

BRUXISM AS A CONTRACTION DISORDER OF THE MASTICATORY MUSCLES - REVIEW

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ABSTRACT

Over the years, several theories regarding the etiology of bruxism have been proposed. Even though these theories are difficult to confirm or infirm, due to the controversial particularities of this disease, most of them suggest a multifactorial etiology. Many authors have emphasized the importance of separating sleep bruxism from awake bruxism, as they might have different etiologies, ending with the New Consensus which provided two different definitions for those two forms of bruxism. In 2020, experts proposed the creation of a standardized system for bruxism evaluation – STAB (Standardized Tool for the Assessment of Bruxism). According to this system, future research over bruxism will be oriented in two directions: axis A that will include studies regarding evaluation methods, and axis B that will concern studies related to etiology, risk factors and predisposing factors.

Key words: bruxism, new consensus, standardized tool for the assessment of bruxism.

INTRODUCTION

1.1 General notions

Over time, the definition of bruxism has evolved, and, in this context, dentists have accepted the terminology adopted for sleep medicine and orofacial pain studies (1). The term *bruxomania* was introduced in 1907; since then, it evolved into the current term - bruxism, derived from the Greek βρυγμός (brygmos) - "teeth grinding" (2).

The first description initially concerned

the sleep bruxism (SB); occlusal interferences have been considered as part of its etiology, and it has been clinically associated especially with tooth wear.

In time, other studies have shown that bruxism is associated with an arousal that occurs during sleep (3). The architecture of sleep has been later understood, and the rhythmic masticatory muscle activity (RMMA) – an activity specific to bruxism – has been described in the masseter muscle. This activity was emphasized by

polysomnography, and, for a long time, it represented the gold standard for the diagnosis of sleep bruxism (4). In the past decades, the role of chemical neuro-mediators in the etiology of bruxism has also been studied (5,6).

In parallel with this theory of diagnosing SB only by polysomnography, other observations also emerged from clinical investigations, leading to a different approach to bruxism. Thus, bruxism has been described as an activity of the masticatory muscles that can occur during sleep, but also during the awake state (7,8). If the phasic and tonic contractions of the masticatory muscles are described for SB, then for AB (awake bruxism) the activity of the masticatory muscles is mainly carried out in the form of clenching of the teeth or strengthening (bracing) of the mandible, which is like closing the teeth without dental contact. Clenching and bracing of the mandible represent prolonged, isometric contractions of the masticatory muscles, different from motor activity, with sudden onset from SB episodes. Therefore, it has been suggested that other motor activities should also be considered for SB, in order to obtain conceptual homogeneity between the definitions of SB and AB, and also assessment methods that can highlight episodes of SB and AB (9). In this context, a series of clinical manifestations common to the two forms of bruxism may also be analyzed (tooth wear, muscle and/or temporo-mandibular joint pain, complications of restorative treatments), but also the instrumental EMG evaluation of the masticatory muscles (10,11,12).

LITERATURE REVIEW

2.1 The New Consensus regarding bruxism

An important moment in clarifying the

diagnostic possibilities of bruxism was the consensus established in 2017 (7). Similar to the consensus established in 2012 (13), another international consensus meeting took place in March 2017, to clarify some aspects related to the classification of bruxism according to the circadian rhythm (7). Bruxism experts from around the world attended this new meeting, held in San Francisco during the General Session of the International Association for Dental Research (IADR) (7).

The objectives of this meeting were: to clarify the definition of bruxism, to develop separate definitions for AB and SB bruxism, to classify bruxism as a disorder or as a risk factor for other conditions, to re-evaluate the diagnostic system, to establish the reliability, sensitivity, and specificity of each source of information, and to set a new agenda for research.

Regarding the definition adopted in 2012, the previously used terms were re-analyzed. Thus, if the terms "clenching" and "grinding" of the teeth were frequently used by practitioners in the field of dentistry and by researchers, the other two terms, respectively "bracing" and "thrusting" of the mandible, required clarification.

Lobbezoo (7) cites Dorland's Medical Dictionary (14), according to which "bracing" could mean "holding the jaw and mandible together or in place" or "making something rigid without movement", while the "thrusting" of the mandible is described as "a sudden forced movement". In accordance with the physiopathology of the dento-maxillary system, "bracing" means the forced lock of the mandible in a certain position, and "thrusting" refers to the forceful movement of the mandible anteriorly or laterally, so propulsion or laterality movements, without teeth contact. The addition of the terms "bracing" and "thrusting" to the terms

“grinding” and “clenching” corresponds to the new guidelines, according to which bruxism is primarily regulated centrally, not peripherally, and therefore it is not determined by peripheral factors such as dental occlusion or the temporomandibular joint, but it corresponds to the current consensus that bruxism involves more than tooth contacts (8).

It should also be noted that the current examination methods cannot differentiate the activity of the masticatory muscles during clenching from that during grinding, neither from that during the mandibular bracing from that during thrusting, being distinct muscle manifestations. New approaches are needed to better understand the physiology and pathophysiology of such jaw activities.

2.2 The new definitions of bruxism

During the 2017 meeting, the classification of bruxism according to the circadian rhythm was redefined: sleep bruxism (nocturnal) and awake bruxism (diurnal), and separate definitions were formulated.

1. *Sleep bruxism* is an activity of the masticatory muscle during sleep that can be characterized as rhythmic (phasic) or non-rhythmic (tonic), and it is not considered a movement disorder or a sleep disorder for individuals considered physically healthy.

2. *Awake bruxism* is an activity of the masticatory muscles during the awake state that is characterized by repetitive or sustained contact of the teeth and/or by bracing or thrusting of the mandible, and it is not considered a movement disorder for individuals considered physically healthy.

It is worth noting that both definitions refer to the activity of the masticatory muscles, thus emphasizing the fact that the contraction disorders of the masticatory muscles are at the origin of bruxism, regardless of whether it is during sleep or

awake state. Although the focus is on the activity of the masticatory muscles, in both forms of bruxism, other manifestations may also occur such as: changes in heart rate, respiratory parameters, or brain activity; however, it is recommended that studies on SB and AB to concentrate on the activity of the masticatory muscles.

Both definitions end with the wording "for physically healthy individuals" which shows that in most people, bruxism is not a condition (disorder) but a sign of a condition (disorder) (e.g.: rapid eye movement sleep disorder, obstructive sleep apnea, epilepsy, etc.), situations in which the basic condition requires specialist attention (15).

Later in 2020, Svensson (2) stated that for clinicians, the semantic debate of bruxism can create misunderstandings regarding the message that bruxism may be considered both a "normal physiological process" that is described as a behavior (16,17) and under certain conditions, in some individuals, it can become a risk factor or be associated with the signs and symptoms of pathological conditions (7,18,19). The main challenge is to find a clear and clinically operational way to separate SB from AB, but currently no clear or definitive answer is available, partly due to the lack of standardization in the clinical field (9,11).

2.3. Bruxism as a risk factor or as a condition

The second issue addressed in the meeting was the context in which bruxism may be considered a risk factor, or a disorder (condition) (16,17,20). Raphael (16,17) believes that an intense activity of the masticatory muscles increases the risk of conditions such as muscle pain, temporomandibular disorder, tooth wear, accidents of prosthetic restorations, which decrease oral health, so that in healthy

individuals, bruxism can be considered a risk factor. Risk factors increase the likelihood of developing a condition but do not cause it; instead the condition or disorder is a self-standing dysfunction that harms the person, physically and psychosocially.

As presented, bruxism should not be considered a condition in healthy individuals but may be considered a risk factor for oral health or a behavioral disorder.

Lobbezoo (7) cites Dorland's dictionary (14) for the definition of behavior which defines it as "the overall activity of a person that can be observed externally", resulting that the behavior can be voluntary or involuntary, thus corresponding to the two types of bruxism. Parallel to the consideration of bruxism as a disorder, risk factor or behavioral disorder, some specialists believe that bruxism can have a beneficial and protective effect on the body, as it happens in sleep apnea, when bruxism causes the release of the upper airway and the resumption of breathing (4,21) or in dental erosion caused by reflux disease, when episodes of bruxism cause increased salivation and dilution of gastric juice (22).

Centralizing these observations, we can consider bruxism according to clinical consequences as follows:

- bruxism is not a risk or protective factor, but it is a harmless behavior;
- bruxism is a risk factor when it is associated with one or more oral health disorders;
- bruxism is a protective factor when associated with one or more beneficial health effects.

It should be noted that the last two possibilities are not mutually exclusive. In order not to create confusion between these clinical forms, Svensson and Lavigne (2) proposed a differentiation of these situations. Thus, they proposed that bruxism, both AB

and SB, associated with normal homeostasis and without signs or symptoms (e.g., related to pain, insomnia, and sleep apnea) and/or pathological impact on the state of oral or general health, could be called "normo-bruxism", while SB or AB related to any type of pathological consequence for the individual could be called "patho-bruxism" (2,23).

In this context, instead of "curing" bruxism, the goal of treatment might be to control "patho-bruxism" and restore "normo-bruxism". The prefix can help to better understand and realize that bruxism is a term that covers a wide range of conditions and with different impacts on oral and general health. Therefore, clinicians and researchers involved in bruxism research and education should adopt these new terms, to guide clinicians to attain best practices in the management of "bruxism" (2).

2.4. Diagnostic principles in bruxism

Another topic of discussion in the consensus meeting was the reevaluation of the diagnostic system and the determination of the reliability, sensitivity, and specificity of each source of information.

The correct, relevant assessment of bruxism in an individual means, apart from highlighting the presence or absence of the masticatory muscles' activity, to establish whether this activity of the masticatory muscles can become a risk (or protective) factor for an oral health disorder. The assessment of bruxism can be non-instrumented or instrumented (24).

2.4.1. Non-instrumental assessment of bruxism

Non-instrumental assessment of bruxism is based on self-reporting (questionnaire or anamnesis) and clinical inspection, for both forms of bruxism (23).

The self-reported assessment of SB or AB continues to be the primary tool in bruxism research and clinical practice. Although there is a poor concordance with instrumental assessment especially for SB (25), self-reporting is useful for some applications (7). Thus, based on self-reporting, it has been established that bruxism may be associated with stress and anxiety (26), as well as with muscle and joint pain (27-29).

Lobbezoo (7) believes that there is a limitation of self-reporting on stress associated with bruxism, in that patients may report stress rather than actual masticatory muscle activity. Self-reported methods should therefore be improved to increase their accuracy and reliability, compared to instrument-based methods. By self-reporting, the possible presence of SB or AB can be assessed as well as the frequency of bruxism episodes over a certain period. Self-reported data on intensity and duration of bruxism episodes cannot be collected (30).

Assessment of AB begins by making the patient aware of what is meant by teeth grinding and jaw clenching. Grinding can be easily defined as contact between the teeth of the two arches outside of masticatory and swallowing function, and clenching refers to increased levels of masticatory muscle activity without tooth contact. After explaining these two concepts, the patient is then asked to monitor their grinding and clenching activities daily for a period of 1 or 2 weeks. Data collection can be improved by the so-called EMA (*ecological moment assessment*), which provides multiple reports over an observation period (31) and allows data collection regarding the association between bruxism and other manifestations (32).

Assessment of self-reported SB is easy to do because it can be done by the patient, bed partner or, in the case of children, by parent

statements. The patient is asked to monitor their own behavior and record whether they notice (or they have been told) that they are grinding their teeth, clenching their teeth, or clenching their jaw while sleeping, preferably using a diary. The bed partner may also be asked to keep a diary to record if they hear the patient grinding their teeth at night. Multiple assessment reports over a 1 or 2-week period may provide bruxism data that can be useful in research and clinical practice.

2.4.2. Clinical evaluation

Clinical features of both AB and SB include the presence of masticatory muscle hypertrophy, as well as fissures on the tongue or lips and/or a white line on the buccal mucosa. Both dental fractures, tooth wear, damage to dental hard tissues (e.g. cracked teeth) and the repetitive failures of prosthetic restorations/constructions can also be indicators of SB and AB. However, although tooth wear may indicate (especially) SB, past SB that is no longer active at the time of examination cannot be ruled out. A comprehensive clinical protocol for the qualification and quantification of tooth wear was developed by Wetselaar and Lobbezoo (33).

2.4.3. Instrumental evaluation

Instrumental assessment has applications in both SB and AB.

Among these assessments, electromyographic (EMG) recordings during the awake state may provide reliable evidence for AB. EMA is very conclusive by obtaining real data about masticatory muscle activity at certain times of the day and may be used in both forms of bruxism.

Electromyographic recordings can be associated with other recordings used in sleep sonography or polysomnography. Audio-video recordings complement the EMG

recordings. In the case of EMG recordings, difficulties may arise in the interpretation of the recorded events, since these recordings must be related to a threshold of activity considered to be normal. This threshold may be considered as a percentage of the maximum level of voluntary contraction, as a multiple of the baseline level of muscle relaxation, or as the level of muscle activity achieved during swallowing.

Difficulties also arise in reporting the number of recorded events. Normally, the number of activities (in the form of bursts, or bursts grouped into episodes) are counted and expressed per hour of sleep (indexes). Other times, the duration of these activities is summed up and expressed per hour of sleep (34). Unfortunately, such reporting provides only a partial representation of the frequency and pattern of muscle activity. For a more complete assessment, EMG measurements such as power (area), maximum amplitude and duration of the interval between events have been proposed (12,35,36), although practical and valid use of such results is not confirmed. Assessments of occlusal forces during clenching and grinding of the teeth may also be useful.

There are also limitations of these assessments, so that polysomnography assessments, considered the gold standard especially for SB, cannot be routinely used in clinically healthy individuals (37,38). Initially, polysomnography was proposed as an investigation method in bruxism, only in research, so it cannot be applied to clinically healthy individuals (39). Establishing a threshold of muscle activity that can have a clinical consequence is difficult to achieve. Many conditions can interact with bruxism (and with each other) in the general context of the body, thus influencing muscle activity in bruxism with negative influences on oral health. For example, prolonged clenching of

the teeth can be an overload mechanism for masticatory muscles and temporomandibular joints (40).

After masticatory muscle fatigue or pain sets in, an adaptation occurs that can lead to reduced masticatory muscle activity (41,42), thus making it difficult to assess the level of muscle activity. It follows so that the activity of the masticatory muscles in bruxism should be evaluated, not only in terms of the number of events, but also in terms of amplitude (power), which has been shown to be greater in cases of temporomandibular disorder (36).

2.5. The standardized system for evaluating bruxism

A Standardized Tool for the Assessment of Bruxism (STAB) is currently being developed (1,9,43). According to it, future research will be directed along two axes: Axis A will deal with studies on the assessment of bruxism (self-report, clinical assessment (signs / symptoms / consequences), instrumental assessment, and Axis B will deal with studies on the etiology, risk factors and concomitant conditions associated with bruxism.

As part of the future work program, specific tools for the assessment of each element will be selected and field-evaluated for inclusion in the expanded version of the Bruxism Assessment System.

This system aims to differentiate bruxism episodes from other motor activities of the masticatory muscles, especially for EMG recordings performed in the patient's environment (9,44).

CONCLUSIONS

1. Concluding these reasonings, for SB, the number of events with an amplitude greater than the relaxation level, their amplitude and duration must be evaluated.
2. For AB, the same indicators of muscle activity recorded by EMG in the

awake state should be evaluated, associated with the probability of the existence of temporomandibular disorder.

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