

Correction of Gummy Smile using Botulinum Toxin

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Abstract

BOTOX is a neurotoxin used in the management of dystonia as it blocks Ach release resulting in temporary muscle paralysis. It could be used for correction of gummy smile resultant from over functioning elevator muscles of the upper lip.

The current study aimed to investigate botulinum toxin as a treatment modality of patients with gummy smile.

This study enrolled 37 patients; gingival display was assessed as the vertical distance from the gingival zenith of the upper central incisor to the upper lip inferior border.

Before Botox, the gingival display during smile ranged between 6-9 mm and 5-7 mm at the incisor and buccal regions, respectively. One week after Botox administration, a significant reduction in gingival display was observed. During smiling, the mean gingival display between maxillary central incisors and upper lip was approximately 1.5 ± 0.2 mm. In addition, the gingival display at the incisor and the buccal regions was ranged between 1.2 to 2 mm and 1-1.6 mm, respectively.

Botulinum toxin injection is simple, effective, painless, conservative way for correction of gummy smile, and achieving high patient satisfaction. It can be used for subjects with excessive gingival display without invasive surgical procedures.

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Introduction

The smile is an essential constituent of an individual's attractiveness and socialization capability in the society. It is a central element in the face expression. A smile analysis can be through assessing the ensemble of its components at rest and during movement.¹ Lips, teeth and gingiva are the chief structures affecting the smile. The formation of dental esthetics is governed mainly by the maxillary incisors. Position, size, and alignment of these

incisors, as well as the gingival line, affect the smile's esthetics.² One of the most common reasons for seeking orthodontic treatment is excessive maxillary gingival display upon smiling (gummy smile or high-smile line)², which is often displeasing (Figure 1).

Normally, the maxillary gingival display ranges between 1-2 mm. When this gingival display exceeds 4 mm the smile esthetic is negatively affected.³ An ideal smile displays the harmony between the teeth, gum, and lips.⁴ Causes of gummy smile include delayed passive eruption, short clinical crowns or upper lip, excess vertical maxillary, dentoalveolar extrusion, hypermobile upper lip, and upper lip elevators hyper function.^{4,5} Such conditions were treated by interventional invasive procedures such as muscle resection, and crown lengthening.⁶

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Botulinum toxin type A (BOTOX), is one of eight neurotoxins released by Clostridium Botulinum (C. Botulinum).⁷ This protein was used for various dystonias as it interferes with neural transmission by hindering the acetylcholine (Ach) release at neuromuscular junction, resulting in temporary muscle paralysis.^{7,8} Muscle weakness produced by botulinum A toxin injection usually persists for 3 months.⁷ Botox injection into upper lip elevator muscles to improve smile aesthetics was initially stated by Polo in 2005.⁹

OBJECTIVE: This study was aimed to investigate botulinum toxin as a treatment modality of patients with gummy smile.



Figure 1. Gummy smile with excessive maxillary gingival display.

Materials and methods

Ethical approval: The study was approved by the research ethics committee of Ajman University (March 2018). Informed written consents were obtained from all participants after the discussion of all the other alternative treatment modalities, benefits and possible complications of treatment with botulinum toxin.

Subjects: The study enrolled 37 patients; 3 males and 34 females, aged 19 - 41 years (Mean 30, SD \pm 7.2), presented to the Aesthetics and Dental Clinic, Medical Center, Ajman University complaining of excessive maxillary gingival display during smile, seeking for a non-surgical solution. Inclusion criteria include gummy smile with clinical evidence of hyper-functional upper lip musculature and gingival exposure greater than 3mm. Exclusion criteria included gummy smile due to skeletal, and / or dentoalveolar causes.

Methods: Gingival display was assessed as the vertical distance from the gingival zenith of the upper central incisor to the upper lip inferior

border.¹⁰ The Toxin used was Botox cosmetic® (Allergan, Irvine, CA, USA). Each vial contains: 100 Units (U) of *C. botulinum* type A neurotoxin complex, 0.9 milligrams of Sodium Chloride, and 0.5 milligrams of Albumin Human in a sterile, vacuum-dried form without a preservative. The vial was diluted with 2.5 ml of 0.9% normal saline, using 3ml disposable syringe.⁷

Before injection of Botulinum Toxin (BT), the skin surface was cleaned with normal saline, then the area dried with sterilized gauze, and then with antiseptic 70% ethyl alcohol, in order to avoid local infection. Then a topical local anaesthesia (Lidocaine 10.56%, Metro Korea Co., Ltd., Korea) was applied for 25 minutes, to reduce the discomfort of needle insertion procedure. The Botox dose used for each point of injection was 4 units (0.1ml) using 1ml disposable syringe and gauge 32 needle. The points of application were marked as shown in Figure 2, into each nasofacial groove, at the pyriform aperture mainly (1 cm from the nostril horizontally and 3 cm from the angle of the mouth vertically). The needle injection direction was perpendicular and deep until touching the bone. The patients were counselled not to lie down, move, or massage the injected area during the first 4 hours after the procedure.¹¹ Frontal photographs were taken at rest and during smiling before beginning of the treatment (T0), and one week after injection (T1) to measure the gingival display.

Statistical Analysis: Statistical analyses were performed using Statistical Package for the Social Sciences for Windows (SPSS, v. 10.0; Chicago, Ill, USA).

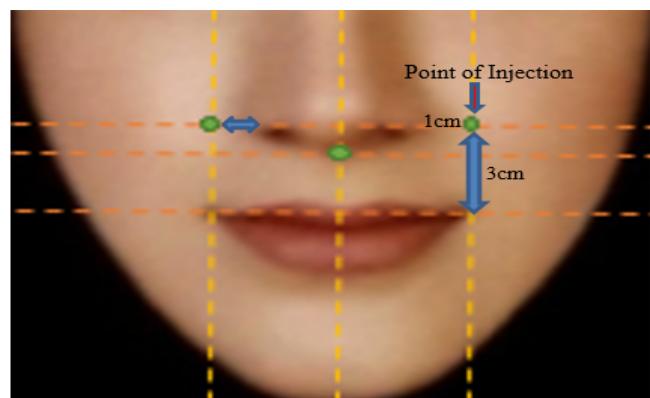


Figure 2. Illustration showing site of injection of Botox.

Results

Before Botox injection, patients presented with good general health. Clinical examination clarified a hyper functioning upper lip muscles. At a full-unopposed smile, the maxillary display of gingiva in the incisor region ranged between 6-9 mm (Mean 7, SE \pm 2), while in the buccal region, it ranged between 5-7 mm (Figure 3 a, b). There were significant differences in bruxism activity.

One week after Botox administration, a significant reduction in the maxillary display of gingiva was observed. During smiling, the mean maxillary display of gingiva was approximately 1.5 ± 0.2 mm. It ranged from 1.2 to 2 mm in the incisor region, and 1-1.6 mm in the buccal region (Figure 4 a, b).



a



b

Figure 3 a, b: Gingival display during smiling before the application of Botox cosmetic®.

Nearly all the patients (97.5%) were pleased and satisfied with the results, which lasted for almost 24 weeks before requiring re-injection. Two female patients (5%) were happy with the results but commented on a strange sensation in the upper lip area and that the vermillion (red part) of the upper lip turned under slightly giving the upper lip a slightly shorter appearance, plus slight lisping in speech. Only one patient (2.5%) disliked the treatment with the

botulinum toxin, in spite of her good results and appearance.



a



b

Figure 4 a, b: Gingival display during smiling after the application of Botox cosmetic®.

Discussion

The facial muscles responsible for the upper lip elevation and lateral retraction upon smiling are Levator Labii Superioris (LLS), Levator Labii Superioris Alaeque Nasi (LLSAN), zygomaticus minor (Zm), risorius, zygomaticus major (ZM), and the depressor septi nasi muscle. These muscles cooperate with the orbicularis oris muscle for the production of a smile. Hyper function of these muscles results in excessive maxillary display of gingiva which is referred to as Gummy smile.^{10,12}

Botulinum toxin type-A (Botox) inhibits ACh release via binding of its light chain with the proteins responsible for Ach vesicles fusion to the cell membrane of the nerve terminals (as synaptosomal associated protein (SNAP) 25, syntaxin and vesicle associated membrane protein) and thus prevents the release of Ach into the neuromuscular junction (the space between the motor nerve and the muscle).⁸ It is used

since long time ago to antagonize excessive muscle contraction.¹³ Treatment of the gummy smile with Botox injection is considered simple, safe, rapid, painless, non-surgical procedure.^{10,12}

The efficacy and influence of Botox, injected in different muscles with different doses, for the management of gummy smiles have been reported by Polo.^{9,14} This botulinum toxin can cause attenuation of the contractility of lip levator muscles without any surgical interference. Thus it could be an alternative way for treatment of hyper functional muscle-induced gummy smile.⁹ They reported that the mean maxillary display of gingiva was 5.3 mm before the injection and decreased to 0.1 mm after Botox injection by 2 weeks.⁶ However, researches related to this subject are inadequate, and the majority of the published articles are case reports.

The present study aimed to show the effectiveness of Botulinum Toxin (Botox) injection in case of Gummy smile. Before treatment (injection), the maxillary display of gingiva ranged from 6 to 9 mm in the incisor region, and 5–7 mm in the buccal region the gum. There were significant ($p= 0.002$) differences in bruxism activity.

A significant decrease in the maxillary display of gingiva was observed after one week of Botox administration. During smiling, the mean maxillary display of gingiva was approximately 1.5 ± 0.2 mm, with a range from 1.2 to 2 mm in the incisor region, and 1–1.6 mm in the buccal region the gum.

In agreement with our results, other researchers have reported a significant reduction in gingival display and patient satisfaction with Botox injection.^{15–21} Mazzucco R. and Hexsel D. (2010)¹⁵ have noticed marked reduction in the gingival display on using Dysport (botulinum toxin A, Ipsen Biopharm Limited. Wrexham, UK). They have noticed marked decline in the degree of gingival display in all patients participating in the study, and the general average improvement attained was 75.09%. A similar result was achieved by Gupta and Kohil (2019)²⁰, when they used BTX-A on 10 patients.

Al-Fouzan et al., (2017)¹⁹ have stated that several applications of botulinum toxin resulted in reduced gum exposure even after the effect of the drug has declined. They have explained that by the decrease in muscle strength after several sequential botulinum toxin injection making it last for a longer.

All of these results indicate that Botox therapy is a promising novel additions to the dentist's arsenal for many orofacial and cosmetic corrections. It provides a conservative, simple, quick, reversible, painless and minimally invasive procedure in comparison to other surgical alternatives. This procedure can be accomplished easily by general dentists with proper training. In addition, the clinical effects appear within 2–10 days after injection. This effect can last for 3–6 months.^{15,22}

Other researchers have evaluated other techniques for correction of gummy smile as positioning the vestibule more coronally²³ and crown lengthening surgery²⁴. The advantage of positioning the vestibule coronally is that the surgery is performed without reduction of the labial mucosa vertical dimension.²³ The crown lengthening surgery was carried out to expose the crown height and reduce the bony protuberance thickness.²⁴ Both procedures have reduced the excessive gingival display and improved the gummy smile too.

Conclusions

Botox injection gives satisfaction and good results for almost all the cases of gummy smile, due to the straightforward, routine, safe, painless and short, non-surgical procedure. Obtaining excellent aesthetic appearance and achieving the main objective of the study successfully in reducing the gummy smile. Botox injection can be effective in subjects with increased maxillary display of gingiva, and do not want to undergo invasive surgical procedures.

Abbreviations: BOTOX: botulinum toxin, LLSAN: Levator Labii Superioris Alaeque Nasi, OO: Orbicularis Oris, LLS: Levator Labii Superioris, U: Units, BTX: BOTOX, Ach: Acetyl Choline, Zm: Zygomatic minor, ZM: Zygomatic Major, BT: Botulinum Toxin.

Declaration of Interest

Authors declare that there is no conflict of interest or financial support associated with this study.

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