Assistive Listening Devices Detail

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Our Communication Needs

All of us share the following four communication needs:

- Face-to-face communication with other people
- Enjoyment of electronic media (radio, stereo system, television, the sound track at the movies, etc.)
- Telephone communication
- Awareness of environmental sounds and situations (doorbell, fire alarm, pager, etc.).

When a hearing problem cannot be corrected medically or surgically, hearing aids are usually recommended to meet these communication needs. For those with profound or severe hearing loss, a cochlear implant may be the treatment of choice. Due to technological advancements in recent years, today's hearing aids do an excellent job of helping people meet these needs. However, sometimes there are situations where additional technologies may be needed. For example, some hearing aid users may continue to experience difficulty understanding speech in noisy environments, from a distance, as when watching TV or attending a movie or play, or while listening on the telephone. At bedtime, a person with even a mild to moderate hearing loss may not hear the smoke alarm located down the hall and behind a closed door if he or she is in a deep sleep and the hearing aids have been removed. This same person might miss a doorbell chime while listening to the TV a room away. Further, a child with normal hearing, who suffers from recurrent middle ear infections or who has a central auditory processing disorder, is at a definite educational disadvantage when seated in a typical classroom with poor room acoustics and excessive noise.

How Assistive Technology Can Help

Many auditory and non-auditory devices — collectively known as *Assistive Technology*, *Assistive Listening Devices (ALDs)*, or *Hearing Assistance Technology (HAT)* — are available to help people with all degrees of hearing loss to meet these important communication needs. These devices can be classified according to the need they address. Devices to facilitate:

1. Face-to-face communication
2. Reception of electronic media
3. Telephone reception
4. Reception of important warning sounds and situations

Devices to Facilitate Face-to-Face Communication and the Reception of Electronic Media

The first two types of assistive technology listed above will be discussed together since both are used to achieve the same goal: improvement of speech understanding through the use of either an enhanced auditory signal or visual signal.

Auditory Technology

Speech is a complex, fast-moving target. It changes in level, depending on vocal effort and distance. It also changes in pitch depending upon gender and the various sounds uttered. It can be spoken in quiet as well as in noise and in reverberation (room echo). How well you hear and understand speech depends on all of these factors, as well as the exact nature of your own hearing difficulty. Today's hearing aids are designed and fitted to provide sufficient audibility so that speech can be heard and understood as clearly as possible, both in quiet and amidst a noisy background. However, they are designed to do this for sounds within a relatively close distance. Beyond this distance, room reverberation makes listening very difficult, even with the best hearing aids. Thus, while hearing aids may form the "heart" of a person's listening system, there are times when additional auditory technology may be needed for effective communication.

Auditory devices can be thought of (roughly) as "binoculars for the ears." By placing a remote microphone next to the talker (or loudspeaker) or by connecting directly into the sound source (TV, VCR, MP3 player, etc.), these devices bring the desired sound closer to one's ear(s) before it has a chance of being mixed with noise and reverberation. The "captured" sound is then sent to the listener via a "hardwired" or "wireless" link.

Hardwired Devices


Figure 1

Use an actual electrical wire or cord to transmit sound, thereby tethering the listener to the sound source with the freedom of movement determined by the length of the cord. An example of a hardwired device is shown in the (Figure 1). Without this technology, a person with a significant hearing loss would not be able to successfully use stereo headphones with the CD player because the sound would not be sufficiently audible. However, thanks to a special Direct Audio Input (DAI) connection between the behind-the-ear (BTE) hearing aids and the CD player, this same individual can now enjoy a stereo signal because the hearing aids are individually programmed to make the music audible. This same device can be used with a PC or laptop computer, home stereo, or other sound source.

Since smaller hearing aids do not have a DAI connection, other hardwired options exist. For example, (Figure 2) shows a neckloop and a silhouette inductor. The neckloop (left) is worn around the neck, while the silhouette inductor (right) is worn behind the ear. Both the neckloop and the silhouette inductor can be plugged into a sound source like the CD player shown in Figure 1. The only other requirement is that the hearing aid (or aids) must have a telecoil circuit. The neckloop or inductor picks up the electronic signal from the CD player or other sound source and changes it to electromagnetic energy. When the hearing aid is set to the telecoil mode, the electromagnetic energy from the neckloop or inductor is picked up by the telecoil, changed to an electrical signal, and eventually delivered into the listener's ear as sound.

BTE hearing aids usually come equipped with telecoils — but not always. This option also is available, upon request, for in-the-ear (ITE) hearing aids and even smaller in-the-canal (ITC)

hearing aids, provided the listener's ear is large enough. However, telecoils are normally not available in the smallest completely-in-the-canal (CIC) hearing aids.

Wireless Systems

Wireless systems consist of a transmitter and a receiver. As shown in (Figure 3), a transmitter picks up the sound via a microphone placed next to a talker's mouth (or loudspeaker). The transmitter also can be plugged directly into the jack of a home entertainment system, computer, telephone, or other device. The desired signal is sent from the transmitter to the receiver via radio waves. In this example, a tiny FM receiver, tuned to the same frequency as the FM transmitter, plugs into the listener's behind-the-ear (BTE) hearing aid using a DAI connection. The tiny "BTE FM" receiver picks up the transmitted FM signal and delivers it to the hearing aid. Thus, the transmitter and receiver form a wireless link from the sound source to the listener.

Body worn styles of FM receivers are also available for use with all hearing aid styles. (Figure 4) illustrates the various coupling methods. With a mild hearing loss, the hearing aids can be removed and the FM receiver can be used with earphones. If the listener uses CIC style hearing aids, it may also be possible to place earphones over the ears and hearing aids. Inductive coupling also may be used (neckloop or silhouette) with ITC, ITE or BTE hearing aids set to telecoil mode. Finally, BTE hearing aids may be coupled to a body worn FM receiver using inductive coupling or a DAI.

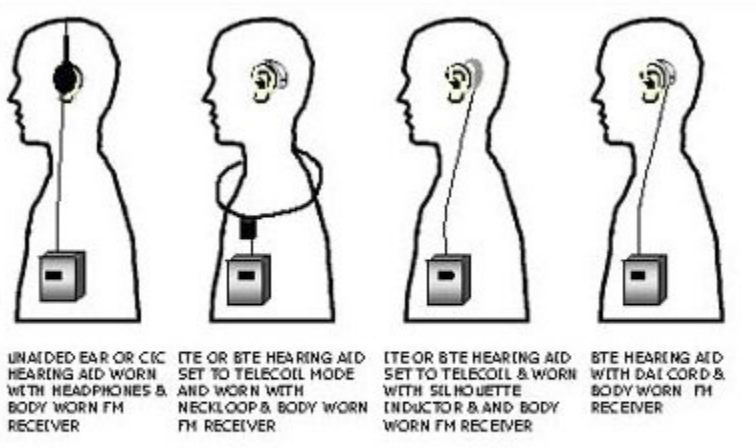


Figure 4

(Illustration courtesy of Cynthia Compton Conley, © 2004)

(Figure 5) shows a close-up of the newer BTE FM receiver. This type of receiver has become very popular due to its cosmetically appealing design. The receiver plugs into the bottom of any brand of BTE hearing aid having DAI capability. Hearing aids with integrated or built-in FM reception are also available. An additional option is to wear a newly developed FM receiver that sends sound directly into the ear canal and into the microphone of a CIC hearing aid. This type of FM receiver is popular with people who have normal hearing but experience difficulty in noise (e.g. children or adults with central auditory processing problems).

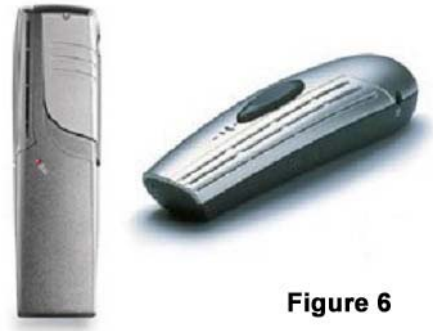


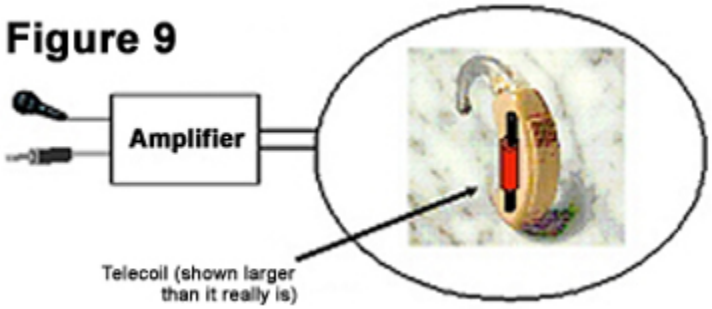
Figure 6

As shown in Figure 4, the traditional style of FM transmitter is body worn. Recently, sleek hand-held transmitters have been introduced by the hearing health industry (Figure 6).

These transmitters can be pointed at the talker, placed on a table top, plugged into a TV, telephone, or other sound

source - as well as worn by the talker. They are equipped with built-in microphones that can pick up sound from all directions or from one direction. Transmitters that serve as a hearing aid remote control and that also provide a two-way link to cellular telephones equipped with Bluetooth technology (Figure 7) are now available. FM systems are the most versatile of all listening technologies because they can be used indoors or outdoors and are very portable.

In addition to FM technology, two other types of wireless systems are also in common use at home, in the workplace, and during recreation: (1) infrared (IR) and (2) audio loop (or induction) systems. IR systems transmit using infrared energy or invisible light waves. Infrared systems can be used at home for TV viewing and are also very popular in movie theaters, at live theater and concert performances where privacy and/or security are a concern. This is because, unlike FM energy, infrared energy stays confined behind the walls of a room. Only body style IR receivers are available. (Figure 8) shows an IR system for home use with an entertainment system. The transmitter can be plugged into the back of a TV set or other sound source. The receiver can be coupled to hearing aids using a neckloop (shown) or silhouette inductor, with DAI cords to BTE hearing aids, or with headphones (no hearing aids or CIC hearing aids). The receiver can be set to mono or stereo mode.



The third type of wireless systems is the audio loop system. The transmitter is a loop of wire connected to the output jack of an amplifier, strung around a room and connected to the input jack of the same amplifier (Figure 9). It can be thought of as a room-sized version of the neckloop shown in Figure 2. The receiver is the listener's hearing aid telecoil inside of a BTE, ITE, or ITC style hearing aid. A loop system works like this: First, the speaker talks into a microphone that is connected to the amplifier. The amplifier can also be plugged into a TV or other sound source. The acoustic energy of the speaker's voice is changed to an electrical signal by the microphone and is sent to the amplifier. The amplified electrical signal is then sent through a loop of wire placed around the room. Like a neckloop, this room-sized coil of wire converts the electrical energy to electromagnetic energy, which is then picked up by the telecoil circuit located inside of the hearing instrument. The audio loop system is very cost-effective if the hearing aid user has hearing aids equipped with telecoils because additional receivers do not need to be purchased or maintained. While loop systems are often installed in large rooms in public areas, smaller versions can be purchased for use in a home.

Mandated by the Americans with Disabilities Act and other legislation, large area versions of these three systems are required to be installed in movie theaters, government buildings, schools, and in other public areas. In order for you to be able to enjoy music and understand speech in these environments, you need to be sure that your hearing aid is compatible with the various systems available. For example, if you want to go to a movie theater that happens to have a room loop, you will need hearing aids equipped with telecoils. If not, then you can ask the theater if you can borrow a device called an induction receiver. This battery-powered body worn device

contains a telecoil to pick up the loop's signal and earphones to deliver the signal to your ears. It can be worn without hearing aids, with CIC hearing aids, and sometimes with larger hearing aids if the hearing aids are turned down and the volume control of the receiver is turned up. If you then want to go to another theater that happens to have an IR or FM system, you must then borrow an IR or FM receiver and couple it to your hearing aids using a telecoil and neckloop (or you can try using headphones as above). If you use a BTE FM receiver and you go to a theater that has FM, you may or may not be able to use your own receiver. It depends on what frequency the system is broadcasting on and whether or not your receiver is on the same channel or can be changed to that channel. Hopefully, in a few years, standards and/or technology will be in place that will make it easier for people to use their own receivers in any public place. For the time being, you might have to borrow the body style receiver from the public area and couple it to your hearing aids using a neckloop (most theaters and other public facilities will not have DAI cords to match the myriad models of BTE hearing aids available. For more info on how to use large area ALDs, visit the following website:
http://www.hearingresearch.org/BulletinConsumers.htm

Visual Technology

Two types of visual systems are available to help people understand speech at a meeting or other live event: (1) Computer-Assisted Note taking (CAN) and (2) Communication Access Real Time Translation (CART), also known as Real Time Captioning.

With CAN, a typist types meeting proceedings in outline, not word-for-word, format onto a computer connected to an LCD projector that displays the type-written words onto a screen or wall for the audience to see. A typist who can accurately type at least 60 words per minute and who has note-taking skills is desired; no other special training is required. CAN is much less expensive than real time captioning and is helpful for meeting and lectures where people need just enough information to keep track of the topic.

With CART, a specially trained court stenographer or "caption writer" listens to the talker and types what is being said onto a stenotype machine. The stenotype code is then translated into verbatim captions, which are then sent to an LCD projector and projected to the audience as for CAN. For very large groups, the captions are displayed simultaneously with a live video picture. Accuracy of real time captioning depends on how well the caption writer enters the code and how complete and accurate the dictionary is in the software program. For information on real time captioning and for referrals, call the National Court Reporters Association in Vienna, VA at 703-556-6272 or visit their website at http://www.ncraonline.org.

Verbatim captioning is also available on your TV and can be accessed by programming your remote control. You can choose to have the captions appear with or without sound. TV captioning can be pre-recorded on a magnetic disk (with mistakes corrected) for broadcast at a later time (as with sitcoms) or can be live (as with the news or other live event).

Devices to Facilitate Telephone Reception

For many people, listening on the telephone can be a frustrating experience as the signal produced by most telephones is not 100% intelligible. Even people with normal hearing often

need to ask for certain names and other information to be spelled out. People with hearing loss experience even more difficulty for two reasons: (1) due to the hearing loss, the telephone signal is softer and therefore less intelligible and (2) unlike with face-to-face communication, there are no visual cues to help with understanding.

Auditory Technology

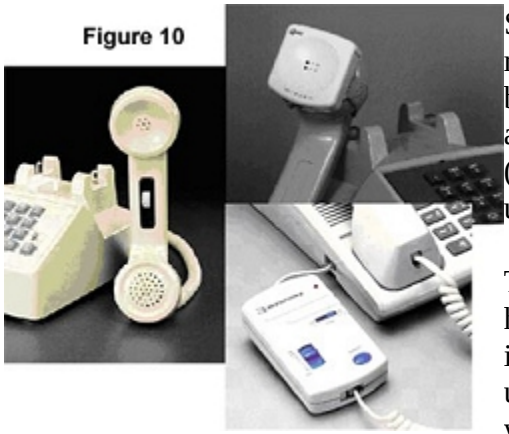


Figure 10

Special telephone amplifiers are available (Figure 10) that replace the telephone handset, attach to the phone between the handset the phone itself (in-line amplifiers), and attach to the handset and are powered by a battery (portable amplifiers). Each of these amplifiers can be used with or without a hearing aid.

These standard telephone amplifiers can be coupled to a hearing aid in two ways: (1) acoustically and (2) inductively. With acoustic coupling, the amplifier is held up to the hearing aid's microphone. While this tends to work well with a CIC hearing aid, it usually results in an annoying whistling sound (feedback) with the larger hearing aid models. However, if the larger models are equipped with a telecoil circuit, then the hearing aid can be set to "T" and held next to the amplifier, with no feedback. Some newer models of hearing aids have an automatic or "touchless" telecoil that turns itself on whenever the hearing aid is held next to the telephone. In order to receive a signal from the phone, the telephone must be "hearing aid compatible (HAC)."


Figure 11

For people who always use a hearing aid with a telecoil, a portable, battery-powered acoustic-to-magnetic adaptor (Figure 11) can be attached to the earpiece of the telephone handset. The device picks up the acoustic energy (sound) from the telephone and changes it to electromagnetic energy, which is picked up by the hearing aid's telecoil. A silhouette inductor can be plugged into the device to allow for listening on the phone with two hearing aid telecoils. This option may be helpful if you are one of those individuals whose speech understanding improves significantly when listening with both ears.

Special telephones with built-in amplification are also available in both standard and wireless handset models. Some models allow the connection of a cochlear implant, a DAI cord, or a neckloop and some are powerful enough to be used without a hearing aid - a big convenience when the telephone rings in the middle of the night.

Also available are devices that enable you to use your hearing aid(s) with a digital cell phone for distortion- and noise-free reception. These devices include the BTE FM system shown in Figure 8 as well as hardwired systems that connect from the cell phone to a neckloop or DAI connection.

Visual Technology

For those who cannot understand over the voice telephone, even with amplification, there are other options such as the Voice Carry Over (VCO) or "read and talk" Telephone. Used with the telephone relay service, VCO allows you to talk directly to the other party while an operator translates what the other party says to you into print that is displayed on a small LCD screen (Figure 12).

Other telecommunications options for people who experience difficulty understanding speech over the telephone include email, instant messaging, TTYs, and two-way pagers. Pagers by Wyndtel, T-Mobile, and Blackberry (Figure 13) can be used not only to house your daily schedule and address book, but also to surf the web as well as to chat back and forth, in real time, with friends, family, and colleagues. Some models also provide two-way paging with voice telephone communication.

Alerting Devices

Alerting devices allow hard of hearing and deaf people to be aware of many environmental sounds and situations in the home, in school or in the workplace, as well as for travel and recreation. Such systems use either microphones or electrical connections to pick up the desired signal and hardwired or wireless transmission to send the signal to you in a form to which you can respond. For example, when someone presses the doorbell button, when the phone rings or the fire alarm is activated, these events can trigger a flashing incandescent or fluorescent light, a loud horn, a vibrational device (pager, bed shaker), or a fan. Some systems use a combination of signals. For example, (Figure 14) shows the photograph of an alarm clock that will beep, flash a lamp, and shake the bed - simultaneously (a nifty idea for heavy sleepers).

Alerting devices can be purchased individually to warn a person of a specific event or as complete systems that warn a person of a variety of events. For example, someone living in a one-room studio apartment might need just a simple device that flashes a single light when someone presses the doorbell, whereas another individual living in a large house with many rooms may need a system that triggers flashing lamps in every room of the house when the doorbell is pressed, the telephone rings, or the fire alarm is activated. Some systems use coded flashing lights (e.g. 5 flashes for the doorbell vs. one flash for every time the phone rings) whereas others use a vibrating body-worn pager that vibrates and displays a number corresponding to the event (e.g. number 1 = fire; number 2 = doorbell). (Figure 15) shows an example of the latter type of system.

WHICH SYSTEM IS BEST?

A broad assortment of auditory and non-auditory technology is available to assist in removing the communication barriers of everyday life. Each system has its pros and cons and some individuals may use more than one type of system. Your audiologist should be able to help you select the best system, or combination of systems, based on your own unique receptive communication needs and lifestyle.

LEGISLATION YOU SHOULD KNOW ABOUT

The Americans With Disabilities Act (ADA) (Public Law 101-336) is landmark civil rights legislation. The ADA went into effect in January 1992 and it provides a comprehensive national mandate for the elimination and prevention of discrimination against individuals with disabilities. Because of the ADA, businesses and employers must take steps to ensure that disabled people, including those with communication disabilities, have access to all goods, services and facilities available to non-disabled people. Additionally, the ADA prohibits discrimination on the basis of disability by private entities and ensures that individuals with disabilities have access to public accommodations, employment opportunities, transportation and telecommunications (U.S. Equal Employment Opportunity Commission, 1992).

All individuals with hearing-impairment, regardless of their age, are affected by the ADA. It is the responsibility of public access facilities, employers, and telecommunication providers to comply with the ADA, but it is the responsibility of the consumer (you!) to demand compliance.

Learn more about your legal rights