

Review Article

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Neurological Interplay between Tinnitus and Temporomandibular Disorders: A Narrative Review of Mechanisms, Diagnosis and Treatment Strategies

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ABSTRACT

This manuscript explores the interconnectedness of Tinnitus and Temporomandibular Disorders (TMD), two conditions affecting the same anatomical region due to their proximity to the jaw and ears. Tinnitus, characterized by internal perception of sound, has subjective and objective manifestations, with a significant increase in research publications reflecting growing interest in the field. TMD, encompassing pain and limitations in jaw movement, is recognized as a complex multi-system condition with widespread implications beyond the jaw joint. Comorbidity between TMD and various other conditions underscores shared risk factors and disease mechanisms, with estimates suggesting a substantial prevalence of TMD within the US population, particularly among women. This abstract highlights the intricate relationship between Tinnitus, TMD, and associated comorbidities, shedding light on the broader impact of these disorders on overall health and well-being.

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Received: August 30, 2024; **Accepted:** September 03, 2024; **Published:** September 14, 2024

Keywords: Temporomandibular Disorders, TMD, Tinnitus, Comorbid Conditions, Clinical Research, TMJ and Tinnitus Management

Introduction

Tinnitus and TMD are related disorders that generally affect the same area due to how close the joints and muscle tissues are to both the jaw and ears, linking Tinnitus and TMD.

Tinnitus is a condition that causes most individuals to hear a noise in one or both ears without the presence of an external auditory source. It is characterized by an internal noise that is heard exclusively by the affected individual [1]. The term Tinnitus is derived from the Latin word "Tinnire", which is directly translated as "to ring" [2].

There are two forms of tinnitus, subjective- and objective tinnitus. Subjective tinnitus is characterized by the perception of sound in the absence of an external auditory stimulus [3]. This is typically attributed to dysfunction within the auditory pathways or abnormalities in the ear's anatomical structures.

The primary cause of tinnitus is damage to either the peripheral auditory system, which includes the cochlea and auditory nerve, or the central auditory nervous system. This type of tinnitus is commonly described as a "ringing in the ear" [3]. Objective tinnitus is a rare condition caused by an actual sound generated within or near the ear, often originating from nearby blood vessels [1]. Unlike subjective tinnitus, this sound can be detected by a physician during clinical examination [1].

Given the diverse manifestations of tinnitus and the scarcity of information highlighted in the "Global prevalence and incidence of Tinnitus," it is evident that there has been a notable surge in publications related to tinnitus since the last prevalence review. This increase amounts to at least 30%, indicative of growing interest and research in the field. Notably, there have been several significant developments, such as the inclusion of pediatric tinnitus as a mandatory aspect in the evidence base [2].

TMD is a musculoskeletal condition that is often characterized as pain and dysfunctions in the temporomandibular joint and/or surrounding structures causing limitations within jaw movements.

The Temporomandibular Joint (TMJ) refers to an anatomical structure located just behind a major facial nerve, which lies at the center of a network of interconnected nerves running through the face, head, and neck. As a result, when the TMJ is impacted, pain can radiate to the eyes, ears, mouth, forehead, cheeks, tongue, teeth, and throat [4]. Recent studies have found that TMD is a complex multi-system condition that is involved within the circulatory, digestive, endocrine, exocrine, immune, MSK (Muscular and skeletal system), nervous, reproductive, and respiratory systems. Due to its complexity, TMD is no longer seen as just an abnormality affecting the jaws, it can affect the entire human system as well [5].

In the 2020 National Academy of Medicine Report, it is noted that patients diagnosed with TMD often suffer from chronic pain in other parts of the body as well as the jaw. These conditions are called “comorbid” because they occur together and share similar risk factors, symptoms, and underlying disease mechanisms. Some of the conditions that have been found include chronic fatigue syndrome, headaches, endometriosis, fibromyalgia, interstitial cystitis (painful bladder syndrome), irritable bowel syndrome, sinusitis, sleep disorders (e.g. obstructive sleep apnea) and heart disease [5].

Some connective tissue disorders and auto-immune diseases that can affect TMD include rheumatoid arthritis, juvenile rheumatoid arthritis, juvenile idiopathic condylar resorption, psoriatic arthritis, ankylosing spondylitis, Sjogren’s syndrome, systemic lupus erythematosus, scleroderma and Ehler-Danlos Syndrome [5].

The national prevalence of TMD is difficult to estimate due to challenges in collecting data. However, estimates range from 10 to over 35 million people within the US are affected at any given time. While both men and women can experience TMD, it is found that females are more likely to experience it. In severe cases, TMD can cause difficulties in how people speak, chew, swallow, make facial expressions and in some cases breathe. Jaw muscle disorders are included as they can accompany TMJ or occur independently [5].

TMD is more common in females due to a combination of health and lifestyle factors. Research indicates that temporomandibular disorders are 1.5 to 2 times more prevalent in females than in males, with female patients comprising 80% of patients undergoing treatment for TMD [6]. An investigative study on the prevalence of TMD symptoms among individuals in their 50s in Sweden revealed that women more frequently experience pain from their temporomandibular joints [7]. These symptoms included difficulties in jaw opening, masticatory problems and others, clearly indicating the gender differences in the manifestation of TMD [7].

A study aimed to evaluate the prevalence and characteristics of self-reported TMD jaw pain in a randomized sample from the general population of Québec, Canada, with people aged 18 and over. These 897 French-speaking individuals answered questions about the frequency, severity, patterns of jaw pain, difficulties in jaw opening, joint clicking, and sleeping problems. The prevalence estimates were adjusted to reflect the sociodemographic distribution of the non-institutionalized population. Their findings revealed that 30% of the population reported TMD jaw pain, with 7% experiencing frequent episodes (quite often or very often), and 69% of these individuals suffering from moderate to severe pain. Frequent difficulty in jaw opening and joint clicking were reported by 9% and 4% of respondents, respectively [8]. About 25% of

those with frequent jaw pain also reported clicking or difficulty opening, with a strong association among those symptoms [8]. The data suggest that approximately 5% of the general population in Québec experiences clinically significant TMD-related jaw pain (frequent and moderate to severe intensity) [8]. In the nine months prior to the survey, around 2% of the total population sought treatment for TMD symptoms.

Symptoms of Tinnitus and TMD

Tinnitus symptoms vary from person to person. Some individuals may hear ringing, buzzing, whistling, or humming while others can hear roaring, clicking or squealing noises. These sounds may vary in level from a low roar to a high squeal and may always be present or come and go. In some cases, the noise can be so intense that it disrupts concentration or impairs the ability to perceive external sounds [9].

A meta-analysis was done by the Global incidence and prevalence of tinnitus to provide further information on the affected population. They had used two different methods to gather this information, one being the umbrella review aimed to identify pooled analyses, published meta-analyses and systematic reviews on the prevalence or incidence of Tinnitus. The second method was a traditional review to identify all original articles: a systematic review of all original articles on the prevalence or incidence of Tinnitus to update the results found within the umbrella review. The result of their analysis concludes that more than 740 million people are affected by tinnitus and of that population 120 million people, mostly over 65 years or older, across the globe suffer from a severe form of tinnitus. Moreover, there were no differentials of statistics between genders with Tinnitus rather there have been higher ratings of prevalence in the older populations [2].

The analysis suggests that pediatric tinnitus cases may be prone to different interpretations due to the questions used to assess tinnitus in children and adolescence. The proposed reasoning behind this is that children are frequently asked about tinnitus without specifically mentioning the name of the symptom. Other researchers suggest that children may report hearing noises to please the interviewers. Although there has been a substantial increase in the studies of pediatric tinnitus, it remains an unrecognized problem that is inadequately assessed within the pediatric population [2].

TMD can manifest in various forms and severities. Symptoms range from sounds of the joint to severe pain that impairs daily function. In other cases, individuals may experience difficulty moving the jaw without any associated pain. Symptoms can include pain in the neck, back, and jaw muscles; severe to chronic headaches; jaw locking; stiffness or soreness in the jaw muscles; grating sensations within the TMJ; an abnormal feeling when moving the jaw; as well as dizziness and vision problems. In addition, some individuals may experience ear-related symptoms such as pressure, ringing, or fullness which relates to tinnitus [5].

Many people may experience discomfort or clicking sounds in the joint when performing jaw movements. However, it may not always be a concern as the problem may subside on its own within a few months [5].

Causes of Tinnitus and TMD

A publication on the population-level analysis named “Tinnitus prevalence, associated characteristics, and related healthcare use in the United States” had stated that tinnitus is the top compensated disability among (US) Veterans during 2023 [10]. The most

common cause of tinnitus is hearing loss and noise exposure. Functional imaging studies have demonstrated that tinnitus is associated with alterations in neuronal activity within central pathways, including non-auditory brain regions [11].

While the Exact Causes of Tinnitus are not Fully Understood it can be Caused by One of the Following

- **Hearing Loss:** The cochlea in the inner ear contains sensory hair cells, including both outer and inner hair cells, which are equipped with stereocilia. These stereocilia respond to sound waves by moving, generating electrical signals that travel along the auditory nerve to the brain, where they are interpreted as sound. Damage or distortion to these sensory hair cells can lead to the generation of erratic electrical impulses, resulting in hearing loss and the perception of tinnitus [12,13].
- **Head or Neck Injuries:** Head or neck trauma can affect the inner ear, hearing nerves or brain function related to hearing. These injuries usually cause tinnitus in only one ear [12].
- **Ear Infection or Ear Blockage:** The ear canals can become blocked with a buildup of fluid, earwax, dirt, or other foreign objects. A blockage can change the pressure in the ear, causing tinnitus [12].
- **Medications:** Medications known to cause tinnitus include nonsteroidal anti-inflammatory drugs and certain antibiotics, cancer drugs, diuretics, antimalarial drugs, and antidepressants. Typically, higher doses of these medications are associated with exacerbated tinnitus symptoms. However, tinnitus often resolves upon discontinuation of these medications [12].
- **Ear Bone Changes:** Stiffening of the bones in the middle ear (otosclerosis) can impact hearing and lead to tinnitus. This condition is caused by abnormal bone growth and is hereditary. [14]

Less common causes of tinnitus may include but are not limited to muscle spasms in the inner ear, temporomandibular joint disorders, and various chronic conditions as described below [12]. Tension and spasms in the muscles of the inner ear can lead to tinnitus, accompanied by hearing loss and a sensation of fullness. This condition may also be associated with neurological diseases such as multiple sclerosis [12]. Tinnitus has been linked to a range of chronic conditions, including migraine, anemia, diabetes, thyroid disorders, and auto-immune diseases such as rheumatoid arthritis [9].

Determining the direct cause of TMD is complex due to the wide range of potential underlying issues, and often no specific cause can be identified. Known contributing factors include infections, auto-immune diseases, jaw injuries, various forms of arthritis, dental procedures, over-extension of the jaw, prolonged jaw opening, and medications that may exacerbate bruxism, increase jaw pain, or contribute to jaw damage [4]. Hormonal imbalances potentially affect pain perception and environmental stressors exacerbating symptoms [6]. The complexity of TMD's origins highlights the need for a multifaceted approach to diagnosis and management, integrating insights from genetic research, medical history, and lifestyle factors.

Diagnoses

The initial step in diagnosing tinnitus involves consulting a primary care physician. The physician will conduct a thorough examination to identify potential causes, such as earwax impaction or fluid from an infection that could be obstructing the ear canal. Additionally, the physician will review the medical history to determine if underlying conditions or medications which may be

contributing to the tinnitus [1].

Subsequently, a referral to an otolaryngologist who will conduct a comprehensive examination of the head, neck, and ears [12]. To further investigate potential underlying issues or structural abnormalities, the ENT may order imaging tests such as computed tomography (CT), magnetic resonance imaging (MRI), or ultrasound. Additionally, referral to an audiologist for further evaluation, such as an audiogram, may be recommended [15].

Screening for TMD has been effectively demonstrated by Gonzales et al., in an article titled "Development of a brief and effective temporomandibular disorder screening questionnaire" [16].

This was Accomplished by Acquiring 732 Participants and Evenly Distributing them into Four Groups

- Control group (healthy individuals who present no current factors of TMD)
- Non-painful TMJ disorder group (those that present a TMJ disorder but are unaffected by it)
- Diagnosed TMD participants
- Undiagnosed TMD participants (those who are undiagnosed however show factors for TMD pain) [16].

After the participants had been sorted, they used the investigations upon the validation project of which developed self-administered symptom instruments which contained 49 items that aided in assessing masticatory pain. These items were used on the temple, jaw, jaw joint or ear with multiple response options [16]. The items were used on a patient to determine where the pain resided within the facial area by having the patient respond "no" if there is no pain and "yes" if there is pain. After going through the items, they had decided to make a screening for TMD which consisted of multiple questions such as "within the last 30 days have you experienced pain or stiffness in the jaw when awakening?" [16]. The results from the study stated that the screening was 97% accurate overall [16].

TMD diagnosis is a thorough process that involves a comprehensive medical assessment. The initial step is to consult with a primary care physician or dentist. These professionals will conduct thorough examinations, including palpation of the jaw, neck, and evaluation of jaw movements, such as opening and closing the mouth. A series of questions regarding past or present traumatic experiences or medical histories related to facial or jaw injuries may also be asked [17]. Based on the specifics and severity of the case, the physician or dentist may recommend imaging studies, such as a panoramic radiograph, magnetic resonance imaging (MRI), or computed tomography (CT) scan. These imaging techniques offer various perspectives essential for an accurate diagnosis [17]. These assessments aid in identifying potential underlying comorbidities or risk factors contributing to TMD-related pain.

In 2011, an OPPERA prospective cohort study found that TMD to be widespread pain that manifested outside of the orofacial region having the presence of multiple comorbid disorders within many patients [18]. This research group discovered that the following conditions could coexist with TMD: Asthma, Back pain, Neck pain, Joint pain, Ankylosing spondylitis, Chronic fatigue, Endometriosis, Fibromyalgia, Headaches, Hypertension, Ehlers-Danlos syndrome, Irritable bowel syndrome, Heart disease, Interstitial cystitis, Osteoarthritis, Neural sensory conditions and Juvenile idiopathic arthritis [18].

Treatment

In most cases, tinnitus is the result of something that cannot be prevented. However, there are some precautions that can help prevent certain forms of tinnitus [12].

Strategies to Mitigate Tinnitus Include:

Limiting Exposure to Loud Sounds: Prolonged exposure to loud music without ear protection or listening to music at high volumes through headphones can contribute to hearing loss and tinnitus.

Use of Hearing Protection: Consistent exposure to loud sounds can damage the auditory nerves, leading to hearing loss and tinnitus [12].

Maintaining Cardiovascular Health: Adopting a healthy diet, engaging in regular exercise, and taking measures to ensure cardiovascular health can help with tinnitus associated with vascular disorders and obesity [12].

Limiting Alcohol, Caffeine and Nicotine: Excessive use of these substances can alter blood flow and contribute to the development and exacerbation of tinnitus [12].

Addressing Underlying Causes: When tinnitus is related to underlying conditions such as earwax impaction or TMD, treating the primary issues can alleviate or reduce symptoms. For many individuals, tinnitus may persist for months or even years.

Treatment Recommendations Include but not Limited to the Following:

Sound Therapy: Sound therapy is based partly on the view that tinnitus stems from changes in neural circuits in the brain due to hearing loss. Evidence suggests that exposure to external sounds may help reverse some of these neural changes and mitigate tinnitus. There are several types of devices that are used in sound therapy and they include one or more of the following:

Tabletop or Smartphone Sound Generators: These devices are typically used as an aid for relaxation or sleep. Positioned near the bed, they can be programmed or set via smartphone app to play calming sounds such as waves, waterfalls, or rain. For individuals with mild tinnitus, this may be sufficient to facilitate sleep [12].

Hearing Aids: A primary treatment option for individuals with both tinnitus and hearing loss, Hearing aids function by amplifying external sounds and enhancing environmental awareness while reducing the prominence of tinnitus [12].

Wearable Sound Generators: These small electronic devices fit in the ear and emit soft, pleasant sounds. They are portable and provide continuous relief from tinnitus throughout the day [12].

Combination Devices: These devices, similar to hearing aids, provide both sound amplification and sound generation in a single unit: fitting directly into the ear [12].

Behavioral Therapy: This type of therapy is counseling that can improve well-being by helping reduce the impact of tinnitus in everyday life [12]. Some options are listed below:

Education: This can reduce anxiety by helping recognize that the condition is unlikely to be linked to a serious medical condition. Through counseling, patients can learn strategies and coping techniques to prevent exacerbating their symptoms [12].

Cognitive Behavioral Therapy: CBT helps individuals identify distressing negative thoughts. Counselors can train patients to modify their responses to these thoughts, focusing on positive actions to reduce the impact of tinnitus on daily life and enhance overall well-being [12].

Tinnitus Retraining Therapy: TRT combines counseling and sound therapy to “retrain” the brain, both physiologically and emotionally, to ignore tinnitus. The counseling aspect helps reclassify tinnitus sounds as neutral, while continuous low-level sound from a device worn in the ear aids in habituation to the

tinnitus [12].

Medications: While there are no medications specifically designed to treat tinnitus, physicians may prescribe antidepressants or anti-anxiety medications to improve mood or help with sleep [12].

An article published by the JCDA titled “Advice for Dentists from Temporomandibular Disorder Patients: A Phenomenological Study” was conducted to help assess TMD patients’ needs from their dentists when communicating about their TMD [18]. The authors stated that TMD patients are lacking information on their diagnosis and are finding themselves consistently pushing to be provided with more information to cope with the diagnosis. They demonstrated this by using the perspective of six TMD participants and two researchers had given them a series of questions which contained general questions regarding their demographic and overall health. The results showed that the 6 participants had stated that there was not enough information regarding treatment and knowledge being communicated [18].

The majority of people with TMD have periodic or acute cases which could potentially improve on their own within weeks or months, however there is no current cure for TMD. With the aid of home therapy. Ways of easing the pain in the form of self-care can range from applying cold or heat towards the joint, eating soft foods and avoiding any strenuous jaw exercises such as singing or yelling [17].

Physicians and dentists alike recommend the most conservative treatments possible as they are not invasive to the tissue of the face, joint or jaw or involve surgery. Treatments that are reversible do not cause permanent changes in the structure or position of the teeth or jaw. When TMD issues become severe, proceeding with aggressive treatments will not always ensure improvement of the symptoms [17].

Primarily dentists have been treating TMD issues since 1936. However, in modern day, due to the discovery of the complexity of TMD, it is now able to be treated by a wider range of physicians and healthcare professionals [19]. To provide the best treatment possible, it is required to rule out all potential conditions that mimic TMD. Conditions like TMD are known to be various types of headaches, sinus infections, ear infections, decayed or abscessed teeth, facial neuralgia, Eagles’ syndrome, dystonia, Lyme disease, scleroderma, tumors, and connective tissue disorders [19].

There is currently no specific way to treat TMD as there are various causes within clinical dentistry. However, there are a variety of health care providers who focus on TMJ, called TMJ specialists, in which each specialist may provide a different treatment depending on their scientific and training background [19]. Rare cases that are often marked by chronic and severe pain that affects jaw dysfunction, comorbid conditions, and diminished quality of life, should seek out a team of doctors from fields such as neurology, rheumatology, pain management, and other specialties for diagnosis and treatment [19].

To prevent TMD, it is important to reduce muscle tension in your jaw. This can be done by managing your stress and anxiety by practicing relaxation methods and avoiding overexerting your body. Opting for softer foods and chewing on both sides of the mouth, while avoiding hard and chewy foods like popcorn, apples, carrots, will reduce the chances of TMD. Adding glucosamine sulfate and chondroitin sulfate supplements to your diet can sometimes help relieve pain. Another important prevention method

is stopping teeth grinding (oral parafunction or bruxism). By noticing when you are clenching your teeth, you can keep your teeth apart except when eating or swallowing. Simple techniques, such as lightly smacking your lips together (lips together and teeth apart exercises) and placing your tongue between your teeth or to the roof of mouth, can help prevent daytime teeth grinding. Maintaining proper posture to prevent the misalignment of your facial bones, shoulders and muscles, will also help in the management of TMD-related pain. Other notable preventative measures tailored avoiding habits such as constantly chewing gum, biting your nails or lips, or resting your chin on your hand, as these habits place unnecessary forces between teeth [20].

TMD can have a wide range of treatment options depending on potential risk factor or cause. Some treatment options may be better than others, for example people who have TMJ-related pain due to stress that causes them to clench or grind their teeth may be prescribed a night guard or relaxation strategies [21]. People with severe and chronic TMD may be prescribed the same thing but it may not work as well for them. In which case, they have the option to have surgery, which is considered the last resort after conservative therapy, to remove or shift the joints. Another option would be to collect synovial fluid from joint spaces via a small needle, for the identification of a disease process for the relief of painful or bothersome symptoms; a procedure called Arthrocentesis [22]. Other options can include injections with therapeutic Botulinum toxin (Botox), counseling, and physical or physio-therapy [20].

Relation between Tinnitus and TMD

A systematic review and meta-analysis of multiple studies in 2018 found that the presence of tinnitus was higher in people with TMD than in those without. A total of five reviews and three meta-analyses were conducted by PubMed/Medline, and in all the selected studies, prevalence of tinnitus was higher in patients with TMD (35.8% to 60.7%) than in patients without TMD (9.7 to 26.0%) [23]. The thought behind this was due to the proximity of the inner ear to the TMJ. The cochlea is located next to the temporomandibular joint, and inflammation or irritation in the joint may damage the cochlea and other parts of the inner ear causing subjective tinnitus [24,25].

A 2019 study conducted by Front. Neurosci. demonstrated that TMJ and tinnitus can occur together in people who were born female at birth, and who were younger than the average tinnitus patient. Tinnitus in that group tended to be severe and accompanied by pain, and high levels of stress and pressure. Some of the symptoms included dizziness, headaches, vertigo, neck pain, and poor quality of life [25].

When a case of tinnitus is connected to TMD, it is known as somatic tinnitus. It is a type of tinnitus caused by musculoskeletal issues. There is some research that suggests that the symptoms of both TMD and tinnitus may be reduced with certain exercises of the head and jaw, while some treatments specifically performed, such as medications and operations to resolve TMD may also help to lessen the symptoms of tinnitus [26]. There are at the minimum 75% of patients who are diagnosed with TMD who also exhibit a psychological abnormality [26].

Clinical Case Study

The following case study will demonstrate an appropriate way of triaging and managing TMD patients that suffer from tinnitus. A case report done by Elsaraj et al, involves a 64-year-old female

that had a consultation on April 15 of 2021 for TMD-related pain consultation [27]. The patient reported having tinnitus, neck, and shoulder pain as well as ear and jaw pain. The patient was diagnosed with TMD using the DC/TMD diagnostic criteria [27]. Upon completion of the examination, it was determined that the patient had restricted motion of range in their jaw while opened and while performing lateral movements. Cervical and facial palpitations had shown bilateral inflammation and pain. Through palpation it was revealed that the muscles were tender to the level of C7. The patient had mentioned wearing dentures for 15 years, and the current existing dentures located on the maxilla and partly lower mandible were found to be unstable and loose. A stomatognathic examination (TMJ exam, all muscles and bones revolving around the oral cavity) revealed that the only tooth present was tooth number 44 [27]. The patient had undergone standard tinnitus therapy, and the resulting case was a poor response. The patient had been examined by an ENT who determined that she had tinnitus and that it had a more prominent affect in her right ear rather than her left [26].

At the initial consultation appointment, an intraoral intramuscular injection was performed bilaterally, within the lateral pterygoid muscles [27]. The injection was completed by inserting the needle at a 45-degree angle into the second molar and through the soft tissue from the point of attachment to the maxillary tuberosity going into the pterygoid muscles. A syringe configured with a 30-gauge needle was used as well as a 1.7cc carpule that contained 3% scandonest plain and 3% hydrochloride to be injected on the site. The needle used had been injected 2 centimeters within the lateral pterygoid muscle. A negative aspiration had been performed and afterwards anesthetics were injected [27].

After the examinations the patient had reported that her tinnitus had subsided post-injection, however her TMD-related pain had remained after the injection. A new set of completed upper and lower dentures were made due to the pre-existing ones being ill suited and unreliable. The new set had a (VDO) increase of 62 consultation appointment. The patient had undergone 7 sessions with the physiotherapist providing treatment to the neck and shoulder pain [27].

The patient had received treatment in the form of intramuscular injection (IM) bilaterally within the Lateral pterygoid, as well as a new set of fabricated dentures that were made with a new vertical dimension of occlusion (VDO). Afterwards three follow up appointments had been made for: May 2021 (1-month), June 2021 (3-months), and on December 2022 (20-months) [27].

The Tinnitus Functional Index (TFI) scale is a validated questionnaire that contains 25 questions allowing the patient to score a range from 0-100, the patient had scored an 80% in having auditory difficulties caused by tinnitus prior to treatment, however after treatment the test was taken again, and the patient scored a 0% with no auditory difficulties [27]. The patient had taken the Tinnitus Handicap Inventory (THI) questionnaire and prior to treatment the patient had scored a 44, this is considered a moderate score (38-56 moderate level). This level of scoring indicated that the patient did not have any difficulties completing daily tasks. However, it is not uncommon to be interfered with sleep or any relaxing activities. After treatment the patient had performed the test again and scored a 0 out of 100 which meant the Tinnitus was no longer present [27].

Conclusions

The correlation between Tinnitus and TMD has been extensively studied, revealing a significant relationship between the two conditions. Tinnitus, resulting from exposure to loud noises causing cochlear damage, varies in severity and can be diagnosed through thorough examinations by medical professionals. Treatment options range from hearing aids to sound machines, with prevention measures including wearing proper ear protection in noisy environments. TMD is a disorder, characterized by jaw abnormalities or damage affecting the joint or the muscles of mastication or both, this condition can cause pain and difficulty in jaw movement and is often diagnosed through examinations by dentists or trained physicians and further evaluations by specialists. Treatment options vary from conservative management to surgical intervention, depending on the severity. It is important to exhaust all conservative treatment options before seeking surgical intervention. The comorbidity of TMD and Tinnitus, termed Somatic Tinnitus, often exacerbates symptoms, with cases showing that addressing one condition may alleviate symptoms of the other. A case study demonstrated complete relief from both Tinnitus and TMD symptoms following an IM injection and modification of vertical dimension through the fabrication of a new set of dentures. This study highlighted the complex interplay between the two conditions and the importance of tailored treatment approaches for optimal management.

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