

Quality Standards



Bone anchored hearing aids for children and young people:

Guidelines for professionals working with deaf children and young people

Our vision is of a world
without barriers for
every deaf child

With thanks to Cochlear Bone Anchored Solutions AB™ and Oticon Medical for providing some of the photographs and images for this publication and the families who gave us permission to use their photographs.

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This document uses the words ‘parent’ and ‘family’ to include the child’s carer with parental responsibility. Throughout this document, the term ‘child’ is used to include babies and children, and ‘young person’ to include older children and young adults.

The good practice and quality standards identified throughout the document are intended to be relevant to services throughout the UK. Some of the policy references highlighted in the text are not relevant to all countries of the UK.

The abbreviation ‘QS’ is used throughout to define quality standards that must be implemented, monitored and audited.

In this document NDCS uses the term ‘bone anchored hearing aid’ to mean any hearing system that uses bone conduction where contact with the skull is maintained by surgical implant and the clinical services that provide them. This document is intended to be applied to all such devices, available now or in the future, regardless of manufacturer. It is not intended to imply any manufacturer, supplier, or trade name.

Currently:

- Cochlear Bone Anchored Solutions AB™ manufactures and supplies a bone anchored hearing aid known as Baha®. For more information see www.cochlear.co.uk.
- Oticon Medical manufactures and supplies a bone anchored hearing system known as Ponto. For more information see www.oticonmedical.com.

Summary

More than two children a day are born in the UK with significant permanent hearing loss (Fortnum et al., 2001). Around 40% of deaf children will have additional needs, such as ophthalmic problems (Bamford et al., 2004, Guy et al., 2003, Fortnum and Davis, 1997) or developmental delay. Early identification and appropriate management lessens the impact of hearing loss on the child, the child's family, and on society (Kuhl et al., 1992; Markides, 1986; Meadow-Orlans, 1987; Ramkalawan and Davis, 1992; Yoshinaga-Itano et al., 1998).



The first bone anchored hearing aid devices were introduced to the UK more than 20 years ago and have been found to be an effective method of aiding some groups of children, such as those with chronic infection of the middle or outer ears, congenital abnormality of the ears or severe-profound unilateral deafness. There are more than 40,000 people worldwide using bone anchored hearing aids. Providing children with a bone anchored hearing aid requires a dedicated multidisciplinary team whose members understand the complex needs of each child and the impact any intervention will have. The paediatric bone anchored hearing aid team must be able to assess the individual needs of the child, be fully conversant with specialised bone anchored hearing aid equipment, and capable of providing long-term habilitative support to the child and their family, until transfer to an adult service. Essentially, the bone anchored hearing aid service must work closely with the child and their parents and involve them in every step of the procedure. The impact of such equipment will mean lifelong care and commitment by the NHS.

NDCS believes that parents have the most important influence on their deaf child's life. Optimal habilitation for the child can only occur when parents are considered and valued as equal members of a well-coordinated and accessible team. To ensure optimum benefit and support to the child, parents must be seen as partners. Equally, young people must be seen as partners when services are providing care to meet their needs.

These Quality Standards are a revision of the NDCS *Quality Standards in Bone Anchored Hearing Aids for Children and Young People* (2003). NDCS has worked with bone anchored hearing aid services and consulted widely with local health and education services, families and young people in updating the quality standards and good practice guidance identified in this document. These quality

standards complement and should be used alongside national and country specific standards (where available) written for newborn hearing screening and audiology services in the UK.

The National Deaf Children's Society would like to thank the working party and all those who have taken part in the development and revision of this document.

The document was available for public consultation on the NDCS website and invitations to respond were sent to NDCS membership and professional groups and organisations.

All comments received have been considered as part of the editorial process. NDCS would like to pay particular thanks to the working party for the many hours spent on the development work and in helping to identify standards and good practice in bone anchored hearing aid provision for children and young people:

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Further information or comments should be emailed to professionals@ndcs.org.uk.

1. Introduction

These quality standards and good practice guidelines have been written by NDCS in conjunction with professionals working in the clinical field. The purpose of this document is to ensure that deaf children and young people who can benefit from specialised bone anchored hearing aids receive the most appropriate service and long-term support to meet their individual needs. It is aimed at commissioners of services and professionals with an interest in providing services to deaf children, young people and their families. The objective is to provide a framework for audit with realistic and attainable standards for a bone anchored hearing aid service.

Good practice guidance and quality standards are identified that will enable providers of health, education and social care services, as well as the voluntary sector, to deliver appropriate and effective support, from referral for a bone anchored hearing aid to transfer to an adult service. Services must be capable of adapting to change in technology and in other related services. Funding authorities have a duty to ensure that funding is made available for those children where a bone anchored hearing aid procedure is the most appropriate intervention method.

‘The bone anchored hearing aid service’ (see section 5) refers to the team responsible for the assessment of children, surgery, fitting and long-term maintenance of the hearing aid/s.

‘The local service’ (see section 4) refers to those services based in the child’s local hospital, education and social care services, which will liaise with the bone anchored hearing aid service to provide day-to-day support.

Parents, children and young people must be fully involved in decisions about appropriate habilitation and implementation of procedures, as well as in monitoring the effectiveness and evaluating the success of any intervention. It is the responsibility of the service provider to ensure that they are well informed and fully aware of the potential implications their decision will have. Services must ensure that information is accessible and produced in a child- and family-friendly format. Young people must be fully involved in every step of their own care (Department of Health, 2002).

Professionals from the bone anchored hearing aid programme should audit their service based on the quality standards identified in this document and on clinical governance. Service evaluation and continuous feedback, including the views of parents, families, users and professionals, are critical to the development of services. The best quality services will have a culture of learning continuously from families and children. Services must develop strategies to support all children with a hearing loss and their families. This will include children with additional needs, children from minority ethnic communities and children from ‘hard to reach’ families.

1.1 A summary of the bone anchored hearing aid pathway

Figure 1a – The local audiology service

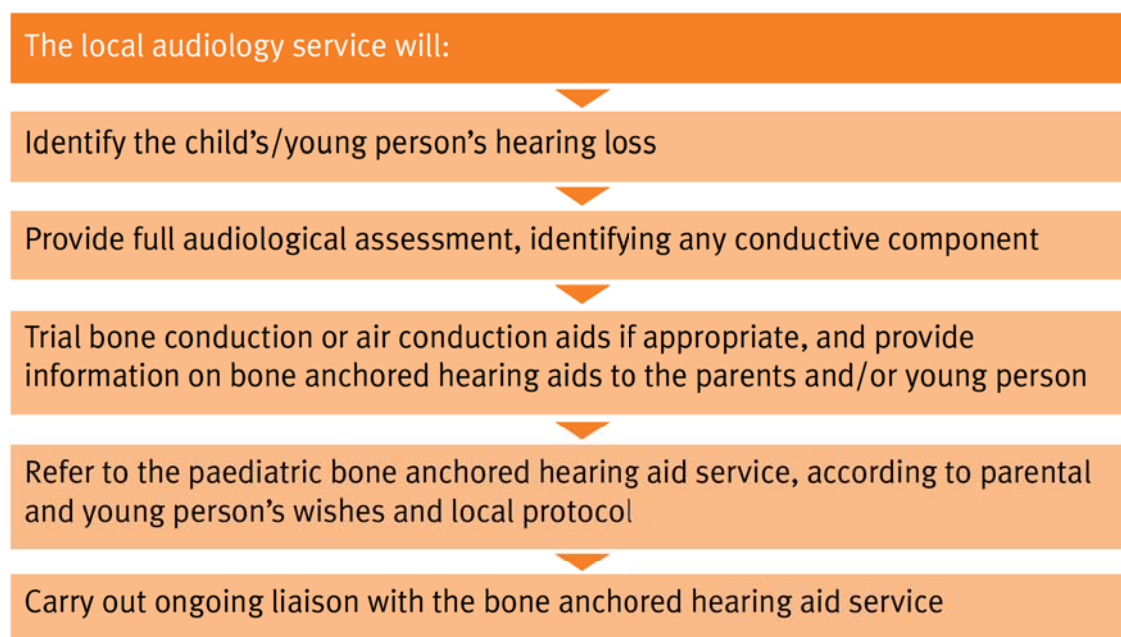
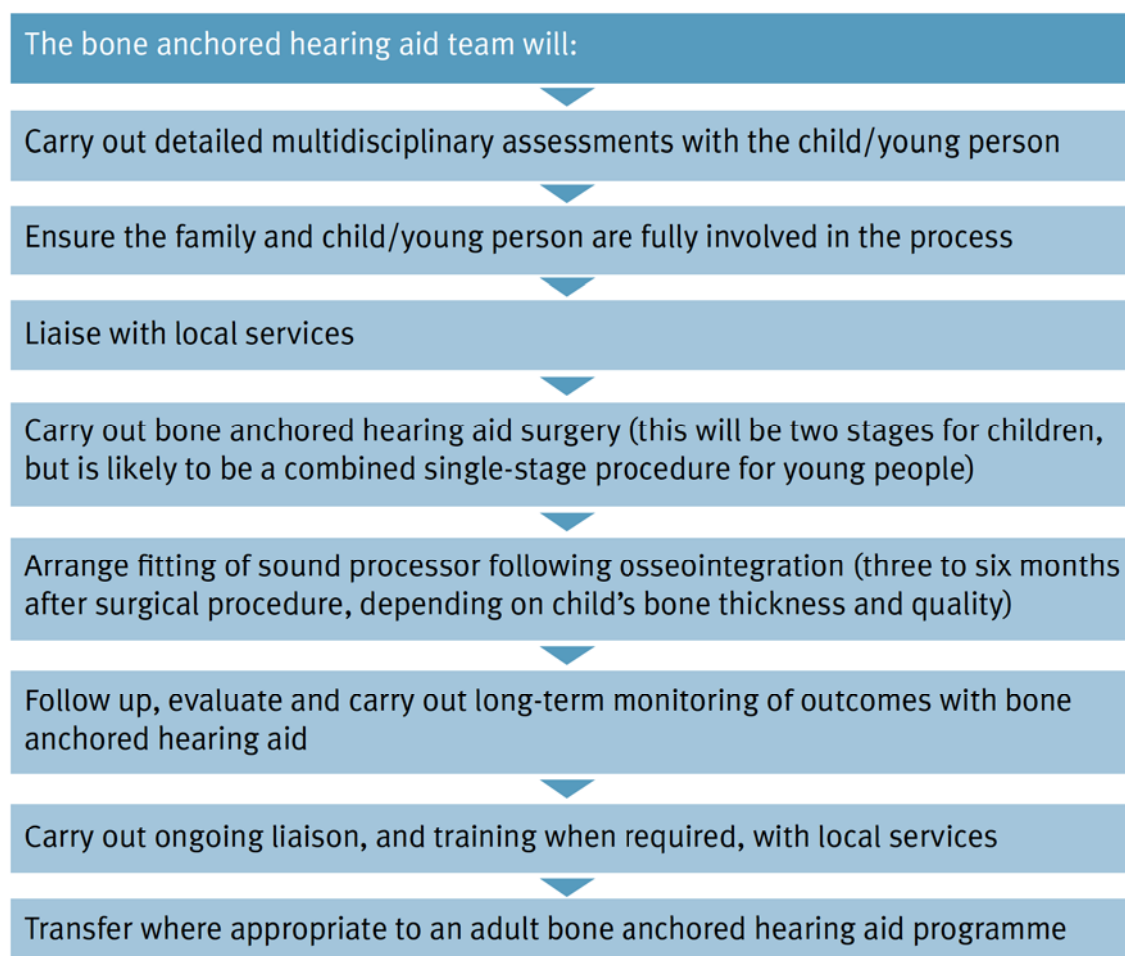


Figure 1b – The bone anchored hearing aid service



2. Hearing aids for conductive hearing loss

Congenital conductive hearing loss is often associated with atresia of the external auditory canal. Atresia is often associated with malformation of the middle ear and pinna. In most cases the cochlea is normal. The incidence of atresia is estimated to be 1 in 10,000 births. In about one quarter of all cases, atresia is bilateral (Declau et al., 1999). Congenital abnormalities can affect any or all of the outer and middle ear structures. The majority occur in isolation, but may be part of a syndrome such as Treacher Collins, Crouzons, Branchio-oto-renal (BOR) syndrome, Goldenhaar syndrome, etc. (Shprintzen, 1997). The severity of the hearing loss cannot be determined by the external examination of the outer ear.

Other causes of long-term conductive hearing loss in children result from infection in the middle or outer ear. Chronic ear infection can cause a fluctuating conductive hearing loss that is dependent upon the severity of infection, inflammation and discharge present. Examples of such cases may be found in chronic suppurative otitis media, following mastoid surgery, or in children with Down's syndrome (Miller et al., 1999; Roizen, 1997).

2.1 Aiding conductive hearing loss

A child with a significant bilateral hearing loss must be provided with suitable amplification soon after diagnosis, and in accordance with published standards and guidance (*Quality Standards in Paediatric Audiology*, Volume IV, NDCS, 2000; *Guidelines for the Fitting, Verification and Evaluation of Digital Signal Processing Hearing Aids within a Children's Hearing Aid Service*, MCHAS, revised 2005; *Quality Standards in the NHS Newborn Hearing Screening Programme*, NHSP, revised 2008; *Quality Manual, Newborn Hearing Screening Wales*, revised 2009; *Quality Standards for Paediatric Audiology Services*, Audiology Services Advisory Group, Scotland, 2009; *Transforming Audiology Services for Children with Hearing Difficulties and their Families*, Department of Health, 2008; *Quality Enhancement Tool (QET) for audiology* <http://audiology.globalratingscale.com>, *Quality Standards in Paediatric Audiology (Wales)*, in development, 2009/10).

Where the child has an infected ear, use of air conduction (AC) hearing aids may not be advisable as this can prevent adequate ventilation of the ear and may exacerbate the infection. The sound produced by an AC aid has to travel through debris and discharge and the sound quality may be lost. Bone conduction (BC) or bone anchored hearing aids can provide more consistent sound quality irrespective of the severity of infection and avoids ear occlusion. Therefore conventional BC hearing aids should be considered irrespective of whether a bone anchored hearing aid is a future consideration. With a congenital abnormality, sound from AC hearing aids is passed to the inner ear through structures that are malformed and therefore not able to conduct sound efficiently. An AC aid for this hearing loss may produce poorer than expected sound quality and elevated aided thresholds. In many cases, the fitting of an AC aid may not be possible due to the congenital abnormality of the external ear. Therefore a BC hearing aid should be fitted as soon as possible.

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Where a chronic conductive hearing loss is present, bone conduction hearing aids should always be considered, tried and evaluated.

2.2 The bone conduction (BC) hearing aid

A BC aid has a transducer that vibrates in relation to the sounds entering the hearing aid microphone. This transducer is held against the mastoid bone by a metal sprung headband or an arm of a pair of glasses. The headband should hold the transducer in place firmly to allow good transmission of vibrations through the skull. This transmission of vibrations through the skull to the cochlea is perceived as sound by the wearer. However, it can be difficult to maintain the correct pressure and position of the vibrating transducer and the levels of sound perceived may vary as a result of this variation in pressure and position of the transducer on the skull.

2.3 The bone anchored hearing aid worn on a headband

Bone anchored hearing aids can be worn as bone conduction hearing aids, on either a metal sprung headband or a soft headband (similar to a sports headband). The soft headbands have a plastic disc that the sound processor couples to.

Wearing a bone anchored hearing aid in this way is useful:

- for young children before they are old enough for the implant surgery
- during the assessment period to trial the sound processor, and before surgery
- during the period of ossification after surgery (four to six months) before the bone anchored hearing aid can be coupled to the abutment
- when the abutment cannot be used (for example, due to infection)
- in the long-term for children and young people when surgery is contraindicated or not wanted.



NB: For children using bone conduction or bone anchored hearing aids on a headband during the osseointegration stage following surgery, or at other times when their abutment cannot be used as usual, the headband should never be placed directly over the implant site or abutment.

As with bone conduction hearing aids, transmission of sound vibrations across the skin and soft tissue attenuates the signal. Wearing a soft headband may be more comfortable for some children. Research with the Baha® on Softband™ suggests that, within certain limits, tension of the headband is not thought to be critical, provided the volume control setting is used appropriately (Hodgetts et al., 2006).

Studies suggest that aided hearing levels with the Baha® on Softband™ are adequate for basal language development. However, to acquire knowledge on more complex language levels (the morpho-syntactic level), generally between the ages of three and six years, improved hearing thresholds are necessary (Snik et al., 2008). This is usually achieved using a bone anchored hearing aid. With this in mind, for those children who are suitable candidates for surgery and whose parents choose this option, this is one consideration in planning timing of surgery.



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2.4 The bone anchored hearing aid

A bone anchored hearing aid is an amplification system by which sound is conducted to the cochlea through direct bone conduction. It is made up of three main parts – the titanium implant, the abutment and the sound processor. The surgically implanted titanium fixture in the mastoid bone is connected to the processor via a skin penetrating abutment. Levels of perceived sounds remain consistent as a result of this type of coupling.

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The percutaneous coupling is much more effective than the transcutaneous set-up of conventional bone conductors. It affords an advantage on the order of 10-15 dB (Hakansson et al., 1985; Cremers et al., 1992), especially at the high frequencies of vital importance to proper speech recognition in noise. The transducer, microphone, and electronics are contained in one housing for ear level devices, which enables bilateral application. Compared to conventional bone conduction hearing aids, the bone anchored hearing aid system not only has better gain at the high frequencies but also less distortion (Cremers et al., 1992). Clinical studies on children show that bone anchored hearing aids outperform conventional bone conduction hearing aids (Powell et al., 1996, Snik et al., 2008).



2.5 The advantages and disadvantages of bone anchored hearing aids when compared to air conduction hearing aids (AC), bone conduction hearing aids (BC) and middle ear surgery (ME)

Figure 2a Comparison table

Advantages of a bone anchored hearing aid	Compared with	Reason
Improved sound quality	AC	Sound bypasses outer and middle ear problem, maximising the level of sound reaching the cochlea with little depreciation of gain, especially at high and low frequencies.
Comfort	AC	No occlusion of the ear. Less discomfort from problems fitting ear moulds/ aids, sometimes due to otitis externa, malformation of the pinna, concha or external auditory meatus.
Consistent levels of perceived sound	AC	Hearing loss caused by infection may cause fluctuating AC thresholds. As the BC thresholds remain stable, the level of sound perceived from the bone anchored hearing aid is consistent.
Improved sound quality	BC	<p>Direct bone conduction via a bone anchored hearing aid means that sound is not 'lost' whilst passing through hair, skin and muscle, so improving the frequency response, especially in the high frequencies.</p> <p>When wearing a BC aid, the bone vibrator should be sited over the mastoid. However, this is difficult to achieve with consistency.</p> <p>A bone anchored hearing aid can give up to 15 dB advantage over a conventionally coupled bone conduction aid.</p> <p>The microphone and transducer are contained on the same side, reducing the unnatural listening condition created by BC devices that transfer sound from one side of the head to the other.</p>

Comfort/cosmetics	BC	Bone anchored hearing aids are attached to the bone so there is no weight or awareness of its presence, thus eliminating discomfort due to pressure of a transducer. The size of the hearing aid and lack of headband significantly improve cosmetic appearance.
Consistent levels of perceived sound	BC	A bone anchored hearing aid eliminates variation of the transducer position and pressure encountered when using a headband or spectacle arm. This ensures consistent levels of perceived sound by the user.
Potentially more consistent use	AC/BC	Greater comfort and improved sound quality which encourages more use.
Safe and reliable intervention	ME Surgery	No risk of additional hearing impairment from surgery. Potentially reversible intervention. Bone anchored hearing aid can be evaluated prior to surgery.

Disadvantages of a bone anchored hearing aid	Compared with	Reason
General anaesthetic(s) Where there are two separate surgical procedures for children	AC/BC	General anaesthetic risk factors apply. A general anaesthetic will be required for both operations.
Surgical complications	AC/BC	Potential for bony overgrowth increases in children implanted at very young age. Potential for inflammatory reaction, particularly in teenagers. Risk of implant loss attributable to children's thinner skull bone. Soft tissue complication rates are slightly higher in children than adults, particularly in children with coexisting developmental delay.
Maintenance of abutment site	AC/BC	As the bone anchored hearing aid user cannot see the abutment area, the user will require a second person to help with keeping the area around the abutment clean. Abutment hygiene may be a particular issue for young children and older children/young people with learning difficulties.
Availability	AC/BC	Bone anchored hearing aid services are becoming more widely available, however there are still fewer UK services than audiology departments which could result in increased travel for assessment, surgery and ongoing care for the family. Bone anchored hearing aids are significantly more expensive than conventional AC and BC hearing aids available from the NHS.
Potential for head trauma	AC/BC	Risk of head trauma, e.g. a blow to the implant site (with or without the presence of the processor), may have more serious consequences than might occur with a conventional AC or BC hearing aid.

2.6 Bone anchored hearing aids for unilateral hearing loss (single-sided deafness)

In contrast to bilateral hearing loss, there is no consensus about the benefit of early aiding of unilateral congenital conductive or sensorineural hearing loss.

Declau et al. (1999) reviewed the literature on the outcomes of reconstructive surgery. They found that the post-surgery hearing thresholds were mostly poor and concluded that it is better to leave the impaired ear untouched.

Cho Lieu (2004) reviewed the literature on problems with language development and school performance in children with unilateral hearing loss. Cho Lieu concluded that these children had a significantly higher risk of developmental delays than their peers with normal hearing. This suggests that intervention is advisable (Snik et al., 2008). However, studies on children with aidable unilateral hearing loss show poor hearing aid compliance (Davis et al., 2002; Kiese-Himmel and Kruse, 2000). The Paediatric Working Group on Hearing Aid Amplification (Bess et al., 2000) summarised the literature and stated that in children with unilateral conductive or sensorineural hearing loss, amplification should be considered on a case-by-case basis, centred on the child's audiometric data, development, and communication needs.

Snik et al. (2008) therefore recommend a trial period with a sufficiently powerful bone anchored hearing aid on a headband before any decisions are made about implantation.

It is important that parents and/or young people fully understand the implications of having bone anchored hearing aid surgery and have realistic expectations of what the technology can provide.

3. Supporting the child, young person and family

Children and young people should receive care that is integrated and coordinated around their particular needs, and the needs of their family. They, and their parents, should be treated with respect (Department of Health, 2002).

Parents have a right to information with regard to the health and educational development of their child. So that they can make informed choices for their child, parents must be provided with balanced, unbiased and up-to-date information on an ongoing basis and throughout their child's development (Department of Health, 2009; Department for Education and Skills and Department of Health, 2006). The bone anchored hearing aid service must provide them with information on their child's audiological and communicative developmental needs, so that they can make an informed decision about a bone anchored hearing aid.

Services must obtain consent from the young person or the child's parent, before passing details about their own care or their child's care to others.

3.1 Communication

All those involved in a bone anchored hearing aid team must be able to communicate effectively and sensitively with the deaf child and their family. This may include signing if this is the most appropriate communication method.

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Families must have equal access to information in their preferred language. This could be written, verbal, video or audio format. Sign language and/or spoken language interpreter(s) must be provided for all visits to the hospital or clinic, when required. Information must be unbiased, up to date, comprehensive, clear, accessible and accurate.

All members of the team should be aware of the principles of family-friendly services (Royal College of Surgeons, 2007; Baguley et al., 2000) and these should be reflected in the written protocols as well as the clinical delivery of a bone anchored hearing aid programme.

The bone anchored hearing aid service will provide the child's family with information on the devices, and the process and procedures involved. The team must ensure that the child, young person and family understand the nature and cause of the hearing loss, as well as the management options. All information must be jargon free, in an accessible format and provided in writing, and in audio format when requested.

3.2 Partnership and parental responsibility

Parents have a central role to play in the assessment of their child's progress and the needs of their child. The bone anchored hearing aid service must provide the child and family with the support they need to carry out this pivotal role. With support from local services, including the medical and educational teams, parents

need to ensure that the child wears their sound processor consistently and that it is maintained in good working order.

The family will also need to ensure the abutment site is kept clean and report any problems to help keep the site healthy. The bone anchored hearing aid service will need to make sure that the family, and where relevant, the child understands that they will need to:

- attend appointments, pre- and post-surgery and until the young person transfers to an adult service
- prepare the child for hospital procedures
- ensure the consistent use of the sound processor
- provide effective feedback on their child's development
- maintain the hygiene of the abutment site
- monitor, care and maintain the sound processor on a daily basis.

3.3 Contact with other families

Parents and children value contact with other families in order to share experiences and learn from one another (Dettman et al., 1996; McCormick and Archbold, 2003; Powell et al., 1996). Such shared experiences are particularly valuable during the assessment phase. However, peer support following surgery and during the ongoing habilitation of the child is equally important. The bone anchored hearing aid service must work with local health and education services, and with support groups and voluntary organisations to ensure this is facilitated and proves a useful experience for the child and their family.

Maintaining a database of willing families will help bone anchored hearing aid services to provide contact details (with full consent) to both parties involved. Once a contact family has been identified and a meeting arranged, the bone anchored hearing aid service should not have any further involvement in the discussions between the families. Patient confidentiality must always be observed and respected.

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It is the responsibility of the bone anchored hearing aid service to provide opportunities for the child and family to meet other children with bone anchored hearing aids during the assessment phase, preferably from the same programme.

3.4 Children with additional/complex needs

Many children have complex needs that cross specialty boundaries and they will need access to a whole range of services. Staff need to collaborate closely to ensure that children and their families are receiving consistent and coordinated support, and the NHS locally will need to design services to achieve this. (Department of Health, 2003, Department of Health, 2002).

Staff working within the bone anchored hearing aid service and also working with local health and education services must have the knowledge and expertise that enable them to work effectively with children with a variety of complex needs, in

addition to hearing loss. They must understand the appropriate referral pathways to other specialised teams and appropriate habilitation for each child. Strategies and protocols must be developed to provide seamless service provision.

The first results of bone anchored hearing aid fitting in children with learning disabilities are encouraging (Sheehan and Hans, 2006; Kunst et al., 2006; Kunst et al., 2007; McDermott et al., 2008). These families require special guidance by the bone anchored hearing aid team (Snik et al., 2008) and particular attention must be paid to counselling the parents regarding the long-term impact, including risk of complications and maintaining hygiene of the abutment site.

The impact of deafness on the child and family should be viewed in the context of the child's whole development, including that of health, educational and social development. It is the responsibility of both health and education services to ensure that all staff involved with a deaf child with additional needs are fully informed and have a full understanding of the good practice guidelines produced by other agencies and organisations supporting such children.

3.5 Children with craniofacial abnormality

A child with a craniofacial abnormality, including those with malformed ears, may be a candidate for prosthetic rehabilitation or surgical reconstruction.

The child should be seen and assessed soon after birth by a multidisciplinary team that may include ENT and maxillofacial specialists, a plastic surgeon and clinical geneticist. The child will need long-term management. Parents must be involved in the development of, and provided with, the long-term plan for their child. The parents and the child (where appropriate) should be informed of the likely causes of the abnormality.

Particular attention must be paid to counselling the parents about the potential outcomes of each type of management. Northern and Downs (1991) addressed the question of what hearing level should be considered a risk when children are developing speech and language abilities. Based on a comprehensive overview of arguments, they stated that hearing loss in excess of 15dBHL can impact on language development in children. In those children with bilateral aural atresia, it cannot be guaranteed that reconstructive surgery will be an effective intervention except in the mildest cases of aural atresia (Wilmington et al., 1994). The focus for families in the early years will probably be hearing aid fitting.

Reviewed data shows that on average, such children benefited significantly more from the bone anchored hearing aid than from reconstructive surgery. Thus bone anchored hearing aid application appears to be the best option to achieve normal communication and speech and language development in children with permanent bilateral conductive hearing loss (Snik et al., 2008).

3.6 Children with otitis media with effusion (OME or glue ear)

There is some evidence that a bone anchored hearing aid on a soft headband may be beneficial to this group of children, particularly in learning situations. Ramakrishnan et al. (2006) described difficulties with compliance with

conventional BTE hearing aids, including the problem of need for repeated ear mould impression appointments. They found that the Baha® on Softband™ offered an alternative method of managing glue ear that is safe, well tolerated, non-invasive and easy to administer.

Children with acquired conductive hearing loss caused by chronic otitis media with effusion that leads to long-lasting hearing loss might benefit from bone anchored hearing aid use, especially when reconstructive surgery or the placement of grommets is not an option (Sheehan and Hans, 2006; NDCS, 2007). Fitting BTE hearing aids involves occlusion of the ear canal by an ear mould, which may have a detrimental effect on existing middle ear disease. Furthermore, depending on the severity of the otitis media infection, the conductive hearing loss may fluctuate over time. In contrast with air conduction devices, no corrections have to be applied to a bone conductor when the hearing loss fluctuates (Snik et al., 2008).

3.7 Support groups and voluntary agencies

Support groups and voluntary organisations are able to provide parents with support and guidance on all aspects of hearing loss, and information on new and changing technological developments for the deaf child and young person, including information relating to bone anchored hearing aids.

The bone anchored hearing aid service should provide families with written details of how to contact local and national support groups, such as BUSK (the bone anchored hearing aid patient support group www.baha-users-support.com), NDCS (www.ndcs.org.uk), local deaf children's societies (www.ndcs.org.uk/family_support/support_in_your_area/index.html), and support groups for specific syndromes, such as the Treacher Collins Support Group (www.treachercollins.net).

QSo4

Information about voluntary sector services must be given to the family at the time of assessment, at key stages throughout the child's life, and when requested by the family.

4. The role of local services

The ‘local service’ refers to those services (health, education or social care services) based in the child’s local hospital, school or community that provide the day-to-day support for that child. It is vital that NHS purchasers and providers of bone anchored hearing aid services recognise that the management of a child involves local services, and liaise closely with them.

Local services should ensure that the child and family are given every opportunity to discuss and explore issues relating to their child’s hearing loss. The local health and education service should:

- promote equal opportunities for all children supported by the service
- raise awareness of conductive hearing loss with the child’s teachers and peer groups to help maximise the child’s potential
- encourage opportunities for children with a hearing loss and their family to meet other similar children and families, and deaf adults
- provide continual support to the child and family in liaison with the bone anchored hearing aid service.

All professionals working with the child must be fully aware of new technologies (including bone anchored hearing aid systems) and current policy and practice, particularly in relation to conductive hearing loss.

4.1 The local audiology service

The local audiology service will provide assessment, diagnosis and appropriate aiding as soon as the diagnosis is made. In discussion with the family and/or young person, they will make the referral to the bone anchored hearing aid service.

The team should work closely with the family to ensure that a suitable hearing aid is fitted, maintained and evaluated. In some children, it may be appropriate for them to try an air conduction (AC) aid prior to a bone conduction (BC) aid. It is essential that the family understand why a BC aid may be more appropriate than AC aiding for their child (see Figure 2a).



4.2 The local education service

The education service will provide specialist equipment that is required by the child at school, e.g. a personal FM system. Professionals from the service will work closely with the bone anchored hearing aid service to ensure that all equipment has the appropriate accessories and meets the individual needs of the child (see section 11.8).

All equipment should be tested on a regular basis to ensure it is working effectively.

Audiological information must be shared with the local education service, with the family’s consent (MCHAS, revised 2005b).

4.3 The local social care service

The role of the social care services team in relation to deaf children and their families is identified in *Deaf Children: Positive practice standards in social services* (Association of Directors of Social Services et al., 2002). Since then, there have been significant changes in the way that social care services, education services and health services work in an integrated way. *Working Together to Safeguard Children* (2006) contains information about the role of local social care services, and how social care, health and education services can work together to safeguard children. To find out more about the role of social care services, see *Social Work at its Best: A statement of social work roles and tasks for the 21st century* (2008).

The Social Work Task Force and the Children's Workforce Development Council are working to redefine the role and core competencies for social care professionals. You can find out more about the Social Work Task Force at www.dcsf.gov.uk/swtf, and more about the Children's Workforce Development Council at www.cwdcouncil.org.uk.

5. The bone anchored hearing aid service

The ‘bone anchored hearing aid service’ refers to the team responsible for the assessment, surgery and maintenance of the bone anchored hearing aid system. This team may not be based in the child’s local hospital or community and may be a tertiary centre. The bone anchored hearing aid service is responsible for advice and coordination of the child’s care. They will work closely with the child’s local service. Ideally, children should only need to visit the tertiary centre for complex assessment and investigations, or specialised treatment. Otherwise tertiary care can be delivered locally through outreach services operating within a clinical network, provided that the network itself is adequately commissioned, funded and staffed, and that there are clear systems for information sharing, clinical governance, accountability and staff development (Department of Health, 2003).

Children with permanent hearing impairment [should] receive ongoing care as close to home as possible by multidisciplinary teams around the child. (Department of Health, 2008b).

Providing a bone anchored hearing aid service involves the formation of a skilled multidisciplinary team that works closely with the child, young person and family. Team members need to allow sufficient time to collaborate on joint working and planning, and to engage in training (this should also be reflected in job descriptions). This will ensure the development of true multidisciplinary working and shared clinical knowledge.

Depending on individual team members’ skills and experience, and local procedure, each team member may have ‘extended roles’ written into their job description. This can help ensure flexibility within the service and enable some functions to continue as usual during periods of staff absence etc. For example, this could include the ENT nurse being trained to check the child’s sound processor, or the audiologist being trained to check the abutment and recognising when earlier ENT care is necessary.

Key members of the bone anchored hearing aid service will consist of the following:

5.1 The clinical scientist (audiology) or audiologist

The clinical scientist (audiology) or audiologist will review the child’s current hearing aid and perform objective and behavioural hearing assessments. They will ensure that the most appropriate bone anchored hearing aid is fitted and that it is set at appropriate levels. They are responsible for ensuring the child and family understand how the hearing aid works and is used. During the habilitation process, they will ensure that the device is maintained and that accessories are issued as required.

QS05

Audiological support and assessment must be undertaken by staff with the necessary skills to perform and interpret testing in relation to conductive hearing loss. Key scientific staff must be appropriately trained at postgraduate level (for example MSc, or equivalent, in audiology or audiological medicine, supplemented by suitably assessed practical experience) and state registered with the relevant body.

Audiological members of the team, with less than three years' experience in paediatric audiology, must not work without the supervision of an experienced clinical scientist (audiology) or audiologist.

5.2 The ENT surgeon

The ENT surgeon will have overall clinical responsibility for the child and will assess the child's medical health and fitness for surgery, perform the surgery and provide medical and clinical care. The surgical technique in children requires greater surgical expertise than adults (Graham et al., 2007).

QSo6

The ENT surgeon must have a paediatric consultant otolaryngological practice with appropriate accreditation and be on the specialist register. The surgeon must have attended recognised surgical training on bone anchored hearing aid equipment.

5.3 The audiovestibular physician

In some centres the audiovestibular physician may carry out some of the medical and audiological care of the child (Papsin et al., 1997).

QSo7

The audiovestibular physician must have the necessary skills to carry out this work and be on the audiological medicine specialist register. The physician must be trained in, and have experience of working with children.

5.4 The speech and language therapist (SLT)

The SLT will assess and evaluate the child's communication development and competence, including their speech and language skills and social development. The SLT will liaise closely with the child's parents and local professionals to plan developmentally appropriate communication goals and implement activities to achieve such goals.

QSo8

The SLT must have a degree and licence to practice, including registration with The Royal College of Speech and Language Therapists and Health Professions Council. The SLT must have appropriate experience working as a generalist speech and language therapist as well as experience of working with deaf children. The SLT must have attended relevant postgraduate training.

5.5 The ENT liaison nurse/advanced nurse practitioner

The liaison nurse will provide an essential link between the child's family, and the surgical and nursing team to ensure continuity of nursing care before, during and after surgery. The liaison nurse will be responsible for providing information on the surgical aspects to the child and family and to local professionals. This information will include pre-admission details and any implications for home and school care post-surgery (see Appendix 4).

QS09

The ENT liaison nurse will be a qualified children's nurse who has specific responsibility for ENT care.

5.6 The administrator

The administrator will provide a comprehensive administrative and clerical service to the bone anchored hearing aid team. The administrator will have the ability to communicate effectively with the child and the child's family.

5.7 The team coordinator

The bone anchored hearing aid service coordinator will have organisational, leadership and clinical professional skills. The coordinator must ensure that appropriate services are provided to the child throughout all phases of the assessment, surgery, fitting and evaluation processes. It is the coordinator's responsibility to ensure that any recommendations are made to the child's local services to establish and/or maintain quality provision of care.

5.8 The key (link) worker

A key member of the bone anchored hearing aid service will act as the key (sometimes known as the link) worker for each family. The key worker will act as a facilitator and link person. The family must be told who their key worker is and have the ability to change their key worker if they so desire. The key worker must be accessible to the child and family and take a flexible approach to their needs. It is the responsibility of the key worker to ensure that there is continuity in the information provided to all those involved with the child or young person.

QS10

Each child must be assigned a key worker who will liaise closely with them, their family and local professionals.

5.9 Additional support

In addition to the expertise of the core team, and to that of local services, there may be a need for professionals with specific expertise to be involved in the care of the child (see Appendices 2a and 2b). Wherever possible, such professionals should have experience of working with children with conductive hearing loss and their families.

For example, Zeitoun et al. (2002) reported that additional psychological support was needed by a significant number of their young bone anchored hearing aid users when they reached adolescence. The problems encountered concerned phobias about cleaning the skin around the abutment, difficulties with coping at school, and refusal to wear the sound processor.

5.10 Clinical facilities and accommodation

Children and young people who need surgery also need a range of supporting services outside the operating theatres. Staff must have a full understanding of what it means to be cared for in an appropriate child- and family-friendly environment. In outpatient clinics, where children are seen side-by-side with adults, there needs to be some geographical separation, for example through partitioning waiting areas (Department of Health, 2003).

Overnight accommodation for the family when the child is an in-patient must be available. Such accommodation must be attached to, or within the immediate vicinity of, the hospital.

5.11 Training requirements

Children and young people should receive appropriate high quality, evidence-based hospital care, developed through clinical governance and delivered by staff who have the right skills. They should be trained in the necessary communication skills to enable them to work effectively with children, young people and families and to support them to be active partners in decision-making.

Experienced members of the team have a duty to provide new personnel with appropriate training, supervision and support. Joint training of staff from different disciplines is encouraged.

Staff should receive training in deaf awareness and sign language, disability and cultural awareness, and customer care, including listening skills. Textphone facilities must be available and training given in their use.

QS11

The bone anchored hearing aid service must provide information and training on bone anchored hearing aid equipment and its use to local service professionals, support groups and voluntary organisations.

QS12

Staff induction must include attendance at team meetings, multidisciplinary clinics, surgical procedures, specialist assessment appointments and joint working with experienced staff. All staff working within a bone anchored hearing aid team must attend recognised training to develop appropriate skills, and have an agreed plan for continued professional development and skills.

QS13

The multidisciplinary clinic must take place in a paediatric hospital or other suitable paediatric setting, and the child's assessment must take place in a paediatric audiology or ENT department that conforms to the *Hospital Standard: Quality of setting and environment* (Department of Health, 2003).

The surgical management for children must take place in an appropriate paediatric setting which conforms to the *National Service Framework* (Department of Health, 2003), the Royal Colleges and the British Association of Otorhinolaryngologists/Head and Neck Surgeons standards.

6. The bone anchored hearing aid equipment and features

Some equipment (such as personal FM systems) may be a shared responsibility with the local services (see *Quality Standards for the use of personal FM systems: Promoting easier listening for deaf children*, NDCS, 2008). See also section 11.8.

6.1 Batteries

Batteries may be provided by the bone anchored hearing aid service or the local audiology service. Funders and commissioners of services need to ensure that it is clear whether the bone anchored hearing aid service or the local audiology service is responsible for battery provision.

6.2 Colours and styles

Bone anchored hearing aids are available in a limited range of coloured cases. Children should be offered the colour of their choice, where possible.

6.3 Listening options

Any bone anchored hearing aid used by children should have the technological features that enable the child to make best use of their hearing in different listening environments. When selecting a particular bone anchored hearing aid, it will be important to consider the child's individual needs, such as their developmental level, flexibility of the programmable features and compatibility with an FM system.

The clinical scientist (audiology) or audiologist should regularly review the programming of the bone anchored hearing aid to ensure that the child/young person has new features introduced as appropriate to their needs.

These features should include direct audio input and telecoil. Programming of the aid and/or user controls should allow the child to have access to:

- microphone or telecoil only, or
- microphone plus telecoil, direct audio input only, or
- microphone plus direct audio input together.

The child's parents, and wherever possible the child, should be informed about other listening options when using a bone anchored hearing aid, such as using the telecoil facility, and the use of the direct audio input facility. These will enable the child to listen to:

- telephones, including mobile phones
- inductive loops
- home entertainment, such as CDs, TV and DVDs
- computers
- language laboratories
- personal FM systems.

6.4 The equipment manufacturer/supplier

The equipment manufacturer or supplier has a duty to provide bone anchored hearing aid services and audiology departments with comprehensive information on their equipment and accessories. This will ensure that all personnel are kept up-to-date with changes and technological developments, enabling key personnel to provide the most appropriate equipment and efficient provision to children with bone anchored hearing aids.

The equipment manufacturer or supplier must also provide information regarding the use of personal FM systems and other listening devices and equipment.

QS14

The bone anchored hearing aid service must provide the most appropriate bone anchored hearing aid system to meet the child's need.



7. The referral and selection procedure

Audiology and ENT services should be familiar with the referral pathways into the bone anchored hearing aid service. Prior to referring the child for assessment, the local audiology service must ensure that the child and family have a clear understanding that a bone anchored hearing aid will not be suitable for all children referred for assessment.

The child should be referred to a bone anchored hearing aid service for assessment as soon as a long-standing conductive or mixed hearing loss is identified that cannot be effectively treated by conventional medical or surgical interventions.

Manufacturers of bone anchored hearing aid systems publish guidance on appropriate candidates. For example see *Baha Candidate Selection Guide* (Cochlear, 2008) and *Audiological Manual* (Oticon Medical, 2009).

QS15

All children meeting the selection criteria must be provided with the opportunity to be referred for assessment to the bone anchored hearing aid service.

A letter of referral, including all relevant medical and audiological details, must be sent to the consultant ENT surgeon or the coordinator on the bone anchored hearing aid service. Referrals will be accepted from medical and audiological personnel, preferably with the knowledge and agreement of the consultant otolaryngologist or audiological physician at the child's local service. If a referral is considered to be inappropriate, a letter must be sent to the referrer with a clear explanation as to why the referral has not been accepted.

Information must be given by the bone anchored hearing aid service to the child and family to ensure that they are able to fully understand the selection criteria. The decision to proceed must be made by the multidisciplinary bone anchored hearing aid team, with the child and family fully involved throughout the assessment and decision-making process.

QS16

The bone anchored hearing aid service will return inappropriate referrals to the referrer, with an explanatory letter, within two weeks of receipt of referral. The referrer has the responsibility of passing such information to the family within five working days of receipt.

QS17

A written reply, confirming acceptance of the referral, will be sent to the child's family, the referrer, and to their GP within 10 working days of receipt.

7.1 Age of child

In order for the child to develop good speech, language and communication skills, a bone anchored hearing aid should be offered and fitted as soon as it is clinically feasible. This will be as soon as the child has been fully assessed and is believed by the ENT surgeon, the bone anchored hearing aid team members and the child's parents to be an appropriate candidate.

A bone anchored hearing aid on a soft headband can be used on infants from the age of six weeks.

In the US, the Food and Drug Administration approves bone anchored implant surgery from age five years. However, it is common for children to be implanted under this age provided the child has sufficient bone volume and bone quality. This can vary from child to child but, based on studies the child should be more than two years old and have a skull bone a least 2.5mm thick.

Surgery should not be attempted much before the second birthday and until that age, the hearing aid part of the device can be employed using a soft headband (Graham et al., 2007).

It is recommended that implant surgery be performed in two stages in children of up to 10 years of age (Snik et al., 2008) and for those with bone thickness <3mm.

7.2 Attendance and commitment by the family and young person/child

It is important for the family to have realistic expectations of their child's audiological, speech and language, educational and general development, and the level of impact that the bone anchored hearing aid may have on these. The child and family will need to understand the necessity of attending the hospital or clinic for appointments as part of the assessment, the surgical intervention, the follow-up care and support, and the long-term monitoring. The family also needs to understand how important it is that the child uses their sound processor consistently during home, social and educational activities. Prompt reporting of skin problems, loose abutment and sound processor problems is crucial. This could result in the need to attend the bone anchored hearing aid clinic at short notice for treatment.

7.3 Hygiene

Good hygiene is essential to the health of the abutment site. It is vital that the child, young person and family fully understand the need for the area to be cleaned regularly (at least weekly) by a person other than the patient. This person must be identified at the time of assessment and demonstrate an understanding of the importance of this task and a commitment to carrying it out.

QS18

The liaison nurse must provide training and written details to the child and family, and other carers, regarding good hygiene and optimum care of the abutment site.

8. The assessment process



The bone anchored hearing aid service will request information from the local health and education services. This should be received before the assessment takes place in order to ensure that it is comprehensive and appropriate to meet the child's needs. The information required about the child includes:

- medical history, including developmental assessment
- history of hearing loss and aetiology, if known
- results of audiological assessments
- use of hearing aids and methods of aiding
- communication method(s) used, including sign and other language needs
- speech and language development
- educational support
- local support provided for the child's parents
- approval for funding.

8.1 Prior to the appointment at the clinic

Before the visit to the hospital or clinic for assessment, the child's parents must be provided with information on the assessment procedure and the tests that may be carried out. It is essential to identify the most appropriate communication methods for use with the child and their family.

8.2 The assessment

The bone anchored hearing aid service must work closely with the child and their parents and involve them in every step of the procedure (Graham et al., 2007).

The bone anchored hearing aid team has a duty to ensure that the child, young person and family are fully involved in the assessment process. As part of the assessment, they must be given realistic expectations regarding the potential outcomes. To enable a comprehensive overview, a number of different multidisciplinary assessments will need to be carried out which may take some time to complete. Parents must be made aware of how frequently their child will need to attend hospital appointments if they proceed to have a bone anchored hearing aid, both during the assessment phase, the surgical phase, and post-surgery.

QS19

The child and family must receive information relating to the bone anchored hearing aid assessment before the assessment date.

A coordinated approach to multidisciplinary assessment will help to reduce disruption to family life and avoid duplication of hospital appointments. Joint appointments should be arranged whenever possible. There must be effective liaison with other specialist paediatric multidisciplinary teams, so that children

attending other clinics at the same hospital can have linked appointments wherever possible. The multidisciplinary team will work closely together with the child and their parents and will share information and outcomes with all those in the team. This will avoid duplication of case history and information gathering. A coordinated approach to assessment will ensure that all members of the team, local professionals and the child and the family, share information and outcomes. This should include the use of parent observations, recording the development and progress of their child, and the impact of their child's aiding on these.

QS20

Multidisciplinary assessment of the child by the bone anchored hearing aid team must include information on a range of areas including:

- speech and language and communication development
- play, early social skills and emotional development
- hearing aid use and benefit.

A detailed assessment should be completed within the current national referral-to-treatment waiting time targets set by each government. At the time of printing the assessment waiting time is 6 weeks in England. The referral-to-treatment waiting times are 18 weeks in England (www.18weeks.nhs.uk), 15 weeks in Scotland (www.scotland.gov.uk), 26 weeks in Wales (www.wales.gov.uk) and 13 weeks in Northern Ireland (www.dhsspsni.gov.uk). However these are likely to change throughout the life of this document and there may be variation based on shorter local Strategic Health Authority or Trust targets. Other factors such as age at referral and additional needs may necessitate a longer assessment. Parents may ask for additional time within the waiting time target pathway to fully consider the options for their child and pause the assessment process.

Commissioners and funders must ensure funding arrangements are pre-agreed to avoid delays in meeting assessment targets.

QS21

The initial assessment must be undertaken within the timescales laid out in the aims and objectives of the bone anchored hearing aid team's employing Trust or national objectives including, where applicable, treatment or service targets.

8.3 The audiological assessment

As part of the assessment, the clinical scientist (audiology) or audiologist in the bone anchored hearing aid team will evaluate the child's hearing status, and their current hearing aid provision using age and development appropriate assessments to evaluate hearing and speech understanding. For very young children this may involve using questionnaires with parents and other care-givers, and other tools such as the *Monitoring Protocol for deaf babies and children* (Early Support, 2006b).

All tests performed on the child must comply with the recommended procedures of the British Society of Audiology (2003) and meet the guidelines laid down in published guidance and good practice, such as *Quality Standards in Paediatric Audiology*, Volume IV, NDCS, 2000; *Guidelines for the Fitting, Verification and Evaluation of digital signal processing hearing aids within a Children's Hearing Aid Service*, MCHAS, revised 2005; *Quality Standards for Paediatric Audiology Services*, Audiology Services Advisory Group, Scotland, 2009; *Transforming Audiology Services for Children with Hearing Difficulties and their Families*, Department of Health, 2008a; *Quality Enhancement Tool (QET) for audiology* <http://audiology.globalratingscale.com>.

QS22

Facilities must be available for:

- pure tone audiometry, including air and bone conduction
- soundfield audiometry, including air and bone conduction
- objective measures, e.g. ABR, including air and bone conduction
- otoscopy
- unaided and aided speech discrimination testing in quiet and noise.

QS23

Testing must be carried out to professionally accepted protocols and procedures (British Society of Audiology, 2003; BS EN ISO 8253-1 and 8253-2, 1998).

Audiological testing must be performed in audiometric test rooms to (BS EN ISO 8253-1,1998) standards for acoustic testing methods suitable for children.

All equipment must be calibrated at least annually using acceptable methods on equipment whose own calibration is traceable to national standards, in accordance with BS EN ISO 8253-1 (1998).

Rooms provided for the above testing must conform to standards outlined in the Building Note 12 (Department of Health, 1993).

Equipment must be no more than five years old.

The assessments may be audio and video recorded, with appropriate parental consent.

QS24

The clinical scientist (audiology) or audiologist will discuss the results of their assessments with the child and the family.

8.4 The speech, language and communication assessment

It is the responsibility of the speech and language therapist to assess the child in a number of settings, such as within the clinic, the child's home or at school. Assessment will be carried out in the preferred mode of communication. The assessment of communication skills and the development of spoken language may take the form of observation, subjective description and objective evaluation of hearing, spoken and sign language development.

The assessment procedure will take into account the age, hearing status and case history of the child. The assessment will include receptive and expressive skills in spoken, signed and written language form including:

- airstream mechanisms
- voice
- resonance
- phonetic and phonological analysis
- vocabulary level
- syntactic analysis
- semantic and pragmatic aspects of communication
- social skills.



QS25

The speech and language therapist will discuss the results of their assessments with the child and the family.

8.5 The medical assessment

The ENT surgeon is responsible for assessing the child's general medical health. This assessment will be taken into consideration when making a decision regarding the suitability of a bone anchored hearing aid and will be discussed with the child, young person and family. If the referring team has not established the aetiology of the child's hearing loss, the ENT surgeon may undertake further investigations as part of the assessment. The ENT surgeon may also request a developmental assessment for the identification of any additional disability.

The ENT surgeon is responsible for assessment of and guidance to the family of the most suitable placement of the implant. Considerations will include:

- physiological factors, such as in the case of complete aural atresia, or children with craniofacial abnormalities
- future procedures, such as placement of implant to allow future reconstructive surgery. Consultation with the reconstructing surgeon provides invaluable input into choosing the optimal site
- positioning of the sound processor to avoid contact with the pinna
- head protection to allow use of helmets for sporting activities etc.
- cosmetic aspects.

Some of these responsibilities may be shared with an audiovestibular physician depending on local procedure.

8.6 Imaging

An X-ray is recommended as part of the surgical planning process for children to help assess bone thickness and density (Oticon Medical, 2009b).

It is generally not necessary to undertake CT scanning of the child pre-operatively or as part of the assessment process, unless there is any other pathology suspected.

8.7 Ophthalmic assessment

Optimum vision is important for deaf children (NDCS and Sense, 2009). Therefore, the bone anchored hearing aid service, as part of the assessment process, must ensure that the child's vision has been assessed, or ensure that the child is referred to the ophthalmology department as appropriate.

See *Quality Standards: Vision care for deaf children and young people* (NDCS and Sense, 2009) for more information on ophthalmic assessment for deaf children.



8.8 Aetiological investigations

If the referring team has not established the aetiology of the child's hearing loss, the ENT surgeon or audiovestibular physician may undertake further investigations as part of the assessment.

8.9 Multidisciplinary and multi-agency working

Collaboration will establish a basis for future cooperation and help to develop an effective relationship between the child, the child's family, local professionals and the bone anchored hearing aid team.

“Where services are well coordinated, families participate in the development of a cumulative understanding of their child’s needs and receive:

- relevant information from a number of different perspectives
- reassurance that needs are recognised and taken seriously by relevant agencies
- input on particular aspects of their child’s development which takes note of other relevant factors in the situation
- consistent messages
- a focus on their child’s abilities as well as impairments
- well coordinated practical help
- continuity of care”

(Department for Education and Skills and Department of Health, 2003).

The designated bone anchored hearing aid team member (usually the key worker) will ensure the child’s local professionals have the knowledge and skills necessary to provide detailed information about equipment and the impact a bone anchored hearing aid will have on the child and their everyday life. This will include information on:

- the care and maintenance of the aid and the surgical site
- expectations
- evaluating the child’s level of functioning in everyday situations.

Where the local services do not yet have this experience, the bone anchored hearing aid service will arrange ongoing training and support to local professionals and may arrange to visit the child’s home and education establishment for joint assessment.

9. The outcome of the assessment



The child and family will be invited to attend and contribute to the multidisciplinary clinic, where the outcomes of the assessment are discussed. These outcomes will be recorded on a bone anchored hearing aid patient profile or similar (for example, see Appendix 3). During the clinic, a decision will be made as to the suitability for the child, and the appropriate timing for the surgical intervention.

Children and young people have a right to be involved in decisions about their care (Department of Health, 2009). Communication should be at a level and method appropriate to their stage of development and degree of understanding. They must be given sufficient time to fully understand the short- and long-term implications of having a bone anchored hearing aid.

QS26

The outcome of the assessment must be communicated to the child and family within the multidisciplinary clinic. A written report and any further information must be sent within three weeks of the final assessment.

QS27

If the outcome of the assessment demonstrates that the child would not benefit from a bone anchored hearing aid, a report must be sent within three weeks to the local audiology and education services, the referrer, and to the child's family regarding the outcome of the assessment. The report must include:

- 1) the reason why it is considered unsuitable or declined at this time
- 2) recommendations for current hearing aid provision
- 3) recommendations for future management, if considered necessary.

QS28

Following the multidisciplinary clinic, a written report and further information must be sent within three weeks to the child's referrer, their GP, local health and education services and any other professional identified during the assessment process as providing support to the child. This report will advise these recipients of the outcome of the assessment and of the family's decision.

9.1 Consent

Children, young people and parents need to be fully informed before they can decide whether to consent to, or refuse, treatment. Information should cover what the treatment will involve, benefits and risks, immediate and long-term implications of not having treatment, what alternatives may be available, and who will be administering the treatment (Department of Health, 2001).

While success rates for bone anchored hearing aid surgery are very high, unexpected situations intra-operatively and post-operatively may occur. The family must be informed of all complications related to safety and effectiveness prior to surgery. In addition to complications seen in all age groups, particular issues for children include:

- bony overgrowth – the potential for bony overgrowth around the implant increases in children implanted at a very young age.
- inflammatory reactions – in some teenagers, predominantly males, an inflammatory reaction occurs around the abutment, which has difficulty settling down and sometimes results in complete overgrowth of the abutment by soft tissue, requiring soft-tissue revision surgery.
- implant loss – there is an increased rate of primary and traumatic implant loss attributable to children's thinner skulls.
- soft tissue complications – are also slightly higher in children, and in those with concomitant developmental delay.

(Cochlear Bone Anchored Solutions AB™, 2008b)

9.2 Establishing funding commitment for long-term NHS care

The long-term commitment both in healthcare needs, graduation to an adult service and funding must be carefully organised (Graham et al., 2007).

The long-term funding commitment by the NHS must include the ongoing costs of staff involved in the child's care. It must also cover the upgrading of the device (approximately every three years), the replacement in the case of device failure, loss, irreparable damage, repairs of equipment, and provision of accessories.

QS29

There must be an agreed commitment by the funding authority for the long-term support of the child.

9.3 The treatment or management plan

QS30

Each child must have a treatment or management plan that is regularly reviewed and developed. The plan must be developed with the child or young person, their parents and key professionals supporting the family. It must be circulated to the referrer, the child's GP, and all involved professionals.

9.4 Bilateral bone anchored hearing aids

The value of bilateral application of bone anchored hearing aids has been debated because of the limited attenuation of sound vibrations in the skull. It is believed that the bone anchored hearing aid will also stimulate the opposite cochlea, which is known as cross hearing (Stenfelt, 2005).

However, a number of small studies on young adults using bilateral devices show that they were able to perceive interaural time and intensity differences to the same extent as the controls with normal hearing. Other benefits for children and young people include still having one working sound processor should the other become faulty, and simultaneous surgery instead of needing two procedures if a second bone anchored hearing aid is considered later. Bilateral hearing aid fitting has been the standard solution for young hearing impaired children for many years (Northern and Downs, 1991; Yoshinaga-Itano, 2003). Thus, bilateral bone anchored hearing aid fitting is advocated in children with bilateral conductive hearing loss. There is also strong evidence that even when the second bone anchored hearing aid is fitted later in life, bilateral application is effective (Snik et al., 2008).

10. Surgery and fitting the sound processor to children and young people

In all cases general anaesthesia is used for children. The two-stage procedure is generally recommended for children. The two-stage procedure is recommended for all children with bone <3mm thick. For children with bone thickness of 3-4mm, factors such as patient age, developmental delay, bone quality, and distance from the hospital may warrant the more conservative two-stage procedure. Children with cortical bone thickness >4mm (typically over the age of 9-12 years of age) can be considered for one-stage surgery. In children, surgery should be a two-stage procedure with at least three to six months between the first and second stages while osseointegration takes place.



Hearing loss in the early years is known to impact on listening and spoken language development. Loss of use of the fixture can lead to the need for further surgery and an additional three to six month delay while osseointegration takes place. Children have an increased risk of damage to the fixture through trauma, poor bone quality, infection, or lack of osseointegration. It is therefore recommended that children with sufficient bone have a second 'sleeper' implant (Zeitoun et al., 2002).

For further guidance see: *Baha® Surgery Guide* (Cochlear Bone Anchored Solutions AB™, 2008) and *Surgical Manual* (Oticon Medical, 2009).

QS31

In children there should be two fixtures implanted unless there is insufficient skull bone to do so.

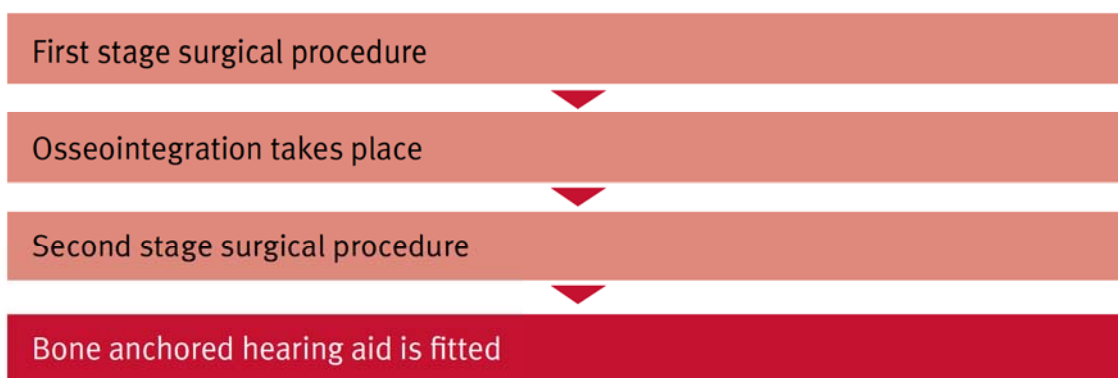
Both procedures should, where possible, be undertaken as day cases (Department of Health, 2003). Surgery should be performed in line with the recommendations of the manufacturer and evidence-based practice (Papsin et al., 1997).

QS32

The operating room staff must have attended a recognised course, and received on-site training, in the placement of the implantable fixture and abutment.

Figure 3a – Surgical procedure and bone anchored hearing aid fitting

In children:



In young people:



10.1 Nursing care prior to surgery, during surgery and post-operatively

The liaison nurse will be available for telephone contact prior to surgery, offering the child and family support and guidance. It is the responsibility of the liaison nurse to refer them to other team members if they are concerned or anxious about any aspect of the surgical procedure or their care. They should seek the help of other personnel, such as play specialists who can provide, for example, expertise for children who face operative procedures, when necessary.

QS33

The liaison nurse will meet with the child and family either at their home or at the hospital, as appropriate, at least two weeks prior to each operative procedure. They will provide the child and family with information regarding hospital admission and pre- and post-operative care (for example see Appendix 4).

QS34

On the day of admission to hospital, and at each stage of the surgical procedure, the liaison nurse will visit the child and family to offer them support during their hospital stay.

The child should be well enough to return to school within a few days of the surgical procedure(s) taking place. The family should be instructed to ensure that

no water is allowed to come into contact with the wound until the healing cap and dressing have been removed and the wound has healed.

The child and family must be instructed that the traditional bone conductor or bone anchored hearing aid on a soft headband must not be placed over the fixtures during the healing period and while osseointegration is taking place.

10.2 First stage surgical procedure in children

QS35

The child must leave the hospital with a date for the second procedure decided and agreed with the family. The date of the second operation should be notified to all team members, the child's GP, the referrer and local services.

After the first stage procedure, and within five working days post-surgery, the liaison nurse must contact the family to answer any questions or concerns that the family may have.

10.3 Second stage surgical procedure in children

QS36

The second stage surgical procedure must not take place before osseointegration is complete (approximately three to six months).

The surgeon will choose one of the fixtures. The unused fixture will act as a 'sleeper' for future use should anything inadvertent happen to the chosen fixture.

10.4 One-stage surgical procedure in young people

In some young people, the clinician/surgeon may choose to carry out a one-stage surgical procedure when both fixture and abutment will be placed during the same surgery.

For further information on appropriate one-stage candidature, see: *Baha® Surgery Guide* (Cochlear Bone Anchored Solutions AB™, 2008) and *Surgical Manual* (Oticon Medical, 2009).

QS37

Regardless of whether there is a one- or two-stage surgical procedure, the implant must not be loaded during the period of osseointegration.

10.5 Seven to ten days post-operatively

The liaison nurse will see the child seven to ten days post-operatively to remove the stitches (if necessary) and dressings, and clean the surgical site.

The liaison nurse will demonstrate proper care of the wound and abutment site. The liaison nurse must emphasise to the child and parents the procedures they should follow if problems occur with the abutment site.

QS38

The liaison nurse must provide the child and family with clear verbal and written instructions for wound and abutment care. The liaison nurse will provide the family with a soft cleaning brush after the one-stage procedure, or following the second stage of the two-stage procedure.

10.6 Post-operative care and out of hours support

If the child or parent is concerned, the liaison nurse, audiologist and/or coordinator will be available for telephone contact.

QS39

The child and family must be given the name and telephone numbers of the liaison nurse, audiologist and/or coordinator in order that they can contact the team if they have any concerns.

10.7 Discomfort, unexplained changes or swelling of the surgical site

Any child who experiences discomfort and unexplained changes, or any swelling of the surgical site, must have direct access to the appropriate ENT professionals. An emergency appointment may include medical and/or audiological staff as appropriate.

QS40

The child and family must have emergency access to an audiological and ENT specialist who has an understanding of the surgery and the potential complications.

10.8 Fitting the sound processor

Following an initial check by the surgeon or specialist nurse that the wound and site has healed and osseointegration has taken place, the clinical scientist (audiology) / audiologist will fit the sound processor.

The sound processor must not be fitted before the fixture has been fully osseointegrated.

QS41

The fixture must be allowed to osseointegrate for a period of at least three to six months (depending on the child's own bone thickness and quality) before the sound processor is fitted. During this period the fixture must not be loaded.

It is essential that the abutment is firm (see section 11.1). The liaison nurse and/or the clinical scientist (audiology)/audiologist have a duty to ensure that the family understands the serious implications of an unstable abutment.

QS42

When the sound processor is fitted, the abutment must be cleaned and checked and the patient's or parent's ability to manage this procedure must be confirmed.

At the time of fitting, the clinical scientist (audiology)/audiologist is responsible for ensuring that the child (where relevant) and the family are familiar with the controls and how to connect and disconnect the sound processor from the abutment. Availability and potential use of additional accessories should also be explained at this time.

The audiologist should reinforce the procedure the family must take if problems occur with the sound processor or abutment site.

QS43

The child, family and carers must be provided with clear written instructions on:

- how to use the sound processor
- good hygiene of the abutment site
- how to care for the equipment
- maintenance of the sound processor.

This will include the manufacturer's written material and the user's handbook.

For small children, a safety line, which attaches between the sound processor and the child's clothing, can be fitted to minimise the risk of loss.



10.9 Records of measurements

Measurements should be made using a skull simulator. Sweep measurements should be taken of:

- full on gain (FOG) 50 dB input
- output saturated power 90 dB input
- frequency response at user volume setting 65 dB input
- total harmonic distortion (THD) 70 dB input at user volume.

QS44

A record must be taken of the performance measurements of the sound processor at the time of issue to the child. It must be performance checked against the above records at intervals of no longer than three months.

Audiological records and measurements must be available on request and, with parental consent, to other parties who may have a legitimate reason for using them, for example by the teacher of deaf children.

11. Ongoing evaluation and care

11.1 Regular inspection of the abutment

The abutment must be inspected on a daily basis. It is crucial that the child and family contact the bone anchored hearing aid service if the abutment does not feel firm to the touch.

11.2 The surgeon's responsibility for ongoing care

It is essential for the surgeon to see the child at appropriate times in order to check on the health of the soft tissue around the abutment site and to assess the overall progress of the child. Providing there are no identifiable problems, this contact should be at six month intervals during the first year and subsequently once per year until transfer to the adult service. The surgeon will need to discuss new technological developments and alternative treatments with the parent and child as they arise.

QS45

The surgeon must see the child, post-surgery, at least at six month intervals during the first year, and then annually.

Regulation of medical devices requires that the manufacturer report adverse events to the appropriate authorities. Should such an incident occur, contact the implant manufacturer soon as possible (Cochlear Bone Anchored Solutions AB™, 2008b; Oticon Medical, 2009b).

QS46

The bone anchored hearing aid service must have policies and procedures in place to ensure that a loose abutment site is tightened within 48 hours of the problem occurring or being reported by the family. It is the responsibility of the bone anchored hearing aid service to ensure that the family understands these procedures.

11.3 The clinical scientist (audiology)/audiologist and the speech and language therapist

The audiologist and the speech and language therapist will see the child and assess their progress at least at three month and then six month intervals during the first year, and subsequently annually. A subjective assessment should take place six months post-operatively to compare with the results of those undertaken during the assessment phase. The results will help ascertain the benefit of the bone anchored hearing aid in relation to previous hearing aid provision. For very young children this may involve using questionnaires with parents and other care-givers, and other tools such as the *Monitoring Protocol for deaf babies and children* (Early Support, 2006b).

QS47

Information on the results of all assessments will be sent to the child and family, their GP and local services, within three weeks of completion.

11.4 Device failure

If the aid does not appear to be working correctly, the child, parent or young person should follow these procedures:

Figure 4a - Device failure: information for the user or carer

If the device is crackling or there is a buzzing sound:

Change the battery

If it is still crackling or there is a buzzing sound

Contact the bone anchored hearing aid service

If the sound processor does not work at all:

Check the position of the volume control, program button and on/off switch

Change the battery

If it still does not work

Contact the bone anchored hearing aid service

QS48

Following loss and/or damage, the bone anchored hearing aid service must provide all replacement equipment, leads and accessories, until the child transfers to the adult programme.

11.5 Loan equipment

The loan aid should be of the same type. The loan aid must have the same audiological settings as the child's regular aid.

QS49

The bone anchored hearing aid service will issue a loan aid or despatch replacements within 24 hours of notification being received by the team that a fault has occurred.

11.6 Safety guidelines

There are several precautions that must be observed by bone anchored hearing aid users. For example, the sound processor should not be worn during:

- direct contact sporting activities
- medical treatments such as MRI
- exposure to water (as the sound processor is not waterproof)
- exposure to extreme heat (e.g. hairdryers).

It is important to provide parents and young people with advice about helmets and other precautions for sporting activities to minimise traumatic events, particularly in patients with underlying developmental delay.

Safety guidelines must be given to the child and family as part of the assessment procedure, and also when the child receives their sound processor. In addition, updated safety information and precautionary guidelines must be given on a regular basis to the parent and any carers in local services, such as the child's school.

QS50

Safety guidelines and instructions must be issued to the child, young person and family, and other carers of the child, at the time the sound processor is fitted. They must be regularly updated and distributed.

11.7 Battery safety

It is the responsibility of the bone anchored hearing aid service to ensure that the child (where relevant) and the family understand that all batteries should be stored safely and that used batteries should be disposed of in a safe manner. The family must be provided with clear guidelines as to what action they should take should the child or anyone else swallow a battery (NDCS, 2008).

11.8 Personal FM systems

“Every child with a hearing loss should be considered as a potential candidate for provision with a personal FM system as part of their amplification package, in line with a written policy on candidacy.” (NDCS and UK Children's FM Working Group, 2008).

All children fitted with a bone anchored hearing aid should have the opportunity to trial and assess a personal FM system when appropriate. The trial should take place at the earliest opportunity. It is the responsibility of the child's local

education service to provide the personal FM system. However, there should be consultation between the professionals in both teams to ensure compatibility between the FM system and bone anchored hearing aid and their appropriateness in meeting the individual's needs.

QS51

A personal FM system will be fitted in consultation between the bone anchored hearing aid team audiologist and the local education service.



At the time of writing there is no widely available equipment that enables the set up of a personal FM system with a bone anchored hearing aid. It is advised that speech testing is used to assess performance with and without FM, and that professionals be guided where possible by user feedback about preferred receiver level.

The child should be able to trial the FM system for a minimum of three months. If it is proven to be beneficial to the child by parents and/or educators and long-term use is indicated, the FM system should be provided and maintained by the child's local education service.

For further information see: Quality Standards for the use of personal FM systems: Promoting easier listening for deaf children (NDCS, 2008) and accompanying Good Practice Guide.

11.9 Routine maintenance and monitoring of the bone anchored hearing aid and/or FM combination

Parents and teachers (or a responsible adult) of young children must be trained and take responsibility for simple maintenance checks of the sound processor or sound processor/personal FM system combination. These should include both visual checks of the equipment (including any leads and adaptors) and subjective listening checks. The nominated persons should be issued with accessories to enable them to carry out these tasks (e.g. BAHA listener www.connevans.com).

QS52

Subjective checks must be performed regularly on the sound processor/FM combination and whenever a part of the system is changed. (NDCS and UK Children’s FM Working Group, 2008).

The interpretation of ‘regularly’ is defined in the light of different contexts and more detail can be found in the Good Practice Guide accompanying the *Quality Standards for the use of personal FM systems* (NDCS and UK Children’s FM Working Group, 2008).

11.10 Other assistive devices

In liaison with local education and social care services, and throughout the child’s development, the ongoing management of the child must include consideration of appropriate accessories and other assistive listening devices.

Technology Test Drive is a service run by NDCS that offers deaf children and their families throughout the UK the opportunity to borrow personal FM systems and other equipment to assess the potential benefits in their own home and at school. See www.ndcs.org.uk for more information.

QS53

It is the responsibility of the clinical scientist (audiology)/audiologist to recommend appropriate assistive devices. They must work closely with local professionals from health and children’s services and the voluntary sector to ensure that appropriate assistive devices are provided for the child’s use.

12. Transition of care

The bone anchored hearing aid service must have policies in place that cover arrangements for:

- transition between services
- the transfer of notes (electronic or paper)
- access and direct self-referral systems.

The bone anchored hearing aid service must provide detailed written information to the parent or young person informing them what they should do if problems occur during transfer between services.

QS54

The paediatric bone anchored hearing aid team must have clear written protocols detailing transition of care.

12.1 Transition to an alternative paediatric bone anchored hearing aid service

When a child or young person needs to transfer to an alternative service, it is the responsibility of the existing service to ensure that smooth transition takes place, and that the child and family fully understand the process involved (Department of Health, 2009).

The young person and family should be informed in writing of details relating to the new service. The accepting service must be provided with the information listed in 12.2.

QS55

The existing service provider will need to arrange an appointment with the new service prior to transfer and the child, family and/or young person notified in writing.

12.2 Transition to adult care

“A transition programme between paediatric and adult-oriented health services must provide co-ordinated, uninterrupted healthcare” (Department for Education and Skills and Department of Health, 2006).

Young people with long-term conditions need preparation for the move from a paediatric to an adult service. All young people with ongoing health needs must have a plan developed with them for the transition of their care to adult services (Department of Health, 2003).

QS56

Each young person must have a transition plan which includes their own input and that of their family and the multidisciplinary team.

At the agreed age, arrangements must be in place for the smooth transfer of ongoing care of the young person. A system must be in operation for the transfer of notes. A clear transfer policy must include a strategy for maintenance of the bone anchored hearing aid equipment, identified age of transfer (and how this might change depending on circumstances), and services for young adults in further and higher education.

Details given to the adult programme must include the following information and copies of this information must also be provided to the young person/family:

- date of first appointment at the adult programme
- dates of surgical procedures
- surgical and post-fitting complications
- audiological test results
- attendance record
- list of local services working with the young person/family
- ongoing recommendations.

It is the responsibility of the paediatric bone anchored hearing aid team to ensure that the young person understands the implications, policies and procedures involved when transferring from their service to an adult service.

The paediatric service must make an appointment with the adult bone anchored hearing aid programme before the young person is discharged, and notify the young person in writing that this appointment is to take place. The local audiology service and GP will be notified in writing of this transfer and of the new appointment date with the adult programme.

QS57

The paediatric programme will request an appointment for the young person to attend the adult bone anchored hearing aid programme to take place six months post-discharge.

QS58

All relevant appointments with the new programme must be arranged by the existing service provider prior to transfer, and the young person and family notified.

QS59

The adult bone anchored hearing aid programme must acknowledge receipt of the transfer information in writing to the paediatric programme, the young person and family and the young person's GP, within two weeks of receipt.

In addition, the young person and parent must be provided with the following information from the adult service before completion of the transfer:

- written advice and information about their transfer
- information about the clinic and contact details, address and telephone numbers etc
- information about local social care services, and contact details
- information about, and contact details of voluntary agencies and support groups
- information on the regularity of appointments and the importance of attending the clinic.

During the first months following transition to an adult service, it is important that the young person is encouraged to contact the paediatric team to discuss any issues of concern regarding their transfer of care.

For more information on transition, see *Quality Standards and Good Practice Guidelines: Transition from paediatric to adult services* (NDCS, 2005).

13. Service evaluation and audit

Multidisciplinary child-specific clinical audits should be undertaken in all specialities in which children are treated (Department of Health, 2003).

The NHS Constitution (Department of Health, 2009) states that “NHS services must reflect the needs and preferences of patients, their families and their carers. Patients, with their families and carers, where appropriate, will be involved in and consulted on all decisions about their care and treatment.” (Department of Health, 2009).

QS60

The bone anchored hearing aid service will carry out an annual audit to evaluate the effectiveness and family-friendliness of the service, as well as identifying and implementing changes to improve service provision. As part of this audit, the views and experiences of users, i.e. children, young people and families, must be gathered.

13.1 Complaints procedure

It is the responsibility of the bone anchored hearing aid service to ensure that the child and family understand the standard hospital complaints procedure, should they wish to make a complaint.

14. Appendices

Appendix 1: Glossary

Abutment: the term used to describe the skin-penetrating device that is attached to the implanted fixture. It is left in place to facilitate fitting and removal of the sound processor.

Air conduction: a term used to describe the transmission of sounds through changing air pressures in the ear canal. Conventional hearing aids deliver sounds to the ear canal using air conduction.

Audio adaptor: a device acting as an interface between the sound processor and an auxiliary sound source, such as a TV, personal stereo or personal FM system.

Baha®: a registered trade name of Cochlear Bone Anchored Solutions AB™. It is made up of three parts which together form a system where contact with the skull is maintained by surgical implant.

Bilateral: both sides of a structure, for example when both ears are receiving signals there is said to be bilateral stimulation.

Binaural: involves the use of both ears for listening.

Bite bar: a tool which may be used in the assessment of bone anchored hearing aids. With a sound processor attached the bite bar is held between the teeth enabling bone conduction to take place via the jaw.

Bone anchored hearing aid: used to refer to a range of bone conduction hearing aids where contact with the skull is maintained by surgical implant.

Bone conduction: a term used to describe a method of hearing sound primarily without utilising outer and middle ear mechanisms, rather than hearing sounds produced by changing air pressures in the ear canal (air conduction).

Bone conduction is achieved by the direct stimulation of the cochlea by the transmission of vibrations from a transducer which is in contact with the skull. The transducer itself vibrates in sympathy with the acoustical waveform of the incoming sounds. The method of contact of the vibrating transducer with the skull varies. The transducer can be held in place by means of a spectacle arm, sprung headband, an elasticated headband, or attached to a bite bar and held between the teeth.

Canal: see External auditory meatus.

Cochlea: the snail shell shaped part of the internal ear, where sound vibrations are converted into nerve impulses.

Concha: the deep depression or bowl in the outer surface of the pinna, leading to the external auditory meatus.

Contact coupled transducer: transducer in contact with the skin.

Direct audio input (DAI): a facility found on many hearing aids that allows sound (in the form of electrical signals) to be fed directly into the aid, bypassing the microphone. DAI can be used to connect the hearing aid to a personal FM system or some other sound source, such as a personal stereo system or language lab.

Directional microphone: emphasises the sound coming from a specific direction.

External auditory meatus: the ear canal running from the tympanic membrane (eardrum) to the outer ear on the outside of the head.

Fixture: a small titanium implant placed in the skull bone behind the ear.

FM system (personal FM/radio aid system): widely used by deaf children in schools. FM systems comprise a radio transmitter and microphone, worn by the speaker, and a radio receiver worn by the child/young person. The receiver is connected to the hearing aid or sound processor using DAI. FM systems are intended to improve the signal-to-noise ratio for the child, by reducing problems caused by background noise, reverberation and the distance between the child and the speaker.

Microtia: congenitally abnormally small ears.

Occlusion: where the ear canal is blocked, or partially blocked, for example by the presence of an ear mould.

Osseointegration: the process by which bone cells grow onto titanium to form a solid bond.

Otitis media: infection of the middle ear which may lead to hearing loss.

Percutaneous: through the skin.

Pinna: the visible cartilaginous outer ear.

Ponto: a registered trade name of Oticon Medical. A bone anchored hearing system made up of three parts where contact with the skull is maintained by surgical implant.

Skull simulator: the scientific instrument used to aid objective measurements of the performance of the bone anchored hearing aid system.

Soft headband: similar to a sports headband, but with a plastic disc to attach the sound processor, enabling it to act as a bone conduction hearing aid. It can be used to trial the sound processor, to wear the sound processor prior to surgery or post surgery before wound healing has occurred, or when the abutment is out of use, for example due to infection. Suitable for use by young babies.

Suppurative: pus present.

Telecoil: a plug-in unit that enables the sound processor to pick up audio signals from induction loop systems.

Transcutaneous: across the surface of the skin.

Transducer: a device that changes one form of energy to another: for example, sound into electrical signals (microphone), or electrical signals into sound (loud speaker), or electrical signals into vibrations (vibrating transducer).

Appendix 2a and 2b

Appendix 2a – Alphabetical listing of key professionals working with the child, family and the bone anchored hearing aid team:

Audiovestibular physician
Clinical scientist (audiology) or Audiologist
Educational audiologist
ENT surgeon
ENT nurse
Geneticist
Genetic counsellor
Paediatrician
Paediatric anaesthetist
Speech and language therapist
Teacher of deaf children

Appendix 2b – Alphabetical listing of professionals involved with the child and family who may need to contribute to the assessment and habilitation of a child with a bone anchored hearing aid (outside the immediate bone anchored hearing aid team):

Child minder
Class teacher
Cleft lip and palate team
Clinical psychologist
Communication support worker
Craniofacial team
Educational psychologist
GP
Health visitor
Maxillofacial prosthetist
Nurse (local)
Ophthalmologist
Radiologist
Respite staff
School nurse
Sign/spoken language interpreter
Social worker
Social worker for deaf people
Special educational needs coordinator (or adviser in Scotland)
Teaching assistant

Appendix 3: Sample patient profile

Sample patient profile

Child's name

Registration Number

Action	Yes or no	Comments
Information questionnaire received		
Full audiological assessment		
Full speech and language assessment		
Met another patient and family		
Contact made with local services		
Met with nurse re. admission and procedure		
Received information in own language		
Received written information		
Attended multidisciplinary clinic for decision		
Surgically suitable		
Consent given		
Funding agreed		
Date for first stage booked		
Date for second stage booked		
Wound check		

Expected date for sound processor fitting

Expected date for first review

Any other information

.....

.....

Appendix 4: Sample information leaflet

Sample information leaflet provided to children and families for the two-stage surgical procedure:

When your child has a bone anchored hearing aid fitted, it will involve surgery. This surgery is done in two stages. This leaflet will give you the information that will help you to understand what the surgery and admission to hospital means.

Stage one

Your child will be admitted to hospital on the day of the operation and they should be able to go home later the same day. This will be discussed with you prior to the operation. You are more than welcome to stay with your child during their stay in hospital.

Before the operation, nurses and doctors will see your child. If you have any concerns or questions please ask.

You are able to go with your child to the anaesthetic room until they are asleep, but if you feel you cannot go into the anaesthetic room a nurse from the ward, who your child knows, will be with them.

Once your child is asleep the surgeon is able to prepare for the operation. This may involve shaving a small amount of hair from the area. A cut is made behind the ear. This cut is about 5cm long.

The surgeon will then put two small titanium fittings (3-4mm long) into the bone and the cut is closed with stitches that do not need to be taken out – they will dissolve naturally.

After the operation – stage one

When your child returns from theatre they will have a bandage on their head. The nurses on the ward will explain how to remove this bandage at home the day after the surgery.

Your child will be given painkillers in theatre, but they may have a little discomfort for the next 24-48 hours. We recommend that you give regular paracetamol (Calpol®) as needed. Please make sure you follow the instructions on the bottle.

Going home – stage one

Your child should be able to go home later on the day of the operation. You will be given an appointment to come back to the hospital for the second stage of the surgery four months after the first stage. This time between the two stages of the surgery lets the fittings ‘knit’ into the bone. This is called osseointegration.

The wound – stage one

The stitches used are dissolvable at this stage, so they do not need to be removed. However, please make sure you look at the wound every day to make sure it is healing well. When looking at the wound the things to look for are:

- swelling
- redness
- discharge
- if your child has a temperature
- pain
- unpleasant smell.

Stage two

This stage is done four months after the first stage. Your child will be admitted on the day of the operation and should be able to go home later the same day. You are more than welcome to stay with your child during their stay in hospital.

Before the operation nurses and doctors will see your child. If you have any concerns or questions please ask.

You are able to go with your child to the anaesthetic room until they are asleep, but if you feel you cannot go into the anaesthetic room, a nurse from the ward, who your child knows, will be with them.

Under a general anaesthetic the cut made at stage one will be opened again. It is at this stage that the abutment is connected to the fixture through the skin. The surgeon will thin the layers of tissue under the skin. This is done so that the skin lies very flat on your child's head. Also by doing this, it removes the hair follicles so that hair will not grow around the abutment site. The surgeon closes the wound and may use stitches that will need to be removed. A dressing soaked in antiseptic cream is then put around the abutment site – we call this dressing 'ribbon gauze'.

After the operation – stage two

When your child returns from theatre they will have a bandage on their head. The nurses on the ward will explain how to remove this bandage at home the day after the surgery.

Your child will be given painkillers in theatre, but they may have a little discomfort for the next 24-48 hours. We recommend that you give regular paracetamol (Calpol®) as needed. Please make sure you follow the instructions on the bottle.

Going home – stage two

Your child should be able to go home later on the day of the operation. You will be given an appointment to come back to the hospital. Your appointment will be for between one and two weeks after the operation.

The wound – stage two

When you remove the head bandage the day after the operation, you will see the ribbon gauze dressing which is held in place with a white plastic disc. This dressing is to be left in place until you return to the hospital for the stitches to be removed. If, however, the dressing starts to unwind, you may cut the end off with scissors. You may also be able to see the stitches and the wound. We advise you to look at the area every day to ensure that it is healing satisfactorily. You do not need to disturb the dressing though.

When checking the wound the things to look for are:

- swelling
- redness
- discharge
- if your child has a temperature
- pain
- unpleasant smell.

It is important to contact the bone anchored hearing aid clinic if you are concerned.

Care of the abutment site

When you come back to the hospital to have the dressing and stitches removed you will be informed about the daily care of the abutment site. It is essential that this area is cleaned every day. You will be given tips and written information about this when you come to the clinic.

What happens next?

You will be given an appointment by audiology for the fitting of the aid.

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Notes

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