



## What do hearing aids do?

You are here: [Home](#) » [About hearing loss](#) » [Hearing aids](#) » **What do hearing aids do?**

It is a common belief that people with hearing loss just can't hear sounds loudly enough, but the problem is much more complicated than that.

- [Four main problems caused by hearing loss](#)
- [How do hearing aids work and compensate for the effects of a hearing loss?](#)

### Four main problems caused by hearing loss

People with a hearing loss don't hear soft sounds. Consequently, the softer speech sounds, which are usually the consonants, may simply not be heard. For example, the sequence of vowel sounds "i-e-a-ar" may have belonged to "pick the black harp" but could be heard by a hearing-impaired person as "kick the cat hard". To overcome this difficulty, a hearing aid has to provide amplification to make these soft sounds loud enough to be heard.

Key parts of particular speech sounds, such as the high frequency parts, might not be audible. To overcome this problem a hearing aid has to provide more amplification for frequencies where hearing loss is the greatest and where speech has the weakest sounds.

A hearing-impaired ear has difficulty separating sounds. When we are listening to a sound in noise, such as a person speaking at a party, the normal ear will send a message to the brain that two separate bundles of sound are coming through. The brain, by using other information available, such as context and direction of the sound, may then be able to ignore the unwanted noise and make good use of the speech. The impaired ear however is much less efficient at this task. Also, once speech and noise get mixed together inside a hearing aid, there is no way the hearing aid can separate the two to compensate. Directional microphones can help prevent the sound and noise from getting mixed together before they are passed to the amplifier.

In a normal ear, a wide range of environmental sounds can fit between the softest sound that can be heard and the loudest sound that can be comfortably tolerated. In a hearing-impaired ear this 'dynamic' range is greatly reduced; ie. soft sound becomes inaudible and loud sound becomes uncomfortable and sometimes painfully loud. If a hearing aid makes all sounds louder so that the hearing-impaired person can hear the softest sounds then most of the loud sounds may be far too loud. So a hearing aid must give more amplification to a soft sound than it does to a louder sound. This squashing of sounds into the reduced range of an impaired ear is called "compression".

So a hearing aid has a big task. It must:

- Make sounds louder but not make loud sounds uncomfortably loud

- Provide more amplification for frequencies where hearing loss is the greatest and speech sounds are the weakest
- Try to keep unwanted sounds, such as background noise, out of the signal provided to the wearer

[back to top](#)

## How do hearing aids work and compensate for the effects of a hearing loss?

Hearing aids amplify sounds so they are loud enough to be heard. A hearing aid also amplifies some frequencies more than others to allow for the characteristics of hearing loss and speech. The audiologist will set the hearing aid to make sure its output never exceeds a predetermined upper limit, so that sounds do not become uncomfortably loud.

### Peak Clipping Versus Compression

The hearing aid limits loud sounds by either clipping off the peaks of the sounds (peak clipping) or by squashing or compressing them into a softer signal (compression).

Both result in some distortion and loss of detail, but the distortion is less noticeable for compression than for peak clipping. In general, compression provides a clearer signal for speech in quiet, better listening situations, comfort for loud sounds, and less need for volume control adjustment.

Research has shown that most people with hearing loss, except some of those with profound hearing losses, prefer compression output limiting. This is why Hearing Australia has had compression as a feature in its hearing aids since 1986.

There are many new types of hearing aids now becoming available that use complex forms of compression, all with the aim of maximizing clarity and filling the impaired dynamic range with audible and comfortable sound.

Hearing Australia's standard hearing aids have many independently adjusted compressors which interact to provide controlled and comfortable loudness. This means that compression can be set to suit the individual needs of each child.

[back to top](#)

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### Related articles:

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Causes of hearing loss  
Hearing aids  
Cochlear implants  
Unilateral hearing loss  
Deaf children with additional needs  
Auditory Neuropathy Spectrum Disorder

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Getting started  
Language and learning  
Milestones of speech and language  
Australian Sign Language  
Spoken language  
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