The aim of this booklet is to provide you with a detailed and easy-to-use guide concerning the different aspects of hearing and hearing loss.
Learning that your child has been diagnosed with hearing loss can be a challenging experience. You may be confronted with new situations and decisions. Take heart, you are not alone. Support groups can give you emotional assistance as well as practical advice for daily life with a hearing loss. Use the resources in your community to help you become familiar with all of the hearing solutions and options that are available. Specialists including physicians, pediatric audiologists and speech therapists can give you professional advice. A thorough understanding of hearing loss will help you to make decisions for your child.

Ensuring a Hearing Future™

MED-EL has been pioneering cochlear implant development since the 1970s. Since then, the majority of MED-EL cochlear implant users all over the world have been children. As a result, MED-EL has been able to develop its CI system to ideally match children's needs, offering uncompromising safety, performance and convenience. At the same time, MED-EL products are designed to be future-ready, ensuring that children can benefit from future technological and medical advances as they come along.

If you have any questions or would like further information, please contact your local implant centre or MED-EL office, a list of which is available at: medel.com
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At first, many terms from the world of audiology and from the medical specialty of ENT (ear, nose and throat) may be new and unfamiliar to you. On the following pages, you will find explanations for the most commonly used terms to help you better understand the world of hearing.

**Important Terms to Know**

**Anatomy of the Ear**

**Auditory Nerve:** Hearing nerve; the auditory nerve carries impulses from the inner ear to the brain.

**Cochlea:** The snail-shaped part of the inner ear that changes sound vibrations to nerve impulses.

**Ear Canal:** The tube running from the outer ear to the eardrum that directs sound into the ear.

**Eardrum:** Also called the tympanic membrane; the eardrum is situated between the outer and the middle ear and changes sound waves into mechanical vibrations.

**Hair Cells:** The hair-like structures in the inner ear that convert the mechanical energy of sound waves into nerve impulses.

**Inner Ear:** The part of the ear that contains the hearing organ (cochlea) and the balance (vestibular) system. The cochlea contains fluid and highly sensitive cells (hair cells) that move with sound vibrations.

**Middle Ear:** The middle part of the ear that includes the eardrum and three tiny bones (ossicles). The middle ear transfers sound vibrations to the inner ear.

**Outer Ear:** The part of the ear that is normally visible is called the pinna. It collects sound waves and directs them into the ear canal.

**Ossicles:** The chain of three tiny bones in the middle ear: hammer (malleus), anvil (incus) and stirrup (stapes). They transmit sound vibrations from the eardrum to the cochlea.
**Audiological Terms**

**Acquired Deafness**: A severe to profound hearing loss that develops later in life.

**Audiogram**: A graph obtained during a hearing test that illustrates a person's hearing for each ear, indicating the degree and type of hearing loss. It shows the amount of hearing loss (in decibels or dB) at different frequencies.

**Audiologist**: A professional who treats individuals with a hearing impairment.

**Audiology**: A science that studies hearing; the profession is concerned with assessment and rehabilitation of auditory and communication problems.

**Audiometry**: A series of tests administered by an audiologist that assess hearing and middle ear function.

**Auditory**: Relating to hearing.

**Auditory Brainstem Response (ABR)**: An objective test used to check the function of auditory pathways by measuring the brain's electrical response to sounds. ABR assessments are commonly used in newborn hearing screenings because the child does not need to react to sound signals.

**Binaural/Bilateral Hearing Loss**: Hearing loss affecting both ears.

**Congenital Hearing Loss**: A hearing loss that is present from birth.

**Decibel (dB)**: The loudness of a sound is measured in units called decibel (dB).

**Frequency**: The pitch of a sound is measured in frequency. Frequency is denoted in Hertz (Hz).

**Hearing Threshold**: The softest sound that a person can hear at a specific frequency. Hearing thresholds are displayed on an audiogram to show an individual's hearing loss.

**Localization**: The ability to determine where a sound comes from.

**Otology**: The branch of medicine dealing with the ear.

**Otologist**: A physician who specializes in the treatment of ear problems.

**Prelingual Deafness**: Deafness that occurs at birth or early in childhood, before language acquisition.

**Postlingual Deafness**: Deafness that occurs after language acquisition.

**Rehabilitation**: Specialized training for people with hearing loss to help them learn to speak and understand language through listening. For children who could never hear or speak, this is sometimes called habilitation.

**Residual Hearing**: The amount of remaining measurable, usable hearing. Most individuals with hearing loss have some degree of residual hearing.

**Speech Frequencies**: The range of frequencies most important for hearing and understanding speech, within about 500 to 4000 hertz (Hz).
Hearing Implants for Children
Ears are extraordinary organs. Unlike eyes, they never sleep, and you cannot close them or give them a break. Ears pick up sound waves and change them into information that the brain can interpret. Knowing how natural hearing works can help you better understand your child's hearing loss.

Hearing is the perception of sound. A sound is a pressure wave that can either vibrate slowly (low frequencies reflect deep sounds) or quickly (high frequencies reflect high-pitched sounds).

**How We Hear**

1. The outer ear collects sound waves and directs them to the eardrum.
2. The eardrum vibrates with sound.
3. Sound vibrations move through the ossicles to the cochlea.
4. Sound vibrations cause the fluid in the cochlea to move.
5. Hair cells sense the vibrations within the fluid of the cochlea and generate wave signals that are transmitted to the brain by the auditory nerve.
6. The brain interprets this stimulation as sound (=hearing).
Your Child's Hearing Development

The most vital period for hearing development in a child's life occurs in the first two years. Children who receive no auditory stimulation during this critical period will face difficulties learning to speak. The brain's ability to learn to process sound and develop spoken language decreases after this critical period until about age seven, when learning language becomes much more difficult. A child's development of speech and language is highly individual. There are, however, milestones for speech and language development that can serve as a guideline for normal development.¹
0–3 months
Reacts to loud and sudden sounds (wakes up, scares, startles)
Recognizes a parent’s voice
Reacts in response to a familiar voice (quiets, smiles)
Looks around to see where a new sound is coming from
Smiles when spoken to
Makes pleasure sounds, coos, chuckles
Uses specific crying patterns (e.g., hunger-cry)

3–6 months
Experiments with own voice, babbles
Pays attention to music
Discriminates between sounds, friendly/angry voices
Localizes sound source/voice
Recognizes own name
Uses different cries, stops crying when spoken to

6–9 months
Babbling is more varied
Listens attentively to music/singing
Reacts to own name
Understands simple verbal requests
Recognizes names of some common objects

9–12 months
Uses exclamations
Speaks first words (dada, mama, bye-bye)
Follows simple commands
Understands simple questions (Where is the ball?)

12–18 months
Says one-word sentences
Says and understands up to 20 words
Understands more new words every week
Enjoys nursery rhymes
Comprehends simple questions
Uses words rather than gestures to express wants and needs

18–24 months
Uses 2–3 word sentences
Follows simple commands
Understands simple questions
Enjoys being read to
Understands more complex sentences
Points to body parts when asked

2–3 years
Speaks in simple sentences
Says and understands 200+ words
Follows simple tasks when asked
Points to the right picture in a book when asked

3–4 years
Speaks clearly enough that people outside the family usually can understand him or her
Uses sentences of four or more words in length
Speech and understanding improve considerably
In many countries, hospital Newborn Hearing Screening Programs\(^2\) check the hearing of all infants. This is a short and painless examination of the auditory pathways performed a few hours after birth. If an infant was not screened in such a program, parents are usually the first to suspect a hearing problem.

**Typical Signs of Hearing Loss**
- Child does not react to loud sounds
- Child is unable to detect where a sound is coming from
- Child may start to babble, but soon stops
- Babbling does not develop into understandable speech
- Child does not react to voices, especially when he or she is not being held
- Child does not follow commands or misunderstands directions
- Child may start acting frustrated

**Hearing Tests**
A variety of different methods are available to test your child's hearing.\(^3\) The audiologist will choose a method that is best suited for your child's age. Usually, hearing tests performed on newborns and babies use objective measuring methods which do not require the active participation of the baby. This can, for example, be Otoacoustic Emission (OAE) screening or an Auditory Brainstem Response (ABR). All of these tests are quick, simple and painless and are performed while the baby is asleep. Older children can participate more actively in behavioral hearing tests. Parents can stay with their child while the hearing test is being carried out.
An audiogram is a graph that shows if your child has a hearing loss, and if so, which type and degree of hearing loss he or she has. The audiologist measures the loudness level at which your child can hear different sounds at different pitches. The softest sound your child is able to hear is called the hearing threshold.

The loudness level of sounds, also shown as hearing level on the audiogram, is measured in decibels (dB). Frequency is measured in hertz (Hz).

A child's average normal hearing ranges between 0 and 20 dB HL (dB Hearing Level). If the hearing thresholds are outside this range, the child is considered to have hearing loss. A child with a hearing loss at 40 dB HL, for example, may not be able to hear certain speech sounds. The degree of loss is determined by the severity, e.g., mild hearing loss, moderate hearing loss, severe hearing loss, profound hearing loss. It is important to be familiar with the details of your child's audiogram so that you can detect any changes in his or her hearing without delay. We recommend that you keep dated copies of your child's audiograms.
Types of Hearing Loss

Conductive Hearing Loss
Any condition in the outer or middle ear that prevents the ear from conducting sound properly is known as a conductive hearing loss. This can be due to a blockage in the outer ear or ear canal, ear infection, or other problems. Conductive hearing loss is usually mild or moderate in nature. In some cases, conductive hearing loss is temporary and can be treated with medication or with surgery. If a conductive hearing loss is irreversible, many people can benefit from a hearing aid or a middle ear implant. Common causes of conductive hearing loss in children include: buildup of earwax or middle ear infections (otitis media).

Experts distinguish between different types of hearing loss, depending on the part of the ear that is affected.
Sensorineural Hearing Loss
Sensorineural hearing loss results from missing or damaged hair cells in the cochlea. This type of hearing loss is usually permanent and can worsen over time. Sensorineural hearing loss can be mild, moderate, severe or profound. Treatment options for mild to severe sensorineural hearing losses include traditional hearing aids and middle ear implants. For the treatment of severe or profound sensorineural hearing loss, cochlear implants are often recommended.

A common cause of sensorineural hearing loss in children is severe infection, like meningitis or infections that require treatment with ototoxic drugs in order to save lives (ototoxic: toxic for the ear). Very often, children are born with sensorineural hearing loss.

Mixed Hearing Loss
A mixed hearing loss is a combination of conductive and sensorineural hearing losses. It results from problems in both the outer/middle and inner ear. Treatment options may include medication, surgery, hearing aids, or a middle ear implant.

Neural Hearing Loss
A problem that results in the absence of or damage to the auditory nerve can cause a neural hearing loss. Neural hearing loss is profound and permanent. Hearing aids and cochlear implants cannot help because the nerve is not able to pass on enough sound information to the brain. In some cases, an auditory brainstem implant may help.
My Child has a Hearing Loss – What Now?

Diagnosis and Emotions

Maybe you already suspect that your child has a hearing loss, or maybe your child’s hearing loss was already diagnosed after a Newborn Hearing Screening. In any case, getting confirmation that your child does not hear properly may evoke a variety of emotions in parents, ranging from shock to denial. These reactions are normal. Allow yourself the time to accept the diagnosis.

Over time, many questions will arise: How well will my child be able to hear and speak? How will the hearing loss impact my child’s future? Which assistive technology will be the best? Talk to your ENT doctor and/or audiologist to get answers to all your questions. Do not hesitate to ask them for details. Knowing as much as possible about your child’s hearing loss helps you to support your child’s development of hearing and speech.

Support groups are a valuable source of information, too. Families who went through the same experiences will understand your worries and can give you helpful advice.

Early Intervention

Early intervention means acting without delay to treat your child’s hearing loss. If your child has an irreversible hearing loss that cannot be otherwise remedied, it is vital to get hearing instrumentation as soon as possible. It is also very important to assess how well the hearing instrument(s) work(s) for the child. If hearing aids are not going to be enough to help the child to develop spoken language, it is crucial to determine this as quickly as possible so that other alternatives can be evaluated while the child is still in the critical language learning phase.
If your child is diagnosed with a severe hearing loss, it is important to act immediately. During the first few months, infants learn to understand a variety of sounds around them. They can very quickly distinguish between human speech and other environmental sounds. The first two years are especially important for language acquisition. Children with hearing loss cannot develop these abilities later on.

The younger a child’s age when receiving a hearing device, the easier it will be for him or her to learn to hear and speak. A baby’s brain is better able to process new information than that of older children, and when children are provided with a hearing device at a very young age, they often develop spoken language quickly and can “catch up” with other children born with normal hearing.4, 5, 6
Hearing Loss – What Are the Options?

If your child has been diagnosed with a hearing loss, your audiologist will discuss the options available for him/her. Depending on the degree and the type of the hearing loss, your child may be a candidate for a hearing aid or a cochlear implant. The graph below serves as a guideline for finding an ideal solution for your child’s hearing loss.

Hearing Aids
Hearing aids may help your child to utilize the hearing abilities that he or she still has by amplifying sounds. Hearing aids can be worn behind the ear (BTE) or in the ear (ITE) and nowadays use digital processing. If your child is a candidate for a hearing aid, your audiologist will advise you about the device that best suits your child’s individual needs.7

Middle Ear Implants
A middle ear implant is a hearing solution for children who cannot use conventional hearing aids for medical reasons. It bypasses the outer ear and directly stimulates middle ear structures.

Cochlear Implants
A cochlear implant is a hearing solution that takes over the function of damaged nerve cells in the inner ear. Unlike hearing aids, cochlear implants do not amplify sounds. Instead, they process the sound signal electronically and use tiny electrical pulses to stimulate the hair cells in the inner ear.

Hearing aids and hearing implants are two different options available to improve your child’s hearing. Your doctor will help you to choose the right solution.
Opening up the world of hearing to your child
Cochlear implants are the first replacement of a human sense, the sense of hearing. Thousands of parents worldwide have chosen MED-EL’s MAESTRO Cochlear Implant System for their children because it offers a superior hearing experience in real-life situations. The system contains features optimized for the appreciation of music and for listening in challenging situations. Made with quality, MAESTRO offers the best hearing performance for your child's active future.
What is the MAESTRO™ CI System?

The MAESTRO Cochlear Implant System bypasses the non-functioning part of the cochlea and delivers sound signals directly to the hearing nerve. It consists of two parts, an implant and an audio processor. The MAESTRO Cochlear Implant System can be used effectively by children who were born with a profound hearing loss, as well as those who develop a hearing loss during childhood.

**IMPLANT**

*Internal — Surgically placed under the skin*

The implant consists of a housing, which contains the electronics and the electrode array, as well as the receiving antenna and a magnet that holds the coil of the audio processor in place behind the ear.

**AUDIO PROCESSOR**

*External — Worn behind the ear*

The audio processor consists of a control unit with the microphone, a battery pack, and a coil that transmits information through the skin to the implant.

How Does it Work?

The MAESTRO CI System converts sounds into coded electrical pulses. These electrical pulses stimulate nerve fibers in the cochlea. The auditory (hearing) nerve transmits the signals to the brain where they are interpreted as sound. The implant continuously stimulates at very high speed. As the brain receives sound information instantaneously, sounds are heard as they occur.
1 Sounds are picked up by the microphone in the audio processor.

2 The audio processor analyses and codes sounds into a special pattern of digital information.

3 This information is sent to the coil and is transmitted across the skin to the implant.

4 The implant interprets the code and sends electrical pulses to the electrodes in the cochlea.

5 The auditory nerve picks up the signals and sends them to the auditory centre in the brain. The brain recognizes these signals as sound ("hearing").
CONCERTO Cochlear Implant
World’s Smallest and Lightest

The future-ready design of the CONCERTO Titanium Cochlear Implant means that your child can benefit from the very latest advances in hearing implant technology from the pioneer in the industry – both today and in the future.

Preserving Your Child’s Cochlea
The cochlea of a child is already adult size at birth. MED-EL’s philosophy is that the delicate inner ear structures need to be specially protected so that they can be preserved in the event of future technological and medical advances. Any residual hearing that your child may have needs to be preserved, too. Therefore, MED-EL electrodes were developed to be uniquely soft and flexible (“atraumatic”) to cause little or no trauma when they are inserted into the cochlea. MED-EL offers a variety of especially soft electrode options to ensure an ideal match with every child’s cochlea, even if a child’s cochlea is malformed or ossified (covered in bony growth).

World’s Smallest and Lightest Titanium Cochlear Implant
The new CONCERTO Cochlear Implant is the smallest CI available with titanium housing. This makes it the ideal implant choice for infants and small children. CONCERTO is designed for minimally invasive surgical techniques that can enable faster recovery.

Reliability and Safety
MED-EL hearing implants are designed according to the highest safety standards for long-term reliability, durability and performance. MED-EL’s safe and effective technology incorporates a variety of additional safety features particularly important for children. For up-to-date, transparent data on the reliability of MED-EL implants, please visit our website at www.medel.com/reliability.
MED-EL offers a particularly long and flexible electrode array designed to be inserted gently into the cochlea. A deep insertion and optimized spacing of electrode contacts – Complete Cochlear Coverage – allows users to hear the broadest possible hearing range, especially low-pitched sounds. Low-pitched sounds contain important speech cues that contribute to intonation, rhythm and vowel discrimination.

MED-EL electrode arrays are designed for placement close to the auditory nerve fibers to achieve better hearing performance. Without stimulation, auditory nerve fibers lose their ability to function; therefore, it is important to stimulate all areas of the cochlea. In children, this stimulation ensures that they learn to effectively use sound information now and in the future.

Like the keys of a piano, the cochlea is arranged in order of pitch (frequency). One end of the cochlea (the basal region) sends high-pitched information to the brain, while the innermost (apical) region sends low-pitched information.
MED-EL has worked closely with parents and cochlear implant professionals to develop an audio processor design that is ideal for children. The unique modular design of the OPUS 2 is easily adaptable to meet children's changing needs as they grow.

New: OPUS 2 Battery Pack XS
Especially suited for our youngest users, the XS features improved balance for best fit. Small enough to blend in and available in color options to match your hair or skin type, the OPUS 2XS is a discreet choice. For those who prefer to stand out, the XS is available in brighter tones as well.

Clear Hearing in All Listening Situations
In everyday life, your child is surrounded by a lot of background noise, which may distract him or her from important speech information. Sophisticated processor features, such as the Automatic Sound Management technology, automatically adapt to changing listening environments and help your child to hear the sounds that are most important. Both soft and loud sounds are heard clearly and comfortably in all listening situations. While some cochlear implant systems require special switches or settings for difficult listening environments, the OPUS 2 processor makes all adjustments automatically. This is particularly beneficial for children who are too young to change audio processor settings to adapt to different listening situations.

Easy-to-Use Featuring FineTuner™
OPUS 2 is the first processor worldwide to feature a modular, switch-free design. All setting changes are made using the unique FineTuner remote control unit. A switch-free design means that parents can make adjustments to sensitivity or volume without removing the processor from the child’s ear.
OPUS audio processors offer a variety of wearing options appropriate for each stage of your child’s life. Among them are the unique BabyBTE™ and Children’s Battery Pack configurations.

1 BabyBTE
As more and more infants and young children are receiving cochlear implants, MED-EL’s BabyBTE wearing configuration has been developed to address their unique needs. The entire processor is worn on the baby’s clothing, with no equipment worn on the ear. Then, when the child is old enough to wear the processor at ear-level, the BabyBTE is easily converted to a standard ear-level wearing configuration without the need to switch to a different processor.

2 Children’s Battery Pack
The Children’s Battery Pack wearing option is ideal for small children because only the small, ultralight (2 g/0.07 oz) control unit is worn on the ear. The battery pack is clipped securely to the collar or other clothing. This design provides additional security: if the control unit is brushed off the ear while a child is playing, the attached battery pack ensures that the processor will not fall to the ground.

3 Mini Battery Pack
The Mini Battery Pack is a body-worn alternative to the standard behind-the-ear power supply wearing option. It is powered with the rechargeable DaCapo Power Pack, offering a full day of use (16 hours). Alternatively, the Mini Battery Pack can be operated with one standard or rechargeable “AAA” battery.
Extremely Energy Efficient
The OPUS 2 processor offers superior hearing in any listening environment and is our most energy efficient processor ever. Better energy efficiency saves users money and reduces battery waste. With a set of three standard zinc-air batteries, the OPUS 2 offers users up to 90 hours of continuous use. Alternatively, the XS Battery Pack provides 60 hours from 2 batteries. The DaCapo rechargeable battery system provides up to 13–16 hours of hearing – a full day of use!

Lightweight and Compact
An audio processor needs to be so comfortable that your child does not even notice he or she is wearing it. The OPUS 2 is extremely thin and lightweight, making it comfortable to wear, and ensuring that the processor does not bend or irritate your baby's small ears.

Quick and Easy Access to External Devices
The FM battery pack cover of the OPUS 2 features a standard input jack as used in hearing aids. This provides convenient access to FM systems, MP3 players, televisions, etc., which your child may need when he or she is older.

Safe and Secure
MED-EL puts a lot of effort into making its products safe and secure for the youngest users. MED-EL audio processors are equipped with a variety of safety features specially geared to children's needs:
- Tamper-resistant battery packs and lockable parts.
- SoundGuard to protect against program loss in the case of exposure to electrostatic discharge (ESD).
- Status light that flashes a series of patterns to indicate various error conditions.
- The FineTuner remote control unit permits the OPUS 2 to be adjusted without any switches. The child is not able to change audio processor settings unintentionally.

Quick Fitting
Because infants and children may not be able to sit through long fitting sessions, the MAESTRO System allows quick fitting while still obtaining ideal results. This reduces stress and fatigue on both you and your child.

You can choose from thirteen different colors for your child's OPUS 2.
The MAESTRO Cochlear Implant System allows people with severe to profound hearing loss to understand speech, speak more clearly, use the telephone, listen to music, communicate with their environment, and enjoy the world of sound in all its aspects.

Numerous studies have proven the positive effects on users’ quality of life as well as the cost-effectiveness of cochlear implants. A US study compared children implanted with a CI for more than two years with their peers with profound hearing loss who did not have implants. Results showed that twice as many CI users could attend mainstream schools, were less dependent on self-contained classrooms, and required fewer hours of special education support.

Benefits of Early Implantation
As cochlear implant surgery has become routine, children are being implanted younger and younger. Surgical procedures have improved and research has proven better results with children implanted at very young ages.

If children with a profound hearing impairment are implanted early enough, their hearing and speech can develop much like a normal hearing child’s. Spoken language appears to emerge almost naturally. This is because children receive auditory information at a time when the brain is really ready to learn language.

For children who have had hearing experience and have lost their hearing later, a similar rule applies: the shorter the period of deafness, the more likely they will benefit from the cochlear implant.

Benefits of the MAESTRO™ CI System

hearLIFE
Enjoy music, participate in conversations, use the telephone
Success Factors

It is important to remember that a cochlear implant is a technical tool for your child’s hearing. Success with the implant depends on many factors. Age of implantation is only one factor influencing the benefit your child will receive from a cochlear implant. A rich communication environment, effective audio processor programming, motivation, rehabilitation, and realistic expectations are all important factors contributing to your child’s overall success.18

It is crucial to speak to your child like you would with a child with normal hearing, even though he or she may not fully understand what you are saying. Talking to your child is the best way to encourage the development of spoken language. Facial expression and body language emphasize the meaning of words and will help your child understand you better. Structured auditory therapy goes along with what you teach your child at home.

Research has shown that wearing an audio processor for longer periods of time throughout the day positively affects children’s performance with their implant.19 The reason for this is that children with a cochlear implant can often acquire language skills and auditory skills incidentally, just by listening and playing.

Learning language is just one goal of cochlear implantation. Making your child’s speech intelligible for other people, even for those who do not know your child, is another goal. A well programmed audio processor that is worn during all waking hours, along with appropriate rehabilitation, will help your child to achieve this goal.

Finally, your expectations play an important part in your child’s success with the CI. Children implanted very young typically make early and steady progress, especially with effective therapy and support. In most cases, it is realistic to expect your child to eventually understand spoken language and to develop speech skills, assuming that no other learning issues exist. Most cochlear implant users are also able to use telephones, some learn second languages, and many enjoy music – auditory tasks that are considered highly complex. It is important for you to help your child to reach his or her full potential. Because every child is different, your child’s ultimate level of success will depend on a number of factors that cannot be predicted before implantation. For this reason, it is important that expectations are realistic.
If you and your audiologist or speech-language professional consider a cochlear implant to be the best solution for your child, the next step is to contact an ENT clinic with a cochlear implant program. A list of cochlear implant centers is available from MED-EL. Your local team of CI specialists will work with you to determine whether your child is a candidate.

Basic candidacy criteria for implantation include:
- Your child has a profound sensorineural hearing loss in both ears
- Your child receives little or no benefit from hearing aids
- There are no medical reasons your child cannot undergo surgery
- Your child has access to appropriate education and rehabilitation follow-up
- You and your child are highly motivated to participate in required rehabilitation programs
Receiving a Cochlear Implant

Assessment
To determine candidacy for a cochlear implant, your child will undergo a number of routine assessments prior to implantation. These tests allow the cochlear implant team to check for any additional factors or needs and allow them to help you know what to expect. These assessments often include medical, audiological and radiological (x-ray) evaluations.

Surgery
Cochlear implantation has now become routine. The surgical procedure usually takes between one and three hours and is done under general anesthesia. The risks involved in cochlear implant surgery are low and comparable to other ear surgeries. Children are usually up and about the next day. The hospital stay can vary from one to several days, depending on what is typical in your area and what your child's individual needs are.

First Fitting
About four weeks after implantation your child will receive his or her audio processor. The audio processor is programmed, or “fitted”, individually for your child by an audiologist. This program contains settings for pitch, loudness and timing so that your child will hear sounds at a comfortable level. Initially, setting up an ideal program for your child requires repeated fitting sessions in order to gradually fine-tune the settings.

Follow-Up Program
A comprehensive rehabilitation program will help your child in making the most of his or her cochlear implant system. Regular training with a speech-language professional is an essential element in learning how to understand sounds and in developing listening and speech skills. For very young children, therapy may initially involve parent-directed therapy activities to help your child detect and recognize sounds. For older children, auditory therapy may focus on helping the child to recognize the new, more detailed way that things sound. Ideally, these skills are integrated into your child's daily life.
Bilateral Implantation

Bilateral implantation is implantation of both ears. Hearing with two ears, also called binaural hearing, has distinct advantages such as precise localization of sounds, better hearing in noisy environments, and improved understanding of speech. In general, “stereo” hearing (with two ears) is less strenuous.

Hearing quality in children was found to be significantly better following bilateral implantation. Bilaterally implanted children respond much faster in group situations; they react more quickly and appropriately in everyday situations and acquire language spontaneously. Hearing is less strenuous and children are less tired after school or kindergarten. Parents report the clear benefits in speech understanding and an increase in their child’s self-confidence.

A variety of features make MED-EL cochlear implant systems especially well suited for bilateral implantation. In particular, the combination of high-rate stimulation and specially designed flexible electrodes that allow deep insertion into the cochlea provides users a maximum amount of acoustic information. High-rate stimulation refers to the speed and amount of information that the implant can deliver to the ear. High rates of stimulation more closely represent the function of the normal cochlea and have been found to be beneficial in speech understanding.

**FineTuner™**

One FineTuner remote control unit can control both audio processors independently, allowing you to make individual setting changes to each processor as desired.
At MED-EL, we don’t consider our job finished once your child has been fitted with a cochlear implant. Rehabilitation following implantation is a crucial component to your child’s success. For your child, learning to use his or her “new ear” is a process. MED-EL is there to help you every step of the way offering a line of rehabilitation materials to assist you and your child.

BRIDGE
The BRIDGE to better communication program is a comprehensive support program developed by MED-EL in cooperation with leading experts worldwide. This program was specially designed for education and rehabilitation to help “bridge” the gap between implantation and the development of improved listening skills and spoken communication. The BRIDGE materials cover a broad range of abilities and needs with one goal in mind: to ensure the best possible results for our family of cochlear implant users.

SoundScape
SoundScape, a new online activities section, is available on soundscape.medel.com. It includes interactive listening activities for different age groups from two years to adult age as well as follow-up activities.

HearPeers Community
HearPeers is an online community website that enables MED-EL implant users and parents from around the world to interact and share their experiences with each other. It’s an excellent place to exchange experiences and learn how to make the most out of your child’s cochlear implant journey.

www.hearpeers.com
In addition to the activities offered on SoundScape, another special site for children is available online at www.medel.com. The “Kids’ Corner” offers simple explanations about hearing, hearing loss and cochlear implantation. It is written in an easy-to-understand way with mascot Mellie, the MEDELephant, guiding the children through the pages.

The Kids’ Corner is complemented by two Children’s Kits, targeted at children aged 0–3 years and 4+ years. The kits have been developed with rehabilitation specialists and aim to prepare children for their life with the cochlear implant in a playful way. They include sound-making toys, story books and mascot Mellie.

**Mascot Mellie**

MEDELephant Mellie and her little friend guide children through their journey to hearing.

**Mellie Makes Music**

Mellie Makes Music, a new nursery song CD is now available! This CD was specifically arranged for the unique needs of children with cochlear implants. It is designed to bring the joy of music to your child in an easy and playful way.
Some children cannot wear hearing aids for medical reasons, e.g., in cases of aural atresia or microtia. For many of these children, MED-EL’s Vibrant Soundbridge Middle Ear Implant System has proven to be an effective solution. The Vibrant Soundbridge is an approved solution for treating sensorineural hearing loss, as well as conductive and mixed hearing losses. The VIBRANT SOUNDBRIDGE® has been approved as a solution for children in Europe and in other countries accepting the CE Mark.
Hearing Implants for Children

What is the VIBRANT SOUNDBRIDGE® Middle Ear Implant System?

The Vibrant Soundbridge Middle Ear Implant System is the optimal choice for children who cannot use conventional hearing aids. It directly stimulates the structures of the middle ear, causing them to vibrate in a manner that is similar to stimulation received during normal hearing. This ‘direct drive’ stimulation enables excellent sound quality without blocking the ear canal.

How Does it Work?
The Vibrant Soundbridge consists of an internal and an external component. The external component, called the audio processor, is worn discreetly on the head and can be covered by hair. The internal part is an implant that mechanically vibrates the middle ear structures. These vibrations can be amplified and adjusted to optimally compensate for different types and degrees of hearing loss.

IMPLANT

*Internal — Surgically placed under the skin*

The internal component, called the implant, is surgically placed under the skin during an operation. The core component of the implant is called the Floating Mass Transducer (FMT). This tiny vibratory structure, which is smaller than a grain of rice, is attached to a structure in the middle ear. When activated, the FMT mechanically vibrates, causing the structures within the ear to vibrate.

AUDIO PROCESSOR

*External — Worn on the head*

The audio processor contains the battery, a microphone, and high-quality, fully-digital signal processing. It converts sounds into electrical signals that are transferred to the implant.
Sounds are picked up by the microphone of the audio processor. The audio processor is held over the implant by magnetic attraction to a magnet in the implanted part.

2. The audio processor converts environmental sounds into electrical signals.

3. The electrical signals are transmitted across the skin to the implant.

4. The implant relays the signal down the conductor link to the FMT.

5. The FMT converts the signal into mechanical vibrations that directly drive a middle ear structure (e.g., the ossicular chain) and cause it to vibrate.

6. These vibrations then conduct sound to the inner ear and to the brain and are perceived as sound.
Better Speech Understanding
The direct drive technology including single point FMT attachment is a unique feature of the Vibrant Soundbridge. Direct drive leads to improved hearing quality and better speech understanding.

Natural Sound Quality
Users generally describe sound quality as “natural”. Hearing in challenging listening environments, particularly with background noise, is also very successful. This is a crucial factor for children, especially when they are confronted with noisy environments such as the classroom.

Normal Speech Development
For Your Child
Studies have shown that children with conditions such as bilateral aural atresia or microtia require immediate auditory stimulation in order to ensure normal speech development. Users of the Vibrant Soundbridge benefit from an open ear canal. If your child cannot tolerate foreign bodies in the ear canal, the Vibrant Soundbridge may be an ideal solution.

Hearing Preservation
Hearing preservation is particularly important for children. The Vibrant Soundbridge is designed not to interfere with the natural ability of the hearing organ and to preserve residual hearing.

Intact Skin
The implant sits beneath the skin. In comparison to other implant systems on the market, no parts of the Vibrant Soundbridge protrude outwards from the user’s head. For parents, this means they do not have to be concerned about the risk of skin infections.

Newest Technology –
Now and in the Future
Because the audio processor of the Vibrant Soundbridge is externally located, you can be sure that your child can always benefit from the latest technology. Upgrading the Vibrant Soundbridge is simple because only the external portion needs to be exchanged. Even years after implantation, your child can undergo a simple fitting and return home able to benefit from the latest technology available.

The VIBRANT SOUNDBRIDGE has proven to be an effective and reliable middle ear implant system for over a decade.
The Vibrant Soundbridge Middle Ear Implant System is designed for individuals who have been diagnosed with mild to severe sensorineural hearing loss or conductive and mixed hearing losses. The system is also recommended for children who cannot use conventional hearing aids for medical reasons. This includes aural atresia, microtia or frequent ear canal inflammation.

The Vibrant Soundbridge is the only middle ear implant system that is attached to one single structure in the middle ear (it is not attached to the skull). This makes it fully independent of skull growth and therefore suitable for children.

Younger candidates must satisfy the standard inclusion criteria and have an adequate anatomy to allow placement of the Vibrant Soundbridge. Use of the Vibrant Soundbridge has been limited to children three years and above*, because it does not include child safety features.

Receiving a Middle Ear Implant System

1. Assessment
Children who are over three years of age and can benefit from the Vibrant Soundbridge must undergo audiological tests and medical examinations to determine if the Soundbridge is a suitable treatment for them. Audiological tests will assess your child’s type and degree of hearing impairment.

2. Surgery
Surgery is a routine procedure for experienced ENT surgeons and usually takes one to two hours. The procedure is performed under general or local anaesthesia. Your surgeon will counsel you concerning any additional details you need to know before the operation.

3. First Fitting
Approximately six weeks following implantation, your child will be fitted with the audio processor. At this time, the Vibrant Soundbridge will be activated for the first time. An audiologist or other hearing professional can counsel you and your child concerning optimal use of the Vibrant Soundbridge.

4. Follow-up Program
Supportive auditory therapy may focus on helping your child to recognize the new, more detailed way that things sound as opposed to the limited sound they knew with hearing aids. If necessary, regular communication training with a speech-language professional can be an essential element in learning how to understand sounds and in developing listening and speech skills.

* The Vibrant Soundbridge is Health Canada approved for individuals with moderate to severe sensorineural hearing loss or conductive and mixed hearing losses (Age 10 & above)
Hearing Implants for Children

Real People, Real Experiences

Although scientific results and technical details tell us a great deal, “real life” experiences of CI users can express even more. Below you can read what parents of children using MED-EL implants have said about the benefits and advantages of cochlear implants in everyday life!

Raquel, age 4

When our daughter Raquel was born, we were thrilled to have a beautiful baby girl. Her hearing test at birth showed normal results, as did the second one at the age of 7 months. Raquel had always been a very happy and communicative baby. At the age of 9 months she started saying her first word, “mama.” Then, as months passed, she improved her vocabulary and seemed to understand what she was told. But later, at about the age of 20 months, she seemed to have fallen behind her peers as far as her speech and comprehension skills were concerned.

We decided to have a special hearing test done when she was about two and a half years old. My husband and I were shocked by the results: she had become profoundly deaf in both ears. Fortunately, the doctor was very nice and professional. She immediately informed us of what turned out to be a wonderful solution: the cochlear implant.

Raquel was fitted with bilateral hearing aids and started regular speech therapy to prepare her hearing skills. The process had begun: diagnosing her deafness, having the preliminary tests done, and finding the right center and the right surgeon for the implant.

None of the tests revealed any anatomical or physiological abnormalities, so it may be that Raquel lost her hearing due to drug therapy she was given as an infant (a side effect that resulted in loss of hearing).

Raquel was implanted shortly before her third birthday, with a PULSAR, which was activated a month later, and the new OPUS 2. She loves it and she is very eager to hear everything going on around her. In the morning, as soon as she gets up, she asks for it to be put on.

It’s hard to believe that Raquel has had the implant for just under a year. I could write pages telling you stories about things we have accomplished in this short time: Seeing the wonder in her eyes as she listened to the sound of her favorite “tip-tap” shoes on the floor the same evening she was activated or her repeating the word “baby” the next morning at breakfast. Seeing her looking in awe at birds chirping. Listening to her sing and play instruments with her older brother and observing her as she also starts to learn and speak in two languages.

At the risk of sounding rhetorical, I have to tell you that the MED-EL implant has been a godsend and has changed our lives forever. Raquel now has a chance for a normal future. The shock of discovering that our beautiful and healthy baby girl suddenly, and seemingly for no rational reason at all, was profoundly deaf is still a strong memory. But the MED-EL device has offered us a glimpse of a better future for Raquel. She remains a very happy and exuberant girl; she loves life. A day does not pass without my husband and I being reminded of what a miracle this is.
When our son Johannes was born, routine newborn hearing screening carried out in the hospital two days after his birth indicated that deafness in both ears was suspected. This first diagnosis was a shock. More hearing tests and an ABR measurement were carried out when he was four and six weeks old, confirming that our little Johannes was severely hearing impaired. Johannes was immediately fitted with hearing aids, which, unfortunately, were completely unsuccessful.

Immediately after the first hearing screening, my husband and I found out everything we could about deafness. During our research, we came across cochlear implants. We had close contact with parents of hearing-impaired children who had also been treated with cochlear implants and they gave us invaluable information about their experiences. Soon we decided on an implant.

The preliminary examinations were promising. The CI team at Würzburg, Germany, recommended immediate implantation. Following consultation with the pediatrician, the anesthetist and the ENT doctor, who encouraged prompt treatment, we decided on a MED-EL cochlear implant. Johannes got through the operation without any problems. The whole CI team was a great support to us emotionally.

The first fitting took place 6 weeks later. The audiologist in attendance played with a triangle. When Johannes heard the first sound he looked astonished and began to laugh. We were overjoyed! The game repeated with each sound. When the sound of triangle could no longer be heard, Johannes also stopped laughing. We watched, full of joy, as Johannes was able to hear sounds in his environment. Even after only a few weeks we could see his progress. Johannes dozed off and would be awoken by a loud noise and he would immediately look for the source of the noise. In the meantime, Johannes has started to make sounds and babble. However, without the CI he does not make a sound.

We work intensively with Johannes and speak to him a lot. Early stimulation has also made a considerable contribution to his success. His progress with the CI has taken away our fear of deafness. We are leading quite a normal life with Johannes and taking part in lots of activities. I can only express that I am very enthusiastic about our MED-EL CI and would like to encourage other parents who are facing the same decision as we did, to take the step and let their child be implanted.

Johannes, implanted at 4 months of age
Hayley, age 3

Hayley was deafened due to meningitis, which was caused by an undiagnosed birth defect. I realized about ten days into the meningitis that Hayley wasn't responding to sound. We had a consult with Hayley’s surgeon and Hayley was implanted five days later.

We were amazed at Hayley's progress. Hayley was deafened at a very critical time in her speech and language development; she only had about 15 words before the onset of the meningitis. It is only 2 ½ weeks after her first fitting and we cannot begin to tell you how thrilled we are with the progress she has made in this short amount of time. She responds to questions and appears to hear and understand much of what I say. To be able to have my daughter start to call me “Mommy” two months after she became deaf and two weeks after she had her initial stimulation was the single greatest gift ever.

My husband and I liked the MED-EL CI System very much because of the options for children. When it was hot, Hayley often ran around in just a diaper with the BabyBTE on her hairclip!

I think that as a parent, you have to give your child every opportunity available, whether they have special needs or are normally developing in all areas. We felt as parents that we owed it to Hayley to give her the ability to hear. And I think that Hayley, if you can drag her away from singing and dancing to her Wiggles videos with her twin sister, April, long enough to ask her, would tell you exactly the same thing.
References

1. Veekmans K et al. (2005) My LittlEARS® Diary, Therapist book. MED-EL.
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