The First Steps
A Guide to Cochlear Implants
You may have recently learned that your child has hearing loss. Whether your child’s hearing loss is hereditary or was entirely unexpected, we understand that this is a challenging and emotional time for you. You’ll have countless questions as you face what may be completely unknown territory, but rest assured: there is a solution for your child.

More than half of the people who use our implants received them as children, so we’re dedicated to designing cochlear implants that look to the future and are suited for even the youngest children. We know your child has unique needs, and we’re here to help you best meet those needs.

This guide has been designed to give you insights into what life with a hearing implant is like so you can support your child in the best way possible. We encourage you to get your whole family involved. You’ll soon see that your child’s life will not be so different from what you might have once imagined.

In the meantime, what can you expect from this brochure? First, we’ll have a look at how hearing works and what sensorineural hearing loss is. You’ll learn about cochlear implant systems, what they are, and how they can help your child. We’ll discuss the benefits of early implantation and give you a glimpse of the process of receiving an implant, from assessment to rehabilitation. Finally, you’ll read about what’s ahead for your child—communication, an education, and anything your child can imagine.

Let’s get started.
How Does Hearing Work?

Sound and the Ear

Knowing how hearing works will help you to better understand hearing loss and how cochlear implants can overcome it. First, let’s take a closer look at the ear.

The ear is made up of three parts—the outer ear, middle ear, and inner ear. The outer ear is the part you can typically see. The middle ear contains the smallest bones in the human body, the ossicles, which help carry sound from the outer ear to the inner ear. The inner ear houses the cochlea, a snail-shaped, fluid-filled organ about the size of a pea. All of these parts work together to detect sound waves and change them into signals that the brain can understand as sound.

How Hearing Works

1. **Outer Ear**
   - The outer ear detects sound waves and funnels them into the ear canal, where they vibrate the eardrum.

2. **Eardrum**
   - The movement of the eardrum causes the ossicles to vibrate.

3. **Ossicles**
   - The ossicles transfer sound waves to the cochlea.

4. **Cochlea**
   - The cochlea converts sound waves into electrical signals.

5. **Auditory Nerve**
   - The auditory nerve sends electrical signals to the brain, where they’re understood as sound.

Want to learn more? Check out our video library at medel.com.
You may have learned from your child’s newborn hearing screening that he has a kind of hearing loss known as sensorineural hearing loss (SNHL). What is SNHL and what causes it?

Sensorineural hearing loss is the result of damage in the inner ear. For those with SNHL, hair cells in the cochlea are either damaged or missing, or the auditory nerve is damaged. Children who have mild SNHL have difficulty hearing quiet sounds and find that even loud sounds seem muffled. Children with severe-to-profound SNHL aren’t able to hear even very loud sounds.

Causes
Approximately half of children born with hearing loss have genetic hearing loss. Other common causes are genetic syndromes, infections such as meningitis, and complications during pregnancy or birth. Hearing loss that occurs during childhood can be caused by infections or even by medications that are necessary and life-saving— but harmful to the ear.1

Treatment
Although sensorineural hearing loss is usually permanent, children with SNHL can be treated successfully with cochlear implants. Cochlear implants have been routinely implanted in children since 1980. On the next few pages, we’ll have a look at what cochlear implants are and how they help children like yours to hear.
What is a Cochlear Implant System?
A Hearing Loss Solution

For some children who are born with hearing loss, hearing aids don’t provide enough—or any—benefit. This is often where cochlear implants come in. You’re probably at least somewhat familiar with hearing aids, but what is a cochlear implant and how does it help a child born with hearing loss to hear?

A cochlear implant is a medical device that replicates the sense of hearing. For people who would otherwise not be able to hear, it can give access to sound. It does this by bypassing the non-functioning parts of the ear and electrically stimulating the cochlea.

A cochlear implant system has two main components—an external audio processor and an internal cochlear implant. A MED-EL audio processor is worn either on or off the ear, depending on the model your family chooses. The audio processor is the part that your child will handle every day and may come to think of as his “ear.”

The audio processor is connected to the implant by a magnet. The implant is placed just under the skin during a straightforward surgical procedure. After surgery, the implant won’t be noticeable to your child or others.
How Does a CI System Work?

1. **Audio Processor**
   The audio processor picks up sound in the environment and converts it into coded electrical signals for the implant.

2. **Coil**
   The audio processor coil sends sound signals through the skin to the implant. The coil is held in place on the outside of the head by a magnet in the implant.

3. **Implant**
   The implant converts these signals into electrical pulses, which are sent to the cochlea by an electrode array.

4. **Auditory Nerve**
   The auditory nerve relays these electrical pulses from the cochlea to the brain, where the signals are understood as sound.

5. **Cochlea**
   In the cochlea, electrical pulses stimulate the nerve fibres that detect sounds.

See how a cochlear implant works at medel.com/cochlear-implants

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**Questions & Answers**

What's the difference between a CI system and a hearing aid?
Whereas a hearing aid amplifies sound, a cochlear implant directly stimulates the inner ear. A hearing aid is typically worn inside the ear canal or on the ear, while an audio processor for a CI is worn on or off the ear and does not block the ear canal. Hearing aids can be suitable for people with mild-to-severe hearing loss. Cochlear implants, however, can help children like yours who have severe-to-profound hearing loss.
Questions & Answers

What is the ideal age for implantation?
Most hearing professionals agree that a child should receive a cochlear implant before the age of 24 months to achieve the best possible outcome. Some research shows that implantation before 12 months is even better. As a consequence, in recent years many children have received implants before their first birthday. Your child’s doctor will be able to discuss any considerations that could affect the optimal implantation age for your child.3,4,5,6,7
A Brighter Future

Your child’s cochlear implant will make it possible for her to recognise your voice, react to the chime of a doorbell, and discern the purr of a cat. She’ll be able to hear these sounds and many more, but how else might a cochlear implant affect her?

Most noticeably, your child will likely gain a greater awareness of environmental sounds. Hearing your voice and interacting with family members will help your child to develop important social, emotional, and cognitive skills. Having the ability to hear everyday sounds such as car horns and the voices of others can help alert her to potential risks and keep her safer in any situation.

Beyond these fundamental benefits, a cochlear implant will also expand your child’s opportunities to communicate with her family, friends, and classmates. Whether your child relies on speech, sign language, or both, a cochlear implant can help her to develop speech and language skills and to be more easily understood by others. Stronger communication skills often result from cochlear implant use, and this can help your child learn, grow, make friends, and do well in school. Early access to sound is an important factor in building vocabulary skills, which form the foundation for reading and overall academic success.

As your child grows up, what changes in her might you observe? Parents of children who have received CIs report that after implantation their children have higher self-esteem, enjoy more rewarding interactions with their family, and participate more actively in school. Each child is different, but no matter what your child’s strengths and weaknesses are, using a cochlear implant can improve her quality of life.

Starting Early

The widespread implementation of newborn hearing screening programmes has contributed to a decrease in the average implantation age. Research has consistently shown that early implantation is associated with better speech and language development as well as academic success.

A child’s auditory system is most receptive to sound input in the first few years. Access to sound in early childhood contributes to the development of the brain and, in turn, many different types of skills. Numerous factors affect speech and language development, but if your child receives an implant early enough, it’s quite possible that she will be able to learn language at a rate similar to that of peers without hearing loss. What if, for any reason, your child is unable to receive a cochlear implant during these formative language-learning years? Children who receive CIs later typically experience less favourable outcomes from those who receive them earlier, but children whose implantation is delayed can still benefit from a CI.
Better With Both

If your child has hearing loss in both ears, you might be wondering how much difference a second cochlear implant would make. Research has shown that children who use two cochlear implants often fare better than children with one CI. Why?12

A second cochlear implant will make it possible for your child to localise sound. When your child knows which direction sounds are coming from, he’s much more likely to develop better language skills, focus more easily on important sounds, and even stay safer.12

Once your child is in school, using two cochlear implants can help him concentrate on the teacher’s voice and tune out distracting background noise. For anyone, listening with two ears requires less mental effort than listening with one ear. Unsurprisingly, parents of children with two cochlear implants have reported that their children are less tired at the end of a school day. Using two CIs frees up some of your child’s mental resources so he can focus more on learning and less on localising.

What to Expect

Assessment
Your child was most likely given a newborn hearing screening test, and then referred for further screening. After referral, a clinician will check that there are no contraindications that would make a CI unsuitable for your child. All of these tests are painless and non-invasive; some can even be performed while your child is sleeping.

Implantation
Surgery typically lasts from 1–3 hours and is performed under general anaesthesia. Your child will most likely be up and about the day after implantation. The duration of his hospital stay could last from one to several days, depending on local practice.

First Fitting
About four weeks after implantation, your child will receive his audio processor during a session called a first fitting. During this session, an audiologist will program and activate your child’s audio processor. This day, sometimes referred to as activation day, is often an emotional one for families since it may be the first time their child is able to hear. Keep in mind that learning to hear with a CI is a process; sounds will become clearer and more understandable over time, as your child progresses through rehabilitation.

Rehabilitation
Rehabilitation is the process of learning to hear with a cochlear implant. During rehabilitation, your child will work with an audiologist and speech therapist on developing hearing, speech, and language skills. Participating in rehabilitation is essential to your child’s success with a CI. Over the next few pages, we’ll take a look at rehabilitation and discuss how it can contribute to your child’s progress.
Questions & Answers

What is the best time to get a second implant?
Opinions differ, but receiving both implants at the same time is generally better than waiting to receive the second. If your child receives both implants at once, he could learn language faster, spend less time overall in surgery, and have to make fewer hospital visits and follow up appointments. Talk to your doctor about any considerations that could affect the ideal implantation time for your child.
Life With an Implant
Steps Towards Success

What is Rehabilitation?

Rehabilitation is the process of training the brain to understand sound with a cochlear implant. Think of your child’s CI as an instrument for accessing sound. As with any instrument, learning how to use a cochlear implant will take motivation and a lot of practice. While participating in rehabilitation, your child will learn strategies for making this practice as effective and fun as possible. You’ll be given guidance on how you can help foster your child’s communication skills at home.

Your child’s rehabilitation programme will be designed by an audiologist or speech therapist, and sessions will most likely be held in a clinic or at a hospital. For the first few years after your child receives his CI, his audiologist and speech therapist will play pivotal roles in guiding his communication development. As your child grows and becomes more independent, he’ll be able to help make decisions about his own rehabilitation programme.

To make the most of his CI, your child should start participating in rehabilitation as soon as his audio processor is fitted. Rehabilitation goals will be established by your child’s therapist, and will evolve based on your child’s progress and needs. You can expect therapy goals to fall into one or more of the following five skill areas:

- Auditory
  From your child’s first fitting, he’ll begin establishing an awareness of sound. He’ll learn to recognise sounds and associate them with people and things in the environment.

- Speech
  Once your child has expanded his awareness of sound and has started babbling, his focus will shift towards learning how to talk and be understood by others.

- Language development
  Your child’s auditory and speech skills will form the foundation for learning more complex language skills. As rehabilitation progresses, your child will learn new words, grammatical structures, and even how to tell a story.

- Communication management
  Your child will sometimes encounter situations that make communication challenging. During rehabilitation sessions, he’ll learn strategies for overcoming these obstacles.

- Practical and technical
  On activation day, you’ll receive some basic information about how to operate and take care of your child’s audio processor. As he gets older, your child will learn how to use assistive listening devices to further improve his listening experience at school and beyond.

Partnering With Your Child’s Therapist

Encourage your child to practice his communication skills whenever possible. One of the most important ways you can help your child succeed is to reinforce rehabilitation goals at home. How can you do this? Cooperate closely with your child’s CI team. Ask which skills you can work on with your child at the various stages in his development. Write down your questions as they arise, and bring a short list to your child’s appointments.
Your Role
Rehabilitation is one of the most important factors in your child’s success with a cochlear implant. More than any other person, you will have the greatest impact on your child’s communication development. Your child will spend much more time with you than with any therapist, so your interactions will have the greatest influence on his language and speech skills. All children need to hear a lot of language before they can learn to speak. With your child, make sure to use both verbal and non-verbal communication throughout the day.5,10

Your Child’s Progress
Some days, you might wonder if your child is making progress at the rate that he should. Keep in mind that rehabilitation is a process and that every child is different. Success with a cochlear implant depends on many factors: your family’s expectations and motivation, your interactions with your child, and your child’s participation in rehabilitation. While it’s difficult to predict exactly how well your child will do with a CI, we can assure you that by actively participating in a goal-driven rehabilitation programme, he’s most likely to improve his communication skills and have a better quality of life.

Check out our LittEARS® Diary, available for download at medel.com.
Learning for a Lifetime

You might be wondering how your child’s cochlear implant will affect his educational opportunities. Will his hearing loss affect his ability to learn and succeed in school? What kind of school will he attend? Although no one can predict exactly how well any child will do in school, there are several factors that are likely to help your child thrive.

Most aspects that influence your child’s overall experience with a CI will also contribute to his performance in school. With early implantation, dedication to rehabilitation, and the support of key individuals, your child will be able to go to school and learn in much the same way that other children learn.

Many children with CIs go to mainstream schools. As your child gets older and gains experience with his CI, he may not need much classroom support. If your child has some additional needs, however, he might do better in a classroom with extra support. The recommendations of your child’s CI team as well as your own observations will guide you in deciding which school is the best option.

How can you help your child to be successful in school? First, reach out to your child’s teacher. We encourage you to request a meeting with the teacher before the school year starts and to communicate often. Show your child’s teacher how to check the audio processor for proper functioning and how to change the batteries. After fitting appointments, inform the teacher about any changes to your child’s audio processor MAP, or program, which might affect your child’s hearing. Your child’s teacher may have a lot of experience with cochlear implants—or none—but by talking regularly, you can address most concerns together.

As with any child, your child’s needs will change as he grows up. When your child is in preschool, his teacher can support him by encouraging his communicative skills, removing noise-related distractions from the classroom, and monitoring his audio processor for optimal functioning. As your child advances though school and his classes become more challenging, teachers should make sure that he has the support he needs to continue to do well.

Just as you communicate with your child’s teacher, the teacher should also communicate with your child’s CI team. Speech therapists can reinforce what your child is learning in the classroom by incorporating new vocabulary and themes from your child’s syllabus. They can also inform the teacher about any communicative challenges your child is facing that might affect his learning experience.

Finally, we encourage you to explore assistive listening device (ALD) options. ALDs can help your child listen more easily and concentrate better in otherwise noisy or distracting classrooms. The school that your child attends may already be equipped with ALD technology. Not sure? Just ask. An ALD is an important tool that can help your child during his school years and throughout his entire life.
LIFE WITH AN IMPLANT
Children With Multiple Special Needs

If your child has a hearing loss as well as an additional disability, you may be wondering how much your child will benefit from a cochlear implant. What’s ahead? What do you and your family need to know to reinforce your child’s development?

Of children with sensorineural hearing loss, up to 40% have additional developmental disabilities. As the number of children with complex needs who receive cochlear implants has grown, we’ve become better equipped to predict how these children can benefit from a CI. Although such children do face some additional challenges, a CI can still improve your child’s quality of life.17,18,19

Families often report that their children experience benefits beyond speech and language. As important as language skills are, we know that you want much more for your child. So what kind of progress is most often made after implantation by children with special needs?18

The most common improvements that parents observe are their child’s increased awareness of environmental sounds, the development of speech skills, the ability to express their wishes, and better engagement at home and in school. Studies suggest that even for those with complex needs, cochlear implantation can lead to advanced outcomes such as better speech. Rest assured that regardless of any delays your child has, there are still significant gains to be made that can enhance his quality of life.17

The individualised rehabilitation plan that your child receives after activation will take into account his degree of hearing loss, age at implantation, strengths and weaknesses, and other factors. By monitoring any difficulties your child might have, his audiologist and speech therapist can recommend tailored rehabilitation strategies. With your family’s support and the dedication of hearing professionals, your child can have access to sound and—more importantly—lead a better and more independent life.

Questions & Answers

How can I help my child to become as independent as possible?

Make sure that your child’s language skills and functional skills are assessed regularly by a professional. We encourage you to build on these assessments with your own observations and notes. By tracking your child’s progress, you can continually identify opportunities for your child and work towards new goals.18
It’s All Possible

Music
Music will be an important component of your child’s rehabilitation programme, but it can also be a transformational and fun part of your child’s daily life. Musical activities help promote communication and overall development. When you listen to music with your child and encourage her to respond to it, you help her develop social, emotional, and cognitive skills as well as listening, speaking, and language abilities. You don’t need to have any musical training to be able to help your child enjoy music.8

Not sure where to start? Try humming, clapping, singing, and dancing along to a song, and try to get your child to do the same. Help her recognise and imitate the melody, rhythm, and tempo. Start early and practice often. If you’re having fun, your child probably will too! For ideas, we encourage you to check out our rehabilitation resources—all designed by MED-EL speech therapists and audiologists. For strategies that are tailored to your child’s needs, enlist the help of your child’s speech therapist. She’ll be glad you asked.

Sports
You might be wondering how your child’s CI will affect her ability to play sports. Whether your child wants to play soccer, compete in track and field, or simply climb a tree, don’t worry. Her CI won’t stop her. Like any child, yours should take a few precautions and always protect her head. Make sure she wears a helmet while riding a bicycle or playing any sports that typically require a helmet. We offer a water-resistant audio processor and a waterproof audio processor cover so your child can even hear wherever there’s water.

Accessories
To ensure that your child’s CI doesn’t interfere with her ability to take part in sports, MED-EL offers accessories for all of our audio processors. Waterproof audio processor covers can be used in fresh-, salt-, and chlorinated water so your child can hear her friends and a lifeguard’s whistle wherever she swims.

Questions & Answers

Will my child be able to enjoy music?
Your child’s listening habits and attitudes about music will depend on many factors, such as her age at implantation, her participation in a rehabilitation programme, and your family’s interests. Many children with CIs like music and even play instruments, although some children are naturally more interested than others in music. Research has shown that children are more likely to enjoy music if their families prioritise and appreciate musical activities.20
About MED-EL

As a parent, you want to do everything you can to help your child prepare for the future. As a family-owned company, we’re doing everything we can to improve quality of life for children with hearing loss, now and in the future. With an unwavering focus on R&D, we provide cochlear implant systems that are designed for reliability and lifelong hearing quality.

Since our founding more than 25 years ago by engineers Ingeborg and Erwin Hochmair, MED-EL has been pioneering innovation in the field of hearing implants. We’re dedicated to supporting your family as you make the transformative decision to get a cochlear implant. We encourage you to contact us with any questions that arise during your child’s hearing journey. From your child’s first fitting to her first job and beyond, MED-EL will be there for your family.
Glossary

Anatomy of the Ear

**Auditory Nerve:** The nerve that sends impulses from the inner ear to the brain.

**Cochlea:** The hearing organ in the inner ear.

**Ear Canal:** The passageway between the outer ear and the eardrum.

**Eardrum:** A thin layer of tissue between the outer and middle ear; also known as the tympanic membrane.

**Hair Cells:** Cells in the inner ear that change sound waves into nerve impulses.

**Inner Ear:** The part of the ear made up of the cochlea and the balance system.

**Middle Ear:** The part of the ear that includes the ossicles and the eardrum.

**Outer Ear:** The part of the ear that is normally visible; known as the pinna. It collects sound waves and directs them through the ear canal.

**Ossicles:** The three tiny bones in the middle ear—the malleus, incus, and stapes.

**Binaural Hearing:** See bilateral hearing.

**Congenital Hearing Loss:** Hearing loss that’s present from birth.

**Decibel (dB):** A unit used to measure the intensity of a sound.

**ENT:** The branch of medicine that concerns the ear, nose, and throat.

**Frequency:** The pitch of a sound; measured in hertz (Hz).

**Hearing Threshold:** The softest sound that can be heard at any given frequency; indicates the degree of hearing loss.

**Otology:** The branch of medicine that concerns the ear and conditions of the ear.

**Otologist:** A physician who specialises in the treatment of ear conditions.

**Prelingual Hearing Loss:** Hearing loss that’s present at birth or that occurs in early childhood before a child learns language.

**Postlingual Hearing Loss:** Hearing loss that occurs after a person learns language.

**Rehabilitation:** Specialised, post-implantation training for the development of listening, speaking, and other communication skills; sometimes referred to as habilitation.

**Residual Hearing:** Hearing that is measurable, usable, and present in varying degrees.

**Sound Intensity:** Relates to the intensity of a sound; measured in decibels (dB).

**Sound Localisation:** The act of identifying where a sound is coming from.

**Speech Frequencies:** The range of frequencies most important for hearing and understanding speech, from 500 to 4000 Hz.

**Vestibular System:** A system in the inner ear that informs your sense of balance.
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