

How a bone anchored hearing aid works

IADs are usually suggested for children who cannot use conventional hearing aids because their ear canal or the outside parts of the ear haven't developed, or children who have a certain type and level of hearing loss.

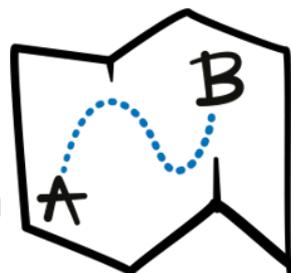
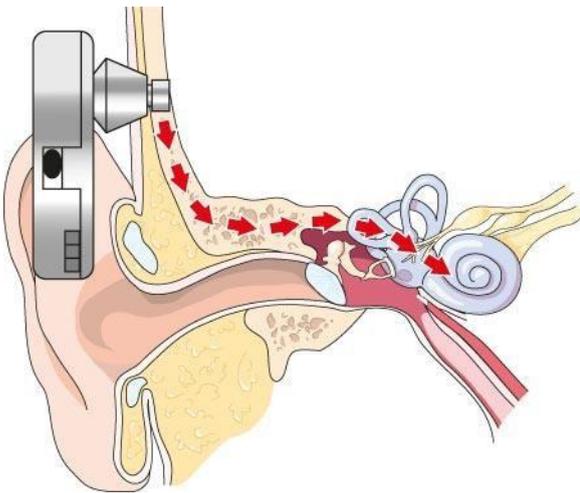
There are four types of IADs available at GOSH.

- A **percutaneous** bone conduction implant (BCI) has an 'abutment' coming through the skin of the scalp. The abutment is attached to the skull on the inside and can be connected to a sound processor on the outside. The sound processor looks like a small box and vibrates to send the sound signal through the implant and skull to the inner ear.
- A **passive transcutaneous BCI** has an implanted magnet in the shape of a flat disc, approximately the diameter of a two pence coin, which sits completely under the skin. The sound processor is attached to an external magnet which is held on the scalp by magnetic attraction. The sound processor sends vibrations through the skin to the internal magnet and then on to the skull and the inner ear.
- An **active transcutaneous BCI** also sits completely under the skin. However, unlike the abutment and magnet BCI, the implant (the internal part) produces the vibrations rather than the sound processor (the external part). An external sound processor is held in place using a weak magnet, and tells the internal implant what sounds to produce.
- A **Middle Ear Implant (MEI)** works similarly to an active transcutaneous BCI, however it sends sounds directly via the bones in the middle ear rather than the skull.

Implantable Acoustic Devices (IADs): information for families

Implantable Acoustic Devices (IADs) are appropriate for particular forms of hearing loss. Like conventional hearing aids, they stimulate the hearing organ in response to sounds, but unlike conventional hearing aids, they do not rely on the outer or middle parts of the ear working normally. This information sheet from Great Ormond Street Hospital (GOSH) describes the type of IADs used at GOSH, what is involved in fitting them and what to expect during treatment.

Instead of transmitting sound through the ear canal as conventional hearing aids do, IADs transmit sounds as vibrations through the skull and middle ear bones to the inner ear.



Each type of BCI has its own advantages and disadvantages (the following lists are not exhaustive but provide an overview):

Percutaneous BCI (e.g. BAHA Connect or Ponto)

- ✓ Better hearing outcomes
- ✓ Can still have magnetic resonance imaging (MRI) scans
- ✗ Risk of complications at the implant site, such as skin irritation, infection and breakdown
- ✗ Not able to swim whilst using the processor



Diagram of magnet BCI - Images courtesy of Cochlear Bone Anchored Solutions AB, © 2021.

Active BCI (e.g. Osia or BONEBRIDGE)

- ✓ The implant is under the skin so lower risk of implant site complications
- ✓ Better hearing outcomes
- ✓ Weaker magnet required so lower risk of skin irritation
- ✓ Able to swim with processor if appropriate casing used
- ✗ Precautions must be taken when undergoing MRI scans
- ✗ If the implant needs to be replaced, this would involve a further surgery

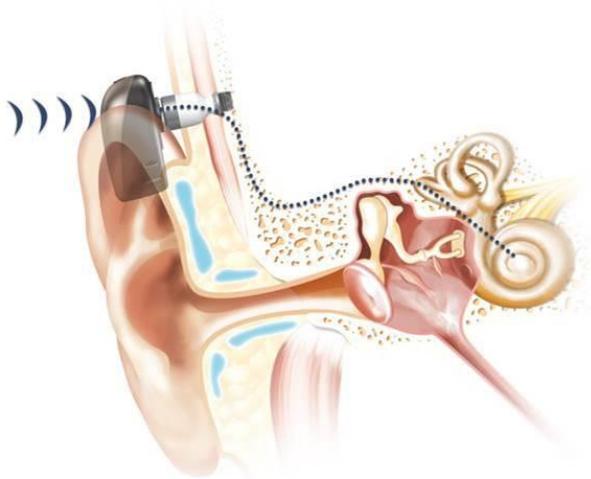


Diagram of Baha connect BCI - Images courtesy of Cochlear Bone Anchored Solutions AB, © 2021.

Magnet BCI (e.g. BAHA Attract)

- ✓ The magnet is under the skin so there's lower risk of implant site complications
- ✗ Precautions must be taken when undergoing MRI scans
- ✗ Less favourable hearing outcomes
- ✗ Not able to swim whilst using the processor

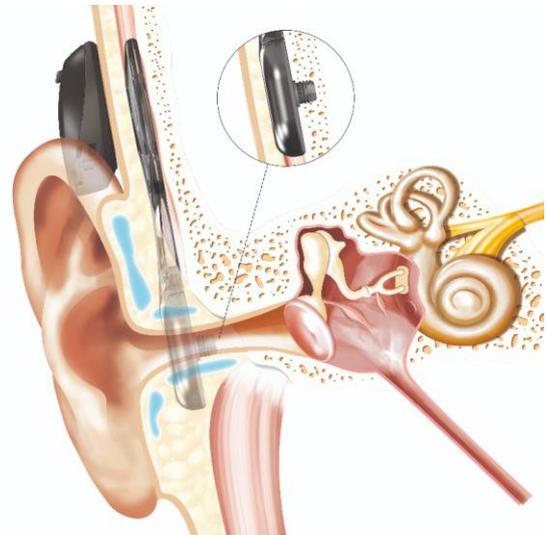
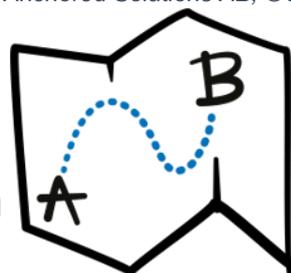


Diagram of Osia BCI - Images courtesy of Cochlear Bone Anchored Solutions AB, © 2021.



Middle Ear Implant (e.g. SOUNDBRIDGE)

- ✓ The implant is under the skin so there's lower risk of implant site complications
- ✓ Better hearing outcomes
- ✓ Directional hearing
- ✓ Weaker magnet required so lower risk of skin irritation
- ✓ Able to swim with processor if appropriate casing used
- ✗ Precautions must be taken when undergoing MRI scans
- ✗ Greater complexity of surgery.
- ✗ If the implant needs to be replaced, this would involve a further surgery

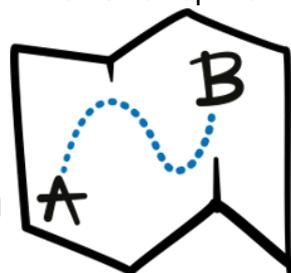


Diagram of VIBRANTSOUNDBRIDGE middle ear implant – Images courtesy of MED-EL, © 2021.

Your child's Audiologist and Ear Nose and Throat (ENT) surgeon will discuss the options for your child with you. Your child may not be suitable for all types of implant.

Initial assessment

Hearing tests and the condition of your child's ears will guide the Audiologist or ENT Surgeon on whether an IAD is suitable for your child.



Sometimes, a CT scan may be recommended.

When we assess how much an auditory implant will help a child, we routinely recommend a trial of some weeks and months using a bone conduction hearing aid secured with a head band. This can give an indication of whether your child will benefit from an auditory implant. Depending on your child's age, the soft band may also be a temporary measure until they are old enough for the operation.

- If the trial is successful, the Audiologist will make an appointment for you to see the ENT surgeon to discuss the options.
- If the trial is not successful, an auditory implant will not be the best option for your child so other treatments may be discussed.

About the IAD surgery

Your child's ENT Surgeon will discuss this in detail both in a clinic appointment and also on the day of surgery. They will answer any questions and ask you to give permission for the operation by signing a consent form.

The operation will be carried out while your child is under general anaesthetic. An anaesthetist will talk to you about this on the day of surgery.

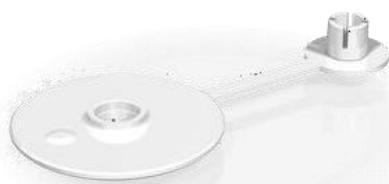
What will the operation involve?

- Insertion of the percutaneous BCI – A small amount of hair may need to be shaved. The surgeon will make a small (2-3cm) incision (cut) behind the ear and fix the implant to the skull. The skin is stitched around the abutment, which comes through the skin. A 'healing cap' or protective cover will be put over the abutment to protect it while it heals.
- Insertion of the passive transcutaneous BCI– Some hair may need to be shaved off. The surgeon will make a C-shaped incision around the proposed location of the magnet and fix the magnet to the skull. They will then stitch up the incision and cover it with

a bandage.

- Insertion of the active transcutaneous BCI– Some hair may need to be shaved off. The surgeon will make an L-shaped incision around the lower part of the proposed location of the implant. The implant will then be inserted and secured to the skull. They will then stitch up the incision and cover it with a bandage.
- Insertion of the middle ear implant – Some hair may need to be shaved. The surgeon will make a C-shaped incision behind the ear. Some of the mastoid bone behind the ear will need to be removed, near the nerve that moves the face. The hearing bones in the middle ear are found and the device is secured to the skull and then attached to the hearing bones in the middle ear. The incision is then stitched up and covered with a head bandage.

Rarely, some operations are conducted over two stages.



Picture of a healing cap (courtesy of Cochlear Bone Anchored Solutions AB, © 2019)

Are there any risks?

All surgery and anaesthesia carries a degree of risk but we will do everything we can to minimise it.

The risk of the anaesthetic will depend on your child's medical condition(s). Risks cannot be removed completely but modern equipment, training and medicines have continued to make anaesthesia safer. An anaesthetist will be with your child throughout their anaesthetic to monitor their progress and to help them to wake up as comfortably as possible.

There is a risk of bleeding and possible infection with any operation. Blood loss during surgery is usually minimal and we may give your child antibiotics to reduce the risk of infection. If implants become infected, they may need to be removed to allow the body to heal, before they are reinserted at a later date.

The implants may occasionally become loose from the skull bone – this is often connected to an infection in the area.

Middle ear implants are more complex operations and therefore have greater risks. Specifically, there are very small chances of causing a hearing loss in the inner ear and of injuring the nerve that moves the face.

There is also a risk that your child may not find adequate hearing benefit from the auditory implant.

Going home after the operation

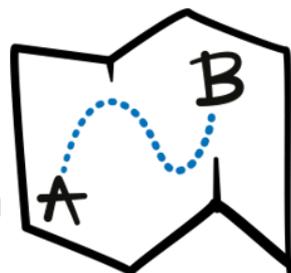
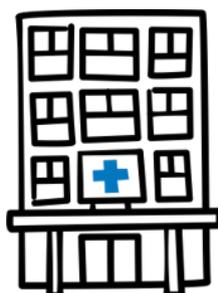
If your child is recovering well from the surgery and anaesthetic, they will be able to go home later on the day of surgery or the following day.

We may give your child a course of antibiotics to reduce the risk of infection. Please complete the course even if your child is feeling better.

For some children the surgical site will still be a bit swollen and uncomfortable when they get home. Carry on giving your child paracetamol and/or ibuprofen pain relief according to the instructions on the bottle or packet.

Looking after the operation site

Keep the wound clean and dry for the first ten days after the operation. After this, take care when hair washing or brushing. The sticky paper stitches will fall off in a few days – the other stitches are dissolvable so will not need to be removed. Your child should not go swimming or take part in sports or PE lessons until they have seen the ENT surgeon at their follow up appointment.



If your child had a percutaneous BCI inserted, there will be a dressing under the healing cap. Do not remove this until the ENT appointment one week after the operation. The dressings under the healing cap may be replaced.

If you see any signs of infection, take your child to your family doctor (GP) or the nearest Accident and Emergency (A&E) department immediately.

During office hours, you can also ring the ENT secretaries on 020 7813 8220 to arrange review or advice from a member of the ENT team. Signs of infection include:

- Your child is in a lot of pain and pain relief does not seem to help
- Your child has a temperature of 38°C or higher
- The operation site is red or inflamed, and feels hotter than the surrounding skin
- There is an unpleasant smell or ooze from the operation site

Follow up appointments

We will make a follow up appointment with the ENT surgeon a few weeks after the operation.

An audiology appointment will be booked for approximately one to three months after the operation, depending on which surgery your child has.

Fitting the hearing processor

Once the wound has healed, the hearing processor will be fitted and reprogrammed. This may be the same processor that was fitted on the soft band. In the meantime, ask your ENT surgeon whether your child should continue using the soft band. Do not attempt to put the soft band processor onto the implant as this may damage the integration.

The fitting appointment will involve either reprogramming your child's existing device to work well with their new implant, or providing a

new processor, depending on which implant your child has. When using a magnet fixture, the audiologist may need to trial different strengths to find out which one is most suitable for your child. The magnet needs to be strong enough to stay on but not too tightly which will avoid complications.

Once your child has been using the hearing device for a few weeks, the Audiologist will then continue to assess your child's hearing with the BCI and arrange appropriate follow ups.

