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CLINICAL TECHNIQUE

Modifying Gummy Smile: A Minimally Invasive Approach

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ABSTRACT

Aim: Excessive gingival display is a problem that can be managed by variety of procedures. These procedures include non-surgical and surgical methods. The underlying cause of gummy smile can affect the type of procedure to be selected. Most patients prefer minimally invasive procedures with outstanding results. The authors describe a minimally invasive lip repositioning technique for management of gummy smile.

Materials and methods: Twelve patients (10 females, 2 males) with gingival display of 4 mm or more were operated under local anesthesia using a modified lip repositioning technique. Patients were followed up for 1, 3, 6 and 12 months and gingival display was measured at each follow up visit. The gingival mucosa was dissected and levator labii superioris and depressor septi muscles were freed and repositioned in a lower position. The levator labii superioris muscles were pulled in a lower position using circumdental sutures for 10 days. Both surgeon's and patient's satisfaction of surgical outcome was recorded at each follow-up visit.

Results: At early stage of follow-up the main complaints of patients were the feeling of tension in the upper lip and circum oral area, mild pain which was managed with analgesics. One month postoperatively, the gingival display in all patients was recorded to be between 2 and 4 mm with a mean of (2.6 mm). Patient satisfaction records after 1 month showed that 10 patients were satisfied with the results. Three months postoperatively, the gingival display in all patients was recorded and found to be between 2 and 5 mm with a mean of 3 mm. Patient satisfaction records showed that 8 patients were satisfied with the results as they gave scores between. Surgeon's satisfaction at three months follow up showed that the surgeons were satisfied in 8 patients. The same results were found in the 6 and 12 months follow-up periods without any changes. Complete relapse was recorded only in one case at the third postoperative month.

Conclusion: This study showed that the proposed lip repositioning technique is an acceptable minimally invasive procedure in managing gummy smile.

Clinical significance: A non-invasive procedure to avoid other complicated surgical procedures.

Keywords: Gummy smile, Lip repositioning, Excessive gingival display.

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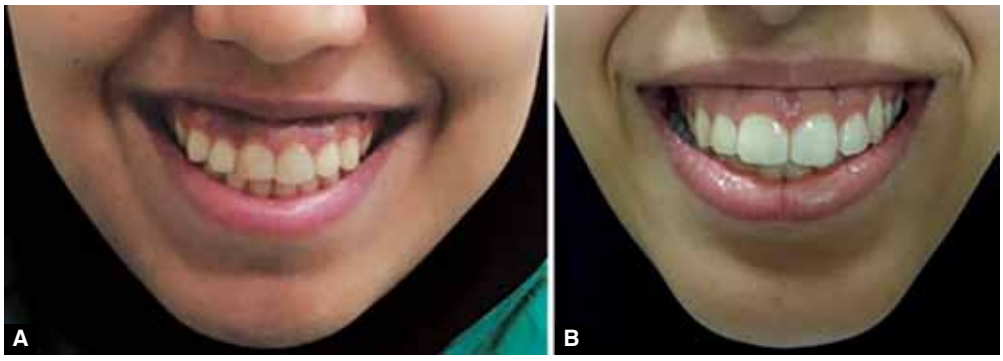
INTRODUCTION

Some individuals show excessive gingival display during smiling and the percentage was reported to be 7% in males and 14% in females.[1] There is a usual debate related to the most attractive smile worldwide. Husley[2] defined the most attractive smile when the upper lip is at the height of the gingival margin of the upper central incisor and the smile line has a near harmony between the arcs of curvature of incisal edges of the upper incisors and the upper border of the lower lip. On the other hand, it has been reported that 2 to 4 mm of gingival display is the most attractive smile.[3,4] It has been shown by Geron and Atalia[5] that the most esthetic range of expected gingiva on the upper incisors is between zero and 2 mm. Varieties of gingival display which do not fit under the above mentioned attractive smile definitions and where gingival show exceeds 4 mm come under the category of gummy smile. Gummy smile can be present for different reasons including delayed teeth eruption or excessive teeth coverage by gingiva, inadequate upper lip movement and skeletal problem related to the maxilla. Genetics could be a factor in the development of gummy smile.[6] Variety of methods have been proposed for management of gummy smile including crown lengthening and orthognathic surgery. Many techniques have been used to restore the dentogingival relation for management of gummy smile. Such techniques include crown lengthening procedures,[7] orthodontic leveling of the gingival margins of the maxillary teeth,[8] maxillary teeth intrusion,[9] lip repositioning,[10,11] orthognathic surgery[12] and nonsurgical procedures such as the use of botulinum toxin A.[13]



Figs 1A and B: Clinical preoperative frontal smile view photographs showing excessive gingival display

Fig. 2: Intraoperative photograph showing A full thickness incision 5 mm above the gingival margins from the second premolar at one side to the contralateral one

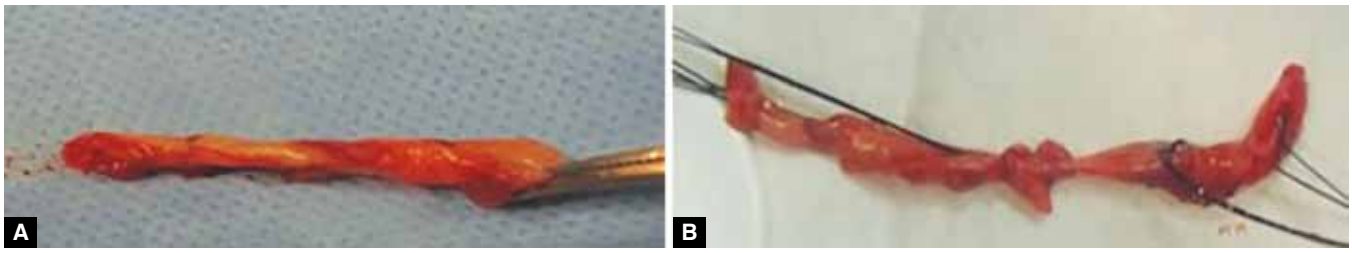
The aim of this study was to evaluate the use of lip repositioning technique in reducing the gingival display in Saudi patients with gummy smile with gingival show of 4 mm or more and acceptable vertical dimension and tooth gingival relationship.

MATERIALS AND METHODS

The study was approved by the College of Dentistry Ethics Committee and all patients gave written informed consent. Participants included in the study were referred for correction of their gummy smile to the Department of Oral and Maxillofacial Surgery, College of Dentistry, King Saud University. Inclusion criteria included patients who had 4 to 6 mm gummy smile with no periodontal disease and had an American Society of Anesthesiologists physical status of I or II and were between the ages of 20 and 29 years (Figs 1A and B). All married women were required to undergo a urine pregnancy test to ensure that they were not pregnant. Treatment plans of all cases were discussed with an orthodontist and a periodontist to confirm the diagnosis and the plan. The study involved 12 patients, 10 females and 2 males. The age of the participants ranged between 20 and 29 years with a mean of 25 years old (Table 1). The gingival exposure ranged between 4 and 6 mm with a mean of 5 mm (Table 2).

SURGICAL TECHNIQUE

According to Simon Z et al 2007,[14] the surgical site was anesthetized with a conventional anesthesia between the first maxillary molars. We used bilateral infraorbital nerve block one (1.8 ml) cartridges of 2% lidocaine with 1:80,000 epinephrine for each side and two other cartridges of the same volume and concentration for infiltration in the area for anesthesia and hemostasis. A full thickness incision was made 4 to 5 mm above the gingival margins from the second premolar at one side to the contralateral one (Fig. 2). A second full thickness parallel incision was made at the labial mucosa at approximately 8 to 10 mm distance apical to the first incision. Surgical Caliper (SAP-W-001-surgical appliance company- Pakistan) was used to mark the second incision line. Three points were marked using this caliber; the first point was at the midline between the other two points which were marked at the canine region bilaterally. Then a line was drawn passing through the three points using a marking pen., Beyond the canine region bilaterally, the line was gradually descended to meet the first incision line at the premolar region creating an elliptical outline soft tissue strip which was removed (Figs 3A and B) then the perioral muscles were dissected from bone (Fig. 4). It has been shown that the amount of tissue excision should be double the amount of gingival display that needs to be reduced,[14] with a maximum of 10 to 12 mm of tissue. In the present study, all cases gingival display were between 4 and 6 mm, so the width of the tissue strip removed was between 8 and 10 mm. The two incision lines are approximated with Vicryl 3/0 (Ethicon, USA) deep sutures that involved both the mucosa and the muscle. Care was taken regarding proper alignment of the midline of the first and second incision lines (lip midline and teeth midline). An additional circumdental sutures one each side were passed deeply and high in the muscle and mucosa and pulled down to be fixed circumdentally around the canine teeth bilaterally in order to secure downward retraction of the muscle during the healing period (Figs 5A and B). Nonsteroidal anti-inflammatory (Ibuprofen 400 mg tablet three times



Figs 3A and B: Intraoperative clinical photograph showing the soft tissue strip which was removed

Fig. 4: A clinical intraoperative photograph showing the surgical area after removing the elliptical outlined soft tissue and after dissection of the perioral muscles from bone

a day for 3 days medications) and oral antibiotic (500 mg amoxicillin capsules every 8 hours for 5 days) were prescribed postoperatively. Patients were instructed to use ice compresses for several hours and to minimize lip movement for one week. Follow-up for the patients were at 3rd, 7th, 14th, 21th, 30th days postoperatively and then delayed follow-up visits were at the 3, 6, and 12 months postoperatively. Early Follow-up included the recording of postoperative symptoms, infection, dehiscence, and bleeding. Patient and surgeon satisfaction were evaluated at the last interval only of early follow-up period after complete resolution of edema. Late follow-up included the recording of patient satisfaction, surgeon satisfaction, scar and relapse.

Surgeon and satisfaction scale	
Score	*Description*
1.	Dissatisfied
2.	Somewhat dissatisfied
3.	Neither satisfied nor dissatisfied
4.	Somewhat satisfied
5.	Satisfied

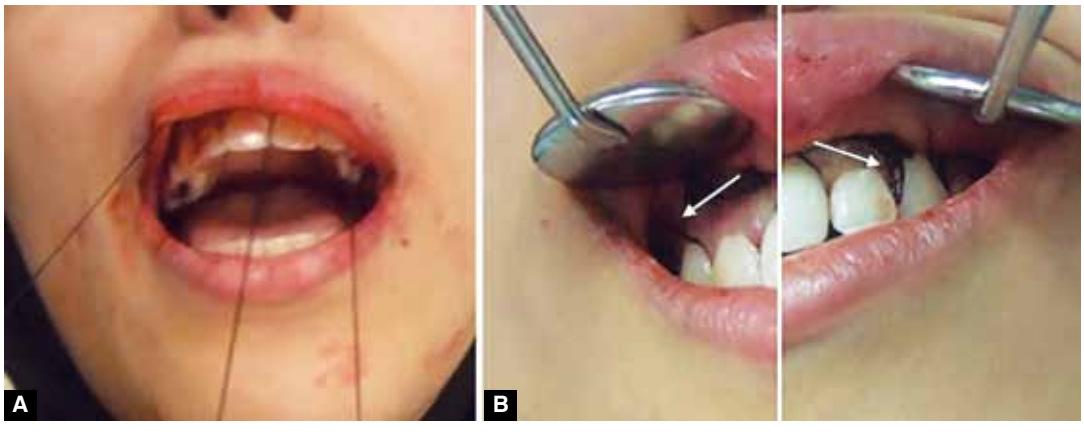
Each patient's overall level of satisfaction about the surgery results was recorded, using a three-point scale of 1: poor, 2: good, 3: excellent.

STATISTICS

Using the SPSS version 17 (SPSS Inc., Chicago, IL), data were analyzed using a descriptive analysis and t-test where p-value < 0.05 was considered significant.

RESULTS

At early stage of follow-up the main complaints of patients were the feeling of tension in the upper lip and circum oral area, mild pain which was managed with analgesics, edema in the perioral area that was extended to the lower eye lids with ecchymosis in one female patient which lasted for 2 weeks, while in all patients edema was moderate and disappeared within 7 days postoperatively. Only one female patient reported mild oozing of blood through the sutures within the first two days of surgery. No dehiscence or infection was reported in any of the patients. The circumdental traction sutures were removed after 14 days of the surgery. One month



Figs 5A and B: Clinical photographs showing the additional circumdental sutures one each side were passed deeply and high in the muscle and mucosa and pulled down to be fixed circumdentally around the canine teeth bilaterally

postoperatively, the gingival display in all patients was recorded to be between 2 to 4 mm with a mean of (2.6 mm), (Table 1). Patient satisfaction records after one month showed that 10 patients were satisfied with the results as they gave scores between 2 and 3, while two female patients were not satisfied as they gave scores of 1, (Table 2). Surgeon satisfaction showed that they were satisfied with the results in 10 patients (satisfaction scores of 3 to 5), and they recorded scores of 2 for two female patients. Three months postoperatively the gingival display in all patients was recorded and found to be between 2 and 5 mm with a mean of 3 mm. Patient satisfaction records showed that 8 patients were satisfied with the results as they gave scores between 2 and 3, while 4 female patients were not satisfied as they gave scores of 1. Surgeons satisfaction at 3 months follow-up showed that the surgeons were satisfied in 8 patients as they gave scores of 3 to 5, and they recorded scores 1 to 2 for 4 female patients. The same results were found in the 6 months and 12 months follow-up periods without any changes. Complete relapse was recorded only in one case at the third postoperative month as in this case the gingival show was 4 mm before the surgery and it was 2 mm after the surgery and it came back to be 4 mm after 3 months of the surgery. Partial relapse were recorded in three patients as shown in Table 1.

DISCUSSION

The increase in demand for an attractive smile in the last 40 years resulted in the development of many surgical techniques for correction of the gummy smile. For many people, excessive gingival display is considered undesirable. Many factors may play a role in the development of gummy smile including problems related to the gum, the maxilla or the upper lip. A true gummy smile should be differentiated from gingival display related to short clinical crowns or excessive gingival coverage due to delayed teeth eruption. Many procedures were reported in the literature for managing gummy smile. Such procedures include non-surgical as well as surgical methods such as botulinum toxin injections, crown lengthening, maxillary jaw impaction or orthodontic teeth manipulation. It has been shown that in 20% of patients there is a muscular capacity to raise the upper lip causing gummy smile.[15] In such cases, the myotomy of levator labii superioris can reduce the function of the muscle and decrease the effect of gummy smile.[10,11] This was not checked in our patients in the current study. The same effect can be obtained using botulinum toxin A injections.[13] Some patients may prefer not to go for major surgery for correction of gummy smile and the other minor procedures could be of help to them. The present technique in this paper involves two full thickness incisions connected

Table 1: Patients demographic data and the gingival display readings preoperatively and throughout the postoperative follow-up period

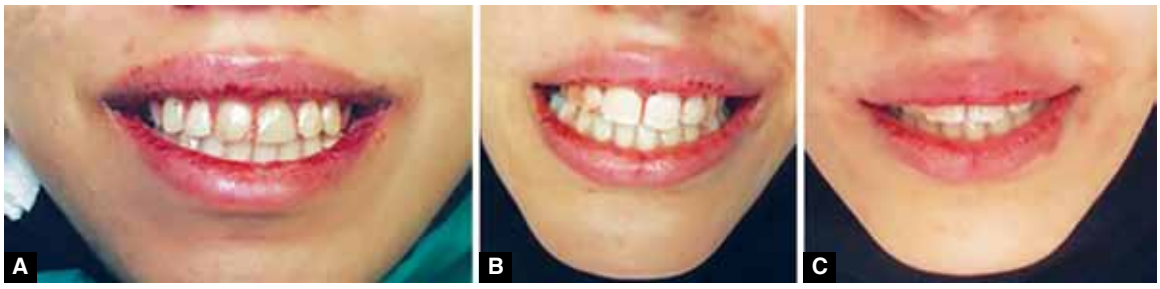
Patient number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*Average*	*SD*
Gender	F	F	F	F	F	F	F	F	F	M	M	F	—	—
Age	21	20	20	22	23	28	29	23	24	24	25	26	23.75	2.89
Preoperative gingival display in mm	6	4	4	5	6	4	6	6	4	5	4	6	5	0.95
Postoperative gingival display (1 month) in mm	3	2	2	2	4	3	3	3	2	2	2	4	2.66	0.77
Postoperative gingival display (3 months) in mm	3	4	2	2	5	3	4	3	2	2	2	5	3.08	1.16
Postoperative gingival display (6 months) in mm	3	4	2	2	5	3	4	3	2	2	2	5	3.08	1.16
Postoperative gingival display (12 months) in mm	3	4	2	2	5	3	4	3	2	2	2	5	3.08	1.16

SD: Standard deviation

Table 2: Patients and surgeon satisfaction results

Patient number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*Average*	*SD*
Patient's satisfaction after 1 month	3	2	2	2	1	1	2	2	2	3	2	2	2	0.60
Surgeon's satisfaction after 1 month	4	4	4	5	2	2	4	4	5	4	4	3	3.75	0.96
Patient's satisfaction after 3 months	3	1	2	2	1	1	2	2	2	3	2	1	1.83	0.71
Surgeon's satisfaction after 3 months	4	1	4	5	2	2	3	4	5	4	4	2	3.33	1.30
Patient's satisfaction after 6 months	3	1	2	2	1	1	2	2	2	3	2	1	1.83	0.71
Surgeon's satisfaction after 6 months	4	1	4	5	2	2	3	4	5	4	4	2	3.33	1.30
Patient's satisfaction after 12 months	3	1	2	2	1	1	2	2	2	3	2	1	1.83	0.71
Surgeon's satisfaction after 12 months	4	1	4	5	2	2	3	4	5	4	4	2	3.33	1.30

SD: Standard deviation



Figs 6A to C: Immediate postoperative frontal smile view

Figs 7A to D: Clinical photographs of the same patient showing the improvement in the amount of gingival display pre- and post-operatively in both frontal and lateral views. A and C preoperative, B and D postoperative

together at the second upper premolar area outlining an elliptical area of soft tissues which is removed and the two incisions are approximated together with deep sutures involving the mucosa and muscles plus two supporting sutures involving the mucosa and the levator labii superioris muscles held on the canine teeth. This procedure involves deep dissection to free the levator labii superioris and depressor septi muscles to lower the upper lip elevation during smiling by reattachment of the levator labii superioris into a new position, (Figs 5A and B). The procedure also involves frenectomy as the labial frenum may restrict the lip coverage of the gingiva. All patients in this study had gingival display of 4 mm or more (mean = 5 mm). The mean postoperative gingival display 1 month after surgery was 2.6 mm. Such improvement in gingival display is considered acceptable by patients and surgeons. After 12 months follow-up, the mean gingival display was 3 mm. There is a statistically significant reduction in gingival display after 12 months follow-up ($p = 0.0002$). Patient satisfaction can be used as a measure of surgical outcome. In the present study, we measured the satisfaction of both surgeons and patients. One month after the surgical procedure, 10 patients were satisfied with the results and stated that the results were good or excellent. Two female patients were not satisfied as they considered the results to be poor on the satisfaction scale. The same satisfaction was reported by the surgeons, where the results of 10 patients were considered satisfactory after one month of the operation. Measuring the satisfaction of patients after 3, 6 and 12 months showed that eight patients were still satisfied with the surgical outcome. This study revealed that there is a similarity rate in patient and surgeon satisfaction scores postoperatively. Although there was some improvement in the 3 patients who were unsatisfied by the surgical outcome, this could be due to the overestimation of the outcome by patients. The same satisfaction results were obtained from patients and surgeons as early as 3 months. This suggests that longer-term satisfaction with outcome may be predicted by satisfaction as early as 3 months post-surgery. A comparison between pre-surgical, immediate postoperative and 12 month visit smile and profile of the patient is shown in Figures 6 and 7. Expectation and surgical complications have been shown to affect the overall satisfaction of patients in surgical procedures.[16] In the present study, no obvious complications were encountered after the surgery, so patient's satisfaction may be based mainly on the expectation of the surgical outcome. Knowing that 58.4% of the involved subject in the study had more than 4 mm gingival display before surgery and eight patients of the 12 patients were satisfied with the surgical outcome after 12 months follow-up, this procedure could be considered reliable as a minimally invasive procedure in managing gummy smile. Although relapse and scar contraction are considered critical and frequent issues in surgical procedures,[17] we encountered only one case with a complete relapse. Since, Rubenstein and Kostianovsky in 1973[18] described the lip reposition surgery which did not include muscles intervention, different investigators modified the technique by proposing the detachment of the elevator muscle, myectomies or partial resection of 1 or 2 levator labii superior muscles, and partial transaction of the lip elevator muscles and implantation of an alloplastic or autogenous spacer.[10,11,14] All these modifications were made to prevent the main complication of lip repositioning surgeries 'relapse'. In

our modification, the authors worked on stripping the muscle origin and the periosteum from the bone, then by using a two strong traction sutures to pull the muscle to a lower level. This theoretically should decrease the chance for relapse or at least decrease its amount. Complete relapse occurred in only one case in the study, and the authors do not have a clear explanation but it could be a result of muscle regeneration or reattachment to its previous place which may be explained by muscle hyper tonality, or incomplete stripping of the muscle from bone during the surgery although all surgeries were done by the same surgeon with the same technique and protocol. There were three females unsatisfied with the surgical outcome after 12 months but without complete relapse. Although of the unsatisfactory results of these 3 patients, they gained gingival coverage of 1 to 2 mm compared to their pre-surgical gingival display.

CONCLUSION

Managing gummy smiles with less invasive procedures under local anesthesia can be of a great help to patients. The proposed lip repositioning technique in the current study can be used to correct gummy smiles in patients with gingival display between 4 and 6 mm.

REFERENCES

1. Tjan AH, Miller GD, The JG. Some esthetic factors in a smile. J Prosthet Dent 1984;51:24-28.
2. Hulsey C. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod 1970;57(2):132-144.
3. Peck S, Peck L. Selected aspects of the art and science of facial esthetics. Semin Orthod 1995;1:105-126.
4. Vig RG, Brundo GC. The kinetics of anterior tooth display. J Prosthet Dent 1978;39:502-504.
5. 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;75:778-784.
6. Livada R, Shiloah J. Gummy smile: could it be genetic? Hereditary gingival fibromatosis. J Mich Dent Assoc 2012;94:40-43.
7. Lee EA. Aesthetic crown lengthening: classification, biologic rationale, and treatment planning considerations. Pract Proced Aesthet Dent 2004;16:769-778.
8. Kokich VG. Esthetics: the orthodontic-periodontic restorative connection. Semin Orthod 1996;2:21-30.
9. Hong RK, Lim SM, Heo JM, Baek SH. Orthodontic treatment of gummy smile by maxillary total intrusion with a midpalatal absolute anchorage system. Korean J Orthod 2013; 43:147-158.
10. Ishida LH, Ishida LC, Ishida J, Grynglas J, Alonso N, Ferreira MC. Myotomy of the levator labii superioris muscle and lip repositioning: a combined approach for the correction of gummy smile. Plast Reconstr Surg 2010;126:1014-1019.
11. Polo M. Myotomy of the levator labii superioris muscle and lip repositioning: a combined approach for the correction of gummy smile. Plast Reconstr Surg 2011;127:2121-2122.
12. Fowler P. Orthodontics and orthognathic surgery in the combined treatment of an excessively 'gummy smile'. NZ Dent J 1999;95:53-54.
13. Suber JS, Dinh TP, Prince MD, Smith PD. Onabotulinumtoxin A for the Treatment of a 'Gummy Smile'. Aesthet Surg J 2014;34:432-437.
14. Simon Z, Rosenblatt A, Dorfman W. Eliminating a gummy smile with surgical lip repositioning. J Cosmet Dent 2014;23: 100-108.
15. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. Am J Orthod Dentofacial Orthop 1992;101:519-524.
16. Harris IA, Harris AM, Naylor JM, Adie S, Mittal R, Dao AT. Discordance between patient and surgeon satisfaction after total joint arthroplasty. J Arthroplasty 2013;28:722-727.
17. Hwang WS, Hur MS, Hu KS, Song WC, Koh KS, Baik HS, Kim ST, Kim HJ, Lee KJ. Surface anatomy of the lip elevator muscles for the treatment of gummy smile using botulinum toxin. Angle Orthod 2009;79:70-77.
18. Rubenstein A, Kostianovsky A. Cosmetic surgery for the malformation of the laugh: original technique. Prensa Med Argent 1973;60:952.