Is There a Relationship Between Otological Symptoms and Temporomandibular Joint Disorders? A Retrospective Study

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Abstract

Introduction: Otological symptoms are often associated with temporomandibular joint disorders (TMD). The exact correlation between these two phenomena is being controversially discussed in the literature for many years. This retrospective study aims to investigate the possible association of otological symptoms with specific TMD findings, as well as stress and chronic pain.

Method: We analyzed the anonymized medical records of 56 patients. This included the assessment of the clinical functional status and Manual Structural Analysis (MSA) in accordance to the German Society for Functional Diagnostics and Therapy (DGFDT) and the Graded Chronic Pain Status (GCPS).

Results: From all 56 patients with TMD 32 had otological symptoms.

The most common TMD symptoms in patients with aural complaints were pain by palpation of the m. masseter (81,82- 83,33%) and m. digastrics venter posterior (81,82% – 100%). Articular sounds were a prevalent finding especially in tinnitus patients (63,64%). An insufficient posterior static occlusion was present in 27,27% – 50% of the cases. Approximately half of the patients with aural complaints mentioned, that they feel stressed. Most of the patients suffered from a functional chronic pain (56,25%). A dysfunctional chronic pain was prevalent in 18,75% of the cases.

Conclusion: The results indicate, that TMD patients with aural complaints have most often pain in the areas of m. digastricus venter posterior and m. masseter, so there might be an association of ear symptoms with a pathology of these muscles. However, no causal relationship could be proven. Arthropathology, malocclusion, psychological condition and stress levels are other factors, that seem to have influence. The etiology is multifactorial and remains unclear.

Keywords: TMD, otological symptoms, tinnitus, otalgia,

Running head: Otological symptoms and TMD

Introduction

The prevalence of otological symptoms among the general population vary in different epidemiological studies between 10 and 31% [1]. However, 50% of the patients with aural complaints do not show any ear pathology [2, 3, 4]. Otological symptoms without an ear pathology were often associated with temporomandibular joint disorders (TMD) [1, 5].

The American Association of Orofacial Pain (AAOP) defines the temporomandibular joint disorders (TMD) as “a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint and associated structures, or both” [6]. Leading symptom is orofacial pain, in particular – pain in the masticatory muscles and in the region of the TMJ, limited mobility of the mandibula, deviation, articular sounds (clicking in the jaw) and also headache, neck, shoulder and ear pain [7, 8]. It is a common disease in the population, but because of the lack of a standard definition and a measurement method for TMD symptoms, the epidemiological data varies in the different studies between 6 – 93%. Approximately 3 – 7% of the individuals look for treatment, mentioning chronic pain as the main reason [9, 10].

Therefore TMD could be considered in some cases as a “chronic pain condition” [11, 12, 13, 14]. Chronic pain is defined as a pain, that persists for more than 3 – 6 months [14]. It is often resistant to treatment and does not correlate with the nociceptor input from the peripheral neural system due to a central sensitization [13, 15]. This means, that like other chronic pain conditions, it is “generated, exacerbated, and/or maintained by central nervous system mechanisms” [13].

TMD symptoms occur mostly in the group of young adults between 20 and 40 years of age, with a predominance of the female gender in the age of 18 to 35 years. In general females are at least twice as much predicted for TMD as males [16, 17]. Vickers et al. found out, that another group between 45 and 60 years of age also show usually TMD symptoms [7].

The etiology of TMD is complex and still not completely scientifically assumed [10]. Most authors agree about a multifactorial cause, which includes biological, biomechanical, neuromuscular, social, psychological and cognitive aspects, such as parafunctions (bruxism) and a muscular hyperactivity, stress, increased levels of estrogen. The role of occlusion is controversially discussed and many authors cannot prove a clear relationship with TMD [9, 17, 18, 19].

Among the TMD patients there is a high percentage (up to 87%), who show aural complaints, so the correlation between these two phenomena has been a subject of scientific research for years [1, 20, 21, 22, 23]. There are several theories trying to explain this relationship, however, the exact etiology has not been clearly identified yet [22, 24, 25, 26, 27]. The association of aural symptoms and TMD and is often known as the „Costen’s syndrome“, named after the one of the earliest supporters of this theory – the American otorhinolaryngologist James Costen. In 1934 Costen published 11 cases of patients, who had both otological symptoms and problems of the temporomandibular joint. He described a complex of pathologic complaints including hearing loss, dizziness, tinnitus and pre-auricular and sinus pain, which is also projected in the areas of the face, head and neck. Later he added the symptoms of glossopyrosis (burning tongue) and lockjaw to this complex of complaints, known as the Costen’s syndrome. According to Costen, the occlusal abnormalities in the posterior area of the jaw, such as the loss of molars (and premolars) results in a dorso-

cranial displacement of the condylus mandibulae. Because of the anatomical proximity to the temporomandibular joint and the structures of the ear, this displacement of the condyle causes a pressure on the n. auriculotemporalis, which is often felt from patients as an ear pain. The dorso-cranial displacement of the condyle could also produce pressure to the Eustachian tube, resulting in otological symptoms like tinnitus and hearing loss [28].

Later research results and newer findings regarding the anatomy and physiology of the ear and the TMJ questioned Costen’s theory [24, 29]. According to Eschler (1967) only the abnormality of the occlusion and the dorso-cranial displacement of the condyle cannot be responsible for the symptoms described by Costen, because there are patients with missing molars, who do not show compression of the TMJ or TMD symptoms, as well as patients with no occlusal pathology (and no dorso-cranial displacement of the condyle), but suffering from Costen’s syndrome complaints. He considered as a reason for the preauricular pain far more the mandibular motor incoordination, as a result of a hyperactivity of the masticatory muscles due to disordered innervation [29].

Because of the common embryological origin of the masticatory muscles (m. masseter, m. temporalis, m. pterygoideus lateralis and medialis) and the tensor muscles of the soft palate and the middle ear (m. tensor tympani, m. tensor veli palatini) from the first pharyngeal arch (the Meckel cartilage) and their innervation from n. trigeminus, the hyperactivity of the masticatory muscles can cause a secondary reflex contraction of the m. tensor veli palatini, which results in an abnormal function of the Eustachian tube and of the m. tensor tympani – causing tinnitus [30, 31, 32]. A similar correlation is seen from some authors through the n. facialis, innervating the muscles of the second pharyngeal arch, in particular the mimic muscles – the venter posterior of m. digastricus, involved in the movements (retrusion) of the lower jaw, and m. stapedius [33, 34]. Other authors see the reasons for the prevalence of otological symptoms in TMD patients in another anatomical fact. Pinto proved in his study on anatomic preparations of the TMJ region in 1962, that the discomalleolar and the anterior malleolar ligament (a continuation of lig. sphenomandibulare) going through the fissure petrotympanica connect the temporomandibular joint, corpus mandible and the middle ear. Because of

GCPS-Fragebogen

Name: _____ Vorname: _____ Datum: _____

Hauptschmerzen: _____

Bitte beantworten Sie die folgenden sieben Fragen Ihre Hauptschmerzen betreffend!

Frage 1:
An ungefähr wie vielen Tagen konnten Sie in den letzten 6 Monaten aufgrund Ihrer Schmerzen Ihren normalen Beschäftigungen (Beruf, Schule/Studium, Hausarbeit) nicht nachgehen?
_____ Tage

In den folgenden Fragen 2 bis 4 geht es um die Stärke Ihrer Schmerzen. Sie können Ihre Schmerzen jeweils auf einer Skala von 0 bis 10 bewerten: Der Wert 0 bedeutet, dass Sie keine Schmerzen nicht schlimmer sein können. Mit den dazwischenliegenden Werten können Sie Abstufungen vornehmen.

Frage 2:
Wie würden Sie Ihre Schmerzen, wie sie in diesem Augenblick sind, einstufen?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Schmerzen										stärkster vorstellbarer Schmerz

Frage 3:
Wenn Sie an die Tage denken, an denen Sie in den letzten 6 Monaten Schmerzen hatten, wie würden Sie Ihre stärksten Schmerzen einstufen?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Schmerzen										stärkster vorstellbarer Schmerz

Frage 4:
Wenn Sie an die Tage denken, an denen Sie in den letzten 6 Monaten Schmerzen hatten, wie würden Sie die durchschnittliche Stärke Ihrer Schmerzen einstufen?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Schmerzen										stärkster vorstellbarer Schmerz

Bei den folgenden Fragen 5 bis 7 geht es um die Beeinträchtigung Ihrer Aktivitäten durch Schmerzen. Sie können Ihre Beeinträchtigung jeweils auf einer Skala von 0 bis 10 bewerten: Der Wert 0 bedeutet, dass Sie keine Beeinträchtigung haben. Der Wert 10 bedeutet, dass Sie aufstehende waren/sind, irgendeine zu tun. Mit den dazwischenliegenden Werten können Sie Abstufungen vornehmen.

Frage 5:
Inwieweit haben Sie Ihre Schmerzen in den letzten 6 Monaten bei Ihren alltäglichen Beschäftigungen beeinträchtigt?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Beeinträchtigung										ich war außerstande, irgendeine zu tun

Frage 6:
Inwieweit haben Ihre Schmerzen in den letzten 6 Monaten Ihre Fähigkeit beeinträchtigt, an Familien- und Freizeitaktivitäten teilzunehmen?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Beeinträchtigung										ich war außerstande, irgendeine zu tun

Frage 7:
Inwieweit haben Ihre Schmerzen in den letzten 6 Monaten Ihre Fähigkeit beeinträchtigt, Ihre Arbeit/Hausarbeit zu verrichten?

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
keine Beeinträchtigung										ich war außerstande, irgendeine zu tun

Vielen Dank!

Auswertung GCPS

1. Ermittlung der Beeinträchtigungspunkte (BP)

Frage 1: Anzahl der Tage: _____ (a) = _____ BP

Frage 5 + 6 + 7: Subjektive Beeinträchtigung
() + () + () = _____ / 3 x 10 = _____ Punkte (b) = _____ BP

0-6 Tage = 0 BP
7-14 Tage = 1 BP
15-30 Tage = 2 BP
über 30 Tage = 3 BP

0-29 = 0 BP
30-49 = 1 BP
50-69 = 2 BP
> 69 = 3 BP

Gesamtbeträchtigung: _____ (a + b) = _____ BP

2. Ermittlung der charakteristischen Schmerzintensität

Frage 2 + 3 + 4: () + () + () = _____ / 3 x 10 = _____ Schmerzintensität

Stadieneinteilung	Definition	Klinische Interpretation
Geringe Beeinträchtigung: • Grad I: Geringe Schmerzintensität • Grad II: Hohe Schmerzintensität	< 3 BP und < 50 Schmerzintensität und >= 50 Schmerzintensität	Funktionaler chronischer Schmerz
Starke Beeinträchtigung: • Grad III: Mäßige Einschränkung • Grad IV: Hochgradige Einschränkung	3-4 BP 5-6 BP unabhängig von Schmerzintensität	Dysfunktionaler chronischer Schmerz (Eine psychologische Schmerztherapie ist notwendig!)

Fig. 2: German version of the GCPS – questionnaire and evaluation form.

Source: Türp J. C., Nilges P.: Diagnostik von Patienten mit orofazialen Schmerzen – Die deutsche Version des „Graded Chronic Pain Status“ in: Quintessenz (2000) 51, S. 721-27.

The clinical functional status and the MSA include anamnesis, muscle and joint palpation, measurement of the mandibula mobility, occlusion check and the examination of the TMJ under compression and traction.

The GCPS is a visual analog scale, that aims to find out whether the patient is suffering from a chronic pain and to investigate the level of disability due to this certain pain and its intensity (fig. 3). According to the approved GCP questionnaire the pain is classified as follows: Grade 0 – no pain; Grade 1 – low disability-low intensity; Grade 2 – low disability-high intensity; Grade 3 – high disability-moderately limiting; Grade 4 – high disability severely limiting [37]. The GCPS-results were analyzed in accordance to the two clinical interpretations: functional chronic pain (Grade I and II) and dysfunctional chronic pain (Grade III and IV) [38, 39].

Results

Out of 56 patients who met the inclusion criteria 32 of them had aural complaints. The patients were between 14 and 83 years of age. 75% of the patients were women, 25% were men, which means a ratio female to male of 3:1.

TMD patients with aural symptoms

57,14% of the patients with TMD showed otological symptoms. The most common aural complaint was tinnitus with 68,75% (n = 22), followed by otalgia -37,50% (n = 12) and vertigo (12,50%; n = 4). Dizziness was in all of the cases a co-symptom to either otalgia (50%) or tinnitus (50%), so it was not analyzed as a different group. One patient had both otalgia and tinnitus.

According to the anamnesis, more than the half of the patients (56,25%), who show both ear and TMD problems, mentioned, that they feel stressed, while 12 of the patients (37,50%) were already in a psychiatric treatment. 43,75% (n = 14) had been diagnosed with cervical spine syndrome and 4 (12,50%) with arthroses of other joints.

The evaluation of the GCPS showed, that 25% had no chronic pain, 56,25% of the patients were suffering from functional chronic pain, while the dysfunctional chronic pain was diagnosed in 18,75%.

Table 1: Prevalence of TMD symptoms in patients with tinnitus (n = 20)

TMD findings in the subgroups – tinnitus and otalgia

The results of the two subgroups of patients with aural problems (tinnitus and otalgia) is being presented in tables 1 and 2. They show, that 81,82% of the patients with tinnitus and all of the patients with otalgia (100%) have palpation pain in r. postmandibularis. M. masseter was tender on pressure in 81,82% and 83,33% respectively for tinnitus and otalgia. The prevalence of articular sounds of the TMJ is higher in the tinnitus group -63,64% vs 33,33% in the otalgia group, while the painful lateral palpation of the TMJ – region correlated more with otalgia (66,67%) than tinnitus (36,36%). The nonocclusion in the posterior region appeared to be more prevalent in the otalgia group with 50%, while in the tinnitus group 27,27% of the cases showed this finding. According to the manual structural analysis the dorso-cranial compression of the condyle to the fossa articularis was painful for approximately one third of the patients: 27,27% in the tinnitus group and 33,33% in the otalgia group. The abrasion of the teeth was similarly high in both groups with 63,44% and 66,67% – respectively for

patients with tinnitus and otalgia, as well as the stress factor – 45,45% and 50%.

TMD findings in patients without aural problems (control group)

24 of the whole group of 56 TMD patients included in the study had no otological symptoms and were used as a control group. The anamnesis showed, that 6 (25%) of the patients suffered from a chronic spine syndrome and 2 (8,33%) had arthroses of other joints. Table 3 presents the prevalence of TMD symptoms for the control group. The predominant TMD findings were: in 58,33% of the cases-pain by palpation in m. masseter, in 41,67%-pain in r. postmandibularis, abrasion, articular sounds and deviation. The dorsal palpation of the TMJ was painful for 33,33% of the patients. M. temporals was tender on pressure in 16,67% of the cases. Same prevalence had the malocclusion in the posterior area, as well as the pain by palpation of the lateral region to the TMJ. 58,33% of the patients felt stressed.

The CPGS analysis showed that 25% had no chronic pain, 50% had a functional chronic pain and 25% had a dysfunctional chronic pain.

Table 2: Prevalence of TMD symptoms in patients with otalgia (n = 12) **Table 3:** Prevalence of TMD symptoms in patients without otological complaints-control group (n = 24)

Discussion

The high prevalence of otological symptoms among the TMD patients, shown in the literature, and their improvement after a functional TMD-Therapie [40, 41, 42, 43, 44], as well as the anatomical proximity and the common embryological origin of the lower jaw, the masticatory muscles and the ear, support the theory about the possible correlation between these two phenomena.

The results of this study indicate also an association of otological symptoms and temporomandibular disorders. However, the limited number of our patients and the retrospective pattern of the study does not allow us to draw decisive conclusions about the causal relationship between TMD and otological symptoms.

Another limitation of the study is, that the ENT-screening was conducted by a different specialist or clinic and not according to specific parameters or methods. Also the examination of the TMJ region was carried out by two different dentists, so it is possible that the amount of pressure, applied by the palpation of the muscles and the TMJ-Region, is not identical. Another variable factor is the individual pain threshold of every patient.

Positive side of the method is the profound clinical examination of the patients, according to a standardized and scientifically proven protocols of the DGFDT, which allows a systematic differentiation of the specific pathological TMD findings. It evaluates many clinical parameters and important anamnestic aspects. Also the role of chronic pain as a factor could be taken to account with the scientifically validated german version of the GCPS [39].

Discussion of the results

The results of the study show a high prevalence of otological symptoms among TMD-patients- 57,14% and as a most common aural symptom- tinnitus with 68,75%, followed by otalgia with 37,50%. This corresponds with the finding in other researches [1, 22, 27, 45]. Some authors represented an even higher rates for otologous symptoms. Tuz et al. reported, that 77,5% of the TMD patients, hat "at least 1 otology complaint" [26]. Kusdra et al. showed in their review in 2018 a prevalence of aural symptoms in 87% of the patients with TMD, tinnitus (42%) and ear fullness (39%) were the most common complaints [22]. In the study of Porto del Toledo et al. (2017) ear fullness (74,8%)

was also the most common complain, followed by otalgia (55, 1%), tinnitus (52,1%) and vertigo (40,8%). In our study the prevalence of vertigo with 12,5% is much lower [27]. Comparing the different subtypes of TMD symptoms, myopathology, in particular tenderness in the area of m. masseter (81,82% – 83,33%) and r. postmandibularis – m. digastricus venter posterior (81,82% – 100%), was the most common TMD finding in the patients with tinnitus and otalgia respectively. This explains also the fact, that there was for both groups a high prevalence of teeth abrasion (63,64% – 66,67%), as a result of bruxism, which represents a hyperactivity of the masticatory muscles and is a sign for TMD [7, 8]. Joint clicking as a TMD symptom was more associated with tinnitus than with otalgia. On the contrary the tenderness by palpation in the lateral region of the TMJ was more prevalent in the otalgia group. This could be explained by the anatomic proximity of the ear and the TMJ and parts of the m. masseter, so the tenderness in this area can often be felt by patients as an ear pain.

Although the data of other studies about the association of otalgia, tinnitus and vertigo with specific TMD symptoms varies, a high rates of muscular disorder has been described also by most of the authors [5, 25, 46, 47]. In 2006 Seedorf found out that 49% of the patients with otalgia and TMD have a palpation pain in m. masseter. Joint disorder alone was diagnosed only in 18% of the cases and in 29% had both myo- and arthropathology [25]. According to Bernhardt, 2004, the tinnitus patients have significantly more myofacial pain and pain in the TMJ [5]. A malocclusion in the posterior region were present only in 37, 50% of the cases with otological complaints. So the results of this study could not support the Costen's theory. The role of occlusion as a factor for TMD is controversially discussed for years, but the most recent literature claims that a causal relationship could not be verified [9, 17, 18, 19]. As supposed by many authors stress and depressive psychical condition seems to be an important factor highly associated with both TMD and aural complaints [48, 49, 50, 51, 52]. This corresponds with the results of this study- approximately half of the patients mentioned, that they feel stressed. 12 of the all TMD patients (21,43%) were already in a psychiatric treatment and had both TMD and aural symptoms.

The evaluation of the Graded Chronic Pain Status showed, that in most of the cases the patients were

suffering from a functional chronic pain. However, a dysfunctional chronic pain was prevalent in 18,75% of the patients with both otological and TMD symptoms and in 25% of the cases with only TMD symptoms. These results are important, because in such cases the TMD-therapy alone will not lead to the expected improvement and a psychologic pain treatment is necessary due to central sensitization [14, 38].

The comparison of the group of the TMD patients with otological problems with the control group-TMD patients without aural complaints, shows, that the symptoms of tenderness in the m. masseter and r. postmandibularis and articular sounds were more prevalent in the groups with otological signs, than for the patients, who had only TMD. The stress factor (45,45%, 50,00% and 58,33%) were similarly relevant for all groups – tinnitus, otalgia and controls-respectively. The pathologic dynamic occlusion was more prevalent for the patients with aural complaints (45% – 50%), vs 8% for the control group. The static malocclusion in the posterior region was also a more often finding for the groups with otological symptoms – 27,27% – 50% vs 16,67%. All TMD parameters and also the relevant anamnestic aspects (chronic spine syndrome and arthroses) were more prevalent in the presence of additional aural symptoms than TMD alone.

Conclusion

The study results correspond with the findings described in the literature concerning otological signs and TMD.

It shows, that aural symptoms without an ear pathology are highly associated with positive TMD findings – most commonly with pain by palpation of the m. masseter and m. digastrics venter posterior. Articular noises were a prevalent symptom, especially for patients suffering from tinnitus. The role of static malocclusion in the area of the molars as a etiological factor, as described by Costen, could not be clearly verified. Emotional stress and pathologic psychiatric condition seem to be relevant co-factors. On the other hand, these positive TMD symptoms were also present in the control group, but not every patient with TMD reported aural problems. This indicates, that the etiology of the otological symptoms in the TMD patients is complex and still unclear. The expression of the aural symptoms can be influenced by many individual factors.

In the ENT practice, when no otological pathology could be found in patients with aural symptoms, an interdisciplinary consultation with a dentist and/ or psychologist would be a reasonable step.

Obtaining a detailed anamnesis, referring to psychological condition and stress level, could help the otolaryngologist to identify a possible relationship of the otological complaints and the mental state of the patient. The palpation of the masticatory muscles, especially the postmandibular region and the masseter muscle, as well as the inspection of the lateral TMJ region for noises are easy diagnostic parameters, which can be conducted by the otolaryngologist himself and can show in which cases a positive association with TMD is more likely.

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