THE IMPACT OF BRUXISM ON THE HEALTH OF STRESS-EXPOSED INDIVIDUALS – SOLDIERS: DIAGNOSIS, TREATMENT, AND PREVENTION

Wpływ bruksizmu na zdrowie osób szczególnie narażonych na stres – żołnierzy: diagnostyka, leczenie i profilaktyka

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Abstract

The article reviews the literature on the impact of bruxism on the health of soldiers – a professional group particularly exposed to chronic stress. The mechanisms underlying bruxism, its health consequences, including temporomandibular joint disorders, and the correlation between stress levels and the severity of bruxism are discussed. Current diagnostic methods (such as polysomnography and surface electromyography) are reviewed, along with various therapeutic strategies: pharmacological, behavioural, physiotherapeutic, and occlusal splints. The paper underscores the value of an interdisciplinary approach and prevention to mitigate the effects of bruxism in this occupational group.

Streszczenie

Artykuł przedstawia przegląd literatury dotyczącej wpływu bruksizmu na zdrowie żołnierzy – grupy zawodowej szczególnie narażonej na chroniczny stres. Omówiono mechanizmy powstawania bruksizmu, jego konsekwencje zdrowotne, w tym zaburzenia stawu skroniowo-żuchwowego, oraz zależności pomiędzy poziomem stresu a nasileniem objawów tego zaburzenia. Zaprezentowano również aktualne metody diagnostyczne (m.in. polisomnografię, elektromiografię powierzchniową) oraz różnorodne strategie terapeutyczne, w tym farmakologiczne, behawioralne, fizjoterapeutyczne oraz stosowanie szyn okluzyjnych. Podkreślono znaczenie interdyscyplinarnego podejścia i profilaktyki w minimalizowaniu skutków bruksizmu w tej grupie zawodowej.

Keywords: bruxism; dentistry; health; soldiers; stress

Słowa kluczowe: bruksizm; stomatologia; zdrowie; żołnierze; stres

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Introduction

Military service requires not only exceptional physical fitness but also considerable psychological resilience. Soldiers are routinely exposed to intense stressors, necessitating constant readiness to perform in challenging, unpredictable environments. Intensive training, combat operations, extended separations from family, and constant responsibility for one's own life and that of comrades are the primary sources of chronic stress in this occupational group.

The impact of stress on human health has been extensively investigated and documented in the scientific literature. Chronic stress disrupts the functioning of the nervous, endocrine, and immune systems, thereby contributing to the development of multiple disorders, including cardiovascular diseases (CVDs), depressive disorders, and immune dysfunction. One less apparent yet clinically significant consequence of stress is its effect on oral health. This issue holds particular significance for military personnel, who are particularly exposed to chronic psychological stress.

Stress may contribute to a wide range of oral health issues, including bruxism, periodontal disease, xerostomia, and recurrent aphthous ulcers. The mechanisms underlying these effects are multifactorial and involve endocrine responses, such as elevated cortisol levels, immune system dysregulation, reduced salivary flow, as well as changes in daily hygiene habits. Individuals experiencing stress may neglect proper oral hygiene, increase the use of harmful substances such as tobacco and alcohol, and adopt unhealthy dietary patterns to compensate for the experienced stress.

Unfortunately, neglecting oral health can have serious consequences. Periodontal disease and dental caries not only compromise aesthetics and overall quality of life, but also induce pain and functional limitations, including masticatory and phonatory difficulties. For soldiers, who are required to sustain peak physical readiness and operational efficacy across all settings, such oral health issues may give rise to substantial limitations and impaired performance.

Bruxism, defined as involuntary grinding or clenching of teeth, is a multifactorial condition in which psychological stress plays a significant aetiological role. Military personnel exposed to sustained psychophysical stress are therefore at particularly high risk of developing this disorder.

Aim

This paper discusses the impact of stress on developing bruxism, with particular emphasis on soldiers—a population exposed to chronic stress. Diagnostic and therapeutic methods are discussed. Research confirming this relationship is also presented, along with effective strategies for preventing and counteracting the negative effects of stress. The aim of this paper was to highlight the importance of oral health in the context of soldiers' operational readiness and overall performance, as well as to encourage the implementation of targeted interventions to reduce stress-related health consequences in this professional group.

Health issues associated with bruxism

Bruxism, particularly its chronic form, may lead to multiple health complications affecting both the stomatognathic system and overall systemic health. Persistent, uncontrolled clenching or grinding of the teeth results in overload of the masticatory muscles, which may subsequently lead to structural and functional disturbances.

In their literature review, Manfredini et al. [1] identified temporomandibular disorders (TMDs) as one of the most common complications of bruxism, affecting up to 85% of patients with chronic forms. TMD manifests clinically with mandibular pain, muscle stiffness, limited mandibular range of motion, and joint clicking upon movement.

In their systematic analysis, Melo et al. [2] demonstrated that sleep bruxists were 2.3 times more likely to develop TMDs compared with non-bruxists (OR = 2.3; 95% CI: 1.6–3.4).

Bruxism is linked to a variety of health issues, including tension-type headaches that affect up to 65% of patients with active disease [3]. Additionally, enamel wear and microcracking can increase, causing tooth sensitivity and gradual loss of dental hard tissues. Nocturnal masticatory activity may also disrupt sleep, often coexisting with conditions like obstructive sleep apnoea [3].

Sleep bruxism is the most common form and manifests as involuntary teeth clenching or grinding during sleep. It most commonly arises during transitional sleep phases, referred to as microarousals, triggered by brief central nervous system activation in response to internal or external stimuli. This activation triggers masticatory hyperactivity, leading to symptoms like headaches, tension in facial and neck muscles, tooth sensitivity, and damage to enamel and other dental hard tissues.

From a general medical viewpoint, bruxism has a negative impact on patients' quality of life through sleep disruption, compromised mental health, and reduced social functioning. The accompanied chronic pain and stress can further intensify symptoms, forming a vicious cycle between bruxism and stress.

Stress as a major risk factor

Although bruxism may stem from multiple causes, such as malocclusion and anatomical abnormalities, recent research highlights psychological stress as a primary trigger. Chronic emotional tension from everyday stressors can trigger unconscious masticatory hyperactivity during both wakefulness and sleep. Teeth grinding can thus serve as a maladaptive mechanism for releasing tension, where the body (lacking other ways to manage built-up emotional stress) triggers an involuntary motor response. Furthermore, chronic stress can impair CNS function, especially in dopaminergic pathways that regulate motor and emotional processing. Dysregulation of these systems may impair control over masticatory mus-

cle activity, thereby contributing to the development of sleep bruxism.

Sleep bruxism, manifested as involuntary teeth clenching or grinding during sleep, is one of the most prevalent forms of this disorder [4]. Studies have shown that individuals experiencing bruxism (whether awake or asleep) report markedly higher perceived stress on the Perceived Stress Scale (PSS), elevated dental anxiety as measured with the Dental Anxiety Scale (DAS), and increased gag reflex sensitivity per the Gag Assessment Scale (GAS), relative to non-bruxers [4].

The mean perceived stress level among bruxers was 14.6, which was significantly higher than that observed in the non-bruxism group (mean score of 9.3). Similarly, the severity of dental anxiety was greater among bruxers, with a mean DAS of 11.2 vs 7.5 in non-bruxers. Sensitivity to the gag reflex was also elevated among bruxers, with a mean GAS of 10.8 vs 7.4 in controls. No significant differences were found between groups in terms of the need for control, as assessed by the Desirability of Control (DC) scale, indicating that this psychological trait does not substantially contribute to bruxism [4]. Figure 1 shows perceived stress, dental anxiety, and sensitive gag reflex in bruxers vs non-bruxers.

Stress and bruxism among military personnel

In their study involving 251 Fort Hood soldiers (USA), Chen et al. found significant correlations between bruxism and three psychosocial factors: perceived stress (Perceived Stress Scale [PSS]: $r = 0.250$; $p < 0.001$), sleep quality (Pittsburgh Sleep Quality Index [PSQI]: $r = 0.325$; $p < 0.001$), and dental anxiety (Dental Anxiety Scale [DAS]: $r = 0.144$; $p < 0.01$). Bruxers demonstrated higher mean perceived stress scores (M = 14.83 vs. 10.66), poorer sleep quality (PSQI: M = 7.02 vs. 4.29), and greater levels of dental anxiety (DAS: M = 6.65 vs. 5.82) compared with non-bruxers.

Impact on oral health

Research shows that psychological stress and associated parafunctional habits, like awake and sleep bruxism, markedly compromise stomatognathic health. Painful TMDs are one of the major consequences of bruxism.

A study involving more than 1,600 participants compared data from patients diagnosed with TMDs ($n = 733$) with those from a non-TMD control group from the general population ($n = 890$). It was found that TMD patients were significantly more likely to report symptoms of bruxism, both during wakefulness (33.9% vs. 11.2%) and sleep (49.4% vs. 23.5%), compared with healthy controls [6].

Importantly, statistical analysis revealed that both awake (OR = 1.7) and sleep bruxism (OR = 1.8) were associated with an increased risk of TM pain. The highest risk, however, was observed in individuals exhibiting both forms of bruxism concurrently, in whom the likelihood of developing TMDs increased nearly eightfold (OR = 7.7). These findings indicate that stress, serving as both trigger and aggravator of parafunctional habits, not only promotes bruxism onset, but also yields severe clinical outcomes, such as chronic pain of facial muscles and TMJ, as well as chewing dysfunctions. Thus, stress-reduction strategies

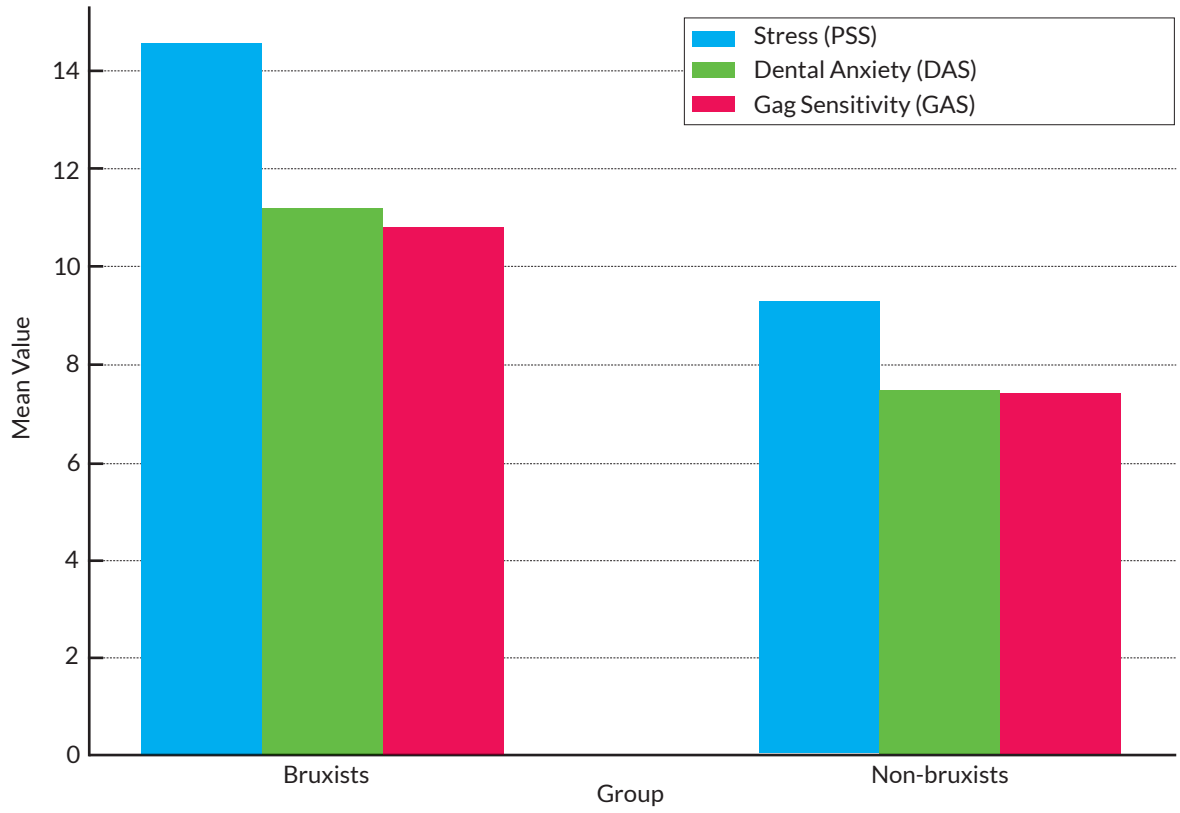

Figure 1. Comparison of variables depending on the presence of bruxism

should be included as a key element in preventing and treating bruxism and its complications [6].

Figure 2 presents a comparison of the prevalence of awake and sleep bruxism between controls and TMD patients. It may be seen that both awake and sleep bruxism are markedly more common in the latter group, reinforcing the idea that bruxism acts as either a risk factor for or outcome of stress-induced muscle hyperactivity and tension.

Diagnosis of bruxism

Precise diagnosis of sleep and awake bruxism is crucial for implementing effective therapeutic interventions. The multifactorial aetiology of this disorder, especially the prominent role of psychological stress, requires a comprehensive and differentiated diagnostic approach.

Lobbezoo et al. proposed a three-tier diagnostic framework for bruxism: "possible" (based on patient history or self-report), "probable" (history plus clinical examination), and "definite" (EMG or polysomnography). This classification system facilitates standardization of diagnostic criteria and improves diagnostic accuracy.

Polysomnography (PSG) remains one of the most precise diagnostic modalities for sleep bruxism, allowing objective measurement of masticatory muscle activity during sleep. Kato et al. [8] demonstrated that individuals with confirmed sleep bruxism experienced an average of approximately 4.1 tooth-clenching episodes per hour of sleep, with rhythmic masticatory muscle activity observed in 86% of patients.

In clinical practice, surface electromyography (sEMG) serves more commonly as a less expensive and more easily available alternative. According to Castroflorio et al. [9], EMG was able to detect patterns of masticatory activity typical of bruxism in approximately 75% of patients. The use of EMG as a diagnostic adjunct is particularly valuable in outpatient settings. In the case of awake bruxism, diagnosis is primarily based on patient self-report and clinical history taking. Manfredini et al. [3] reported that daytime teeth clenching is reported by about 20–30% of the general population; however, confirming awake bruxism requires systematic observation and often an interdisciplinary input.

Despite diagnostic advances, researchers emphasize the lack of clear, universally accepted diagnostic criteria. A systematic review by Manfredini et al. [1] points to substantial variability in sleep bruxism classification in the available literature, resulting in reported prevalence differences of up to 40%.

In summary, accurate diagnosis of bruxism requires a multimodal approach, integrating history taking, clinical examination, and specialised assessment of masticatory muscle activity. Such a comprehensive strategy may prove vital for effective management, particularly in patients with bruxism closely linked to elevated stress levels.

Pharmacotherapy

Pharmacotherapy is an adjunctive option for bruxism, especially in cases with severe symptoms and stress- or anxiety-related aetiology. Clinical trials to date have primarily targeted sleep bruxism management, using agents such as dopamine agonists, benzodiazepines, antidepressants, anxiolytics, and muscle relaxants.

In their systematic review, Lobbezoo et al. [7] evaluated the efficacy of several pharmacological agents. Clonazepam, given at 0.5–1.0 mg before bedtime, significantly reduced bruxism episode frequency in about 69% of treated patients. Buspirone, an anxiolytic, also showed beneficial effects, especially in patients with high stress levels, by decreasing the intensity of parafunctional activity.

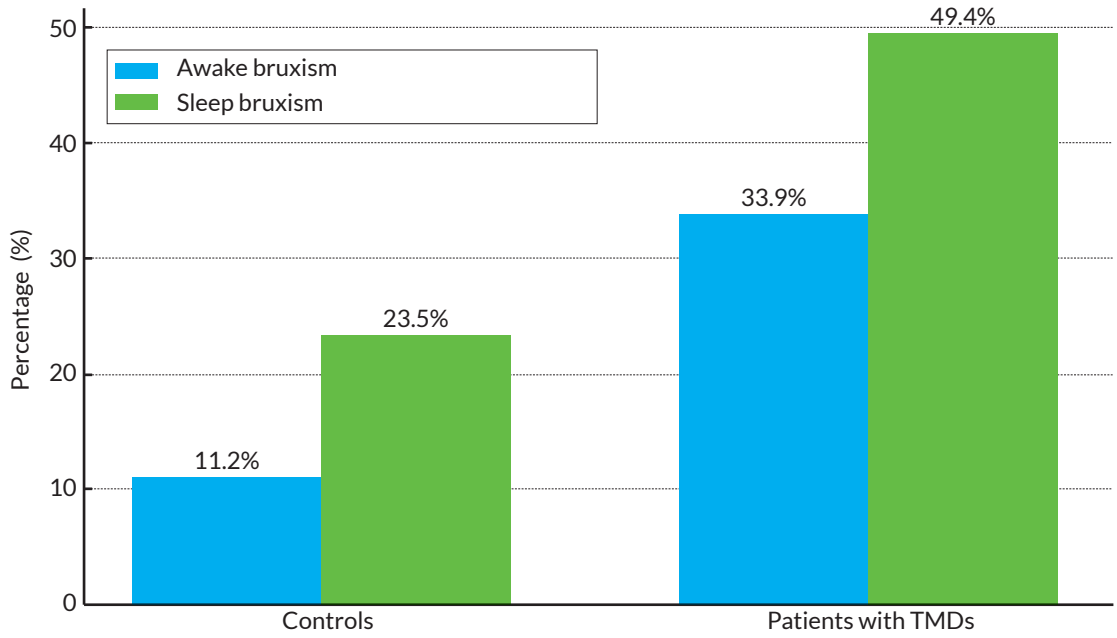

Figure 2. The prevalence of bruxism in healthy individuals and patients with temporomandibular joint disorders (TMDs)

In their review of randomized controlled trials, Macedo et al. [10] reported that dopamine agonists (including pergolide) were the most effective pharmacological agents for sleep bruxism, reducing masseter muscle activity by up to 30–40%. However, the authors cautioned against routine use due to potential adverse reactions and stressed the need for treatment individualization.

Huynh et al. [11] evaluated the effectiveness of pharmacological treatments for sleep bruxism and found that therapeutic outcomes varied depending on the underlying aetiology of the disorder. Patients with stress-induced bruxism achieved symptom reduction of about 25–35% with anxiolytics (like diazepam).

Although pharmacological interventions may provide meaningful benefits, they are generally not recommended as first-line therapy for bruxism, but short-term adjunctive treatment, particularly in psychogenic cases. Furthermore, the potential risks of adverse effects, tolerance, and dependence, especially with prolonged benzodiazepine use, must be carefully considered.

Botulinum toxin

In recent years, botulinum toxin type A (BTX-A) has gained increasing attention as an effective therapeutic option for bruxism, particularly in patients with severe symptoms. A systematic review of 68 publications [12] identified four randomized trials that met the inclusion criteria and compared the efficacy of BTX-A against placebo (saline) or standard treatments like occlusal splints, pharmacotherapy, and cognitive-behavioural therapy (CBT).

The research showed that BTX-A injections significantly decreased bruxism episode frequency, as evidenced by patient reports and objective measures (EMG). Additionally, a marked reduction in muscle pain associated with masticatory hyperactivity was observed. Furthermore, a reduction in maximum occlusal force was achieved, thereby decreasing the risk of dental damage and TMJ overload. The treatment demonstrated superior efficacy compared with controls, including both placebo and conventional modalities, with the most pronounced therapeutic effects observed in patients with severe bruxism.

Based on the available evidence, the authors of the review concluded that BTX-A injections are generally safe and well tolerated. They may prove useful in routine clinical practice, especially for patients with severe or refractory bruxism unresponsive to other therapies.

Behavioural therapy

Behavioural therapy, including biofeedback and CBT, is one of the recommended non-invasive methods for alleviating bruxism, especially one linked to chronic stress and emotional tension. Available evidence shows that behavioural interventions significantly reduce teeth grinding and clenching episodes, along with associated masticatory muscle pain.

In their systematic review, Vieira et al. [13] demonstrated that biofeedback reduced the frequency of parafunctional episodes by up to 40% in awake bruxists compared to controls. Similarly, Ilovar et al. [14] reported that biofeedback therapy significantly decreased masseter muscle activity during both sleep and wakefulness in adult patients, with clinically meaningful improvement observed in 73% of participants.

Orthlieb et al. [15] reported that raising patient awareness of parafunctional habits like bruxism, followed by their modification via CBT, yields significant symptom relief, especially in "reactive" bruxism triggered by emotional stressors. It is important to note that the effectiveness of behavioural interventions largely depends on patient engagement and therapeutic consistency. Moreover, unlike pharmacological treatments or invasive methods, these therapies are not associated with adverse effects, which makes them an attractive long-term option, especially for those with chronic stress-induced bruxism.

Physiotherapy

Physiotherapy has gained popularity as an adjunctive treatment for bruxism, especially in patients with significant muscle tension and TMJ dysfunction. Physiotherapeutic interventions typically include manual therapy, deep tissue massage, stretching exercises, and postural improvement.

El-Gendy et al. [16] found that deep stripping massage significantly improved sleep quality (drop in PSQI by 5.8) and increased maximum mouth opening of an average by 0.87 cm at treatment week 6 in sleep bruxists.

A systematic review by Amorim et al. [17] evaluated the efficacy of physiotherapeutic interventions in bruxism. The analysis revealed that masticatory muscle massage, therapeutic exercises, and relaxation techniques significantly reduced pain (based on visual analogue scale, VAS), and enhanced masticatory function. The authors further highlighted the potential of physiotherapeutic interventions to alleviate bruxism, including masticatory hyperactivity. However, they pointed to considerable heterogeneity among the included studies and limited quality of some of the available evidence.

Considering the above, physiotherapy constitutes an effective element of bruxism management, particularly among patients whose symptoms are aggravated by stress and increased masticatory muscle tension. Physiotherapeutic interventions can be effectively combined with other therapeutic modalities, including occlusal splints and relaxation techniques, thereby increasing the efficacy of comprehensive treatment.

Occlusal splints

Occlusal splints, also known as stabilization or relaxation splints, represent one of the most common therapeutic interventions for both stress-related and idiopathic bruxism. Their primary objectives are to protect dental structures from excessive wear, reduce masticatory hyperactivity, and alleviate pain due to stomatognathic overload. However, the available evidence suggests variable clinical efficacy. In their systematic review, Macedo et al. [10] reported that, despite the widespread use of

occlusal splints for sleep bruxism, there is no conclusive evidence supporting their superiority over placebo or no therapeutic intervention. However, more recent analyses, including a review by Ainoosahy et al. [18], suggest a higher level of clinical efficacy for occlusal splints. Their review compared different types of splints and showed a reduction in the frequency of bruxism episodes by approximately 36–47% within the first 6–8 weeks of treatment.

In another study, Vrbanović and Alajbeg reported that occlusal splint therapy reduced masticatory muscle pain in 68% of bruxists vs 42% controls, confirming the beneficial effect of occlusal splint therapy on stress-induced somatic symptoms of bruxism.

However, Hardy and Bonsor [20] note that the long-term efficacy of occlusal splints remains uncertain, with their effectiveness potentially limited in cases where severe psychological stress or anxiety disorders are the dominant aetiology; in such cases, supplementation with behavioural or pharmacological therapy is recommended.

In summary, occlusal splints may represent a valuable therapeutic option for managing bruxism, particularly for short-term relief of physical symptoms. However, splint therapy should be used as part of a combined treatment approach in cases where stress constitutes a key aetiological factor.

Bruxism prevention and lifestyle modification

Contemporary research increasingly underscores the crucial role of psychological and behavioural factors in the pathogenesis of bruxism, thereby redirecting therapeutic focus toward non-pharmacological modalities, including lifestyle modifications. Many systematic reviews and meta-analyses demonstrated significant correlations between psychosocial stress, sleep disorders, and excessive consumption of stimulants, such as caffeine, alcohol, and tobacco, and both the occurrence and severity of awake and sleep bruxism [21–23].

Observational and clinical studies indicate that interventions targeting stress reduction, enhanced sleep hygiene, and elimination of maladaptive habits substantially reduce the incidence and intensity of bruxism episodes, particularly in mild to moderate cases [22]. Regularly performed relaxation techniques, including breathing exercises, meditation, and progressive muscle relaxation, have demonstrated efficacy in mitigating daytime jaw clenching and subjective masticatory muscle tension within several weeks of treatment onset [23].

Furthermore, the authors emphasize that chronic bruxism frequently co-occurs with chronic emotional stress, adjustment disorders, and sleep deprivation; the implementation of cognitive-behavioural strategies combined with efforts to reduce exposure to stressful environmental stimuli may lead to significant clinical improvement, including a marked reduction in the frequency of bruxism episodes [23]. Although lifestyle modifications are rarely sufficient as monotherapy for advanced bruxism, they constitute a vital element of adjunctive therapy, particularly when integrated with dental, physiotherapeutic, or pharmacological interventions, as well as help prevent symptom recurrence.

Conclusions

Bruxism, which is a parafunctional disorder with complex, multifactorial aetiology, represents an escalating health concern, particularly among occupational cohorts exposed to chronic stress, such as military personnel. A growing body of evidence underscores the central role of chronic psychological stress in the development and persistence of both sleep and awake bruxism. In the investigated populations of military and non-military adults, statistically significant correlations were identified between stress levels, dental anxiety, increased sensitivity to dental stimuli, and bruxism. Moreover, risk analyses have linked coexisting sleep and awake bruxism with an approximately 8 times higher risk of TMDs.

An interdisciplinary therapeutic approach appears essential for effective management of bruxism. Pharmacological interventions, including benzodiazepines, dopamine agonists, and anxiolytics, have demonstrated moderate efficacy, particularly in cases with psychogenic aetiology. BTX-A injections have demonstrated efficacy in mitigating masticatory muscle hyperactivity and the frequency of bruxism episodes, particularly among patients exhibiting severe or treatment-resistant symptoms. Behavioural interventions, including biofeedback and cognitive-behavioural therapy, also play an important role in bruxism management by mitigating clinical symptoms and targeting underlying stress- and anxiety-related mechanisms. Physiotherapy, encompassing manual therapy techniques, masticatory muscle massage, and relaxation exercises, contributes to improved mandibular mobility and sleep quality. Occlusal splints, which effectively alleviate somatic symptoms, are used as an adjunct in comprehensive treatment, alongside lifestyle modifications and stress-reduction strategies.

For military personnel, effective diagnosis, treatment, and prevention of bruxism should be closely integrated with both general healthcare and psychological support systems. Regular mental health screening, stress management training, and targeted preventive programmes may substantially reduce the incidence of bruxism and its complications. This literature review highlights that a comprehensive understanding of the interplay between chronic stress and bruxism forms the cornerstone of effective therapeutic strategies, which aim to enhance the quality of life and psychophysical resilience among armed forces personnel.

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