ORIGINAL SCIENTIFIC ARTICLE

ASSOCIATION BETWEEN TEMPOROMANDIBULAR DYSFUNCTION AND PARAFUNCTIONAL ORAL HABITS IN STUDENTS

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DOI 10.69559/issn.2233-1794.2026.15.1.4

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ABSTRACT

Objective: To examine the extent to which oral parafunctional habits may influence the development of temporomandibular disorders (TMD) in students.

Subjects and Methods: The sample consisted of students of the Faculty of Dentistry, Faculty of Medicine and Faculty of Architecture of the University of Sarajevo, a total of 183 students. Students received two questionnaires electronically, which are anonymous. The questionnaire related to the presence of symptoms and signs of TMD is the Fonesca anamnestic index. The second questionnaire is a Oral Behaviors Checklist (OBC), additional instruments of axis II of the new Diagnostic Criteria for Temporomandibular Disorders (DC/TMD).

Results: A total of 183 students were included in the research, of which 38 were men and 145 were women. 68 (37,2%) subjects were without TMD while 115 (62,8%) had TMD. The results of the ANOVA test showed that students who had symptoms and signs of TMD had on average a significantly higher score of parafunctional oral habits (OBC) compared to students who did not have TMD. There is a moderately strong positive correlation between the Oral Behaviors Checklist (OBC) and the Fonesco Anamnestic Index (FAI) ($r = 0.430$, $p < 0.001$, $n = 182$).

Conclusion: There is a significant association between parafunctional oral habits (OBC) and TMD symptoms (FAI).

Keywords: temporomandibular joint, parafunctional oral habits, temporomandibular disorders

Introduction

Temporomandibular disorders (TMDs) represent one of the primary causes of non-odontogenic pain in the orofacial region. Recent studies indicate that TMDs constitute a complex group of heterogeneous disorders with a multifactorial etiology, influenced by genetic factors, sex, and age. Symptoms may range from mild to debilitating pain accompanied by functional limitations, negatively affecting quality of life. Research has shown that the prevalence of TMDs is significantly higher in females than in males, which is attributed to several factors, primarily the influence of estrogen on joint structures [1-4].

The most common symptoms and signs of TMD include pain in the temporomandibular joint (TMJ) and associated muscles, myofascial pain, restricted mandibular movements, joint sounds within the TMJ, mandibular deviation and deflection during mouth opening, and headache. Pain may radiate to adjacent structures such as the dental arches, ear region, temporal region, occiput, shoulder girdle, and cervical spine, making diagnosis particularly challenging in some cases. Pain intensity may increase during function or parafunctional activities. In patients with bruxism characterized by tooth clenching, most commonly occurring during sleep, symptoms of pain and jaw stiffness are particularly pronounced in the morning. Restricted mandibular movements may result from intracapsular limitations within the TMJ or from muscular tension. Furthermore, symptoms such as headache, neck and shoulder pain, and hearing impairment are nonspecific for TMD and require differential diagnostic evaluation to exclude other etiologies. The first standardized research diagnostic criteria for TMD were the RDC/TMD [5-10]. Subsequently, the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) were introduced, consisting of two axes: Axis I, which focuses on physical diagnoses of the most common TMDs and pain assessment, and Axis II, which includes questionnaires evaluating behavioral and psychosocial factors that may predispose individuals to the development of these disorders [11-14]. Studies have also shown that the Fonseca Anamnestic Index, which assesses the presence of TMD symptoms and signs, demonstrates high diagnostic accuracy [15-17]. Bruxism, object biting, lip and cheek biting, mouth breathing, and tongue thrusting between the dental arches are among the most common parafunctional habits found in the population. These habits can lead to muscle overload and hyperactivity, ultimately resulting in pain, tooth wear (abrasion), tooth fractures, periodontal changes, and tooth loss [18–20].

The aim of this study was to investigate the extent to which parafunctional oral habits may influence the development of TMD among students at the University of Sarajevo.

Subjects and Methods

The sample included students from the Faculty of Dentistry, Faculty of Medicine, and Faculty of Architecture at the University of Sarajevo, comprising a total of 183 participants. The students received two anonymous questionnaires electronically and completed them voluntarily after providing informed consent.

The questionnaire assessing the presence of TMD symptoms and signs was the Fonseca Anamnestic Index, which has high diagnostic accuracy. It consists of ten questions with three possible responses: “yes” (10 points), “sometimes” (5 points), and “no” (0 points). By summing the total score, TMD severity can be classified as follows: absence of symptoms (0–15 points), mild disorder (20–45 points), moderate disorder (50–65 points), and severe disorder (70–100 points) [15-17]. Based on these scores, participants were categorized into groups with and without TMD.

The second questionnaire was the Oral Behaviors Checklist (OBC), part of Axis II of the Diagnostic Criteria for Temporomandibular Disorders, used to assess parafunctional oral habits over the previous month. It consists of 21 items, including two related to sleep-related habits and 19 to habits during wakefulness. Questions 14 and 19, related to singing and playing musical instruments involving the mouth or jaw, were excluded; therefore, 19 items were included in the evaluation. Sleep-related habits were scored as follows: never = 0, <1 night/month = 1, 1–3 nights/month = 2, 1–3 nights/week = 3, and 4–7 nights/week = 4. Awake behaviors were scored from 0 to 4 based on frequency: 0 = never, 1 = rarely, 2 = sometimes, 3 = frequently, and 4 = always during wakefulness. The total score ranged from 0 to 76 points [11-14], categorized as follows: 0 = none, 1–16 = low OBC, and 17–76 = high OBC.

Statistical methods of data analysis

Statistical analyses were performed using SPSS IBM software (version 22). Descriptive statistics included means and standard deviations for continuous variables, and absolute and relative frequencies for nominal variables. Parametric methods applied to quantitative variables included the independent samples t-test, one-way analysis of variance (ANOVA), and Pearson's correlation. The Mann–Whitney U test was used as a non-parametric method for nominal and ordinal variables.

Results

A total of 183 participants were included, comprising 38 males and 145 females. Of the total sample, 68 participants (37.2%) had no TMD, whereas 115 (62.8%) presented with TMD. The majority of participants (87%) reported mild TMD, while a smaller proportion reported moderate (9.6%) or severe TMD (3.5%). Cumulative percentages indicated that most participants (96.5%) had mild or moderate forms of the disorder, suggesting relatively low overall severity.

The Mann–Whitney U test revealed significant differences in the presence of parafunctional oral habits between groups with and without TMD. Participants with TMD exhibited certain habits more frequently compared to those without TMD, with statistically significant differences confirmed (Table 1).

The one-way analysis of variance (ANOVA) examined the relationship between parafunctional oral habit scores and the prevalence of TMD symptoms and signs. The results of the ANOVA (Table 2) showed significant differences in several aspects of oral health. Participants experiencing difficulty in mouth opening, muscle fatigue or pain during chewing, headaches, ear or TMJ pain, joint sounds during chewing or opening, tooth clenching or grinding, or occlusal discomfort demonstrated significantly higher score of parafunctional oral habits (OBC) compared to those without TMD symptoms and signs.

Correlation analysis demonstrated a weak to moderate positive correlation between the Oral Behaviors Checklist (OBC) and the Fonseca Anamnestic Index (FAI) ($r = 0.295$, $p < 0.001$, $n = 115$). The correlation coefficient indicates the presence of significant weak to moderate association between parafunctional oral habits (OBC) and TMD symptoms (FAI) (Figure 1). These findings suggest that individuals with TMD who report a higher frequency of parafunctional oral habits tend to exhibit a higher level of TMD symptoms and clinical signs.

The results of the Student's t-test indicated the presence of gender-related differences in the scores of the Fonseca Anamnestic Index (FAI) and the Oral Behaviors Checklist (OBC). The mean FAI score for male participants was 17.2 ($SD = 16.2$, $n = 38$), whereas female participants demonstrated a significantly higher mean score of 26.5 ($SD = 15.9$, $n = 145$). The t-test results confirmed a statistically significant difference between genders ($t = -3.19$, $p = 0.002$), indicating that women reported a higher frequency and severity of TMD symptoms and signs compared to men. With regard to parafunctional oral behaviors assessed using the OBC, the mean score for male participants was 22.0 ($SD = 10.0$, $n = 37$), while female participants exhibited a slightly higher mean score of 24.3 ($SD = 8.0$, $n = 145$). Although females demonstrated higher mean values, the difference was not statistically significant ($t = -1.32$, $p = 0.192$). These findings suggest that, despite observable differences in mean scores, there is insufficient statistical evidence to confirm significant gender-related differences in the prevalence of parafunctional oral behaviors (Table 3).

Table 1. Testing differences using the Mann–Whitney U test in the presence of oral parafunctional habits between groups with and without TMD

	Group					
	Without TMD		With TMD			
	n	Mean Rank	n	Mean Rank	U	p
Clenching or grinding of the teeth during sleep, of which you are aware or have been informed by another person	68	73.1	115	103.2	2625.0	0.000
Sleeping in a position that exerts pressure on the mandible	68	80.0	115	99.1	3095.5	0.012
Grinding of the teeth while awake	68	83.7	115	96.9	3344.0	0.021
Clenching of the teeth while awake	67	70.3	115	103.9	2430.5	0.000
Clenching, touching, or maintaining the teeth in contact when not eating.	68	76.2	115	101.3	2835.5	0.001
Tensing, straining, or maintaining contraction of the muscles without tooth contact or clenching	68	71.1	115	104.4	2487.0	0.000
Protrusion of the mandible forward or laterally, or maintaining it in that position	68	81.4	115	98.3	3189.5	0.008
Applying strong pressure to the teeth with the tongue.	68	81.4	115	98.3	3186.5	0.013
Positioning the tongue between the teeth.	68	88.5	115	94.1	3669.0	0.431
Biting or chewing the tongue, cheeks, or lips, or manipulating them with the tongue	68	79.3	115	99.5	3046.0	0.010
Maintaining the jaw in a rigid or tense position for the purpose of supporting or protecting it	68	80.5	115	98.8	3125.0	0.007
Holding objects between the teeth or biting on items such as hair, pencils or pens, fingers, nails, pipes, etc	68	83.9	115	96.8	3357.5	0.083
Chewing gum	68	93.8	115	90.9	3787.5	0.714
Supporting the chin with the hand	68	81.3	115	98.3	3184.0	0.029
Chewing food on only one side.	68	79.5	115	99.4	3058.0	0.011
Eating between meals (refers to food requiring mastication)	68	90.7	115	92.8	3818.5	0.779
Continuous speaking (e.g., teaching, sales presentations, customer service work	68	85.2	115	96.1	3444.5	0.159
Yawning	68	86.9	115	95.0	3562.5	0.268
Holding a phone between the head and shoulder	68	89.0	115	93.8	3707.0	0.524

n – sample size, Mean Rank – mean rank of variables, U – value of the Mann–Whitney U test for independent samples, p – probability of rejecting the null hypothesis at a 5% significance level

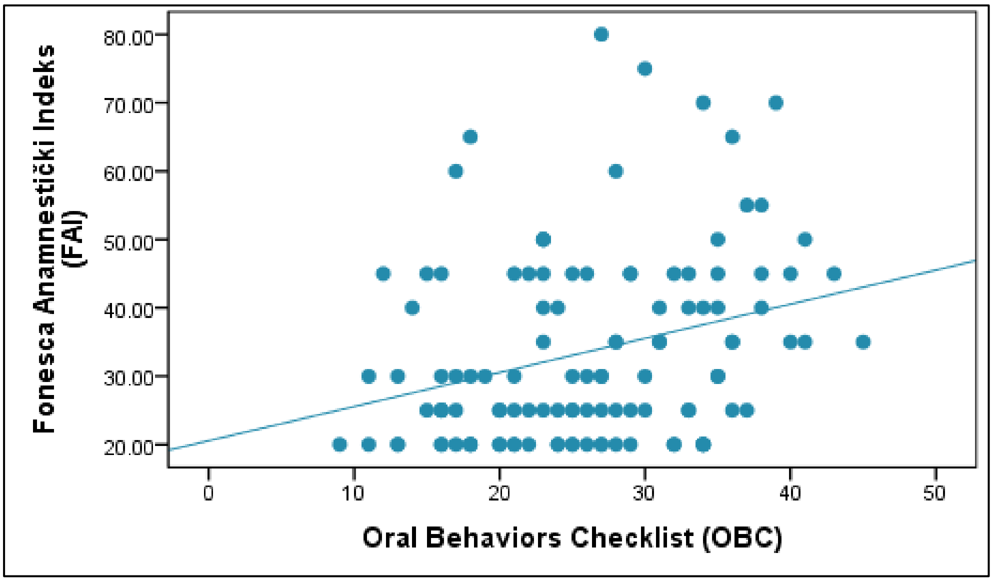

Figure 1. Correlation between oral parafunctional habits (OBC) and TMD symptoms (FAI)

Table 2. Association between prevalence of TMD signs and symptoms and parafunctional oral habits scores (OBC)

		Oral Behaviors Checklist (OBC)				
		n	Mean	SD	F	p
Do you experience difficulty during wide mouth opening?	No	143	23	8	3,226	0,042
	Sometimes	29	25	8		
	Yes	10	30	8		
Do you have difficulty in mandibular movement?	No	167	24	8	1,094	0,337
	Sometimes	8	27	7		
	Yes	7	27	9		
Do you experience fatigue or pain in the masticatory muscles during chewing?	No	141	23	8	5,956	0,003
	Sometimes	28	28	10		
	Yes	13	26	8		
Do you suffer from frequent headaches?	No	117	23	8	3,124	0,046
	Sometimes	38	26	9		
	Yes	27	26	9		
Do you have neck pain or cervical stiffness?	No	89	23	8	2,093	0,126
	Sometimes	41	25	9		
	Yes	52	25	8		
Do you have ear pain or pain in the TMJ region?	No	148	23	8	6,005	0,003
	Sometimes	17	30	7		
	Yes	17	26	8		
Have you ever noticed any sounds within your TMJ during chewing or mouth opening?	No	50	22	8	8,624	0,000
	Sometimes	35	21	7		
	Yes	97	26	8		
Do you have habits such as clenching or grinding your teeth?	No	98	21	8	14,074	0,000
	Sometimes	31	26	7		
	Yes	53	28	9		
Do you feel that your teeth do not occlude properly during biting?	No	109	22	8	7,343	0,001
	Sometimes	25	26	9		
	Yes	48	27	8		
Do you consider yourself a tense (nervous) person?	No	182	24	8		/
	Sometimes	0	.	.		
	Yes	0	.	.		

n – sample size, Mean – arithmetic mean, SD – standard deviation, F – value of the F-test (ANOVA), p – probability of rejecting the null hypothesis at a 5% significance level / – not tested due to an inappropriate frequency distribution in groups

Table 3. Testing differences in the degree of oral parafunctional habits and TMD symptoms between sexes

	Sex							
	Male			Female				
	N	Mean	SD	N	Mean	SD	t	p
Fonesca Anamnestički Indeks (FAI)	38	17,2	16,2	145	26,5	15,9	-3,19	0,002
Oral Behaviors Checklist (OBC)	37	22,0	10,0	145	24,3	8,0	-1,32	0,192

n – sample size, Mean – arithmetic mean, SD – standard deviation, t – value of the Student's t-test for independent samples, p – probability of rejecting the null hypothesis at a 5% significance level

Discussion

The findings of the present study demonstrated that specific parafunctional oral behaviors are significantly more prevalent among students with TMD compared to those without TMD. These behaviors include tooth clenching and grinding, sleeping in positions that exert pressure on the mandible, awake bruxism, maintaining tooth contact (clenching or touching) when not engaged in mastication, sustained contraction of masticatory muscles without occlusal contact, mandibular protrusion or lateral movement, excessive tongue pressure against the dentition, biting or chewing of the tongue, cheeks, or lips, maintaining the mandible in a rigid or tense position for support or protection, resting the chin on the hand, and unilateral mastication (Table 1).

These findings are consistent with those reported by Hoffman et al. in whose study as many as 47% of participants with TMD reported the presence of parafunctional behaviors, particularly tooth clenching. Furthermore, their study indicated an increased prevalence of comorbid conditions among patients with TMD, including fibromyalgia, depression, rheumatoid arthritis, allergies, and chronic fatigue syndrome [2]. Several studies have demonstrated that individuals with bruxism have an elevated risk of developing temporomandibular disorders [3, 21-24]. Winocur et al. identified that in addition to bruxism there is other behavioral risk factors for intra-articular and muscular dysfunction, including habitual chin support, excessive gum chewing, and jaw play activities [18]. Beyond parafunctional behaviors, Özdinç et al. emphasized the role of perceived stress and sleep quality. Their findings indicated that individuals with TMD exhibit poorer sleep quality and higher levels of perceived stress compared to healthy controls [15].

The results of the ANOVA test showed that students with higher scores of parafunctional oral behaviors (high OBC scores) had significantly greater prevalence of TMD-related symptoms and clinical signs, including difficulty in mouth opening ($p = 0.042$), muscle fatigue or pain during mastication ($p = 0.003$), pain in the temporomandibular joint (TMJ) region ($p = 0.003$), joint sounds during mouth opening or mastication ($p < 0.001$), parafunctional activities such as clenching or grinding ($p < 0.001$), perceived occlusal disharmony ($p < 0.001$), and headache ($p = 0.046$) (Table 2). These findings indicate a potentially harmful effect of parafunctional oral habits on the stomatognathic system. The present results are in agreement with findings reported by Michelotti et al. who suggested that parafunctional activities act as precipitating factors for certain TMD subgroups and that daytime clenching and grinding contribute to the development of myofascial pain as well as internal derangements of the temporomandibular joint, including disc displacement [19]. Conversely, studies by Manfredini and Lobbezoo indicate that prolonged jaw clenching may induce acute muscular tenderness but does not necessarily represent a primary etiological factor in the onset of chronic pain conditions [25].

Furthermore, the results of this study demonstrated a weak to moderate positive correlation between parafunctional oral behaviors and TMD symptoms ($r = 0.295$, $p < 0.001$). Students exhibiting a higher frequency of parafunctional habits also presented with a greater number of TMD-related symptoms and signs (Figure 1). These findings suggest that parafunctional oral behaviors may play an important role in the multifactorial etiology of TMD and confirm their association as reported in previous studies [26, 27]. Glaros et al. reported that parafunctional oral habits, as well as emotional states such as stress and sadness, are strongly associated with the intensity of orofacial pain. Increased muscle tension resulting from parafunctional activity may lead to multiple biological consequences affecting both temporomandibular joints and masticatory muscles. Reduction of parafunctional activity through appropriate therapeutic interventions has been shown to significantly decrease pain intensity [28]. Similarly, Kobs et al. demonstrated a statistically significant relationship between the degree of palpatory tenderness of the masticatory muscles and temporomandibular joints and the intensity of clenching and grinding behaviors [29].

The present study also confirmed that female participants reported TMD symptoms and signs more frequently than male participants ($p = 0.002$) (Table 3), which is in accordance with findings by Hoffman et al. who reported that as many as 90% of female participants exhibited TMD-related symptomatology [2]. Likewise, Winocur et al. reported a higher prevalence of TMD symptoms and signs in females, identifying both parafunctional behaviors and female sex as significant risk factors in the development of TMD [18]. In contrast, no statistically significant difference was observed between male and female participants with regard to the prevalence of parafunctional oral behaviors (OBC scores) ($p = 0.192$), indicating that these behaviors were similarly distributed across both sexes.

Conclusion

The prevalence of TMD symptoms and clinical signs such as masticatory muscle and joint pain, difficulty in mouth opening, temporomandibular joint sounds, and headaches was higher among students with increased scores of parafunctional oral habits (OBC). Students exhibiting a greater number of parafunctional oral habits demonstrated a higher prevalence of TMD-related symptoms and signs, thereby confirming a significant association between parafunctional oral habits (OBC) and TMD symptoms (FAI). Parafunctional oral habits represent an important contributing factor within the multifactorial etiology of temporomandibular disorders.

Declaration of interest: There is no conflict of interest.

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