German Cochlear Implant Society
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Questions and Answers about Cochlear Implantat

Deutsche Cochlear Implant Gesellschaft e.V.

German Cochlear Implant Society
Deaf but hear anyway!
speak discuss articulate
act participate
communication integration acceptance

Cochlear Implant
Hearing with an inner-ear device

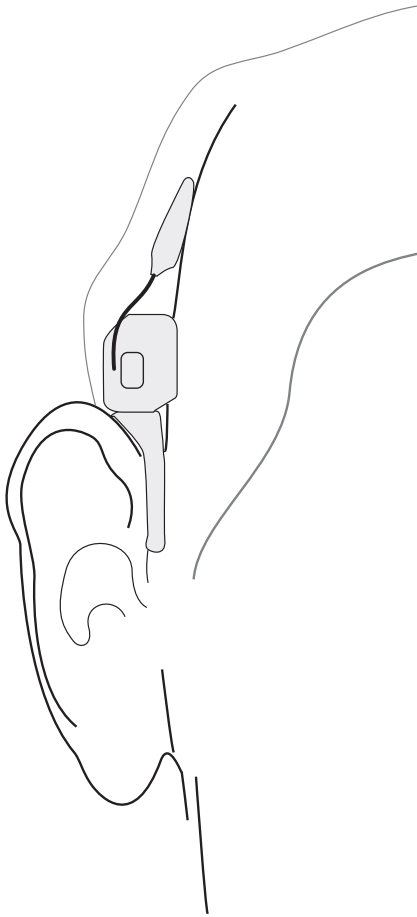
Taub und trotzdem hören!

Table of Contents Page index

What is a cochlear implant?

A cochlear implant (CI for short) is an inner-ear device for children and adults with severe hearing impairment and hearing loss for whom conventional hearing aids are of little or no benefit. CIs convert sound into electrical impulses, which stimulate the auditory nerve in the cochlea. In this way, speech and sound can be perceived again.

A CI consists of two parts:
The implant, which is fitted underneath the skin behind the ear, and the speech processor (SP) containing the transmission coil, which is worn like a hearing aid behind the ear.



How does “normal” hearing work?

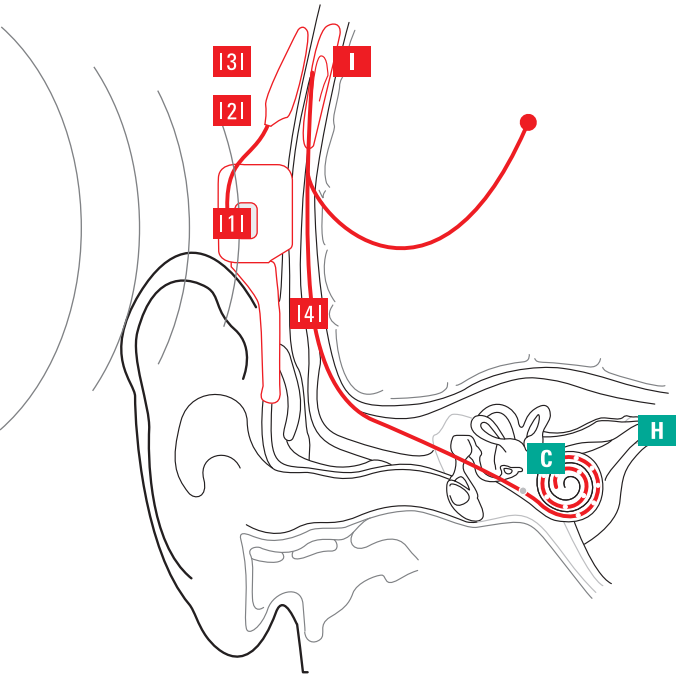
Sound is received in the form of sound waves by the outer ear [a] via the pinna and is carried via the auditory canals [b] to the eardrum [d]. This starts to vibrate, setting in motion the three small bones [e] – the hammer, anvil and stirrup – in the middle ear. This movement makes the fluid in the inner ear move, which in turn moves the hair cells in the cochlea [C]. The hair cells convert this movement into electrical impulses – which are then carried to the auditory nerve [H] and on to the brain, where they are perceived as sound.

[a] Outer ear (pinna) [b] Auditory canal [d] Eardrum
[e] Hammer, anvil, stirrup
C Cochlea **H** Auditory nerve

How does the cochlear implant work?

Sound vibrations received by the microphone in the speech processor [1] are converted into electrical signals, which, after being processed as patterns of electrical pulses, are carried to the coil [3] via the cable [2]. The coil, which is held in place above the implant [1] by magnetism, sends these coded signals by radio waves through the skin to the implant. This decodes the signals and carries them to the cochlea [C] via the electrode [4]. These electrical impulses stimulate the auditory nerve [H], which responds by producing what are known as action potentials and carrying them to the brain.
The brain receives the action potentials from the auditory nerve and recognises them as an acoustic event (speech, noise, sound).

[1] Speech processor with microphone [2] Cable
[3] Coil [4] Electrode
I Implant **C** Cochlea **H** Auditory nerve



The main difference compared with a hearing aid is that the hearing aid amplifies sound and therefore relies on the presence of a sufficient number of functioning hair cells in the cochlea in order to transmit sound.

Who is a cochlear implant suitable for?

Cochlear implants are suitable for children born without hearing, for children and adults who have lost their hearing after acquiring speech and for people with severe hearing impairment. Children born without hearing should be fitted with a CI as early as possible in order to make the most effective use of the short period of time in which the hearing and language centre in the brain develops during the first few years of life.
Children who have lost their hearing as a result of meningitis should be fitted a few weeks after the illness because there is a very high risk of the cochlea turning into bone. It may then be more difficult to insert the electrode and the result may therefore be poorer.

What conditions must be met for successful implantation?

The basic prerequisite for successful implantation is a healthy auditory nerve. Whether or not the auditory nerve is intact can only be established at an ENT hospital. Many hearing-impaired people who fail to achieve speech recognition despite having an optimally adjusted hearing aid meet this condition. The inner ear should also be full of fluid, i.e. the cochlea must not have turned into bone.

In adult patients, the hearing impairment should not have started until after speech acquisition. A cochlear implant will be of benefit to adults who lost their hearing before or during speech acquisition only if they are competent with speech. The willingness of future CI wearers and their relatives to accept and train the new sense of hearing as well as to participate actively in rehabilitation is also very important.

The final crucial factor is the individual medical and personal situation of the patient. Screening examinations in a specialist hospital will be carried out to establish specific diagnoses and to determine, on a case by case basis, whether there is any point in fitting a CI. A preliminary advice session will be followed by general medical and specialist ENT examinations, a variety of hearing tests, X-rays and a check of the auditory nerves.

Are there different implants?

Today, there are four implants on the market
(in alphabetical order):
Clarion by Advanced Bionics
Combi 40+ by MED-EL
Digisonic by MXM
Nucleus by Cochlear

Over the years, all the devices have been continuously upgraded with a range of different implant models and different speech processors. The devices available from these suppliers differ only in the speech-coding strategies used, the number of stimulation channels, the technical features, the material used and the design. The service life information available to date shows that the materials used for the CI systems currently available meet all biocompatibility requirements and are well tolerated. Patients are provided with precise details at the screening examination.

What is the cost of implantation?

The cost of fitting a CI, including rehabilitation, is about 40,000 Euros and is usually paid for by the health-insurance funds.
Under sections 27 ff of the German Social Security Code (SGB V), subsequent costs (e.g. batteries) are refunded by the statutory health-insurance companies.

What are the risks of the operation?

The operation takes 2 to 3 hours and is performed during a stay in hospital lasting for a few days. The risks of CI implantation are the same as for any type of operation on the middle and inner ear performed under a general anaesthetic. These days, the CI operation is a routine procedure for experienced ENT surgeons. Different implant models require only minor modifications in implantation technique. Once the healing phase is complete, the speech processor is individually programmed and adjusted.

Postoperative follow-up is a key factor in achieving the best possible results. Children and adults with a CI should attend hospital for a medical check-up once a year, or more frequently if necessary.

What should I consider when choosing an implant?

Specific advice on how to choose an implant is provided in hospital. Considerations include both technical and audiological criteria.

The following points are particularly important to consider in the decision-making process:
- Are the safety and service life of the implant certified?
- What additional devices can be connected to it?
- Will it be possible to hear via an induction loop?
- Is the energy supplied via disposable or rechargeable batteries?
- Is it a behind-the-ear speech processor or a pocket processor?
- What speech-processing strategies does the implant work with?
- How many pulses per second does the speech processor work at?
- How easy is the speech processor to operate?
- How much do the design and colour(s) of the speech processor appeal to me personally?

How will I be able to hear after implantation?

When an implant is used, the CI wearer is not able to hear straightaway because it is only after the wound has healed that the speech processor is adjusted, using a special computer program.
During the programming process, each individual electrode is adjusted in such a way as to match the hearing ability of the CI wearer. In this way, each CI wearer has his or her speech processor individually set. The aim of programming is to enable the CI wearer to hear the full range of noises and sounds, to enjoy wearing the speech processor all the time – except when sleeping, showering, swimming, etc – and ultimately to be able to understand speech.

It is very important not to hold excessively high expectations of the individual benefits of the cochlear implant. To achieve the best possible hearing result, it is important to be open-minded about the new sense of hearing, to persevere, be patient and keep training the hearing. The CI offers people with hearing impairment and hearing loss (new) hearing, even though hearing with the CI does have its limitations, and this can differ vastly from one individual to another.

Can the CI be used in combination with hearing aids?

Yes. The advantages of combining a hearing aid on one ear with a CI on the other ear are well established. The ideal hearing aid will ensure a pleasant sound and improve speech recognition in background noise. Above all, directional hearing will be further increased.

There is also a special option to use a hearing aid and a CI on one ear by means of "Electrical Acoustic Stimulation" (EAS). This combines the facilities offered by CIs and hearing aids. This method is suitable for people with severe hearing impairment who may have good low-pitch hearing but have severe hearing loss above 1000 Hz, which is not sufficient for speech recognition. The CI makes high frequencies audible, while the hearing aid amplifies low frequencies.

Are both ears automatically fitted?

No. However, the results of bilateral fitting show much better speech recognition in background noise, better directional hearing and more active participation in a social life due to the greater ease of understanding. The German Cochlear Implant Society is actively working towards establishing the bilateral fitting of cochlear implants as a matter of routine.

Does rehabilitation take place after implantation and the initial adjustment?

To gain the greatest possible benefit from the CI, comprehensive training of children with a CI, and rehabilitation in the case of adults, is the top priority. Hearing and speech training for adults and children with a CI is central to this. Many CI wearers achieve speech recognition with a CI alone, while for other CI wearers a combination of hearing and lip-reading is an essential aid to understanding.

There are a variety of rehabilitation hospitals that specialise in CI rehabilitation. This is paid for by the health-insurance companies but must be applied for and approved by the health-insurance company in advance.

– The addresses of various rehabilitation centres are available from the DCIG –

Where can I obtain advice and information?

Cochlear implant – Hearing with an inner-ear device

The implant makes speech-competence and communication possible naturally for children and adults who were born without hearing, who lost their hearing, or who have severe hearing impairment.

We offer advice, support and information on all matters relating to cochlear implants.

The German Cochlear Implant Society
– DCIG e.V. –

The DCIG is an umbrella organisation representing the interests of existing and would-be CI wearers.

The DCIG funds its work from membership contributions and donations. The DCIG is in urgent need of additional active and financial support.
The association is recognised as non-profit-making and eligible for tax relief. Please get involved!

Bank details:
Sparkasse Illertissen, bank sort code 730 500 00,
account no. 190 025 536

Listed in the Register of Associations at
Hanover District Court under no. 5668
Neu-Ulm Finance Office tax identification
no. 151/107/60377

Deutsche Cochlear Implant Gesellschaft e.V.
Rosenstraße 6, 89257 Illertissen
Telephone 07303-3955, fax 07303-43998
E-mail: dcig@dcig.de, www.dcig.de

Bayerischer Cochlear Implant Verband e.V.
Franz Hermann, Chairperson
Rosenstraße 6, 89257 Illertissen
Telephone 07303-3955, fax 07303-43998
E-mail: bayciv@dcig.de, www.bayciv.de

Cochlear Implant Verband Baden-Württemberg e.V.
Udo Barabas, Chairperson
Roossweg 25, 79790 Küssaberg
Telephone 07741-63905, fax 07741-9697999
E-mail: udo.barabas@civ-bw.de, www.civ-bw.de

Berlin-Brandenburgische CI Gesellschaft e.V.
Renate Willkomm, Chairperson
CIC "Werner Otto Haus"
Paster-Behrens-Straße 81, 12359 Berlin
Telephone 030-609716-11, fax 030-609716-22
E-mail: bbcig.ev@berlin.de, www.bbcig.de
Home: Mehringdamm 33, 10961 Berlin
Fax 030-6918280
E-mail: R_Willkomm@freenet.de

Cochlear Implant Verband Hessen-Rhein-Main e.V.
Michael Schwaninger, Chairperson
Ringstraße 48, 61231 Bad Nauheim
Telephone 0173-2766152
E-mail: schwaninger@civhrm.de
www.civhrm.de, www.ohrenseite.de

“Kleine Lauscher” – hessische Elterninitiative zur lautsprachlichen Förderung hörgeschädigter Kinder e.V.
[Hessen parents’ initiative for the promotion of speech in hearing-impaired children]
Achim Keßler, Chairperson
Neugasse 1, 35428 Langgöns
Telephone 06403-74428, fax 06403-76112
E-mail: a.kessler@kleine-lauscher.de
www.kleine-lauscher.de

Cochlear Implant Verband Nord e.V.
George Kulenkampff, Chairperson
Strehlowweg 28, 22605 Hamburg
Telephone and fax 040-88129164
E-mail: george.kulenkampff@freenet.de

Cochlear Implant Verband Nordrhein-Westfalen e.V.
Leo Tellers, Chairperson
Scheifendahl 9, 52525 Heinsberg
Telephone 02452-22707, fax 02452-187707
E-mail: leo.tellers@onlinehome.de

Cochlear Implant Verband Sachsen-Anhalt e.V.
Dr. Christine Rasinski, Chairperson
Martin-Luther-Universität Halle-Wittenberg
Klinik für HNO-Krankheiten
Magdeburger Straße 12, 06097 Halle
Telephone 0345 5571827, fax 0345 5571859
E-mail: christine.rasinski@medizin.uni-halle.de

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