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From risk factors to treatment: a holistic approach to managing bruxism

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ABSTRACT

Introduction and purpose

Bruxism, characterized by involuntary clenching or grinding of teeth, affects individuals across all age groups, often leading to significant oral health complications and diminished quality of life. While its etiology is multifactorial, involving genetic, psychological, and physiological factors, the management of bruxism remains challenging due to the variability in its presentation. This study aims to characterize bruxism and evaluate various therapeutic interventions, including pharmacological treatments, botulinum toxin injections, occlusal splints, and non-invasive methods such as cognitive behavioral therapy (CBT), biofeedback therapy (BFT), and physiotherapy.

Materials and methods

A comprehensive review of recent clinical trials and studies was conducted, focusing on the efficacy, safety, and limitations of both invasive and non-invasive interventions.

State of knowledge

Botulinum toxin injections and dry needling demonstrated significant efficacy, though their effects were temporary. Non-invasive therapies, including CBT and BFT, were noted for their safety but showed limited effectiveness. Combining sleep hygiene with mindfulness practices produced promising results, particularly in children. Physiotherapeutic methods, such as manual therapy and home exercises, helped alleviate muscle tension and pain.

Conclusions

While bruxism management has advanced with diverse treatment options, challenges persist, particularly concerning the durability of effects and patient compliance. A multidisciplinary

approach integrating psychological, physical, and pharmacological strategies appears essential for optimal outcomes. Further research is needed to refine therapies and establish long-term efficacy.

Keywords: bruxism; manual therapy; dry needling; botulinum toxin; occlusal splints; physiotherapy

1. Introduction

Bruxism is a centrally mediated neurological parafunctional movement disorder characterized by the involuntary clenching, grinding, or thrusting of teeth, often without conscious awareness. [1] It can occur during sleep, known as sleep bruxism, or while awake, referred to as awake bruxism. [2] While a certain amount of bruxism-related motor activity is not necessarily pathological, the behavior can cause significant harm, especially when it leads to complications such as tooth damage, myalgia, and temporomandibular disorders (TMD) [3], as well as feelings of fatigue or stiffness in the muscles [4], which require clinical intervention. Bruxism poses a significant concern that can impact not only oral health but also overall well-being and should not be underestimated. The global prevalence of bruxism is estimated at approximately 22%, with sleep bruxism affecting 21% and awake bruxism affecting 23%, regardless of sex. [5] In children, the prevalence ranges from 13% to 49% [6], with a decrease in frequency with age. [7] With numerous potential impacts in mind, effective management strategies are crucial for alleviating symptoms and improving patient outcomes. As bruxism is a multifactorial disorder, a comprehensive, multidisciplinary approach involving dentists, physiotherapists, and other healthcare professionals is often necessary to address the various aspects of the condition and provide effective relief.

2. Objective of the work

The aim of this study is to provide an overview of bruxism, including its prevalence, risk factors and diagnostic methods, while offering a critical analysis of the efficacy of different treatment options. The focus will be on evaluating their effects on pain reduction, muscle activity regulation, and the overall management of bruxism-related disorders.

3. Materials and methods

To write this article, databases such as PubMed, Google Scholar and ResearchGate were searched using the following terms: bruxism, manual therapy, dry needling, botulinum toxin, occlusal splints, physiotherapy in various combination and in the review context.

4. State of knowledge

4.1 Risk factors

Awake bruxism is primarily associated with nervous tics and stress responses. Although the exact physiology and pathology of awake bruxism remain unclear, stress and anxiety are considered major risk factors. [3] Sleep bruxism has been classified as a sleep-related movement disorder, is believed to be secondary to sleep-related micro-arousals—characterized by a rise in autonomic cardiac and respiratory activity that typically occurs 8–14 times per hour during sleep. [3] Among adults emotional stress, tobacco use or coffee consumption, sleep apnea syndrome, and anxiety disorders have been identified as significant risk factors. Alcohol consumption is proved to increase the likelihood of sleep bruxism by almost six times. [8] In children and adolescents, aside from distress, behavioral abnormalities and sleep disturbances are more prevalent. [9] A cross-sectional study involving parents of 460 children showed that as screen time and sugar consumption increased, the frequency of bruxism in children also increased. [10] Studies reveal that hereditary factors can also contribute to bruxism. [4]

4.2 Diagnostics

Bruxism can be diagnosed using both instrumental and non-instrumental tools. Non-instrumental methods include self-reporting, questionnaires, medical history and clinical diagnostic criteria. Instrumental tools involve the use of intra-oral bite appliances, electromyography, and polysomnography. Polysomnography is considered the gold standard for diagnosing bruxism, as it requires specialized equipment and/or access to a sleep laboratory. [1]

4.3 Pain association

Although bruxism is not a life-threatening disorder, it can significantly impact quality of life, particularly through dental issues such as tooth wear, frequent fractures of dental restorations, and pain in the oro-facial region. [11] Some studies do not support the view that bruxism is a

direct cause of pain, which should be considered when treating and managing patients. [12] However, other studies suggest that while pain is not present in all individuals with bruxism, repetitive parafunctional activities are key factors that contribute to the perpetuation of pain. [13] Research has shown that clenching and/or grinding of the teeth can trigger muscle sensitization in the masticatory system after exercise, leading to damage in muscle fibers and surrounding tissues. [14] Additionally, chronic local muscular contracture is known to cause inflammation and localized muscular hypoxia, which can lead to chronic myofascial pain. [15] Bruxism also plays a role in temporomandibular disorders (TMD) and may influence headache symptoms. [16, 17] Previous studies have indicated that limited mouth opening, jaw movement restrictions, as well as fatigue or stiffness in the muscles, are directly related to bruxism. [4] In addition to oral health problems, bruxism can cause myalgia, temporomandibular joint arthralgia, hypertrophy of the masticatory muscles, and disrupted sleep. [17] Myalgia in the masticatory muscles is a prominent symptom associated with bruxism. [18]

4.4 Oral health-related quality of life

Oral health-related quality of life (OHRQoL) measures the impact of oral health—along with functional, psychological, and social factors, as well as pain or discomfort—on an individual's overall well-being. Previous studies have shown that individuals with bruxism tend to have significantly lower OHRQoL compared to non-bruxists. [12, 16] Bruxism is strongly associated with negative effects on OHRQoL in adults, with the physical pain domain being most affected, followed by the psychological discomfort and psychological disability domains. [10][19]

5. Therapy

Bruxism is a multifactorial disorder, so there is no single, specific treatment available. As a result, multidisciplinary approaches involving teams of dentists, physiotherapists, and other health professionals are often required. [20] As etiology of bruxism is yet not fully understood, there is currently no definitive treatment for bruxism. However, its symptoms can be managed. [21] Treatment options vary and include non-invasive approaches such as cognitive behavioral therapy (CBT), biofeedback therapy (BFT), oral appliances including occlusal splints (OS) and oral rehabilitation through correction of malocclusion, manual therapy (MT) and pharmacological treatments (PT). Interventional therapies including dry needling (DN), local anesthetic injections and botulinum toxin (BoNT-A) injections are also available. [4]

Despite operating through different mechanisms, the overarching aim of all these therapies is to alleviate muscle hyperactivity and manage pain. [22]

5.1 Botulinum toxin injection (BoNT-A)

Botulinum toxin (BoNT-A) is a widely used bacterial-derived extract that inhibits muscle contraction by acting directly on the absorption of acetylcholine, thereby reducing muscular hyperactivity. [23] BoNT-A injections represent a viable therapeutic solution, particularly for bruxers who show poor compliance or those seeking earlier symptom relief. [21]

Several randomized controlled trials (RCTs) have evaluated the effectiveness of intramuscular BoNT-A injections into the masseter muscle for pain relief. M. Alwayli et al. [22] investigated the efficacy of injectable BoNT-A in managing pain in the masseter muscles associated with nocturnal bruxism. In this study, 40 participants were divided into two groups: 20 received bilateral injections of 20 units of BoNT-A, while the other 20 received saline injections. Pain at rest and during chewing was assessed using the Visual Pain Scale (VPS) at baseline and at 2, 4, 8, 12, 16, 18, and 24 weeks. The mean VPS score significantly decreased two weeks after the BoNT-A intervention. However, from 8 to 24 weeks, the mean VPS difference gradually diminished. This study indicated that BoNT-A effectively reduces pain associated with nocturnal bruxism. De la Torre Canales et al. [24] examined mandibular range of motion and muscle tenderness to palpation in patients with persistent myofascial pain (MFP). The study included 80 female patients divided into four groups (n=20): three BoNT-A groups with low, medium, and high doses, and a placebo control group receiving saline. All BoNT-A groups, regardless of dose, showed significant improvements in mandibular range of motion and reductions in muscle tenderness at 28 and 180 days post-treatment. In contrast, Ayala et al. [25] compared BoNT-A injections in the masseter muscle to saline injections in 14 female patients (n=7) with painful temporomandibular dysfunction (TMD). Both treatments were equally effective in reducing perceived pain after 30 days. Shim YJ et al. [26] evaluated the long-term effects of BoNT-A for sleep bruxism (SB). They compared BoNT-A injections (25 IU per masseter) to saline injections (n=15 per group). Audio–video–polysomnographic recordings were conducted before treatment, and at 4 and 12 weeks post-injection. BoNT-A significantly reduced the peak amplitude of electromyographic bursts during SB for 12 weeks, suggesting it is an effective management option by reducing the intensity of masseter muscle contractions. A recent study [27] assessed the effects of BoNT-A

injections on bite force and muscle thickness in patients with SB by comparing injections into the masseter muscle alone versus both the masseter and the anterior belly of the digastric muscle (ABDM) in a clinical trial (n=12). No significant differences were observed between the two groups in bite force or ABDM thickness. This suggests a need for further research into BoNT-A's ability to control intense ABDM contractions during sleep and the potential impact of suprahyoid muscles on rhythmic masticatory muscle activity.

While BoNT-A injections into the masticatory muscles are effective, their effects are temporary, typically lasting only a few months, necessitating repeated treatments. [21] BoNT-A injections can lead to complications, including alterations in muscle histology, muscular and neurogenic atrophy, reduced muscle fiber diameter and mass, decreased masticatory force, and reduced bone volume in the condyloid and coronoid processes, especially at higher doses. [23] Although a single injection does not appear to affect muscle thickness [28], recent evidence suggests that repeated low-dose BoNT-A injections can reduce muscle thickness, impair the ability of the masseter muscle to contract, and diminish masticatory performance, potentially leading to long-term detriments in muscle function. [23] Other possible side effects of BoNT-A injections include swallowing difficulties, temporary facial muscle paralysis, reduced electromyographic activity, and decreased contralateral mandibular movements. [23, 29] It remains unclear whether the changes in neuromuscular function and masseter morphology are permanent or reversible over a longer recovery period than currently anticipated. [23]

5.2 Dry needling (DN)

DN is a therapeutic technique, classified as a type of acupuncture. It involves the use of a thin filiform needle to penetrate the skin and target myofascial trigger points (MTrPs)—hypersensitive spots within taut bands of skeletal muscle fibers. Dry needling is used to treat muscles, ligaments, tendons, subcutaneous fascia and scar tissues. Its primary objective in managing bruxism is to alleviate muscle tension and restore pain-free muscle function without the introduction of additional substances [30]. The effectiveness of DN in the orofacial region has also been investigated. The effects of DN on masseter MTrPs were evaluated in comparison to a simulated DN technique in patients with myofascial TMD (n=36). [31] Participants were assessed at three intervals: before treatment, 10 minutes post-treatment, and during a follow-up 15 days later. DN significantly reduced facial pain and was accompanied

by a marked decrease in muscle activity 10 minutes after the procedure. Similarly, another study [32] reported a statistically significant improvement in jaw joint mobility, pain reduction, and sleep quality six weeks after DN treatment in patients with TMD (n=30). A comparative study of botulinum toxin type A (BoNT-A) injections and acupuncture for masticatory myofascial pain [33] assessed outcomes using the Visual Analog Scale (VAS), pain pressure threshold (PPT), and EMG measurements of the anterior temporal and masseter muscles. Baseline and one-month post-treatment evaluations were conducted. Participants (n=18) were divided into three groups receiving traditional acupuncture, BoNT-A injections (30U in the masseter and 10U in the anterior temporal muscles), or saline injections. Both acupuncture and BoNT-A significantly reduced self-reported pain after one month, with no significant difference between the two. However, only BoNT-A improved PPT values (a positive outcome) and reduced EMG activity in the treated muscles (an adverse effect). Acupuncture, in contrast, did not alter EMG activity, which may be considered an advantage over BoNT-A.

The efficacy of DN is attributed to its biochemical effects, including the stimulation of pain receptors at trigger points [34], as well as increased masseter muscle oxygenation [33]. Minor complications of DN may include pain during or after the procedure, bleeding, and bruising - common responses to needle insertion. Although rare, major complications can occur, such as nerve injury, infection, significant symptom exacerbation, drowsiness, or retained needles [34]. Vasovagal responses, including fainting, dizziness, and nausea, may also arise but are not unique to DN and are frequently associated with needle-related procedures. Another commonly observed issue is a temporary reduction in pain tolerance following DN, which typically resolves within 72 hours [35].

5.3 Occlusal splints (OS)

Oral appliances, such as OS, are simple-to-fabricate dental devices that have long been the preferred and most widely used treatment for bruxism [36]. While they are not curative, these devices act as protective barriers against the dental, oral, and muscular consequences of bruxism [37]. The primary goals of splint therapy include protecting tooth structures from attrition (and potentially abfraction), safeguarding dental restorations from damage, and preventing overload of oral structures such as the periodontium, jawbone, and masticatory musculature [8].

A recent systematic review classified the certainty of OS effectiveness as low to moderate [38]. Despite this, OS offers notable advantages: they are non-invasive and do not reduce bite force [39]. A recent study [40] compared OS with botulinum toxin type A (BoNT-A) for managing jaw muscle pain in patients with sleep bruxism (SB). Both treatments were effective in reducing jaw muscle pain, improving patients' quality of life, and enhancing mandibular function. Clinically, occlusal splints may provide additional benefits in specific functional parameters, such as pain-free mouth opening, unassisted maximum opening, assisted maximum opening, and protrusion. However, the use of OS may be limited in some patients due to factors like a sensitive gag reflex [41]. Another drawback is the need for consistent and regular use, which requires patient compliance. In contrast, BoNT-A injections do not require ongoing patient adherence, offering a distinct advantage in this regard [36].

5.4 Physiotherapy (MT)

Physiotherapy has long been a cornerstone in the treatment of musculoskeletal disorders [42].

Manual therapy (MT) is a hands-on form of physiotherapy that involves specialized maneuvers and techniques to treat muscles, joints, ligaments, fascial tissues, and nerves. In the treatment of bruxism, its primary goals are to reduce muscle tone and activity, provide reflexive relaxation by stretching shortened muscles, increase local blood circulation and metabolic activity, and thereby alleviate pain [43]. The efficacy of MT may be linked to the resolution of local ischemia [17]. A randomized controlled trial (RCT) [44] evaluated the effects of different types of MT on sleep quality and jaw mobility in bruxism patients, showing significant improvements in a group treated with deep-stripping massage. This effect is likely attributed to the mechanical pressure exerted during the technique, which stimulates mechanoreceptors and proprioceptors.

Exercises, another form of physiotherapy, can effectively strengthen the jaw and neck muscles. These exercises include:

- Opening and closing the mouth with the tongue placed on the upper palate.
- Stretching the masseter, temporalis anterior, and neck muscles to relax the jaw and facial muscles.
- Performing isometric exercises and self-post-isometric relaxation techniques.

- Posterior tilt exercises and posture correction to reduce pain, decrease involuntary contractions of the masticatory muscles, and improve their nutrition, flexibility, and coordination [42].

A recent study [43] compared the effectiveness of manual therapy (MT) and home exercise (HE) treatment in bruxism patients. The study included 30 participants, assessed before treatment and after eight weeks. Both MT and HE were shown to reduce perceived stress and pain intensity, as well as improve quality of life and sleep. While HE was as effective as MT in reducing pain and stress and improving quality of life, MT was more effective in enhancing sleep quality and alleviating symptoms of temporomandibular disorder (TMD). These findings suggest that both MT and HE are viable alternative treatments for bruxism. [44] Physiotherapy treatments, including those mentioned above, are generally safe and do not cause major complications. However, they may be associated with temporary adverse effects such as muscle soreness, increased pain, or stiffness [45].

5.5 Pharmacological treatment (PT)

PT for bruxism involves the use of sedatives, anxiolytics, tranquilizers, anti-inflammatory drugs, antidepressants, proton pump inhibitors, anticonvulsants, antihypertensives, and muscle relaxants, each targeting specific pathways through their active ingredients [4]. However, the use of drugs in bruxism treatment remains controversial due to insufficient evidence supporting the effectiveness of pharmacotherapy for sleep bruxism [46]. Additionally, certain antidepressants may exacerbate bruxism, particularly during the initial stages of use [47]. This highlights the need for more well-designed randomized controlled trials (RCTs) with larger sample sizes, robust allocation methods, appropriate outcome assessments, and extended follow-up periods [46]. Disadvantages of PT can vary depending on the specific medication used. Extended use of some pharmacological treatments may raise safety concerns, including potential side effects or risks of dependency [48].

A recent study [17] evaluated and compared the effectiveness of four treatment methods for managing bruxism-related symptoms: BoNT-A injections, DN, PT (a combination of 380 mg metocarbamol and 300 mg paracetamol) and MT. Eighty patients with bruxism were randomly assigned to four groups of 20 patients each. The study's findings revealed no significant differences among BoNT-A, DN, PT, and MT regarding subjective outcomes, such

as pain relief and OHRQoL, or objective outcomes, such as MMO, during the early treatment period. Based on factors such as competitive efficacy, non-invasiveness or minimal invasiveness, and cost-effectiveness, DN, MT, and PT emerged as promising alternatives for managing bruxism and its symptoms.

5.6 Other treatments

Cognitive Behavioral Therapy (CBT) and Biofeedback Therapy (BFT) have garnered significant research interest due to their non-invasive nature. CBT employs psychological techniques to help individuals replace negative thought patterns and behaviors with more constructive [ones. However, studies have indicated that CBT alone is not effective in reducing muscle activity [38].

Although no adverse events have been reported in studies involving CBT and BFT, the evidence supporting their overall efficacy remains limited [49]. Recent research [50], however, suggests that combining sleep hygiene practices with mindfulness meditation can effectively reduce sleep bruxism (SB) in children [51].

6. Conclusions

Bruxism is a complex, multifactorial disorder that significantly affects oral health, overall well-being, and quality of life. Its prevalence across all age groups, combined with its diverse risk factors, underscores the importance of accurate diagnosis and effective management strategies. While bruxism is not fully curable, advances in therapeutic options—ranging from botulinum toxin injections, dry needling to non-invasive interventions like physiotherapy and occlusal splints - have proven effective in alleviating symptoms and improving patient outcomes. Multidisciplinary approaches, integrating dentists, physiotherapists, and mental health professionals, remain pivotal in addressing the diverse manifestations of bruxism. Treatments like manual therapy, home exercises, and cognitive-behavioral interventions have demonstrated promising results, offering non-invasive alternatives to pharmacotherapy and invasive procedures. Despite these advances, several challenges persist, including the temporary effects of certain therapies, the need for patient compliance, and the potential side effects of pharmacological interventions. Future research should aim to refine existing

treatments, explore the long-term impact of interventions like botulinum toxin, and establish more robust evidence for emerging therapies such as biofeedback and mindfulness. By focusing on personalized, evidence-based approaches, clinicians can better manage bruxism and its associated complications, ultimately enhancing patients' oral and systemic health.

Disclosure

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