



Cochlear Implant Overview

Cochlear implants are prosthetic devices designed to restore some hearing to adults and children with a severe to profound sensorineural hearing loss by converting the acoustic input signal into an electrical pattern that is interpreted as sound by the user. A cochlear implant consists of internal components that are surgically placed and external components that require fitting and programming. Cochlear implants are considered the only medical treatment for severe to profound hearing loss.

Cochlear Implant V. Hearing Aid

Cochlear implants are different from hearing aids. A hearing aid acoustically amplifies sound and relies on the responsiveness of healthy, inner ear sensory cells to receive that sound and send the message to the brain. In patients with severe to profound sensorineural hearing loss, the inner ear sensory cells are lost or damaged to the degree that a hearing aid is no longer beneficial for understanding speech because there are not enough healthy sensory cells to relay the message to the brain. A cochlear implant, however, bypasses the absent or damaged sensory cells and stimulates the hearing nerve directly by converting acoustic sound input into an electrical pattern that is recognizable to the hearing nerve for the transmission of sound information to the brain.

Cochlear Implant Components and Functions

The cochlear implant system consists of a microphone, sound processor, headpiece, cable and internal implant.

The implanted part (HiRes 90K Implant) is surgically positioned beneath the muscle tissue and skin on the side of the head by a surgeon. The small implant electrode is threaded down into the hearing mechanism of the inner ear, the cochlea, during the surgery. The external component is a miniature computer sound processor that is worn on the outside of the body, either over the back of the ear (Harmony™ Sound Processor), or at waist level (Platinum Series™ Sound Processor).

A microphone connected to the sound processor detects nearby sounds and the processor converts these sounds into digitally-coded signals. The headpiece transmitter, magnetically aligned over the implant and connected to the sound processor, rapidly sends these signals as radio waves through the skin and to the implanted part.

The HiRes 90K implant receives these digitally-coded signals and interprets them using its sophisticated microelectronic architecture and multiple independent output circuits to send specialized patterns of electrical current down the electrode to the inside of the cochlea. Multiple contact sites located along the length of the electrode emit these electrical currents in the form of electrical stimulation pulses to the surrounding hearing nerve receptors inside the cochlea. Nerve fibers send this information to the brain for central processing, interpretation, hearing perception and developmental recognition of the incoming sounds.

Cochlear Implant Surgery

Adults and children 12 months of age and older, with severe to profound sensorineural hearing loss, may be candidates for a cochlear implant. Typically candidates will have been fitted with hearing aids but receive minimal benefit. Benefit with hearing aids is determined by standard diagnostic tests administered by audiologists as well as parent and teacher/therapist questionnaires, which measure a child's response to sound and development of speech with hearing aids.

Once a child or an adult is determined to be a candidate for a cochlear implant, has completed the evaluation process, and insurance approval has been received, surgery will be scheduled. The surgical placement of the internal portion of the device is performed under general anesthesia and takes approximately two hours. Typically, this surgery is done on an outpatient basis in which the adult or child would arrive in the morning and go home in the late afternoon. Occasionally, an overnight stay may be necessary.

Following a 3-6 week recovery period, the recipient will return to the audiologist for the fitting of the external components. This first fitting is often referred to as the "initial stimulation" or "hook up". An audiologist programs the device during the fitting process. Programming involves setting specific parameters of stimulation for the recipient, particularly the levels perceived as soft and comfortable. Special programming software (SoundWave™ Professional Suite) is used by the cochlear implant audiologist to create, adjust, fine-tune and optimize sound processing programs on the sound processor computing system, to best fit individual hearing needs.

Following the initial stimulation, the recipient will require frequent adjustments or "fine tuning" as they adapt to the device. While some recipients adjust very quickly, others require several weeks or months. How much sound is understood by the recipient depends on several factors, including age at implantation, length of deafness, previous experience with sound, and access to aural rehabilitation and therapy services.

Experience of cochlear implant users can vary. The best way to understand more about what a user experiences with a cochlear implant is to speak to a cochlear implant recipient. Through our Bionic Ear Association we can assist you throughout your hearing journey by matching you with other recipients so that they may share their story and experience with you to help you better understand the benefits of a cochlear implant.