



TOXIN BOTULINUM FOR THERAPEUTIC MANAGEMENT OF BRUXISM

Literature Review

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ABSTRACT: Botulinum toxin is a substance that is based on a bacterium called *Clostridium Botulinum* and can be used for aesthetic and therapeutic purposes to inhibit muscle contraction. This literature review deals with the management of bruxism symptoms, which will depend on the severity and type of the individual, thus being evaluated individually, and treated in different ways. The objective of this study was to review the literature in search of

information regarding the efficacy of the use of toxin for the therapeutic management of bruxism, with the purpose of reducing the symptoms caused by this parafunction. According to the articles reviewed, despite the scarcity of studies, this substance can bring relief to the problem, relieving tension and its symptoms.

KEYWORDS: Bruxism. Sleep Bruxism. Botulinum Toxins, Type A.

INTRODUÇÃO

C

Currently, Botulinum Toxin type A (BTX-A) has become one of the most requested procedures in Brazilian medical and dental offices with the aim of reversing or delaying aging, establishing harmonic proportions and potentiating the organic functions of the tissue in order not to stop expressing vigor and energy. In addition, it is

considered less invasive compared to other surgeries, and allows the patient to resume their activities more quickly.¹

According to Cardoso et al. (2002), BTX is produced by the bacterium *Clostridium Botulinum* and is a protease that causes temporary chemical denervation of skeletal muscles, blocking the neurotransmission of acetylcholine, causing the muscle not to receive the brain message to contract.²⁻³ Thus, muscles spasm stop or reduce after application, decreasing excessive contraction and relieving pain.³

Bruxism is considered by specialists to be a continuous muscular activity of the jaw characterized by clenching or grinding of the teeth and/or by paralysis or projection of the jaw. This parafunction can have two distinct manifestations: it can occur at night (sleep bruxism) or during the day (wakefulness bruxism).⁴ The dysfunction can play a significant role in TMJ, and can generate imbalances in the stomatognathic system, leading to complications.⁵ Its cause is not yet specific, although it has some factors that can trigger this problem.⁶

At the present time, there is no consensus on the definition and diagnosis of bruxism, but there is a discussion carried out by an international group of bruxism specialists to formulate a definition of bruxism and suggest a classification system for its performance.⁴

Several management modalities for bruxism have been investigated, including: occlusal splint, benzodiazepines, psychotherapy, biofeedback, behavioral therapy, botulinum toxin, among others. Some of these therapies have not been shown to be effective⁷ and others, such as the occlusal splint, can cause changes in occlusion⁸ and used in case of secondary bruxism may worsen the patient's condition.⁹

It is noticed that every day the BTX-A becomes the most used in dentistry both for aesthetics and for therapy.¹⁰ In patients with symptoms of bruxism, BTX-A, through application in certain places, seems to promote relaxation in the related muscles, bringing improvement in the pain caused and more comfort to the patient.¹¹ There are disagreements about the management of bruxism, thus generating many doubts about which management is more effective, especially in relation to the management of bruxism with BTX-A, since many professionals disagree on whether or not to indicate this procedure. Therefore,

the objective of this study is to review the literature regarding the current scientific evidence regarding the effectiveness of the use of BTX-A in the management of bruxism.

METHODS

Three electronic database - Pubmed, Google Scholar and Scielo- were searched. The words used for these "online" searches were adapted according to each database. Papers in English and Portuguese language were included, there was no date restriction in the search.

Inclusion criteria were randomized controlled trials, clinical trials, systematic review and case reports. Articles that did not report the effects of botulinum toxin in the management of bruxist patients were excluded.

LITERATURE REVIEW

BOTULINUM TOXIN

Botulinum toxin is naturally produced by *Clostridium Botulinum*,¹²⁻¹³ an anaerobic bacterium that produces seven different types of toxin, namely: A, B, C, D, E, F and G. Botulinum toxin type A is the most used clinically and has high potency.¹⁴⁻¹⁵ BTX-A is a stable crystalline substance, lyophilized in human albumin and presented in a sterile vacuum flask that can be diluted in saline solution.¹⁵

In the 1970s, this substance was introduced as a therapeutic agent to treat strabismus and since then it has been studied for therapeutic applications in other fields, such as bruxism and tension headache.²⁻³

BTX-A is very well known and one of the most potent and can be used as a biological weapon in past decades, due to its high toxicity and acidity power when found at 10°C without oxygen.¹⁰⁻¹⁶ In high doses they can be lethal and in low doses they are used as therapeutic agents for some pathologies and in dentistry, type A and B are used, bringing controlled effects.^{15,16,17}

Mecanism Action

TxB acts on light and heavy chains, where they are subdivided into two: the HC that

connects to the motoneuron and the HN that will be responsible for the internalization and translocation of the nerve cell membrane. The light chain is responsible for activating the botulinum toxin in the cell, causing this molecule to compete with acetylcholine, thus inhibiting its action. In this way, the neurotoxin connects to the presynaptic membrane leading to muscle relaxation.¹⁸⁻¹⁹

Muscle contraction will depend on this release in the synaptic cleft of the myoneural junction, and at this location the nerve impulse will arrive through the axon promoting contraction of the corresponding muscle fibers. As long as this acetylcholine release process is compromised, it will not be released into the synaptic cleft, so there will be no contraction of the muscle fibers of that transmitter.¹⁶

However, the effect is temporary, in which these neurons generate new ones, thus creating transmission bridges.^{15,16} Thus, around 4 to 6 months, the musculature returns to activities.¹⁷ It is necessary to respect about 90 days between applications, because immunogenicity can occur, in which the body becomes resistant to botulinum toxin through the formation of antibodies.¹⁵

Bruxism classification

Bruxism is considered a parafunctional habit, characterized by non-functional movement, which may be voluntary or involuntary²⁰, and there are two types of bruxism, being awake bruxism that occurs during the waking period and sleep bruxism, where the name itself characterizes it.²¹ This dysfunction it can cause pain in the face and tiredness in the head and neck region.¹⁰

Bruxism in its classifications brings a subdivision into primary or secondary. The primary is not associated with medical, clinical or psychiatric causes, but with genetic causes. On the contrary, secondary bruxism is associated with other clinical disorders, whether neurological, psychiatric, sleep disorders and drug and medication use.²⁰ Currently, therapies for this type of dysfunction are not efficient. Thus, botulinum toxin has been studied as a therapeutic method for those who suffer from this pathology.²²

It is not considered a pathology, but in severe cases it can generate a stomatognathic imbalance leading to complications that can affect the daily life of the individual. In addition, patients with sleep bruxism are three to four times more

likely to develop orofacial pain, joint sounds and temporomandibular joint locking.²⁰ Teeth clenching is a semi-voluntary jaw activity, and normally occurs when the individual is concentrating or performing tasks that require a lot of physical effort, however, can still happen during sleep.²³

A recent systematic review¹¹ points out that among adults the percentage of involvement is from 22% to 30%, while in children and adolescents it is from 3% to 49%. The most common factors associated with bruxism are: use of alcohol, tobacco, psychotropic medications, esophageal acidification and passive smoking.

In addition, signs and symptoms present a plausible associated temporomandibular disorder, leading to complications, such as biomechanical complications related to the dental implant.¹¹

In prosthetic patients, bruxism affects the success of treatment. Thus, before starting a treatment plan, a protocol must be followed to have a correct planning. Patients like these cases can lose prosthesis retention and have greater wear of artificial teeth. There are some treatment options including physical therapy, behavioral management, sound ultratherapy and trigger point injections, associated with the rehabilitator.²⁴

Etiology

The etiology of bruxism is still not fully understood in the literature, finding disagreements between authors and research results, however, there is a consensus on the multifactorial nature of the origin of bruxism. In the past it was believed that bruxism was the cause of dental interference causing changes in occlusal and muscular patterns. Currently, it has been found that these factors are not so significant for the cause of bruxism.²⁴

Bruxism has a broad etiology. The severity of the damage tends to vary in each individual, being observed that the greater the patient's awareness of the habit, the better the prognosis and the more motivated he will be for it. Therefore, it is necessary for the professional to clarify the patient regarding the relationship between the parafunctional habit and the triggering factors.²²

It is suggested that nocturnal bruxism, for example, is a response to sleep arousal, as parafunction precedes or occurs after arousal. As well, the dysfunction appears to be modulated by some neurotransmitters in the central nervous system, more especially, disturbances of the central dopaminergic system.¹⁵ Bruxism, apparently, is articulated by neurotransmitters of the central nervous system. In addition, some reasons such as medication, drugs, trauma, neurological or psychiatric diseases and even genetics are associated with the origin of the problem. It is worth mentioning that stress is mentioned as a factor associated with bruxism.²⁰

Signs, symptoms and diagnosis

It is of great importance in the act of evaluating the patient, that the professional clearly evaluates the signs and symptoms.²⁰ This dysfunction, in studies, has been reported that there is a prevalence of 8% to 31.4% generically on bruxism, while the sleep bruxism has a prevalence of 22.1% to 31%.²⁵

Signs and symptoms commonly reported by bruxist patients include pain in the jaw muscles, tenderness in the masseter and temporal muscles, morning headaches and fatigue. In addition, psychological factors such as stress and anxiety may be associated.⁷ This definition includes not only grinding and clenching the teeth, but also patients may have oral habits such as nail biting, tongue thrusting and jaw clenching.²⁵

Recently, bruxism has been classified into primary and secondary, where the primary includes daytime clenching and sleep bruxism, while the secondary is associated with neurological, psychiatric, sleep disorders, or medication use.²¹

In addition to the patient's report and clinical evaluation, there are evaluations through questionnaires. It should be noted in this exam: the main complaint, location of pain, onset, characteristic, behavior, duration, intensities, concomitant symptoms, if the patient uses any medication, if he has experienced any emotional stress, what is his sleep quality, review of systems and psychological assessment. Muscle pain is the most common complaint in patients who

have a masticatory muscle disorder, which varies from mild to extreme discomfort.²⁷

The standard reference for diagnosing a bruxist is through polysomnographic (PSG) or electromyography (EMG) devices. PSG is the best choice for diagnosing nocturnal bruxism, but its biggest disadvantage is its high cost. EMG, on the other hand, offers satisfactory evidence of bruxism generally, but there is a risk of overestimating the true numbers of sleep bruxism events.^{17,22,23,24,26} These devices are capable of capturing sounds and movements.

The criteria for performing the device diagnosis include one or more signs such as: teeth grinding sounds during sleep, tooth wear, muscle pain, fatigue and articular disc disorders. Pain intensity should also be analyzed using an analog scale (VAS).²¹

In this way, the diagnosis will depend on the history, tooth wear, if there is mobility and if there are clinical findings such as headache, TMJ pain or pain in mastication muscles, among other factors.⁶ The final diagnosis, for confirmation, can be performed through a polysomnography, thus identifying the episodes of bruxism during sleep. Electrodes are added to the masseters and temporals with an audio recording microphone to check for noise.³

Botulinum toxin application techniques for bruxism

The application of BTX-A in the masseter muscle is divided into regions with six parts, three in the upper half and three in the lower half, but it is recommended that it be performed in the three points of the lower segment. During application, the dots must be about 2 cm apart to allow a sufficient and effective action. The non-recommendation of application in BTX-A in the upper segment is due to the risk of causing damage to the parotid gland and ducts.²⁸

Regarding the amount, twenty-five units are normally used divided by the three points, about 5U per point on the masseter.²⁸ It is suggested to apply the substance to the temporal muscle at four points, namely: three diagonally along the long axis of the muscle and one behind the zygomatic apophysis, and should always be held about 2 cm away from one point to the

other for better distribution. Generally, ninety units are used on average. There are several types and brands of TxB, and, in general, the powder must be dissolved in saline (0.9%) for use.²⁹

The effect begins three to five days after the procedure is performed and its duration varies from four to six months depending on the type of patient's metabolism, the amount of dosage applied and the application plan. The application is done through an insulin needle and the dose will vary.³⁰ Following the application, the patient may experience some reactions such as pain, swelling, headache, bruising, nausea, fatigue, headache and facial pain, flu-like symptoms, anxiety and itching.³¹

Regarding the application points, BTX-A was applied at three different points on the masseter and four points on the temporal. We observed, through the literature, effectiveness in the application of the toxin in application only in the masseter, which may suggest that applications in the temporal muscle may not be necessary for bruxism.¹⁵

Table 1: Summary of results

Authors	N BTX-A group	N Control group	N 'another method' group	Results
Sener et al. (2007) ³³	13	13	-	both significantly reduced symptoms and were equally effective for bruxism.
Bolayr G et al. (2005) ³⁴	12	-	-	50IU applied to the masseter resulted in an improvement in the patients' pain.
Guarda-Nardini et al. (2008) ³⁵	10	10	-	Improvement in TxB-A Group
Lee et al. (2010) ³⁶	6	6	-	Contraction events in the masseter muscle were significantly reduced in the BTX-A group. In the temporal muscle there was no significant difference between the groups.
Zhang et al. (2016) ³⁷	10	10	10	All groups had a reduction in occlusal force, but BTX-A was more superior in all requirements.
Al-Wayli et al. (2017) ³⁸	25	-	25	BTX-A significantly reduced symptoms caused by bruxism.
Tan e Jankovic (2000) ³⁹	18	-	-	3.4 (+/- 0.8) on a scale where 4.0 represented total absence of bruxism. The authors concluded that BTX-A, administered by qualified professionals, is an optimal, safe and effective treatment for patients with severe bruxism.

N-sample size

Clinically, it is necessary to protect the tooth, reduce grinding, relieve facial pain and thus improve the individual's quality of sleep, for which an individual assessment is necessary for each patient. Currently, there is no method or cure for bruxism, however, there are behavioral, dental, therapeutic management and combinations.²⁴

The BTX-A injection is a great alternative as it does not depend on patient compliance. According to the study by Ali et al. (2021) who compared

RESULTS & DISCUSSION

This review included seven studies^{33,34,35,36,37,38,39} shown in table 1.

This study found that BTX-A has been shown to be very effective, including for sleep bruxism.³⁸ A single session can reduce the number and intensity of masseter muscle movement during sleep, lasting an average of 3 months. proving to be a safe and effective therapy.^{39,40,41} Furthermore, the therapeutic approach is performed in the mandibular elevator muscles, with the portion injected superficially in the lower two thirds, and the puncture point must be spread horizontally so that BTX-A involves a larger area and is more effective. After application, bruxism starts to decrease in the first fourteen days, and the effect will vary according to your biotype.¹⁰

There are a few ways to treat the bruxism problem in order to relieve the symptoms such as: medications, occlusal splints and behavioral therapies, yet none of these methods were totally efficient.

the effectiveness of botulinum toxin in patients with fixed dental prostheses (implant overdenture) and compares it to other controls for the reduction of bruxism symptoms. In this study, patients were divided into three groups: group I being the control, removing the DOs during the night; group II with occlusal stent management and group III using botulinum toxin injection applied to the masseter and temporal muscles points. Therefore, it is concluded that both BTX-A and occlusal appliances are effective in satisfying and providing

better sleep quality to patients with bruxism rehabilitated with single-arch implants compared to removable prostheses.¹¹

Studies carried out by Bolayir et al. (2005) and Sener et al. (2007) also reported the effectiveness of botulinum toxin in improving masticatory muscle sensitivity in participating patients.³⁴⁻³⁵

In an open-label study, Tan and Jakovic (2010) evaluated the effectiveness of BTX-A in 18 patients who had severe bruxism. The doses were administered to the masseter muscles at time intervals between 3 to 7 months, and thus had a follow-up of 4 to 8 years. The authors concluded that BTX-A, administered by qualified professionals, is an optimal, safe, and effective treatment for patients with severe bruxism.⁴⁰

Lee et al. (2010), carried out a study in 12 patients, where they answered a questionnaire with the symptoms of bruxism in order to assess the symptomatology and were thus divided into two groups, one with the toxin substance and the other with saline solution. As far as it is concerned, they developed a method to evaluate the effectiveness of botulinum toxin type "A" in the masseter muscle in patients with nocturnal bruxism, using a portable electromyography (EMG) device, and all of them were instructed and trained to use a device portable at home to record bruxism movement. They soon noticed that patients who were treated with botulinum toxin had a significant increase in the electromyographic activity of the masseter muscle, thus improving the symptoms caused by bruxism. Therefore, they concluded that the treatment is effective.³⁷

Sener et al. (2007), conducted a controlled study where there were 13 participants. It was divided into two phases and the initial phase patients used intraoral plates for 2 months and after these 2 months they received a dose of botulinum toxin on both sides of the masseter muscle. Both effectively lessened symptoms and were equally effective for bruxism.³⁴

Guarda-Nardini et al. (2008) evaluated the effectiveness of BTX-A through a placebo-controlled study in 20 patients who had bruxism and

myofascial pain. Ten of them were treated with the toxin and the rest with a saline solution. The authors reported that with respect to symptoms assessed using a visual analogue scale (VAS), the BTX-A group showed a decrease, while the placebo group remained constant, although the chewing efficacy did not improve in any group.³⁶

Al-Wayli et al. (2017), compared the effectiveness of treatment with Botulinum Toxin with conventional treatments for bruxism. It took 50 patients with nocturnal bruxism, where 25 were injected with botulinum toxin and the rest of the individuals were treated with traditional methods such as behavioral therapies, occlusal splints and drugs. All subjects had a follow-up period of six months. Results were based on pain score distributed into four scores: preoperatively, 3 weeks postoperatively, 2 months postoperatively, and 6 months postoperatively. In the preoperative score there was no significant difference between the two groups. From the third postoperative week onwards, there were great differences in both groups. Thus, the results suggested that BTX-A injection reduced the score and, consequently, the events caused by bruxism.³⁹

Zhang et al. (2016), recruited 30 patients with bruxism to evaluate the therapeutic efficacy of BTX-A in order to assess the occlusal strength and therapeutic efficacy of the masseter muscles after application. Patients had to follow the appropriate criteria: having subjective symptoms with a diagnosis of TMD; with permanent teeth; bruxism or history of daytime clenching, electromyographic activity of the masseter in the posture position and with no change in the joint upon clinical examination. The individuals were divided into three groups: the one that had the application of BTX-A, and the saline solution group and the control group without intervention. The toxin group had three points to be injected bilaterally into the masseter muscles and the entire treatment took place in one session with six applications. The placebo group was injected with a saline solution in the same way as the previous one, and finally, the control group did not receive any application. It was analyzed

through an occlusal force analyzer to collect data such as the duration of biting and closing, the maximum occlusal force and distribution, and no patient showed any organic alteration in the TMJ and they were followed up for 6 months after treatment, not there being no reaction. With the follow-up, it was observed that the BTX-A group after three months had an increased grip time, but it decreased after six months, however, with no significant change between the participating groups. Therefore, among the groups, the BTX-A was the group that most showed improvements in bite and maximal force occlusion, and no group improved the asymmetrical appearance. Thus, the results obtained by this study showed that in all groups there was a reduction in occlusal force, but BTX-A was more superior in all requirements. The authors concluded that the toxin is effective in reducing occlusal force, but the intervention of a psychologist helps in the treatment for a more effective result.³⁸

According to Bolayir et al. (2005), in this study also used BTX-A in 12 patients with sleep bruxism. An average of 50 U of the solution was applied and injected into the masseter muscles and thus, there was a decrease in the pain scores existing in these muscles. The authors reported that the application of the toxin is an efficient method in cases of bruxism, as they observed that individuals abandoned these habits and did not report any adverse effects.³⁵

It is important to emphasize that for a professional in the field of dentistry to apply, he must follow some guidelines and laws on BTX-A determined by the Federal Council of Dentistry.⁴² It is also extremely important that the dental surgeon collects necessary information about the patient's health in general and finally, the individual must sign a contractual and consent term by which it was proposed to perform the procedure. In addition, the professional must know the product he will use and follow the manufacturer's information, storage method, handling processes, exact application points, dosage and especially knowledge of facial anatomy.¹⁰

FINAL CONSIDERATIONS

The studies presented in the review showed that botulinum toxin can reduce the symptoms of bruxism, offering satisfactory results. TBX-A is a safe, effective and well accepted by patients as an alternative for the management of bruxism. In general, there is still a need for studies with rigorous methodology to evaluate the effectiveness of different therapies for bruxism in its most varied forms.

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