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Mini Review

A Review of Sound Therapies for Tinnitus

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SOUND THERAPY

Tinnitus is one of the most common chronic syndromes that can affect one's quality of life. If left untreated, it can cause problems with work and socialization. Some even experience suicidal thoughts. Although there are no cures for sensorineural tinnitus, many patients' sensations of tinnitus can be reduced by individualized counseling and sound therapy. The term sound therapy means the use of external sound to alter patient's perception of, or reaction to, tinnitus. They can partially or completely cover the tinnitus. There are many products now available to provide sound therapy; hearing aids also provide sound therapy.

Categorize sounds

Most devices for sound therapy are able to produce different types of sound; within the right counseling these sounds can help many patients to reduce the sensation of tinnitus.

Broadband noise: There are many types of broadband noise. White noise implies equal energy at all frequencies, which is rarely possible. Pink noise is spectrally shaped, with a reduction of energy in the higher frequencies. Brown noise has an even greater reduction in the higher frequencies. These noises sound like static, with slightly different pitches. Study shows that that broadband noise takes away some of the noise from tinnitus signal to reduce the magnitude (loudness) of tinnitus [1], which makes it easier to listen to those noises than their tinnitus.

Waterfalls/ raindrops: Calming water sounds can also partially mask the tinnitus and can help some patients to relax. Soft calming sounds usually will not trigger the brain's "threat activated vigilance system". Those sounds allow patients to feel relaxed and focus less on tinnitus.

Modulated tones: Several pure tones can be presented together. This can sound like a pulsing or beating. Some sound like 'spa tones' A tone can be modulated in frequency or amplitude and can creating modulations or waving sensations, which can also reduce the prominence of the tinnitus [2].

Music: Two general strategies can be used with music. First, when there are no other attention obligations, a person can focus on the music, even sing along. This could occur at home, or driving, for example; focusing on the music and not on the tinnitus. Second, music can be played in the background when the person is focused on another task. The music should be 'in the background', and not grab attention away from tasks at hand. Some chose baroque or soft piano music.

Notched noise and music: Some strategies use music or noise with a spectral "notch" (frequency band) around the most prominent pitch-match frequency. These approaches are based on one of the many theories of tinnitus. The proposed mechanism of this technique is reducing the hyperactivity of auditory cortical neurons; therefore make tinnitus less noticeable [3].

Categorize options for users

Hearing aids with sound therapy: Hearing aids are often involved in the management of tinnitus. Near all patients with tinnitus have with some hearing loss, so devices like hearing aids are often an important first step in tinnitus. Surr et al. [4], reported that approximately half of those who use hearing aids to treat tinnitus receive. Recently, a survey revealed that two out three tinnitus patients reported hearing aids helped with their tinnitus [5].

Hearing aids help people communicate and interact with others. This is very important in our quality of life. This puts the tinnitus patient in a better framework to deal with the challenges of their tinnitus. In addition, hearing aids can amplify low-level background sounds, which can partially mask their tinnitus.

Sound therapy wearable devices: The first wearable sound therapy devices were promoted by Vernon [6]. Today, there are many. And many sound therapy options are available on hearing aids. Also, apps from a mobile phone can stream sounds to ear buds. There are also softwires which can be installed and played from mobile phone; patients can listen in their office, bedroom, etc.

STRATEGIES BEHIND SOUND THERAPIES

The theoretical rational behind sound therapies can be different with different approaches, but generally the idea is to reduce the patient's tinnitus sensation and therefore reduce stress and anxiety caused by tinnitus. Some argue that the background sound must overlap the perceived frequency region of the tinnitus, but others would argue this is not necessary. Still other theoretical approaches suggest that the best approach is to create a notch in the spectrum of the masker around the prominent pitch-match frequency of the tinnitus.

External sound masks the tinnitus

There are two types of masking, one is partial masking which means the patients can hear the noise and tinnitus simultaneously, but the loudness of the tinnitus is reduced. Another type of masking is complete or total masking. In this case the masker completely covers up the tinnitus, so patients don't hear the tinnitus but now hear a different sound. A potential disadvantage of complete masking is that without proper adjustment the masker can be too loud, which might damage hearing or increase the tinnitus.

External sound reduces prominence of tinnitus

It's well known that maskers and hearing aids combined treatment with counseling are one of the best ways to help patients with tinnitus. Some hearing aids are equipped with tinnitus masking, meaning that they can self-generate sounds that can mask or partially mask the tinnitus. This external sound reduces the prominence of tinnitus, so it does not stand out as much.

External sound reduces loudness of tinnitus

Sensorineural tinnitus is a subjective percept; only the person who has it can hear it. People often describe hearing sounds like ringing and buzzing, but the tinnitus loudness can be very different in different patients. The sound some people hear can be loud and unbearable. Many patients with tinnitus reported that background noise can reduce the loudness of tinnitus. A self-generating noise device can reduce the loudness of tone and lower the sensation of tinnitus for many.

Proposed physiological correlates of tinnitus and how external sound might impact this

Tinnitus is classified as either sensorineural or middle ear tinnitus [7]. Tinnitus must correspond to activity in the auditory cortex, as that is where sound is perceived. The psychoacoustic tuning curve experiments of [8, 9] suggested that some patients' tinnitus might originate on the basilar membrane! It is also noteworthy, that for some patients, their tinnitus cannot be masked at all. There are clearly many different mechanisms behind tinnitus.

SOUND THERAPIES CURRENTLY AVAILABLE

Patients with tinnitus often experience constant ringing or buzzing in the ears, which are reported bothersome and annoying. Sound therapies, sometime known as acoustic therapy uses various techniques to either cover the tinning or make it less noticeable. Although, sound therapy won't cure the condition, but it can make tinnitus more manageable and easier to live with. Currently, some special devices can make quiet background noise, which can help to ease tinnitus. One such device is customized hearing aids. Unlike conventional hearing aids, customized ones can mask the tinnitus or distract patients from it. In addition, some devices (i.e., sound generators) like media players, computers, or electric fans can generate different types of sound such as broadband noise, music, and modulated tones which can also reduce tinnitus.

Hearing aids and tinnitus

It is important to note that roughly 90% of patients with tinnitus also some degrees of hearing loss [10]. It is true that some special hearing aids are equipped with features that can provide relief on tinnitus, which we will talk more about this in the next section. There are two reasons why that's the case.

From the psychological perspective, patients with tinnitus often report that they are frustrated, which this feeling overtime can develops to anxiety. Social anxiety can intensify tinnitus and make it less tolerable to patients. But hearing aids can apply more gain to patients, which makes speech louder and easier to be understood. This provides more opportunity for patients to interact under normal social environment. Overtime, this can ease the feeling of anxiety, therefore ease tinnitus.

From physiological perspective, the auditory sensitivity can be increased in some tinnitus ears [11], which means tinnitus patients are more vulnerable to have the feeling of intolerance to everyday sounds. In the server form, this hyper-sensitivity can cause nausea, dizziness, and imbalance. With the properly tuned hearing aids, sounds can be desensitized due to the making effect of hearing aids. Most importantly, hearing aids can amplify the environmental sounds and speech, if the amplification is louder than tinnitus, then it can be covered (masked) or made less noticeable.

Hearing Aid Companies: There are many hearing aids companies that produce products that can benefit patients with tinnitus. We provide a general overview here of the sounds and approaches by some of these.

Widex: The company Widex created the ZEN therapy. The program also includes four major components (counseling, amplification, sound stimulation, stress reduction) to help patients to manage their tinnitus. The Zen sound stimulation is a "fractal tone" and sounds like "wind chimes".

Signia: The Signia strategy includes a notch therapy. The theory here is that the notch therapy can relegate the tinnitus sounds into the background over time, in result to "train" the brain to ignore tinnitus, this could reduce the annoyance of tinnitus in weeks.

Starkey: Starkey created a "multiflex" tinnitus approach, which generates a broadband noise with many different frequencies to help manage tinnitu. This technology is equipped in the Z series hearing aids.

Resound: Resound has "soundscapes". The sounds are white noise signals, which use to cover up tinnitus. The app combines sound therapy and relaxation exercises.

Oticon: Oticon provides Tinnitus Sound Support, which plays a variety of relief sounds, such as "white"/pink noise, shaped noise, and 3 different types of ocean noises. The patients can self-adjust the sound from their mobile phone.

Relax offers the following sounds:

Chimes, Rainforest, Ocean Waves, Rainfall

Marimba, Acoustic Guitar

Babbling Brook

Thunderstorm

Nature

Oscillating Fan

Crackling Fire

THE FUTURE

Tinnitus can be a severe challenge to our patients' mental health. Indeed, society needs to be better educated on the importance of hearing and of tinnitus [12]. Although there is no cure, there are effective counseling approaches, and very helpful sound therapies. There are many mechanisms and subtypes of tinnitus that will likely require different approaches. The different sounds therapies have evolved to provide a wide range of sounds, enabling patients to choose something that meets their individual preferences. The ease of use and the variety of available sounds will likely increase. The ability to stream selected sounds depending on the environment (home, work, sleep, driving, talking, listening) will likely improve. A recent controlled study has documented that sound therapy can be effective [13].

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