

# Tinnitus

---

Updated: Feb 27, 2020

Author: Aaron G Benson, MD; Chief Editor: Arlen D Meyers, MD, MBA [more...](#)

---

## Medical and Otopsychoiatric Therapy

---

### Electrical stimulation

Suppression of tinnitus by electrical stimulation of the inner ear has met with mixed success since Volta attempted direct current (DC) stimulation of his inner ears in the 1800s. Many variations of electrical stimulation have been tried, including cutaneous stimulation, brain stimulation, promontory stimulation, an electrically stimulating headset, and others. Although the authors of these studies frequently report tinnitus resolution in as many as 80% of their patients, the effects are often transient or continued stimulation is impractical. Since the first single channel cochlear implants were available, the reduction of tinnitus has been an interesting topic. But even in the case of continuous electrical stimulation of the inner ear using cochlear implants, results have been mixed. Therefore, electrical stimulation has advocates, but it is not considered one of the primary mainstream therapies for tinnitus.

### Biofeedback

This technique has a 25-year history of successful treatment for pain and other stress-related disorders. As described above, the patient's psychological state of mind may have more to do with the status of his tinnitus than the actual loudness of the tinnitus itself. With biofeedback in tinnitus, the goal is to decrease stress and anxiety levels that may be contributing to tinnitus. For biofeedback success, the patient must be cooperative and committed. The patient is taught to relax and is encouraged to relate his state of relaxation to the stress of living and the gradual reduction of the tinnitus. Therapy may require weekly sessions over several months to demonstrate improvement. A psychologist who can work as a team with the otologist to gain maximum benefit from the therapy conducts this therapy. Up to 80% of patients find some relief of their symptoms, and 20% of patients may find total relief in this therapy.

### Repetitive transcranial magnetic stimulation

Transcranial magnetic stimulation (TMS) is a method of stimulating the brain through the intact scalp without causing pain at the surface. It is a minimally invasive method for depolarizing cortical neurons and is based on the principle of electromagnetic induction. The rhythmic application of a series of single stimuli is referred to as repetitive TMS (rTMS), a method that has been demonstrated to induce long-term potentiation (LTP) or long-term depression (LTD)-like changes of cortical excitability that outlast the stimulation period. rTMS has been investigated as a therapeutic tool for depression, schizophrenia, and stroke. <sup>[14]</sup>

Tinnitus is considered by some to be a result of excitability of the cerebral cortex and, more specifically, the primary auditory cortex. rTMS has proven effective in the treatment of other disorders, such as auditory hallucinations, by modification of cerebral excitability.

Studies have indicated that the technique can alleviate tinnitus in the short-term by modulating the excitability of neurons in the auditory cortex, <sup>[15]</sup> and a report stated that the use of rTMS with

neuronavigation imaging resulted in a reduction in tinnitus severity after 6 months of follow-up compared with sham therapy. [16] Further studies regarding the long-term clinical effectiveness of rTMS are required.

## Neuromonics

Neuromonics tinnitus treatment uses spectrally modified music in an acoustic desensitization approach in order to help patients overcome the disturbing consequences of tinnitus. Studies have both supported and refuted its efficacy.

## Counseling

Usually, patients simply want to know that their tinnitus is not caused by cancer or malignant brain tumor. A skilled counselor can easily provide this reassurance. For most patients, once more serious possibilities are eliminated, counseling suffices. Amplification with hearing aids or other devices may improve subjective tinnitus in more than 50% of patients. Occasionally, the professional services of a psychologist are necessary. The otolaryngologist should be prepared with a teammate who can assist in the care of more complicated tinnitus cases.

In a literature review, Phillips et al, looking at patients in the no-intervention or waiting-list control arm of tinnitus intervention studies, found that, in self-reported results, individuals experienced a small but significant improvement in tinnitus measures over time. Although the investigators could not specify the clinical significance of this, they indicated that the information can be cautiously employed in patient counseling. [17]

## Support groups

People with tinnitus often feel alone with their condition. The opportunity to share experiences in a group session, either with or without a counselor, is helpful. Many cities have support groups that meet on an irregular basis. These groups can be found by calling the local public library or the newspaper for meeting times. Many otolaryngologists who care for large groups of tinnitus patients have assisted a local group through its formation and development.

### *American Tinnitus Association*

The American Tinnitus Association (ATA), based in Portland, Oregon, is one of the best-known organizations providing sympathetic support. The organization directs research and education pertaining to tinnitus across the country. The ATA publishes a monthly newsletter that many patients find reassuring. They know that research is being conducted and that others in the world have similar symptoms.

## Pharmacologic therapy

Pharmacologic therapy helps in the treatment of tinnitus for the 80% of patients who endure related depression. Administration of nortriptyline (50 mg at bedtime) is the most helpful treatment. Nortriptyline may induce dry mouth, often causing patients to terminate treatment before achieving therapeutic effect. Often, 3-4 weeks of therapy are necessary before benefits appear. Other antidepressants may be useful in treating tinnitus, but judgment in their use is paramount. Selective serotonin reuptake inhibitors are considered to have a better safety profile compared with tricyclic antidepressants. Paroxetine (Paxil) in low doses of 10 mg at bedtime has recently been shown to be helpful. Also, sertraline (Zoloft), at a fixed dose of 50 mg/d, demonstrated a significant reduction in tinnitus severity, as well as a reduction in anxiety and depressive symptoms.

Many physicians have used benzodiazepines to treat tinnitus. The theory has been that this is an anxiety disorder and the benzodiazepines should help. Unfortunately, because depression and obsessive-compulsive disorders predominate in this group, the benzodiazepines can cause more harm than good. Thus, they should be avoided as initial therapy.

A 2009 study by Jalali determined that alprazolam improved visual analog scale (VAS) scores in tinnitus patients who did not have depression or anxiety disorders. [18]

Hurtuk et al conducted a prospective, double-blind, cross-over study comparing 3 mg of melatonin HS to placebo in adults with chronic tinnitus. There was a significant reduction of tinnitus severity scores on 2 of 3 measures of tinnitus severity. Melatonin was more effective in men, subjects with severe tinnitus, and those who had not had prior treatment. [19]

A study by Albu and Chirtes indicated that combining an intratympanic corticosteroid with melatonin can improve treatment results in tinnitus over those obtained with melatonin therapy alone. In a prospective, randomized, controlled, double-blind trial, 30 patients with acute unilateral idiopathic tinnitus were treated with melatonin alone, while another 30 patients with the condition were treated with melatonin and intratympanic dexamethasone, with results after three months being evaluated using tinnitus loudness and awareness scores, the THI, the Beck Depression Inventory, and the Pittsburgh Sleep Quality Index. Although both groups in the study demonstrated significant improvement, the investigators determined that significantly greater improvement occurred in the dexamethasone/melatonin patients. [20]

### *N-methyl-d-aspartate*

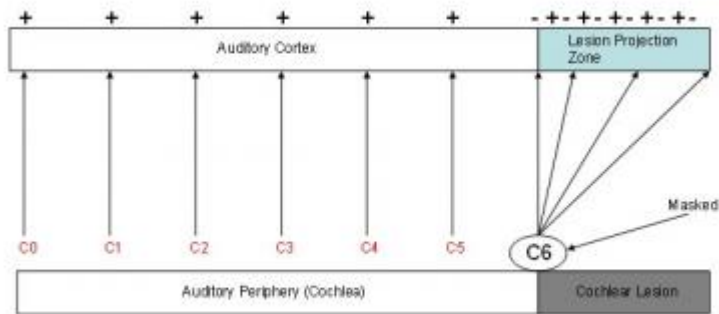
Drugs that increase synaptic inhibition, such as benzodiazepines and GABA-B receptor agonists, have been one avenue of investigation for potential new treatments for tinnitus. However, the mechanisms underlying the neuronal hyperactivity associated with tinnitus are not entirely understood, and drugs that block excitatory synaptic neurotransmission may also be effective. For example, some evidence suggests that salicylate-induced tinnitus may involve an increase in glutamatergic neurotransmission at the *N*-methyl-d-aspartate (NMDA) subtype of glutamate receptor in the cochlea and that NMDA receptor antagonists can block this effect. Moreover, long-term tinnitus induced by acoustic trauma was prevented by locally applying another NMDA receptor, polyamine site, antagonist, ifenprodil, into the cochlea within the first 4 days after the acoustic trauma. [21]

## **Tinnitus maskers**

Tinnitus masking has been central to tinnitus therapy for over 50 years. From a psychoacoustic viewpoint, masking is an important tool in the clinical armamentarium because it relieves the percept of tinnitus, even if only transiently, when the masking noise is present. From a neurophysiology point of view, masking appears to act by relieving hyperactivity in the auditory cortex (and associated pathways) that accompanies peripheral deafferentation.

A literature review by Makar et al indicated that tinnitus is best treated with a combined approach incorporating masking, counseling, and attention diversion. [22]

Perhaps the most elegant treatment of the topic of masking is from the neuro-computational literature, where the phenomenon of 'homeostatic plasticity' is used to describe how the loss of peripheral afferents can cause central hyperactivity. Importantly, this literature explains the paradoxical finding that stimulation of the region of damage (ie, the lesion-edge frequencies) is the most efficient way to decrease this central hyperactivity.



Masking. In this graphic, masking sounds are applied at C6, the tinnitus frequency. The result is that the sensation of tinnitus is reduced. In the auditory cortex, this corresponds to decreased spontaneous firing rates.

These devices resemble hearing aids and fit either behind or in the ear. Tinnitus maskers create and deliver constant low-level white noise to the ear(s) of the patient. This device is recommended for patients with normal or near-normal hearing who are disturbed by the tinnitus. Patients should be advised to wear the device during their waking hours (successful wearers tend to wear the device even while sleeping). Of patients referred for a masker, two thirds investigate the possibility, one third rent the device, and one sixth actually wear the device for a time and find it helpful.

Many people are bothered most by tinnitus at bedtime. In these cases, a bedside clock or radio may serve as a useful masker. Such instruments fill the ambient silence with low-level noise that masks tinnitus. An obvious problem with maskers is that sound is masked from inside and outside the ear. Tinnitus maskers, therefore, may interfere with hearing and communication. However, patients have reported better hearing when their tinnitus was helped with the masker. Occasionally, a residual inhibition of tinnitus occurs, so patients can wear maskers at bedtime and still benefit from the effect when not wearing the device during the day.

## Hearing aids

"If this tinnitus would stop, I could hear better!" is a common comment from patients with mild or moderate hearing loss. Patients often perceive no hearing loss and think that their tinnitus alone interferes with hearing. Improvement in the overall situation can be achieved by directing attention to the underlying problem (hearing loss). Characteristics of hearing loss have been studied and show no correlation with successful hearing aid use. Common sense suggests that residual inhibition characteristics of tinnitus and hearing loss determine which patients would be helped by hearing aids.

Unfortunately, such is not the case. The only way to determine if a hearing aid is successful is to try one. Success at treating tinnitus with hearing aids is about 50%. That is, about 50% of patients who try hearing aids are helped and are happy with the treatment. Many hearing aid dealers offer trial programs to determine suitability for individual patients. Studies demonstrate a benefit of ear-level devices (hearing aids and sound generators) in patients enrolled in comprehensive tinnitus management programs. [23] Patients who use hearing aids and sound generators show a greater improvement in their tinnitus severity index scores and self-rated tinnitus loudness.

## Tinnitus feedback retraining

Recently, another type of therapy has been developed. White noise or a derivative of the patient's tinnitus that is chosen during a diagnostic session is programmed into a special hearing aid and worn in the ear. This therapy is accompanied by counseling sessions and continuing efforts to assist the patient in coping with the tinnitus. Such sessions may last for one hour once a week or once a month depending on the severity of the tinnitus. Patients occasionally use this therapy for periods of up to 1-2 years. The success with this therapy varies with the severity of the tinnitus and the patient's other problems.

One of the biggest factors in resistance to this therapy is the associated psychiatric and emotional disorders. Recognition and treatment of these disorders are very helpful. One of the best ways to decide if this therapy is appropriate is to visit a therapy session and experience it firsthand. Therapists must regularly practice the regimen to do it well, and patients must use the therapy for a period of months to determine if it is useful. Long-term studies have shown that up to 82% of patients enrolled showed improvement in their subjective tinnitus. This method of treatment remains a valuable tool in the management of severe tinnitus.

**e**medicine  
TOP PICKS FOR YOU