Digital Hearing Aids

Micky Tamayo – Biomedical Engineering – University of Rhode Island

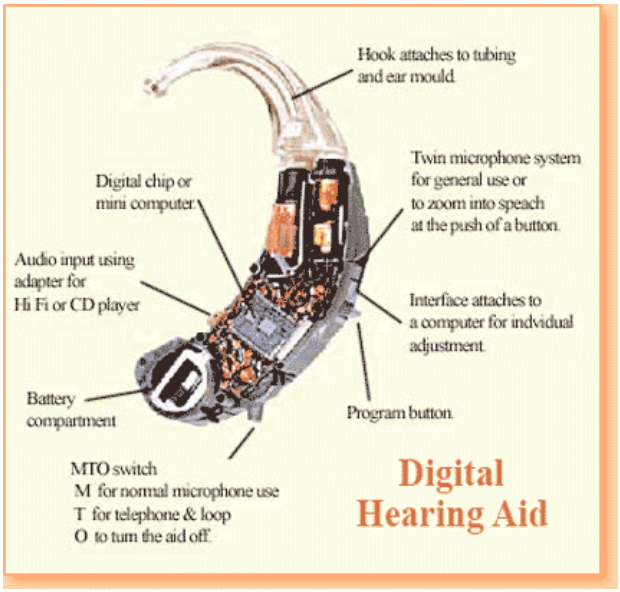
Hearing loss is the diminishing ability to distinguish sounds. This condition has an effect on over 10% of Americans, and becomes more apparent with aging or loud and unnecessary noise exposure. There are two different kinds of hearing loss, conductive and sensorineural, both of which can be helped by using a hearing aid. Conductive hearing loss is damage to the outer or middle ear and makes it difficult to hear faint sounds. Sensorineural hearing loss occurs deeper within, when there is damage to the inner ear or in the nerves between the ear and the brain. This type of hearing loss affects all levels of hearing. Since the digital hearing aid is so accommodating, it may be programmed in different ways to be used for different types of hearing loss.

The human ear is a part of the body that only gets worse with age. The common teenage person can hear frequencies of about 20,000 hertz, which diminishes to less than 14,000 hertz as they age. Because of this loss of frequencies the hearing aid was invented in order to pick up the higher ranged tones and amplify them. There is more than one type of hearing aid, but the digital one is the most effective as well as the most recent. This is how the digital hearing aid works.

The typical digital hearing aid consists of two microphones, a digital signaling processor and a speaker. To put it simplistically, the two microphones are positioned at the front and the back of the hearing aid. The microphones pick up sounds and generate an analog signal. These analog signals allow the circuits to produce an output proportional to the input. This way when the sounds are amplified, certain sounds will not be louder than others, therefore preventing further damage to the ear. These microphones on both the front and back of the hearing aid are unidirectional, making it easier to hear regularly, as the same sound won't come across both microphones.

Next, the audio analog signals become joined with the sound processor creating a digital sound. The sound processor is joined with the speaker, which amplifies the sound to the desired level for the listener (by a volume control usually on the hearing aid itself). The speaker delivers sound waves directly into the ear canal, so that it will be heard by the user no matter their type of hearing loss.

The digital hearing aid also has an individual subsystem. This system picks up the user's own voice so that they themselves can hear exactly what they are saying. This prevents people who are hard of hearing from allowing their own voice to become unclear or indistinguishable. The speaker has controllable amplification intensity so that both the microphones' and occlusion subsystem's gain level may be heightened or flattened.



New digital hearing aids have a lot of interesting features to them. There is usually an MTO switch, which allows you to switch between having the power off (O), for using the telephone or other close sound objects (T), as well as the regular microphone mode (M). Because of the unidirectional microphones it is possible to focus in on a conversation or a speaker some distance away. There are also a couple of ports on the hearing aid, one of which lets you plug into a computer program and re-encode the settings on the hearing aid. The other is an input that allows one to plug into a CD player or similar object.

The one problem with digital hearing aids is the price. Because they are often made custom for the person's ear, prices will range from about $1,500 to $3,000 per ear. However, this is still a small price in order to gain your hearing back.

References:

http://hypertextbook.com/facts/2003/ChrisDAmbrose.shtml
http://www.asha.org/public/hearing/disorders/types.htm
http://www.patentstorm.us/patents/6937738.html
http://www.repair-your-hearing-aid.com/digitalvsanalog.shtml
http://www.ucsfhealth.org/adult/medical_services/audio/hearingloss/index.html
http://www.widexusa.com/inteo_info5.php