

Correlation between Mental Stress and Bruxism: A Systematic Review

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ABSTRACT

With a prevalence of approximately 10 percent and an incidence of approximately 3 percent per year, Temporomandibular Disorders (TMD) is a significant health condition that cannot be ignored. The prevalence of TMD in adult populations is between 10 and 15 percent, but only 5 percent of the population seeks treatment.

The PICO structured summary approach was selected as a strategy for organizing clinical research issues related to evidence synthesis. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) criteria and protocols. A comprehensive search was conducted using EBSCOhost, PubMed, NCBI, Scopus, and Clinical Key.

Based on the available literature, mental stress is considered a predisposing factor that causes bruxism. It is of high importance to relieve this excessive clenching effect to further preserve the morphological and physiological teeth, periodontium and temporomandibular joint functions. Therefore, updates and appraisals of the available evidence and literature are needed to sufficiently send information to healthcare providers. It is recommended to further educate the general population about bruxism, its causes and how to limit the risk factors associated with it through the national public health education programs.

Key words: Bruxism, Temporomandibular, TMD disorders, Stress, Mental

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INTRODUCTION

With a prevalence of approximately 10 percent and an incidence of approximately 3 percent per year, Temporomandibular Disorders (TMD) is a significant health condition that cannot be ignored. The prevalence of TMD in adult populations is between 10 and 15 percent, but only 5 percent of the population seeks treatment. TMD is more prevalent in women than in men, with symptoms ranging from mild discomfort to severe pain with restricted jaw movement and function, headaches, TMJ clicks, masticatory muscle fatigue, deviation of mandibular trajectory, and tinnitus. TMD has a multifactorial aetiology, as multiple factors may contribute to its predisposition, onset, and maintenance [1]. Trauma, emotional and psychological

factors, degenerative processes, occlusal problems, and parafunctional activity are all possible causes of TMD. Parafunctional activity is one of the underlying causes of TMD. There are two different types of parafunctional behaviours: Clenching and bruxism. Psychological and emotional variables contribute to clenching and bruxism as predisposing factors. Bruxism is a parafunctional activity characterized by recurrent jaw muscular activity manifested by teeth grinding, mandibular bracing or thrusting, and clenching. According to several research, the prevalence of bruxism ranges from 8 to 31, percent and declines with age. Daytime bruxism (diurnal bruxism) and sleep bruxism (nocturnal) are the two types of bruxism; more precisely, awake and sleep bruxism. With sleep bruxism, about 90 percent of episodes involve grinding, but with awake bruxism, most of the episodes involve clenching. In addition, with awake bruxism, people are typically aware of the disease and want to avoid it, whereas with sleep bruxism, the symptoms are typically experienced upon awakening [2]. Therefore, sleep bruxism is difficult to detect and control, and the individual usually learns about it from their partners. High levels of stress, smoking, and the consumption of alcohol, caffeine, and drugs are all

etiological factors that can trigger bruxism [3]. Several studies have demonstrated that diagnosing bruxism, particularly sleep bruxism, can be difficult because many individuals are unaware that they have this disorder. To identify and diagnose bruxism, multiple axes, such as questionnaires, an oral history taken by asking the bed partner about grinding sounds during sleep, extra- and intra-oral inspection, and an electromyography (EMG) used to record the activity of the masticatory muscles or a polysomnographic (PSG) used to record the sleeping patient, should be utilized. EMG and PSG have been considered the gold standard for diagnosing sleep bruxism, but they are expensive, difficult to obtain, and need more time to study a big sample. Consequently, the questionnaires would be more appropriate and desirable for big sample populations. There have been numerous researches examining the connection between sleep bruxism and TMD, as well as multiple inspections and identification methods [4]. The purpose of this study is to examine the association between sleep bruxism and TMD or non-TMD, as well as the variance associated with these diseases.

MATERIALS AND METHOD

The PICO structured summary approach was selected as a strategy for organizing clinical research issues

related to evidence synthesis. It directs the questioner to identify the problem, intervention, and outcome associated with a patient's individual care. The PICO used in this article is as follows: Population (P)-18-year-olds and above with TMD, I (intervention): sleep bruxism and nonsleep bruxism. C (Comparative): TMD against non-TMD (Result): relationship between bruxism and mental stress. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) criteria and protocols. A comprehensive search was conducted using EBSCO host, PubMed, NCBI, Scopus, and Clinical Key.

The following keywords were assigned: bruxism, temporomandibular, TMD disorders.

English language articles with individuals at least 18 years old, with or without sleep bruxism, and TMD constitute the inclusion criteria for this study. The design of the study is a quantitative descriptive cross-sectional study with descriptive statistics and frequency, case-control study, retrospective cohort study, and duplication.

Exclusion criteria include people under the age of eighteen, non-English language, and case studies of design studies. Each submission must include

Table 1: Summary of selected articles.

Title	Authors	Research Design	Research Purpose	Subject	Result	Conclusions
Psychic and occlusal factors in bruxers	Manfredini, et al. [5]	Case control	To study the associations, present between Bruxism, psychic and occlusal factors.	85 (47 males, 38 females) individuals participated in this study. Two groups, bruxers (n=34) and non-bruxers (n=51), based on the presence of both clinical and anamnestic indicators of bruxism. Mean age 25 years Questionnaires were answered to evaluate mood (MOODS-SR) and panic agoraphobic (PASSR) spectra. Dentition were also recorded.	For psychiatric investigation, It was significant by the presence of both depressive and manic symptoms in MOODS-SR For stress sensitivity, anxious expectation and reassurance sensitivity symptoms in PAS-SR.	Some psychic traits are present in bruxers. Occlusal factors are not useful to differentiate between bruxers and nonbruxers.
The relationship between sleep bruxism behavior and salivary stress biomarker level	Makino, et al. [6]	Clinical trial	To clarify the relationship between bruxism and a salivary stress biomarker level.	46 (23 males, 23 females) individuals participated in this study. Bruxism was assessed by the use of self-administered questionnaire, study casts, and BiteStrip. Saliva samples were collected to measure levels of CgA.	There is an association between bruxism and jaw functional limitation. Occlusal wear wasn't associated significantly with occlusion, jaw functional limitation, or dentition, but it was significant with self-reported bruxism and BiteStrip score. The salivary CgA level was significantly negative associated with BiteStrip score.	Psychological stress level is negative significantly correlated with bruxism.
Correlation between stress, stress-coping and current sleep bruxism	Giraki, et al. [7]	Case control	To investigate whether specific stress-factors correlate with Sleep bruxism (SB) activity.	69 (23 males, 46 females) individuals participated in this study. Two groups, study group (n=48) and control group (n=21). Mean age 29 years Completed questionnaires for assessing different stress parameters and stress-coping-strategies. Bruxism was measured by the Bruxcore-Bruxism-Monitoring-Device, worn for 5 consecutive nights and analyzed using a computer-based method.	Stress and coping questionnaires significantly correlate with bruxism.	The more the problems in daily life, the higher was the incidence of bruxism.

Association between sleep bruxism and stress sensitivity in an experimental psychological stress task	Abekura, et al. [8]	Case control	To inspect the correlation between bruxism and psychological stress.	76 (36 males, 40 females) individuals participated in this study. Two groups, bruxers (n=22) and non-bruxers (n=54). Mean age 24 years It was assessed by measuring the subjects CgA levels and using a ten-division visual analog scale (VAS).	The mean salivary CgA levels of the non-bruxism group were not significantly increased after the stress task. The mean salivary CgA levels of the bruxism group were significantly increased after the stress task. The mean VAS scores of the groups without and with bruxism were significantly increased after the stress.	There is a significant correlation between bruxism and psychological stress.
Association Among Stress, Personality Traits, and Sleep Bruxism in Children	Negra et al. [9]	Case control	To study the relationship between stress levels, personality traits and bruxism in children.	360 (180 males, 180 females) individuals participated in this study. Two groups, bruxers (n=120) and non-bruxers (n=240). Mean age 9 years Psychological tests were administered and evaluated by psychologists. Sleep bruxism was diagnosed from parents' reports.	Children with a high level of stress, due to psychological reactions and a high sense of responsibility vs those with low levels of these psychological traits, had a greater chance of exhibiting the habit of sleep bruxism.	High levels stress and responsibility has an impact on the development of bruxism in children.
Relationship Between Sleep Bruxism and Stress Determined by Saliva Biomarkers	Karakoulaki, et al. [10]	Case control	To evaluate the relationship between sleep bruxism (SB) and stress through the estimation of salivary stress-related biomarkers.	45 (20 males, 25 females) individuals participated in this study. Mean age 35 years BiteStrip was used to evaluate bruxism. Salivary cortisol and α -amylase levels were evaluated.	Bruxers showed higher levels of stress than nonbruxers. A positive correlation existed between bruxers BiteStrip scores and the cortisol levels. Study group had higher levels of cortisol than nonbruxers, while α -amylase levels were not significant between in bruxers and nonbruxers.	Bruxism is related to a higher level of psychological stress and salivary cortisol.
Relationship between stress and sleep bruxism in children and their mothers: A case control study	Sampaio et al. [11]	Case control	To investigate the prevalence of bruxism in children and their biological mothers relating it to perceived stress.	48 (36 males, 40 females) individuals participated in this study. Two groups, children with SB and their mothers (n=24) and control group (n=36). Mean age 24 years Teeth were evaluated for wear, then identification of socio-demographic data and stress evaluation which was composed of 35 questions.	No significant associations existed between socio-demographics and bruxism. There was an increase in the occurrence of SB in children when their caregiver also had this condition.	Bruxism and psychological stress wasn't significant in both the children nor mothers.
Correlation between Sleep Bruxism, Stress, and Depression—A Polysomnographic Study	Smardz et al. [12]	Clinical trial	To evaluate the correlation between bruxism, perceived stress and depressive symptoms.	77 (21 males, 56 females) individuals participated in this study. Two groups, study group (n=58) and control group (n=19). Patients underwent video-polysomnography to evaluate stress, and occurrence of depressive symptoms was evaluated.	The analysis showed nonsignificant correlation between Bruxism Episodes Index (BEI), Perceived Stress Scale-10 and Beck's Depression Inventory scores, when comparing bruxers and control group.	Intensity of sleep bruxism was not statistically significantly correlated with self-reported perceived stress and depression.
Relationship between Sleep Bruxism, Perceived Stress, and Coping Strategies	Saczuk et al. [13]	Case control	To evaluate the relationship between perceived stress, coping mechanisms and sleep bruxism.	60 (17 males, 43 females) individuals participated in this study. Two groups, study group (n=35) and control group (n=25). Mean age 30 years Participants experienced detailed examinations. Bruxism Index was recorded overnight using Bruxo. The Perceived Stress Scale (PSS-10) used for stress evaluation, Brief-COPE for coping strategies.	The higher the PSS-10, the higher the Bruxism Index in the study group. Positive coping strategies were chosen most often by control group, while maladaptive strategies were chosen by study group.	There's a relationship between stress and sleep bruxism. The type of coping strategies may have an influence on sleep bruxism.
The correlation between sleep bruxism, salivary cortisol, and psychological status in young, Caucasian healthy adults	Flueraşu et al. [14]	Analytical, observational, cohort, transversal and prospective study	To analyze the association between sleep bruxism (SB), salivary cortisol, and psychological state in healthy adults.	60 (27 males, 33 females) individuals participated in this study. Mean age 23 years A questionnaire evaluated and analyzed the presence of bruxism in general and psychological states of the participants. The TMJ and teeth examination were performed. The cortisol level was also determined.	Participants with bruxism were characterized by stress compared to control group. Also presented work-induced depressive attitude when compared to control group. The cortisol levels were higher in participants with bruxism.	Bruxism is correlated with general and job-induced psychological changes. Salivary cortisol is not a definitive marker for the evaluation of bruxism severity.

statistically validated data. This systematic review includes articles on sleep bruxism, awake bruxism, and the use of questionnaires to examine sleep and awake bruxism. The collection of non-questionnaire data was excluded from the evaluation procedure. For the diagnosis of Temporomandibular Disorder, RDC/TMD was utilized in most published works (Research Diagnostic Criteria for TMD). The SIGN (Scottish Intercollegiate Guidelines Network) checklist was used to assess the overall quality and risk of bias for case-control and cohort studies, and the JBI (Joanna Briggs Institute) checklist was used to examine cross-sectional articles. Articles considered in this review were required to be formally published and to employ validated tests and questionnaires. The participants were asked for permission to participate in the study and consented to sign an informed consent form. In addition, each local Research Ethics Committee approved the project. The contents of each of the literature were summarized in Table 1, which was organized by authorship, research design, research objective, sample structure, results and conclusion.

RESULTS

Figure 1 is a flowchart of the search and selection procedure for articles based on PRISMA 2020 guidelines. According to the SIGN checklist, cohort studies are acceptable and case-control studies are of good quality, while all selected publications are acceptable according to the JBI checklist. All ten studies from the selected databases meet the age requirement of 18 years old. Two of the ten studies have descriptive cross-sectional study designs, seven has case-control study research designs, and one has retrospective cohort study designs. RDC/TMD was utilized to assess and diagnose TMD in six of the investigations, RDC/TMD and Fonseca Index in one study, and FAI index in one study (Fonseca Anamnesis Index).

DISCUSSION

This review covers ten articles that studied the association between mental stress and bruxism. The results showed that stress has a direct effect causing bruxism, whether it was in children, as the stress coping strategies or as a result of depression. Some articles also discussed stress effect at the cellular level through biomarkers.

Two of the articles included in this review had some associations related to children. A study conducted by Negra, et al. studied the relationship between stress and children's personalities and its influence on bruxism. The study included 360 participants with equal numbers of both sexes and mean age of 9 years. The sample was divided to bruxers (n=120) and non-bruxers (n=240). Mental stress was assessed by phycologists using some tests, while bruxism was assessed by reports made by parents. Children with high levels of stress and responsibilities had a higher chance of bruxism. So this study concluded that stress and responsibility has an influencing effect on bruxism [9].

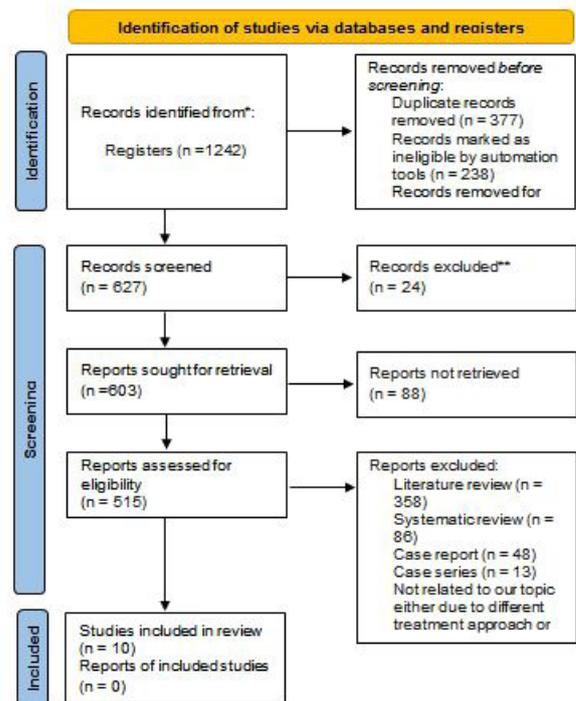


Figure 1: PRISMA 2020 flowchart.

Study done by Sampaio, et al. studied if stress has an effect of bruxism in both children and their mothers. It included 48 (36 males, 40 females) participants, with mean age of 24 years. The study included a questionnaire for sociodemographic identification and to asses' stress. Clinical examination was also done to evaluate wear in teeth. Results included that there was no relationship between demographics and bruxism, while there was increased prevalence of bruxism in children when the mothers are also bruxers. As for this study it concluded that there is no association between demographics and bruxism for both children and mothers [11-14].

According to the authors, we can conclude that stress have an effect in causing bruxism. This finding correlates with the recent findings of Alvarez, et al. bruxism in children will have an increased prevalence when mothers are bruxers. The most distinctive signs and symptoms for bruxism are dental wear and headaches, which related to anxiety, stress and behavior problems mainly due to emotional changes that occur during childhood thus altering sleep quality and aid in the development of bruxism [15].

Other studies agree with stress causing bruxism, but also discussed other aspects of this topic. Gomes, et al. looked into separation anxiety being another risk factor for developing bruxism, which is usually a reaction to stress that happen in 12-18 months children whom are separated from their caregivers thus both physical and emotional attachment is disrupted. Same thing occur in their mothers psychological characteristics change causing stress and depression, thus this will have an effect on the children to present bruxism. Even though bruxism severity in children might be of lesser

degree than adults, their teeth wear is more intense as the characteristics of primary teeth exhibit a less mineralization compared to permanent teeth [16].

Two articles investigated the effect of stress and its coping strategies on the development of bruxism. Saczuk, et al. included 60 (17 males, 43 females) participants with mean age of 30 years, and were grouped as bruxers (n=35) and nonbruxers (n=25). They have studied the relationship between bruxism, stress and coping mechanism. Bruxism was assessed by clinical examination and by use of Bruxo overnight. Stress was assessed by Perceived Stress Scale (PSS-10), while coping mechanism by Brief-COPE. There was a significant relation between stress and bruxism. The type coping strategy done by stressed individuals, it may increase the chance of bruxism [13].

As for second study, it was conducted by Giraki, et al. and it included 69 (23 males, 46 females) participants with mean age of 29 years. The study investigated if stress factors correlate with bruxism. Participants answered a questionnaire to assess stress and coping mechanism. Bruxism was assessed by a monitoring device, Bruxcore. Both questionnaire and device analysis correlated significantly with bruxism. The study concluded that the as problems increase, stress levels will also increase, thus having an impact on teeth wear by bruxism [7].

These findings comply with a study conducted by Gungormus, et al. that proposed that certain personality characteristics such as stress and anxiety are primary psychological factors responsible for the development of bruxism in both children and adults [17], were as Saczuk, et al. found that participants who use Self-Blame as a coping mechanism achieved the highest bruxism score [18]. It was also reported by a study conducted by Zadworna, et al. that choosing Self-Blaming is the strongest predictor of perceived stress [19].

Other two articles correlated stress and psych with bruxism. A study conducted by Manfredini, et al. studied the correlation between bruxism and psychic factors. The study included 85 (47 males, 38 females) participants with mean age of 25 years and were grouped in bruxers (n=34) and non-bruxers (n=51). A questionnaire was distributed to the participants to assess mood (MOODS-SR) and panic agoraphobic (PASSR) spectra, while teeth were evaluated clinically. The study concluded with the presence of some psychic traits in bruxers. Stress have an effect on psych thus the higher the chance of bruxism, but it's difficult to differentiate bruxers and nonbruxers based only on dentition [5].

While a study conducted by Smardz, et al. has studied the relationship between stress and depression symptoms and bruxism. It included 77 (21 males, 56 females) participants, that were divided into two groups bruxers (n=58) and nonbruxers (n=19). The participants experienced video-polysomnography to evaluate stress and any depressive symptoms occurred. The study concluded with that there was no significant correlation

between stress, depression and intensity of bruxism when compared between bruxers and nonbruxers [12].

These findings correlated with a study done by Flueraşu, et al. which indicated a statistically proven involvement of psychological factors in the occurrence of bruxism. Stress and anxiety can be favorable factors in the appearance of both types of bruxism; however, depression was associated only with awake bruxism [20].

Most of the articles included in this review, six articles investigated stress within salivary biomarkers and its relation to bruxism. A study conducted by Makino, et al. to explain the correlation between stress salivary biomarkers level and its relation to bruxism. The study included 46 (23 males, 23 females) participants. A questionnaire, diagnostic casts and BiteStrip to assess bruxism. Saliva was also collected to measure CgA levels. Dentition wear was associated significantly with questionnaire and BiteStrip scores, while CgA level was not significantly associated with bruxism [6], while a study conducted by Abekura, et al. aimed to examine if there was any relation between bruxism and psychological stress. The study included 76 participants (36 males, 40 females) with mean age of 24 years. The sample was divided into two groups bruxers (n=22) and non-bruxers (n=54). Bruxism was assessed by measuring levels of CgA and by use of visual analog scale (VAS). The mean salivary CgA levels of the non-bruxism group were not significantly increased after the stress task. While CgA levels of the bruxism group were increased significantly after the task. Thus the study concluded that there is a correlation between bruxism and psychological stress [8].

Another study conducted by Karakoulaki, et al. evaluated the association between stress and bruxism by assessing stress salivary biomarkers. The study included 45 participants (20 males, 25 females) with mean age of 35 years. Bruxism was determined by BiteStrip, where in cortisol and α -amylase levels in saliva was also evaluated. There was a correlation between BiteStrip scores and the salivary cortisol levels within bruxers whereas salivary α -amylase level was nonsignificant between bruxers and nonbruxers. The study concluded that as the psychological stress and cortisol level increase, there will be higher chance of bruxism [10].

Flueraşu, et al. studied the association between salivary cortisol, psychological state and bruxism. 60 individuals (27 males, 33 females) participated in this study with mean age 23 years. Clinical examination of teeth wear, questionnaire to assess psychological state and salivary cortisol level was measured. Participants who had bruxism were characterized with stress. Cortisol level was higher in participants with bruxism. So this study concluded that bruxism is correlated with psychological state such as stress, as well as cortisol level, but is not a definitive marker for its severity [14].

Many studies agree with the theory that salivary biomarkers is a predisposing factor for bruxism. As a

study conducted by Kobayashi, et al. stated that stress is a determinant of bruxism and can be measured by some biomarkers such as cortisol and alpha amylase. These biomarkers are usually elevated in stressed patients and present TMJ issues. Anxiety usually over-activates the hypothalamic, pituitary, adrenal glands thus increasing cortisol levels [21].

Based on the reviewed literature, bruxism will be classified at the time of examination as awake bruxism, sleep bruxism, and nonbruxism. The three groups can yield distinct study outcomes and conclusions. Literature-based TMD diagnosis and screening techniques result in a number of diagnostic variants. Literature demonstrated that sleep bruxism could increase the likelihood of TMD and lead to the development of other diseases, including TMD discomfort, chronic migraine, cervical muscle pain, and headache.

Articles reveal that the most often studied types of bruxism are sleep bruxism and awake bruxism. In the reviewed literature, the analysed participants are at least 18 years old, and the prevalence of sleep bruxism in the adult age group (18-60 years) was reported to be 56.8 percent, with a higher frequency in women than in men. Examining and determining the presence or absence of sleep bruxism can be accomplished by a variety of methods, including questionnaires, PSG, and EMG. In the examined literature, the majority of researchers employed questionnaires that are ideal for large sample sizes and can swiftly gather data from a large number of respondents in a short period of time, while one study employed EMG.

According to Manfredini, et al. [5] the diagnostic utility of questionnaires is contingent upon the patient's ability to differentiate between sleep and awake bruxism. However, the use of PSG and EMG is restricted due to high prices and the difficulty of examining large numbers of people. In screening, the ability of the operator or clinician to perform anamnesis and assess patient data using a questionnaire is vital.

LIMITATIONS

The articles involved in this systematic review had some limitations. The included articles discussed stress and bruxism in different aspects thus not being a specific study and altered statistical comparisons. Some studies have been designed with inadequate sample sizes or incomparable age and gender distributions. Bruxism was measured by different methods; some were subjective through self-reported questionnaire. Due to these limitations, it is recommended to do further studies of higher evidence-based, larger sample and randomization is needed. In addition, all other variables (such as: age, stress factors, coping strategy) needs to be standardized to confirm the results of this review. Not many articles described the relationship between mental stress and bruxism. Most included non-biased articles were case-control studies which could introduce a potential bias in the study outcomes and conclusions,

so increasing number of cohort and clinical trials would make this review higher evidence-based study. Only two randomized controlled trials, and one cohort study was identified in this systematic review.

CONCLUSION

In conclusion, based on the available literature, mental stress is considered a predisposing factor that causes bruxism. It is of high importance to relieve this excessive clenching effect to further preserve the morphological and physiological teeth, periodontium and temporomandibular joint functions. This parafunction activity is more prevalent in adult patients and significantly more prevalent in women than in males. Bruxism and its management are a hot topic discussed among several academics and dentists. Therefore, updates and appraisals of the available evidence and literature are needed to sufficiently send information to healthcare providers. It is recommended to further educate the general population about bruxism, its causes and how to limit the risk factors associated with it through the national public health education programs.

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