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Uses of *Botulinum* toxin in dental practice in the Orofacial region

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Abstract

Introduction: The use of *Botulinum* toxin has come to revolutionize and give solutions to different problems. Studies and clinical cases have shown the different uses and benefits that this has in oral and maxillofacial area.

Objective: Analyze the literature to share the information that has been investigated of uses of *Botulinum* toxin. We will explain some of the uses that it has such as: help patients with bruxism, correction of gingival smile, aesthetic use in face and in patients with migraine.

Methodology: An electronic search was carried out through PubMed, SCOPUS, Google Scholar and Mendelley, using the terms: "*Botulinum* toxin", "bruxism", "lips", "pain", "teeth". We identified 241 results and used 44.

Results: The use of *Botulinum* toxin as a treatment in Orofacial area has become very popular nowadays for different purposes. Some applications in this region are: in patients with bruxism for the decrease of muscle strength removing pain; in the correction of gingival smile when controlling the power of the lip lifting muscles; in facial aesthetics by causing muscle semi paralysis dynamic wrinkles are reduced; and as a treatment in patients with migraine in muscle application inhibiting the release of pain-inducing substances. It is important to study the anatomy of the craniofacial region and to have experience and enough knowledge to do this treatment because a wrong technique may bring complications.

Discussion: Even when *Botulinum* toxin has many benefits, the diffusion of the treatment has brought a lot of patients that want it without even knowing the adverse effects that it can bring, and sometimes they are treated with non-prepared injectors. It is important to share the information about this topic and the importance of doing it with a well prepared professional.

Conclusion: *Botulinum* toxin is an excellent treatment if applied in the right way. It is essential that this treatment is carried out with a professional with extensive knowledge in the area.

Keywords: *Botulinum* toxin, bruxism, lips, pain, teeth

1. Introduction

Nowadays the use of *Botulinum* toxin is very common. *Botulinum* toxin is FDA-approved to treat some therapeutic treatments such as migraines and also for cosmetic uses [1].

Botulinum toxin emerged in the 19th century when the Belgian bacteriologist Van Ermengem discovered it in 1895. In 1950, Brooks showed that the toxin blocks the release of acetylcholine in motor neurons, causing the muscles to relax [2]. In terms of their mechanism of action, BoNT penetrate the nerve endings, inactivating soluble proteins from the soluble N-ethylmaleimide sensitive factor attachment protein receptor that are essential for the release of neurotransmitters [3].

All BoNT share a sustained action (three to six months), after their time of action, muscle function is recovered [4]. Interest in *Botulinum* toxin research and clinical use has increased exponentially. This includes interest in the Orofacial area [5].

Botulinum toxin type A (BoNT-A) is increasingly used, however safe doses and reinjection intervals still need to be established [6]. Complications are usually technique-dependent, and their incidence decreases as the injector becomes experienced. Undesired effects due to the distant spread of BoNT include blepharoptosis, eyebrow ptosis, undesired eyebrow shape, unnatural face, eye opening difficulty, and unsatisfactory results.

Temporary Blepharoptosis is seen in approximately 1–5% of patients. Nasopharyngitis, sinusitis, blurred vision, upset stomach, voice changes, restricted mouth opening, muscle atrophy, and stiffness were also adverse events encountered after injection [7].

2. Materials and Methods

A search was conducted by looking for published articles using the PubMed database and Mendeley. We reviewed summaries and full texts with information about the topic. The Boolean operators AND, NOT were used in the search. Keywords used for the search include: “*Botulinum* toxin”, “bruxism”, “lips”, “pain”, “teeth”. We identified 241 results and used 44.

3. Results and Discussion

3.1 Bruxism

Bruxism, refers to the repetitive action of the chewing muscles involving either teeth grinding or clenching, along with jaw thrusting or reinforcement [8]. An alternative definition, describes bruxism as a non-functional activity involving involuntary movements like grinding, rubbing, or clenching of the teeth within the dentomaxillary apparatus [9].

The primary outcomes linked to bruxism, include headaches and tooth wear. Various causes of bruxism have been investigated [10]. In adults, factors such as emotional stress, tobacco or alcohol consumption, coffee intake, sleep apnea, and anxiety are among the studied contributors. For adolescents and children, potential factors encompass behavioral abnormalities and sleep disturbances [11].

Individuals with bruxism often experience temporomandibular joint (TMJ) disorders. These conditions typically manifest as pain, restricted movement, fatigue, and muscle weakness in the facial and chewing muscles [12].

Various treatment strategies have been proposed to treat bruxism, encompassing conservative therapies like pharmacotherapy, physiotherapy, ultrasound, transcutaneous electrical nerve stimulation, occlusal therapy through the use of occlusal splints, and psychotherapy [13]. Recently, *Botulinum* toxin type A (BTX-A) has emerged as an alternative for providing prolonged relief from chronic myofascial pain [14]. BTX-A operates a dual mechanism at the neuromuscular junction, involving the inhibition of acetylcholine exocytosis from nerve terminals, causing temporary weakening or paralysis of nerve endings and subsequent relaxation or reduced muscle contraction, depending on the dosage. Additionally, it inhibits the release of substance P and glutamate, thereby lessening inflammatory pain [15].

Studies have indicated that low doses of *Botulinum* toxin are effective in treating persistent myofascial pain linked to temporomandibular disorders [16]. This toxin also shows promise as a potential management option for bruxism by lessening the intensity of the masseter muscle [17].

Bruxism is one of the most common disorders in the dental office. This is a way for the body to release excess stress by frequently clenching and grinding the teeth, thus having a greater than normal activity and muscle strength, as a consequence those who suffer from it usually have muscle pain. There are different treatments for this condition. Currently the use of *Botulinum* toxin is a very good proposal to control muscle activity by weakening, relaxing and decreasing the strength and tone of the chewing muscles, in patients with bruxism it is injected into the masseter muscle. If you decide to carry out this treatment, it is important that it

is done with an expert, it is necessary to know the correct placement and dosage, and to verify if the patient is a candidate, if it is their best option, or if it should be carried out in conjunction with another treatment.

3.2 Gummy smile

Gummy smiles can have a significant impact on both appearance and mental well-being, often leading to decreased self-confidence and attempts to conceal or moderate smiling. Recent research has highlighted that the amount of gum visible during a smile plays a crucial role in its attractiveness [18]. A smile showing more than 2 mm of gum exposure is classified as a gummy smile [19], affecting a significant portion of the population, with a prevalence ranging from 10.5% to 29%, notably more common in females [20]. Several causes contribute to this condition, including irregular tooth eruption, excessive tooth exposure, an excess of upper jaw bone, short or overly active upper lip muscles, or a combination of these factors [21].

Surgical intervention aims to reshape the gumline, reduce excessive gum exposure, and showcase the appropriate tooth proportions [22]. *Botulinum* toxin injections have emerged as a valuable supplementary treatment to enhance aesthetics and patient satisfaction, offering a less invasive and immediate non-surgical option [23].

Botulinum toxin Type A (BTX-A) stands as an effective corrective measure for aesthetic issues by inhibiting muscle contractions [24], particularly beneficial for individuals with hyperactive smiling muscles [25]. Clinical studies have demonstrated that the controlled application of *Botulinum* toxin is a swift, safe, and effective alternative, yielding pleasing and balanced results when targeted at specific muscles, considering the appropriate dosage and smile type. Hence, this technique significantly contributes to enhancing smile aesthetics, especially when combined with gingival surgery [26].

Nowadays, having a good smile is essential. Having a gummy smile can lead patients to have low self-esteem and consequently avoid smiling. *Botulinum* toxin semi-paralyzes the muscle, with its correct application it decreases the strength of the muscles of the lip, having the effect of reducing the exposure of the gums when smiling. An ideal treatment is carried out by experts in the area to correctly analyze whether the application of the toxin is sufficient or if the best option is to carry it out in conjunction with surgical treatment.

3.3 Facial aesthetics

Botulinum toxin Type A (BoNT-A) has seen a substantial rise in its use within aesthetic medicine since its initial applications in the mid-1980s [27]. Botox, due to its effectiveness, tolerability, and minimally invasive nature, quickly gained popularity upon its introduction to the market [28]. Nowadays, BoNT-A finds widespread use in various aesthetic treatments, including treating glabellar lines, forehead wrinkles, periorbital and perioral lines, platysma bands, horizontal neck lines, and masseter lines, among numerous other applications [29].

The natural movement of facial muscles over time can cause skin wrinkling and decreased elasticity. BoNT-A, derived from a specific bacteria, works by temporarily relaxing these muscles. It is commonly injected into facial muscles to reduce the appearance of lines and wrinkles [30].

Among the most prevalent injectable aesthetic treatments today are BoNT-A and hyaluronic acid fillers [31]. The toxin

induces muscle paralysis locally, typically taking effect within 24 hours to two weeks post-injection [32].

A study in China demonstrated BoNT-A as an effective and well-tolerated treatment for crow's feet, exhibiting an average treatment duration of about 5 months [33]. However, in broader facial applications, most patients tend to observe effects lasting 3 to 4 months with currently available BoNT-A products. Real-world clinical data suggest that patients usually undergo repeat treatments approximately every 5 to 6 months [34]. Common side effects experienced by patients might include headaches and injection site discomfort [35].

Nowadays, facial aesthetics and preventing aging from being noticed is a priority for the population. The use of *Botulinum* toxin for this purpose is a treatment that has become popular. The reason for the appearance of wrinkles is that the skin ages and loses elasticity over time, muscle activity is what leads us to the result of how much they will be marked and how they will be. The application of BoNT-A is carried out at the muscle level, causing a semi-paralysis of these, thus preventing further wrinkles or the formation of new ones. It is of the utmost importance to have this treatment done by an expert since the application in the wrong place can lead to undesired results, resulting in the opposite of what was expected, which is to improve facial aesthetics. It should be considered that *Botulinum* toxin, when working at the muscular level, controls dynamic wrinkles, that is, wrinkles that are observed in repetitive facial movements, such as frowning, raising eyebrows, smiling, squinting, pursing the mouth, among others. The type of static wrinkles, which are those observed at rest, do not always change with the use of this treatment, they must be treated with other products such as hyaluronic acid also called "filler" to have a better effect, as indicated by the treating expert.

3.4 Migraine

Chronic migraine stands as a significant medical concern, estimated to be the second most prevalent disorder [36]. *Botulinum* toxin type A (BoNT-A) has been a pivotal treatment for chronic migraine prevention for over a decade, establishing itself as a well-tolerated therapy option [37].

Ona *Botulinum* toxin A (OBTA) is specifically indicated for chronic migraine. Diagnostic criteria include experiencing headaches at least 15 days a month, with at least eight of those days being migraine headaches [38].

Reports in 1998 highlighted the relief of frontal and periorbital headaches in patients treated with *Botulinum* toxin for blepharospasm [39]. Additionally, a publication on the use of BTA in tension-type headaches indicated a reduction in the severity and frequency of migraine-type headaches [40].

By 2002, some headache specialists were noting that clinical trials, retrospective studies, and case reports suggested the safety and efficacy of BoNT-A for both preventive and acute migraine treatment [41]. OBTA operates by interrupting the migraine sequence, inhibiting the release of CGRP (a molecule causing migraine attacks) and other neuropeptides from nociceptive C-fibers [42].

The PREEMPT studies provided an established injection approach for chronic migraine, necessitating a minimum of 31 injections of 5 units each at specific points in areas like the glabella, frontal, temporal, occipital, upper cervical, and trapezius regions. Additionally, eight further injections may be administered in specific regions (temporal, occipital, and trapezius) as a "pain tracking" approach, depending on headache location or tender points [43].

Migraine is a common and very painful medical disorder for

those who suffer from it. There are different treatments for migraine, the use of *Botulinum* toxin and it is a very innovative one that has been researched and proven to be effective in controlling this condition. As puncture sites are sensitive areas, it is essential that the person applying it has extensive knowledge in the area since application in incorrect places or doses can lead to adverse effects as a result.

4. Conclusion

The use of *Botulinum* toxin has come to revolutionize the medical sector, as it can be applied for different purposes as a treatment. Among these approaches is the application in the orofacial region, which can be: as a treatment in patients with bruxism for the decrease of muscle strength, thus achieving relaxation and removing pain from the muscles involved in chewing; in the correction of the gummy smile by controlling the function of the muscles of the lip, having the effect that when smiling, patients do not show as much gum as they used to; in facial aesthetics, by causing muscle semi-paralysis, dynamic wrinkles and the formation of new ones are reduced by reducing the strength in gesticulation movements; and as a treatment in patients with migraine in muscle application, inhibiting the release of pain-inducing substances. It is important that this treatment is carried out with an expert because it is essential to know the correct doses and puncture areas to have a good result and avoid adverse effects or harm to the patient.

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