

Relationship between Otological Symptoms and TMD

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Abstract

Background: Patients with any type of temporomandibular disorder (TMD) may have several symptoms in their temporomandibular joints, masticatory muscles and associated structures, and may have otological symptoms such as tinnitus, ear fullness, ear pain, hearing loss, hyperacusis, and vertigo, which may be due to the anatomical proximity between the temporomandibular joint, muscles innervated by the trigeminal nerve, and ear structures. Objective: This study found a prevalence of ear complaints described in the medical records of patients (n = 485) at the Center for Diagnosis and Treatment of the Temporomandibular Joint and Dental-Facial Functional Alterations at Tuiuti University of Paraná (CDATM/UTP), with TMD evaluated by the Research Diagnostic Criteria/Temporomandibular Disorders (RDC/TMD).

Method: After approval by the ethics committee were examined 485 medical records of patients of the CDATM/UTP, of both sexes a period of 2 years. The data analyzed were gender, age and the presence of reported otologic symptoms. The data were organized and subjected to statistical analysis using SPSS (IBM Statistic 20.0).

Results: The results showed a higher number of female patients between 41 and 50 years old. There was a prevalence of otological symptoms (tinnitus, deafness, dizziness, imbalance, and ear fullness) in 87% of TMD cases, regardless of sex and age. Tinnitus was the symptom with the highest prevalence (42%), followed by the ear fullness (39%).

Conclusion: These data support the correlation between temporomandibular disorders and otological symptoms, even without being caused directly by the ear.

Keywords: temporomandibular joint, tinnitus, ear ache, temporomandibular joint disorders, facial pain, dentistry.

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Paper submitted to the ITJ-EM (Editorial Manager System) on June 07, 2017; and accepted on April 15, 2018.

INTRODUCTION

The temporomandibular joint (TMJ) is the joint between the temporal bone and jaw, with an articular disc separating the two structures¹. The TMJ is essential to the execution of jaw movements such as propulsion, laterality, the opening and closing of the mouth. These movements are fundamental to the execution of stomatognathic functions². Temporomandibular disorders include several problems associated with the muscles of mastication, the temporomandibular joint, and associated structures, and are considered a sub-classification of musculoskeletal disorders³. These structures act in the functions of chewing, swallowing, speech and breathing. Temporomandibular disorders are characterized by pain in the temporomandibular joint or around it, joint noises present in mandibular movements, and changes in mandibular kinematics, with the presence of deviations in mandibular opening and closing, as well as laterality and protrusion difficulties⁴.

Barreto et al. and Pita et al. in their literature reviews on TMDs and the relationship with auditory symptoms, concluded that there is a link between the stomatognathic system and the auditory system, which is also observed in the causes and consequences TMDs, from hearing disorders to muscular and functional alterations^{5,6}.

Studies have postulated that the pathophysiology of otological symptoms in TMD patients may be due to the anatomical proximity of the TMJ, muscles innervated by the trigeminal nerve, and ear structures⁷.

Moreover, the complaints of dizziness/vertigo, decreased auditory acuity, and tinnitus may be associated with central or labyrinthine problems, for example: Meniere's disease; vestibular function, visual, or psychological disorders; benign tumors; otosclerosis; presbycusis; and acoustic trauma or noise induced hearing loss. Such situations present audiological tests compatible with hearing loss and may be associated with other symptoms such as ear fullness, hyperacusis, nausea, vomiting, as well as attention and concentration disorders. For these patients, ENT and hearing tests are usually within normal ranges⁸.

Multifactorial diversity that can lead to the onset of TMDs makes it difficult to identify a single cause for the presence of ear complaints in such a population⁹.

Epidemiological findings have shown that the prevalence of ear symptoms in the general population may vary from 10% to 31%, but this increased to 85% in patients with TMD and that 50% of patients referred to otological complaints without presenting problems in the ear^{10,11}.

Based on these assumptions, this research found the prevalence of ear complaints described in the medical records of patients at the Center for Diagnosis and Treatment of the Temporomandibular Joint and Dental-Facial Functional Alterations at Tuiuti University of Paraná

(CDATM/UTP), determining which are the most frequent symptoms in this group of patients.

METHODOLOGY

After approval by the Ethics Committee (CEP-UTP N. 0002/2007), all clinical records routinely used for patients treated at CDATM/UTP for a two-year period were initially selected, for a total 573 records. For the final sample 88 records were excluded because they were not completely filled out, leaving 485 records in the final data collection.

These records contain patient information on identification, clinical, medical and dental history, physical and clinical examinations, examinations of the masticatory and posterior muscles of the head, functional tests of the temporomandibular joint, and occlusal examinations.

The data analyzed were gender (male and female), age (up to 20 years old, between 21 and 30, between 31 and 40, between 41 and 50, and 51 or older), and the presence of reported otological symptoms in question related by the patient to the dentist responsible for patient care. Related symptoms were: tinnitus, deafness, dizziness, ear fullness, and imbalance.

The data collected in this study were organized and subjected to statistical analysis using SPSS (IBM Statistic 20.0). Initially descriptive analyses were carried out (frequency of variables and central tendency and dispersion measures).

The correlation between age and the symptoms of tinnitus, deafness, dizziness, ear fullness, imbalance and the number of symptoms were dichotomized (up to 1 symptom present and more than one symptom present) and evaluated. Comparisons between age and the symptoms of tinnitus, hearing loss, dizziness, ear fullness, imbalance and the number of symptoms were dichotomized (up to 1 symptom present and more than one symptom present) and the Mann-Whitney test was performed. The significance level was 5%.

RESULTS AND DISCUSSION

The observed results demonstrate that the number of female patients is higher than male, with a ratio of 78.54% to 21.45%, respectively. Regarding the age groups, the highest prevalence of otological symptoms occurred in the 41-50 year-old group (37%) followed by the 51-60 year-old group (32%).

The findings indicated that the prevalence of otological symptoms (tinnitus, deafness, dizziness, ear fullness, and imbalance) is 87% regardless of sex and age.

When we study the presence of symptoms alone we observed that tinnitus had the highest prevalence, present in 42% of all records, followed by ear fullness 39%.

The difference in age distribution between the groups was statistically significant for reporting tinnitus,

ear fullness, and the number of otological symptoms dichotomized as shown in Table 1.

When these same symptoms relate to gender, there were significant relationships ($p < 0.05$) in symptoms of tinnitus and dizziness, as shown in Table 2.

Several theories attempt to explain the association between otological symptoms and TMD, but so far no one has provided a unique explanation. Wright describes Costen study theories speculating that TMD could cause damage to auriculotemporal nerves or lead to improper adjustment of intratympanic pressure by blocking the Eustachian tube, producing otological symptoms. Another theory was proposed in which hyperactivity of the masticatory muscles may induce a secondary reflex contraction of the tensor muscle of the soft palate causing inefficient function of the Eustachian tube, hence the otological symptoms. Since the middle and inner ear receive trigeminal nerve impulses and sympathetic nerves from the middle ear through the tympanic plexus, other authors speculate these entry points may be responsible for the association between TMD and otological symptoms. Dissections of TMJ and middle ear in cadavers produce speculation that there may be a structural basis for an association between TMD and otological symptoms. In 68% of the samples, it was observed that the sphenomandibular ligament has a connection to the jaw and palate through the petrotympanic fissure, and through the middle ear for

8%, attaching to the hammer. This theory has speculated that the abovementioned mechanisms may be the trigger point that cause otological symptoms. Although many theories have been postulated, no consensus was found for association between TMD and otological symptoms¹².

Patients with temporomandibular disorders may have several symptoms in temporomandibular joints, masticatory muscles and associated structures, and may have otological symptoms such as tinnitus, ear fullness, ear pain, hearing loss, vertigo, and hyperacusis^{7,13-16}. The occurrence of otological symptoms concurrently with TMD occurs frequently, as demonstrated in this study, even without local causes in the ear, such as infections or other diseases^{11,17}.

The relationship between these diseases is not yet fully established, and the type of TMD presented may not be related to the otological symptoms, however the presence of otological symptoms in patients with painful tenderness in the masticatory muscles is more common and may also cause pain or the aforementioned symptomology with varying auditory symptoms^{7,11,18}.

Among the otological symptoms, one of the most frequent is tinnitus, consistent with the data found in this work. It is known, however, that the causes of tinnitus are not limited to the ear and can be influenced by several factors, including muscle and joint factors. Such factors, in addition to being a cause, can also modulate tinnitus with jaw movements or pressure applied to the head

Table 1. Distribution of individuals per variables for tinnitus, deafness, dizziness, ear fullness, imbalance, number of symptoms dichotomized, and age (N = 485).

Variables	Frequency (%)	Mean (14)	Median	Minimum	Maximum	p*
Tinnitus						
Present	223 (46)	40.95	39	15	81	<0.001
Absent	262 (54)	35.39	34.5	13	68	
Deafness						
Present	85 (17.5)	41.92	39	23	72	0.001
Absent	400 (82.5)	37.1	35	13	81	
Dizziness						
Present	148 (30.5)	39.44	36	16	69	0.094
Absent	337 (69.5)	37.29	36	13	81	
Ear Fullness						
Present	186 (38.4)	37.59	36	15	78	0.74
Absent	299 (61.6)	38.16	36	13	81	
Imbalance						
Present	72 (14.8)	40.54	38.55	20	69	0.056
Absent	413 (85.2)	37.49	36	13	81	
Number of Symptoms						
Up to 1 symptom	280 (57.7)	36.26	34.5	13	81	0.001
> 1 symptom	205 (42.3)	42.1	37	15	78	

*Mann-Whitney

Table 2. Distribution of otological symptoms in accordance with gender (n = 485).

	Tinnitus		Deafness		Dizziness		Fullness		Imbalance	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Female	191	194	72	313	128	257	154	231	59	326
Male	32	68	13	87	20	80	32	68	13	87
$p \leq 0.05$	0.0016		0.1815		0.0104		0.1427		0.5602	

and neck, and treatment can contribute to a reduction or complete remission of symptoms. As causes for tinnitus may be associated in one person, the diagnosis becomes difficult, requiring a comprehensive and interdisciplinary evaluation of the individual to perform the correct diagnosis¹⁵.

To determine the association between otological symptoms and TMD, many authors conducted research involving this pathology, focusing on the joint, muscle, or both, with the results varying according to the methodology applied. Variations for the presence of tinnitus concomitantly with TMD was from 20% to 76%; otalgia from 10.8% to 88%; ear fullness from 20% to 90%; vertigo and/or dizziness from 10% to 63%; hypoacusis from 8% to 64%; and finally hyperacusis from 26% to 80%. In this study, the prevalence of otological symptoms was 87% and tinnitus was observed in 42% of cases. Despite the wide variation in results, there is no evidence of a relationship between otological symptoms and TMD; however, there is need for further research to confirm the specific cause-effect between them^{2,5,7,15,19-24}.

Perceiving the presence of otological symptoms associated with TMD, other studies were performed to verify the possibility of reducing symptoms by performing conservative therapy for TMD using occlusal splints, physical therapy, drugs, and other adopted therapies^{12,21,24,25}. Sobhy et al. found that tinnitus showed a significant reduction after treatment²⁵. Improvement in cochlear function was also shown after conservative therapy for TMD. Tullberg and Ernberg found that, immediately after treatment, 73% of patients reported improvement in tinnitus, especially in patients with oscillating tinnitus, and that this characteristic may be associated with a better prognosis²⁴. Webster et al. have obtained positive results in the reduction of tinnitus with conservative treatment for TMD, explaining that this may be due to the fact that the average age of the sample was lower, having patients with minimal exposure to noise and chronic diseases, as well as the presence of only a few individuals with audiometric alterations²⁶. Nevertheless, TMD should be considered as a likely isolated or concomitant etiology for tinnitus symptoms. Buegers et al. concluded that the significant increase of tinnitus in patients with TMD maintains that there is a relationship between these two symptoms, and that the incidence of concomitant unilateral tinnitus with TMD on the same side reinforces the evidence of this association²⁷. Improvement in tinnitus (44%) after therapies with stabilizing plates, condylar distraction, and/or physiotherapy, is further evidence of this interaction, but it cannot be said if these symptoms are coexisting, independent, or casually connected from the results of this research.

For some patients, Wright indicated treatment with psychologists, psychiatrists, or rheumatologists, besides the aforementioned conservative procedures¹². The author found that there was a significant correlation between tinnitus, ear pain and dizziness at the age where

younger patients were more benefited from the adopted therapy. For tinnitus and ear pain, a significant correlation was found when it was related to the beginning or a worsening of otological symptoms were concomitant with the onset or worsening of TMD, even when they were stress-related. Uemoto et al. and Nichthausser et al. found that the use of muscle-relaxant plates or flat and smooth occlusal appliances were effective in promoting the remission of TMD signs and symptoms and otological symptoms reported together with TMD^{9,28}. Another type of therapy adopted was orofacial myofunctional therapy (OMT) applied by Felício et al. where it was found that the group of TMD patients who received treatment with OMT presented decreased sensitivity upon palpation and articulation, as well as a decrease in TMD and otological symptoms, proving that this therapy acted positively on the orofacial and otological symptoms presented by patients¹⁰.

Some studies have found that although there are otological symptoms present, some audiological tests performed showed up within the normal range, making it not possible to relate TMD and audiological symptoms with the results of these tests^{7,19,22}. In contrast, for Pekkan et al. analysis revealed a significant increase in trend peaks in audiometric tests (audiogram, tympanogram, and function of the Eustachian tube) in the TMD group, and also the presence of negative pressure as a result of the tympanogram in some patients²³. This can be interpreted as occurring due to the contraction of the tensor tympani muscle, showing that the audiologic parameters are different in patients with and without TMD. The authors concluded that there is an association between TMD and auditory function, but this relationship can only be proven if, after treatment for TMD, the otological symptoms also show improvement. In the work of Riga et al. conventional tympanometry showed no significant difference between ears²⁹. The resonance frequency obtained after the multiple frequency tympanometry (MFT) test, which shows a measure of acoustic impedance, was greater on the ipsilateral side for TMD in 85% of patients when compared to the contralateral side of the same patient, showing up even more sharply in patients over 45 years of age. Thus, TMD is an example where subtle changes in middle ear biomechanics can be detected by MFT, unlike the results obtained from conventional tympanometry, as done in other studies that used only the latter test to analyze acoustic impedance. Therefore, in patients with TMD, the significant increase in the resonance frequency values on the ipsilateral side to the TMD provides the first precise evidence of an increase in middle ear system rigidity, offering new information to the pathophysiology of otological symptoms in TMD patients.

CONCLUSION

The presence of otological symptoms in patients with TMD is very common, even without local causes in the ears. The commonly reported symptoms are tinnitus,

ear pain, ear fullness, dizziness/ vertigo, and hypo- or hyperacusis.

The results support a correlation between TMD and the reported symptoms, showing a high prevalence of otological symptoms in TMD patients.

It is not possible to specify in what kind of TMD these symptoms are most prevalent.

Further studies are needed using research with appropriate and standardized methodologies, which can draw more objective methods to be carried out for differential diagnosis for ear symptoms from audio logical test results and those from temporomandibular conditions.

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