

# Tinnitus: causes, effects and treatments



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One age-related disease is Tinnitus. Tinnitus is a disease that affects the hearing, it is a chronic ringing in the ears without a sound source. Tinnitus is mainly developed from damage inflicted in the cochlea (Eggermont & Roberts, 2012). The symptoms include ringing in ears, sleep disturbance, anxiety, depression, irritation, concentration disturbances, and hearing loss (Langguth, 2011). There are different forms of tinnitus, such as objective and subjective. Objective tinnitus is caused by sounds within the body traveling to the ear through conduction in body tissue (Møller, 2007). Objective tinnitus is not as common. Subjective tinnitus occurs without any physical sounds reaching the ears, it is when there is abnormal neural activity generated in the ear, the auditory nerve, or the central nervous system (Møller, 2007). Since there are many forms of tinnitus as well as a variety of causes it is hard to find a single cure.

Some causes of tinnitus include otologic causes, which have to do with the anatomy and physiology of the ear and include noise-induced hearing loss such as deafening music or sounds, sudden deafness, Meniere's disease, and other causes of hearing loss (Han et al. 2009). Another cause would be neurologic which includes head injury, whiplash, multiple sclerosis, and other cerebellopontine-angle tumors (Han et al. 2009). Tinnitus can also be caused by infections such as otitis media and sequelae of Lyme disease, meningitis, syphilis, and other infectious or inflammatory processes that affect hearing (Han et al. 2009). Tinnitus is also a side effect of some oral medications, nonsteroidal anti-inflammatory drugs, aminoglycoside antibiotics, and chemotherapy agents (Han et al. 2009). Due to the wide variety of causes

that could lead to tinnitus, it is challenging to find the real root of the disease in an individual, therefore difficult to find a cure that could work for everyone.

However, there are many different types of treatments to alleviate the symptoms of tinnitus. Most treatments aim to directly reduce the intensity of tinnitus or to alleviate the annoyance associated with tinnitus symptoms (Langguth, 2011). These treatments can include pharmacotherapy, cognitive and behavioral therapy, sound therapy, music therapy, tinnitus retraining therapy, massage and stretching, hearing aids, and electrical suppression (Han et al. 2009). Pharmacotherapy is a therapy using pharmaceutical drugs and is mainly used to reduce the intensity of tinnitus (Han et al. 2009).

Cognitive therapy focuses on how one thinks about tinnitus and on the avoidance of negative thoughts, and behavioral therapy uses the systematic desensitization approach and tries to make positive associations (Han et al. 2009). Sound therapy uses sounds found in natural settings to decrease the strength of the tinnitus-related neuronal activity within the auditory system (Han et al. 2009). Music therapy is a desensitization method that utilizes music that has been modified according to the hearing characteristics of each patient to mask tinnitus and to facilitate relaxation at a comfortable listening level (Han et al. 2009). Hearing aids are designed to improve the audibility of speech which distracts from the tinnitus noise and to amplify ambient sounds which mask tinnitus (Han et al. 2009). Tinnitus retraining therapy (TRT) is a form of habituation therapy (Han et al. 2009). TRT uses naturally occurring mechanisms of plasticity in the brain to achieve habituation to the physiological reactions to tinnitus (Han et al. 2009). Electrical stimulation of the cochlea uses trains of pulses at 5,000 pulses per second to substantially

or entirely suppress tinnitus with either no perception or only a transient perception of the stimulus (Han et al. 2009).

Further research on new treatments and therapy for tinnitus are being developed. A treatment that is currently being developed is the use of neuromodulation techniques which would aim at alternating nerve activity through a targeted delivery of a stimulus (Peter and Kleinjung, 2018). Studies suggest that individually different brain states and networks are involved in the generation and perception of tinnitus (Peter & Kleinjung, 2018). In order for the technique to be effective sophisticated stimulation regimens and parameters need to be developed to dynamically stimulate various regions at different frequencies and intensities (Vanneste & Ridder, 2012). Therefore, in the future, individually tailored neuromodulation strategies could be a promising approach in tinnitus treatment for achieving a more substantial and longer lasting improvement (Peter and Kleinjung, 2018).

Since there is no cure for tinnitus the best treatment would be a multidisciplinary treatment approach using current treatment methods. Using techniques from different disciplines would be the best approach mainly because tinnitus has many different symptoms. Tinnitus retraining treatment would be the best treatment at the moment along with other minor treatments to help with underlying causes such as cognitive and behavioral therapy, followed by pharmacologic intervention. The current treatments have the most success in clinical trials and an abundance of research done. Neuromodulation techniques could be a potential option in the future but because of the lack of research on how these techniques work and how the brain responds to neuromodulation, it is a liability at the moment.

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