

Botulinum Toxins and Lip Repositioning Surgery with Repeated Botulinum Toxin Injection: A Combined Approach for Gummy Smile Treatment

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Summary: This study was conducted to evaluate the longevity and efficacy of neurotoxin injection before lip repositioning surgery in addition to reinjection of two sustaining doses along three different postoperative intervals (2, 4, and 8 months). This experimental study included 10 female patients who had a gummy smile resulting from upper lip hypermobility or short upper lip. Preoperative measurements were taken during spontaneous smiling; the interlabial distance and the amount of gingival exposure. IncoBotulinum Toxin A was injected into the elevator muscles of the upper lip followed by performing the lip repositioning surgery after 2 weeks of IncoBotulinum Toxin A injection. IncoBotulinum Toxin A was then reinjected at three different postoperative intervals (2, 4, and 8 months). All patients were followed up at 14 days, 4 months, 8 months, and 12 months. Postoperative measurements at 14 days follow-up showed a significant reduction in the amount of gum exposure and in the interlabial distance during smiling. Both changes remained stable up to 1 year, despite the minimal relapse that was observed; all the patients reported a high degree of satisfaction. Combining neurotoxins before and after the lip repositioning surgery may provide long-lasting results up to 1 year and better stability for the success rate of the surgery, where the use of each approach alone (IncoBotulinum Toxin A alone/surgery alone) may offer a temporary improvement. (*Plast Reconstr Surg Glob Open* 2023; 11:e5198; doi: 10.1097/GOX.0000000000005198; Published online 15 August 2023.)

INTRODUCTION

Excessive gingival show is considered to be not aesthetically pleasing in smile aesthetics.^{1,2} For a patient considered to have an excessive gingival display, this means that the amount of gum exposure, measured during spontaneous smiling, should be 4 mm or more.² Short upper lip, hypermobility of the elevator muscles of the upper lip, vertical maxillary excess, altered passive eruption, and other factors may contribute to a gummy smile.^{3,4}

Lip repositioning surgery is a technique that aims to reduce the depth of the vestibule by removing a strap of epithelium and suturing the labial mucosa to the mucogingival junction; therefore, this new proposed position should limit the muscle pull of the elevator muscles of the

lip.^{5,6} This procedure is thought to be effective in treating gummy smile and to be a better alternative to orthognathic surgery in treating mild to moderate cases; however, relapse is one of the main drawbacks of this approach.^{7,8} Several modifications have been proposed for upper lip repositioning surgery.^{5,6,9} Botulinum toxin, on the other hand, can be injected into the elevator muscles of the lip to provide temporary relaxation for the muscles, thus providing a temporary treatment for gummy smile.¹⁰

The purpose of this study was to propose a new approach of combining both neurotoxins and lip repositioning surgery to solve the issue of the muscle pull from the elevator muscles of the lip, thus providing more stable results for the lip repositioning surgery and decreasing the relapse rate.

MATERIALS

Ten White female patients aged 25–37 years old complained of the excessive display of gums during their

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Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

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smile. Histories from all patients, including past and present medical and dental histories, were taken; extra-oral examination of the lip architecture was performed followed by intraoral examination of the gingiva and associated peridontium. Only patients with upper lip hypermobility and short upper lip were included in the study.

The upper lip length was assessed by an endodontic ruler, where the measurement was taken by recording the distance from the subnasale to stomion superiors; the normal upper length should range from 20 to 24 mm. Upper lip hypermobility was assessed by subtracting the incisal exposure at rest from the dentogingival exposure during spontaneous smiling.

Preoperative assessment was performed by measuring both the amount of gingival show and the interlabial distance at involuntary smile digitally using Adobe Photoshop Cs6 through standardized photographs. The amount of gum exposure was recorded by measuring the vertical length from the free gingival margin of the upper central incisor to the inferior border of the upper lip; on the other hand, the interlabial distance was recorded by measuring the distance between the inferior border of the upper lip and the superior border of the lower lip. Written informed consent was obtained from all patients after careful explanation of the whole procedure and the expected outcome along with the possible complications.

All patients underwent five stages for the whole treatment:

Stage 1: Xeomin injection.

Stage 2: Lip repositioning surgery after 2 weeks of Xeomin injection.

Stage 3: Xeomin injection at 2 months.

Stage 4: Xeomin injection at 4 months.

Stage 5: Xeomin injection at 8 months.

STAGE 1: XEOMIN INJECTION

Xeomin 100 unit vial (incobotulinumtoxinA, Merz Company) was diluted with a 2-mL saline free of preservative. The points for injection were chosen depending on the type of gummy smile: patients with anterior gummy smile were injected at the Yonsei point only (the Yonsei point is a point 1 cm from the ala of the nose); patients with mixed gummy smile were injected at three points bilaterally (Yonsei point, a point 1 cm above the deepest point of contraction at the nasolabial fold, and a point mid-way between the other two points). Some patients received additional points right at the vermilion border at the meeting of the orbicularis oris peripheralis and orbicularis oris marginalis. The need for this point was decided depending on the activity of the orbicularis oris muscle, which was evaluated clinically from the side view by the rolling of the red part of the lip inward toward the labial vestibule during involuntary smiling.

All injections were administered superficially (depth: 2 mm) using a BD micro fine ultra plus insulin syringe 100 unit; the dose for the injection was determined depending on the amount of gum exposure. The Yonsei point received a dose equal to the amount of gum exposure

Takeaways

Question: Does injecting neurotoxins before and after the lip repositioning surgery provide long-lasting results in treating gummy smile patients?

Findings: The proposed technique offers stable results up to 1 year.

Meaning: The combined use of neuromodulators and lip repositioning surgery might provide long-lasting results for treatment of excessive gingival display.

(eg, 4 mm gingival display = 4 units of Xeomin). Half the dose was injected at the other two points in case of mixed gummy smile cases (eg, 4 mm gingival display = 4 units of Xeomin at Yonsei, 2 units at mid-point, and 2 units at the third point, which is 1 cm above the deepest point of contraction at the nasolabial fold). For those patients who required additional points at the vermilion border, 1 unit was injected intradermally at each side, right at the tip of the Cupid bow.

STAGE 2: LIP REPOSITIONING SURGERY AFTER 2 WEEKS OF XEOMIN INJECTION

Bilateral intraoral infraorbital block in addition to a vestibular infiltration was performed using long-acting anesthesia with a vasoconstrictor. A full-thickness flap was performed by making an inferior incision right at the mucogingival junction and a superior incision right at the mucosa, then connecting the two incisions laterally at the premolars or, in certain cases, at the area of the first molar (depending on the width of the smile), and suturing was then performed using a 5-0 Vicryl resorbable suture. (See Video [online], which shows the points for botulinum toxin injections, steps of the lip repositioning surgery, and the results of the patient after 1-year follow-up.)

The following stages were performed in the same manner as done in stage 2:

Stage 3: Xeomin injection at 2 months.

Stage 4: Xeomin injection at 4 months.

Stage 5: Xeomin injection at 8 months.

POSTOPERATIVE CARE

After IncoBotulinum Toxin A injection, all patients were instructed not to touch their face, put on make up, bend forward, or wash their face for the first hour. As for the postoperative care after lip repositioning surgery, all patients were strictly instructed not to get near their lips and to avoid excessive mouth opening, kissing, going to the dentist for any treatment, sucking on a straw, licking the surgical site, or trying to see it in the mirror. All patients came for revision at the following follow-up periods: 14 days after the procedure, and at 4 months, 8 months, and 12 months. Postoperative amount of gingival display and interlabial distance while smiling were recorded in all the follow-up visits. IncoBotulinum Toxin A was reinjected at 2 months, 4 months, and 8 months postoperative.

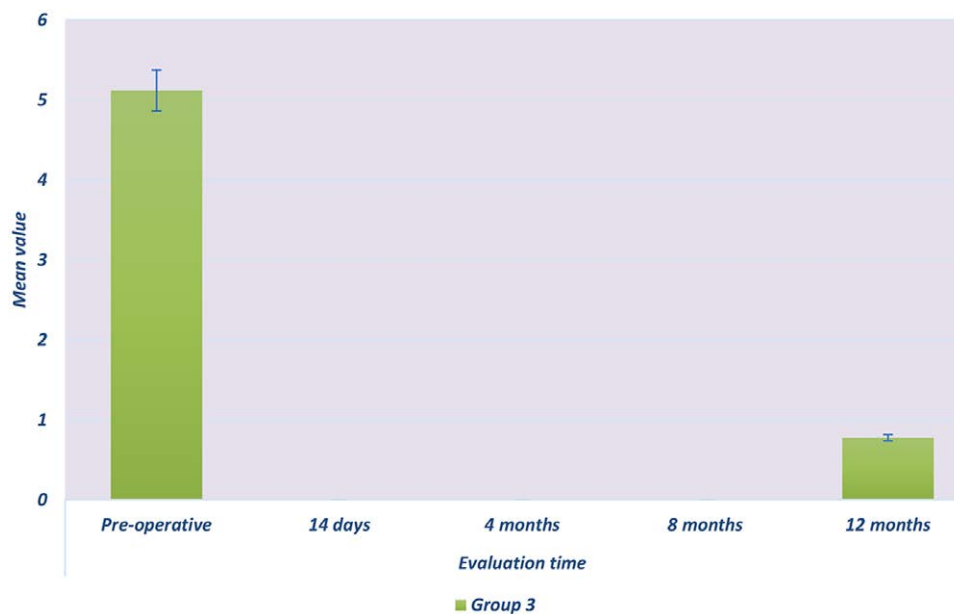


Fig. 1. Column chart showing gingival display while smiling mean values as a function of evaluation time.

RESULTS

None of the patients reported paresthesia or any serious complications after the botulinum toxin injection or the surgery; only edema was observed in all patients right after the surgery, which was controlled using medications and settled down within 1 week.

The interlabial distance and the amount of gingival display were recorded digitally using the Adobe Photoshop CS6 software program through standardized digital

photographs. Statistical analysis was conducted with the raw data obtained for evaluation (Figs. 1 and 2).

The amount of gingival display at baseline was 5.12 ± 0.52 mm. It markedly decreased after 14 days to reach zero; this change was maintained until 8 months. However, at 12 months, a slight relapse was detected, which was not noted by the patient. Regarding the interlabial distance, at 14-days follow-up, there was a marked decrease at this measurement, and a slight re-increase in

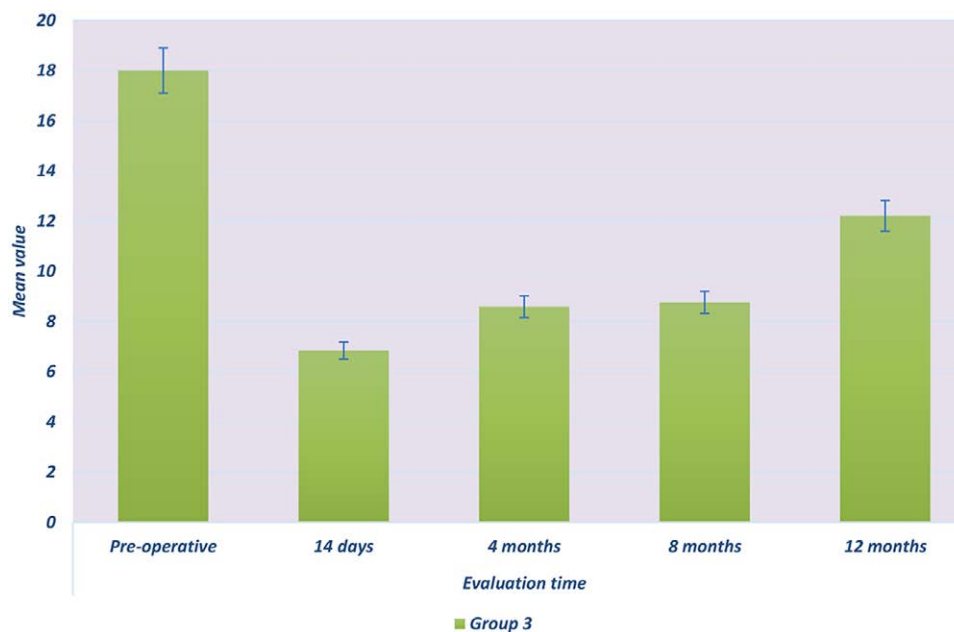


Fig. 2. Column chart showing interlabial distance while smiling mean values as a function of evaluation time.

Table 1. Mean Values and SDs of Gingival Display while Smiling (mm) Recorded as a Function of Evaluation Time

Variables	Statistics	
	Group 3	
Evaluation time	Preoperative	5.12±0.52
	14 days	0.00±0.00
	4 months	0.00±0.00
	8 months	0.00±0.00
	12 months	0.78±0.43
Statistics	P	<0.0001*

*Significant ($P < 0.05$); nonsignificant ($P > 0.05$).

Table 2. Mean Values and SDs (SD) of Interlabial Distance while Smiling (mm) Recorded as a Function of Evaluation Time

Variables	Statistics	
	Group 3	
Evaluation time	Preoperative	17.99±1.12
	14 days	6.84±1.43
	4 months	8.59±0.56
	8 months	8.76±0.56
	12 months	12.21±0.74
Statistics	P	<0.0001*

*Significant ($P < 0.05$); nonsignificant ($P > 0.05$).

the value was noted in 4 months, which remained stable until 8 months and was followed by a further increase at 12 months. By the end of the study, the patients were highly satisfied with their end result (Tables 1 and 2).

DISCUSSION

The goal of this study was to evaluate the combined approach of injection neurotoxins before and after lip repositioning surgery in offering stable results in treatment of patients with excessive gum exposure during smiling. It is worth mentioning that lip repositioning surgery is considered to be a less-invasive approach than the traditional jaw surgery due to the lower risk of complications.¹¹

Different treatment modalities have been advocated for treatment of gummy smile. The treatment modality is chosen depending on the etiological factor contributing to the problem.^{3,12} Patients with vertical maxillary excess are not ideal patients for lip repositioning surgery; thus, it is contraindicated for them.¹¹ The presence of inadequately attached gingiva in the maxillary anterior region may have a negative impact on the flap design and suturing; therefore, lip repositioning surgery may not be the best option for these patients.¹³

Neurotoxins offer a temporary improvement for gummy smile treatment, which will need a reinjection after a period of time.¹⁴⁻¹⁶ On the other hand, lip repositioning surgery is associated with a high degree of relapse due to the high muscle power of the elevator muscles of the upper lip, which affects the surgical outcome¹⁷; thus, the aim of this study was to evaluate the success rate of combining both neurotoxins (to counteract the high muscle power by relaxing it) and the surgery using fixed parameters measured digitally.

The idea of combining both techniques is because the botulinum toxin will provide muscle relaxation; thus, when the surgery is performed, there will be no tension or force on the newly proposed surgical site, which will allow better healing and maintain the new proposed vestibular position. However, once the botulinum toxin effect wears off, the muscle action will be regained, which will compromise the surgical area. This is why botulinum toxin was reinjected to prolong the muscle relaxation, thus providing more stable results by stabilizing the surgical site. The aim of the surgery is to decrease the vestibular depth, thus forming a fibrous tissue in the form of scar, which will resist muscle contraction. Neurotoxin injections will maintain this newly formed depth by blocking the force of the muscle.

Some clinicians advocated the myotomy and myectomy of the elevator muscles in addition to lip repositioning surgery as a favorable approach to avoid the relapse.^{18,19} However, we see the latter technique to be aggressive, in addition to the muscle having a high regeneration power, which will eventually cause a relapse again. In our concept, we think that the most acceptable approach until now is to relax the muscle for the longest period of time possible to help in stabilizing the results of the surgery. The repeated neurotoxin injection itself is a favorable approach for long-lasting results. All patients reported an increase at the vermilion height of the upper lip, which could contribute to the lip repositioning surgery and the botulinum toxin injection at the orbicularis oris.

Moreover, we emphasize that all our patients were followed up at a 1-year interval, and they showed good results up to this period. Further studies with a longer follow-up period will help in better assessment of our proposed technique.

CONCLUSIONS

The use of botulinum toxin as an adjunct before lip repositioning surgery may offer better healing and stable results due to the decrease of the muscle pull, thus decreasing the tension on the surgical area. Reinjecting botulinum toxin at further intervals during 2, 4, and 8 months may provide better longevity for the outcome of the procedure through a 1-year follow-up due to prolonged muscle relaxation, thus preventing the degranulation of the proposed vestibular position after the surgery.

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DISCLOSURE

The author has no financial interest to declare in relation to the content of this article.

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