

Cochlear Implants

What is a cochlear implant?

A cochlear implant is an electronic device that is designed to provide hearing to those with severe-to-profound hearing loss. The internal component of the device is surgically implanted into the skull and inner ear with the external piece worn behind the ear. As a prosthetic device, the cochlear implant electrically stimulates the hearing nerve directly, bypassing the damaged part of the inner ear. Many viable nerve fibres remain in the auditory nerve even in cases of profound deafness, and the cochlear implant can restore activity to this nerve and the hearing pathway.

Many individuals who have lost their hearing after acquiring speech and language are capable of excellent speech understanding with their cochlear implant. When young children with profound hearing loss are provided with cochlear implants, they can perceive speech and environmental sounds previously unavailable to them. As they learn to attach meaning to the sounds they are hearing, they build the foundations for spoken language.

How does a cochlear implant work?

The implant has two components, an externally worn microphone and speech processor and the internal electrode array. The microphone picks up sounds near the ear level and sends it to the speech processor. The speech processor takes the acoustic signal and codes it for speech electrically. The signal is sent to the transmitter worn on the head where it is then sent through the skin to the implanted device. Under the skin, the receiver decodes the signal and sends it to the electrode array. The electrode array distributes the signal and stimulates the nerve endings in the cochlea, producing nerve impulses. The impulses are sent along the hearing nerve to the brain where they are interpreted as sound.

Who is a candidate for a cochlear implant?

Cochlear implants are available to children and adults in Canada who meet the following criteria:

Adults

- Must demonstrate a moderate to severe/profound sensorineural hearing loss
- Have limited benefit from optimally fitted amplification
- Prelingually deafened adults who use oral language as their primary mode of communication or after (post-linguistic) learning speech and language
- Postlingually deafened (as defined by acquired deafness after the age of five years)
- No medical contraindications
- Realistic expectations and a desire to be a part of the hearing world

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Children

- 12 months of age or older
- Severe-to-Profound sensorineural hearing loss bilaterally
- Receive little or no benefit from appropriate hearing aids
- No medical contraindications
- An educational placement where the development of listening and speaking skills is emphasized
- Family support that includes the commitment to the rehabilitative process

What is the process of getting a cochlear implant?

Before receiving a cochlear implant, an extensive evaluation is performed that includes a hearing aid evaluation, an audiological evaluation, an otological evaluation, CT scan, a speech-language evaluation, and possibly a psychological evaluation. These tests are performed to ensure that candidacy requirements have been met and that certain benefits may be provided by the implant. Counseling will also be provided by the cochlear implant team regarding the benefits and risks of cochlear implantation.

This will include the medical and surgical risks, the possible benefits to be expected, and the follow-up necessary to ensure an appropriate fitting of the speech processor and rehabilitation.

When does surgery take place?

Once patients have completed the necessary testing to determine candidacy, surgery can be scheduled. Surgery is performed under general anaesthesia, and typically takes two to three hours to complete. The electrode array is fed into the cochlea, and the receiver is placed behind the ear. Most hospitals require a one to two day hospital stay before going home.

What happens after surgery?

Four to six weeks following surgery the speech processor will be programmed. Threshold and comfort levels are obtained for each electrode on the internal array, which creates a “map” that is stored on a computer chip inside your processor. This process is usually done in two to three hours.



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During the first three months of wearing the device, some fine-tuning needs to take place. Numerous “mapping” sessions may need to be performed to obtain the best possible sound for each patient. Typically once a stable map is established, the map is checked and speech perception testing is performed every six months following activation.

Why is rehabilitation important?

Rehabilitation following cochlear implantation offers a structured approach by which patients learn to identify and associate meaning to the new sounds they are hearing. For children, rehabilitation is vital to develop an understanding of what is being heard through a cochlear implant. Therapy allows children to take the restored level of sensitive hearing and learn to understand spoken language and produce intelligible speech. Unlike adults who have lost their hearing after the development of speech and language, deaf children have no auditory memories to draw upon to understand spoken communication.

Rehabilitation is a lifelong process that takes the child through language acquisition learning to attach meaning first to syllables, then to words, phrases, sentences and ultimately to conversation. For adults, rehabilitation can provide the structure necessary to fine-tune their listening and communication skills.