

Binaural Hearing - A Guide for Educators

BINAURAL HEARING SERIES



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Hearing with both ears, also known as binaural hearing, gives optimal access to sound. Hearing is normally accomplished with two ears, and the brain is organized to receive and then process sounds from two ears. Evidence shows that bilateral cochlear implantation improves binaural hearing, providing a range of benefits to recipients with severe-to-profound hearing loss: ^{1,2,3}

- Localization of sound. Localization refers to the ability to identify the direction that a sound or speech comes from. For example, we can hear a person calling us on our right side, and we know which way we need to turn to respond.
- Better understanding of speech in both quiet and noisy situations. Hearing with two ears means that speech can be heard more clearly and easily in situations with loud background noise (e.g., classroom, cafeteria, playground).
- Improved ability to track voices in group conversation to identify who is speaking.
- Reduced listening effort. Listening with two ears requires less effort to listen to a conversation compared to when listening with one ear.

How Children with Hearing Loss Hear Binaurally

Hearing technology, such as a cochlear implant (CI) or hearing aid (HA), can help children access oral instruction and communication in the classroom. A CI provides an electrical signal that stimulates the auditory nerve directly. A HA amplifies the acoustic signal sent to the inner ear but does not bypass any dysfunction occurring there. For this reason, the clarity of sound provided by a HA can vary widely depending on the dysfunction in the cochlea. For children who are deaf, hearing through a CI provides greater access to sound but it is not *normal hearing*. To find out how CI recipients compare normal hearing to hearing via a CI, visit the [MED-EL Blog](#).

Children who rely on hearing technology are often integrated into the regular education classroom where binaural hearing is essential. There are three distinct ways in which a student with deafness may achieve binaural hearing in the classroom:

- Students who use two cochlear implants, or *bilateral* recipients, are deaf in both ears. They may have received both devices at the same time or separately. If significant time has passed between the first and second implants, the student's auditory skills may differ substantially between the two ears. Students who use bilateral CIs are at risk for auditory, spoken language, social-emotional, and academic delays. ^{4,5,6}
- Students who wear two different devices, or *bimodal* recipients, are those who use a CI on one side and a HA on the other. The degree of hearing loss may be the same or different between both ears. The level of benefit received from the HA will depend on the degree of hearing loss in that ear. Like bilateral CI recipients, they are at risk for auditory, spoken language, social-emotional, and academic delays. ^{4,5,6,7}
- Students with deafness in one ear, single-sided deafness (SSD), hear with the assistance of a CI in one ear and normally in the opposite ear. Students with SSD do not always have concerns related to their spoken language development but the hearing loss can negatively impact their binaural listening skills, social-emotional development, and academics. ^{8,9,10}

Challenges to Binaural Listening at School

Environmental acoustics. There are three key environmental factors that affect the quality of sound in the school setting: noise, distance, and reverberation.

- *Reduce the background noise.* The impact of background noise is particularly severe for children who listen with hearing technology. Moreover, students with an early childhood hearing loss may lack the language skills to *fill* in the parts of a message that they did not hear. Common sources of background noise in the classroom include sounds entering through open doors, radios or music players, air conditioning units, pencil sharpeners, and personal conversation. When these sounds cannot be avoided, consider placing the child with hearing loss away from these noise sources to the extent possible.
- *Close the distance.* Sounds become softer as the distance from the speaker increases. Shouting across a distance is not helpful because the softer sounds of speech become harder to hear. Instead of raising the volume, the speaker can move closer to the student to ensure that all the sounds in speech remain clear. Reducing the distance between the speaker (e.g., teacher) and the student by 50% will automatically make the speaker's voice sound 6 dB louder to the listener.
- *Soft is good, hard is bad.* Sound is reflected from hard surfaces more easily than soft ones. Reflected sounds can compete with other sounds in the environment and cause distortion. A classroom environment with soft surfaces absorbs more reflected sound so that the important sounds are easier to hear (e.g., teacher's voice). Create an inviting listening environment by covering hard floors with carpets or rugs, hanging curtains or drapes, using fabric panels or displays on walls, and placing soft padding or rubber on the bottom of chair legs.

Language development & peer communication.

Social time is vital for students with hearing loss as it provides exposure to a wider use of social language (e.g., slang, idiomatic expressions, humour) necessary for peer communication. Delays in social language skills negatively impact students' abilities to establish and maintain friendships among classmates and can further isolate them from their peers.⁵ Unfortunately, social settings are also among the most challenging communication scenarios because of the poor environmental acoustics that are common in these settings (e.g., cafeteria, playground, auditorium). In the school setting, these often impact the student's ability to engage with peers during lunch breaks, recess or unstructured play, and music education. Create an individualized plan to manage communication during these times. See *Peer Communication* in the section *School-Based Support for Binaural Listening in the Classroom* for more ideas.

Listening fatigue. Students with hearing loss demonstrate greater difficulty performing two tasks at once (e.g., listening to the teacher and taking notes) compared to their classmates without hearing loss. In turn, this fatigue can impact the student's behaviour, motivation, and overall academic performance.¹¹ Reduce the impact of daily listening fatigue by offering short *listening breaks* during the day where the student may engage in a non-listening activity (e.g., independent reading, drawing) in a quiet setting. Some students may benefit from more frequent *listening breaks* dependent on their class schedule, temperament, and ability.

School-Based Support for Binaural Listening in the Classroom

Assessment and monitoring. Ongoing assessment of the student's listening and spoken language skills should be monitored by the rehabilitation professional(s). Classroom teachers can support this process through ongoing communication with parents/caregivers and other professionals about the student's classroom performance. For example, teachers may send an email or a journal with notes home to the family. Periodically, every six months or so, the teacher can also complete a more formal assessment of the student's academic performance to identify or monitor areas of concern. One assessment tool that specifically investigates the school behaviour and performance of children with hearing loss is the *Screening Instrument for Targeting Educational Risk*, [available here](#).

Assistive listening devices (ALDs). Contemporary cochlear implant(s) and hearing aids have software technology to minimize the impact of noise, distance, and reverberation. However, the most direct way to overcome these barriers is through assistive technology such as a soundfield system or an individual neckloop, FM, or infrared device. The primary function of these devices is to transmit the speaker's voice via a microphone directly to a fixed speaker (i.e., soundfield system) or to the student's hearing technology (i.e., CI or HA) through a receiver coupled to the device. ALDs are fitted and maintained by a hearing professional such as an audiologist. When used, they can also benefit classmates with typical hearing and reduce vocal strain for teachers.^{12,13} For more information on the different types of ALDs available, please visit the [MED-EL Blog](#).

Conduct a daily listening check. Young students may not report that their device is not functioning properly, particularly if they use two devices and one remains working. To ensure proper access to all the sounds of speech, conduct a daily listening check with the student in the classroom at the start of the day. If the student relies on assistive technology, such as an FM or infrared system, be sure to conduct a listening check

after it is activated. The *Ling Six Sound Test* is a quick and effective check of functional listening. For more information about the *Ling Six Sound Test* and a short video on how it is used, please visit the [MED-EL Blog](#).

Device maintenance and use. Device maintenance is a shared responsibility among caregivers and professionals. The classroom teacher can assist by knowing how to complete a visual inspection of the device, test and change a battery, and replace a CI cable. Consult with the student's family and hearing professional to develop a plan for what to do in the case of a flat battery or malfunctioning cable. For example, CI users who rely on rechargeable batteries will need access to a spare rechargeable at school or need to use an audio processor accessory that can accept a disposable battery. Keep appropriate contact information in the classroom and inform other school professionals (e.g., a substitute teacher or classroom aide) about what to do in case of a concern. Over time, students in primary school can be encouraged to learn how to complete basic device use and maintenance, such as how to place an FM receiver in the morning or replace a battery.

Hearing aids, cochlear implants and ALDs, like any piece of technology, are vulnerable to faults or breakages that require repair. If a replacement device is not available during the repair period, keep in mind that the student will have increased difficulty following conversations, tolerating low levels of noise, and may show signs of greater listening fatigue.

Classroom management. Classroom noise cannot be managed effectively through technology alone. Here are two strategies to consider throughout the day.

- Transitions between activities or from one classroom to the next can be the noisiest times of the day. Consider if it would be suitable to provide the student with hearing loss with a classmate or listening partner whom they could ask questions or follow to help ease these transition periods.
- Set expectations throughout the day about the level of personal conversation allowed during classroom routines and activities. For young students, a visual system may help them understand when personal conversation is allowed (e.g., red for quiet times, yellow for indoor or soft voices, and green for normal conversation). This is preferable to lowering the lighting in the classroom as poor lighting makes it difficult for children with hearing loss to see someone's face when they are speaking.

Instructional support. In addition to managing noise in the classroom, there are strategies the educator can use to help the student access the classroom instruction more easily. Share the following ideas with all the instructors and aides (e.g., physical education or music teachers, classroom aides) for the student with hearing loss:

- Speak clearly
- Use visual aids during classroom routines; write the day's agenda and important due dates on the board for all to see
- Position the student close to where most of the teaching takes place; the second row allows the student to remain close to instructions while also observing classmates if help is needed
- Face the student with hearing loss during individual or group address
- Minimize glare on visual aids (e.g., whiteboard) and avoid standing directly in front of a light source (e.g., window, the sun) as backlighting obscures the face

- Stand in one place when giving oral information or tests (e.g., spelling exams) rather than roaming the class
- Be conscious of jewelry (e.g., earrings, necklaces, bracelets) that makes noise when wearing an ALD transmitter (e.g., FM microphone)
- Show videos with captions turned on for students who can read or are learning to read
- Check that students have understood instructions by asking open-ended questions that prompt them to restate what they have heard

Peer communication. Have a plan in place to ensure that small and large group conversation with peers is well-managed. Some ideas may include:

- Allowing students with hearing loss to share with the class about their hearing, the importance of their technology, and how it functions
- Creating a social group for lunch time discussion in a supervised, quiet setting
- Requesting that classmates speak one at a time during large and small group discussion
- Encouraging peers to face the student with hearing loss while talking during free play and recess
- Repeating questions or comments from peers during large group discussions (e.g., circle time, storytime) before responding to them
- Teaching the student's peers to pass the microphone when using ALDs

Managing behaviours. When a student is having difficulty hearing, this may manifest in behaviours that can be challenging. Recall that listening with two ears helps students turn towards a sound or speaker and increases the overall loudness of sound. Some challenging behaviours may disguise a hearing difficulty. For example,

- talking in a loud or elevated voice is often used to hear one's voice better;
- walking over to other student's desks may be an effort to hear peers better; and
- difficulty persisting during independent tasks, particularly later in the school day, may suggest listening fatigue.

When these subtle behaviours arise, it may mean that the auditory processor(s) or hearing aid is not working as intended. Be cautious by conducting a listening check of both devices and informing the student's parent or caregiver as needed. For children with bilateral hearing loss who use only one CI, documenting these behaviours can contribute to a discussion with the family about the benefits of binaural hearing.

Collaboration with rehabilitation professionals. The educator is a key professional of the rehabilitation team for students who use hearing technology. Optimal outcomes can only be achieved through collaboration among all team members (e.g., parents/caregivers or caregivers, hearing and rehabilitation professionals, and educators). There are many ways in which team members can support one another:

- Parents/Caregivers and rehabilitation professionals can support classroom lessons by pre-teaching key vocabulary or concepts when they know the content of the lesson plan in advance.
- If the teacher needs to advocate for an ALD in the classroom, the hearing professional can provide evidence of potential benefit by evaluating the student's speech perception skills at different levels of noise.
- Students who use technology and exhibit social or behavioural problems in the classroom may be better supported when the rehabilitation professional can provide intervention directly inside the classroom (i.e., inclusive therapy) with their peers. With a commitment to flexibility, openness, and engagement, the team can ensure that the school experience for students who use hearing technology remains a positive one.



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MED-EL Offices Worldwide

AMERICAS

Argentina

medel@medel.com.ar

Canada

officecanada@medel.com

Colombia

office-colombia@medel.com

Mexico

office-mexico@medel.com

United States

implants@medelus.com

ASIA PACIFIC

Australia

office@medel.com.au

China

office@medel.net.cn

Hong Kong

office@hk.medel.com

India

implants@medel.in

Indonesia

office@id.medel.com

Japan

office-japan@medel.com

Malaysia

office@my.medel.com

Philippines

office@ph.medel.com

Singapore

office@sg.medel.com

South Korea

office@kr.medel.com

Thailand

office@th.medel.com

Vietnam

office@vn.medel.com

EMEA

Austria

office@at.medel.com

Belgium

office@be.medel.com

Finland

office@fi.medel.com

France

office@fr.medel.com

Germany

office@medel.de

Italy

ufficio.italia@medel.com

Portugal

office@pt.medel.com

Spain

office@es.medel.com

South Africa

customerserviceZA@medel.com

United Arab Emirates

office@ae.medel.com

United Kingdom

customerservices@medel.co.uk

MED-EL Medical Electronics
Fürstenweg 77a | 6020 Innsbruck, Austria | office@medel.com

medel.com

