THE COCHLEAR IMPLANT

A New Hope for the Totally Deaf

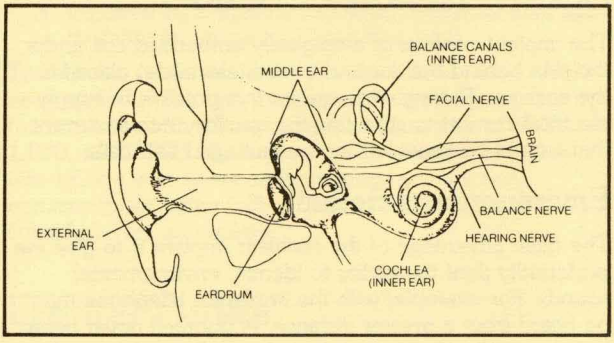
A Program of the ILSHF
(Iowa Lions Sight and Hearing Foundation)

Department of Otolaryngology—
Head and Neck Surgery
(Ear, Nose, and Throat)

The Cochlear Implant

Approximately 10 percent of the U.S. population has some degree of hearing impairment. Few of these impairments ever progress to total hearing loss, but some do. This pamphlet is concerned with the cochlear implant for restoration of some hearing to the totally deaf.

The cochlear implant may be described as a "bionic ear." Part of this electronic device is implanted in the temporal (ear) bone, and part is worn like a pocket-type hearing aid. It enables the user to distinguish a growing variety of environmental sounds, greatly aids lipreading, and enables the patient to modulate his or her own voice. However, at its present stage of development only some speech is directly understood.



Function of the Normal Ear

The ear is divided into three parts, each performing an important function in the process of hearing. The *external ear* consists of a visible ear and the ear canal, structures which gather sound and direct it toward the eardrum. The *middle ear* chamber lies between the external and inner ear and consists of an eardrum and three small bones. These structures amplify sound vibrations transmitted to the inner ear by converting the vibrations of the external ear into fluid waves in the inner ear.

Fluid waves set in motion by movement of the three ear bones are transmitted to the cochlea, a small snail-shaped organ, where they stimulate over sixteen thousand delicate hearing cells (hair cells). Movement of these hair cells generates an electrical current in the auditory nerve. This current is then transmitted to the brain and recognized as sound.

Types of Hearing Impairment

When there are some diseases or obstructions in the external ear or middle ear, a *conductive* hearing impairment results. It is often correctable by medical or surgical treatment. When the problem is in the inner ear, a sensorineural impairment results. If the disease involves only the hair cells, it is a *sensory* impairment, which is the type that can be helped by the cochlear implant. When the nerve is damaged, the impairment is *neural* and cannot be helped by cochlear implantation. Most hearing losses originating in the inner ear, however, are sensory, commonly the result of high fever or drugs used in the treatment of a disease or infection. A third type of hearing disorder, not commonly encountered, is the central hearing loss, so-called because the problem is not in the ear but in the brain.

The Cochlear Implant System Restores Sound

The implant consists of a surgically embedded coil under the skin behind the ear and a wire (electrode) placed in the cochlea. Through this system it is possible to supply electrical current to stimulate the auditory nerve, current that cannot be provided by the damaged hair cells.

Environmental Sound

The main advantage of the cochlear implant is to give the profoundly deaf the ability to identify environmental sounds. For example, with the implant a telephone may be heard from a greater distance. A doorbell never heard before may be recognized. A garbage disposal formerly left on (to burn out) would be heard and shut off. Driving a car would be easier and safer since the implant user would hear the motor running, the click of a turn signal, or the approach of a roaring siren. Many implant users report a greater sense of security since they can now hear approaching footsteps, firebells, the opening and closing of doors. The forgotten (or unknown) sound of bacon sizzling or a bird chirping is exhilarating. Implant users can hear the sound of people talking and thus are unlikely to interrupt conversations. They feel less isolated.

Understanding Speech

Implanted patients have limited understanding of speech, but they can hear their own voices and therefore monitor the loudness of their speech. They can tell the difference between a man's and woman's voice, but describe speech as sounding very muffled or distorted like a radio that is not tuned accurately to a station. Lipreading is much improved in implant users because they can combine the

clues that they see with the sounds and rhythms of speech which they hear.

Telephone Communication

Implanted patients can hear sounds of speech over the phone, but, in general, are not able to understand words. However, they can still communicate effectively by using a special code which can be quickly taught to the party called.

Becoming a Cochlear Implant Patient

Criteria for Selection

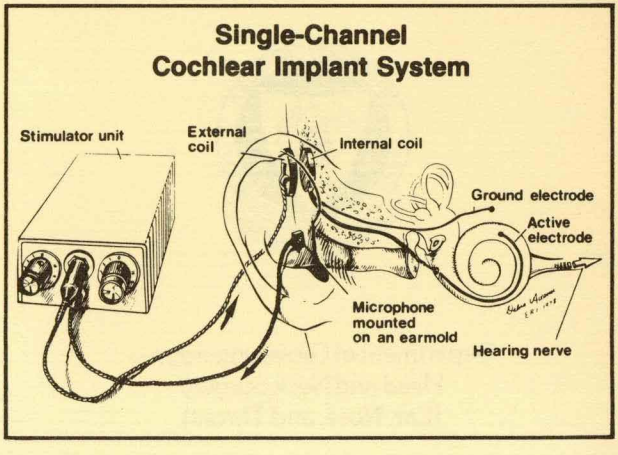
At the present time persons are considered for the implant operation if they are:

1. more than 18 years of age,
2. deaf in both ears, and
3. impaired by a hearing loss which occurred after age six (after language had been acquired).

Technically, deafness means that the hearing level would be recorded at the very bottom of the audiogram, that is, hearing loss of 95 dB or more for frequencies of 500, 1,000, and 2,000 Hz. A person with more hearing than this, or one who hears environmental sounds and communicates better with a hearing aid, would not be considered for an implant.

For the Future

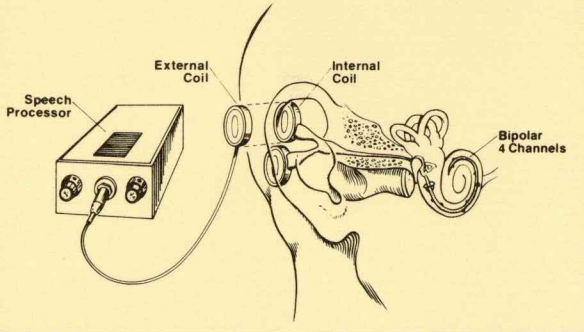
These criteria exclude large numbers of young people, all persons with congenital deafness, and all who are deaf in one ear only. It is hoped that as experience is gained with



the implant and the electronic components are improved, the cochlear implant can be made available to increasing numbers of persons with a wider range of hearing problems. Meanwhile it offers a significant beginning in the journey from total silence to sound.

The four-channel cochlear implant below is one of the devices currently being tested. It may be compared to the single-channel implant opposite. Another multiple-channel device, different in concept and design, is also being used at The University of Iowa. By detailed testing of different implants as they become available, it will be possible to select a specific device suited to the individual patient in the future.

Four-Channel Cochlear Implant System



Research and Development

The Department of Otolaryngology—Head and Neck Surgery at The University of Iowa is engaged in ongoing research into conserving hearing, America's largest, yet least recognized, physical ailment. In recognition of the magnitude of this problem, the Iowa Lions Sight and Hearing Foundation is sponsoring varied research projects in the prevention and treatment of hearing disorders.

The cochlear implant is an example of the kind of progress that can be achieved through research. In partnership with the Lions of Iowa, this research can be continued and strengthened.

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