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Assessment of awake bruxism in undergraduate students, using Ecological Momentary Assessment, through WhatsApp.

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ORIGINAL PAPER

ABSTRACT

This study assessed awake bruxism (AB) in undergraduate students using WhatsApp and examined the association of this behavior with quality of life and anxiety. The sample was composed of 36 healthy young adults of both genders, with an average age of 20.74 years. AB behaviors (teeth contact, teeth clenching, teeth grinding and mandible bracing) and relaxed jaw muscles were reported with Ecological Momentary Assessment, through WhatsApp, 15 times a day, for 7 days, between 8:00 am and 7:00 pm. Quality of Life (QoL) and anxiety were assessed using the SF-36 and GAD-7 questionnaires, respectively. The Mann-Whitney U non-parametric, Pearson and Spearman correlation and Pairwise non-parametric multiple comparisons 2- to-2 tests were used. The frequency of AB was 40.7%. The most frequent AB behavior was teeth contact (23.1%). Higher frequency of AB occurred on weekdays (42.3%) compared to the weekend (35.5%) ($p<0.05$). There was a negative correlation of AB behaviors and mandible bracing with the QoL - emotional aspects domain ($p<0.05$) and positive correlation of mandible bracing with anxiety ($p<0.01$). There was no difference between genders for QoL, anxiety and AB behaviors ($p>0.05$). This study highlights the importance of AB and anxiety control to improve undergraduate students' quality of life.

Keywords: Quality of life, Anxiety, Ecological Momentary Assessment, Bruxism.

Avaliação do Bruxismo em Vigília em estudantes universitários, usando a Avaliação Momentânea Ecológica, por meio do WhatsApp.

RESUMO

Este estudo avaliou a BV em estudantes universitários, por meio do WhatsApp e analisou a associação desse comportamento com a qualidade de vida e a ansiedade. A amostra foi composta por 36 jovens adultos saudáveis de ambos os sexos, com idade média de 20,74 anos. Comportamentos de BV (dentes encostados, dentes apertados, ranger de dentes e mandíbula tensionada) e mandíbula relaxada foram relatados pelo método Avaliação Momentânea Ecológica, por meio do WhatsApp, 15 vezes ao dia, durante 7 dias, entre 8:00 e 7:00 horas. A qualidade de vida (QV) e a ansiedade foram avaliadas usando os questionários SF-36 e GAD-7, respectivamente. Foram usados os testes Não paramétrico U de Mann-Whitney, Correlação de Pearson e de Spearman e omparações múltiplas Pairwise não paramétricas 2 a 2. A frequência de BV foi de 40,7%. O comportamento de BV mais frequente foi dentes encostados (23,1%). A maior frequência de BV ocorreu nos dias úteis (42,3%) em comparação com o final de semana (35,5%) ($p<0,05$). Houve correlação negativa entre os comportamentos de BV e mandíbula tensionada com o domínio QV - aspectos emocionais ($p<0,05$) e correlação positiva de mandíbula tensionada com ansiedade ($p<0,01$). Não houve diferença entre sexos para QV, ansiedade e comportamentos de BV ($p>0,05$). Este estudo destaca a importância do BV e do controle da ansiedade para melhorar a qualidade de vida dos estudantes universitários.

Palavras-chave: Qualidade de vida, Ansiedade, Avaliação Momentânea Ecológica, Bruxismo.

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INTRODUCTION

Awake bruxism (AB) is an activity of the masticatory muscles during wakefulness, in which teeth are repeatedly and sustainably in contact several times a day or for prolonged duration and/or by bracing or thrusting of the mandible [1]. Nonfunctional occlusal contacts can lead to increased muscle activity causing microtrauma to the muscle, which in turn can lead to myalgia [2] and increased frequency of temporomandibular dysfunction in some individuals [3, 4].

The behaviors of sustained teeth contact and teeth clenching during wakefulness have been associated with stress and anxiety [5]. Thus, it is important to evaluate AB in university students, since for many of them, the beginning of academic life leads to high levels of psychological stress as they are exposed to personal responsibilities, the transition to adulthood, a phase marked by many demands [5]. Research involving undergraduate students showed a prevalence of AB of 36.5% [6] and 37.9% [7] and frequency of 38% [8] and 23.6% [9], respectively.

Studies investigating AB in university students have typically relied on questionnaires [7, 10], which only make it possible to answer yes or no once, relative to any period of time in the past. This characteristic may overestimate true prevalence of AB behaviors, being efficient only to diagnose individuals who present symptomatic bruxism or who are aware of this behavior [10]. Thus, the Ecological Momentary Assessment (EMA) method came into use, an assessment modality that allows for repeated sampling during several everyday occurrences [11]. Respondents are asked at regular or occasional times to answer questions about what they are doing, repeatedly, over a period of time in the course of their daily routines [12].

EMA has been utilized to evaluate the frequency of AB by means of a smartphone app developed for bruxism control and research [8, 9, 12, 13], which proved to be a suitable tool for this purpose [8, 11]. WhatsApp (Facebook Inc.) is the most popular app in Brazil, used by 99% of the population [14]. Due to its practicality and speed of data transmission, it is an excellent tool for real-time data collection [15], and the acceptance of its use by students within the institutional environment in healthcare areas has been confirmed [16]. Thus, this tool is promising for research purposes and data collection

related to AB frequency.

The present research evaluates the frequency of AB in undergraduate students, by the EMA method, through the WhatsApp application, which to our knowledge has not yet been used for this purpose. It also compares the frequency of AB on weekdays versus weekend and verifies the association of AB with quality of life and anxiety levels of students.

MATERIAL AND METHODS

Observational longitudinal study was conducted, according to STROBE guidelines. The local Research Ethics Committee approved the project (no. 2.890.021).

The sample size calculation was performed using the sampling method of proportions for finite population (N=140 students from the 1st period of Medicine and Dentistry courses), with 95% confidence, considering the prevalence of 22.1% of AB in the population (p = 0.221), indicating a minimum N of 30, with a maximum margin of error of 13.2%.

Participant recruitment took place in 2019, during the 1st period of medical and dental undergraduate courses at a private university. A single face-to-face meeting between the researcher and each group of university students occurred in their respective classrooms for sample selection, application of the questionnaires, and orientation on the methodology for assessing oral behaviors. One hundred thirty students attended the meeting and those who agreed to participate and met the established eligibility criteria signed the Informed Consent Form. Healthy young adults between the ages of 18 and 26 who were attending university were eligible according to the inclusion criteria. The study excluded students who were undergoing orthodontic treatment or taking psychotropic and muscle relaxant medications.

Assessment of Quality of Life (QoL) and Anxiety

The SF-36 (Medical Outcomes Study 36-item Short-Form Health Survey) questionnaire was applied to assess QoL, and the GAD-7 (The General Anxiety Disorder-7), to assess anxiety, both printed and filled out by the students themselves.

The SF-36 questionnaire is composed of 36 questions about QoL, distributed in

eight domains, which assess physical and mental health. The results' evaluation is performed by assigning scores for each question, which are transformed into a scale from zero to 100, where zero corresponds to the worst and 100 to best QoL. Each domain is analyzed separately [17].

The GAD-7 features seven questions regarding anxiety symptoms experienced during the past two weeks. Possible answers are "not at all", "several days", "more than half the days" and "nearly every day", which score 0, 1, 2 and 3, respectively. The result is calculated by summing the answers of the seven questions and it can range from 0 to 21. Values greater than or equal to 10 indicate the presence of anxiety disorder. The ranges for the disorder classification of severity are: 0 to 4 – minimum; 5 to 9 – low; 10 to 14 – moderate, and 15 to 21 - severe. According to values obtained from the questionnaires, for statistical purposes, the following scale for anxiety symptoms was used: 0- minimal, 1- low, 2- moderate and 3- severe [18].

Assessment of Awake Bruxism

After the questionnaires were completed, an orientation was given on the methodology to be employed for the evaluation of oral behaviors and obtaining the diagnosis of the Possible AB, based only on the individual's positive self-report [1]. Students accessed EMA through the multiplatform instant messaging application WhatsApp. All students already had the app installed on their smartphones, so the researcher requested that her contact be registered and guided them on how the app's *Broadcast list tool* operates, which was used without automation. Finally, she gave an oral presentation in order to enable the students to recognize the 5 possible oral behaviors [9], which are: teeth contact (condition of slight teeth contact when the mouth closed); teeth clenching (more marked teeth contact than the previous and jaw muscles kept tense); teeth grinding (opposite teeth are gnashed or ground, regardless of intensity and direction of antagonist teeth contact); mandible bracing (jaw muscle stiffness or tension resembling that occurring during teeth clenching, but without teeth contact), and; relaxed jaw muscles (perceived jaw muscle relaxation without teeth contact).

The first four oral behaviors are considered AB activities, while relaxed jaw muscles, is a normal behavior [1]. These concepts, as well as the definition of AB and its

implications, were not explained to the students.

The app presented the five oral behaviors in the form of questions. The participant was prompted to choose a number corresponding to the option best representing his behavior at each moment, as follows: 1- Are your teeth in contact?; 2- Are your teeth clenched?; 3- Are you grinding your teeth?; 4- Is your mandible tensed, with no contact between your teeth?; and 5- Are you with your mandible relaxed and teeth unclenched?

The study protocol commenced one week after the orientations. For seven days, students received messages with the questions 15 times a day [12], between 8:00 am and 7:00 pm, at random intervals in order to limit expectancy bias. They were instructed to respond to the message within 10 minutes of receipt. If this was not possible, they would respond to the subsequent one. Daily reminders were sent by the researcher via WhatsApp to encourage participants to respond as often as possible to the messages.

Out of total number of participants, only those who responded 60% or more to the messages about oral behaviors (compliance) were included in the study [19].

Statistical Analysis

Statistical analysis was performed using the SPSS program IBM Statistics version 25.0. The significance level for all statistical tests was 0.05. The frequency of each oral behavior was calculated as the percentage of YES responses in relation to the total number of valid responses (YES and NO). Unanswered messages were disregarded.

To determine whether differences between the genders existed, normality was evaluated through the Shapiro Wilk test for the variables age, quality of life domains, anxiety, each of the five oral behaviors and the four AB behaviors associated (teeth contact, teeth clenching, teeth grinding, and mandible bracing), during the week, weekdays, and weekend. Since most variables didn't present normal distribution for gender, and the male portion of the sample was small (n=7), the comparison of mean values of these variables with gender was made using the non-parametric Mann-Whitney U test.

To examine the correlation between the continuous variables, Pearson's correlation coefficient was used. To evaluate the correlation between anxiety, an ordinal variable, and the numeric scale variables, Spearman's non-parametric test was used.

Friedman's nonparametric ANOVA test was used to compare each of the five oral behaviors and the associated AB behaviors during the week, on weekdays, and on the weekend. When this test indicated a statistical difference between one of the three time points, the non-parametric 2-by-2 pairwise multiple comparisons test was used.

RESULTS

Eighty-five students comprised the initial sample, 18 dropped out due to academic workload, leaving a working sample of 67. After applying the criterion of adherence of 60% or more (compliance) to the research, the final sample consisted of 36 students (with a maximum margin of error of 11.8%), with an average compliance of 78.07% ± 9.66 during the week. The mean age was 20.74 (± 1.42) years for the total sample, 20.74 (± 1.08) for males (7 individuals, 19.44% of the sample) and 20.73 (± 1.50) for females (29 individuals, 80.56% of the sample).

To evaluate reliability, considering the eight domains of QoL (physical function, role-physical, bodily pain, general health, vitality, social function, role-emotional, mental health) and anxiety, Cronbach's alpha coefficient was calculated. The obtained value was 0.75, considered normal range, and demonstrating consistency in the answers supplied by students to the administered questionnaires.

In the QoL assessment, it was observed that students had lower scores for the vitality and role-emotional domains and higher scores in the pain and physical function domains. When analyzing mean anxiety scores, the participants' anxiety disorder was found to be between low and moderate (1.44 ± 1.00). There was no difference between genders for all domains of QoL, anxiety and AB behaviors ($p>0.05$) (Table 1).

During the week, the frequency of AB behaviors was 40.68% and teeth contact was the most frequent AB behavior, 23.13%. When comparing weekdays with the weekend, regarding AB behaviors, a higher frequency was observed on weekdays, 42.3% compared to the weekend, 35.48%. Relaxed jaw behavior was more frequent on the weekend, 64.5%, unlike each AB behavior, observed more frequently on weekdays ($p<0.05$). During the three studied periods, teeth contact was the most frequently occurring AB behavior (Table 2).

When correlating each oral behavior and the AB behaviors during the week with

QoL, it was found a regular and negative correlation between mandible bracing during the week and the domains general health ($p<0.01$), vitality ($p<0.05$) and role-emotional ($p<0.05$). There was also a regular and positive correlation of relaxed jaw during the week with role-emotional and a regular and negative correlation of AB behaviors during the week, for this same domain ($p<0.05$). The other correlations were not significant ($p>0.05$) (Table 3).

When correlating oral behaviors and AB behaviors with anxiety during the week, a strong and positive correlation was observed for mandible bracing ($p<0.01$). For other correlations, no statistical difference was observed ($p>0.05$) (Table 4).

Table 1 Means for the variables studied per sex and for the total sample in the week

Variable	Sex	Mean ± SD	*p* value
Age	Male	20.74 ± 1.08	0.66
	Female	20.73 ± 1.50	
	Total	20.74 ± 1.42	
QoL-Physical function	Male	90.00 ± 12.25	0.453
	Female	84.48 ± 17.59	
	Total	85.56 ± 16.68	
QoL-Role-physical	Male	71.43 ± 30.37	0.446
	Female	61.21 ± 31.04	
	Total	63.19 ± 30.76	
QoL-Bodily pain	Male	77.71 ± 18.50	0.247
	Female	68.07 ± 21.40	
	Total	69.94 ± 20.98	
QoL-General health	Male	75.43 ± 15.27	0.16
	Female	64.55 ± 19.96	
	Total	66.67 ± 19.43	
QoL-Vitality	Male	59.29 ± 19.88	0.096
	Female	45.34 ± 18.61	
	Total	48.06 ± 19.39	
QoL-Social function	Male	69.64 ± 25.88	0.807
	Female	67.24 ± 25.53	
	Total	67.71 ± 25.24	
QoL-Role-emotional	Male	52.33 ± 17.80	0.804
	Female	49.41 ± 42.37	
	Total	49.98 ± 38.63	
QoL-Mental health	Male	61.14 ± 19.00	0.92
	Female	60.69 ± 18.05	
	Total	60.78 ± 17.96	

Anxiety	Male	1.14 ± 0.69	0.425
	Female	1.52 ± 1.06	
	Total	1.44 ± 1.00	
AB behaviors[a]	Male	43.21 ± 29.27	0.734
	Female	40.07 ± 22.81	
	Total	40.68 ± 23.77	

[a] Teeth contact, teeth clenching, teeth grinding, mandible bracing
Mann-Whitney U non-parametric test
*p<0.05 indicates statistically significant difference
QoL - Quality of Life; AB - Awake Bruxism
Male (n=7); female (n=29); total sample (n=36)

Table 2 Frequency of Oral Behaviors and Awake Bruxism (AB) behaviors and comparison between weekdays and weekend

Oral Behavior	Week	Weekdays	Weekend	Weekdays x Weekend
	Mean ± SD	Mean ± SD	Mean ± SD	p value
Teeth contact	23.13 ± 18.98	23.80 ± 18.59	20.50 ± 24.17	0*
Teeth clenching	9.51 ± 11.83	10.09 ± 12.31	7.90 ± 12.01	0.001*
Teeth grinding	0.49 ± 1.03	0.62 ± 1.41	0.21 ± 1.28	0.028*
Mandible bracing	7.55 ± 11.40	7.82 ± 11.46	6.86 ± 15.80	0.027*
Relaxed mandible muscles	59.32 ± 23.77	57.67 ± 23.87	64.52 ± 28.18	0.005*
AB behaviors[a]	40.68 ± 23.77	42.33 ± 23.87	35.48 ± 28.18	0.005*

Week - days 1 to 7; Weekdays - days 1 to 5; Weekend- days 6 and 7; (n=36)
[a] Teeth contact, teeth clenching, teeth grinding, mandible bracing
Non-parametric 2-by-2 pairwise multiple comparisons test
*p<0.05 indicates statistically significant difference

Table 3 Correlation of Oral and Awake Bruxism (AB) behaviors and Quality of Life (QoL) in the week

Variable	QoL-Physical function	QoL-Role physical	QoL-Bodily pain	QoL-General health	QoL-Vitality	QoL-Social function	QoL-Role-emotional	QoL-Mental health

Teeth contact	0.167 0.332	0.161 0.348	0.258 0.129	0.194 0.257	0.177 0.301	0.27 0.112	-0.062 0.719	0.104 0.545
Teeth clenching	0.094 0.585	-0.026ª 0.88	0.098 0.568	-0.124 0.472	-0.166 0.333	0.092 0.594	-0.327 0.052	-0.102 0.554
Teeth grinding	0.020ª 0.908	0.036ª 0.835	-0.231 0.176	-0.23 0.178	-0.221 0.195	-0.199 0.245	-0.25 0.142	-0.144 0.401
Mandible bracing	-0.162 0.345	-0.062 0.719	-0.128 0.459	-0.499**ª 0.002ª	-0.388*ª 0.019ª	-0.326 0.052	-0.385*ª 0.021	-0.325 0.053
Relaxed mandible muscles	-0,103 0,55	-0,087 0,612	-0,184 0,283	0,156 0,364	0,137 0,427	-0,096 0,577	0.408*ª 0.014ª	0.13 0.451
AB behaviors [b]	0,103 0,55	0,087 0,612	0,184 0,283	-0,156 0,364	-0,137 0,427	0,096 0,577	-0.408*ª 0.014ª	-0.13 0.451

Week - days 1 to 7; n=36
* Correlation is significant at the 0.05 level
** Correlation is significant at the 0.01 level
[b]Teeth contact, teeth clenching, teeth grinding, mandible bracing
Pearson's parametric correlation test
ª *p*<0.05 indicates statistically significant difference

Table 4 Correlation of Anxiety with Oral and Awake Bruxism (AB) behaviors in the week

Variable	Spearman's Correlation Coefficient	Teeth contact	Teeth clenching	Teeth grinding	Mandible bracing	Relaxed mandible muscles	AB behaviors ª
Anxiety	Correlation	-0.108	0.124	0.19	0.603**	-0.198	0.198
	p value	0.531	0.471	0.268	0.000*	0.247	0.247

Week - days 1 to 7; n=36
ªTeeth contact, teeth clenching, teeth grinding, mandible bracing
** Correlation is significant at the 0.01 level
Pearson's non parametric correlation test
* *p*<0.05 indicates statistically significant difference

DISCUSSION

It was observed over the last decades there has been a significant increase of studies that relate Dentistry and Psychology, focused on understanding of psychological factors associated with dysfunctions of the craniomandibular region [20]. Related to this, the present research evaluates AB through the application WhatsApp, and measures its association with QoL and degree of anxiety in university students. It was found that the frequency of AB behaviors during the period evaluated was 40.7% with a strong and positive association between mandible bracing and anxiety confirmed.

As AB can occur at any time of day, data were collected in real time, 15 times a day, for 7 days [12], thus implementing the EMA method, which illuminates epidemiological characteristics of many diseases [21]. Additionally, this method can be readily implemented using smartphone technology [11], already a familiar part of everyday life for most of the population [22] and can be used to collect data for clinical purposes and research [11].

WhatsApp was selected for the application of EMA and proved to be suitable for this purpose due to its simplicity, in addition to its status as the smartphone application most often used by university students [23]. This app demonstrates practicality and innovation, as it offers the possibility of chatting with several people at the same time, exchanging messages individually or in groups. The app also offers the *Broadcast list tool*, which allows synchronous group messaging with individual responses, ensuring confidentiality [16].

Even though it was easy for participants to respond, many failed to answer at various times across the 7-day duration of the survey, though they received daily incentive messages. To increase the students' oral behaviors results' reliability, it was decided to leave in the sample only those who answered 60% or more of all questions, a frequency considered adequate [19]. After this redefinition of the sample, 78.04% of all questions were answered during the week, an compliance rate similar to that of another smartphone app study (73.4%) [9] and that of 71.52% from a survey that applied EMA through another online device (Mentimeter)[24].

According to study results, participating university students displayed a frequency of AB behaviors during the week of 40.7%. This result was similar to that of a

study conducted with Italian students attending a variety of undergraduate courses, whose frequency of AB was 38.0% [8]. Another study found that students preparing to enter university had a frequency of 38.4% [13]. Both studies used the smartphone app BruxApp®. In other studies, however, [9, 12] lower frequencies were observed, 28.3% and 23.6%, respectively, which might be explained by the fact that the participants were final-year dental students. They would have greater knowledge about the negative consequences of AB compared to the students in the present study, who were in the 1st period of Medicine and Dentistry programs. In addition, the app used in these studies provide guidance regarding AB behaviors [25], which may have promoted self-awareness and positive changes toward avoiding such behaviors [8]. In the present research, we decided not to explain concepts related to AB and oral behaviors that might be harmful to participants, to avoid potential bias.

Teeth contact was the most frequently occurring condition during the week, with an average of 23.1%. Higher frequency of this behavior was also seen in another study with university students, 20.0% [8]; students in a university preparatory course, 18.6% [13] and dental students, 14.5% [12]. This possibly occurred because this is the easiest behavior to recognize and due to the fact that individuals associate bruxism to teeth in contact [13], which may have influenced their responses.

The presence of psychiatric disorders, such as depression and anxiety, is increasingly frequent in students of health courses [26]. The Dentistry and Medicine students evaluated in the present study showed a low to moderate degree of anxiety. This aligns with the literature, which reports a prevalence of 27.53% [27] to 73% [28] of stress among Medical students, which may lead to anxiety and depression [29, 30] and that 47% of Dentistry students have perceived stress and 29% report abnormal levels of anxiety [31]. In addition to the tasks common to any undergraduate course, health area academics also need to manage the responsibility of "caring for the other", thus increasing feelings of overload and pressure [26].

Additionally, results showed that frequency of AB behaviors on weekdays (42.3%) was higher than during the weekend (35.5%), which can be explained by the fact that students face many stressors during academic activities. Stress and anxiety are associated with AB behaviors, such as teeth contact and teeth clenching [5]. Such factors

include the large volume of information that needs to be studied, competition among academics, concern about academic performance, loss of interest in leisure [21], limited time for leisure, fear of failure [32] and exclusive dedication to university activities [30].

Mandible bracing is one of the most clinically relevant behaviors of AB because the sustained contraction can lead to muscle fatigue, pain and overload in the temporomandibular joint [13]. The students in this research reported this behavior at a relatively low frequency (7.55% ± 11.40), perhaps due to the difficulty in recognizing it [9]. However, a strong, positive correlation of this behavior with anxiety was confirmed, corroborating studies that detected an association of AB behaviors with psychosocial factors. Anxiety-related processes occur in the central nervous system and involve interactions between the prefrontal cortex, limbic, paralimbic structures and motor regions of the brainstem, leading to motor and physiological responses [33]. Sustained muscle contraction of the head and neck also relates to body posture associated with the fight-or-flight response. Thus, muscle contraction during AB may be part of a cluster of defense behaviors associated with stress and anxiety [34].

When assessing the QoL of these students, low scores were detected for the vitality domain, which reflects energy, exhaustion and tiredness, and role-emotional factors, associated with problems and/or pressures at work or any daily activities due to emotional problems [35]. An association of AB with the individual's QoL was also confirmed. Our results show that as the frequency of AB increases, the role-emotional domain for QoL decreases. These results align with those of the study carried out with medical students, in which low scores were obtained for females in the domains role-physical, pain, vitality, social function and role-emotional, as well as mental health. The authors also reported a difference between genders, with higher values for males [36], which was not observed in this study.

The main limitation observed in this research was the difficulty encountered in obtaining the collaboration of some participants, considering that the EMA method requires availability of the individual, due to the large number of messages sent during the period. In addition, use of automation in the application for sending messages would facilitate the development of this study. Automation might be incorporated in new studies employing the use of WhatsApp.

Although not all individuals with AB behaviors present pathological signs and symptoms in oral health [12], the frequency of AB observed in this and other studies is a source of concern. The possible damage to oral health in a portion of individuals who present such behaviors, as well as the extreme difficulty in accurately determining the orofacial and psychological characteristics of this population, suggests the need for studies with larger samples and innovative assessment methods. Since some individuals are not aware of AB behaviors, and use of warnings leads the individual to reduce their frequency by self-awareness [8, 9], it is suggested that in addition to awareness-raising actions, it may be useful to promote the use of these applications, such as No clenching / Desencoste seus dentes® and BruxApp® for AB control. It is likely to bring substantial benefit to oral health in the population.

CONCLUSION

University students had an AB frequency of 40.7% during the 7-day study, which was higher on weekdays compared to the weekend. There was a higher frequency of teeth contact (23.13%), negative correlation of AB behaviors and mandible bracing with QoL and positive correlation between mandible bracing and anxiety.

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Compliance with Ethical Standards

The observational longitudinal study was conducted according to STROBE guidelines. The authors declare that the local Research Ethics Committee approved the project (no. 2.890.021) and that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent was obtained from all individual participants included in the study.

Competing Interests

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