

# A Hearing Aid Primer 1

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## WROCC Outreach Site at Western Oregon University 1

This hearing aid primer is designed to define the differences among the three levels of hearing instrument technology: conventional analog circuit technology (most basic), digitally programmable/analog circuit technology (moderately advanced), and fully digital technology (most advanced).

Both moderate and advanced technologies mean that hearing aids can now be programmed with a computer for various listening situations. Both advanced technologies may offer multiple channels and multiple microphones. Both advanced technologies allow the audiologist to shape the hearing aid's responses to various listening situations and gives the user more control over the hearing instrument.

A fully digital instrument may be completely automatic, provides superior sound quality, minimizes cell phone interference, and minimizes "whistling." A digital hearing aid may also have the capability

to automatically switch from a directional microphone to an omnidirectional microphone, depending on the listening environment. The most advanced digital circuitry means that more technology can be loaded into a smaller package; although behind-the-ear instruments are still preferable for the most severe hearing loss.



**EAR LEVEL HEARING AIDS 1**

Hearing aid technology has come far; however, even the most advanced hearing aids cannot bring the speaker's voice closer to the listener's ear. In order to accomplish that, assistive listening devices must be used in addition to hearing aids, since the loudness of the speaker's voice decreases with distance. This is true for the hearing aid user and the non-hearing aid user alike. Consequently, counseling an individual about the advantages of a hearing instrument which includes a strong telecoil for an assistive

listening device should be part of any hearing aid evaluation and fitting process.

## Definitions

**Analog hearing aid** A hearing aid that amplifies an electrical signal in proportion to the sound signal.

**Bilateral** Regarding hearing loss in both ears

**Binaural** Regarding two hearing aids fitted bilaterally

**Channels** Incoming sounds are electronically separates into bands and the sound intensity in each band is adjusted independently

**Compression circuitry** Amplifies soft and loud sounds by different amounts (in digital hearing aids). May be single channel or multichannel.

The compression circuit may affect the input to the hearing aid or the output from the hearing aid and amplifier. Automatic adjustment is called "automatic signal processing."

**Digital hearing aid** The hearing aid which processes sound using binary technology (computer chips). The digital information is then converted to an analog signal so the user can hear sound. The hearing aid may be programmed by a computer, a hand-held programmer, or a screw driver. The hearing aid may have a telecoil or "microlink" technology for assistive devices.

**Digital Hybrid hearing aid** A hearing aid which uses analog technology. The programming of the hearing aid, however, is done digitally, using computer or hand held programmer.

**Direct Auditory Input (DAI)** Allows a microphone to be directly connected to a hearing aid with a wire or with FM technology.

**Directional microphone** One or more microphones in a hearing aid which suppress background noise.

**Monaural** Regarding a hearing aid fitted to one ear

**Multi-memory** A feature on a digitally programmable hearing aid which enables the audiologist to configure a hearing aid to the specific needs of a client. The number of memories which may be programmed depend on the style and the manufacturer of the hearing aid and whether it is analog or digital.

**Omni-directional microphone** A microphone in a hearing aid which transmits environmental sounds (sounds and voices picked up from all directions equally), in addition to transmitting the speaker's voice.

**Peak Clipping** A method of limiting the output of an analog hearing aid by reducing the peaks of soundwaves.

**Potentiometer** A volume wheel or screw set control which allows fine-tuning of an analog hearing aid.

**Telecoil** A magnetic receiver which picks up signals from various magnetic sources which include compatible telephones, neck loops, or a magnetically looped room.

**Unilateral** Regarding hearing loss in one ear

## Hearing Aid Styles

Hearing aids fall in one of two basic styles: Body and Ear Level instruments.

### Body Aid

#### Features

- The circuitry is analog and may be linear or compression.
- Although not commonly used, body aids are occasionally fitted to infants whose ears are not large enough to accommodate a BTE instrument.
- Uses AA batteries which have a battery life of approximately 4 weeks
- Has a volume wheel
- Has optional features of a telecoil, and direct auditory input (DAI)
- Omnidirectional microphone only

#### Advantages:

- Earmold does not distort the cartilage of the ear
- Controls are easy to manipulate
- Appropriate for all types of hearing loss



**B O D Y A I D**

Photograph courtesy of Willamette Educational Service District

### Disadvantages

Cumbersome for the parent to place, remove, and use the body aid with infants

Rustling of clothing and body noise are amplified

Although amplification may be routed to one or both ears, the body aid can only be set for the hearing loss of

### Ear Level

Ear Level instruments come in the following styles, which refers to where the aid is worn:

- Behind the ear (BTE)
- In the ear (ITE)
- In the canal, (ITC), and
- Completely in the canal (CIC).

The battery size and life vary with each Ear Level style:



**N T H E E A R**

ery and should  
eeks. May have a tele-  
coil, directional microphone, and/or DAI.

ery and should  
e a battery life of 10-15 days. May have a tele-  
coil, directional microphone, but rarely has the

battery and should  
e a battery life of 10-14 days. May accom-  
modate a telecoil but will not have a directional  
microphone nor DAI.

- A CIC uses a #10A or a #5A battery and should have a battery life of 7-10 days. Will not accom-  
modate a telecoil, directional microphone, nor  
DAI.

## Hearing Aid Types

There are three types of Ear Level hearing aids:  
Analog, Digital Hybrid, and Digital.

### Analog Hearing Aid

#### Features

- Volume wheel
- May have telecoil, depending on style
- May have direct auditory input, depending on style

#### Circuitry

- Linear
  - For every decibel of sound into the hearing aid, one decibel of sound is amplified. The amplified sound is crisp, however all sounds are amplified equally.
  - Linear hearing aids amplify speech and noise equally.
- Compression
  - May have screw sets for low frequency and high frequency tuning 1
  - Will have a screw set for output loudness 1

#### Advantages

- Inexpensive

## Statement: The Need for an Assistive Listening Device 1

A communication needs assessment must be conducted when an individual receives an audiologic evaluation. It is important to look at a person's lifestyle, age, and dexterity before discussing which options are available. It is most helpful to use the team approach that includes the client, the client's family, the audiologist, the vocational rehabilitation counselor, and the physician, if warranted. Although hearing loss and word discrimination ability may be factors that will guide the audiologist toward determining the need for amplification, case history information provided by the client and the team will determine the type of technology that is most appropriate. There are no rules for degree of hearing loss or word discrimination scores that rule in or rule out the appropriateness for any specific communication device.

When amplification is recommended, it is important to counsel the client about the types of hearing aids available and the styles of hearing aids that are compatible with assistive devices. The client and his or her family are the ones most knowledgeable about needs in home and recreational settings. The vocational rehabilitation counselor or college/university special programs director would be most knowledgeable of classroom or work environment needs.

Regardless of degree of hearing loss, once a client is fitted with the appropriate amplification and assuming the client performs more poorly in noise than in quiet when aided, the client must also be evaluated with various assistive devices in a controlled setting to determine which device is most appropriate. Communication devices should be considered when an individual's aided word discrimination in quiet, but particularly in noise, indicate performance less than 100%. It should be remembered that even persons with normal hearing and excellent word discrimination abilities will lose about 10% of the message when the speaker is 3 feet away from the listener. The further away that the listener sits from the speaker, the greater the degradation of the speech signal. When 10% of the message is lost, the listener will miss subtle



IN THE CANAL



Some individuals with profound hearing loss prefer linear amplification.

- More user control except for volume adjustment
- Linear amplification at some frequencies
- Being replaced by digital technology
- Inability to fully match client amplification needs to the hearing instrument
- Requires significant period of adjustment

## Digital Hybrid Hearing Aid

### Features

- May have volume wheel
- May have remote control
- May have ALD interface, depending on style
- May have directional microphone, depending on style

### Advantages

- More user control
- More audiologist control
- BTE connects well to an assistive listening device
- Less time to adjust to hearing aid use by the newly fitted client
- Ability to adjust the hearing aids to a variety of listening conditions by programming "channels"

### Disadvantages

- Generally twice as expensive as analog hearing aids
- Even though the hearing aid is programmed digitally, the components of the hearing aid are still analog
- Each manufacturer requires separate programming equipment
- The variety of manufacturer's terms for internal controls are confusing: the number of "channels,"

conversational cues.

Communication devices are divided into four categories:

- 1 Listening devices that interface with hearing aids to put the speaker's voice at the listener's ear. All listening devices require a microphone, either worn by a speaker or one which is "remote", that is, pointed toward the speaker. Listening devices include:
  - o 1 hard-wired direct auditory input
  - o 1 a device to "link" an FM signal to the hearing aid
  - o 1 use of a neck loop, although neck loops are quickly being replaced by "link" systems
- 1 Notetakers, closed captioning for television, computers, and direct auditory input for radios and televisions
- 1 Telephone communication
- 1 Alerting devices for smoke alarms and alarm clocks

the number of "programs," each manufacturer saying its hearing aid is "best."

## Digital Circuitry

### Features

- Industry standard for several manufacturers
- May have volume wheel
- May have remote control
- May have ALD interface, depending on style
- May have directional microphone, depending on style

### Advantages

- Most user control
  - Less time to adjust to hearing aid use by the newly fitted client
- Most audiologist control
  - Ability to adjust the hearing aids to a variety of listening conditions by programming "channels"
  - Greater ability to fine tune the hearing aid to the client's hearing loss
  - Most flexibility
- BTE connects well to assistive listening device
- Built in limitations for loudness control
- Automatic adjustment to different listening situa-



- tions: in quiet, in various noise situations
- Some manufacturers offer models which may be less expensive than digital hybrid hearing aids

### Disadvantages

- Depending on manufacturer and model, may be twice as expensive as digitally programmable hearing aids and four times as expensive as analog hearing aids
- Each manufacturer requires separate programming equipment
- The variety of manufacturer's terms for internal controls are confusing: the number of "channels," the number of "programs," each manufacturer saying its hearing aid is "best"

## Ear Level Hearing Aid Arrangements

### Monaural

Fitting a hearing aid to one ear only. This type of fitting is rarely recommended but may be appropriate for a stroke victim who has only one aidable ear and would find a CROS/BICROS fitting too difficult.

### Binaural

Fitting hearing aids to two ears when both have hearing loss. There are several advantages to this fitting:

1. Better hearing in noise
2. The ability to hear speech sounds such as /s/, /t/, /f/, and /sh/ regardless of speaker's position in the room

3. Improved ability to locate the source of sound
4. Lower volume is needed for hearing the speech signal
5. Improved quality of speech sounds for user and possible improved spoken speech
6. Possible loss of word discrimination ability in the unaided ear

### Contralateral routing of signal

CROS (contralateral routing of signal) amplification

- Employed when one ear has normal hearing and the other ear has no useable hearing (word discrimination ability)
- Available with analog or digital circuitry
- Available in BTE or ITE style
- Uses FM technology or a hardwire cord to route the signal to the better ear, giving the perception of hearing from both ears

BICROS (binaural amplification with contralateral routing of signal) amplification

- Employed when one ear has some hearing loss and the other ear has no useable hearing (word discrimination ability)
- Available with analog or digital circuitry
- Available in BTE or ITE style
- Uses FM technology or a hardwire cord to route the signal to the better ear, giving the perception of hearing from both ears
- Provides amplification to the ear with useable word discrimination

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WROCC is one of the four Regional Postsecondary Centers for Individuals Who Are Deaf and Hard of Hearing which make up PEPENet, the Postsecondary Education Programs Network. The centers combine their efforts to provide a biennial conference, online trainings, cross-regional training and consultation, distance learning opportunities, and transition services. For more information, visit the PEPNet website at [www.pepnet.org](http://www.pepnet.org).



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### Other items in this series:

What Is A Hearing Aid Evaluation?  
How to Read an Audiogram

*All brochures are available for download at [www.wou.edu/wrocc](http://www.wou.edu/wrocc). Click on Training Materials and scroll down to the brochure name(s).*

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