Sanar | International Hospitals

+91-124-3528444

Golf Course Road, DLF Phase-5
Sector - 53, Haryana - 122002

www.sanarhospitals.com
info@sanarhospitals.com

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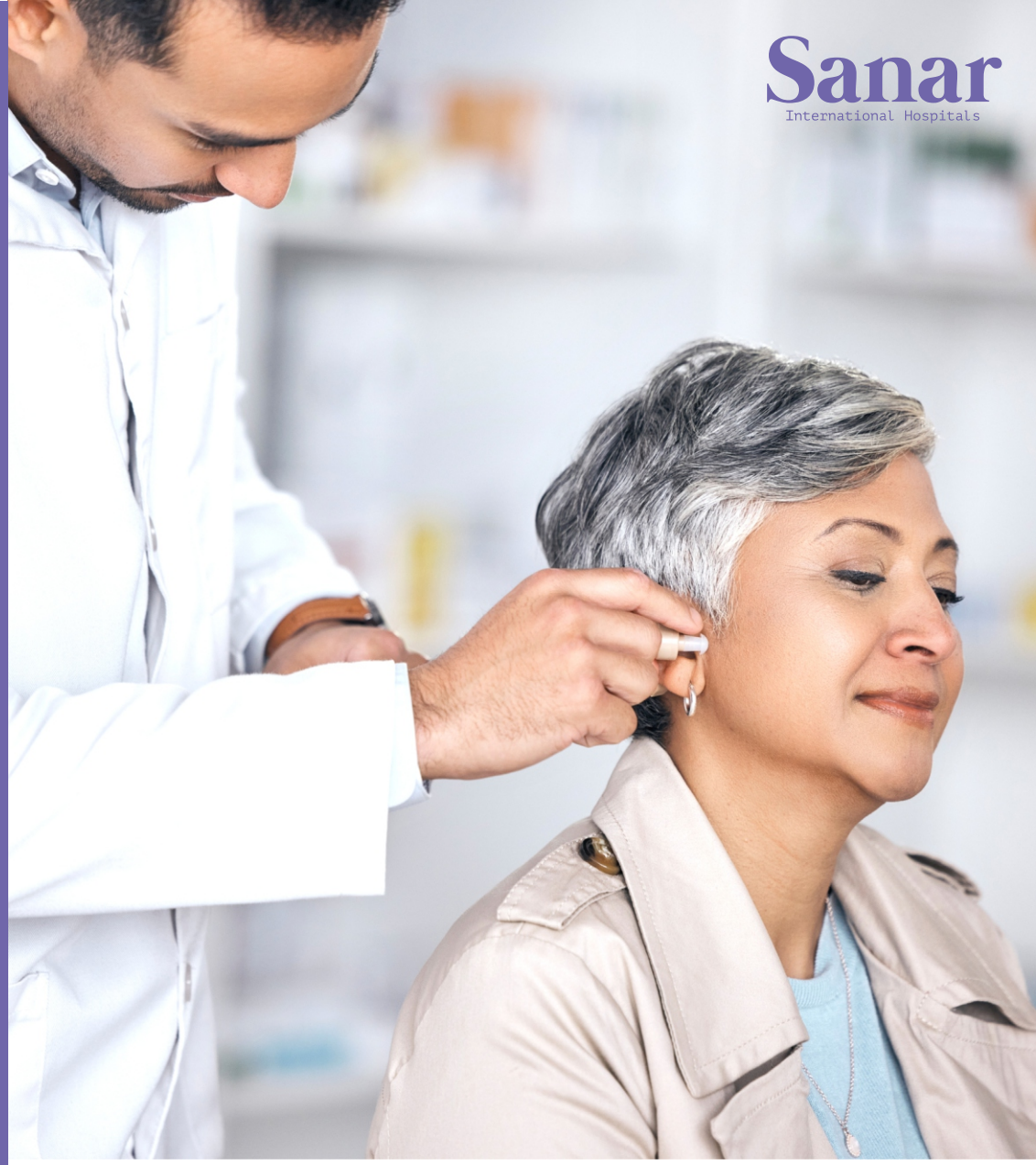


What is
Cochlear Implant

What is Cochlear Implant?

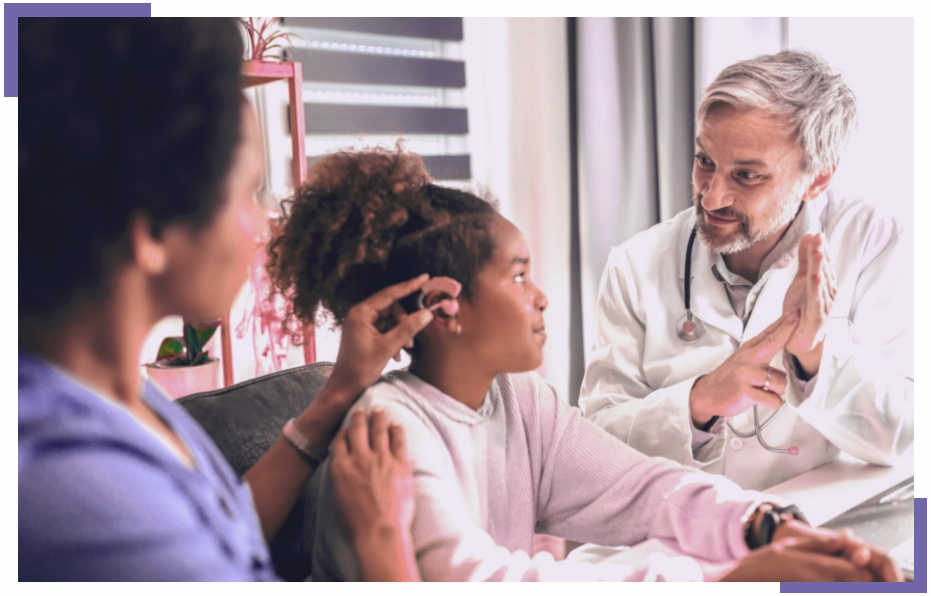
Cochlear Implant is an electronic device that stimulates cells of the auditory spiral ganglion to produce a sense of sound. The implant directly stimulates the auditory nerve (the nerve that carries sound from the cochlea to the brain) using electrical signals.

A Cochlear Implant has two components - external and internal

- **External component -** a microphone and speech processor worn externally behind the ear, and a transmitter coil worn on the side of the head.
- **Internal component -** a receiver / stimulator package surgically implanted in the mastoid bone. It receives and translates data into electrical signals which are delivered to electrodes placed in the cochlea. These electrodes stimulate the spiral ganglion cells that innervate the fibres of the auditory nerve. This provides a sensation of hearing.

Assessment before the Surgery

- Preliminary tests of hearing and speech recognition - these help to predict outcome. Standard pure-tone and speech audiometry tests are used for screening. Several speech recognition tests are currently in use (eg, the Hearing In Noise Test (HINT) which tests speech recognition in the context of sentences).
- CT scan or MRI to evaluate the cochleovestibular apparatus and internal auditory canals - eg, to exclude cochlear dysplasia. In children or young adults with progressive hearing loss, MRI is required to exclude neurofibromatosis type 2. MRI is better at revealing fluid spaces of the cochlea and is increasingly the primary imaging of choice.
- Auditory brainstem response tests may also be used in children.
- The promontory stimulation test is sometimes used:
  - This tests the auditory nerve by stimulating the promontory (in the middle ear) with small pulses. This is carried out under local anaesthesia and involves an electrode being inserted through the eardrum. The audiological scientist delivers small amounts of electrical current at different frequencies to the electrode. The patient indicates when they hear a sound.



Hearing Rehabilitation

Following Cochlear Implant there is an ongoing process of rehabilitation. This involves, firstly, programming the device (so the user can hear sounds through it) and, secondly, the rehabilitation process (learning to 'make sense of' the sounds heard).

The cochlear implant processor is only switched on a few weeks after the operation. It will then be 'tuned' by the team to suit the patient, who may take a while (weeks or months) to become accustomed to the new sounds.

Rehabilitation usually involves a team of speech specialist, language therapist, and specialist teachers of the deaf.

The rehabilitation programme may include a structured set of exercises designed to help the Cochlear Implant user understand and recognise the sound signal. It might begin with simply detecting sounds, move on to distinguishing different sounds, and then to recognising spoken words.

Outcomes

- The benefit is highly variable. Overall, studies consistently show statistically significant benefits in various specific areas (such as hearing and speech production) as well as in more general areas (such as quality of life).
- The age at onset of deafness and duration of deafness before implantation are important.
- Benefit increases with time and the mode of action appears to be multifactorial. Implants also improve tinnitus which often co-exists with hearing loss.
- There is evidence that bilateral implants produce a better result than unilateral implants, especially when listening in adverse conditions.

Children

- Cochlear Implants are associated with improvement of hearing, speech perception and speech production. The quality of life as perceived by the child and by the parents has also been noted to improve.
- Many children with a Cochlear Implant can develop spoken language to the exclusion of sign language. Earlier implantation may lead to better language outcomes. Research suggests that children given a Cochlear Implant in their first year of age can develop language skills at a comparable rate to normal-hearing children.
- Sometimes children have multiple handicaps which may not be evident until after implantation. Even if results are less than perfect, such children seem to benefit.
- Bilateral Cochlear Implants help to improve speech perception in environments such as excessive quiet or noise.
- A multidisciplinary approach is needed, both for assessment of the child pre-implant and to maximise the benefit.

Adults who are post-lingually deaf

- This term refers to patients who have previously been able to hear and have acquired language.
- The quality of life in adults given Cochlear Implants improves, with less isolation and depression.
- Elderly patients too can benefit from Cochlear Implants, according to a study of those who are post-lingually deaf.
- Some studies suggest that with ongoing improvement in implant technology and support, even patients who are 'borderline' in terms of meeting the criteria for a Cochlear Implant, may benefit in terms of useful speech recognition and quality of life.

Pre-lingually deaf young people and adults

- This term refers to those who were deaf before acquiring language (eg, those born without hearing).
- Those in this group of patients only, rarely develop full spoken language; however, many do obtain some benefit from implantation. Therefore, age alone should not be an absolute contra-indication to implantation.
- Any benefit will usually be evident within the first year after the implant.