Texas School for the Blind and Visually Impaired
Outreach Programs
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Hearing Issues Webinar Series:

Assistive Listening Devices for Students with Deafblindness

January 22, 2015

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Texas Deafblind Outreach

Developed for

Texas School for the Blind & Visually Impaired

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Review of types of hearing loss

Conductive Hearing loss occur when sound is not conducted efficiently through the outer ear canal to the eardrum and the tiny bones (ossicles) of the middle ear. (ASHA)
Sensorineural Hearing loss occur when there is damage to the inner ear (cochlea) or to the nerve pathways from the inner ear to the brain. (ASHA)
Mixed - If a child has both sensorineural and conductive hearing losses it is considered a mixed loss.

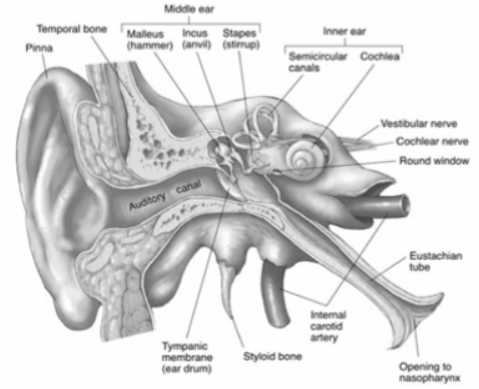

Figure 1 A diagram of the ear showing the structures of the outer, middle and inner ear. The different sections of the ear are indicated by boxes of different colors. The structures of the outer ear are contained in a box with no coloring, the structures of the middle ear are in a box with yellow shading and the structures of the inner ear are indicated by a box that is shaded pink.

Is there a similarity between vision and hearing loss?

- A conductive hearing loss is similar to a loss of visual acuity in that there is the potential for correction to normal or near normal.
- While there are no medical devices comparable to hearing aids or CI's that can improve vision for a person with a neurological vision loss, neither a CI nor a hearing aid is going to be the equivalent of normal hearing.
- Visual loss does not compromise language - hearing loss does

Medical Devices

Depending on the type of hearing loss, medical devices like hearing aids or cochlear implants may be prescribed to help sound reach the brain.

Medical Devices - Hearing Aids

A hearing aid is a small electronic device worn in or behind the ear.
It amplifies speech and uses signal processing to attempt to filter out unwanted noise.

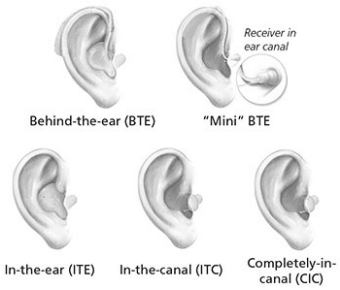

Figure 2 This is a chart which shows drawings of different kinds of hearing aids. The hearing aids are labeled from top to bottom and left to right. NIH Medical Arts, Styles of hearing aids

Hearing Aids - Basic Parts

This aid has a hard plastic case that fits behind the ear (BTE). Inside is a receiver, amplifier and speaker. It also has a compartment for a small battery. The hearing aid is connected to an earmold that rests inside the opening of the ear.

Figure 3 a woman wears a Behind the ear hearing aid. The receiver/processor is attached by an hook which allows it to rest just behind the ear. The earmolds places inside the ear. a more detailed pholo of the external receiver/processor, amplifier, speaker and earpiece for a BTE.

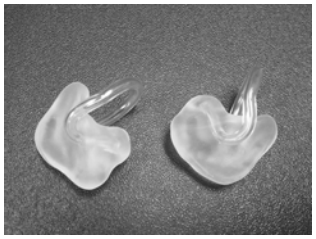

Figure 4 armolds for a BTE

Hearing Aids-Bone Anchored Hearing Aid (BAHA)

A bone anchored hearing aid or BAHA is used by people who have a conductive hearing loss or unilateral sensorineural hearing loss. Instead of sending the signal into the ear canal the BAHA provides direct auditory stimulation to the bones behind the ear.

Figure 5 A woman wears a Bone Anchored hearing aid which appears as a small box about the size of a quarter which is attached to her head behind her ear. Josabeth,User:OgreBot/Uploads by new users/2013 December 19 12:00

Hearing Aids Work Differently than Cochlear Implants

Hearing aids gather, process, and amplify sound, shaping it according to an individuals specific listening needs.

Cochlear implants require surgery and bypass the damaged cochlea to send a signal directly to the auditory nerve. Cochlear implant is an electronic medical device that replaces the function of the damaged inner ear. Unlike hearing aids, CIs do the work of damaged parts of the inner ear to provide sound signals to the brain.
-cochlear corp.

Medical Devices- Cochlear Implants

Cochlear Implants have external (outside) and internal (surgically implanted) parts that work together to help the child experience sound.

Figure 6 Photo of a young boy with a cochlear implant. He is wearing the external processor which is hooked behind his ear like a BTE hearing aid. He is also wearing a transmitter, a round piece which is attached to the processor via small cord and is attached

Cochlear Implant -External Parts

The processor often looks like a hearing aid and is held in place with an earhook.

It picks up sounds, converting them to an electrical signal which is mapped based on individual needs.

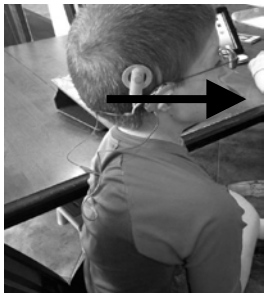

Figure 7 This is the same photo of the boy with the cochlear implant. There is an arrow pointing to the processor, which is located behind his ear.

The coil (transmitter) is worn on the head and secured by a magnet
It sends the mapped signals from the processor to the receiver

Figure 8 This is the same photo of the boy with the cochlear implant with an arrow pointing to the transmitter attached to the side of his head

Cochlear Implant-Internal Parts

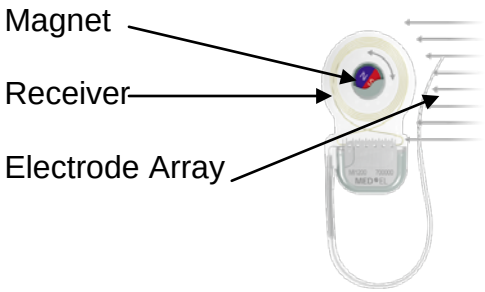

Figure 9 Photo of the internal structures of a cochlear implant. A coil of very thin wire in a circular pattern constitutes the receiver. In the middle of the circular coil of wire that makes up the receiver there is a small round magnet. The wire from the the receiver is attached to rectangular transistor which has another very long wire coming from it. At the end of this wire are very small dots. These are the electrodes which are embedded in the cochlea and stimulate the auditory nerve. Coppelia12,SYNCHRONY (PIN) MRI Safe at 3.0 Tesla,CC BY-SA 4.0

Cochlear Implant - Internal Parts

The receiver is implanted just under the skin behind the ear. It sends the coded signals to electrodes that have been inserted to the cochlea.

The electrodes stimulate the fibers of the auditory nerve and the brain receives a sensation of sound.

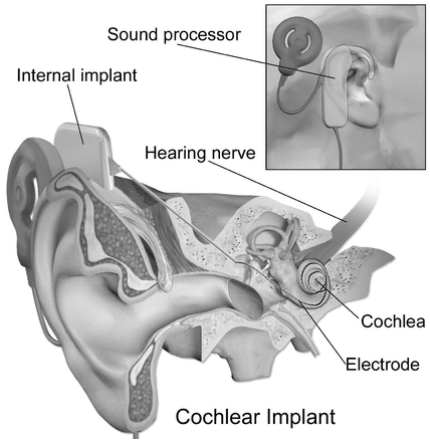

Figure 10 A diagram of the ear with a cochlear implant. This diagram shows the structures of the outer, middle and inner ear and where the components of a cochlear implant are located in relationship to the structures of the ear. Blausen.com staff. "Blausen gallery 2014". Wikiversity Journal of Medicine.DOI:10.15347/wjm/2014.010. ISSN 20018762.

How a Cochlear Implant Works…

Ulf Nagel Advanced Bionics 2004

Figure 11 Picture of a transmitter antenna on a cochlear implant.

Medical Devices

Hearing aids, CIs and BAHAs can be very versatile. Most devices have the option of multiple programs which can be changed to support multiple listening goals. For example, one program could be designed for the classroom another for traveling outside, and another for listening to music.

The information you provide the audiologist can help guide them in programming for the greatest benefit of a student's individual listening needs - think of a person's day to day experiences.
A very different program might be designed for travel in the community.

Lower frequency (pitch) environmental sounds (traffic, lawn mowers etc.) are important for travel cues and are amplified.

An omnidirectional microphone will be used to pick up sounds that may be behind or to one side of the child.

By pushing a button on the hearing aid, you can switch between the programs. Some aids also have a remote that controls the settings.

Deafblind Difference

A child with deafblindness will have additional and unique goals that are different than a student who is hard of hearing with typical vision.

Figure 12 Photo of a boy wearing a personal FM device with cords running from the receiver to earmolds in his ears. He is using an adapted Braille keyboard to write on a computer.

What are the implications and the differences in programming personal amplification for a child who is deafblind as opposed to a child with normal vision?

- In a typical education setting the focus of using and implementing personal amplification for a child is on the development of speech and language.
- However, because environmental sounds are important to students who are deafblind in order to orient and travel safely, the devices may need to be adjusted by the audiologist to filter out fewer of these sounds and thereby assist the child with other types of listening skills beyond speech and language.

Hearing Assistive Technology - HATs

Devices used with or without hearing aids or cochlear implants to make listening easier.

- FM Systems
- Infrared
- Induction Loop

FM System

FM Systems are used to describe systems used to amplify a speaker's voice.

They are designed to make it easier to hear a speaker's voice or other sound source in noisy classrooms, hallways or in the community.

Figure 13 Photo of a small lapel microphone attached by a chord to an personal FM transmitter. Also pictured is a BTE hearing aid with a small FM receiver attached to the base of the hearing aid. ImGz, PhonakCampusS.jpg

Assistive Devices for Maximizing Hearing

With a Personal FM system, the speaker wears a microphone/transmitter and her voice is sent directly to a receiver attached to the student's hearing aid or CI.

Figure 14 A photo of a BTE hearing aid and the FM receiver that attaches to the base of the hearing aids receiver/processor.

Induction (wide area) Loop

An induction, or wide area loop, utilizes an electromagnetic field to deliver sound to the telephone coil (t-coil) of a hearing aid. Anyone with a t-coil enabled hearing aid can access the Induction loop signal.

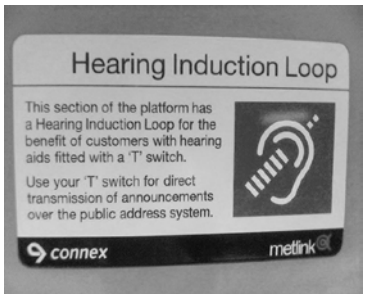

Figure 15 Photo of a sign with the symbol for induction loop and a brief description of the loop's function. The sign reads: **"Hearing Induction Loop: This section of the platform ha a Hearing Induction Loop for the benefit of customers with hearing aids fitted with a "T" switch. Use your "T" switch for direct transmission of announcements over the public address system."** avlxyz, https://www.flickr.com/photos/avlxyz/107168188/sizes/o

Personal Neck Loop

A loop FM system transmits a signal to a personal receiver which is worn around the listener's neck. The receiver then transfers the signal to a telecoil that is built into the hearing aid.

Figure 16 Photo of a "neck loop"-an FM receiver that looks like small cordless phone with a chord attached to it iso that can be worn around the user's neck. www.phonak.com/us/b2c/en/products/wireless-accessories/products/receivers/universal.html

Assistive Devices for Maximizing Hearing

With a sound field system, the speaker wears a microphone/transmitter and the voice is projected by speaker(s) placed in the room. It amplifies the speaker's voice evenly across the room.

Figure 17 Photo of a teacher using a hands free microphone which is attached to her ear to transmit an audio signal to the sound field speaker. Behind her is a the sound field speaker which looks like a tall thin aluminum tube. In front of her are two students who have their hands raised. www.phonak.com/us/b2c/en/products/more_products/soundfield/features.html

Pairing Assistive Listening Device to other Technology

Bluetooth vs. FM pairing in the classroom

An Educational Audiologist...

- recommends and programs the devices.
- aligns Hearing Assistive Technology Systems (HATS) for use with other devices such as iphones, tablets and computers
- will discuss the physical limits of the student's ability to interpret sounds accurately

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Figure 18 TSBVI logo.

This project is supported by the U.S. Department of Education, Special Education Program (OSEP). Opinions expressed here are the authors and do not necessarily represent the position of the Department of Education.

Figure 19 IDEAs that Work logo and OSEP disclaimer.