

GUMMY SMILE TREATMENT USING LIP REPOSITIONING SURGERY

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ABSTRACT

Aim: The present study was performed to evaluate the longevity and efficacy of the lip repositioning surgery by assessment of the gingival display changes that occur after the surgery through clinical & digital methods.

Methods: This prospective study included ten female patients who suffered from excessive gingival display due to upper lip hypermobility or short upper lip. Pre-operative measurement of the amount of gingival display were recorded both clinically using an endodontic ruler & digitally using Adobe Photoshop cs6 through a well standardized photographs. The surgery was performed under local anesthesia for all patients by removing part of the labial mucosa (labial vestibule) followed by suturing of the wound by interrupted 0-5 resorbable suture. All patients were followed up at 14 days, 4 months, 8 months and 12 months, postoperative assessment was done by measuring the changes in the gingival display using the same clinical & digital techniques.

Results: Post-operative measurements at 14 days follow up, showed obvious reduction in the amount of gum exposure. However complete relapse was observed at 4 months.

Conclusion: The longevity of the procedure is questionable with almost complete relapse.

KEY WORDS: lip repositioning, gummy smile, excessive gingival display, upper lip.

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INTRODUCTION

Gummy smile is a term which describes excessive gum show during involuntary smiling, however the amount of gingival exposure should be more than two or three millimeter¹; it is important to notice that this variable may differ among different races, population. Though a 4 mm gingival exposure is thought to be unattractive among all populations^{2,4}. Excessive gingival display may be caused by lots of factors such as, altered passive eruption, anterior dento alveolar extrusion, vertical maxillary excess, short upper lip and hyperactive elevator muscles. Many treatment modalities have been advocated for treatment of excessive gum exposure, these of which includes aesthetic crown lengthening⁵, intrusion of the maxillary teeth⁷, Jaw adjustment surgery⁸, neurotoxin injections and lip repositioning surgery^{9,10}. (Table1)

TABLE (1) Etiological factors causing excessive gingival display

Etiological factors causing excessive gingival display	
Jaw related factors (Skeletal in origin)	Vertical Maxillary Excess
Teeth related factors (dental in origin)	Anterior dento – alveolar extrusion
Periodontium related factors	Altered passive eruption
Soft tissue related factors	Short upper lip Hypermobility in the elevator muscles of the lip

Rubinstein and Kostianovsky introduced the lip repositioning surgery as a part of medical plastic surgery in 1973¹¹; later on the original technique was modified by Rosenblatt and Simon in 2006¹² and was introduced in the field of oro facial surgery. The surgery is a conservative technique that is performed under local anesthesia for treatment of excessive gum exposure and is thought to be of a permanent effect where the aim of the surgery is to shorten the vestibule by removing part of it thus limiting the pull of the elevator muscles of the lip¹³.

Several modifications have been added to the original technique since then, these of which includes; modified lip repositioning by leaving the labial frenum intact, muscle containment surgery and myotomy of the elevator muscles of the lip¹⁴⁻¹⁶. Lots of studies claims that the technique shows a permanent effect where each author advocate a certain modification for the surgery that may add a more stable results out of the procedure. There is a lack of a standardized data for surgeons to make informed decisions when choosing this technique for the treatment of patients with excessive gum exposure. From here comes the necessity for our study to evaluate the lip repositioning surgery through a well-designed study using fixed parameters. The goal of this study is to evaluate the effect and assess the results of the lip repositioning surgery in terms of treating patients with excessive gingival display.

MATERIALS

Ten Caucasian female patients aged from 25 – 37 years with the chief complaint of a gummy smile. History from all patients including past and present medical and dental histories were taken, extraoral examination of the lip architecture was performed followed by intraoral examination of the gingiva and associated peridontium. None of the patients had any dental misalignments or occlusion problems. Only patients with upper lip hypermobility and short upper lip were included in the study. Patients with altered passive eruption, anterior dento alveolar extrusion and vertical maxillary excess was excluded from the study. Lateral cephalometric analysis was performed for all patients to exclude patients with vertical maxillary excess.

The normal upper lip length ranges from 20 – 24 mm¹⁷ so measuring the upper lip length at rest were performed by recording the vertical length from the subnasale to the stomion point by an endodontic ruler in addition to measuring the amount of incisor show at rest in order to diagnose the short upper lip (normal lip length should be from

21 – 24 mm), while upper lip hypermobility was diagnosed by measured by subtracting the incisal exposure at rest from the dentogingival exposure during spontaneous smiling. (Figure1)

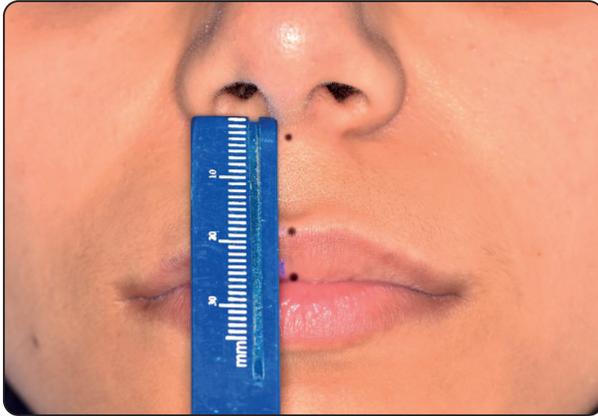


Fig. (1): Measuring the outer lip length at rest.

Preoperative assessment included measuring the following measurements clinically using manual tools & digitally using Adobe Photoshop Cs6 through a standardized photographs; amount of gingival display at 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 base of the upper lip. Written informed consent was obtained following a discussion of benefits and treatment alternatives with all patients. (Figure2)



Fig. (2): Measuring the amount of gingival display at maximum smiling using a periodontal probe.

Digital photography:

In order to obtain standardized photograph all variables was fixed every time during photography. These variables included the relationship between the camera and the patient, camera position in space and adjusting the values of the camera's settings.

To standardize the camera position in relation to the patient, we made sure that the position of the three legs of a tripod were positioned in the same exact position and distance from the patient head every time the photos were being taken. To fix the position of the camera in space, the pan handle was used to adjust the horizontal axis, the round spirit level was used to adjust the vertical axis and the crack handle was used to adjust the center column height to at the same level of the patient head. Camera settings were adjusted where the focal length was 105 mm, shutter speed 1/125, ISO (200) and the F-stop (9-25).

After adjusting all those variables each patient was asked to stand upright in rest position and multiple pictures were taken, this was applied again but by asking the patient to give a full social smile. Multiple pictures were taken and compared and the best pictures giving the full social smile were selected for the pre and post-operative assessment.

Digital measurements using Adobe Photoshop cs6 software:

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 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 left mouse button and shift key in 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.

Surgical procedure:

Local anesthesia was administered through a bilateral infraorbital block in addition to local infiltration at the labial vestibule using a long acting anesthetic agent solution with epinephrine. The procedure consists of creating an elliptical incision in the labial mucosa. A marker was used to draw the outline of the proposed flap. The lower border of the flap was placed at the mucogingival junction and was extended from the mesial aspect of the first premolars bilaterally, upper border of the incision was placed above and parallel to the lower

one at a distance double the amount of gingival display. The outlined mucosa was removed by sharp dissection leaving the underlying connective tissue exposed. The first suture was placed at the area of the labial frenum to help in achieving a midline symmetry while the remaining closure bilaterally was completed with interrupted sutures using a 5-0 resorbable suture. (Figure 3 – 6)

It is worth mentioning that the lateral border of the flap is chosen depending on the exposed teeth during smiling, so in some cases we can extend the border to include the upper first molar, Furthermore the distance between the upper and lower border of the flap could be more than double the amount of gingival display, however care should be taken not to violate the wet / dry border.



Fig. (3) Marking the incision outline



Fig. (4) Complete excision of the mucosa

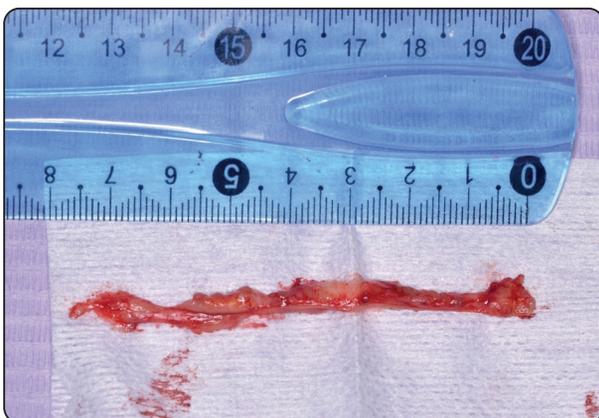


Fig. (5) Strap of epithelium after excision



Fig. (6) Closure of the wound & suturing it to the attached gingiva

Postoperative care

All patients were strictly instructed not to touch their lips and to restrict any lip movements for a minimum of three weeks. They were also instructed to apply ice packs at 20 minute intervals for 24 hours and soft diet during the first postoperative week. Postoperative medications included; analgesics, anti-inflammatory and antibiotics to help in reducing pain and edema and to prevent infection. Since the sutures were resorbable, some of the knots dissolved on its own, other knots had to be removed after 3 weeks, we strongly advise on leaving the knots for 3 weeks because this may further add to stabilization of the wound area as the main aim of the procedure is to shorten the vestibule and as the mucosa is highly stretchable, this seemed to be a reasonable approach. However we didn't observe any infection around the knots. Patients were followed up at the following periods; 14 days after the procedure, 4 months, 8 months and 12 months. Post-operative amount of gingival display were re-

corded in all the follow up visits.

RESULTS

All patients reported pain that was tolerable and controlled with analgesics, the main concern of all patients was the postoperative swelling and upper lip edema which subsided within a week. None of the patients reported paresthesia or any serious complications. A scar line was observed at the new proposed vestibular position which was obtained by the surgery, however the scar line was hidden inside the vestibule at the mucogingival junction so it didn't cause an aesthetic problem to the patient.

All pre and postoperative measurements were taken either clinically or digitally using Adobe Photoshop CS6 software program through a standardized digital photographs, Statistical analysis was done to the raw data obtained clinically & digitally and were compared with each other. We chose to rely on the data taken digitally due to their accuracy. (Figure 7)



Fig. (7) Series of photos during smiling representing a patient treated with lip repositioning surgery, (A) baseline, (B) after 14 days, (C) after 4 months, (D) after 8 months, (E) after 12 months

The preoperative amount of gingival display was 4.91 ± 0.57 mm, it was markedly improved after 14 days to be zero, and then start to relapse to return to the baseline reading (4.91 ± 0.57 mm), the marked reduction in the amount of gingival display was only noted after 14 days, and however complete relapse happened thereafter. By the end of the study, the patients were unsatisfied with their end result. It seems very difficult to convince patients of this group to come back for another option due to the experienced pain, edema and other sequelae of the surgery in addition to the disappointing result. (Table 2 & Figure 8).

TABLE (2) Mean Values and SDs of Gingival Display at Smiling (mm) Recorded as a Function of Evaluation Time

Variables	Statistics	
	Group 1	
Evaluation time	Pre-operative	4.91 ± 0.57
	14 days	0.00 ± 0.00
	4 months	2.0 ± 0.07
	8 months	4.79 ± 0.47
	12 months	4.91 ± 0.57
Statistics	P value	<0.0001*

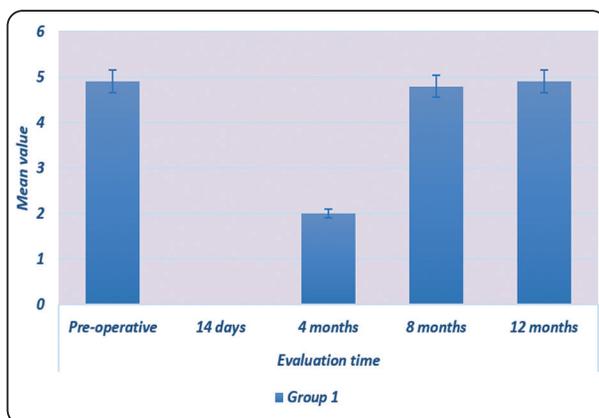


Fig. (8): Column chart showing gingival display at smiling, with mean values recorded as function of evaluation time

DISCUSSION

The proposed surgery is believed to be less invasive than the traditional orthognathic surgeries and also associated with less complications, However the main concern after any cosmetic surgery which is the longevity of the procedure remains questionable for this particular surgery due to the high relapse rate¹⁹.

Several factors may cause a patient to have an excessive gingival display, these factors may be bony changes, dento-periodontal changes and soft tissue changes, and it also could be a combination of the latter. The scientific literature contains many researches of different treatment options for gummy smile treatment^{20,21}. Patients with vertical maxillary overgrowth are not good candidate for lip switch surgery, thus it's contraindicated for them, and Orthognathic surgery on the other hand may be a better treatment alternative¹⁹. The presence of inadequate attached gingiva in the upper anterior region of the jaw may possess difficulties in the flap design, stabilization and suturing therefore lip switch surgery is not a good line of treatment in those patients as well²².

As we mentioned before due to the lack of accurate data about the relapse rate associated with the lip switch surgery especially that some researches claims that the surgery provides stable results up to one year²⁹, thus the aim of our study was to evaluate the success rate using fixed parameters measured digitally. It is of no doubt that digital methods are more reliable because its avoids the errors associated with manual measurements thus affecting the accuracy of the results, therefore we chose to rely on the statistical analysis for the data obtained digitally in our study due to their accuracy. This also explains why many previous researches about lip repositioning²⁴⁻²⁶ may have presented in-accurate results about the relapse of the procedure as they depended on clinical means for their measurements.

At 14 days after the procedure, marked decrease in the amount of gingival display was observed to reach zero. It is worth mentioning that there was a slight increase in the vermilion height (Outer lip length = Philtrum length + vermilion height), such a change was appreciated by the patient and were previously noted in other researches^{2,23}, the patient described the latter change as if she had a subtle dermal filler injection, unfortunately this change didn't last after one month. We believe the reason for the marked reduction in the gingival display is due to the fact of the effect of tension after suturing to this area and the restriction of the movement. We also noted an increase in the outer lip length at smiling only with no change at lip length at rest, this change may be due to the downward pull of the upper lip after suturing the new vestibular position, and however this increase didn't last as well. Therefore we don't believe that the procedure may provide any elongation for the upper lip in case of patients with short upper lip. At 4 month follow up and thereafter, complete relapse was observed with almost complete return of the same preoperative amount of the gingival display, which shows the procedure doesn't have a stable results, this was reported also in other researches that states that the long term stability of this procedure is controversial³⁰.

The high muscle power of the elevator muscles of the lip especially in these patients with hyperactive muscles will always have a negative effect on the sutured area, where mucosal excision alone is not adequate to treat the condition, the injection of neurotoxin prior to the surgery may theoretically aid in providing more stable results. Some researches claims that muscle myotomy may provide more stable results^{27,28}, however we do think that the muscle have a high regeneration power which might eventually cause relapse too. The concept of vestibular excision in this surgery was aiming to create a fibrous tissue at the scar area which might resist the muscle contraction, however it seems that this approach is not adequate to resist the muscle pull.

CONCLUSION

Lip repositioning surgery doesn't provide a long lasting results as claimed by other surgeons, where the results are only stable for the first 14 days after surgery and may remain stable up to one month only after the procedure, eventually relapse is un avoidable. We believe that the high muscle power of the elevator muscles of the lip will lead to degranulation of the decreased vestibular length due to the high force create on the sutured area thus causing relapse with complete regain of the amount of gum exposure therefore the mucosa excision is not a favorable approach. We also advocate injecting neurotoxins in the elevator muscles of the lip prior to surgery and may also be reinjected twice after a couple of months after surgery in different intervals to help in stabilizing the results as it will decrease the muscle pull, the latter approach seems reasonable to provide a stable results up to one year after surgery with almost no relapse, this approach will be released soon in another research (**in process of submission**).

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