

Association between temporomandibular disorders and pain in other regions of the body

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SUMMARY The pain from temporomandibular disorder (TMD) is often associated with physical symptoms of other chronic pain disorders and comorbidities, such as generalised muscle and joint pain. However, this association is not widely studied. To evaluate the prevalence of comorbid pain in joints, specifically in the knees, hips, ankles, shoulders, wrists and elbows, in individuals with and without TMD. We evaluated 337 patients from a public hospital in the city of Rio de Janeiro, Brazil. The Research Diagnostic Criteria for TMD questionnaire were used for the diagnosis of TMD. To assess the presence of other joint pain, the patients were asked to answer questions considering: the presence of pain in the knee, hip, ankle, shoulder, wrist and elbow joints and time duration of pain. Individuals with TMD are 5.5 times more likely to present with other joint pain

compared with those without the disorder. TMD muscle disorders were most associated with a higher number of pain at the other locations. There was a significant association between the presence of pain at the other locations, muscle ($P < 0.001$) and joint disorders ($P = <0.001$), as well as age advance, in TMD participants, showed to be a covariate factor for pain at the other locations. Individuals with TMD showed a high prevalence of pain in other joints of the body when compared with individuals without the disorder, and knee pain was the most prevalent pain complaint.

KEYWORDS: temporomandibular joint disorders, facial pain, arthralgia, myalgia, central nervous system sensitisation, comorbidity

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Introduction

Temporomandibular disorders (TMD) are characterised by painful and/or dysfunctional changes involving the masticatory muscles and temporomandibular joints (TMJ) (1), and collectively, they are considered the most common cause of chronic pain in the oro-facial region. According to the National Institute of Dental and Craniofacial Research (NIDCR), 5–12% of the US population suffer or have suffered from problems related to TMD (2).

The pain from temporomandibular disorder (TMD) is often associated with physical symptoms of other chronic pain disorders and comorbidities, such as generalised muscle and joint pain (3). In the past, the diagnosis of individuals with multiple pain complaints was underestimated and the presence of diffuse pain conditions was attributed to psychological or unreal factors (4). Currently, it is believed that multiple and persistent pain complaints can be associated with changes in the peripheral and central nervous system (5). Genetic factors, such as polymorphisms in *COMT*

– catechol-O-methyltransferase – and *ADRB2* – beta-2 adrenoceptor genes, may be responsible for hypersensitivity to experimental pain in at least 50% of the cases studied. These same factors may make individuals more susceptible to developing chronic pain throughout life (6). However, other predisposing systemic conditions involving genetic aspects, not directly related to central neurotransmission of pain, may be present and should be considered.

It should be noted, though, that individuals are not equally susceptible to joint disorders and different genetic variants can increase predisposition to particular development (7). Joint pathologies may be related to systemic manifestation of autoimmune diseases (8), hormonal changes (9) or tissue metabolism (10). The presence of such conditions might justify the development of painful and/or degenerative changes in different joints and simultaneously (9).

There is a genetic and clinical basis for the comorbid development of TMD and the presence of others arthralgia. Our hypothesis is that the association between both diseases is not random. Therefore, the aim of this study was to evaluate the prevalence of comorbid pain in joints, specifically in the knees, hips, ankles, shoulders, wrists and elbows, in individuals with and without TMD.

Materials and method

This is a descriptive case–control study, approved on 3 December 2013 by the Research Ethics Committee of the Jamil Haddad National Institute of Traumatology and Orthopedics (INTO), under protocol number 477.594. Free and informed consent was obtained from participants in writing prior to conducting the research. The recommendations from Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) were followed for the study's design and development (11).

We selected randomly three hundred and thirty-seven individuals, who were companions of patients seeking hospital care in INTO, with ages between 21 and 65 years and no history of macro-trauma in the TMJ region and/or knee, hip, ankle, shoulder, wrist and elbow joints. The recruitment period was 2 years by a single blinded examiner. The exclusion criteria were as follows: diagnosis of rheumatoid arthritis, systemic erythematosus lupus, fibromyalgia, other systemic joint diseases and/or previous treatment for TMD.

The study methodology was divided into two stages:

Step 1 – Clinical diagnosis of TMD:

All participants were examined clinically by the same evaluator, using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) – Axis I (12), the tool validated for the physical diagnosis of TMD, and that allows classification of participants into some of the following diagnostic subgroups: (i) no TMD; (ii) painful muscle disorders; (iii) joint disc position changes; and (iv) painful and/or degenerative TMJ conditions (Table 1). This process occurs in a manner that is not mutually exclusive, allowing each participant to belong to more than one diagnosis subgroup. The RDC/TMD was administered in all patients by a single trained examiner (author L.L.B.).

It is noteworthy that the joint diagnoses (subgroups 2 and 3) were grouped to form a single group called 'joint disorders'. Thus, three groups were formed: (i) control (absence of TMD diagnosis); (ii) muscle disorders; and (iii) joint disorders.

Step 2 – Evaluation of the presence and duration of other arthralgias:

During this stage, each participant answered an orally presented questionnaire, considering the presence of pain in the knee, hip, ankle, shoulder, wrist and elbow joints. The questions referred involving each of the joints were as follows: (i) Do you have joint pain? (ii) What is the frequency of pain episodes? (iii) How long have you had the pain (which may vary in days, months or years) and (iv) What is the affected side? The questionnaire was administered exclusively by a second examiner (author V.Q.), who had no prior knowledge of the presence or absence of TMD in the participants assessed.

Table 1. Diagnostic criteria of the RDC/TMD

Diagnostic subgroups	Description
No TMD	Individuals who did not have TMD
Subgroup 1	Painful muscle disorders
Subgroup 2	Temporomandibular joint disc displacement
Subgroup 3	Painful and/or degenerative TMJ conditions

Data processing and statistical analysis were performed using STATA 12.0.* The sample size included the spontaneous demand of patients and companions at the National Institute of Traumatology and Orthopedics, over 2 years, respecting the inclusion criteria. This calculation was designed to detect a risk factor that reached 40% of the sample, with alpha of 5% and 90% power. To verify normal distribution of the numerical variables, the Shapiro–Wilk test was used, followed by analysis of variance with the Student's *t*-test and Mann–Whitney test, for normal and non-normal distributions, respectively. Differences in the frequency between groups were analysed using the chi-square test. Values of $P < 0.05$ were considered statistically significant, and the risks associated with comorbid presence of joint pain were calculated by the odds ratio (OR), with a 95% confidence interval (CI).

Results

A total of 337 individuals, 231 women (68.5%) and 106 men (31.5%), participated in the study, of which 165 (48.9%) were diagnosed with TMD (mean age of 40.3 ± 16.3 years) and 172 (51.1%) were controls (without TMD) (mean age of 38.2 ± 14.4 years).

Among the individuals diagnosed with TMD, 90.9% ($n = 150$) (124 women and 26 men) presented pain at other locations, while just 64.5% ($n = 111$) of participants (67 women and 44 men) in the control group presented pain at other locations. The group of individuals with TMD, but who did not had pain at other locations, consisted of eight women and seven men. The totally asymptomatic group was composed by 32 women and 29 men.

The chi-square test showed a highly significant relationship between TMD and other joint pain ($P = <0.0001$). Patients with TMD were 5.5 times more likely to present pain at other locations than the controls (Table 2).

Considering the number of painful joints, we observed that in the TMD group the mean for painful joints was 3.1 ± 1.8 other than the TMJ, while the mean was 2.0 ± 1.4 in the control group. The Pearson correlation test showed a tendency ($r = 0.28$; $P > 0.05$) that the number of individuals increased in

Table 2. Assessment of the association between the presence of TMD and pain other joints

Parameters	Total ($n = 337$)	Without other arthralgias ($n = 76$)	With other arthralgias ($n = 261$)
TMD			
Absent	172 (51.1%)	61 (18.1%)	111 (32.9%)
Present	165 (48.9%)	15 (4.5%)	150 (44.5%)

P -value = <0.0001 ; Odds ratio = 5.49; 95% CI = 2.96–10.17.

the TMD group as the number of affected painful joints increased, contrary to what occurred in the control group (Fig. 1).

As for the age factor, the age group with the highest prevalence of pain in other joints other than the TMJ in the control group was 21 and 30 years ($n = 42$; 37.8%). In the group with TMD diagnosis, individuals between 51 and 60 years of age were those who reported more sites of painful joints (Fig. 2).

The assessment of patients with TMD according to the diagnostic subgroup showed that 52 (31.5%) patients presented painful muscle disorders, 25 (15.1%) joint disorders, whereas 88 (53.3%) presented dual diagnoses. Of these, respectively, 48, 22 and 80 individuals reported pain in other joints. Regarding the average number of joints affected in each group, the values were 3.03 ± 1.89 (muscle disorders), 2.48 ± 1.66 (joint disorders) and 2.33 ± 1.42 (multiple diagnoses), respectively.

The ANOVA test was used to evaluate the significance of the association between the presence of pain in other joints other than the TMJ and previous diagnoses of muscular or articular TMD. We observed a significant association between the presence of muscle disorders and the presence of pain in other joints ($P < 0.001$) as well as between the presence of pain at the other locations and diagnosis of articular TMD ($P < 0.001$). We found no statistical differences between the muscle and joint groups ($P = 0.24$).

As for the duration of pain in other joints other than the TMJ, a mean of 4.8 ± 1.01 years was found in the group with muscle disorders, 3.01 ± 0.7 years in the group with joint disorders, 3.7 ± 1.02 years in the group with multiple diagnoses and 2.01 ± 1.3 years in the control group.

Table 3 shows the most frequent joints affected by pain in the volunteers assessed. It is noteworthy that knee pain was the most prevalent in all groups.

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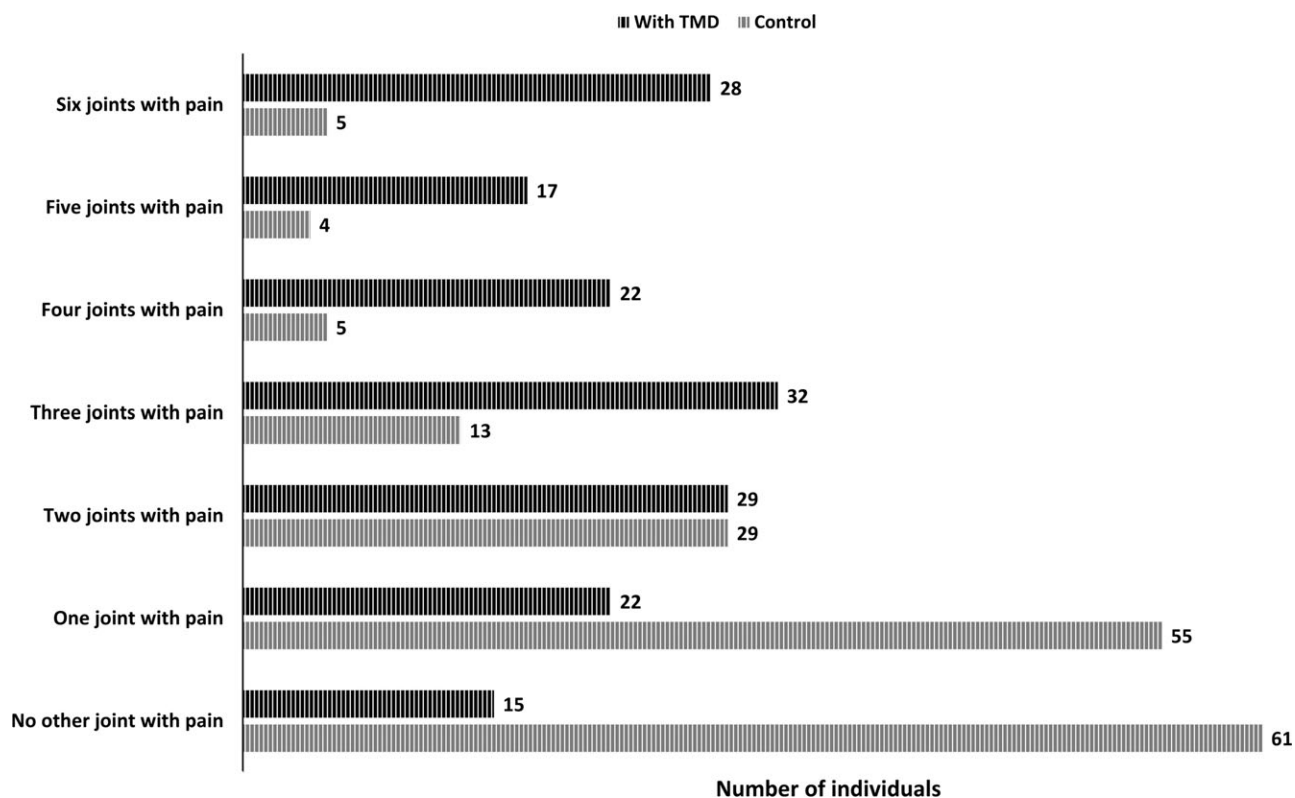


Fig. 1. Number of other painful joints besides temporomandibular joints.

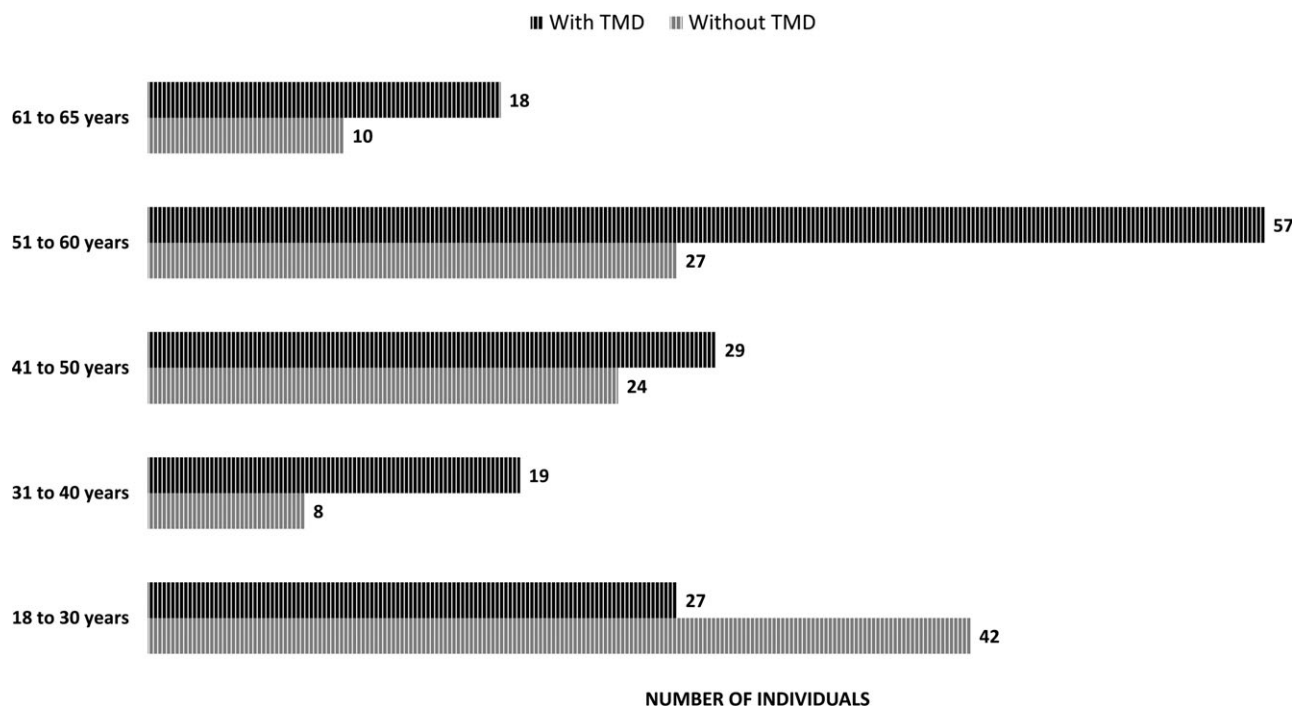


Fig. 2. Prevalence of reported joint pain according to age.

Table 3. Prevalence of pain in different joints other than the TMJ according to the RDC/TMD diagnostic groups

SITE	Without TMD (<i>n</i> = 111)	With muscle diagnoses (<i>n</i> = 48)	TMJ diagnoses (<i>n</i> = 22)	Multiple diagnoses (<i>n</i> = 80)
Knee	71 (63.9%)	30 (62.5%)	14 (63.6%)	64 (80%)
Hip	12 (10.8%)	6 (12.5%)	3 (13.6%)	12 (15%)
Ankle	6 (5.40%)	3 (6.2%)	1 (4.5%)	3 (3.75%)
Shoulder	13 (11.7%)	3 (6.2%)	2 (9%)	5 (6.2%)
Wrist	9 (8.1%)	3 (6.2%)	0 (0%)	1 (1.25%)
Elbow	3 (2.7%)	0 (0%)	1 (4.5%)	0 (0%)

Through ANOVA test, considering the three main groups (control, muscular TMD and articular TMD) and the gender and age factors, age progression proved to be a positively associated with the presence of other joint pains in all groups with high statistical significance ($P < 0.001$). Similarly, once having TMD, regardless if it is muscular or articular, individuals show greater risk to have pain in other joints in the body ($P < 0.001$).

Discussion

Although in most cases, the symptoms of TMD are simple and transient, about 10% of patients develop severe changes associated with the presence of chronic pain (13), which may involve, in addition to the oro-facial region, other areas of the body causing neck pain, back pain, besides temporomandibular joint pain (14). The realisation that chronic pain is 'a disease in itself' explains the analysis of how other painful conditions relate to the distribution of TMD symptoms (15). Therefore, the aim of this study was to evaluate the prevalence of comorbid pain in joints, in individuals with and without TMD. The results showed that individuals with TMD are 5.5 times more likely to present other joint pain than individuals without TMD.

Temporomandibular disorder, as well as other chronic pain syndromes, is painful states that are capable of sensitising the central nervous system, causing hyperalgesia and diffuse allodynia (4, 6). Additionally, characteristics such as gender (women), genetic susceptibility, personal or family history of chronic pain and history of other centrally mediated symptoms (such as insomnia, fatigue, memory and mood disorders) are more frequent in individuals with chronic

pain. The presence of these characteristics has a predictive value in identifying individuals with a higher probability of transition from acute to chronic pain (6).

A prospective longitudinal study followed a cohort of 2737 adults for three years, with ages from 18 to 44 years with no history of TMD in an attempt to determine the risk factors for the development of TMD. Approximately 20% of the volunteers, mostly women, developed symptoms related to this disorder. After analysing the individual medical history, it was found that the incidence of TMD was strongly associated with the presence of other body pain, especially lower back and genital pain as well as other non-specific conditions such as depression and sleep apnoea (15).

Similarly, in another study assessing the comorbid prevalence of TMD and other pain complaints, of the 189 977 adults assessed, 83% of individuals diagnosed with TMD reported feeling other body pains, and 62.4% reported pain and/or stiffness in other joints, predominantly women (16). In our study, we observed that the comorbid presence of pain at the other locations was present in 90.9% of patients with TMD, of which 82.5% were women. It is noteworthy that despite the control group also showing a high prevalence of painful joints (64.5%), the number of individuals in the TMD group increased as the number of painful joints affected by TMJ increased, contrary to what occurred in the control group.

The presence of generalised pain showed to be associated with the concomitant presence of local masticatory muscle pain (17), as well as the increase in intensity, duration and related disability (13). In the present study, individuals with muscular diagnosis, as well as those with dual diagnoses, presented more pain in other joints of the body and reports of longer pain duration than those diagnosed with exclusive articular diagnosis, corroborating the hypothesis of the strong influence of central sensitisation phenomena in subjects with muscular TMD (3) on the development of other chronic pain such as those present in other body joints. It is believed that this diagnosis is more prevalent in women between 20 and 40 years, corroborating the present study, where the age group with the highest prevalence of pain in other joints other than the TMJ in the control group was 21 and 30 years ($n = 42$; 37.8%).

The high prevalence of knee pain in the groups studied, both with muscular (57.6%) and articular

(56%) diagnosis, was also the subject of a previous study. The role of central sensitisation in the development and perpetuation of pain was assessed in patients with knee osteoarthritis. Through algometry pressure, the pain thresholds were much lower than those present in controls without the disease (18).

However, it should be noted that this study has limitations. As this is a cross-sectional design, it was not possible to assess which of the pain at the other locations presented by the participants had a primary source, making it impossible to determine the cause and effect relationship. The participants were self-selected, at least to some degree, as the individuals sought treatment at the hospital where the study was being conducted. In addition, the participants were predominantly women and mean age of 50.3 ± 11.3 years, which does not represent the usual age group seeking treatment for TMD.

Thus, the importance of multidisciplinary approaches in patients with multiple painful complaints is evident. However, further studies need to investigate the mechanism underlying this pattern of comorbidity. Recognising these mechanisms may facilitate the development of more comprehensive treatment protocols, identification of patients at risk and preservation protocols.

Conclusion

Individuals with TMD showed a high prevalence of pain in other joints of the body when compared to individuals without the disorder, and knee pain was the most prevalent pain complaint.

Ethical approval

This study was conducted according to the recommendations of the National Institute of Traumatology and Orthopedic Research Ethics Committee (registration number 477.594).

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Competing interests

The authors have stated explicitly that there are no conflict of interests in connection with this article.

Patient consent

All participants included in this study provided informed consent.

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