Sleep bruxism (SB) may be defined as repetitive jaw-muscle activity characterized by clenching or teeth grinding and/or by bracing or even thrusting the mandible during sleep.\(^1\) SB has been receiving increased attention because of its association with dental, periodontal, and facial complications.\(^2\)-\(^4\) However, for clinicians and researchers, the clinical assessment of SB is still a challenge.\(^5\)

Laboratory sleep assessment is required to establish a definitive diagnosis of SB.\(^1\) Polysomnography (PSG) with audio and video recordings is the gold standard for SB diagnosis in that it permits a quantitative assessment of oromandibular movements.\(^6\)-\(^11\)

Estimating the magnitude of SB accurately in the general population is difficult because there are still problems using PSG, especially those related to cost, number of nights, patient habituation, and the natural fluctuation of SB. Indeed, the PSG environment is not very conducive to natural sleep.\(^8\),\(^12\)-\(^14\)

**ABSTRACT**

**Statement of problem.** Validated questionnaires and guidelines for assessing sleep bruxism (SB) that can be administered by dentists in clinical practice are still lacking.

**Purpose.** The purpose of this preliminary study was to compare the third edition of the International Classification of Sleep Disorders (ICSD-3) criteria for diagnosing SB with the results of the gold standard polysomnography (PSG) examination.

**Material and methods.** Twenty consecutive postgraduate students and staff at Bauru School of Dentistry, University of São Paulo, Bauru, Brazil, participated. Each participant underwent interview, clinical assessment, and a PSG evaluation. Bruxers and nonbruxers were identified based only on the PSG analysis. The validity of the ICSD-3 criteria was assessed by receiver operating characteristics curve analysis, area under the curve (AUC), likelihood ratios (LR), and the diagnostic odds ratio (DOR).

**Results.** The ICSD-3 diagnostic criteria items for SB had fair to moderate concordance with the PSG diagnosis, with AUC ranging from 0.55 to 0.75. The best value of agreement was the association of SB more than once a week with transient morning jaw muscle pain or fatigue with a moderate but significant agreement with the PSG diagnosis of SB (AUC=0.75), with 90% specificity, positive LR=6, and DOR=13.5. When the frequency of self-reported SB increased to more than 4 times a week, the combination of this finding with tooth wear also had high values of agreement with the PSG diagnosis of SB (AUC= 0.75, +LR=6, DOR=13.6).

**Conclusions.** The report of regular or frequent SB and the presence of (1) incident of abnormal tooth wear or (2) incidents of transient morning jaw muscle pain or fatigue were the best discriminatory items of ICSD-3 for SB diagnosis. (J Prosthet Dent 2017;117:61-66)
Clinical Implications

The International Classification of Sleep Disorders (ICSD-3) has been used in clinical and population studies for the diagnosis of sleep bruxism (SB). Although self-reported SB combined with the presence of signs and symptoms is still considered the best available approach to diagnose SB clinically, the application of ICSD-3 for SB clinical diagnosis may be limited.

Because of the PSG limitations, questionnaires and physical evaluation are often used to diagnose SB in clinical practice and also in large population studies.1,15 SB has been associated with jaw pain and/or lock, headache, and tooth wear.14-19 Recently, Paesani et al20 reported that, in several systematic reviews of the etiology and prevalence of SB, the usual study limitation was related to SB diagnostic accuracy, which could lead to low internal validity.

Evidence suggests that the clinical diagnosis of SB should be based on the criteria of the International Classification of Sleep Disorders (ICSD) proposed by the American Association of Sleep Medicine (AASM).2 These criteria have been used in clinical and population studies19,21-24 and in systematic reviews25 and have been updated in the 2014 edition of the classification (ICSD-3). They included, for SB diagnosis, the report of regular or frequent tooth grinding sounds and the presence of one or more of the following clinical signs and/or symptoms consistent with reports of tooth grinding during sleep: abnormal tooth wear consistent with reports of tooth grinding during sleep; or transient morning jaw muscle pain or fatigue; and/or temporal headache; and/or jaw locking upon awakening consistent with reports of tooth grinding during sleep.10

Despite all efforts, validated questionnaires and guidelines for assessing ICSD-3 criteria for SB that can be administered by dentists in clinical practice are lacking. To test the accuracy of some questions on the symptoms of SB and the clinical examination, a preliminary validation study was conducted to compare directly the ICSD-3 clinical assessment of SB with the gold standard PSG examination.

MATERIAL AND METHODS

The study was conducted in accordance with the Helsinki guidelines and was approved by the local ethics committee. Participants were recruited from postgraduate students and staff at the University of São Paulo. They responded to a social media advertisement looking for self-reported SB and healthy volunteers. Written informed consents were obtained from all eligible participants.

Questionnaires and clinical assessment were performed to identify SB and exclusion criteria features; for data analysis, bruxers (SB group) and nonbruxers (control group) were identified based only on the PSG analysis. Exclusion criteria were the presence of temporomandibular disorders (TMDs); current illness or history of neurologic or psychiatric disorders; history of chronic musculoskeletal pain; previous diagnosis or signs and symptoms of other sleep disorders (such as, snoring, sleep apnea, or periodic limb movement); use of prescription medicine or drugs with possible sleep effects or alterations of motor behavior; presence of gastroesophageal reflux and alimentary disorders; smoking, alcohol abuse, consumption of more than 3 cups of coffee per day; electrode gel allergy; current medical or dental treatment; pregnancy; use of pacemaker or implanted defibrillator; some dental characteristics including loss of more than 2 posterior teeth except for the third molars and wearers of removable partial or complete dentures; and enlarged tonsils, skeletal class II, and with Mallampati score III or IV for the risk of concomitant sleep apnea.

After the initial screening, 21 participants were eligible and agreed to participate in the study. One withdrew from the study after refusing to sleep in the laboratory. Twenty individuals (mean age 27.1 ±4.9 years, 95% single, 5 men and 15 women) comprised the final study sample.

A trained dentist (J.S.B.) applied a standardized diagnostic protocol to all participants equally. It consisted of a systematic evaluation of SB signs and symptoms according to the following:

1. The Brazilian Portuguese translation of the Research Diagnostic Criteria - RDC/TMD questionnaire.26 Individuals received the diagnosis of self-reported SB if they answered “yes” to RDC/TMD question 15c: Have you been told or do you notice that you grind your teeth or clench your jaw while sleeping at night?

2. The frequency of days of self-reported SB, which was evaluated with 5 possible choices: (0) none of the time; (1) <1 night per month; (2) 1-3 nights per month; (3) 1-3 nights per week; (4) 4-7 nights per week.27

3. The questionnaire for SB based on the ICSD-3, which included 3 questions about the presence or absence of transient morning jaw muscle pain or fatigue, temporal headache, and jaw locking upon awakening.10

4. The assessment of occlusal and incisal tooth-by-tooth wear, which was scored on a 5-point ordinal scale: (0) no wear; (1) visible wear within the enamel; (2) visible wear with dentin exposure and loss of clinical crown height of ≤ 1/3; (3) loss of
crown height > 1/3 but < 2/3; and (4) loss of crown height > 2/3. The examination consisted of the inspection of the last present molar in the fourth dental quadrant (right mandibular dental arch).

After the diagnostic protocol examination, all participants then slept for 2 consecutive nights in a sleep laboratory for PSG recordings. The first night was used for habituation to the environment and to confirm the exclusion criteria. The second night was used to collect experimental data.

An ambulatory PSG system (Alice 5 International; Philips Respironics) was used to perform a full sleep study. The following channels were recorded: electroencephalography (EEG) (F3M2, F4M1, C3M2, C4M1, O1M2, O2M1); electrooculogram (EOG) (right and left); electrocardiogram (ECG) (3 derivations); electromyography (EMG) from the chin and masseter muscles (rhythmic masseter muscle activity - RMMA scoring), and from the anterior tibialis (bilateral) for scoring periodic limb movements. Respiratory parameters were assessed by recording abdominal and thoracic respiratory effort, airflow (oronasal cannula), snoring, and oximetry. Movement sensors were used to capture the sleep position. Audiovisual recordings were made simultaneously to distinguish SB episodes from other oromandibular activities.

An experienced sleep technician scored the PSG signals. The scores were confirmed by a physician certified by the Brazilian Association of Sleep Disorders and by one of the authors (J.S.B.). PSG analysis was performed using software (Alice Sleepware; Philips Respironics).

All sleep analyses were carried out using 30-second epochs. Sleep stage was scored according to standard criteria. Masseter EMG bursts were detected based on a predefined EMG threshold (20% of maximal voluntary
positive LR=6, and DOR=13.5. When the frequency of self-reported SB increased (more than 4 times in a week), the combination of this finding with tooth wear had the best values of agreement with the PSG diagnosis of SB (AUC=0.75; LR=6, DOR=13.6). Although the combination with reports of transient morning jaw pain or fatigue was less powerful, it was still significant (Table 3).

DISCUSSION

These findings provide initial evidence regarding the validity of the ICSD-3 diagnostic criteria for SB in comparison with the gold standard PSG method. AUC and DOR were used to evaluate the potential diagnostic value of the ICSD-3 criteria for a clinical SB diagnosis. The results indicated that the presence of transient jaw pain or fatigue associated with frequent weekly self-reports of SB was the most reliable combination for a SB diagnosis (AUC=0.75; DOR=13.5). Because there is considerable heterogeneity in the results, some criteria of ICSD-3 for SB clinical diagnosis may be limited.

If a patient reports bruxism 4 or more times in a week, the combination with the presence of tooth wear could also be considered accurate for SB diagnosis (AUC=0.75; 13.6). Although DOR is difficult to interpret clinically, it is useful in the assessment of the overall test accuracy and, in this study, it permitted the comparison between the ICSD-3 criteria combinations. In addition, substantial specificity (0.9) was found, and the positive LR was equal to 6 with the best combinations.

The new ICSD-3 clinical diagnostic criteria published in 2014 by the AASM included the report of regular or frequent tooth grinding sounds during sleep. However, what is considered regular or frequent is not described in the diagnostic guidelines. In this study, the weekly (more than once in a week in the last past month) self-reported SB was considered as “frequent” for SB clinical diagnosis, and we used 2 frequencies to produce the combination for the ICSD-3 diagnostic criteria.

The need for a report of tooth grinding sounds is also a limitation of the ICSD-3 diagnostic criteria for SB. People who sleep alone or with a sleep partner who is not disturbed by tooth grinding sounds are not able to provide a reliable report. In this study, almost all participants were single and lived alone, which could be a limitation. In this sense, the question included in the RDC/TMD questionnaire for SB detection was used. This question has been used frequently in studies involving SB diagnosis.

The report of transient morning facial pain or fatigue was frequent in the SB group and, in combination with self-reported SB, may represent an important symptom for SB diagnosis. Others studies have also described that sleep bruxers frequently report transient or low pain intensity in the jaws upon waking. The interesting finding was when self-reported SB frequency increased, the LR, AUC, and DOR values for this combination decreased. Although the EMG activity from the PSG results for pain evaluation was not evaluated, this finding is consistent with the results of Rompré et al, in which participants with a low frequency of SB were more likely to report craniofacial pain than those with more frequent SB. The report of jaw muscle pain was associated with 40% fewer episodes of SB per hour in PSG, which indicated that when a jaw pain report is concomitant with a PSG diagnosis of SB, the number of SB episodes tends to decrease. The so-called pain-adaptation model (an inverse relationship between agonist jaw muscle activity and pain intensity) may explain these findings.

Tooth wear is widely reported as a classic dental sign of SB. The scale described by Lobbezoo and Naeije was used to evaluate tooth wear in this study. The right
mandibular arch was examined. As previously reported, there was no effect of dental quadrant and the left and right sides had comparable reliabilities.28

Abe et al3 demonstrated no difference in the tooth wear grade found between low and high frequency muscle contractions in young adults with SB. These findings are in agreement with the present results, indicating that tooth wear alone cannot be used as an absolute criterion for SB detection. Tooth wear is a cumulative record of both functional and parafunctional wear and may be related to other factors like chemical erosion, age, occlusal conditions, and dental characteristics.2,3,5,8,28 Also, it neither proves ongoing bruxism activity nor can indicate whether the individual has static tooth clenching.5 The nonsignificant AUC and lower values of DOR and positive LR indicated that the diagnostic accuracy of the combinations with temporal headache or jaw locking upon awakening is insufficient for clinical application.

The strength of this study includes the use of PSG as a gold standard tool for SB diagnosis. PSG studies for SB are rare because of cost, time investment, and limited technologic access.15 An acclimation night was included in this study to avoid concerns about sleep behaviors. However, the natural fluctuation of SB also means that more than 1 night of examination must be done.14

The short-term nature of evaluation, as well as the relatively small number of individuals are limitations of the present investigation and need to be considered when the actual findings are judged. The validity of the items was based on a limited number of occurrences, thereby limiting comparability. The limitations of the study include sample bias in that graduate student/staff participants in this study because of technical problems.10 Analyses of first night PSG recordings were used for 2 participants in this study because of technical problems. Although it could be a limitation, no differences between first and second nights of PSG recordings on SB outcome variables or standard sleep variables have been described in the literature.11,13

The use of questionnaires and clinical examination for SB diagnosis has many advantages, including low cost and their capacity to gather large amounts of information. This study clarified some items with respect to the use of the ICSD-3 SB criteria, which could improve their use.

CONCLUSIONS

Because there is considerable heterogeneity in the results, the application of ICSD-3 for SB clinical diagnosis may be limited. In the diagnostic criteria for SB, the report of regular or frequent SB and the presence of (1) incident of abnormal tooth wear or (2) incidents of transient morning jaw muscle pain or fatigue were the best discriminatory items for SB diagnosis.

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Acknowledgments
The authors thank Maria Rita de Cássia Moratelli Costa and her staff for scoring the polysomnography results.

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