BETTER HEARING INSTITUTE

HEARING SOLUTIONS- Hearing Aids

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Brief Guide to Modern Hearing Aid Technology

In addition to the basic features of hearing aids discussed earlier, there are many other features available in modern hearing aids-some of them are for convenience and ease of use, others are designed to improve speech understanding or listening comfort.

Adaptive Feedback Cancellation:

Acoustic feedback (whistling from the hearing aid) can be annoying, embarrassing, and in some cases, prevent the hearing aid wearer from using the correct amount of gain. Many of today's hearing aids have an automatic feature that quickly detects acoustic feedback and cancels it. This feature is designed to manage transitory feedback (e.g., caused by placing one's hand or a telephone next to the ear), and is not a solution to a poorly fitted ear mold or hearing aid.

Automatic Gain Control-Output (AGCo):

AGCo or output compression is used to put a "ceiling" on loud sounds. It handles the output after the amplifier, and can be adjusted to correspond to the patient's threshold of discomfort (maintaining sounds below this level).

Automatic Gain Control-Input (AGCi):

AGCi, or input compression, often referred to wide dynamic range compression (WDRC) is used to "repackage" the speech signal (and other incoming sounds) to correspond to the reduced dynamic range of the hearing aid user. That is, if the incoming sounds have a 60 dB range, and the patient only has a 30 dB range of useful hearing, the sounds might be "compressed" by 2:1 to fit into the useful auditory region. The notion is that most people with a hearing loss need more gain for soft sounds than for average, and more gain for average sounds than for loud. WDRC accomplishes this automatically-in fact, if the WDRC is programmed correctly across frequencies, many hearing aid users have little need for a volume control.

Digital Noise Reduction:

With digital hearing aids, it is possible for the hearing aid to analyze an incoming signal and differentiate speech from a broad-band noise signal. This can be accomplished simultaneously in several channels. If the dominant signal is believed to be noise in a given channel, there is a reduction in gain. Note, however, that what a typical hearing aid user might consider to be "noise," (background talkers at a party) might not be considered "noise" by the hearing aid. While this feature has the potential to improve speech understanding in typical difficult listening situations, this has yet to be verified by research.

Digital Signal Processing:

Until recently, the majority of hearing aids utilized analog signal processing. This has changed rapidly the past few years, and today, nearly all hearing aids sold in the U.S. utilize digital signal processing. The advantage of digital processing is that less space is required, allowing manufacturers to include many more "programmable features" in a small package. Through the use of digital signal processing, the hearing aid can conduct an analysis of an incoming signal, and make a reasonable classification of the content-speech versus broad-band noise versus acoustic feedback (whistling) versus music, for example. This classification can then be used to trigger automatic activation of other special features.



Directional Microphone Technology:

Using special microphones or phase cancellation signal processing, it is possible to configure a hearing aid so that sounds from the side, and especially the back of the hearing aid user are amplified less than sounds originating from the front. It can serve as a type of "spatial" noise reduction if the user is correctly positioned. Directional technology is available on all hearing aid styles except CICs (because of size constraints). Importantly, directional technology does not improve localization of sounds. Research has shown that many hearing aid users prefer directional technology for listening in noise, usually when:

- the noise originates from behind the listener,
- the talker is in front of the listener,
- the listener is close to the talker,
- the room has low reverberation.

Some hearing aids automatically switch to a directional mode when the signal type and/or input intensity are matched to the characteristics of the algorithm. Adaptive directional hearing aids automatically tracks a dominant single noise source (e.g., a car passing by someone on a sidewalk), attempting to provide maximum reduction in gain toward the location of the source.

Multiple Channels:

The majority of today's hearing aids have multiple channels. Each channel represents a portion of the frequency range important for understanding speech. One advantage of multiple channels is that features such as gain and compression can be programmed differently to reflect changes in the patient's hearing across frequencies. Multiple channels also are

useful for implementing other features such as digital noise reduction and feedback cancellation (which will be discussed later). There is no consensus regarding how many channels are enough (or how many are too many)-to some extent, this depends on the feature utilized within the channels.

Multiple Memories:

A memory is a location to store hearing aid settings that are designed for a particular listening situation. It is common for hearing aids to have two or three memories. For example, in a hearing aid with three memories, it is common that memory one will be for listening in quiet, memory two will be for listening in noise, and memory three will be for telephone. On the other hand, many hearing aid users find that a single memory works in a variety of listening situations, and may only use one memory. Changing memories is accomplished by using a button (or toggle switch) on the hearing aid, with a remote control device. In some digital hearing aids, it happens automatically.

Telecoils:

With this special circuit, electromagnetic signals can be picked up from the handset of the telephone and amplified in a manner similar to the amplifying function of the hearing aid. Although many hearing aid wearers report benefit with this circuit, there is substantial variability across hearing aids. Telecoils are not available in some smaller custom-made models due to space limitations. Often, hearing aids with multiple memories will devote one memory to the telecoil. In these instruments, the telecoil can be accessed through a push button on the hearing aid or by the use of a remote control device.