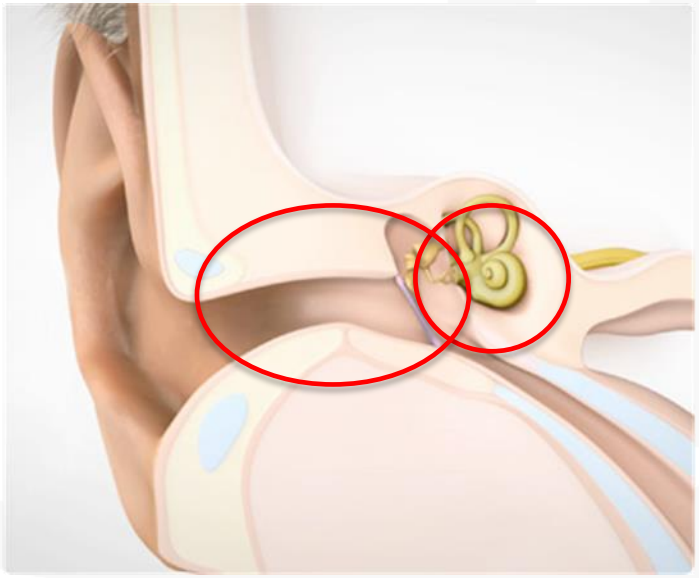
CAUTION: Investigational device. Limited by US law to investigational use.

VSB Clinical Trial

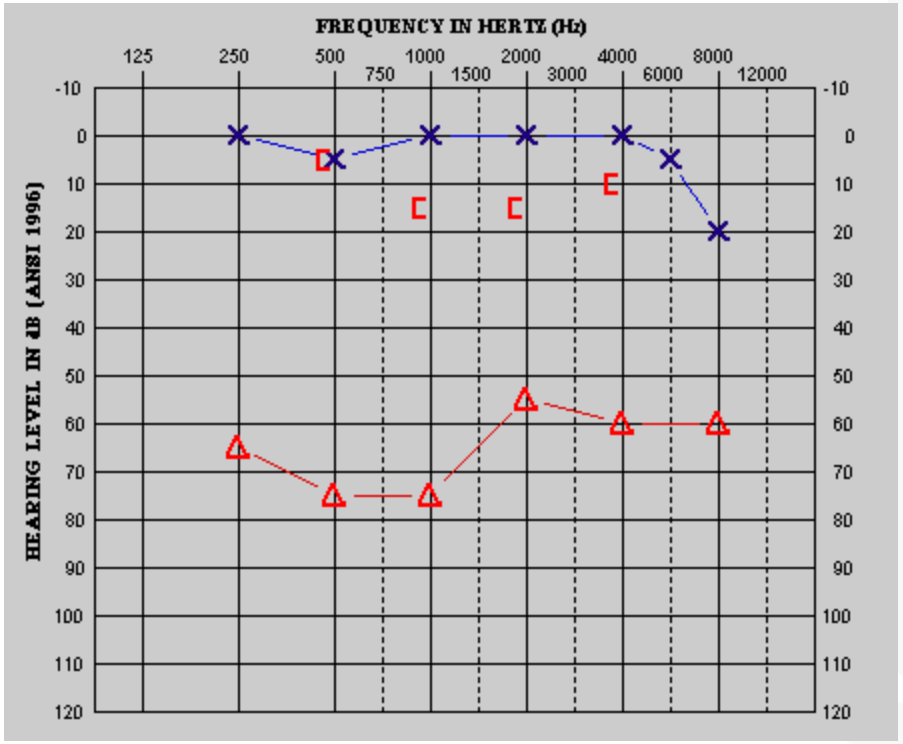
- Candidacy Criteria
  - » Conductive & mixed hearing loss
  - » Traditional amplification unsuccessful
  - » Word Rec > 30%
    - CNC Words

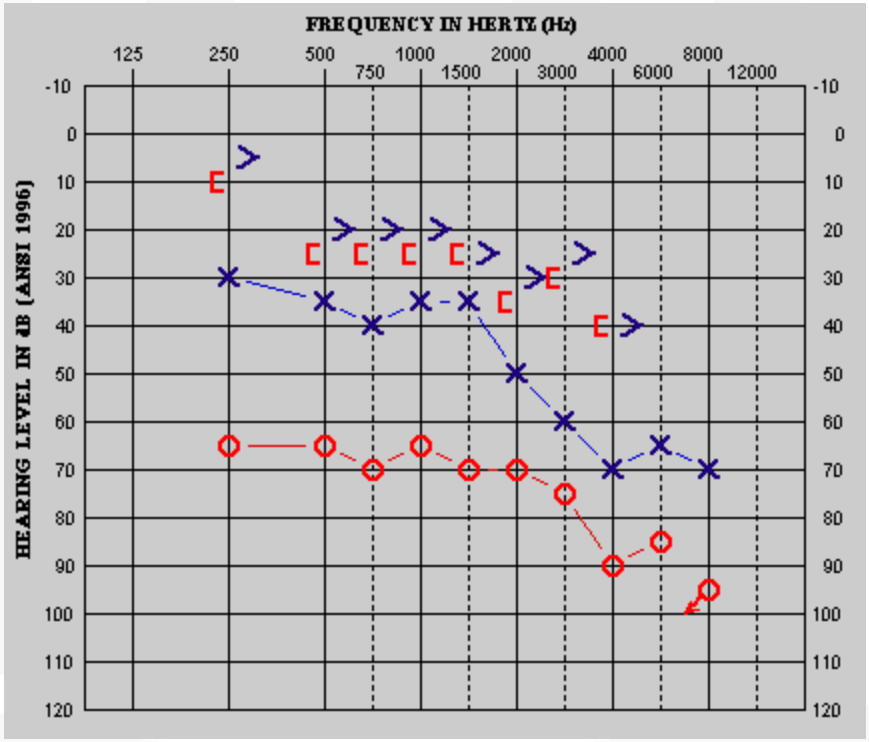




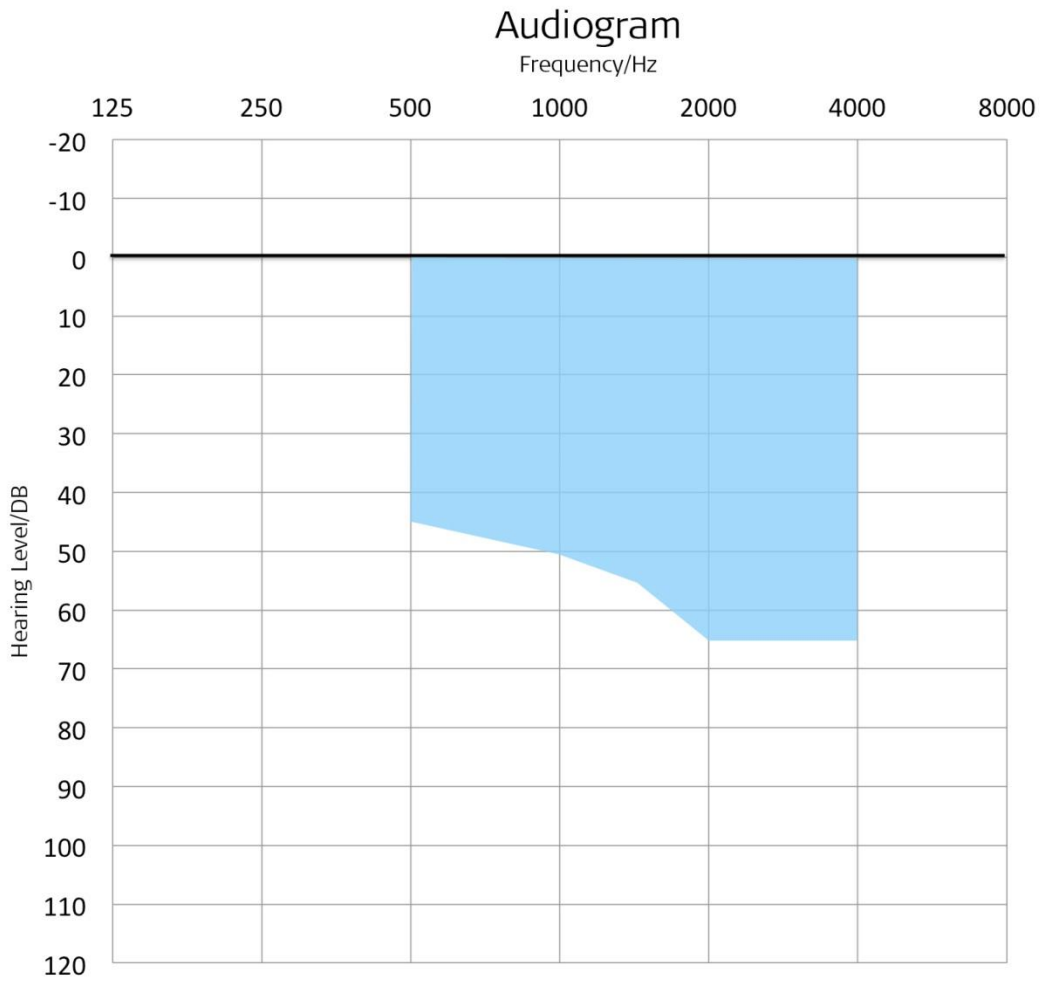
VSB Clinical Trial

- Candidacy Criteria
  - » Conductive & mixed hearing loss





VSB Clinical Trial



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VSB Clinical Trial

- Potential Conditions
  - Congenital malformations (Atresia, Microtia)
  - Stenosis of external auditory canal
  - Allergies to earmold material
  - Chronic otitis externa
  - Chronic draining ears
  - Eczema/Psoriasis of the ear
  - Unresolved acoustic feedback
  - Large mastoid bowl following surgery

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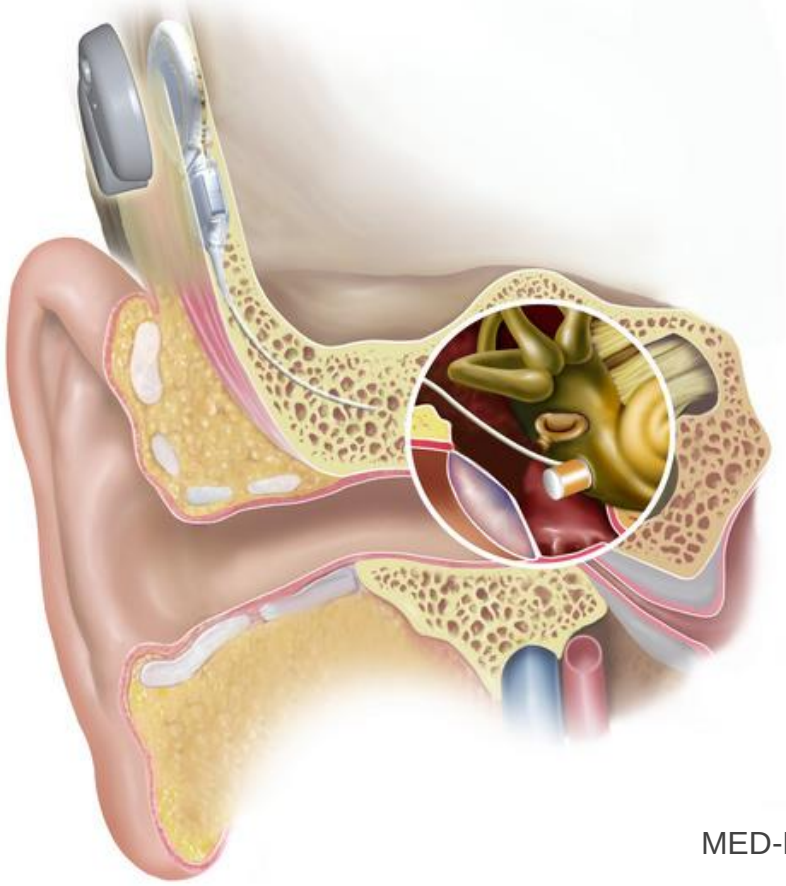
VSB Clinical Trial

- FMT placed in Round Window (RW) Niche
  - » Bypass conductive component to deliver vibrations directly to the cochlea
  - » Active RW stimulation



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CAUTION: Investigational device. Limited by US law to investigational use.

VSB Clinical Trial

- Potential Benefits
  - » Appropriate amplification
  - » Little to no acoustic feedback
  - » Improved ability to understand speech in quiet and noise
  - » Ability to wear technology without occluding the ear canal

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VSB Clinical Trial

- Results

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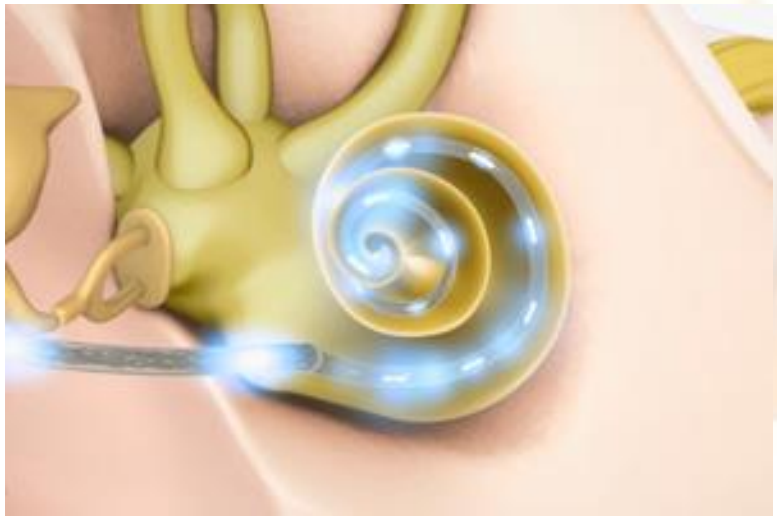
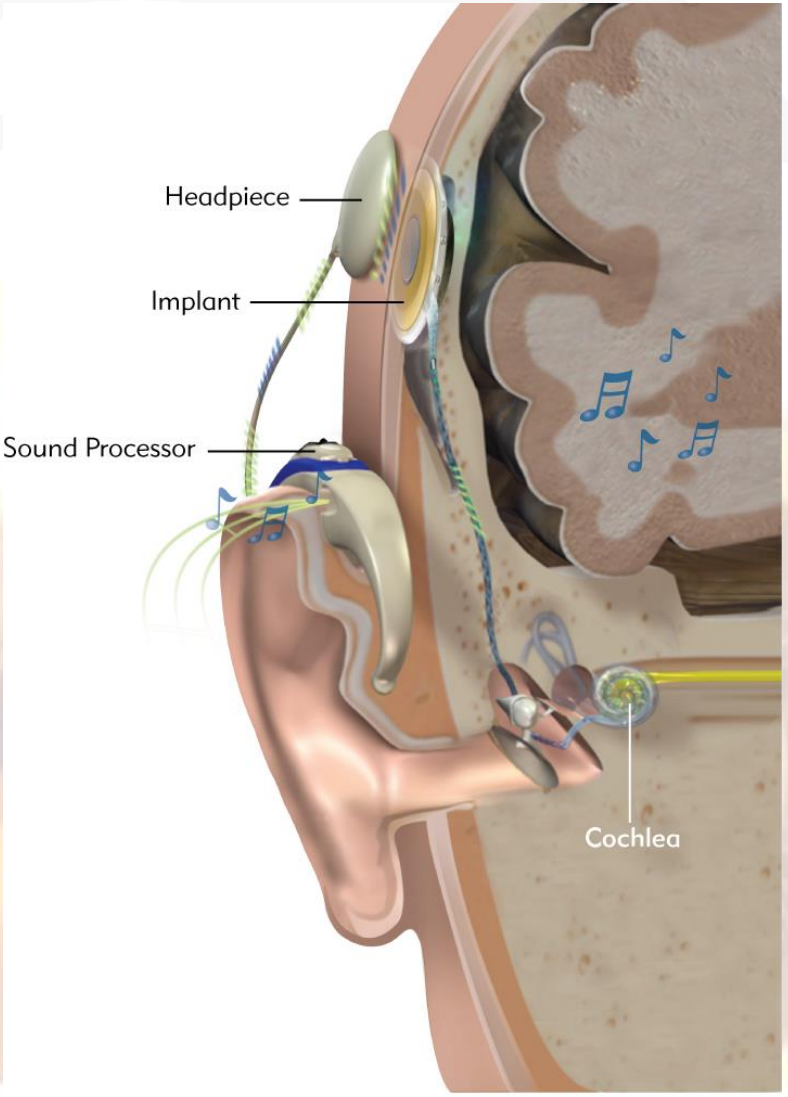
Cochlear Implantation

- Electrical representation of an acoustic signal
  - » Insertion into scala tympani of the cochlea
  - » Bypass damaged sensory cells





Components of the Cochlear Implant System

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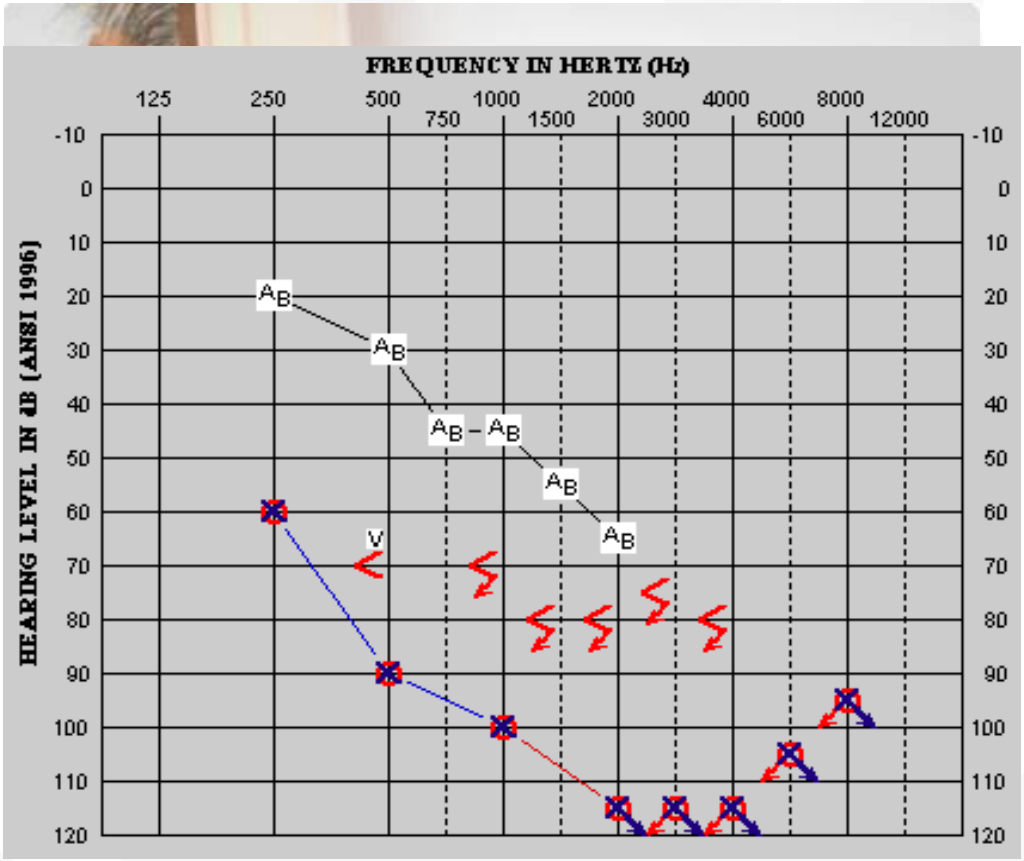
Cochlear Implantation

Cochlear Corporation

Cochlear Implantation

- Indications
  - » Moderate-to-profound sensorineural hearing loss
  - » Limited speech perception abilities with conventional amplification.



Pre-Operative

Aided Speech Testing

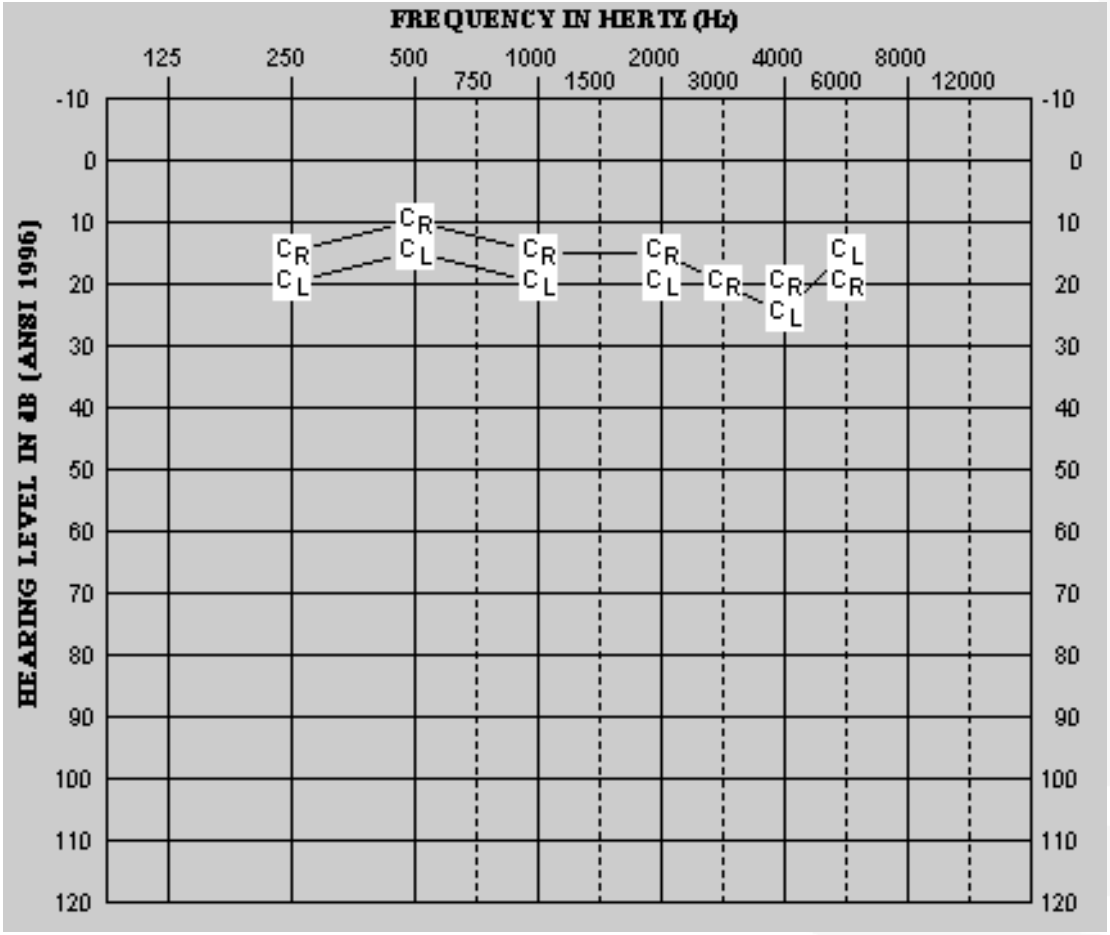
Word Test

Hearing Aid: **16%**

A_B = Hearing Aid Both Ears

Cochlear Implantation

Post-operative



Post-Operative

Aided Speech Testing

Word Test

CI Right **80%**

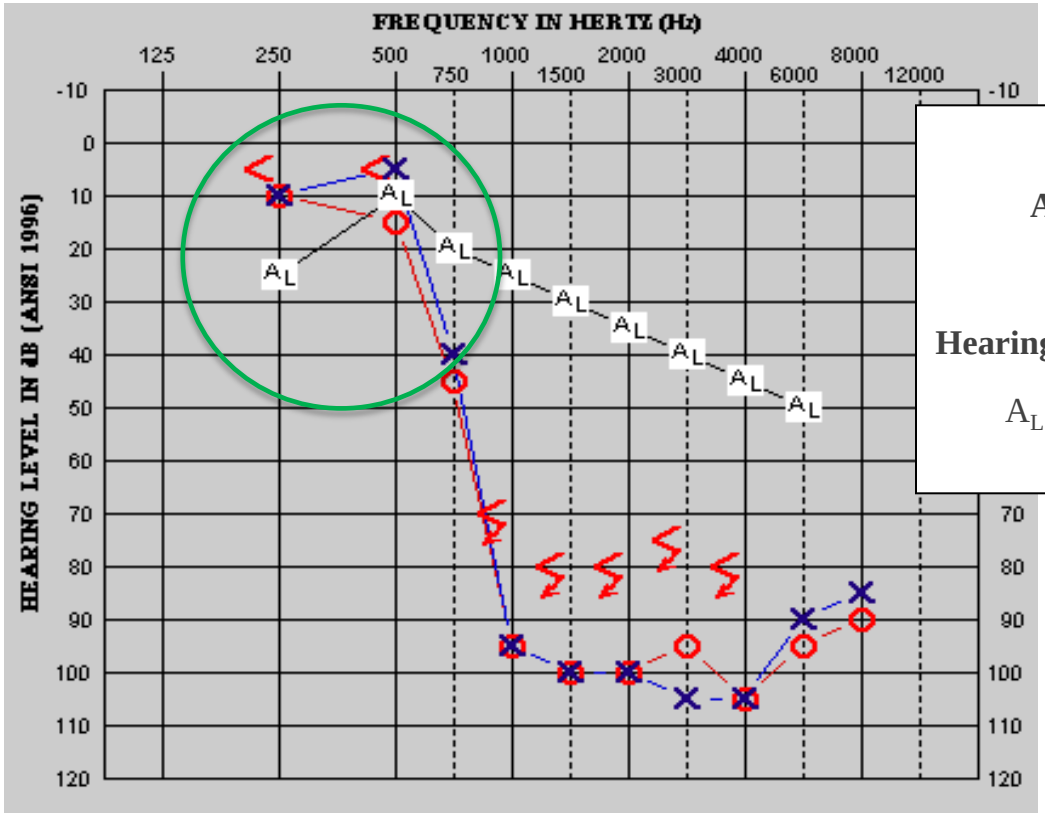
CI Left **84%**

C_R = Cochlear Implant Right Ear

C_L = Cochlear Implant Left Ear

Cochlear Implantation

- Cochlear Implant Candidate?
  - » Greater residual low-frequency hearing, yet poor speech perception



Pre-Operative

Aided Speech Testing

Word Test

Hearing Aid: **26%**

A_L = Hearing Aid Left Ear

CAUTION: Investigational device. Limited by US law to investigational use.

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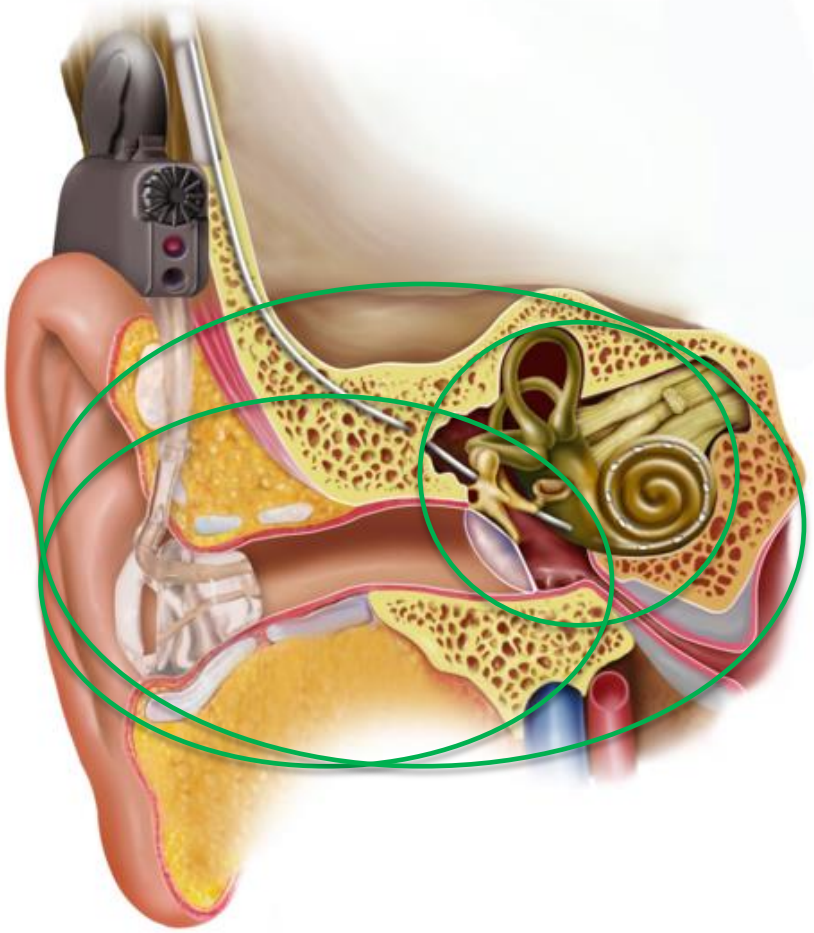
Electric-Acoustic Stimulation



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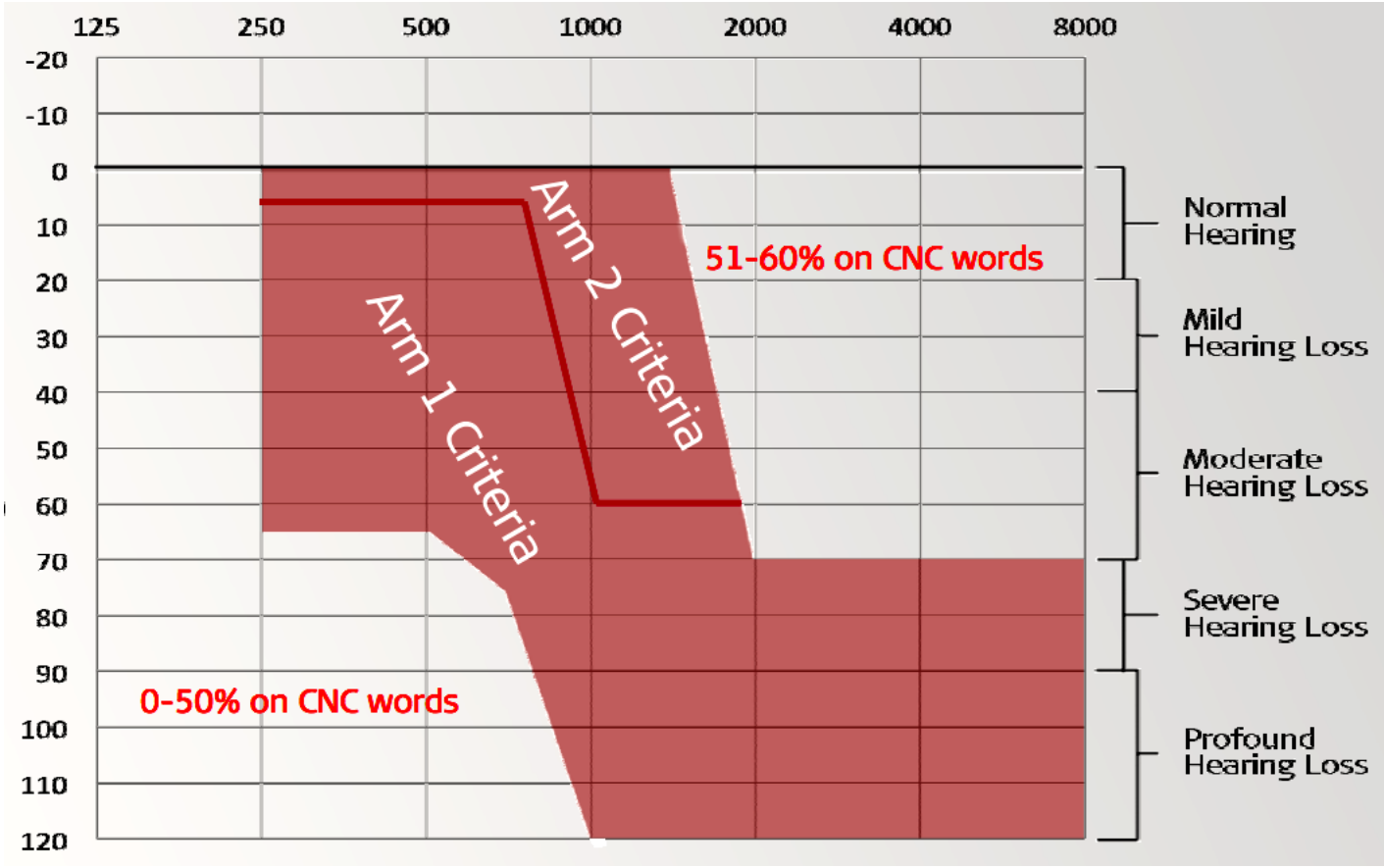
Electric-Acoustic Stimulation

- Candidacy criteria



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Electric-Acoustic Stimulation

- Candidacy Criteria
  - » Adults (>18 years)
  - » Stable hearing thresholds
  - » Poor speech perception with appropriately fit hearing aids

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Electric-Acoustic Stimulation

- Results

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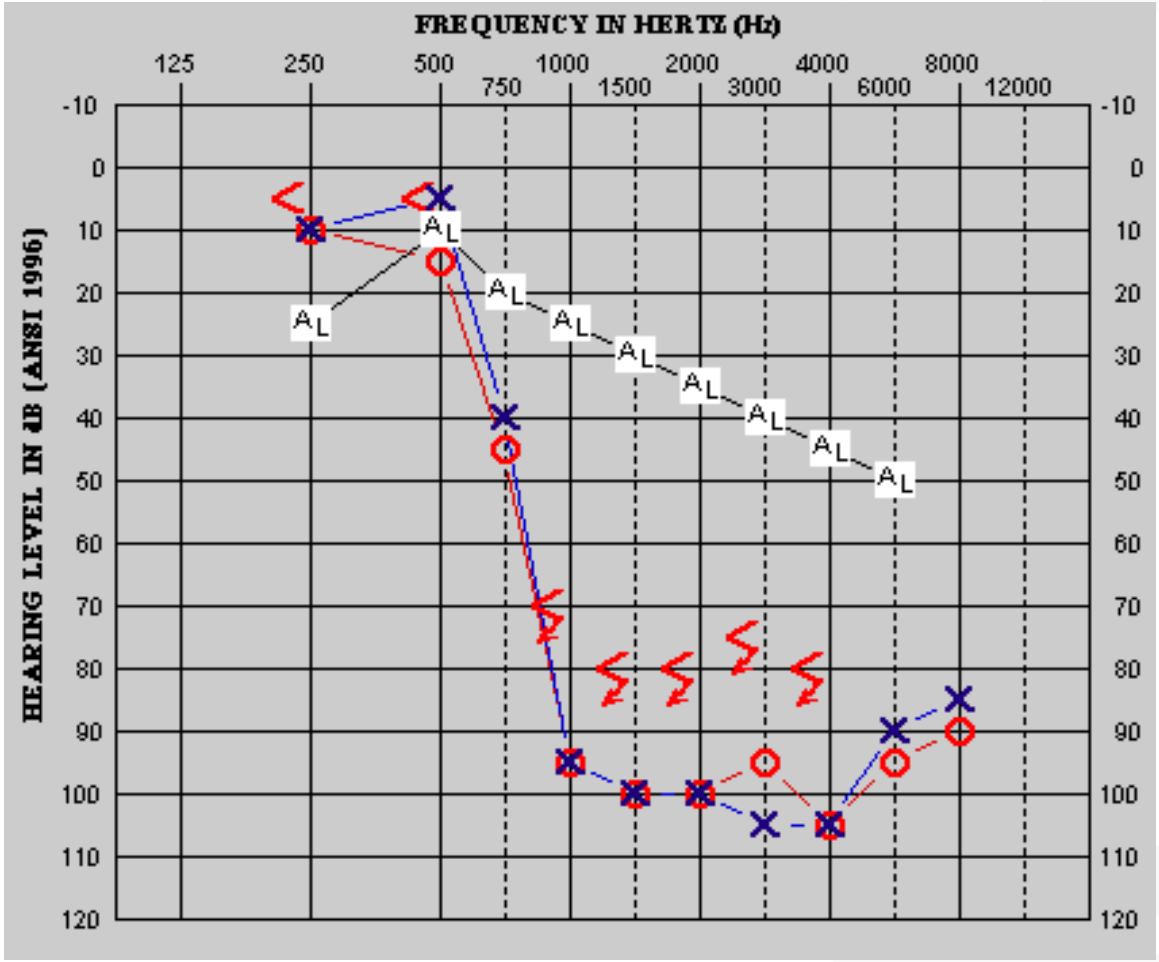
Electric-Acoustic Stimulation

- Preoperative



Pre-Operative

Aided Speech Testing

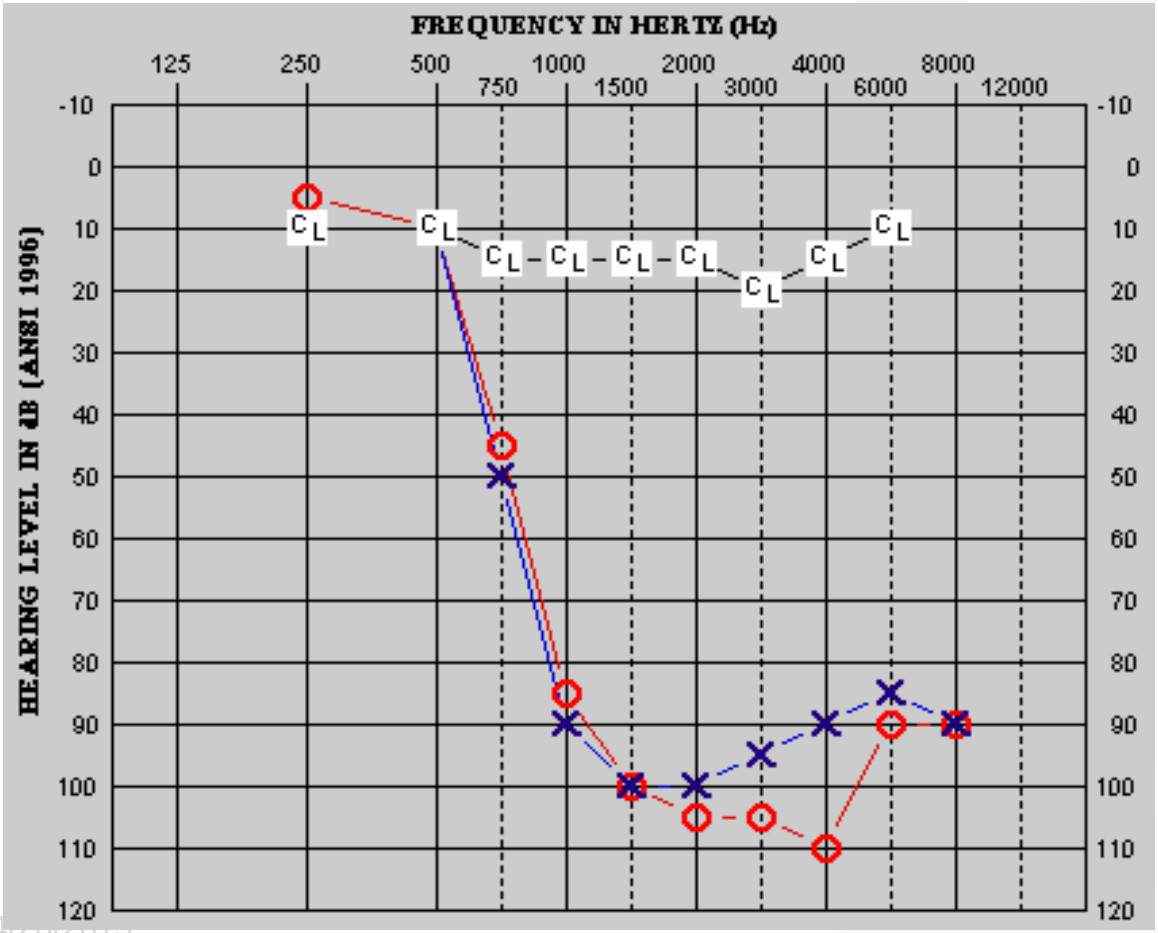
Word Test

Hearing Aid: **26%**

A_L = Hearing Aid Left Ear

Electric-Acoustic Stimulation

- Post-operative



Post-Operative

Aided Speech Testing

Word Test

EAS **90%**

C_L = Cochlear Implant Left Ear

CAUTION: Investigational device. Limited by US law to investigational use.

Contact

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