

Awake bruxism, temporomandibular disorders, and quality of life in dental students during COVID-19 lockdown: association with mental health

Bruxismo de vigília, disfunção temporomandibular e qualidade de vida em estudantes de odontologia durante o lockdown da COVID-19: associação com saúde mental

Impacto del encierro en el bruxismo de vigilia, los trastornos temporomandibulares y la salud mental en estudiantes de odontología

Received: 04/25/2022 | Reviewed: 05/05/2022 | Accept: 05/12/2022 | Published: 05/15/2022

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Abstract

The aim of this study was to assess the prevalence of awake bruxism (AB), temporomandibular disorders (TMD), quality of life (QoL), and their association with anxiety, depression, and stress levels, during COVID-19 lockdown. To this aim, 268 final-year dental students were asked about AB and TMD-related pain. QoL, anxiety and depression, and stress sensitivity were evaluated with the WHOQOL-bref instrument, the Hospital Anxiety and Depression Scale, and the Perceived Stress scale, respectively. Associations were tested by independent t-test, chi-square test, and simple regression analysis ($\alpha = 0.05$). AB and TMD symptoms were reported by 54.8% and 64.2% of the volunteers, respectively, which presented worse quality of life ($P < 0.05$). Regression models showed that anxiety, depression, and stress predicted AB ($P < 0.001$) and QoL ($P = 0.0001$). Final-year dental students demonstrated high prevalence of self-reported AB and TMD, both of which correlated with lower QoL and were predicted by psychological factors.

Keywords: Bruxism; Temporomandibular joint disorders; Anxiety; Depression; Quality of life.

Resumo

O objetivo desse estudo foi avaliar a prevalência de bruxismo de vigília (BV), disfunção temporomandibular (DTM), qualidade de vida (QV) e sua associação com níveis de ansiedade, depressão e estresse, durante o confinamento do COVID-19. Para isso, 268 estudantes de odontologia do último ano foram questionados sobre BV e dor relacionada à DTM. QV, ansiedade e depressão e a sensibilidade ao estresse foram avaliadas pelo WHOQOL-bref, Escala Hospitalar de Ansiedade e Depressão e Escala de Estresse Percebido, respectivamente. As associações foram avaliadas pelo teste-t independente, qui-quadrado e análise de regressão simples ($\alpha=0,05$). Sintomas de BV e DTM foram relatados por 54,8% e 64,2% dos voluntários, respectivamente, que apresentaram pior qualidade de vida ($P<0,05$). Modelos de regressão mostraram que BV ($P<0,001$) e QV ($P=0,0001$) foram preditas por ansiedade, depressão e estresse. Assim, estudantes do último ano de odontologia demonstraram alta prevalência de BV e DTM, ambas correlacionadas com menor QV e preditas por fatores psicológicos.

Palavras-chave: Bruxismo; Desordem temporomandibular; Ansiedade; Depressão; Qualidade de vida.

Resumen

El objetivo de este trabajo fue evaluar la prevalencia de bruxismo de vigilia (BV), trastornos temporomandibulares (TTM), calidad de vida (CV) y su asociación con niveles de ansiedad, depresión y estrés, durante el confinamiento por COVID-19. Se preguntó a 268 estudiantes de odontología de último año sobre el dolor relacionado con la BV y la TTM. La CV, la ansiedad y la depresión y la sensibilidad al estrés se evaluaron mediante el instrumento WHOQOL-bref, la Escala de Ansiedad y Depresión Hospitalaria y la Escala de Estrés Percibido, respectivamente. Las asociaciones se evaluaron mediante la prueba t independiente, la prueba de chi-cuadrado y el análisis de regresión simple ($\alpha=0,05$). Los síntomas de BV y TTM fueron informados por el 54,8% y el 64,2% de los voluntarios,

respectivamente, que tenían una peor calidad de vida ($P < 0,05$). Los modelos de regresión mostraron que la ansiedad, la depresión y el estrés predijeron BV ($P < 0,001$) y CV ($P = 0,0001$). Los estudiantes de odontología del último año demostraron una alta prevalencia de BV y TTM autoinformados, ambos correlacionados con una CV más baja y predichos por factores psicológicos.

Palabras clave: Bruxismo; Trastorno temporomandibular; Ansiedad; Depresión; Calidad de vida.

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has affected millions of people around the world, and several countries are still dealing with *SARS-CoV-2* and its variants. Due to the large number of lives lost and the colossal impact of this pandemic on the global economy, awareness and concern for mental health has greatly increased (Wang et al., 2020).

Restrictive lockdowns as part of the response to the pandemic has resulted in a loss of social connections among individuals. As a result, feelings of loneliness and anger have been widespread. Moreover, worries regarding the spread of COVID-19, family and self security, as well as changes in life and work plans, may further elevate mental stress, anxiety, and depression levels. It has been recognized that the elderly population is at highest risk for severe illness from COVID-19 (Shahid et al., 2020), and consequently, they have experienced increased fear regarding this disease (Khademi et al., 2020). However, young adults, such as university students, have also presented a higher incidence of emotional disorders related to COVID-19 (Wang et al., 2020). Recent studies in several countries have reported high levels of anxiety and depression among undergraduate students (Cao et al., 2020; Dragun et al., 2020; Medeiros et al., 2020; Odriozola-González et al., 2020), particularly due to university closures and uncertainties regarding future.

Psychological effects are usually accompanied by autonomic, endocrine, and skeletal motor responses, and these depend on subcortical areas of the central nervous system. The human body may respond to transient anxiety generated by stressful events with the fight-or-flight response and/or with contraction of head and neck muscles, including the masticatory muscles. Masticatory muscle activity during wakefulness, represented by repetitive or sustained tooth contact and/or by bracing or thrusting of the jaw, is called awake bruxism (AB) (Lobbezoo et al., 2018).

Anxiety and stress may be considered somatic mediators for AB onset and maintenance (Przystańska et al., 2019). Higher stress levels have been found to potentially increase the probability of self-reporting AB six-fold (Quadri et al., 2015). Additionally, the association between muscle hyperactivity and psychosocial impairment are considered to be initiating and/or perpetuating factors of painful temporomandibular disorders (TMD) (De La Torre Canales et al., 2018). Consequently, such clinical conditions may, cyclically, worsen psychosocial factors and directly influence quality of life.

Therefore, studies assessing the influence of the COVID-19 pandemic on psychological factors, as well as its consequences on oral behaviors and quality of life, are relevant and important. In particular, little is known about the effect of this recent pandemic on students subjected to lockdown conditions. Thus, the aim of this study was to evaluate the prevalence of self-reported AB, TMD-related pain, and quality of life among final-year dental students during the seventh month of a COVID-19 related lockdown in São Paulo, Brazil. The association of these factors with mental health in terms of anxiety, depression, and stress levels was also evaluated.

2. Methodology

Participant recruitment

The research protocol for this cross-sectional study was approved by the Ethics Committee of Piracicaba Dental School (CAAE: 38129220.7.0000.5418). Undergraduate dental students were evaluated with an online survey (Google Forms; Google, Mountain View, CA, USA) and data were collected in October 2020, during the seventh month of a lockdown mandated in São Paulo, Brazil in response to COVID-19. Participants were recruited via class e-mails and individual

Whatsapp® messages that were sent to the students who regularly enrolled in seven public dental schools in São Paulo (Brazil). A sample size calculation considered the 597 students registered and the prevalence of anxiety reported in a previous study (42.9%) (Fernandes et al., 2018). A design effect of 1.0 and 95% confidence level were also considered to obtain 80% power. Thus, 233 participants were required for this study.

Inclusion criteria for participation were: at least 18 years of age, general good health, and regular enrollment in a final year of study at a public university in São Paulo with an expected graduation date in 2020 or 2021. Participants under medical treatment for depression, anxiety, and/or pain prior to the COVID-19 pandemic, and those with neuropathic pain or neuralgias, were excluded.

When voluntarily accessing the survey, participants encountered an informed consent form on the first page, which had to be read and digitally signed by them. This form explained the study aim and provided risks and benefits for participation. Volunteers were assured that all responses would be treated confidentially and anonymously.

Data collection

Participants were initially screened for age, gender, and socioeconomic data. Subsequently, behavioral changes experienced by the participants during lockdown were surveyed, particularly regarding teeth clenching, grinding and/or slight contact, alcohol consumption, and smoking. Further questions addressed feelings of stress and pain onset in the masticatory muscles and/or temporomandibular joint.

Validated questions from the Oral Behaviors Checklist (OBC) were used to report which AB activities had been experienced within the previous 30 days and their frequency (Markiewicz et al., 2006). Specific statements included: (*Q1*) Clench teeth during waking hours; (*Q2*) hold, tighten, or tense muscles without clenching or bringing teeth together; (*Q3*) press tongue forcibly against teeth; (*Q4*) hold the jaw in a rigid or tense position, such as to brace or protect the jaw. For each of the statements, the participant was asked to answer whether this behavior was performed “none of the time”, “a little of the time”, “some of the time”, “most of the time”, or “all of the time”. The scores associated with these answers ranged from 0 to 4, respectively. To evaluate these findings, data were classified dichotomously and as a weighted average score. A positive self-report of AB was recorded when the participant indicated “some of the time”, “most of the time”, or “all of the time” to at least one of the affirmatives. A weighted average score was obtained by multiplying each value in the set by its weight: *Q1* x 5, *Q2* x 5, *Q3* x 1, *Q4* x 3. The sum of this multiplication was then divided by 14 (the sum of all the weights).

TMD-related pain was assessed with two questions from the TMD-Pain Screener (Gonzalez et al., 2011), an instrument of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) (Ohrbach et al., 2016): ‘In the last 30 days, which of the following best describes any pain in your jaw, temple, in the ear, or the front of the ear on both sides?’; and ‘In the last 30 days, have you had any headache that included the temple area of your head?’. For the first question, the participant could answer ‘no pain’, ‘pain comes and goes’, or ‘pain is always present’. For the second question, answers were limited to ‘yes’ or ‘no’. Volunteers who positively responded to the presence of pain in either of the two questions were further asked to answer according to a visual analog scale (VAS) ranging from 0 to 10. A score of 0 indicated ‘no pain’, while a score of 10 indicated “pain as bad as it could be”. The VAS was used to obtain the intensity of pain: 1) at the moment while replying to the questionnaire, 2) during the worst pain felt in the last month, and 3) the average pain experienced within the last 30 days. Pain intensity was subsequently determined based on the mean of these three responses.

Quality of life was evaluated with a shortened version of the World Health Organization Quality of Life instrument (WHOQOL-bref) (Fleck et al., 2000). The WHOQOL-bref includes 26 questions and provides scores from four domains: physical, psychological, social relationships, and environment. Each question is answered according to a 5-point Likert scale, with higher scores indicating a better quality of life.

Anxiety and depression levels were assessed with the Hospital Anxiety and Depression Scale (HADS). This scale includes 14 questions, with seven questions addressing anxiety symptoms and seven questions addressing depression. The final score for each outcome can vary from 0 to 21 (Botega et al., 1995). To measure stress sensitivity, the 10-item Perceived Stress Scale (PSS) was used (Reis et al., 2010). This scale included questions about how unpredictable and uncontrollable life events were for the respondent within the last 30 days. For both the HADS and the PSS, higher scores indicate a more anxious/depressive personality and increased stress sensitivity, respectively.

Statistical Analysis

Data collected on the digital platform were exported and tabulated. Descriptive statistics were performed to identify frequencies and distributions of the outcomes of interest. The Chi-square test was used to evaluate the association between self-reported AB and TMD-related pain. An independent t-test was adopted to verify possible associations between AB and TMD-related pain with quality of life. A simple regression analysis was subsequently performed to test the relationships among anxiety, depression, stress, AB, and quality of life. Analyses were performed with SAS software, version 9.3 (SAS Institute, Inc., Cary, NC, USA) with a 5% significance level.

3. Results

The sample size for this study included 268 final-year dental students (221 females, 47 males), with a mean age of 23.7 ± 2.8 y. Among the behavioral habits reported, alcohol consumption was highly prevalent, while smoking was least prevalent (Table 1). The frequency of behavioral modifications due to the COVID-19 lockdown, such as clenching, grinding and/or holding teeth together, feeling more stressed, and increased alcohol consumption and/or smoking, are presented in Table 1.

Table 1. Behavioral characteristics of the studied sample.

Behaviors	<i>N</i>	%
<i>Alcohol intake</i>	170	63.4
<i>Tobacco consumption</i>	33	12.3
<i>Behavioral changes due to lockdown</i>		
Higher incidence of teeth clenching/grinding	149	55.6
Increased alcohol consumption/smoking	50	18.7
Higher stress sensitivity	234	87.3
<i>Oral Behaviors Checklist</i>		
<i>Q1.</i> Clench teeth during waking hours	134	50.0
<i>Q2.</i> Hold, tighten, or tense muscles	140	52.2
<i>Q3.</i> Press tongue forcibly against teeth	67	25.0
<i>Q4.</i> Hold jaw in a rigid or tense position	128	47.8

Source: Authors.

AB was reported by 54.8% ($n = 147$) of the participants, with answers of “some of the time”, “most of the time”, or “all of the time” indicated for at least one of the evaluated behaviors. Among the statements for AB activity, ‘hold, tighten, or tense muscles without clenching or bringing teeth together’ was the most reported (52.2%), while ‘press tongue forcibly against teeth’ was least reported (25%) (Table 1). The weighted average AB score was 1.48 ± 0.96 .

TMD-related pain was reported by 64.2% ($n = 172$) of the participants, with 40.3% reporting onset of muscular and/or articular pain during the period of social isolation due to COVID-19. Pain intensity, as measured by the VAS, was 42.74 ± 20.00 , and this outcome was significantly associated with self-reported AB ($P < 0.0001$).

Mean scores for each WHOQOL-bref domain were considered according to self-reported AB and TMD-related pain (Table 2). Participants with self-reported AB had lower values for all of the domains, indicating worse quality of life ($P < 0.05$). Meanwhile, TMD-related pain was only found to be significantly associated with the physical and psychological domains of the WHOQOL-bref ($P < 0.001$, Table 2).

Table 2. Mean scores (SD) for each domain assessing quality of life, according to the presence or absence of self-reported AB.

Domains	Self-reported AB ($n = 147$)	No self-reported AB ($n = 121$)	<i>P-value</i>	TMD-related pain ($n = 172$)	No TMD-related pain ($n = 96$)	<i>P-value</i>
Physical	13.80 ± 2.76	15.04 ± 2.48	< 0.001	13.88 ± 2.42	15.19 ± 2.42	< 0.001
Psychological	12.44 ± 2.96	14.24 ± 2.52	< 0.001	12.76 ± 2.99	14.15 ± 2.59	< 0.001
Social relationships	14.04 ± 3.36	15.12 ± 3.32	0.010	14.80 ± 2.53	15.38 ± 2.38	0.067
Environment	14.60 ± 2.44	15.52 ± 2.44	0.014	14.42 ± 3.40	14.72 ± 3.31	0.480

AB, awake bruxism; TMD, temporomandibular disorder. Source: Authors.

Mean scores for anxiety, depression, and stress are presented in Table 3. These psychological outcomes were also considered predictors to WHOQOL-bref domains and self-reported AB, and a coefficient of determination (R^2) was calculated. For anxiety and depression as predictors, the physical, psychological, and social relationship domains demonstrated a negative linear model. This result indicates that higher scores for anxiety/depression predict a lower quality of life as measured by those domains. The environment domain followed a quadratic model for such predictors, while self-reported AB was represented by a positive linear model. Thus, higher anxiety or depression predicts higher AB. For stress as a predictor, all of the WHOQOL domains fit to a negative linear model, while a positive linear model was associated with self-reported AB. All of the models exhibited statistically significant differences.

Table 3. Regression model of anxiety, depression, and stress predictors for the WHOQOL-bref domains and the weighted average for AB.

	Regression Model	R² (%)	P-value
Predictor: Anxiety (Mean: 9.7; SD: 4.4)			
Physical	$4.427 - 0.086 \times \text{Anxiety}$	36.65	0.0001
Psychological	$4.402 - 0.112 \times \text{Anxiety}$	44.74	0.0001
Social	$4.432 - 0.082 \times \text{Anxiety}$	18.32	0.0001
Environment	$4.524 - 0.127 \times \text{Anxiety} + 0.004 \times \text{Anxiety}^2$	12.82	0.0001
Self-reported AB	$0.7275 + 0.07520 \times \text{Anxiety}$	12.17	< 0.0001
Predictor: Depression (Mean: 6.9; SD: 4.1)			
Physical	$4.259 - 0.097 \times \text{Depression}$	41.23	0.0001
Psychological	$4.236 - 0.134 \times \text{Depression}$	56.45	0.0001
Social	$4.259 - 0.091 \times \text{Depression}$	19.71	0.0001
Environment	$4.465 - 0.141 \times \text{Depression} + 0.004 \times \text{Depression}^2$	28.62	0.0001
Self-reported AB	$1.0785 + 0.05487 \times \text{Depression}$	5.74	< 0.0001
Predictor: Stress (Mean: 23.3; SD: 5.4)			
Physical	$5.101 - 0.065 \times \text{Stress}$	38.22	0.0001
Psychological	$5.451 - 0.091 \times \text{Stress}$	55.42	0.0001
Social	$5.072 - 0.062 \times \text{Stress}$	19.01	0.0001
Environment	$4.959 - 0.052 \times \text{Stress}$	24.54	0.0001
Self-reported AB	$0.3520 + 0.04732 \times \text{Stress}$	8.93	< 0.0001

WHOQOL-bref, World Health Organization Quality of Life instrument; AB, awake bruxism; SD, standard deviation. Source: Authors.

4. Discussion

This web-based survey study found that self-reported AB was prevalent in 54.8% of the dental students evaluated, and those presenting AB had a significantly lower quality of life. These outcomes were also significantly predicted by anxiety, depression, and stress. Meanwhile, TMD-related pain was reported by 64.2% of the students and was significantly associated with self-reported AB, as well as both physical and psychological domains of quality of life.

Overall, 54.8% of the participants in the present study reported some extent of AB activity, and this positively correlated with the psychological factors examined in a linear regression model. Considering the context of the COVID-19 pandemic, concerns related to finances, health, and social relationships may increase anxiety and stress levels (Wang et al., 2020), and muscle contraction is a possible defense behavior associated with these factors (Emodi-Perlman et al., 2020). Only one study has investigated oral behaviors in undergraduate dental students (Medeiros et al., 2020), and a positive correlation between OBC scores, anxiety, depression, and TMD symptom outcomes was observed during a social isolation period due to COVID-19. The findings of the present study are consistent with these results.

Regarding TMD, 64.2% of our participants reported painful symptoms. This result is consistent with the high prevalence of TMD reported among university students prior to the pandemic (Lövgren et al., 2018). Anxiety plays an

important role in TMD since it interacts with pain-modulating networks, lowers the pain threshold, and/or modifies pain perception (Vedolin et al., 2009). Thus, it is consistent that highly stressful situations like the COVID-19 pandemic could worsen TMD. In a recent study that evaluated TMD patients, those with chronic TMD were found to be more susceptible to COVID-19 distress (Asquini et al., 2021). These patients presented a decline in psychological status that correlated with an increase in chronic facial pain severity (Asquini et al., 2021). In addition, an association between awake oral behaviors and painful TMD has been observed (Chow & Cioffi, 2019; Poluha et al., 2020). Oral activities, such as AB manifestations, require repeated and sustained contraction of the masticatory muscles. These manifestations were highly prevalent in the present cohort, and they can result in muscle overload, local ischemia, and pain. These behaviors, which are associated with psychological and social factors such as anxiety, stress, and depression, can contribute to TMD onset and chronification.

Among the participants with self-reported AB and TMD-related pain, their quality of life was significantly decreased. Quality of life is affected by physical health, psychological state, level of independence, social relationships, personal beliefs, and the relation of each with the environment (Skevington, 2007). Considering that psychological factors can also act to affect AB activity and pain onset, it is reasonable to predict that one would interfere with the other, with anxiety, depression, and stress sensitivity being mediating factors.

The four WHOQOL-bref domains showed a negative and significant association with anxiety, depression, and stress. The highest coefficient of determination was achieved in the psychological domain. It is known that anxiety, depression, and stress factors diminish quality of life, and consequently, this was an expected finding. Moreover, it is possible that this higher association is related to the tools used for data collection (The WHOQOL Group, 1998).

Regarding the physical domain, it contains questions related to possible pain symptoms, as well as questions related to energy and motivation in daily activities and work. Considering the pandemic context, university students have experienced dramatic changes in routine with both universities and public places undergoing closures, thereby inhibiting outdoor activities. Thus, lack of motivation explain justify the findings obtained.

Social relationships and environmental domains are also determined by psychological outcomes (i.e., anxiety, depression, and stress). A sense of loneliness, social isolation, and lack of physical activity have been reported by students after fitness clubs, swimming pools, gyms, and public recreational areas were closed (Szczepańska & Pietrzyka, 2021). Moreover, prolonged isolation can lead to a significant decline in mood and intensify depressive symptoms (Palinkas et al., 2004). Data collection for this study was performed during the seventh month of university closure. Therefore, the findings of the present study are consistent with those published by Silva et al. (2020) which showed that low to moderate quality of life characterized 44.8% of students evaluated during a lockdown.

It is important to highlight that the studied cohort was composed of dental students in their final year, and normally this group of students would be engaged in clinical practice. Thus, the closure of the university dramatically affected the life and work goals of this group of students, since virtual classes could not provide the technical experience and training needed to graduate. Such factors would be expected to affect stress sensitivity, and this may account for the great proportion of participants (87.3%) who reported feeling greater stress due to lockdown measures.

Since this study has a cross-sectional design, it was not possible to determine whether AB and TMD-related pain were previously present, and this represents a potential limitation of the present study. Another consideration is that a TMD diagnosis was only obtained through self-reporting and did not include any type of clinical examination. Thus, participants' knowledge and perception regarding these entities represent another potential limitation of this study. The reliance on self-reporting was a consequence of the pandemic context, as in-person evaluations were not feasible during the period of this study. Moreover, nowadays, it has been highly discussed the use of an ecological momentary assessment (Bruxapp[®]) to detect AB. It has been proposed to be one of the most reliable instruments to detect AB activity. However, considering the large

population of the present research, and mandatory compliance needed for Bruxapp[®] use, AB diagnosis was based on self-report. It would be of interest for future studies to assess the same participants in a post-pandemic context to determine if fluctuations in outcomes are observed.

5. Conclusion

Thus, during the COVID-19 lockdown, final-year dental students in Brazil demonstrated a high prevalence of self-reported AB and onset of painful TMD, both of which correlated with lower quality of life and were predicted by high rates of anxiety, depression, and stress.

Acknowledgments

This study was supported by The São Paulo Research Foundation (FAPESP; Grant 2017/23429-3); and by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES), Finance Code 001.

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