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RESEARCH ARTICLE

# Relationship between depression levels and sexual activity in patients with temporomandibular joint disorder

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## ABSTRACT

**Aim:** This study aimed to examine the relationship between temporomandibular joint (TMJ) problems, sexual disorders, and depression in male and female individuals.

**Materials and Methods:** A total of 228 participants (116 females and 112 males) participated in the study. The level of temporomandibular joint disorder (TMD), severity of depression, and sexual function were evaluated using the Fonseca Anamnestic Index (FAI), the Beck Depression Inventory (BDI), the Female Sexual Function Index (FSFI) and the International Index of Erectile Function (IIEF), respectively.

**Results:** The results revealed a statistically significant difference between the sexes, with severe TMD scores being significantly higher in females than males ($p<0.05$). The BDI scores for females (13.25±9.51) were observed to be higher than those for males (10.99±8.00). However, the difference did not reach statistical significance ($p=0.105$). We also observed a negative correlation between erectile function scores (IIEF) and both FAI ($r=-0.102$) and BDI ($r=-0.312$) in males. Similarly, a negative correlation was observed between sexual function values (SFV; IIEF, FSFI) and both FAI ($r=-0.122$) and BDI ($r=-0.019$) in females.

**Conclusions:** The results indicated a significant correlation between severe TMD and depression in females and males. Sexual dysfunction may also be associated with TMD and depression.

**Keywords:** depression, sexual dysfunction, survey, temporomandibular joint disorder

## INTRODUCTION

Temporomandibular joint dysfunction (TMD), a disorder characterized by non-dental pain affecting masticatory muscles and the temporomandibular joint (TMJ), may manifest in a number of ways (1). The development of TMD is associated with a number of factors, including parafunctional habits such as teeth grinding or clenching, as well as stress, anxiety, traumatic injuries to the head and neck, occlusal

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interferences, and central nervous system disorders. However, no single etiological factor has been identified as fully accounting for the underlying causes of TMD (2).

Psychological issues, particularly those pertaining to emotional distress such as depression, are pivotal in the etiology of TMD (3). Depression is a set of physiological and psychological disorders characterized by a loss of the will to live, accompanied by pessimism about the future, regret, guilt, and suicidal ideation (4). The presence of these symptoms is not necessarily indicative of depression; rather, they stem from the challenges posed by recurring depression, its duration, and its impact on daily life (5). Individuals suffering from myofascial pain and TMD tend to exhibit depressive symptoms, diminished performance in daily activities, and a reduction in the quality of life. Psychological disorders such as depression have an impact on the central nervous system that, in turn, reduce patients' pain threshold. Consequently, TMD is commonly associated with orofacial pain in patients with depression. This interdependence can contribute to a vicious cycle in TMD patients, which may result in increased functional limitations, such as those associated with smiling, speaking, or yawning (6). Therefore, TMD patients with depression or other psychological problems, as well as with central nervous system-related pain sensitivity, are recommended to undergo multidisciplinary treatment (7).

Sexual dysfunction (SD) is a complicated and multi-dimensional phenomenon that comprises both physiological and psychological factors (8). A number of risk factors, such as increasing age, bad-controlled diabetes mellitus, hyperlipidaemia, urinary tract symptoms, hypertension, psychological stress, and low physical activity may contribute to the etiology of this disorder (9). Despite the differences in female vs. male sexual physiology, SD in both sexes leads to alterations in the venous system of the genital area, primarily affecting endothelial tissues. Consequently, this may lead to issues such as inadequate wetting, delayed sexual arousal, diminished clitoral and vaginal sensation, as well as an inability to reach orgasm in females or to achieve or maintain erection in males (10).

Survey studies are a cost-effective method to evaluate the applicability of epidemiological research and patient follow-up. Moreover, as patients respond to survey questions without undue influence from the clinician, they are less susceptible to the impact of external factors, which helps reduce overall variability in the results (11). The Fonseca Anamnestic Index (FAI), which allows for the classification of TMD severity and the assessment of bruxism, is an effective method to gather epidemiological data. The FAI can also be used to determine the presence of TMJ pain, headaches, bruxism, mandibular movement limitations, malocclusions, and emotional stress (11,12).

In the literature, SD was reported to be related to depression and anxiety (8,13). However, physiopathology of this relationship remains poorly understood. Specifically, it remains unclear whether depression causes SD or, alternatively, whether SD is a common cause of emotional disorder. Similarly, there is no conclusive evidence demonstrating whether depression and anxiety, which play a part in the primary etiology of TMD, exert an influence on the development of TMD in a manner similar to that observed in SD. To the best of our knowledge, none of the previous studies analyzed the relationship between SD, TMD, and depression. To fill this gap in the literature, the present study evaluates the relationship between SD and depression levels of female and male patients with TMD.

## METHODS

The sample size was calculated using G*Power Software version 3.1.9.2 with an alpha error probability of 0.05 and a power of 95% (14). The results of this analysis indicated that a sample of 86 would be necessary; however, to achieve more reliable results, we recruited a total of 228 participants (116 males and 112 females). The participants were recruited among the patients who presented at the Department of Orthodontics, Faculty of Dentistry, Ordu University, between 29 January 2022 and 22 March 2022, as well as their first-degree relatives who were willing to take part in the study. This study was approved by the Clinical Research Ethics Committee of Ordu University (Number: 2022/14). All participants signed informed consent forms.

The self-report survey was conducted after routine intra-oral and extra-oral examinations. Demographic data collected included age, gender, profession, monthly income, marital status, number of children, and harmful habits.

Inclusion criteria were as follows: (1) systematically healthy individuals; (2) age between 18 and 60 years old; (3) regular sexual intercourse in the last 6 months; and (4) no history of orthodontic or bruxism treatment. From the sample, we excluded (1) individuals with total edentulism; (2) those who had no sexual intercourse in the last 6 months; (3) pregnant or breastfeeding females; and (4) individuals receiving psychological treatment.

All eligible participants filled in the 21-item Beck Depression Inventory (BDI) and the 10-item Fonseca Anamnestic Index (FAI). Additionally, female participants completed the 19-item Female Sexual Function Inventory (FSFI), while male respondents filled in the 5-item International Index of Erectile Function (IIEF) form.

### TMD assessment

The 10-item FAI questionnaire was administered to the participants to evaluate factors such as parafunctional habits, chewing, movement restrictions, sounds coming from the TMJ, and dizziness. Responses were scored as follows: "Yes" (10 points), "Sometimes" (5 points), or "No" (0 points) (11). The scores for all questions were then summed up to obtain the total score. Severity of the TMD was evaluated according to a scoring system where 0-15 points meant the absence of signs and symptoms of TMD, 20-45 points indicated mild TMD, 50-65 indicated moderate TMD, and 70-100 points were assumed to indicate severe TMD (12).

### Assessment of sexual dysfunction

Sexual dysfunction among the female participants was evaluated using the Turkish version of the FSFI, originally developed by Rosen (15) and subsequently translated into Turkish by Öksüz and Malhan (16). This translation has been deemed reliable and appropriate for the purposes of this study.

The FSFI is a validated 19-item self-report questionnaire designed to evaluate sexual function based on six factors: desire, arousal, lubrication, orgasm, satisfaction, and pain. The FSFI was previously found to have high internal consistency and re-testing reliability and is extensively used to identify females with or without sexual dysfunction. Participants rated the FSFI items using a 6-point Likert scale, with each response assigned a value between 0 and 5. The total score ranged from a minimum of 0 to a maximum of 93.

Sexual dysfunction among the male participants was evaluated using the IIEF-5 form, a variant of the International Index of Erectile Function (IIEF) developed by Rosen (17). More specifically, we used the 5-item Turkish variant of the index developed by Deveci et al. (18) as this version has been proven to be valid and reliable.

The five items on the IIEF were rated using five options. The total index score ranged from a minimum of 5 to a maximum of 25 points.

### Assessment of depression levels

The BDI is a 21-item self-report index that assesses the level of depression in individuals receiving and not receiving psychiatric treatment. Responses to items on the scale are scored between 0 and 3 points. Total BDI scores range from 0 to 63, with scores between 10 and 16 indicating mild depression, 17 to 21 indicating moderate depression, and 30 to 63 indicating severe depression (19,20). Hisli reported that the Turkish version of the scale is reliable and valid (21).

### Statistical analyses

Statistical analyses were conducted using SPSS for Windows (version 20.0; SPSS Inc., Chicago, Illinois). The Kolmogorov-Smirnov test was employed to ascertain whether the data exhibited a normal distribution. The independent t-test was used for parameters showing a normal distribution; otherwise, the Mann-Whitney U test was used. Correlation tests were conducted to evaluate the impact of depression and sexual dysfunction on bruxism. The statistical significance was set at a p value of $<0.05$.

## RESULTS

The mean age of male participants (35.76±8.45 years) was very close to that of the female participants (35.35±7.80 years). Table 1 illustrates gender-based distribution of the FAI scores. The results revealed that the probability of severe TMD was significantly higher in females than in males ($p<0.05$). Similarly, gender-based comparison of the individuals with respect to the absence of TMD problems revealed that the number of males (n=49) was higher than that of females (n=31).

Furthermore, a comparison of BDI scores revealed that the mean BDI score for females (13.25±9.51) was higher than that for males (10.99±8.00). However, this difference did not reach statistical significance ($p=0.105$; see Table 2).

In both groups, mild depression was identified with BDI scores between 10 and 16 points. The results of Kendall's tau-b correlation analysis revealed a positive correlation between FAI and BDI scores in male patients. The incidence of TMD increased in male patients with higher depression levels. However, no similar trend was observed in female patients (Table 3).

In addition, as shown in Table 4, the IIEF scores of males negatively correlated with both FAI (-0.102) and BDI (-0.312**) scores. Male participants with higher TMD severity scored lower on sexual function indexes (SFV; IIEF, FSFI). Similarly, a negative correlation was identified between SFV, FAI and BDI scores of female patients (Table 4).

Next, a comparison of FAI scores and SFV revealed a reduction in SFV scores among both male and female patients with severe TMD. However, this decrease was not statistically significant. The lowest IIEF score (19.00±8.49) was observed in males with severe TMD (maximum IIEF: 25.00). Similarly, females with severe TMD exhibited the lowest FSFI scores (44.38±17.30), which were less than half of the maximum score of 95.00 (Table 5).

**Table 1.** Distribution of TMD Scores by Gender

| | No TMD | Mild TMD | Moderate TMD | Severe TMD | P-value* |
|---|---|---|---|---|---|
| Male | 49 | 44 | 21 | 2 | 0.022 |
| Female | 31 | 42 | 31 | 8 | |

*Results of Fischer's Exact test. TMD: Temporomandibular joint dysfunction.

**Table 2.** Comparison of BDI Scores by Gender

| | Male | Female | P-value* |
|---|---|---|---|
| | Mean (SD) | Mean (SD) | |
| BDI Scores | 10.99 (8.00) | 13.25 (9.51) | 0.105 |

*Mann-Whitney U test. SD: Standard Deviation; BDI: Beck Depression Inventory.

**Table 3.** Comparison of Beck Depression Inventory (BDI) and TMD Scores by Genders Using Kendal Tau-b Correlation

| | BDI Score | |
|---|---|---|
| | Male | Female |
| Fonseca Anamnestic Index Score | 0.224* | 0.096 |

*p<0.01. BDI: Beck Depression Inventory.

**Table 4.** Comparison of Erectile Function (IIEF) and Female Sexual Function (FSFI) Scores with TMD and BDI Scores

| | Fonseca Anamnestic Index Scores [α] | BDI Score [β] |
|---|---|---|
| Female Sexual Function scores | -0.122 | -0.019 |
| Erectile Function scores | -0.102 | -0.312** |

[α] Kendall's tau-b correlation; [β] Spearman's rho correlation; *p<0.01. BDI: Beck Depression Inventory; IIEF: Comparison of Erectile Function; FSFI: Female Sexual Function Index; TMD: Temporomandibular joint disorder.

Table 6 shows the results of the comparison between BDI and sexual function scores by gender. A statistically significant difference was observed between BDI and IIEF scores ($p<0.05$). Likewise, in females, the FSFI scores declined as the severity of depression increased; however, this difference did not show statistical significance ($p>0.05$).

**Table 5.** Comparison of TMD Scores and Male Erectile Function / Female Sexual Function Scores by Gender

| | Male Erectile Function scores | Female Sexual Function scores |
|---|---|---|
| No TMD | 21.63 (3.70) | 50.13 (12.39) |
| Mild TMD | 20.95 (3.67) | 47.86 (13.43) |
| Moderate TMD | 21.00 (3.00) | 45.10 (17.77) |
| Severe TMD | 19.00 (8.49) | 44.38 (17.30) |
| P-value* | 0.606 | 0.443 |

*Kruskal-Wallis H test. TMD: Temporomandibular joint disorder.

**Table 6.** Comparison of BDI Scores and Male Erectile Function / Female Sexual Function Scores by Gender

| | Male Erectile Function scores | Female Sexual Function scores |
|---|---|---|
| Minimal Depression | 21.96 (3.31) | 47.84 (15.32) |
| Mild Depression | 21.30 (3.21) | 46.89 (14.30) |
| Moderate Depression | 20.14 (4.38) | 46.54 (17.25) |
| Severe Depression | 17.00 (3.74) | 44.75 (16.80) |
| P-value* | **0.025** | 0.920 |

*Kruskal-Wallis H test. BDI: Beck Depression Inventory.

## DISCUSSION

The results of the present study showed a negative correlation between SFV and BDI scores. Similarly, both male and female participants exhibited a negative correlation between their SFV and FAI scores. A statistically significant relationship was identified between SFV and BDI scores exclusively among male participants. Likewise, a positive correlation was identified between FAI and BDI scores, which was statistically significant only in males. As males and females developed TMD problems, there was a concomitant increase in their respective depression levels. Yet, the association between depression and TMD problems reached statistical significance only in males.

Previous research have documented those symptoms of depression are more common in adult females. Compared to their male counterparts, females are more likely to experience psychiatric disorders, such as stress-related depression, throughout their lifetimes. In contrast, such as violence were reported to be more prevalent in males (22). Our analysis of the distribution of depression scores by gender revealed that females (13.25±9.51) had higher BDI values than males (10.99±8.00). Furthermore, previous research have documented that anxiety and depression reduce the pain threshold or alter pain perception in affected individuals (23), leading to symptoms such as pain in the TMJ and orofacial muscles. In addition, available evidence suggests that TMD patients exhibit similar psychological profiles and dysfunctions to those of individuals with chronic musculoskeletal pain problems (24). Our findings are consistent with those reported in a recent study (25). On the correlation between depression, stress and TMD. The authors found that 56% of TMD patients exhibited varying degrees of depressive symptoms, with 66.6% of this group being women. No statistically significant difference in the prevalence of elevated depressive symptoms was observed between genders. In our study, depression levels were higher in females than in males, and TMD severity increased with rising levels of depression.

Overall, TMD, SD, and depression can mutually reinforce one another in a complex manner. Specifically, depression may precipitate pain and muscle tension, thereby exacerbating TMD (26). Additionally, depression may impact libido and cause SD. Reduced libido may be a symptom of major depressive disorder. It is also a recognized consequence of depression, which can exacerbate both conditions (27). Individuals experiencing chronic pain related to TMD may subsequently develop depression. TMD can also impede sexual activity, thereby leading to the development of SD. Sexual dysfunction can adversely impact self-esteem and emotional well-being-which, in turn, may lead to or exacerbate depression. Moreover, stress, anxiety and depression associated with sexual dysfunction may also cause increased muscle tension, which could possibly exacerbate TMD symptoms (28). Laurent et al. (29) proposed that the relationship among sexual dysfunction, anxiety, and depressive disorders is multifaceted, complex, and often develops concurrently. Accordingly, and considering the pivotal role of psychological factors such as anxiety and depression in TMD, in this study, we aimed to elucidate the correlation between TMD and sexual dysfunctions. The findings revealed a negative correlation between TMD severity and SD values in both male and female

subjects, with correlation coefficients of -0.102 and -0.122, respectively. However, it is crucial to acknowledge that all three conditions can be affected by a broad range of factors, resulting in a complex network of interactions. This underscores the need for a holistic approach that addresses physical pain, psychological well-being, and sexual health in order to effectively manage these interconnected issues.

Previous epidemiological studies confirmed that psychiatric disorders are risk factors for sexual desire and arousal (30). Furthermore, recent studies reported strong associations between anxiety and depression, on one hand, and orgasm difficulties and sexual pain, on the other (13,31). Similarly, in a self-assessment study, Liu et al. (32) found that 61.9% of patients with major depressive disorder experienced sexual dysfunction. Of note, this prevalence was significantly higher in females (75.3%) compared to males (38.4%). In another relevant investigation, Galati et al. (33) found a significant association between SD and depressive symptoms in married couples, as well as a positive correlation between depressive symptoms and marital dissatisfaction. In our study, we observed a negative correlation between BDI and SD scores (male r=-0.312, female r=-0.019). The patients with advanced depression symptoms exhibited lower SD values, in both male (17.00±3.74) and female (44.75±16.80) groups. These findings are broadly consistent with previous research (34).

Furthermore, an increased level of muscle activity, the clenching and grinding of teeth, traumatic injuries to the masticatory system and postoperative complications following dental treatment are all factors that contribute to the etiology of TMJ problems (35). Over time, parafunctional habits have been reported to cause a number of adverse effects, such as pain in the masticatory muscles and neck, headaches, pain and loss of function in the TMJ, limitation of mandibular movement, decreased pain threshold in the orofacial and surrounding muscles, depression, anxiety and increased stress (36). Such physiological and psychological alterations prompt the adrenal cortex to secrete cortisol, a stress hormone that can lead to infertility, particularly in females. Moreover, elevated cortisol levels in the bloodstream can diminish libido and reproductive function by reducing dehydroepiandrosterone, a steroid hormone secreted by the adrenal glands (37,38). In the light of these considerations, a potential correlation between TMD, depression, and SD merits discussion. The results of the present study revealed that these three issues are interrelated, although the strength of the association between them was not statistically significant in all comparisons. This outcome may be attributed to physiological differences between males and females, as well as the relatively small sample size.

It is insufficient to rely on FAI alone to evaluate the severity of TMD. Considering that the clinical and radiological evaluation of TMD is of undeniable importance in its classification, its absence constitutes one of the limitations of the present study. Moreover, through diverse diagnostic techniques, it is possible to explore how parafunctional habits and other TMD etiologies affect the functionality of multiple physiological systems, including brain activity, muscle activity, heart function, and breathing. Therefore, it is thought that TMD is not caused exclusively by mechanical factors such as occlusal incompatibilities or psychological diseases such as stress, anxiety or depression or a combination of the two. Rather, it is now understood to be a condition with multiple etiologies (24,39).

Another limitation of the present study is a potential response bias in the survey data, which may have compromised the reliability of our data set. While our results enabled us to observe the interaction between males and females with varying degrees of TMD, depression, and SD, our findings do not provide sufficient evidence to establish a causality between these parameters. Consequently, it is not possible to determine whether these disorders have causality. However, based on the findings of the present study and previous research, it is reasonable to conclude that individuals with varying degrees of depression are more susceptible to TMD and sexual dysfunction. Nevertheless, further research is required to confirm this correlation.

## CONCLUSIONS

The results of the present study indicate that elevated depressive symptoms are associated with an increased prevalence of TMD in both males and females, and that there is a correlation between sexual dysfunction and depression. In addition, we also observed that male gender is a strong predictor of the prevalence of TMD, depression, and sexual dysfunction.

Furthermore, our results suggest that as the severity of TMD increases, so does the prevalence of sexual dysfunction. However, when psychological factors are taken into account, it is difficult to determine whether TMD contributes directly or indirectly to this phenomenon.

### Ethical approval

This study has been approved by the Clinical Research Ethics Committee of Ordu University (approval date 28.01.2022, number 2022/14). Written informed consent was obtained from the participants.

### Author contribution

Surgical and Medical Practices: NB, FA; Concept: SKB; Design: RT; Data Collection or Processing: NB, FA; Analysis or Interpretation: SKB; Literature Search: RT; Writing: RT. All authors reviewed the results and approved the final version of the article.

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### Conflict of interest

The authors declare that there is no conflict of interest.

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