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Research Article

"Elevating Smiles And Comfort: The Artistry Of Botox In Periodontics"- A Review

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ABSTRACT

This review highlights the increasing use of Botulinum Toxin (Botox) in periodontics for enhancing facial aesthetics and addressing various oral problems. With a focus on gummy smile correction, bruxism treatment, and improving dental implant outcomes, the paper outlines the mechanism of Botox action and its diverse uses in dentistry. This article emphasizes the importance of proper training for periodontists to effectively integrate Botox into comprehensive treatment plans, ensuring both therapeutic and aesthetic benefits. Despite discussing potential ill effects and contraindications, the paper underscores the dynamic and minimally invasive nature of Botox in periodontics. As the field continues to evolve, Botox presents opportunities for a holistic approach to optimize oral health care and enhance patient satisfaction.

KEYWORDS: Botox, botulinum toxin, Botox in periodontics, gummy smiles.

Introduction

In the past ten years, periodontal and dental practises have seen an increase in the use of facial cosmetic operations. Techniques that maximise aesthetics have evolved in response to growing patient expectations and the demand for facial aesthetics. It is postulated that the initial impression is the one that lasts a lifetime, and that the impression is greatly influenced by dental attractiveness. Since a smile may convey a wide range of emotions, glowing smiles are in high demand. Three essential elements are necessary for dentofacial harmony: the lip, the teeth, and the gingiva.1
Many people associate Botox with cosmetic treatments for lines and wrinkles on the face, however the botulinum toxin from which Botox is generated has a long history of medically therapeutic uses, including cervical dystonia, hyperhidrosis, strabismus, and blepharospasm. Botox is presently being utilised more frequently in dentistry due to its therapeutic benefits in the treatment of certain oral disorders.2
Botulinum toxin is displaying various applications in periodontology. Its significance in the goal of comprehensive dental care is expanding, from addressing gummy smiles to assisting in the treatment of quick loading implants, regulating parafunctional behaviours like clenching, and minimising temporomandibular dysfunctions, including trismus. This trend in incorporating Botox into dentistry reflects a greater recognition of the drug's diverse therapeutic potential. As the sector embraces these innovations, it will be able to provide patients with not only enhanced oral health but also a seamless balance of aesthetics and function.3

What is botox?

Botox (botulinum toxin-BTX or botulinum neuro toxin) is a protease exotoxin released by Clostridium botulinum, which is a gram-positive, rod-shaped, anaerobic, spore-forming, motile bacterium. It has emerged as one of the safest and potent biologic toxin, with exceptionally high therapeutic results in modern medicine.

Botox is famous for its minimally invasive reversible treatment modality. The Dental Quality Assurance Commission (DQAC) of Washington, New Jersey state board and Michigan board of dentistry have approved the use of botox and dermal fillers by dentists.2,4
Currently, seven serotypes of botulinum neurotoxin have been identified (serotypes A–G).5 At present, three different serotypes of botulinum toxin A (Botox, Dysport, Xeomin)(figure1) and just one type B botulinum toxin (MyoBloc) have been commercialised for cosmetic and medical use.6

Figure 1: botox type A. Picture courtesy, https://biologydictionary.net/botulinum-toxin/

Each vial of BOTOX includes :

1. 100 Units (U) of Clostridium botulinum type A neurotoxin complex,
2. 0.5 milligrammes of Albumin Human,
3. and 0.9 milligrammes of sodium chloride in a sterile, vacuum dried form that is without a preservative.

Mechanism of action

BTX inhibits neuromuscular transmission by blocking extracellular acetylcholine release, thereby lowering signals to muscle cells, resulting in diminished muscle action or an entire lack of muscle contraction, as demonstrated below.7 figure 2

Ach is a neurotransmitter that is responsible for muscular contraction and glandular secretion. Docking proteins like SNAP-25 and synaptobravin are essential for vesicle transport to the presynaptic membrane.

Botulinum Toxin Activity:

Botulinum toxin A's endopeptidase activity targets the docking protein SNAP-25.

Type B botulinum toxin cleaves synaptobravin in vesicular-associated membrane protein (VAMP).2,8 Cleavage of these proteins hinders Ach vesicle transport to the presynaptic membrane.

Functional Impact:

Presynaptic block causes functional denervation of muscles, resulting in atrophy and a decrease in muscular bulk.9 For approximately 3 to 4 months, there is a temporary loss in muscle tone and flaccid paralysis.10 Recovery and Repeat Injections:

Neuromuscular transmission is re-established by the regeneration of new axon terminals.11 Therapeutic effects peak within 1-4 weeks, declining after 3-4 months.

Repeat injections (2-3 times a year) are advised with a minimum 3-month gap to prevent antibody formation against the toxin.

Preventive Measures:

Administering injections 2-3 times a year minimizes the risk of antibody formation and subsequent botox workup issues.12

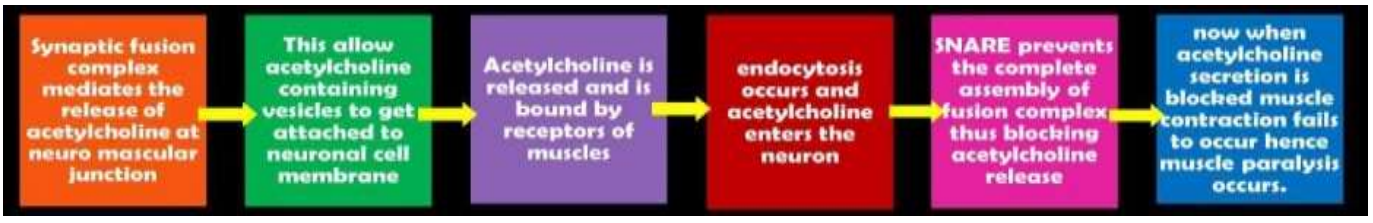

Figure 2: Mechanism of action simplified

Applications in periodontology gummy smiles:

The term "gummy smile" refers to a condition in which there is excessive maxillary gingival display more than 2 mm when smiling. Its frequency is estimated to be around 10%, with females aged 20-30 years being particularly susceptible.13,14

A gummy smile can be caused by a number of factors, including hyperactive upper lip muscles such as the levator labii superioris, levator labii superioris alaeque nasi, levator anguli oris, depressor septi, zygomatic major, and zygomatic minor. Other potential causes involve altered tooth eruption, dentoalveolar extrusion, and vertical maxillary excess. A proper diagnosis, often classified as low, moderate, or high gingival exposure using the Goldstein classification, is required for effective treatment.

Gummy smiles can be treated using a variety of surgical and non-surgical procedures. Notably, the use of Botulinum toxin (BTX) is a non-surgical method that is gaining popularity. This procedure is thought to be minimally invasive, and it provides an alternative to standard therapies.

Botulinum toxin, particularly Botulinum toxin A (BTX), is increasingly favored for patients with hyperactive upper lip elevator muscles that result in mild gingival show.12,15 The injection site, named as the Yonsei site, strategically targets the core of the triangle formed by the levator labii superioris, zygomatic minor, and levator labii superioris alaeque nasi (figure3). Injections at this point cause muscle paralysis, which reduces upper lip lift and muscle contractibility. As a result, there is a decrease in gingival show when smiling.16,17

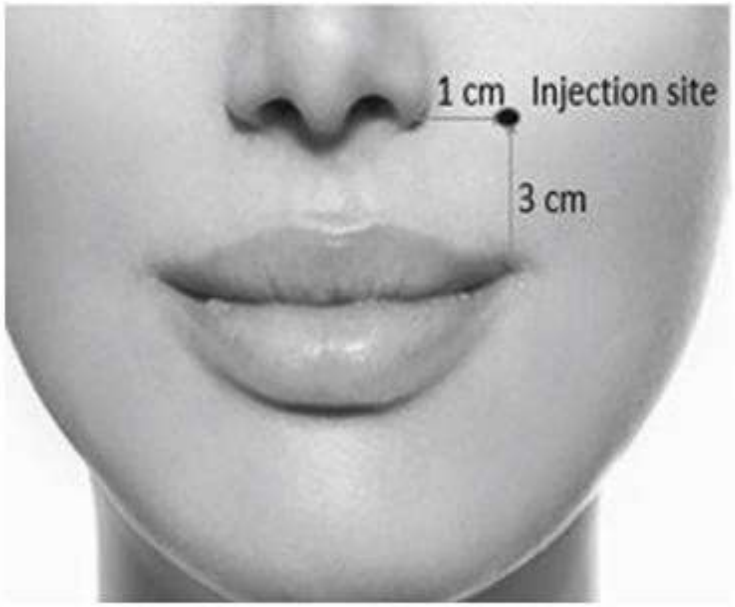

Figure 3: Yonsei point, a point located at the centre of a triangle formed by levator labii superioris, levator labii superioris alaeque nasi and zygomaticus minor. Picture courtesy Festi Lova et al, 2018

Bruxism:

Bruxism is a parafunctional habit that causes excessive tooth grinding due to masticatory muscle hyperactivity. Injections of botulinum toxin type A into the temporalis and masseter muscles hinder nerve impulse transmission to these muscles, resulting in temporary paralysis of these muscles and assisting in the successful treatment of individuals with severe bruxism. FIGURE 418

Van Zandijcke and Marchau (1990)[12] injected 100 U of a botulinum toxin Type A injection into the masseter and temporalis muscle after which he saw significant reduction in severe bruxism symptoms. Ivanhoe et al (1997)[19] injected 200 U of botox injection into the masseter muscle and saw an improvement in theraupeutic response after 19 weeks.

It has an advantage over other treatment alternatives such as oral splints, behavioural techniques, and muscle relaxants for cases with sleep bruxism.It is a non-invasive conservative method that lowers tooth wear and protects against early implant loss.20,21

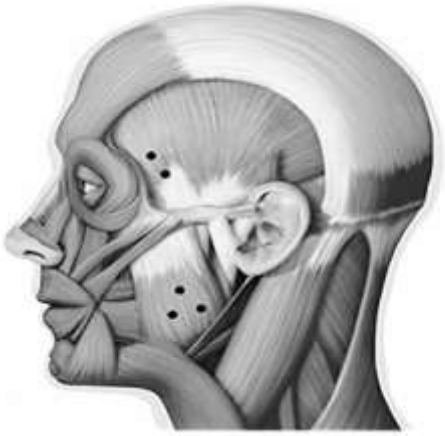

Figure 4: Site of injection in masseter and temporalis muscle for treatment of bruxism. Picture courtesy M.Spósito et al,2014

Dental implants:

Overloading of the masticatory muscles can prevent or impair implant osseointegration and/or cause micro-fractures at the bone-implant interface as it exceeds the bone physiologic threshold [22]. Botulinum toxin type A injections to the masticatory muscles can be therapeutically useful by allowing implants to achieve better unhindered osseointegration and heal in a more stable environment.

Black triangles:

Dermal fillers are injected into the interdental papilla between the teeth or dental implants to puff up the tissue and seal the black triangles. (figure 5)[23] Daines SM and Williams EF. (2013) [23,24] discovered that using interdental soft tissue fillers in conjunction with Botox injections filled in the black triangles and that the effect lasted 3-4 months.[24]

Figure 5: treatment of black triangles using botox, site of injection between the interdental papillae. Picture courtesy : http://www.dentaltown.com/dentaltown.

Other uses of botox in dentistry25

1. Temporomandibular joint disorders
2. Sialorrhea
3. Masseter hypertrophy
4. Facial aesthetics
5. Trigeminal neuralgia
6. Toothache
7. Orthodontic treatments (in pathologic clenching)
8. Mandibular Spasm
9. Oromandibular Dystonia
10. Correction of lip deformity
11. Oral surgery (in treatment of fractures)
12. Prosthodontic considerations (in new denture wearers)

Adverse effects of botox 26

1. Temporary side effects such as fever, palpitations, tingling sensations, and nausea that normally go away after 1-2 days.
2. Partial temporary weakening of the injected muscle
3. Muscle soreness for a few days following injection
4. If Botox is administered over an extended period of time, it may produce muscular atrophy, which is reversible if the Botox therapy is stopped.
5. Localised edema near the injection site

6. Mild, localised, and temporary headache
7. Ecchymosis that lasts 3 to 10 days
8. Numbness and parasthesia are symptoms of this condition.
9. Myalgias and mild malaise
10. Vomiting on occasion

Contraindications 25

1. Patients who are psychologically unstable and have unrealistic expectations
2. Patients who rely on intact facial movements and expressions for a living (for example, actors, singers, musicians, and media figures)
3. Neuromuscular disorder patients (Myasthenia gravis, Eaton-Lambert syndrome)
4. Patients who are allergic to either of the Botox A or B
5. Patients taking drugs such as aminoglycosides, penicillamine, quinine, and calcium blockers, which interfere with neuromuscular impulse transmission and potentiate the effects of Botox.
6. patients who are pregnant or lactating.

Conclusion

the integration of Botox in periodontics represents a dynamic and minimally invasive approach to addressing various orofacial concerns. The therapeutic benefits of Botulinum toxin A, coupled with its safety and reversibility, make it an appealing adjunct in periodontal practice. Dentists, particularly those specialized in periodontics, can harness the advantages of Botox to enhance patient outcomes, providing not only functional improvements but also aesthetic benefits. As the field continues to evolve, proper training and continued education become essential for periodontists to navigate the nuanced application of Botox, ensuring its effective integration into comprehensive treatment plans. The versatility of Botox in periodontics underscores its potential to contribute to a holistic approach in optimizing oral health and patient satisfaction.

Table 1: Research investigations into the effectiveness of Botox in managing bruxism.

SR NO.	AUTHORS	INJECTED MUSCLE	TYPE OF TOXIN	DOSAGE (MU)	OUTCOME
1.	van Zandijcke et al., 1990 [12]	Masseter Temporalis	Toxin hemagglutin in complex of BTX-A	25	Marked reduction
2.	Ivanhoe et al.,1997[19]	Masseter Temporalis	BTX-A	50	Complete recovery
3.	Watts et al., 1999 [27]	Masseter	BTX-A	50	Reduction in bruxism
4.	Tan et al., 2000 [28]	Masseter	Botox	61.7± 11.1	Marked improvement
5.	See and Tan, 2003 [29]	Masseter	Dysport	50	Great improvement
6.	Manzano et al., 2004 [30]	Masseter Temporalis	BTX-A	150–75	Significant decrease in bruxism
7.	Nash et al.,2004 [31]	Masseter Temporalis	BTX-A	25–50	Great improvement
8.	El-Maaytah et al., 2006 [32]	Masseter Temporalis	Botox	Total of 100 U	Great improvement
9.	Monroy and da Fonseca, 2006 [33]	Masseter	Botox	15	Improvement
10.	Guarda- Nardini et al., 2008 [34]	Masseter Temporalis	Botox	20–30	Marked improvement
11.	Lee et al.,2010 [35]	Masseter Temporalis	Dysport	80	Reduction in frequency
12.	Andrea Santamato et al.,2010 [36]	Masseter Temporalis	BTX-A	25-40	decrease in bruxism symptoms
13.	Young Joo Shim et al., 2014 [37]	Masseter Temporalis	BTX-A	25	Reduced symptoms of sleep

					bruxism for a month
14.	Long-dan Zhang et al, 2016 [38]	Masseter	BTX-A	Not specified	effective in reducing the occlusal force, but psychological intervention is also needed
15.	Hyun-Suk Kim et al.,2016 [39]	Masseter Temporalis	dysport	500	pain relief and improved masticatory functions after the treatment.
16	Hessa Al-Wayli,2017 [40]	Masseter	BTX-A	20	Reduction in the mean pain score and number of bruxism events
17.	Jadhao et al., 2017 [41]	Masseter Temporalis	BTX-A	20-30	Marked improvement and decrease in bruxism symptoms
18.	Hatice Hosgor et al., 2020 [42]	Masseter Temporalis	dysport	100-150 IU	Marked improvement
19.	Zaed Ghassan Shehri et al., 2022 [43]	Masseter	BTX-A	10	Marked improvement and decrease in bruxism symptoms
20.	Bok Ki Jung et al.,2023 [44]	Masseter	praBTX-A	15-30	relieve bruxism symptoms

ons into the effectiveness of Botox in immediate loading of implants

SR NO.	AUTHOR	INJECTED MUSCLE	TYPE OF TOXIN	DOSAGE [MU]	OUTCOME
1.	Eitan Mijiritsky et al., 2016 [45]	Masseter Temporalis	dysport	70-90	Improvement in results in immediate loading of implants
2.	Sara El Shafei et al., 2022 [46]	Masseter	botox	30 IO	Temporary reduction in biting force percentage led to decreased bone changes around placed implants supporting partial overdentures

Table 3: Research investigations into the effectiveness of Botox in treatment of gummy smiles.

SR NO.	AUTHOR	TYPE OF TOXIN	MUSCLE INJECTED	DOSAGE [MU]	OUTCOME
1.	Polo M 2005 [47]	BTX-A	LLS, LLSAN, and at the overlap areas of the LLS and Zmi muscles	0.25 U per muscle bilaterally	Authors reported that treatment modality was effective,

					producing esthetic smiles.
2.	Polo M 2008[48]	BTA - A	yonsei point - LLSAN and LLS and the LLS and Zmi	2.5 UI/0.1 mL	Mean gingival display had declined from 5.2 mm (+/-1.4 mm) to 0.09 mm (+/-1.06 mm) in 2 weeks. 24 weeks, average gingival display was 2.9mm.
3.	Mazzuco R 2010 [49]	BTA - A	LLSAN and LLS and the LLS and Zmi	2.5 UI/0.1 mL	Authors reported general average improvement by 75.09%.
4.	Sucupira E 2012 [50]	BTA - A	LLSAN	3.1 UI/0.1 mL	Authors reported average satisfaction level of 9.75 on a 10-point scale
5.	Somaiah S 2013 [51]	BTX- A	LLSAN, LLS, Zmi	2.5 U R	Authors reported decrease in the gingival display (mean 75.09%). Mean gingival display decreased from 4.7 ± 1.06 from the 1st week to 0.95 ± 0.72 in the second week. After 12 weeks it was 3.7 ± 1.16mm
6.	Suber JS 2014 [52]	BTA - A	LLSAN, LLS	2 UI/0.1 mL	Authors reported 85% and 83% reduction in gingival display for both central incisor and canines.
7.	Al-Fouzan AF 2017[53]	Botox type I	GS LLS, LLSAN	not specified	Authors reported clear reduction in gingival display after 2 weeks with 96.6% reduction in GS.
8.	Pedron IG 2018 [54]	dysport	Laterally to each nostril	2 UI/1.7ml	Authors reported reduction in GS.
9.	Mostafa D 2018 [55]	BTX A	each side of the nasolabial fold, 1 cm lateral and below the nasal	4 units	Authors observed results that was extremely

			ala - Yonsei point		significant, as the exposed gingival area became 1 mm
10.	Duruel O 2019 [56]	BTA -	A Yonsei point - LLSAN and LLS and the LLS and Zmi	5 IU	Authors reported gingival display percentage of improvement for each case was calculated 100%
11.	Al Wayli H – 2019 [57]	BTX-A	Yonsei point	NOT	Authors reported that single dose of BTX-A injected at the Yonsei point was effective in the treatment of GS and achieved better results than multiple injections at various sites.
12.	Cengiz et al. 2020 [58]	BTX-A	levator labii superioris alaeque nasi and orbicularis oris muscles	5 IU	Botox injection might be effective in patients with increased gingival exposure. Showed significant improvement.
13.	Skaria et al. 2021 [59]	BTX-A	Injected on either side of the face	2.5 IU	Gingival exposure reduction from 4.93 to 3.705 mm with a decrease in the nasolabial fold
14.	Mate et 2021 al. [60]	BTX-A	LLSAN, LLS, ZM and ZMn	1.25 U	BTX-A was effective in the management of gummy smile, and the results persisted up to three months and then gradually returned to baseline post six months.
15.	Gong et al. 2021 [61]	BTX-A	bilateral single-point injections	2 IU	The effect of the average dose of Botox for the treatment of gummy smile depends on the patient's gender and the severity of the

				gummy smile rather than the etiology of the condition.		
	Yonsei points			3 IU injection	Zinc supplement prior to BT can enhance clinical efficacy and maintain its effects for a sustained amount of time.	
16. 2021 [62]	Shemais et al.	Oral zinc supplement intake prior to BTX A injection				
17. al. 2021 [63]	Rajagopal et	(BTX) A	yonsei point	Group 1: 3 units Group 2 : 5 units		Authors recommend Botulinum Toxin (BT) for gummy smile treatment, citing its safety, affordability, and ease of usage. Despite temporary results, it may serve as a prelude to surgery, especially for those with significant maxillary vertical excess.
18.	Aldhaher and Bede	BTX A 2022 [64]	Two groups: the first received 2.5 IU point per side and the second group received 5 IU of BT at two points per side	2.5 and 5 IU group injection at one	The second group showed a better result in terms of the degree of satisfaction and clinical measurements	
19.	Costa [2022] [65]	BTX A al.	levator labii superioris alaeque nasi and levator labii superioris muscles		Group 1 (G1) (2 U/point) Group 2 (G2) (2 U/point)	Expanding the number of injection points for BTX-A prolonged the impact on reducing excessive gingival display (EGD) and enhancing patient satisfaction. However, it did not escalate the intensity of the result
20.	Soris [2022] [66]	et al.	BTX-A BTX-A	Yonsei triangle	4 units	Use of this is a novel, efficient,

					harmless and minimally invasive nonsurgical therapy that can extensively improve smiles.

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Conflicts of interest:

There are no conflicts of interest.

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References:

1. Garber AD, Salama AM. The essentials of a smile: Diagnosis and treatment. Perio 2000; 1996: 11: 18-28.
2. Nayyar P, Kumar P, Nayyar PV, Singh A. Botox: broadening the horizon of dentistry. Journal of clinical and diagnostic research: JCDR. 2014 Dec;8(12):ZE25.
3. Shetty G, Mitra D, Dabak S, Shah R, Rodrigues S, Prithyani S, Vijayakar H. Botox in Periodontics–A Brief Review. International Journal for Advance Research and Development. 2017;2(12):27-32.
4. Jankovic J. Botulinum toxin: State of the art. Movement Disorders. 2017 Aug;32(8):1131-8.
5. Kattimani V, Tiwari RVC, Gufran K, Wasan B, Shilpa PH, Khader AA. Botulinum Toxin Application in Facial Esthetics and Recent Treatment Indications. J Int Soc Prev Community Dent. 2019; 9(2): 99-105.
6. Silberberg N, Goldstein M, Smidt A. Excessive gingival display - etiology, diagnosis and treatment modalities. Quintessence Int. 2009; 40(10): 809-18.
7. Azam A, Manchanda S, Thotapalli S, Kotha SB. Botox Therapy in Dentistry: A Review. J Int Oral Health. 2015; 7 (Suppl 2): 103-5.
8. Xu-Dong Ding, Wei Wang, Zhi-Gang Ding, Yan-Ping Liu, Jing Zhong, and Hua-Xian Chen . Impact of Botox-A SNAP-25 protein expression and the mechanism of inhibitory neurotransmitter imbalance in chronic sciatic nerve pain rat model. Exp Ther Med. 2017 Jun; 13(6): 2783–6.
9. NivMor, Christropher Tang and Andrew Blitzer. Temporomandibular Myofacial Pain Treated with Botulinum Toxin Injection. Toxins. 2015; 7: 2791-800.
10. Christine M Cheng. Cosmetic use of botulinum toxin type A in the elderly. Clin Interv Aging. 2007 Mar; 2(1): 81–3.
11. Sanjeev Srivastava, Smriti Karbhanda,U S Pal,Vinit Shah.Applications of botulinum toxin in dentistry: A comprehensive review. Natl J Maxillofac Surg. 2015 Jul-Dec; 6(2):152–9.
12. Van Zandijcke M, Marchau MM. Treatment of bruxism with botulinum toxin injections. J Neurol Neurosurg Psychiatry. 1990;53(6):530
13. Peck S, Peck L, Kataja M. The gingival smile line. Angle Orthodont. 1992; 62(2): 91-100. 30.
14. Polo M. Botulinum toxin type A in the treatment of excessive gingival display. Am J Orthod Dentofacial Orthop. 2005; 127(2): 214-8
15. . Hwang WS, Hur MS, Hu KS, Song WC, Koh KS, Baik HS et |al. Surface anatomy of the lip elevator muscles for the treatment of gummy smile using botulinum toxin. Angle Orthod. 2009; 79 (1): 70-7
16. . Cersosimo MG, Bertoti A, Roca CU,Micheli F. Botulinum toxin in a case of hemimasticatory spasm with severe worsening during pregnancy. Clin Neuropharmacol. 2004; 27(1): 6-8.33.
17. Blitzer A, Brin MF, Greene PE, Fahn S. Botulinum toxin injection for the treatment of oromandibular dystonia. Ann Otol Rhinol Laryngol. 1989; 98(2): 93-7.
18. Bansal A, Jain M, Joshi M, Agarwal D. Botox in Dentistry: The Healing Side of a Poison. J Adv Med Dent Scie. 2014; 2 (1):95-99.
19. Ivanhoe CB, Lai JM, Francisco GE. “Bruxism after brain injury: Successful treatment with botulinum toxin-A”. Arch Phys Med Rehabil 1997; 78: 1272-3.
20. . Tan EK, Jankovic J. Treating severe bruxism with botulinum toxin. J Am Dent Assoc. 2000; 131: 211-6.

21. 44. Tintner R, Jankovic J. Botulinum Toxin Type A in the Management of Oromandibular Dystonia and Bruxism. Scientific and Therapeutic Aspects of Botulinum Toxin. Lippincott Williams & Wilkins, Philadelphia PA. 2002; 343-50
22. Nishimura K, Itoh T, Takaki K, et al. Periodontal parameters of osseointegrated dental implants: A four-year controlled follow-up study. Clin Oral Implants Res.1997;8(4):272-78
23. Freund B, Finkelstein I and Ko G. "Review of the applications of Botulinum Toxin and Tissue Fillers in Dental Practice". 2015;3:1-16
24. Daines SM, Williams EF. "Complications associated with injectable soft-tissue fillers: a 5-year retrospective review". JAMA Facial Plast Surg. 2013;15:226-31.
25. Bhat PR, Janiani P, Trasad VA. Botox: An advancement in dentistry: An overview. AOHDR. 2018;1:1-5.
26. Sinha A, Hurakadli M, Yadav P. Botox and derma fillers: The twin-face of cosmetic dentistry. International Journal of Contemporary Dental and Medical Reviews. 2015 Feb;2015:131214.
27. Watts MW, Tan EK, Jankovic J. Bruxism and cranial-cervical dystonia: is there a relationship? J Craniomandib Pract. 1999;17:196–201.
28. Tan EK, Jankovic J, Ondo W. Bruxism in Huntington's disease. Mov Disord. 2000;15:171–3.
29. See SJ, Tan EK. Severe amphethamine-induced bruxism: treatment with botulinum toxin. Acta Neurol Scand. 2003;107:161–3.
30. Manzano FS, Granero LM, Masiero D, dos Maria TBR. Treatment of muscle spasticity in patients with cerebral palsy using BTX-A: a pilot study. Spec Care Dentist. 2004;24:235–9.
31. Nash MC, Ferrell RB, Lombardo MA, Williams RB. Treatment of bruxism in Huntington's disease with botulinum toxin. J Neuropsychiatry Clin Neurosci. 2004;16:381–2.
32. El Maaytah M, Jerjes W, Upile T, Swinson B, Hopper C, Ayliffe P. Bruxism secondary to brain injury treated with botulinum toxin-A: a case report. Head Face Med. 2006;2:41.
33. Monroy PG, da Fonseca MA. The use of botulinum toxin-A in the treatment of severe bruxism in a patient with autism: a case report. Spec Care Dentist. 2006;26:37–9.
34. Guarda-Nardini L, Manfredini D, Salamone M, Salmaso L, Tonello S, Ferronato G. Efficacy of botulinum toxin in treating myofascial pain in bruxers: a controlled placebo pilot study. Cranio. 2008;26:126–35.
35. Lee SJ, McCall WD, Kim YK, Chung SC, Chung JW. Effect of botulinum toxin injection on nocturnal bruxism: a randomized controlled trial. Am J Phys Med Rehabil. 2010;89:16–23.
36. Santamato A, Panza F, Di Venere D, Solfrizzi V, Frisardi V, Ranieri M, Fiore P. Effectiveness of botulinum toxin type A treatment of neck pain related to nocturnal bruxism: a case report. Journal of Chiropractic Medicine. 2010 Sep 1;9(3):132-7.
37. Shim YJ, Lee MK, Kato T, Park HU, Heo K, Kim ST. Effects of botulinum toxin on jaw motor events during sleep in sleep bruxism patients: a polysomnographic evaluation. Journal of Clinical Sleep Medicine. 2014 Mar 15;10(3):291-8.
38. Zhang LD, Liu Q, Zou DR, Yu LF. Occlusal force characteristics of masseteric muscles after intramuscular injection of botulinum toxin A (BTX–A) for treatment of temporomandibular disorder. British Journal of Oral and Maxillofacial Surgery. 2016 Sep 1;54(7):736-40.
39. Kim HS, Yun PY, Kim YK. A clinical evaluation of botulinum toxin-A injections in the temporomandibular disorder treatment. Maxillofacial plastic and reconstructive surgery. 2016 Dec;38:1-5.
40. Al-Wayli H. Treatment of chronic pain associated with nocturnal bruxism with botulinum toxin. A prospective and randomized clinical study. Journal of clinical and experimental dentistry. 2017 Jan;9(1):e112.
41. Jadhao VA, Lokhande N, Habbu SG, Sewane S, Dongare S, Goyal N. Efficacy of botulinum toxin in treating myofascial pain and occlusal force characteristics of masticatory muscles in bruxism. Indian Journal of Dental Research. 2017 Sep 1;28(5):493-7.
42. Hosgor H, Altindis S. Efficacy of botulinum toxin in the management of temporomandibular myofascial pain and sleep bruxism. Journal of the Korean Association of Oral and Maxillofacial Surgeons. 2020 Oct 31;46(5):335-40.
43. Shehri ZG, Alkhouri I, Hajeer MY, Haddad I, Hawa MH, Sh Z. Evaluation of the efficacy of low-dose botulinum toxin injection into the masseter muscle for the treatment of nocturnal bruxism: A randomized controlled clinical trial. Cureus. 2022 Dec 4;14(12).
44. Jung BK, Park H, Cheon YW, Yun IS, Choi JW, Kim HJ, Lee MY, Kang BS, Kang TJ. Clinical investigation of botulinum toxin (prabotulinumtoxin A) for bruxism related to masseter muscle hypertrophy. Journal of Cranio-Maxillofacial Surgery. 2023 May 27.
45. 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. Journal of Craniofacial Surgery. 2016 May 1;27(3):668-70.
46. El Shafei S, Raafat S, Amin A. Botilinium Toxin Injection, A Potentially Effective Method For Preventing Implant Failure In Patients With Bruxism. Egyptian Dental Journal. 2022 Jul 1;68(3):2561-70.
47. Bas B, Ozan B, Muglali M, Celebi N. Treatment of masseteric hypertrophy with botulinum toxin: a report of two cases, Med. Oral Patol Oral Cir Bucal. 2010; 15 (4): 649-52.
48. Polo M. Botulinum toxin type A (Botox) for the neuromuscular correction of excessive gingival display on smiling (gummy smile). Am J Orthod Dentofacial Orthop. 2008; 133(2): 195-203.

49. Mazzuco R, Hexsel D. Gummy smile and botulinum toxin: a new approach based on the gingival exposure area. J Am Acad Dermatol. 2010; 63(6): 1042-51
50. Sucupira E, Abramovitz A. A simplified method for smile enhancement: botulinum toxin injection for gummy smile. Plast Reconstr Surg. 2012;130(3): 726-28.
51. Sanju Somaiah MK, Muddaiah S, Shetty B, Vijayananda KM, Bhat M, Shetty PS. Effectiveness of botulinum toxin A, in unraveling gummy smile: A prospective clinical study. APOS Trends Orthod. 2013; 3: 54-8.
52. Suber JS, Dinh TP, Prince MD, Smith PD. On a botulinum toxin A for the treatment of a "gummy smile". Aesthet Surg J. 2014; 34(3): 432-70
53. Al-Fouzan AF, Mokeem LS, Al-Saqat RT, Alfalah MA, Alharbi MA, Al-Samary AE. Botulinum Toxin for the Treatment of Gummy Smile. J Contemp Dent Pract. 2017; 18(6): 474-8.
54. Pedron IG, Mangano A. Gummy Smile Correction Using Botulinum Toxin with Respective Gingival Surgery. J Dent Shiraz Univ Med Sci. 2018; 19(3): 248 -52
55. Mostafa D. A successful management of sever gummy smile using gingivectomy and botulinum toxin injection: A case report. Int J Surg Case Rep. 2018; 42: 169-74
56. . Duruel O, Ataman-Duruel ET, Tözüm TF, Berker E. Ideal Dose and Injection Site for Gummy Smile Treatment with Botulinum Toxin-A: A Systematic Review and Introduction of Case Study. Int J Periodontics Restorative Dent. 2019; 39(4): e167-e173
57. Al Wayli H. Versatility of botulinum toxin at the Yonsei point for the treatment of gummy smile. Int J Esthet Dent. 2019; 14(1): 86-95.
58. Cengiz AF, Goymen M, Akcali C. Efficacy of botulinum toxin for treating a gummy smile. American Journal of Orthodontics and Dentofacial Orthopedics. 2020 Jul 1;158(1):50-8.
59. Skaria J, Hegde N, George PP, Michael T, Sebastian J. Botulinum toxin type-A for the treatment of excessive gingival display on smiling. The Journal of Contemporary Dental Practice. 2021 Jan 20;21(9):1018-21.
60. Mate PP, Nilesh K, Joshi A, Panda A. Clinical and electromyographic evaluation of botulinum toxin type A in the treatment of gummy smile: A prospective clinical study. Journal of dental research, dental clinics, dental prospects. 2021;15(2):122.
61. Gong X, Huang H, Gu C, Li F, Zou L, An Y, Han X, Tang Z. Individual factors of botulinum type A in treatment of gummy smile: a prospective study. Aesthetic Surgery Journal. 2021 Jul 1;41(7):NP842-50.
62. Shemais N, Elarab AE, ElNahass H. The effect of botulinum toxin A in patients with excessive gingival display with and without zinc supplementation: randomized clinical trial. Clinical oral investigations. 2021 Nov;25(11):6403-17.
63. Rajagopal A, Goyal M, Shukla S, Mittal N. To evaluate the effect and longevity of Botulinum toxin type A (Botox®) in the management of gummy smile–A longitudinal study upto 4 years follow-up. Journal of oral biology and craniofacial research. 2021 Apr 1;11(2):219-24.
64. Aldhaher HA, Bede SY. Comparison of two botulinum toxin injection methods for treatment of excessive gingival display. Journal of Craniofacial Surgery. 2022 Jan 1;33(1):e65-8.
65. Costa AB, Romansina D, Ramalho J, Pereira P, Tedesco TK, Morimoto S, Gonçalves F, Ramalho KM. Botulinum toxin A in the management of a gummy smile: a clinical controlled preliminary study. Aesthetic Surgery Journal. 2022 Apr 1;42(4):421-30.
66. Soris BA, Shenoy KV, Ramadorai A, Kumar CS, Marimuthu L. Botulinum Toxin-A in the Treatment of Excessive Gingival Display: A Clinical Study. Journal of maxillofacial and oral surgery. 2022 Mar:1-7.