Is there an association between tinnitus and temporomandibular disorders?

Original Article

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Abstract

The frequent coexistence of tinnitus and temporomandibular joint and masticatory muscles disorder (TMD) has led to the assumption that there is a relationship between both conditions. The aim of this study was to evaluate the tinnitus prevalence in patients with TMD and the effects of its treatment on tinnitus. A total of 57 patients followed in a Stomatology - TMD consultation in 2021 and the first half of 2022 were included. The presence of tinnitus was questioned and the Tinnitus Handicap Index (THI) questionnaire was applied. 72% had 1 or more episodes of tinnitus. 89.5% were female and there were 2 peaks of incidence in the age group between 18-30 (21.1%) and 41-50 years (24.6%). In 85.4% of patients, tinnitus was intermittent and 41.5% had a reduced degree. An association was found between the side of tinnitus and TMD ($p<0.001$). 67% improved tinnitus after TMD therapy ($p= 0.0135$).
Keywords: tinnitus; temporomandibular disorder; Tinnitus Handicap Index.

Introduction

Tinnitus is a sound that is perceived in the absence of an external acoustic stimulus,[1] and in the vast majority of patients with tinnitus, the sound is only heard by the patient and is thus classified as subjective tinnitus.[2] It is often described as the sound of, for example, crickets, wind, running water, vapor, or even a combination of sounds.[1] Tinnitus can be perceived in one or both ears or more centrally "in the head".[3] In the general population, the prevalence of tinnitus varies between 10% and 15% among adults,[4] and increases to around 18% among those aged over 60 years.[5]

In addition to the involvement of the hearing system,[6] the somatosensory system appears to contribute to tinnitus, which may result from the somatosensory-auditory interactions in the central nervous system.[7] The somatic involvement of the structures external to the

ear, for example the temporomandibular joint (TMJ) and masticatory muscles, can also contribute to tinnitus (somatic tinnitus).[7]

Several cranial nerves, including the trigeminal (V), facial (VII), glossopharyngeal (IX), and vagus (X) nerves contribute to ear innervation. The TMJ is also innervated by cranial nerves V and VII, with communicating branches such as the chorda tympani lying proximal to the ear structures. Because the inner ear and the TMJ share cranial nerves, it is thought that auditory phenomena such as tinnitus, otalgia, and vertigo are related to temporomandibular disorders (TMDs).[8] TMDs is a collective term used to describe disorders that involve the TMJ, masticatory muscles, and related structures.[9] All these disorders share a myriad of symptoms, including (A) auditory symptoms: hypoacusis, otalgia, tinnitus, and vertigo[10]; (B) pain: originating in the muscular or joint structures,[11] headaches at the level of the vertex, occipitally, and posterior to the auricular pavilions, and sensation of oropharyngeal burning at the level of the tongue and laterally up to the nasal pyramid[10]; (C) other symptoms such as xerostomia[10] and limited mouth opening.[12]

Tinnitus and TMDs are common complaints; however, the occurrence of one of them in patients who also have the other does not necessarily indicate a causal relationship. Tinnitus has been described more frequently in individuals with a TMD (36.6%) than in control groups (4.4%).[13] Patients with tinnitus also have a significantly higher incidence of TMDs (85%) than individuals without tinnitus (55%).[14]

Thus, the objective of the present study was to determine the prevalence of tinnitus in patients with a TMD and the potential effects of TMD treatment on the symptoms of tinnitus.

Materials and Methods

The clinical records of the patients followed at the Dentistry – Temporomandibular disorder clinic during 2021 and the first semester of 2022 were reviewed. One hundred patients were selected according to the following inclusion criteria: age 18 years and over with confirmed TMD and pain in the masticatory muscles, joint crepitus, and limited range of motion. All patients were contacted via telephone and 57 agreed to participate in the study. They were asked about the presence of tinnitus and those who had it were administered the Portuguese version of the Tinnitus Handicap Index (THI).[15, 16] The score obtained in this questionnaire indicates the degree of interference and impact of tinnitus on the patient's quality of life. This instrument is composed of 25 questions divided into the following domains: Functional – indicates the disturbance caused by tinnitus; Emotional – measures the emotional responses to tinnitus; and Catastrophic – quantifies the despair and incapacity caused by this symptom. Three response options are available: "yes" (four points), "sometimes" (two points), and "no" (zero points). The sum of the points is categorized into five groups or degrees of severity: no or slight (0–16), mild (18–36), moderate (38–56), severe (58–76), and catastrophic (78–100). [17]

Statistical analysis was performed using the EZR software, version 1.61. The non-parametric chi-square test was used to assess the association between two categorical variables when the Cochran criteria were applicable and Fisher's test was used when they were not. The level of significance (α) was set at 0.05.

Results

The distribution of the 57 patients according to age was as follows: 13 (23%) 18–30 years, 10 (18%) 31–40 years, 14 (25%) 41–50 years, nine (16%) 51–60 years, seven (12%) 61–70 years, three (5%) 71–80 years, and one (2%) over 80 years. The female/male ratio was 51:6.

Forty-one patients (72%) had or had had tinnitus: 35 patients (85%) had intermittent tinnitus and six patients (15%) had permanent tinnitus. Twenty-three patients (56%) reported an abrupt onset of the tinnitus, while 18 patients (44%) said it started gradually. Eighteen patients (44%) and 23 patients (56%) complained of bilateral and unilateral tinnitus, respectively; of the latter, 12 out of 23 (52%)

complained of tinnitus in the right ear and 11 out of 23 (48%) had it in the left ear.

Fisher's test was used to test the association between sex and presence of tinnitus in patients with TMD, and no association was found between these variables (p=0.6).

Fisher's test was also used to investigate the association between the side affected by tinnitus and side of TMD. Among a total of 41 patients with tinnitus, there was an association (p<0.001) between the side of TMD and that of tinnitus in 26 patients (63%).

In the Portuguese version of the THI questionnaire, 17 patients (41%) had a score corresponding to degree 1 tinnitus (zero to slight); seven (17%) patients had degree 2 tinnitus (mild); 12 (29%) patients had degree 3 tinnitus (moderate); two (5%) patients had degree 4 tinnitus (severe); and two (5%) patients had degree 5 tinnitus (catastrophic).

Tinnitus improved in 19 (63%) of the 30 patients who underwent treatment for TMD.

Fisher's test was used to investigate the association between the improvement in tinnitus after treatment of TMD and degree of tinnitus (the grades were divided into three groups - negligible, mild to moderate, and severe to catastrophic). There was an association between these variables (p= 0.0135). Of the patients whose tinnitus improved (20–67%), twelve (60%) had zero to slight tinnitus (grade 1), seven (35%) had mild to moderate tinnitus (grades 2 and 3), and one (5%) had severe to catastrophic tinnitus (grades 4 and 5). Of the patients who did not improve (10–33%), one (1%) had zero to slight tinnitus, six (60%) had mild to moderate tinnitus, and three (30%) had severe to catastrophic tinnitus.

Discussion

In most of the published studies on this topic, there was a predominance of women among patients with TMD; however, the female/male ratio was considerably higher in the present study compared to other studies (51:6).

The frequency of tinnitus was higher among patients with TMD than among individuals without TMD.[18] Moreover, the results of the present study showed that a higher percentage of patients with TMD complained of tinnitus (72%) and that there was an association between the side of TMD and side of tinnitus in 63% of the patients.

Physical examination of the TMJ and neck region may help to explain some of the phenomena described by patients with tinnitus.[18] In addition, the results of the present study suggest that in a significant number of patients, treatment of TMD has a beneficial effect on tinnitus. Moreover, explaining to the patients that there might be an association between these two conditions helps them to understand and learn to cope with their tinnitus.

According to a review conducted by Shaghayegh Omidvar et al. in 2019.[19], the characteristics of tinnitus in patients with TMD differed among studies. In a population with tinnitus and TMD (n=30), all patients with unilateral TMD and simultaneous unilateral tinnitus exhibited both symptoms on the same side (8/8), while patients with bilateral TMD complained of bilateral tinnitus (14/17) or unilateral tinnitus (3/17).[20] In another study, unilateral tinnitus (n=26) was more frequent than bilateral tinnitus (n=19) in patients with TMD and tinnitus (n = 45).[21] In contrast, the frequency of bilateral tinnitus (n = 83/200) in patients with TMD was higher than that of unilateral tinnitus (n = 37/200) in another study.[22] In the present study, the prevalence of unilateral (44%) and bilateral (53%) tinnitus was similar.

Moreover, 60% of the patients in whom the tinnitus improved after treatment of TMD had zero to slight tinnitus and 35% had mild to moderate tinnitus, whereas 60% of those who did not improve after TMD treatment had mild to moderate tinnitus and 30% had severe to catastrophic disease. Thus, it appears that when the tinnitus is severe with a substantial impact on the patient's life, it is more refractory to treatment. This may be explained by one of the following: the TMD itself is more severe or the pathophysiological mechanisms of the higher-degree tinnitus are not related to the

TMD, unlike lower-degree tinnitus. The main limitations of this study are as follows: absence of a control group, which did not allow the determination of the prevalence of tinnitus among individuals without TMD; absence of exclusion criteria such as existing hearing loss and history of exposure to occupational acoustic trauma; and the retrospective nature of the study, which did not allow application of the THI before and after TMD treatment.

Conclusion

In the present study, there was a high prevalence of tinnitus among patients with TMD, which supports the hypothesis of an association between TMD and some types of tinnitus. However, further better randomized studies with control groups are necessary to investigate the mechanisms shared by tinnitus and TMD.

Conflict of interest

The authors declare no conflict of interest regarding this article.

Data confidentiality

The authors declare that they followed the protocols in use at their working center regarding the publication of patients' data.

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Availability of scientific data

There are no publicly available datasets related to this study.

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