J Oral Res
oral and craniofacial sciences

Article

Comparison between sleep disorders and polysomnographic records of young adults with and without sleep bruxism: A cross-sectional study.

Comparación entre trastornos del sueño y registros polisomnográficos de adultos jóvenes con y sin bruxismo del sueño: Un estudio transversal.

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Receipt : 08/09/2019 Revised: 05/18/2020
Acceptance: 08/25/2020

Abstract: Objectives: To compare sleep disorders and polysomnographic records among a group of young adults with sleep bruxism (SB) and a control group (C). **Material and methods:** This cross-sectional study considered a consecutive sampling of students from the target population, searching for cases of SB until 20 individuals with and without SB were obtained. Sleep disorders were determined by applying both medical records and physiological records during sleep which were gathered from a polysomnography exam. To establish the difference of the means according to SB, the T-Student or Mann-Whitney U tests were used, depending on the data. A Logistic Regression analysis was also applied. **Results:** The study found differences (p-value<0.05) in the variables related to the sleep disorder: the possibility of major depressive episode (SB: 30% - C: 5%), degree of nasal airway obstruction (SB: 20% - C: 10%) and in polysomnographic registers: sleep time stage 1 (SB: 9 min - C: 18 min), Rapid Eye Movement (REM) stage (SB: 123 min C: 93 min), number of periodic movement of the limbs (SB: 84.2 - C: 49.7), bruxism index (SB: 40.2 - C: 10.1) and average of total arousals (SB: 71.9 - C: 57.5). According to the logistic regression model, the Odds Ratio (OR) of SB, in relation to the periodic movement of the limbs and the degree of airway obstruction, it showed a statistically significant relationship (p-value<0.05). **Conclusion:** There were significant differences recorded in two sleep disorders between the two groups: the degree of airway obstruction and the possibility of having a major depressive episode. Differences were found in sleep and REM time stages, periodic movement of limbs and bruxism events.

Keywords: Bruxism; sleep bruxism; sleep wake disorders; polysomnography, parasomnias; dyssomnias.

Cite as:
López-Soto O, Orellana-Cáceres J, de Mejía FR & Aguilera-Eguía R.
Comparison between sleep disorders and polysomnographic records of young adults with and without sleep bruxism: A cross-sectional study.
J Oral Res 2020; 9(4):326-335.
Doi:10.17126/joralres.2020.074

Resumen: Objetivo: Comparar los trastornos del sueño y los registros polisomnográficos entre un grupo de adultos jóvenes con bruxismo del sueño (BS) y un grupo control (C). **Material y Métodos:** Este estudio transversal consideró una muestra consecutiva de estudiantes de la población objetivo, buscando casos de BS hasta obtener 20 individuos con y sin BS. Los trastornos del sueño se determinaron aplicando registros médicos y fisiológicos durante el sueño que se obtuvieron de un examen de polisomnografía. Para establecer la diferencia

ISSN Print 0719-2460 - ISSN Online 0719-2479. www.joralres.com/2020

de las medias según BS se utilizaron las pruebas t-Student o U de Mann-Whitney, según los datos. También se aplicó un análisis de regresión logística. **Resultados:** El estudio encontró diferencias (p<0,05) en las variables relacionadas con el trastorno del sueño: posibilidad de episodio depresivo mayor (BS: 30% - C: 5%), grado de obstrucción de la vía aérea nasal (BS: 20% - C: 10%) y en registros polisomnográficos: tiempo de sueño etapa 1 (BS: 9 min - C: 18 min), etapa de Movimiento Ocular Rápido (REM) (SB: 123 min C: 93 min), número de movimientos periódicos del extremidades (BS: 84.2 - C: 49.7), índice de bruxismo (BS: 40.2 - C: 10.1) y promedio de despertares totales (BS: 71.9 - C: 57.5). Según el modelo de regresión logística, el Odds Ratio (OR) del BS, en relación al movimiento periódico de las extremidades y al grado de obstrucción de la vía aérea, mostró una relación estadísticamente significativa (p<0,05). **Conclusión:** Se registraron diferencias significativas en dos trastornos del sueño entre los dos grupos: el grado de obstrucción de la vía aérea y la posibilidad de tener un episodio depresivo mayor. Se encontraron diferencias en las etapas de sueño y tiempo REM, movimiento periódico de extremidades y eventos de bruxismo.

Palabra Clave: *Bruxismo; bruxismo del sueño; trastornos del sueño-vigilia; polisomnografía; parasomnias; disomnias.*

INTRODUCTION.

Sleep Bruxism (SB) is a complex multi-systemic physiological process, potentially with a multifactorial etiology. The advancement of knowledge through studies has transformed some of the concepts previously considered true. SB is no longer considered a parasomnia and its etiology is not associated with purely mechanical or physiological factors.[1] The International Consensus on the Assessment of Bruxism in 2018 defines BS as "[a] masticatory muscle activity during sleep that is characterized as rhythmic (phasic) or non-rhythmic (tonic) and is not a movement disorder or a sleep disorder in otherwise healthy individuals".[2]

Among adults, prevalence of SB is 1%-15%, and SB among children and adolescents is 3%-49%. Major factors consistently associated with SB were use of alcohol, caffeine, tobacco, several psychotropic medications, acid reflux disease and passive smoking. Several temporo-mandibular disorder signs and symptoms present a plausible association with SB. Bruxism might result in biomechanical complications related to dental treatments, however, evidence has so far not supported periodontal damage.[3]

SB, as a sudden phasic tonic activity of the mandibular muscles, can be associated with dental grinding but may also have secondary gold-dental consequences such as dental fractures, occlusal and alteration to the function of the temporo-mandibular joint, pain in the orofacial muscles or movement limitation and temporal headaches.[4]

SB also contributes to excessive wear of restorative materials,[1,2] cracks in posterior teeth, and failure in the treatment of over-dentures and dental implants.[7,8]

SB is diagnosed by records of audible dental grinding during sleep reported by a roommate, signs of dental wear with masseter muscle hypertrophy, pain in the temporal region when awakening, and polysomnographic examination considered the definitive diagnostic test.[9]

There is controversy regarding the phases of sleep during which SB occurs, although, most of them appear to be associated with Non-Rapid Eye Movement (NREM) sleep phases 1 and 2.[10] It has been suggested that bruxism may be closely associated with the phases of awakening from sleep.[11] SB can occur concomitantly with sleep disorders including: obstructive apnea, parasomnias, restless legs syndrome, increased jaw activity, and behavioral disorders related to rapid eye movement.[9]

Maluly, *et al.*,[12] research work in 2013 sought to associate SB with sleeping disorders. This study, however, had the limitations of a descriptive design, considered a wide age range (between 20 and 80 years), did not report inclusion criteria, nor evidence of intervening variables control, such as: drug consumption, neurological, chronic or psychic diseases. Its main objective was to establish the prevalence of SB. Kang *et al.*,[13] analyzed sleep disorders in 1,081 patients regarding polysomnographic records, but it did not include the SB variable nor the Nashed *et al.*,[14] research. It only considered SB episodes associated with significant changes in arterial blood pressure.

In contrast to the studies cited earlier, the present study aimed at comparing sleep disorders identified by clinical records designed for a complete diagnosis, including physical aspects related to sleep disorders (which were not considered in the previous studies).

Polysomnographic records analyzed in this paper are those that are traditionally considered.

Generally, the authors who work on the subject only select some records, but in this study, all were considered. The aim of this study was to compare sleep disorders and polysomnographic records among a group of young adults with SB and a control group.

MATERIALS AND METHODS.

This cross-sectional study used a consecutive sampling from a target population to complete the sample size of the groups with and without SB. (Figure1)

The group of individuals with SB were selected by applying three screening tests, from the most sensitive to the most specific, according to the guidelines set by Klasser in 2015.[1] These are as follows:

Test 1: SB self-reported during night.

Test 2: Diagnostic criteria for oral inspection – determined by an oral rehabilitator, with clinical examination, the presence of tooth facets or abnormal molar wear, masseter muscle hypertrophy in maximum voluntary clenching and the symptoms of discomfort, fatigue or pain in the masticatory muscles (transient pain in these muscles or in the temporal muscle region in the morning) as long as this muscle pain could not be explained by another cause such as a neurological or medical disorder, or drugs consumption or abuse of psychoactive substances.

Test 3: Polysomnographic (PS) examination: individuals who were positive for the first two tests were submitted to a polysomnography. SB events were counted using the automatic analysis tool incorporated into the Cadwell Easy III polysomnography software. The cut-off to assign subjects to the SB group was through that which was proposed by Lavigne *et al.*,[15] of 25 SB bursts per hour. If they were positive in polysomnography test, they were definitively considered in the SB group.

Otherwise, they were included in the control group. Through applied screening, selection bias and poor classification were controlled. Each case included an individual similar in age and sex and with no SB. If there was more than one candidate, they were randomly selected from the control candidates. The necessary examinations were performed until the numbers of individuals with SB and control group were reached, respectively, according to the calculated sample size. Sleep disorders were determined by applying an accepted medical record used for research in sleep laboratories of university entities. This medical record included a questionnaire about the individual's identification data, the Epworth ESE sleepiness scale, sleeping habits according to adequacy and variability in day sleep and the probability of having a major depressive disorder or anxiety. Regarding specific sleep disorders, records investigated insomnia, parasomnias and movement disorders during sleep. In addition, it determined if there was a disorder due to poor sleeping hygiene.

To determine the physical conditions, which could be related to respiratory disorders associated with sleep disorders, the records considered a clinical examination performed by a physiatrist to determine Body Mass Index (BMI), neck circumference, size of gold space - pharyngeal according to the Mallampati index and the degree of airway obstruction by the tonsils. A dentist determined the facial skull structure and the type of occlusion that was related to respiratory function.

All variables related with sleep disorders. (Table 1 and Table 2)

The PS was performed by a sleep laboratory technologist who did not know the objectives of the research and the characteristics of the patient in relation to the records of bruxism and the others related to it. The PS considered electro-oculography, an electromyogram, an air flow measurement, the measurement of respiratory effort, the measurement of the presence of snoring, the monitoring of cardiac function, the measurement of oxygenation and the monitoring of the body position. Electroencephalography recorded the brain`s superficial electrical activity and allowed the identification of the stages of sleep and insomnia. The PS sensors were fixed in the patient in a non-invasive way, with the use of an adhesive tape (fixomull).

The application of the electrodes and sensors was considered the most critical part of the examination, so that the re-checking protocol at each of the points, which were monitored, was fulfilled. This re-check was recorded in the exam log. The PS variables considered. (Table 3)

PS was analyzed after the recording of sleep stages by a trained and calibrated physiatrist in the investigation of sleep disturbances. The information was collected from the automated analysis tool incorporated in the software of the polysomnographer Cadwell Easy III, version updated in 2016. Records were processed in the statistical program STATA version 13.1.

The sample study size was obtained considering a

frequency of exposure in the SB group of 0.60,12,16 and 0.10 in the control group, a confidence level of 96%, a Statistical Power of 80% and a ratio of SB with no SB equal to 1.

The final sample size was 20 individuals in each group. This research requested a written informed consent from the participants and authorization to the bioethics committee of the university where the project was carried out (Act 059 of 2016). The reference population was made up of university students enrolled in an oral prevention program, with ages between 18 and 28 years.

The SB group was selected initially from undergraduate students of this program who were consulted for dental grinding or clenching during sleep. The control group was selected from university students who participated in the same preventative program but did not have any alteration of the stomatognathic system, nor did they report dental grinding or clenching during sleep.

The following conditions were considered as the exclusion criteria for both SB and control groups: ongoing dental treatment, more than four conservative prosthetic restorations of the crowns, drug consumption that affects sleeping and/or the motor system, disorders of the central or peripheral nervous system, more than two nonfunctional edentulous areas, excluding the third molars, presence of removable dentures or extensive prosthetic restorations, severe malocclusions, and psychiatric or neurological diseases.

The distribution of the quantitative variables was established by the Shapiro-Wilk test. In order to establish the mean difference according to SB, the Student t-test was used if the data followed a normal distribution; otherwise, the rank and sum test (Mann-Withney U) were applied. The Pearson or Spearman correlation tests were used between the variables with the number of SB events. A logistic regression model was also applied.

RESULTS.

The two groups in the sample, with sleep bruxism (SB) and a control group (C), were gender-balanced (p=0.71). There was a significant difference in age. Men with an average age of 22 ± 3.08 years were 23%.

Among the continuous variables of sleep disorder, only the variable degree of airway obstruction presented statistically significant differences between the SB group and the control group (p=0.03). People with SB are expected to have, on average, between 0.38 to 20.38 percent points more obstruction than the control group, with 95% confidence interval (Table 1).

Among the categorical variables only the proportion of subjects with a probability of a major depressive episode presented statistically significant differences

Figure 1. Procedure for selecting study subjects.

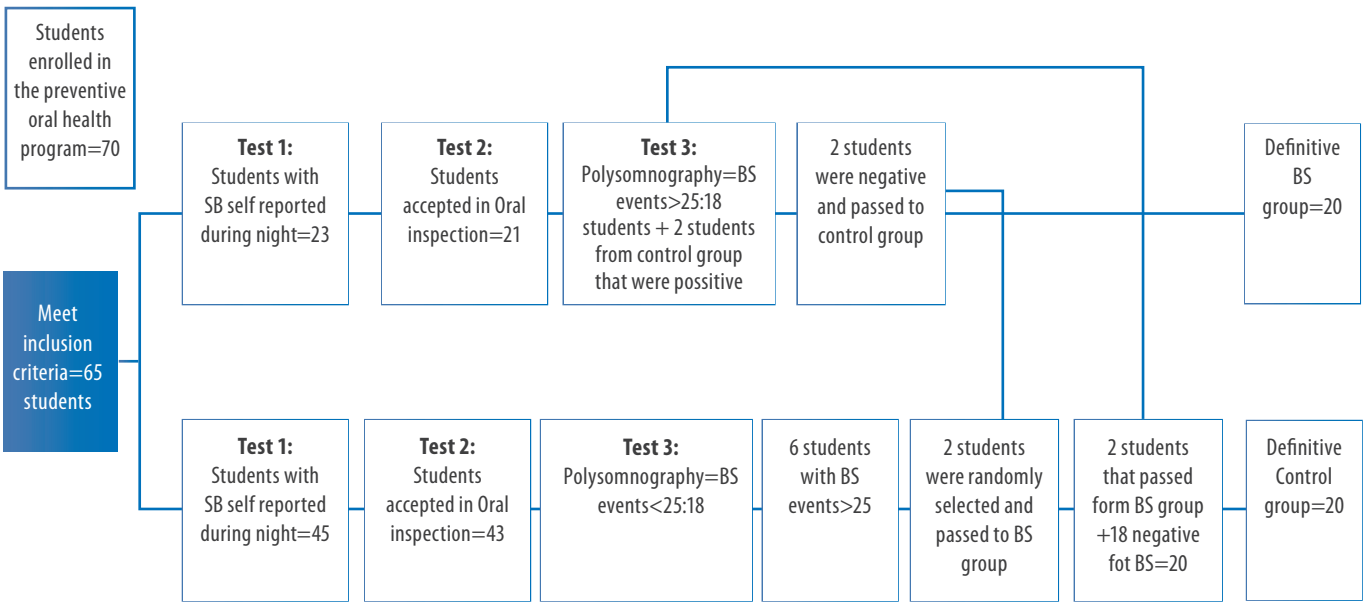


Figure 2. Probability of belonging to the SB group, according to the periodic movement of the limbs without obstruction to the periodic movement of the limbs without obstruction of the airway and with an obstruction of 25.

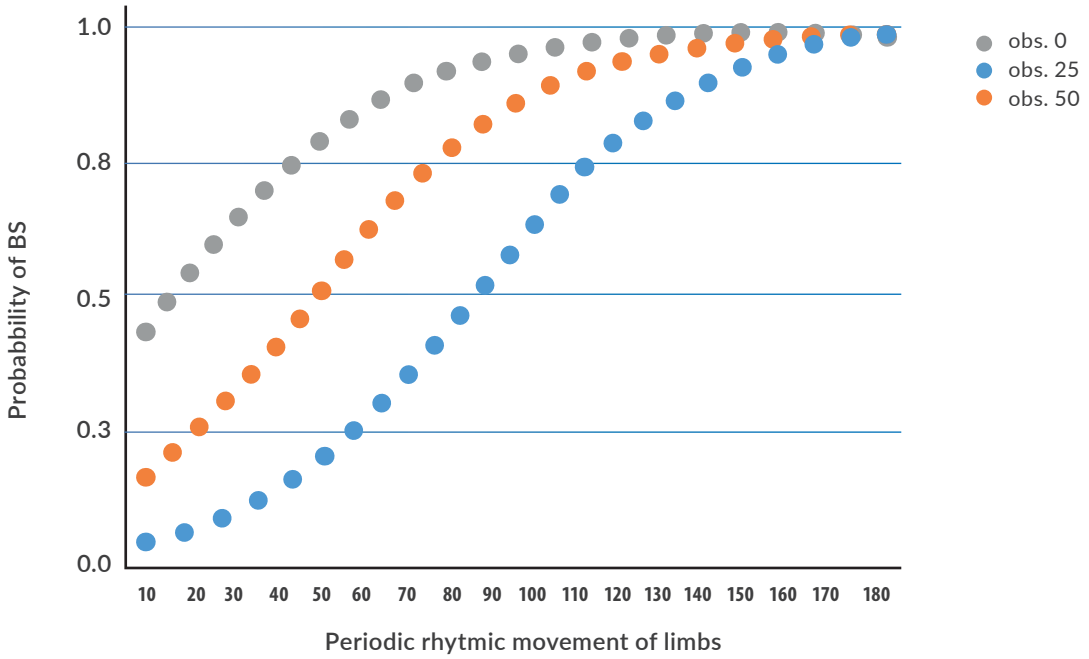
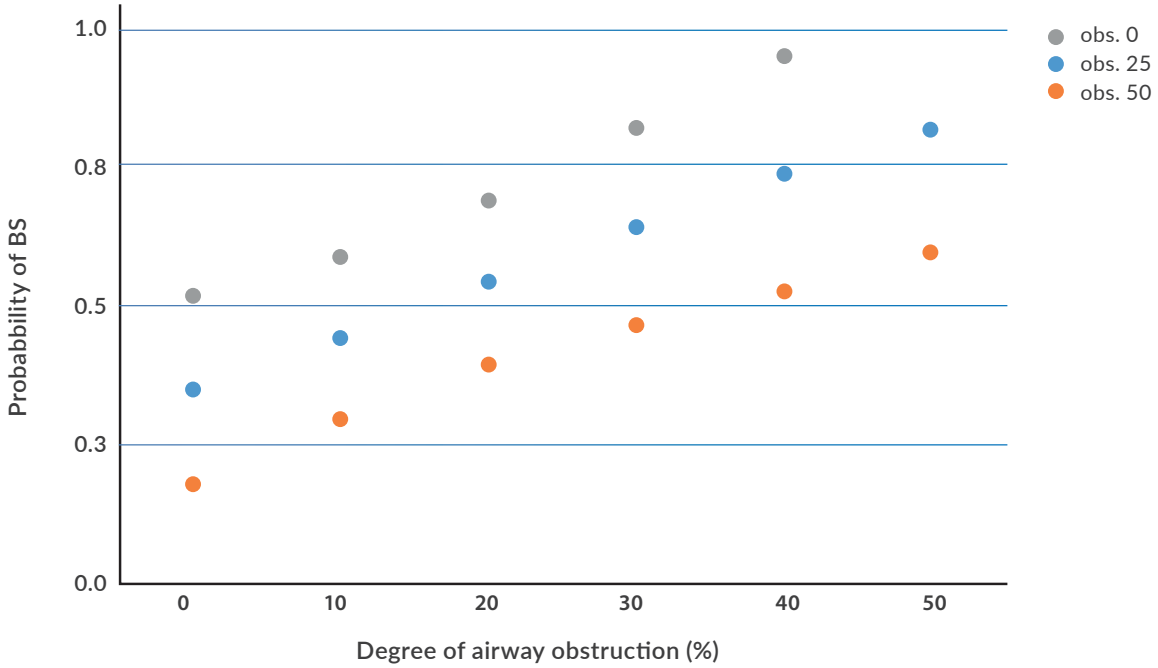


Figure 2. Probability of belonging to the SB group, according tothe degree of airway obstruction



ISSN Print 0719-2460 - ISSN Online 0719-2479. www.joralres.com/2020

Table 1. Mean of sleep disorder variables according to bruxism.

	Group SB		Group Control		*p*-value	CI 95 %
	X	SD.	X	SD		
Epworth scale	11.0	4.09	10.4	3.93	0.61[aaa]	-1.92 – 3.22
Differences between sleeping working and non-working hours	1.9	0.79	2.1	1.34	0.42[aa]	-0.99 – 0.42
Possibility score for major depressive Episode	3.6	2.92	1.9	1.83	0.08[aaa]	0.08 – 3.21
Possibility score for anxiety disorder	5.6	2.66	4.7	2.90	0.29[aaa]	-0.98 – 2.58
CMI	23.6	4.95	2.,4	2.90	0.25[aaa]	-2.63 – 2.93
Neck circumference	33.2	3.24	32.4	2.32	0.49[aaa]	-1.13 – 2.48
Degree of airway obstruction	20.0	15.39	10.0	17.02	0.03[aaa]	-0.38 – 20.38

SB: sleep bruxism. **X:** mean. **CI:** confidence interval.**SD:**Standard deviation[a]. T test with homogeneous variances[aa]. T test with no homogeneous variances[aaa]. Mann Whitney U test; Level of significance: p<0.05

Table 2. Prevalence of sleep disorders according to bruxism.

	Group SB		Group Control		*p*-value	CI 95 %
	X	%	X	%		
Variables related to sleep habits						
Excessive daytime drowsiness	12	60	9	45	0.34	-0.2 – 0.5
Insufficient sleep	8	40	6	30	0.50	-0.2 – 0.4
Variability in day-to-day sleep schedule	10	50	10	50	1.00	-0.3 – 0.3
Variables related to psychiatric or behavioral disorders						
Probability of major depressive episode	6	30	1	5	0.04	0.0 – 0.4
Probability of generalized anxiety disorder	9	45	7	35	0.51	-0.2 – 0.4
Variables related to specific sleep disorders						
Insomnia	6	30	3	15	0.25	-0.1 – 0.4
Parasomnias						
Nightmares	4	20	7	35	0.28	-0.4 – 0.1
Somnambulism	1	5	0	0	0.31	-0.1 – 0.2
Night terrors	2	10	3	15	0.63	-0.3 – 0.2
Somniloquia	15	75	10	50	0.10	-0.0 – 0.5
Night cramps	5	25	5	25	1.0	-0.3 – 0.3
Sleep enuresis	2	10	2	10	1.0	-0.2 – 0.2
Variables related to movement disorders during sleep						
Restless leg syndrome	1	5	3	15	0.29	-0.28 – 0.08
Sleep rhythmic movements	3	15	3	15	1.0	-0.22 – 0.22
It is believed to have sleep bruxism	10	50	11	55	0.52	-0.41 – 0.21
Variables related to associated respiratory disorders						
Possibility of Obstructive Sleep Apnea Syndrome (OSAS)	9	45	5	25	0.18	-0.1 – 0.5
Variables related to physical conditions Related to sleep						
Hypertension or heart problem records	0	0	3	15	0.07	-0.3 – 0.01
Body mass index risk	6	30	6	30	1.00	-0.3 – 0.3
Neck circumference risk	3	15	4	20	0.67	-0.3 – 0.3
Mallampati index for macroglossia risk	1	5	1	5	1.0	-0.1 – 0.1
Airway obstruction degree	1	5	2	10	0.55	-0.2 – 0.1
Facial skull structure risk	4	20	3	1015	0.67	-0.2 – 0.3
Angle II or III occlusal Relationship Risk	1	5	3	15	0.29	-0.3 – 0.1
Sleep disorder due to poor sleep hygiene	9	45	8	40	0.75	-0.3 – 0.4
Poor sleep hygiene	19	95	18	90	0.55	-0.1 – 0.2

Table 3. Polysomnographic records according to bruxism.

Polysomnographic records	Group SB X	Group SB %	Group Control X	Group Control %	*p*-value	CI 95 %
Total sleep time in minutes	389.6	32.5	371.7	60.1	0.52[aaa]	-12.9 – 48.8
MOR sleep time in minutes	123.7	45.8	116.2	86.1	0.12[aaa]	-36.6 – 51.7
NMOR sleep time in minutes	265.9	49.5	278.1	86.1	0.51[a]	-49.5 – 25.1
Duration of stage 1 in minutes	9.4	11.7	18.1	15.2	0.02[aaa]	-17.3 – 0.0
Duration of stage 2 in minutes	200.2	52.5	175.0	57.4	0.19[a]	-13.9 – 64.3
Duration of stage 3 in minutes	56.2	25.8	65.50	22.4	0.23[a]	-24.7 – 6.2
REM Time in Minutes	123.7	45.8	93.9	34.2	0.03[a]	2.3 – 57.2
Total "arousals"	71.9	7.9	57.5	6.0	0.38[aaa]	-3.5 – 21.3
Index arousals MOR "arousals" / hour /	13.3	7.0	11.4	7.1	0.51[aaa]	-2.6 – 6.4
Index "arousals" NMOR "arousals" / hour /	11.15	7.86	8.3	4.50	0.362[aaa]	-1.25 – 6.96
Central Apnea Episodes	0.6	1.3	0.2	0.52	0.228[aaa]	-0.18 – 1.1
Obstructive Apnea Episodes	1.4	3.8	0.4	0.88	0.683[aaa]	-0.76 – 2.76
Episodes of Mixed Apnea	0.7	1.5	0.2	0.41	0.213[aaa]	-0.15 – 1.25
Hypopnea Episodes	28.9	33.2	19.4	25.71	0.244[aaa]	-9.45 –28.55
NMOR Oximetry	93.5	1.4	93.1	1.5	0.58[aaa]	-0.4 – 1.3
Oximetry in MOR	93.8	1.3	89.6	19.0	0.82[aaa]	-4.4 – 12.9
Heart rate (l / min) in NMOR	65.4	6.6	65.0	11.7	0.89[a]	-5.7 – 6.5
Heart rate (l / min) in MOR	66.8	7.1	66.2	12.3	0.86[aa]	-5.9 – 7.0
TEC	66.0	6.9	65.2	11.3	0.79[aa]	-5.2 – 6.8
Count of periodic movements of the total extremities	84.2	45.8	49.7	20.3	0.01[aaa]	11.8 – 57.2
Periodic movements of the limbs with "arousals"	6.5	6.7	4.0	3.3	0.334[aaa]	-0.9 – 5.9
Events of Bruxism	260.5	119.0	61.9	39.7	0.00[aaa]	141.8 –255.3
Events of NREM Bruxism	135.4	77.8	37.2	29.5	0.00[aaa]	60.5 –136.9
Events of REM Bruxism	120.2	90.2	31.1	32.5	0.00[aaa]	45.7 –132.5
Index of Bruxism	40.60	18.9	10.1	6.1	0.00[aaa]	21.5 – 39.4
NREM Bruxism Index	30.5	15.9	7.8	5.1	0.00[aaa]	15.1 – 30.3
Bruxism during "arousals"	86.7	57.0	281	20.3	0.00[aaa]	31.2 – 86.1

SB: sleep bruxism. **X:** mean. **CI:** confidence interval.**SD:**Standard deviation[a]. T test with homogeneous variances[aa]. T test with no homogeneous variances[aaa]. Mann Whitney U test; Level of significance: p<0.05

between the SB group and the control group (p=0.04).

People with SB are expected to have, on average, between 0.03 and 0.47 percentage points more obstruction than control group, with 95% confidence (Table 2).

Polysomnographic records showed statistically significant differences between the SB group and the C group in the variables: duration of sleep stage 1 (p=0.02), REM stage (p=0.03), periodic movements of limbs (p=0.01), bruxism events in REM (p=0.00) and NREM (p=0.00), bruxism index (p=0.00), NREM (p=0.00) and bruxism events in "arousals" (p= 0.00). The other variables analyzed did not present differences (p=0.02) (Table 3).

According to the logistic regression model, the Odds Ratio (OR) of SB, in relation to the periodic movement of the limbs and the degree of airway obstruction, showed a statistically significant relationship (p<0.05). From 80 periodic movements of the limbs, regardless of the degree of obstruction, the probability of belonging to the SB group was higher than 90% (Figure 2).

Only when the probability of airway obstruction was considered, it was observed that after a degree of obstruction of 10%, the probability of belonging to the SB group exceeded 50% (Figure 3).

DISCUSSION.

This study aimed to compare polysomnographic records and sleep disorders in people with and without SB. Two sleep disorders recorded significant

differences between the two groups: the degree of airway obstruction and the possibility of having a major depressive episode.

Bender *et al*.,[17] studied the degree of airway obstruction with respect to SB. The author stated that there was a similar symptomatology in individuals with SB and respiratory disorders; and even suggested that SB would be the result of these disorders being recognized as a compensatory mechanism to restore the upper airway muscle tone during sleep. In the present study, according to the logistic regression model, after a degree of airway obstruction of 10%, the probability of belonging to the SB group exceeded 50%.

This is in line with the conclusion of the systematic review of 2017 by Jokubauskas *et al*.,[18] that obstructive sleep apnea syndrome is often accompanied by SB because obstructive sleep apnea events produce a desaturation of oxygen and produce arousals, which are followed by secondary events of SB. Another author in 2016, Saito *et al*.,[19] suggested that different mechanisms exist for sleep arousals to explain the simultaneous occurrence of SB and episodes of apnea-hypopnea and that the link between these events was weak.

According to these investigations, SB could occur alongside periodic limbic movements such as swallowing, yawning or body movements that would determine the likelihood of observing oral motor activity which is not specific to SB in people with apnea or hypopnea.

In 2019, systematic review of da Costa *et al*.,[20] concluded that the causality between sleep bruxism and obstructive sleep apnea remains unclear. Despite research being unable to confirm that sleep apnea is a trigger for sleep bruxism, it is important to consider them as overlapping comorbidities. Well-designed and randomized studies with control groups are needed to investigate whether possible mechanisms common to SB and OSA exist.

The difference between the possibility of presenting major depressive episodes in the SB group and the C group in this investigation does not coincide with the investigative work of Karakoulaki *et al*.,[21] in which the quantitative biomarker cortisol alpha Amylase, secreted as an initial response to stress, did not show increased values in individuals with SB compared to a group C.

Recent studies, both case-based and experimental, have not shown that bruxism is increased with stress,[22] although anxiety symptoms are more prevalent in SB subjects, as this work has shown, which may be related with an oxidative imbalance that would contribute to the SB.

Individuals with SB had statistically significant differences with controls on polysomnographic variables related to sleep stage one duration, REM sleep time, and periodic limb movements. Sleep stage 1 had, is expected to have, on average, a shorter duration in the SB group; this stage is known as the stage of "numbness".

The decreased duration of stage 1 in people with SB could be a manifestation of Chronic Fatigue Syndrome (CFS) that would explain the rapid passage to stage 2 of sleep. Bruxism was related by Maness *et al*.,[23] with CFS as a condition of fragmented, non-restorative sleep. Mean REM sleep time was significantly higher in SB subjects. In this REM stage (associated with deep sleep or repair), the mean number of bruxism events was also significantly higher in subjects with SB, which would indicate that these individuals could have a normal sleep process, in terms of duration of sleep REM stage, but with greater instability compared to group C members.[23]

In this study, the difference of the total counts of the periodic movement of the limbs was statistically higher in the SB group and was identified as a predictive variable of SB. It is evidenced that there is a common neurophysiological antecedent for the events of bruxism and the movements of the extremities. Authors such as Van der Zaag *et al*.,[24] stated that both events are the product of the same neurophysiological mechanism.

The results of this investigation found differences between some variables that could contribute to a differential diagnosis. An important aspect of SB treatment would be the study and treatment of sleep disorders. Additionally, the predictor variable called airway obstruction -identified in the present study- may be key in a differential diagnosis.

Study limitations

Polysomnography exams taken in a sleep laboratory are considered accurate systems but the mental and physical stress that a laboratory can produce should be kept in mind. It would be important, in future research, to compare the variables considered in this investigation with occlusal and orofacial muscle conditions to identify the conditions that could determine the appearance of pathological manifestations in subjects with SB.

CONCLUSION.

There were significant differences in two recorded sleep disorders between the two groups: the degree of

airway obstruction and the possibility of having a major depressive episode.

Polysomnographic records: duration of sleep stages 1 and REM, periodic movement of the extremities, events of SB in REM and NREM, index of bruxism, and events of SB in "arousals", registered statistical difference between the groups. Periodic limb movement and the degree of airway obstruction were identified as predictor variables of SB.

Conflict of interests: The authors declare no conflicts of interest.

Ethics approval: Institutional bioethics committee approval (Act 059 of 2016).

Funding: This study was funded by Universidad Autónoma de Manizales, Colombia.

Authors' contributions: All authors contributed to the work.

Acknowledgements: The authors acknowledge Diana E. Abril B, Alexandra Suaza R and Thomas Owen Lock who work at the Translation Center of the Universidad Autónoma de Manizales for translating and reviewing this final manuscript.

REFERENCES.

1. Klasser G, Rei N, Lavigne G. Sleep Bruxism Etiology: The Evolution of a Paradigm. J Can Dent Assoc 2015;1(1).
2. Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, Santiago V, Winocur E, De Laat A, De Leeuw R, Koyano K, Lavigne GJ, Svensson P, Manfredini D. International consensus on the assessment of bruxism: Report of a work in progress. J Oral Rehabil. 2018;45(11):837-844.
3. Melo G, Duarte J, Pauletto P, Porporatti A, Stugiski-Barbosa J, Winocur E, et al. Bruxism: An umbrella review of systematic reviews. J Oral Rehabil 2019;46(7):666-690.
4. Castrillon E, Exposto F. Sleep Bruxism and Pain. Dent Clin North Am 2018;62(4):657-663.
5. Mengatto C, Coelho-de-Souza F, de-Souza-Junior O. Sleep bruxism: challenges and restorative solutions. Clin Cosmet Investig Dent 2016;22(8):71-77.
6. Nakayama R, Nishiyama A, Shimada M. Bruxism-Related Signs and Periodontal Disease: A Preliminary Study. Open Dent J 2018; 12:400-405.
7. Ratcliff S, Becker I, Quinn L. Type and incidence of cracks in posterior teeth. J Prosthet Dent 2001; 86:168-172.
8. Chrcanovic B, Kisch J, Albrektsson T, Wennerberg A. Bruxism and dental implant treatment complications: a retrospective comparative study of 98 bruxer patients and a matched group. Clin Oral Implants Res 2017;28(7): e1-e9.
9. Carra M, Huynh N, Lavigne G. Sleep bruxism: a comprehensive overview for the dental clinician interested in sleep medicine. Dent Clin North Am 2012; 56:387-412.
10. Mayer P, Heinzer R, Lavigne G. Sleep Bruxism in Respiratory Medicine Practice. Chest 2016;149(1):262-271.
11. Carra M, Rompré P, Kato T, Parrino L, Terzano M, Lavigne G. Sleep bruxism and sleep arousal: an experimental challenge to assess the role of cyclic alternating pattern. J Oral Rehabil 2011;38(9):635-642.
12. Maluly M AM, Dal-Fabbro C, Garbuio S, Bittencourt L, Siqueira J.. JDR Clin Res 2013;92(1):97-103. Polysomnographic study of the prevalence of sleep bruxism in a population sample. JDR Clin Res 2013;92(1):97-103.
13. Kang J, Lee S, Kwon S, Kim Y, Kim K, Song J. Analysis of sleep questionnaires of patients who performed overnight polysomnography at the university hospital. Tuberculosis and Respiratory Diseases 2006;60(1):76-82.
14. Nashed A, Lanfranch iP, Rompré P, Carra M, Mayer P, Colombo R. Sleep bruxism is associated with a rise in arterial blood pressure. Sleep. 2012 2012; 35:5429-4536.
15. Lavigne G, Rompré P, Montplaisir J. Sleep bruxism: validity of clinical research diagnostic criteria in a controlled polysomnographic study. J Dent Res. 1996;75(1):546-552.
16. Macaluso G, Guerra P, Di Giovanni G, Boselli M, Parrino L, Terzano M. Sleep bruxism is a disorder related to periodic arousals during sleep. J Dent Res. 1998;77(4):565-573.
17. Bender S. Critical Appraisal. Sleep Bruxism and Sleep-Disordered Breathing. Esthet Restor Dent. 2016;28(1):67-71.
18. Jokubauskas L, Baltrušaityte A. Relationship between obstructive sleep apnoea
syndrome and sleep bruxism: a systematic review. J Oral Rehabil 2017;44(2):144-153.
19. Saito M, Yamaguchi T, Mikami S, Watanabe K, Gotouda A, Okada K, Hishikawa R, Shibuya E, Shibuya Y, Lavigne G. Weak association between sleep bruxism and
obstructive sleep apnea. A sleep laboratory study. Sleep Breath 2016;20(2):703-709.
20. da Costa-Lopes A, Cunha T, Monteiro M, Serra-Negra J, Cabral L, Júnior P. Is there an association between sleep bruxism and obstructive sleep apnea syndrome? A systematic review. Sleep Breath 2019;10.1007:1007/s11325.
21. Karakoulaki S, Tortopidis D, Andreadis D, Koidis P. Relationship Between Sleep
Bruxism and Stress Determined by Saliva Biomarkers. Int J Prosthodont. 2015;28(5):467-474.
22. Tan M, Yap A, Chua A, Wong J, Parot M, Tan K. Prevalence of Sleep Bruxism and Its Association with Obstructive Sleep Apnea in Adult Patients: A Retrospective Polysomnographic Investigation. J Oral Facial Pain Headache. 2019;33(3):269-277.
23. Maness C, Saini P, Bliwise D, Olvera V, Rye D, Trotti L. Systemic exertion intolerance disease/chronic fatigue syndrome is common in sleep centre patients with hypersomnolence: A retrospective pilot study. Sleep Res 2018;1(e12689.).
24. van der Zaag J, Naeije M, Wicks D, Lobbezoo F. Time-linked concurrence of sleep bruxism, periodic limb movements, and EEG arousals in sleep bruxers and healthy controls. Clin Oral Implants Invest 2014;18(2):507-513.