A Modification for Treatment of Excessive Gingival Display: Tooth-Based Lip-Repositioning Technique

Onurcem Duruel, DDS, PhD¹
Nazan Ece Erduran, DDS²
Tolga Fikret Tözüm, DDS, PhD³

Exposure of maxillary gingiva more than 3 mm while smiling is referred to as “excessive gingival display” or “gummy smile.” Various treatment options for excessive gingival display are published in the literature, including lip repositioning, crown lengthening, botulinum toxin-A injections, and orthognathic surgeries. This case report aims to present a novel approach to the lip-repositioning procedure for treatment of excessive gingival display. The patient, who visited the department to demand a more esthetic smile, was diagnosed with excessive gingival display caused by hyperactivity of upper lip muscles. Lip repositioning procedure was considered. While evaluating the patient’s smile, the amount of gingival display for each tooth region varied. A novel tooth-based modification was planned for the patient for a more precise result. No complication was noted during 10- and 30-day follow-ups. The amount of gingival display while smiling was less than 3 mm for each tooth region. The tooth-based lip-repositioning technique may provide an opportunity to more precisely treat patients with gummy smile. Int J Periodontics Restorative Dent 2020;40:457–461. doi: 10.11607/prd.4465

Lip position, teeth, and accompanied gingival architecture are the essential elements of an esthetic smile.¹ To evaluate lip position, the amount of gingival display is measured. Normal gingival display is 1 to 2 mm, which is between the gingival margin of the central incisors and the inferior border of the upper lip. Exposed maxillary gingiva of 2 to 3 mm is cosmetically acceptable. However, more is considered to be unesthetic. This unesthetic situation while smiling is commonly called “high lip line,” “excessive gingival display,” or “gummy smile.”² Excessive gingival display may be caused by many reasons, including muscular hyperactivity, altered passive eruption (short anterior tooth crowns), and skeletal disorders.³,⁴ Various treatment techniques are used, such as the lip-repositioning procedure, botulinum toxin-A injections, gingivectomy, and orthognathic surgeries, according to etiologic factors.⁵–⁶

Lip repositioning is a surgical treatment option for gummy smile, performed by removing a strip of mucosa and suturing the wound margins.⁶ As a result of removing the mucosa strip, the vestibular sulcus shortens, and the effects of muscles that cause hyperfunction of upper lip, such as levator labii superioris alaeque nasi and zygomatic muscles, are decreased.⁶ A rule of

¹Department of Periodontology, Faculty of Dentistry, Hacettepe University, Ankara, Turkey; Department of Periodontics, College of Dentistry, University of Illinois at Chicago, Chicago, Illinois, USA
²Department of Periodontology, Faculty of Dentistry, Hacettepe University, Ankara, Turkey.
³Department of Periodontology, College of Dentistry, University of Illinois at Chicago, Chicago, Illinois, USA

Correspondence to: Dr Tolga F. Tözüm, Department of Periodontics, College of Dentistry, University of Illinois at Chicago, 801 S. Paulina St, 469G, Chicago, IL 60612, USA.
Fax: +1-312-996-0943. Email: ttozum@icloud.com

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the lip-repositioning procedure is that the distance between horizontal incisions to remove mucosa strip should be twice of the gingival display while smiling. In addition to lip repositioning, myotomy of elevator muscles is recommended to eliminate postoperative relapse. However, a lack of randomized controlled clinical trials about lip-repositioning procedures was noted in the literature. To best of the authors’ knowledge, no detailed recommendation was given about treatment of patients with atypical or asymmetric gummy smile. Thus, the aim of this case report is to present a patient with asymmetric gummy smile treated via a novel modification of the lip-repositioning procedure.

Case Report

Prior to Surgery

A 24-year-old healthy female patient referred to the Department of Periodontology complained about her excessive gingival display while smiling. The amount of gingival display for each tooth region was measured by digital caliper individually, and interocclusal relation was evaluated radiologically. Based on clinical and radiologic examinations, she was diagnosed as having an asymmetric gummy smile, especially more severe in the posterior region and on the left side (Fig 1). The etiologic factor was hyperactivity of muscles. All treatment options including anatomic crown lengthening, botulinum toxin-A injection, and lip-repositioning procedure were explained. The patient opted for the lip-repositioning procedure to avoid possible removal of her alveolar bone and the short-term effects of botulinum toxin-A injections. All possible surgical and postsurgical complications were explained to her. A written consent form was signed by the patient.

Surgical Procedures

Intervention was conducted under local anesthesia (4% articaine containing 1:100,000 epinephrine) by an experienced periodontist (O.D.). Once the soft tissue was dried, incision lines were marked with a sterile surgical marking pen. The inferior horizontal incision line was at the mucogingival junction between the second premolars. The position of the upper horizontal line was determined by the amount of gingival display. As a general rule, it was suggested that the distance between the incision lines should be twice of the gingival display while smiling. The patient had an asymmetric smile, where the left side of the patient’s lip was in a higher position than the right side. Thus, the authors planned to make the left side of the upper incision line 1 mm higher. In addition, the height of the mucosa strip was determined for each separate tooth region. For each tooth region, the amount of excessive gingival display was measured and twice its height was calculated. The incision lines were

![Fig 1 Preoperative view of the patient's smile.](image-url)
rounded to prevent folding of the mucosa while suturing wound margins (Fig 2). The mucosa strip was removed. A linear incision was performed by scalpel on the periosteum between the second premolars, and the myotomy was performed via a periosteal elevator (Fig 3). The operation was closed with 5.0 monoprolen sutures.

**Postoperative Instructions**

A cold compress was proposed immediately after surgery. For pain reduction and edema control, ibuprofen (600 mg) was given four times daily. Oral hygiene was provided by chlorhexidine gluconate rinse (0.12%) twice daily for 3 weeks. The patient was warned to keep the surgical area from excessive trauma, including stretching upper lip, extensive smiling, and brushing activity, for 3 weeks.

**Results**

Sutures were removed 10 days after surgery. Wound healing was uneventful and the patient had no complaints. The patient was recalled at 30 days for follow-up, which was also without any problems. The amount of gingival display for each tooth were measured by digital caliper and all were less than 3 mm (Table 1). The patient was satisfied with her smile (Fig 4). Follow-up visits were scheduled for every 3 months.
The etiologic factors of excessive gingival display include: (1) delayed passive dental eruption; (2) hyperfunction of upper lip elevator muscles; and (3) skeletal excess, as described by Ezquerra et al.\textsuperscript{9} Various techniques (eg, gingivectomy, botulinum toxin-A injections, crown lengthening, lip repositioning, and orthognathic surgeries) are presented to treat gummy smile according to the etiologic factor(s) of a gummy smile.\textsuperscript{10–13}

Lip repositioning is one of the surgical options, first introduced in 1973 by Rubinstein and Kostianovsky, and provides positive improvement of excessive gingival display in a short healing time with a lack of relapse or recurrence.\textsuperscript{6} In the literature, some modifications of the lip-repositioning procedure are described.\textsuperscript{11,14,15} However, no modification is presented to treat gummy smile based on the amount of gingival display for each tooth region. Thus, this case report presented a patient with gummy smile treated via tooth-based lip-repositioning technique.

The technique introduced by Rubinstein and Kostianovsky later had some modifications to maintain labial frenulum or including myotomy.\textsuperscript{11,14,15} In 1983, Miskin\textsuperscript{15} presented a novel modification for performing the lip-repositioning procedure, including myotomy and partial resection of the levator labii superior muscle. Litton and Fournier\textsuperscript{16} reported that detaching the lip muscles was a successful treatment modification for the patients with short upper lips. In 2010, cases treated with myotomy of the upper lip elevator muscles and frenectomy were reported by Ishida et al.\textsuperscript{17} Additional modifications with various myotomy techniques were noted in the literature.\textsuperscript{18,19} In addition, Torabi et al.\textsuperscript{20} presented a case with unilateral gummy smile treated with a unilateral lip-repositioning procedure in which one mucosa strip was removed on the patient’s left side. Tawfik et al.\textsuperscript{8} demonstrated that severing the upper lip elevator muscles improved the stability of

<table>
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<th>13</th>
<th>12</th>
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<td>2.83</td>
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Table 1 Mucosal Strip and Pre- and Postsurgical Gingival Measurements According to Each Tooth Region

Discussion

The etiologic factors of excessive gingival display include: (1) delayed passive dental eruption; (2) hyperfunction of upper lip elevator muscles; and (3) skeletal excess, as described by Ezquerra et al.\textsuperscript{9} Various techniques (eg, gingivectomy, botulinum toxin-A injections, crown lengthening, lip repositioning, and orthognathic surgeries) are presented to treat gummy smile according to the etiologic factor(s) of a gummy smile.\textsuperscript{10–13}

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treatment results. The authors reported that patients who underwent lip-repositioning procedure with myotomy had greater reductions in excessive gingival display compared to those without myotomy. Although botulinum toxin-A injections may be minimally invasive and a predictable treatment option for treating gummy smile, patients may choose the lip-repositioning technique due to botulinum toxin-A injections’ temporary effect. Additionally, no study found a relationship between postoperative complications and myotomy of the upper lip elevator muscles.

This clinical report describes a modification of the lip-repositioning procedure for gummy smile treatment. Various gummy smile classifications were presented in the literature. However, some cases cannot be categorized in any subgroup due to varying levels of gingival display for each tooth region. The limitation of these classifications also prohibits creating a decision tree for treatment of excessive gingival display. A solution may be to design the surgical procedure based upon the gingival display at each tooth individually. Additional studies with a greater number of patients are needed to evaluate the efficacy and potential complications of this modified lip-repositioning technique.

Conclusions

The lip-repositioning procedure is a predictable surgical technique for treatment of excessive gingival display. In addition, a tooth-based lip-repositioning technique may be an option to more precisely treat patients with excessive gingival display.

Acknowledgments

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References