

Modified Lip Repositioning Surgery with and without Dual-layered Suturing for Treatment of Gummy Smile Patients

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Background: The present study was performed to evaluate the differences in the efficacy of treating excessive gingival display with the standard modified lip repositioning surgery or the modified lip repositioning surgery with dual-layered suturing.

Methods: This study included 20 female patients who had a gummy smile resulting from upper lip hypermobility or short upper lip. Preoperative measurements of the amount of gum exposure were taken during involuntary smiling. The patients were randomly divided into two groups; the first group was treated with the standard technique, whereas the second group was treated with the double-layered suturing method. All patients were followed up at 14 days, 3 months, and 6 months; postoperative assessment was done by measuring the changes in the gingival display during spontaneous smiling.

Results: Postoperative measurements at 14 days follow-up showed a significant reduction in the amount of gingival exposure in both groups. However, at 3 months, there was a complete relapse for the first group of patients, whereas the second group showed a slight regain in the amount of gum exposure, though the latter group showed a complete relapse at 6 months postoperative.

Conclusions: The dual-layered suturing for the modified lip repositioning surgery did not provide any long-term improvement for treating gummy smile patients; however, it did delay the relapse to a certain extent for the first 3 months postoperative in some of the patients. (*Plast Reconstr Surg Glob Open* 2024; 12:e5521; doi: 10.1097/GOX.0000000000005521; Published online 23 January 2024.)

INTRODUCTION

An increase in the amount of gum exposure during both voluntary and involuntary smiling have a negative impact on the beauty of the smile for the patients.^{1,2} The term excessive gingival display or gummy smile should only be used in the case of a 4-mm gingival display during involuntary smiling, which is measured from the free gingival margin of the central incisors to the inferior border of the upper lip.² There are lots of etiological factors that contribute to a gummy smile, which include vertical maxillary excess, altered passive eruption, short upper lip, hyperactivity in the elevator muscles of the

lip, and dento alveolar extrusion, especially in the anterior area.^{3,4}

One of the techniques advocated for treating gummy smile is lip repositioning surgery, which aims at removing part of the mucosa and suturing this area into another level, thus limiting the muscle pull of the elevator muscles of the lip.^{5,6} One of the major drawbacks of this surgery is the relapse that occurs with almost full regain in the preoperative amount of gum exposure.⁷⁻⁹ That is why several authors proposed lots of modifications for the original technique to overcome this drawback.^{5,6,10} Another complication that might happen is the midline shift during suturing due to the removal of the labial frenum, which is why modified lip repositioning surgery was proposed, as it aims at preserving the frenum, thus preventing this complication.^{11,12}

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The goal of this study is to propose the dual-layered suturing approach with the modified lip repositioning surgery to provide an internal fixation to hold the tissues, thus counteracting the effect of the muscle pull from the elevator muscles of the lip and, therefore, providing a more stable outcome for the procedure.

MATERIALS

Twenty Middle Eastern female patients aged 25-37 years complained of an excessive gum display while smiling. Medical and dental history was taken for all patients; careful examination of the lip architecture was performed followed by examination of the gingiva and associated periodontium. Only patients with upper lip hypermobility and short upper lip were included in the study.

The upper lip length was measured by recording the distance from the subnasale to stomion superiors; the normal upper length should range from 20 to 24mm. Upper lip hypermobility was evaluated by subtracting the incisal exposure at rest from the dentogingival exposure during involuntary smiling. The amount of gingival display was recorded by measuring the vertical length from the free gingival margin of the upper central incisor to the lower border of the upper lip. All the previously mentioned parameters were measured digitally using Adobe Photoshop Cs6 through standardized photographs. Serial photographs for each patient were taken using a Nikon D7500 DSLR camera at every follow-up interval with an endodontic ruler included in the photograph as a reference for normalization of the required measurements. After opening each photograph using the Photoshop program, the ruler tool was selected to measure the required measurement. A centimeter on the ruler included in the photograph was measured by the ruler tool by pressing the left mouse button and shift key at the same time to ensure pure vertical direction of the ruler tool, then dragging the mouse downward to the end point of the centimeter. This measure of the centimeter shows the magnification factor in the image; any measurement in the photograph was then divided by the calculated factor giving the real measurement of the required parameters.

Patients were randomly divided into two groups:

- The first group was treated with modified lip repositioning surgery.
- The second group was treated with modified lip repositioning surgery with dual-layered suturing.

Group 1

A bilateral intraoral infraorbital block, in addition to an intraoral infiltration, was performed using a long acting anesthesia with a vasoconstrictor. A partial thickness flap was performed by making an inferior incision right at the mucogingival junction opposite to the right central incisor and a superior incision right at the mucosa, and 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). The same step was done on the left side, leaving the labial frenum intact. Suturing was then performed using a 5-0 Vicryl resorbable

Takeaways

Question: Will the dual-layered suturing technique with the modified lip repositioning provide stable results for treating gummy smile patients other than using the modified lip repositioning surgery alone?

Findings: The proposed technique does not add much to the efficacy of the procedure.

Meaning: The dual-layered suturing technique with the modified lip repositioning surgery does not provide a long-term stability the same as when the modified lip surgery is performed alone; however, it may stabilize the results for the first 3 months after the procedure.

suture by approximating the superior and inferior parts of the mucosa.

Group 2

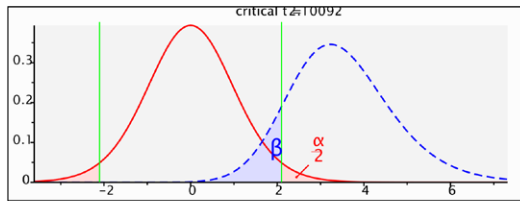
The same steps applied in group 1 were performed in this group; however, after removal of the strap of epithelium, the connective tissue bed was sutured by a resorbable suture by approximating the superior edge of the bed and the inferior edge, followed by suturing of the external part of the wound as in group 1 (Fig. 1). (See Video [online], which displays stages of modified lip repositioning surgery with dual-layered suturing.)

POSTOPERATIVE CARE

All patients were strictly instructed not to get near their lips, 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. We instructed all patients to use a chlorhexidine mouthwash. However, we firmly instructed not to use it as a gargle but instead to put it in their mouth and to move their head in a circular motion to allow the solution to move freely to prohibit any lip movements. Moreover all patients were instructed to take a broad spectrum antibiotic for 5 days in addition to a single shot of dexamethasone injection as an intramuscular shot. All patients came for the follow-up periods: 14 days, 3 months, and 6 months after the procedure. The amount of gingival display was assessed in all the follow-up periods.



Fig. 1. Diagram illustrating the outline for the flap excision.



t tests - Means: Difference between two independent means (two groups)

Analysis: A priori: Compute required sample size

Input: Tail(s) = Two

Effect size d = 1.5

α err prob = 0.05

Power (1- β err prob) = 0.85

Allocation ratio N2/N1 = 1

Output: Noncentrality parameter δ = 3.3541020

Critical t = 2.1009220

Df = 18

Sample size group 1 = 10

Sample size group 2 = 10

Total sample size = 20

Fig. 2. Sample size.

SAMPLE SIZE

Sample size calculation was performed using G*Power version 3.1.9.7 based on the results of previous studies.^{13,14} A power analysis was designed to have adequate power to apply a two-sided statistical test to reject the null hypothesis that there is no difference between groups. By adopting an alpha level of 0.05 and a beta of 0.15, that is, power of 85% and an effect size (d) of 1.5 were calculated based on the results of a previous study. The predicted sample size (n) was 20 (ie, 10 samples per group) to detect for different amount of gingival display between groups (Fig. 2).

RESULTS

None of the patients reported paresthesia or any serious complications after the surgery; however all patients reported great tension at the upper lip from the suturing, which affected their daily life to an extent. Also, edema was observed in all patients right after the surgery, which was controlled using medications, and the edema settled down within 3 days. All sutures were removed at the 14 day follow-up interval; however, in a few patients who had a delayed healing pattern, the knots were left for 3 week intervals. None of the patients had any infections near the knots or experienced any problems around the suture sites.

The amount of gingival display at baseline was 4.12 ± 0.52 mm; it was markedly decreased after 14 days to reach zero in both groups. However, the first group experienced a full regain in the amount of gum exposure at the 3 months interval. On the other hand, the results were maintained till 3 months in the second group to remain zero in some patients, where other patients experienced a relapse. However, this significant improvement did not last, as it reached baseline at 6 months. By the end of the study, the patients of both groups were not satisfied with their results, only because the results were

not maintained, where neurotoxins were offered as a different line of treatment with a temporary effect.

The following figures are for a patient from group 2 who underwent modified lip repositioning with dual layered suturing: Figs. 3–6.

Statistical Analysis

Kaplan-Meier survival analysis is a descriptive procedure for examining the distribution of time-to-event



Fig. 3. Preoperative picture.



Fig. 4. Fourteen days after the procedure.



Fig. 5. Three months postoperative.



Fig. 6. Six months postoperative.

variables (Fig. 7). Log rank test was used to compare time-to-event variables by levels of a factor variable. The confidence interval was set to 95%, and the margin of error accepted was set to 5%. So, the *P* value was considered significant as the following:

Probability (*P*value)

P less than 0.05 was considered significant.

P less than 0.001 was considered as highly significant.

P greater than 0.05 was considered insignificant.

DISCUSSION

The purpose of this study is to evaluate the dual-layered suturing technique in the modified lip repositioning surgery and whether it will help in maintaining the results and give a superior result than while doing the modified lip repositioning surgery alone. The latter-mentioned surgery was advocated in the literature as a less-invasive approach than the traditional jaw surgery due to the lower risk of complications,¹² despite the fact that orthognathic surgery provides more stable results than the lip repositioning procedure.

Due to the different causative factors contributing to a gummy smile, several treatment options have been advocated in the literature.^{3,15} Case selection is important, as patients with vertical maxillary excess are not good candidates for this procedure.¹² Moreover, the presence of an adequate keratinized gingiva is vital for this procedure for a proper flap design and suturing.¹⁶

The use of botulinum toxin injections for treating gummy smile is a good option; however, it does not provide long lasting results.^{9,17-19} Furthermore, lip repositioning surgery is associated with a high degree of relapse due to the power of the muscle pull from the levator labii superiors alaque nasi, levator labii superiors, zygomaticus minor, and zygomaticus major.²⁰ Thus, our study aimed to evaluate the success rate of dual-layered suturing, which

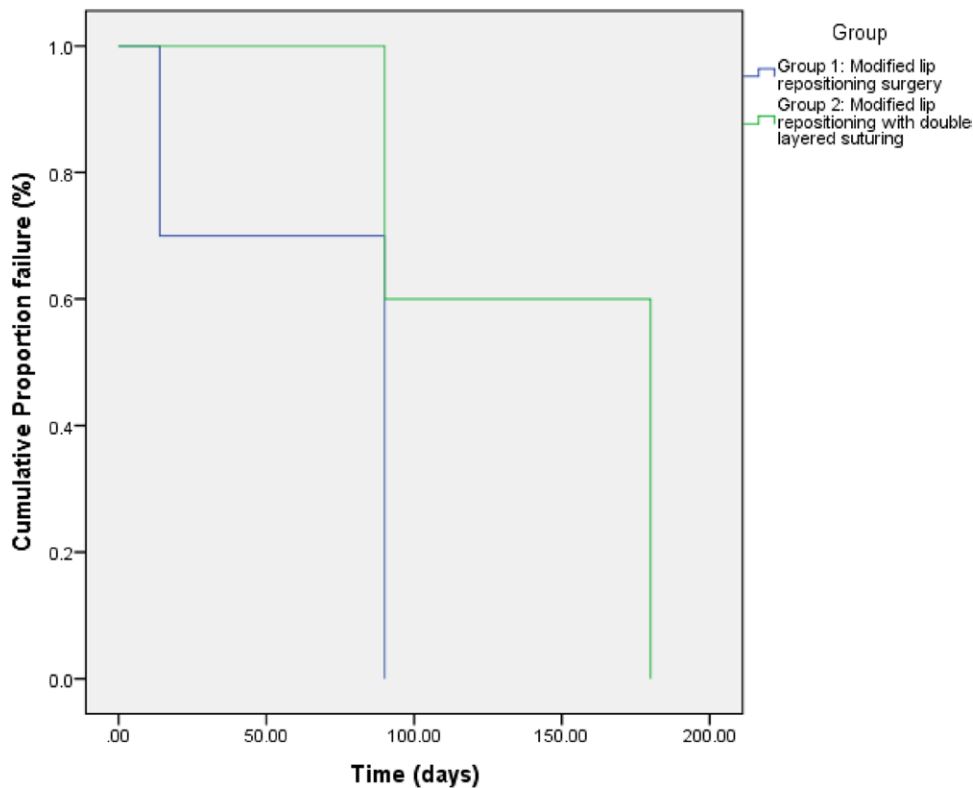


Fig. 7. Kaplan-Meier curves in group 1 and group 2. There was a statistically significant difference between two curves according to time “days” (log-rank chi-squared= 9.439, df = 1, *P* = 0.002). All patients (100%) had failure over the period, but group 1 shows that the time was shorter to failure in group 1 [90 (60-117 days) than group 2 (180 days)].

may resist the muscle pull of the elevator muscles of the lip.

The idea of suturing the edges of the connective tissue bed is to provide an internal fixation inside the tissue, which may provide more stable results by stabilizing the surgical site. The surgery aims to decrease the vestibular depth, thus forming fibrous tissue in the form of a scar which will resist muscle contraction. This will be further aggravated by providing a lock inside the tissue with the internal suturing to resist the contraction of the elevator muscles of the lip.

Some authors proposed cutting the muscles as a favorable approach to prevent the relapse of this procedure.^{21,22} In our concept, we think that the most acceptable approach to providing long-term results until now is to either relax the muscle before the procedure by a preoperative injection of a botulinum toxin, provided that the botulinum toxin injection is repeated in different intervals as mentioned in our previous research, or to just use botulinum toxin injections alone, taking into consideration that the latter procedure is a temporary line of treatment.

At the end of our study, we realized that we do not recommend this procedure due to its high relapse rate and the downtime associated with the procedure. Further studies with longer follow-up periods will help in a better assessment of our proposed technique.

CONCLUSIONS

The modified lip repositioning surgery does not provide long-lasting results for gummy smile treatment. However, dual-layered suturing may help in delaying the relapse, but this is applicable only for the first 3 months in some patients, followed by complete relapse in the future period. We do not think this procedure should be practiced for patients due to its downtime and the nonlasting results.

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DISCLOSURE

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

PATIENT CONSENT

Written informed consent were obtained from all patients explaining the nature of the treatment as well as the expected outcome and side effect as well as the alternative treatment in case of relapse. Patients provided written consent for the use of their images.

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