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SKI-SLOPE HEARING LOSS AND HYBRID COCHLEAR IMPLANT

People with high-frequency hearing loss have trouble hearing sounds in 2,000 to 8,000 Hertz (Hz) range. In speech, this means the consonants such as /s/, /h/ or /f/ are harder to hear. Individuals with high-frequency hearing loss may have trouble understanding female and children's voices more than male voices and difficulty hearing the high-pitched beeping sound. Speech may seem muffled, especially when using the telephone or in noisy situations. People with this type of hearing loss may feel like they can hear, but not understand. When children have high-frequency hearing loss, it can impede their ability to learn speech and language, affecting their ability to excel in school.

High-frequency hearing loss can be identified by a routine hearing test with Pure Tone Audiometry. Out of different types of high frequency hearing loss configurations, sloping hearing loss is one of the common condition where the hearing range can be seen from normal to moderate hearing loss in low frequencies and severe to profound hearing loss in high frequencies (steeply sloping hearing loss). This type of high-frequency hearing loss is also called as ski-slope hearing loss, as it has the shape of a ski-slope in an audiogram.

A high-frequency hearing loss is normally managed with good quality digital hearing aids. In case of profound hearing loss at high frequency, the digital hearing aid won't be beneficial as expected. In such cases cochlear implant is the option. In ski-slope hearing loss, low frequencies can be corrected with amplification using hearing aid but high frequencies loss can not be made audible with hearing aids leading to poor compliance of adult individuals towards hearing aid. In paediatric patients with this type of hearing loss the speech will remain defective even after speech therapy with use of hearing aid over a period of time. This is due to uncorrected high frequency loss. In this situation parents might think that their child is benefitted with hearing aids due to improvement in low frequencies, even without correction of high frequency loss. The solution for this condition is Hybrid Cochlear Implant (CI).

Hybrid Cochlear Implants use electro-acoustic stimulation (EAS) to improve an individual's such hearing problem. This means it combines the electro-stimulation technology used in normal Cochlear Implants with the acoustic amplification technology used in Hearing Aids. Combining these technologies allows the wearer

to have sound sensations in the higher frequencies while the hearing aid technology amplifies the sounds being heard in the lower frequencies. By using two different technologies in one device, EAS provides access to hear the full range of sounds making it much easier to communicate in everyday life.

To get the successful result of Hybrid Implant, the surgical technique is also very important. There is a risk of permanent irreversible damage to residual hearing from the surgery and placement of the electrode itself. Therefore the insertion of electrode array of Hybrid cochlear implant should be smoother and should follow hearing preservation techniques. With hearing preservation surgical techniques and flexible cochlear implant electrode arrays, preservation of structures and residual hearing is made possible.

The mechanism how EAS works is complicated. Sound signal is detected by microphones of the audio processor, low frequency sounds are amplified and sent through the ear-mold to the ear. Simultaneously the high frequency sounds detected are converted into electrical signals and sent to the internal implant. Even though both the signals stimulate different regions in the cochlea, they are processed similarly by higher centres in the brain

Published research indicates that hybrid cochlear implant provides on an average of 50% better benefit in understanding monosyllabic words in cases with ski slope hearing loss compared to traditional mode of amplification i.e. hearing aids. Hybrid cochlear implant provides better speech perception, particularly in environmental noise, music appreciation and thus improves quality of life.

