



Hearing Tests for Babies & Young Children

This factsheet explains how the hearing of newborn babies is tested and when and how hearing may be tested again at other times during childhood.

WHY IS THE SCREENING OF BABIES HEARING IMPORTANT?

In the UK, around 840 babies are born each year with a permanent hearing loss in both ears. If not identified early, a hearing loss can seriously hinder language acquisition and communication development and have a long term impact on educational achievement, confidence and social skills. On the other hand, research shows that with early identification of a hearing problem and appropriate support, a child can develop such skills at a similar rate to their hearing peers.

It is not easy to predict whether a baby will be born with a hearing difficulty. Some 90% of hearing impaired babies are born into families where there is no history of deafness.

For many years the first hearing check a baby received was at the age of seven or eight months. The test used, which was performed by health visitors, was the Infant Distraction Test (IDT). As the test relied on babies reacting appropriately to sounds, it was not very accurate and resulted in approximately 50% of babies with a hearing loss failing to be identified until eighteen months old, with a further 25% remaining unidentified at three years. A consequence of this was that a deaf child at age three had an average vocabulary of just twenty-five words whereas a child with normal hearing has a vocabulary of more than seven hundred.

The importance of early identification of hearing loss has been accepted for many years, but it is only in the last few that the technology has become available to objectively determine a child's hearing ability shortly after birth. This has led to the replacement of the Infant Distraction Test with Newborn Hearing Screening Programmes throughout the UK.

WHAT DOES NEWBORN HEARING SCREENING INVOLVE?

Newborn hearing screening uses two tests. The first test was developed in the UK and is called the Automated Otoacoustic Emissions Test (AOAE). It followed the discovery in the late 1970s that in response to sound heard by the ear, the healthy ear itself produces an 'echo' known as an otoacoustic emission.

The test involves placing a small ear-piece into a baby's outer ear which sends out gentle clicking sounds. The 'echo' responses are then measured by a computer and indicate if a baby has a functioning middle and inner ear (cochlea).

The test is performed by a dedicated newborn hearing screener in the first few weeks of life, often before a baby leaves the hospital, but sometimes at home or in a local clinic by a trained health visitor.

Parents remain with their baby while the test is carried out and it takes only a few minutes to produce the results. No participation is required from the baby, and they often sleep through the test unaware.

If the test does not show a clear response, it will be repeated. This does not necessarily mean they have a hearing loss as sometimes conditions at the time of the screening are not right; a baby may be unsettled or there may still be fluid in the ear canal from the birth.

If after the second AOAE a baby still does not show a clear response, they will be referred for a second type of test called the automated auditory brainstem response (AABR). This too can be performed whilst a baby is sleeping and generally takes between five and thirty minutes to perform.

The AABR measures activity in the brainstem (which processes sound signals on the route between the ear and the brain) in response to sounds and involves placing three small sensors on the baby's head and neck and headphones on the baby's ears. A series of clicking sounds is then played and a computer records the brain's response.

Where a baby does not achieve a clear response to the AABR screen, they will be referred to an audiologist for further hearing tests. The aim of these tests will be to diagnose the type of hearing loss and the severity of it.

If a baby is cared for in a neonatal intensive care unit or a special care baby unit for more than 48 hrs then they will receive both tests.

WHAT ARE THE BENEFITS OF NEWBORN HEARING SCREENING?

With the new method of hearing screening, a child with a permanent hearing loss can now be identified much earlier, the average age being two months old. This means a child can start receiving appropriate support within the first six months of life.

WHAT HAPPENS IF THE TESTS IDENTIFY A HEARING LOSS?

If a baby is found to have a permanent hearing loss, an audiologist will explain the degree of deafness and discuss appropriate management options with the family. These may include the fitting of hearing aids or cochlear implants and the provision of early intervention support.

In some cases it may be possible to identify the cause of the hearing loss. For example, many cases of permanent hearing loss occur because of genetic changes that have been passed on from one or both parents. Research has so far identified a number of genetic mutations that cause deafness. For more information please request a copy of the Deafness Research UK factsheet 'Genetics and Deafness.'

Alongside audiologists and doctors, there are a number of other professionals who work with families where there has been a diagnosis of permanent hearing loss. These include teachers of the deaf and speech and language therapists. If a parent would like to consider the option of cochlear implantation then their baby will be referred to a cochlear implant centre for initial assessment of suitability. With earlier identification of deafness, babies as young as six months old are now able to receive a cochlear implant.

For information about cochlear implants please request a copy of the Deafness Research UK factsheet on cochlear implants.

Sometimes a baby may be suspected of having a temporary hearing loss caused by a condition such as glue ear. In this case a baby's hearing may initially be monitored with hearing tests at regular intervals as this condition can clear up without any intervention. For further information, request the Deafness Research UK 'Ear Infections and glue ear in children' leaflet.

ARE OTHER HEARING TESTS CARRIED OUT IN CHILDHOOD?

A child will not have their hearing tested again until they start school unless there is cause for concern. A general developmental assessment is conducted by a health visitor when a child is around two years of age. Among other things, this checks speech development which can sometimes indicate a hearing problem. If this is suspected, the child's hearing will be checked at an audiology (hearing) clinic.

In some parts of the UK, children undergo another general assessment at the age of three. Where this is carried out, it will be arranged by the child's health visitor.

In the UK most children currently have a hearing assessment when they start school, known as the School Entry Hearing Screen (SES). Although in future this may be stopped, it involves a 'sweep test' which is a modified form of the most common method of hearing testing known as Pure Tone Audiometry (PTA). See the hearing test section below for further explanation. If there are any concerns following this screening a child will be referred to a local audiology clinic for further hearing tests.

As babies and children can develop or acquire a hearing loss, it is important that you think carefully about your child's hearing and speech and share any concerns you have with your health visitor or family doctor.

WHAT ARE THE SIGNS TO LOOK OUT FOR?

Symptoms of hearing loss in children are easily mistaken, but signs can be that the child:

- Doesn't react when called
- Appears inattentive or prone to daydreaming
- Listens to the TV at high volumes
- Talks too loudly
- Mispronounces words
- Becomes unsettled at school
- Is often tired, grumpy, frustrated or over-active

WHAT OTHER KINDS OF TEST MIGHT MY CHILD HAVE?

If a hearing loss is suspected and a child is referred to an audiology clinic some of the following tests may be carried out. A child identified with a hearing loss may have hearing tests repeated at intervals that enable their hearing to be monitored. If a child has hearing aids, this will enable an audiologist to ensure the hearing aids are giving maximum benefit.

- **Infant Distraction Test** –The child will sit on their carer's lap while a 'tester' stands behind them making sounds and another stands in front watching the child's reaction. This will only give a general indication of a hearing problem so further tests may be required if a hearing difficulty is suspected.
- **Visual Reinforcement Audiometry (VRA)** – This is generally used with children from the age of six months old until two or three years. It uses an audiometer, a machine used to measure hearing, to play sounds of different volumes and frequencies through loudspeakers. When a child is at first presented with a sound, they are encouraged to respond and turn towards the source by being presented with a visual reward such as a toy lighting up.

- After this process is repeated a few times and a child has associated the identification of a sound with a visual reward the test can be used to identify the quietest sounds a child can hear. It can also be used with small earphones to test each ear individually.
- **Play Audiometry** – This may be used with children from around the age of two and a half years. It again uses an audiometer to play sounds through a loudspeaker or headphones. A child is shown how to respond to a sound they hear by performing a simple task such as placing a peg in a board. They are then presented with further sounds at different volumes and frequencies.
- **Pure Tone Audiometry** – This can be used with children over the age of three years. Sounds are played through headphones and the child is asked to respond when they hear them, for example by pressing a button. In the case of the school entry ‘sweep test’, this checks whether a child can hear four frequencies (high to low) at a set level of loudness. Most children with a severe or profound hearing loss will already have been identified, but the test is useful to pick up progressive deafness, which may not have been apparent before, as well as mild or one-sided problems. The test can also help identify children with glue ear, which causes temporary hearing loss.
- **Bone Conduction Audiometry** – Sometimes the above audiometry tests are also carried out using a small vibrating device placed behind a child’s ear so that sound can be transferred through the bone directly to the inner ear. By comparing the results of these tests it is possible to see whether a hearing loss is due to a middle ear or inner ear problem.
- **Speech discrimination test** – This test is used to assess a child’s ability to hear words without any visual information to help. Younger (pre-school) children are asked to identify pictures, toys or objects, while older children may be asked to repeat words or sentences. The words may be played through headphones or a loudspeaker, or spoken to the child. From this, the tester can identify the quietest level at which the child can correctly identify the words used.
- **Tympanometry** – This is a test which can be used on children of all ages to find out how flexible the eardrum is. For good hearing the eardrum needs to be flexible in order for it to pass the vibrations created by soundwaves through to the middle ear space, and from there into the inner ear. If the eardrum is rigid (e.g. if there is fluid ‘glue’ trapped behind it) it will not vibrate well enough to do this.

To perform tympanometry, a small tube with a soft rubber tip is placed at the entrance to the ear canal. The air pressure in the external canal is varied and the ability of the eardrum to move is measured. If there is little movement of the eardrum, this is an indication that the child is likely to have glue ear. However, the tester won’t be able to tell how well the child can hear so to check hearing, audiometry will be required.

WHAT RESEARCH HAS BEEN CONDUCTED INTO NEWBORN HEARING SCREENING?

Deafness Research UK has been at the forefront of hearing screening technology for over a decade, developing the pioneering otoacoustic emissions testing methods which are now revolutionising screening programmes worldwide.

- In 1988, Deafness Research UK funded the development of the ILO88 otoacoustic emission analyser, a milestone in the development of screening technology.
- Deafness Research UK funded an early pilot of the new screening programme in Wessex. The results gained from this study were of great value in developing plans for a nationwide screening programme.
- Deafness Research UK supported the production of guidelines on best practice to ensure that, as universal screening programmes were introduced across the UK, all families could expect the same high standards of service.

Deafness Research UK is continuing its work to improve newborn hearing screening. The existing methods for screening hearing in babies, as described above, are designed to detect deafness arising from damage to the inner ear, or cochlea.

However, these methods do not pick up deafness which results from damage to the area of the brain that processes hearing (the auditory cortex) or to the brainstem. This kind of deafness is known as central hearing impairment. Babies who are born prematurely are at particularly high risk of central hearing impairment because they frequently suffer perinatal asphyxia (a lack of oxygen during labour or delivery) which can damage the brainstem.

- Deafness Research UK supported a project to assess how well a new test works for detecting central hearing impairment early, in babies who have suffered perinatal asphyxia. The test, called the maximum length sequence brainstem auditory evoked response (MLS BAER) involved playing a complex sequence of sounds to sleeping babies while recording the electrical activity caused by the brain in response to the sounds, using three small sensors placed on the babies' head and ears.

Results showed that MLS BAER test can detect damage to the brainstem from perinatal asphyxia during the first month after birth. This could be very important for early therapeutic intervention to prevent further damage.

- Deafness Research UK funded a study to improve the test for detecting finding out what sort of hearing loss a baby has. A bone-conduction test uses a device to present sounds to the cochlea while bypassing the outer and middle ear. This can be used to reveal whether there is hearing impairment due to the inner ear alone.

The response to bone-conducted sound was measured using the auditory steady state response (ASSR) which picks up the brain's activity caused by changes in volume of sounds. However problems with the bone-conduction device previously meant that the sensors used to measure the ASSR could pick up false signals that hid the true amount of hearing loss.

Results showed that changing the design of bone-conductors to improved electrical shielding reduces the false signals. This will mean that babies can be diagnosed more accurately.

WHAT RESEARCH IS CURRENTLY BEING UNDERTAKEN?

Deafness Research UK has also been active to find out the effects of being identified early by the newborn hearing screening programme.

- Positive Support in the Lives of Deaf Children and Their Families is a project that explores how different interventions such as provision of hearing aids, the role of the family and professional support (including education and health services) can affect the development of a deaf child. The four year study, supported by the National Lottery through the Big Lottery Fund is a partnership between Deafness Research UK, the University of Manchester, University College London and the National Deaf Children's Society. Results from the study will be published later in the year.

WHO SHOULD I CONTACT FOR MORE INFORMATION?

If any of your questions concerning hearing tests for babies and children have not been answered by reading this factsheet, contact the Deafness Research UK Information Service for further assistance. Our Information team will either answer your enquiry directly or refer it to one of our scientific or medical advisers.

Open: 9.00 a.m. to 5.00 p.m., Monday to Friday (a message can be left at other times).

Freephone: 0808 808 2222

Textphone: 020 7915 1412

E-mail: info@deafnessresearch.org.uk

or click the 'ask question' option from our website homepage:
www.deafnessresearch.org.uk

For further information about the Newborn Hearing Screening Programmes in the UK visit:

England: www.hearing.screening.nhs.uk

Scotland: www.nsd.scot.nhs.uk/services/hearing/

Wales: www.screeningservices.org.uk/nbhsw/

Northern Ireland contact:

Newborn Hearing Screening Programme Northern Ireland
Children's Audiology
Level 7D, Outpatients Department
Eye and Ear Building
Royal Victoria Hospital
Belfast
BT12 6BA

Tel: 028 9063 3558

For a wide range of information and advice about childhood deafness contact:

National Deaf Children's Society (NDCS)

15 Dufferin Street, London, EC1Y 8UR

Helpline: 0808 800 8880 (freephone, voice and textphone)

Fax: 020 7251 5020

Website: www.ndcs.org.uk

Email: ndcs@ndcs.org.uk

Deafness Research UK is the only national medical research charity dedicated to helping people with deafness, tinnitus or other hearing problems.

Scientists are now predicting much more effective treatments for tinnitus and that a cure for some forms of deafness is not only possible but likely within the next few years. Deafness Research UK is at the forefront of this work.

You can support us by making a donation or joining the Deafness Research UK League of Friends. For more information call us on 0207833 1733 or write to:

Deafness Research UK, 330-332 Gray's Inn Rd, London WC1X 8EE

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