Hearing Aid FAQs from the American Academy of Audiology

©2006 American Academy of Audiology –www.audiology.org

How do I determine if I am a candidate for a hearing aid?

The critical variable is whether you experience difficulty hearing or are having increased stress and strain in your daily function. Amplification may simply relieve the strain of hearing, as opposed to making sounds louder or even improving your understanding of speech. However, this alone can be a very significant benefit. You must ask yourself whether you find you are becoming stressed or fatigued after a day of straining to listen. Ask yourself whether the ability to hear, but not understand, is adequate for your needs. Unselfishly examine whether you are becoming a burden to your family and friends, even if you do not personally recognize difficulty hearing. Remember that wearing a hearing aid is not necessarily a mark of infirmary, rather it is a mark of courtesy to others. Thus, sometimes it is advisable to arrange to try hearing aids within your own unique environments to determine whether the benefit warrants the expense.

Is it really necessary to wear two hearing aids, or can I get by with just one?

There are four main reasons why binaural (two eared) listening is superior to monaural (one eared) listening. They are:

1. Better Hearing in Noise: An individual's hearing in noise can be improved if the signal reaching each ear arrives at a slightly different moment in time. This is technically referred to as phase. When the brain receives slightly different, yet still audible signals at the two ears, it has the ability to cross-correlate and process the primary signal (usually speech) better than if the signal is received monaurally.
2. Improved Signal versus Noise Level from Optimizing Position: Sound loses intensity (loudness) when it travels across the head. This occurs mostly for the high frequencies which are the most important for understanding of consonants, such as /s/, /t/, /f/, and /sh/. If you have a hearing aid on only one ear, say the left one; and the person you wish to hear is speaking to you from the right side, the consonants may be decreased by nearly 20 decibels by the time it gets to your aided ear. Unfortunately, noise in the room may occur from any or all directions, so while the noise level is not decreased, the speech level is. Wearing two hearing aids ensures that the speech sounds will not be diminished any more than necessary because of your position in the room.
3. Improved Localization Ability: We determine where a sound is coming from on the basis of 1) the relative time in which the sound arrives at each ear, 2) the relative difference in loudness at the two ears, and 3) the relative difference in the pitch of the sound at the two ears. When there is a large difference in hearing between two ears (as might occur when a person with similar hearing in both ears only wears one hearing aid) the brain cannot make use of these subtle relative differences and their ability to locate sounds may suffer.

4. Possible Deterioration of the Unaided Ear: We hear in our brain, not in our ears. The ultimate goal of hearing aids is not just to send sound into the ear. It is also essential to retrain the central auditory system in the brain. While it is uncertain whether hearing sensitivity (ability to hear soft sounds) will decrease if your ear is not stimulated adequately, research now suggests that there can be changes in the way in which your brain processes sound when it is "starved." Thus, providing stimulation may be important in preserving your auditory potential.

What determines what kind of hearing aid I should wear?

There are four primary styles of modern hearing aids. They are: Behind-The- Ear (BTE); In-The-Ear (ITE), In-The-Canal (ITC), and Completely-In-The-Canal (CIC).

CIC ITC ITE BTE

While many people choose style based on vanity, decisions regarding which style of hearing aids are most appropriate for you may need to be based on a variety of factors.

Physical factors include:

1. The shape of your outer ear: deformed outer ears may not allow for wearing of BTE styles.
2. The depth of the depression near the ear canal (technically called the concha): if your ears are very shallow there may not be adequate space for certain ITE model aids.
3. The ear canal size and shape: certain ear canals may be too narrow or shaped in a manner such that ITC or CIC hearing aids will either not go in easily, or may fall out too easily.
4. Manual dexterity: not only is the removal and insertion of canal style hearing aids difficult for some people, but some individuals are unable to insert the battery or manipulate the volume control.
5. Wax in the ear: some people build up large amounts of earwax, or may have extremely moist ear canals that require adequate ventilation. For these people ITC, or even certain full size ITE aids may not be appropriate.
6. Draining ears or ears otherwise having medical problems may not be able to safely utilize hearing aids that completely block the ear canal. For these ears, it is vital to allow ventilation so hearing aids that do not fully block the ear may be required. Sometimes, BTEs that are connected to earmolds that have large vents (openings to let air pass through) are useful.

Hearing related factors include:

1. The shape of the audiogram (hearing test); individuals who have hearing loss for certain pitches (frequencies) but not others, (for example those who hear the low frequencies fine, but have a high frequency hearing loss) may be better served by systems that do not fully block the ear canal.
2. Degree of loss; currently, severe and profound hearing losses are best served by BTE style aids. This style may also minimize the likelihood of feedback (whistling).
3. The need for special features such as directional or multiple microphones and/or the use of a telecoil (a small magnetic loop contained in the hearing aid that allows for better use with telephones or assistive listening devices), may dictate the preferred style.
4. Acoustic feedback (whistling) occurs when the microphone is close to the loudspeaker. BTE aids have a clear advantage over the smaller ITE or ITC aids because feedback is less likely to occur. While you may feel that you will only wear an inconspicuous device, check the appearance of a small or mini-BTE aid coupled to the ear with an open earmold. A mini-BTE aid connected to the ear with an open earmold may be less conspicuous than most ITE and many ITC aids. Most importantly, discuss the pros and cons of different styles with your audiologist.

Why does my voice sound so strange to me when I'm wearing my hearing aid?

Some hearing aid users report that they feel as if they are in a barrel or experiencing an echo when talking. This is called "the occlusion effect." Normally, when your ear is unblocked and you are speaking, you hear yourself both through the air traveling through your ear canal, (air conduction) and through vibrations that you create in your skull and ear canal (bone conduction). When your ear is occluded or blocked, however, air conduction transmission is reduced and bone conduction perception enhanced. Try this experiment. Hum aloud and then alternately plug and unplug one ear while humming. Notice how the sound changes pitch and loudness in your plugged ear? This happens because the vibrations are blocked from their usual escape route. Most new users adapt to this effect and it isn't a problem. However for some, the following steps might help:

1. keeping the ear as open as possible.
2. reducing the amount of gain (amplified volume) in the low frequencies.
3. using an earmold that fits very deeply into the ear canal so that it contacts with the bony rather than the soft cartilaginous portion (to reduce vibration).

What can I do about the whistling (feedback) prodcued by hearing aids?

There are two types of acoustic feedback: that produced internally from the hearing aid - indicating a device in need of repair; and the more common external feedback produced by a leakage of amplified sound out of the ear canal and back into the microphone of the

hearing aid. Feedback that occurs when the hearing aid is being inserted or removed or when your hand is cupped near the device is common, and does not necessarily signal the need for action. If however, you experience feedback when you speak, chew, yawn or change position, you need to consult your audiologist. Feedback is more likely to occur in smaller hearing devices because the microphone is closer to the area at which the sound comes out into the ear. So, a behind-the-ear style may be less likely to produce feedback than in in-the-canal style device. Usually, external feedback can be corrected by:

1. properly reinserting the hearing aid or earmold
2. remaking the earmold (or in-the-ear shell)
3. plugging, or reducing the diameter of any vents (holes)
4. reducing the amount of high frequency gain, (typically an unacceptable trade-off because of the resultant loss of high frequency hearing)
5. altering the sound by means of filters in the hearing aids or changes in the way the devices are programmed
6. adding a "canal lock" (a piece of plastic) to better hold canal hearing aids in place so they don't work their way out of the ear canal as you chew

Recently some manufacturers have introduced digital feedback reduction. With this technology, feedback is sensed by the hearing aid and canceled by means of a new signal generated by the hearing aid itself.

What are digitally programmable hearing aids?

Some of the characteristics of the sound produced by hearing aids can be modified using computers or other devices. Hearing aids that have this capability are called "digitally programmable."

They have several advantages over non-programmable instruments.

1. Flexibility: changes in hearing can easily be accommodated, as can unusually shaped and fluctuating hearing losses.
2. Multiple Programs: It is often useful to be able to change the hearing aid characteristics depending on the environment one encounters. With these hearing aids, you can change program with the touch of a button or a remote control.
3. Advanced Compression Circuitry: Most hearing impaired people suffer from an abnormally rapid growth in loudness perception. This is why some hearing aid users complain that they can't hear soft sounds, but when sounds are made just a little louder, they are much too loud for comfort. Therefore, hearing aids are designed so that they will amplify soft sounds more than they will amplify loud sounds. This is called compression. Compression works almost like an invisible finger reaching up and changing the volume control so that soft sounds are made loud enough to hear and loud sounds are turned down so that they don't become uncomfortable.

What are multi-channel (multiband) hearing aids?

Now that audiologists have a better understanding of the importance of providing adequate gain without exceeding the physical saturation limit of the aid and the individual's loudness discomfort level at each frequency, the accurate measurement of these features have become an essential part of the fitting process. As a result of these enhanced procedures, it has become abundantly clear that significant differences exist not only among individuals with nearly identical audiograms, but also among the loudness growth of specific frequencies for a given individual. In other words, a patient can demonstrate loudness tolerance problems for certain frequencies, but not for others. Therefore, the electroacoustic characteristics programmed into the hearing aid should differ for the various frequencies. Through the use of multiple compression channels (some systems have two, some have three) a completely unique set of signal processing instructions can be utilized. As such, a certain acoustic environment can trigger a response which, for example, produces additional high frequency boost while simultaneously reducing low frequency gain.

In addition, hearing aids containing single channel compression unfairly penalize certain sounds. For example, if a low frequency noise exceeds a certain level, compression (a reduction in gain) will occur for ALL frequencies, not just the offending ones. With multi-band compression, the reduction in gain is limited to those frequencies containing the offending signal. This may be the most important advantage of all.

How are directional and multiple microphones used?

Most of the time, listeners are facing the person they are speaking to. Noise, however, is often located in front of, behind, and/or to the sides of the listener. Some hearing aids now contain directional or multiple microphones which "communicate" with each other in a manner such that sounds originating from the front of the hearing aid receive maximum amplification and sounds originating to the sides or behind the hearing aid receive considerably less amplification. This effectively suppresses some of the annoying background noise that creates so much difficulty for hearing impaired listeners. The technology using these types of microphone arrangements is very promising. They can be found in several different hearing aids but are generally limited to behind-the-ear or full shell in-the-ear hearing aids due to size restrictions.

What about the new, digital hearing aids?

The future of hearing aid technology has arrived! Advancements in the ability to manufacture hearing aids that process sound digitally offer the potential for dramatic improvements over previously available instruments. Hearing aid researchers have been investigating the use of true digital technology for over a decade but were held back because the increased power consumption needed to operate such instruments required the instruments to either be very large, or to be connected to a separate power source worn on the body. As a compromise, digitally programmable hearing aids were introduced on the market about six years ago. These devices represented an improvement over previous technology in that they were extremely flexible, could be fine-tuned, and had advanced compression (loudness limiting) capabilities. They were still somewhat

limited, however, because even though they were programmed by a computer (the digital portion) they still operated in an analog fashion. This meant that sound entering the hearing aid microphone would be amplified and filtered by a variety of electronic components. Because hearing is such a complex sense, the extent of filtering and amplifying required to partially correct an impairment added to the limitations of the hearing instrument by producing distortion and noise.

Digitization means that incoming sounds are converted to numbers, which are then analyzed and manipulated via a set of rules (algorithms) programmed into the chip controlling the hearing aid. There are now nearly a dozen digital hearing devices available. Some of these digital aids analyze incoming sound, make a determination regarding speech versus noise content, then convert this information to numbers. The resultant digitized numbers are then manipulated according to algorithm instructions, reconverted to an analog form (sound waves) and delivered to the ears without producing the types of distortion that were often associated with analog technology hearing aids.

Why do hearing aids amplify so much noise and make sounds too loud but not clear enough?

Among the most frequent complaints voiced by hearing aid users are that noise is amplified too much and that certain sounds become too loud for the user to bear. Some modern hearing aids contain sensors that allow the hearing aid to detect sounds exceeding a certain loudness level, and then self-adjust to reduce the amplification (gain) for those sounds. Unfortunately, because noise is comprised of many of the same frequencies as speech, it is virtually impossible to "shut out" noise without also adversely affecting the quality of the speech signal. The good news is that audiologists have learned to utilize modern technology to measure and control the maximum sound intensity reaching your ear. If sounds (speech or noise) exceed either the saturation level (maximum level the hearing aid can amplify without distortion) or your personal loudness discomfort level, distortion or discomfort will be the result. Modern hearing aids utilize technology that allows for adequate gain for soft sounds while minimally (or not at all) amplifying loud input signals. Concerning background noise, new techniques using multiple microphones within the same hearing aid aids are improving the listener's ability to function in noisy environments. With regard to clarity, even the most sophisticated hearing aids' ability to clarify speech is limited by the degree of inner ear and/or central auditory nervous system distortion.

How much time is needed to adapt to a hearing aid?

While each person's experience will vary, hearing aids may allow a person to experience certain sounds they had never heard before (or at least for some time). Relearning takes place in the central auditory nervous system and not in the ear itself. Recent experiments suggest that a listener's ability to comprehend speech may continue to increase over a period of several months when wearing a new amplification system. This process is termed acclimatization. Most dispensing audiologists currently allow for a trial or adjustment period with new hearing aids.

Why do hearing aids cost so much?

The reasons hearing aids cost so much are:

1. They are sold in relatively low volume (i.e. approximately 1.7 million hearing aids for some 30 million hearing impaired) are sold per year, as compared to several million stereos.
2. The amount of time and money spent by manufacturers on research and development is considerable. One manufacturer claims to have spent over twenty million dollars developing a single model.
3. The amount of time spent by an audiologist with a patient is very significant. Data indicate that an average of five direct contact hours is spent during the first year a patient receives hearing aids. This time is critical for new users, particularly to assist during the acclimatization process. Mail order or budget clubs can afford to sell hearing aids at lower prices because the electronic components often are inexpensive and the hearing aids themselves are often placed on the user with minimal (or in the case of mail order) no instructions or fine tuning adjustments. Furthermore, the patient may be charged for every return visit, including minor tubing change and adjustments. Thus, in the long run the patient is likely to pay as much or even more. Additionally, the minimum amount of training required for a dispensing audiologist is a Masters degree while mail order or discount centers are often staffed by sales people having minimal technical training. Audiologists, like consumers, are concerned about keeping the cost of hearing aids affordable. The reality is, communication is one of the most important skills humans have. So if wearing hearing aids allows you to resume normal activities and communicate with loved ones, the cost becomes a lot more justifiable.

How often must hearing aids be replaced?

Generally speaking, hearing aids should last for at least five years. The need for new hearing aids may occur if a patient's hearing status changes, but with the availability of programmable and digital hearing aids, changes can be made in the audiologist's office and should reduce the need to order new hearing aids merely because of changes in hearing status.

What are assistive listening devices (ALDs) for TVs, telephones and theaters?

One of the major goals of signal processing schemes is to enhance the signal to noise ratio perceived by the listener. The use of aids with automatic low frequency reduction represent an attempt at this goal. Unfortunately, despite all the new technological advances, a basic problem remains for which wearable amplification falls woefully short. That problem relates to the physical distance between the microphone of the hearing aid and the source of the sound desired to be heard. Intensity (loudness) decreases as physical distance increases. Unfortunately most background noise surrounds the listener, so while the intensity of the speech decreases with distance, the intensity of the noise may not. This is one reason why hearing aids transmit sound so well if the speaker talks directly into the microphone, but at longer, more realistic distances reception diminishes. It would be ideal to have the sound produced at the source transferred directly to the listener without losing any intensity. It is usually impractical to ask the speaker to move closer to

the listener's ear. One way of achieving this effect is with direct audio input, in which the speaker holds a microphone that is hard wired to the hearing aid itself near his mouth. Many hearing aid wearers are reluctant to ask the speaker to do this. An alternative approach is available through infrared transmission, FM transmission, or inductance loop transmission. These systems are currently used in many theaters, concert halls, houses of worship and households. One of the best uses is for television listening. The portable transmitter (usually smaller than most cable boxes) and microphone are located near the TV loudspeaker. The sound picked up by the microphone is then transmitted in the same intensity to a receiver worn by the listener. These devices can transmit with minimal distortion over a considerable distance (up to 50 feet). ALDs are becoming increasingly common in public places, due to the legislative enactment of the Americans with Disabilities Act. Other non-wearable devices that assist the hearing impaired listener include telephone amplifiers, vibrating alarm clocks, TV closed caption decoders, inexpensive personal hand held or body borne amplifiers, visual alarm systems, and TDDs (telephone devices for the deaf).

What should new users of hearing aids realistically expect?

When wearing hearing aids:

1. Your hearing in quiet environments (one to one communication watching TV, etc) should be improved.
2. Your hearing in moderate background noise should be improved.
3. Your hearing in background noise is NOT going to be as good as your hearing in quiet.
4. Your hearing in loud background noise should be NO WORSE than without the hearing aids.
5. Soft speech should be audible, average speech should be comfortable; loud speech should be loud, but never uncomfortable.
6. Your earmolds should be comfortable.
7. Your own voice should be "acceptable" to you.
8. There should be no feedback when the hearing aids are properly seated in your ears.
9. You may hear sounds you have not heard for a while (like footsteps or the refrigerator humming). This is not abnormal.

Be patient. It requires time to adjust to hearing aids. Your listening skills should improve gradually as you become accustomed to amplification.

Hearing aids WILL NOT restore your hearing capabilities to "normal" or to pre-existing levels.