Bone Conduction Hearing Devices and Implants (BCHDs and BCHIs)

Information for Patients

Hearing with bone conduction as an implantable solution
How does the human ear work?

1. Sound is ‘funnelled’ into the ear canal by the external ear (pinna). It travels down the ear canal where it strikes the ear drum.
2. This causes the eardrum and middle ear bones (ossicles) to vibrate.
3. The hearing organ (cochlea) detects these vibrations and converts them into electrical impulses.
4. These impulses are sent to the brain via the hearing nerve where they are interpreted as sound.

What is a Bone Conduction Hearing Device? (BCHD)

• Conventional hearing aids send sound down the ear canal, ear drum and middle ear to the cochlea.
• BCHDs are a type of hearing aid which are positioned on the bone behind the ear.
• BCHDs send sound directly to the cochlea using vibrations sent through the skull, bypassing the middle ear.

There are three parts to this hearing system:

1. Implanted titanium fixture (screw)
2. Titanium abutment (like a press stud)
   The fixture and abutment together are known as the implant.
3. Sound processor (hearing aid)

The sound processor clips on and off:
How does a BCHD/BCHI work?
1. The sound processor picks up sound and converts this into vibrations.
2. These vibrations are transferred to the abutment and fixture and sent into the bones of the skull.
3. The vibrations pass through the skull to the cochlea which is encased in bone.
4. The cochlea detects these vibrations (similar to those from the ear drum and ossicles) and converts them into electrical impulses which are sent to the brain to be interpreted as sound.

Who might benefit from a BCHD?

Patients with a conductive hearing loss
This may be caused by a problem with the ear canal, the middle ear, or both.
A conventional hearing aid may struggle to overcome these problems and the sound may not be delivered correctly.
However, a BCHD would bypass this and send the sound directly to the cochlea via the bone surrounding it.

Patients unable to wear a conventional hearing aid
Reasons may include:
- Very frequent ear infections
- Severe allergies
- Absent or extremely small outer ear or ear canal
A BCHD is not worn within the ear, therefore, leaving the ear open.

Patients with single sided deafness
Some patients have useful hearing in only one of their ears and gain no benefit from a hearing aid in their non-hearing ear.
As they can only hear sound through one ear they struggle in noisy environments and find it difficult to locate sounds.
A BCHD can be implanted on the poorer hearing side.
As a BCHD sends vibration of sound through the skull to both ears at the same time, they will be heard in the better ear.
This allows the patient to detect sounds on the poor side and hear them on the good side.
How is a BCHI fitted?

• Involves a surgical procedure performed by the Ear, Nose and Throat (ENT) consultant (however, there is a non-surgical option in certain cases)
• The surgery is performed under local anaesthetic for adults (the patient will be awake and the area is numbed) or general anaesthetic for children (the patient will be asleep).
• Patients tend to go home on the same day and will be given advice on caring for the abutment site.
• One week after surgery you will have a review with the surgical team.
• Three weeks after the procedure the sound processor will be fitted by the audiologist.
• Ongoing care of the abutment site is provided by the BCHI nurses in ENT.

Surgical overview

There are three different methods of performing the surgery, the technique used will be determined by a range of factors including age and general health.

For all techniques a small area of hair around the implant site is shaved and the area where the implant will be is marked with a pen.

Minimally Invasive Ponto Surgery (MIPS)

1. A small hole is punched through the skin.
2. A small tube is then placed into the space.
3. A hole is then made through the tube using a small drill.
4. The tube is removed, the fixture and abutment are implanted simultaneously, and the area is then dressed.
Linear incision technique

1. A small incision is made and the skin is held apart with metal 'retractors' and the implant is inserted using a small drill.

2. The abutment is attached.

3. A small hole is punched through the skin over the abutment.

4. The incision is closed using dissolvable stitches and the area is dressed.

Skin flap technique

1. A semi-circular incision is made, creating a flap of skin.

2. This is pulled back and the implant placed using a small drill.

3. A small hole is punched through the skin over the implant.

4. The flap is then closed using dissolvable stitches and the area is dressed.
Possible complications

- The largest study to date was performed by Audiology in Manchester in 2009. The study looked at the complications than can arise following BCHI surgery.
- The study reviewed 602 implants in patients ranging from 4 to 87 years of age.
- Most of the complications reported can be addressed by one of the BCHD nurses.

Most common complications include:

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percentage of Patients</th>
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<tbody>
<tr>
<td>Skin growing around the sides of the abutment (soft tissue overgrowth)</td>
<td>8% of all patients</td>
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<tr>
<td>Localised skin infection</td>
<td>8% of all patients</td>
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<tr>
<td>Implant coming out</td>
<td>4% of all patients</td>
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<td>Damage through trauma e.g. head injury</td>
<td>1% of all patients</td>
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<tr>
<td>Exposed bone caused by skin not healing to the edge of the abutment</td>
<td>&lt;1% of all patients</td>
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<tr>
<td>Persistent numbness of head</td>
<td>&lt;1% of all patients</td>
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<tr>
<td>Persistent pain</td>
<td>&lt;1% of all patients</td>
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<tr>
<td>Bone fails to grow around the implant (failed osseointegration)</td>
<td>&lt;1% of all patients</td>
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Images throughout provided by the companies, Oticon Medical and Cochlear.
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