Original Article

Soft tissue changes after a combined lefort I and anterior maxillary osteotomy: A clinical and cephalometric study

I. Packiaraj, S. M. Abdul Rahman, K. Retnakumar, Genmorgan, Alaguvelrajan

Department of Oral and Maxillofacial Surgery, Rajas Dental College and Hospital, Tirunelveli, Tamil Nadu, India

ABSTRACT

Background: Orthognathic Surgery is indicated in severe skeletal disharmony on the best means of improving functional facial esthetic. Assessment of the facial harmony in relation to soft tissue contour the thickness of the tissues, the lip length to postural tone plays an important role. This article aims determining the changes of the soft tissue profile cephalometrically after maxillary osteotomy. **Material and Methods:** The entire concept of orthognathic surgery involves the identification of the hard and soft tissue deformity by clinical examination, cephalometric radiographs, models and photographs. This study is to assist the pre and post-operative soft tissue changes clinically including width of the nasal bone and upper incisor exposure of rest and cephalometrically including nasolabial angle, facial convexity, lip protuberance and inter-labial gap by using Rickets E Line, Steiner's S Line, Merrifield's Z Angle and Holdaway Soft Tissue Analysis. **Results:** There is significant dramatic improvement in the soft tissue profile cephalometrically after maxillary osteotomy. **Conclusion:** The conclusion of the study is that there is a change in the soft tissue in relation to the hard tissue movement, and also the stability of the soft tissue profile was established by rigid fixation of bony segments.

Key words: Anterior maxillary osteotomy, lefort I osteotomy, soft tissue changes

INTRODUCTION

Orthognathic surgery has emerged as a decisive treatment in improving the patient's profile thereby providing a better esthetics and function of the jaws. Lefort I osteotomy has been the workhorse for the surgeons in the management of maxillary vertical excess, in all three planes of space whereas anterior maxillary osteotomy (AMO) is indicated mainly for dentoalveolar protrusion, correction of open bite and closing dental spaces between segments.[1] The first report of AMO was done by Cohn Stock in 1921.[2]

Any surgical movement of the bony skeleton will definitely influence the overlying soft tissues. The changes in soft tissue profile after an orthognathic surgery depends on several factors including the incisions made and closure done.[3-6] Most authors[7-9] suggest that the soft tissues stabilize within 6 months after the orthognathic surgery, however, Hack *et al.*[10] reported evidence of continued soft tissue settling several years after surgery.

Address for correspondence:
Dr. Abdul Rahman, 48, Parasuramapuram North Street, Kadayanallur, Tirunelveli - 627 751, Tamil Nadu, India.
E-mail: rahman.bds@Gmail.Com

Access this article online	
Quick Response Code:	Website: www.jiadsr.org
	DOI: 10.4103/2229-3019.166109

How to cite this article: Packiaraj I, Abdul Rahman SM, Retnakumar K, Genmorgan, Alaguvelrajan. Soft tissue changes after a combined lefort I and anterior maxillary osteotomy: A clinical and cephalometric study. J Indian Acad Dent Spec Res 2015;2:16-9.

Literature reveals that changes in the vertical plane are less predictable compared to the horizontal plane, which may be attributed to smaller movements in vertical plane, and use of soft and hard tissue landmarks better suited for horizontal measurements.[11]

The aim of this retrospective study was to analyze the soft tissue changes clinically and cephalometrically after a combined lefort I and AMO.

MATERIALS AND METHODS

This study was conducted on five patients (one male and four female) in the age group of 23-27 years with a skeletal class II division I malocclusion with vertical maxillary excess who underwent lefort I maxillary impaction in conjunction with AMO. In all patients, alar cinch and V-Y closure was done. Clinically patients with an incisor exposure of >8 mm on a smile and incompetent lips and cephalometrically patients with an acute nasolabial angle increased facial convexity and an inter-labial gap of >4 mm were included in the study. The mean follow-up period of the patients was 1-year.

The clinical parameters assessed pre- and post-operatively were alar base width using vernier calliper and also upper incisor exposure at rest and the cephalometric evaluations made were upper lip protrusion –L_S to (S_n-P_g'), lower lip protusion –L_l to (S_n-P_g'), facial convexity angle G-S_n-P_g, nasolabial angle C_o-S_n-L_s, inter-labial gap stm-stm, Merrifield Z angle analysis, and in Holdaway soft tissue analysis the upper lip thickness and upper lip curvature was assessed. The soft tissue analysis used in this study were Ricket's E-Line, Steiner's S-Line, The Holdaway soft tissue analysis, Merrifield's Z angle and COGS analysis.

RESULTS

Five patients were included in the study. The mean age was 24 years with a range of 20-30 years. The postoperative assessment was made 1-year postoperatively to allow soft tissue settling. Clinical assessment of the alar base width revealed a decrease in alar base width with a mean postoperative value of 34.3 mm. There was a significant decrease in the upper incisor exposure at rest compared to the preoperative values with a mean incisor exposure of 2.8 mm postoperatively. Cephalometric measurements of upper lip protrusion showed decreased significant changes with a mean difference of 2.58 mm between the pre- and post-operative values with an average of 6.2 mm. The lower lip protrusion decreased significantly with a mean lower lip protrusion of 6.52 mm postoperatively. There was a decrease in the facial convexity angle. On the contrary, the nasolabial angle increased with a mean value of 90.1° nearing normal values suggesting a significant decrease in maxillary proclination. Similarly, the inter-labial gap significantly decreased, the mean interlabial gap being 2.23 mm postoperatively depicting competent lips. In Merrifield's analysis, the mean postoperative angle is 74.3. In Holdaway soft tissue analysis, the upper lip thickness attained normal values with a mean value of 13.1 mm and there was a decrease in the upper lip curvature toward normal measurements compared to the preoperative measurements with a mean value 2 mm. These results showed a dramatic improvement of soft tissue profile. Statistical value analysis is given in Tables 1 and 2.

Table1: Pre- and post-operative cephalometric evaluation for five patients

Parameter examined	Serial number	Cephalometric analysis		*P*
		Preoperative	Postoperative	
Upper lip protrusion	1	9.8	6.2	0.003*
	2	7.2	5.8	
	3	8.1	6.3	
	4	9.4	6.4	
	5	9.4	6.3	
	Mean	8.78	6.2	
Lower lip protrusion	1	11	6.5	0.001*
	2	12.6	6.3	
	3	14.3	7.1	
	4	10.7	6.2	
	5	10.3	6.5	
	Mean	11.78	6.52	
Facial convexity angle (°)	1	32.4	22.6	0.001*
	2	27	21.2	
	3	28.4	19.1	
	4	32.6	22.4	
	5	33	22	
	Mean	30.68	21.46	
Nasolabial angle (°)	1	81	89	0.001*
	2	82.4	90	
	3	79.4	91.3	
	4	82	93.6	
	5	79	87	
	Mean	80.76	90.18	
Inter labial gap	1	9.6	2.8	0.0001*
	2	8.4	2.6	
	3	7.9	2.8	
	4	8.7	2.5	
	5	8.9	2.7	
	Mean	8.7	2.68	
Merrifield's Z angle analysis	1	53	73.5	0.004*
	2	57	73	
	3	67	74	
	4	54	77	
	5	52	74	
	Mean	56.6	74.3	
Upper lip thickness	1	9	14	0.030*
	2	17	19	
	3	7	8.5	
	4	11.5	12.5	
	5	9.5	11.5	
	Mean	10.8	13.1	
Upper lip curvature	1	4.5	1.5	0.003*
	2	5	2.5	
	3	4.5	2	
	4	3.5	2.5	
	5	3.5	1.5	
	Mean	4.2	2	

Table 2: Pre- and post-operative clinical evaluation for five patients

Parameter examined	Serial number	Clinical evaluation		*P*
		Preoperative	Postoperative	
Width of nasal bone	1	34.2	30.5	0.001*
	2	45	41	
	3	29	26.2	
	4	40	37.4	
	5	38.9	36.4	
	Mean	37.42	34.3	
Upper incisor exposure at rest	1	11.2	2.8	0.0001*
	2	13	3.2	
	3	10.6	2.6	
	4	11.8	2.7	
	5	12.4	2.7	
	Mean	11.8	2.8	

*Paired *t*-test

DISCUSSION

Significant advances have been made in the stability and predictability of maxillary surgeries over the years. However, minimal attention has been paid on the effects of these surgeries on soft tissues. According to Motta *et al*.[12] surface displacements indicate that the postoperative adaptation at different anatomic regions are significantly correlated.

Literature reveals widening of the alar base with maxillary impaction as well as with an AMO,[13-15] Park *et al*.[16] in their study on soft tissue changes after AMO reported an increase of nasal width by 3% with slight widening of alar base, on the contrary in our study even when both procedures were done in conjunction there was a decrease in alar base width which could be attributed to the alar cinch suture and V-Y closure done. However Shoji *et al*.[17] who on using alar cinch suture and V-Y closure in 30 patients after lefort I and mandibular osteotomies demonstrated no alteration of alar base width. The significant decrease in the upper incisor exposure at rest reported in the study was seen to be proportional to the amount of maxillary impaction, and a maxillary impaction of >6 mm required a trimming of the nasal septum to avoid buckling of the septum. The decrease in upper and lower lip protrusion seen in our study could be because of a combined AMO and maxillary impaction.

Superior repositioning of maxilla leads to a decrease in the nasolabial angle on the flip side. In AMO, there is an increase in the nasolabial angle. In a study of Nadakirini *et al*.[18] there was a mean increase of nasolabial angle after AMO. This change of nasolabial angle occurs due to pushing of upper lip backwards. In the reported study, there was an increase in the nasolabial angle suggesting that a combined maxillary impaction and AMO could have a better esthetic profile of the nasal soft tissues.

The decrease in the interlabial gap improving the lips competency is sequential to the AMO. There was an increase in the upper lip thickness and satisfactory lip curvature in our study similar to the studies of Shawky *et al*. 2011[6] on soft tissue changes after anterior segmental osteotomies where they reported an increase in lip thickness, but they suggested that variation may occur because of differences in the amount of posterior movement of the upper anteriors, operative technique, lip thickness, and lip strength.

CONCLUSION

The ability to predict the hard and soft tissue changes prior to an orthognathic surgical procedure is critical to the treatment planning process. The profile of soft tissue changes according to the bony foundation and also promotes skeletal relapse. The combination of lefort I osteotomy and AMO definitely improves the esthetic profile of patients in terms of nasal and labial soft tissues. However, the sample size being small, a larger randomized controlled study is needed to assess the effectiveness of this combination in patients with class II division I skeletal malocclusion with vertical maxillary excess. However, the choice the combination of surgeries should be individualized to the need of each patient striking a balance between esthetics and function.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Jayaratne YS, Zwahlen RA, Lo J, Cheung LK. Facial soft tissue response to anterior segmental osteotomies: A systematic review. Int J Oral Maxillofac Surg 2010;39:1050-8.
2. Daniel HT, White RP Jr, Proffit WR. Anterior maxillary osteotomy in dental treatment. J Am Dent Assoc 1971;83:338-43.
3. Waite P. Simultaneous orthognathic surgery and rhinoplasty. Oral Maxillofac Surg Clin North Am 1990;2:339-50.
4. Ingersoll SK, Peterson L, Weinstein S. Influence of horizontal incision on upper lip morphology. J Dent Res 1982;61:218.
5. O'Reilly MT. Integumental profile changes after surgical orthodontic correction of bimaxillary dentoalveolar protrusion in black patients. Am J Orthod Dentofacial Orthop 1989;96:242-8.
6. Shawky MM, El-Ghareeb TI, Hameed Abu Hummos LA. Evaluation of the three-dimensional soft tissue changes after anterior segmental maxillary osteotomy. Int J Oral Maxillofac Surg 2012;41:718-26.
7. Tomlak DJ, Piecuch JF, Weinstein S. Morphologic analysis of upper lip area following maxillary osteotomy via the tunneling approach. Am J Orthod 1984;85:488-93.
8. Subtelny J. A longitudinal study of the soft tissue facial structures and their profile characteristics, defined in relation to underlying skeletal structures. Am J Orthod 1959;45:481-507.
9. Rosen HM. Lip-nasal aesthetics following Le Fort I osteotomy. Plast Reconstr Surg 1988;81:171-82.
10. Hack GA, de Mol van Otterloo JJ, Nanda R. Long-term stability and prediction of soft tissue changes after Le Fort I surgery. Am J Orthod Dentofacial Orthop 1993;104:544-55.

11. Nadkarni PG. Soft tissue profile changes associated with orthognathic surgery for bimaxillary protrusion. J Oral Maxillofac Surg 1986;44:851-4.
12. Motta AT, Cevidanes LH, Carvalho FA, Almeida MA, Phillips C. Three-dimensional regional displacements after mandibular advancement surgery: One year of follow-up. J Oral Maxillofac Surg 2011;69:1447-57.
13. Guymon M, Crosby DR, Wolford LM. The alar base cinch suture to control nasal width in maxillary osteotomies. Int J Adult Orthodon Orthognath Surg 1988;3:89-95.
14. Betts NJ, Vig KW, Vig P, Spalding P, Fonseca RJ. Changes in the nasal and labial soft tissues after surgical repositioning of the maxilla. Int J Adult Orthodon Orthognath Surg 1993;8:7-23.
15. Lew KK, Loh FC, Yeo JF, Loh HS. Profile changes following anterior subapical osteotomy in Chinese adults with bimaxillary protrusion. Int J Adult Orthodon Orthognath Surg 1989;4:189-96.
16. Park JU, Hwang YS. Evaluation of the soft and hard tissue changes after anterior segmental osteotomy on the maxilla and mandible. J Oral Maxillofac Surg 2008;66:98-103.
17. Shoji T, Muto T, Takahashi M, Akizki K, Tsuchida Y. The stability of alar cinch suture after Le Fort I and mandibular osteotomies in Japanese patients with Class III malocclusions. Br J Oral Maxillofac Surg 2011;50:361-4.
18. Nadkarni PG. Soft tissue profile changes associated with orthognathic surgery fo bimaxillary protrusion. J Oral Maxillofac Surg 1986;44:851-4