

UBC Residents Otology Lecture Series, Sep 13, 2013



- ***Dr. Amir Soltani***
- Clinical Audiologist
- *Director of Audiology, Mainland Hearing*
- *404-1200 Burrard Street Vancouver*

- Clinical Instructor,
- UBC School of Audiology & Speech Sciences



www.dramirsoltani.com

Statistics



About 10% of Canadians have a hearing loss

1 in 6 (14.6%) of “Baby Boomers” ages 41 to 59 have a hearing loss

1 in 14 (7.4%) of “Generation X” members ages 29 to 40 have a hearing loss.

Average age of onset of hearing loss is 51 years.

Source: Better Hearing Institute and US Dept. of Public Health



- ◆ 3 in 10 people over the age of 60 have a hearing loss
 - ◆ Nearly 50% of people over the age of 75 have a hearing loss
 - ◆ 85% of people with hearing loss can benefit from amplification in the form of hearing instruments
 - ◆ Only approximately 10 to 15% of hearing loss can be treated medically
- Source: Better Hearing Institute, US Dept of Public Health and Marketrak Surveys

Hearing Loss & Impact on Quality of Life



- The National Council on Aging reports that depression is more prevalent in the hearing loss population when hearing loss is untreated. Depression symptoms increase in relation to the severity of the hearing loss present. They report similar correlation with symptoms of paranoia, emotional instability, participation in group activities and overall health rating.

Hearing Loss & Impact on Quality of Life



- Many recent studies reports:
- ***Untreated Hearing loss is a contributing factor in Dementia!***
- Also:
- ***Early amplification prevents:***
- ***Auditory Deprivation***
- Greater benefits & easier adaptation

Importance of Hearing Testing



- Up to 60% of seniors have never had their hearing tested
- A large number of people who are experiencing communication difficulties are not taking advantage of amplification
- Wide variety of hearing instruments are available to improve audibility of conversation

Communication is a Two Way Process



- Frustration from frequently repeating themselves may lead others to avoiding conversation with a hearing impaired individual
- It takes patience and understanding when speaking to someone with a hearing loss.
- Often words are left out during repetition
- The person with hearing loss may feel left out of conversations, jokes etc.

Behavior may be Misinterpreted



- Hard of hearing people may be perceived as:
 - -Inattentive
 - -Disinterested
 - -Unintelligent
 - -Preoccupied
 - -Absentminded
 - -Nonsocial
 - -Paranoid

Attitudes Associated with Hearing Loss:



- Denial
- Loneliness (isolation)
- Bitterness (resentment)
- Distress (fear, nervousness)
- Confusion
- Self consciousness
- Depression
- Frustration
- Insecurity



Solutions

- As with any physical limitation, a good attitude, facing the problem honestly, and finding solutions will help reduce it's social ramifications.
- New advancements in hearing instruments are a big step toward solutions.

What is involved in Hearing aid evaluation?



- 1: **Case history**
- 2: Identifying patients perception of hearing loss & patients listening needs
- 3: **Basic Audiological assessments**, determining severity of hearing loss ,SDS, type of loss, site of lesion & diagnostic evaluation (if necessary)



Next Step is

- Refer to ENT if **red flag** exists:
- External ear disorders (Canal stenosis, Osteoma, polyps, impacted Cerumen, fungal infection etc.)
- Middle ear complication
- Retro-cochlear pathology? (Ruling out)

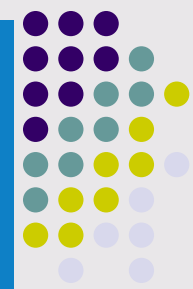
Hearing aid assessment



- Explaining test results
- **Counseling** (is your patient ready for amplification??)
- No!?! (What %?) = More counseling (Why not? Common reasons A: Denial B: Stigma attached C: Price D: Father used to have hearing aids in drawer E: Upset with previous experience! (Previous Counselling)

**PERFECT
HEARING
LOOKS
LIKE
THIS.**

**IMPAIRED
HEARING
LOOKS
LIKE
THIS**





Hearing assessment

- Yes, I am ready
- A: Educated patient about adaptation process
B: Life Style and listening need assessment (Professional listening needs, acoustical environments, Devices (Phone, computer, teleconference etc)
- C: Options Hearing aid Styles, Benefit & Disadvantage of each model



Hearing aid Styles

- Mini CIC
- CIC
- ITC
- ITE (Full shell)
- RIC(RITE)
- BTE
- Open fit
- Extended wear (Lyric)

Mini CIC (Invisible CIC)



Mini CIC (Invisible CIC)





Mini CIC & CIC

- ***Benefits:***

- Very small and discrete
- Good on telephone
- Uses ear's natural directionality

- ***Disadvantages:***

- Small battery has shorter battery life
- Electronics exposed to high amount of moisture in ear canal and are therefore more prone to breakdown
- Occluding
- Will not work for severe hearing losses
- Not available with directional microphone
- Not widely available with wireless technology

Design and Function



- Custom Hearing Aids
 - CIC (completely-in-the-canal):



In-the-canal (ITC) or half-shell (HS)





ITC/HS

- **Advantages**
 - More powerful than CIC
 - Still cosmetically appealing
 - Available with volume control and program switch
 - Available with directional microphone
 - Available with wireless receiver

ITC/HS



- Disadvantages

- Larger than CIC – more visible
- Still not powerful enough for severe losses
- More prone to feedback (FB) because of proximity of microphones and receiver

In-the-ear (ITE) or full-shell (FS)





In-the-ear (ITE) or full-shell (FS)

- **Advantages**

- Most powerful custom aid
- Takes advantage of ear's full retention
- Can fit larger battery for improved life
- Directional mic
- Wireless
- Larger for those with dexterity problems

In-the-ear (ITE) or full-shell (FS)



- Disadvantages
 - Most visible in the ear
 - Very occluding

Behind-the-ear (BTE)





Behind-the-ear (BTE)

- Advantages
 - Microphone on top of ear is more suitable for directionality
 - Smaller instruments are concealed by pinna
 - Larger instruments can be very powerful
 - Wireless and directionality available
 - Ear mold is replaceable and electronics not housed inside ear canal
 - Reduced feedback compared with custom instruments



Behind-the-ear (BTE)

- Disadvantages
 - Can be bulky behind ear, sore for those with sensitive ears
 - Can interfere with wearing glasses
 - More difficult to use with telephone

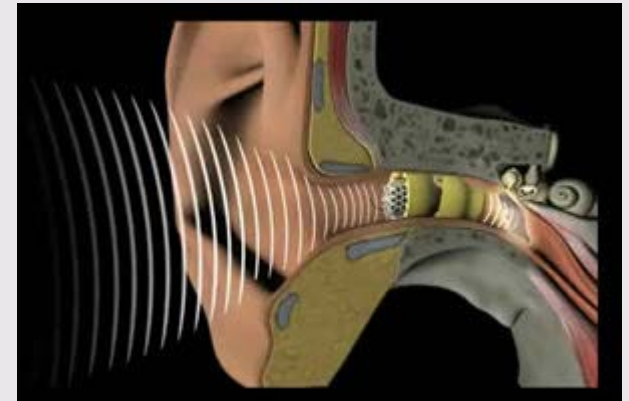
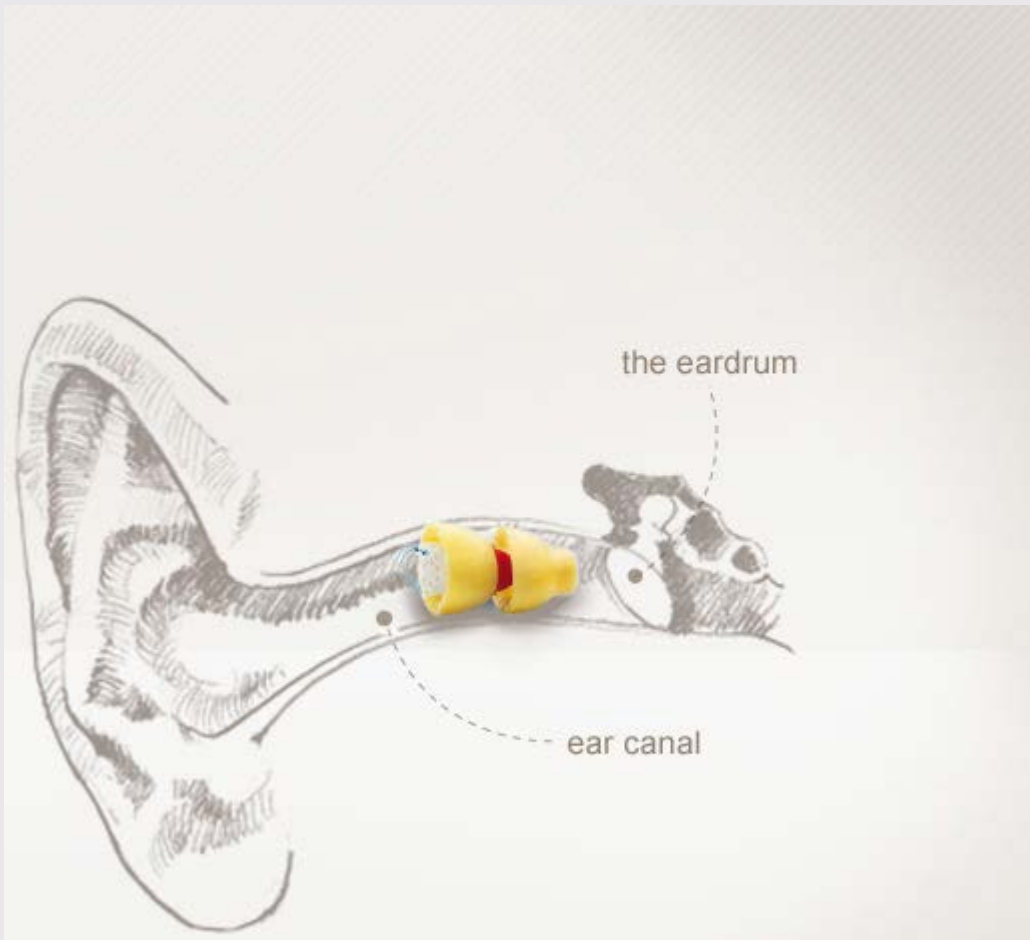
Open-fit BTE



Receiver-in-the-ear (RITE)



Extended wear hearing aids





Lyric

- Benefit:
- **24/7 hearing**
- No maintenance, battery replacement
- **Excellent sound quality, no occlusion**
- **Disadvantages**
- Patients can't take it out
- Expensive
- Limited gain, needs large EAC



Introduction

- **How to fit: Selection and Fitting Rationale**
 - Prescriptions
 - Fitting Range
 - Verification, validation, and outcome measures



Introduction

- **When should hearing aids not be fit?**
 - Otologic “red flags” and referral protocol
 - Binaural degradation and monaural fitting
 - Non-audiological considerations

Current Hearing Aid Technology

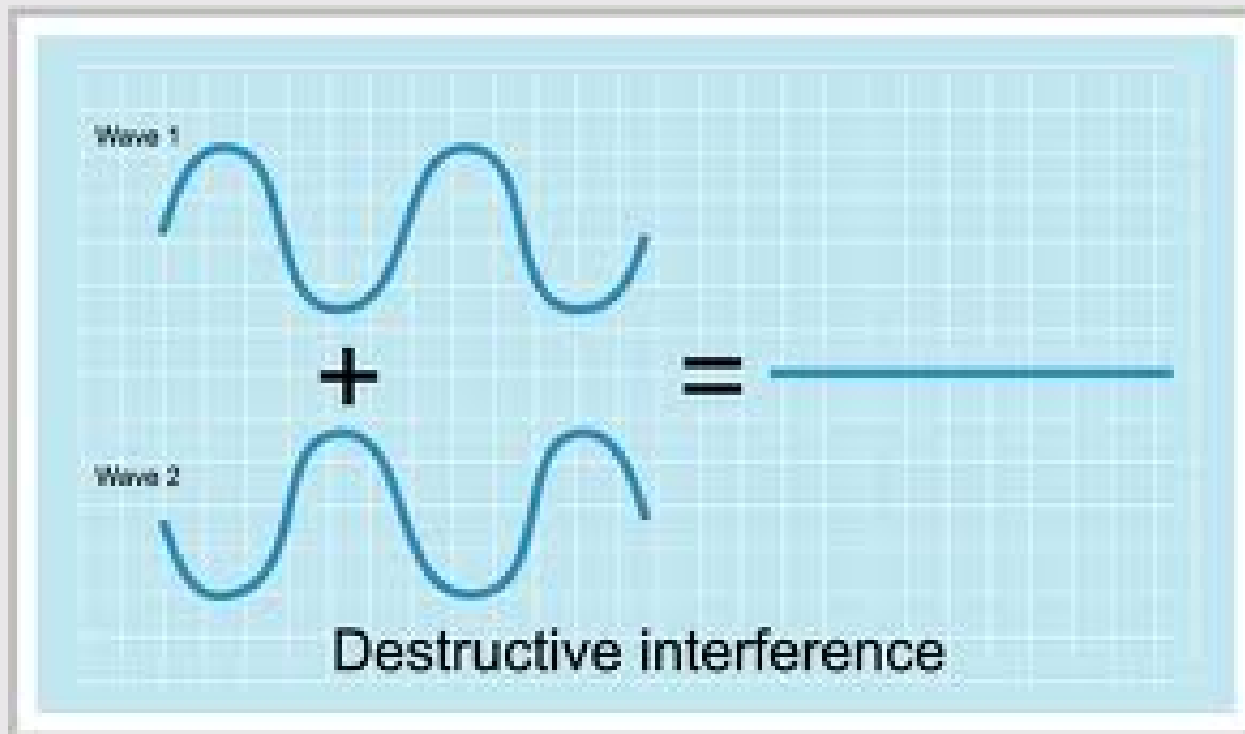


- Digital Signal Processing (DSP)
 - First digital aid fit in 1983 (Nunley et al., 1983), but was not practical until mid-1990's.
 - Microphone and receiver are still analog, but DSP eliminates need for other analog components like capacitors, diodes, etc. and instead uses hardware controlled by software (Staab et al., 1997).
 - DSP has all but replaced analog circuitry.
 - Many improvements in past 4 – 5 years, including...

...DSP continued



- Digital Feedback Suppression (DFS):
 - DFS using an anti-phase algorithm = no more whistling!

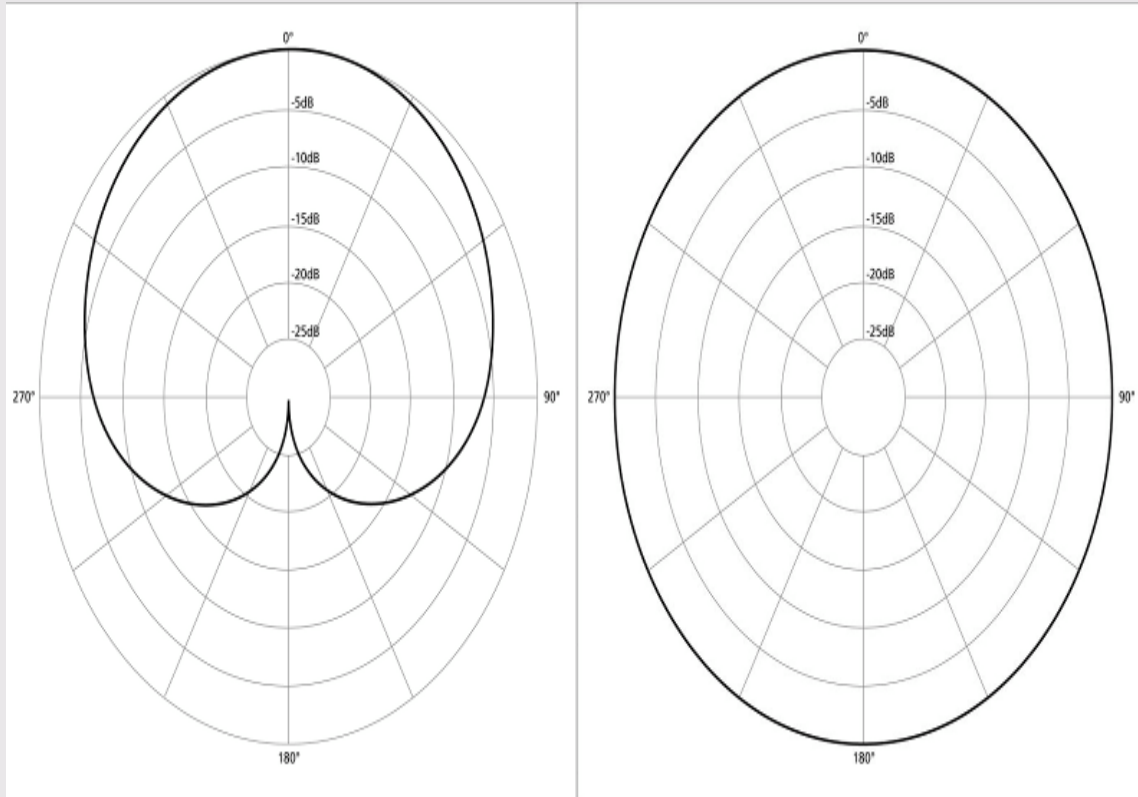


... DSP Continued



- The Directional Microphone
 - Most significant improvement in hearing aid technology (beginning in 1970's)
 - Improves signal-to-noise ratio (SNR) by over 7 dB (Valente and Sweetow, 1999) by focusing on speaker (signal) in front of patient (signal) while not enhancing background noise.

... DSP Continued



Polar Plots

Left: Directional
Microphone

Right: Omnidirectional
Microphone

... DSP Continued

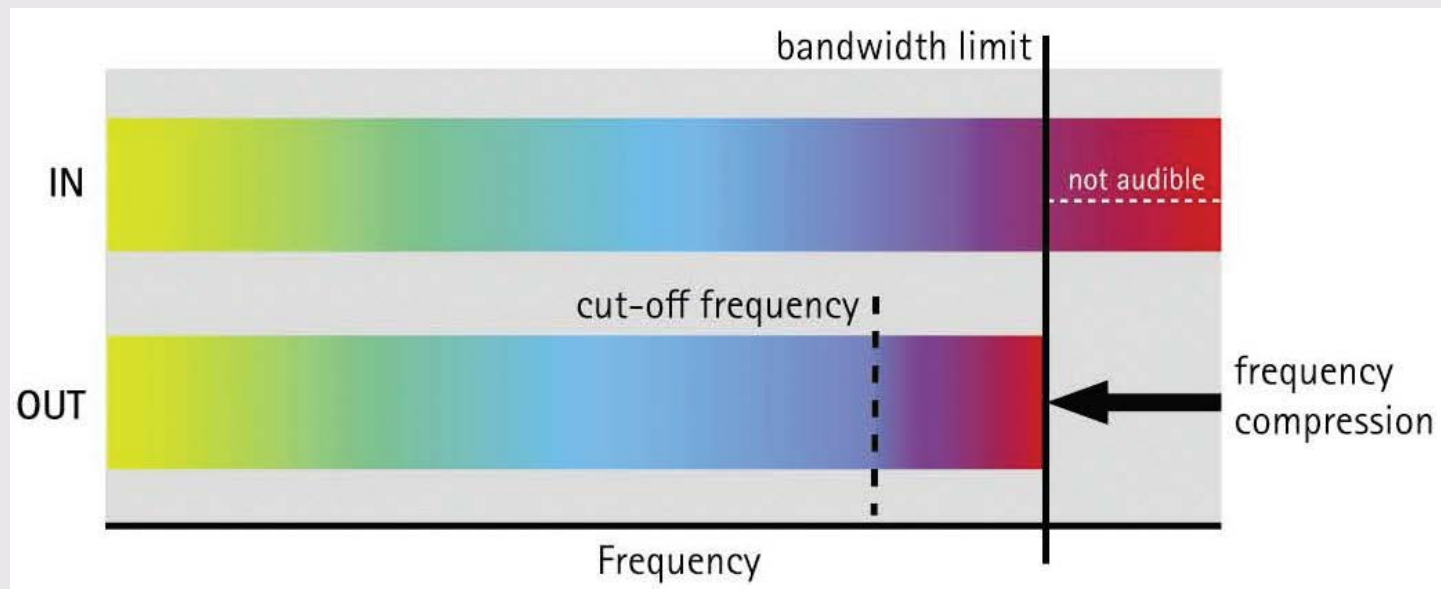


- Compression (in a nutshell)
 - Non-linear gain compression settings can be configured to increase the gain of soft signals, while suppressing or eliminating gain of loud signals.
 - Based on audiometric configuration and individual loudness discomfort levels (LDLs or UCLs)
 - Important for protection of residual hearing and in cases involving hyperacusis.

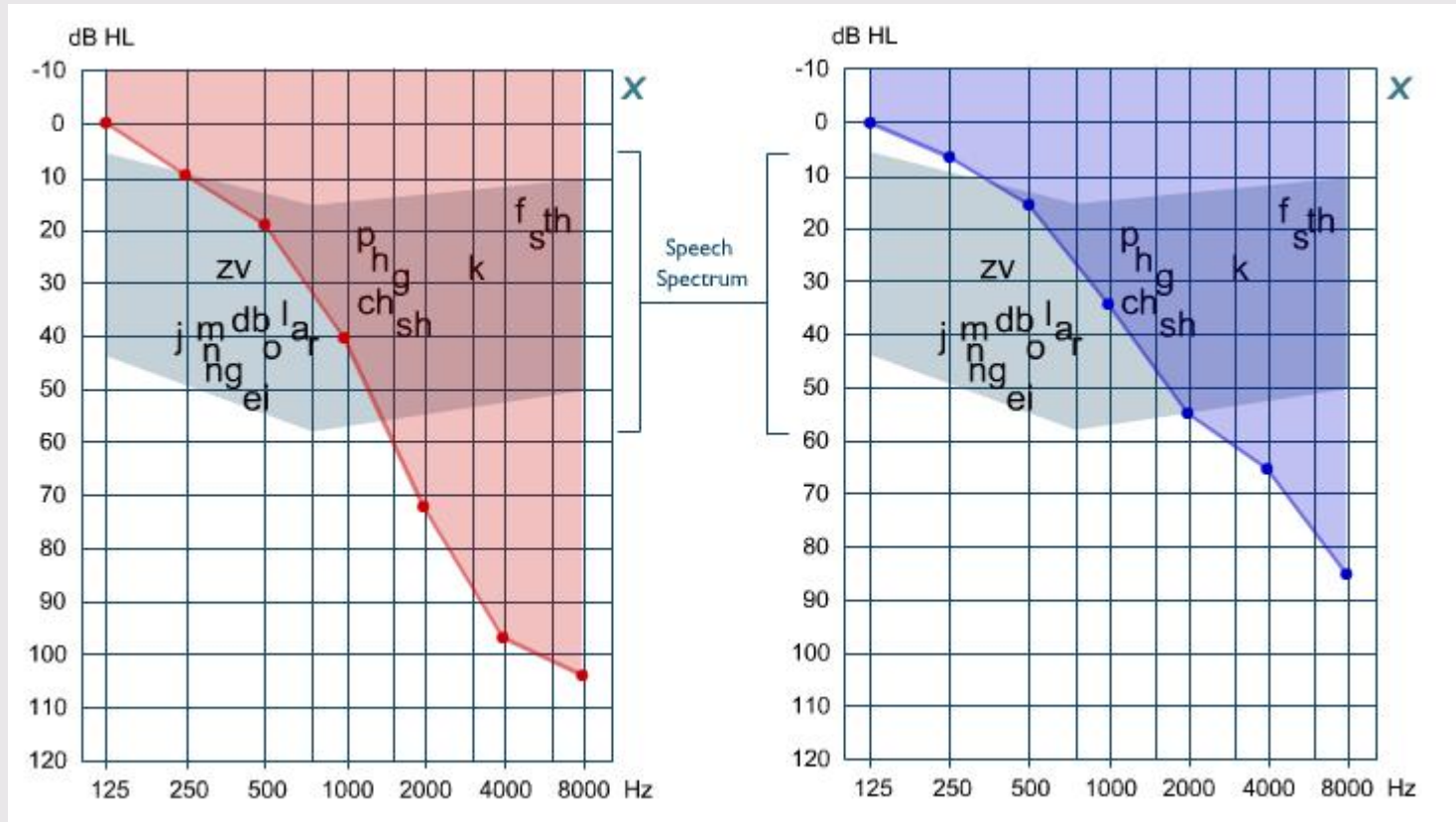
Non-linear frequency compression



- Compresses and shifts high-frequency sounds to the user's audible range, improving audibility of high-pitched sounds and fricatives like /s/sh/f/ (McDermott, 2010)
- Developed for pediatric use and is now becoming widely available to adults



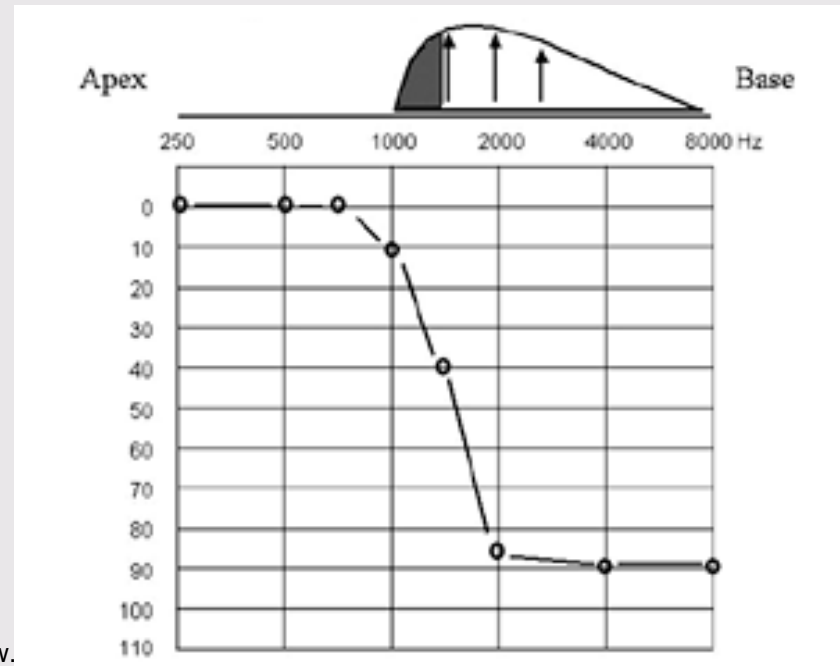
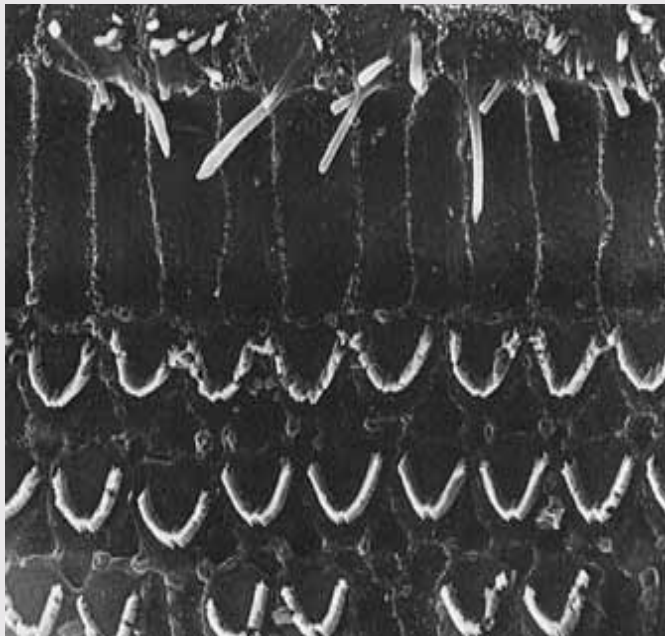
...Non-linear frequency compression continued



...Non-linear frequency compression continued



- Revolutionary in the context of fitting hearing aids for a patient with a cochlear dead region (CDR), where hearing thresholds obtained through routine audiometry may not be accurate (Moore et al., 2000).



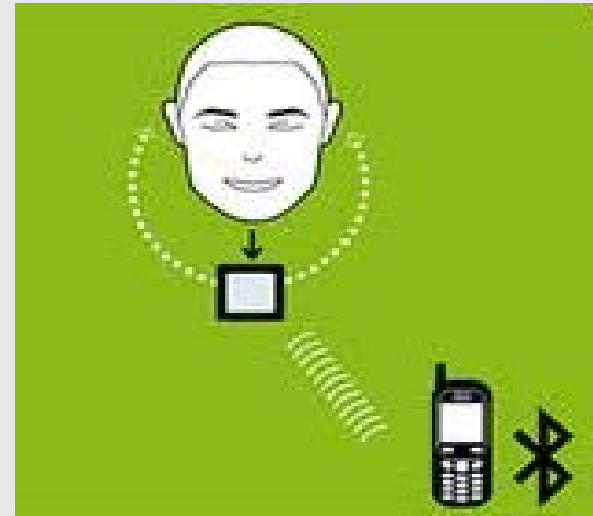
Bluetooth® and Wireless Accessories



- Allows users to connect hearing instruments directly to peripheral accessories such as:
 - Cellular and home phone
 - Television and music players
 - Signaling devices like door bells and fire alarms

With this technology, hearing instruments are becoming more like personal communication devices.

...Bluetooth and Wireless cont'd...





FM technology

- FM system consists of a microphone, transmitter, and receiver.
- Can dramatically improve SNR as hearing aid microphones can be attenuated, allowing the user to focus on signal from transmitter.
- Initially developed for pediatric educational purposes, personal FM for adults is becoming more discrete and user friendly.

...FM technology cont'd...





...DSP continued

- Other benefits over analog circuitry
 - Adaptive directionality
 - Noise reduction/suppression algorithms which can improve speech intelligibility in noise (SIN) (May, 1998)
 - Remote control compatible for those who prefer user control
 - Eliminates moving parts
 - Not susceptible to interference

Who to fit: Determining Candidacy



- Audiometric configuration and severity of hearing loss are primary determining factors
- Subjective details of communication problems and needs
- Word Recognition Scores
- Propensity to afford and patient motivation
- Other non-audiological factors

How to fit: Selection and Fitting Rationale



- Select instrument based on audiological determinants and budget
- Audiogram will determine amount of gain needed and style of instrument
- Hearing aid fittings are verified using Real Ear Measurement (REM) to ensure adequate amplification at proper frequencies

How to fit: Selection and Fitting Rationale



- Patient comfort needs to be considered... adaptation process often used
- Trial period will determine if patient is able to benefit from using hearing aids



Funding

- In Canada, the majority of hearing aids for adults are purchased privately. Costs range from \$500 to nearly \$4000
- Other avenues include:
 - WorkSafe BC or other provincial compensation boards
 - Veterans Affairs Canada
 - Non-Insured Health Benefits (under the First Nations Act)
 - Ministry of Housing and Social Development
 - ICBC
 - Third Party Health Insurance
 - Organizations such as Lions Club

When should hearing aids not be fit?.... Cont'd



- Binaural degradation – if WRS are excellent in one ear and very poor in the other, binaural WRS may be worse when poorer ear is aided, therefore a monaural fitting may be indicated.
- Other non-audiological factors should be considered, such as accompanying cognitive impairment, socio-economic conditions, etc. Extensive counseling may be required in these situations
- Outcome expectations have to be realistic prior to fitting with hearing aids

Questions?



drsoltani@mainlandhearing.com

www.dramirsoltani.com

404 – 1200 Burrard St.

Vancouver

(604) 688-5999