Comorbidity between fibromyalgia and temporomandibular disorders: a systematic review

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Objective. Fibromyalgia (FM) is characterized by bodywide diffuse and chronic musculoskeletal pain, which, in some patients, can include pain in the masticatory muscles and temporomandibular joints; those patients are defined as having temporomandibular disorders (TMDs). The purpose of this systematic review is to study the association between FM and TMD, as well as the prevalence and characteristics of TMD in patients with FM or the features and prevalence of FM in patients with TMD.

Study Design. Our bibliographic search was conducted from January 1, 2005, to May 31, 2018, in the MEDLINE database by using its free search engine PubMed and the keywords "fibromyalgia," "temporomandibular joint disorder," and "orofacial pain."

Results. Of the 185 studies found in this search, only 19 met the inclusion criteria. These studies showed a high prevalence of TMD in patients with FM. Muscle pain, temporomandibular joint pain, and muscle tenderness on palpation are the most common symptoms. These results suggest an association between TMD and FM; FM can be an etiologic or aggravating factor for TMD, or it may represent a general vulnerability to pain disorders. Besides, the 2 pathologies may share some regional or central mechanisms in common.

Conclusions. The high prevalence of TMD in patients with FM emphasizes the need to consider the signs and symptoms of TMD in the diagnosis of FM to improve pain management in these patients. (Oral Surg Oral Med Oral Pathol Oral Radiol 2019;128:33−42)

Fibromyalgia (FM) is a chronic syndrome characterized by bodywide musculoskeletal pain, asthenia, anxiety, and sleep impairment. FM is predominantly diagnosed in women after age 40 years. Its diagnosis is confirmed after 3 months of widespread pain and tenderness in 11 of 18 musculoskeletal locations. Other symptoms, such as chronic headache, stress, morning stiffness, fatigue, and mood disorders, are often found in patients with FM.[1,2] These signs and symptoms are also frequently diagnosed as part of temporomandibular disorders (TMDs).

TMDs comprise several of pathologic conditions characterized by pain and tenderness in the temporomandibular joints (TMJs) and/or in the masticatory muscles and may reach the preauricular area.[3] These conditions also include functional movement limitations of the mandible, clicking sounds, or grinding and clenching. It occurs in young adults age 20 to 40 years, mostly in women.[4-7]

FM and TMDs have some clinical characteristics in common, for instance, the chronic evolution, the incompletely understood pathophysiology, the serious physical and psychological impacts, and the common predisposing factors.

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It has been demonstrated that TMDs are more prevalent in patients with FM compared with controls in the range of 33% to 97%.[1] The relationship between the 2 diseases is the topic of a growing number of meticulous studies.[1,8-12] These studies showed greater involvement of the stomatognathic system in FM syndrome (FMS) and the myogenic disorders of the masticatory system are the most common symptoms found in patients with FM. In addition, FM appears to have characteristics that are predisposing and triggering factors for TMDs. Generators in different muscles can be involved in TMDs and neck−face pain in association with FM. Those studies also demonstrated that a greater number of patients with FM have TMDs compared with patients with TMDs not diagnosed with FM. The authors suggested that FM can lead to TMD symptoms and that an association may exist between the 2 pathologies.

The aim of this review was to study the association between FM and TMDs as well as the prevalence and features of TMD in patients with FM and the prevalence of FM in patients with TMD.

MATERIALS AND METHODS

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and

Statement of Clinical Relevance

A high prevalence of temporomandibular disorders in patients with fibromyalgia suggests comorbidities and the need to consider the signs and symptoms of temporomandibular disorders in the diagnosis of fibromyalgia to improve pain management in these patients.

Meta-Analyses guidelines.[13] Taking into consideration the nature of the present study, no approval by an institutional review board was necessary.

Search strategy and focused question

The aim of this review was to study the prevalence and the characteristics of TMD in patients with FM and the features and prevalence of fibromyalgia in patients with TMD and to better understand the association between FM and TMDs.

An electronic and manual literature search was conducted in the MEDLINE/PubMed database for articles in English and French addressing the focused question and published between January 1, 2005, and May 31, 2018, by using the following combinations of Mesh terms: ("fibromyalgia" [Mesh]) AND "temporomandibular joint disorder" [Mesh]; and ("fibromyalgia" [Mesh]) AND "orofacial pain" [Mesh]. The search was performed on November 6, 2018.

Eligibility criteria

The inclusion criteria for this review were articles published only in English or French languages in the period between January 1, 2005, and May 31, 2018; systematics reviews; meta-analyses; case-controls studies; cohort studies; comparative studies; clinical trials; cross-sectional studies; descriptive studies; experimental studies; case reports; series; and human studies only. All those that investigated the prevalence and characteristics of TMDs in patients with FM and the association between the 2 pathologies were included in the study.

The following exclusion criteria were applied: articles published in a language other than English or French, narrative literature reviews, articles published outside the specified period, inaccessible articles, animal studies, and articles that did not study the association between FM and TMDs or the prevalence and characteristics of TMD in patients with FM or features and prevalence of FM in patients with TMD.

Data collection and analysis

The relevant studies selected on the basis of the eligibility criteria mentioned above were analyzed independently by 2 reviewers (I.A., R.C.). The two reviewers assessed the titles and abstracts of the articles if the abstracts were well structured and had the necessary information, if the data given in the abstract were insufficient for definite inclusion or exclusion; however, the reviewers read the full article carefully before making the final decision. Any disagreement between the reviewers regarding the inclusion or exclusion of an article was resolved through discussion until a consensus was reached. A checklist was used to collect the relevant data from each article and to assess the quality of the study to make the overall appraisal (i.e., include or exclude the article). The checklist included the following items:

1. Identification of the article (title, author, journal, year of publication, language, etc.)
2. Objective of the study
3. Study design
4. Characteristics of the studied population (patients and controls)
5. Features of FM and TMDs
6. Results found
7. Authors' conclusions
8. Evidence level
9. Grade of recommendation

Level of evidence and grade of recommendation

The included studies were evaluated according to the recommended grading of the French National Health Authority (2010).[14]

RESULTS

Results of the database search

The database search in Medline using the 2 predefined combinations of Medical Subject Headings terms identified 185 articles. After removal of duplicates, 156 articles were selected. During the screening stage, 4 articles were excluded on the basis of the exclusion criterion related to language. After critical reading of the remaining articles, 133 articles were excluded because they did not meet the eligibility criteria. Finally, 19 articles were included in this systematic review and processed for data extraction. Figure 1 summarizes the described outcomes.

These 19 studies included 1 systematic review, 1 retrospective study, 4 comparative studies, 4 cohort studies, 4 case control studies, and 5 cross-sectional studies.

Main results from the 19 analyzed articles are summarized in Tables I through V, which include the following items: authors, year, study design, study objective, population, main outcomes, and conclusions.

Level of evidence and grade of recommendation

According to the recommended grading of the French National Health Authority (2010),[14] only 1 study[10] had a high level of evidence and grade of recommendation (level 1 evidence and grade A recommendation); 8 studies[1,3,8,15-19] had a moderate level of evidence and grade of recommendation (level 2 evidence and grade B recommendation); and 10 studies[9,11,12,20-26] had low level of evidence and grade of recommendation (level 3 evidence,[9,12,20,21] level 4 evidence,[11,22-26] and grade C

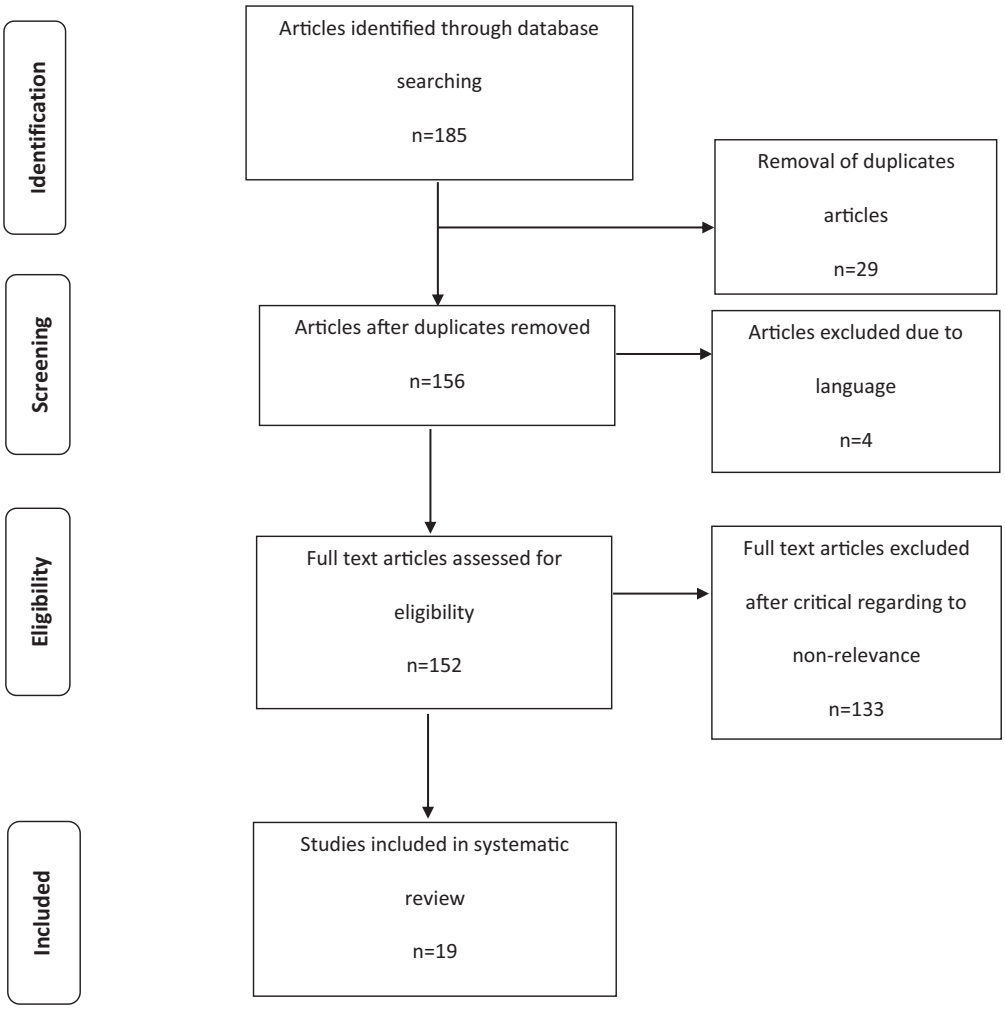

Fig. 1. Search method, identification, selection, and inclusion of articles.

recommendation). Thus, 52.63% of the 19 studies had low level of evidence and low grade of recommendation.

The levels of evidence and grades of recommendation of the included studies in this systematic review are summarized in Table VI.

DISCUSSION

Almost all of the included studies in the present systematic review investigated the prevalence of TMDs among patients with FM. TMD diagnoses in those studies included myogenous TMDs, arthralgia, osteoarthritis, and osteoarthrosis of the TMJs. These studies confirmed the high prevalence of the signs and symptoms of TMDs in patients with FM as well as significant orofacial involvement in FMS. Indeed, this prevalence was around 77.5% and 80% in the studies conducted by Pimentel et al. and Leblebici et al., respectively.[3,12] Moreover, some of these studies showed a higher prevalence of TMDs in patients with FM compared with patients with other diseases that could be associated with TMDs (migraine, trigeminal neuralgia, etc.). For instance, Balasubramaniam et al.,[15] in their cohort study, found that TMDs were significantly greater in patients with FM compared with those with spine syndrome that was surgically treated. This could be explained by the fact that FM is characterized by a polyalgic syndrome affecting various parts of the body and is not limited to a well-defined region. In addition, some studies investigated the prevalence of FM in patients with TMDs. For example, Leblebici et al.,[3] in their comparative study, found that the prevalence of FM in the TMD group was 52% and was significantly higher than that in those with TMD of arthrogenous origin with masticatory myofascial pain. Velly et al.[19] also studied the prevalence of FM in a sample of 572 patients with TMDs and found that 11% of TMD patients were positive for a coexisting FM diagnosis based on the American College of Rheumatology criteria.[2]

The results of the 4 case-control studies included in this review (see Table V) showed that patients with

Table I. Systematic review and retrospective study

Author, year	*Study design*	*Study objective*	*Materials and methods*	*Authors' conclusions*
Gui et al., 2014[10]	Systematic review	Present a review of literature about the relation between FM and signs and symptoms of TMD.	Bibliographic search: Medline, PubMed, Lilacs, and Scielo. Selected articles follow a cross sectional study design.	FM presents a set of conditions, such as chronic and diffuse musculoskeletal pain, depression, sleep disorders, stress, and central sensitization, which constitute predisposing and triggering factors for TMDs, explaining the high prevalence of TMD signs and symptoms in patients with FM.
Losert-Bruggner et al., 2017[11]	Retrospective study	Establish possible relationships between FMS and CMD/CCD.	555 patients with CCD and CMD were investigated with the respect to the diagnostic criteria of FMS, otolaryngologic, and dental examinations and instrumental functional analysis for the diagnosis of CMD/CCD.	Symptoms of TMD in patients with FMS: clenching or grinding, pathologic lateral deviation, limitation of interincisal−measured mouth opening, bradykinesia, and dyskinesia of jaw movement. FMS is a factor of great importance for the onset of CMD and CCD. CMD/CCD could also be responsible for various clinical aspects of FMS.

CCD, craniocervical dysfunction; *CMD,* craniomandibular dysfunction; *FM,* fibromyalgia; *FMS,* fibromyalgia syndrome; *TMDs,* temporomandibular disorders.

FM had a higher prevalence of signs and symptoms of TMDs compared with healthy controls. The following symptoms were significantly greater in patients with FM compared with healthy controls: pain in the orofacial area, tenderness on palpation of the TMJs and masticatory muscles, muscle pain during opening and closing movements, limited mouth opening, complaints of fatigue in the orofacial region, complaints regarding mastication, and higher trigger point counts and scores.

Masticatory muscles and TMJ pain, in addition to muscle tenderness on palpation, were the most common symptoms of TMDs among patients with FM in the included studies. The most painful palpation reported was at the masseter[17,22,25] and the temporalis muscles.[25] In their case control study,[15] Balasubramaniam et al. found that palpation was painful in the TMJs and the retrodiskal zone in all if the patients with FM. In a study by Fraga et al.,[1] palpation of the TMJs and all of the masticatory muscles was reported to be very painful by patients with FM. The high prevalence of pain in the temporalis muscles could be explained by the high prevalence of headaches in patients with FM,[1] whereas the reported pain in the masseter muscles could be explained by the fact that these muscles are very involved in mandibular movements, such as mouth opening and closing and laterality movements during mastication and phonation, which are considered as aggravating factors for this pain.[20-22,26]

The intensity of pain in the orofacial area was measured by a visual analogue scale (VAS) in the some of the included studies.[9,11,17,20-22] It was significantly higher in patients with FM, with mean values ranging from 5.39 ± 3.13 to 9 ± 1.7 on a scale of 0 to 10. It was greater in patients with FM compared with those with TMD without FM[17,20,21] and healthy controls.[9] Balasubramaniam et al.[15] and de Siqueira et al.[21] found that the average duration of TMDs was 4.19 years and 5.25 ± 2.91 years, respectively.

Seven studies[1,9,11,12,15,18,22] had investigated the TMD of articular origin and showed that they are mainly joint sounds during opening, closing, and laterality movements of the mandible, grinding, clinching, disk displacement with reduction, and degenerative inflammatory joint disorders. Osteoarthrosis of the TMJs has also been found in patients with FM, but at a lower prevalence compared with that of joint noises and degenerative inflammatory joint disorders. In addition to these symptoms, limitation of mouth opening was found in patients with FM in 4 studies[9,11,12,15] of the present systematic review.

Pain threshold in the orofacial region in patients with FM had been studied by few of the included studies,[21,24,25] which showed that pressure pain threshold in the trigeminal area in both left and right masseter was lower in patients with FM compared with healthy controls, that mechanical pain threshold in the trigeminal area was lowest in patients with FM in comparison with healthy volunteers, that patients with FM had

Table II. Cross-sectional studies

Authors, year	*Study objective*	*Population*	*Main outcomes*	*Conclusions*
Fujarra et al., 2016[22]	Identify the signs of TMD in 2 FM groups, depending on the temporal relation between the onset of FP and GBP.	53 women with FM and FP. Group A: Onset of FP predated GBP. Group B: Onset of FP concomitant or after GBP.	Masticatory muscle pain was reported by all patients with FM but statistically different between the 2 groups. In Group B, myofascial pain with no limited mouth opening was more prevalent while myofascial pain with limited mouth opening was more common in Group A.	All the FM patients reported signs and symptoms of TMD, mainly muscle disorders.
Hilgenberg-Sydney et al., 2016[24]	Evaluate the conduction, maintenance and modulation mechanisms of pain in 3 groups of patients with FM, CDH, and MPMM.	80 women divided into 4 groups: MPMM group, FM group, CDH group, and HV group.	FM and MMPM groups: Lower PPT in the trigeminal area and masseter muscles compared with other groups. FM and CDH groups: Lower MPT in the trigeminal and extratrigeminal areas compared with other groups. FM group: CPS in the trigeminal zone showed higher pain intensity compared with other groups. Longest AS in the trigeminal zone.	Central sensitization process may exist in patients with MPMM and FM . Patients with MPMM, FM, and CDH seem to share common pain mechanism and similar etiology.
Schur et al., 2007[26]	To examine interrelationships among 9 chronic conditions, including FM and TMDs.	3982 twins from the University of Washington Twin Registry.	The association between FM and TMDs is characterized by an OR equal to 10.4 (5.4−20.1) for FM patients and 7.0 (3.7−13.4) for patients with TMDs. Strong association is considered for an OR $\geq$ 5.	Distressed patients are not merely accumulating diagnoses or somatic complaints but frequently have a constellation of coexisting conditions.
Gui et al., 2013[23]	Investigate the association between neuromuscular control and chronic facial pain in FMS and TMD patients.	27 patients diagnosed with FMS. 28 patients with TMD.	FMS group: 87.1% received at least 1 diagnosis of TMD. Facial pain intensity was 4.47 $\pm$ 2.52 (VAS) and 74.1% had oral parafunctions. TMD group: 100% had oral parafunctions and higher number of joint disorders. Facial pain intensity was 3.27 $\pm$ 3.03 (VAS). Most painful region of the face is the temporalis muscle for patients with FMS and those with TMDs.	FMS can play a role in triggering TMD, and the sensorimotor system fails to inhibit muscle contraction with pain in people with FMS.
Pfau et al, 2009[25]	Determine similarities and differences between patients with FMS and those with TMD.	23 TMD participants, 14 FMS participants, and 18 healthy controls.	Patients with FMS showed increased pressure sensitivity over trigeminal foramina and increased pressure pain sensitivity during palpation of temporal and masseter muscles; 89% showed face and neck pain and 44% had TMDs.	Shared underlying pain mechanisms may be present in patients with TMD and FMS, rather than comorbidity.

AS, aftersensation; *CDH,* chronic daily headache; *CPS,* cold pain sensitivity; *FM,* fibromyalgia; *FMS,* fibromyalgia syndrome; *FP,* facial pain; *GBP,* generalized body pain; *HV,* healthy volunteers; *MPMM,* myofascial pain of the masticatory muscles; *MPT,* mechanical pain threshold; *OR,* odds ratio; *PPT,* pressure pain threshold; *TMDs,* temporomandibular disorders; *VAS,* visual analogue scale.

Table III. Comparative studies

Authors, year	*Study objective*	*Population*	*Main outcomes*	*Conclusions*
Alonso-Blanco et al., 2012[8]	Compare the prevalence of TrPs and the anatomic localization of the referred pain areas between patients with myofascial TMD and FMS.	20 women (age 46 ± 8 years) with TMDs. 20 women (age 48 ± 6 years) with FMS	FMS group: Larger areas of usual pain symptoms and larger referred pain areas for sternocleidomastoid and suboccipital muscles. TMD group: More active TrPs in the temporalis and masseter muscles. Referred pain originated from active TrPs in head and neck−-shoulder muscles reproduced the pain pattern in the orofacial region in women with TMD or FMS.	Generators in different muscles can be involved in TMD and neck−face pain associated to FMS.
Salvetti et al., 2007[18]	Investigate and compare the clinical characteristics of stomatognathic dysfunction in patients with FM and TMDs.	FM group: 93 patients (88 women and 5 men). TMD group: 181 patients (137 women and 44 men).	FM group: 79.6% fulfill at least 1 RDC/TMD diagnosis, 40.9% muscle disorders, 29% disk displacement, 71% inflammatory-degenerative disorders and lower mean of MVMO and MPMO values. TMD group: 50.8% muscle disorders, 41.4% disk displacement and 49.2% inflammatory-degenerative disorders. High incidence of TMD in the FMS.	TMD can be an integrating part of the clinical image of FM and comorbidity may exist between FM and TMD. FM may represent an etiologic or worsening factor for TMD. TMD patients need a careful multidisciplinary approach.
Leblebici et al., 2007[3]	Determine the association of FM with TMDs and MMP.	52 female patients divided into 2 groups: FM group (31 women). TMD group (21 women).	FM group: 80% patients diagnosed with TMDs, all of them had MMP and only 19% patients had TMDs of arthrogenous origin with MMP. TMD group: FM was found in 52% of patients which was significantly higher in those with TMDs of arthrogenous origin with MMP.	Coexistence of FM and TMDs with MMP is high. Pain and tenderness in the masticatory muscles appear to be an important part in FM and needed to be checked.
Karibe et al., 2011[17]	Compare pain intensity and difficulty in performing ADLs in patients with TMDs, MP, NP, and FM.	296 patients divided into 5 groups: TMD (n = 107), MP (n = 87), NP (n = 33), FM (n = 10), and others (n = 59).	Gender ratio: 4:1 in TMD group, 6:1 in MP group, and 2:1 in NP group and FM group consisted of only female patients. Intensity of pain in the orofacial region was the highest in the FM and NP groups. TMD patients reported lower pain intensity. ADL-related difficulty was higher in the FM group.	Patients with TMDs were 4−6 times more likely to be females. Patients in the FM group had the highest scores for all items of pain intensity, except toothache.

ADL, activities of daily living; *FM,* fibromyalgia; *MMP,* masticatory myofascial pain; *MP,* myofascial pain; *MPMO,* maximum passive mouth opening; *MVMO,* maximum voluntary mouth opening; *NP,* neuropathic pain; *TMDs,* temporomandibular disorders; *TMJ,* temporomandibular joint dysfunction; *TrPs,* trigger points.

lower thresholds of deep pain and increased mechanical detection thresholds over the trapezius and the cheeks compared with controls.

The authors of 12 included studies[1,3,8,10,11,18,19,20-26] confirmed the existence of a positive relationship between FM and TMDs. For instance, Losert-Bruggner et al.[11] concluded that that FM is a factor of great importance for the onset of craniomandibular dysfunction and could also be responsible for the various clinical aspects of the FMS. Schur et al.[26] found a strong association between FM and TMDs characterized by an odds ratio (OR) of 10.4 (5.4−20.1) for patients with FM and 7.0 (3.7−13.4) for patients with TMDs. According to Salvetti et al.,[18] TMD signs and symptoms can be an integral part of the clinical image of FM, and they suggested that an association may exist between FM

Table IV. Cohort studies

Authors, year	*Study objective*	*Population*	*Main outcomes*	*Conclusions*
Balasubramaniam et al., 2007[15]	Determine prevalence of TMDs in patients with FM compared with patients with FBS.	32 FM patients (0 males, 32 females). 19 FBS patients (6 males, 13 females).	FM group: 19 fulfilled clinical RDC for TMD diagnosis (8, myofascial pain with limited opening; 6, myofascial pain; 4, disk displacement with reduction; 3, arthralgia; 5, osteoarthritis of TMJ; 7, osteoarthrosis of TMJ). FBS group: 3 fulfilled clinical RDC for TMD diagnosis (2 myofascial pain with limited opening; 1 arthralgia; 1 osteoarthrosis of TMJ). Pain severity and duration were not significant different between FM and FBS.	Prevalence of TMDs is greater among patients with FM compared with patients with FBS.
Fraga et al., 2012[1]	Determine prevalence of TMD in FM patients, especially those related to pain in masticatory muscle and TMJ.	60 FM patients: 52 women and 8 men.	Prevalence of TMD symptoms in FM patients: 81.7% facial pain, 63.3% joint sounds, 93.3% tenderness in the masticatory muscles (80% masseter, 76.7% posterior digastrics, 70% temporal), and 83.3% tenderness in TMJ. 68.4% of patients with FM: Reported association pain, joint sounds, and alteration of mandibular movements (at least 2 of them).	FM can be a medium- or long-term risk factor to the development of TMDs. TMDs may represent a manifestation of a more global pain sensitivity disorder.
Hoffmann et al., 2011[16]	Identify clinical manifestations associated to TMJD.	1511 TMJD-affected participants and 57 controls.	The prevalence relative risk was highest for FM (8.8-fold) and trigeminal neuralgia. FM represents one of the most frequent comorbid conditions associated with TMJD.	TMJD represent a spectrum of disorders with different pathophysiology and associated comorbid conditions.
Vellya et al., 2010[19]	Determine the effect of FM on the onset and persistence of clinically significant TMJD pain.	572 TMJD divided into 2 groups: onset cohort and persistence cohort.	Sixty 11% of the 572 participants were positive for a coexisting FM diagnosis. At the 18 months follow up: 8% of the onset cohort patients (clinically non-significant pain) were diagnosed with FM. 13% of the persistence pain cohort patients (clinically significant pain) were diagnosed with FM. Increased risk for the onset of clinically significant TMJD pain, when patients had FM.	TMJD pain may have centrally generated and overlapping peripheral mechanisms related to FM and widespread pain.

FBS, failed back syndrome; *FM,* fibromyalgia; *RDC,* research diagnostic criteria; *TMDs,* temporomandibular disorders; *TMJ,* temporomandibular joint; *TMJD,* temporomandibular muscle and joint disorders.

and TMDs and that FM could represent an etiologic factor for TMDs; in particular, it seems to be a worsening factor in the evolution of TMDs. da Silva et al.[20] had also investigated the association between TMDs and FM and concluded that orofacial complaints, including TMDs, may either be present as symptoms of FM or represent a comorbidity associated with it. da Silva et al.[20] also suggested that a comprehensive evaluation of patients with FM is necessary to identify the need for specific treatments for orofacial complaints and that future studies should be conducted to clarify the role of orofacial complaints in FM and the cause−effect relationship between FM and TMDs. Vellya et al.[19] suggested that clinically significant TMJ pain has centrally generated mechanisms related to FM and widespread pain and could have overlapping peripheral and central mechanisms of pain. Fraga et al.,[1] in their cohort study, showed that the signs and symptoms of TMDs are very

Table V. Case-control studies

Authors, year	*Study objective*	*Population*	*Main outcomes*	*Conclusions*
García-Moya et al., 2015[9]	Measure differences in lateral and opening movements of the mandible and investigate differences in the level of painful symptoms in a group of patients with FM and comparing them with a control group.	20 FM women aged between 35 and 60 years. 18 healthy controls.	High percentage of free of pain individuals in the control group. Painful masseter muscles, joint and retrodiskal zone palpation was significantly higher in patients with FM. Jaw opening was lower in the case group. The following symptoms were significantly higher in the FM group: Mean VAS pain score, pain or difficulty in opening the mouth speaking or chewing, pain in the ears, temples or cheeks, recent changes in bite and stiff or tired jaw.	Patients with FM showed a significantly higher prevalence of symptoms of TMDs, such as reduced jaw opening, painful muscle and joint palpation, and intra-articular noises.
Pimentel et al., 2013[12]	Characterize TMDs present in FM syndrome by determining the TMD prevalence of symptoms in comparison with healthy controls.	FM group: 40 women. Control group: 40 healthy controls.	FM group: 85% facial pain and 77.5% myofascial pain. Muscle pain during opening and closing movements (77.5%) and during lateral movements (45%). 22.5% disk displacement. 47% sleep vs 60% daytime bruxism and clenching. 40% Inflammatory degenerative joint disorders. Painful palpation of masticatory muscles. Lower mouth opening average. Control group: 10% fulfilled of RDC/TMD criteria. FM patients are 31 times more likely to have a diagnosis of facial muscle pain compared with patients without the condition.	High prevalence of TMDs with muscle pain on palpation and during mandibular movements, high self-reported facial pain, and limited mouth opening are the main features of TMDs in the FM group.
da Silva et al., 2012[20]	Investigate the orofacial complaints and characteristics of patients with FMS compared with healthy controls.	25 patients with FS and 25 healthy controls (24 women and 1 man).	FS patients showed higher pain Intensity (VAS = 78 ± 1.60), higher signs of TMDs, more fatigue complaints in the orofacial region, more pain caused by mandibular movements than controls. No significant difference between the 2 groups regarding the dental and intraoral examinations; however, mastication complaints were more frequent in patients with FMS.	Orofacial complaints, including TMDs, may either be present as symptoms of FMS or represent a comorbidity associated with this condition.
de Siqueira et al., 2013[21]	Investigate the orofacial and sensory characteristics in orofacial pain patients compared to healthy controls.	75 patients divided into 6 diagnostic groups: ITN, TMD, NINP, BMS, PIFP, and FM. 41 healthy controls.	FM group: 87.5 % daily facial pain. Pain duration 5.25 ± 2.91 years. Mean pain intensity using VAS 9.00 ± 1.71. Lower deep pain thresholds than controls. Masticatory abnormalities, pain upon awaking, pain in	Sensorial abnormalities were observed in both neuropathic and somatic pain patients. The masticatory system is associated with and may be a secondary cause of pain in those patients.

(*continued*)

Table V. *Continued*

Authors, year	Study objective	Population	Main outcomes	Conclusions
			mandibular movements and pain during craniofacial muscular palpation were significantly higher in the FM group compared with controls.	

BMS, burning mouth syndrome; *FM,* fibromyalgia; *FMS,* fibromyalgia syndrome; *ITN,* idiopathic trigeminal neuralgia; *NINP,* trigeminal non idiopathic neuropathic pain; *PIFP,* persistent idiopathic facial pain; *TMD,* temporomandibular disorders; *VAS,* visual analogue scale.

common in the FM population. They suggested that the high prevalence of TMDs in patients with FM indicates the need for adequate management of those disorders and that FM can be a medium- or long-term risk factor for the development of TMDs, mainly when its treatment is unsuccessful.

Recently, the association between FM and TMDs has been the subject of a growing number of studies,[3,10,18,19,23,24,] which have suggested the existence of a certain degree of association between the 2 pathologies. According to the American College of Rheumatology criteria,[2] the diagnosis of FM is confirmed if patients have tenderness in at least 11 of 18 specified tender points, not including the masticatory muscles. Thus, the American College of Rheumatology criteria do not include the signs and symptoms of TMDs. Given the high prevalence of TMDs in patients with FM, we emphasize the importance of including the signs and symptoms of TMDs in the diagnostic criteria for FM for an early diagnosis and timely treatment of TMDs. Even though a medication is already prescribed by the rheumatologist, it remains insufficient in terms of efficiency in the TMJs and the masticatory muscles, which represent certain particularities compared with other articulations and muscles of the human body. Treatment of TMDs may range from manual treatments—such as myocentric splint therapy, therapy with oral orthesis, and physiotherapy, which are of particular clinical importance[11,25]—to surgery, which could be a good therapeutic strategy mainly for patients with severe forms of TMDs. The surgical treatment of TMDs includes less invasive techniques, such as arthrocentesis and arthroscopy, and invasive procedures, such as condylectomy, condylotomy, coronoidectomy, eminectomy, and maxillary or mandibular osteotomy.[16]

Limitations of the current review

The quality of the evidence included in this systematic review was affected by the heterogeneity of the included studies; as well, an overall risk of bias could not be assessed. In fact, 10 of the 19 studies (52.63%) had a low level of evidence (see Table VI). Besides, the literature search was conducted in only 1 database. Therefore, further systematic reviews that are

Table VI. Level of evidence of the included studies and grade of recommendation

Author, year	Type of study	Level of evidence	Grade of recommendation
Losert-Bruggner et al., 2017[11]	Retrospective	4	C
Fujarra et al., 2016[22]	Cross-sectional	4	C
Hilgenberg-Sydney PB et al., 2016[24]	Cross-sectional	4	C
García-Moya et al., 2015[9]	Case control study	3	C
Gui et al., 2014[10]	Systematic review	1	A
de Siqueira et al., 2013[21]	Case-control study	3	C
Pimentel et al., 2013[12]	Case-control study	3	C
Gui et al., 2013[23]	Cross-sectional	4	C
Alonso-Blanco et al., 2012[8]	Comparative study	2	B
da Silva et al., 2012[20]	Case-control study	3	C
Fraga et al., 2012[1]	Cohort study	2	B
Hoffmann et al., 2011[16]	Cohort study	2	B
Karibe et al., 2011[17]	Comparative study	2	B
Vellya et al., 2010[19]	Cohort study	2	B
Pfau et al., 2009[25]	Cross-sectional	4	C
Balasubramaniam et al., 2007[15]	Cohort study	2	B
Leblebici et al., 2007[3]	Comparative study	2	B
Salvetti et al., 2007[18]	Comparative study	2	B
Schur et al., 2007[26]	Cross-sectional	4	C

conducted in as many databases as possible and include high-quality studies are essential to better understand and clarify the association between TMDs and FM.

CONCLUSIONS

The findings of the current systematic review showed a high prevalence of signs and symptoms of TMDs in patients with FM and a strong association between the 2 conditions. We suggest that an association exists between FM and TMD. Therefore, FM could be an etiologic or aggravating factor for TMDs. The 2 pathologies may have certain central mechanisms or etiologies in common. Given the high prevalence of TMDs in patients with FM, it is important to emphasize the need to consider the symptoms and signs of TMDs in the diagnosis of FMS. Besides, investigating and determining the association patterns between FM and TMDs will lead to better management of patients with FM, who eventually need multidisciplinary collaboration among different specialties (rheumatology, psychiatry, and dentistry).

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