



Otological Symptoms and Temporomandibular Disorders: Is it Possible?

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Abstract

Temporomandibular disorders are a group of conditions that involve the temporomandibular joint, mastication muscles, as well as the adjacent bone, nerve, and vascular structures. Likewise, other structures could be affected, such as the auditory system. The aim of this literature review is to evaluate the relationship between TMD, auditory system and otologic symptoms. The presence of otic symptoms related to TMD has been widely described, among which the following stand out: otalgia, tinnitus, ear fullness, vertigo, and subjective hearing loss. Several studies have studied the relationship between ear symptoms and TMD, however, the exact reason why this occurs has not yet been clarified; however, the multidisciplinary management of these patients is important, once the main cases of otological symptoms have been ruled out, where the otorhinolaryngologist could rely on oral surgeons, maxillofacial and maxillary orthopedists for the management of TMD that could improve the otological symptoms of these patients. Additional studies are necessary to establish treatment protocols.

Keywords: Temporomandibular Disorders; Otologic Symptoms; Temporomandibular Joint

Introduction

Temporomandibular disorders (TMDs) are a broad group of clinical problems that involve the temporomandibular joint (TMJ), mastication muscles, as well as the adjacent bone, nerve, and vascular structures. They are considered frequent disorders in the population, with a prevalence of around 5%; Although they occur in a wide age range, there is a peak of incidence between the second and fourth decade of life, being 4 to 6 times more common in females than in males. Symptoms of TMD may include pain in the muscles of mastication, decreased jaw range of motion, TMJ pain,

joint noises such as clicking, popping or crepitus during function, generalized myofascial pain, as well as mandibular deviation to the opening and/or closing [1,2].

However, otological symptoms (OS) associated with TMDs have also been described, in order of frequency they have been reported: otalgia, tinnitus, aural fullness, vertigo and subjective hearing impairment [3]. Although several studies have studied the relationship between OS in conjunction with TMD, attempts to verify the real origin of these ailments, together with an appropriate assessment of the organ of hearing, have been rare [4,5]. The aim of this

literature review is to evaluate the relationship between TMD and auditory system.

Theories of relationship between TMDs and otologic symptoms

Several authors have tried to find an explanation between otic symptoms and TMD. In 1934, Costen described the relationship between otologic symptoms and TMDs and attributed it to a misdisplacement of mandibular condyle, causing pressure on ear structures [6]. Since then, although the structural theories of Costen have been discarded, they have been the basis of numerous hypotheses that have attempted to explain the underlying reasons for reporting otologic signs in TMDs [7].

Otalgia in individuals with TMD without a pathological condition in hearing or in the nasopharynx can be explained as a referred pain from the masticatory muscles, TMJ and associated structures according Miller and Wyrwa [8]. On the other hand, due to the common cranial nerves between the ear and TMJ, ear difficulties like tinnitus, otalgia, and vertigo have been postulated to be connected to temporomandibular disorders [9]. Other theories presented in the literature include the similar embryonical origin of the middle ear and chewing muscles; the medial pterygoid muscle and the tensor tympani muscle develop from the temporal blastema. These structures along with the tensor veli palatini are innervated by V3 through the otic ganglion, which innervates the masticatory muscles coming from the mesoderm of the first branchial arch [10].

Another hypothesis was proposed linking temporomandibular disorders, Eustachian tube dysfunction and inner-ear dysfunction. Irritation in the TMJ region was hypothesised to result in the release of inflammatory mediators in the Eustachian tube via an axon reflex, which could further activate the anterior cervical sympathetic system. The latter would enhance neurogenic inflammation in the Eustachian tube, resulting in reduced middle-ear ventilation. The imbalance between middle-ear and inner-ear pressure could alter the polarisation state of cochlear hair cells, thereby causing sensorineural hearing loss [7].

Relationship between otologic symptoms and TMJ disorders

The association of otologic symptoms with TMDs has been controversial, because Costen's article in 1934 reported direct causal relationships between temporomandibular joint disorders and tin-

nitus/otalgia. The most prominent ear symptom in TMD patients with otologic complaints was found to be otalgia, followed by tinnitus, ear fullness, vertigo, and subjective hearing loss according to Pekkan., *et al* [11].

Porto de Toledo., *et al.* [12] carried out a systematic review to investigate the prevalence of otologic signs and symptoms in adult patients with TMD, including 8 articles. The results of this meta-analysis showed that the most frequent symptom associated with TMD in adult is ear fullness with 74.8% of cases, the second most frequent symptom is otalgia with 55.1%, followed by tinnitus with 52.1% and hearing loss with 38.9%. However, as this is a small sample, the results should be carefully considered.

In contrast, Maciejewska-Szaniec., *et al.* [5] evaluated the frequency and type of OS in 246 patients with TMD. On the basis of the audiological survey, they found otologic symptoms in more than one-third of the participants (36.18% or n = 89). In these patients after more specialized examination, objectively-found audiological abnormalities were confirmed in 46.07% (n = 41) Regarding the type of OS, in the group with alterations in the audiological evaluation, hearing loss and earache were the most common symptoms, with 73.17% and 43.90% respectively. While, in the group without alterations in the audiological evaluation, earache, ear fullness and tinnitus were the most common with 77.08%, 68.75% and 43.75% respectively.

Epidemiologic studies have demonstrated tinnitus to be a common symptom in the general population, but with a higher prevalence in patients with TMD symptoms. One study reported the incidence of tinnitus to be 10% to 31% of the general population and up to 85% in the population of patients with TMD symptoms [13]. Morais., *et al.* carried out a prospective and cross-sectional study seeking to characterize tinnitus in individuals with normal hearing and its relationship with TMD. They found that 70% of the individuals were women with an average age between 20 to 55 years [14].

In terms of characteristics, most individuals reported having a high pitch tinnitus, continuous and bilateral; concerning the acuphenometry, they noticed that the individuals classified their tinnitus as high and with a mean loudness value of 14.1 dB above their hearing thresholds. The mean THI score of the individuals was 25 points, classifying the tinnitus as mildly bothersome. There were

no statistically significant correlations between the TMD checklist and the other parameters analyzed. Thus, it was not possible to identify a type of tinnitus suggestive or characteristic of TMD [14].

Çebi AT [15] evaluated the incidence of tinnitus and hearing loss in individuals with TMD. The sample consisted of 33 patients with tinnitus, who underwent clinical and imaging evaluations of the TMJ for the diagnosis of TMDs. They found an incidence of tinnitus of 11.46% among patients diagnosed with TMDs. The occurrence of tinnitus was found to be significantly higher in patients with disc displacement with reduction than in patients with disc displacement without reduction, also tinnitus severity levels were higher in patients with disc displacement without reduction. Hearing loss was examined by pure tone audiometry tests in individuals with TMDs and tinnitus, and no statistically significant results were found in hearing loss in either the right or left ear.

Effat, *et al.* [7] conducted a prospective study in order to characterize hearing loss in patients with TMD. The 104 patients included had earache or headache associated with alterations in the masticatory system, while 110 healthy patients without TMD were included in the control group. All patients underwent pure tone audiometry and tympanometry. The prevalence of all otological symptoms, apart from a blocked ear sensation, was significantly higher in temporomandibular disorder patients than in control participants. In the study, pure tone audiometry revealed ipsilateral or bilateral hearing loss in 25% of patients with unilateral or bilateral temporomandibular disorder, respectively. Hearing loss was usually mild and most commonly sensorineural. Audiometric findings were significantly different from those of the control group.

Effects of TMD treatment in otologic symptoms

A wide range of treatment options have been described for the management of TMD, being classified as non-invasive, minimally invasive and invasive; which may vary according to the specific diagnosis and severity of the disorder, with the aim of reducing pain, improving function, preventing further damage to associated structures and improving the quality of life of patients. Some of the options described are education and self-care, occlusal or stabilization splints, pharmacotherapy, physical therapy and behavioral techniques [1].

Regarding otologic symptoms, screening TMD symptoms in patients with tinnitus and suggesting an appropriate treatment over

current clinical approaches might lead to a reduction in tinnitus perception [9]. Buegers, *et al.* [16] studied 25 patients with TMD and simultaneous tinnitus, who underwent 2 therapeutic measures according to their needs for 3 to 5 months: night occlusal splints and, according to the clinical characteristics of the patient, individualized physiotherapeutic treatments. Prevalence of tinnitus was found to be 8 times higher in participants with TMD than in participants without TMD. All the participants with unilateral TMD and unilateral tinnitus showed these conditions on the same side. Stomatognathic therapy improved tinnitus symptoms in 11 of 25 participants (44%).

However, Attanasio, *et al.* [17] conducted a study taking into account 55 patients with subjective chronic tinnitus with a 12-month evolution without hearing impairment. These patients were divided into 3 groups: without TMD, with predisposition to TMD and with TMD. Treatment consisted of therapy with neuromuscular occlusal splints for 6 months at night with a minimum of 8 hours and a maximum of 15 hours. The treatment was effective in all 3 groups, especially in the groups predisposed to TMD or with TMD, which provides indirect evidence that TMDs are related to the development of tinnitus, since the improvement in TMD reduces the severity of the otological symptom.

Miechels, *et al.* [18] conducted a systematic review to investigate whether TMD treatment can positively influence tinnitus complaints. In the studies consulted, they observed. In the studies consulted, they observed a general positive effect in the combined use of split therapy and exercise treatment with respect to the intensity and severity of tinnitus. However, due to the heterogeneity of the included studies, they concluded that despite finding a good effect of TMD treatment on tinnitus, studies with a high level of evidence should be carried out to verify these results.

Conclusion

The presence of otological symptoms is a frequent presentation in patients with TMD, although the reason why it occurs has not been fully clarified, it is important to take it into consideration when the otological, neurological, infectious or pharmacological origin has been ruled out. In this way, it is importing the multidisciplinary management of these patients, where the oral or maxillofacial surgeon and maxillary orthopedist are included within the ENT team, taking into account that the management of TMJ disorders could have a positive effect on the otological symptoms. How-

ever, it is necessary to carry out more studies to establish management algorithms in this type of patients.

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