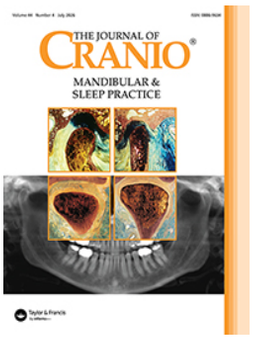

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Prevalence of self-reported temporomandibular disorder symptoms, bruxism-related behaviors, and non-functional oral habits among dentistry students: A cross-sectional study

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RESEARCH ARTICLE

Prevalence of self-reported temporomandibular disorder symptoms, bruxism-related behaviors, and non-functional oral habits among dentistry students: A cross-sectional study

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ABSTRACT

Objective: This study aimed to determine the prevalence of self-reported temporomandibular disorder (TMD) symptoms, bruxism-related behaviors, and non-functional oral habits among dentistry students, and to examine their associations with demographic and behavioral factors.

Methods: A cross-sectional survey was conducted among 323 dentistry students at Istanbul Kent University. Data were collected using the Fonseca Anamnestic Index to assess TMD-related symptom burden and the Oral Behavior Checklist to evaluate non-functional oral behaviors. Descriptive statistics, chi-square tests, and multivariate logistic regression analyses were performed.

Results: Female students had significantly higher odds of reporting TMD-related symptoms than males (OR = 2.57, 95% CI: 1.50–4.38, p = 0.001). High parafunctional habit levels were independently associated with TMD-related symptoms (OR = 3.57, 95% CI: 2.08–6.12, p < 0.001).

Conclusion: TMD symptoms and parafunctional behaviors were highly prevalent, highlighting the need for early screening and behavioral awareness in dental education programs, particularly within a high-risk student population exposed to clinical demands.

KEYWORDS

Temporomandibular disorders; bruxism; oral parafunctional habits; dental students; fonseca anamnestic index

Introduction

The masticatory system consists of the muscles around the head and neck, chewing muscles, ligaments, temporomandibular joint (TMJ), teeth, cheeks, lips, and salivary glands. This system is constantly at work not only during chewing but also during swallowing, breathing, and speaking [1]. Masticatory system activities are commonly divided into functional activities, such as chewing, speaking, and swallowing, and non-functional oral behaviors, which may include nail biting, lip or cheek biting, gum chewing, and other repetitive oral habits. In line with contemporary literature, bruxism is no longer conceptualized simply as a parafunctional activity, but rather as a distinct behavioral phenomenon with specific phenotypes and measurement frameworks [2,3].

Temporomandibular disorders (TMD) encompass a group of disorders involving the temporomandibular joint, masticatory muscles, and the anatomical structures associated with these components [4].

Bruxism is currently defined as a behavioral construct rather than a disease entity, characterized by repetitive jaw muscle activity that may include teeth grinding, clenching, or mandibular bracing and thrusting. According to the international consensus, bruxism is not inherently pathological and does not necessarily imply the presence of tissue damage or clinical consequences, but rather represents a motor behavior that may act as a risk or protective factor depending on individual susceptibility and contextual factors [2]. Idiopathic bruxism occurs without any specific cause, while iatrogenic bruxism is associated with neurological and psychiatric diseases, medications, and sleep disorders [5]. Contemporary models distinguish between sleep bruxism and awake bruxism as separate behavioral phenotypes, each characterized by distinct neurophysiological mechanisms, contextual triggers, and assessment strategies. Sleep bruxism is primarily evaluated using electromyographic (EMG) or polysomnographic approaches, whereas awake bruxism is increasingly assessed using ecological momentary assessment (EMA) techniques, which capture real-time behavioral reports in naturalistic settings [6,7].

The prevalence of bruxism has been reported to be around 14–20% in children, 13% in young adults aged 18–29, 9% in adults, and 3% in the age group 60 and older [8]. The prevalence of bruxism generally decreases with age; it is more common in children and young

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adults. The prevalence of bruxism in the general population is reported to range from 8% to 31%; this rate is generally around 12% for sleep bruxism and can be as high as 20% for awake bruxism [9]. Regarding gender, awake bruxism appears to be more common in women, but no significant gender difference can be identified for sleep bruxism [10]. Geographic and cultural differences also influence prevalence. For example, studies conducted in some European countries have reported higher prevalence rates compared to studies in North America [11].

Although the etiology of bruxism is widely recognized as multifactorial, recent literature emphasizes that bruxism should not be interpreted through a linear cause – effect or disease-centered model. Instead, it is increasingly conceptualized as a complex biopsychosocial behavior influenced by neurophysiological regulation, psychological traits, stress sensitivity, sleep mechanisms, and contextual and environmental factors. Importantly, the presence of bruxism does not necessarily imply adverse clinical outcomes, and its role as a potential risk factor, adaptive response, or neutral behavior remains an area of ongoing investigation [12]. Furthermore, the development of bruxism-related behaviors and non-functional oral habits has been associated with genetic predisposition, adverse life experiences, psychosocial stress, substance use (e.g., smoking and alcohol), pharmacological agents, and systemic or neurological conditions. Experimental studies have shown that the electrical activity of the masticatory muscles increases, particularly in situations of increased psychological stress. Several studies have shown an increased incidence of bruxism, particularly in students under intense academic stress [10]. Dentistry students are frequently exposed to sustained academic and clinical demands, which may interact with individual differences in stress sensitivity, a construct that has been identified as a pivotal factor in bruxism-related behaviors. Early conceptual work suggested that individuals with heightened stress sensitivity may exhibit increased jaw muscle activity as part of broader psychophysiological coping responses [13]. This perspective provides a theoretical basis for interpreting bruxism-related behaviors not solely as harmful habits, but also as context-dependent motor expressions influenced by emotional regulation and environmental pressures.

Early diagnosis of TMD and bruxism is crucial for preventing future, advanced problems. In advanced cases, treatment becomes more difficult and can lead to irreversible joint problems [14]. The assessment of temporomandibular disorders has evolved toward standardized, evidence-based diagnostic frameworks. While the Fonseca Anamnestic Index (FAI) is widely used as a screening and epidemiological tool due to its feasibility and low cost, it does not replace clinical diagnostic systems such as the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) [15]. In accordance with recommendations by the International Association for Dental Research, FAI results in the present study are interpreted as indicators of symptom burden and risk profiling rather than as definitive clinical diagnoses [16]. Its ease of use and low cost are the most important reasons why this instrument is commonly selected for large-scale screening and epidemiological research. This index consists of 10 questions. The questionnaire assesses the presence of pain in the TMJ, head, back, and chewing regions, parafunctional habits, limited movement, clicking, malocclusion, and emotional stress [17].

Parafunctional habits (teeth grinding, nail, lip, cheek, pencil biting, gum chewing, and clenching teeth day and night) also play an important role in the pathogenesis of TMD [18]. Studies have reported a generally significant relationship between parafunctional habits and TMD [19]. The 21-item Oral Behavior Checklist (OBC) was used to assess the frequency of non-functional oral behaviors. In line with recent conceptual frameworks, the OBC is considered part of the Standardized Tool for the Assessment of Bruxism (STAB), serving as a self-report measure that captures behavioral tendencies rather than providing a definitive diagnosis of bruxism. Accordingly, OBC findings in the present study are interpreted as indicators of behavioral exposure and habit frequency, rather than as direct markers of bruxism presence or severity [6].

This study aims to explore the prevalence and distribution of bruxism-related behaviors and non-functional oral habits within a population of dentistry students. This group represents a highly specific and non-representative subpopulation, characterized by increased academic pressure, heightened health awareness, and potential reporting bias. Therefore, findings are interpreted within an educational and behavioral context rather than as estimates generalizable to the broader population, in line with similar student-based investigations [20].

Materials and methods

This cross-sectional study was conducted at the Department of Restorative Dentistry at the Istanbul Kent University, Faculty of Dentistry and included 323 students (209 female, 114 male). Ethical approval for this study was obtained from the Institutional Ethics Committee of Istanbul Kent University (Approval No: 2025–10). The primary aim of the study was to

investigate the distribution of TMD-related symptoms and their associations with bruxism-related behaviors and non-functional oral habits among dental students. All students participated voluntarily and were informed about the study's objectives, risks, and benefits.

The inclusion criteria were being a dental student and providing voluntary informed consent. Exclusion criteria included incomplete or incorrect survey responses and the presence of significant medical conditions other than TMD, such as severe neurological disorders or a history of joint surgery.

Data were collected via an online survey titled "Evaluation of Temporomandibular Joint Disorders and Oral Habits among Dental Students," developed by the researchers and administered through Google Forms. The survey consisted of three main sections: Demographic Information (gender, age, and academic year); TMD (difficulty with jaw movements, headache, neck pain, earache, and chewing fatigue); and Oral Habits (teeth clenching/grinding teeth, jaw muscle pain, tongue and lip habits, gum chewing, and unilateral chewing). Participant anonymity was maintained, and responses were kept confidential.

To determine TMD severity, the Turkish version of Fonseca's 10-item Anamnestic Index was used (Table 1). Participants responded to each question with "yes" (10 points), "sometimes" (5 points), or "no" (0 points). Total scores were categorized as follows: 0–15, no TMD; 20–40, mild TMD; 45–65, moderate TMD; and 70–100, severe TMD. Additionally, the 21-item Oral Behavior Checklist (OBC) was used to assess the frequency and distribution of non-functional oral behaviors (Table 2). Items were scored according to frequency: 0, none; 1, a few times; 2, sometimes; 3, most of the time; and 4, always. Total OBC scores ranged from 0 to 84 and were categorized as follows: 0, no parafunctional habits; 1–24, low parafunctional habits; and 25–84, high parafunctional habits.

Table 1. Fonseca Anamnestic Index.

Do you have difficulty opening your mouth?
Do you have difficulty shifting your lower jaw from right to left?
Do you experience muscle fatigue/pain while chewing?
Do you have frequent headaches?
Do you have neck pain or stiff neck?
Do you have ear pain or temporomandibular joint pain?
Have you ever heard a clicking sound from TMJ while chewing or opening your mouth?
Do you have a habit of clenching or grinding your teeth?
Do you feel that your teeth don't close properly?
Do you feel tensioned (nervous)?

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 30.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies (n) and percentages (%). Group comparisons were conducted using the chi-square test.

Table 2. OBC survey questions.

Activities During Sleep	None of the time	<1 night/ month	1–3 nights/ month	1–3 nights/ week	4–7 nights/ week
Do you clench or grind your teeth when asleep?					
Do you apply pressure to your jaw when asleep?					
Activities During Waking Hours	**Never**	**Several times**	**Sometimes**	**Most of the time**	**Always**
Do you grind your teeth during waking hours?					
Do you clench your teeth during waking hours?					
Do you let your teeth contact together other than eating?					
Do you experience pain or tension in your jaw muscles without clenching?					
Do you hold your jaw front or to the side during the day?					
Do you push your tongue against your teeth during the day?					
Do you keep your tongue between your teeth during the day?					
Do you bite or chew your tongue during the day?					
Do you keep your lips or cheeks closed continuously during the day?					
Do you hold objects (pens, nail bits) between your teeth during the day?					
Do you chew gum?					
Do you use a mouth-played instrument?					
Do you support your jaw with your hand when lying down or resting?					
Do you chew on one side while eating?					
Do you eat something between main courses?					
Do you talk all the time? (customer service representative, etc.)					
Do you sing?					
Do you yawn?					
Do you talk on your phone while holding it between your head and shoulder?					

Multivariate logistic regression analysis (enter method) was performed to identify factors associated with self-reported temporomandibular disorder symptoms and high parafunctional habit (PH) levels. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Model fit was assessed using the Hosmer – Lemeshow goodness-of-fit test. A p-value of <0.05 was considered statistically significant.

Results

A total of 323 students participated in the study, comprising 64.7% ($n = 209$) female and 35.3% ($n = 114$) male participants. The majority of the study population (92.9%, $n = 300$) was in the 18–25 age group, followed by those aged > 25 years (6.5%, $n = 21$) and <18 years (0.6%, $n = 2$). Based on their academic years, 13% pi ($n = 42$) of first-year students, 12.1% ($n = 39$) of second-year students, 27.9% ($n = 90$) of third-year students, 13% ($n = 42$) of fourth-year students, and 34.1% ($n = 110$) of fifth-year students participated.

Evaluation of Fonseca Anamnestic Index

The responses to the Fonseca Anamnestic Index (FAI) revealed significant clinical symptoms among the students (Tables 3 and 4). The most frequently reported symptoms were:

-Feeling tense and nervous: 38.4% “yes” and 34.4% “sometimes”

-Neck pain or stiff neck: 35% “yes” and 26.3% “sometimes”

-Teeth clenching or grinding: 34.1% “yes” and 24.5% “sometimes”

-TMJ clicking sounds: 30.7% “yes” and 22.3% “sometimes”

Conversely, difficulty in shifting the lower jaw was the least reported symptom, with 84.5% of participants answering “no”.

Severity of temporomandibular disorders (TMD)

According to the FAI scoring, TMD severity was significantly associated with gender. Severe TMD was observed in 22 female students compared to only 4 male students,

Table 3. Categorical and percentage values of participants’ responses to Fonseca Anamnestic Index.

	YES	NO	SOMETIMES
Do you have difficulty opening your mouth?	4.3%	81.7%	13.9%
	n = 14	n = 264	n = 45
Do you have difficulty shifting your lower jaw from right to left?	3.7%	84.5%	11.8%
	n = 12	n = 273	n = 38
Do you experience muscle fatigue/pain while chewing?	17%	55.4%	27.6%
	n = 55	n = 179	n = 89
Do you have frequent headaches?	24.8%	50.5%	24.8%
	n = 80	n = 163	n = 80
Do you have neck pain or stiff neck?	35%	38.7%	26.3%
	n = 113	n = 125	n = 85
Do you have ear pain or temporomandibular joint pain?	18%	66.3%	15.8%
	n = 58	n = 214	n = 51
Have you ever heard a clicking sound from TMJ while chewing or opening your mouth?	30.7%	47.1%	22.3%
	n = 99	n = 152	n = 72
Do you have a habit of clenching or grinding your teeth?	34.1%	41.5%	24.5%
	n = 110	n = 134	n = 79
Do you feel that your teeth don’t close properly?	21.1%	64.1%	14.9%
	n = 68	n = 207	n = 48
Do you feel tensioned (nervous)?	38.4%	27.2%	34.4%
	n = 124	n = 88	n = 111

Table 4. Evaluation of Fonseca Anamnestic Index results in terms of TMD after scoring.

		NO-TMD (n)	MILD-TMD (n)	MODERATE-TMD (n)	SEVERE-TMD (n)	p-value
GENDER	Female	41	86	60	22	
	Male	46	42	22	4	$p < .001$
AGE	<18	0	2	0	0	
	18–25	76	120	78	26	0.081
	>25	11	6	4	0	
CLASS	1st Grade	7	21	12	2	
	2nd Grade	12	15	10	2	
	3rd Grade	31	32	19	8	0.262
	4th Grade	5	16	16	5	
	5th Grade	32	44	25	9	

and the overall prevalence of self-reported TMD symptoms was significantly higher in women ($p < .001$).

While the highest frequency of TMD symptoms was observed in the 18–25 age group, no statistically significant relationship was found between age and TMD severity ($p = .081$). Similarly, although fifth-grade students showed the highest rate of TMD, academic grade level did not have a statistically significant effect on the prevalence or severity of the disorder ($p = .262$).

Oral parafunctional habits (Oral Behavior Checklist)

The categorical and percentage values of the participants' answers to the OBC survey questions are shown in Table 5, and the evaluation of the OBC survey results after scoring in terms of Parafunctional Habits is shown in Table 6.

Evaluation of the Oral Behavior Checklist (OBC) results indicated a high prevalence of various parafunctional habits among participants:

- During Sleep: 10.5% of students reported clenching or grinding their teeth 4–7 nights per week.
- Waking Hours: Common habits included keeping lips or cheeks closed continuously (38.1% most of the time), eating between main courses (33.4% most of the time), and letting teeth contact together other than eating (20.4% most of the time).

Table 5. Categorical and percentage values of participants' responses to OBC survey questions.

QUESTIONS	4–7 NIGHTS/ WEEK	1–3 NIGHTS/ WEEK	1–3 NIGHTS/ WEEK	<1 NIGHTS/ WEEK	NONE OF THE TIME
Do you clench or grind your teeth when asleep?	10.5% n = 34	15.5% n = 50	22.3% n = 72	18% n = 58	33.7% n = 109
Do you apply pressure to your jaw when asleep?	8.7% n = 28	14.6% n = 47	23.2% n = 75	15.2% n = 49	38.4% n = 124
	ALWAYS	MOST OF THE TIME	SOMETIMES	SEVERAL TIMES	NEVER
Do you grind your teeth during waking hours?	3.1% n = 10	3.1% n = 10	13% n = 42	18% n = 58	62.8% n = 203
Do you clench your teeth during waking hours?	2.5% n = 8	9% n = 29	31% n = 100	22.3% n = 72	35.3% n = 114
Do you let your teeth contact together other than eating?	8.4% n = 27	20.4% n = 66	44.3% n = 143	15.5% n = 50	11.5% n = 37
Do you experience pain or tension in your jaw muscles without clenching?	1.9% n = 6	7.4% n = 24	35% n = 113	21.4% n = 69	34.4% n = 111
Do you hold your jaw front or to the side during the day?	0.6% n = 2	3.4% n = 11	20.7% n = 67	14.2% n = 46	61% n = 197
Do you push your tongue against your teeth during the day?	3.1% n =10	8% n =26	28.8% n =93	19.5% n =63	40.6% n =131
Do you keep your tongue between your teeth during the day?	2.8% n = 9	7.1% n = 23	25.4% n = 84	14.2% n = 46	50.5% n = 163
Do you bite or chew your tongue during the day?	0.9% n = 3	2.2% n = 7	15.8% n = 51	18.6% n = 60	62.5% n = 202
Do you keep your lips or cheeks closed continuously during the day?	10.2% n = 33	38.1% n = 123	29.7% n = 96	9% n = 29	13% n = 42
Do you hold objects (pens, nail bits) between your teeth during the day?	1.5% n = 5	3.7% n = 12	22.6% n = 73	20.7% n = 67	51.4% n = 166
Do you chew gum?	4% n = 13	18.3% n = 59	22.6% n = 73	17.6% n = 57	9.6% n = 31
Do you use a mouth-played instrument?	0.3% n = 1	0.9% n = 3	6.2% n = 20	5.9% n = 19	86.7% n = 280
Do you support your jaw with your hand when lying down or resting?	5.3% n = 17	15.2% n = 49	29.1% n = 94	15.2% n = 49	35.3% n = 114
Do you chew on one side while eating?	4.3% n = 14	25.7% n = 83	38.7% n = 125	13% n = 42	18.3% n = 59
Do you eat something between main courses?	8.7% n = 28	33.4% n = 108	42.7% n = 138	10.2% n = 33	5% n = 16
Do you talk all the time? (customer service representative, etc.)	3.4% n = 11	17.6% n = 57	39% n = 126	19.8% n = 64	20.1% n = 65
Do you sing?	5.3% n = 17	10.2% n = 33	38.4% n = 124	23.8% n = 77	22.3% n = 72
Do you yawn?	8.4% n = 27	27.9% n = 90	51.4% n = 166	9.6% n = 31	2.8% n = 9
Do you talk on your phone while holding it between your head and shoulder?	2.2% n = 7	7.4% n = 24	34.7% n = 112	24.5% n = 79	31.3% n = 101

Table 6. Evaluation of OBC questionnaire results in terms of parafunctional habits (PH) after scoring.

		No PH (n)	Low PH (n)	High PH (n)	*p*-value
GENDER	Female	0	57	152	0.159
	Male	1	39	74	
AGE	<18	0	1	1	
	18–25	0	85	215	$p < .001$
	>25	1	10	10	
CLASS	1st Grade	0	7	35	
	2nd Grade	0	11	28	
	3rd Grade	0	35	55	0.318
	4th Grade	0	11	31	
	5th Grade	1	32	77	

- Stress-Related Habits: 31% of participants reported clenching their teeth "sometimes" during the day, and 35% reported experiencing jaw muscle pain or tension without clenching.

Severity of parafunctional habits (PH)

Based on total OBC scores, parafunctional habits were categorized as "High PH" in 71.3% ($n = 215$) of students in the 18–25 age group. This concentration in the young adult group was statistically significant ($p < .001$). However, gender ($p = .159$) and academic grade level ($p = .318$) did not show a statistically significant effect on the overall severity of parafunctional habits.

Multivariate logistic regression revealed that female gender and high parafunctional habit level were independently associated with the presence of self-reported TMD symptoms. Female students demonstrated significantly higher odds of reporting TMD-related symptoms compared to males (OR = 2.57, 95% CI: 1.50–4.38, $p = .001$). Similarly, students with high parafunctional habit levels had significantly increased odds of TMD compared to those with low or no parafunctional habits (OR = 3.57, 95% CI: 2.08–6.12, $p < .001$) (Table 7).

In the model evaluating factors associated with high parafunctional habits, the presence of self-reported TMD symptoms emerged as a significant independent factor. Students reporting TMD-related symptoms exhibited higher odds of high parafunctional habits compared to those not reporting such symptoms (OR = 3.57, 95% CI: 2.08–6.13, $p < .001$) (Table 8).

Table 7. Multivariate logistic regression analysis for predictors of TMD.

Variable	OR	95% CI	*p-value*
Female (vs Male)	2.57	1.50–4.38	0.001
Age > 25 (vs ≤ 25)	0.47	0.18–1.26	0.132
Academic Grade (per level)	1.00	0.83–1.22	0.966
High PH (vs Low/No)	3.57	2.08–6.12	p < .001

Dependent Variable: Presence of TMD (mild/moderate/severe = 1, no TMD = 0) Independent Variables: Gender (female), Age (>25), Academic grade, Parafunctional habits (High PH) CI: Confidence Interval; OR: Odds Ratio.

Table 8. Multivariate logistic regression: high parafunctional habits (OBC).

Variable	OR	95% CI	*p-value*
Female (vs Male)	1.04	0.61–1.77	0.898
Age > 25 (vs ≤ 25)	0.50	0.19–1.32	0.162
Academic Grade (per level)	0.95	0.79–1.14	0.571
TMD Present (vs No TMD)	3.57	2.08–6.13	$p < .001$

Dependent Variable: High PH = 1, Low/No PH = 0.
Independent Variables: Gender, Age (>25), Academic Grade, Presence of TMD CI: Confidence Interval; OR: Odds Ratio.

For the severe symptom burden model, age could not be reliably included due to complete separation, as no severe symptom burden cases were observed in the >25 age group. Therefore, the adjusted model was constructed without the age variable.

Discussion

The high rate of self-reported TMD symptoms observed in our study is consistent with previous findings in dental student populations. For example, in a study conducted by Akarca et al. [21] on 1533 Turkish dentistry students, the prevalence of self-reported TMD symptoms was reported as 58.6% using the Fonseca Anamnestic Index (FAI) and was found to be significantly higher in female students than in males. In another study conducted at Kırıkkale University [22] the Fonseca Anamnestic Questionnaire revealed a significantly higher prevalence of self-reported TMD symptoms among dentistry students, with more severe TMD observed among fifth-year students. Furthermore, the risk of TMD in female students is approximately 1.9 times higher than in males. These results are consistent with our study's finding of higher TMD scores in female students. A 2010 study by Robin et al. [23] involving 300 patients treated for TMD at a dental school in France found that the number of female patients applying for TMD treatment was 3.4 times higher than that of males (75.6% vs. 22.7%). This finding is similar to our study

and previous studies, confirming the higher prevalence of self-reported TMD symptoms in women. Possible reasons for this include differences in women's pain perception, greater sensitivity to hormonal changes, and greater exposure to psychological stressors compared to men. However, contrary to the current findings, Ushakar et al. [24] conducted a study among dental students in Ernakulum, India. Despite a comparable overall prevalence rate (59.3%) according to the Fonseca Anamnestic Index, no statistically significant difference in the prevalence of self-reported TMD symptoms was reported between male and female students. This discrepancy may be due to regional, cultural, or educational differences, as well as differences in stress perception and reporting behavior among students.

The high rate of parafunctional habits reported in our study is also noteworthy. Behaviors such as clenching teeth while awake (31% sometimes, 9% often), touching teeth (44.3% sometimes), and jaw muscle pain (35% sometimes) were particularly common among students.

Epidemiologically, awake bruxism occurs in more than one-third of the population [11] with a higher prevalence in younger individuals and a decrease with age [25]. A study by Italian researchers [26] showed a prevalence of 37.9% for awake bruxism as determined by self-report.

In our study, common parafunctional habits (gum chewing, unilateral chewing) showed a positive correlation with TMD symptoms. A study conducted by Yeler et al. [27] on Cumhuriyet University students found a significant association between possible sleep bruxism and TMD, suggesting that unilateral chewing may also be associated with TMD. This finding supports the notion that occlusal factors (occlusion) may have a limited effect on TMD, but that actions such as clenching and grinding play an important role in the development of symptoms by increasing joint load. Recent literature suggests that the relationship between self-reported bruxism-related behaviors and temporomandibular disorders should be interpreted within a probabilistic rather than deterministic framework. Large-scale and multicenter studies have demonstrated that while self-reported bruxism is associated with an increased likelihood of TMD symptoms, this association does not imply a direct causal pathway. Instead, shared psychological, behavioral, and neurophysiological factors – such as stress sensitivity, pain modulation, and behavioral awareness – may contribute to the observed overlap between these constructs [28,29]. Recent studies have further supported this perspective by emphasizing the multifactorial and biopsychosocial nature of temporomandibular disorders and their association with oral behaviors. These studies highlight that TMD symptoms are influenced not only by mechanical factors but also by behavioral and psychosocial components, reinforcing the interpretation of bruxism-related behaviors as contributing factors rather than direct causal agents [30–32].

A 2021 study [33] conducted with 212 dentistry students in Turkey found that 24% ($n = 51$) reported clenching their teeth during sleep. This study also determined that female participants were at higher risk of sleep bruxism than male participants. These results are similar to those of our study.

In a survey conducted by Huhtela et al. [34] with 4.403 Finnish university students in 2012, 17.9% of the students reported clenching their teeth at night, while 2.3% reported clenching their teeth during the day. Of the students participating in the study, 17.8% reported experiencing TMD pain "occasionally," and 2.7% reported experiencing TMD pain "constantly."

In their 2010 study [23], Robin et al. found that prevalence of self-reported TMD symptoms was notably high at 85.7% in patients with disorders such as anxiety, depression, and stress. Of this group of patients, 59.3% reported experiencing high levels of stress in their daily lives due to personal problems or professional reasons.

In our study, high levels of parafunctional habits were identified in 71.3% ($n = 215$) of students aged 18–25. This finding suggests that academic pressure and clinical responsibilities may contribute to an increased expression of non-functional oral behaviors in this age group, which coincides with the clinical internship periods (3rd-5th years) of dental education. Indeed, the detection of high levels of parafunctional habits in 70% ($n = 77$) of 5th-year students supports this association.

Another striking aspect of the study is the high prevalence of habits such as clenching teeth, touching teeth, and pushing the tongue against the teeth while awake. In particular, teeth touching (44.3% sometimes, 20.4% often) and pain or tension in the jaw muscles (35% sometimes, 21.4% a few times) demonstrate the prevalence of parafunctional activity among dental students. These findings suggest that the association between bruxism and TMD may be explained by neuromuscular mechanisms. Increased tone in the masseter and temporalis muscles, tension in the capsular ligaments, and changes in articular disc position [35] may underlie intra-articular pathologies, particularly clicking. Furthermore, the high prevalence of neck stiffness may be related to the prolonged static postures of dental students in clinical practice.

Dentistry students are at high risk for TMD due to their intense academic workload, clinical responsibilities, and high-performance expectations. Some studies

in the literature [36] have shown that dental students experience higher stress levels than other student groups, leading to an increased incidence of bruxism. Under these circumstances, some strategies can be developed for faculty implementation.

The first of these is "Early Diagnosis and Screening." Regular TMD screening should be conducted using valid and reliable scales such as the Fonseca Anamnestic Index. Second, "Stress Management Programs," which include psychological support and mindfulness training to improve students' stress coping skills, can be integrated into the curriculum. Informational seminars on parafunctional habits should be organized, and "Behavioral Education" aimed at teaching jaw relaxation and muscle awareness exercises should be implemented. Finally, a multidisciplinary approach should be adopted for the effective treatment of TMD; dentists, physiotherapists, and psychologists should work in coordination to develop holistic treatment plans that address both physical and psychological components.

The study also has limitations. Using only a survey as a data collection method may increase the potential for participant bias. Furthermore, the lack of objective diagnostic tools such as electromyography (EMG) or polysomnography (PSG) is a limitation in confirming bruxism. Future investigations would benefit from integrating objective and ecological measurement approaches, such as electromyographic (EMG) monitoring for sleep bruxism and ecological momentary assessment (EMA) protocols for awake bruxism. These methods are increasingly recognized as advanced reference approaches for capturing real-time motor activity and behavioral fluctuations in naturalistic environments, thereby improving the precision and interpretability of bruxism-related data. The fact that the study was conducted solely with students from Istanbul Kent University limits the generalizability of the findings to the general population. The students surveyed in our study were diverse across grade levels, and gender distribution was not evenly distributed. Future studies, including equal numbers of students across grades and genders, can help produce better results. Furthermore, the lack of a direct measurement of stress levels allowed for only an indirect assessment of the impact of psychological variables.

Despite the strengths of the present study, certain limitations should be acknowledged. The reliance on self-reported measures may introduce recall and reporting biases. Moreover, the single-center design may limit the external validity of the findings. Additionally, TMD assessment was performed using an anamnestic index without clinical confirmation based on standardized diagnostic criteria such as DC/TMD [15], which should be considered when interpreting the prevalence estimate. Additionally, the cross-sectional design precludes any inference of temporal or causal relationships, and the observed associations should therefore be interpreted with caution.

An important methodological limitation of the present study is the partial conceptual overlap between the measurement tools used. Specifically, the Fonseca Anamnestic Index (FAI) includes items related to clenching and grinding behaviors, while the Oral Behavior Checklist (OBC) also assesses similar behaviors. Therefore, the observed association between self-reported parafunctional behaviors and TMD-related symptoms may, to some extent, reflect this overlap rather than entirely independent constructs. This issue has been previously discussed in the literature, suggesting that correlations between self-reported bruxism and TMD outcomes should be interpreted with caution [28].

Another limitation relates to the novelty of the findings. The observed association between self-reported oral behaviors and TMD-related symptoms is consistent with previous literature and may not be considered entirely novel. However, the present study contributes to the existing body of knowledge by focusing on a specific high-risk population – dentistry students – characterized by unique academic stressors and behavioral patterns.

Conclusion

Bruxism-related behaviors and temporomandibular disorder symptoms among dentistry students should be interpreted within a broader biopsychosocial and behavioral framework. In line with recent perspectives that conceptualize bruxism as a potential "medical gateway for dentistry" [37], these behaviors may serve as indicators of underlying systemic, psychological, and lifestyle-related factors rather than as isolated oral conditions. Educational institutions may therefore play a critical role in promoting interdisciplinary awareness, early behavioral screening, and stress-informed preventive strategies. The more severe course of these disorders, particularly among female students, highlights the importance of addressing the issue with a multidisciplinary approach. Educational institutions should integrate strategies into their curricula that not only enhance students' clinical skills but also support their ability to maintain their own orofacial health. This will enable future dentists to both maintain their own health and more effectively guide their patients in the management of TMD and bruxism.

From a clinical and educational perspective, these findings emphasize the importance of routine screening for parafunctional habits in dental students, as early

behavioral interventions may help improve awareness and early behavioral management of developing clinically relevant temporomandibular disorders.

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Author contributions

CRediT: **Özlem Erçin DDS:** Formal analysis, Methodology, Supervision, Writing – review & editing; **Devrim Akdoğan DDS:** Data curation, Investigation; **Büşra Akyüz DDS, PhD Candidate:** Writing – original draft.

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The study was approved by the Institutional Ethics Committee of Istanbul Kent University. Written informed consent was obtained from all participants.

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