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LOUD MUSIC AND HEARING DAMAGE



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HOW LOUD IS LOUD?

Common Noise Levels and Typical Reactions

	Noise Level [dB]	Apparent	Typical Physical	

Activity	(A)]	Loudness	Response
Rocket launching	180		Danger level
Threshold of pain Gunshot Jet engine taking off	140		Danger level
Military jet Air raid siren Shotgun Hydraulic press (3 m away)	130	512 times as loud	Limited ability to hear amplified speech. Noise may cause pain. Can damage hearing after 3.75 minutes exposure per day
Car horn Propeller aircraft Air-raid siren	120	256 times as loud	Can damage hearing after 7.5 minutes exposure per day
Sand-blasting Squealing pigs Inboard motorboat Typical night club Unsilenced motorcycle (7m away)	110	Over 128 times as loud!!	Maximum vocal effort. Can damage hearing after 30 minutes exposure per day
Amplified Rock Music	110-130	Over 128 to 512 times as loud!!	Can damage hearing after 3.75 – 30 minutes exposure per day
Helicopter Motorised/power mower	105		Can damage hearing after 1 hour exposure per day
Jet takeoff @ 500m Train horn @ 30m Diesel truck Pneumatic		64 times as	Can damage hearing after 2 hours exposure per

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drill/jackhammer	100	loud	day
Heavy truck @ 15m Busy city street passing motorcycle Lawn mower Loud shout Screaming child	90	32 times as loud	Very annoying. Can damage hearing after 8 hours exposure per day
Average factory Electric shaver	85		
Busy traffic intersection Motorway construction site Outboard motor Alarm clock (with bell) Freight train (15m away)	80	16 times as loud	Annoying .
Motorway traffic @ 15m Roadside traffic Train horn @ 500m Vacuum cleaner Mixer electric sewing machine Noisy restaurant Conversation in a loud voice	70	8 times as loud	Telephone use difficult.
Washing machine/dishwasher	65		
Light car traffic @ 15m City or commercial areas Noisy office Normal conversation Clothes dryer Background music	60	4 times as loud	Intrusive.
Quiet office	50	2 times as loud	Speech interference.
Refrigerator	45		
Quiet residential area Kitchen/bathroom Public library	40	Arbitrary Base Reference Level	Quiet .
Leaves rustling Very soft music Recording studio			

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Living/dining/bedroom	30	1/2 as loud	Very quiet.
Threshold of sound perception	10	1/8 as loud	Just audible.
Threshold of hearing	0	N/A	Not audible.
			

Question:

What do Bill Clinton and Pete Townsend of the Who have in common?

Answer:

They both have hearing damage resulting from exposure to loud music. In Bill Clinton's case, by playing the saxophone in a band during his teens.

October 3, 1997: NY Times

Midlife is catching up with Bill Clinton: Doctors fitted the baby-boom president with hearing aids on Friday. Clinton, who turned 51 in August, has complained for years about hearing loss, listing it as a problem in his annual physicals since his days as Arkansas' governor.

He found it had worsened this year and reported having trouble hearing people in crowded receptions. Presidential press secretary McCurry said "indeed, he often can't make out what hecklers occasionally shout at him while he is making speeches..."

For what doctors termed a high-frequency hearing loss in both ears, Clinton was fitted for the type of hearing aid that can be easily placed fully inside his hearing canal, hardly noticeable to other people.

The president's problem, a moderate difficulty in hearing high-frequency sounds, is typical of hearing loss due to ageing and exposure to loud noise



Rock machismo lives, despite the threat of permanent hearing loss

Taken from Anderson, Brett, *The treble and the damage done...* Vol. 20, *Twin Cities Reader*, 01-11-1995, pp 15. Sometimes my ears ring dull and low. I hear something that sounds like a cross between the hum of a Hammond organ and the purr of a well-tuned luxury car. Other times the noise is a faint, high squeal that alternately surges and recedes like surf. Most often, my head

hisses like the inside of seashell, causing a cool sensation that feels like my ears are leaking gas. As unpredictable as the nature of my own private echoes might be, it's certain that I will awake from a night spent sucking down loud rock music with a hangover that has nothing to do with booze.

I'm not alone.

“What happens is the hair cells are damaged, but they're not dead,” Dr. Sam Levine (an otolaryngologist) explains. “As they're damaged, you lose some of your hearing. Most of the time, if you get out of the environment, your hair cells will recover somewhat. Each day, it [your hearing] comes back, but not as good as it did the day before. Eventually, over a long period of time, hair cells are permanently damaged instead of temporarily damaged.”

Most people would rather believe that hearing loss is like car accidents, violent crime and tax audits - something that affects other people. There are some famous cases. Who guitarist Pete Townshend was perhaps the first major rock musician to bring public attention to the problems of hearing loss.

Update – December 2002 – [Pete Townsend](#) reports that his hearing has gone almost completely, he can no longer hear what other people say.



Two years later, rumor spread widely that Soul Asylum's Dave Pirner had tinnitus. Although he never has confirmed it to the press, his band's sudden turn to acoustic music and the temporary use of a sound-deflecting barrier around Grant Young's drums lent credence to the report. Bob Mould has spoken out about his hearing loss, telling *Rolling Stone* last year, “I know I'm reaching the end of what I can do because of my hearing.”

Dr. Levine explains that if the hair cell is damaged or destroyed, what comes out is an abnormal sound that's not physically created and is a sound that's literally ‘in your head’, known as tinnitus.

Benno Nelson, leader of the band National Dynamite: “I mean, sometimes it will get so bad, I'll think to myself, ‘Could this drive me crazy? Will the ringing ever stop?’ It fucking sucks.”

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Dr. Levine says regular exposure to noise that exceeds 85 decibels “is considered to be dangerous.” For perspective, the doc says a normal conversation should measure about 50 dB and a chart in his office has a food blender checking in at 88 dB, a jet flying overhead at 103 dB, a rivet machine at 110 dB and a rock band topping out the list at 114 dB.

Cows drummer Norm Rogers says he only notices hearing problems when his band is on a busy tour. At the tail end of a gruelling European jaunt, for instance, he says the scene in the band’s van was like “being in a geriatric home. It was pathetic. We were screaming at each other because we just couldn’t hear a thing.”

Given the trouble and the damage done, why aren’t bands turning down the volume? Why are 25dB earplugs still such a relatively rare sight in clubhounds’ ears?

One local musician insists that high volume is simply part of the package. “It’s totally fucking cool. It’s rock and roll,” says the musician, who also suffers from tinnitus and lives with “a gentle, soothing ring at about 6 kilohertz. Like anything that’s bad for your body, absorbing healthy doses of deafening monster rock happens to be awesome. – at lower volumes it’s dry and altogether unsatisfying”.

“My ears used to get like warm,” he says of his days before tinnitus. “They’d get warm and tingle when I’d totally be jammin’ to loudness, and I love that sensation.” (Yeah well, we can’t all be sane).

But could continuing to go without earplugs lead to deafness? “Absolutely,” Levine says. “There’s no cure for tinnitus or hearing loss. Your ears are trying to tell you something. That ringing is the scream of your hair cells dying. Each time you do that, more and more damage is done.”



SO JUST WHAT IS THE PROBLEM?

Any kind of loud music, not just rock music, can cause temporary and permanent hearing loss. Constant ‘pounding’ music and noise that goes on for long periods of time are common causes of deafness.

If a noise is so loud that you have to shout to make yourself heard (which happens a lot or when you go to a concert), over time the mechanism of the inner ear will be injured.

Protecting the Ears

Noise-induced hearing loss can occur at any age.

Noise-induced hearing loss is often a very preventable condition. Physicians recommend that people take steps to protect their ears against damaging high levels of noise.

Temporary hearing loss can happen after you've been exposed to loud noise for only 15 minutes. If you have temporary hearing loss, you won't be able to hear as well as you normally can; and you may have **tinnitus** (say: tin-eye-tuss), which is a fancy word for ringing in the ears. Your ears can also feel 'full'. These things usually go away and your hearing soon returns to normal.

How do I know if I need hearing protection?

If you have to raise your voice to be heard by someone less than three feet away, then you should be wearing a protective device.

- Stereos and other types of amplification devices should be kept to a moderate level. People should be able to talk and be heard over the music. If people need to shout to be heard above the music, then the volume is too loud.
- For those who wear headphones (eg walkmans), the volume is also too loud if a person standing near a listener can hear the music coming through the headphones.
- Exercise can also aggravate noise-induced hearing loss. "People are more stressed when they work out at the gym. When we're stressed our ears become more susceptible, noises don't have to be as loud to affect hearing."

Can loud rock music cause deafness?

You bet, but music doesn't have to be so loud that it hurts your ears for it to cause damage. If it's so loud you can't hear a normal conversation, it's probably damaging your hearing.

Can going to one concert really damage your hearing?

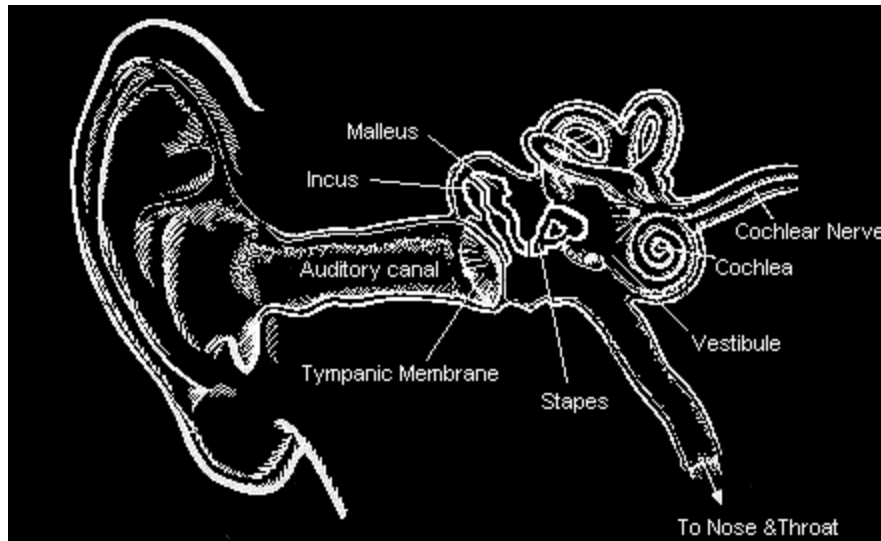
It depends on how loud the sound is and for how long you are exposed. In general, the louder the sound, the less time required before hearing damage will occur.

Typically, you may experience a temporary hearing loss after going to a concert. You may notice that your ears are ringing or that speech is muffled when you leave the concert.

This temporary hearing loss usually returns back to normal in a day or two, **but with repeated exposure, the hearing loss will become permanent.**



WHAT LOUD MUSIC DOES TO YOUR EAR



Physiology of the Ear and Hearing

The ear has three areas: the outer (visible part of the ear), middle, and inner ear. A thin membrane, called the eardrum (tympanic membrane), divides the middle and outer ear. When we hear, sound vibrations, or sound waves, funnel through the outer ear and down the ear (auditory) canal, where the sounds hit the eardrum, and cause the eardrum to vibrate.

These vibrations are passed through the three small bones in the middle ear - the malleus (hammer), incus (anvil), and stapes (stirrups). From the middle ear, the sound vibrations are transmitted to the inner ear (vestibule). Tiny hairs in the cochlea (a snail-shaped organ in the inner ear) transform the sound vibrations into nerve impulses. The impulses are transmitted to the brain through the auditory (cochlear) nerve.

Noise and Hearing Loss

Excessive exposure to loud noise can damage the tiny hairs in the cochlea and lead to hearing loss. Generally, this type of hearing loss is reversible (except in some cases of a sudden, very loud noise, such as an explosion).

However, over time, repeated exposure to loud noise can cause permanent damage and hearing loss. This condition is known as noise-induced hearing loss.



Watch your hearing!

Your ears are very delicate, prolonged exposure to sound pressure levels above 85dBA will cause damage to your hearing. If you have ever been to a party or to a concert where loud music was played, you may have experienced Temporary Threshold Shift (TTS). This temporary loss of hearing can become permanent if exposure is done on a regular basis.

One way to tell if you've been exposed to excessive sound pressure levels is that you tend to hear a ringing in your ears.

Ringling in your ears, hissing, clicking or buzzing sounds all represent the effects of tinnitus, which is often a side effect of noise-induced hearing loss. Inner-ear cells are sensitive to vibrations. But if they're damaged, the ears will still record ringing or buzzing, **even when there's no sound.**

Remember, it is your high frequency hearing that deteriorates first. Think of what music would sound like if you couldn't hear anything above 10KHz: just like with a crummy old transistor radio or listening to music over a telephone (no cymbals or high pitched instruments, voices sounding deadened). Protect yourself or just turn it down!

The high frequencies are lost first, so you may have difficulty hearing high-pitched voices. Loss of high-frequency hearing makes many words sound alike, especially those containing the high-frequency sounds S or soft C, F, SH, CH or H. Words like "hill," "fill" and "sill" may sound exactly the same.



headphones, ear-pieces and "ear bud" phones

as often used, loud ipods and mp3 players damage hearing

- "The big culprits aren't the devices themselves [iPods and MP3 players], but the tiny "ear bud" style headphones that the music players use."
- "the earbuds are even more likely to cause hearing loss than the muff-type earphones that were used on Walkman and portable CD players"
- "on average, the smaller [the headphones] were, the higher their output levels at any given volume-control setting." [Harvard Medical School study]
- "tiny phones inserted into the ears are not as efficient at blocking outside sounds as the cushioned headsets, users tend to crank up the volume to compensate."
- "a quarter of iPod users between 18 and 54 years of age listened at volumes sufficient to cause hearing damage." [Australian research]

As one researcher found was often the case, listening to music/muzak at 110 to 120 decibels damages hearing in less than an hour and a half. Thus, the "longer-lasting batteries and more storage capacity encourages people with portable players to listen longer, not giving the ears a chance to recover".

Pete Townshend on iPods

"Who guitarist [Pete Townshend](#) is warning iPod users they may face hearing loss if they pump up the volume on the devices.

"Townshend, 60, said his hearing was irreversibly damaged from using studio headphones, and he now takes 36-hour breaks between recording sessions. The band was known for loud performances.

" "Hearing loss is a terrible thing because it cannot be repaired," Townshend said on [his website](#). "If you use an iPod or anything like it, or your child uses one, you may be OK. (...) But my intuition tells me there is terrible trouble

ahead." ”



“[...] a typical person can safely listen to an iPod for 4.6 hours per day at 70 per cent volume using stock earphones, said Cory Portnuff, a doctoral researcher at the University of Colorado, Boulder and co-author of the study.

“ "Damage to hearing occurs when a person is exposed to loud sounds over time," he said Thursday. "The risk of hearing loss increases as sound is played louder and louder for long durations, so knowing the levels one is listening to music at, and for how long, is extremely important." ” [Quoted from cbc.ca]

iPod sound level	Safe listening time
70% level	4.6 hours per day
80% level	90 minutes per day
95% level	5 minutes

There is now information from Apple on [how to set the maximum volume limit on fifth generation iPods](#).



Experimental evidence

Researchers at the University of Florida tested the hearing of some middle and high-school students. The investigators found that about 17 percent of the children had some degree of hearing loss. Most of the hearing loss was in higher pitches, which are usually the first ranges of sound to be lost after hearing damage. The investigators believe that exposure to excessive noise results in a serious hearing impairment at an early age.

Significant hearing losses were detected in a group of students who had a history of frequent attendance to pop music entertainments. Losses due to loud noises in jobs, gunfire, etc. were also identified. (The Lancet 2:203-204, August 2, 1975).

A ‘guinea pig’ showed hearing impairment in his right ear after listening to high-intensity rock music for 88 hours over a two month span. The left ear, protected by a plug during most of the music, demonstrated no cytological changes. The damage to the right ear was permanent. (Archives of Otolaryngology 90:29, 1969)



I’M NOT GOING TO STOP GOING TO

GIGS!

Fine, fine. Who said you should?

But if you don't want to end up deaf in a few years time you **MUST** protect your hearing now and that means

either a maximum exposure time of 15 minutes per gig – which I don't see you raving about!

or by using hearing protection – that is ear-plugs.

Problems with Conventional Earplugs

Musician's earplugs are not intended for maximum attenuation. For that application, conventional foam or fully sealed pre-moulded hearing protectors or earmuffs are recommended.

1. Existing earplugs attenuate more than necessary for much of the noise in industry and the environment.
2. Regardless of their exact construction, existing earplugs produce 10 to 20 dB of high frequency attenuation and the result is that people often reject them because they can't hear speech clearly.
3. Conventional earplugs make the wearer's own voice sound hollow (known as the occlusion effect).
4. Many people risk their hearing by either wearing earplugs loosely or wearing no protection at all so they will be able to hear voices, machinery or music more clearly.

Finally, **cottonwool and tissue are useless**. They only reduce sound by less than 7 dB.



SO, WHAT DO THE BANDS DO?

Lars Ulrich/Metallica:

“Three of the four members of Metallica wear earplugs. Some people think earplugs are for wimps. But if you don't want to hear any records in five or ten years, that's your decision.”

If I wear hearing protection devices while I'm playing, won't it be hard to hear myself or the other instruments?

No, actually with distracting noise removed or minimised you will hear more clearly.

If a hearing device cuts down on the noise from my instrument or voice, how will I know what I sound like?

Your ears adjust very quickly to the protectors.

Don't people in places with loud music or sounds just get used to the volume?

No. Hearing loss and tinnitus (ringing in the ears) are insidious. Problems can occur

gradually. People often don't know they have a problem until it's too late.

After years of not wearing hearing protectors why start wearing them now?

Protective devices can prevent further damage. Hearing problems because of exposure to excessive noise do not have to happen.

“Musicians’ plugs allow some sounds in, but block others out. The musician’s hearing focuses on voice blending.” (Janser).

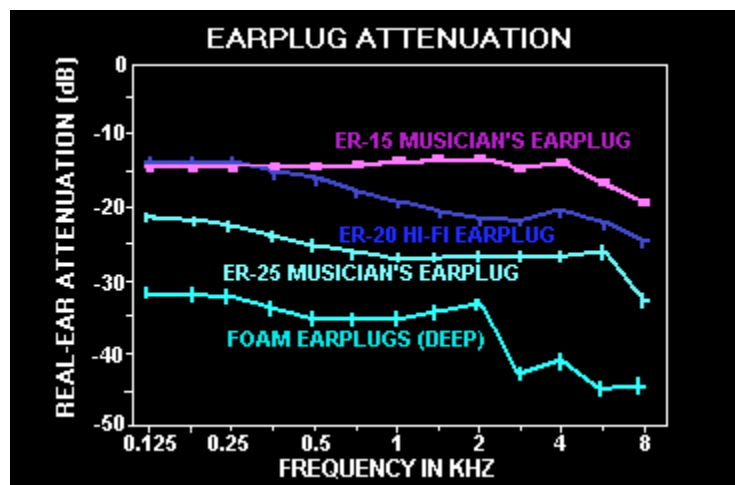
These specialised earplugs run from \$150 - \$200. The price may seem steep, but it's quite reasonable compared with the financial and physical toll of wearing a hearing aid.

Custom fit earplugs, worn by many musicians, are made from an impression of the ear canal taken by an audiologist or other hearing health professional. The impression is sent to a lab, where the final ear-mould is made. Custom earplugs are comfortable, easy to insert correctly, and filter sound better than disposable plugs.

Your local medic (doctor), audiologist or hearing aid dispenser will be able to advise you further.



TYPICAL HIGH GRADE PLUGS (as used by musicians)



The ER-15 and ER-25 models are popular with musicians because of a special filter that lets the listener hear music at a safe level without sacrificing quality. Instead of cutting out the high frequencies, musician’s plugs attenuate all the frequencies evenly in relation to your hearing.

A flat-response attenuator (reducer) must have a frequency response that follows the shape of the natural frequency response of the open ear, but at a reduced level. Both the Musician’s Earplug ER-15 and ER-25 use a diaphragm, similar to a passive speaker cone, to achieve the desired response curve. The ER-20 uses a tuned resonator and acoustic resistor. To reduce the occlusion effect, a deep seal of the plug in the second bend of the ear canal is necessary. In general, the ER-15 attenuators are designed for environments where the A-

weighted sound pressure level is 105 dB or less. The ER-25 attenuators are for use in environments above 105 dB and below 120 dB.

The attenuation shown in the above graph is for an average ear: at least 10 dB of protection for the ER-15, at least 15 dB of protection for the ER-20 and at least 20 dB of protection for the ER-25 are achieved in almost any ear with these attenuators properly in place. These custom ear moulds are to be fitted by an audiologist or hearing aid dispenser.



IF YOU NEED FURTHER HELP OR ADVICE

If you have concerns regarding your own hearing, seek advice from your doctor, audiologist or local hearing aid centre.

You may also ask these for information about ear-plugs, hearing aids and sound-level meters.



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