

I went to a concert last night and my ears are still ringing- hidden hearing loss?

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Introduction:

We have all had the experience that our hearing felt numb or reduced after a noisy event such as watching a fireworks display or a rock concert. And indeed if one were to have their hearing tested just before such an event, and then immediately after, there would be some temporary hearing loss. After 16-18 hours the hearing typically returns to the pre-exposure (hopefully normal) level. The ringing in the ears, also known as tinnitus, may last for several days.

Up to the year 2000, we considered such a “temporary” hearing loss, also known as “Temporary Threshold Shift” or TTS to be a benign and uninteresting side effect of being exposed to loud noise or music. After all, it seemed to get better on its own. Researchers in this time period went as far to study TTS in detail in hopes that it could be a predictor of permanent hearing loss. As it turned out, there was no evidence that TTS, or the recovery from TTS, can be used to predict whether any one person would eventually suffer from permanent hearing loss down the line.

If two people went to a rock concert and one appeared to experience TTS and bothersome tinnitus, that person is no more, nor any less, susceptible to future permanent hearing loss than his friend who experienced no TTS.

After the year 2000 a number of animal studies started to appear in the literature demonstrating that despite a complete resolution of TTS, there may be some neurological problems that persisted, either permanently, or long after the TTS had resolved. That is, despite the animal’s hearing thresholds returning to a pre-exposure state, there were some problems with how sound was transmitted from the inner ear to the brain. This has been called “cochlear synaptopathy”.

Cochlear Synaptopathy:

Partly because it was difficult to pronounce, and partly as a misunderstanding of those early 2000 studies, the popular media referred to cochlear synaptopathy as “hidden hearing loss”. Although this is a less accurate phrase, it is not wrong. While cochlear synaptopathy gives some indication of where the problem is (e.g. in the synapse between nerves), hidden hearing loss is quite descriptive. This refers to a deficit that just does not show up on a conventional hearing test.

Animals experiencing cochlear synaptopathy appeared to have normal hearing thresholds which indicates that their inner ear hair cells and nerve endings were functioning well. Using conventional hearing testing methods that audiologists may perform, these animals would have “normal” hearing. And other measures that Audiologists use to test the cochlear or inner ear function such as otoacoustic emissions, a frequently used test in infant hearing screening programs, would also be normal. But more advanced neurological tests that are not typically performed would indicate difficulty.

If cochlear synaptopathy would be found with humans, one would indeed see a normal hearing test (e.g. a normal “audiogram”) but they might report greater than average difficulty hearing in noisy locations. This is not to say that all people that have trouble in hearing in noisy places have hidden hearing loss,

but at this point, all we can say is that some people may have this. We are not sure of the prevalence of hidden hearing loss is with humans.

There are some neurological tests that can be performed with people that may indicate this difficulty, but at the present time there is quite a bit of controversy regarding which tests to use. For example, there is a test where electrodes are attached to the head while a person listens to clicks under headphones. The brain wave activity in response to these clicks can be assessed by looking for differences in the Summating Potential (SP) and the Action Potential (AP). This SP/AP ratio test is not new and has been used for quite some time in trying to determine whether a person has been diagnosed with Meniere's Disease.

There are a number of other neurological tests that can be performed but at this point in time, the debate is still going on.

More recently there have been several studies on the temporal bones of deceased people. In these studies neural degeneration was found despite these people having normal inner ear hair cells. This suggests that they may have had normal (or near normal) hearing tests but indeed had some degree of cochlear synaptopathy. More information will be found as more of these post-mortem studies are performed.

So, is TTS so benign?

With the current body of research it is fair to conclude that TTS is not as benign and uninteresting as we once thought. While it is true that a person's hearing test will return to their pre-exposure level in most cases after going to a rock concert, we need to be aware of the possibility that the nerves that take sound impulses up to the brain may have some dysfunction.

Hearing loss prevention, whether its moderation to loud sound or using hearing protection, is a cornerstone principle to any hearing health program. We are not yet at the point where we can definitely conclude that even temporary hearing loss can be associated with permanent difficulties down the line but there is a growing body of evidence.

As one preventative measure the "temporary hearing loss test" app has been developed (available on both the iPhone (iOS) and Android platforms). With this app one measures their hearing threshold at 6000 Hz (just above the top note on the piano) before an exposure to noise or music, and then again, after the exposure. The difference is a measure of TTS.

This app provides information on whether any potential exposure is potentially damaging and depending on the outcome provides hearing loss prevention information by way of a link to the Musicians' Clinics of Canada website at www.MusiciansClinics.com.