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Effectiveness of Piriformplasty in Preventing Alar Base Widening Following Lefort 1 Superior Positioning Osteotomy – A Prospective Study

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Abstract

It is a well-established fact that widening of the alar base is an important factor which contributes to the worsening of facial esthetics after Lefort I maxillary surgery. Several surgical techniques have been suggested to control the unwanted effects to the nasal tissues associated with maxillary surgery. They include the alar cinch suture, contouring of the ANS, Piriformplasty, and Weir procedure and septum reduction.

An alternate technique for preventing alar base widening is piriformpalsty. This study was designed to evaluate the effectiveness of piriformplasty in preventing or reducing alar base widening following Lefort I superior positioning osteotomies among patients who underwent treatment at the Department of oral & maxillofacial surgery, Government dental college, Kozhikode, Kerala

The comparison between the two groups show that the study group and the control group do not have any statistically significant increase in the alar base width at all-time points except at the six month period where the alar base width in the control group is significantly smaller than the study group. However at the end of the one year period the two groups did not demonstrate any significant differences in the increase of alar base width. This demonstrated that the there is no significant difference in the ability of the two techniques in preventing the alar base widening over the one year period.

The study helps us to infer that there is significant increase in alar base width with either of the techniques and although the alar cinch technique has resulted in lesser

increase than piriformplasty the difference was not statistically significant.

Keywords: Alar Base Widening, Lefort 1 Surgery, Orthognathic Surgery, Piriformplasty

Introduction

Improving facial esthetics, as well as the functional aspect, has been shown to be a strong motivating factor in patients undergoing orthognathic surgery. The nose is a keystone of facial esthetics and thus is of prime importance in planning and execution of orthognathic surgery.

Maxillo-facial surgical procedures modify the relationship of the nose to the rest of the face. Maxillary surgery, in particular, alters the basic morphology of the nose, which may be beneficial or detrimental, depending on the pre-existing nasal anatomy. The knowledge attained from the clinical examination allows modifications in the treatment planning and surgical techniques accordingly. Surgery is then modified to alter unaesthetic nasal features present prior to surgery and to avoid any unwanted changes that can occur with maxillary surgery.

Maxillary surgery, more specifically, the LeFort I osteotomy results in significant changes of the nose and lips [1-3]. Typically, there will be widening of the nasal base and secondary flattening and thinning of the upper lip, especially noticeable in loss of the visible vermillion border associated with surgical repositioning [4].

Repositioning of the maxilla affects the lower parts of the nasal dorsum. The general trend is a widening of the alar base in all patients regardless of the direction of maxillary movement. When the alar base is widened, the shape of the nostrils will get altered. Excessive widening and superior retraction result in an ugly deepening of the alar-cheek groove, giving the patient an aged look. There is also the risk of asymmetry, associated with the transection of the perioral and peri-nasal muscles without re-approximation, resulting in further shortening and lateralization of the muscles.

Thus it is a well-established fact that widening of the alar base is an important factor which contributes to the worsening of facial esthetics after Lefort I maxillary surgery. Therefore it is essential that the surgeon tries to prevent these undesirable effects. It is also imperative that any corrective procedure being employed should be thoroughly weighed upon during treatment planning.

Several surgical techniques have been suggested to control the unwanted effects to the nasal tissues associated with maxillary surgery. They include the alar cinch suture, contouring of the ANS, Piriformplasty, and Weir procedure and septum reduction.

An alternate technique for preventing alar base widening is piriformpalsty. In piriformplasty, a butterfly shaped trough is made on the piriform rim with a vulcanite bur. The ala of nose will seat in the trough made in the piriform rim. This snug fit will ensure that the alar base does not widen following superior impaction of the osteotomised segment. Even though many techniques have been employed for preventing alar base widening following maxillary Lefort I osteotomy and superior positioning, not many studies have been conducted to examine whether these techniques are clinically useful.

This study was designed to evaluate the effectiveness of piriformplasty in preventing or reducing alar base widening following Lefort I superior positioning osteotomies among patients who underwent treatment at the Department of oral & maxillofacial surgery, Government dental college, Kozhikode, Kerala

Materials & Methods

This study was part of a prospective study comparing efficacy of two techniques in preventing alar base widening following Lefort 1 superior positioning osteotomy, conducted at the Department of Oral &

Maxillofacial surgery, Government Dental College, Kozhikode, kerala from March 2011 to September 2012.

Seventeen patients with skeletal maxillary excess in vertical as well as horizontal planes were recruited for this study from patients reporting for orthognathic surgery to the outpatient wing of the Department of Oral and Maxillofacial Surgery, Government Dental College, Kozhikode. Patients who underwent Lefort I superior and posterior positioning osteotomy with or without anterior maxillary osteotomy were included in this study.

All subjects were required to provide a written informed consent. The consent form and study protocol was previously approved by the Institutional ethics and research committees, Government Dental College, Kozhikode.

A. Inclusion criteria

1. Healthy adult patients who had skeletal vertical and horizontal maxillary excess in whom Lefort1 superior and posterior positioning osteotomy with or without anterior maxillary osteotomy was planned.

2. Patients with wide alar base were included.

B. Exclusion criteria

1. Patients with congenital/acquired nasal deformities or syndromes.

2. Patients who did not provide written, informed consent.

3. Patients on whom previous nasal surgeries were performed.

C. Surgical procedure

All patients underwent a standard Lefort I osteotomy with superior and posterior positioning of maxilla. All patients were treated with piriformplasty to avoid widening of the base of the nose. The procedures were performed by a single operator.

D. Piriformplasty

Seventeen cases posted for lefort I osteotomy for superior and posterior positioning were considered for the study. Five of these patients were males and twelve were females. All of these patients were diagnosed as having vertical maxillary excess with maxillary protrusion. The age of these patients ranged from 18-35, the mean being 23.8823. Each of these cases was subjected to a detailed clinical examination lateral cephalogram, orthopantomogram, study models and facial photographs. Patients were subjected to a joint clinical discussion with orthodontic colleagues to finalize the treatment plan. All patients underwent pre-surgical orthodontic treatment with fixed appliance therapy and non-extraction of upper premolars. After initial alignment and space closure, lateral cephalogram and study models were again obtained. The patients were evaluated with these records by the treating orthodontist and the oral surgeon to ascertain whether surgery could be performed on them with expectations of a good functional and esthetic result. Patient was taken up for surgery, under general anaesthesia after a thorough medical evaluation.

All patients undergoing surgery was sent for oral prophylaxis, then their plaster models were prepared and articulated in a semi anatomical articulator. The surgery was simulated in the articulator and the final splint was fabricated.

All patients were operated under general anaesthesia, after nasotracheal intubation, the maxillary first premolar was extracted on the table and a standard Lefort I osteotomy was performed. After down fracture of the osteotomized segment, the piriform recess on either side were widened by a flame shaped vulcanite bur under copious irrigation. The maxilla was then repositioned according to the prefabricated splint and fixation done. The alar bases were tucked into to the piriform recess so that they fitted snugly into the recess. The incision was then closed with 3-0 vicryl sutures.

E. Measurements

To assess alar base width before surgery and after surgery, measurements were taken preoperatively and at 3 time points: 10 days following surgery, 6 months following surgery and at one year following surgery as well as standard photographs were taken. Changes in width of the alar base were recorded within one month of operation. A degree of swelling of the nasal soft tissues is expected at this short time after operation and can affect the width measurements accordingly. All measurements were taken by single operator using a classic Digimatic Caliper manufactured by Yamayo Instruments.

Distance between the right and left alar base points were used as a measure of alar base width.

F. Statistical Analysis

Statistical analysis was done using SPSS software for windows version 13. Mean values for alar base width were compared at 3 different time points: Baseline, 10 days following surgery, 6months following surgery and at one year following surgery. Paired sample t tests were used for these comparisons. P values less than 0.05 were considered as significant.

The results were analyzed and compared with a control group of case series which included 20 patients on whom alar base cinch sutures were done instead of piriformplasty.

Results & Discussion

This study assessed the changes in alar base width following piriformplasty in patients who underwent Lefort I osteotomy. A total of 17subjects participated in the study. Table 1: shows the demographic values and baseline values for the entire study subjects.

1.	Age (Mean ± S.D)	23.88±4.73
2.	Gender (No: of Males, Females)	5, 12
3.	Baseline Alar base width (Mean ± S.D)	29.76±2.24

Table 1: Demographic characteristics of study population

Fig.1 shows the comparison between alar base width recorded at baseline and the same 10 days after surgery. There was an increase of 2.12± 1.08 mm (Table 2) in the alar base width in the immediate postoperative period and this increase was statistically significant (P value < 0.05 Table 3).

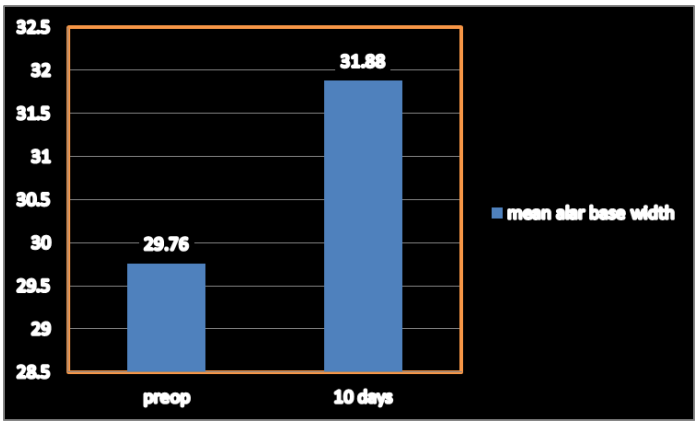

Fig.1: comparison between baseline and 10 days post-surgery

Sl No:	Time of observation	Alar base width (in mm) (Mean ± S.D)
1.	Baseline	29.76±2.24
2.	10 days after surgery	31.88 ± 1.91
3.	6 months after surgery	31.9 ± 1.45
4.	1 year after surgery	32.66 ±0.94

Table 2: Alar base widths during study period

Sl No:	Time Interval	Alar base width (mm) (Mean ± S.D)	P value
1.	Baseline – 10 days after surgery	2.12 ± 1.08	<0.05*
2.	Baseline – 6 months after surgery	2.1 ± 1.04	<0.05*
3.	10 days after surgery- 6 months after surgery	0.4± 0.66	> 0.05
4.	Baseline – 1 year after surgery	2.33± 1.25	<0.05*

Table 3: Comparison of change in Alar base widths

When the change in alar base width was compared between baseline and six months postoperative, an increase of 2.1±1.04 mm was observed. This increase was statistically significant as assessed by a paired t test (P value < 0.05 Table 3, Table 2, fig. 2). However the comparison of alar base width between 10 days postoperative and six months postoperative showed a difference of 0.4± 0.6 mm (fig. 3, table 2). However this change was not statistically significant when assessed using a paired t test. (P value >0.05, Table 3).

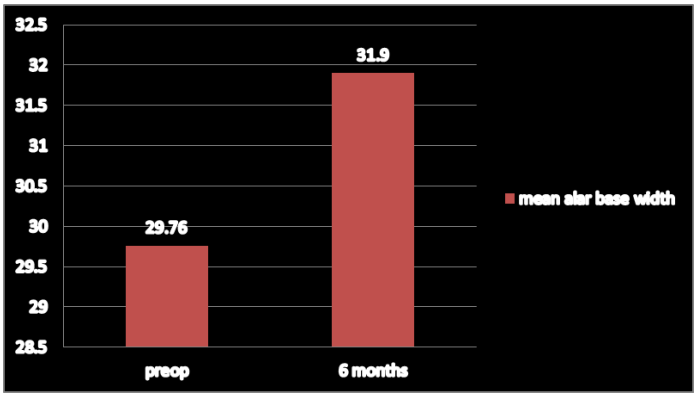

Fig.2: comparison between baseline and 6 months post-surgery

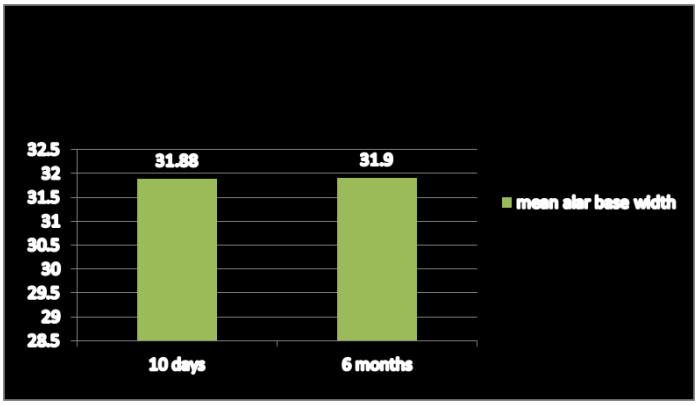

Fig 3: comparison between 10 days and 6 months post-surgery

The long term stability of piriformplasty was compared using assessment 1 year after surgery. The difference between 1 year post-operative measurements as compared to baseline measurement was an increase of 2.33± 1.25 mm (fig. 4, table 2). A paired t test showed that this change was also statistically significant (P value< 0.05, Table 3). However the comparison between alar base widths at six months post-surgery to that of 1 year post surgery revealed no significant increase (Fig.5)

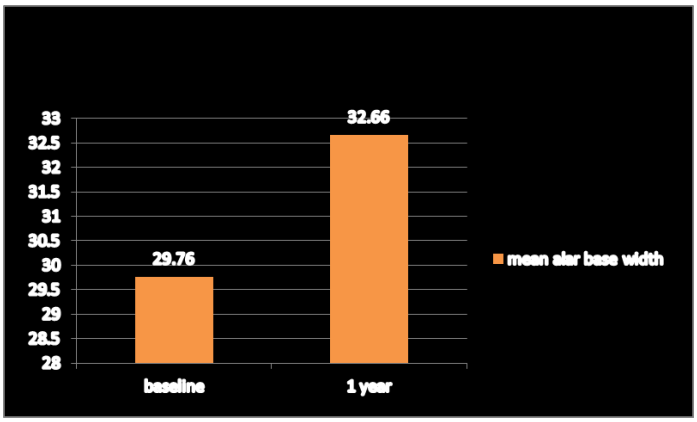

Fig.4: comparison between baseline and one year post surgery

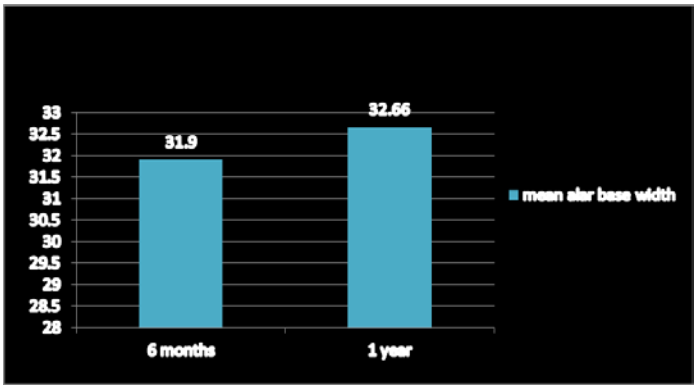

Fig 5: comparison between 6 months and one year post surgery

Fig. 6 shows the change in alar base widths over the entire study duration. It reveals that the lowest value was at baseline (29.76± 2.24 mm) while the highest was observed one year after surgery (32.66± 0.94mm).

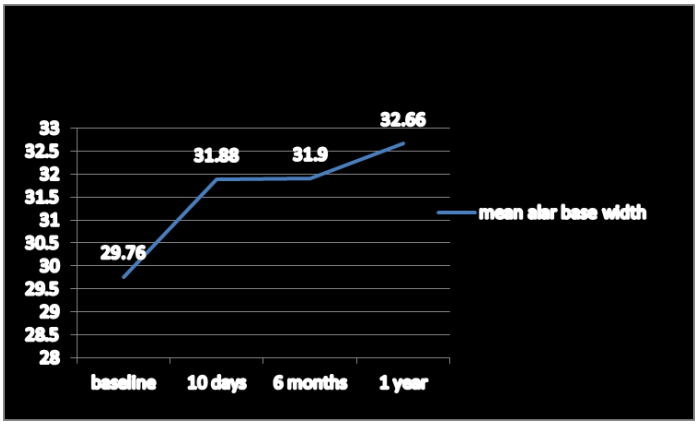

Fig 6: Changes in alar width during study period

Discussion

The main aim of surgical correction of maxillofacial anomalies is to improve the jaw function and the aesthetic appearance of the face. Both goals are equally important and the achievement of one should not be at the cost of the other. The principal aim of orthognathic surgery is the establishment of a balanced, harmonious and stable dento-skeleto-facial unit. One of the objectives of this is the achievement of an aesthetically pleasing facial soft tissue envelope [5]. Thus the surgeon should be completely aware of the soft tissue response to surgical movement of the maxilla or mandible during the orthognathic surgery.

Undesirable secondary changes of the nose and lips after the Lefort I osteotomy procedure are notorious, which include widening of the alar base of the nose, upturning of the nasal tip, flattening and thinning of the upper lip, and down turning of the commissures of the mouth. Of these unwanted post-operative changes, widening of the alar base of the nose probably is the most common [6-9].

Several surgical techniques have been suggested to help control the undesirable secondary soft tissue changes associated with maxillary orthognathic surgery. They are the alar cinch suture, a combination of the alar cinch suture and the V-Y closure, contouring of the ANS, piriformplasty, and Weir procedure and septum reduction.

This clinical study assessed the effectiveness of piriformplasty in reducing alar base flaring in patients who underwent Maxillary LeFort I osteotomy with superior positioning with or without segmentation.

Previous authors have suggested that postsurgical widening of alar base after maxillary Lefort I procedure may be a favorable outcome in a patient with vertical maxillary hyperplasia and thin, slit like nares [10]. Therefore we have specifically excluded such patients from this study.

However it has been established that these same changes become undesirable especially with superior or anterior repositioning of the maxilla [6, 11-12]. Hence we selected only patients who were indicated for maxillary orthognathic surgery with superior repositioning

The superior positioning of the osteotomised maxillary segment usually causes the flaring of the maxillary alar base because of the re-attatchment of the nasal mascular apparatus to a more lateral position. Piriformplasty as a treatment option to reduce alar flare was adopted in this study on the premise that the widened piriform aperture will accommodate the lateral margins of the ala within its

confines so that its muscular re-attachment will be prevented from migrating too far laterally.

Although few studies have been performed to evaluate the effect of various techniques to prevent alar base widening, only few studies have used a long re-evaluation period. While many authors have suggested an optimum period of six months for soft tissue stabilization [13-17], others have opined that it requires at least 12 months [18]. Betts [4] suggested that because of swelling, tissue redistribution and functional adaptation long term follow up is needed to assess soft tissue changes following surgical procedures. Wolford L M [19] in a discussion opined that evaluations prior to 12 months may cause minor discrepancies in the evaluation of soft tissue changes.

In our study, we employed a digital caliper to record the alar base width using the alar base points as previously described. Wolford M [20] suggested that measurements should be directly recorded at the alar bases rather than at widest part of the alar rims.

In our study, we have employed the piriformplasty in conjunction with a V- Y closure of the vestibular incision. Many advantages have been attributed to this technique. Guymon et al [11] in 1988 opined that this combination provides good control of alar base width, minimizes lip shortening and antero-posterior thinning of upper lip while also minimizing loss of visible vermillion.

The effects of simultaneous placement of piriformplasty and V-Y closure are successful repositioning of lip muscles in a predictable manner [7], prevention of shortening of upper lip in impaction cases [7,11] maintenance of normal lip pout, and prevention of drooping of corners of mouth [7].

Our study assessed the effectiveness of piriformplasty in reducing the alar base width following Lefort I superior positioning osteotmies. The results of our study showed that the alar base width increased by 2.33±1.25 mm at 12 months following maxillary orthognathic surgery. This increase was comparable with the increase occurred with alar cinch sutures (1.88±2.28 *mm*).

The mean baseline alar base measurement was 29.76±2.24 mm for the study group (piriformplasty) whereas it was 36.257± 1.17 mm for the control group (alar cinch suture). Ten days after surgery, the two measurements stood at 31.9±1.45 mm and 38.727±1.19 mm respectively. This difference showed a statistically significant increase in the alar base measurement. However the measurement at the six month review showed that while the study group showed an increase in alar base width (31.9±1.45 mm) which was not statistically significant the control group actually registered a significant reduction in alar base width (37.725±1.13mm). The difference in alar base width was statistically significant between the two groups at the six month interval. After one year the alar bases showed a mild increase in both the groups although this increase was not statistically significant.

When the two groups were compared at the one year interval it was found that although the widening was less in the control group (1.88± 2.28 mm) than in the study group (2.23±1.25 mm) the difference was not statistically significant.

The comparison between alar base width at 6 and 12 months following surgery revealed no significant increase. Thus the results of our study indicates that the alar base width remains stable up to 12 months following Lefort I superior positioning osteotomy when piriformplasty is employed.

We have also found that in the study group the alar base width showed an increase at all the time points after surgery. However the increase at the 10- day post-operative period was the most significant. Although the

alar base width showed an increase at the six month and one year time point, the increase was not statistically significant.

The comparison between the two groups show that the study group and the control group do not have any statistically significant increase in the alar base width at all-time points except at the six month period where the alar base width in the control group is significantly smaller than the study group. However at the end of the one year period the two groups did not demonstrate any significant differences in the increase of alar base width. This demonstrated that the there is no significant difference in the ability of the two techniques in preventing the alar base widening over the one year period.

Conclusion

The study helps us to infer that there is significant increase in alar base width with either of the techniques and although the alar cinch technique has resulted in lesser increase than piriformplasty the difference was not statistically significant.

Thus within its limitations the study provides evidence that neither piriformplasty nor alar cinch suturing is fully effective in preventing alar base widening following Lefort I osteotomy and that there is no significant difference in the ability of either technique in limiting alar base widening.

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