The Effects of Loud Music on Hearing

Information for Music Industry Workers

Hearing impairment and tinnitus (ringing in the ears or head noises) can endanger your ability to earn a living in the music industry. They can also reduce your enjoyment of listening to music, job satisfaction and quality of life. Anyone who is exposed to excessive noise is at risk of damaging his or her hearing. This includes musicians (classical and rock), sound crews, recording engineers, night club/hotel employees and patrons, dancers and aerobics instructors.

What Is Sound?

When air is mechanically disturbed, sound waves are created. Sound waves enter the ear canal causing the eardrum and a series of three small bones in the ear to vibrate. This vibration is carried further into the inner ear (or cochlea), which is filled with fluid. As the fluid vibrates, it causes tiny hair cells in the cochlea to bend, resulting in the generation of electrical impulses, which are carried to the brain via the hearing nerve. The brain interprets this as sound and characterises the sound by its pitch (frequency) and volume (intensity).

Effects of Sound on Ears

Ears were designed to process the moderate levels of sound that exist in our natural environment e.g. Dogs barking, thunder clapping. However, today we are often being exposed to higher levels for longer periods e.g. rock concerts, power tools. Temporary exposure to loud sound can overload the hearing system, resulting in symptoms of hearing loss and/or tinnitus, which often recover overnight. If the exposure to the loud sound continues, the damage to the hearing system that results is permanent and irreversible, not responding to any medical or surgical treatment.

The damage occurs at the level of the tiny hair cells in the cochlea and is known as sensorineural hearing loss or nerve deafness. High frequency hearing is affected first. With repeated exposure it spreads to the lower frequencies.
Symptoms of Hearing Damage

Depending on its severity, people with noise induced hearing loss typically report varying degrees of:
- difficulty following conversation in a group
- difficulty following conversation in competing background noise
- difficulty following the television
- a lack of clarity of speech in a one to one listening situation
- distortion of music sound quality
- reduced tolerance to loud sounds
- tinnitus (see A Guide to Tinnitus fact sheet)

What are the action levels and limit values?
The Noise Regulations require you to take specific action at certain action values. These relate to:
- The levels of exposure to noise averaged over a day or week; and the maximum noise (peak sound pressure) to which you are exposed in a day.
- The values are:
  - lower exposure action values:
    - daily or weekly exposure of 80 dB
    - peak sound pressure of 135 dB
  - upper exposure action values:
    - daily or weekly exposure of 85 dB
    - peak sound pressure of 137 dB
- There are also levels of noise exposure, which must not be exceeded: exposure limit values:
  - daily or weekly exposure of 87 dB;
  - peak sound pressure of 140 dB.
These exposure limit values take account of any reduction in exposure provided by hearing protection.

Sound levels reaching the ear during a live performance will vary depending on:
- whether or not the music is amplified and by how much
- the size and other physical/acoustic properties of the venue
- how close you stand to the speakers
- what instrument you play

<table>
<thead>
<tr>
<th>NOISE DOSE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DBA Sound Level</strong></td>
</tr>
<tr>
<td>94</td>
</tr>
<tr>
<td>91</td>
</tr>
<tr>
<td>88</td>
</tr>
<tr>
<td>86</td>
</tr>
<tr>
<td>85</td>
</tr>
</tbody>
</table>

Recent studies shows the average classical music performance reaches up to 90-100dB, whereas the average rock concert can often exceed 100-110dB.

How to Preserve Hearing

Once you know the volume and duration of sound you are exposed to, it is a matter of calculating how much attenuation (reduction of volume) is necessary to ensure you are not being overexposed. This will guide you in your selection of the appropriate hearing protection device.

Example: David plays in a rock band for an average of four hours per day. Sound levels reach around 110dBA.

The safe level of sound for a four period of exposure is 88dBA (see table). He therefore
needs to find some hearing protection that gives him at least 110-88 = 22 decibels of attenuation.

Hearing Protection Devices

There are many types of hearing protection available commercially. Most have been designed specifically for heavy industry workers and may therefore be unsuitable for musicians’ special requirements.

Musician’s Earplugs, however, have been especially designed for musicians. They are individually moulded to the shape of the wearers’ ears to be comfortable and discreet and to reduce the perceived echo or boomy quality of the wearer’s own voice known as the “occlusion effect”. A special filter is placed in the earpiece to attenuate the frequencies more evenly. The resulting sound has a better balance of low and high frequency components, so that the volume but not the quality of the music is reduced. Musician’s Earplugs are available in different degrees of attenuation to accommodate most types of music, however they will not attenuate as much as the stronger industrial hearing protection devices (described below). Although initially a more costly option than disposable earplugs, they should last a minimum of 12 months before the earpieces need to be remoulded.

For Industry, the most commonly worn are:

Earplugs are the one-size-fits-all, single use, disposable foam plugs. When rolled into a small cylinder and placed deeply into the ear canal they provide a lot of attenuation. Before the development of Musician’s Earplugs, these were the preferred method of hearing protection amongst musicians, however they do have several disadvantages. High frequencies are attenuated significantly more than low frequencies, resulting in a flatter, deeper quality to the music. Wearers may also notice the occlusion effect, which is particularly troublesome for vocalists, and when worn for longer periods of time, earplugs may become uncomfortable. They are however very effective at reducing sound levels and are relatively cheap and easy to obtain from a local pharmacy.

Earmuffs come in various degrees of attenuation. Generally, the more attenuating the earmuffs, the tighter they clamp against the head and the less comfortable they are to wear. Earmuffs, like earplugs, will generally provide too much attenuation in the high frequencies resulting in a reduction in quality of the music. Although they are considered less appealing cosmetically than earplugs, earmuffs are very effective at reducing sound levels, and once bought they don’t need to be replaced for some time.

What Can Be Done About Sensorineural Hearing Loss?

If hearing protection is incorrectly used or not used at all, the damage that results is permanent. As there is no medical cure for sensorineural hearing loss, hearing aids are fitted to provide access to the sounds that can no longer be heard unassisted by the damaged ear. Hearing aids do not restore normal hearing but are of great help to many hearing impaired people.
If you require any further information on hearing protection, please contact The Hearing Care Centre 0800 096 2637.