Effect of alar cinch suture and V-Y closure (ACVY- closure) on lip length after Le Fort I impaction osteotomy

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Abstract: Lip shortening and loss of vermilion border is a common problem of Le Fort I impaction surgery. This may lead to unsightly excessive gum showing and compromised soft tissue profile outcome in spite of an adequate hard tissue repositioning. ***Objective:*** To evaluate lip length stability after Le Fort I impaction surgery using V-Y closure technique plus alar base cinch. ***Method:*** The study involved 15 patients who needed Le Fort I impaction surgery to correct their facial disharmony. All Patients presented with a chief complaint of showing excessive gum upon smiling. Clinical and cephalometric analyses demonstrated vertical maxillary excess with variable degrees. Surgery was planned to impact the maxilla through Le Fort I impaction osteotomy so that only the crowns of the upper incisor teeth will be visible on smiling. At the end of surgery, the soft tissue wounds were closed using a single V-Y closure of the vestibular incision, also alar base cinch was applied using a single transverse suture at the alar bases. Lateral cephalometric radiographs were taken preoperatively and 6 months post surgery. Radiographs were taken with the teeth in centric occlusion and lips in repose position. On the lateral cephalometric tracings, the following landmarks were registered, Subnasale (Sn), the most posterior superior point on the nasolabial curvature. Stomion (Sto), the lowest point on the convexity of the upper lip. Lip length was recorded according to the distance (Sn-Sto). ***Results:*** The amount of maxillary impaction ranged from 5 to 7 mm with a mean of 5.6 mm .The preoperative lip lengths ranged from 21 to 23.5mm with a mean of 22.44 mm± 0.73 SD. At 6 months postoperatively the lip length ranged from 21 to 27 mm with a mean of 23.19 mm± 1.89 SD. The gain in lip length ranged from 0.5 to 5mm with a mean of 0.7 mm ± 2 SD mm. Paired *t* test showed that the difference between the mean preoperative and postoperative lip lengths was statistically insignificant (p=0.34). ***Conclusion:*** V-Y closure of the soft tissue wound plus alar base cinch following Le Fort I impaction is strongly recommended to maintain the stability of the upper lip length postoperatively and make soft tissue profile outcome more predictable.
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1. Introduction

In recent time the focus on esthetics has encouraged patients with dentofacial deformities to inquire about options for improving the appearance of their teeth and smiles with images and perceptions of what the ideal smile should look like.

It is the responsibility of clinicians through comprehensive diagnostic examination and evaluation to develop a treatment plan that fulfills not only functional but also the esthetic requirements of those patients as well.

The clinical esthetic characteristics of vertical maxillary excess (VME) have been described in the literature. According to Schendel *et al.,*[(1)] in " long-face syndrome," the middle third of the face is characterized by excessive lower facial height, poor maxillary tooth-to-lip relationship, large interlabial distance, a short mandibular ramus, retruded chin and excessive exposure of maxillary teeth upon smiling. Nasal characteristics in this deformity include a narrow nose, narrow alar bases, a prominent nasal dorsum, and deficient paranasal and nasolabial areas.

Patients with vertical maxillary excess (VME) is treated basically by maxillary impaction through Le Fort I osteotomy. Superior repositioning of maxilla has many indications that include closure of open bite, correction of excessive gingival display on smile, reduction of lip incompetence, and reduction of excessive lower facial height [(2)].

The Le Fort I osteotomy results in soft tissue changes, which could be difficult to control because of considerable variation in their adaptation. Adverse changes of the lip and nose including alar flaring, upturning of the nasal tip, and flattening of the lip

and nasolabial region, resulting in accentuation of the nasolabial groove, reduced vermilion exposure and thinning and lateral retraction of the lip, with down-turning of the mouth angle [3-5].These changes are affected by the amount and direction of movement, the type of closure, the surgical soft tissue healing and scarring and orthodontic treatment [6]. Rosen [5], summarized several reasons for lip shortening; high vestibular incision, release of periosteum and muscle attachment around the pyriform rim, concomitant soft tissue edema and taking large bites during closure.

Several methods can be found in the literature and can be used in combination with each other: alar base cinch suture [4], partial or total removal of the anterior nasal spine in combination with an alar base cinch suture [7], V-Y closure of the wound in combination with a cinch suture through the nasalis [8], vertical incisions with tunneling on the buccal side [9].

A muco-musculo-periostal closure in a V-Y fashion of the vestibular incision has been advised to prevent adverse effects on the lip after Le Forte I osteotomy [10]. The alar cinch suture is thought to be crucial for the beneficial effect on restoration of the labial form. The classic alar cinch suture runs in front of the anterior nasal spine [11]. As a result, an anterior-cranial rotation of the lateral crurae might occur,

leading to an upward rotation of the nasal tip. In order to prevent this unwanted effect a modified alar cinch suture closure was proposed combined with a muco-musculoperiosteal V-Y closure [12].

The present study aims at evaluating the esthetic result in the upper lip in a group of patients with vertical maxillary excess after maxillary impaction via Le Fort I osteotomy, using V-Y closure plus alar base cinch.

2. Patients and Methods

The study included 15 patients with an age ranged from 23 to 33 with a mean of 27.6 years. All patients reported a chief complaint of showing excessive gum upon smiling.

Clinical and radiographic examination showed vertical maxillary excess with varying degrees, lip incompetence, and excessive gingival display upon smiling in all patients.

Surgery was planned to impact the maxilla through Le Fort I impaction osteotomy so that only the crowns of the upper incisor teeth will be visible on smiling.

Preoperative evaluation included a standardized lateral cephalometric radiograph, panoramic radiograph, and frontal and profile photographs of the patient.

Le Fort osteotomy:

The performed technique was described by Obwegeser [13] (Fig.1): The horizontal incision was low vestibular incision extending from the first molar on one side to the first molar on the other side, sub-periosteal degloving including nasal spine, osteotomy of the lateral wall of the maxillary sinus, and rim of the pyriform aperature, separation of the nasal septum, osteotomy between tuber maxillae and the pterygoid plates. Refinement of osteotomy lines, marking of amount of bone to be removed, and maxillary down-fracture. Bone removal was performed and ranged from 5-7 mm and made at least 5 mm above the roots. Acrylic splint was seated and maxillo-mandibular fixation (MMF) was performed, seating of maxillary-mandibular complex and semi-rigid miniplate osteosynthesis at pyriform rims and zygomatic buttresses.

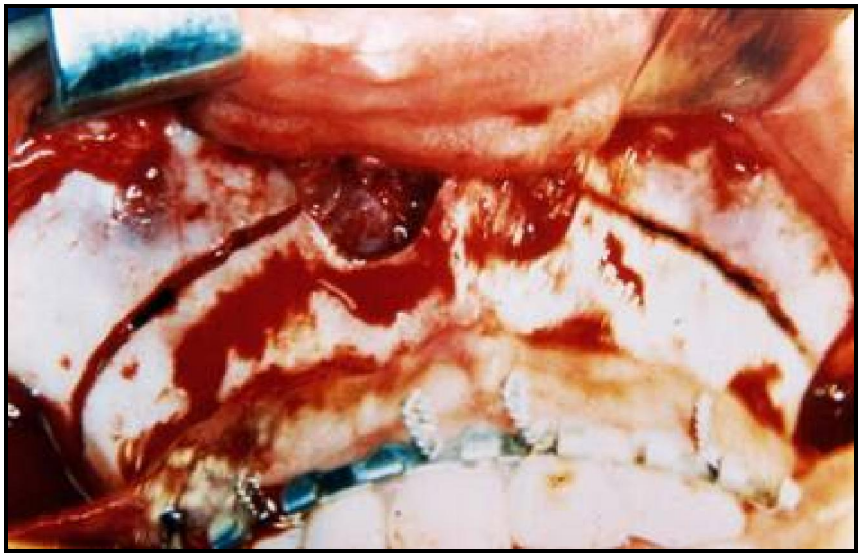

Fig.1: Complete Le Forte I osteotomy.

Soft tissue procedure:

An alar base cinch suture through transverse nasalis muscle and periosteum using a single transverse suture [4] was performed (Fig.2). Converting the horizontal incision into V-Y pattern and suturing both vertical and horizontal arms of the incision with Vicryl 3.0 (Johnson and Johnson, Amersfoort, The Netherlands) (Fig.3).

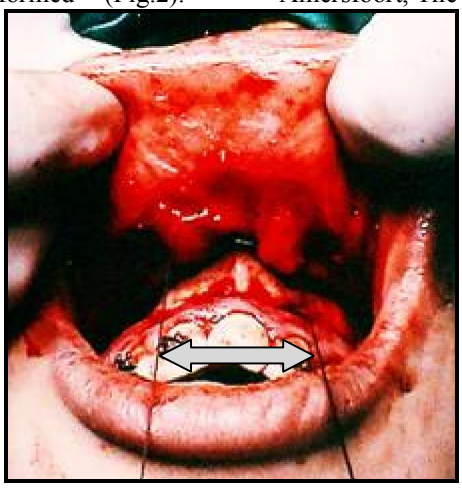

Fig.2 (A)

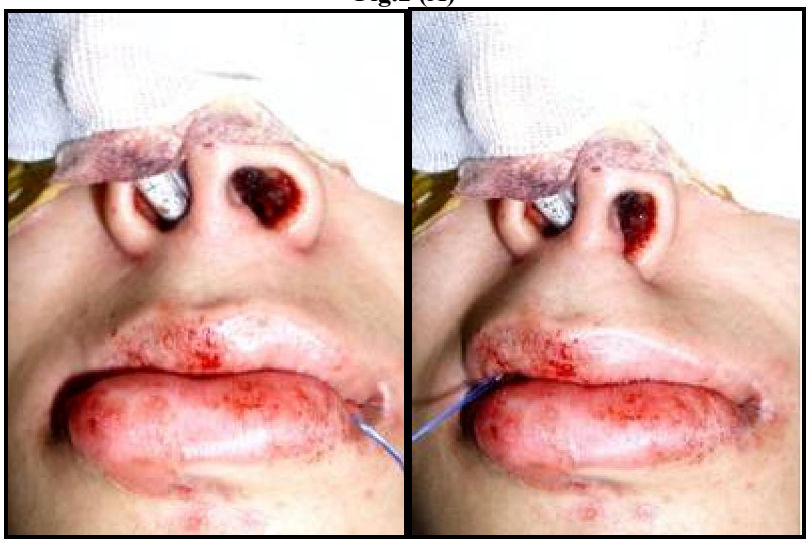

Fig.2 (B) **Fig.2 (C)**

Fig.2: (A) Passing cinch suture through alar base. **(B)** Alar base before suture tightening. **(C)** Alar base after suture tightening (Notice effect on alar base width).

Fig.3 (A) **Fig.3 (B)**

Fig.3: (A) Incision closure into V-Y fashion. **(B)** Effect of alar base cinch and V-Y closure on philtrum length and alar base width.

Cephalometric Analysis and Photographs:

Lateral cephalometric radiographs were taken to all patients preoperatively and 6 months postoperatively. Radiographs were taken with the teeth in centric occlusion and lips in repose position. Frontal and lateral photographs were obtained at the same periods.

Cephalometric radiographs were traced on 0.003 matt paper recording Subnasale (Sn); The most posterior superior point on the nasolabial curvature, Stomion superius (Sto). The lowest point on the convexity of the upper lip in relation to Frankfort horizontal plane, and upper lip length was measured according to the distance (Sn-Sto) perpendicular to Frankfort horizontal plane (Fig.4).

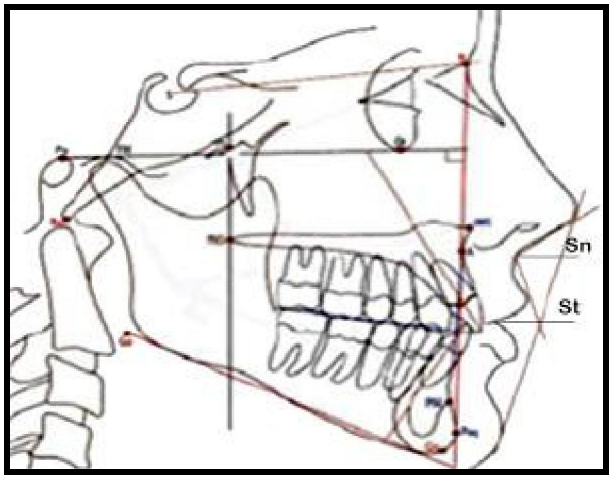

Fig.4: Cephalometric landmarks used: subnasale (Sn) and stomion of upper lip (St).

Statistical Analysis:

Paired *t* test was done comparing the mean preoperative and postoperative lip lengths. A *P* value < 0.05 was considered to be statistically significant.

3. Results

Fifteen patients were included in this study. The mean age was 27.6 years with a range of 23 to 33 years. Immediately after surgery, although the upper lip appeared swollen and edematous, there was an obvious gain in lip length manifested in the mid part of the lip, and after edema resolution and adaptation of soft tissue to the new osseous foundation, the esthetic was much improved.

The amount of maxillary vertical impaction ranged from 5 to 7 mm with a mean impaction of 5.6 mm.

The mean preoperative vertical lip length (Sn-Sto) ranged from 21 to 23.5 mm with a mean of 22.44 mm± 0.73 SD. The mean postoperative vertical lip length (Sn-Sto) after six months period ranged from 21.5 to 27 mm with a mean of 23.19 mm± 1.89 SD. (Fig.5)

All patients showed gain in lip length ranged from 0.5 to 5 mm with a mean of 0.7 mm ± 2 SD. X The measurement were statistically insignificant, Paired *t* test showed no significant difference between the mean preoperative and postoperative lip lengths (*P*=0.34).

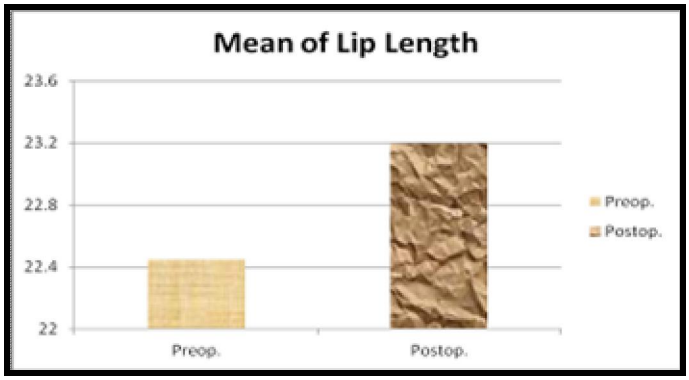

Fig.5: Preoperative and postoperative mean vertical upper lip length.

4. Discussion

This study investigated the effect of use of alar cinch and V-Y closure on lip length after Le Forte I osteotomy with maxillary impaction.

Although orthognathic surgery brings changes through mobilizing the skeletal units, however, it is the soft tissue proportions, not the skeletal dimensions that are the goals of orthognathic surgery.

Moreover, attainment of an ideal soft tissue profile is not always the result of concomitant favorable hard tissue movements.

In orthognathic surgery, accurate treatment planning and prediction of postoperative esthetics are dependent on the ability to correlate the soft tissue response to the underlying osseous movement.

Lip shortening in gummy smile patients following maxillary impaction will result in excessive gingival display more than predicted, making postoperative results less than satisfactory. Hence, maintaining lip length stability is very crucial for those patients.

Le Forte I osteotomy with vertical impaction of maxilla has the potential of upper lip shortening and widening of alar base. These unwanted outcome of Le Forte I osteotomy can be overcome by cinching the alar base through vestibular incision and muco-musculo-periosteal closure in a V-Y fashion (ACVY).

In accordance with our study, Brooks *et al.* (2001) [14], studied the upper lip response to 4-piece maxillary LeFort I osteotomy, with cinching the alar base and closure of the incision in a V-Y pattern, stated that the upper lip length increased by 0.73 mm from subnasale (Sn) to upper lip Stomion (St) and concluded using that technique makes the upper lip response can be accurately predicted.

Peled *et al.* (2004) [10], Comparing the effects of V-Y advancement versus simple closure on upper lip aesthetics after Le Fort I advancement, found that the upper lip shortened by 0.79 mm in the simple continuous suturing group and lengthened by 1.10 mm in the V-Y advancement group.

Rosenberg A. *et al.* (2002) [7], investigated the Nasolabial esthetics after Le Fort I osteotomy and V-Y closure and mentioned that V-Y cheiloplasty as a single soft tissue procedure is adequate only in advancement cases, however, in maxillary impaction, additional procedures are necessary. These include alar cinch suture, reduction of the anterior nasal spine, or grinding of the paranasal area in order to prevent adverse soft tissue changes.

Muradin *et al.* (2009) [15], studied the effect of alar cinch sutures and V-Y closure on soft tissue dynamics after Le Fort I intrusion osteotomies, showed that ACVY-closure does significantly improve the horizontal movement of cheilion with both maximum closed mouth smile and maximum smile, as well as the vertical movement of crista philtri with maximum closed mouth smile and concluded that Le Fort I osteotmy with ACVY improves the orofacial dynamics.

Shoji T *et al*. (2011) [16], used alar cinch suture and V-Y closure in 30 patients after Le Fort I and mandibular osteotomies in Japanese patients with Class III malocclusions, and demonstrated no shortening of lip length and no alteration of the alar base width.

Our results showed that there was no significant difference between the mean preoperative and postoperative lip length (Fig.6), when V-Y closure and alar base cinch were employed in maxillary impaction cases.

Fig.6 (A) **Fig.6 (B)**

Fig.6: Preoperative (A) and postoperative (B) photographs after maxillary impaction.

Maintaining lip length satiability could be attributed to; performing low vestibular incision as higher incision creates more scarring causing the lip to retract more superiorly, alar cinch prevents widening of the alar base and lateral expansion of the soft tissue, which contribute to more lip shortening, and V-Y plasty brings some increase in the lip length.

Conclusion

The use of adjunctive soft tissue surgery namely, V-Y plasty and alar base cinch, prevented lip shortening following maxillary impaction and provided more stability of the lip length which yielded more predictable results in patients with vertical maxillary excess (gummy smile).

Conflict of interest

The authors strongly declare that there is no conflict of interest.

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