Types of hearing loss

- **Conductive hearing loss**: occurs when sound is not conducted efficiently through the outer ear canal to the eardrum and the tiny bones (ossicles) of the middle ear. This type of hearing loss can often be corrected medically or surgically. Common causes of conductive hearing loss include: otitis media, wax buildup, eardrum perforation, and absence of the outer ear, ear canal, or middle ear.

- **Sensorineural hearing loss (SNHL)**: occurs when there is damage to the inner ear (cochlea), or to the nerve pathways from the inner ear to the brain. Most of the time, SNHL cannot be medically or surgically corrected. This is the most common type of permanent hearing loss. For patients with SNHL, even when speech is loud enough to hear, it may still be unclear or sound muffled. Common causes of SNHL include: hereditary or genetic, illness, medications that are toxic to the ear (ototoxic), exposure to loud sounds, and malformations of the inner ear.

- **Mixed hearing loss**: a combination of both a conductive hearing loss and a sensorineural hearing loss (SNHL). In other words, there may be damage in the outer or middle ear and in the inner ear (cochlea) or auditory nerve.

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• **Auditory neuropathy spectrum disorder (ANSD):** a clinical syndrome where the cochlea is functioning normally (or near-normal), but there is either absent or abnormal nerve pathway function from the inner ear to the brain. Patients with ANSD have the following clinical findings reported: hearing fluctuation, difficulty hearing in noise, and poorer than expected speech recognition abilities for the degree of hearing loss. Some individuals with ANSD have little or no communication difficulties while others are functionally deaf. Management of a patient with ANSD involves multiple diagnostic audiologic tests, and consistent monitoring of the patient’s speech and language understanding abilities. Not all individuals diagnosed with ANSD experience the same problems or to the same degree; therefore, there is not a hard and fast rule of specific amplification intervention with a patient with ANSD.

**Degrees of hearing loss**

• **Audiogram:** a patient’s hearing is plotted on an audiogram. Along the “x” axis is pitch, from low pitch up to high pitch represented from left to right; the “y” axis is a plot of volume, or loudness, with soft sounds down to loud sounds represented from the top to the bottom. Below is a plot of where different speech sounds will occur on the audiogram. Low pitch speech sounds include sounds we use our voice to produce, such as “m” and “b” and high pitch speech sounds include those that we do not use our voice to produce, such as “s” and “th.”

• **Mild hearing loss:** hearing levels between 26-40 dBHL. This is one of the more challenging degrees of hearing loss to notice with a child, and will frequently go undetected, unless it is diagnosed via hearing testing. These patients will appear as if they are hearing as they will respond to most sounds, and can understand most of what is said if the speaker is in a quiet environment and their face is visible. These patients will miss out on softer sounds of speech. They might have a speech and language delay, or, depending on the degree of loss and length of time the patient has had the loss, they might develop normal speech and language skills. Patients with mild losses will also have issues understanding speech in the presence of background noise or at a distance, such as in the classroom or in the car.

• **Moderate hearing loss:** hearing levels between 41-55 dBHL. These patients may be unable to hear sounds such as normal conversation or the ringing of the phone.

• **Moderately-severe hearing loss:** hearing levels between 56-70 dBHL. These patients may be unable to hear normal conversation or the barking of a dog.

• **Severe hearing loss:** hearing levels between 71-90 dBHL. These patients may be unable to hear sounds like loud conversation or traffic noise.

• **Profound hearing loss:** hearing levels over 91 dBHL. These patients may be unable to hear very loud sounds like airplane engines or fire alarms.
Most patients with hearing losses ranging from the mild to severe degree will benefit from hearing aids. Some patients with hearing losses ranging from the severe to profound degree may benefit from cochlear implants. However, not all patients with hearing loss will benefit from a hearing aid or a cochlear implant. An audiologist is the professional who can determine and recommend appropriate amplification.

**Explanation of hearing loss**

- **Configuration of hearing loss:** refers to the degree and pattern of hearing loss across frequencies (tones), as illustrated in a graph called an audiogram. The “X” symbols represent a patient’s left ear and the “O” symbols represent a patient’s right ear. Sounds above these symbols are inaudible to the patient. Sounds below these symbols are audible.
- **Bilateral versus unilateral hearing loss**: Bilateral hearing loss means hearing loss in both ears; unilateral refers to hearing loss in one ear.

- **Symmetric versus asymmetric hearing loss**: Symmetrical means the degree and configuration of hearing loss are the same in each ear. Asymmetrical means degree and configuration of hearing loss are different in each ear.

- **Progressive hearing loss**: the hearing loss becomes worse over time.

- **Sudden hearing loss**: the hearing loss happens quickly. Most patients of age who experience a sudden hearing loss can typically tell you the exact day and time when this happened. Such a hearing loss requires immediate medical attention to determine its cause and treatment.

- **Fluctuating hearing loss**: the hearing loss changes over time—sometimes getting better, sometimes getting worse. Possible causes of a fluctuating hearing loss can be either anatomical or related to middle ear fluid.

### Types of testing

*With multiple testing options available to evaluate a patient’s hearing, audiologists are capable of ACCURATELY testing patient’s hearing from 1 day old up to 200 years old! Therefore, a referral for a hearing evaluation with an audiologist should be made as soon as reduced hearing is suspected – DON’T WAIT!*

- **Otoacoustic emissions (OAEs)**: sounds given off by the inner ear when the cochlea is stimulated by a sound. When sound stimulates the cochlea, the outer hair cells vibrate. The vibration produces a nearly inaudible sound that echoes back into the middle ear. The sound can be measured with a small probe inserted into the ear canal. People with normal hearing produce emissions. Those with hearing loss greater than 25–30 decibels (dB) do not produce OAEs. Generally speaking, patients with a conductive component to their hearing (i.e. otitis media) will not produce emissions. The OAE test is often part of the newborn hearing screening. Testing typically takes under 10 minutes to perform and the patient needs to remain fairly quiet for the
test. No patient response is necessary. Otoacoustic emissions are generally reported as either “present” or “absent.”

- **Auditory Brainstem Response (ABR):** provides information about the inner ear (cochlea) and brain pathways for hearing. This test is also sometimes referred to as auditory evoked potential (AEP). The ABR is performed by pasting electrodes on the head—similar to electrodes placed around the heart when an electrocardiogram is run—and recording brain wave activity in response to sound. The person being tested rests quietly or sleeps while the test is performed. No patient response is necessary.

The diagnostic ABR can be used with children or others who have a difficult time with conventional behavioral methods of hearing screening, or for patients under 6 months of age. Test results for an ABR highly correlate with those of the behavioral audiogram. Testing typically takes a couple of hours to complete.

The ABR can also be a neurodiagnostic test that is indicated for a person with signs, symptoms, or complaints suggesting a type of hearing loss in the brain or a brain pathway. Neurodiagnostic ABR testing typically takes under an hour to complete.

The ABR can also be used as a screening test in newborn hearing screening programs. When used as a screening test, only one intensity or loudness level is checked, and the baby either passes or does not pass the screen. Hearing screening via an ABR can take anywhere from 5 minutes to up to 45 minutes.

- **Visual reinforcement audiometry:** the method of choice for testing children between 6 months and 2 years of age. The child is trained to look toward a sound source. When the child gives a correct response (e.g., looking to a source of sound when it is presented), the child is "rewarded" through a visual reinforcement. Examples of visual reinforcements include a moving toy or a flashing light.

- **Conditioned play audiometry:** method of choice for testing toddlers and preschoolers (ages 2–5). The child is trained to perform an activity each time a sound is heard. The activity may involve putting a block in a box, placing pegs in a hole, or putting a ring on a cone.

- **Bone conduction:** method of testing that sends a tone through a small vibrator placed behind the ear (or on the forehead). The signal reaches the inner ear (or cochlea) directly through gentle vibrations of the skull. This testing can measure response of the inner ear to sound independently of the outer and middle ears. Is helpful for determining if hearing loss is conductive versus sensorineural in nature.

- **Tympanometry:** assists in the detection of fluid in the middle ear, perforation of the eardrum, or wax blocking the ear canal. Tympanometry pushes air pressure into the ear canal, making the eardrum move back and forth. The test measures the mobility of the eardrum. Graphs are created, called tympanograms. No patient response is necessary. Testing takes generally under one minute to perform.
- **Acoustic reflexes**: can add information about the possible location of the hearing problem. A tiny muscle in the middle ear contracts when a loud sound occurs. The loudness level at which the acoustic reflex occurs—or the absence of the acoustic reflex—gives information to the audiologist about the type of hearing loss. No patient response is necessary. Testing generally takes a few minutes to perform.

- **Auditory processing disorder**: difficulty with the brain’s ability to accurately perceive speech in both quiet and noisy settings, although the patient has normal to near-normal hearing. Common symptoms include: trouble hearing in background noise, difficulty localizing sounds, and mishearing words or similar sounds. In order to receive an auditory processing evaluation from an audiologist, the patient must be: at least 7 years of age, have normal to near-normal hearing, without significant cognitive or developmental delays, with English as their primary language. The auditory processing evaluation typically takes two hours to complete. A common differential diagnosis for auditory processing disorder is a language-based learning disability.

**Types of amplification**

- **Hearing Assistance Technology (HAT), formerly known as an FM system**: HAT systems are like miniature radio stations operating on special frequencies. The personal HAT system consists of a transmitter microphone used by the speaker (such as the teacher in the classroom, or the speaker at a lecture) and a receiver used by the listener. The receiver transmits the sound directly to the receiver, which could consist of an attachment to the hearing aid or cochlear implant, an earpiece that is worn in the patient’s ear, or to a speaker for the entire class to hear.

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- **Cochlear implant**: A cochlear implant is a device that provides direct electrical stimulation to the auditory (hearing) nerve in the inner ear. Children and adults with a permanent severe to profound hearing loss who receive limited benefit from hearing aids may be helped with cochlear implants. Cochlear implants involve a surgery that inserts an internal electrode in the inner ear. Sound is transmitted to this electrode via an external speech processor that the patient wears on their head, connected by a magnet.
- **Bone conduction hearing aid:** uses a headband and a bone vibrator for individuals who have a significant, mainly conductive hearing loss or no ear canal or outer ear. These devices bypass the outer and middle ear and directly stimulate the cochlea. This hearing aid is for long-standing or permanent hearing losses that are mainly conductive in nature.

- **Bone anchored hearing aid (BAHA):** an osseointegrated hearing aid (bone anchored), which is implanted in the skull via surgery. In the past, this device had three parts: a titanium implant, an external abutment, and a detachable sound processor. More recently the device has two parts: a titanium implant with an internal magnet and a detachable sound processor that connects with another magnet. The BAHA is typically not provided to patients less than 5 years of age. This hearing aid is for long-standing or permanent hearing losses that are mainly conductive in nature.
**Hearing aid:** an electronic device that collects sound, amplifies it, and directs the amplified sound into the ear. While the style of hearing aid may vary, all hearing aids have similar components: a microphone to pick up sound, an amplifier to make sounds louder, a receiver (miniature loudspeaker) to deliver the amplified sound into the ear, and batteries for power.

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**Possible recommendations**

- **Preferential seating:** seating the student near and facing the teacher, away from areas of greatest noise, allowing full view of the teacher’s face, and being able to hear other students as well.

- **Educational audiologist:** educational audiology is the practice of audiology that focuses on supporting students with hearing difficulties in an educational setting.

**References**

- American Speech-Language and Hearing Association: www.asha.org
- Success for Kids with Hearing Loss: www.successforkidswithhearingloss.com