Hearing to Succeed and Achieve

A guide for families and early years practitioners

EWING FOUNDATION

Contents

Introduction

The early years of a child's life are vitally important for all areas of development.

Learning language and how to communicate with others is fundamental to wellbeing and to our sense of belonging.

Research has shown that by the age of 4, 80% of all children will have had a hearing loss at some point.[1] A child needs to hear the sounds of speech clearly to be able to develop spoken language.

Hearing loss in the early years can impact all aspects of a child's learning.

The aim of this guide is to provide clear information about why so many young children have a hearing loss and how this will impact on their ability to listen to speech. Possible interventions are explained and top tips provided.

This guide will help you to take simple steps, so that a young child with a hearing loss can **succeed** in developing speech and language and **achieve** their potential.

Succeed and achieve

[1] Zielhuis.G., Rach.G., Van Den Broek.P., (1990) 'The occurrence of otitis media with effusion in Dutch pre-school children.' *Clinical Otolaryngol* 15 pp. 147 -153.

The importance of early listening

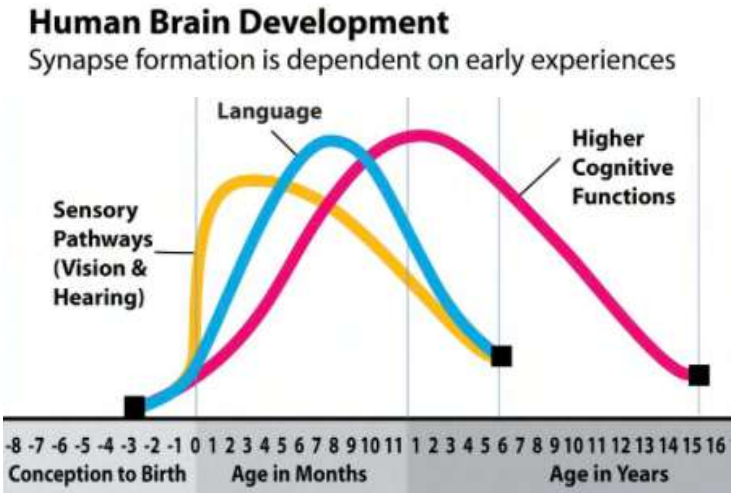
Did you know that listening starts in the womb? As early as 16 weeks gestation a baby can respond to its mother's voice.[2] At 30 weeks a baby hears the rhythm and intonation of speech and can access some vowel sounds in the womb.[3] Babies can distinguish family voices even before they are born.[4]

The first twelve months of life is a critical period for developing the sensory pathways, language and cognitive function. The rate at which the brain grows and develops in the first year of life is greater than at any other time after birth.[5]

The first three and a half years of life is a critical development period for the central auditory pathways when the brain's ability to change is at its greatest.[6]

A young child needs to hear the sounds of speech clearly to learn to understand language and move on to saying words.

Ultrasound picture of baby in womb



Synapse formation begins declining before the age of 3 years

Source: C.A.Nelson (University of Minnesota) in Neurons to Neighborhoods: The Science of Early Childhood Development (2000) Shonkoff,J and Phillips,D. (Eds.) pg. 188.

Synapses are the link between brain cells or neurons and are where learning occurs. The brain learns faster in early childhood than at any other time in life and experiences in the early years have a lasting effect on development.

[2] Shahidullah, S. & Hepper, P. (1992) 'Hearing in the foetus: pre-natal detection of deafness'. *International Journal of Prenatal and Perinatal Studies.*4 (3/4) pp. 235-240

[3] Crystal, 2010

[4] May, L., Byers-Heinlein,K., Gervain, J., Werker, J.F. (2011) 'Language and the newborn brain: does prenatal language experience shape the neonate neural response to speech?' Front. Psychol., 2011; 2:222

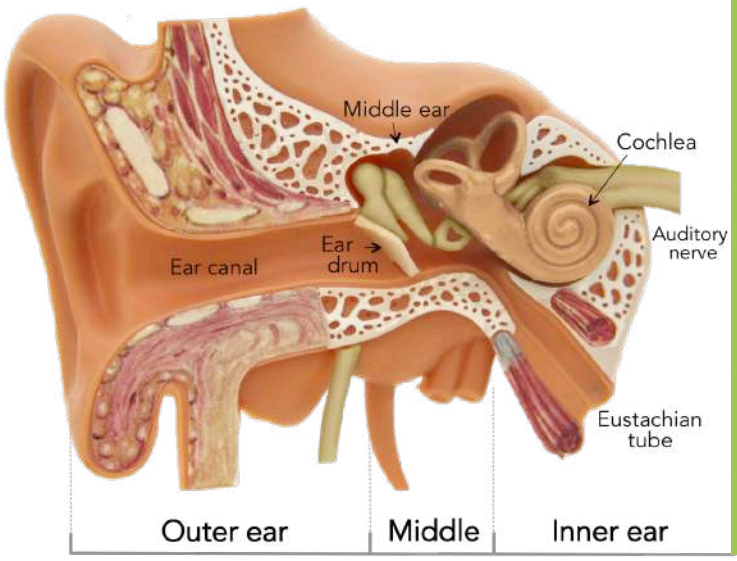
[5] Kretschmann, H., Kammradt, G., Krauthausen,I., Sauer, B., Wingert, F. (1986) 'Brain growth in man' *Bibliotheca Anatomica.*Jan.1986 (28) pp.1–26.

[6] Sharma, A., Nash, A. & Dorman, M. (2009) 'Cortical development, plasticity and re-organization in children with cochlear implants'. *Journal of Communication Disorders.* Volume 42, Issue 4, July-August 2009 pp. 272 – 279

How we hear

Hearing

The ear has three parts, the outer, middle and inner ear. Sound waves are collected by the outer ear and pass down the ear canal to the eardrum, which vibrates and transmits the sound to the middle ear. The tiny bones (ossicles) of the middle ear pass the sound to the cochlea, the small snail shaped, fluid filled organ of hearing, with tiny hair cells that move in response to the vibrations. As the hair cells move, small electrical signals are created, which are carried along the nerve of hearing to the brain, where they are interpreted as sound.



Anatomy of the ear

Permanent hearing loss

One to two babies in every thousand are born with, or develop permanent hearing loss in one or both ears. This is likely to be an inner ear hearing loss, also known as a sensorineural hearing loss. Newborn screening helps find babies who are born with hearing loss, so that they can be offered help to develop their speech, communication and language skills. Hearing technology such as hearing aids and cochlear implants will be recommended based on the level of hearing loss.

Permanent & Temporary Hearing Loss

Temporary hearing loss

Temporary hearing loss is very common in young children. When sound is unable to effectively pass from the outer and middle ear to the inner ear it is called a conductive hearing loss. This can be caused by excessive ear wax, ear infections, damage to the ear drum and middle ear congestion. One of the most common causes of temporary hearing loss is middle ear congestion, also known as otitis media with effusion or glue ear.

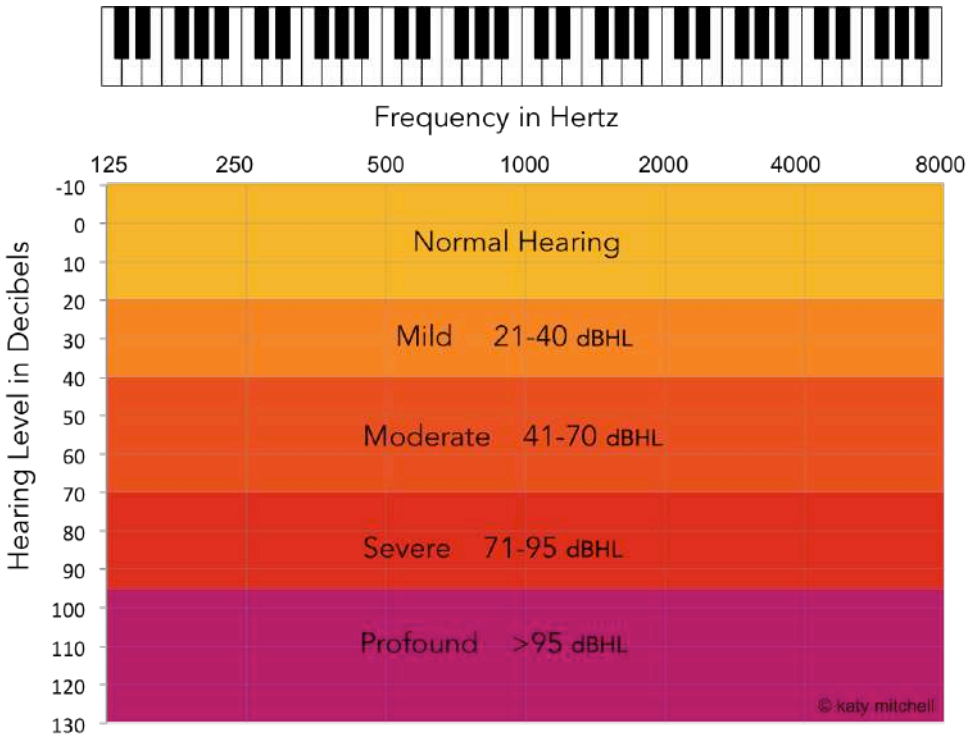
Hearing threshold

Our hearing threshold is the quietest sound that we can hear at different frequencies.

Sound is measured in decibels (dB) with conversational voice around 60dB and a whisper around 30dB. A hearing test measures the quietest sounds that can be heard at different frequencies from low (125Hz) to high frequency sounds (8000Hz), similar to the low notes and high notes on a piano. This information is recorded on a graph called an audiogram, shown in the picture below.

The British Society of Audiology uses the following descriptors to categorise the degree of hearing loss.

	Average hearing threshold levels (dBHL)
Mild hearing loss	21 - 40
Moderate hearing loss	41- 70
Severe hearing loss	71- 95
Profound hearing loss	In excess of 95



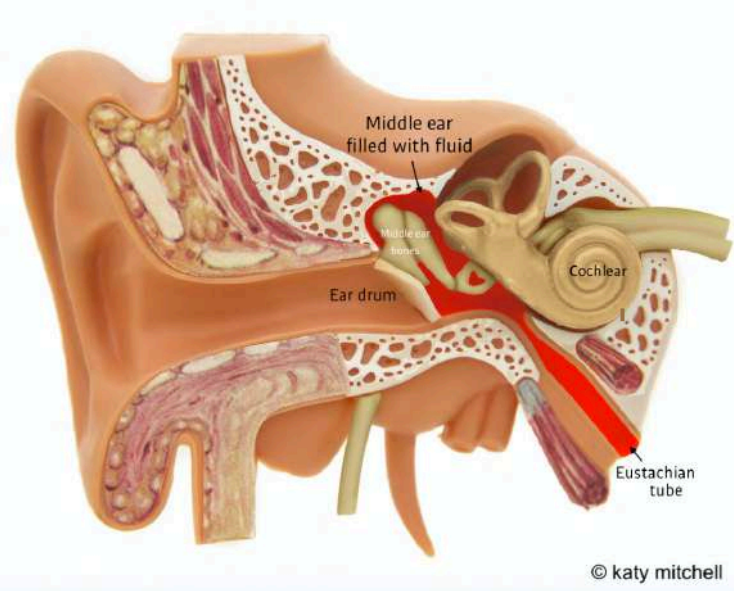
Mild to moderate

Glue ear can result in a mild to moderate hearing loss

Glue ear

A large number of young children have reduced hearing caused by otitis media with effusion, commonly known as glue ear. This is usually a temporary condition, which children often grow out of fairly quickly.

Glue ear is when a build up of sticky fluid in the middle ear reduces how effectively the little middle ear bones transfer sound vibrations from the eardrum to the inner ear. The presence of fluid in the middle ear prevents the eardrum and these tiny bones from moving freely. It dampens the sound waves as they travel through the eardrum and the ossicles. This results in a temporary conductive hearing loss.



Middle ear filled with fluid

The Ossicles

The middle ear contains three tiny bones (the ossicles), called the malleus (hammer), incus (anvil) and stapes (stirrup), which are the smallest bones in the body.

Glue ear is sometimes associated with coughs and colds.

The fluid is produced by mucous glands in the middle ear and is essentially similar to the mucus that is produced in the nose i.e. snot. If the snot is runny, you can hear through it but if it is thick this can affect hearing. We call it glue as it can be quite sticky.

Children grow out of glue ear and it is less likely to occur in children over the age of 8 years.

It can affect one or both ears and will usually resolve without treatment.

Cause of glue ear

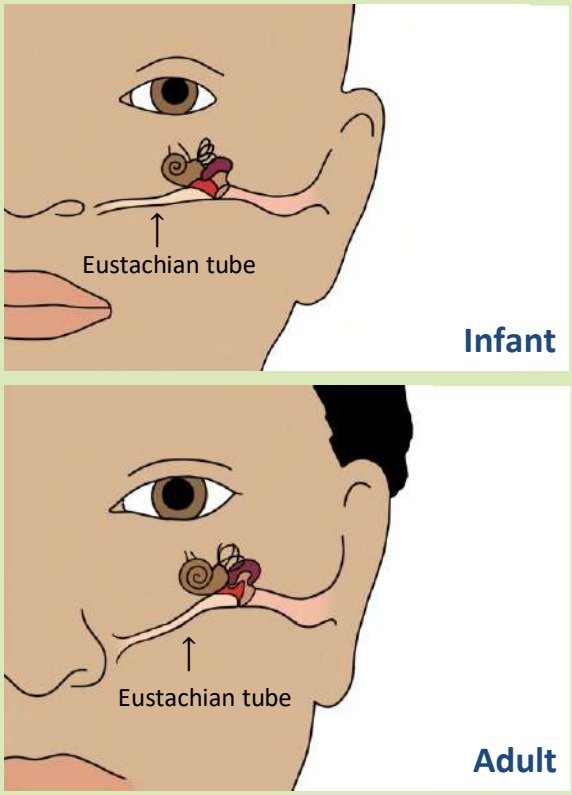
The reason why lots of young children get glue ear is because they are little! The Eustachian tube, which connects the middle ear to the back of the nose and throat, is a narrow tube. When we swallow the Eustachian tube opens to allow fresh air to enter into the middle ear. As we grow, this tube becomes wider, with a steeper angle and adults rarely have glue ear. For young children however, with smaller faces, the Eustachian tube is narrower and more horizontal, so it does not drain as effectively as in adults.

If the Eustachian tube closes, becomes blocked or inflamed (sometimes called Eustachian tube dysfunction) fresh air can no longer reach the middle ear and the pressure falls. The lining of the middle ear secretes a fluid, which can be thin and watery or a thicker glue-like substance.

Glue ear in the early years

Glue ear increases after birth reaching a peak at around 2 years of age. Attending nurseries leads to an increased risk of upper respiratory tract infection, which in turn causes glue ear. After two years, prevalence decreases followed by a second increase at 5 years of age when children start school.[7]

The incidence of glue ear decreases with age. Only 5.6% of 8-year-olds are affected, compared to 16.5% of 5-year-olds.[8]



Picture showing the Eustachian tube more horizontal in children compared to adults.

© katy mitchell

Glue ear is more common in the winter months.[9]

[7] Zielhuis.G., Rach.G., Van Den Bosch.A., Van Den Broek.P., (1990) 'The prevalence of otitis media with effusion: a critical review of the literature.' *Clinical Otolaryngology* 15 pp. 283 – 288

[8] Williamson, I., Dunleavey, J., Bain, J., Robinson, B., (1994) 'The natural history of otitis media with effusion - a three-year study of the incidence and prevalence of abnormal tympanograms in four South West Hampshire Infant and First schools.' *The Journal of Laryngology and Otology*. Vol 108, pp. 930-934.

[9] Midgley, E., Dewey, C., Pryce, K., Maw. A., & Alspac Study Team (2000) 'The frequency of otitis media with effusion in British pre-school children: a guide for treatment.' *Clinical Otolaryngology* Vol 25 Issue 6 pp. 433-576

Identification

A baby's hearing is tested shortly after birth as part of the Newborn Hearing Screening Programme and will not be tested again unless a child lives in an area that has a school age screen.

Children are not born with glue ear but it is common in the first year of life.

It is vitally important that parents, carers and early years practitioners are aware that it is very common for a young child to have a hearing loss due to glue ear and there is no test in place to routinely diagnose this.

Glue ear can go unnoticed and unidentified in a young child. It is not normally associated with pain, but children may experience fullness or popping in their ears.

Glue ear often occurs at a time when a young child is learning to communicate, may have a short attention span and like to do things their own way. Picking up on symptoms related to glue ear at this point in a child's development can be difficult.

Newborn hearing screen

Symptoms

Symptoms often fall into these four areas:

- **Hearing**: may find it difficult to hear speech, mishear instructions, ask for repetition, want the volume turned up, not respond to their name when called.
- **Speech**: may be unclear, delayed or louder/quieter than normal.
- **Behaviour:** may become frustrated or withdrawn and prefer to play alone because they are not able to hear clearly. Listening will be hard work, so they may tire easily.
- **Attention:** find it difficult to concentrate and attend to what's happening, particularly in noise.

Diagnosis of glue ear

Glue ear is usually diagnosed by audiologists at a local audiology department. In order to confirm glue ear, the audiologist will complete the following tests:

Otoscopy: a handheld device that has a magnifying glass and light (otoscope) can be used to see if there is fluid behind the eardrum. Sometimes this is not possible if, for example, the eardrum is obscured by wax.

Tympanometry: this involves placing a small ear plug in the ear canal. Pressure is applied to the eardrum and the equipment records how the eardrum responds to the change in pressure. Normally the eardrum will move back and forth and this will be shown as a peaked curve. When there is fluid present, the eardrum will be rigid and the graph will show a flat line.

Audiometry: this is a hearing test which will find the quietest sounds that the child can hear. A child shows that they can hear by turning when they hear a sound to a visual reward (visual reinforcement audiometry) or by carrying out an action with a toy, such as placing a toy person in a boat (play audiometry).

Examination by otoscope

Otoscopy
Tympanometry
Audiometry

Child with hearing aid

Implications

Speech and Language

The first years of life are crucial for the development of speech and language.

A child needs to hear the sounds of speech clearly to understand words and to start to copy what they hear.

Glue ear can result in speech sounding muffled, unclear and difficult to understand. This can result in a delayed speech and language development.

Children enjoying interaction through play

Behaviour

At a young age, the frustration of not understanding or being misunderstood can impact behaviour. A study found that 55% of pre-school children who had glue ear for 3 months or more, presented with behavioural problems.[10]

Parents of children who have experienced glue ear convey that their child may be isolated and withdrawn because they are unable to follow the conversation or frustrated and disruptive, with the additional listening effort leading to more temper tantrums.

A child with glue ear may appear to misbehave, simply because they have not heard and respond inappropriately. Some children will 'switch off' and appear to be in a world of their own as they are unable to access speech. Others become dominant controlling the conversation.

Speech & Language
Behaviour
Listening & Attention

Listening and Attention

Listening will be hard work and tiring, so a child with glue ear may find it hard to concentrate and be easily distracted.

A fluctuating hearing loss due to glue ear can affect the development of listening and attention skills. Additional support to develop these skills may be needed.

[10] Wilks, J., Maw, R., Peters, T., Harvey, I., Golding, J. (2000) 'Randomised controlled trial of early surgery versus watchful waiting for Glue Ear: the effect on behavioural problems in preschool children'. *Clinical Otolaryngology,* June, Volume 25, Issue 3 pp. 169-240.

Interventions for glue ear

Grommets
Hearing Aids
Otovent

Once a child is diagnosed with a hearing loss due to glue ear, the audiology service will monitor this, as it will usually resolve without intervention. Where the hearing loss persists, there are a number of interventions that can be considered.

Child wearing a bone conduction hearing aid

Hearing Aids

A child with glue ear may benefit from a low-powered hearing aid. Hearing aids can be worn for many months while waiting for glue ear to clear and may be preferable to surgical treatment.

A hearing aid is worn behind the ear, attached to an ear mould. A bone conduction hearing aid is worn on a band and works by vibrating bone on the child's head to send the signal straight to the inner ear.


Grommet

Grommets

A grommet is a small ventilation tube that is surgically inserted (under general anaesthetic) into the eardrum to ventilate the middle ear. The current glue is removed, before inserting the grommet. The grommet will fall out after a period of time and the eardrum will normally heal. Whilst the grommet is in place, it allows air to go into the middle ear to help the little bones move freely and transmit sound to the inner ear.

Otovent

An otovent consists of a nosepiece and a balloon and is considered suitable for children over 3 years of age. The nosepiece is placed against the nostril whilst the other nostril is held closed and the balloon is inflated by blowing with the nose. This procedure helps to open the Eustachian tube, equalise the air pressure and allow the fluid in the middle ear to drain down the back of the throat.


With kind permission from Kestrel Medical
Otovent in use

Ways to help *it's as easy as a, b, c*

There are some very simple steps that you can take that will really help.

A Attention

It is important to get your child's attention before starting to talk to them.

B Background Noise

Trying to make sense of speech when there are lots of competing sounds will be very difficult. It will be much easier to hear speech in a quiet room e.g. turn the television off.

C Clear Speech

Get closer and speak clearly, avoid speaking from a distance and shouting. In group settings, ensure that your child is seated at the front, closest to the speaker.

D Don't smoke

Ensure that children are not exposed to passive smoking as this increases the risk of colds and chest infections and makes it more likely for a child to develop glue ear.

E Encourage

Listening with glue ear is hard work and tiring. Try to give a child extra clues and repeat instructions to help them to access the spoken word.

F Face to Face

Make sure that your face can be clearly seen. Use visual aids and gestures to promote understanding of the spoken word.

Mother and child enjoying engagement

Singing to promote language

The rhythm and intonation experienced by a baby before birth is the foundation of language. Music is a tool for learning language and research has shown that music in the early years can benefit all areas of development.

Singing with a young child will help to develop pre-verbal skills such as eye contact, attention, copying, turn taking and vocalising. It can then be used to promote learning early sounds and words.

A child needs to hear a word over and over again before they understand it, and even more times, before they will start to use the word in their own speech.

The engaging rhythm and intonation of songs, make accessing words easier, particularly for a child with a hearing loss. The speed of the words can be slowed down, to make them clearer, but most importantly, key words and sounds are repeated over and over again. For example, in the 'Wheels on the bus' song, the words 'round and round' are repeated four times in quick succession, reinforcing the word 'round' eight times, every time the verse is sung!

Child having fun making music

Following these simple suggestions will help:

- Have a time to sing every day.
- Choose songs with repetitive phrases such as 'Heads, shoulders, knees and toes.'
- Use actions to reinforce meaning.
- Sing at a natural pace so that all the words are clear.
- Use musical instruments to tap a beat to the rhythm of music.
- Be close and reduce background noises.
- Have fun and enjoy.

Sing, sing and sing some more

At nursery and pre-school

Reduce background noise and get closer

Nurseries and pre-schools are typically very busy and noisy environments. With lots of children playing and having fun, comes lots of noise!

Research has shown that background noise has a greater impact on children's speech perception and listening comprehension than adults, with high levels of noise affecting a child's progress.[11] A young child is not able to make sense of the words that they have missed, as their brain's auditory network is not fully developed.[12]

High ceilings, hard floors and lots of windows can result in very poor listening environments. These echoey rooms are noisy and make it harder to understand speech.

Softer surfaces are better than hard as they absorb sound.

Nursery area with a large rug, bean bags, cushions and blankets.

Nursery with carpet, bean bags, blinds, soft toys and wall displays.

All of the following will help to improve the listening environment:

- Carpets and rugs
- Bean bags and cushions
- Soft toys
- Curtains and blinds
- Wall displays
- Suspended sails
- Tablecloths and table coverings
- Foam in pen pots
- Carpet squares in toy trays
- Felt pads on chair legs
- Switch off noisy equipment
- Close doors and windows where possible, to reduce external noise

[11] Klatte, M., Lachmann, T. and Meis, M. (2010) 'Effects of noise and reverberation on speech perception and listening comprehension of children and adults in a classroom-like setting.' *Speech Perception and Understanding 12*. pp. 270-82.

[12] Cole, E. B., Flexer, C. (2011) *Children with hearing loss, developing listening and talking*. San Diego, CA: Plural Publishing.

Improving the listening environment

With kind permission from The Woolly Shepherd

If the listening environment of a nursery or pre-school is very noisy due to high levels of reverberation (echo) it ideally needs acoustic improvement.

Acoustic improvement involves making changes to the room to make it easier to hear speech clearly and more comfortable to listen. Making these changes will benefit **all** children and adults in the room.

Special acoustic panels can be placed on walls and ceilings. These absorb sound to reduce the echo in the room, making a more comfortable listening environment where speech is clearer.

Woolly Shepherd acoustic clouds

One example of a company providing acoustic improvement is the Woolly Shepherd, an award-winning acoustic panel manufacturer supplying sustainable acoustic solutions and panels from natural fibres. They are best known for their acoustic clouds, which help to reduce background noise and improve speech intelligibility. Acoustic clouds and other types of acoustic panels can be used in nurseries and pre-schools to improve the listening environment.

A parent's perspective

Katherine was diagnosed with glue ear at 15 months old. From that point, we have been on a mission to ensure she can access the world of sound, and most importantly the sound of speech.

We have used a range of different ways to improve her access to communication – from boosting her hearing with the use of bone conductive hearing bands and behind the ear hearing aids – to supporting the development of her receptive and expressive language with the use of various resources. The Makaton language programme particularly has been invaluable in supporting her communication development by the use of signs and symbols to support speech.

Our journey has led us to an understanding of the fluctuating nature of glue ear, and the challenges that can present. No two months, weeks or even days are the same when levels of congestion change and the world becomes less accessible to Katherine through an increase in hearing loss, or suddenly overwhelming, when sounds unexpectedly become louder.

You will get to know your child's 'tell-tale' signs of any changes in hearing due to a variance in congestion. For us that can be irritability, lack of responsiveness, increase in frustration or refusing to even stay in a room with certain noise levels, but indicators can be unique to each child so the best thing parents can do is monitor behaviour and feedback any changes and difficulties to your supporting professionals.

With kind permission from Pret-a-Portrait

Early years staff can make a real impact in being able to report a full picture of a child's day-to-day experience of glue ear by feeding back to parents any changes and difficulties in a child's behaviour.

Parents and early years staff are on the front line of a child with glue ear's daily battle to access sound, and your ability to monitor, report back and adapt, can make a real difference!

With the intervention of hearing aids, improvements to the listening environment and everyone following advice to help Katherine to hear speech clearly, she is making amazing progress in her development of speech and language. Her success in these areas means that she is a confident, happy and caring little girl. We are delighted with all that she has achieved and she is continuing to succeed.

Hear Glue Ear App

'Hear Glue Ear' is an award-winning App that provides parents with advice about glue ear. It includes audiobooks, songs and listening games to help support speech and language and develop listening skills.[13]

There is also information for parents, videos about improving speech and language skills as well as a hearing game that parents or carers can complete with a child at home (for example between appointments) to help guide their understanding of what sounds and volume levels the child is finding more difficult, so that they can successfully manage and support their child appropriately.

Further research

The creators of the Hear Glue Ear app have also been researching the benefits of children with glue ear using bone conduction headphones. These particular headphones don't cover the ears like conventional headphones (which can be useful if a child has any ear pain or discharge) and use technology that routes sound vibrations directly to the healthy inner hearing system (cochlear), therefore bypassing the middle part of the ear with the fluid or 'glue'. Research[14] [15]has shown children with glue ear find it easier to hear through bone conduction headphones, which means they can listen to audio-books or songs more easily on the Hear Glue Ear app. or other audio books or films on devices or phones.

Child using a bone conduction headphone paired with a microphone

Research[16] has also trialled the head-phones being used paired directly to a microphone so that a child can hear a teacher more easily in a classroom. Further information is available at www.hearglueear.co.uk.

Parents have commented:
"His learning is much quicker now... it has given him a kick start."
"This has made an astronomical improvement to my child's quality of life."

Bone conduction headphone paired with a device

Help children to hear by pairing the headphone with a microphone.

Stop children falling behind by pairing the headphones to the Hear Glue Ear App providing free remote speech and language therapy, free audiobooks and a hearing screen.

[13] Fordington S, Brown TH, Holland Brown T. An evaluation of the hear glue ear mobile application for children aged 2-8 years old with otitis media with effusion. Digit Health 2020;6:1–16

[14] Holland Brown T, Salorio-Corbetto M, Gray R, et al. Using a bone-conduction Headset to improve speech discrimination in children with otitis media with effusion. Trends Hear 2019; 23:1–9

[15] Holland Brown TM, Fitzgerald O'Connor I, Bewick J, et al. Bone conduction hearing kit for children with glue ear. BMJ Sept 2021 doi:10.1136/ bmjinnov-2021-000676

[16] Holland Brown TM, Marriage J, Salorio Corbetto M. Speech discrimination and word identification with a consumer-level bone-conduction headset and remote microphone for children with normal hearing. *International Journal of Audiology* (IIJA) Article ID: IIJA 2049379. DOI: 10.1080/14992027.2022.2049379

Glue Ear Together

Glue Ear Together, a charity supported by the Ewing Foundation, provides information about glue ear.

The charity offers clear and concise information on the Glue Ear Together website.

Advice is provided on strategies to support children with glue ear at home and nursery, to promote wellbeing and the associated wellbeing of their parents/carers.

Through collaboration with colleagues in health, education and charities, a pro-active approach to the management of glue ear is promoted.

Glue Ear Together recognises the need for parents/carers to support one another by sharing their experiences. It is hoped that with increased knowledge about glue ear, they will be empowered to engage confidently with professionals and make informed choices about interventions and management for their child.

By bringing together the expertise of professionals in the field to share the latest guidance and research, it is hoped that the information provided will help to promote improved wellbeing for young children with glue ear.

www.glueeartogether.org.uk

An awareness of the very simple steps that can be taken to help a child to hear will make a huge difference in enabling young children with glue ear to succeed and achieve.

get information
get advice
get together

EWING FOUNDATION
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With kind permission from Phonak

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Thank you both for your amazing help and support.

Promoting inclusion and achievement for deaf children through listening and speaking.

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Feedback

Your feedback would be greatly appreciated to develop this booklet and further resources. Please could you help by answering **4 quick questions here.**

Thank you.

Contact us

Ewing Foundation provides training, technological and educational support for the professionals who work with deaf children and young people. If we can help you, please contact us.

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