Medical Science

To Cite:
Kędzierska M, Wójcicki M, Kowalska A, Biernacki M. Botulinum toxin in the treatment of bruxism and temporomandibular joint disorders. *Medical Science* 2026; 30: e35ms3800
doi: https://doi.org/10.54905/disssi.v30i168.e35ms3800

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Peer-Review History
Received: 3 October 2025
Reviewed & Revised: 15/October/2025 to 30/January/2026
Accepted: 12 February 2026
Published: 18 February 2026

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

Botulinum toxin in the treatment of bruxism and temporomandibular joint disorders

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ABSTRACT

Bruxism and temporomandibular disorders (TMD) are common problems with the jaw and chewing muscles. These conditions have many causes, including overactive jaw muscles, stress or other psychological factors, and changes in how pain is processed. Standard treatments, like mouthguards, physiotherapy, and medicines, often help only a little. Because of this, Botox (botulinum toxin, BTX) is being used more to relax overactive muscles and reduce pain. This review aimed to look at the current evidence on how well Botox works, how safe it is, and how useful it is for treating bruxism and TMD. We searched PubMed for full-text articles in English and Polish from the last ten years (January, 2015 – September, 2025). We included systematic reviews, meta-analyses, and clinical trials that studied Botox for bruxism and TMD. The evidence shows that Botox can reduce jaw muscle activity, muscle soreness, and pain in people with bruxism, especially when standard treatments do not work. Studies show that people feel less pain, sleep better, and can do daily activities more easily. However, the results for TMD that involve the jaw joint are mixed. Meta-analyses often do not show that Botox works much better than a placebo for overall pain or jaw movement, although it can help with sore spots in the muscles. Botox is generally safe, and most side effects are mild and go away on their own. More high-quality studies are needed to understand the best uses of Botox, how well it works long-term, and the best ways to give the treatment.

Keywords: Botulinum Toxin, Bruxism, Temporomandibular Disorders (TMD), Masticatory Muscles.

1. INTRODUCTION

Bruxism is when people use their jaw muscles too much. They may grind or clench their teeth while sleeping or when awake. Grinding teeth during the day is common and can happen because of stress or worry. Bruxism can also happen with TMD, which can make the jaw hurt, click, or be hard to move (Stanisic et al., 2025). The causes are complicated and include both physical and psychological factors (Kapos et al., 2020). Physically, these problems are often made worse by overactive muscles and tension caused by stress (Stanisic et al., 2025). This is where Botox (Botulinum toxin, BTX) can help. It works by blocking signals from nerves to muscles, which makes the muscles relax for a while (Delcanho et al., 2022). But Botox does more

than just relax muscles—it can also reduce pain by stopping the release of certain chemicals that signal pain. Even though Botox is often used in clinics to treat enlarged jaw muscles and muscle pain, the evidence for using it to treat joint-related TMD is still mixed, and there are no standard rules yet. Because the research results vary, we need to look at the evidence more closely. That's why this work aims to review the current evidence on how effective Botox is for treating bruxism and TMD (Delcanho et al., 2022).

2. REVIEW METHODS

A systematic literature search was performed in PubMed. The search strategy utilised keywords: „Botulinum Toxin", „Bruxism", „Temporomandibular Disorders (TMD)", and „Masticatory Muscles". Inclusion & Exclusion We included English and Polish full-text publications from the last 10 years (January, 2015 – September, 2025). The review focused on systematic reviews, meta-analyses, and RCTs concerning the efficacy, safety, and injection protocols of BTX in bruxism and TMD. Case reports, editorials, aesthetic-only studies, and articles without full-text access were excluded. Study Selection: Three independent authors conducted the selection and data extraction. In cases of disagreement, a consensus was reached. The final selection process is illustrated in the PRISMA diagram (Figure 1).

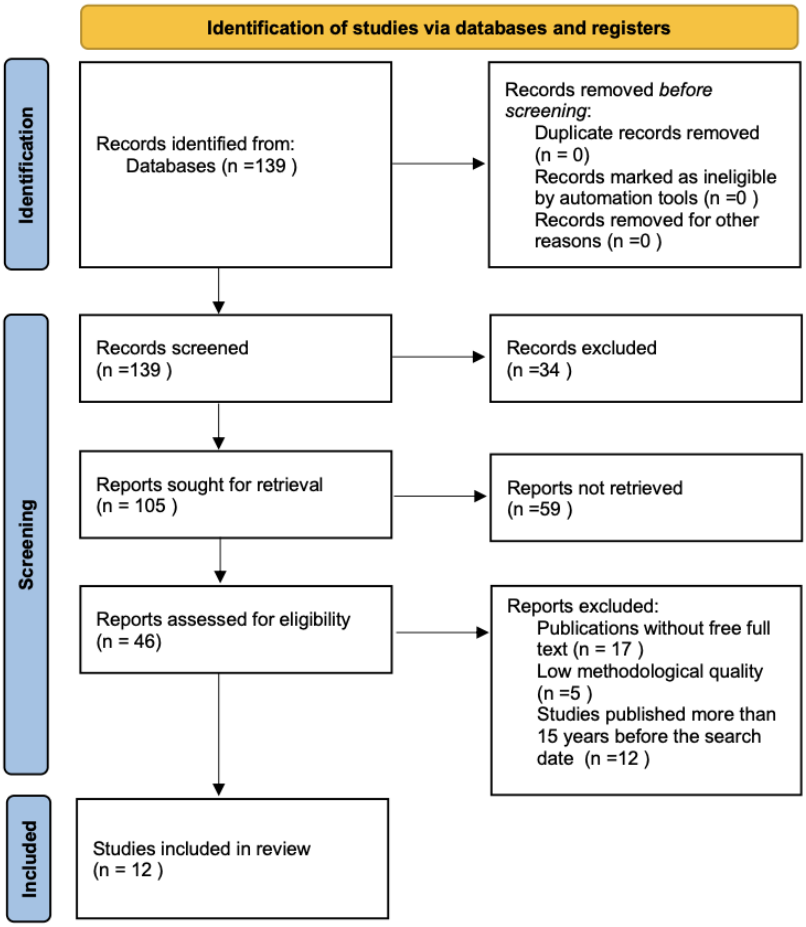

Figure 1. PRISMA Chart

3. RESULTS & DISCUSSION

Mechanisms of botulinum toxin action on the structure and function of masticatory muscles in histopathological and clinical terms

Botulinum toxin, also called BoNT, affects the jaw and chewing muscles in more ways than just temporarily stopping nerve signals. It also changes the structure and function of the muscles, which has been seen in both animal studies and clinical observations. The effects of BoNT can last longer than the usual active time of the toxin (Baldwin et al., 2022). About a month after an injection, muscle fibres often shrink, and the connective tissue (collagen) increases, showing that the muscle is going through significant changes. These

changes do not happen evenly in the whole muscle. After three months, studies show a mix of shrunken and dead fibres together with enlarged fibres, which shows that nerves grow back unevenly and some muscles try to compensate. From a nerve and muscle perspective, recovering full muscle function after BoNT is complicated and does not always happen completely (Baldwin et al., 2022). Even when the length of muscle signals (measured by EMG) goes back to normal after 12 weeks, the signal strength is still lower. This means that some nerves reconnect, but many muscle fibres may still not have a proper nerve supply, causing a lasting drop in muscle strength, even close to where the injection was given. This means that BoNT works by affecting the nerves and can provide stronger and longer-lasting results than many people expect. Because of this, BoNT can be invaluable for treating jaw problems like oromandibular dystonia (OMD) or bruxism. Studies show that kids and adults who had long-lasting jaw problems and didn't get better with other treatments improved a lot after special Botox shots into the jaw muscles. Before the shots, they could open their mouths only about 1.2 cm, but after, they could open them about 3.6 cm, which helped them eat and talk normally (Ali et al., 2025). The effects of Botox can last a long time, but doctors still need to check in case the problems come back. One year after treatment, most patients (about 2 out of 3) were still feeling better, but about 1 in 4 had their problems return and needed another shot (Ali et al., 2025). These results match Baldwin's research: lasting improvement happens when some muscle fibres get better, but in some people—or in some parts of the muscle—problems can come back, which may mean needing another treatment (Baldwin et al., 2025).

Botulinum Toxin in the Treatment of Bruxism – Clinical Evidence

Research shows that botulinum toxin, called Botox, can help people who grind or clench their teeth, which is called bruxism. Botox works by relaxing the jaw muscles. This can reduce pain and help the jaw and joints move more easily. Many studies, including trials and reviews, show that Botox is useful. One study found that Botox injections lowered jaw muscle activity at night and reduced pain for people with sleep bruxism (Shim et al., 2020). People who got Botox clenched their teeth less, had less soreness in the morning, and felt better than people who got a placebo. Other studies say the same. After Botox treatment, the jaw muscles feel softer, the jaw feels more comfortable, and teeth grinding happens less often (Fernández-Núñez et al., 2019; Buzatu et al., 2024). Botox works well because it relaxes muscles that are too active (Fernández-Núñez et al., 2019; Yacoub et al., 2025). It helps people who do not get better with normal treatments or still have jaw problems (Coelho et al., 2025). Botox makes the jaw muscles weaker. This means night-time grinding and clenching are less strong and happen less often (Shim et al., 2020; Buzatu et al., 2024). Studies show that after Botox, the muscles are less active and not as strong (Yacoub et al., 2025). Many people sleep better because their jaw feels calm and relaxed (Shim et al., 2020). Over time, Botox can even make big jaw muscles smaller because relaxed muscles do not have to work hard (Fernández-Núñez et al., 2019; Coelho et al., 2025). In general, Botox helps calm the jaw muscles, reduce pain, and make the jaw more comfortable. Studies use different doses and methods, so there are no exact rules yet, but most results are positive (Fernández-Núñez et al., 2019; Buzatu et al., 2024; Yacoub et al., 2025).

The use of botulinum toxin in the treatment of functional disorders of the masticatory system

Contemporary scientific literature indicates a growing interest in the use of botulinum toxin (BTX) in the treatment of temporomandibular disorders (TMD), but evidence of its effectiveness remains inconclusive and varies depending on the type of diagnosed condition. Significantly better results compared to placebo in assessments 1, 3, and 6 months after treatment. The theoretical basis for the use of botulinum toxin appears to be sound—by blocking the release of acetylcholine and modulating pain neurotransmitters, this substance should provide relief in conditions involving excessive muscle tension. Research data does not always match these expectations, and proving the superiority of BTX over placebo can be problematic. Just look at the results of the meta-analysis by Saini et al., (2024), where, despite the wide range of studies, the analgesic effect of the injection proved to be statistically insignificant. Although positive results were reported in individual studies included in the review, the pooled analysis of the data did not confirm the superiority of BTX in the overall reduction of pain measured on the VAS scale. Delcanho et al., (2022) present a similar position. Their analysis of the literature indicates that the evidence supporting the use of BTX in muscle disorders remains inconclusive, mainly due to the high variability of results reported in individual studies. However, it is essential to distinguish between subjective pain perception and objective muscle tenderness.

In a randomized study by Kim et al., (2023), no statistical advantage of the toxin over placebo was demonstrated in terms of overall pain severity (OVAS). Nevertheless, the therapy had a measurable effect in the physical examination—patients treated with BTX showed a significant decrease in the number of tender points, which was clearly visible at 4 and 12 weeks after the injection. This shows that the treatment can help reduce sensitivity in the jaw, temple, and neck muscles. The patient may still feel pain sometimes. Botox

does not have a big effect on how wide the mouth can open. No evidence was found that injections improved mouth opening range (MMO) more effectively than a placebo. This thesis is also supported by data published by Saini et al., (2024) and Kim et al., (2023). In this context, it is worth noting the position of Delcanho et al., (2022), who point out that other modalities, such as dry needling or biostimulation laser therapy, may offer faster therapeutic effects in terms of mandibular mobility. With regard to joint disorders, evidence for the effectiveness of BTX is scarce; individual reports suggest a possible reduction in joint clicking, but do not affect the position of the articular disc visible on MRI. Also, in the case of bruxism, meta-analyses do not confirm that BTX is more effective than a placebo in reducing the number of teeth grinding episodes or the force of occlusion. The safety of the therapy is considered high. A comparison of both groups in terms of safety did not show that patients receiving BTX were exposed to statistically more frequent complications than those receiving a placebo. The safety analysis of the therapy indicates that any complications are mild in nature. Patients mainly reported transient symptoms such as headaches or flu-like symptoms. Occasionally, there were changes in the aesthetics of the smile resulting from weakening of the facial muscles, but the reviewed studies did not report any severe systemic reactions or cases of permanent facial asymmetry.

Technical Aspects of Botulinum Toxin Use and Safety in Bruxism and TMD Therapy

In daily practice, how botulinum toxin is injected is just as important as choosing the right patients. Studies show that injection protocols for bruxism and TMD vary a lot. Some use small doses, around 10–25 units per masseter, while others use higher doses or inject different muscles like the temporalis or medial pterygoid. The main goal is usually the same: to relax overactive jaw muscles to reduce pain and clenching. Clinicians also differ in how they give the injections. Most still use the traditional landmark-based method, which relies on skill and knowledge of anatomy. The masseter is a complicated muscle with several parts, so the toxin can spread unpredictably. Doctors use ultrasound more and more. It helps them see the muscles and the area around them. This can stop problems like uneven muscles, a crooked smile, or hitting the wrong gland. Side effects are usually small and do not last long. They can have a weaker bite, trouble chewing for a short time, or soreness where the injection was. Many people think the risks are bigger than they are. Infections or big changes in the face are very rare. Safe and good Botox treatment for teeth grinding or jaw problems depends on careful planning and good technique for each person, not on one "perfect" way to do it. A comprehensive summary of selected meta-analyses and systematic reviews on the use of botulinum toxin in bruxism and temporomandibular disorders is presented in Table 1.

Table 1: Comparison of selected meta-analyses and systematic reviews on the use of botulinum toxin in bruxism and temporomandibular disorders

Author (year)	Type of study	Main outcomes assessed	Key findings	Conclusions
Delcanho et al., (2022)	Systematic review	Pain intensity, muscle tenderness, mandibular mobility	High variability of results; no consistent superiority of BTX over placebo for overall pain or mandibular mobility	Evidence for BTX in TMD remains inconclusive; possible benefit limited to muscle tenderness
Saini et al., (2024)	Meta-analysis	Pain intensity (VAS), mouth opening range (MMO)	No statistically significant reduction in overall pain compared to placebo; no improvement in MMO	BTX does not demonstrate clear superiority over placebo for general TMD pain outcomes
Fernández-Núñez et al., (2019)	Systematic review	Muscle activity, pain, muscle hypertrophy	Reduction in muscle hyperactivity, pain, and muscle volume after BTX injections	BTX may be effective for refractory bruxism by reducing excessive muscle activity
Buzatu et al., (2024)	Systematic review	EMG activity, pain, functional outcomes	Decreased nocturnal muscle activity and pain; improved patient comfort	BTX appears beneficial for patients with bruxism unresponsive to conventional therapy

Yacoub et al., (2025)	Systematic review	Muscle strength, EMG parameters	Sustained reduction in muscle activity and strength following BTX injections	BTX effectively modulates hyperactive masticatory muscles in bruxism
Coelho et al., (2025)	Systematic review	Pain, muscle function, quality of life	Positive effects mainly in muscle-related symptoms; inconsistent results for joint-related disorders	BTX is useful primarily for muscular disorders, not for intra-articular TMD

4. CONCLUSION

Botulinum toxin is a safe and effective way to reduce muscle activity and pain in people with bruxism, especially when other treatments don't help. Its effects on jaw joint problems are less clear, with only minor improvements shown. Differences in how studies are done, the dose used, and injection methods likely cause the mixed results. More research is needed to create clear treatment guidelines.

List of Abbreviations

BoNT / BTX: Botulinum Toxin.
EMG: Electromyography.
MMO: Maximum Mouth Opening (Mouth opening range).
MRI: Magnetic Resonance Imaging.
OMD: Oromandibular Dystonia.
OVAS: Overall Pain Severity.
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses.
RCTs: Randomized Controlled Trials.
TMD: Temporomandibular Disorders.
VAS: Visual Analogue Scale.

Acknowledgments

The authors have no acknowledgments to disclose.

Authors' Contributions

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Writing-review and editing: Michał Biernacki, Michał Wójcicki.
Visualization: Agnieszka Kowalska, Milena Kędzierska.
All authors have read and agreed with the published version of the manuscript.

Informed consent

Not applicable.

Ethical approval

Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

Funding

This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Conflict of interest

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on reasonable request to the corresponding author.

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