



Audiology



Understanding Your Child's Hearing Loss



My Child's Hearing Loss Is...

	Right Ear	Left Ear
Degree of Hearing Loss	<ul style="list-style-type: none"> • Normal • Mild • Moderate • Moderately Severe • Severe • Profound 	<ul style="list-style-type: none"> • Normal • Mild • Moderate • Moderately Severe • Severe • Profound
Type of Hearing Loss	<ul style="list-style-type: none"> • Sensorineural • Conductive • Mixed • Auditory Neuropathy Spectrum Disorder (ANSI) 	<ul style="list-style-type: none"> • Sensorineural • Conductive • Mixed • Auditory Neuropathy Spectrum Disorder (ANSI)
Comments/ Recommendations: <ul style="list-style-type: none"> • Hearing Aids • Bone Anchored Device (BAHA) • CROS System • Cochlear Implant Evaluation • Other: _____ 		
Notes: <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>		

The Audiology Practice at Valley Children's Hospital provides expert diagnosis and treatment of hearing loss in infants and children from birth to 21 years of age. Services occur in both the inpatient and outpatient settings. We utilize a team approach and often collaborate with speech-language pathologists, otolaryngologists and the Craniofacial Anomalies Clinic to develop comprehensive treatment plans.

Children who are suspected of having hearing loss or are at risk for developing auditory disorder may be referred for an age-appropriate audiologic evaluation in order to establish the presence of hearing loss and, if present, to determine the degree and type of hearing loss. We also provide comprehensive hearing aid dispensing services.

Next Steps:

Your child will need to be seen by an otolaryngologist – or ear, nose and throat (ENT) specialist - **before** he/she can be fitted with amplification.

- Contact your child's primary care doctor:
- Ask for a referral to an ENT specialist.
- Schedule an appointment with the ENT practice. At that appointment, the doctor will review hearing test results and sign a medical clearance form, if appropriate.
- The physician's office will need to fax a copy of the medical clearance form to us:

Valley Children's Hospital, Madera
Fax: 559-353-6950

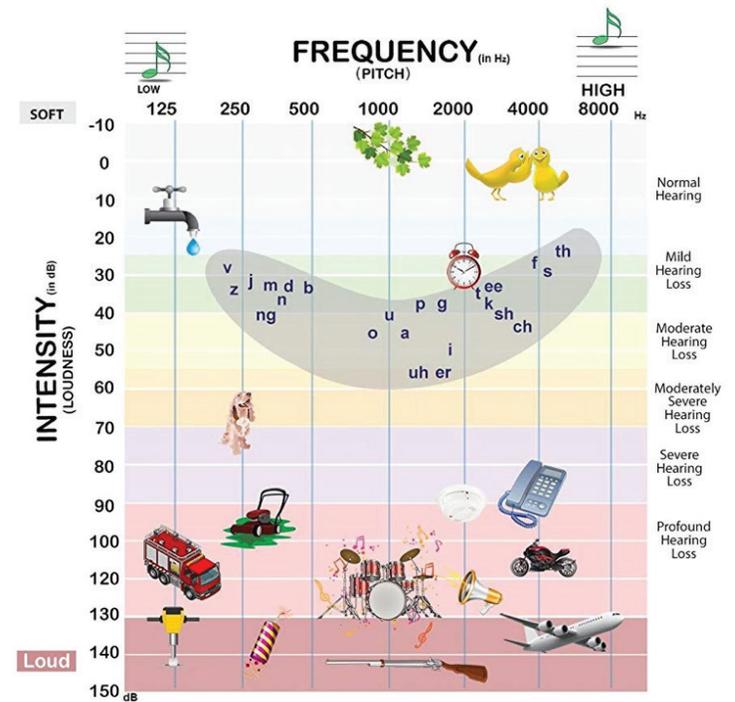
Eagle Oaks Specialty Care Center, Bakersfield
Fax: 661-564-3307

OR you can bring a copy to us:

Valley Children's Outpatient Therapy Center
9325 Valley Children's Place
Madera, CA 93636-8762

Once we receive the medical clearance form, we will contact you to set up the next appointment for hearing device services.

Audiogram of Everyday Sounds



Understanding the Audiogram

The outcome of a hearing evaluation is graphed on a chart called an audiogram. This records the softest sound your child hears during the behavioral hearing test (hearing thresholds). Loudness is measured in decibels hearing level (dBHL) and is represented on the vertical axis of the audiogram. This evaluation ranges from 0 dBHL, which is very soft, to 110 dBHL, which is very loud. Frequency (or pitch) is measured in hertz (Hz) and is represented on the horizontal axis of the audiogram. 250 Hz is a very low pitch sound and 8000 Hz is a very high pitch sound. Hearing test results are typically measured in degrees. The degree of hearing loss is based on the audiometric thresholds and ranges in severity from mild to profound.

Impacts of Hearing Loss in Children



Speech and Language Development

Degree of Hearing Loss	Potential Impact on Speech and Language
Normal Hearing (-10-25 dBHL)	<ul style="list-style-type: none">• Child can detect all sounds at soft levels• Child should be able to develop speech and language spontaneously
Mild Hearing Loss (25-40 dBHL)	<ul style="list-style-type: none">• Child may have difficulty hearing conversations, especially in noisy settings• Child misses fragments of speech, leading to misunderstandings• Child may miss up to half of classroom discussions• Children often experience difficulty learning early reading skills such as letter/sound associations
Moderate Hearing Loss (40-55 dBHL)	<ul style="list-style-type: none">• Without early amplification, the child will likely have delayed or disordered syntax, limited vocabulary, imperfect speech production, and flat voice quality

Degree of Hearing Loss	Potential Impact on Speech and Language
Moderately/Severe Hearing Loss (55-70 dBHL)	<ul style="list-style-type: none">• Child may miss all speech information without amplification• Child will likely have delayed spoken language, syntax, reduced speech intelligibility and flat voice quality
Severe Hearing Loss (70-90 dBHL)	<ul style="list-style-type: none">• Child may only hear loud noises about one foot away from their ear• Conversational speech is not audible and loud speech is difficult to hear or understand
Profound Hearing Loss (90 dBHL+)	<ul style="list-style-type: none">• Child may perceive sounds as vibrations

Reminder

It is important to remember that the age at which amplification begins, the consistency of hearing aid use and early language intervention is strongly tied to the success of speech, language and learning development. Individual ability and intensive intervention prior to six months of age will determine the degree that sounds detected will be understood by the brain and processed as meaningful input.

Hearing and Speech Developmental Milestones



Birth to One Year of Age

Hearing and Understanding	Talking
Birth - 3 Months	
<ul style="list-style-type: none"> Startles to loud sounds Quiets or smiles when spoken to Seems to recognize your voice and quiets if crying Reacts when sucking on a toy or pacifier in response to sound 	<ul style="list-style-type: none"> Makes pleasure sounds (cooing, gooing) Cries differently for different needs Smiles when they see you
4 - 6 Months	
<ul style="list-style-type: none"> Moves eyes in direction of sound Responds to the changing tone in your voice Notices toys that make noise Pays attention to music 	<ul style="list-style-type: none"> Makes babbling sounds that are more speech-like with many different sounds, including <i>p</i>, <i>b</i> and <i>m</i> Chuckles and laughs Vocalizes excitement and displeasure Makes gurgling sounds when left alone and when playing with you
7 Months - 1 Year	
<ul style="list-style-type: none"> Enjoys games like peek-a-boo and pat-a-cake Turns and looks in the direction of sounds Listens when spoken to Recognizes words for common items like "cup," "shoe," "book" or "juice" Begins to respond to requests ("Come here!" or "Want more?") 	<ul style="list-style-type: none"> Babbling has both long and short groups of sounds such as "tata upup bibibibi" Uses speech or non-crying sounds to get and keep attention Uses gestures to communicate (waving, holding arms to be picked up) Imitates different speech sounds Can say one or two words (hi, dog, dada, mama) around first birthday, although sounds may not be clear

One to Two Years

Hearing and Understanding	Talking
<ul style="list-style-type: none"> • Points to a few body parts when asked • Follows simple commands and understands simple questions ("Roll the ball." "Kiss the baby." "Where's your shoe?") • Listens to simple stories, songs and rhymes • Points to pictures in a book when named 	<ul style="list-style-type: none"> • Says more words every month • Asks one or two word questions ("Where kitty?" "Go bye-bye?" "What's that?") • Puts two words together ("more cookie," "no juice," "mommy book") • Uses many different consonant sounds at the beginning of words

Two to Three Years

Hearing and Understanding	Talking
<ul style="list-style-type: none"> • Understands differences in meaning ("go-stop," "in-on," "big-little," "up-down") • Follows two requests ("Get the book and put it on the table.") • Listens to and enjoys hearing stories for longer periods of time 	<ul style="list-style-type: none"> • Has a word for almost everything • Uses two or three words to talk about and ask for things • Uses <i>k, g, f, t, d</i> and <i>n</i> sounds • Speech is understood by familiar listeners most of the time • Often asks for or directs attention to objects by naming them • Asks "Why?" • May stutter on words or sounds

Three to Four Years

Hearing and Understanding	Talking
<ul style="list-style-type: none"> • Hears you when you call from another room • Hears television or radio at the same loudness level as other family members • Understands words for some colors, like red, blue and green • Understands words for some shapes, like circle and square • Understands words for family, like brother, grandmother and aunt 	<ul style="list-style-type: none"> • Talks about activities at school or at friends' homes • Talks about what happened during the day and says about four sentences at a time • People outside of the family usually understand child's speech • Is able to answer simple "who?", "what?" and "where?" questions • Asks when and how questions • Says rhyming words, like "hat-cat" • Uses pronouns, like I, you, me, we and they • Uses some plural words, like toys, birds and buses • Uses a lot of sentences that have four or more words



Four to Five Years

Hearing and Understanding	Talking
<ul style="list-style-type: none">• Understands words for order, like first, next and last• Understands words for time, like yesterday, today and tomorrow• Follows longer directions at home and at school• Hears and understands most of what is said at home and in school	<ul style="list-style-type: none">• Says all speech sounds in words but may make mistakes on sounds that are harder to say, like <i>l, s, r, v, z, ch, sh, th</i>• Responds to, "What did you say?"• Can name letters and numbers• Uses sentences that have more than one action word but may make mistakes, like, "Zach got two video games, but I got one."• Tells a short story, keeps a conversation going• Talks in different ways depending on the listener and place



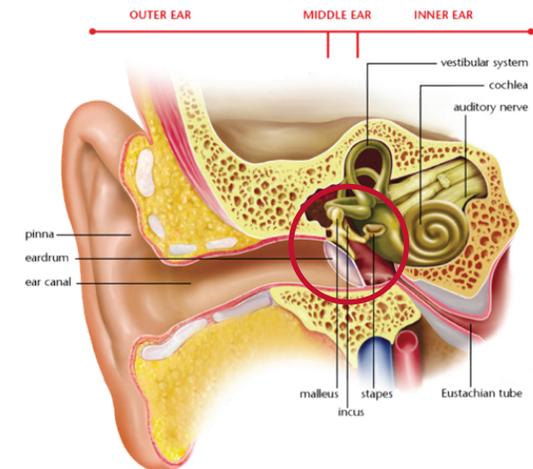
Types of Hearing Loss

Conductive Hearing Loss

Conductive hearing loss occurs when sound is not transmitted efficiently through the outer ear, to the eardrum and to the tiny bones (ossicles) of the middle ear. Conductive hearing loss usually involves a reduction in sound volume.

Some possible causes of conductive hearing loss include:

- Fluid in the middle ear
- Ear infection (otitis media)
- Allergies
- Poor Eustachian tube function
- Perforated eardrum (hole in the eardrum)
- Plugged earwax (impacted cerumen)
- Infection in the ear canal (external otitis)
- Presence of a foreign body (debris or object in the ear canal)
- Absence or malformation of the outer ear, ear canal or middle ear (atresia, microtia, stenosis of the ear canal)

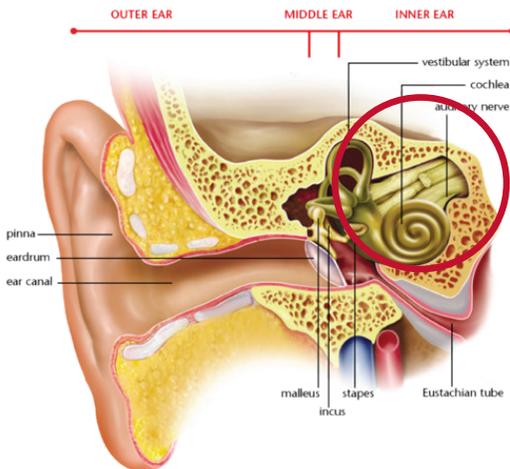


Sensorineural Hearing Loss

Sensorineural hearing loss (SNHL) occurs when there is an abnormality or damage to the inner ear (cochlea) or to the nerve pathways from the inner ear to the brain. SNHL cannot be medically or surgically corrected. With SNHL, even when speech is loud enough to hear, it may sound unclear or muffled.

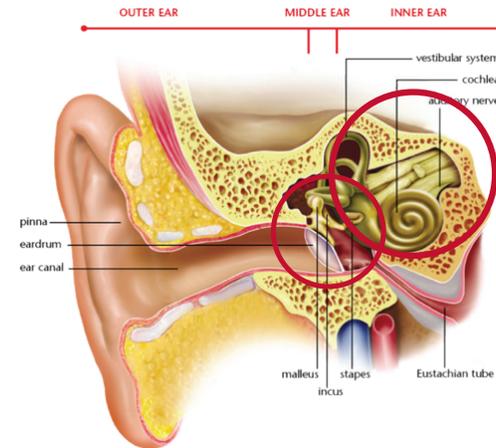
Some possible causes of SNHL include:

- Hearing loss that runs in the family (genetic or hereditary)
- Congenital hearing loss with unknown cause
- Illnesses (meningitis)
- Malformation of the inner ear
- Drugs that are toxic to hearing (ototoxic)
- Head trauma
- Exposure to loud noise



Mixed Hearing Loss

Sometimes a conductive hearing loss occurs in combination with sensorineural hearing loss (SNHL). In other words, there may be a problem in the outer or middle ear and in the inner ear (cochlea) or auditory nerve. When this occurs, the hearing loss is referred to as a mixed hearing loss. (See previous pages on conductive and sensorineural hearing losses).



Auditory Neuropathy Spectrum Disorder

Auditory Neuropathy Spectrum Disorder (ANSD) is an auditory disorder in which the neurons in the hearing nerve and brain stem do not "fire" properly. As a result, a person with ANSD may have difficulty distinguishing one sound from another and/or trouble understanding speech clearly. In some cases, ANSD causes only mild hearing difficulties and/or is only a problem in noisy situations. However, in many cases there are significant hearing difficulties and amplification of some type is required.

The causes of ANSD are unknown. However, children who are born prematurely, require extended oxygen support or have a family history of the condition are at a higher risk. Symptoms can develop at any age, but most children with ANSD are born with it and are diagnosed within the first few months of life.



Types of Amplification

Hearing Aids

How does a hearing aid work?

A hearing aid usually consists of two main parts: the electronic part of the hearing aid and the earmold. Sound is picked up by the microphones on the hearing aid and sent to the amplifier within the device. The amplified sound is then sent through a tube that is connected to the earmold. Hearing aids are programmed for your child's specific hearing levels and should be adjusted regularly by an audiologist.

Who can wear a hearing aid?

Hearing aids are suitable for almost all types and degrees of hearing loss and for all ages. They can be worn in different styles, including behind-the-ear (BTE) or in-the-canal (ITC). Your audiologist will discuss the different options for your child so that you can select the right device for his or her age and hearing needs.

How do you wear a hearing aid?

A behind-the-ear hearing aid sits tucked behind the ear. An earmold is used to anchor the hearing aid to the ear and to direct amplified sound into the ear canal. Both should fit tightly and comfortably so they can do their job properly.

As babies grow, they will need their earmolds replaced frequently, but can continue to use the same hearing aid for several years. Earmolds are replaced most often for infants and toddlers. By the time a child is six years old, the need to replace earmolds on a regular basis will decrease significantly.

For younger children, there are features that allow parents to see if the device is working, such as indicator lights. There are also clips that secure hearing aids to a child's clothing to help ensure they don't get lost. Ask your audiologist for suggestions on what to use with your child's hearing aids to make sure they are functioning as they should.



Bone-Anchored Hearing Aid (BAHA) System

How does a BAHA work?

BAHA systems work by direct bone conduction. Sound waves are first received by the sound processor and changed to vibrations. Sound vibrations are transmitted through the bones of the skull, bypassing the outer and middle ear, directly stimulating the cochlea (inner ear).

Who can wear a BAHA system?

- Individuals with conductive hearing loss
 - Congenital ear malformations, like atresia, microtia or stenosis of the ear canal
 - Chronic inflammation of the ear canal or ongoing middle ear issues that restrict the ability to wear a conventional hearing aid

How do you wear a BAHA?

- **BAHA Softband** is used for infants and young children who are not surgical candidates, those awaiting surgery and/or older children as a trial prior to surgery. The BAHA Softband includes an elastic headband, with the sound processor connected via a plastic snap connector
- **Implantable BAHA System** consists of external parts (sound processor and abutment) and internal component (titanium implant). The BAHA abutment and implant are surgically placed in the skull bone behind the ear and the sound processor connects to the abutment.

Cochlear Implants

How does a cochlear implant work?

A cochlear implant is a surgical procedure where a device that provides direct electrical stimulation to the auditory (hearing) nerve is placed into the ear. With a cochlear implant, the damaged hair cells are bypassed and the auditory nerve is stimulated directly. The cochlear implant does not result in "restored" or "cured" hearing. It does, however, allow for the perception of the sensation of sound.

Who can get a cochlear implant?

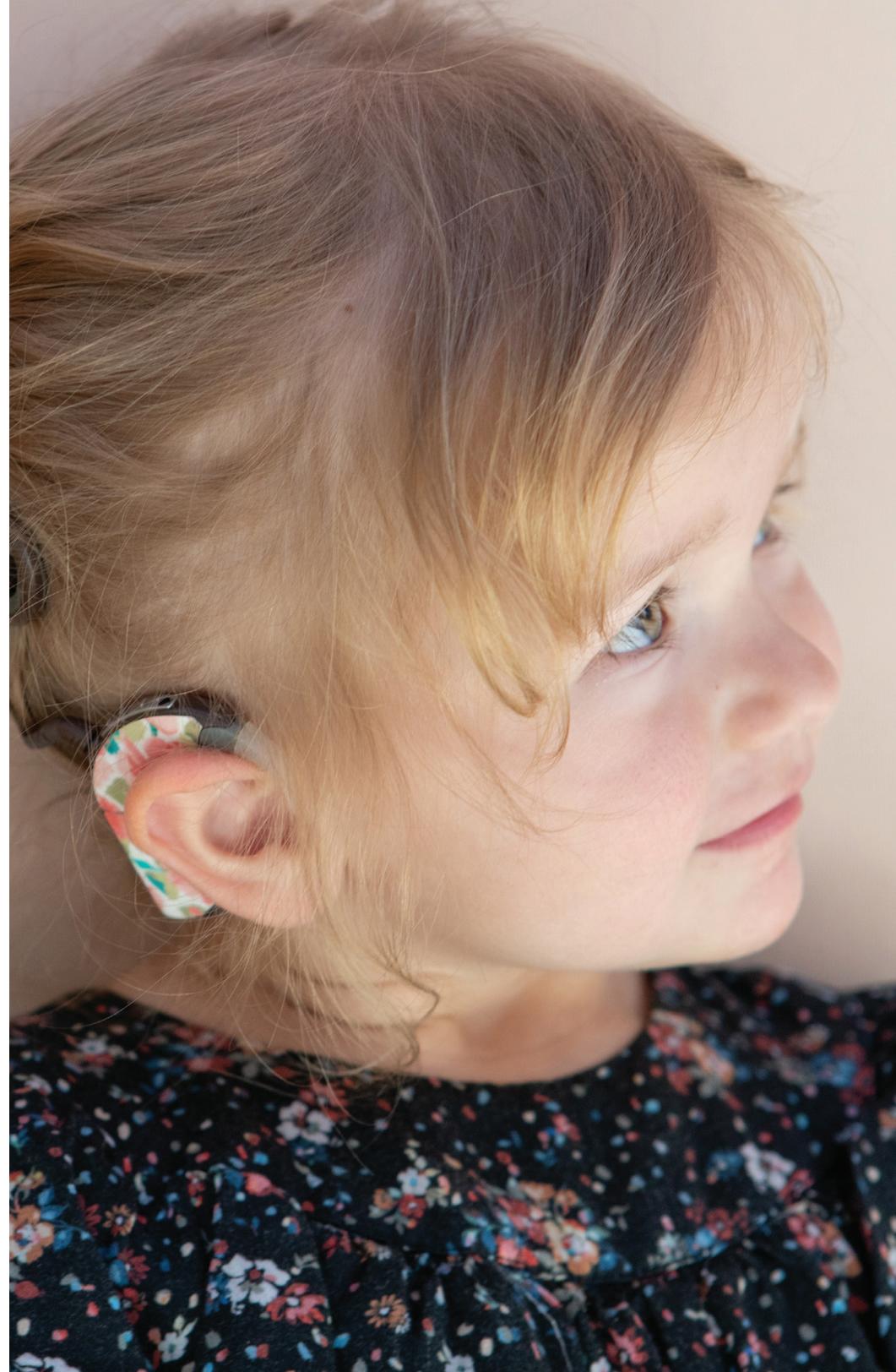
Individuals with moderately severe to profound hearing loss who cannot be helped with hearing aids may be helped with cochlear implants. However, certain factors determine how successful they may be. These factors include:

- The age of the patient when he or she receives the implant
- Whether the hearing loss was present before or after the patient developed speech and language skills
- The motivation of the patient and his or her family

How do you wear a cochlear implant?

There are two parts to a cochlear implant:

- An internal electrode array. This is surgically implanted into the cochlea by a specialist. After surgery, this is under the skin and not visible.
- An external processor. This sits behind the ear and is connected to the electrode array by a magnet. It looks similar to a large behind-the-ear hearing aid, but does not send sound through the ear canal. It converts sound into electrical signals that the nerve and brain can use to simulate hearing.



Contralateral Routing Of Signals (CROS) or Bi-CROS Hearing Aid System

How does a CROS hearing system work?

A CROS system uses two hearing aids (a transmitter and a receiver) to help a person hear sounds from one side of the head to the better-hearing ear. The transmitter picks up sounds from the environment and sends them to the receiver. This allows someone to hear what is happening from the poorer hearing side.

Who can wear this type of device?

An individual who has normal or aidable hearing in the good ear and a severe/profound or unaidable hearing in the worse ear is a candidate for a CROS hearing aid system.

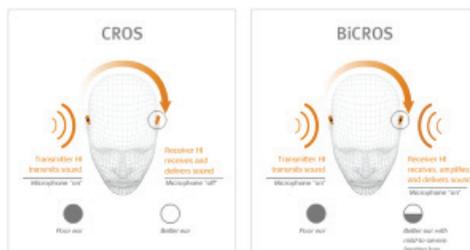
A CROS hearing aid system DOES NOT do the following:

- Provide amplification to the poorer hearing ear
- Help someone find where a sound is coming from (localization)
- Improve speech understanding in noise

Success with a CROS device depends on the child's motivation and an understanding of when and where the use of a CROS system is most beneficial.

How do you wear this system?

The better ear wears a regular hearing aid or receiver. The poorer ear also wears a device transmitter. The way it is fit or sits in the ear can vary depending on the individual needs of the patient.



Educational Considerations

Children with hearing loss have unique and important communication needs that should be considered in all aspects of their daily life.

Early Intervention Services (Age 0-3 years)

- Once your child has been diagnosed with hearing loss, the audiologist will make a referral for early intervention services. These services are available through your local County Office of Education and are available free of charge to the family of any child with hearing loss. You have the choice to accept or decline these services as you feel necessary.

School District Support (Age 3+)

- Most school districts have access to specialists who work with deaf or hard-of-hearing children. The availability of services is different for each school district; therefore, it is important to contact your local school district to discuss the goals for your child, as well as their academic needs.
- Please make sure your school district has a copy of the most current hearing test results. This will help the school better understand your family's goals and your child's needs. This information can also help in planning how to support the specific classroom environment and select the best educational option for you and your child.



Parent Support Resources

As a parent, it is important you know that you are not alone in this journey. There are many resources available to support your needs as you face the challenges of having a child with hearing loss. The following resources are available for you to explore:

**California Department of Health
Care Services**

dhcs.ca.gov/services/nhsp

**Deaf and Hard of Hearing Service
Center (DHHSC)**

dhhsc.org

Hands and Voices

handsandvoices.org

**Parenting a Child who is Deaf or
Hard of Hearing**

babyhearing.org

Parent Links

empoweryourfamily.org/parentlinks

Social Media

Facebook Groups, Instagram,
Twitter, etc (Search "Families of
children with hearing loss")



Additional Resources

For information about hearing loss, audiology professionals and research, please explore these resources:

American Academy of Audiology
audiology.org

American Speech-Language-Hearing Association (ASHA)
asha.org/public

Alexander Graham Bell Association for the Deaf and Hard of Hearing
agbell.org

National Center for Hearing Assessment and Management
infanthearing.org

National Institute on Deafness and Other Communication Disorders
nidcd.nih.gov

Valley Children's Hospital Outpatient Audiology Practice

9325 Valley Children's Place
Madera, CA 93636
Phone: 559-353-6801
Fax: 559-353-6951

Valley Children's Hospital Speech Therapy

41169 Goodwin Way
Madera, CA 93636
Phone: 559-353-3801

Valley Children's Otolaryngology (ENT) Practice

9300 Valley Children's Place
Madera, CA 93636
Phone: 559-353-6453



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