

# Lip Repositioning Techniques and Modifications



Dimitris N. Tatakis, DDS, PhD, FICD

## KEYWORDS

- Esthetics • Dental • Lip surgery • Mouth mucosa surgery • Smiling
- Treatment outcomes • Plastic surgery • Gingiva

## KEY POINTS

- Hypermobile upper lip is highly prevalent in patients presenting with excessive gingival display (gummy smile) and represents a common cause of gummy smile.
- Lip repositioning surgery was introduced as an alternative to orthognathic surgery for patients with gummy smile due to hypermobile upper lip.
- Since the original description of the surgical technique, several modifications have been proposed to improve patient experience and stability of clinical outcomes.
- Lip repositioning surgery, a procedure with minimal complications, is effective in significantly reducing gingival display and improving smile esthetics.
- Patients who underwent lip repositioning surgery report high levels of satisfaction with the treatment outcomes and the overall experience.

## INTRODUCTION

Gingival display during smile, that is, the exposure of the gingival tissues surrounding the maxillary anterior teeth when smiling, is common. Studies report that 14% to 70% of females<sup>1–6</sup> and 7% to 38% of males present with gingival display,<sup>1–6</sup> that is, they have a high smile. Females are, on average, twice as likely as males to have a high smile, regardless of age or ethnic origin.<sup>1–8</sup> Intrinsically, gingival display is an acceptable component of a pleasing smile; however, smile attractiveness typically decreases when gingival display exceeds 2 to 3 mm, which is termed excessive gingival display.<sup>9–13</sup>

Excessive gingival display, often referred to as gummy smile, is a condition resulting from diverse causes and is often multifactorial. Gummy smile may be due to

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Division of Periodontology, College of Dentistry, The Ohio State University, Postle Hall, 305 West 12th Avenue, Columbus, OH 43210-1267, USA

*E-mail address:* [tatakis.1@osu.edu](mailto:tatakis.1@osu.edu)

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developmental (eg, due to skeletal development), anatomic (eg, short upper lip), or disease (eg, drug-induced gingival enlargement) conditions, as well as others.<sup>14–17</sup> Among the identified causes of gummy smile, the 2 most common are altered passive eruption,<sup>18–20</sup> usually managed by esthetic crown lengthening,<sup>19,21</sup> and hypermobile upper lip.<sup>14,16</sup>

Hypermobile upper lip has been defined as lip movement, from rest to maximum smile, which exceeds 8 mm.<sup>14</sup> The prevalence of hypermobile upper lip in the population at large is unknown; however, it is highly prevalent in patients with gummy smile. Among North American<sup>22</sup> and Asian<sup>23</sup> adults with gummy smile, more than 85% have hypermobile upper lip. In more than 40% of the cases, it is the sole soft tissue cause identified, and in another 35% to 40% it is combined with altered passive eruption.<sup>22,23</sup> These findings suggest that, for patients with esthetic dissatisfaction because of gummy smile, management of hypermobile upper lip could be an essential approach to provide esthetic improvement and resolution of patient concerns. As with every other therapy, proper diagnostic assessment, patient selection, and thorough treatment planning are essential to obtain optimal results.

## MANAGEMENT OF HYPERMOBILE UPPER LIP

### *Overview of Treatment Approaches*

Given the underlying muscular activity and extent of physical translocation that characterize a hypermobile upper lip, most proposed treatment modalities take aim either at curbing the function of the lip-elevating muscles or at placing physical limitations on the tissues' ability to move. Hypermobile lip treatments are categorized into nonsurgical and surgical approaches. A commonly used nonsurgical treatment is application of botulinum toxin.<sup>24–26</sup> When properly applied, botulinum toxin paralyzes specific muscles and results in reduced lip movement during smile.<sup>24–26</sup> This is a transient outcome, lasting 3 to 6 months, and requires repeated application when the toxin effect wears off.<sup>24,26,27</sup>

Surgical treatments for hypermobile upper lip range from procedures that are more invasive, for example, myotomy,<sup>28–30</sup> which severs select muscles implicated in lip lift during smile, to ones that are less invasive, for example, lip repositioning,<sup>31,32</sup> which reduces lip mobility through reduction of the available vestibular mucosa. Myotomy is performed via nasal<sup>29,30</sup> or intraoral<sup>28</sup> access. The reported approaches include: resection of 1 to 2 cm of the levator labii superioris muscle;<sup>28</sup> simple division of the levator labii superioris along with subperiosteal dissection of the alveolar mucosa and gingiva, subcutaneous dissection of the ergotrid area, and maxillary labial frenectomy;<sup>30</sup> and, partial myotomy of the levator labii superioris and insertion of a physical barrier (spacer).<sup>29</sup> Myotomy of the depressor septi nasi muscles, through nasal<sup>33</sup> or oral<sup>34</sup> approach, has been applied in patients with smiles characterized by combination of nasal tip drooping (nasal tip displacing inferiorly and posteriorly), shortened upper lip with a transverse furrow beneath the columella, and with/without excessive gingival display.<sup>33,34</sup> These surgical techniques are effective and result in limited lip elevation during smiling and/or in lip elongation. However, they are nonreversible, due to the transection of the muscles, and may have greater postoperative morbidity.<sup>28</sup>

### *Lip Repositioning Surgery*

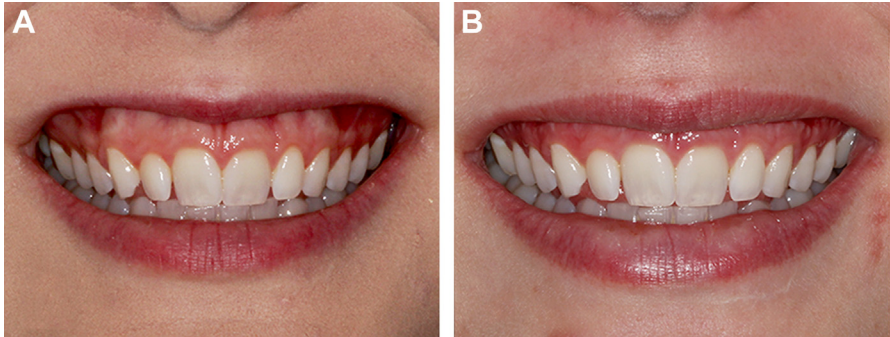
Lip repositioning surgery was first described in a 1973 Spanish article by Rubinstein and Kostianovsky,<sup>35</sup> 2 Argentinian plastic surgeons. The original technique described a cosmetic surgery for the “malformation” of the smile, which consisted of the removal

of a partial-thickness mucosal strip from the labial aspect of the alveolar mucosa and suture of the apical wound margin to the mucogingival junction (MGJ), thus shortening the vestibule and limiting lip excursion during smile. The described technique included midline frenulum “reconstruction” by creating a fold on the elevated flap. This first report, which introduced lip repositioning as a direct and less invasive alternative to orthognathic surgery, did not provide specific indications or quantitative outcomes. The same authors published the first English-language paper on the technique in 1977.<sup>31</sup> In addition to a detailed description of the surgical procedure, the report stated that lip repositioning was performed on 92 patients with gummy smile, all of whom had improved satisfactorily. However, a “few cases,” wherein the excision was “too conservative,” experienced recurrence and required a secondary revision procedure. Soon thereafter, in 1979, the technique was described again by Kamer<sup>32</sup> and by Litton and Fournier.<sup>36</sup> The latter report introduced full-thickness elevation and omitted frenulum reconstruction; the investigators added that, in cases of short lip, muscle detachment could be included; they concluded that all their cases had normal appearance after the postoperative edema subsided.<sup>36</sup>

Lip repositioning surgery was introduced to the periodontal and dental cosmetic literature in 2006 and 2007 by Rosenblatt and Simon<sup>37</sup> and Simon and colleagues,<sup>38</sup> who described the original technique, without frenulum reconstruction, and with the coronal incision positioned at the level of the MGJ, instead of 2 to 3 mm coronal to it.<sup>31</sup> Therefore, the surgical technique introduced to the dental community consisted of removal of a single band of mucosa, elevated as a partial-thickness flap, outlined by a coronal incision at the MGJ, an apical incision parallel to the coronal one, and connecting incisions bilaterally, positioned at the level of the projection of the labial commissures during smiling, that is, from the second premolar and up to the level of the second molar, depending on the width of the patient’s smile. The apical incision was positioned either at the depth of the vestibule<sup>31</sup> or at a distance that is double the amount of gingival display (in mm) during smile<sup>38,39</sup> but not greater than 10 to 12 mm



**Fig. 1.** The lip repositioning surgery as originally described in the dental literature. Retracted views of a case (images presented clockwise): preoperatively (A), following removal of the single mucosal band (B), with sutures in place (C), 6 months postoperatively (D). Note the slight scarring at the level of the mucogingival junction (D).



**Fig. 2.** Preoperative (A) and 6-month postoperative (B) smile of the same patient treated with the procedure shown in Fig. 1 (Modified from Andijani RI, Paramitha V, Guo X, et al. Lip repositioning surgery for gummy smile: 6-month clinical and radiographic lip dimensional changes. *Clin Oral Investig* 2021.). Note the decrease in gingival display and the concomitant increase in vermilion length.

from the coronal incision.<sup>37,38</sup> Figs. 1 and 2 illustrate a representative case treated with this technique.

The procedure, which is technically reversible, is typically characterized by minor complications. Bleeding during or immediately after removal of the mucosal band is the main intraoperative complication and can be readily managed by application of pressure or electrocautery. Postoperatively, patients usually report mild pain, edema, and tension during smiling or speaking, especially during the first week.<sup>40–42</sup> Rarely, transient numbness<sup>40,42</sup> and paresis,<sup>32</sup> early relapse,<sup>41,43</sup> suture loss,<sup>39,41</sup> ecchymosis,<sup>43,44</sup> mucocele development,<sup>37,38</sup> and formation of double lip<sup>41</sup> have been reported. Healing resulting in slight scarring at the coronal incision line is typically present (see Fig. 1).<sup>40</sup> When full-thickness flap elevation and muscle manipulations are incorporated into the procedure (see later), flap dehiscence has been reported,<sup>44</sup> and transient numbness may be more frequent and longer lasting.<sup>44</sup>

The 2 different approaches proposed to determine placement of the apical incision, that is, using depth of the vestibule or twice the amount of gingival display during smile, may or may not result in significant dimensional differences. Novel data from patients with gummy smile indicate that the distance from the central incisor incisal edge to the depth of the vestibule averages  $21.2 \pm 2.4$  mm at rest.<sup>45</sup> When this measurement is considered along with the  $10.2 \pm 0.9$  mm average central incisor length<sup>46</sup> and the  $4.4 \pm 1.4$  mm average gingival width on the same tooth,<sup>47,48</sup> the estimated average apicocoronal distance from MGJ to the depth of the vestibule, at rest, would be 6.5 to 7 mm. Although this distance would appear smaller than the alternative approach (twice the gingival display), this potential difference may be reduced when vestibular depth is determined with the lip (mucosa) stretched. These dimensional considerations are also affected by the coronal incision position. As already mentioned, the proposed coronal incision position has varied; it has been placed 1 mm<sup>49</sup> and 2 mm<sup>50</sup> apical to the MGJ, at the MGJ,<sup>37,38,41,51,52</sup> 1 mm<sup>40,44</sup> and 2–3 mm<sup>31,32</sup> coronal to the MGJ, and 3–4 mm<sup>36</sup> and 4–5 mm<sup>43</sup> apical to the gingival margin. Other investigators have proposed more complex formulas to calculate the apicocoronal dimension of the planned tissue excision, evaluating different landmarks.<sup>50</sup>

Regardless of the choices for placement of the coronal and apical incisions, when contemplating the maximum possible apicocoronal dimension of excised tissue the surgeon should always consider, in addition to the amount of gingival display, the

need to (1) maintain a minimum width of 2–3 mm of attached gingiva on all teeth included in the surgical flap design, (2) avoid encroaching on the vermilion border, and, relatedly, (3) allow for postoperative vestibular depth that will not hinder masticatory and other lip functions.

Besides the aforementioned minor variations in basic design, other minor reported modifications include the use of lasers—instead of steel blades—to either mark the location of the incisions or perform the incisions outlining and/or excising the mucosal band area,<sup>42,49,51,53,54</sup> and incorporation of a reversible preoperative outcome assessment trial through temporary use of sutures placed to mimic the end result and thus help patients make informed decisions.<sup>42,53</sup>

Several more distinct modifications have also been introduced. One modification consists of preservation of the midline mucosa (frenulum) and removal of 2 bilateral bands of mucosa (**Fig. 3**) instead of the single mucosal band encompassing the midline.<sup>40,55</sup> This modification was introduced to reduce postoperative morbidity and help maintain the proper position of the labial midline. In contrast, most modifications were introduced to increase postoperative outcome stability and reduce the



**Fig. 3.** Modified lip repositioning surgery with retention of the midline maxillary labial frenum. Retracted views of a case: following removal of the bilateral mucosal bands (A), with the wounds sutured (B), and 6 months postoperatively (C). Note the slight scarring at the level of the mucogingival junction (C).



occurrence of reported partial relapse.<sup>31,44,52</sup> These modifications include combination of split- and full-thickness flaps,<sup>50</sup> split-thickness flaps combined with periosteal fenestrations,<sup>56</sup> combination of the procedure with botulinum toxin injections,<sup>57,58</sup> use of internal or external anchoring sutures of various designs,<sup>43,50,54,56,58</sup> and integration of muscle management, either through full-thickness<sup>43,44</sup> or partial-thickness<sup>52</sup> flap elevation and blunt dissection of muscle attachments or through application of internal sutures for muscle containment.<sup>59,60</sup>

In cases with subnasal depression, gingival display reduction has been achieved by placement of custom polymethylmethacrylate-based blocks (spacers) after elevation of full-thickness mucoperiosteal flaps, which start at the gingival margin<sup>61,62</sup>; analog<sup>61</sup> and digital<sup>62</sup> approaches have been used for spacer planning and fabrication. Although this approach has been used to achieve repositioning of the lip, it is not directly related to the original lip repositioning procedure.

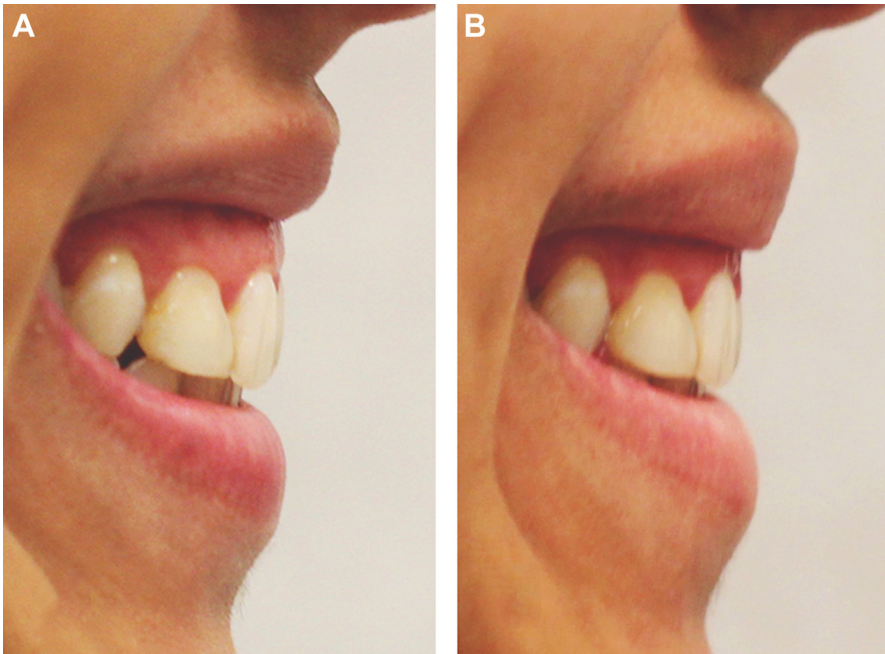
In cases of asymmetric smile, the technique can be modified to vary the dimensions of the mucosal band removed from each side of the mouth. It can also be applied unilaterally, when indicated.<sup>41,56</sup> Lip repositioning can be used, concurrently or sequentially, in conjunction with other procedures, such as esthetic crown lengthening, when treating patients who present with excessive gingival display of multiple causes.<sup>50,63,64</sup> In such cases, proper treatment planning and procedure sequencing is essential to avoid either unsatisfying esthetic outcomes or the performance of procedures that would be unnecessary.

#### **Clinical and Patient-Reported Outcomes**

Despite the numerous earlier reports on lip repositioning surgery, it was not until the 2013 study by Silva and colleagues<sup>40</sup> that quantitative clinical and patient-reported outcomes became available. The study showed that, at 6 months postoperatively, the procedure resulted in approximately 80% reduction of the preoperative gingival display and a concomitant increase in the upper lip vermilion vertical length (see [Fig. 2](#); [Figs. 4](#) and [5](#)), with a strong correlation between the changes in these 2 clinical parameters.<sup>40</sup> This increase in upper lip vermilion length is considered an esthetic advantage, because vermilion vertical length has been shown to be one of the most significant components of a pleasant smile.<sup>65</sup> Concomitantly, limited gingival display is considered much more esthetically pleasing,<sup>9–13</sup> and gingival display reduction is



**Fig. 4.** Modified lip repositioning surgery with retention of the midline maxillary labial frenum. Preoperative (A) and 6-month postoperative (B) smile of the same patient treated with the procedure shown in [Fig. 3](#). Note the decrease in gingival display and the concomitant increase in vermilion length.



**Fig. 5.** Profile view of patient shown in **Fig. 4**. Preoperative (A) and 6-month postoperative (B). Note the changes in gingival display and lip appearance during smile.

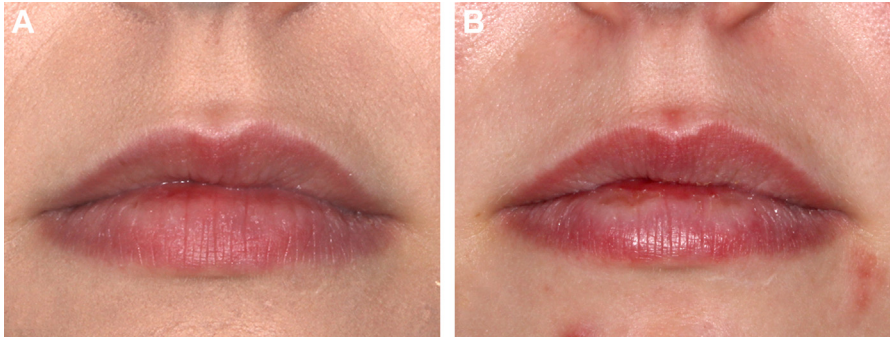
a significant determinant of the observed postoperative increase in smile attractiveness of patients with gummy smile, regardless of the procedure involved.<sup>66</sup>

The same 2013 study reported that, at 2.5 years postoperatively, 70% of the patients were very or extremely satisfied with their smile, compared with 0% preoperatively; moreover, 70% thought the amount of postoperative gingival display was about right, when 100% had thought it was too much or way too much preoperatively.<sup>40</sup> Notably, more than 90% of the patients reported that they would be likely to choose to have the procedure again.<sup>40</sup> These first clinical and patient-reported outcomes were subsequently corroborated by several studies that reported similar quantitative outcomes.<sup>49,51,52</sup> It has been recently documented, through clinical and radiographic assessments, that lip repositioning results in significant postoperative reduction of the maxillary vestibular depth, confirming that the procedure works as intended.<sup>45</sup>

Although lip repositioning consistently decreases gingival display and increases vermilion length during smile, recent evidence indicates that it does not cause significant changes to the vertical lip dimensions at rest.<sup>45</sup> Therefore, patients can be reassured that lip repositioning can help improve the esthetics and attractiveness of their smile without affecting their appearance at rest (**Fig. 6**).

Although the procedure is simple and associated with minor complications and high patient satisfaction, partial relapse is a limitation.<sup>31,44,52</sup> Relapse may be noticeable at 12 months or later, and the magnitude apparently depends on surgical technique<sup>40,44,52,54,67,68</sup> and pretreatment conditions, that is, patient selection (Tatakis et al., Unpublished observations).

In 2018, the first systematic review<sup>69</sup> on lip repositioning surgery was published, and, based on the limited available evidence, it was concluded that the procedure resulted in an average 3.4-mm gingival display decrease and, therefore, could be



**Fig. 6.** Frontal view of patient lips at rest (same patient as in [Figs. 1](#) and [2](#)). Preoperative (A) and 6-month post-operative (B) images. Note the lack of any lip dimensional changes.

used to treat excessive gingival display. In the last year, several additional systematic reviews have been published.<sup>70–72</sup> The consensus emerging from the systematic reviews is that lip repositioning surgery is effective in reducing gingival display for appropriately selected cases, that incorporation of muscle management approaches might improve long-term outcome stability, and that further research is needed to identify determinants of success and outcome stability.

When dealing with esthetic concerns and procedures aiming to address them, it is important to have independent assessment, excluding the potential bias of the provider or the patient. In the case of lip repositioning surgery, 50 independent raters of varying educational and professional background who evaluated actual pretreatment and posttreatment patient smiles scored the postoperative smiles significantly higher.<sup>56</sup> Similar results were reported when 6 raters assessed preoperative and postoperative patient smiles.<sup>52</sup> These positive independent assessments, in conjunction with the consistently reported high level of patient satisfaction,<sup>40,49,51,52</sup> indicate that the esthetic benefits of lip repositioning surgery can be appreciated by both the patients themselves and those around them.

## SUMMARY

Lip repositioning surgery can significantly reduce gingival display caused by hypermobile upper lip and can significantly improve smile attractiveness and patient satisfaction, with minimal complications.

## CLINICS CARE POINTS

- Lip repositioning surgery can be used to treat excessive gingival display cases (gummy smile) caused by hypermobile upper lip.
- When additional excessive gingival display causes are present, thorough treatment planning and appropriate procedure sequencing are essential for optimal outcomes.
- Partial relapse can occur and may be minimized by the use of muscle management technique modifications and proper case selection.
- The procedure is effective in reducing gingival display, resulting in high patient satisfaction.



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## DISCLOSURE

The author has nothing to disclose.

## REFERENCES

1. Tjan AH, Miller GD, The JG. Some esthetic factors in a smile. *J Prosthet Dent* 1984;51(1):24–8.
2. Rigsbee OH 3rd, Sperry TP, BeGole EA. The influence of facial animation on smile characteristics. *Int J Adult Orthodon Orthognath Surg* 1988;3(4):233–9.
3. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. *Am J Orthod Dentofacial Orthop* 1992;101(6):519–24.
4. Maulik C, Nanda R. Dynamic smile analysis in young adults. *Am J Orthod Dentofacial Orthop* 2007;132(3):307–15.
5. Miron H, Calderon S, Allon D. Upper lip changes and gingival exposure on smiling: vertical dimension analysis. *Am J Orthod Dentofacial Orthop* 2012;141(1):87–93.
6. Han SH, Lee EH, Cho JH, et al. Evaluation of the relationship between upper incisor exposure and cephalometric variables in Korean young adults. *Korean J Orthod* 2013;43(5):225–34.
7. Zhang YL, Le D, Hu WJ, et al. Assessment of dynamic smile and gingival contour in young Chinese people. *Int Dent J* 2015;65(4):182–7.
8. Awad MA, Alghamdi DS, Alghamdi AT. Visible portion of anterior teeth at rest and analysis of different smile characteristics in the Saudi Population of the Jeddah Region. *Int J Dent* 2020;2020:8859376.
9. Hunt O, Johnston C, Hepper P, et al. The influence of maxillary gingival exposure on dental attractiveness ratings. *Eur J Orthod* 2002;24(2):199–204.
10. Geron S, Atalia W. Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. *Angle Orthod* 2005;75(5):778–84.
11. Kokich VO, Kokich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofacial Orthop* 2006;130(2):141–51.
12. Ker AJ, Chan R, Fields HW, et al. Esthetics and smile characteristics from the layperson's perspective: a computer-based survey study. *J Am Dent Assoc* 2008;139(10):1318–27.
13. Ioi H, Nakata S, Counts AL. Influence of gingival display on smile aesthetics in Japanese. *Eur J Orthod* 2010;32(6):633–7.
14. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. *Periodontol* 2000 1996;11:18–28.
15. Robbins JW. Differential diagnosis and treatment of excess gingival display. *Pract Periodontics Aesthet Dent* 1999;11(2):265–72 [quiz: 273].

16. Silberberg N, Goldstein M, Smidt A. Excessive gingival display—etiology, diagnosis, and treatment modalities. *Quintessence Int* 2009;40(10):809–18.
17. Dym H, Pierre R 2nd. Diagnosis and Treatment Approaches to a "Gummy Smile". *Dent Clin North Am* 2020;64(2):341–9.
18. Volchansky AC-J. Delayed passive eruption. A predisposing factor to Vincent's infection? *J Dental Assoc South Africa* 1974;29:291–4.
19. Coslet JG, Vanarsdall R, Weisgold A. Diagnosis and classification of delayed passive eruption of the dentogingival junction in the adult. *Alpha Omegan* 1977;70(3):24–8.
20. Alpiste-Illueca F. Altered passive eruption (APE): a little-known clinical situation. *Med Oral Patol Oral Cir Bucal* 2011;16(1):e100–4.
21. Mele M, Felice P, Sharma P, et al. Esthetic treatment of altered passive eruption. *Periodontol 2000* 2018;77(1):65–83.
22. Andijani RI, Tatakis DN. Hypermobile upper lip is highly prevalent among patients seeking treatment for gummy smile. *J Periodontol* 2019;90(3):256–62.
23. Çetin MB, Sezgin Y, Akinci S, et al. Evaluating the Impacts of Some Etiologically Relevant Factors on Excessive Gingival Display. *Int J Periodontics Restorative Dent* 2021;41(3):e73–80.
24. 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.
25. Hwang WS, Hur MS, Hu KS, 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.
26. Sucupira E, Abramovitz A. A simplified method for smile enhancement: botulinum toxin injection for gummy smile. *Plast Reconstr Surg* 2012;130(3):726–8.
27. Zengiski ACS, Basso IB, Cavalcante-Leao BL, et al. Effect and longevity of botulinum toxin in the treatment of gummy smile: a meta-analysis and meta-regression. *Clin Oral Investig* 2021;26(1):109–17.
28. Miskinyar SA. A new method for correcting a gummy smile. *Plast Reconstr Surg* 1983;72(3):397–400.
29. Ellenbogen R, Swara N. The improvement of the gummy smile using the implant spacer technique. *Ann Plast Surg* 1984;12(1):16–24.
30. Ishida LH, Ishida LC, Ishida J, et al. Myotomy of the levator labii superioris muscle and lip repositioning: a combined approach for the correction of gummy smile. *Plast Reconstr Surg* 2010;126(3):1014–9.
31. Kostianovsky AS, Rubinstein AM. The "Unpleasant" smile. *Aesthet Plast Surg* 1977;1(1):161–6.
32. Kamer FM. How I do it"—plastic surgery. Practical suggestions on facial plastic surgery. Smile surgery. *Laryngoscope* 1979;89(9 Pt 1):1528–32.
33. Cachay-Velasquez H. Rhinoplasty and facial expression. *Ann Plast Surg* 1992;28(5):427–33.
34. Benlier E, Top H, Aygit AC. A new approach to smiling deformity: cutting of the superior part of the orbicularis oris. *Aesthet Plast Surg* 2005;29(5):373–7 [discussion: 378].
35. Rubinstein AM, Kostianovsky AS. Cirugia estetica de la malformacion de la sonrisa. *Prensa Med Argentina* 1973;60:952.
36. Litton C, Fournier P. Simple surgical correction of the gummy smile. *Plast Reconstr Surg* 1979;63(3):372–3.
37. Rosenblatt A, Simon Z. Lip repositioning for reduction of excessive gingival display: a clinical report. *Int J Periodontics Restorative Dent* 2006;26(5):433–7.

38. Simon Z, Rosenblatt A, Dorfman W. Eliminating a gummy smile with surgical lip repositioning. *Cosmet Dent* 2007;23:100–8.
39. Humayun N, Kolhatkar S, Souiyas J, et al. Mucosal coronally positioned flap for the management of excessive gingival display in the presence of hypermobility of the upper lip and vertical maxillary excess: a case report. *J Periodontol* 2010;81(12):1858–63.
40. Silva CO, Ribeiro-Junior NV, Campos TV, et al. Excessive gingival display: treatment by a modified lip repositioning technique. *J Clin Periodontol* 2013;40(3):260–5.
41. Bhola M, Fairbairn PJ, Kolhatkar S, et al. LipStaT: The Lip stabilization technique—indications and guidelines for case selection and classification of excessive gingival display. *Int J Periodontics Restorative Dent* 2015;35(4):549–59.
42. Gabric Panduric D, Blaskovic M, Brozovic J, et al. Surgical treatment of excessive gingival display using lip repositioning technique and laser gingivectomy as an alternative to orthognathic surgery. *J Oral Maxillofac Surg* 2014;72(2):404.e1–11.
43. Abdullah WA, Khalil HS, Alhindi MM, et al. Modifying gummy smile: a minimally invasive approach. *J Contemp Dent Pract* 2014;15(6):821–6.
44. Alammar A, Heshmeh O, Mounajjed R, et al. A comparison between modified and conventional surgical techniques for surgical lip repositioning in the management of the gummy smile. *J Esthet Restor Dent* 2018;30(6):523–31.
45. Andijani RI, Paramitha V, Guo X, et al. Lip repositioning surgery for gummy smile: 6-month clinical and radiographic lip dimensional changes. *Clin Oral Investig* 2021;25(10):5907–15.
46. Sterrett JD, Oliver T, Robinson F, et al. Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man. *J Clin Periodontol* 1999;26(3):153–7.
47. Bowers GM. A Study of the Width of Attached Gingiva. *J Periodontol* 1963;34(3):201–9.
48. Muller HP, Eger T. Gingival phenotypes in young male adults. *J Clin Periodontol* 1997;24(1):65–71.
49. Suh JJ, Lee J, Park JC, et al. Lip Repositioning Surgery Using an Er,Cr:YSGG Laser: a case series. *Int J Periodontics Restorative Dent* 2020;40(3):437–44.
50. Chacon G. Modified lip-repositioning technique for the treatment of gummy smile. *Int J Esthet Dent* 2020;15(4):474–88.
51. Ozturan S, Ay E, Sagir S. Case series of laser-assisted treatment of excessive gingival display: an alternative treatment. *Photomed Laser Surg* 2014;32(9):517–23.
52. Tawfik OK, Naiem SN, Tawfik LK, et al. Lip repositioning with or without myotomy: a randomized clinical trial. *J Periodontol* 2018;89(7):815–23.
53. Jacobs PJ, Jacobs BP. Lip repositioning with reversible trial for the management of excessive gingival display: a case series. *Int J Periodontics Restorative Dent* 2013;33(2):169–75.
54. Mateo E, Collins JR, Rivera H, et al. New surgical approach for labial stabilization: a long-term follow-up case series. *Int J Periodontics Restorative Dent* 2021;41(3):405–10.
55. Ribeiro-Junior NV, Campos TV, Rodrigues JG, et al. Treatment of excessive gingival display using a modified lip repositioning technique. *Int J Periodontics Restorative Dent* 2013;33(3):309–14.
56. Torabi A, Najafi B, Drew HJ, et al. Lip repositioning with vestibular shallowing technique for treatment of excessive gingival display with various etiologies. *Int J Periodontics Restorative Dent* 2018;38(Suppl):e1–8.

57. Aly LA, Hammouda NI. Botox as an adjunct to lip repositioning for the management of excessive gingival display in the presence of hypermobility of upper lip and vertical maxillary excess. *Dent Res J (Isfahan)* 2016;13(6):478–83.
58. Vergara-Buenaventura A, Mayta-Tovalino F, Correa A, et al. Predictability in lip repositioning with botulinum toxin for gummy smile treatment: a 3-year follow-up case series. *Int J Periodontics Restorative Dent* 2020;40(5):703–9.
59. Storrer CL, Valverde FK, Santos FR, et al. Treatment of gummy smile: gingival recontouring with the containment of the elevator muscle of the upper lip and wing of nose. A surgery innovation technique. *J Indian Soc Periodontol* 2014;18(5): 656–60.
60. Ganesh B, Burnice NKC, Mahendra J, et al. Laser-assisted lip repositioning with smile elevator muscle containment and crown lengthening for gummy smile: a case report. *Clin Adv Periodontics* 2019;9(3):135–41.
61. Arcuri T, da Costa MFP, Ribeiro IM, et al. Labial repositioning using polymethylmethacrylate (PMMA)-based cement for esthetic smile rehabilitation-A case report. *Int J Surg Case Rep* 2018;49:194–204.
62. Freitas de Andrade P, Meza-Mauricio J, Kern R, et al. Labial repositioning using print manufactured polymethylmethacrylate- (PMMA-) based cement for gummy smile. *Case Rep Dent* 2021;2021:7607522.
63. Gibson MP, Tatakis DN. Treatment of gummy smile of multifactorial etiology: a case report. *Clin Adv Periodontic* 2017;7(4):167–73.
64. Sanchez IM, Gaud-Quintana S, Stern JK. Modified lip repositioning with esthetic crown lengthening: a combined approach to treating excessive gingival display. *Int J Periodontics Restorative Dent* 2017;37(1):e130–4.
65. McNamara L, McNamara JA Jr, Ackerman MB, et al. Hard- and soft-tissue contributions to the esthetics of the posed smile in growing patients seeking orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2008;133(4):491–9.
66. Silva CO, Rezende RI, Mazuquini AC, et al. Aesthetic crown lengthening and lip repositioning surgery: Pre- and post-operative assessment of smile attractiveness. *J Clin Periodontol* 2021;48(6):826–33.
67. Dilaver E, Uckan S. Effect of V-Y plasty on lip lengthening and treatment of gummy smile. *Int J Oral Maxillofac Surg* 2018;47(2):184–7.
68. Foudah MA. Lip repositioning: an alternative to invasive surgery a 4year follow up case report. *Saudi Dent J* 2019;31(Suppl):S78–84.
69. Tawfik OK, El-Nahass HE, Shipman P, et al. Lip repositioning for the treatment of excess gingival display: a systematic review. *J Esthet Restor Dent* 2018;30(2): 101–12.
70. Ardakani MT, Moscowchi A, Valian NK, et al. Lip repositioning with or without myotomy: a systematic review. *J Korean Assoc Oral Maxillofac Surg* 2021; 47(1):3–14.
71. Dos Santos-Pereira SA, Cicareli AJ, Idalgo FA, et al. Effectiveness of lip repositioning surgeries in the treatment of excessive gingival display: a systematic review and meta-analysis. *J Esthet Restor Dent* 2021;33(3):446–57.
72. Younespour S, Yaghoobee S, Aslroosta H, et al. Effectiveness of different modalities of lip repositioning surgery for management of patients complaining of excessive gingival display: a systematic review and meta-analysis. *Biomed Res Int* 2021;2021:9476013.