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Botulinum Toxin in Dentistry: A Literature Review

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Abstract

Objective: the aim of this study was, through a literature review, to discuss the mechanism of action, the botulinum toxins use characteristics, their aesthetic and therapeutic indications, preparing a practical and illustrated content so that undergraduate dentistry students and dental surgeons have a first contact with the topic. **Materials and Methods:** a survey was conducted in Google Scholar, Pubmed and Scielo databases, using the keywords: Botulinum Toxins, Dentistry, Botulinum Toxins, Dentistry. 32 articles in Portuguese and English, published from 2008 to 2019, in their full and free versions, were selected. Articles that did not directly address to the topic were excluded. **Results:** it is known that Botulinum Toxin Type-A (BTX-A) has numerous applications, and in dentistry it presents numerous aesthetic and therapeutic indications. The toxin was effective in the treatment of bruxism, temporomandibular disorders, masseter hypertrophy, gingival smile, smile asymmetry, sialorrhea and implantology. Because of that, it tends to be increasingly present in dental offices. **Conclusion:** it was possible to conclude that, when used by trained professionals who follow proper protocols, it is a minimally invasive and safe treatment, capable of improving patients' quality of life.

Keywords: Botulinum toxins; Dentistry; Botulinum toxins; Dentistry.

Introduction

In the past years, there has been a significant change in society's beauty standards and therefore an increase in its aesthetic demand. Botulinum toxin (also known as Botox - refers to a trademark, from the company Allergan, the first available on the market and used until today - Table 1), has been used in medicine since the late 1970s, in cases of strabismus and also to reduce the signs of aging.[1]

Botulinum toxin is produced by the fermentation of an anaerobic bacterium called Clostridium botulinum and has 7 serological types, from A to G, with type A (Botulinum Toxin Type-A (BTX-A)) being the most commonly used. It acts by temporarily preventing the action of acetylcholine at the neuromuscular junction, without interfering with its production or storage, which justifies its reversible effect in a few months. With the inhibition of acetylcholine, muscle contraction is reduced.[1]

A few years ago, botulinum toxin also began to be used by dental surgeons (DDS). This action is based on the decree: CFO-112/2011. In 2019, resolution CFO-198/2019 recognized Orofacial Harmonization as a dental specialty and defined its areas of competence, which represented a major milestone in the toxin use by DDS's. Due to the growth of training and specialization courses, the use of botulinum toxin in dentistry is gradually becoming a reality. It consists on a reversible and minimally invasive treatment with satisfactory results. On the other hand, its reversibility can be a disadvantage because it is a short-term treatment, with an average duration of 4 to 8 months, depending on the patient and the frequency of the applications.[2]

In Dentistry, botulinum toxin is used in several situations and, although its aesthetic purpose is better known, it has numerous therapeutic uses. Among its indications are the softening of expression lines, gingival smile, asymmetrical smile, bruxism, sialorrhea, temporomandibular disorder (TMD), masseter muscle hypertrophy, tension headache, and after an implant surgery.

Despite being considered a recent treatment, it has proved to be a very efficient tool, that tends to grow in dentistry. To be used safely, the professional must have scientific support,

Table 1. Main brands of botulinum toxin type A on the market

Main Features	Comercial Brands				
	Botox	**Prosigne**	**Dysport**	**Xeomin**	**Botulift**
Company	Allergan	Cristália	Ipsen	Merz Biolab	Bergamo - Amgen
Units per bottle	50U; 100U e 200U	50U-100U	300U-500U	100U	100U
Storage	Pre dilution: 2º a 8ºC Post dilution: 2º a 8ºC	Pre dilution: 2º a 8ºC Post dilution: 2º a 8ºC	Pre dilution: 2º a 8ºC Post dilution: 2º a 8ºC	Pre dilution: No refrigeration needed Post dilution: 2º a 8ºC	Pre dilution: 2º a 8ºC Post dilution: 2º a 8ºC

including knowledge of head and neck anatomy and a especific botulinum toxin training.[1]

The aim of this study is, through a literature review, to discuss the mechanism of action, the botulinum toxin indications in dentistry, highlighting limitations and possible side effects. It is also aimed to develop practical content so that undergraduate dentistry students and dental surgeons can have their first contact with the topic.

Material and Methods

For the present Literature Review, a survey was carried out in Google Scholar, Pubmed and Scielo databases, using the keywords: Toxinas botulínicas, Odontologia, Botulinum Toxins, Dentistry. 32 articles in Portuguese and English, published from 2008 to 2019, in their full and free versions, were selected. Articles that did not directly address to the topic were excluded. To illustrate the texts, photographs of the main points used in the BTX-A indications were taken by a volunteer student, who authorized the disclosure of her image.

Results

This Literature Review aims to point out the mechanism of action of botulinum toxins, discuss its indications, elaborating a practical and illustrated content so that undergraduate dentistry students and dentists can have a first contact with the subject. In order to make it more didactic, it was divided into topics:

Mechanism of Action

Botulinum toxin is a catalyst protein produced by a gram-positive anaerobic bacterium called *Clostridium botulinum*. It acts on nerve endings, blocking calcium channels and decreasing the release of acetylcholine, responsible for the muscle contraction. There are 7 different types of botulinum toxin, going from A to G. However, type A is the most used by doctors and dentists.[3,4]

After the intramuscular injection of this toxin, the skeletal musculature innervation of that particular area is blocked, reducing muscle contraction, with no effects on the central nervous system or systemic implications. Thus, muscle spasms cease or reduce. This process is influenced by the application location and the used dose.[5,6]

The toxin's blockage of acetylcholine is due to its irreversible binding to receptors on the presynaptic membrane of motor nerve endings, which are responsible for its endocytosis. Then, this molecule is separated into two chains, the heavy and the light one. The light chain is transported through the endocytic vesicle membrane to the cytosol. Inside of it, the toxin light chain, which has high specificity with the complex of a protein called SNARE, carries out the proteolytic cleavage of this complex. Thus, it prevents the synaptic vesicle from anchoring on the internal surface of the cell membrane, blocking the vesicular fusion and, therefore, blocking the acetylcholine release. This only occurs because this complex is responsible for the vesicles fusion. The acetylcholine release blocking will prevent muscle contraction. The clinical effects appear from 2 to 10 days after the injection and the maximum visible effect occurs after 14 days of the injection.[3,7,8]

This first effect, programmed to be progressive, is also reversible, lasting approximately from 3 to 6 months.[9] This period depends both on the patient and on the frequency and amount of dose applied. A re-establishment of neuromuscular transmission will later occur, promoting a gradual reactivation of muscle function. For this reason, it

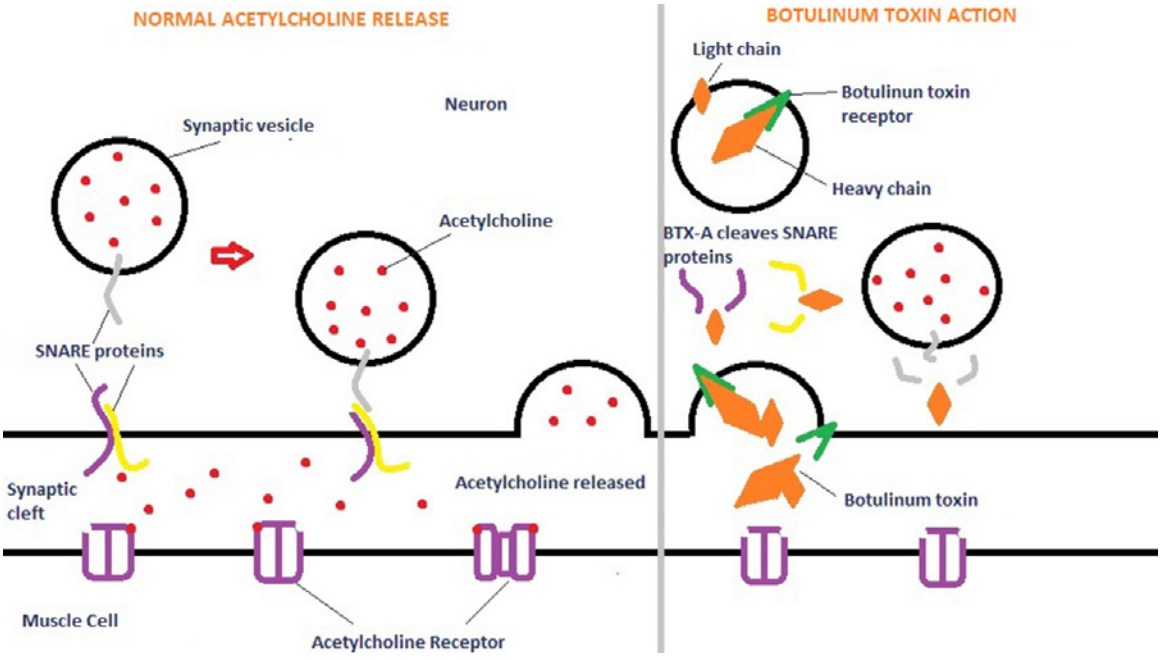

Figure 1. Mechanism of action of Botulinum Toxin Type-A (BTX-A).

can be said that the application of botulinum toxin consists of a short-term reversible treatment.[10]

In addition, this cleavage also blocks the release of neuropeptides involved in the transmission of painful sensations, theoretically reducing the pain sensibility from peripheral nerves.[8]

Legal Aspects in Brazil

From 2011 to 2016, numerous resolutions were published on the rights to apply BTX-A in dentistry. Resolution CFO-112/2011 guaranteed the right to apply botulinum toxin for therapeutic, but not aesthetic purposes and prohibited the use of hyaluronic acid; Resolution CFO-145/2014 allowed the hyaluronic acid use; Resolution CFO-146/2014 emphasized that botulinum toxin could be used for dental procedures but was prohibited for non-dental purposes; Resolution CFO-176/2016, on the other hand, allowed botulinum toxin use for functional and / or aesthetic therapeutic purposes, and 10 facial fillers, as long as the dentist did not use it in points not contained in his allowed anatomical area. This area includes the hyoid bone, up to the nasion point (nose bones) and until the tragus and attached structures. In addition, in cases of non-surgical procedures and for aesthetic purposes (facial harmonization), the face's upper third is also included.[11,12]

Recently, on January 29, 2019, Resolution CFO-198 was published, recognizing Orofacial Harmonization as a dental specialty. This resolution was a big achievement for dentistry, and it is a growing area, not only based on the use of botulinum toxin, but with several other treatments. The tendency is that DDS's perform gradually more procedures of this kind, supported by the resolutions mentioned above, as long as they are always aware of legal issues in order to avoid litigation. The dentist needs to take some precautions related to the toxin's application, such as guiding the patient on the various treatment options for the condition he presents (which is a legal obligation).

All aspects of each treatment must be explained to the pacient, including the advantages, disadvantages, costs and possible complications. In addition, the professional needs to be properly trained for this type of treatment.[11]

Botulinum toxins

The different brands of BTX-A have specific use recommendations. It is necessary that these rules are known and respected, so that the treatment's result is effective and adverse effects are avoided.[5,7,13]

What determines the number of applied units is the BTX-A indication, the involved muscles size and how severe the dysfunction is.

It is very important that the patient about to be treated is informed that there must be 4 hours without activity in the region. The dentist should not massage the treated area as well as instruct the patient not to do it. In case of hematoma or small swelling, a cold compress can be applied. The patient should also be instructed not to do any physical exercise, air travel, to lower his head, lie down or to talk excessively in these first 4 hours after the application.[14]

The patient must return to the dentist's office after 14 days of the procedure, so that the results can be observed.[14]

Indications

Wrinkle reduction

Today's society often associates youth with beauty. Facial rejuvenation has gained visibility in the cosmetic industry and several treatments are emerging in order to obtain it. Among these treatments, those that are less expensive and more conservative have gained strength and popularity. The application of botulinum toxin is one of the most commonly used treatments for the attenuation of wrinkles, in the upper, middle and lower regions of the face and neck becoming the non-surgical cosmetic procedure most performed by health professionals. It has a high rate of effectiveness and satisfaction. Botulinum toxin indications related to rejuvenation are: to attenuate frontal wrinkles, to stabilize the nasal tip, in peribuccal, in chin wrinkles, in drooping lips, in glabellar wrinkles, in eyebrow elevation, in periorbital wrinkles, in nasal wrinkles, in plastyma bands and others.[7]

The administration of BTX-A for wrinkles is usually simple, an adequate dose should be injected considering the face region's anatomy. Positive results have been reported over the years, regarding dynamic expression lines across the face.[15]

Figure 2. "A" - Marking for injection points of Botulinum Toxin Type-A (BTX-A) in the frontal muscle and injection of the BTX-A. "B" - Marking for injection points of BTX-A in the muscles: masseter and temporal. The red cosses indicate the location of the parotid gland that should be avoided in this BTX-A application technique.

Figure 3. "A" - Pacient before the injection of the Botulinum Toxin Type-A (BTX-A) to the upper third of the face to treat facial wrinkles. "B" - Pacient after the injection of the BTX-A to the upper third of the face to treat facial wrinkles.

Bruxism

Bruxism is characterized by a repetitive masticatory activity in which the individual grinds or clenchs his teeth, consciously or unconsciously.[16] It is a parafunction and therefore consists of non-functional mandibular movements, which are not performed during normal chewing and / or swallowing movements. Bruxism has two distinct circadian manifestations that can be classified as nocturnal or sleep, which is the most common one, or diurnal. It can also be classified as primary or idiopathic (associated with peripheral or central factors) and secondary (associated with drugs or substances abuse, sleep, neurological or psychiatric disorders and other diseases).[17,18]

It is a condition that has a multifactorial etiology, including systemic, psychological, occupational and hereditary factors and, therefore, requires a multidisciplinary approach to be treated. About 90% of people report performing bruxism at a certain degree during some period of life. It can occur in a way that involves only the musculature, or it can trigger or perpetuate temporomandibular disorders, involving damage to the temporomandibular joint (TMJ).[6,17]

Bruxism's treatment is indicated when the dysfunction causes damage to the patient's health, both physical or mental. The main symptoms include dental and restorations fractures, excessive tooth wear, muscle hypertrophy, pain and fatigue of masticatory muscles such as masseter and temporal, TMJ symptoms, tension headaches and / or neck and tooth sensitivity.[18]

BTX-A applications help in this treatment because they promote a decrease in the masticatory activity, and, thus, reduce the frequency and intensity of bruxism episodes, as well as the painful symptoms involved. The purpose of this kind of treatment is to remove excess masticatory force from the masseter and temporal muscles. The application is, in most cases, supporting the bruxism patient's treatment, that often includes psychological care and the use of an occlusal splint to sleep. Some studies have shown positive results from replacing the use of occlusal splints with intramuscular injections of botulinum toxin for some patients that feel uncomfortable with using the device at bedtime, or who do not have enough dental structure to use it. This situation is frequent in cases of special need patients treatment and this alternative ends up being very effective because patient cooperation is not required, as in cases treated with that device. Even though it is not the main method of treating this disorder, the toxin's application is a simple and easily predictable treatment. In addition, studies have shown positive results related to improving pacient's the quality of life when the toxin is applied.[6,17]

When treated with BTX-A, the target muscles are the masseter and the temporal. There are other muscles that have a masticatory function such as the medial and upper and lower lateral pterygoids, however, the treatment is only performed on the masseter and temporal muscles because they can suffer from hypertrophy and cause damage to the stomatognathic system.[14]

Applications in anterior positions of the masseter can reach the risorius muscle by diffusion. When they are done above the masseter, they may spread to the larger zygomatic muscle. In both situations it would provide aesthetic loss to the patient, which causes asymmetrical and disharmonious smiles. In addition, areas very close to the parotid gland should be avoided as there may be saliva secretion reduction when the gland is affected.[14]

Masseter hypertrophy

Good facial aesthetics and a harmonious smile are considered essential factors for most patients self-esteem in medical and dental clinics. Hence, the facial contour is widely inserted in this aesthetic context. The masseter muscle effectively participates in the facial contour and when it is hypertrophied, causes facial aesthetic damage. In addition, such hypertrophy can also generate orofacial pain, which is difficult to heal.[19]

Masseter hypertrophy appears as an asymptomatic enlargement of the masseter muscle that can be categorized into symmetric or asymmetric bilateral hypertrophy and unilateral hypertrophy. An unilateral masseter hypertrophy, for example, proves to be extremely detrimental to the the patient aesthetics, as it promotes an asymmetry of the face. In women, this damage is slightly greater since this hypertrophy provides a more masculine face contour. Its etiology, in most cases, is unknown, however, patients who present this condition usually have clenching as a habit, temporomandibular joint dysfuncion, bruxism and malocclusion. Botulinum toxin has emerged as a possible way of treating this condition, being a more conservative alternative. The application of BTX-A, in contrast to the surgical option for resection of the masseter muscle, has few and rare adverse effects and complications.[2,20]

The applications must be carried out bilaterally, as a compensatory state of spasm and pain can be developed in the contralateral masticatory muscles that do not receive the drug.[19]

Temporomandibular Disorder

Temporomandibular disorder (TMD) is a collective term that represents a series of clinical problems involving the masticatory muscles, the temporomandibular joint (TMJ), associated structures, or all of these factors.[21] This dysfunction is characterized by pain in the region of the TMJ and masticatory muscles, limitation or deviation in the mandibular movement and sounds from the TMJ during movement or function of the mandible. Its prevalence varies according to studies, but about 33% of the population has at least one characteristic symptom of TMD. It may have infectious, traumatic, structural, inflammatory, parafunctional or genetic causes, among others. Dysfunctions can be divided into articular and muscular. Articular dysfuntions are associated with intra or extra articular disorders in the internal structures of the joints or in the joint capsules and in their adjacent structures. The muscular ones refer to the TMJ-related muscles, such as masseter, temporal, medial pterygoid and lateral pterygoid.[15,18]

The prevalence of the muscular TMD is considerably higher than TMD related only to the joint. Many of the complaints of patients related to pain near the TMJ are related to the masticatory musculature and not to the joint itself. Therefore, it is extremely important that the dentist knows the diagnostic criteria for this dysfunction.[14] A viable option for these patients, especially the ones with muscular TMD, is the application of Botulinum Toxin type A. This neurotoxin has proved to be very effective in improving the quality of life of patients and, for this reason, its use is expanding.[16,22]

Gingival Smile

There is a lot of concern around the white aesthetic of smiles, formed by teeth. However, a harmonic smile also needs to present a pink aesthetic, composed of gingival tissues; and black aesthetics, composed by the shadows that are part of the smile.[23]

Regarding the pink aesthetic, one of the biggest complaints of the patients is the gingival smile. A gingival smile happens when the patient has 3 mm or more of gingival exposure in the smile. Such condition is the result of several etiologies, including the abnormal vertical growth of the maxilla, hyperactivity of the lip elevating muscles, short clinical crowns and late passive eruption.[5,24]

There are some treatments for this condition: orthognathic surgery, myectomy, lip repositioning, periodontal surgery and the application of botulinum toxin. Myectomy, lip repositioning or orthognathic surgery represent more invasive alternatives with a high degree of morbidity, while botulinum toxin is an easier alternative with minimal invasion and presents very satisfactory results. The advantages of this option of treatment are the easier technique, the almost total absence of side effects and its immediate effect. Its main disadvantage is its short-term effect. It is recommended when the patient's gingival smile has at least 5mm of exposed gum when the patient smiles.[21]

As botulinum toxin has the function of reducing muscle activity, this treatment is ideal for the gingival smile with a muscle related etiology, in which the excessive gingival exposure is caused by the hyperactivity of the lip elevating muscles. For an efficient diagnosis, the following aspects must be observed: interlabial distance at rest; exposure of the upper incisors during rest and speech; smile arc; width / length ratio of the upper incisors; morphofunctional characteristics of the upper lip.[5,24]

The smile activity is determined by several facial muscles, such as the levator labii superioris, zygomaticus minor and major, the levator anguli oris, orbicularis oris and risorius. Among them, the first three perform a greater function and determine the amount of lip elevation, therefore, these muscles must be affected by the injection of the toxin. Their fibers converge to the same area, forming a triangle, suggesting that the appropriate point of choice comprises the 3 muscles in a single injection. The toxin, when injected, can spread over an area of 10 to 30 mm, allowing an effective reach. When injected into predetermined sites, the toxin decreases the contraction of the muscles responsible for elevating the upper lip, reducing gingival exposure.[9]

Figure 4. "A" - Patient wrinckling her nose to mark the injection points of Botulinum Toxin Type-A (BTX-A) in the levator labii superioris muscle. "B" - Marking for injection points of BTX-A in the levator labii superioris muscle.

Asymmetric smile

The asymmetry of the smile can have many causes. Among them, hyperactivity of the levator labii superioris, hyperactivity of the depressor labii inferioris muscle and facial paralysis. In cases of lip asymmetry, which occurs due to differences in muscular activity, patients should receive injections of botulinum toxin with different doses on each side of their face.[9]

Sialorrhea

Sialorrhea is characterized by unintentional loss of saliva through the oral cavity. It is a common condition, present mainly in patients with neurological diseases, who often do not have oral motor control, and may even aspirate saliva, leading them to death.[25]

Some causes of sialorrhea are: Parkinson's disease, cerebral palsy, medications such as tranquilizers, anticonvulsants, anticholinesterases, epilepsy, stroke, hyperthyroidism, Alzheimer's disease, facial paralysis, anatomical deformities caused by accidents or carcinoma removal surgeries, among others.[17]

In cases of sialorrhea treatments commonly used include pharmacotherapy with the use of anticholonergics and antihistamines. In most cases, these treatments are insufficient, in addition to having side effects. A surgical approach can also be performed, such as salivary duct connection, denervation of the parotid gland and bilateral excision of the subligual glands. Nevertheless, this approach is not widely used due to the risks it presents, its irreversibilities and to represent a more invasive practice.[16,26]

A widely used treatment is the application of botulinum toxin on the patient's salivary glands: the parotid and submandibular glands, since this is a minimal invasion intervention with very few side effects. It is beneficial because the parasympathetic nerves release acetylcholine, which binds to receptors located in the glandular tissue, increasing the production of saliva. The sympathetic system acts by modulating salivary secretion. Thus, the inhibitory action of acetylcholine release promoted by the action of BTX-A is favorable to patients who have sialorrhea. The results in patients with large salivary flows after the application of botulinum toxin were positive, with improvement, in particular, in the swallowing of these patients. As a result, there is a consequent improvement in the mobility and strength of the oropharyngeal structures. This technique improves the quality of life of these patients, both in the physiological aspects and in their social integration.[17,27]

Dental Implants

Currently, implants named "immediate loading implants", characterized by only one surgical stage, have been used to reduce the treatment period and simplify tooth replacement. It is extremely important that primary stability is obtained for the success of these implants and so that this patient has occlusal stability. At the same time, an increasing prevalence of bruxism patients has also been observed, which may compromise the effectiveness of osseointegration of these implants, especially in cases of immediate loading implants. Bruxism leads to an increase in the magnitude and frequency of the occlusal forces that will act on the implant, so this parafunction is a risk factor for its success.[28]

The application of botulinum toxin type A is presented as a tool that helps the implantodontist by providing a reduction in the contraction of the masticatory muscles, reducing occlusal loads on this implant, benefiting its osseointegration and consequently contributing to the success of oral rehabilitation, especially in patients with parafunctions.[4,28,29]

Adverse Effects

Adverse effects can happen in BTX-A applications. When they occur, they are most of the time reversible, which makes the application of botulinum toxin a safe treatment. Some of the problems that may occur are due to technical error in its application, frequency, inadequate quantity of doses or improper storage of the toxin, which can be easily avoided.[6]

Some adverse events include pain at the injection site, bruises, infection, edema, hypotension, nausea, vomiting, dysphonia, dysphagia, pruritus, flu-like syndrome, lack of salivation control, problems with word articulation, ptosis or superior lip stretching and smile asymmetry. There may also be generalized weakness of muscles distant from the toxin administration site due to the hematogenous dissemination of the toxin.[9,10]

In order to avoid such complications, the dentist must be attentive to carry out an effective diagnosis and planning in addition to advising the patient regarding the possibility of the adverse effects occurrence. It is essential that the dentist is aware of the dosage, precision of the technique and location of the intramuscular injection.[9]

Contraindications

Some contraindications to the use of botulinum toxin include its application during pregnancy or breastfeeding; presence of inflammation / infection at the injection site; allergy to human albumin, botox toxin or saline; patients with neuromuscular problems including: neuromuscular transmission disorders and acquired autoimmune diseases such as myasthenia gravis, muscular neuropathy, Lambert Eaton syndrome, muscular dystrophy, multiple sclerosis; recent use of the anti-tetanus vaccine; people who use calcium channel blockers and aminoglycosides, as these drugs

interfere with neuromuscular transmission.[2,8]

Discussion

Botulinum toxin is a catalyst protein, produced by a Gram positive anaerobic bacterium, *Clostridium botulinum*. This substance acts on nerve endings, blocking calcium channels, decreasing the release of acetylcholine, which is responsible for the response of muscle contraction and movement.[10] The inhibition of acetylcholine produces a temporary and reversible dose-dependent weakening of muscle activity, without systemic effects.[5] The effect of BTX-A has an average duration of 6 months and can vary from 4 to 8 months. It is important that professionals warn their patients about the importance of not reapplying the toxin prematurely, as this can result in the formation of antibodies, which will decrease the useful life of the procedure.[24] In addition to inhibiting muscle contraction, Archana,[30] in 2016, reported that the mechanism of action of botulinum toxin also includes inhibition of the release of substance P, a neuropeptide neurotransmitter that acts as a neuromodulator involved in the transmission of painful sensations, producing analgesic effects through peripheral inhibition of delta fibers C and A. Future research is needed to quantify the efficacy of neurotoxin in chronic symptoms and its role in the pain mechanism.[22]

The main advantages of the treatment using botulinum toxin type A are: easiness of the techniche, high tolerability by the patient, low rate of complications and the almost immediate and natural effect. Its main disadvantage is the maintenance of the result for a short period of time.[24]

For Silva,[5] 2013, the application of BTX-A is one of the most effective techniques for facial rejuvenation. There is a decrease in muscle activity in a precise area, without creating a motor deficit, attenuating existing wrinkles in regions of the face where muscle action is not directly involved with functions. Treatment success depends largely on patient satisfaction, besides executing the correct technique and good results. Thus, the evaluation of some factors such as unrealistic expectations, depression and other emotional issues of the patient is crucial for the success or not of the aesthetic procedure.[31]

Current therapies for bruxism are not entirely effective. Botulinum toxin type A has emerged as an alternative to this problem. Clinical studies have shown that applications of botulinum toxin can decrease pain levels, the frequency of bruxism events, in addition to not causing major adverse effects.[6,17,32]

An important number of patients who present masseter muscle hypertrophy do not respond to conventional treatments, which shows yet another indication for treatment with Botulinum Toxin type A. The author stated that, for these patients, treatment with neurotoxin is a useful and efficient alternative.[22]

Still about the indications for BTX-A, Donini,[29] in 2013, reported that neurotoxin represents a therapeutic alternative for patients with painful temporomandibular joint syndrome. It promotes relaxation of the masticatory muscles, reducing pain and enabling an appropriate mandibular function. Side effects are rare and, even if they exist, they are temporary, avoiding major problems for patients with TMD.

Most treatments for gingival smiles are based on invasive procedures, such as surgical corrections, which end up causing greater morbidity for patients, unlike botulinum toxin, which is simpler and less invasive for the treatment of gingival smiles caused by hyperactivity of the upper lip.[23]

Regarding the indication of BTX-A for patients with sialorrhea, Shilpa,[2] in 2014, stated that the neurotoxin significantly reduces the production of saliva when injected into a salivary gland, blocking the release of acetylcholine from the terminal nerves. Up to now, local injection of botulinum toxin into the salivary glands is the therapeutic option with the most evidence of efficacy and safety, especially if guided by ultrasound. The author pointed out that the injection of neurotoxin in the parotid and submandibular glands for the treatment of sialorrhea, when guided by ultrasound, provides a simple, non-invasive and real-time visualization of the muscular and glandular tissues and their surrounding structures, optimizing effectiveness and treatment safety as it ensures that the injection gets into the glands, unlike the technique guided only by anatomical sites.[2,3]

An extremely effective way of "deprogramming" the muscles responsible for the excess of destructive forces would be through the intramuscular injection of botulinum toxin type A in rigorously calculated doses. This toxin prevents occlusal overload, which is a result of bruxism, from interfering with the osteointegration process.[29]

Treatment with BTX-A is relatively safe, and the occurrence of dysphagia and paresis of the masticatory and facial muscles is uncommon.[29] For a well-performed procedure, side effects are minimal, such as minor discomfort at the injection site. However, it is dangerous in case of overdose.[24] Treatment with BTX-A is an expensive option because the product has a high cost, besides the need to reapply it in an approximate interval of 4 months.[18]

BTX-A has several indications and contributes to improving patients' quality of life. The professionals who use it must follow protocols, respect rules and indications and strictly comply with the indicated dosage.[7] Moreover, they must be trained through specific courses so that they can work with botulinum toxin in the best way.[5]

Conclusion

- The mechanism of action of botulinum toxin occurs at nerve endings, blocking calcium channels and thus

decreasing the release of acetylcholine, responsible for the muscle contraction response.

- Botulinum toxin can be used in aesthetic and therapeutic procedures. Its main indications are: softening of expression lines, gingival smile, asymmetrical smile, bruxism, sialorrhea, temporomandibular dysfunction (TMD), masseter hypertrophy, tension headache and aid in post-surgical of dental implants.

- It is a minimally invasive, safe, effective technique, which has few adverse effects and contraindications.

- The dentist is a professional with legal support and adequate scientific knowledge to perform the technique as long as he receives proper training.

References

1. Marciano A, Aguiar U, Vieira PGM, Magalhães SR. Toxina Botulínica e sua aplicação na Odontologia. UninCor. 2014;4(1):65-75.
2. Shilpa OS, Kaul R, Sultana N, Bhat S. Botulinum toxin: The Midas touch. J Nat Sci Biol Med. 2014;4(1):8-14.
3. Franck JB, Fernades RDCL, Costa FHDR, Rosso ALZ. Toxina Botulínica para o tratamento da sialorreia nos pacientes com doença de Parkinson. Rev Bras Neurol. 2018;54(3):16-21.
4. Mijiritsky E, Mortellaro C, Rudberg O, Fahn M; Basegmez C.; Levin L. Botulinum Toxin Type A as Preoperative Treatment for Immediately Loaded Dental Implants Placed in Fresh Extraction Sockets for Full-Arch Restoration of Patients With Bruxism. J. Craniofac Surgery. 2016;27(3):668-670.
5. Silva MLDS. A Toxina botulínica no tratamento do sorriso assimétrico: descrição de caso clínico [Trabalho de Conclusão de Curso]. Porto Alegre: Universidade Federal do Rio Grande do Sul, Faculdade de Odontologia Especialização em Dentística Restauradora, 2013.
6. Teixeira SAF, Sposito MMDM. A utilização de Toxina Onabotulínica A para bruxismo: Revisão de Literatura. RBO. 2013;70(2):202-204.
7. Bratz PDE, Mallet EKV. Toxina Botulínica Tipo A: abordagens em saúde. Rev. Sal. int. 2015;8(15-16).
8. Senise IR, Marson FC, Progiante OS, Silva CDOES. O uso de toxina botulínica como alternativa para o tratamento do sorriso gengival causado pela hiperatividade do lábio superior. Rev. Uningá. 2015;23(3):104-110.
9. Pedron IG. Aplicação da toxina botulínica associada a cirurgia gengival ressectiva no manejo do sorriso gengival. Rev Odonto. 2015;20(2):243-247.
10. Cazumbá FDB, Sá RC, Kalil MTADC, Fernandes GVDO. Uso de toxina botulínica em Odontologia, Revista fluminense de odontologia, 2017.
11. Pedron IG. Considerações ético-legais sobre a aplicação de toxina botulínica pelo cirurgião-dentista. Odonto Clin. -Cient. (Online). 2015; 14(4):b789-796.
12. Rosa KSS, Rodrigues LS, Giansante JRL. Aspectos éticos e legais do uso da toxina botulínica e preenchedores faciais na odontologia [Trabalho de Conclusão de Curso]. Aracaju: Universidade Tiradentes, Faculdade de Odontologia, 2017.
13. Freund B, Rao A. Efficacy of Botulinum Toxin in Tension-Type Headaches: A Systematic Review of the Literature. Pain Pract. 2019; 19(5):541-551.
14. Lupozeli F. Curso de habilitação em Toxina Botulínica na Odontologia .1ª ed. São Paulo; 2015.
15. Park KS, Lee CH, Lee JW. Use of a botulinum toxin A in dentistry and oral maxillofacial surgery. J Dent Anesth Pain Med. 2016;16(3):151-157.
16. Lora VRMM, Cury AADB, Jabbari B, Lackovic Z. Botulinum Toxin Type A in Dental Medicine. J Dent Res. 2019;0(0):1-8.
17. Neto RD. Toxina Botulínica e Preenchedores da Odontologia. 1ª ed. Porto Alegre: RGO; 2015.
18. Patel J, Cardoso JA, Mehta S. A systematic review of botulinum toxin in the management of patients with temporomandibular disorders and bruxism. Br. Dent. J. 2019;226(9):667-662.
19. Davantel HT, Oliveira RCG, Oliveira RCG, Costa JV. Tratamento de Assimetria Facial causada por hipertrofia do músculo masseter com o uso de toxina botulínica tipo A Relato de caso. Rev. Uningá. 2016;25(2):41-43.
20. Baş B, Özan B, Muğlali M, Çelebi N. Treatment of masseteric hypertrophy with botulinum toxin: A report of two cases. Med Oral Patol Oral Cir Bucal. 2010;15(4):649-652.
21. Dall'magro AK, Santos RD, Dall'magro E, Fior B, Matiello CN, Carli JPD. Aplicações da toxina botulínica em odontologia. Salusvita. 2015;34(2):371-382.
22. Chechetto AL, Oliveira RCG, Costa JVD, Oliveira RCGD, Torch SDO. Avaliação dos benefícios do tratamento da dor orofacial causada pela hipertrofia dos músculos masseter e temporal com o uso da toxina. Rev. Uningá. 2015;24(3):11-14.
23. Bispo LB. Toxina botulínica como alternativa do arsenal terapêutico na odontologia. Univ Cod São Paulo. 2019;31(1):74-87.
24. Senise IR, Marson FC, Progiante PS, Silva CDOES. O uso de toxina botulínica como alternativa para o tratamento do sorriso gengival causado pela hiperatividade do lábio superior. Rev. Uningá. 2015;23(3):104-110.
25. Filho AFDO, Silva GADM, Almeida DMX. Aplicação da toxina botulínica no tratamento da sialorreia em pacientes com esclerose lateral amiotrófica: revisão da literatura. Einstein. 2016;14(3):431-434.
26. Sposito MMM, Teixeira SAF. Toxina Botulínica Tipo A para o tratamento da Sialorréia: revisão sistemática. Acta Fisiátr. 2013;20(3):147-151.
27. Costa CC, Ferreira JB. Aplicação de toxina botulínica nas glândulas maiores para o tratamento de sialorréira crônica. Rev Bras Cir cabeça e pescoço. 2008;14(3):431-434.
28. Rao LB, Sangur R, Pradeep S. Application of Botulnum toxin Type A: An arsenal in dentistry.Indian J Dent Res. 2011;22(3):440-445.
29. Donini ED, Tuler WF, Amaral MA. Uso da toxina botulínica tipo A em pacientes com bruxismo reabilitados com prótese do tipo protocolo em carga imediata. Rev Jornal Ilapeo. 2013;7(1):39-45.
30. Archana MS. Toxin yet not toxic: Botulinum toxin in dentistry. Saudi Dent J. 2016;28(2):63-69.
31. Kattimani V, Tiwari RVCT, Gufran K, Wasan B, Shilpa PH, Khader AA. Botulinum toxin application in facial esthetics and recent treatment indications (2013-2018). J Int Soc Prev Community Dent. 2019;9(2):99-105.
32. Francescon AA. Uso da Toxina Botulínica no controle do Bruxismo. Repositório Institucional da UFSC, 2014.

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