# Two Flavors of Tinnitus

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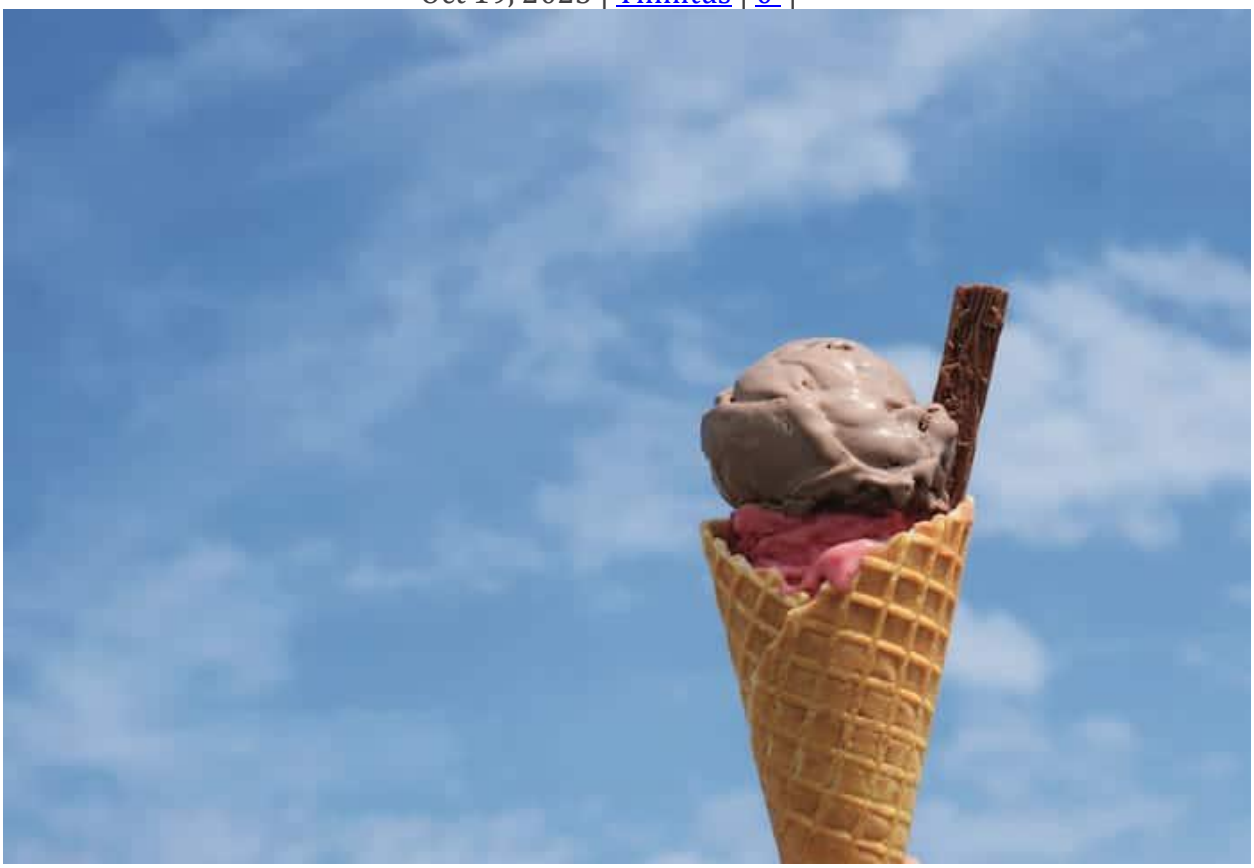

*Tinnitus in an older lifelong steel worker and a young struggling musician likely stem from very different causes.*

## By Marshall Chasin, AuD

Is the reported tinnitus from a 72-year-old man who had spent much of his life working in a steel mill the same as the tinnitus reported by a 21-year-old struggling musician? These two forms of reported tinnitus can have quite different etiologies and require quite different approaches to their resolution.

In the case of someone experiencing age-associated hearing loss exacerbated by a lifetime of occupational noise exposure, reported tinnitus is caused by a peripheral sensorineural decline which creates central changes. In essence, the "central gain" has been turned up.(1) In such cases, therapies and approaches have traditionally followed some form of a model where masking and habituation combined with some form of cognitive therapy(2) have shown significant benefit for many.

## Struggling Musicians

However, in the case of a younger person who is just starting out in their musical career and who still has excellent peripheral hearing sensitivity, their reported tinnitus may be an entirely different flavor. Combine this with the fact that many musicians who are just starting out, and indeed almost anyone working in the "gig economy" will have a barely subsistent income, and given their life stresses, reports of tinnitus are almost expected.

Clinically, the number one complaint I receive from my musician patients is not hearing loss, but that of tinnitus. And it is the fear of increasing tinnitus that results in them making an appointment to obtain hearing protection and to learn about other hearing loss prevention strategies. But what is the mechanism of their tinnitus?

## Unaddressed Stress

Two interesting articles came out more than a decade ago that delineate what may be happening with the young person's reported tinnitus. One is by Miller, Maletic, and Raison in 2009(3) and the other is by Szydlowska and Tymianski in 2010.(4) Both of these articles appeared in physiology journals and not audiology ones. Essentially, these articles delineated the mechanism by which stress can exacerbate the auditory mechanism, and if left unaddressed, can become worse over time. This mechanism delineated in the 2010 publication is called "glial excito-toxicity" and can result in long-lasting allostatic changes to the brain.

*Further reading: Veterans Guide Offers Hearing Loss, Tinnitus Resource*

Here is how it works: Stress can create higher levels of the stress hormone cortisol. Through a series of biochemical mechanisms, the cortisol can facilitate higher levels of glutamate in the brain. And higher levels of glutamate can cause changes (and even damage) to the auditory cortex. Since both stress and high levels of noise or music result in higher levels of glutamate, at the smallest molecular level, the effects of loud noise or music are similar to the effects of stress. Essentially, calcium ions cross the cell boundaries and begin a depolarizing process.

## Positive vs. Negative

But let's take a step back to 1970, when Hormann, Mainka, and Gummlich(5) performed an interesting study. They took a group of university students and had them perform a benign task. Some could do it, and others could not. For those who could do the task they were treated like royalty and praised, and for those who could not, the treatment was the opposite.

Both groups were ushered into a room—one well-lit and clean with happy experimenters, and the other a dark and smelly room with mean-looking experimenters. For both groups, their hearing was assessed, then a period of noise was provided which caused a temporary threshold shift (TTS). Then their hearing was again assessed; the difference being a measure of TTS. Unbeknownst to both groups, the noise exposure was the same for all, but for one group it was positively viewed and for the other it was negatively viewed.

The TTS in the reward group was as expected from calculations, being on the order of 12 dB, whereas the punishment group had a TTS of over 18 dB. This difference could be related to stress and its effects on the auditory system.

Lindgren and Axelsson,(6) in studying music and noise of equal energy, found that in four of their 10 subjects, the noise and the music created similar TTS levels. But in the other six subjects, the noise had a greater effect with subsequent higher TTS values, despite the noise and the music having equal sound levels and durations. Again, stress (or the negative view of noise as opposed to music) being a potential issue.

It should be pointed out that it's not that enjoyable things such as music are less potentially damaging; it's that unenjoyable, stressful things may be more damaging.

## Less Stress

These studies suggest that stress reduction techniques—which have been emphasized by Jastraboff and Hazell(2) and others—can be learned and utilized for those patients complaining of tinnitus, and can be quite useful for this group. Even the knowledge that it is "only" stress that can be contributing to the tinnitus and not something more insidious such as impending permanent hearing loss goes a long way toward helping young musicians get on with their lives.

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*Photo: Dreamstime*

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