

# International Federation of Hard of Hearing

## Position Statement: Cochlear Implants

### Background

A cochlear implant is an electronic device that can help in providing a sense of sound to persons who are deaf or severely hard of hearing. The implant consists of an external receiver/processor that sits behind the ear and an internal part consisting of an electrode array placed surgically within the cochlea. An implant does not restore normal hearing, instead it can give a useful representation of sounds and enhance speech comprehension. According to the Food and Drug Administration (FDA), as of April 2009 approximately 188,000 patients worldwide have been implanted<sup>1</sup>.

Over the last 30 years cochlear implants have developed from a speculative laboratory procedure to an accepted clinical practice. Initially, cochlear implants were primitive, single channel devices that could convey only the most salient speech cues (the duration and relative intensity of the speech wave). At first implanted people were mainly those who were deafened as adults, and had no residual hearing. The limited benefits possible with this generation of implants - improving overall speech reading skills and auditory "coupling" to a sound-producing environment were of sufficient value so as to encourage continued research on the device. Early studies demonstrated that cochlear implants were beneficial in enhancing speech reading skills, however apart of exceptional cases; cochlear implants could provide little or no open-set speech perception.

Over the years, cochlear implants have benefited from the remarkable advances occurring in microprocessors and miniature electronic circuitry. The primitive single channel cochlear implants have been superseded by complex multi-channel devices. This development enabled the processor to closely mimic the spectral envelope of a speech input. In addition, processing algorithms were added translating this information into electrical stimulation at various sites of the electrode array,

There are currently a number of implant brands on the market. These implants generally function in a similar manner, based on the same basic principles, yet at the same time have their unique features and characteristics. All current devices provide multichannel stimulation, use communication between the external hardware and the internal receiver, incorporate telemetry (which enables monitoring of the integrity of the intracochlear electrodes) and utilize advanced speech processing strategies.

Current devices contain inbuilt telecoils and, therefore, are compatible with assistive listening devices such as FM systems. Some devices have directional microphones and offer additional features that are thought to assist in reducing the disturbance of background noise. Ongoing research is being conducted into ways to further improve the functioning of cochlear implants in

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National Institute of Deafness and other Communication Disorders (US) – Web Site.

noise and other environments, and to improve its ability to process music. Research is continuously underway into ways of preserving residual hearing during cochlear implantation especially in those candidates who have significant residual low frequency hearing; such devices aim to combine hearing aid and cochlear implant technologies.

Over the last years there has been an increasing tendency towards bilateral cochlear implantation, so much so that in many centres this is now becoming almost standard clinical practice for patients who meet the relevant criteria. Much research has been conducted on this subject and there have been numerous studies that have shown the significant benefit of both simultaneous and sequential bilateral implantation in both adults and children.

As postlingually deafened adults are concerned, results to date clearly indicate that such individuals generally receive a significant degree of benefit from an implant, with most of these people demonstrating substantial improvement in auditory alone speech perception. Research has shown that there are number of significant factors that contribute to the outcome of such individuals such as duration of profound loss, level of residual hearing, aetiology, use of hearing aids. Over the years criteria for implantation of this group has changed significantly. As mentioned earlier, only adults with profound to total hearing loss were originally considered candidates. Currently adults with moderate to severe hearing loss are also being considered. In the case of adults with significant residual hearing, the decision to implant is based not only on their absolute hearing thresholds, but more importantly on their aided speech perception scores which gives a stronger indication of the level of difficulty they may experience in everyday communication and as such, their potential to improve with a cochlear implant.

When dealing with the cochlear implantation in congenitally hearing impaired adults and older children results are much more varied and individual than postlingually deafened adults. Although many have reported enhanced detection of environmental sounds, as well as improved speech reading ability, and even some auditory alone speech recognition, other individuals have reported little to no benefit and have subsequently become non users. As with postlingually deafened adults, there are various factors that affect outcomes in this group, including age of onset of hearing loss, age at first hearing aid fitting, duration of profound loss and communication mode. For example, an individual who has employed sign language as their primary communication mode is likely to experience limited benefit from a cochlear implant. Similarly the duration of profound deafness may give an indication as to the extent of auditory deprivation and the ability of the auditory pathways to make use of electrical stimulation. Results in this group are highly variable, highly individual and highly subjective. For example, 0% speech perception scores may be clinically seen as unsuccessful, but for the same individual the increased awareness of environmental sounds may be highly advantageous and could be subjectively viewed as a highly successful outcome.

The decision of both postlingually deafened and congenitally deafened adults whether to have cochlear implant must be fully informed and the clients are to be aware of possible outcomes as well as the possible risks involved with the surgery and thereafter.

Regarding children, the age at which a child is considered for cochlear implantation has decreased significantly over recent years. This is based on research showing that the earlier a child is implanted the more likely they will be to develop normal speech and language with minimal delay compared to normal hearing peers.

This is based on research showing that the earlier the implant, the greater impact it has on speech development. This decision, made by the parents should also be an informed decision, based on the consequences of the implantation in the long run.

Based on the current research, the results with children can be broken down into two groups. The first group of children are those who were born with normal hearing, but who developed a

severe to profound hearing loss sometime after birth. The best candidates in this group are generally those who have had the longest period of normal hearing, as well as the shortest period from the onset of the profound hearing loss to the date of implantation. The results with these children indicate that the implant gives them immediate access to important speech features, which they can demonstrate by imitating most phonemes and combinations of phonemes through audition alone. Sustained auditory language training is necessary, as with training and experience, most of these children are capable of comprehending speech through the auditory channel alone. Those whose training program does not emphasize auditory learning continue to make auditory progress, but not at the same rate as those that receive adequate training.

The second group of children are those with congenital hearing losses. When implanted, these children do not display the same auditory responsiveness as the children in the first group. Lacking an auditory memory, the goal with these children is to help them **develop** auditory awareness. Unlike the first group who simply need their previous auditory memory status **restimulated**, this second group of children must be taught to be aware of sounds in the environment, to "scan" for auditory events, and to listen and to imitate incoming speech sounds. Progress is slower than the first group, but what research and clinical observations are making increasingly evident, is that **given an appropriate auditory language training program**, auditory progress does continue. The most recent observations suggest that after several years of experience and training, this group of children may reach the same auditory developmental level as that of the first group.

## Policy recommendations

### A Preamble

IFHOH recognizes cochlear implants as a "Hearing Aid", the currently final step in a continuum which began with a cupped hand behind the ear, leading to non-electronic ear trumpets, various forms of electronic hearing aids, and acoustic signal processors of all kinds. Future technology may include; other types of implants to more central auditory brain structures, the application of stem cell research, the regeneration of inner ear hair cells or other, not yet conceived possibilities. Conceptually and functionally all of these devices have had the same purpose - to improve oral communication - and cochlear implants are no different. As with other such devices the employment of cochlear implants depends upon the needs, expectations and evaluation of the involved individual.

In accordance with the principles of the U.N Convention on the Rights of Persons with Disabilities (2006), assistive technologies enhancing full participation and inclusion in society should be made available. Recognizing the importance of such devices for the development of people with hearing loss in all aspects of life, IFHOH encourages all states to establish health programs providing hearing rehabilitation to all, including the supply of hearing aids, cochlear implants and other assistive devices.

### B Adults

1. IFHOH recommends that all adults with severe / profound or total hearing loss, congenital or acquired, be considered **potential** candidates for a cochlear implant. The hearing loss must be of sufficient degree, that even when aided, speech perception through audition alone is limited. The decision as to whether to undergo cochlear implantation **must** depend upon the informed consent of the individual involved and also upon recommendation by a health care professional (i.e. audiologist and ENT specialist).

2. The key prerequisite is information. All cochlear implant candidates must be fully informed of the entire process including the pre-operative investigations, the surgical procedure, and the post-operative program. Only those surgical facilities which offer a satisfactory range of pre- and post-operative services should be considered.
3. IFHOH recommends that persons contemplating cochlear implantation be evaluated and implanted in a centre with demonstrable expertise. Factors to consider are the experience of the centre, the nature of the pre-operative evaluations, the frequency of the routine follow-up evaluations, and whether an Aural Rehabilitation program is recommended and conducted. When in doubt, the person with a hearing loss should obtain a second opinion.
4. IFHOH recommends that individuals be eligible for two cochlear implants when necessary and that nation states establish health programs to make this possible.

### **C Children**

1. As a general rule, the decision to implant should be made as soon as possible after an acquired hearing loss has been diagnosed, and as early in the child's life as possible for those with congenital hearing loss. No child should be considered a candidate unless he or she undergoes a significant trial period with appropriate conventional amplification followed by appropriate assessments to determine their ability to maximise any residual hearing. As a general rule, children who have severe to profound hearing losses, who show limited access to the speech spectrum with appropriate amplification are considered candidates for cochlear implantation. This decision should not be made solely on absolute audiological measurements, but should be made in combination with the speech therapists report regarding the child's functional progress.
2. The final decision regarding a cochlear implant **must** be made by a child's parents. The responsibilities of the professional team involved in the implant process are to provide the parents with all the information they need to make such a decision. The full range of possible results must be explained, including explicit comments that the procedure **does not** replace the ear (as many parents think) or produce normal hearing. It is reasonable to use the **average** accomplishments of children who have been implanted to date a legitimate prognostic marker.
3. The ability of a child to benefit from a cochlear implant is directly related to the adequacy of the subsequent educational program. If audition is not intensively and continually stressed in the training program, it is less likely that the full potential benefits of the implant can be realized.
4. As yet there is not enough information on the ultimate social and psychological consequences of implanting a young deaf child. We do not fully know how implantees will feel about the procedure when they are young adults, as they begin making their own decisions regarding their future. Judging from experiences to date with severely and profoundly hearing-impaired children who utilize conventional amplification techniques, there will be no unanimity of responses. Some will resent the "imposition" of a prosthetic device upon them, others will bless their parents for making the decision.

This updated policy paper is based on a former policy paper of IFHOH. Valuable contributions and changes were made by Ricki Salomon (Israel), Ruth Warick (Canada) and Marcel Bobeldijk (Netherlands) and edited by Ahiya Kamara and Gaby Admon-Rick (Israel)