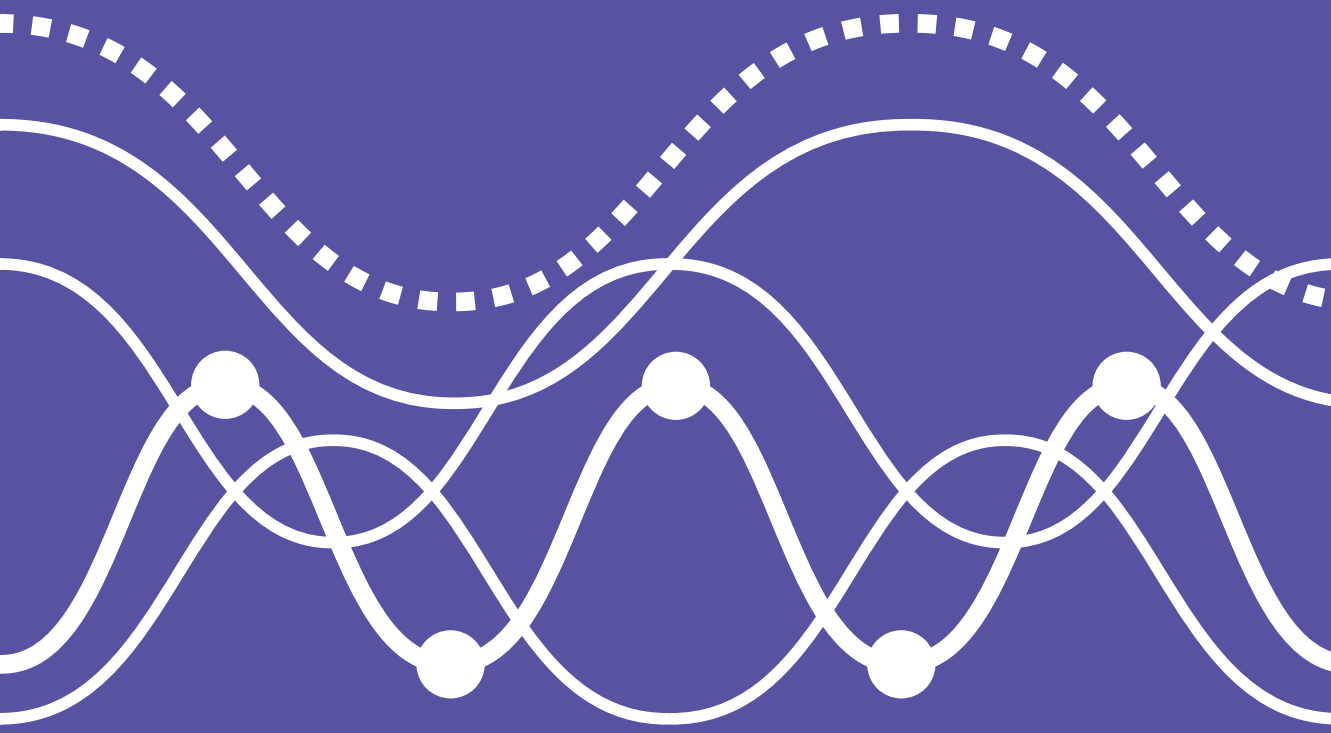
Tinnitus: Its Causes & Potential Treatments



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What Is Tinnitus?

Tinnitus is an incredibly common medical condition affecting 10-15% of the population. It is a bothersome neurological issue in which people experience a sound or noise that does not have a legitimate external source. Although it's more common in adults, it can affect people of all ages - even children.

Tinnitus is most often described as a ringing in the ears, but it can vary significantly from person to person. For those living with tinnitus, it can be experienced intermittently or it can persist all day long. For many, it can become particularly apparent at night when it is quieter.

In mild cases, it's an issue that the person can learn to live with. But in cases where it's more severe, tinnitus can result in significant stress, negatively impacting the person's quality of life. Though no cure has yet been found, there are both well established and emerging paths towards the effective management of tinnitus, ranging from information to support, counselling and various forms of treatment and therapy, some of which are very promising.

Tinnitus can take many forms:

Roaring
Ringing
Clicking
Hissing
Buzzing
Crickets
Humming

Characteristics of Tinnitus

The experience of tinnitus varies greatly from person to person. It may present itself in just one ear or both ears, the latter of which is more common. Unilateral (one ear) tinnitus often requires further investigation as it is more likely to be a sign of an underlying health condition. There are then cases where the sound will be perceived as coming from the centre of the head as opposed to the ears, making it difficult to pinpoint the exact location.

Tinnitus may be experienced as a single noise or tone, or described as having two or more components (multiple tones). The noise may also be continuous or in cases of what's known as 'pulsatile tinnitus', the noise may present itself in a rhythmic pattern, sometimes in sync with the heartbeat. Although 'tinnitus' comes from the Latin word for 'ringing', it can take a variety of forms including buzzing, whistling, hissing, whooshing, or humming. Some people become aware of their tinnitus only when they are in quiet environments, whilst many others will experience it even in noisy environments. For some people, their individual experience of tinnitus will also vary; the loudness of the condition, the pitch and the quality of their tinnitus can change day to day.

When diagnosing tinnitus, it can be broadly categorised as Subjective or Objective. Subjective is the most common type of tinnitus and is only audible to the individual who is experiencing it. This means that during an examination, a healthcare professional would not be able to hear it. It can be initiated by issues in the outer, middle or inner ear. It can also stem from problems with the hearing nerves or from the nerve signals into your brain that interpret sound. There are numerous contributors that can cause subjective tinnitus, all of which are explored in the next section. Objective tinnitus, on the other hand, can often be audible to both the individual who experiences it as well as their clinician/doctor. Objective tinnitus is quite rare.

What might be surprising to learn is that tinnitus is actually heard by most people at some point in their lives, even those with 'normal' hearing. It can also happen spontaneously without any reason, and then disappear as suddenly as it began. Whether it's a short bout of tinnitus that comes and goes within minutes or the kind of tinnitus that is experienced all day every day, it's important to remember that despite the distress it may cause to a person, tinnitus is generally not life-threatening.

What Causes Tinnitus?

'Why am I experiencing tinnitus?' is the first question that any person distressed by the condition is likely to ask.

Tinnitus can occur due to a variety of causes related to dysfunction along the human auditory system (our hearing system) from the outer ear up through the auditory nerve and the brain itself, but is most often associated with some type of hearing loss.

With subjective tinnitus, some of the most common causes include:

- Age-related hearing loss which is called presbycusis.
- Exposure to a noisy environment that can cause noise-induced hearing loss.
- Head or neck injuries or trauma to the head or neck that can affect the inner ear, its nerves and the brain function linked to hearing.
- Temporomandibular joint (TMJ) disorder, which is a pain in the jawbone that can cause swelling of the joint and in some cases lead to tinnitus.
- Some medications, for example antibiotics and antidepressants, which can trigger tinnitus symptoms or make them worse depending on the type and dosage of the drug.

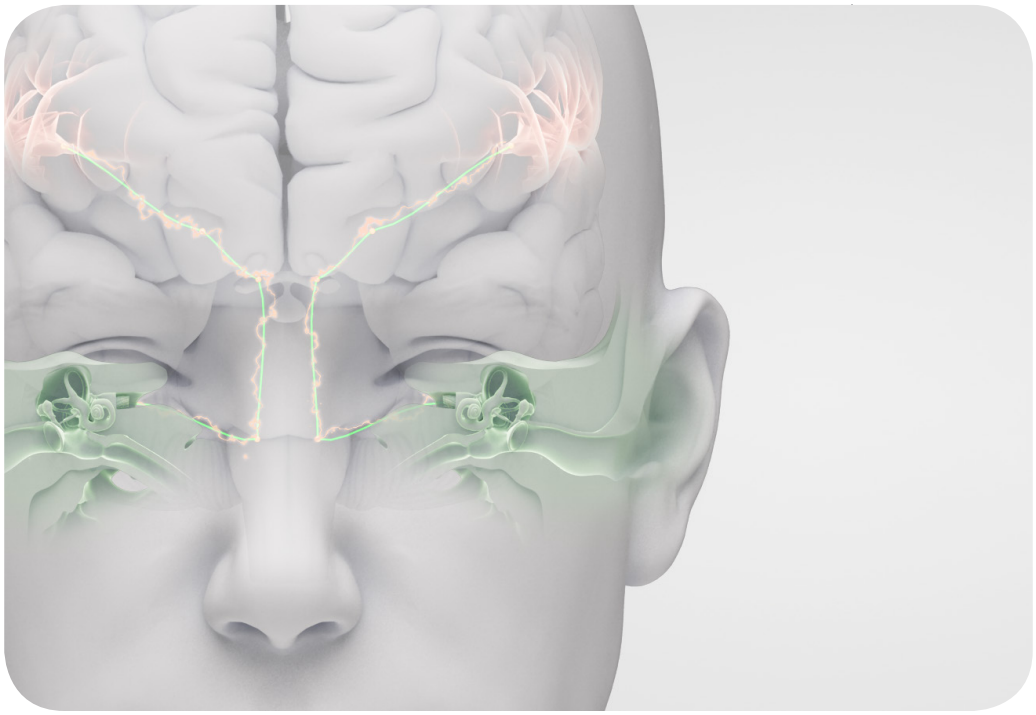
Objective tinnitus is believed to be caused by an underlying medical condition such as:

- A blood vessel disorder that is known by those in the medical field as 'pulsatile tinnitus'. This can arise as a result of high blood pressure or a build-up of cholesterol and other deposits in the blood vessels close to your ear. This causes your ear to hear the beats of the blood as it moves forcefully through the vessel.

Many theories have attempted to explain tinnitus and most focus on defects within the ear, especially the inner ear. However, if tinnitus were simply due to damage in the inner ear, we could not explain why some people with tinnitus may have normal hearing or why many people with hearing loss do not have any tinnitus.

To fully understand tinnitus, we must consider how hearing occurs, what happens when something goes wrong and also something called 'neuroplasticity'.

The Auditory System and Neuroplasticity



Whenever we hear, feel, smell or see something, our nerves transmit this external information to specific regions in the brain. The auditory system is a complex sensory system responsible entirely for our sense of hearing. In order for us to hear something, the following chain of events must occur: sound waves enter your ear and travel through the ear canal where they will be intercepted by our eardrums. The eardrum will vibrate as a result of the incoming sound and send these vibrations, converted into neural signals, to a region in the brain called the auditory cortex. The auditory cortex interacts with other parts of the brain via neural connections called “pathways” and as a result of these interactions we finally have the sensation of “hearing” the sound.

This, of course, is a delicate process that relies on a complex series of structures and connections between the ear and brain. As such, it is susceptible to damage. For the many reasons already discussed - be it hearing loss due to natural ageing or exposure to loud noise, to name but a few - the auditory system can, as a result, find itself damaged. When any kind of damage occurs, it is believed that a cascade of changes is then triggered. New neural pathways are formed as the brain attempts to right the wrong caused by the lesion or damage.

This ability of the brain to reprogram itself - which it does so throughout a person's lifetime - is called neuroplasticity. Neuroplasticity is often beneficial (or what you might call adaptive), such as our brain's ability to learn an instrument or a new language. In the case of tinnitus, however, it is considered unhelpful (or maladaptive) neuroplasticity. For reasons that are not yet fully understood, when this overwriting happens, the new pathways between the ear and the brain are believed to produce tinnitus in the majority of people.

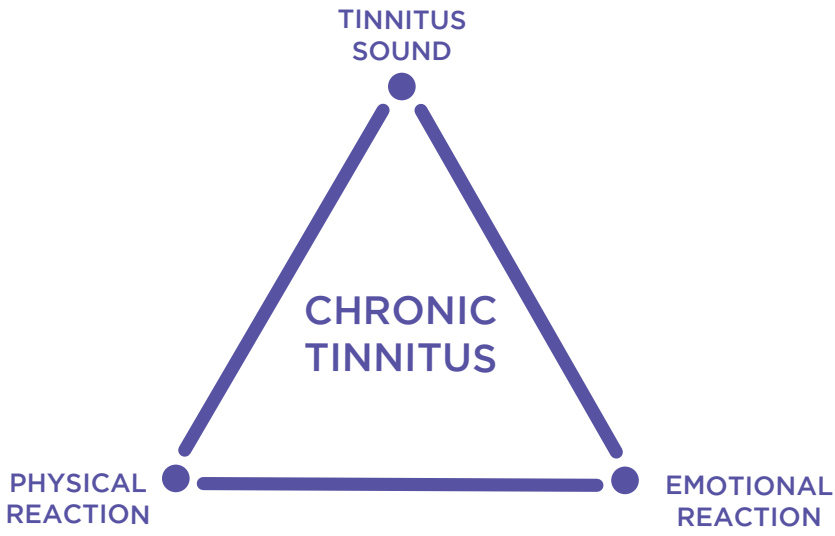
The Impact of Tinnitus

Tinnitus affects people in different ways. In milder cases, those living with tinnitus are not particularly bothered by it; at the very most they may find it only somewhat annoying. Fortunately, these people learn to live with it. But for a good many people, where the tinnitus is severe and perhaps constant, it can cause significant stress, negatively impacting their quality of life. The initial onset of tinnitus is quite often linked with stress, which can lead to negative thoughts and emotions, particularly if the tinnitus persists [3]. Tinnitus also becomes more of a problem when it is perceived as a threat, appears continuously intrusive, or when patients have difficulty coping [4]. Tinnitus can lead to a repeating cycle of annoyance, mood changes, fear, and anxiety, all of which are associated with tinnitus severity [5].

The Vicious Cycle

For about 15% of people with tinnitus, the tinnitus signal is labeled by the brain as ‘important’. Furthermore, the experience of tinnitus is associated with something negative where the human brain can place more focus and importance on that which it deems threatening or negative. This is because our brain’s primary role is to ensure our survival. This negative association is reinforced when tinnitus is first experienced; in some cases, an unpleasant or traumatic event may have occurred at the same time. Anxiety and annoyance caused by the event are then linked to the tinnitus itself, which in turn, causes the tinnitus to become more of a problem.

It’s not always linked with a negative event, however. For some, regardless of how or why it has come about, the continuous presence of tinnitus symptoms can understandably lead to anxiety and stress. Once this negative connection is established, a vicious cycle can begin that affects the emotional centre of the brain, known as the limbic system. When tinnitus is perceived, it can prompt a number of emotions, including fear, danger and unhappiness. These can in turn cause emotional reactions such as anxiety and stress, thus reinforcing the tinnitus and making the cycle repeat itself to worsen the overall tinnitus experience. For this reason, working on the person’s mindset is a crucial aspect of managing the tinnitus overall.



Common Misconceptions

Tinnitus is a disease:
Tinnitus is actually a symptom of another condition, such as hearing loss, high blood pressure, depression or anxiety.

There is no treatment for tinnitus:
There is no cure for tinnitus, but there are many treatment options that have proven effective and in some cases, life-changing.

Tinnitus is all in the mind:
Tinnitus is a very real neurological condition that affects function in the inner ear or in the brain. It can be incredibly challenging to live with. Whether it is categorised as subjective or objective tinnitus, it is not an imagined condition.

Hearing aids can't help with tinnitus:
Hearing aids can be very helpful in treating or coping with tinnitus, either by cancelling out the tinnitus with another sound or by making other sounds clearer.

Tinnitus is an elderly person's condition:
Tinnitus has been reported in all age groups, even young children. It just happens to be more common in older people as it is strongly linked with hearing loss which increases with age.

Tinnitus causes hearing loss/deafness:
Although severe tinnitus can interfere with your hearing, the condition has not been shown to directly cause hearing loss.

Tinnitus gets progressively worse over time:
Not necessarily. Tinnitus symptoms can fluctuate over time and can improve over time.

Tinnitus always sounds like 'ringing' in the ear:
Tinnitus can take many different forms of sounds, including ringing, buzzing, hissing, humming and noise-like, which can also change over time.

What to Do If You Have Tinnitus?

Because tinnitus is unique from person to person, it is important to find a treatment plan that is personalised for your needs and works best for you. For this reason, an examination by a Healthcare Professional (HCP) is the essential starting point so as to establish whether the case can be medically treated or not. Seeking medical attention is very important in order to ensure and improve the wellbeing of the individual living with the symptoms. Before informing you about the treatment options available, a HCP will carry out an initial examination. A hearing test may be performed to determine if your tinnitus is a result of hearing loss. Tinnitus pitch and loudness may also be measured. Your HCP may also ask you to complete a number of questionnaires to get a better picture of how your tinnitus impacts your daily life.

If a person is very distressed and anxious about their tinnitus, their HCP may prescribe mild sedatives or sleeping medication. This sometimes also results in a lessening of the severity of the tinnitus noise. If a simple issue, such as hardened earwax, is the cause of the tinnitus, then the HCP may organise referral for wax removal. In some circumstances patients are referred on to an Ear, Nose and Throat (ENT) specialist. An MRI or other procedures may be carried out to ensure that there are no serious underlying conditions. Occasionally, tinnitus is associated with Ménière's Disease, a disorder of the inner ear, for which medication can be helpful. Surgical intervention to treat tinnitus is rare. As a result, ENT specialists may not have an ongoing role in managing your tinnitus.

Audiologists and hearing therapists, who may be of assistance in relation to hearing difficulties, can also help in tinnitus management. There are some audiological (hearing-related) tests that may be carried out to provide more information regarding your tinnitus. The individual with troublesome tinnitus needs reassurance and encouragement in the early stages, as well as information to aid their understanding of the condition. Knowing that others experience the same symptoms and have reached a stage where they are no longer affected by the tinnitus in their day-to-day life, can be reassuring.

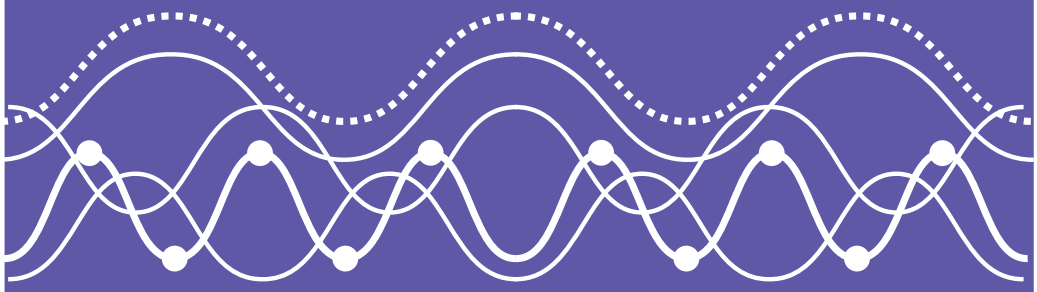
Assuming there is no underlying medical condition at play, you can help yourself significantly with lifestyle changes. Most notably, it's advised to avoid unnecessary exposure to loud noise by wearing ear protection. In certain situations, your tinnitus may disappear if a symptom of an underlying condition is treated or resolved. It may be as simple as a build-up of earwax or a side-effect of certain

medications. In a lot of cases, the symptoms may disappear as quickly as they came on. Regardless of your kind of tinnitus or how it manifests for you, the goal for you as the person living with it, as well as any treatment plans you may embark upon, is to break the vicious cycle and divert your attention away from the tinnitus. Of course, this is easier said than done. It is common knowledge that stress can bring on or worsen your tinnitus. As such, Cognitive Behavioural Therapy (CBT) or other counselling modalities may be advised to help you work on the mindset element of your tinnitus management.

Whether it's a simple case of lifestyle changes or a more specific treatment path, it is important to understand that it can take time to achieve a reduction in stress or tinnitus symptoms. Some immediate relief may be achieved, but ultimately the goal is to become more comfortable with the tinnitus, realise it is not life threatening and, most importantly, that you are always in control of your response to it.

Simple Tips to Improve Your Tinnitus

- Avoid exposure to loud sounds and noises.
- Review your medication with your GP, especially if your doctor has changed or recently increased your prescription.
- Exercise daily to improve your circulation and boost your body's overall wellbeing, sleep included, which in general will help in the goal of managing your tinnitus.
- Avoid excessive caffeine – caffeine can increase your blood pressure, making your tinnitus more noticeable.
- Stress and anxiety can exacerbate tinnitus, therefore mindfulness meditation or other relaxation techniques can be practiced to reduce stress and improve sleep.
- Play gentle or comforting music – a quiet melody gives your brain something else to focus on instead of the ringing.
- Clear your ears of wax – do not do it at home. A doctor can use a microscope and small tools to remove ear wax. Using a cotton swab tends to only push the wax further into your ear canal, possibly making things worse.



Can Tinnitus Be Treated?

As of yet, there is no clinically proven cure for tinnitus. That being said, there are several treatments available that can help to effectively manage, relieve or reduce the symptoms of tinnitus. Currently, both pharmacological and nonpharmacological treatments are used to great effect. These range from different forms of psychological therapy, sound therapy and neuromodulation. The chosen treatment modality is often a function of the severity of the condition and what is comfortable or acceptable for each individual.

Current Treatment Options

Drug/Pharmacological

While there is no evidence for the effectiveness of drug treatments specifically for tinnitus, certain medications may be prescribed to help with the psychological or emotional aspects that can surround a person's experience of tinnitus, such as anxiety or depression. The focus of research has shifted from drugs that act on the ear to drugs that act on the auditory, emotional and awareness pathways in the brain. Although many of these trials have been reported on in the media, it is important to note that they are still considered to be experimental. It is not yet known whether or not they will have any lasting effect and it is possible that some of the drugs being tried will have various side effects. More research on medication, complete with trials, is still required.

Psychological Treatments

It is well known that tinnitus can cause emotional disturbance and this emotional disturbance can worsen the tinnitus (the vicious cycle). The most established and clinically supported psychological treatment offered is Cognitive Behavioural Therapy (CBT). CBT encourages you to examine how your thoughts, feelings and behaviours interact with one another. For example, your thought processes may be adversely affecting your behaviour and when you change your ways of thinking about tinnitus, you can positively impact your physical feelings and your behaviour. Research has shown that CBT can reduce the impact of tinnitus, proving the importance of the person's mindset in relation to their experience of tinnitus. CBT by itself does not necessarily influence the loudness of the tinnitus or improve the associated depression, but it may increase an individual's quality of life by increasing the patient's ability to deal with tinnitus [11]. The main goal of CBT is to recognise and then correct any negative thoughts or emotions you have about your tinnitus.

Hearing Aids and Cochlear Implants

It has long been good clinical practice to offer hearing aids to individuals with tinnitus who have associated hearing loss. The aim is to increase stimulation of the auditory system in the brain with external sounds so that the tinnitus does not seem as intrusive and the brain pays less attention to the tinnitus. Also, if there is hearing loss, the individual may strain to hear, which in turn can make them more aware of their tinnitus. As described earlier, hearing loss can also be contributing to the initiation or maintenance of the tinnitus; thus, increasing sound stimulation into the auditory brain could help alleviate the tinnitus. It is now possible to have a hearing aid fitted for mild hearing loss and individuals with tinnitus often benefit from using them, however the benefits or relief experienced tends to be temporary [5].

Cochlear implants may be a solution when hearing ai ds are not enough. Cochlear implants can be effective in alleviating tinnitus but as they involve surgery, they are usually recommended for patients with significant hearing loss to justify the procedure. They are not typically recommended for patients suffering solely with tinnitus [12].

Sound Therapy

Sound therapy, used in many ways depending on the specific product, clinical setting or clinician, works by distracting the brain with other sounds. It can be introduced by means of a TV, radio, portable music player, fans, table-top sound generators and sound pillows. Sound therapy introduces a signal into the auditory pathway of the brain to help reduce the perceived strength of the tinnitus signal and possibly making it easier to fade the tinnitus into the background sounds. Over time, the goal is to make the individual less aware of the tinnitus as the brain adapts or habituates to it. [13]

Tinnitus Retraining Therapy (TRT)

Tinnitus Retraining Therapy (TRT) is a commonly used habituation (where the brain adapts to the sound) programme that combines sound therapy with directive counselling. Sound is used to make the tinnitus less noticeable as opposed to masking it out, and it is used in conjunction with an intense form of direct counselling. The role of the counselling is to reclassify the tinnitus into the category of a neutral stimulus. The combination of sound therapy and counselling, via TRT, is designed to lead to habituation. When habituation has been achieved, the tinnitus-related brain activity is blocked from reaching the limbic and autonomic nervous system and consequently there are less negative reactions to the tinnitus [14].

Neuromodulation

Most promising of all potential tinnitus treatments to have emerged in recent years, is neuromodulation; a therapeutic modality which can be used for a wide variety of health and brain conditions. Neuromodulation has been used successfully for many years to help patients with pain, epilepsy, movement disorders and depression. It works by targeting a specific nerve or brain region with a stimulus, such as low levels of electrical energy, in order to alter or adjust the activity within the body or brain to improve a health condition. Currently investigated neuromodulation techniques for tinnitus treatment include non-invasive methods such as repetitive transcranial magnetic stimulation, transcranial electrical stimulation, neurofeedback, and transcutaneous vagus nerve stimulation, as well as invasive methods such as implanted vagus nerve stimulation and invasive deep brain stimulation. Several of these neuromodulation techniques have provided positive therapeutic results in some individuals with tinnitus [16].

Lenire® (Bimodal Neuromodulation)

Neuromod Devices has developed a novel treatment for tinnitus that takes neuromodulation one step further by stimulating two targets or nerves at the same time (this is known as bimodal neuromodulation). The product is named Lenire. Lenire is a non-surgical device designed for use by patients in the comfort of their home after being fitted and evaluated by an appropriately qualified healthcare professional.

Lenire delivers bimodal treatment that combines sound stimulation to the ear with gentle electrical stimulation to the tongue to promote therapeutic neuroplasticity in tinnitus patients. In essence, Lenire works to counter the maladaptive neuroplasticity and negative reactions associated with tinnitus. It does this by retraining the brain to reduce its attention and sensitivity to the tinnitus sound that was previously active in the brain. The signals are coordinated through the Lenire control device, which plays relaxing or comfortable sounds through the recommended headphones while sending electrical pulse signals through the tonguetip® device. The 'tonguetip' rests on the tip of the patient's tongue. This diverse activity in the brain not only interferes with the ongoing activity caused by tinnitus, but also makes the brain attend to the novel or changing stimuli that are being continuously presented to the individual, leading to an individual being less aware or bothered by their tinnitus.

Already, in clinical trials involving 500+ participants, the Lenire system has been shown to reduce and soothe the symptoms of tinnitus. The first commercially available treatment of its kind, a unique feature of Lenire is the combined presentation of the two inputs (sound and tongue stimulation) that drives stronger neuroplasticity, which in turn can reduce the brain's attention and sensitivity to the tinnitus sound to a greater extent than when stimulating only a single input at a time.

Dental Treatment

TMJ disorder is a very common disorder which arises from the temporomandibular joints found in your jaw and associated structures. Symptoms of TMJ include pain, tenderness, abnormal bite, headaches and facial sensitivity. Tinnitus can also be a symptom of temporomandibular joint dysfunction. If you feel your tinnitus is a result of TMJ, it may benefit you to treat the associated symptoms first. You should consult your healthcare provider who may refer you on to an ENT or specialising Dentist for suitable treatments.

Complementary Therapy

This includes acupuncture, reflexology, craniosacral therapy, homoeopathy, herbalism, aromatherapy, massage, osteopathy, biofeedback, hypnosis and meditation. Many of these therapies have not been validated as treatments for tinnitus. However, for some patients these treatments provide relief and can help to relax an individual, which in turn has a positive impact on both their mindset and their symptoms of tinnitus.

Reassurance

Reassurance and a clear understanding of why and how you are experiencing tinnitus can help you to comfortably live with tinnitus. This is because, when tinnitus begins, it is common to be anxious and fearful of it. As with a lot of health concerns, simply understanding what is causing the problem is a great help in dealing with the problem [15].

More Information

For more information or guidance on how to deal with or treat tinnitus, you can visit the links below or find your local or national tinnitus association.

Ireland:
Chime/Irish Tinnitus Association
www.chime.ie/tinnitus

United Kingdom:
British Tinnitus Association
www.tinnitus.org.uk

Germany:
Deutsche Tinnitus Stiftung
www.deutsche-tinnitus-stiftung-charite.de

America:
American Tinnitus Association
www.ata.org

Canada:
Canadian Hearing Society
www.chs.ca/tinnitus-and-hyperacusis

Australia:
Tinnitus Austrailia
www.tinnitusaustralia.org.au

It's also recommended to take caution when seeking advice from forum websites, as not all information on the internet is linked to a reliable source and should not be taken as credible medical advice.

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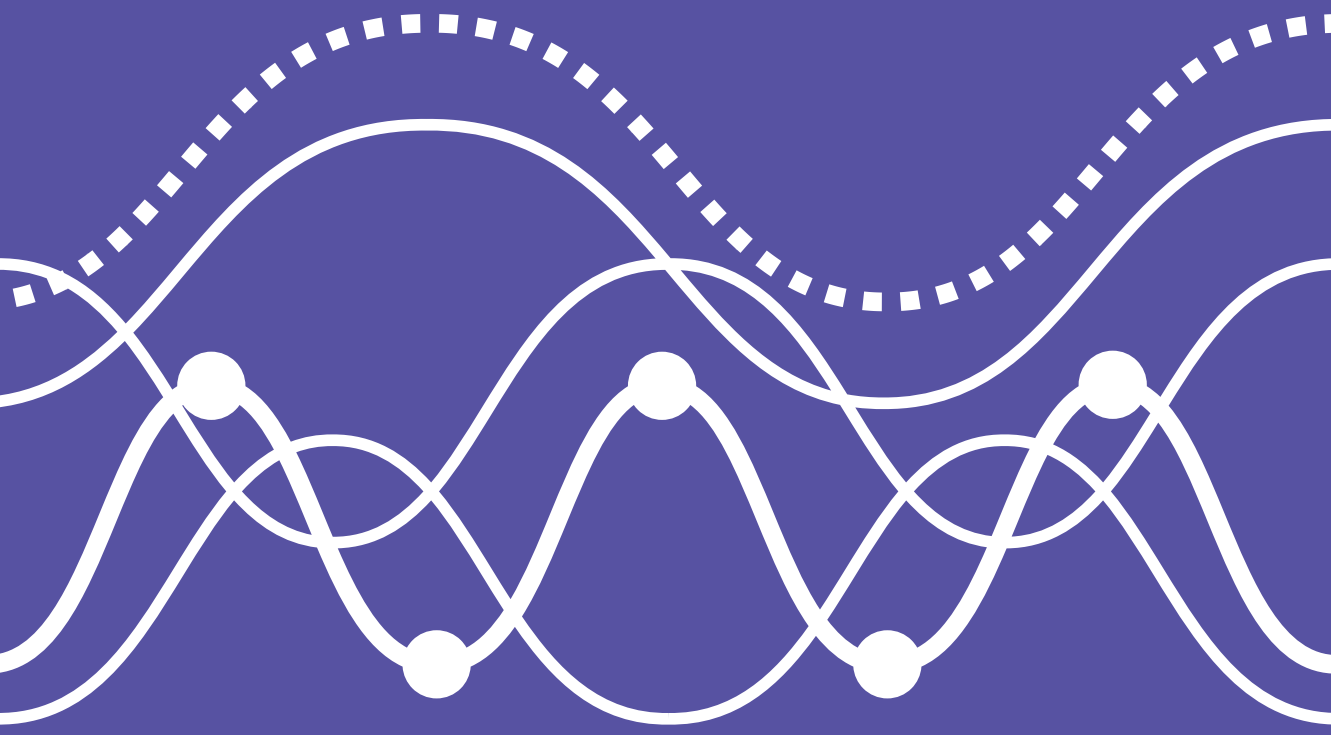

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