Predictability in Lip Repositioning with Botulinum Toxin for Gummy Smile Treatment: A 3-Year Follow-up Case Series

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The aim of this case series was to describe the successful treatment of excessive gingival display (EGD) using a lip repositioning technique (LRT) and botulinum toxin injections (BTIs) for long-term stability. Eight patients diagnosed with EGD were enrolled. A partial-thickness horizontal incision was made from the right first molar to the left first molar along the mucogingival line, leaving the midline frenum intact. The next day, all patients received BTIs. Mean reductions in gingival display between baseline and 3, 6, 12, 18, 24, and 36 months after surgery were considered. BTIs prevent movement of the upper lip during the healing phase of the LRT, improving the results and offering long-term outcomes with a follow-up period of 3 years. Int J Periodontics Restorative Dent 2020;40:703–709. doi: 10.11607/prd.4645

Excessive gingival display (EGD), commonly called gummy smile (GS), has a prevalence of 10.57%, is more frequently seen in women, and is considered an esthetic problem that negatively affects the appearance of a person.

EGD can be managed with different techniques, depending on the amount of gingival display. When patients show an excessive growth of the maxilla, orthognathic surgery is the first option; however, as it is extremely invasive and requires hospitalization in most cases, patients look for a safe and less invasive technique. The lip repositioning technique (LRT) is the most widely used alternative option to treat EGD, but if it is not performed using myectomies, patients can present a relapse within 6 months. Surgical literature regarding LRT has reported successful results, but the vast majority of them are case reports or case series with a follow-up period of only 1 year.

The main complications reported are relapse and, in some cases, development of an asymmetrical smile. A probable explanation to these phenomena could arise from muscle contraction or movements immediately after surgery that may inhibit correct healing.

Based on these findings, the aim of this 3-year follow-up case
series was to evaluate and describe the successful treatment of EGD with a combination of LRT and botulin toxin injections (BTIs) for long-term stability. The adjunct use of BTIs will help to avoid muscle contraction to prevent movement of the upper lip during the healing phase of the LRT.

Materials and Methods

Case Selection

This prospective case series was performed between January 2015 and January 2018. All patients with a chief complaint of EGD when smiling were referred to the Department of Periodontology of the Universidad Cientifica del Sur in Lima, Peru. The study protocol was in accordance with the guidelines of Helsinki Declaration of 1975, revised in 2013.

Eight patients (seven women and one man; average age: 30 ± 5.94 years) who met the inclusion criteria were included in this case series. Inclusion criteria were as follows: 18 to 45 years of age, good oral and general health, GS ranging from 3 to 7 mm (EGD[E] subclasses 1, 2, and 3 as described by Bhola et al3), lip mobility > 8 mm, and amount of attached gingiva ≥ 3 mm.

Exclusion criteria were: smoking; pregnancy; lactation; neuromuscular diseases; diagnosis of fibromyalgia; previous use of botulinum toxin in the zone during the last 6 months; use of warfarin, platelet inhibitors, or other anticoagulants, including aspirin and nonsteroidal anti-inflammatory drugs, for 1 week prior to injection; and those with a reported history of hypersensitivity to BTIs.

Gingival display was measured, during full smile to determine the amount of tissue to be excised, with a periodontal probe (UNC, Hu-Friedy) placed along the longitudinal axis of the maxillary central incisor from the gingival zenith to the inferior border of the upper lip vermilion (Fig 1).

Surgical Technique

Session 1
Extraoral and intraoral disinfection was carried out using 0.12% digluconate chlorhexidine mouthrinse for 30 seconds. The surgical site was anesthetized with topical anesthesia containing 20% benzocaine and then by local infiltration (2% lidocaine with 1:100,000 epinephrine). All patients were treated by a single experienced periodontist (G.M.).

A partial-thickness horizontal incision along the mucogingival line was made in the labial mucosa from the maxillary right to left first molars, leaving the midline frenum intact using the Silva et al12 technique.
A parallel incision to the first incision was made. The exact amount of tissue excised was twice the amount of the EGD measured during the presurgical examination. The tissue was excised following the modified technique described by Tawfik et al.19 Finally, the two horizontal incisions were connected, and an elliptical outline was performed (Fig 2a).

After the epithelium tissue was removed, the connective tissue was sutured to the periosteum with a resorbable suture (5/0 Coated Vicryl [polyglactin 910], Ethicon) for stabilization (Fig 2b). For the mucosa, interrupted sutures (5/0 Ethilon Nylon Suture, Ethicon) were used to approximate both flaps (Fig 2c).

Session 2
The following day, all patients received BTIs. Extraoral disinfection was performed using 0.12% gluconate chlorhexidine and topical anesthesia containing 20% benzocaine. The botulinum toxin was diluted in 1.7 mL of saline according to the manufacturer’s instructions and Global Aesthetics Consensus.20 For the injections, 10-mL syringes were used with a 31-gauge, 8-mm needle. Botulinum toxin A (1 U) was injected at two points located laterally to each wing of the nose. Each side received a total of 2 U (Fig 2d).

All subjects were prescribed the same anti-inflammatory medication given prior to surgery to use for 3 days and instructed to use 0.12% chlorhexidine mouthrinse twice a day for 2 weeks. Postoperative instructions included a diet of soft foods, applying ice to the surgical site, avoiding any mechanical trauma to the treated sites, and minimizing lip movement for the following 2 weeks.

Postoperative Examination
All patients were evaluated at the Department of Periodontology of the Universidad Cientifica del Sur 1 week after surgery. Pain and discomfort were observed in patients who required a larger amount of epithelium to be removed or when the incision was made closer to the upper lip. Uneventful healing patterns were observed in all other patients.

Sutures were removed 2 weeks postoperatively. The patients were evaluated weekly for the first month and then every 3 months for the next 3 years. Follow-up examinations after 1 to 3 years revealed a reduced and stable gingival display, as seen in Figs 3 to 5.
### Statistical Analysis

For the statistical calculations, mean reductions in gingival display between baseline and 3, 6, 12, 18, 24, and 36 months after surgery were considered. All calculations were made using a Stata Statistical Software: Release 12 program (StataCorp 2011).

### Results

All subjects completed all evaluations, and at 3 years postsurgery, all showed gingival display reductions and had complete satisfaction with the surgical results. The postoperative progress was uneventful in all patients. No patients presented with loss of sensitivity or infections.

The mean preoperative (baseline) gingival display measured from the zenith of the central incisors was $4.75 \pm 1.49$ mm. The mean postoperative gingival display at 3 months after surgery was $0.5 \pm 0.75$ mm and at 36 months was $2.125 \pm 1.13$ mm (Table 1). No mean differences in gingival display were found between 24 and 36 months after surgery.

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Fig 3 Case 2. (a) Gingival display at baseline. (b) At the 3-year follow-up.

Fig 4 Case 3. (a) Gingival display at baseline. (b) At the 3-year follow-up.

Fig 5 Case 4. (a) Gingival display at baseline. (b) At the 3-year follow-up.
The mean gingival reduction was greater at 3 months after surgery (4.19 mm). At 36 months, the gingival reduction was 2.625 mm and ranged between 2 to 3 mm. No mean differences in gingival display reductions were found between 24 and 36 months after surgery (Table 2). No cases of relapse compared with baseline were found (Fig 6).

**Discussion**

All patients were satisfied with the results. No patients experienced...
postoperative complications such as infection, edema, or loss of muscle strength. All authors conclude that LRT is an excellent alternative for the treatment of EGD, which offers successful results, as documented in the literature.²,¹⁶,²¹

Kostianovsky and Rubinstein¹⁰ described the procedure for the first time, making an elliptical excision of the gingiva and suturing the edges. Since then, different modifications to the original technique have been described. This study followed the recommendations of the modified technique described by Tawfik et al,¹⁹ who recommend removing double the amount of tissue compared to the amount of gingival display (maximum 12 mm). All cases in this study showed a gingival display between 3 and 7 mm, thus the width of the tissue removed was between 6 and 12 mm.

To ensure the correct repositioning of the tissue, the present authors decided to keep the frenulum intact.¹¹,¹²,¹⁷ It was also decided to perform LRT without muscle severance to reduce morbidity, as reported by various authors.⁵,¹¹,¹²

Short-term results in the present study showed an average gingival reduction of 3.5 mm at 6 months following surgery. This was similar to the results from: the full-thickness technique performed by Abdullah et al,⁹ who concluded that LRT improved EGD by 3.08 mm; Ishida et al,²² who reported a mean gingival reduction of 3.31 ± 1.05 mm; and Tawfik et al's clinical trial,¹⁹ in which the classic technique and LRT with muscle severance were performed and offered mean reductions in EGD of 2.73 ± 1.281 mm and 3.57 ± 1.62 mm, respectively. Finally, a systematic review conducted by Tawfik et al¹⁴ concluded that LRT can achieve an average 3.4-mm improvement in gingival display (95% confidence interval: 3.0 to 3.8 mm) after 6 months.

Different techniques have been reported to avoid complications related to the reappearance of GS. The first relapse after surgery was reported by Ellenbogen and Swara,²³ where partial relapses were noticed at 3 months postoperative. They suggested the use of alloplastic pieces called spacers to prevent the reunion of the levator labii superioris.

This case series demonstrates the predictable management of EGD with a combination technique using LRT and BTI to provide long-term stability for up to 3 years. Subjects treated in the study showed an average gingival reduction between 4.19 mm and 2.625 mm at 3 and 24 months after surgery, respectively. This average gingival reduction was maintained from 24 to 36 months, providing a stable long-term result. Only three studies that evaluated the results of LRT with a follow-up greater than 1 year were found, and they only reported stability in gingival reductions up to 6 months.⁵,¹¹,²²

The technique used in the present study was based on observational findings, and the authors believe that the complications related to the relapse and reappearance of a GS may be due to the fact that the upper lip does not remain immobile during the healing process.²⁴ Alammari¹³ confirmed that the relapse may be due to the fact that muscles try to restore their preoperative activity. Following a review of the literature, the present authors decided to apply the combination technique described by Aly and Hammouda,⁷ who used BTI as an adjuvant therapy to guarantee and enhance long-term surgical results. BTI is used to prevent or reduce the contraction of the muscles responsible for lifting the upper lip²⁵ and allows the proper healing suggested by Silberstein.²⁴ The effect of BTI lasts up to 12 weeks,²⁶,²⁷ which is enough time for homogeneous and complete healing, avoiding recurrences or asymmetries as seen in other cases.⁵

The main limitation of this case series study was the number of patients and the lack of a control group. It is possible that a randomized prospective and comparative study with a larger sample size could be more useful to evaluate this modified technique and determine the beneficial action of BTI during the healing phase of the LRT. The authors strongly recommend conducting a randomized clinical trial.

Conclusions

Within the limitations of this study, these case series show that the combination of surgical lip repositioning procedure plus internal sutures to the periosteum and the use of botulinum toxin for treating GS successfully reduced the preoperative EGD in all cases, thus offering stable long-term results.
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