

Bone Anchored Hearing Aid or Cochlea Implants?

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Over the years, researchers have been coming up with ways, both invasive and noninvasive, to combat hearing loss. When one thinks of hearing loss, they tend to think about hearing aids. The use of hearing aids is limited to those who need sound to be modulated and amplified in order to fully hear it. In the case of those who lost their hearing due to disease or accident, other hearing devices may be more appropriate. The Bone Anchored Hearing Aid (BAHA) and Cochlea Implant (CI) fall under this category.

Both BAHA and CI are forms of Bone Conduction Hearing Aids (BCHA). The BAHA contains a transducer that sends signals to a titanium plate implant in the skull. The titanium implant is osseointegrated into the skull and surrounding tissue. This allows sound vibrations to travel to the cochlea more efficiently, allowing a broader range of sound when compared to a device that sends vibrations through the skin and skull. The CI uses a microphone to pick up sound, a transmitter to transmit the signal through the skull, a receiver located under the skin behind the ear to pick up the signal and transmit it as an electrical signal, and an electrode array that passes into the cochlea for stimulation. Both BCHAs are intended for use by patients who suffer from mixed hearing loss, such as sensorineural hearing loss, otosclerosis, and chronic otitis.

To determine which BCHA was most appropriate for a patient, several experiments were conducted to find the effective ranges of BAHA and CI with respect to Hearing Levels (HL) and Sound Pressure Levels (SPL). One experiment consisted of a 10+ year study of 5 patients who used BAHA for 5 years, and then CI for 5 years. The second experiment consisted of three groups of people, one with BAHA and two with CI, to determine the cutoff point between using BAHA and CI. The second experiment excluded patients with sensorineural hearing loss. The first CI group contained 123 patients with normal cochlea; the second CI group contained 14 patients with otosclerosis.

For the first experiment, the ages of the 5 patients ranged from 57 to 77. Patient 1 was a 57 year old man with a mean aided threshold (MAT) of 60dB HL. Upon implantation of the BAHA his MAT became 40dB HL, and his SPL at 65dB (PS65) was 65%. Due to mixed hearing loss, within three years his PS65 was below 35%. To prevent more hearing loss, the BAHA was switched with a CI, and his MAT was recorded to be 35dB HL with a PS65 of 62. Since a lower HL is desirable, and a larger PS65 is also desirable, one can say the CI was delivering

good results for this patient. The other 4 patients showed significant improvement upon being fixed with a CI. The age of the patients was their age at the end of the study.

For the second experiment, the patients were required to take a speech recognition test, in which they sat in front of a speaker 1 meter away and had to identify 13 words. The testing room was insulated to prevent ambient noise from seeping in. Upon compiling the results, a regression curve was fitted to the results for the BAHA patients comparing their score and hearing loss. The first CI group results could not be plotted as easily as the BAHA group results, since the scores were independent of the hearing loss for each person. This could be compensated for by computing the median score, and the 10th percentile score from the first CI group results. From this, it was found that 50% of the CI patients scored greater than 74%, and 90% scored greater than 42%. Thus the results from the first CI group could be added to the BAHA group plot as a line at 74% and a line at 42%. The results from the second CI group were 45% and 10% for the median and 10th percentile marks.

From the results of the second experiment, it was concluded that those who scored less than 42% with a BAHA should consider getting a CI. Another cut-off point was determined by observing the HL point for BAHA users where their speech test score was lower than 90% of CI users. This point is somewhere between 65 and 70 dB HL, thus giving two criteria for when patients should switch over from BAHA to

CI.

In the end, this research produced results that show when a BAHA or CI is more appropriate for a patient's hearing loss. If a patient is suffering from mild sensorineural hearing loss, then BAHA is a good hearing aid to use. If the patient suffers from mixed hearing loss, otosclerosis, and/or is not benefiting from the use of a BAHA, then CI is the better option. The cut-off points found from this research are: below 42% speech test score and greater than 65dB hearing loss.

References:

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