European Journal of Neurodegenerative Diseases
ISSN 2279-5855 / 2022 Vol. 11, ISSUE N. 1, January-June

AWAKE BRUXISM: FREQUENCY, PROGRESS AND CORRELATION WITH PHYSICAL, ENVIRONMENTAL, PSYCHO-SOCIAL PARAMETERS IN A SAMPLE OF HEALTHY ADULT SUBJECTS

A. Del Giudice* and G. Benedetti

Postgraduate School of Orthodontics, University of Ferrara, Ferrara, Italy.

**Correspondence to:*
Dr. Alberto Del Giudice,
Postgraduate Specialist in Orthodontics,
Postgraduate School of Orthodontics,
University of Ferrara,
Via Luigi Borsari 46,
Ferrara 44121, Italy.
e-mail: alberto.delgiudice@gmail.com

ABSTRACT

Bruxism is a multifactorial pathological behaviour that consists of a repetitive jaw-muscle activity characterised by clenching or grinding of the teeth and/or bracing or thrusting the mandible. Polysomnography is today considered the gold standard for diagnosis, but momentary ecological assessment (EMA) studies are also currently being used. In particular, a smartphone application named BruxApp® can provide real-time data on awake bruxism (AB) with great precision. The aim of the study is to analyse the correlation between the frequency of awake bruxism and physical, environmental and psycho-social parameters in a specific cohort, i.e. adult asymptomatic patients. Of a sample of 152 subjects with age ≥ 30, we obtained a 73,4% of responses during the 7-day long records. The mean percentage of AB recorded through BruxApp® was 35% (SD 25%), while patients' self-assessment questionnaire reported a 30% AB prevalence. No significant association was found between AB and age or gender. There is, however, a statistically significant association between AB and familiarity. The present study provided new data about the prevalence and correlation of AB in healthy adult patients. Further evidence has been produced about the absence of a relevant correlation between bruxism and age/gender, nor negative clinical consequences, linea alba aside. The psychological and neurological sphere and familiarity appeared to be much more positively associated with AB.

KEYWORDS: *bruxism, polysomnography, BruxApp®, masticatory muscles activity*

INTRODUCTION

Bruxism is defined as a repetitive jaw-muscle activity characterised by clenching or grinding of the teeth and/or bracing or thrusting of the mandible. This activity has two distinct circadian manifestations: it can occur during sleep (sleep bruxism-SB) or wakefulness (awake bruxism-AB) (1). SB is defined as a masticatory muscle activity during sleep characterised as rhythmic (short-term phasic activity) or non-rhythmic (long-term tonic activity); AB is characterised by repetitive or sustained tooth contact and/or bracing or thrusting of the mandible.

Received: 16 March, 2022
Accepted: 08 May, 2022

2279-5855 (2022)

The aetiology is uncertain and multifactorial: while the occlusal discrepancies and the anatomy of the bony structures of the orofacial region play only a minor role, other factors, like smoking, alcohol, drugs, systemic diseases, stress, trauma, and heredity factors, appear to have an important role. This oral behaviour has been associated with tooth wear, masticatory muscle tenderness, headaches, and painful TMJ.

Polysomnography is the gold standard for diagnosing bruxism; however, a momentary ecological assessment (EMA) can be used to evaluate the muscles' prolonged isometric activity. EMA studies assess particular events in subjects' lives or assess subjects at periodic intervals, often by random time sampling, using technologies ranging from written diaries and telephones to electronic diaries and physiological sensors (2). Based on these EMA approaches, some recent research has been proposed for studying bruxism: a smartphone application named BruxApp®. This app collects real-time data on awake bruxism and has already been used in different studies in the literature (3-5).

The aim of the study is to investigate the frequency of awake bruxism in an asymptomatic adult patient because, until now, the samples were only students, and also to analyse the correlation between the frequency of awake bruxism and physical, environmental and psycho-social parameters.

MATERIALS AND METHODS

A dedicated smartphone application has been used (BruxApp®) on a sample of 152 subjects with age ≥ 30 until 100 questionnaires obtained a negative answer to item Q65 (Fig.1): in this way, 53 males and 47 females were selected with a mean age of 37.99 ± 8.98 years. This study is made to record real-time reports on five specific oral conditions (relaxed jaw muscles, tooth contact, teeth clenching, teeth grinding, mandible bracing) related to the spectrum of AB activities. Data were recorded over a 7-day period where the subject responded from 12 to 20 daily alerts within 5 min of the input. Seventeen subjects could not complete the data correction, so they were not considered for the final clinical test, narrowing the sample to 83 subjects. The distribution by gender comprises 41 males and 42 females. Mean age 38,7± 9,6 years while then stratification of the sample by age range discovers a significant majority between 30-39.9 (63 subjects) and a remaining distribution between 40-49.9 (11 subjects) and above 50 years (9 subjects).

Two questionnaires were utilised: the first one, DC for bruxism-anamnesis ITA (version 1.2), was anonymous about age, gender, and ID with different items; the other one was a self-assessment questionnaire. All data were collected in Excel and analysed with R 3.5 software.

First, an evaluation with a paired t-test was performed to compare the answers to the initial self-evaluation questionnaire with the results detected by BruxApp®. Subsequently, a descriptive statistical analysis of the data obtained was made: the correlation between the percentage of awake bruxism and ordinal categorical variables was evaluated with Spearman's Rank correlation coefficient. Finally, the association between the percentage of awake bruxism and binary variables was evaluated with Student's t-test. A p-value below 0.05 was considered significant.

Pain

56. Have you ever had pain in one or more highlighted areas in the figure below?

no□ yes□

Fig. 1. *Question 56 from anamnestic questionnaire DC for Bruxism - Anamnesis ITA (version 1.2).*

RESULTS

The mean compliance recorded with BruxApp® was 73.4% of the total alert. The average frequency of relaxed jaw muscles (RR) reports 64.4%; mandible bracing (SM)14.2%; teeth contact (CD) 17.9%; teeth clenching (SD) 3.1%; teeth grinding (DD) 0.2%. Overall, the mean percentage of AB was 35 (SD 25%). The numerical comparison with the data obtained from the self-assessment questionnaire completed before starting to use BruxApp® is graphically shown below (Fig.2). From the data obtained from the questionnaire, it was possible to calculate the prevalence of AB in the sample equal to 30.1% (25 subjects with self-report AB ≥ 3 on the scale from 1 to 10). After that, the averages of the 6 percentage values of BruxApp® are calculated, and the results are the following: 71.7% alert; 50.2% RR; 27.4% SM; 17.5% CD; 4.8% SD; 0% DD. Therefore, the total value of AB for both AB+ (anamnestic self-assessment parameter on the presence of AB) and the total sample is 49.8% and 35.4%.

Fig. 2. *Numerical comparison with the data obtained from the self-assessment questionnaire completed before starting to use BruxApp®.*

Finally, from the available database, the average responses attributable to the frequency of AB were obtained for the first 3 and the last 3 days of the test: the results were 36.7% and 34.5%, with a differential of -2.2% (biofeedback).

DISCUSSION

Regarding the analysis of the average value, the examined sample responded on average to 73.4% of the alerts proposed by the app in the 7 days of registration which is indicative of a level of compliance slightly lower than that detected by Colonna et al. (5). As for the average of the values relating to the 5 conditions, the result (RR=64.6%, SM=14.2%, CD=17.9%, SD=3.1%, DD=0.2%) is correspondent with what was detected by Zani et al. (3) whose values (at the first week) were similar (RR=62%, SM=14%, CD=20%, SD=3%, DD=1%). Even the prevalence obtained from the initial anamnestic questionnaire equals 30.1% of the sample (6).

When analysing the reliability of the self-assessment questionnaire, the comparison of the data of the questionnaire and that obtained by BruxApp® showed that the average value of RR from the questionnaire was found to be 83.5%, while for MS, the average value was 2.8%; a clear difference is immediately evident for both conditions. On the other hand, analysing the BruxApp® data, only 45 subjects have an average of less than 10% responses. Therefore, SM would seem to be a condition hardly perceived by patients.

The subject predicts a minor discrepancy in the preliminary phase and the result obtained after 7 days of registration concerning the values of CD and DD, as the differences are + 5.4% and + 1.4%. However, even in this case, the Paired t-test resulted in a statistically significant difference for both conditions (Fig.3, $p < 0.05$).

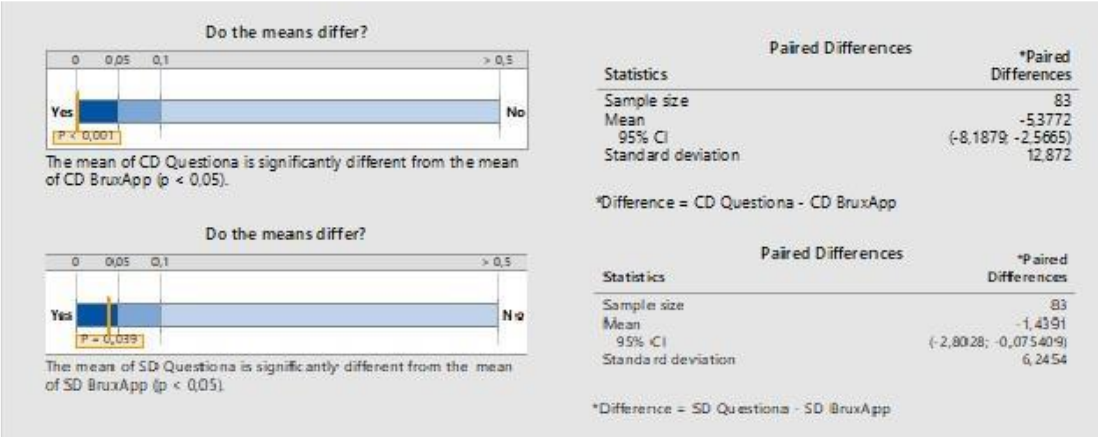

Fig. 3. *Paired t-test - comparison between CD and SD frequency expected by the subject and detected with BruxApp.*

The analysis of the associations between "AB" and the variables considered done in this study, just like in other works based on data collection through EMA devices (3, 4, 5), showed no significant association between male and female genders and AB values obtained ($p = 0.39$). Instead, a higher % of awake bruxism with a positive self-report for sleep bruxism, familiarity, non-functional oral habits and mostly the presence of linea alba was highlighted.

When discussing the frequency of AB and clinical correlates, it is impossible to completely detach the presence of AB with a relapse on a physical level; however, the findings align with what was recently stated in the consensus (7) regarding the clinical correlates of bruxism. Therefore, as proposed by the experts, we can identify situations in which bruxism is a harmless muscular behaviour just like others in which an increase in muscular activity is associated with one or more negative clinical consequences. Furthermore, although there are borderline cases, these subjects showed slight muscle pain but not high on clinical examination; this further confirms that bruxism should not be considered a pathology per se (7).

On the other hand, the analysis of the frequency of AB and statistically insignificant variables also suggests a possible correlation between the percentage of awake bruxism and the intake of alcohol, tobacco, and caffeine. However, the result was only near to the significance statistics ($p = 0.08$) and mainly, contrary to what is reported in the literature (8-11), the association turns out to be inverse; hence, as the score increases, the percentage of bruxism decreases.

On the sample studied, it is not possible to make any assertions concerning the correlation with dental information and the association with parafunctions, pain in the head, neck, shoulders and TMJ, noises and joint dysfunctions, presence of tinnitus, jaw trauma, whiplash and other habits (Table I). The frequency of AB was also analysed with the age of the subjects; however, the data showed no association (neither linear, quadratic, nor cubic) between them.

Table I. *Correlation with dental information and association with parafunctions.*

VARIABILITY	Average (SD)	p-value
Gender: Woman Man	 38 (23) 33 (27)	0.39
Report AB: No Yes	 34 (25) 50 (26)	0.21
Report SB: No Yes	 30 (23) 53 (23)	0.0003
Familiarity: No Yes	 32 (24) 48 (26)	0.02
Non-functional oral AB: No Yes	 31 (25) 43 (24)	0.04
Parafunction: No Yes	 36 (25) 34 (27)	0.84
Drugs and medicines use: No Yes	 35 (25) 52 (11)	0.25
Head/neck/shoulder/ATM pain: No Yes	 33 (24) 44 (27)	0.14
ATM click/dysfunction: No Yes	 35 (25) 42 (24)	0.40
Tinnitus: No Yes	 31 (23) 40 (27)	0.10
Mandibular trauma: No Yes	 35 (25) 34 (37)	0.96
Colpo di frusta: No Yes	 35 (25) 37 (26)	0.75
Other problems: No Yes	 34 (26) 39 (24)	0.43
Linea alba: No Yes	 19 (15) 50 (23)	<0.0001
Previous fixed orthodontic therapy: No Yes	 34 (26) 40 (20)	0.32
Previous removable orthodontic therapy: No Yes	 34 (24) 39 (29)	0.56

CONCLUSIONS

Thorough studies have been made to investigate the normality of awake bruxism; however, these were limited only to university students. The research has now been extended to asymptomatic adult patients, using the same variables used for the students. It also includes the correlation between awake bruxism and physical, environmental, and psycho-social parameters. The analysis of the collected data has shown that, regarding the frequency of awake bruxism in adult patients, the average values registered from the entire sample in the 7 days of registration through BruxApp® is equal to 35.4% of responses. As for the correlations between awake bruxism and the lifestyle, associated pathologies and clinical signs and symptoms from the study, the conclusive results differ. They reveal no significant association between AB and age or gender. There is, however, a statistically significant association between AB and familiarity. The causes related to the psychological and neurological sphere have also been implied. There has been further confirmation that awake bruxism

is considered a behaviour which can also not be correlated with negative clinical consequences. In addition, there is a correlation with clinics, which is not necessarily a source of spontaneous symptoms. Lastly, there is a strong association between high percentages of AB and the presence of mono- or -bilateral linea alba.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Lobbezoo F, Ahlberg J, Glaros AG, et al. bruxism defined and graded: an international consensus. *Journal of Oral Rehabilitation*. 2013;40(1):2-4. doi:10.1111/joor.12011
2. Schwartz JE, Stone AA. Strategies for analysing ecological momentary assessment data. *Health Psychology*. 1998;17(1):6-16. doi:10.1037//0278-6133.17.1.6
3. Zani A, Lobbezoo F, Bracci A, Ahlberg J, Manfredini D. Ecological Momentary Assessment and Intervention Principles for the Study of Awake Bruxism Behaviors, Part 1: General Principles and Preliminary Data on Healthy Young Italian Adults. *Frontiers in Neurology*. 2019;10:169. doi:10.3389/fneur.2019.00169
4. Bracci A, Djukic G, Favero L, Salmaso L, Guarda-Nardini L, Manfredini D. Frequency of awake bruxism behaviours in the natural environment. A 7-day, multiple-point observation of real-time report in healthy young adults. *Journal of Oral Rehabilitation*. 2018;45(6):423-429. doi:10.1111/joor.12627
5. Colonna A, Lombardo L, Siciliani G, et al. Smartphone-based application for EMA assessment of awake bruxism: compliance evaluation in a sample of healthy young adults. *Clinical Oral Investigations*. 2019;24(4):1395-1400. doi:10.1007/s00784-019-03098-2
6. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *Journal of Orofacial Pain*. 2013;27(2):99-110. doi:10.11607/jop.921
7. Lobbezoo F, Ahlberg J, Raphael KG, et al. International consensus on the assessment of bruxism: Report of a work in progress. *Journal of Oral Rehabilitation*. 2018;45(11):837-844. doi:10.1111/joor.12663
8. Shetty S, Pitti V, Satish Babu CL, Surendra Kumar GP, Deepthi BC. Bruxism: A Literature Review. *The Journal of Indian Prosthodontic Society*. 2010;10(3):141-148. doi:10.1007/s13191-011-0041-5
9. Lavigne GJ, Kato T, Kolta A, Sessle BJ. Neurobiological Mechanisms Involved in Sleep Bruxism. *Critical Reviews in Oral Biology & Medicine.* 2003;14(1):30-46. doi:10.1177/154411130301400104
10. Koob G. Drug Reward and Addiction. In: Squire L, Bloom F, McConnell S, Roberts J, Spitzer N, Zigmond M, eds. *Fundamental Neuroscience*. 2nd ed, Academic Press, San Diego, California, pp. 1127-43; 2003.
11. Rintakoski K, Kaprio J. Legal Psychoactive Substances as Risk Factors for Sleep-Related Bruxism: A Nationwide Finnish Twin Cohort Study. *Alcohol and Alcoholism*. 2013;48(4):487-494. doi:10.1093/alcalc/agt016