Acıbadem Univ. Sağlık Bilim. Derg. 2024; 15 (4)
https://doi.org/ 10.31067/acusaglik.1366521

ORIGINAL ARTICLE / ARAŞTIRMA YAZISI

Rehabilitation / Rehabilitasyon

The Effect of Bruxism on the Severity of Temporomandibular Dysfunction and Chewing Functionality: A Cross-Sectional Study

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ABSTRACT

Objective: The study was conducted to investigate the effect of bruxism on the severity of Temporomandibular Dysfunction (TMD) and chewing functionality in individuals with TMD.

Methods: This cross-sectional study was conducted with 91 individuals diagnosed with TMD, with a mean age of 31.14 (7.35) years, 65 (71.4%) of whom were female. TMJ pain was assessed with the Numeric Pain Scale (NPS), maximum mouth opening (MMO), TMD severity was evaluated with the Fonseca Anamnestic Questionnaire (FAQ), and chewing functionality was considered with the Jaw Functional Limitation Scale-20 (JFLS-20).

Results: The NPS (p=0.002), MMO (p=0.000), FAQ (p=0.000) and JFLS-20 (p=0.000) score results of TMD patients with bruxism were significantly worse than those of TMD patients without bruxism. The probability of having moderate-severe TMD (FAQ≥ 50) increased statistically significantly 16.236 times (95% CI: 3.485-75.651) with bruxism (p=0.000). Limitation in chewing functionality (JFSL-20> 5) was significantly increased 4.364 times (95% CI: 1.127- 16.906) in the presence of bruxism (p=0.033).

Conclusion: The study results showed that pain, TMD severity, and chewing functionality limitation were higher in individuals with TMD accompanied by bruxism. Knowing the bruxism and its effects that may accompany TMD, which is very common and increasing in number and severity daily, in the evaluation or treatment phase is essential in improving rehabilitation success.

Keywords: Temporomandibular dysfunction, bruxism, chewing functionality.

(Trial registration number: NCT06053723)

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ÖZET

Amaç: Çalışma, Temporomandibular Disfonksiyonu (TMD) olan bireylerde bruksizmin TMD şiddeti ve çiğneme fonksiyonelliği üzerine etkisini incelemek amacıyla yapıldı.

Yöntem: Bu kesitsel çalışma, TMD tanısı almış, yaş ortalaması 31.14 (7.35) yıl, 65'i (%71.4) kadın olan 91 birey ile yürütüldü. Araştırmada TME ağrısı Numerik Ağrı Skalası (NAS) ile, maksimum ağız açıklığı (MAA), TME rahatsızlığının şiddeti Fonseca Anamnestik Anketi (FAA) ile ve çiğneme fonksiyonelliği Çenenin Fonksiyon Kısıtlanma Skalası-20 (ÇFKS-20) ile değerlendirildi.

Bulgular: Bruksizmi olan TMD'li bireylerin NAS (p=0.002), MAA (p=0.000), FAA (p=0.000) ve ÇFKS-20 (p=0.000) sonuçları bruksizmi olmayan TMD'li bireylere kıyasla anlamlı derecede daha kötüydü. Orta-ciddi şiddette TMD'ye sahip olma olasılığının (FAA≥ 50) bruksim varlığı ile birlikte istatistiksel olarak anlamlı şekilde 16.236 kat (%95 GA: 3.485-75.651) arttığı görüldü (p=0.000). Çiğneme fonksiyonelliğinde kısıtlanmanın (ÇFKS-20 >5) ise bruksizm varlığında anlamlı şekilde 4.364 kat (%95 GA: 1.127- 16.906) arttığı görüldü (p=0.033).

Sonuç: Çalışma sonuçları bruxismin eşlik ettiği TMD'li bireylerde ağrı, TMD şiddeti ve çiğneme fonksiyonelliğinde kısıtlanmanın daha yüksek olduğunu göstermiştir. Çok yaygın olarak görülen, her geçen gün sayısı ve şiddeti artan TMD'nin değerlendirme ya da tedavi aşamasında eşlik edebilecek bruksizm ve etkilerinin bilinmesinin rehabilitasyon başarısını arttırma açısından önemli olduğu düşünülmelidir.

Anahtar sözcükler: Temporomandibular disfonksiyon, bruksizm, çiğneme fonksiyonelliği.

(Trial registration number: NCT06053723)

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Received: 26.09.2023
Accepted: 24.08.2024

Temporomandibular Joint Dysfunction (TMD) refers to dysfunctions caused by temporomandibular joint (TMJ) and musculoskeletal structure irregularities. (1). Bruxism, known as clenching and grinding of teeth, is the most common parafunctional activity in the etiology of TMD and affects the quality of life the most (2).

Bruxism is a parafunctional activity in sleep or wakefulness characterized by clenching and teeth grinding, most commonly seen in the age range of 20-50 years (3). Clinical findings of sleep bruxism include hypertrophy of the masseter muscle, abnormal wear and fracture of the teeth, limitation in the range of motion of the jaw joint, tenderness and pain in the masticatory muscles, especially in the morning (4).

Since the use of polysomnographic records, which provide definitive detection of bruxism in sleep, is limited due to high cost and lack of well-equipped sleep laboratories, clinical or self-report approaches are frequently used in the clinic as an alternative (5, 6). The prevalence of self-reported bruxism was found to be 39.6% in a study using the self-report method, and it was reported that self-reported bruxism was associated with TMD symptoms and signs related to pain, as well as TMD diagnoses (7). In two studies investigating the prevalence of bruxism in individuals diagnosed with TMD, the prevalence was approximately 80% and 57% (8,9).

Although there seems to be some debate in the literature as to whether bruxism, as a risk factor for TMD, is a potential cause of masticatory muscle disorders and/or joint overload, it has been proposed that bruxism can cause peripheral sensitization. It has been hypothesized that prolonged myofascial pain may constitute a risk for TMD (10,11). It is known that bruxism may accompany TMD in studies (7-13). Still, no study has been found to examine in detail how the presence of concomitant bruxism affects the severity of TMD and chewing functionality in individuals with TMD. Therefore, this study aimed to investigate the effect of bruxism on TMD severity and chewing functionality in individuals with TMD.

Methods

Design

This cross-sectional study was conducted between April 2023 and September 2023 with individuals aged 20-55 years with TMD. Approval for this study was granted by the Non-Interventional Research Ethics Committee of Bandırma Onyedi Eylül University (decision no: 2023-54). The clinical trial number of the study is NCT06053723. All study methods conform to the Helsinki Declaration of the World Medical Association. All participants provided written informed consent.

Participants

Individuals aged 20-55 years with TMD who volunteered to participate in the study were included. Exclusion criteria included having a non-reducible disc problem, undergoing surgical operation related to the spine, and TMJ problem, cancer, trauma, congenital anomalies, neurological problems, musculoskeletal problems, facial paralysis, and receiving any treatment related to the spine and TMJ in less than six months.

Sample Size

The sample size was calculated using a population of 20000 and a prevalence of 15% (14) with a 95% confidence interval with the Rasoft sample size calculator. Considering the two-sided alpha value of 0.05, a power of 0.80, and dropout, 84 individuals were planned to be included in the study. The study included 91 individuals diagnosed with TMD.

Outcome Measurements

Those who volunteered to participate in the study completed the Descriptive Data Form, including demographic characteristics. Diagnostic classification (myofascial, disc and joint disorder) of the individuals diagnosed with TMD were recorded. The presence of bruxism in individuals with TMD was questioned, and the maximum mouth-opening measurement was recorded. TMD severity was assessed with Fonseca's Anamnestic Questionnaire (FAQ), pain severity was evaluated with the Numeric Pain Scale (NPS), and TMJ functionality was set with the Jaw Functional Limitation Scale-20 (JFLS-20). The evaluations of the participants were performed only once.

Bruxism: Sleep bruxism reported by the individual was recorded. As clinical diagnostic criteria for bruxism, the presence of regular or frequent teeth clenching and grinding sounds followed by pain or fatigue in the jaw muscles on waking up in the morning, temporal headache, masseter muscle hypertrophy, abnormal tooth abrasion and/or jaw locking was questioned. The presence of one or more clinical findings was recorded as bruxism (15).

Maximum mouth opening (MMO): Maximum pain-free mouth opening was measured with a 15 cm ruler (16).

Fonseca's Anamnestic Questionnaire (FAQ): It assessed TMD severity. The questionnaire includes ten questions about joint, head, and neck pain, pain during masticatory activity, parafunctional habits, decreased joint motion, impaired occlusion, and emotional stress. As a result of the questionnaire, the presence of TMD is accepted in those with 25 points and above. At the same time, severity can be classified as mild TMJ disorder (25-45), moderate TMJ disorder (50-65), and severe TMJ disorder (70-100). The Turkish validity and reliability of the questionnaire were performed by Kaynak et al. in 2020 (17).

Numeric Pain Scale (NPS): It is a simple, reliable, and short-term method frequently used to measure pain intensity in the clinic. The patient was told that the most severe pain they felt in the TMJ region was 10, and if they had no pain, the pain intensity was 0. The participant was asked to give a number between 0 and 10 corresponding to the intensity of pain felt in the TMJ region (18).

Jaw Function Limitation Scale-20: It assessed chewing functionality, including 20 items, with "0" indicating no limitation and "10" indicating a severe limitation in each item, about the function of the TMJ during different activities, difficulty in chewing, and jaw limitation. As a result of the questionnaire, it has been reported that TMJ functionality is limited in those with a score of 5 and above. Acceptable reliability and validity have been reported for the scale (19).

Statistical Analysis

IBM-SPSS 25.0 for the macOS package program was used to evaluate the participants' findings. In parametric testing, variables determined by measurements were reported as mean±standard deviation (SD), median (minimum-maximum) in nonparametric testing, and distributions for variables defined by counting were calculated as (%). The conformity of the variables to normal distribution was analyzed using the Shapiro-Wilk test. Mann-Whitney U Test for age, Independent Samples t Test for BMI, NPS, MMO, JFSL-20, and FAQ were used between the groups with and without bruxism. The relationship between TMD severity and diagnostic classification with the presence of bruxism and gender was compared by the Chi-Square Test. The Kruskal Wallis test evaluated TMD severity and JFLS-20 variability in diagnostic classification. After adjusting for age and gender, multiple logistic regression analysis was performed to determine whether the presence of bruxism was a statistically significant determinant of TMD severity (FAQ≥50) and limitation of chewing functionality (JFSL >5). The degree of statistical significance was determined as $p<0.05$.

Results

65 (71.4%) were female, 26 (28.6%) were male were included in the study and the median age was 29.0 (20-55) years. In the study, 63 (69%) individuals with TMD reported bruxism (Table 1). The NPS (p=0.002), MMO (p=0.000), FAQ (p=0.000) and JFLS-20 (p=0.000) score results of TMD patients with bruxism were significantly worse than those of TMD patients without bruxism (Table 2).

Table 1: Participants' descriptive and clinical data

N=91	**Min-Max**	**Mean**	**SD**
Age (years)	20.0- 55.0	31.14	7.35
BMI (kg/m^2)	15.47- 36.24	24.19	4.30
NPS (cm)	2.0- 8.0	4.53	1.57
MMO (mm)	22.0- 58.0	36.94	6.99
JFSL-20	3.0- 85.0	36.18	19.89
FAQ	25.0- 85.0	44.78	17.07
	n (%)		
Gender Female Male	65 (71.4%) 26 (28.6%)		
Bruxism Yes No	63 (69%) 28 (31%)		
RDC/TMD • Myofascial • Disc • Joint	 34 (37.36%) 31 (34.06%) 26(28.58%)		
TMD Severity • Light • Medium • Serious	 54 (59.34%) 22 (24.17%) 15 (16.49%)		

Min:Minimum, Max: Maximum, SD: Standard Deviation, BMI= Body Mass Index, NPS: Numeric Pain Scale, MMO: Maximum Mouth Open, JFLS-20: Jaw Functional Limitation Scale-20, FAQ: Fonseca Anamnestic Questionnaire, RDC/TMD: Research Diagnostic Criteria/ Temporomandibular Disorders.

Table 2: Comparison of chewing function in TMD diagnostic classification and severity difference

N=91	n	JFSL-20 median (min-max)	p
RDC/TMD n (%)			
• Myofascial	34	30.0 (3.0- 85.0)	0.000*
• Disc	31	33.0 (6.0-85.0)	
• Joint	26	45.0 (17.0- 83.0)	
TMD Severity n (%)			
• Light	54	29.0 (3.0- 47.0)	0.000*
• Medium	22	44.0 (26.0- 85.0)	
• Serious	15	63.0 (33.0- 85.0)	

**= p<0.05, p= Kruskal-Wallis Test, RDC/TMD: Research Diagnostic Criteria/ Temporomandibular Disorders.*

Table 3: Pain, maximum mouth opening, chewing functionality and dysfunction score in participants with and without bruxism

	TMD with bruxism (n=63)	TMD without bruxism (n=28)	p
NPS (cm) X (SD)	4.87 (1.61)	3.78 (1.19)	0.002*
MMO (mm) X (SD)	35.63 (7.03)	39.89 (6.13)	0.000*
JFSL-20 X (SD)	42.87 (19.02)	21.14 (12.20)	0.000*
FAQ X (SD)	50.23 (16.88)	32.50 (9.57)	0.000*

**= p<0.05, p=Mann-Whitney U test, X:Mean, SD: Standard Deviation, NPS: Numeric Pain Scale, MMO: Maximum Mouth Open, JFLS-20: Jaw Functional Limitation Scale-20, FAQ: Fonseca Anamnestic Questionnaire.*

In Table 3, JFSL-20 values in different diagnostic classifications and severity of TMD were compared. Chewing functionality was significantly more limited in individuals with joint TMD and individuals with severe TMD (p=0.000).

Table 4: The effect of bruxism on TMD severity and chewing functionality

N=91	OR	%95 CI	Wald	p	Model Summary
FAQ ≥50					
Age (years)	0.992	[0.932- 1.056]	0.062	0.803	-2 Log likelihood: 100.142
Gender (female)	0.625	[0.231- 1.839]	0.728	0.394	Nagelkerke R^2: 0.299
Bruxism (no)	16.236	[3.485- 75.651]	12.602	0.000*	Hosmer Lemeshow: 0.574
JFSL >5					
Age (years)	1.028	[0.920- 1.149]	0.241	0.623	-2 Log likelihood: 59.934
Gender (female)	0.450	[0.114- 1.784]	1.290	0.256	Nagelkerke R^2: 0.145
Bruxism (no)	4.364	[1.127- 16.906]	4.548	0.033*	Hosmer Lemeshow: 0.517

**p<0.05, Multivariate logistic regression analysis, OR: Odds Ratio, CI: Confidence Interval, FAQ: Fonseca Anamnestic Questionnaire, JFLS-20: Jaw Functional Limitation Scale-20,*

In Table 4, when age and gender were included, multivariate logistic regression analysis analyzed whether bruxism effectively affected TMD severity and limitation in chewing functionality. TMD severity was defined into two groups: mild and moderate-severe. The probability of having moderate-severe TMD increased statistically significantly 16.236 times (95% CI: 3.485-75.651) with bruxism (p=0.000). Limitation in chewing functionality was significantly increased 4.364 times (95% CI: 1.127- 16.906) in the presence of bruxism (p=0.033). Age and female gender were not statistically significant determinants of TMD severity and limitation in chewing functionality (p>0.05).

Discussion

In our study examining the effectiveness of bruxism on TMD severity and chewing function, pain, TMD severity and chewing function limitation were higher in individuals with TMD accompanied by bruxism.

Trauma, occlusal disorders, emotional stress, deep pain, and parafunctional activities are prominent in the etiology of TMD (20). Bruxism is an oral condition characterized by repetitive jaw muscle activity such as supporting or pushing the mandible and/or clenching or grinding the teeth

known as clenching and teeth grinding, the most common parafunctional activity associated with TMD (2). In epidemiological studies, bruxism is highest between the ages of 20-50, and its prevalence is similar in women and men. Still, bruxism with TMD is four times higher in women than men (3,21). In a study conducted by Magnusson et al. in which 420 individuals were followed for 20 years, it was reported that bruxism and TMD were most commonly seen in the same age range, with a significant correlation between bruxism and TMD (12). In this study, we studied individuals between the ages of 20 (min) and -55 (max), which is expected to be shared in TMD and bruxism, and among individuals with TMD accompanied by bruxism, women were approximately three times more than men. In this context, the study aligns with the literature regarding age and gender.

Pathophysiologically, the definitive detection of bruxism in sleep can only be achieved through polysomnographic records. Still, the use of these records is limited due to the need for more adequately equipped sleep laboratories and high costs (5). Therefore, clinical or self-report approaches are among the most accessible and widely adopted methods as an alternative to diagnosing bruxism (6). A recent study with 1962 participants looked at the prevalence of self-reported bruxism and its connection to TMD; the frequency of self-reported bruxism was 39.6%. According to the study's findings, self-reported bruxism was linked to TMD symptoms and indicators of discomfort, as well as TMD diagnoses (7). In two studies investigating the prevalence of bruxism in individuals diagnosed with TMD, bruxism was found to be approximately 80% and 57%, while it was found to be 37% in healthy individuals (8,9). In this study, 69% of individuals with TMD reported the presence of bruxism, which is consistent with the literature. Although there seems to be uncertainty in the literature as to whether bruxism is a risk factor for TMD as well as a potential cause of masticatory muscle disorders and joint overload or, muscle damage, or both, it has been proposed that bruxism can cause peripheral sensitization, and it has been hypothesized that long-standing myofascial pain may constitute a risk for TMD (10,11). In this context, bruxism, one of the parafunctional activities that play an essential role in the etiology of TMD, can be observed at high rates in individuals with TMD.

A population-based study showed a positive relationship between bruxism and a series of orofacial and temporomandibular joint pain symptoms (13). A study found that experimental and continuous jaw clenching caused acute muscle tenderness in the masticatory muscles, and bruxism led to a positive relationship with jaw pain (6). Another study found that pain-related TMD symptoms and signs were significantly higher in individuals with bruxism than those who did not report bruxism (7). In this study, it was found that the pain level of individuals with bruxism was higher. This expected situation can be explained by non-physiological continuous clenching causing more pain due to fatigue and sensitivity in the masticatory muscles. In addition, as stated in other studies, the hypothesis that myofascial pain formation in individuals with bruxism may be due to lower resistance to fatigue comes to the fore (22).

While the limitation of mouth opening is among the most frequently observed findings in TMD, bruxism is also known to cause limitation in the jaw joint range of motion (1,4). A study found that individuals with bruxism had 30.3% difficulty opening/closing their mouths wide (13). This study found that the range of motion decreased more in individuals with TMD accompanied by bruxism. In the literature, this situation is expressed as tension in bruxism, which starts to restrict functions by damaging the joint and related tissues more after a while. This situation supports the result of this study (23). This may be explained as bruxism, which may further increase the limitation of the TMD in the range of motion with pain in the TMJ and facial region.

Bruxism may cause problems such as tooth wear, jaw joint and face pain, and limitation in jaw movements (23). In a study, 19.7% of individuals with bruxism had difficulty chewing, and 18.4% had pain in chewing (13). This study found chewing functionality decreased more in individuals with TMD accompanied by bruxism. It was also observed that chewing functionality was affected by the TMD diagnostic classification; the most limitation was observed in TMD originating from the joint, and the functionality decreased more in severe TMD. This study observed that chewing functionality was more limited in individuals with TMD accompanied by bruxism; chewing functionality limitation in individuals with TMD increased 4.364 times with bruxism. This shows that tooth wear, TMJ, facial region pain, and limitation in jaw movements with bruxism also negatively affect chewing. Therefore, based on the results of this study, concomitant bruxism affects the limitation of chewing functionality at high rates in individuals with TMD.

Bruxism has been suggested to be a continuous factor for TMD (7-13). According to two recent studies, TMD

symptoms were more common in individuals who clench their teeth while awake (23, 24). Another study discovered that individuals with bruxism had significantly more pain-related TMD symptoms and signs than those who did not report bruxism (7). A study by Leketas et al. (25) showed that bruxism was associated with a 10. 83 times higher risk of TMD. This study observed that the dysfunction scores and TMD severity of individuals with TMD with bruxism were higher; when age and gender were included, the probability of having high-severity TMD increased 16.236 times with bruxism. Considering the study's other findings, this situation can be explained in the direction of increased severity of TMD in individuals with bruxism due to more intense pain in the TMJ region and more decreased range of motion and functionality. The literature shows that pain associated with muscle fatigue in bruxism is a serious risk factor for TMD by increasing peripheral sensitivity (10,11). However, based on the results of the study, it can be said that bruxism is not only a serious risk factor for TMD but also increases the severity of TMD significantly.

The long course of the disease and the variability of symptoms in TMD create a difficult situation for patients, physicians, and therapists. Therefore, it is essential to determine the etiological factor when making a treatment plan for TMD to ensure that recovery occurs in the shortest time (26). At this point, evaluating bruxism, frequently encountered in parafunctional activities that have an essential place in the etiology of TMD, should be critical in effective rehabilitation. This study aimed to investigate the effect of bruxism on TMD severity and chewing functionality in individuals with TMD. As a result, it was observed that pain, TMD severity, and chewing functionality limitation were higher with accompanying bruxism in individuals with TMD who had a high rate of bruxism.

Limitations and Strength

The limitation of the study was that pain assessment was performed only in the TMJ region, and objective assessment methods, including the cervical region, were not used. In addition, although it will not affect the primary effect analysis of our study, the difference in the number of individuals in the analysis comparing individuals with and without bruxism is a situation that may affect the statistics and is among our limitations. On the other hand, the study's strength is that it holistically examines the effect of bruxism, which has a significant role in the etiology of TMD, on TMD severity and chewing functionality.

Recommendations

It is recommended that future studies be conducted with a larger sample size, including evaluation methods, including the cervical region and comparative examination of the effects of sleep and wakefulness bruxism on TMD severity and chewing functionality.

Conclusion

In the study, it was observed that bruxism was honored at a high rate in individuals with TMD, and bruxism accompanying TMD increased pain, TMD severity, and chewing functionality limitation. While it is known that the relationship with TMD, which is an essential problem in bruxism studies and bruxism treatment, should be evaluated, it should be considered that knowing the bruxism and its effects that may accompany TMD, which is very common and increasing in number and severity day by day, in the evaluation or treatment phase is essential in terms of growing rehabilitation success.

Declarations

Funding

The author reports no financial support**.**

Conflict of Interest

The author declares that she has no conflict of interest.

Ethics Approval

This cross-sectional study was approved by the Ethics Committee. (Decision no: 2023-54). All study procedures comply with the provisions of the World Medical Association Declaration of Helsinki. Written informed consent was obtained from all participants.

Availability of Data and Material

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Clinical Trials Number

The study is registered in the WHO International Clinical Trials Registry Platform: NCT06053723.

Acknowledgments

The author thanks the participants in this study.

Author Contributions

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