

Case Report

Modified Lip Repositioning Surgery in the Treatment of Gummy Smile

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Abstract: The smile is a characteristic that expresses emotions and affects interpersonal relationships, significantly impacting self-esteem and influencing personal and professional life. The growing emphasis on aesthetics has made patients increasingly well-informed and demanding regarding available procedures. Excessive gingival display (EGD) can result from various factors, such as altered passive eruption, vertical maxillary excess, and short or hyperactive upper lip, among others. In this case report, where EGD was caused by upper lip hypermobility, the proposed treatment involved the modified lip repositioning surgical technique (MLRS) using sutures in the modified horizontal mattress technique, aiming to limit muscle and tissue movement and to approximate the mucosal edges. The outcome was an improved aesthetic harmony of the smile, with a more suitable position of the upper lip during spontaneous smiling, as observed in a six-month follow-up.

Keywords: gummy smile; gingival exposure; gingival aesthetics; lip repositioning surgery; LipStat



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1. Introduction

The smile plays a significant role in expression and appearance. Nowadays, achieving a ‘perfect smile’ has become an essential goal for many patients. Therefore, in addition to teeth, the condition of oral tissues, gingival contour, and lip position all affect the final aesthetics of a smile. Creating the ideal smile is a challenge, as treatment requires meticulous planning and a multidisciplinary approach [1]. Excessive gingival display (EGD), commonly known as a ‘gummy smile’, presents an aesthetic issue and leaves an individual dissatisfied with their smile [2].

One study compared oral health-related quality of life between individuals with and without EGD. Fifty-three patients with EGD and fifty-three control patients were selected in the southern region of Brazil. Through a questionnaire that assessed various aspects, it was observed that the aesthetic satisfaction of patients with EGD was 21.1%, while for control patients it was 78.9% [3].

A smile is defined as pleasant when the upper teeth are fully exposed; however, the degree of gingival exposure considered aesthetically pleasing varies according to the geographic location and culture. Generally, gingival exposure of no more than 2–3 mm is considered pleasant, while exposure exceeding 3 mm is typically regarded as unattractive [4].

Excessive gingival display is a common finding that can occur due to various etiologies. The amount of gingival exposure depends on the position of the smile line, which is defined as the relationship between the upper lip and the visibility of gingival tissues and teeth. There are many factors that contribute to excessive gingival display (EGD), and it is common for this condition to result from the interaction of multiple etiologies [5]. These factors include altered passive eruption, vertical maxillary excess, short upper lip, excessive upper

lip mobility, and other conditions that lead to gingival enlargement [4]. To this day, there are still diagnostic and treatment challenges faced by healthcare professionals.

Appropriate treatment techniques should be chosen based on the identification and definitive diagnosis of the causes of EGD [4]. Therefore, more than one procedure can be performed to achieve the desired aesthetic [6].

The most well-known technique for correcting a gummy smile is esthetic crown lengthening. However, when crown proportions are appropriate, other treatment approaches should be considered. Surgical lip repositioning (LipStat) can be used when indicated. It is a minimally invasive procedure with fewer post-operative complications compared to orthognathic surgery, which aims to shorten the depth of the vestibular sulcus, limiting the retraction of the elevators of the upper lip muscles [4].

Historically, in 1973, a technique similar to LipStat was first described in the medical literature by Rubenstein and Kostianovsky [7]. In 1979, a study already advocated this procedure for correcting EGD in the presence of a short upper lip [8]. Subsequently, some authors proposed variations of the technique, including the retention of lip elevator muscles (the levator labii superioris alaeque nasi, the levator labii superioris muscle, the minor zygomatic muscle, and the major zygomatic muscle), resulting in a reduction in EGD [9]. In 2010, another study recommended myotomy of the levator labii superioris muscle after removing the mucosal band in the sulcus base to minimize tension after suturing the edges and prevent recurrence of the lip position at the anterior height [10]. In 2013, a modification was proposed, maintaining the labial frenum. The reasons for this were to maintain a midline reference and reduce post-operative morbidity [11].

In this case report, the modified lip repositioning surgical technique (MLRS) was used, along with internal sutures, to reposition the upper lip and limit its movement during smiling [12]. The aim of this study is to demonstrate the relevance of deep sutures in lip repositioning surgery, providing dentists with an additional safe and predictable treatment option for achieving an ideal smile.

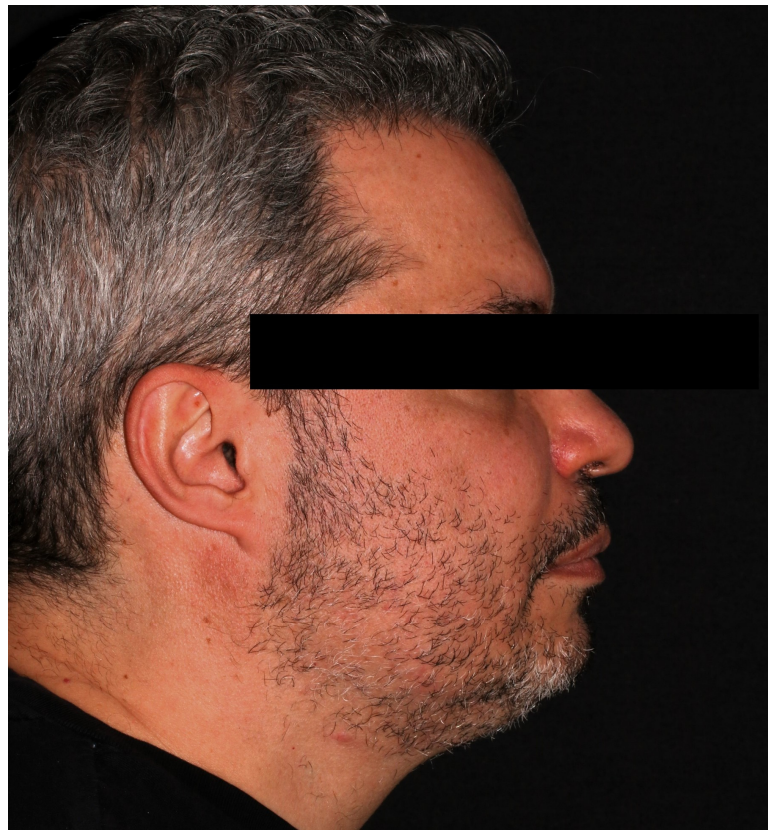
2. Case Presentation

A 47-year-old male patient, despite being a smoker, presented with good systemic and periodontal health. He attended the Egas Moniz School of Health and Science with the main complaint of excessive gingival display (EGD) (Figure 1A). The patient, classified as Angle Class I, had a brachyfacial appearance (Figure 1B), and exhibited clinical crowns without altered passive eruption, along with some incisal wear.



(A)

Figure 1. Cont.



(B)



(C)

Figure 1. Cont.



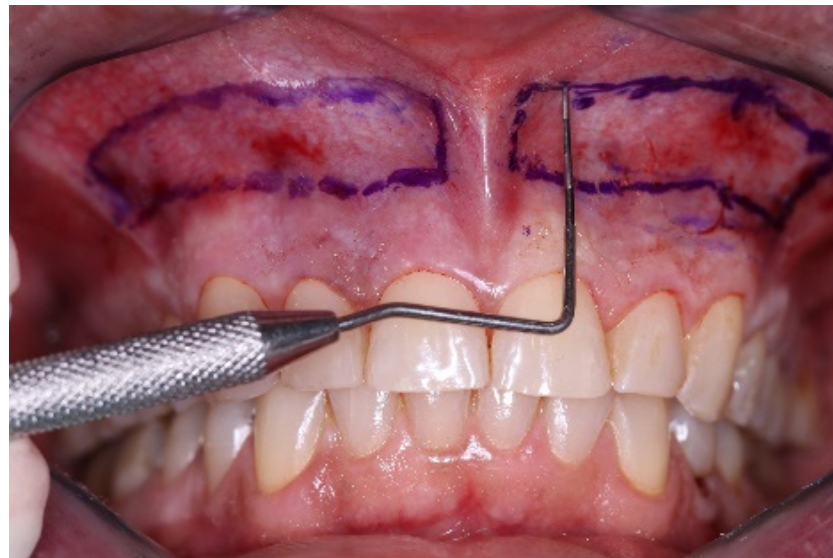
(D)

Figure 1. (A) Initial appearance of the smile. (B) Side view photograph (brachyfacial appearance). (C) Smile with an average 5 mm of EGD. (D) Cephalometry where normal size and position of the upper jaw were observed.

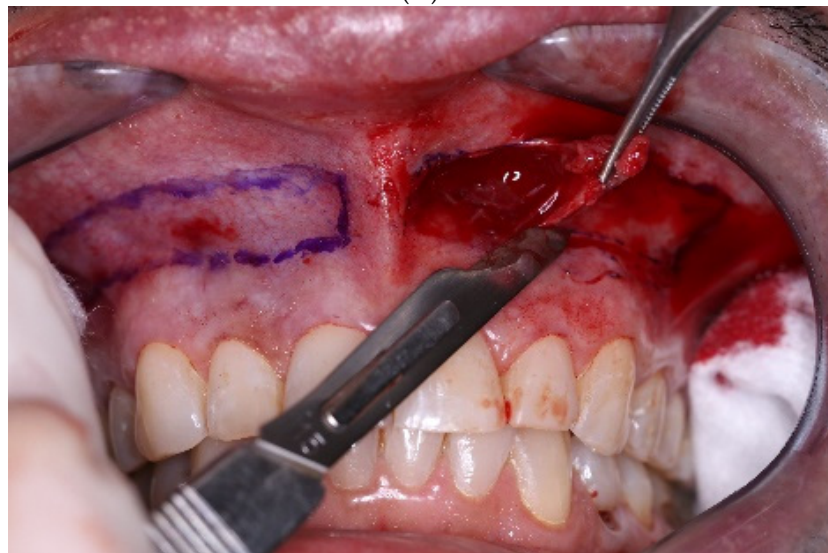
A length of 9.5 mm was observed in the central incisors due to incisal edge wear, along with EGD being observed during the smile, extending from the right upper second premolar to the left upper second premolar. The height from the nasal base to the lower edge of the upper lip was 24 mm, which is considered a normal lip height for a male. The patient demonstrated hypermobility of the upper lip elevator muscles during smiling. In a situation considered normal, the upper lip rises 6 to 8 mm from the resting position to the spontaneous smiling position; however, in this case, the upper lip position rose on average 1.5 times more than what is considered normal. The height of exposed gingiva in the central incisor region during spontaneous smiling was approximately 5 mm (Figure 1C). According to the patient's report, there was a genetic predisposition as his father had the same lip condition.

Cephalometric radiograph was obtained to exclude excess vertical growth of the maxilla, which may also lead to excessive gingival display (Figure 1D).

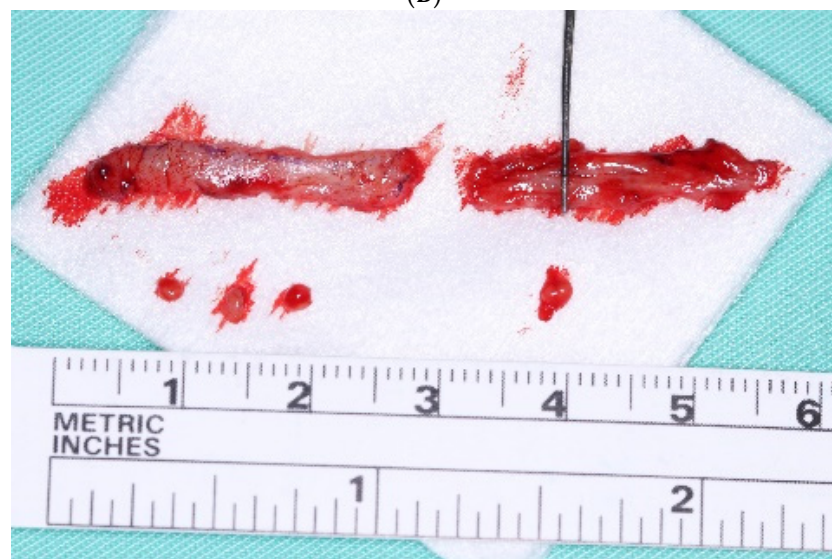
A proposed lip repositioning surgery was performed after extra and intra-oral disinfection using chlorhexidine. The procedure was carried out under local anesthesia of the infraorbital nerve, supplemented with anesthesia in the vestibular sulcus and the keratinized gingival region, bilaterally, using 2% Articaine with 1:100,000 epinephrine. To delineate the areas for incision, a bilateral lip retractor (Espandex) was used to ensure consistent lip expansion on both sides (right and left). The initial contour of the incisions was marked with a sterilized dermatological pencil (Surgical Marker) (Figure 2A). The lower border of the incision was delimited approximately 1 mm above the mucogingival line, and the upper border was delimited 10 mm above the previous one (twice the average gingival exposure height). The two lines were connected at the distal ends (in the regions of the first premolars), and the labial frenulum was preserved in the midline to maintain a reference during closure of the surgical edges.



(A)



(B)



(C)

Figure 2. Cont.

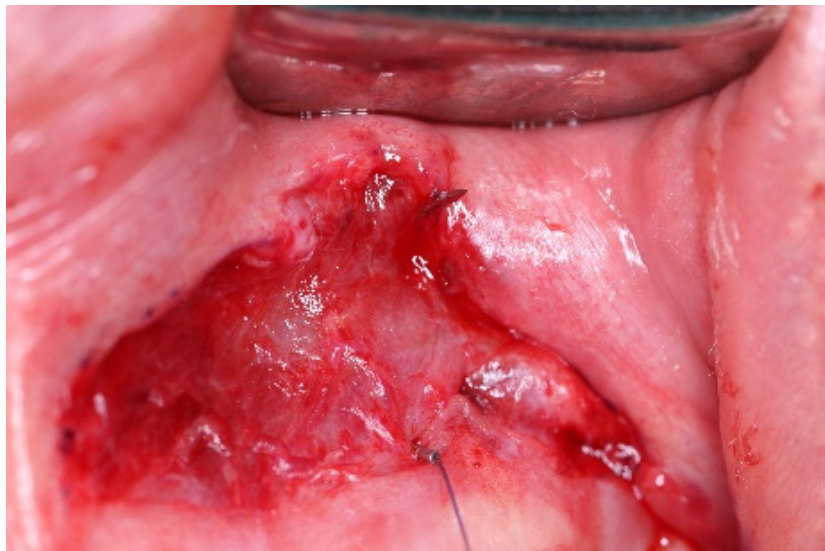


(D)

Figure 2. (A) Markings. (B) Removal of the mucosal band. (C) Strips of mucosa removed. (D) Exposure of the connective tissue.

For the superficial mucosal incisions, the same bilateral lip retractor (Espandex) was employed to maintain adequate exposure. N° 15C scalpel blades were used. A partial-thickness dissection was performed, and all epithelium was excised along the rectangular contour, exposing the underlying connective tissue (Figure 2B–D).

After removal of the mucosal strip on both sides, the first stage of deep suturing was initiated using slow-absorbing Polidioxanone (PDS) 5/0 suture (Atramat® Internacional Farmacéutica S.A. de C.V., Cuautitlán Izcalli, Mexico). Modified horizontal mattress sutures were performed to limit movement of the muscles and tissues in the region, as well as to approximate the surgical edges before external sutures (Figure 3A,B).



(A)

Figure 3. Cont.



(B)

Figure 3. (A) Deep sutures. Needle entry and exit points in the modified horizontal mattress suture. (B) Deep sutures (modified horizontal mattress) providing approximation of the upper and lower edges.

The second stage of suturing was performed using the same absorbable thread. The technique used was interrupted simple sutures, ensuring complete coaptation of the surgical edges to guarantee proper alignment of the midline of the lip with the midline of the teeth (Figure 4).



Figure 4. External sutures with complete coaptation of the mucosa.

A corticosteroid (Deflazacort 30 mg) was prescribed, starting 2 h before the procedure and maintained for 2 days; an antibiotic (Amoxicillin 1 g) started 2 h before the procedure and maintained for 7 days; an analgesic (Paracetamol 1 g) in case of pain; and a 2% chlorhexidine mouthwash (2 times per day for 15 days). The patient was instructed to rest and apply ice, maintaining a soft and cold diet for 2 days.

The patient was reevaluated after 7 days, reporting minimal discomfort on the first day, with a sensation of tension at the surgical site. The patient also described numbness in the right subnasal region. Healing was considered excellent for the period (Figure 5A,B).



(A)



(B)

Figure 5. (A) Appearance of the smile 7 days after surgery. (B) External sutures after 7 days post-operatively.

After 15 days, the patient was reevaluated, and mucosal healing was complete. The patient did not report any complaints (Figure 6A,B).



(A)

Figure 6. Cont.



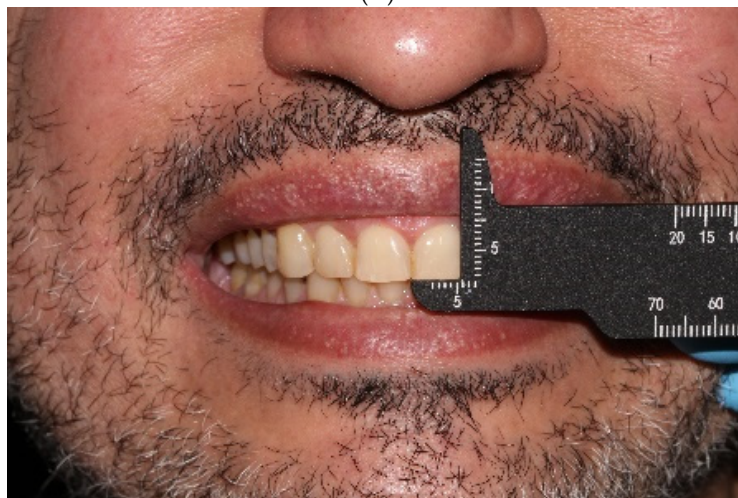
(B)

Figure 6. (A) 15 days post-operative follow-up. (B) External sutures after 15 days post-operatively.

At 30 days post-operatively, a scar line was observed (Figure 7A), confirming other reports in the literature. Gingival exposure decreased to an average of 1.5 mm (Figure 7B).



(A)



(B)

Figure 7. (A) Visible scar above the mucogingival line. (B) A 30-day of post-operative follow-up with an average gingival exposure of 1.5 mm when smiling.

After 6 months of follow-up, gingival exposure remained reduced, and the mucosa appeared healed. The patient was quite satisfied with the results of the treatment (Figure 8A–C).



(A)



(B)



(C)

Figure 8. (A) At 6 months post-operatively. (B) Improvement in healing. (C) Aspect of the smile at 6-month post-operative follow-up.

3. Discussion

For many years, aesthetic problems treated by dentists were limited to those involving teeth, without considering the gums. However, it is now well established that these structures must be in balance to appear aesthetically pleasing. More than 3 mm of gingival exposure during smiling is considered excessive gingival display, also known as a gummy smile, which is unattractive [13–16]. When achieving an ideal smile, it is also well established that structures—dental, gingival, skeletal, and muscular—must be in balance to appear aesthetically pleasing [4,13].

The literature classifies gummy smiles according to their different etiologies and reports the possibility of a combination of some of these factors [4,17–19]. The latest classifications confirm that this variety of factors can act alone or in combination. These factors include altered passive eruption, vertical maxillary excess, short upper lip, hyperactive upper lip, among other factors that cause gingival enlargement [4]. In some cases, it is not possible to treat the patient solely through gingival recontouring because the amount of gingival exposure remains significant [20–22].

Many cases of EGD have multiple etiologies and require more than one technique to achieve desirable aesthetic results. Several techniques and variations have been reported, including myotomy or repositioning of the levator labii superioris muscle, Le Fort impaction, maxillary gingivectomies, botulinum toxin injections, and lip stabilization. Treatment is tailored to each type of etiology, and two or more techniques can be combined to resolve the issue [17,23–28].

Surgical lip repositioning (LipStat) for the treatment of EGD in mild to moderate cases is a less invasive procedure, with fewer post-operative complications and provides faster recovery compared to orthognathic surgery [4,18,27,29,30]. It can be said that LipStat is a viable treatment option for improving the gummy smile, provided that a systematic evaluation of the case is performed to choose the appropriate treatment option [29,31].

The contraindications of the technique include cases with severe vertical maxillary excess (>8 mm). These severe skeletal deformities should ideally be treated with orthognathic surgery [4,18]. A reduced width of the inserted gingiva can result in scar exposure during smiling. In such situations, the possibility of scar exposure over the mucogingival line is a limitation for this technique and should be explained to the patient [27].

Reports in the literature have shown some post-operative complications, such as discomfort, bruising, and edema of the upper lip. A less frequent complication may be the formation of a mucocele due to the cutting of the minor salivary glands in the upper lip, which arises in the post-operative period [18]. Other rare complications reported in the literature include paresthesia and transient paralysis [32]. Complications reported regarding the lip repositioning surgery are generally minor and include post-operative edema, mild pain, and tension when smiling or speaking, especially during the first week. Complications such as transient numbness and paresthesia, early recurrence, suture loss, bruising, mucocele development, and double-lip formation are rarer, while mild scarring near the mucogingival junction is often present. When more invasive approaches, such as muscle detachment, are used, complications can increase in both prevalence and duration. Although some authors report significant recurrence rates and severity, several studies show good long-term stability of results; these discrepancies may depend on the technique and possibly the operator. In addition to these complications, inadequate diagnosis or poor treatment planning, where other underlying causes are not adequately considered, can lead to inappropriate use of the lip repositioning surgery, resulting in questionable aesthetic outcomes [27].

The complications of LipStat reported in the literature include discomfort, bruising, post-operative edema, some rare cases of mucocele, paresthesia, and transient paralysis [3,16,18,23,27,31]. Additionally, the risk of recurrence should be thoroughly discussed. Previous reports have shown a higher likelihood of recurrence, especially in cases with limited indications for this technique [21,22,33–35].

A study conducted in 2021 subjected four patients with EGD of 6 to 8 mm to modified lip repositioning surgery, using internal horizontal mattress sutures to immobilize the upper lip elevator muscle. None of the patients experienced complications, and healing occurred without incident. All patients demonstrated favorable results with stability over an average follow-up period of 3.5 years [12].

Accurate case selection is crucial for reducing the risk of recurrence in lip repositioning surgery, and if followed correctly, the results will be sustainable for months [13,36]. The stability of the lip in its new position is crucial for the overall success of the procedure. Therefore, it is recommended to use appropriate suturing techniques for an adequate period to limit the action of the lip elevator muscles for an extended time [37–39]. The stability of the sutures in the post-operative period is crucial. After closing the surgical edges, in cases where orthodontic brackets are present, they can be used as anchorage for suspensory sutures in the sulcus, further limiting the mobility of the upper lip during the post-operative period [35]. The risk of an asymmetric smile can also occur when the surgeon does not pay attention to different levels of gingival exposure in patients who already have a pre-existing asymmetric smile [27]. The use of botulinum toxin can be an alternative in the treatment of gummy smile [6,17,19,23,24,27,39].

A systematic review conducted in 2018 investigated cases of excessive gingival display (EGD) treated with upper lip repositioning (LipStat). On average, they observed a reduction of 3.4 mm in gingival exposure, suggesting that the technique could be successfully used to treat EGD [1]. This reduction in gingival exposure was also observed in the present case (average of 3.5 mm).

Another method used for surgical lip repositioning is the use of a diode laser due to its beneficial characteristics, such as efficient tissue ablation capacity, reduced wound contraction, minimal scar formation, and decreased pain after surgery. Thus, the use of lasers in lip repositioning surgeries aims to minimize pain, bruising, swelling, and discomfort, providing long-term aesthetic benefits [40]. Patients often report that the most challenging aspects are discomfort, pain, hematoma, swelling, and limited lip movement during the initial recovery period. However, laser surgery has proven to be more effective than conventional scalpel surgery, as it can mitigate these effects [41].

Several reports showed improved outcomes, with reduced recurrence, when the surgical lip repositioning technique is combined with myotomy of the levator labii superioris alaeque nasi muscle [18–20,42]. Despite promising results, there are still inconsistencies in the existing evidence. Conducting further structured clinical trials is essential to determine the effectiveness of myotomy compared to the traditional method [42].

In 2021, a study evaluated the long-term clinical results of a modified lip repositioning technique that utilized periosteal sutures in a population of 12 twins with hypermobility of the upper lip. The patients were divided into two groups: the control group received treatment with the original LipStat technique, while the test group was treated with the addition of periosteal sutures. In the control group, there was a slight increase in gingival exposure over 3 years. On the other hand, in the test group, higher satisfaction and more stable results were observed over a 3.5-year follow-up [43].

Another study in 2021 analyzed four patients with 6 to 8 mm of excessive gingival display (EGD) who underwent modified surgical lip repositioning (Modified LipStat) with internal horizontal mattress sutures to immobilize the levator labii superioris muscle. All patients demonstrated stability over a 3.5-year follow-up period [12].

A recent study, involving 20 female patients with hypermobility of the upper lip or short upper lip, compared the standard technique versus the other with dual-layer sutures. Authors observed that after surgery there was a significant reduction in gingival exposure in both groups at 14 days. However, at 3 months, the first group experienced complete relapse, while the second group showed slight improvement, although it also fully relapsed by 6 months [39].

In 2023, a study with 200 patients compared the clinical outcomes and long-term stability following modified surgical lip repositioning with the addition of periosteal

sutures (test group, $n = 100$) versus conventional surgical lip repositioning (control group, $n = 100$). The results demonstrated stability and no recurrence with the modified technique up to one year of follow-up [38]. The patient satisfaction level with the results of modified lip repositioning was significantly higher when compared to the satisfaction level of patients undergoing the conventional technique [44].

Several preoperative procedures must be performed, including the administration of analgesics, cleaning of the surgical site, and application of local anesthesia. When appropriate and necessary, prophylactic antibiotic therapy may also be recommended. After the surgery, it is essential to alleviate pain and inflammation to ensure a comfortable recovery period, with specific instructions for the patient [31].

Despite the emergence of studies with larger sample sizes in recent years, the importance of proper patient selection and choosing the best option for internal sutures is still lacking in the current literature.

4. Conclusions

When the diagnosis and classification of excessive gingival display are carried out correctly, modified surgical lip repositioning performed either alone or in conjunction with other techniques, demonstrates itself as an effective and predictable procedure with low post-operative morbidity compared to orthognathic surgery.

According to recent publications, modified lip repositioning surgery is a viable and successful treatment option for patients with EGD. Typically, with MLRS, a 2 to 3 mm reduction in EGD can be expected.

The modified surgical lip repositioning technique, with internal mattress sutures in a modified horizontal mattress pattern, appears to provide more reliable long-term results in patients with excessive gingival display, with a lower risk of recurrence. However, it is important to pay attention to the quality of well-tensioned sutures to ensure effective stabilization of the upper lip.

A limitation of this manuscript was the 6-month follow-up period. Despite the promising results, further longitudinal studies with a larger sample size are needed to determine the efficacy and stability of this treatment modality.

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Institutional Review Board Statement: Accordance with the guidelines of the Egas Moniz School of Health and Science, the study in question meets the required ethical standards. The Informed Consent Form was duly signed by the participant involved, ensuring the protection of their identity, as established by the Declaration of Helsinki and Decree-Law No. 80/2018. Therefore, in accordance with current legislation and ethical standards, submission to the Ethics Committee does not apply in this specific case.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available in the article.

Conflicts of Interest: The authors declare no conflicts of interest.

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