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Botox in Orthodontics: a review

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Abstract
Botox which is a FDA approved procedure has been widely used for cosmetic procedures to reduce wrinkles and fine lines. But lately Botox has seen a marked increase in dentistry due to its therapeutic benefits in a number of dental conditions like temperomandibular joint disorders, bruxism, gummy smile etc to name a few. Orthodontists have also taken help of Botox in a number of clinical conditions with relatively good results. The aim of this review is to present and discuss the mechanism of action, clinical applications in dentistry and orthodontics in particular, adverse effects and contradictions of Botox so as to help and guide the orthodontist make an informed choice on the versatile uses of Botox in dentistry and whether it can be considered as an adjunctive to traditional methods of dental treatment.

Keywords:*botox, botulinum, dentistry, orthodontist*

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I. Introduction

Botox has been dubbed as the elixir of youth. Many people think of Botox as a cosmetic treatment used primarily to reduce fine lines and wrinkles. Botox is widely known as a cosmetic lunch time procedure that takes years away from your face without having to go under the knife. It has gained immensely popularity since FDA approved the use of Botox for the cosmetic purpose of reducing glabellar forehead frown lines [2].

Although Botox is widely popular as a cosmetic procedure, the botulinum toxin from which Botox is derived has a long history of medically therapeutic uses such as strabismus, blepharospasm, cervical dystonia and hyperhidrosis [7]. Botox is now used in dentistry as well to treat certain oral conditions. It has been used to treat a number of dental conditions successfully over recent times. Orthodontists also come across a number of patients who present with a number of dental conditions and use of Botox can successfully help treat them and this widens the scope of treatment planning by an orthodontist. Botulinum toxin (BT) is a neurotoxin derived from the bacterium Clostridium botulinum, an anaerobic, gram positive, spore forming rod [2]. BT can be differentiated serologically into eight kind of toxins named from A to G (A, B, Cb, C2, D, E, F and G) [5]. Commercially available BT are botulinum toxin type A and botulinum toxin type B [5]. The toxin is heat labile and denatured by cooking [8].

Each vial of Botox contains:

1. 100 Units (U) of Clostridium botulinum type A neurotoxin complex,
2. 0.5 milligrams of Albumin Human,
3. And 0.9 milligrams of sodium chloride in a sterile, vacuum- dried form without a preservative[7]

Mechanism of Action

The BT primarily acts on cholinergic receptors and prevents the release of neurotransmitter acetyl choline, thus causing widespread paralysis of muscles, characteristic feature of botulism infection [5]. It is believed that inhibitory action of BT first involves binding of toxin to presynaptic nerve membranes followed by proteolysis of SNAP-25, a protein required for the successful docking and release of acetylcholine from vesicles located within nerve endings [5]. Intramuscular injection of BT results in local chemical denervation and the loss of

neuronal activity in the target organ [5]. This localised paralysis of the muscle usually lasts three to six months and muscle activity is regained after neural sprouting which re-innervates the muscle.

Clinical Applications in Dentistry and Orthodontics

Botulinum toxin type A can be used in following dental conditions:

1. Temporomandibular joint disorders
2. Bruxism
3. Pathologic clenching
4. Masseteric hypertrophy
5. Gummy smile
6. Oromandibular dystonia
7. Sialorrhoea
8. Palatal and stapedius myoclonus
9. First bite syndrome
10. Masticatory myalgia
11. Mandibular spasm
12. Dental implants and maxillofacial fractures
13. Cosmetic applications

Temporomandibular joint disorders

Temporomandibular disorder (TMD) is a term used to describe a number of diseases affecting masticatory function, which may include true pathology of the temporomandibular joint as well as masticatory muscle dysfunction [7]. Usually TMD symptoms include jaw pain, joint sounds, headache, earache, pain behind eyes, neck pain, difficulty chewing food and occluding teeth. Most of the TMD cases include a myogenic component [7] and muscular spasticity secondary to bruxism. Treatment options of TMD include analgesics, anti-inflammatory drugs, muscle relaxants, physiotherapy, orthodontic correction, dental restoration and surgical intervention. However, none of these treatment options have proved beneficial in the long run as they are not consistently effective and may also produce adverse side effects.

Orthodontists can choose BT injections as a method of choice for patients who haven't responded well to other conventional approaches and orthodontic treatment has also not delivered expected outcome. BT injection causes inhibition of the maximum contractile force of the injected muscles, and inhibition of efferents resulting in a reduction in the resting muscle tone [5]. Thus, botulinum toxin A can be successfully used as a least invasive and viable treatment option for TMD.

Bruxism

This is characterized by non-functional contact of the mandibular and maxillary teeth resulting in clenching or tooth grinding due to repetitive, unconscious contraction of the masseter and temporalis muscles[4]. Bruxism can adversely affect not just the dentition as a whole but can also create a hindrance during orthodontic treatment and it is imperative to treat the bruxism before commencing orthodontic treatment. One of the earliest reports on use of botulinum toxin type A for bruxism was by Van Zandijcke and Marchau who described the successful treatment of a brain- injured patient with severe bruxism with 100 U of a botulinum toxin type A injections to the temporalis and masseter muscles [6].

Pathologic clenching

Similarly, excessive forces created by parafunctional clenching impede healing and reattachment of gum and bone in the mouth after trauma [7]. BT type A can help to reduce the clenching by limiting the muscle contraction. This helps in healing of traumatised tissue and patients feel more comfortable with better functional activity like eating and swallowing.

After periodontal surgery, BT type A can be used to improve healing by limiting the clenching. Further, in this application, the use of a splint is often contraindicated because the teeth should be functional during healing, so Botulinum toxin acts as a pharmaceutical splint [7].

Masseteric hypertrophy

Masseteric hypertrophy is an asymptomatic enlargement of one or both masseter muscles. The etiology in most cases are unclear but few reasons attributed to it are malocclusion, bruxism, emotional stress or temperomandibular disorders. Patient mostly seeks treatment for cosmetic reasons. Common treatment used was partial resection of the masseter muscle which gave rise to conditions like hematoma formation, facial nerve paralysis, infection, mouth opening limitation, and substantial contracture [5]. Smyth and Moore in 1994 introduced the technique of BT injection into the masseter muscle and considered BT as less invasive modality for cosmetic

sculpting of the lower face [5].The injection of small aliquots (e.g., 30 U per side) of Botox into the masseter muscles resulted in a sustained reduction of masseter hyperactivity [7].

Gummy Smile

An excessive display of gingival tissue on smiling is known as a ‘‘gummy smile”, which can be aesthetically unpleasant. This can cause psychological issues as the patient becomes self conscious regarding the same. Several etiologic factors have been proposed in the literature; these include skeletal, gingival, and muscular factors that may occur alone or in combination.[1,2] Although vertical maxillary dental and/ or skeletal excess or gingival problems from delayed passive eruption[3–5] [6–8] have been treated in the orthodontic field, hyperactive lip elevator muscles have not been managed as often, possibly because hard tissue has been the main target for most orthodontists[1].

Minimally invasive treatment modality like BT would be advantageous when the gummy smile is due to hyper functional upper lip elevator muscles. BT limits muscular over-contraction when applied in small, carefully titrated doses [5]. Intramuscular injection for correction of excessive gingival display is given at ―Yonsei point [3]. It is basically a point located at the centre of triangle formed by levator labii superioris, levator labii superioris alaeque nasi and zygomaticus minor [7]. A dose of 3U is recommended at each injection site. The effect lasted for 3-6 months and should be repeated every six months to one year since the improvement is temporary.

Oromandibular dystonia

This disorder is characterized by involuntary, action-induced, tonic or clonic spasms of the masticatory, lingual and pharyngeal musculature. Symptoms include dysphagia, dysarthria, bruxism and tempomandibular joint subluxation [4]. There is no known cure for oromandibular dystonia but BT injections show promising results. The largest study to date was a prospective open-label conducted by Tan and Jankovic that treated 162 patients with OMD over a 10-year period. Botulinum toxin type A was injected into the masseters and/or the submentalis complex. Improvement in function for chewing and speaking was reported in 67.9% of the patients, and mean duration of clinical improvement was 16.4 ± 7.1 wk [7].

Sialorrhoea

Sialorrhoea or hypersalivation can occur in neurological and akinetic disorders like Parkinson’s disease and cerebral palsy. There are several RCTs where the efficacy of Botox injections to the parotid and/or submandibular glands in such patients has been demonstrated [4]. This toxin also blocks the release of acetylcholine at the cholinergic synapses of the autonomic nervous system; thus, this toxin can block cholinergic parasympathetic secretomotor fibers of the salivary gland [7]. The effects last 3–6 months and can be repeated. Injections can also be used for sialorrhoea caused by salivary fistulas and sialadenitis [4].

Palatal and stapedius myoclonus

Palatal myoclonus is characterized by involuntary palatal contractions and this action of the soft palate muscles on the membranous Eustachian tube causes clicking tinnitus. Similarly, stapedius myoclonus can cause clicking tinnitus due to the contractions of the stapedius muscle. Two case reports have been presented where the use of Botox has been shown to be beneficial in relieving the patients’ symptoms. For palatal myoclonus, Botox was injected in the soft palate under EMG guidance, while for stapedius myoclonus, Botox was placed trans-tympanically into the middle ear on a piece of gelfoam.[4] In the latter case, the beneficial effects of Botox lasted for four months.[4]

First bite syndrome

This is characterised by facial pain after the first bite of each meal and is seen after surgery in the parapharyngeal space, especially deep lobe parotidectomy [4].This may be due to autonomic dysfunction of salivary myoepithelial cells. It can be misdiagnosed as a malocclusion and it is upto the orthodontist to correctly diagnose it based on patient medical and dental history. Intraparotid BT injection was found to significantly decrease symptom severity in a case series of five patients and a case report [4].

Masticatory myalgia

Masticatory pain can be explained by chronic nociceptive irritation of the tendons and fascias of the masseter, temporalis and medial pterygoid muscles [4]. It can arise from pathologic and functional processes in the masticatory muscles. There are three RCTs showing Botox to be more effective than placebo (saline) in reducing masticatory myalgia. Botox causes a disuse atrophy of the affected muscle which relieves tension, improves

aerobic metabolism and enables decompression of afferent nociceptive neurons through reduction of substance P-mediated neurogenic inflammation [4].

Mandibular spasm

Sometimes when the mandibular closing musculature remains semicontracted or in spasm, mouth opening is limited. This type of muscular spasm places limitations on completing the basic oral hygiene necessary to prevent oral disease [7]. There is difficulty in opening the mouth and there is reduction in oral utility like brushing teeth etc. which will adversely affect orthodontic treatment as well. Botulinum toxin treatment to the masticatory musculature diminishes the effects of hyperfunctional or spastic muscles [7].

Dental implants and maxillofacial fractures

After implant placement, osseointegration can be hindered by excessive functional forces especially in patients with para functional habits. This overloading may result in failure of the implants. Similarly, the strong forces of masticatory musculature should be overcome in case of multiple fixation sites after maxillofacial fracture. Excessive forces from these muscles can prevent or impede fracture callus formation. The muscular relaxation achieved with BT injections to the masticatory muscles can be therapeutically beneficial by allowing better implant integration and more stable environment for fracture healing [5].

Kayikvioglu and colleagues conducted a study to examine the use of BT as an adjunct to zygomatic fracture fixation surgery, in an attempt to reduce the number of fixation sites and to prevent dislocation of the zygomatic bone. Patients with zygomatic bone fractures were injected with 100 U of BT into the masseter muscle of the fractured site. Patients were then operated on 12 to 48 hours after the injection, and the temporary paralysis of the masseter muscles allowed for fewer miniplate and/or microplate insertions in patients. Kayikvioglu's group also found no complications related to either the BT injections or surgical procedures [5].

Cosmetic Applications

Orthodontists should ideally not only try to improve the hard tissues but the soft tissue profileas well and certain aesthetic anomalies like deep mentolabial sulcus, poppy chin and deep nasolabial folds are quite common. BT can also be injected to temporarily relax the corresponding muscle of the anomaly and makes it facially acceptable.

Adverse effects

Injections with botulinum toxin are generally well tolerated and side effects are few. Generalized idiosyncratic reactions are uncommon, generally mild, and transient. There can be mild injection pain and local edema, erythema, transient numbness, headache, malaise or mild nausea. bruising can occur, particularly if a small vein is lacerated or a patient is taking aspirin, vitamin E, or NSAIDs. Ideally, patients should stop taking these products two weeks before the procedure [2].

Contraindications

Patients should not be treated or treated with extreme caution who are [5]:

• Psychologically unstable[2] or who have questionable motives and unrealistic expectations[7].

• Dependent on intact facial movements and expressions for their livelihood (e.g. actors, singers, musicians and other media personalities)[7].

• Afflicted with a neuromuscular disorder (e.g.myasthenia gravis, Eaton-Lambert syndrome)[2,7].

• Allergic to any of the components of BTX-A or BTX-B (i.e. BTX, human albumin, saline, lactose and sodium succinate)[7].

• Taking certain medications that can interfere with neuromuscular impulse transmission and potentiate the effects of BTX (e.g. aminoglycosides, penicillamine, quinine, and calcium blockers)[2,7].

• Pregnant or lactating (BTXs are classified as pregnancy category C drugs)[2,7].

II. Conclusion

Botox is a minimally invasive procedure and if done properly can work efficiently in indicated conditions. In the dental clinic, Botox can provide solutions to the trained dental practitioner and can be a boon to orthodontists in particular. Botox may be an alternative when other treatments have failed to work. However, there are still a number of procedures in which more research is required to be treated by botulinum toxin. In future, development in this field will revolutionise and further aid the expanding and interesting use of botox in dentistry. It is imperative to note here that infusion of Botox ought not be given rashly before the impact of prior treatment has worn off totally as this can result in development of antibodies to Botox that will weaken the im-

pact of further medications. Additionally the treatment may at some point create deviated results because of infusion at wrong site or by an unpracticed clinician and the expense is likewise high for such a treatment [9].

References

[1]. Hwang WS, Hur MS, Hu KS, Song WC et al. Surface Anatomy of the Lip Elevator Muscles for the Treatment of Gummy Smile Using Botulinum Toxin Angle Orthod. 2009;79:70–77

[2]. Nigam PK, Nigam A. Botulinum Toxin. Indian J Dermatol. 2010 Jan-Mar; 55(1): 8–14.

[3]. Patel D, Mehta F, Trivedi R, Thakkar S, Suthar J. Botulinum Toxin and Gummy Smile- A Review. IOSR Journal of Dental and Medical Sciences Volume 4, Issue 1 (Jan.- Feb. 2013), 01-05

[4]. Persaud R, Garas G, Silva S, Stamatoglou C, Chatrath P et al. An evidence-based review of botulinum toxin (Botox) applications in non-cosmetic head and neck conditions. J R Soc Med Sh Rep 2013;4:10.

[5]. Shilpa PS, Kaul R, Sultana N, and Bhat S. Botulinum toxin: The Midas touch. J Nat Sci Biol Med. 2014 Jan-Jun; 5(1): 8–14.

[6]. Dinker S, Anitha A, Sorake A, Kumar K. Management of gummy smile with Botulinum Toxin Type-A: A case report. Journal of International Oral Health 2014; 6(1):111-115

[7]. Nayyar P, Kumar P, Nayyar PV, Singh A. Botox: Broadening the Horizon of Dentistry. Journal of Clinical and Diagnostic Research. 2014 Dec, Vol-8(12): ZE25-ZE29

[8]. Azam A, Manchanda S, Thotapalli S, Kotha SB. J Int Oral Health. 2015; 7(Suppl 2): 103–105.

[9]. Salem W, Alshammari A, Alshehri F. The botox in dentistry, a review study. MOJ Immunol. 2018;6(5):213–215.