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Original Article

Investigation of temporomandibular disorders in patients with fibromyalgia syndrome: A case-control study

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ABSTRACT

Introduction: The aim of this study is to compare the frequency of temporomandibular disorders and to examine the temporomandibular pain and functionality levels between healthy female participants and female patients diagnosed with fibromyalgia.
Materials and methods: Our study included 300 participants. Patients were evaluated according to the Diagnostic Criteria for Temporomandibular Disorders: Assessment Instruments (DC/TMD). While evaluating the patients using DC/TMD, TMD Pain Screener and Symptom questionnaire were used within the scope of Axis I, and Graded Chronic Pain Scale, Jaw Functional Limitation Scale-8 (JFLS-8), Patient Health Questionnaire (PHQ-4) and Oral Behaviors Checklist were applied.
Results: Bruxism, tooth grinding and masseter hypertrophy were found to be significantly higher in fibromyalgia patients compared to healthy volunteers ($p<0.001$). The pain screener, JFLS-8, PHQ-4 and OBC scores and GCPS levels were found to be increased in the fibromyalgia group compared to healthy individuals ($p<0.001$). Considering the post-examination diagnoses of the participants, the diagnoses of myalgia ($p=0.022$) and disc displacement with reduction ($p<0.001$) were significantly higher than healthy individuals.
Conclusions: Fibromyalgia is a common pathology, therefore, TMD symptoms, which are more difficult to diagnose and often missed, should be questioned in fibromyalgia patients and should be kept in mind in the management of fibromyalgia patients.

1. Introduction

Fibromyalgia can be defined as a cognitive disorder with the cortical integration of chronic pain, amplification of painful and sensory nociception, a decrease in the pain perception threshold, and the persistence of a stimulus such that continues the process chronically. The prevalence of fibromyalgia varies between 5% and 12%, which depends on the population and increases with age. The peak prevalence occurs in middle age and then declines in the highest age groups. In studies that do not employ tender points as a criterion, the female/male ratio is approximately 3:1. Significant ethnic disparities in occurrence have been poorly recorded [1].

Chronic pain disorders are prevalent in the general population. Back pain, neck pain, and temporomandibular disorders (TMDs) are all examples of pain diseases involving soft tissues such as muscles, ligaments, and joints in various body regions. TMD is an umbrella term that refers to not only painful diseases affecting the jaw muscles and temporomandibular joint (TMJ), but also functional jaw problems such as locking and clicking [2]. In a recent meta-analysis examining the prevalence of TMD in the general population, the prevalence of TMD in adults was reported as 31%. Additionally, the most common TMD group was found to be disc displacement (DDs) with reduction [3]. TMD is associated with a variety of concomitant conditions, including fibromyalgia, chronic fatigue syndrome, tinnitus, and sleep problems [4].

Chronic multi-symptom disorders such as TMD and fibromyalgia frequently co-occur and share a number of characteristics. There is no universally recognized cause of either illness, despite the identification of multiple overlapping risk factors. Psychosocial problems such as worry, stress, and depression are thought to contribute to the development of TMDs [5]. Stress has a detrimental effect on the circulation within the local muscles, resulting in continual tooth-on-tooth interlocking. Additionally, they have the potential to alter the ionic balance within cellular membranes. As a result, lactic and pyruvic acids can build up and stimulate pain receptors [6].

TMD and fibromyalgia frequently coexist in clinical settings and, like other types of chronic pain, are more prevalent among women. Both disorders are frequently associated with high rates of comorbidities, including insomnia, irritable bowel syndrome, somatic symptoms, and elevated psychological distress (e.g., anxiety, depression,

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and pain catastrophizing) [7]. While fibromyalgia is not a cause of intra-articular TMD, patients with fibromyalgia typically present signs and symptoms similar to inflammatory articular disease, including pain with mandibular function, pre-auricular discomfort, limited mouth opening, and diurnal shifts in symptoms. While arthritic TMJ disease may present in patients with fibromyalgia, it is not the source of the disorder [8].

Previously, TMDs and fibromyalgia were regarded as independent entities, but multiple investigations have demonstrated orofacial symptoms in individuals with fibromyalgia, indicating a possible association between these two ailments [9–12]. They are caused by similar etiological stimuli, such as stress. The high level of muscle pathology in TMD and the muscular symptoms in common with fibromyalgia suggest that probable associations between the two illnesses should be investigated [13].

Accurate identification and treatment of patients with these conditions might take years, which could worsen their overall suffering. As a result, persistent musculoskeletal pain is a prevalent reason for absenteeism, which places a considerable economic burden on society in terms of healthcare expenditures, workforce loss, and lower productivity. There is a need to increase the understanding in this area in order to improve management strategies and the prognoses of these disorders, with the ultimate goal of easing patient suffering and minimizing economic costs [7]. There are few studies comparing TMDs in fibromyalgia patients and healthy individuals, and their sample numbers are low [12–15]. Thus, the aim of this study is to compare the frequency of TMDs and to examine the temporomandibular pain and functionality levels between healthy female participants and female patients diagnosed with fibromyalgia.

2. Materials and methods

2.1. Study design and study population

300 female participants between the ages of 18-65 who were examined in the physical therapy and rehabilitation outpatient clinic between May and August 2021were included in study. The study included 150 women who were previously diagnosed according to the American College of Rheumatology 2010 diagnostic criteria and followed up by our physical therapy and rehabilitation outpatient clinic. The patients were invited to the hospital by phone to be examined and participate in the study. And as control group 150 healthy volunteer women were evaluated. Healthy volunteers were selected from those without any symptoms of jaw or body pain. Patients who had surgery or trauma in the temporomandibular area, congenital TMJ diseases, a systemic disease, treated for osteoporosis, diagnosis of psychiatric disease were excluded from the study.

2.2. Measurements

Patients were evaluated according to the Assessment Instruments of The Diagnostic Criteria for TMDs (DC/TMD). The TMD Pain Screener and symptom questionnaire were used within the scope of Axis I, and the Graded Chronic Pain Scale (version 2), Jaw Functional Limitation Scale-8 (JFLS-8), Patient Health Questionnaire (PHQ-4), and Oral Behaviors Checklist were applied within the scope of Axis II [16]. Additionally, demographic information (age, gender, height, weight, marital status, and level of education) and the duration of the fibromyalgia diagnosis were collected.

All of the patients' physical examinations and evaluations were performed by same two physiatrist experienced in jaw diseases. In the physical examination, the mouth opening of the patients was measured with the help of a ruler that allows milimeter (mm) measurement. While the patients were in a sitting position, the patient was asked to open their mouth as much as possible. The distance between the anterior incisors was recorded. The presence of bruxism in the patients was detected by physical examination findings such as tooth marks on the tongue and abrasion on the teeth. It was classified as awake and sleep bruxism by symptom questionnaire. Masseter hypertrophy was defined as a difference in one of the two lower triangles of the mandible on inspection and the presence of a soft tissue mass that became evident when the patient clenched the jaws [17]. Using the index and middle fingers of both hands, the examiner palpated the patient's jaw joint to search for Jaw joint sounds and TMJ locking. Patients were evaluated and classified according to the DC/TMD Clinical Examination Protocol.[18]

2.2.1. DC/TMD symptom questionnaire

The DC/TMD is a comprehensive assessment tool for the most common TMD diseases. The DC/TMD protocol is separated into two axes, one for each of the most frequent pain-related TMDs and intra-articular diseases. The Symptom Questionnaire is used to examine jaw discomfort, temporal-region headache, joint sounds, and TMJ locking [18]. The instrument is meant to be used in conjunction with an interview to clarify and confirm all responses.

2.2.2. Oral behaviors checklist

The Oral Behaviors Checklist (OBC) is a self-report questionnaire for assessing jaw overuse. It was created as a checklist to help identify parafunctional habits with no intention of scoring beyond a simple count. Since its creation, the instrument has been utilized in numerous investigations and provided some validity for TMD design [19].

2.2.3. Four-Item Patient Health Questionnaire (PHQ-4)

The PHQ-4 is a subscale of anxiety and depression that is meant to be an ultra-brief screener for distress. The total score is the sum of four item scores. Anxiety is indicated by a score of 3 for the first two questions, while a score of 3 for the last two questions suggests depression [20].

2.2.4. Jaw Functional Limitation Scale (JFLS-8)

A universal scale of eight items was created to assess the masticatory system's overall functional limitations. These items and psychometric data were used to redevelop the measure into a 20-item assessment that includes masticatory, vertical movement, and verbal and non-verbal communication limitations. The subscale scores are equivalent between the two settings due to the great dependability of the global score, regardless of whether it was obtained using the entire instrument or the short instrument. A JFLS-8 form was used to detect jaw function restriction from the DC/TMD Axis-II [20].

2.2.5. TMD pain screener

The TMD Pain Screener is one of two self-report instruments for Axis I. The entire instrument can be used, which is advised for individual assessments, or only the first three items can be used for population studies. A positive screening result is followed by additional evaluation to determine the precise TMD pain diagnosis. The first item has a score of 0-2 (a=0, b=1, c=2), but the remaining items have only a=0 and b=1 as possible choices. A total is calculated, and values greater than three for the complete six-item version of the test or two for the three-item version suggest the possibility of TMD [21].

2.2.6. Graded Chronic Pain Scale (GCPS)

The Graded Chronic Pain Scale (GCPS) is a brief, reliable, and valid measure for assessing pain severity and impairment associated with chronic pain [22]. The two GCPS subscales are the Characteristic Pain Intensity (CPI) and the pain-disability rating. CPI reliably measures pain intensity, with a score of 50/100 indicating "high intensity." The pain-disability rating is based on the number of days on which pain interferes with activity and the extent to which pain interferes with social, work, or routine daily activities. High levels of pain and interference or moderate to severe disability (Grades 3 or 4) should be

understood as disability caused by pain, indicating that the individual is experiencing a major impact from the TMD on his or her life. The third device is a head, jaw, and body pain sketch that enables the patient to report the location of all pain complaints. Widespread discomfort indicates the importance of doing a thorough examination of the patient [18].

2.3. Statistical analysis

Statistical analysis was performed using the software IBM SPSS version 25.0. Descriptive data were expressed as the mean with the standard deviation or a number and frequency. The distribution of variables was checked with the Kolmogorov–Smirnov test. To compare between two groups, a χ^2 test was performed for categorical data, and an independent-sample t test and Mann Whitney-U test were performed for quantitative variables. Independent variables were screened by binary logistic regression. The results with p<0.05 were defined as statistically significant.

2.4. Ethical approval

This case-control study was conducted in accordance with the ethical standards of the institutional ethics committee (approval number: 2017-KAEK-89_2021.03.10_17) and the 1964 Helsinki declaration and its later amendments or comparable ethical standards. It is registered at ClinicalTrials.gov (NCT04867044), and informed consent was obtained from all individual participants included in the study.

3. Results

Our study included 300 participants, of whom 150 were diagnosed with fibromyalgia and 150 were healthy volunteers. The mean age of the participants was 43.30±10.1 years, and the mean BMI was 26.92±4.10. Between the two groups, there was no statistically significant difference in demographic characteristics such as age, BMI, marital status, education level, and occupation (p>0.05). When the habits of the patients were evaluated, smoking was found to be significantly more common in the fibromyalgia group (p<0.001) (Table 1).

The mean diagnosis time of fibromyalgia patients was 27.02± 28.28 months. Daytime and sleep bruxism, tooth grinding, and masseter hypertrophy were found to be significantly more common in fibromyalgia patients than healthy volunteers (p<0.001). It was found that mouth opening of the patients was decreased in the fibromyalgia group compared to the healthy individuals (p<0.001). The pain screener, JFLS-8, PHQ-4, OBC, and GCPS scores were found to be higher in the fibromyalgia group than healthy individuals (p<0.001) (Table 2). Post-examination, the diagnoses of myalgia (p=0.022) and disc displacement with reduction (p<0.001) were significantly more common than in healthy individuals (Table 3).

Table 1
Demographic characteristics of participants.

	Control group	FM group	p value
Age (mean±SD)	42.38±11.54	44.22±8.15	0.113
BMI (mean±SD)	26.57±4.89	27.26±3.96	0.216
Marriage n (%)			0.345
Married	123 (82)	129 (86)	
Unmarried	27 (18)	21 (14)	
Education n (%)			0.204
Elementary	59 (39.3)	68 (45.3)	
Secondary	48 (32.7)	53 (35.3)	
University	42 (28)	29 (19.3)	
Occupation n (%)			0.145
Unemployed	63 (42.00)	74 (49.3)	
Desk worker	39 (26.0)	43 (28.7)	
Physically demanding	48 (32.0)	33 (22.0)	
Habits n (%)			
Cigarette	20 (13.3)	47 (31.3)	<0.001
Alcohol	25 (16.7)	21 (14.0)	0.522

BMI: Body mass index.

4. Discussion

Determining the accompanying TMD while evaluating a fibromyalgia patient is essential for multidisciplinary management, pain control, and functionality of the patient. The reverse of this is also true: awareness of the presence of accompanying fibromyalgia in TMD patients is necessary for the evaluation and management of TMD. Fibromyalgia itself and widespread pain are factors that complicate the treatment of TMD [23,24].

Moreover, understanding the relationships between TMJ and fibromyalgia allows for better management of patients. We planned our study in the light of this information. The results revealed that rates of bruxism and teeth-grinding levels were higher in fibromyalgia patients than healthy controls, and fibromyalgia patients had higher pain levels. FM patients reported more TMD-related functional limitations and distress and had more parafunctional habits than a healthy group.[24] TMD has been demonstrated to develop as a result of mandibular compression during sleep and daily living activities in fibromyalgia patients, and the coexistence of these pathologies results in a highly complex clinical outcome [25]. Fibromyalgia and widespread pain are both factors that complicate TMJD management and should be taken into account during both the evaluation and treatment of TMJD [24].

Hedenberg-Magnusson et al. analyzed questionnaires on craniomandibular problems among patients with fibromyalgia, which revealed that 94% of the sample had symptoms of these diseases [26]. Pleshy et al. discovered that 75% of 60 fibromyalgia patients fit the criteria for craniomandibular muscular abnormalities [27]. This finding is consistent with that of the current study and is greater than that of Korsun et al., who discovered some form of TMD in 42% of 92 patients [28]. The literature has demonstrated that patients with fibromyalgia have a significantly higher prevalence of signs and symptoms of craniomandibular disorders such as decreased mouth

Table 2
Comparison of assessment results between groups.

	Control group	FM group	p value
Awake bruxism			<0.001
No	107 (71.3)	58 (38.7)	
Yes	43 (28.7)	92 (61.3)	
Tooth grinding			<0.001
No	135 (90)	106 (70.7)	
Yes	15 (10)	44 (29.3)	
Sleep bruxism			<0.001
No	128 (85.3)	101 (67.3)	
Yes	22 (14.7)	49 (32.7)	
Masseter hypertrophy			<0.001
No	134 (89.3)	102 (68.0)	
Yes	16 (10.7)	48 (32.0)	
Mouth opening (mm)	43.38±5.5	40.73±5.6	<0.001
Pain screener	1.32±1.58	2.43±1.88	<0.001
JFLS-8 scores	0.66±0.95	1.37±1.03	<0.001
OBC scores	7.1±6.0	14.0±8.2	<0.001
PHQ-4 scores	1.56±1.59	4.66±2.51	<0.001
GCPS n(%)			<0.001
0	93 (62)	28 (18.7)	
1	23 (15.3)	52 (34.7)	
2	21 (14)	41 (27.3)	
3	11 (7.3)	23 (15.3)	
4	2 (1.3)	6 (4)	

JFLS-8: The jaw functional limitation scale-8, OBC: Oral Behaviors Checklist, PHQ-4: The Four-Item Patient Health Questionnaire, GCPS: Graded Chronic Pain Scale.

Table 3
Comparison of participants' diagnoses.

	Control group n (%)	FM group n (%)	p value
Normal	**90 (60)**	**36 (24)**	**<0.001**
Masticatory Muscle Disorders and Headache	**47 (31.3)**	**71 (47.3)**	**0.005**
Myalgia	34 (22.7)	52 (34.7)	0.022
Myofascial pain with referral	3 (2.0)	4 (2.7)	0.702
Arthralgia	5 (3.3)	9 (6.0)	0.274
Headache atrributed to TMD	5 (3.3)	6 (4.0)	0.759
Temporomandibular Joint Disorders	**13 (8.7)**	**43 (28.7)**	**<0.001**
DD with reduction	7 (4.7)	26 (17.3)	<0.001
DD with reduction with intermittent locking	2 (1.,3)	8 (5.3)	0.054
DD without reduction without limited opening	1 (0.7)	3 (2.0)	0.622
DD without reduction with limited opening	-	2 (1.3)	0.498
Degenerative Joint Disorders	3 (2.0)	5 (3.3)	0.723
Subluxation	1 (0.7)	-	1.000

DD:Disc displacement, TMD:Temporomandibular disorders.

opening, increased pain, painful muscle palpation at specific points, painful joint palpation, and intra-articular pain [13]. Our data corroborate this as well.

In one study, women with fibromyalgia reported higher levels and longer durations of orofacial pain [9,12]. The results of our study show that temporomandibular pain levels and chronic pain are higher in women with fibromyalgia than healthy women. We think that this may be related to the long-term and chronic nature of fibromyalgia, which is characterized by increased pain sensitivity.

It has been reported that TMD may develop as a result of mandibular compression during daily living activities and sleep in patients with fibromyalgia [25]. In our study, fibromyalgia patients reported more bruxism, which we think may be related to the high level of distress in fibromyalgia patients and may contribute to the development of TMD. It has also been reported that central pain and psychological dysfunction should be considered together for evaluation and treatment [29]. We think that distress management is an important factor in terms of the clinical course of the disease in both fibromyalgia and TMD patients.

Leblebici et al. studied the prevalence of craniomandibular disorders in a group of women diagnosed with fibromyalgia. They found that 80% showed TMJ disorders, which mainly affected the muscles. In this study, prominent painful spots were detected in muscles in 65% of the case group [30].

The results of our study indicated that not only pain-related TMD, but also intra-articular joint disorders were more common in those with fibromyalgia than in healthy individuals. This made us think that fibromyalgia may have a direct effect on the TMJ, apart from susceptibility to pain and muscle pain. In other words, temporomandibular pain in fibromyalgia patients is caused by a pathology involving the jaw joint itself rather than being a part of widespread pain. This relationship is valuable in terms of fibromyalgia disease management. It is important to determine the factors affecting the coexistence of TMD and FMS. We thought that the increased frequency of bruxism in fibromyalgia patients may contribute to this situation [30].

It has been reported that patients with fibromyalgia and TMD share several core symptoms, such as multiple chemical sensitivities, irritable bowel syndrome, atypical facial pain, and tension headache. In addition, many studies have shown that serotonergic dysfunction may mediate the pathophysiology of fibromyalgia and TMD, as in chronic pain disorders, and many fibromyalgia and TMD patients have irregular activity in the sympathetic nervous system [5,11,25]. All these factors can be considered to result from central hypersensitivity, and it is clear that this association creates a complex clinical outcome.

Fibromyalgia, chronic fatigue, irritable bowel syndrome, chronic pelvic pain, and chronic daily headache all share many symptoms, and many patients have numerous diagnoses [5,25]. Both fibromyalgia and chronic fatigue syndrome involve myalgias, fatigue, sleep disturbance, and depression [9]. Atypical face discomfort, irritable bowel syndrome, various chemical sensitivities, and tension headaches are common co-morbidities of fibromyalgia and TMD [9]. Even for fundamental symptoms, there is extensive overlap in case definitions and diagnostic criteria [31]. From fibromyalgia arthralgias and myalgias to headaches, abdominal issues, and pelvic concerns, these enhanced sensations may represent the first presentation of central sensitization as medically unexplained symptoms.

Central sensitization occurs when the central nervous system increases sensory input across many organ systems. This heightened sensory response involves neural plasticity that increases sensitivity to subsequent stimuli, such as pain from non-painful stimuli (allodynia) and pain from painful stimuli that is greater than predicted (hyperalgesia). Visceral hypersensitivity can cause severe pain in any organ system [31]. It has been claimed that chronic pain syndromes are mostly caused by changes in the central nervous system, with serotonin being the primary neurotransmitter responsible for modulating endogenous processes. Numerous studies have demonstrated that serotoninergic dysfunction may have a role in the pathogenesis of fibromyalgia and TMD [25].

These data imply that a significant proportion of fibromyalgia and TMD patients have dysregulated sympathetic nervous system activity, which may directly contribute to their myalgia as well as to changes in their cardiovascular and catecholamine responses at rest and in reaction to stressors [11]. Significant correlation between the TMJ and the vertebral column has also been reported. One review indicated that there is a significant relationship between fibromyalgia and conditions affecting the craniomaxillofacial and craniomandibular regions [32]. The review's findings indicate a strong association between fibromyalgia and changes in the craniomaxillofacial and craniomandibular districts. This highlights once again the critical relationship between the TMJ and the vertebral column, with all of the systemic ramifications that implies.

Certain fibromyalgia symptoms may aid in early diagnosis. Numerous studies have analyzed the presence of discomfort in the TMJ area, which is frequently related to usage of analgesic medications. Additionally, there are reports of occlusal and TMJ-sensitive anomalies or muscular issues. To easily comprehend oral problems associated with fibromyalgia, analyzing the TMJ may be the first step toward early diagnosis [32]. Although the etiopathogenesis of TMD and fibromyalgia is controversial, it has been reported that these two conditions may share some similar pathophysiological mechanisms, and this situation is associated with facilitated nociceptive processes [8,12]. One study reported an increased risk for the onset of clinically significant TMD pain among subjects with fibromyalgia, which is similar to the results of our study [9]. Fibromyalgia is a common pathology, so TMD symptoms that are more difficult to diagnose and often missed. Therefore, its possibility should be considered for fibromyalgia patients and should be kept in mind in their management. Similarly, when evaluating TMD patients, investigations should examine whether the patient have central hypersensitivity syndrome, chronic pain, or concomitant fibromyalgia disease. In such a case, we think that an interdisciplinary approach may have a positive effect on the patient's symptom management and functional status.

The data of our study was collected during the COVID -19 pandemic. It has been reported that the COVID-19 pandemic has a negative effect on conditions such as anxiety and depression, and this inreases the symptoms of bruxism and TMD. Therefore, this situation

should be taken into account when evaluating the results of our study [33,34].

5. Conclusion

According to the results of our study; bruxism, functional limitation, masseter hypertrophy, temporomandibular joint pain and chronic pain are higher in women with fibromyalgia than in healthy women. When evaluated in terms of diagnostic classification; In patients with fibromyalgia, not only pain-related TMD, but also intra-articular joint disorders, especially DD with reduction, are more common than healthy individuals. Nevertheless, because of the small number of participants in this study, these findings should be regarded with caution. Studies with bigger samples utilizing longitudinal methodologies will be required to establish the relationship between the two conditions with confidence.

Declarations

Ethics and consent to participate, the study was approved by the ethics committee of the Yozgat Bozok University Faculty of Medicine, Turkey (approval number: 2017-KAEK-89_2021.03.10_17). The study was performed in accordance with the Declaration of Helsinki of 1964. All patients provided written informed consent before any measurements were conducted.

Conflict of interest

The authors declare no competing interests

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