

Cochlear Implants in NZ

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Definition of a C.I.

A cochlear implant is a device which provides auditory sensations to severely or profoundly deaf individuals who derive no significant benefit from the use of hearing aids or vibro-tactile devices.



Reality

A C.I. should be regarded as a sophisticated hearing aid
People with a C.I. are still profoundly deaf (when not using it)
Inserting it involves surgery
Learning to use it (habilitation) is vital
Changes recipients lives

Indications for C.I.- 1

Severe to profound hearing loss in adults with previous hearing experience and recent use of a hearing aid in at least one ear

Indications for C.I. - 2

Congenitally deaf children with no auditory experience preferably as soon after diagnosis as possible ie at 6 months+

New born hearing screening program

Indications for C.I. - 3

Progressive congenital deafness in older children if hearing aids have been fitted and used but are no longer helpful

Urgent indications for C.I.

Meningitis causing profound hearing loss as there is a risk of ossification of the inner ear



Early referral of profound deafness in babies

Important considerations in C.I.

- Early diagnosis in infants
- Previous hearing experience
- Realistic expectations
- Understanding the limitations of C.I.
- Family dynamics
- Access to habilitation

What must be present

An inner ear that can be implanted

A functioning cochlear nerve

An auditory cortex that can make use of the new sounds

The cognitive ability learn to use the implant

What isn't important

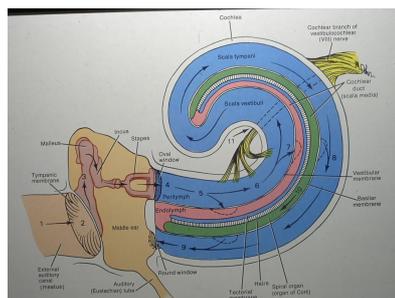
Age is no barrier if cognition is acceptable

The operation is generally well tolerated

Multiple handicaps complicate but don't exclude

Physiological hearing

A traveling fluid wave through the scala media causes movement of the basilar membrane which in turn stimulates the cochlear nerve endings



Why does a C.I. work?

The C.I. directly stimulates the nerve endings from the scala tympani, bypassing the scala media.



C.I. hardware

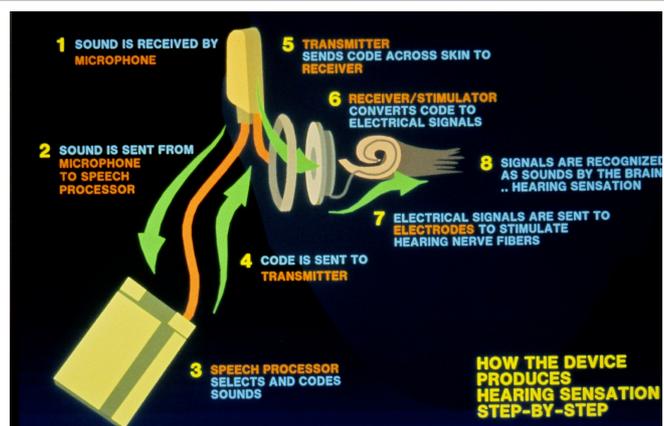
External microphone, speech processor and transmitter



Internal receiver and electrode array



What happens to sound in a CI



C.I. software

Many upgrades

Aims are to improve speech discrimination and ability to enjoy music

Improve speed of understanding of speech

Remote mapping with out-reach management

Can be used in the oldest implants so minimal redundancy

Assessment for C.I.

Referral and acceptance to the CI program

Audiological work up

ORL consultation

Radiology examination – CT / MRI

Meetings with the habilitationists

Psychological assessment

Final approval includes patient, family and professionals

Referral to the C.I. program

Referrals are accepted from audiologists, ORL surgeons, advisers of deaf children and CI habilitationists.

If in doubt, consult with your local professional as we would rather exclude potential recipients than not see them in the first place!

Often adjustment to HAs will delay/avoid the need for a CI

Audiology

Confirm the degree of deafness as there are quite strict criteria

Must be able to demonstrate that a CI is likely to give more help than HAs at maximum performance

Look for auditory neuropathy

Describe the process of switch-on and “mapping”

ORL surgeon

Assess cause of deafness

Associated or contributing medical conditions

Risks and expectations re surgery

Contribute to the decision on which side to implant

- Duration of hearing loss in each ear
- Residual hearing
- Anatomy / pathology

Habilitationists

Assess dynamics of the family

Discuss the work involved to learn to use the implant

Encourage and monitor daily practice

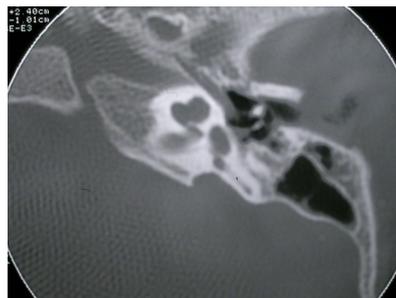
Troubleshoot problems

Moral support especially for struggling recipients

Radiology - CT

CT is essential to determine anatomy of the inner ear

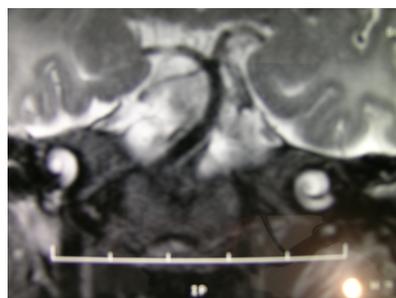
Obliteration can occur with meningitis and otosclerosis



Radiology - MRI

MRI scans can delineate the membranous cochlear duct to confirm adequate patency

Useful to exclude cortical lesions and confirm presence of the auditory nerve



Psychological assessment

Increasingly important with most adults and all children and their families

Early warning of non-compliance, lack of understanding and potential conflicts

May lower incidence of non-users, the ultimate measure of failure

The final steps

A meeting is held to discuss any concerns of the professionals and the patient or their family with approval (or further assessment / removal) to go on the CI waiting list

Confirmation of funding is the main block to surgery, especially for adults, as children have automatic funding once approved

nb: In the Northern program, if approved but not funded the patient is reassessed and re-prioritized every 2 years

Selection of device

Factors: anatomy, residual hearing, surgeon

512 - contour – “workhorse”

522 – slim, straight, preservation of hearing

532 - slim modiolar – new technique

632 - slim modiolar, MRI compatible

Slim Modiolar Electrode (CI532)



✓ CLOSE TO THE HEARING NERVE FOR OPTIMAL HEARING PERFORMANCE

✓ CONSISTENT AND COMPLETE SCALA TYMPANI PLACEMENT

✓ ATRAUMATIC DESIGN TO PROTECT & PRESERVE THE DELICATE INNER EAR

✓ SMOOTH AND EASY INSERTION VIA ROUND WINDOW OR COCHLEOSTOMY

✓ RELOADABLE



Surgery

Usually 2-3 hours in theatre

532 x/ray during operation

NRT testing

Care with balance



Post-operative Care

Overnight stay

Pain relief is prescribed but ear surgery is not too painful

Usually balance is ok but the occasional patient is very dizzy

- Balance always goes back to pre-implant level

Keep ear dry for a few days – avoid washing hair

External device worn on other ear until the incision has healed

It is a big mental effort so don't rush back to work – enjoy the new sounds and experiences

“Switch on”

Usually next day if possible

Mapping is finding comfortable thresholds for all the channels

Per-operative NRT used to establish thresholds

Patients then start using the implant

- Practice and family support essential
- Recognising “new” sounds
- Voices are different but adaption can be quite rapid
- Everyone learns at a different rate – it is not a competition!

Follow Up

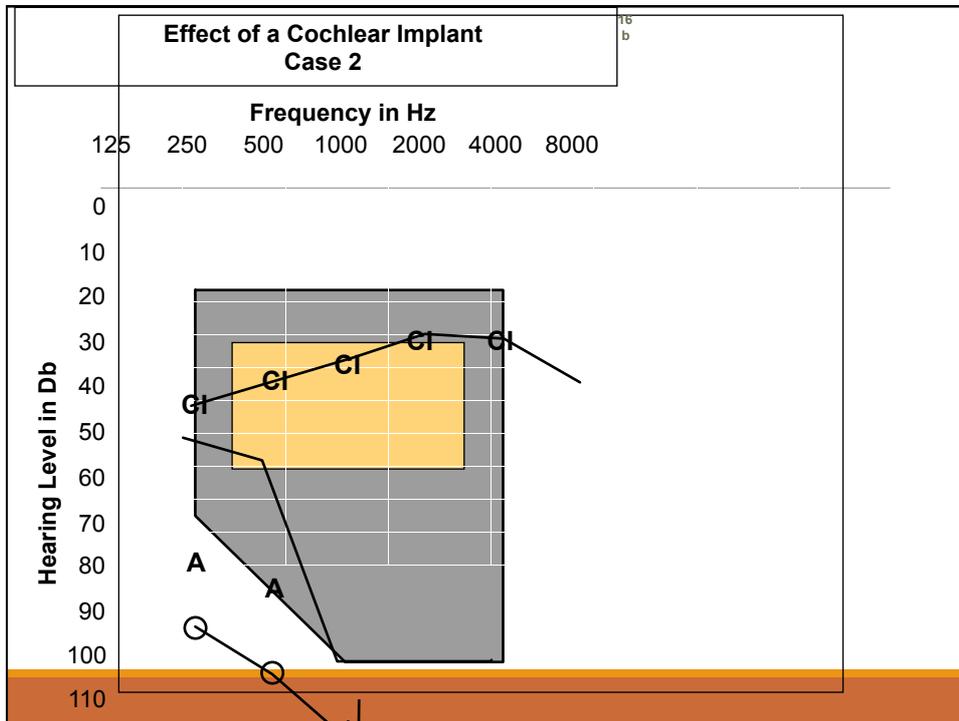
Re-mapping determined by progress and response

Listening exercises encouraged - family or friends important

Seen at increasing intervals to alter the map as needed

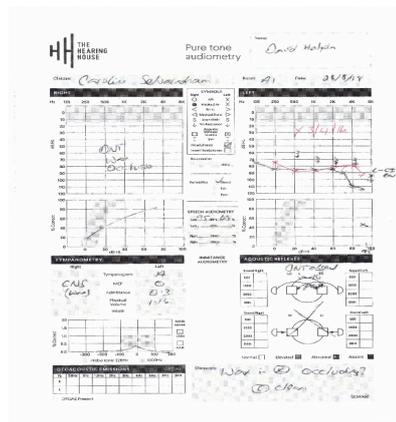
Use of the telephone depends on the patient (it is not a race)

Rate of improvement slows but new sounds and experiences occur for many months after switch on



Hearing preservation

- Gentle technique
- Avoid suction
- Dexamethasone
- RW approach
- Slim line electrode



Cost per QALY for technology-US\$

Neonatal intensive care	7968
Coronary bypass (3 vessel)	11255
Coronary angioplasty	11485
Cochlear implant	15593
Intracranial aneurysm repair	18500
Implantable defibrillator	29200

Potential Benefits of Bilateral Implants

Bilateral benefit through the head shadow effect

Binaural advantage of combining information from 2 ears

Capturing the ear with the best monaural CI performance

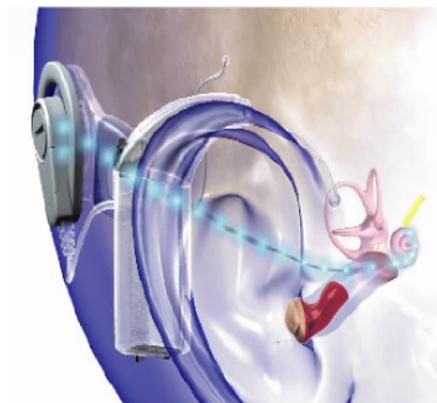
Improving horizontal sound localization

Repair/service less inconvenient if a second working system is available

WHAT IS ELECTRO-ACOUSTIC STIMULATION ?

Hybrid CI

- ◆ Electrical stimulation of high frequency via CI
- ◆ Acoustic stimulation of low frequency via **Ipsi-lateral Hearing Aid**



THE POTENTIAL BENEFITS OF ELECTRO-ACOUSTIC STIMULATION

- Access to high frequency information
- Improved speech perception in noise
- Improved sound localisation
- Improved sound quality
- Enhanced music appreciation

C.I. in 2020

NCIT works with the Southern Trust as the providers for CI in NZ

- Cost efficiencies maximise number of CIs funded per year

The Pindrop Foundation is the advocacy and educational arm of NCIT, particularly concentrating on adult needs in CI

Lobbying the government achieves increased funding but is unpredictable and there is still an unacceptable adult waiting list

- Risk of cognitive/physical decline contraindicating CI use
- Bilateral implants are not funded

Paediatric implants aren't capped and if appropriate, bilateral implants are either immediate or sequential depending on circumstances

What Are the (Remaining) Problems?

Wide range of outcomes – not fully understood

Speech reception in noise – common to all hearing loss

Sound localization - safety

Reception of signals more complex than speech, e.g., symphonic music

High effort in listening for the great majority of patients but hugely easier than with HAs

In NZ - Length of adult w/l once approved to receive a CI

The Next Twenty Years

- ❖ Affordable
- ❖ Drug Delivery
- ❖ Better and more consistent outcomes
- ❖ Speech Coding & Programming Advances
- ❖ Bilateral implantation
- ❖ Hybrid CI
- ❖ Totally Implantable CI (TIKI)

Hear now. And always

Redundant but still loved!

