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Evaluation of Nasal Morphology Changes Following Le Fort I Superior Impaction

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Abstract

Background And Objectives: Le Fort I osteotomy is performed for correction maxilla in all three planes, Maxillary Le Fort I osteotomy for superior impaction includes several adjuvant procedures in bone, cartilage and soft tissues in order to achieve satisfactory results. The purpose of study is to evaluate post operative changes occurred in nasal tip height, nasal tip upward displacement, nasal tip rotation and nasal width in patients who underwent maxillary LeFort I superior impaction.

Method: Prospective study was carried out in twenty patients reported with maxillary excess. Le Fort I superior impaction was carried out in all patients. Various hard and soft tissue changes like nasal tip height, nasal tip displacement, nasal tip rotation and nasal width changes were measured preoperatively and post operatively, clinically and using cephalogram with an interval of one and three months.

Results: The results showed a decrease in nasal tip height in three months post operatively follow up. Nasal tip rotation and nasal width increased in three-month post operatively, no change was noticed in nasal tip displacement.

Conclusion: Le Fort I superior impaction results in high degree of certainty of outcome with regards to nasal morphology. Several adjuvant procedures like pyriformplasty, alar-cinch suturing and reduction of nasal septal cartilage are necessary to maintain good nasal morphology following Le Fort I superior impaction.

Keywords: LeFort I osteotomy, nasal tip height, nasal tip displacement, nasal tip rotation and nasal width

Introduction

LeFort I osteotomy is named after fracture pattern originally described by Rene LeFort in 1901 that extends from nasal septum, along anterior wall of maxillary wall above tooth apices and to pterygomaxillary junction. First description of LeFort I osteotomy was by Cheever in 1864 for resection of nasopharyngeal tumour[1]. Difference in osteotomy and fracture relates to the pterygoid plates, LeFort I osteotomy spares the pterygoid plates stopping at the pterygomaxillary junction. Le Fort I osteotomy is performed for correction maxillary deformities in all three planes. Maxillary Le Fort I osteotomy results changes in mid facial morphology, like upward rotation of nasal tip, widening of alar base, increase in nasal tip protrusion, reduction of nasofrontal angle, nasolabial angle, fullness of nasal bases[1]. Secondary changes in nasal morphology are common and can affect overall aesthetic of face.

Being the central and most prominent unit of face, nose plays a major role in facial aesthetics. Important aesthetic factor to be considered during LeFort I osteotomy are width of nasal base, distance from of nose to anterior extent of nares and from the anterior aspect of nares to the tip of nose (Fig A &B) The prominence of dorsum, the shape of nasal tip as well as the sharpness of the supra tip break must also be considered in relation to intended orthognathic surgery

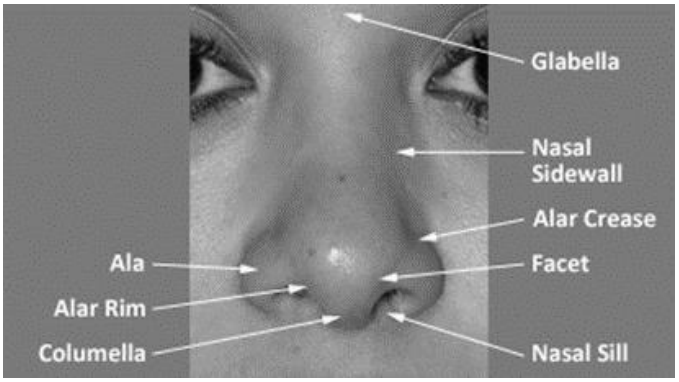


Figure 1 A : Soft tissue morphology of nose

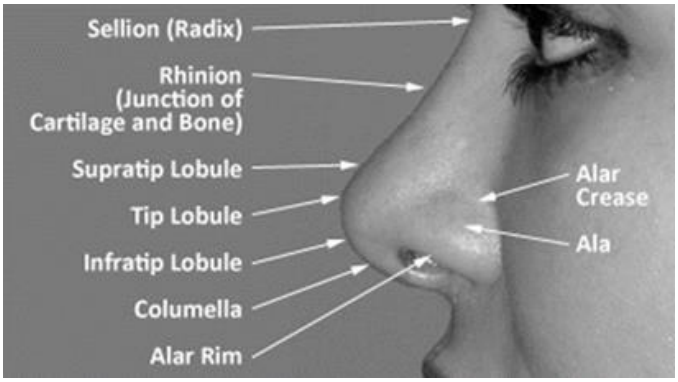


Figure 1 B: Soft tissue morphology of nose (profile view)

Nasal widening may be an aesthetic benefit to some patients[2,3]. Narrow nose with prominent dorsum is associated with long face. Superior positioning of maxilla in this type of case usually alters nasal appearance by widening alar base[4]. Excessive widening of alar base and superior retraction of nasal tip result in unaesthetic nasal appearance with alar asymmetry. In performing maxillary surgery, it is imperative that surgeon should understands preoperative esthetic facial relationship and anticipate the potential effects that surgical procedure may produce on nasal region[5].

This clinical prospective study was conducted in the department of Oral &maxillofacial Surgery Government Dental College, Kottayam. Twenty patients with vertical maxillary excess were selected and Le Fort I osteotomy with superior impaction was carried in all patients. Study was conducted over a period of 18 months (January 2015-June2016). Changes in nasal tip height, anteroposterior nasal tip displacement, nasal tip rotation, and nasal alar base widening were evaluated preoperatively and post operatively at an interval of three months and six months.

Following parameters were compared preoperatively and post operatively.

1.Analysis of facial photographs (Frontal, lateral profile, oblique)

2.Clinical evaluation of nasal base width

3. Cephalometric analysis

Clinical evaluation of nasal base width

General and local examination carried out. Hard tissue and soft tissues, oral function, temporomandibular joint, occlusal relationship, frontal and lateral facial proportions were assessed. Nasal base width was calculated by measuring the distance between alar crease on each side by using a vernier caliper.

Cephalometric Analysis

Following landmarks were used for cephalometric tracing based on Heliovaara etal[6].

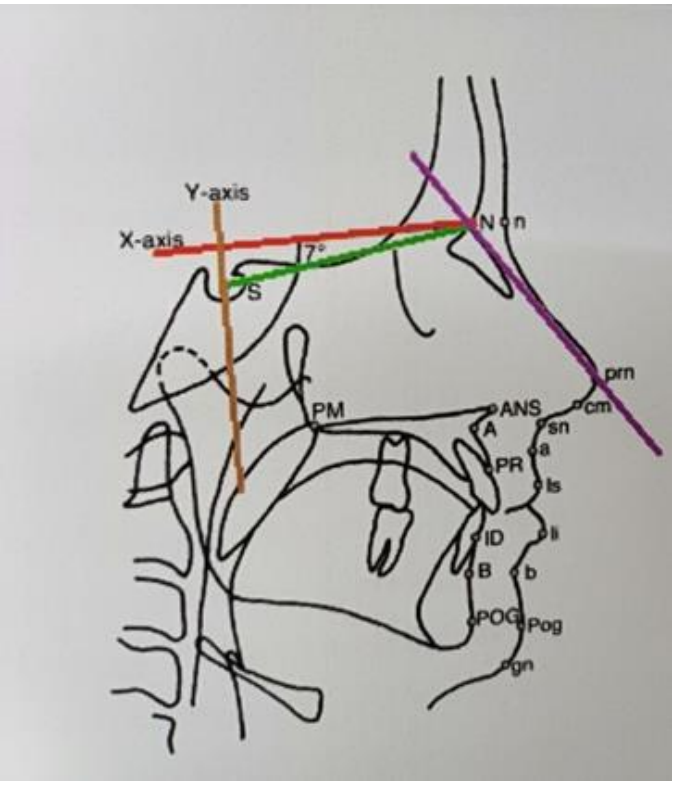


Fig 2A: Schematic diagram showing cephalometric landmarks.

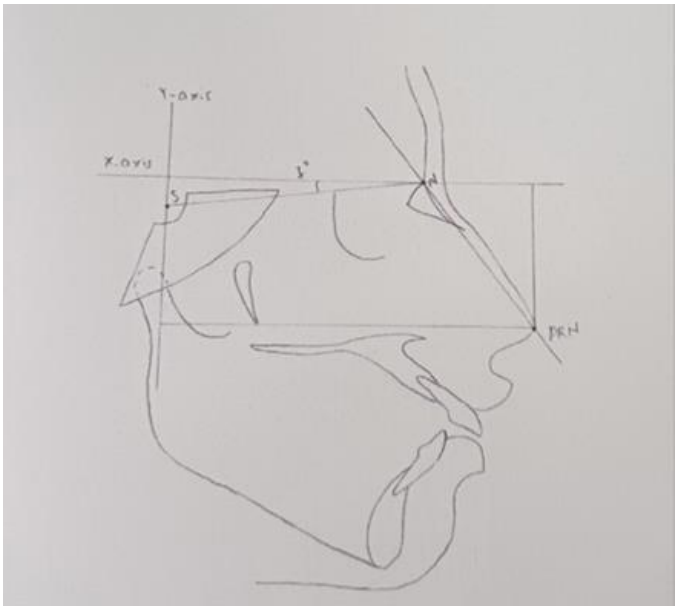


Fig 2B: Cephalometric landmarks with emphasis on nasal morphology

1. S point
2. N point
3. SN line
4. X axis (horizontal line starting at point N, ascending 70 of SN line)
5. Y axis (vertical line perpendicular to the horizontal line passing through the S point)
6. PNS point (posterior nsal spine)
7. A point (deepest point in the anterior contour of maxillary alveolar arch)
8. PR point (prosthion-Most anterior –inferior point of upper dentoalveolar margin)
9. PRN point (most anterior point of nasal tip)

1) Nasal tip height (distance between PRN point and reference line X)

2)Nasal tip displacement (displacement between PRN point and the reference line Y)

3)Nasal tip rotation (Sn-Pr-No)

Lateral cephalogram taken at one month and three month following surgery to assess the changes in nasal tip height, nasal tip displacement, nasal tip rotation.

Changes in nasal tip height was evaluated by measuring the distance between PRN point and reference line X. Change in nasal tip displacement was evaluated by measuring the distance between PRN point and reference line Y. Change in nasal tip rotation was evaluated by measuring the angle between SN line and N-PRN line.

Evaluation of nasal base width

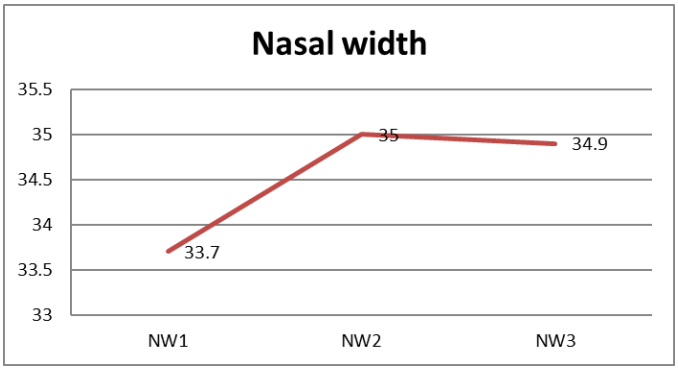
Nasal base width was calculated by measuring the distance between alar crease on each side by using a vernier caliper.

Results

Table 1: Changes in Nasal width

Sn.	NW1	NW2	NW3	D1	D2	D3
1	34	35	36	1	1	2
2	31	32	31	1	1	0
3	34	35	34	1	1	0
4	36	37	38	1	1	2
5	30	32	34	2	2	4
6	30	32	31	1	1	0
7	36	37	38	1	1	2
8	36	37	38	1	1	2
9	34	36	34	2	2	0
11	35	37	35	2	2	0
11	33	35	32	2	3	1
12	32	34	36	2	2	4
SL NO	NW1	NW2	NW3	D1	D2	D3
13	35	36	37	1	1	2
14	31	32	31	1	1	0
15	37	38	37	1	1	0
16	33	34	35	1	1	2
17	36	37	36	1	1	0
18	33	34	35	1	1	2
19	32	33	32	1	1	0
20	35	37	38	2	1	3

Nasal width showed a significant increase in nasal width from preoperatively to post operatively one month and three months respectively. But changes were insignificant when it was compared between post operative one month and post operative three month.



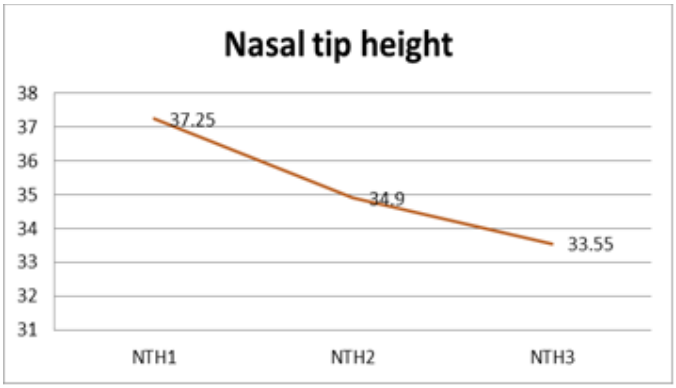
Graph 1: Line diagram showing change in the nasal width between preoperative, post operative (one month) and post operative (three months).

Table 2: Change in Nasal tip height.

Sn.	NTH1	NTH2	NTH3	D1	D2	D3
1	38	32	33	6	1	5
2	40	36	33	4	3	7
3	41	38	37	3	1	4
4	35	37	36	2	1	1
5	35	33	31	2	1	4
6	33	35	34	2	1	1
7	27	26	26	1	0	1
8	38	36	34	2	2	4
9	41	37	36	4	1	5
10	40	40	39	0	1	1
11	31	30	30	1	0	1
12	41	40	39	1	1	3
13	34	32	30	1	2	4
14	38	35	33	3	2	5
15	43	37	36	6	1	7
16	36	34	32	2	2	4
17	43	36	35	7	1	8
18	36	35	33	1	2	3

19	36	34	32	2	2	4
20	39	35	32	4	3	7

Nasal tip height decreased significantly from preoperatively to post operatively one month and three months respectively. It also decreased between post operative three month and one month.

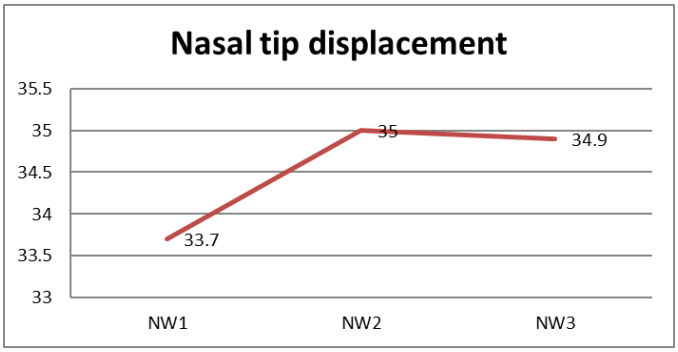


Graph 2: Line diagram showing change in the nasal tip heights between preoperative, post operative (one month) and post operative (three months).

Table 3: Change in the nasal tip displacement.

Sn.	NTH1	NTH2	NTH3	D1	D2	D3
1	83	80	79	3	1	4
2	72	77	70	5	7	2
3	75	73	73	2	0	2
4	87	94	92	7	2	5
5	76	79	78	3	1	2
6	75	80	79	5	1	4
7	76	81	80	5	1	4
8	84	81	76	3	5	8
9	87	86	86	1	0	1
10	79	75	75	4	0	4
11	93	98	98	5	0	5
12	75	75	73	0	2	2
13	87	84	81	0	3	6
SL NO	NTH1	NTH2	NTH3	D1	D2	D3
14	89	86	85	3	1	4
15	82	79	78	3	1	4
16	84	81	80	3	1	4
17	73	78	71	5	7	2
18	89	86	85	3	1	4
19	71	76	69	5	7	2
20	80	79	76	1	3	4

Nasal tip displacement decreased significantly from post operative one month to three months. But changes were insignificant when it was compared between pre and post operative one month as well as between preoperative and post operative three months.



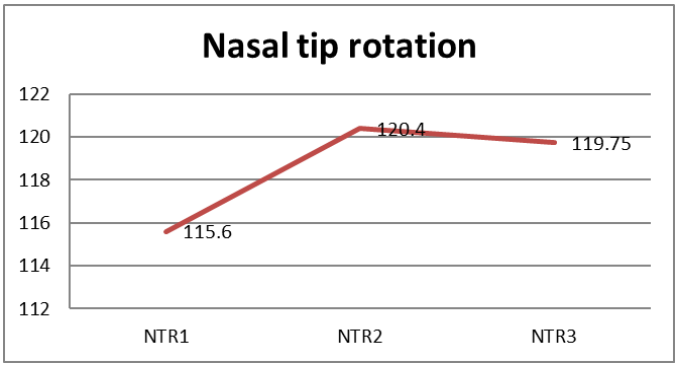
Graph 3: Line diagram showing change in the nasal tip displacement between preoperative, post operative (one month) and post operative (three months).

Table 4: Change in nasal tip rotation.

Sn.	NTH1	NTH2	NTH3	D1	D2	D3
1	112	119	116	7	3	4
2	108	116	119	8	3	11
3	113	113	112	0	1	1
4	123	124	122	1	2	1
5	114	121	118	7	3	4
6	118	119	118	1	1	0
7	126	127	125	1	2	1
8	117	125	126	8	1	9
9	113	116	119	3	3	6
10	109	119	120	10	1	11
11	131	134	132	3	2	3
12	113	120	117	7	3	4

13	118	126	129	8	3	11
14	117	117	116	0	1	1
15	108	116	119	8	3	11
16	118	127	128	9	1	10
17	116	116	113	0	3	3
18	112	119	116	7	3	4
19	113	114	113	1	1	0
20	113	120	117	7	3	4

Nasal tip rotation increased significantly from pre operatively to post operatively one month and three months respectively . But changes were insignificant when it was compared between post operative one month to post operative three months.



Graph 4: Line diagram showing change in the nasal tip rotation between preoperative, post operative (one month) and post operative (three months)

Cases

Fig 3 A: Pre-Op (Frontal View)

Fig 3B: Pre-Op (Profile)

Fig 3 C: Post Op(Frontal)

Fig 3D: Post Op (Profile)

Discussion

Le Fort I osteotomy indicated for mobilization of maxilla in three dimensional spatial planes allow

correction of several maxillary deformities of maxilla. This study was conducted in Department of Oral & Maxillofacial Surgery Government Dental College Kottayam from January 2015 to june2016. This study was mainly focused on the amount of changes in nasal tip height, nasal tip displacement, nasal tip rotation and nasal width changes follow ling Le Fort I Osteotomy

Le Fort I osteotomy and superior positioning of maxilla results hard and soft tissue changes, outcome of procedure is not always desirable. Despite achieving a perfect occlusion and a pleasant profile in most cases, deleterious changes in aesthetic appearance may occur in others. Undoubtedly, good occlusion and function should not be achieved at the expense of aesthetics, therefore the ability to predict soft tissue changes is much important in Le Fort I osteotomies. Betts etal[8] reported that the soft tissue changes associated with maxillary Le Fort surgery is more related to position of soft tissue incision and method of closure than to surgically induced hard tissue changes. Soft tissue changes are more depend upon surgical dissection like degloving lower cartilages and separation of nasal septum .

Nasal tip height was calculated by measuring the distance between PRN point and reference line X, decreased significantly from pre operative to post operative one month and three month respectively which is accordance with study conducted by Wagner Ranier Macial Dantas etal4 , Radney and Jacobs[9] In their study stated there was a decrease in nasal tip height post operatively

Nasal tip displacement was calculated by measuring the distance between PRN point and reference line Y, decreased significantly from post operative one month to three months. When it is compared with post operative first and third months the results were insignificant.

Nasal tip rotation was calculated by measuring the distance between SN line and N-PRN point. In our study there was a significant increase in nasal tip rotation from preoperative to post operative interval, and insignificant between one and three months. These results were consistent with studies done by Ubaya, A. Shrriff etal [10] who described that nasal tip rotation was larger and more obtuse following Le Fort I superior impaction.

Nasal width was calculated by measuring the distance measuring the distance between the alar crease on each side. In our study showed a significant increase in nasal width from preoperative to post operative one month and preoperative three month The changes were insignificant when compared to pre operative one month and post operative three month. Yamada et al[11]eavulated soft tissue changes following Le Fort I osteotomy using a 3D laser scanner, in which they found significant increase in width and nasal tip protrusion.

The present study showed that regardless of the amount of Le Fort I superior impaction in most cases there was decrease in nasal tip height, increased nasal width, upward nasal rotation and nasal tip elevation. A probable explanation for this fact is that there was a new positioning of anterior nasal spine and with dissection of soft tissue the standard preoperative measures were partially lost generating distortion. It is utmost important to evaluate nasal and paranasal aesthetics as well as the bilateral symmetry before and after Le Fort I osteotomy.

Maxillary Le Fort I osteotomy is a challenging endeavor in restoring function and esthetic. Given its central location in the middle of face and its contribution to key elements like orbit, zygomatic complex, nasal unit and stomatognathic complex. The maxilla functions as key stone of middle face and unites these elements into one functional and esthetic unit. Le Fort I superior impaction results in high degree of certainty of outcome. There was

a marked decrease in incisor visibility and improvement in facial profile with Le Fort I procedure along with alteration in nasal profile. This study showed that Le Fort I superior impaction resulted in the betterment of nasal esthetics. As this is short term evaluation long duration follow up with larger sample size is needed to prove the definitive outcome.

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