

# The BAHA System: An option for treating hearing loss

## Introduction

Sound is transmitted to the inner ear for processing in two ways; air conduction and bone conduction. During air conduction, the principle method, sound is funnelled down the ear canal of the outer ear to cause vibration of the eardrum which in turn causes the small bones of the middle ear to vibrate. This vibration force is in turn transmitted to the cochlea, the organ of hearing, in the inner ear where sound vibrations are converted into electrical signals which are conveyed to the brain. During bone conduction sound is transmitted through the skull bone, directly to the cochlea, bypassing the ear canal and middle ear.

Fig. 1



Hearing loss is a common feature of Down's syndrome. It is estimated that 30-50% of individuals with Down syndrome have a hearing loss; most commonly a conductive hearing loss where sound is not transmitted very well across the middle ear bones to the inner ear. This is usually caused by Otitis Media with Effusion (the medical term for Glue ear). Glue ear is common in children with DS for a number of reasons; mainly because the Eustachian tube, which connects the middle ear space to the back of the throat and which equalises pressure, is poorly functioning. But other factors may also play a part in the common problem of glue ear. People with Down's syndrome have a small space at the back of their nose, poor muscle tone and low immunity. These problems have all been implemented in the causation of glue ear.

The conventional treatment for a conductive hearing loss is to provide hearing aids or to insert grommets (ventilation tubes) into the eardrum. However, hearing aids are not tolerated well by

children, particularly by children with Down's syndrome. In the very young it can be a real battle to keep the hearing aids in place. Grommets on the other hand can be helpful but again they have their problems. In children with DS, grommets tend to remain in place for a shorter period of time than in children without DS. They therefore have to be replaced more frequently and so necessitate further general anaesthetics. While waiting for reinsertion of grommets children with DS are often left with poor hearing. Also, it is often technically difficult for the surgeon to fit grommets because the ear canals are so narrow, another common feature of Down's syndrome. Therefore, many children are sadly left with no form of hearing amplification either because they will not tolerate hearing aids in their ears or because they cannot be fitted with grommets due to narrow ear canals or because they are waiting for reinsertion of grommets that have fallen out. Yet the evidence is clear that amplification of hearing loss, even if a minor loss, is essential if speech, language and communication skills are to be improved. The BAHA system is an amplification system that works in a different way.

## What is the BAHA system?

BAHA; Bone Anchored Hearing Aid; is a form of hearing aid that amplifies sound by conducting sound, through bone, directly to the cochlea in the functioning inner ear. The technology was first taken from implant dentistry and adapted to hearing aids. A small titanium fixture is implanted surgically into the bone of the skull behind the ear, where over a few months it knits (osseointegrates) with the living bone. A metal attachment called an abutment is attached to the fixture and the sound processor (the

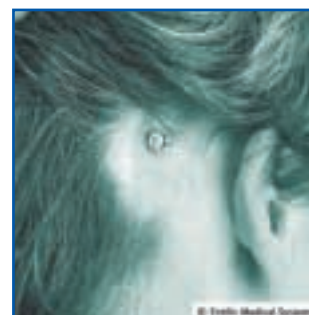


Fig. 2



Fig. 3

# in those with Down's syndrome

hearing aid) is clipped on to the abutment. The hearing aid can be worn at any time or taken off at any time (photo 2)

The BAHA system works on the same basis as a conventional bone conduction hearing aid (CBCA), a hearing aid attached to a steel spring headband

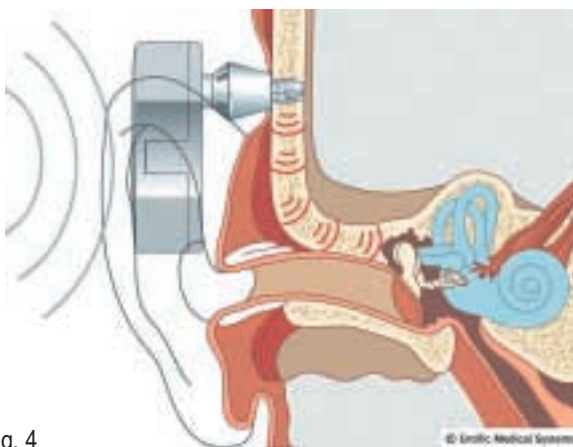


Fig. 4

similar to a hair band. However, the BAHA system is more comfortable than the headband. It also transmits sound better than the CBCA because sound is transmitted from the hearing aid receiver directly to bone without interference from hair and skin and then to the cochlea in the inner ear (fig.4). The BAHA system gives about 10-20 dB better amplification than the CBCA. The sound quality is very close to a conventional air conduction hearing aid.

The BAHA has been used in adults for many years who for some reason cannot wear ordinary hearing aids, usually because of chronic (meaning long - continued) discharging ears. In children they have been used in certain situations where children cannot wear ordinary hearing aids, for example children with missing or deformed ears. The BAHA system has been used to a small extent in the UK in individuals in Down syndrome, again mainly because of chronic draining ears as a result of chronic infection.

## Can the BAHA be used from any age?

Young children's skull bones are thinner and the bone softer than an adult's and therefore clinicians

recommend that you wait for the BAHA fixture placement until the child's skull is thicker and strong enough. This is usually after the age of 7 or 8. Often this is too late for children with DS who experience hearing problems at a younger age. But there is good news. The company that supply the BAHA system have introduced the BAHA Softband.

## What is the BAHA Softband?

The BAHA Softband is an elastic softband similar to a sweat band used in sports (photo 5). The BAHA sound processor clips onto the Softband via a connector disc sewn into the band. No surgery is required and the BAHA can be used immediately. The Softband can be used from a very early age and is used until your child is old enough to go through surgery for the fixture if they still need hearing aid amplification.

Fig. 5



## What are the advantages of the BAHA Softband?

Research at Manchester Children's Hospitals is ongoing as it is felt that children with DS will tolerate a BAHA Softband better than a conventional hearing aid. It has been demonstrated that once children get accustomed to the BAHA Softband they feel happy to continue to wear it. The advantage of its comfortable fit and the amplification it provides, allows children to wear their BAHA continuously and therefore obtain maximum benefit from their hearing aid.

The BAHA proper with fixture placement has been used for certain conditions where the wearing of conventional behind the ear hearing aids is not suitable. It may be that in children with Down syndrome who are old enough and who need repeated insertion of grommets or are unable to wear conventional hearing aids may benefit from this system.

## What does the BAHA system proper entail?

A minor surgical procedure, under general anaesthetic, is needed to place the fixture into the bone of the skull behind the ear. Sometimes the abutment is attached to the fixture straight away and brought out through the skin during the same operation. Sometimes the fixture is inserted under the skin and a second operation is performed 6 months later to pierce the skin and attach the abutment to the fixture. The decision to do the procedure in one operation or two is made by the surgeon and is dependent on the age of the child and thickness of the bone, among other factors considered. After the operation/operations the hearing aid is attached to the abutment. This usually occurs 6 to 8 months from the time the fixture is placed in the bone. The hearing aid is detachable and is taken off at night or when bathing. In all other aspects it is similar to a conventional hearing aid.

More information on the BAHA system can be got from the manufacturer's website or the author at the contact details below. You can also get further information on this system from your local ENT department, although not all hospitals provide this service and particularly not for children.



Conor models the BAHA Softband

## Summary

Hearing is a vital part of the child's learning process and it is therefore of utmost importance to start stimulation of the speech and linguistic development as early as possible. The BAHA system is an alternative method of amplification in those young children with Down's syndrome with hearing loss who do not tolerate conventional hearing aids and/or where placement of grommets is a poor solution, either because of problems of frequent reinsertion and general anaesthetics or because of technical surgical problems due to very narrow ear canals. The BAHA Softband is suitable for treating hearing loss in very young children with DS. The BAHA system with fixture placement is an option for treating hearing loss in the older child, teenager or adult with Down syndrome. The BAHA system is a safe, proven and predictable solution for hearing amplification and its use in individuals with Down syndrome should be considered more often. It is another option in our treatment of hearing loss.

## References

1. BAHA Softband-hear from the start pamphlet supplied from Entific Medical Systems
2. BAHA-hear the difference pamphlet supplied from Entific Medical Systems
3. Utilization of bone-anchored hearing aids in children. *International Journal of Pediatric Otorhinolaryngology* 58 (2001) 75-80

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