

# Effective Management of Pain Hyperacusis

By Dennis Colucci, AuD, MA

Tinnitus that develops gradually with age and is managed through directive counseling and the use of amplification devices, is different from tinnitus that exhibits pain or hyperacusis, aural fullness, tonic tensor tympani syndrome (TTTS), headaches or migraines, and insomnia. These latter conditions have also been associated with sudden sensorineural hearing loss (UHF-SSH), high-level noise-induced hearing loss, and acoustic shock (*Noise Health.* 2013;15[63]:117). Although the mechanisms are not well understood, it has been suggested that disruption in the homeostasis of the tonic firing rate due to ear damage results in central gain enhancements and network maladaptation. These occur at different levels within the auditory system, and also in regions outside of the auditory pathways (*Front Neuro.* 2014;5:206). Furthermore, patients with hyperacusis complain of headaches (76%) or earaches (10%) in response to sound (hyperacusisresearch.org).

In a recent study, Manohar, et al., found that pain and inflammatory gene expression signals produced after ear damage "may induce sterile inflammation, neuropathic pain, microglial activation, and migration of nerve fibers from the trigeminal, cuneate, and vestibular nuclei into the cochlear nucleus" (*Mol Cell Neurosci.* 2016;75:101). Although there are no pain receptors in the inner ear, the Type II nerve fibers (those that innervate the outer hair cells within the cochlear nerve) have been implicated to behave like pain receptors following noise exposure and are routed to the cochlear nucleus, the first processing center in the auditory system where pain is processed (*Curr Biol.* 2015;25[5]:606).

## IMPORTANCE OF EARLY INTERVENTION

Regardless of the cause or network mechanisms involved, intense and early treatment is a critical part of the therapy to improve sleep, control headaches or migraines, and the associated anxiety, in addition to controlling sound pain. This is because severe levels of negative reinforcement caused by sound sensitivity and pain support hypervigilance, fear, and the development of psychopathology. Breaking this cycle early on leads to successful reinforcement, a downward trend in awareness and annoyance, and a more controlled sense of self-management.



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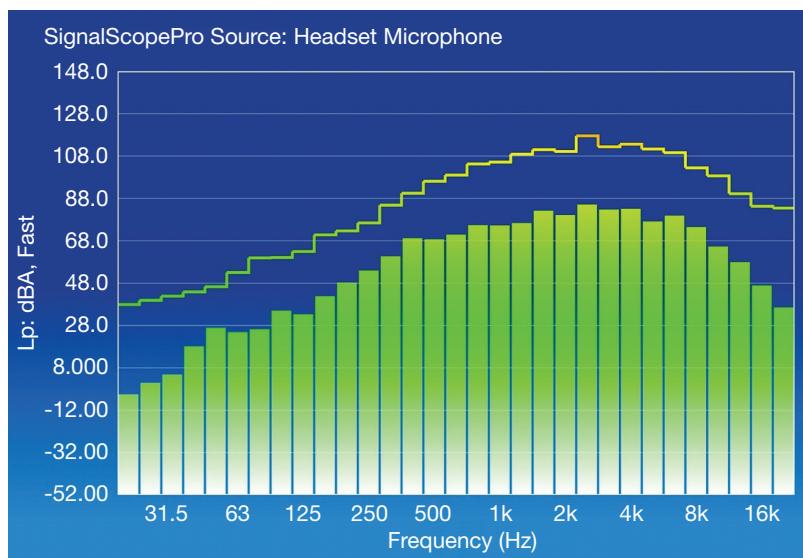
Failure to take early corrective actions can lead to isolation and overuse of hearing protection. Because of the sudden onset of and debilitating changes associated with pain tinnitus and hyperacusis, patients tend to avoid various social activities, especially in the early stages of the treatment process. However, patients should, in fact, maintain interactions to neutralize any negative emotions, avoid sound isolation and quiet time, and gradually increase the noise floor.

## IDENTIFYING SOUND TRIGGERS

In the home environment, managing sound pain can be accomplished with the help of family and friends. Patients must take proactive steps to self-manage offending sound exposures while engaging in sound therapies to increase their loudness discomfort levels (LDLs) and tinnitus awareness. Patients and family members should understand the layout of the home and identify the sounds that may trigger pain. For example, the kitchen is the biggest offender because the sound pressure levels can easily exceed 70 dBA. In fact, pots and pans and utensils can reach over 105 dB in the high frequencies. A list of potential triggers is found in Table 1, while Figure 1 shows an example of dB peak and Lp dBA.

**Table 1. Potential Sound Triggers in the Home Environment**

Kitchen	TV Room	Garage	Bathroom
Dishes	Windows	Electric Door Opener	Hair Dryer
Utensils	Shutters	Tools	Toilet Flushing
Pots and Pans	Doors	Trash Cans	Drawers
Running Water	TV Audio Levels	Drawers and Doors	Doors
Garbage Disposal	Loud Speech	<b>Laundry Room</b>	<b>Backyard</b>
Plastic Bag Inflation	Newspaper Folding	Running Water	Street Traffic
Electric Can Opener	Electric Stapler	Washer and Dryer	Neighbor Noises
Oven Door	Vacuum	Cabinet Doors	Lawnmower/Tools
Tin Foil	Furniture Cabinet	Drawers and Doors	Lawn Furniture
Kitchen Drawers	Printer	Windows	Dog Barking



**Figure 1. Dishes on Marble Counter at 24 Inches. Representation of dishes repeatedly moved on a marble counter with peak levels and dBA represented.**

For the most part, many patients will react negatively to sounds at a determinable base level, which is typically between 65-85 dBA. Patients get the most discomfort when exposed to sounds with frequencies above 1,000 Hz and certainly those above 4,000 Hz.

For example, in the case of the UHF-SSH, the audiometric LDL measures approximated 75 dB HL from 250-1,000 Hz and 60-70 dB HL from 2,000-16,000 Hz (*Hearing Journal*. 2016;69[12]:36). The tinnitus tone was matched to 9,000 Hz at 60 dB in the affected ear. During the first three months, the patient reported having instantaneous head pain or a migraine from generalized loudness or specific high-tone sounds. Initially, some sounds would trigger a migraine that lasted three to four hours. For this reason, home sounds need to be identified and controlled as part of sound therapy, especially upon its inception.

## SELF- AND ENVIRONMENTAL MANAGEMENT

Sound triggers are universal for most hyperacusis patients. Once a sound exceeds 70 dBA, a reaction may ensue. In some rare cases, hyperacusis patients may also react to sounds below 60 dBA. This should be predictable based on the patient's LDL intake data. It's also important to teach patients and their family members how to identify triggers, control exacerbations, and at the same time, maintain family communication, TV listening, video games, or other sound activities on an ongoing basis. Quiet time must be avoided, and a minimum noise floor should be measured and maintained. Sound generators or sound machines are useful for this training, especially when the sounds are blended with those from daily household activities. Patients and their families must also be prepared to deal with accidents. Patients should be taught when and how to respond to family members when a sound exacerbation occurs due to an accident. These instances should be anticipated and minimized through counseling.

## ENVIRONMENTAL ACCOMMODATIONS

The goal of sound therapy is to increase sound tolerance, habituate tinnitus, and eliminate the reaction to sound and the pain factor. The home is the best place for this, and most often, the primary environment and sound training facility. The design should include safe zones, where sound is highly controlled so that it's not startling, loud, or high-toned, and noise areas where hearing protection may be effective against sound-induced pain and headaches. Safe zones are typically the bedroom and the TV room. This is because outside noise is reduced, sounds from electronics can be controlled and measured for sound therapies, and sound triggers can be minimized.

The kitchen, on the other hand, will be the most offensive because of the necessity to use metal utensils, pans and pots, and electric mixers. As seen in Figure 1, accidentally dropping dishes on the counter can produce high-frequency sounds with peaks of 109 dB, causing instant and long-lasting pain to the patient, who may consequently require medication and hours of rest. This kind of environment is best to be avoided as the patient makes progress in spontaneous recovery, medical treatments, counseling, and sound therapy.

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### EAR PROTECTION AT HOME

The use of hearing protection in the home should be limited. Wearing hearing protection at home is much different from using one in public, which also carries a burden. The home is a training environment that offers a remarkable advantage when properly designed and used in conjunction with both sound therapies and counseling.

Patients can wear hearing protection to avoid overstimulation. A preferred method is using a pair of musician's ear plugs with the appropriate filter set (-9 dB, -15 dB, -20 dB, -25 dB). Too much protection from ear muffs or full occlusion can result in difficulty adapting to increased sound levels. In certain situations, ear plugs will be effective in reducing high-frequency sounds such as those produced in areas where metal or ceramic tools are commonly used. Using placemats with dishes and napkins with utensils may help in making sounds more tolerable. Alternatively, paper plates and plastic utensils can be used. The greater the sound experience without discomfort, the better. In the safe zones, no hearing protection is needed and a sense of safety should prevail.

Pain hyperacusis is a rare condition typically seen in patients with acoustic shock, as well as those with loud noise exposure, and sudden hearing loss. The mechanisms are not well understood but take place at the molecular level within the ear and brainstem, but they also have central connections. The patient can be highly disturbed by sound pain exacerbations, especially earlier in the condition; significant physical and psychological consequences can develop. Every attempt to squelch sound-related pain exacerbations, headaches and migraines, and insomnia are key factors in treatment. The negative effects of exacerbations of pain hyperacusis are relentless; however, knowing how and when to use protection, safe zones, and prescribed sound therapies on an ongoing basis is crucial to reducing the effects of painful hyperacusis and tinnitus. 

### A Brave New OTC-World for Audiologists

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As a veteran hearing aid user, I knew that my brain was struggling to adjust to this new level of sound, and, in fact, my audiologist had warned me this might happen. Nonetheless, I called her for a quick morale boost. I only wanted to speak with her for a few minutes. Instead, the appointment desk insisted on scheduling an office visit. I declined, and my audiologist missed an important opportunity to deepen our patient-provider relationship.

Audiologists have a real opportunity to improve post-purchase, follow-up care. Ideally, patients with new hearing aids would receive a call from a care coordinator within 24 hours of leaving the office, then another call five days, two weeks, and one month after purchase. Patients wishing to speak with the audiologist could schedule a follow-up call or visit.

This level of care would differentiate independent audiologists from online retailers such as Amazon. To create post-purchase service, audiologists will need to reconfigure their practices. Tracking multiple calls for each patient will require process definition and the appropriate calendaring software. In addition, practices will need to identify the best resource to serve as care coordinators like audiology student interns.

Another option is retired people who would do the outreach from home, particularly to patients who are over 65 years old. Other health care sectors, such as pharmaceutical companies encouraging medication adherence, have found that seniors performing peer-to-peer calls are highly effective at providing support and coordinating follow up.

#### 2. Offer patient-centered, ongoing support.

For years, I was afraid to change my hearing aids wax guards because that tiny white cup intimidated me. When I confessed my fear to my hearing health advocate friends, I was shocked to learn a few of them felt the same way.

In this case, independent audiologists have another opportunity, to help patients with basic care and maintenance of their hearing aids. Patients need help not only with my nemesis, the wax guard, but also with changing batteries, cleaning the aid, and keeping it dry—in other words, all the questions and issues that surface from wearing a hearing aid. And patients want to receive that coaching in a timely and convenient manner.

The quick demonstrations audiologists give in the office are necessary but not sufficient. Some patients are trying to cope with the feel of the device or the new level of sound. Many patients need to hear instructions at least twice.

Audiologists could experiment with a medium that many health insurers offer today—clinical videos through telehealth. Telehealth could help audiologists demonstrate elements of care when patients have questions, and provide patients with the convenience of interacting with their audiologists from home.

The proposed OTC hearing aids present a threat to audiologists, yet also offer an enticing opportunity. Hearing aid wearers need care and coaching resources that are accessible, affordable, and knowledgeable. Audiologists who embrace change will meet those needs. 