Cochlear Implants

Andrew Rosenberg - URI Department of Electrical, Computer, and Biomedical Engineering - BME 181

The level of complexity of the human ear is still not completely understood. The human ear is divided into three sections: the outer ear, middle ear, and the inner ear. The outer ear (otherwise known as the Pinna) is responsible for catching sound waves in a specific way to help the brain recognize the direction from which the sound was produced. The sound waves then travel through the ear canal into the middle ear. The middle ear is composed of the tympanic membrane (or ear drum), which relays the sounds waves to the middle ear ossicles (bones) for amplification. The sound waves amplify through the malleus, incus, and stapes into the inner ear for processing. The cochlea takes the physical vibrations and translates them into electrical impulses that the brain can interpret. Once the vibrations have entered the cochlea, they travel across the basilar membrane. The thousands of auditory nerve fibers and hair cells located on the basilar membrane work together to translate the sound waves into electrical impulses for the brain.

When the ear is not working properly the cause could be conductive, sensorineural, or mixed damage. A hearing aid can benefit someone with conductive damage, because the issue is located in the outer or middle ear, meaning that the sound simply is not being amplified properly. However, when someone does not benefit from a hearing aid and suffers from sensorineural damage (or damage to the cochlea hair cells), they are candidates for a cochlear implant. Unlike a hearing aid, which simply amplifies the sound waves, a cochlear implant bypasses the damaged part of the ear altogether.

A cochlear implant is composed of both external and surgically placed internal parts. These parts include: a microphone, speech processor, transmitting coil, receiver/stimulator, internal cable, and an array of electrodes. Sound is received by the microphone and sent to the speech processor where the sound is translated into coded signals and sent through the transmitting coil to the internal parts. The coil sends the coded signals to the receiver/stimulator where it is translated into electrical impulses that are sent to the electrodes located throughout the cochlea. The electrodes then send the impulses to the auditory nerve to be interpreted by the brain.

Considered to be one of the most cost-effective medical procedures, a cochlear implant will save society a large portion of the one-million dollars it would otherwise cost to accommodate a hearing impaired individual. As these devices improve, insurance companies are more willing to help pay for these procedures and the extensive rehabilitation process that comes after.

Considered to be relatively new technology, the cochlear implant is improving quickly and holds a great deal of potential for the future. New devices will be smaller, stronger, and much easier to surgically implant.

Works Cited

American-Speech-Language-Hearing Association. Web. 08 Feb. 2013. <http://www.asha.org/public/hearing/Cochlear-Implant/>.

"Cochlear Implants." NIDCD, n.d. Web. 08 Feb. 2013. <http://www.nidcd.nih.gov/health/hearing/pages/coch.aspx>.