



Research Article/Özgün Araştırma

Assessment of bruxism and temporomandibular disorder in mothers of children with cerebral palsy

Serebral palsili çocuğu olan annelerde bruksizm ve temporomandibular rahatsızlığın değerlendirilmesi

Ömer DURSUN<sup>1</sup>, Erhan DİNCER<sup>1</sup>, İbrahim Hakkı SAĞOL<sup>2</sup>

<sup>1</sup>Bitlis Eren University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, 13000, Bitlis-Turkey

<sup>2</sup>Van Training and Research Hospital, 65300, Van-Turkey

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**Abstract**

**Aim:** The aim of this study was to assess bruxism and temporomandibular disorder in mothers of children with cerebral palsy (CP).

**Materials and Methods:** 18 mothers of children with CP and 18 mothers of healthy children were included in study. The pressure pain threshold of the masticatory muscles and the upper trapezius were measured with a digital dynamometer. Maximum mouth opening was assessed with a digital caliper. Bruxism was evaluated by a non-instrumental method. Sleep quality, depression, neck disability, and temporomandibular disorder were evaluated with the Pittsburgh Sleep Quality Index, Beck Depression Index, Neck Disability Index, and Fonseca Questionnaire.

**Results:** Pain thresholds were lower ( $p<0.05$ ), sleep disturbance, depression, neck disability, and temporomandibular disorder were higher in the mothers of children with CP ( $p<0.05$ ).

**Conclusion:** Our study showed that bruxism and temporomandibular disorder are highly observed in mothers of children with CP.

**Keywords:** Pain threshold; Bruxism; Depression.

**Öz**

**Amaç:** Bu çalışmanın amacı serebral palsili çocuğu olan annelerde bruksizmi ve temporomandibular rahatsızlığı değerlendirmektir.

**Gereç ve Yöntem:** Çalışmaya serebral palsili çocuğu olan 18 anne ve sağlıklı çocuğu olan 18 anne dahil edildi. Çiğneme kasları ve üst trapez kasının ağrı eşiği dijital dinamometre ile ölçüldü. Maksimum ağız açma mesafesi dijital kaliper ile ölçüldü. Bruksizm non-enstrümental yöntemle değerlendirildi. Uyku kalitesi, depresyon, boyun özürüllüğü ve temporomandibular rahatsızlık; Pittsburgh Uyku Kalitesi İndeksi, Beck Depresyon Envanteri, Boyun Özürüllük İndeksi ve Fonseca Anketiyle değerlendirildi.

**Bulgular:** Serebral palsili çocuğu olan annelerde kas ağrı eşikleri düşüktü ( $p<0,05$ ), uyku bozukluğu, depresyon, boyun özürüllüğü ve temporomandibular rahatsızlık daha yüksekti ( $p<0,05$ ).

**Sonuç:** Çalışmamız serebral palsili çocuğu olan annelerde bruksizm ve temporomandibular rahatsızlığın yüksek oranda görüldüğünü gösterdi.

**Anahtar Kelimeler:** Ağrı eşiği; Bruksizm; Depresyon.

**Yazışma Adresi/Address for Correspondence:** Ömer DURSUN, Bitlis Eren University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, 13000, Bitlis-Turkey, E-mail: [fztomdrsn@gmail.com](mailto:fztomdrsn@gmail.com)

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## Introduction

Cerebral palsy (CP) is a group of disorders affecting infant brain development and characterized by motor and functional impairment.<sup>1</sup> Although the definition of CP specifies children, mothers whose children were diagnosed with CP are one of the individuals that have been considered to be deeply affected by CP.<sup>2</sup> Upon the diagnosis, mothers' hope gives way to frustration, and they try to make sense of the circumstances that they are facing.<sup>3</sup> After that, they comprehend the situation by experiencing it daily and realize that their responsibility is much heavier than that of the mothers of healthy children because their children look up to them for their daily living activities.<sup>4</sup> At this point, mothers must balance the scale between the needs of their children and their other duties.<sup>4</sup> In this endeavor, they make sacrifices like quitting their job, giving up their social life, and even leaving aside their personal care.<sup>5</sup> Unfortunately, the sacrifices mentioned above are only one dimension. They sacrifice their psychological health, sleep quality, and physical health as well.<sup>6-8</sup> More than half of the mothers whose children were diagnosed with CP had depression, neck disability, and sleep impairments.<sup>6-8</sup>

Interestingly, individuals with bruxism and patients with temporomandibular disorder (TMD) harbor similar symptoms with mothers whose children were diagnosed with CP. Poor sleep quality is correlated with bruxism and TMD, and nearly half of the patients with TMD experience sleep impairments.<sup>9</sup> Depression is commonly observed in patients with TMD,<sup>10</sup> and bruxism aggravates the severity of depression in patients with TMD.<sup>11</sup> TMD and bruxism are correlated with neck disability.<sup>12</sup>

Considering the common symptom characteristic observed in mothers whose children were diagnosed with CP and bruxers and patients with TMD, the following question comes to mind: Do mothers whose children were diagnosed with CP have bruxism or TMD? To our knowledge the answer to this question is not directly addressed in the literature. From this point of view, this study aimed to assess the TMD and bruxism in

mothers whose children were diagnosed with CP. In this direction, the hypothesis of the study was a high rate of bruxism and TMD observed in mothers whose children were diagnosed with CP.

## Materials and Methods

This study was performed at Bahçesaray Special Education and Rehabilitation Center between August 15, 2022, and November 24, 2022, once the ethical approval was obtained. The control group was recruited from the mothers of healthy children who are the residents of Bitlis and Van provinces. Before enrollment mothers were verbally informed, and then their written approval was acquired. Mothers aged 18 to 65 who have children under the age of 18 and diagnosed with CP were included in the study group. Mothers of healthy children under the age of 18 were included in the control group. Mothers using sleeping pills, diagnosed with any psychiatric, neurodegenerative, or neurological disease or fibromyalgia, having a history of jaw, head, or neck surgery, and already being treated for bruxism were excluded from both groups. A total of 41 mothers were excluded from the study (Figure 1).

## Type of the study

The study is a cross-sectional study.

## The sample size of the study

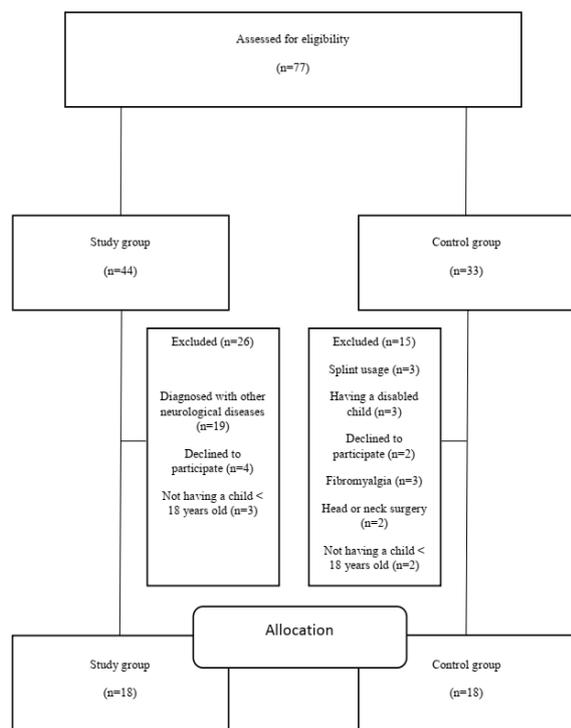
Considering no study exists related to the topic, we performed a post hoc power analysis based on the bruxism questionnaire score of mothers included in the study using G Power 3.1.9.5. The study had very large size effect (1.08).<sup>13</sup> Then, the power of the study was analyzed, and the power of the study was found to be 88 %.

## Data collection tools

Data related to the characteristics of CP was collected by one author (İ.H.S.), and other data related to bruxism and TMD was collected by two authors (Ö.D. and E.D.). The evaluation methods used in the study are mentioned below.

The predominant motor type of the CP was categorized as spastic, ataxic, and dyskinetic.<sup>14</sup>

Spastic types are further subtyped as diplegic, hemiplegic, and quadriplegic.<sup>15</sup>



**Figure 1.** Study flow chart.

The gross motor function classification system (GMFCS) was used to determine the severity of the motor disability. GMFCS consists of five levels, from one to five. The children's age-specific activity competence is questioned to determine the appropriate level. From levels one to five, a decline in the activity competence of the children is observed.<sup>16</sup>

Bruxism's existence was determined by a questionnaire developed by Pintado et al.<sup>17</sup> The questionnaire consists of six questions assessing the daytime and nighttime grinding or clenching and the symptoms caused by the bruxism, such as fatigue, headache, and soreness. Mothers who have answered at least two of the questions with a yes are considered to have probable bruxism.

The maximum mouth-opening distance of the mothers was evaluated with a digital caliper. Mothers were asked to open their jaws as much as possible, and then the vertical distance was measured.<sup>18</sup>

TMD was assessed with the Fonseca Anamnestic Index (FAI). The index consists of ten questions that can be answered as no, sometimes, or yes. The total score is categorized into four levels: no TMD (0-15

points), mild TMD (20-40 points), moderate TMD (45-65 points), and severe TMD (70-100 points).<sup>19</sup>

The Neck Disability Index (NDI) was used for the evaluation of the cervical area-related disabilities of the mothers. The index has ten questions with six possible choices ranging from zero to five points. The total score of the index is 50 points. A higher score indicates a higher neck disability.<sup>20</sup>

Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality. The index consists of 19 questions and seven subdivisions. Four questions are open-ended and self-rated. Questions in the subdivisions have four answers and are scored between zero and four. The total score of the index is 21 points. A higher score indicates low sleep quality.<sup>21</sup>

Depression level was evaluated with the Beck Depression Inventory (BDI). The index has 21 questions with four possible choices, scored from zero to three points. The total score of the inventory is 63 points, and high scores indicate a high depression level.<sup>22</sup>

The pain thresholds of the masticatory muscles and the upper trapezius muscle were measured with a digital dynamometer. Masticatory muscles and the upper trapezius muscle were measured.<sup>23,24</sup> Measurements were taken four times for each point. Because the first measurement value is generally high, the average of the other measurements was recorded.<sup>23,25</sup>

## Data analysis

The data were given as mean, standard deviation, or median, minimum, and maximum for continuous variables. Frequency and percentage were given for the categorical variables. The normal distribution of the data was evaluated with the Shapiro-Wilk test. Intergroup comparison of the variables was performed by independent t-test, Mann-Whitney U test, and chi-square test. Correlation analysis was performed by Spearman and Pearson correlation tests. Statistical analysis was performed with the SPSS 25 program, and the significance level was adjusted as  $p < 0.05$ .

### Ethics committee approval

The study was approved by the Clinical Research Ethics Committee of the Van Training and Research Hospital (Approval date: 06.07.2022, Approval number: 2022/15-05) and conducted in accordance with the Declaration of Helsinki.

### Results

Both groups' baseline physical and sociodemographic characteristics were similar ( $p>0.05$ ). More than half of the children diagnosed with CP were non-ambulant. Spastic type CP was the most commonly seen predominant motor type in children with CP (Table 1).

**Table 1.** CP characteristics and intergroup comparison of the physical and sociodemographic characteristics.

	Study group		Control group		t	p
	X±SD		X±SD			
Age (y)	38.83±10.26		35.44±8.03		1.103	0.278
Height (cm)	161.33±5.45		163.05±7.74		0.771	0.446
Body weight (kg)	77.63±12.11		75±16.45		0.548	0.587
BMI (kg/m <sup>2</sup> )	29.93±4.71		28.30±6.25		0.884	0.383
GMFCS score	n	%				
I	3	17				
II	5	28				
III	-	-				
IV	-	-				
V	10	55				
Types of CP						
Ataxic	2	11				
Quadriplegic	11	61				
Hemiplegic	4	22				
Diplegic	1	6				

\* $p<0.05$  statistical significance, independent t test, CP: Cerebral palsy, BMI: Body mass index, GMFCS: Gross motor function classification system

Bruxism was highly observed in the study group ( $p<0.05$ ). Nearly three-quarters of the study group had bruxism. Similarly, TMD was highly prevalent in the study group ( $p<0.05$ ).

About one-fifth of the mothers in the control group had bruxism, and two-fifths had TMD (Table 2).

**Table 2.** Intergroup comparison of bruxism and TMD.

		Control group		Study group		x <sup>2</sup>	p
		n	%	n	%		
Bruxism	Yes	3	17	13	72	11.25	<b>0.001*</b>
	No	15	83	5	28		
TMD	Yes	7	39	17	95	12.5	<b>&lt;0.001*</b>
	No	11	61	1	5		

\* $p<0.05$  statistical significance, chi square test, TMD: Temporomandibular disorder

Mothers in the study group had poorer sleep quality, higher depression, and neck disability compared to mothers in the control group

( $p<0.05$ ). The FAI score of the mothers in the study group was higher as well ( $p<0.05$ ) (Table 3).

**Table 3.** Intergroup comparison of FAI, NDI, PSQI, BDI and bruxism questionnaire scores.

	Control group		Study group		u	p
	Median	Min-Max	Median	Min-Max		
FAI	4	(1-14)	29	(5-38)	-3.707	<b>&lt;0.001*</b>
NDI	15	(5-75)	42.5	(10-70)	-4.439	<b>&lt;0.001*</b>
PSQI	7.5	(5-16)	13	(5-17)	-2.96	<b>0.003*</b>
BDI	5	(0-23)	31.5	(6-49)	-4.562	<b>&lt;0.001*</b>
Bruxism Questionnaire Score	0	(0-5)	3	(0-5)	-2.952	<b>0.004*</b>

\* $p<0.05$  statistical significance, Mann Whitney U test, FAI: Fonseca Anamnestic Index, NDI: Neck Disability Index, PSQI: Pittsburgh Sleep Quality Index, BDI: Beck Depression Inventory

Pressure pain thresholds of the masticatory and upper trapezius muscles were lower in the study group compared to the control group ( $p<0.05$ ) (Table 4). While mothers in the study

group had limited mouth opening, mouth opening of the mothers in the control group had acceptable interincisal distance (Table 4).

**Table 4.** Intergroup comparison of pressure pain thresholds and maximum mouth opening.

		Control group	Study group	t	p
		X±SD	X±SD		
Maximum mouth opening (cm)		41.99±4.90	39.26±5.38	1.591	0.121
Right	Masseter anterior (kg/cm <sup>2</sup> )	1.46±0.32	1.11±0.23	3.789	<b>0.001*</b>
	Masseter inferior (kg/cm <sup>2</sup> )	1.48±0.31	1.17±0.22	3.421	<b>0.002*</b>
	Temporalis anterior (kg/cm <sup>2</sup> )	1.99±0.30	1.55±0.34	-3.386	<b>0.001*</b>
	Temporalis middle (kg/cm <sup>2</sup> )	2.18±0.32	1.67±0.30	4.848	<b>&lt;0.001*</b>
	Upper trapezius (kg/cm <sup>2</sup> )	2.25±0.46	1.70±0.35	3.975	<b>&lt;0.001*</b>
Left	Masseter anterior (kg/cm <sup>2</sup> )	1.37±0.29	1.09±0.24	3.081	<b>0.004*</b>
	Masseter inferior (kg/cm <sup>2</sup> )	1.46±0.31	1.22±0.21	2.668	<b>0.012*</b>
	Temporalis anterior (kg/cm <sup>2</sup> )	1.98±0.25	1.56±0.33	4.372	<b>&lt;0.001*</b>
	Temporalis middle (kg/cm <sup>2</sup> )	2.12±0.28	1.65±0.32	4.759	<b>&lt;0.001*</b>
	Upper trapezius (kg/cm <sup>2</sup> )	2.28±0.39	1.69±0.31	4.893	<b>&lt;0.001*</b>

\* $p<0.05$  statistical significance, independent t test

While a significant positive correlation was found between PSQI score and BDI, NDI, and FAI scores ( $p<0.05$ ), no significant correlation was found between PSQI score and bruxism questionnaire score in the study group ( $p>0.05$ ). A significant positive correlation was found between BDI score and PSQI, NDI, the bruxism questionnaire, and FAI scores in the study group ( $p<0.05$ ). A significant positive correlation was found between NDI score and PSQI, BDI, the bruxism

questionnaire, and FAI scores in the study group ( $p<0.05$ ). While a significant positive correlation was found between bruxism questionnaire score and BDI, NDI, and FAI scores ( $p<0.05$ ), no significant correlation was found between bruxism questionnaire score and FAI score in the study group ( $p>0.05$ ). A significant positive correlation was found between the FAI score and the PSQI, BDI, NDI, and bruxism questionnaire scores in the study group ( $p<0.05$ ) (Table 5).

**Table 5.** Correlation between the FAI, NDI, PSQI, BDI and bruxism questionnaire scores of the study group

	PSQI	BDI	NDI	FAI	Bruxism assessment questionnaire
PSQI		<b>0.479*</b>	<b>0.647**</b>	<b>0.542*</b>	0.148
BDI	<b>0.479*</b>		<b>0.765**</b>	<b>0.714**</b>	<b>0.676**</b>
NDI	<b>0.647**</b>	<b>0.765**</b>		<b>0.705**</b>	<b>0.733**</b>
FAI	<b>0.542*</b>	<b>0.714**</b>	<b>0.705**</b>		<b>0.651***</b>
Bruxism assessment questionnaire	0.148	<b>0.676**</b>	<b>0.733**</b>	<b>0.651***</b>	

\* $p<0.05$ , \*\* $p<0.01$  statistical significance, Spearman correlation test, <sup>a</sup> Pearson correlation test, FAI: Fonseca Anamnestic Index, NDI: Neck Disability Index, PSQI: Pittsburgh Sleep Quality Index, BDI: Beck Depression Inventory

## Discussion

This study revealed that mothers whose children were diagnosed with CP may tend to develop bruxism and TMD.

TMD in the study group was characterized with limited mouth opening and lower mechanical sensitivity of masticatory muscles, which are the cardinal symptoms of TMD.<sup>26</sup> While almost all the mothers in the study group had TMD, nearly two-fifths of the mothers in the control group (39%) had TMD. It was reported that one-third of the population (31%) develops TMD.<sup>27</sup> Considering the prevalence

of TMD, both groups in our study had a high rate of TMD. TMD most commonly develops in females aged 20 to 40 years.<sup>28</sup> Considering the control group's average age and gender, these factors might play a role in the high rate of TMD in the control group. However, a high rate of TMD in the study group cannot be explained by risk factors for TMD. At this point, bruxism might have caused the development of TMD in the study group. Bruxism is a rhythmic grinding and clenching masticatory muscle activity.<sup>29</sup> Constant overloading of the temporomandibular joint due to bruxism causes biochemical changes in

the synovial fluid, triggers the inflammatory process, and results in adhesions.<sup>30</sup> Ciancaglini et al.<sup>31</sup> reported that bruxers experience difficulties in mouth opening. Likewise, mothers whose children were diagnosed with CP had limitations in mouth opening. Repetitive muscle activity in bruxism results in microtraumas that might trigger chronic pain by inducing firing in low-frequency muscle nociceptors.<sup>32</sup> In addition, repetitive contraction of masticatory muscles causes hyperirritable spot formation.<sup>33</sup> These sensitive spots might have developed in the study group. Poor sleep quality is another factor causing a lower pressure pain threshold in the masticatory and upper trapezius muscles. A reduction in sleep quality causes a reduction in descending pain inhibition, which results in a central pain modulation deficiency.<sup>34</sup> Considering the effect of reduced sleep quality on pain modulation, poor sleep quality observed in the study group might have a role in lowering pressure pain threshold in the masticatory and upper trapezius muscles.

In this study, 17 % of the mothers in the control group and 72 % of the mothers in the study group had bruxism. Bruxism prevalence in adults is between 8 % and 31.4 %.<sup>35</sup> Although the rate of bruxism in the control group is in line with the reported prevalence, bruxism in the study group was relatively higher than the reported prevalence. Depression might be the primary reason for such a high bruxism rate. A study by Çebi et al.<sup>36</sup> emphasizes that bruxers had a higher BDI score than healthy individuals. Similarly, in our study, a positive correlation was found between the BDI score and the bruxism questionnaire score ( $p=0.002$ ,  $r=0.676$ ).

Apart from the cardinal symptoms of TMD, the study group had a high prevalence of secondary symptoms accompanying TMD as well. This study characterized these with high PSQI index, NDI, and BDI score.

Poor sleep quality in mothers whose children were diagnosed with CP was remarkable. Several studies report that there is a relationship between depression and sleep deterioration.<sup>37,38</sup> Nutt et al.<sup>38</sup> report that nearly three-quarters of individuals with depression had sleep deprivation. In line with the study of

Nutt et al.<sup>38</sup>, there was a positive correlation between the PSQI score and the BDI score ( $p=0.044$ ,  $r=0.479$ ). Pain might be another factor affecting the sleep quality of mothers whose children were diagnosed with CP. Sarıparlı and Takinacı report that there is a significant positive correlation between PSQI global score and NDI score.<sup>39</sup> In our study, a significant positive correlation was found between the NDI score, which assesses the disability caused by neck pain, and the PSQI score ( $p=0.004$ ,  $r=0.647$ ). It was reported that individuals with bruxism had poor sleep quality.<sup>40</sup> Yet, there was no correlation between bruxism and sleep quality in our study. Mothers whose children were diagnosed with CP without having bruxism had poor sleep quality as well. In this regard, the effect of bruxism on sleep quality might be overshadowed by the effect of depression on sleep quality.

Depression is commonly seen in mothers whose children were diagnosed with CP.<sup>41</sup> In our study, similar to previous studies, mothers whose children were diagnosed with CP had a higher depression rate. It was reported that having a child with CP is already enough to trigger depression in mothers. Sajedi et al.<sup>41</sup> reported that having a child with CP increases the risk of depression by 2.12-fold. Poor sleep quality might be another contributing factor to depression. A study by Hu et al.<sup>42</sup> points out an association between poor sleep quality and depression. Accordingly, the PSQI and BDI scores of the study group were positively correlated ( $p=0.044$ ,  $r=0.479$ ). Another factor causing depression might be neck disability.<sup>43</sup> In our study, there was a correlation between NDI and BDI scores ( $p<0.001$ ,  $r=0.765$ ).

Musculoskeletal problems are observed in mothers whose children were diagnosed with CP.<sup>44</sup> In our study, neck pain was characterized by a lower pressure pain threshold in the upper trapezius and a higher NDI score. In our study, mothers whose children were diagnosed with CP were the primary caregivers of the children. Caregiving includes a variety of activities, ranging from bathing to transfer activities. These activities may result in musculoskeletal problems. During the assessment of the mothers of children, we had the opportunity to

observe the mothers carrying their children for the rehabilitation session. As a result of these activities, neck disability might develop in mothers whose children were diagnosed with CP. Bruxism might be another factor in the development of neck disability in mothers whose children were diagnosed with CP. Neck pain is reported to be one of the symptoms developed due to bruxism.<sup>45</sup> There is a close relationship between neck muscles and masticatory muscles, as mentioned in the study by Giannakopoulos et al.<sup>46</sup> In their study, Giannakopoulos et al. report that during maximum isometric contraction, co-contraction occurs in the neck muscles with up to 11% of their maximum voluntary contraction. This supports our hypothesis, considering the reported close neurophysiological relationship between orofacial and cervical regions.<sup>47</sup> This close neurophysiological relationship emerged in studies as the dynamic interplay between orofacial pain and neck pain.<sup>48</sup> Piekartz et al.<sup>12</sup> found that bruxism and TMD are correlated with neck disability. Accordingly, positive correlations were found between NDI score and FAI score ( $p=0.001$ ,  $r=0.705$ ) and NDI score and bruxism questionnaire score ( $p=0.001$ ,  $r=0.733$ ).

### Limitations

Our study has several limitations. A self-reported questionnaire determined bruxism, so we were only able to prove the existence of probable bruxism in mothers whose children were diagnosed with CP. FAI is used to determine the existence and severity of the TMD; for this reason, we could not determine the subtypes of TMD. For further studies, the use of instrumental assessment methods to diagnose bruxism and the use of DC/TMD to determine the subtypes of the TMD would be much suitable.

### Conclusion

Our study showed that mothers whose children were diagnosed with CP may tend to develop TMD and bruxism and once again emphasized the dynamic relationship between factors that might have a role in the development of bruxism and TMD. In clinical settings, mothers whose children were

diagnosed with CP should not be ignored, and approaches and assessments should be performed to improve their overall health status as well. In this point of view, TMD and bruxism should be evaluated in these individuals in the context of preventive health services.

### Ethics Committee Approval

The study was approved by the Clinical Research Ethics Committee of the Van Training and Research Hospital (Approval date: 06.07.2022, Approval number: 2022/15-05) and conducted in accordance with the Declaration of Helsinki.

### Informed Consent

Before enrollment, participants were verbally informed, and their written approval was acquired.

### Author Contributions

All authors contributed to every stage of the study.

### Conflict of Interest

None.

### Financial Disclosure

The authors funded the study.

### Peer-review

Externally peer-reviewed

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