

Botox In Dentistry: A Review

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Introduction

We all can't disgrace with the fact that all we want to look younger less than our age. And Botox one option available fulfills our needs in looking younger and esthetic in advancing age. Today BOTOX is the name which is hottest in the field of cosmetic and esthetic industry. There is no question that BOTOX and dermal fillers are well known for their esthetic results in terms of smooth skin and replacing lost volume in face, especially the oral and perioral areas.¹

BOTOX is a toxin produced by bacterium clostridium botulinum.² It is also produced commercially for medical, cosmetic, and research use. There are two main commercial types: botulinum toxin type A and botulinum toxin type B. Three forms of botulinum toxin type A (Botox, Dysport and Xeomin) and one form of botulinum toxin type B (MyoBloc) are available commercially for various cosmetic and medical procedures.

History

In the nineteenth century, Justinus Kerner described botulinum toxin as a "sausage poison" and "fatty poison" (from latin botulus meaning "sausage"),³ because the bacterium that produces the toxin often caused poisoning by growing in improperly handled or prepared meat products. Kerner, a physician, first conceived a possible therapeutic use of botulinum toxin and coined the name Botulism. In 1897, Emile van Ermengem found the producer of the botulin toxin was a bacterium, which he named Clostridium botulinum.⁴ P.T. Snipe and Hermann Sommer purified the toxin for the first time in 1928.⁵ In 1949, Arnold Burgen's group experimentally discovered that botulinum toxin blocks neuromuscular transmission through decreased acetylcholine release.⁶ Botulinum toxin can cause botulism, a serious and life-threatening illness in humans and animals. Popularly known by one of its trade names, botox, it is used for various cosmetic and medical procedures. Botulinum can be absorbed from eyes, mucous membranes, respiratory tract or nonintact skin.³

Mechanism of Action

Injecting overactive muscles with minute quantities of botulinum toxin type-A results in decreased muscle activity. Botulinum toxin type-A inhibits the exocytosis of acetylcholine on cholinergic nerve endings of motor nerves,⁷ as it prevents the vesicle where the acetylcholine is stored from binding to the membrane where the neurotransmitter can be released. Botulinum toxin achieves this effect by its endopeptidase

activity against SNARE proteins, which are 25-kd synaptosomal associated proteins that are required for the docking of the ACH vesicle to the presynaptic membrane.⁸ Botulinum toxin type-A thus blocks the release of acetylcholine by the neuron. This effectively weakens the muscle for a period of three to four months.⁹

Application of Botox In Dentistry

Botulinum toxin A can be used in temporomandibular joint disorders, bruxism, oromandibular dystonia, mandibular spasm, dental implant and surgery, gummy smile and masseter hypertrophy.

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 temporo mandibular joint as well as masticatory muscle dysfunction.^{10,11} TMD manifests with facial pain, joint sounds, headache, peri-auricular pain, neck pain, and/or decreased jaw excursion. The majority of TMD cases include a myogenic component and muscular spasticity secondary to bruxism, external stressors, oromandibular dystonia, and psychomotor behaviours are common aetiologic factor of TMD.^{12,13,14} TMD caused by excessive biting forces has conventionally been treated with intraoral appliances, occlusal adjustments, dental restoration, and/or surgery. These techniques are invasive, irreversible, and expensive for the majority of patients.

Techniques currently employed for aesthetic, conservative restorations may not withstand the parafunctional forces continually applied by some patients. Thus, many of these treatment options are not ideal for all patients, and muscular relaxation with botulinum toxin A is a viable alternative. When a muscle relaxant is used with the muscles of mastication, this clenching reflex can be reduced or eliminated.¹⁵ Because a very small percentage of available force is required to masticate food, a slight relaxation of muscle function reduces bruxing and is usually insufficient to affect chewing and swallowing.¹⁶

Treatment Protocol For Tmd

The treatment begins with a lower dose, because it is always possible to titrate up to a higher dose, if necessary, the temporalis component of pain is treated with bilateral injections of 7.5 U into the anterior vertical fibers of each temporalis muscle. In more severe cases, 2.5 U are given into the middle and posterior third of the temporalis muscles. Pain relief for the

tendon of temporalis is achieved with multiple injections of 2.5 U equidistantly spaced in the temple area outside the orbital rim. The masseter component of pain is treated with 5 U injected into the belly of the masseter below an imaginary line joining the tragus of the ear and the corner of the mouth.¹⁷

There are several case reports, which are supporting the efficacy of BOTOX treatment for TMD:

- Freund et al. conducted a large open-label trial with 46 patients suffering from TMD and found that 150 U injections of BOTOX to the temporalis and masseter muscles significantly decreased pain and tenderness and improved function and mouth opening.¹⁶
- Tan and Jankovic conducted a long-term open-label trial on 18 patients with a history of severe bruxism. Injections of BOTOX given to the masseter muscle (mean dose: 61.7 U/side; range 25- 100 U), yielded a total duration of therapeutic response of 19 weeks.¹⁸
- Lee et al. conducted a small open-label trial study to evaluate the effect of BOTOX on pain in six patients with limited mouth opening due to TMD. All patients showed clinical remission of pain symptoms without any adverse effects during the 5-12 months follow-up period.¹⁹

Bruxism

Bruxism is a repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible. Bruxism has two distinct circadian manifestations: it can occur during sleep (indicated as sleep bruxism) or during wakefulness (indicated as awake bruxism). Botulinum neurotoxin has also shown promise in alleviating the symptomatology of bruxism. Excessive forces created by parafunctional clenching impede healing and reattachment of gum and bone in the mouth after trauma.²⁰ Botulinum toxin type A limits the muscle contraction, and this reduction in clenching intensity will allow traumatized tissue to heal. Because parafunctional clenching contributes to periodontal trauma, botulinum toxin type A can limit clenching before and after periodontal surgery to improve healing. 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. 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.²¹

Oromandibular Dystonia

Oromandibular dystonia (OMD) is a movement disorder characterized by involuntary spasms and muscle contractions. It manifests as distorted oral position and function resulting in difficulty in speaking, swallowing, and eating. Although it is a neurologic disorder, it is included as a subset of TMD because of its involvement of the masticatory apparatus.²² Most of the reported literature on OMD has been open-label studies, but all have reported improvement with botulinum toxin injections.²³⁻²⁷ 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.²⁷ Botulinum toxin type A was injected into the masseters and/or the submental is 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.²⁶

Mandibular Spasm

It is a condition when the mandibular closing musculature remains semi-contracted or in spasm, resulting in restricted mouth opening. This type of muscular spasm limits completing the basic oral hygiene necessary to prevent oral disease and places restrictions on dental treatment. BOTOX treatment to the masticatory musculature diminishes the effects of hyper-functional or spastic muscles that can significantly improve function and mouth opening, and effectively decrease pain and tenderness to palpation. Several case reports have been published, describing the effectiveness of BOTOX in patients with hemi-masticatory spasm, which include studies conducted by (1) Cersosimo et al.,²⁸ (2) Auger et al.,²⁹ (3) Kim et al.,³⁰ and (4) Kim et al.,³¹ Where all the patients responded positively to BOTOX injections.

Dental Implant And Surgery

Implant patients will benefit from pre-surgical BOTOX treatment. Overloading of the muscles of mastication can prevent or impede osseointegration of implants and/or fracture callus formation.^{32,33} The muscular relaxation achieved with botulinum toxin type A injections to the masticatory muscles can be therapeutically beneficial by allowing implants better unimpeded osseointegration and fracture healing in a more stable environment.

Kayikvioglu and colleagues conducted a small open-label study to prospectively examine the use of botulinum toxin type A 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. Five male patients with zygomatic bone fractures were injected with 100 U of botulinum toxin type A into the masseter muscle of the fractured side. Patients were then operated on 12 to 48 h after the injection and EMG confirmation of muscle denervation. The temporary paralysis of the masseter muscles allowed for fewer miniplate

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and/or microplate insertions in all patients, and resulted in no complications related to either the botulinum toxin injections or surgical procedures. Kayikvioglu's group also found similar benefits of adjunct botulinum toxin treatment for surgical reduction of mandibular and condylar bone fractures.³³

Gummy Smile

The display of excessive gingival tissue in the maxilla upon smiling or the "gummy smile" is both an oral hygiene and aesthetic issue with no simple remedy. Several surgical techniques have been reported in the literature for the correction of hyper-functional upper lip elevator muscles, such as (a) Rubinstein and Kostianovsky, (b) Miskinyar (c) Rees and LaTrenta techniques. However, they are not routinely used to treat gummy smiles. In general, the most common surgical corrections currently used are the LeFort I maxillary osteotomies with impaction for skeletal vertical maxillary excess and gingivectomies for delayed passive dental eruption with excessive gingival display.

Excessive gum exposure is frequently attributable to over contraction of the upper lip muscles, particularly the levator labii superioris alae-que nasi. When this is the case, a less invasive approach is to limit muscular over-contraction. If applied in small, carefully titrated doses, these muscles can be proportionately weakened with BOTOX, which will reduce exposure of the upper gums when smiling. Polo conducted a study in which five patients with excessive gingival display due to hyper-functional upper lip elevator muscles were treated with BOTOX under electromyographic guidance. Patients received one 0.25 U injection per muscle bilaterally into the levator labii superioris, superioris-labii alae-que nasi, and at the overlap areas of the levator labii superioris and zygomaticus minor muscles. All the patients were pleased with the results and the effective increase in upper lip length upon smiling averaged 124.2% and the duration of effect ranged from 3 to 6 months and no adverse effects were reported or observed.³⁴

Messtetric Hypertrophy

Patients who are chronic jaw clencher frequently present with masseteric hypertrophy.³⁵ The increased size of these muscles is evident in the patient's facial appearance, which is often altered, e.g., the jaw can appear swollen and misshapen. To treat this, surgical resection was commonly resorted to which often resulted in substantial contracture. In several small but well-documented clinical trials by (1) Al-Ahmad, Al-Qudah,³⁶ (2) Mandel and Tharakan,³⁷ and (3) Rijdsdijk and Vanes,³⁸ injection of small aliquots of BOTOX into the masseter muscles resulted in a sustained reduction of masseter hyperactivity.

Discussion

Botox is a safe, conservative, non surgical, reversible, minimally invasive treatment modality to achieve cosmetic results. Training is absolutely necessary for dentists to administer injections, but learning curve is very short, because dentists can already achieve profound

anesthesia in the orofacial region, thus making patient more comfortable and at ease. BOTOX produces partial chemical denervation of the muscle resulting in localized reduction in muscle activity. BOTOX can be used as a sole therapy or as an adjunct to oral medication. Botulinum toxin A is kept frozen (2–40C) in a vial until it is ready to use. Adding 4 ml of 0.9% preservative-free normal saline solution makes injections and the preparation should be used within 4 h. Each vial of BOTOX contains: 100 Units (U) of Clostridium botulinum type A neurotoxin complex, 0.5 milligrams of Albumin Human, and 0.9 milligrams of sodium chloride in a sterile, vacuum-dried form without a preservative. The preferred syringe is a calibrated 1.0-mL tuberculin syringe, and the needle selected for injection usually is between 26 and 30 gauge.

The potency of BOTOX is expressed as mouse units. A unit of BOTOX is defined as the LD 50 for a colony of 20 gm Swiss-Webster mice,³⁹ extrapolated to the 70 kg human and each 0.1 ml contain 2.5 U of BOTOX. It is dispensed in small vials containing 100 U or 500 U. The lethal dose of BOTOX in humans is not known. Although it has been estimated to be about 3000 U.^{17,40} The usual maximum dose recommended for dental applications at an injection session is about 80-100 U. It means that 30 vials of BOTOX will have to be injected before a potentially lethal outcome. Before injecting Botox into the muscle and/or joint and/or skin, the skin has to be cleaned with an alcohol/betadine/chlorhexidine swab. Aspiration before injection is recommended to avoid involuntary deposition of toxin into the facial arteries. Botulinum Toxin A achieves close to immediate results in one short appointment, but the results are not permanent and last for 6 months, with a range of 4-8 months.⁴¹ Botulinum Toxin needs to be administered 2-3 times a year depending upon the declination of its effect. The therapeutic effects of Botulinum toxin A first appear in 1 to 3 d, peak in 1 to 4 wk, and decline after 3 to 4 months.⁴²

At the cellular level, 3 to 4 wk after a single injection of Botulinum toxin A in mice, there is sprouting of new processes along the nerve axon, with formation of multiple synapses with the muscle and up regulation of the muscle nicotinic receptors. Subsequently, the neuronal sprouts undergo regression and the original synaptic connection is restored, with restoration of the original neuro-muscular junction.^{43,44} Therefore, Botulinum toxin injections are needed to be administered 2-3 times a year, thereby increasing the cost factor to slightly higher level. Injections are spaced out for a minimum of three months to minimize the risk of antibody formation to the protein, which would prevent BOTOX from working the subsequent time.⁴⁵ Mild stinging, burning or pain with injection, edema and erythema around injection site are the localized adverse effects which are of limited duration. The potential adverse effects of botulinum toxin in oromandibular disorders include facial nerve palsy, pain at the injection site, flu-like symptoms, non-targeted muscle weakness,

dysphagia, and hematoma. These complications are generally transient, and resolve within a couple of weeks. Hands-on training is essential in learning proper techniques of administration and intertwining them with dental treatment plans. With proper training, dentists are usually more proficient than any of other healthcare professionals in providing these treatments to patients, both for dental and cosmetic needs. The Indian Academy of Facial Aesthetics (IAOFE) in

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conjunction with the American Academy of Facial Aesthetics (AAFE) is also offering Botox and dermal fillers training course for dentists and physicians.⁴⁶

Conclusion

Botox no doubt is emerging as an attractive treatment option in comparison to surgical alternatives. However much more is still to be discovered to allow its routine use in dental clinics for various problems. There are still many

dental conditions which require FDA approval to be treated by botulinum toxin. The use of BOTOX is minimal invasive and will surely take dental profession to one step ahead in the field of progress.

References

References are available on request at editor@healtalkht.com

From the Desk of Associate Editor.....

How to Avoid Medico Legal Cases

A lot is being talked these days about how to tackle medico legal cases against doctors. With increased awareness and all information available on internet, some patient come with presumed diagnosis. Medico legal cases are on the rise with lawyers, insurance co.s and various forums intervening. I will talk about how to avoid medico legal cases rather than tackling them.

Most of the medico legal cases arise when a patient is dissatisfied from a doctor on two aspects. One behavioral aspect and two treatment aspect. Many of the cases are filed against doctors out of failure of treatment augmented by unpleasant arguments and unruly behavior. This can be avoided and minimized to a great extent by taking few precautions.

Before starting the treatment always explain the procedure and cost of treatment to the patient. Always give breakdown of cost treatment instead of giving lump sum cost. It's better if you give the cost in writing.

Take the written consent as far as possible regarding procedures.

Never lose your temper and try to understand patient's point of view rather than forcing yours on the patient. Most of the matters can be

resolved by reasoning. While talking to patient be firm but not rude.

Be very careful in selection of words. Never use words like "guarantee. Or warranty" never commit anything in particular as every procedure has some failure rate may be as low as 2-3%. Always explain about failure rate in advance.

Never raise patients hopes sky high if not met it will lead to bitterness.

Lastly your behavior should be polite. Always greet the patient with a hello or smile at the beginning of treatment and "are you comfortable" at the end of the treatment. This small gesture can avoid lot of problems later on.

A patient will file law suit because of failure and dissatisfaction from treatment. This can be avoided to a great extent.

Before starting treatment or committing to the patient access the case properly. Take radiographs, proper relevant medical history and ask for previous treatment records. A proper assessment of case can reduce failure rate. Avoid "biting more than you can chew". If you feel you cannot handle a case refer it to a specialist.

Always use good quality materials and equipment. . Never compromise on quality as it increases failure rate.



The same applies to lab. Why compromise.

If a procedure fails be it a denture a crown or Rct always own the responsibility instead of blaming the patient or lab. If you are true to yourself it leaves good impression on patient and avoids altercation.

In certain cases if you think the patient is a troublemaker firstly access him and avoid treatment. . It avoids tension, damage to your reputation and bigger financial loss.

Most important never ever criticize your fellow dentists. Most of the medico legal cases are filed after instigation from one professional against other. This is unethical and must be avoided at all costs.