

Current Considerations About Bruxism: a Literature Review

Considerações Atuais Sobre Bruxismo: uma Revisão da Literatura

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Abstract

Bruxism has been receiving new classifications and definitions over the years. The objective of this study was to review the literature on definitions and updates about bruxism, etiology, and therapeutic possibilities. The search strategy was carried out using relevant keywords. Four databases were searched until May 2024. Duplicate studies were identified and excluded. Any language restrictions or publication period were considered. A total of fifty-three studies were included in the present review and a qualitative analysis was performed. Bruxism is defined as a masticatory muscle activity, which can occur during sleep and the day. It is subdivided into awake bruxism and sleep bruxism, according to the corresponding circadian rhythm. This definition denotes that bruxism should be considered a behavior and not a disorder, but it can be a risk factor for certain clinical consequences and can occur in healthy individuals. Studies indicate that the etiology of bruxism is probably multifactorial and that several underlying mechanisms may play a role in its genesis, including psychosocial factors. The definite diagnosis of bruxism is based on instrumental approaches, such as Electromyography and Polysomnography, combined with audio and video recordings. Intervention modalities are often related to the reduction of tooth wear through the use of stabilizing plates. However, pharmacological, behavioral, and psychological therapies are also common. In conclusion, bruxism is multifactorial and the reduction of clinical signs and symptoms is the most current therapeutic possibility, combining an approach in a multi-professional and interdisciplinary team.

Keywords: Therapeutics. Behavior. Diagnosis.

Resumo

O bruxismo vem recebendo novas classificações e definições ao longo dos anos. O objetivo deste estudo foi revisar a literatura sobre definições e atualizações sobre bruxismo, etiologia e possibilidades terapêuticas. A estratégia de busca foi realizada utilizando palavras-chave relevantes. Quatro bases de dados foram pesquisadas até maio de 2024. Estudos duplicados foram identificados e excluídos. Nenhuma restrição de idioma ou período de publicação foram consideradas. Um total de cinquenta e três estudos foram incluídos na presente revisão e uma análise qualitativa foi realizada. O bruxismo é definido como uma atividade muscular mastigatória, que pode ocorrer durante o sono e durante o dia. É subdividido em bruxismo acordado e bruxismo do sono, de acordo com o ritmo circadiano correspondente. Essa definição denota que o bruxismo deve ser considerado um comportamento e não um distúrbio, mas pode ser um fator de risco para determinadas consequências clínicas e pode ocorrer em indivíduos saudáveis. Estudos indicam que a etiologia do bruxismo é provavelmente multifatorial e que vários mecanismos subjacentes podem desempenhar um papel na sua gênese, incluindo fatores psicossociais. O diagnóstico definitivo do bruxismo é baseado em abordagens instrumentais, como Eletromiografia e Polissonografia, combinadas com gravações de áudio e vídeo. As modalidades de intervenção tentam frequentemente diminuir o desgaste dentário através da utilização de placas estabilizadoras. No entanto, terapias farmacológicas, comportamentais e psicológicas também são comuns. Concluindo, o bruxismo é multifatorial e a redução dos sinais e sintomas clínicos é a possibilidade terapêutica mais atual, aliando uma abordagem em equipe multiprofissional e interdisciplinar.

Palavras-chave: Terapêutica. Comportamento. Diagnóstico.

1 Introduction

Bruxism is a condition that affects approximately 20% of the adult population, with a higher prevalence among females^{1,2}. Several classifications and definitions of bruxism have been proposed over time. The current definition was proposed in 2018, and conceptualized bruxism as a Repetitive Masticatory Muscle Activity (RMMA) occurring during sleep or during the day, called sleep bruxism (SB) and

awake bruxism, according to the circadian cycle³. Bruxism, according to the latest consensus, is no longer considered a disorder, but a behavior, and can occur in healthy individuals⁴. The authors of this consensus proposed a classification of the SB diagnosis based on the available instruments, which could be based on non-instrumental approaches, such as self-report (questionnaires) and clinical inspection, and instrumental approaches - by polysomnographic recording, combined with

audio recordings - and video is considered the gold standard³.

The etiology of this behavior is considered multifactorial and several underlying mechanisms may play a role in triggering and perpetuating events³. The most recurrent are the psychosocial factors - stress and anxiety. Recent studies indicate that SB is modulated by the central nervous system, and not peripherally³⁻⁵. Some signs are reported in the literature such as wear of teeth and restorations, and symptoms such as pain and hypertrophy in the muscles of the face, and headache can be observed⁷. However, despite the prevalence of tooth wear being often attributed to bruxism, the association between the two remains a subject of debate within the dental literature⁸. While most studies reported weak or no associations between tooth wear and bruxism, those focusing on cervical tooth wear tended to demonstrate a stronger correlation⁸. The management of signs and symptoms includes local approaches, with the use of occlusal splints, and pharmacological and behavioral therapies^{5,9,10}. However, the interventions effectiveness has presented mostly inconclusive and contradictory results across the studies².

Considering that bruxism can affect people's quality of life through dental and orofacial problems, such as tooth wear, muscle pain in the face region, and headache^{11,12}, it is important to provide clinicians with the best evidence-based information to support their clinical practice. Thus, the objective of this study was to review the scientific literature on definitions and updates about bruxism, etiology, and therapeutic possibilities, allowing a new look and thinking about this topic that has been routine in the field of dentistry.

2 Development

2.1 Methodology

The search strategy was carried out using relevant keywords and MeSH terms: ((Sleep Bruxism [MeSH Terms]) OR (grinding disorder, teeth) OR (grinding disorders, teeth) OR (teeth grinding disorders) OR (bruxism, sleep) OR (sleep bruxism) OR (nocturnal teeth grinding disorder) OR (teeth grinding disorder, nocturnal) OR (bruxism, nocturnal) OR (nocturnal bruxism) OR (childhood sleep bruxism) OR (sleep bruxism, childhood) OR (sleep-related bruxism) OR (bruxism, sleep-related) OR (sleep related bruxism) OR (Awake Bruxism)). Four databases (Virtual Health Library (BVS), PubMed-Medline, Scopus, and Web of Science) were searched until May 2024. The retrieved records were uploaded into EndNoteTM software (Thomson Reuters, Rochester, New York, NY), and a virtual library was built. Duplicate studies were identified and excluded. Any language restrictions or publication period were considered. One author (ERA) read all the titles and abstracts of the documents and selected the studies for full-text. In this stage, the studies were included. A total of fifty-three studies were included in the present review. A qualitative analysis was performed.

2.2 Evolution of the definition of bruxism and emerging concepts

Performing a search for the word "Bruxism" in Mesh terms, there is a historical overview of the use of this term. The first time the term "Bruxism" was inserted into the Mesh terms was in 1965, being defined as a "disorder characterized by the act of grinding and clenching the teeth". Already in the year 2000, the definition of "Sleep bruxism" is found. This, in turn, is characterized as a "sleep disorder, caused by the act of grinding and clenching the teeth; as to force lateral or protuberant mandibular movements, being associated with that of teeth". In this period, bruxism was broadly defined in other sources as "a parafunctional activity that consisted in the act of grinding or clenching the teeth consciously or unconsciously"¹³.

In 2013, a new meeting of the International Consensus was held where the definition of bruxism was changed, which was defined as a masticatory muscle activity characterized by clenching or grinding of the teeth and/or bracing or thrusting of the jaw, being separated SB or bruxism for awake bruxism: depending on its circadian phenotype¹⁴. As early as 2017, a new (and with few significant changes) definition of the Glossary of Prosthodontics Terms, "The Glossary of Prosthodontics Terms", defined bruxism as consisting of; 1. grinding for functional teeth; 2. an oral habit consisting of involuntary or spasmodic rhythmic rhythm. Non-functional grinding, grinding or clenching of teeth, other than masticatory movements of the jaw, that nocturnal bruxism, occlusal neurosis, tooth grinding¹⁵.

The recently published international consensus on bruxism³, aimed to summarize the current understanding of bruxism. The consensus brought together some of the most renowned international experts to clarify aspects of the definition, classification, and future perspectives on bruxism. In this 2018 consensus, it was defined that bruxism should be considered a behavior and not a disorder, but it can be a risk factor for certain clinical consequences and can occur in healthy individuals. It is further subdivided into SB and awake bruxism according to the circadian phenotype³.

2.3 Types of Bruxism

According to Lobbezoo; et al.,³ the new definition of bruxism reveals that there are substantial differences in behavior and differences between bruxism that occurs during the night - SB - and bruxism that occurs during the day - awake bruxism. However, awake bruxism is a masticatory muscle activity that occurs during wakefulness, characterized by repetitive or sustained tooth contact and/or by bracing or thrusting of the jaw, not being a movement disorder or disorder in healthy individuals³.

SB, in turn, is an oral habit that occurs while the sleep cycle takes place, and is characterized by movements of the temporomandibular muscles, forcing contact between the

dental surfaces¹⁶. Lobbezoo et al.³ defined SB as a masticatory muscle activity that occurs during sleep, characterized as rhythmic (phasic) or non-rhythmic (tonic), not being a movement disorder or sleep disorder in healthy individuals.

In both definitions, masticatory muscle activities are presented, which may - or may not - trigger clinical changes. However, the emphasis on masticatory muscle activity is not limited to this type of assessment, but studies that assess both types of bruxism should include other assessment methods, such as respiratory parameters, audio and video recordings, and heart rate variability, for example^{3,16}.

The existing knowledge considers that the associated factors are different in the two types of bruxism, according to the two circadian manifestations³. It is known that the myological trait of SB¹⁷ appears to be modulated through various neurotransmitters in the central nervous system^{6,18}, and emerging evidence suggests that biological and psychological factors are more involved than morphological factors in their etiology³.

2.4 Disorder or behavior?

Currently, it is considered that the term bruxism should be considered a risk factor and not a disorder, but a behavior. The term risk factor is assigned when it increases the probability of generating disorder but does not guarantee that this occurs³. Whereas a disorder is characterized by being a condition of harmful dysfunction, causing inherent damage to the human being, configuring a dysfunction in healthy people¹⁹.

Thus, bruxism is not a disorder - since it can occur in healthy individuals - but it can be a risk factor for negative consequences on oral health. Higher levels of masticatory muscle activity are imminent risk of negative consequences in the oral cavity, such as muscle pain and the Temporomandibular Joint (TMJ), as well as severe wear on teeth and restorations²⁰. Despite the prevalence of tooth wear being often attributed to bruxism, the association between the two remains a subject of debate within the dental literature⁸. A comprehensive review of thirty publications on this topic revealed a mix of cross-sectional and longitudinal studies assessing the relationship between tooth wear and bruxism⁸. While the majority of these studies utilized self-report methods for bruxism assessment, some employed instrumental tools for a more definitive diagnosis. Interestingly, while most studies reported weak or no associations between tooth wear and bruxism, those focusing on cervical tooth wear tended to demonstrate a stronger correlation. This suggests that the location and type of tooth wear may play a significant role in determining the relationship with bruxism⁸.

It is known that bruxism has undergone several modifications, the most current definition is that of Lobbezoo and Ahlberg³, which reveals that bruxism should be considered a behavior and not a disorder, but it can be a risk factor for certain clinical consequences and can occur in healthy individuals. Two major changes were presented in

this classification: the first is related to the separation between night and day; the second is associated with the fact that both are no longer considered disorders, but rather a behavior that - in certain circumstances - may or may not be considered pathological³. In this way, bruxism - by itself - is no longer considered a pathology and does not require treatment in cases that do not cause pain or other pathological changes, such as tooth wear²¹.

Likewise, both definitions emphasize that bruxism is not configured as a disorder. In the view of medicine that studies and classifies diseases, the adoption of different names for bruxism to be or not to be a sign of a disorder can be considered, since it can lead to a diagnosis of some disorders, such as Obstructive Sleep Apnea (OSA) and epilepsy³. According to the Dorland Medical Dictionary, the term "behavior" is defined as - "behavior or conduct; any or all of a person's total activity, especially that which can be observed externally". This implies that the behavior does not necessarily mean that it is aware of the activity, or that - in contrast - the activity is involuntary, which is captured by the activity, and circadian bruxism phenotypes (BS and awake bruxism)³.

2.5 Physiological symptoms

Teeth mobility, generalized pain in the face, hypertrophic facial muscles, and reduced ability to open the mouth, especially when waking up in the morning, are changes observed in individuals who have bruxism²⁰. In the mouth, or clinically, these people may present wear facets on teeth, fractured dental restorations, in an isolated or generalized way, hypermobility, and dentinal hypersensitivity. In addition, hypertrophy in the mastication muscles and pain in the TMJ can also be observed²¹.

Symptoms commonly triggered by bruxism include headache, facial and neck pain, decreasing range of motion, and enhancing possible temporomandibular disorders (TMD)^{22,24}. Pain and tenderness in the jaw muscles are common findings in individuals with TMD and bruxism, making it difficult to separate them²⁵.

2.6 Etiology

The etiology of bruxism is considered multifactorial, and central and psychosocial factors are relevant to the pathophysiology of bruxism⁶. Among the factors responsible for triggering it are psychological changes, such as stress, depression, and anxiety; factors that correspond to an excessive response to sleep arousal, and changes of a genetic nature²⁶. However, it is currently accepted that the pathophysiology of SB is modulated by the central nervous system^{6,14,18,27}.

In children, the multifactorial etiology has been associated with the immaturity of the masticatory system²⁸, although biological and psychological factors have also been correlated with the development of bruxism, suggesting an important involvement of morphological factors¹⁸.

Studies bring the relationship between bruxism and TMD; however, this relationship is still not well clarified as there are several different methods of identification for both complications³. Several theories associate emotional factors with the triggering of SB²⁹, researchers reported an association with anxiety³⁰, Tension³¹, and emotional behavior³². Recent findings showed that patients with BS showed impaired sleep architecture and often tiredness and drowsiness during the day³³. In addition, salivary levels of cortisol (i.e., stress-related hormones) were investigated in the study by Cruz et al.³⁴, and showed that children with SB had higher levels of stress, as determined by measuring salivary cortisol³⁵. Other studies discuss the suspicion that the occurrence of SB has a hereditary component and that a persistent trait between childhood and adulthood can be attributed to the genetic component³⁶.

Bruxism itself, in turn, can generate some musculoskeletal and dental consequences; such as tooth wear, hypertrophied masticatory muscles, fractures and failures of restorations or implants, masticatory muscle pain, and TMJ disc displacement³. In addition to changes in masticatory muscles, muscle hyperactivity, sleep disturbances, headache, and fatigue, result in symptoms of pain and discomfort^{3,30}.

2.7 Diagnostic and measurement methods

The presence of bruxism can be identified by instrumental approaches - PSG and EMG - portable method, or through self-report and/or clinical inspection^{3,37}. Thus, the use of EMG seeks to monitor the electrical activity of the muscles involved during mandibular movement (Masticatory Muscle Activity - MMA), specifically of the excitable membranes of muscle cells, showing the action potentials evidenced through an electrical voltage reading over some time a period³. Non-instrumental approaches as a method of evaluating bruxism include self-report - questionnaires and oral history, in addition or without clinical inspection, both for BD and BS³⁸ (Figure 1).

Figure 1 - Sleep bruxism definitions

Possible sleep bruxism: is based on a positive self-report only.
 Probable sleep bruxism: is based on a positive clinical inspection, with or without a positive self-report.
 Definite sleep bruxism: is based on a positive instrumental assessment, with or without a positive self-report and/or a positive clinical inspection.

Source: Adapted from Lobezzo et al.³

Polysomnography will identify bruxism episodes (number of events per hour) during the night's sleep period³⁹. The use of PSG together with audio and video recordings (PSG-AV) is configured as the gold standard for the diagnosis of SB, as it allows a quantitative assessment of masticatory muscle movements and mandibular movements³⁸. The audio and video images allow the recognition of orofacial activities and other muscular activities, which could be easily confused with MMA events, which could lead to an overestimation of the

severity of SB³.

Concerning the diagnosis of bruxism, the self-reported assessment of SB or BD continues to be the main tool in research and clinical practice as a method, given to the facility through questionnaires referred by the person himself or herself. However, there is a low agreement between self-report and instrumental approaches, such as specific methods to assess bruxism activity. It is justified by the bias of somatizing several other psychological pains, caused by stress - depression, so the self-report could reflect the anguish felt, instead of the real MMA. With this, instrumental measures should be prioritized to increase reliability and validity compared to self-report³⁷⁻³⁸.

Accurately estimating the magnitude of SB in the population is still difficult, PSG has disadvantages in terms of cost and feasibility, the number of monitoring nights, the person's habituation, and the natural fluctuation that occurs in the SB. Likewise, EMG as a separate method can overestimate the magnitude of bruxism presenting a very low precision⁴⁰. However, it should be noted that the techniques and/or methods in which they are used to diagnose bruxism cannot differentiate between the muscle activities associated with squeezing, grinding, and pushing, which results in new approaches being needed to better clarify the physiology and pathophysiology of these jaw activities³, thus, the use of assessment instruments/tools for both is essential for a more reliable and reliable diagnosis.

Recently, a standardized tool for the assessment of Bruxism was proposed⁴¹. The Standardised Tool for the Assessment of Bruxism (STAB) is a newly developed instrument aimed at providing a comprehensive evaluation of bruxism status, associated conditions, causes, and consequences. It consists of two axes: Axis A assesses bruxism status and consequences, incorporating self-reported, clinical, and instrumental assessments across 14 domains; while Axis B evaluates risk factors, etiology, and comorbid conditions through self-reported information across five domains. Axis A includes Subject-Based, Clinical, and Instrumentally Based Assessments, while Axis B encompasses various assessments related to psychosocial factors, concurrent sleep-related and non-sleep conditions, medication use, and additional factors. The tool integrates existing instruments where applicable and provides a user's guide for scoring. Ready for field testing and refinement, it is expected to significantly impact clinical and research efforts in bruxism.

Taking into account the significant impacts on people's quality of life, an accurate diagnosis would be inherent to a therapeutic protocol to reduce signs and symptoms. Therefore, in daily practice, dentists (DC) are faced with the need to make decisions about the most appropriate approach to diagnose and control bruxism, and this can change according to sleep or awake bruxism. Thus, requiring the recognition of whether or not a particular treatment is necessary^{19,42}.

2.8 Strategies to reduce bruxism in adults

Although there is no consensus on strategies to reduce bruxism, the methods of reducing the signs and symptoms available to inhibit bruxism, as well as protection and damage reversal are diverse, and already documented therapies can be useful in managing the signs and symptoms of this condition, including approaches through occlusal appliances - plates, pharmacological therapies, and behavioral and psychological therapies, among more recent ones, such as the use of botulinum toxin⁴³.

The occlusal splint also makes it possible to dissipate the load bilaterally and simultaneously, helping to relieve the signs and symptoms resulting from bruxism through the regulation of bruxism, creating a biomechanical balance between the physiological load and the stress generated⁹. The use of botulinum toxin, according to Canales et al.⁴⁴; represents a possible management option for the supposed consequences of SB, minimizing symptoms and reducing the intensity of contractions for RMMA, but it does not act directly on SB.

The use of Botulinum Toxin as an SB reduction strategy has been studied. The results of some randomized clinical trials suggest that botulinum toxin injection was able to reduce the mean pain score and the number of bruxism events, probably acting on the decrease in masseter muscle activity^{45,46}. Some recent studies evaluate homeopathy as a method of reducing bruxism in children, however, the results are inconclusive⁴⁷.

A recent study shows that the use of occlusal splints/plates acts as a stress relaxant and allows for the dissipation of extra tensions generated during the act of bruxism, as well as assisting in TMJ deviations due to bruxism. The intervention modalities often related to the reduction of tooth wear through the use of stabilizing plates cannot be supported by current literature high evidence level⁸. Indeed, occlusal splints are commonly used for bruxism and orofacial pain, although their exact mechanism of action is not fully understood^{24,28}. While some studies show positive results⁴⁹, there's insufficient evidence supporting long-term effects like reducing muscle activity⁵⁰.

On the other hand, botulinum toxins disrupt nerve signaling, particularly by inhibiting acetylcholine release, resulting in prolonged muscle relaxation^{51,53}. While botulinum toxin-A injections don't prevent bruxism episodes, they can effectively manage muscle activity and pain, often with good patient tolerance⁵³. However, conflicting evidence exists regarding their efficacy for pain relief, with some meta-analyses showing improvement compared to placebos while others do not¹⁰.

Moreover, pharmacological, behavioral, and psychological therapies are also common approaches in the management of bruxism and orofacial pain. These therapies encompass a range of interventions, including medication, habit-reversal techniques, cognitive-behavioral therapy, and relaxation exercises, aimed at addressing both the physiological and psychological aspects of these conditions. Integrating

these modalities into treatment plans can offer patients comprehensive care and improve outcomes in addressing bruxism and associated orofacial discomfort, but the evidence level remains low^{43,54}.

In cases where intervention is needed, for a more complete approach, seeking rehabilitation, a multidisciplinary therapeutic protocol would be inherent, associating the approach with the etiological and secondary factors of the problem, in addition to the restoration of the affected structures. In most articles, the description of the therapeutic method offered to patients lacked details. Several authors do not clarify the form used in the therapeutic method of relieving signs and symptoms and its periodicity^{55,56}. Other studies show that there is a reduction in pain during the therapeutic intervention period, but when it is interrupted, the pain returns^{9,43}. Perhaps a more clinical and pragmatic approach is needed to define SB and the coexisting health problems that need to be addressed by the clinician since the etiology of bruxism is multifactorial⁵⁷.

2.9 Strategies to reduce bruxism in children

In children, bruxism reduction strategies are based on approaches that involve the use of medications, occlusal splints, orthodontic interventions, and psychological and physical therapy interventions⁵⁸. There is also a combination of different approaches. More invasive treatments, such as medication administration, should be performed with caution, as they can generate side effects and no study has evaluated whether bruxism episodes have not returned after discontinuation of the medication. Therefore, this type of approach should be restricted to extreme and acute cases of pain.⁵⁹ Psychological and physiotherapeutic therapies are indicated for children since they did not present contraindications or side effects⁵⁸.

3 Conclusion

The present literature review demonstrates that dental surgeons need to constantly update themselves on this topic which has been widely discussed in the scientific literature and is increasingly found in everyday clinical practice. It is considered that bruxism is multifactorial and that one factor alone does not play an integral role on its genesis; the reduction of clinical signs and symptoms is the most current therapeutic possibility, combining an approach in a multi-professional and interdisciplinary team.

References

1. Oliveira JMD, Pauletto P, Massignan C, D'Souza N, Goncalves DAG, Flores-Mir C, et al. Prevalence of awake Bruxism: a systematic review. *J Dent* 2023;138:104715. doi: 10.1016/j.jdent.2023.104715
2. Melo G, Duarte J, Pauletto P, Porporatti AL, Stuginski-Barbosa J, Winocur E, et al. Bruxism: An umbrella review

- of systematic reviews. *J Oral Rehabil* 2019;46(7):666-90. doi: 10.1111/joor.12801
3. Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, et al. International consensus on the assessment of bruxism: report of a work in progress. *J Oral Rehabil* 2018;45(11):837-44. doi: 10.1111/joor.12663
 4. Manfredini D, Poggio CE, Lobbezoo F. Is bruxism a risk factor for dental implants? A systematic review of the literature. *Clin Implant Dent Relat Res* 2014;16(3):460-9. doi: 10.1111/cid.12015
 5. Pauletto P, Polmann H, Conti Reus J, Massignan C, de Souza BDM, Gozal D, et al. Sleep bruxism and obstructive sleep apnea: association, causality or spurious finding? A scoping review. *Sleep* 2022;45(7). doi: 10.1093/sleep/zsac073
 6. Boscato N, Exposto F, Nascimento GG, Svensson P, Costa YM. Is bruxism associated with changes in neural pathways? A systematic review and meta-analysis of clinical studies using neurophysiological techniques. *Brain Imaging Behav* 2022. doi: 10.1007/s11682-021-00601-w
 7. Nota A, Pittari L, Paggi M, Abati S, Tecco S. Correlation between Bruxism and Gastroesophageal reflux disorder and their effects on tooth wear. a systematic review. *J Clin Med* 2022;11(4). doi: 10.3390/jcm11041107
 8. Bronkhorst H, Kalaykova S, Huysmans MC, Loomans B, Pereira-Cenci T. Tooth wear and bruxism: a scoping review. *J Dent* 2024;145:104983. doi: 10.1016/j.jdent.2024.104983
 9. Gholampour S, Gholampour H, Khanmohammadi H. Finite element analysis of occlusal splint therapy in patients with bruxism. *BMC Oral Health* 2019;19(1):205. doi: 10.1186/s12903-019-0897-z
 10. Saini RS, Ali Abdullah Almoayad M, Binduhayyim RIH, Quadri SA, Gurumurthy V, Bavabeedu SS, et al. The effectiveness of botulinum toxin for temporomandibular disorders: a systematic review and meta-analysis. *PLoS One* 2024;19(3):e0300157. doi: 10.1371/journal.pone.0300157
 11. Thymi M, Lobbezoo F, Aarab G, Ahlberg J, Baba K, Carra MC, et al. Signal acquisition and analysis of ambulatory electromyographic recordings for the assessment of sleep bruxism: a scoping review. *J Oral Rehabil* 2021;48(7):846-71. doi: 10.1111/joor.13170
 12. Ahci S, Bal B, Benbir-Senel G, Karadeniz D, Oral K. Polysomnographic characteristics of sleep-related bruxism: What are the determinant factors for temporomandibular disorders? *Cranio* 2021:1-7. doi: 10.1080/08869634.2021.2014167
 13. Santos Miotto Amorim C, Firsoff EF, Vieira GF, Costa JR, Marques AP. Effectiveness of two physical therapy interventions, relative to dental treatment in individuals with bruxism: study protocol of a randomized clinical trial. *Trials* 2014;15:8. doi: 10.1186/1745-6215-15-8
 14. Lobbezoo F, Ahlberg J, Glaros AG, Kato T, Koyano K, Lavigne GJ, et al. Bruxism defined and graded: an international consensus. *J Oral Rehabil* 2013;40(1):2-4. doi: 10.1111/joor.12011
 15. The Glossary of Prosthodontic Terms: Ninth Edition. *J Prosthet Dent* 2017;117(5S):e1-e105. doi: 10.1016/j.prosdent.2016.12.001
 16. Bulanda S, Ilczuk-Rypula D, Nitecka-Buchta A, Nowak Z, Baron S, Postek-Stefanska L. Sleep Bruxism in children: etiology, diagnosis, and treatment: a literature review. *Int J Environ Res Public Health* 2021;18(18). doi: 10.3390/ijerph18189544
 17. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *J Orofac Pain* 2013;27(2):99-110. doi: 10.11607/jop.921
 18. Manfredini D, Serra-Negra J, Carboncini F, Lobbezoo F. Current Concepts of Bruxism. *Int J Prosthodont* 2017;30(5):437-8. doi: 10.11607/ijp.5210
 19. Raphael KG, Santiago V, Lobbezoo F. Bruxism is a continuously distributed behaviour, but disorder decisions are dichotomous (Response to letter by Manfredini, De Laat, Winocur, & Ahlberg (2016)). *J Oral Rehabil* 2016;43(10):802-3. doi: 10.1111/joor.12425
 20. Wetselaar P, Manfredini D, Ahlberg J, Johansson A, Aarab G, Papagianni CE, et al. Associations between tooth wear and dental sleep disorders: a narrative overview. *J Oral Rehabil* 2019;46(8):765-75. doi: 10.1111/joor.12807
 21. Beddis H, Pemberton M, Davies S. Sleep bruxism: an overview for clinicians. *Br Dent J* 2018;225(6):497-501. doi: 10.1038/sj.bdj.2018.757
 22. Didier HA, Marchetti A, Marchetti C, Gianni AB, Tullo V, Di Fiore P, et al. Study of parafunctions in patients with chronic migraine. *Neurol Sci* 2014;35:199-202. doi: 10.1007/s10072-014-1770-0
 23. Palinkas M, De Luca Canto G, Rodrigues LA, Bataglion C, Siessere S, Semprini M, et al. Comparative capabilities of clinical assessment, diagnostic criteria, and polysomnography in detecting sleep bruxism. *JCSM* 2015;11(11):1319-25. doi: 10.5664/jcsm.5196
 24. Costa FDS, Fernandez MDS, Silva-Junior IFD, Karam SA, Chisini LA, Goettems ML. Association involving possible sleep bruxism, stress, and depressive symptoms in brazilian university students: a cross-sectional study. *Sleep Sci* 2023;16(3):e317-e22. doi: 10.1055/s-0043-1772808
 25. Kuang B, Li D, Lobbezoo F, de Vries R, Hilgevoord A, de Vries N, et al. Associations between sleep bruxism and other sleep-related disorders in adults: a systematic review. *Sleep Med* 2022;89:31-47. doi: 10.1016/j.sleep.2021.11.008
 26. Kuhn M, Turp JC. Risk factors for bruxism. *Swiss Dent J* 2018;128(2):118-24
 27. Smardz J, Martynowicz H, Wojakowska A, Michalek-Zrabkowska M, Mazur G, Wieckiewicz M. Correlation between Sleep Bruxism, stress, and depression: a polysomnographic study. *J Clin Med* 2019;8(9). doi: 10.3390/jcm8091344
 28. Barbosa Tde S, Miyakoda LS, Poczaruk Rde L, Rocha CP, Gaviao MB. Temporomandibular disorders and bruxism in childhood and adolescence: review of the literature. *Int J Pediatr Otorhinolaryngol* 2008;72(3):299-314. doi: 10.1016/j.ijporl.2007.11.006
 29. Brancher LC, Cademartori MG, Jansen K, da Silva RA, Bach S, Reyes A, et al. Social, emotional, and behavioral problems and parent-reported sleep bruxism in

- schoolchildren. *J Am Dent Assoc* 2020;151(5):327-33. doi: 10.1016/j.adaj.2020.01.025
30. Vladutu D, Popescu SM, Mercut R, Ionescu M, Scricciu M, Glodeanu AD, et al. Associations between Bruxism, Stress, and Manifestations of Temporomandibular Disorder in Young Students. *Int J Environ Res Public Health* 2022;19(9). doi: 10.3390/ijerph19095415
 31. Reus JC, Polmann H, Mendes Souza BD, Flores-Mir C, Trevisol Bittencourt PC, Winocur E, et al. Association Between Primary Headache and Bruxism: an updated systematic review. *J Oral Facial Pain Headache* 2021;35(2):129-38. doi: 10.11607/ofph.2745
 32. Riemann D. Sleep, bruxism, sleep-related breathing disorders, insomnia, sleep, neurology and much more. *J Sleep Res* 2021;30(5):e13467. doi: 10.1111/jsr.13467
 33. Palinkas M, Semprini M, Filho JE, de Luca Canto G, Regalo IH, Bataglioni C, et al. Nocturnal sleep architecture is altered by sleep bruxism. *Arch Oral Biol* 2017;81:56-60. doi: 10.1016/j.archoralbio.2017.04.025
 34. Cruz T FS, Galvão EL. Association between bruxism and salivary cortisol levels: a systematic review. *Int J Odontostomatol* 2016;10:469-74
 35. Bach SL, Moreira FP, Goetts ML, Brancher LC, Osés JP, da Silva RA, et al. Salivary cortisol levels and biological rhythm in schoolchildren with sleep bruxism. *Sleep Med* 2019;54:48-52. doi: 10.1016/j.sleep.2018.09.031
 36. Takaoka R, Ishigaki S, Yatani H, Ogata S, Hayakawa K. Evaluation of genetic factors involved in nocturnal electromyographic activity of masticatory muscles in twins. *Clin Oral Investig* 2017;21(1):319-25. doi: 10.1007/s00784-016-1794-3
 37. Manfredini D, Ahlberg J, Wetselaar P, Svensson P, Lobbezoo F. The bruxism construct: From cut-off points to a continuum spectrum. *J Oral Rehabil* 2019;46(11):991-7. doi: 10.1111/joor.12833
 38. Lobbezoo F, Aarab G, Ahlers MO, Baad-Hansen L, Bernhardt O, Castrillon EE, et al. Consensus-based clinical guidelines for ambulatory electromyography and contingent electrical stimulation in sleep bruxism. *J Oral Rehabil* 2020;47(2):164-9. doi: 10.1111/joor.12876
 39. Tan MWY, Yap AU, Chua AP, Wong JCM, Parot MVJ, Tan KBC. Prevalence of sleep bruxism and its association with obstructive sleep apnea in adult patients: a retrospective polysomnographic investigation. *J Oral Fac Pain Headache* 2019;33(3):269-77. doi: 10.11607/ofph.2068
 40. Casett E, Reus JC, Stuginski-Barbosa J, Porporatti AL, Carra MC, Peres MA, et al. Validity of different tools to assess sleep bruxism: a meta-analysis. *J Oral Rehabil* 2017;44(9):722-34. doi:10.1111/joor.12520
 41. Manfredini D, Ahlberg J, Aarab G, Bender S, Bracci A, Cistulli PA, et al. Standardised Tool for the Assessment of Bruxism. *J Oral Rehabil* 2024;51(1):29-58. doi: 10.1111/joor.13411
 42. Manfredini D, Colonna A, Bracci A, Lobbezoo F. Bruxism: a summary of current knowledge on aetiology, assessment and management. *Oral Surgery* 2019;13(4). doi: 10.1111/ors.12454
 43. Mesko ME, Hutton B, Skupien JA, Sarkis-Onofre R, Moher D, Pereira-Cenci T. Therapies for bruxism: a systematic review and network meta-analysis (protocol). *System Rev* 2017;6(1):4. doi: 10.1186/s13643-016-0397-z
 44. De la Torre Canales G, Camara-Souza MB, do Amaral CF, Garcia RC, Manfredini D. Is there enough evidence to use botulinum toxin injections for bruxism management? A systematic literature review. *Clin Oral Investig* 2017;21(3):727-34. doi: 10.1007/s00784-017-2092-4
 45. Al-Wayli H. Treatment of chronic pain associated with nocturnal bruxism with botulinum toxin. A prospective and randomized clinical study. *J Clin Exp Dent* 2017;9(1):e112-e7. doi: 10.4317/jced.53084
 46. Lee SJ, McCall WD, Jr., Kim YK, Chung SC, Chung JW. Effect of botulinum toxin injection on nocturnal bruxism: a randomized controlled trial. *Am J Phys Med Rehab* 2010;89(1):16-23. doi:10.1097/PHM.0b013e3181bc0c78
 47. Tavares-Silva C, Holandino C, Homsani F, Luiz RR, Prodestino J, Farah A, et al. Homeopathic medicine of *Melissa officinalis* combined or not with *Phytolacca decandra* in the treatment of possible sleep bruxism in children: a crossover randomized triple-blinded controlled clinical trial. *Phytomedicine* 2019;58:152869. doi: 10.1016/j.phymed.2019.152869
 48. Keskinruzgar A, Kucuk AO, Yavuz GY, Koparal M, Caliskan ZG, Utkun M. Comparison of kinesio taping and occlusal splint in the management of myofascial pain in patients with sleep bruxism. *J Back Musculoskelet Rehabil* 2019;32(1):1-6. doi: 10.3233/BMR-181329
 49. Al-Moraissi EA, Farea R, Qasem KA, Al-Wadeai MS, Al-Sabahi ME, Al-Iryani GM. Effectiveness of occlusal splint therapy in the management of temporomandibular disorders: network meta-analysis of randomized controlled trials. *Int J Oral Maxillofac Surg* 2020;49(8):1042-56. doi: 10.1016/j.ijom.2020.01.004
 50. Hardy RS, Bonsor SJ. The efficacy of occlusal splints in the treatment of bruxism: A systematic review. *J Dent* 2021;108:103621. doi: 10.1016/j.jdent.2021.103621
 51. Munoz Lora VRM, Del Bel Cury AA, Jabbari B, Lackovic Z. Botulinum Toxin Type A in Dental Medicine. *J Dent Res* 2019;98(13):1450-7. doi: 10.1177/0022034519875053
 52. Shim YJ, Lee HJ, Park KJ, Kim HT, Hong IH, Kim ST. Botulinum Toxin Therapy for Managing Sleep Bruxism: a randomized and placebo-controlled trial. *Toxins (Basel)* 2020;12(3). doi: 10.3390/toxins12030168
 53. De la Torre Canales G, Poluha RL, Lora VM, Araujo Oliveira Ferreira DM, Stuginski-Barbosa J, Bonjardim LR, et al. Botulinum toxin type A applications for masticatory myofascial pain and trigeminal neuralgia: what is the evidence regarding adverse effects? *Clin Oral Investig* 2019;23(9):3411-21. doi: 10.1007/s00784-019-03026-4
 54. Ierardo G, Mazur M, Luzzi V, Calcagnile F, Ottolenghi L, Polimeni A. Treatments of sleep bruxism in children: A systematic review and meta-analysis. *Cranio* 2019;1-7. doi: 10.1080/08869634.2019.1581470
 55. Kim SH. A Case of Bruxism-Induced Otalgia. *J Audiol Otol* 2016;20(2):123-6. doi: 10.7874/jao.2016.20.2.123

56. Ohrbach R, Michelotti A. The Role of Stress in the Etiology of Oral Parafunction and Myofascial Pain. *Oral Maxillofac Surg Clin North Am* 2018;30(3):369-79. doi: 10.1016/j.coms.2018.04.011
57. Ekman A, Tiisanoja A, Napankangas R, Sipila K. Association of health-related factors with self-reported sleep and awake bruxism in Northern Finland Birth Cohort 1966: a cross-sectional study. *Cranio* 2023;1-11. doi: 10.1080/08869634.2023.2198462
58. Chisini LA, San Martin AS, Cademartori MG, Boscato N, Correa MB, Goettems ML. Interventions to reduce bruxism in children and adolescents: a systematic scoping review and critical reflection. *Eur J Pediatr* 2020;179(2):177-89. doi: 10.1007/s00431-019-03549-8
59. Ghanizadeh A. Treatment of bruxism with hydroxyzine. *Eur Rev Med Pharmacol Sci* 2013;17(6):839-41