

Evaluation Of Nasal Morphology In Patients With Vertical Maxillary Excess Before And After Lefort 1 Osteotomy - A Cephalometric Study

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ABSTRACT

The aim of this study was to assess the nasal morphology in Vertical maxillary excess patients before and after Le Fort 1 osteotomy and to evaluate the relationship of palatal plane and nasal upward tip angle. **Materials and Methods:** Pre-treatment and Post-treatment lateral cephalograms of 19 non growing patients with vertical maxillary excess treated with Le Fort 1 osteotomy were obtained and soft and hard tissue Cephalometric measurements were assessed and compared between two groups. **Results:** Post surgically there was significant decrease in total facial height (N-Me), upper facial height (N-ANS), mandibular plane inclination (GoGn-SN), palatal plane inclination (SN-Pp) and mild decrease in lower anterior facial height (ANS-Me). A significant increase in the angle of inclination (AOI) was observed. **Conclusion:** The present study showed a positive correlation between Angle of inclination(AOI) and Upper nasolabial angle (UNLA) in patients with vertical maxillary excess which revealed that increased A.O.I of the palatal plane is associated with increased UNLA and can be considered as a diagnostic criteria. But post surgically after Le fort 1 osteotomy, a weak negative correlation between these two parameters revealed that, even though the palatal plane tipped upward, there was a decrease in the Nasolabial angle.

Key Words: Vertical maxillary excess, Nasal morphology, Lefort 1 osteotomy, Angle of inclination.

1. INTRODUCTION

Treatment planning should begin with visualization of the final result with respect to both hard tissue and soft tissue changes. Analysis of the soft tissue of the face has been an important part of orthodontic treatment planning since 1950s, when Riedel[1], Holdaway[2] and Subtelny[3] independently described the salient aspects of the soft tissue profile, as well as the relationship of soft tissue landmarks to the underlying skeletal structures. With this study, an attempt was made to cephalometrically evaluate the nasal soft tissue changes in vertical maxillary excess patients treated with Le Fort 1 osteotomy. The knowledge of potential soft tissue changes that may result from the Le Fort 1 osteotomy is essential to plan a better soft tissue treatment outcome.

2. MATERIALS AND METHODS

The material consisted of 19 Pre and post surgical Lateral cephalograms of patients with vertical maxillary excess who underwent Le fort 1 maxillary osteotomy. This study was conducted by using longitudinal retrospective records obtained from the Department of Orthodontics and Dentofacial Orthopedics, MeenakshiAmmal Dental College, Chennai.The age of the subjects included in the study ranged from 18-27 years with a mean age of 22.5 years. The obtained sample was divided into 2 groups,Group 1– Consisting of 19 pre-surgical lateral cephalograms of patients with vertical maxillary excess(Fig-1)Group 2 – Consisting of 19 post-surgical lateral cephalograms of the same patients who underwent Le Fort 1 osteotomy mostly maxillary impaction with setback(Fig-2)



Figure 1 - Pre-surgical lateral cephalograms of the patient with vertical maxillary excess.

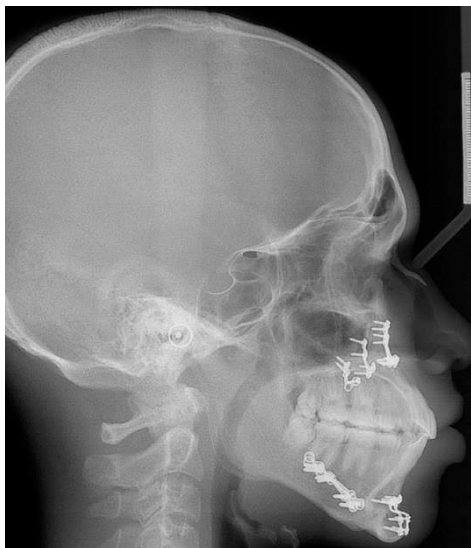


Figure 2 - Post-surgical lateral cephalograms of the same patient who underwent Le Fort 1 osteotomy mostly maxillary impaction with setback

A comprehensive set of cephalometric measurements was developed, consisting of seven vertical facial skeletal parameters and six soft tissue nasal parameters(Fig - 3).

Vertical Facial Skeletal Parameters:-

GoGn-SN: It is an antero-inferior angle formed by relating mandibular plane (GoGn) to the anterior cranial base (SN).

S-Go: It is the linear distance from Sella (S) to Gonion (Go), which gives posterior facial height

N-Me: It is an anterior facial height measured between Nasion (N) and Menton

N-ANS: This linear measurement between Nasion and Anterior nasal spine gives the anterior maxillary height or mid facial height

ANS-Me: It gives the lower anterior facial height, which is measured between Anterior nasal spine (ANS) and Menton (Me)

SN-Pp: Inclination of palatal plane is the angle between the SN plane and Palatal plane.

AOI (Angle of inclination): This is the angle between the perpendicular drawn from N' (soft tissue nasion) on Se -N' line and the Palatal plane (ANS-PNS).

SOFT TISSUE PARAMETERS USED TO ASSESS THE NASAL MORPHOLOGY:-

Nasal length (N Lth) : The distance between N' (Soft tissue nasion) and Pr (Pronasale)

Nasal depth (N Dpt) : The perpendicular distance between Pr (Pronasale) and the line drawn through N' (Soft tissue nasion) to Sn (Subnasale)

Nasiolabial angle (NLA) : The angle formed by the intersection of the PCm (Posterior columella) tangent and PCm-Ls line (Ls-Labrale superius)

Upper nasolabial angle (UNLA) or Nasal upward tip angle: The postero-inferior angle formed when PCm (Posterior columella) tangent is extended anteriorly to intersect the FH (Frankfort horizontal) plane.

Lower nasolabial angle (LNLA): The antero-inferior angle formed by the PCm-Ls line extended superiorly to intersect the FH plane.

Nasal tip angle (NTP): The angle formed by the axis of the nasal dorsum and PCm tangent.

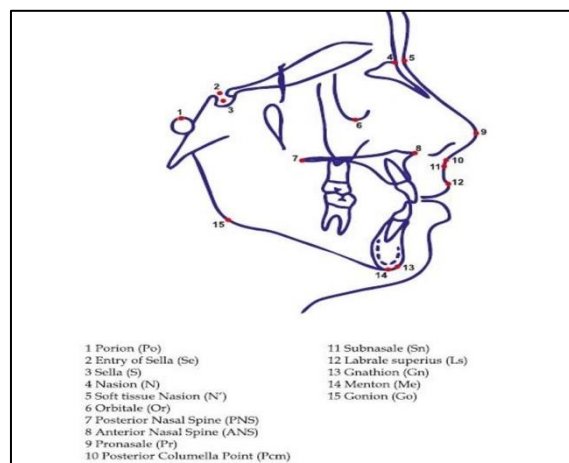


Figure 3 - Cephalometric landmarks used in the present study

3. RESULTS

The statistical analysis for the present study was carried out with the statistical package for social service, version 15.0 software (SPSS ver. 15.0). The results obtained from the analysis were tabulated. Mean and standard deviation were estimated for the sample groups, Group 1 (pre-treatment) and Group 2 (post-treatment) separately. Mean values were compared and correlation

values(r value) were obtained with the student paired t test. R value ≥ 0.7 was considered as the level of significance. In the present study, P values were estimated for the mean of difference and to find the level of significance between the two groups. $P < 0.05$ was considered as the level of significance. The obtained mean values, standard deviations, level of significance, were tabulated (Table 1).Significant correlations were seen between the following pre-treatment skeletal and soft tissue parameters. In vertical skeletal parameters, a significant level of decrease was found in GoGn-SN ($P=0.000$), N-Me ($P=0.001$), SN-Pp ($P=0.014$) and N-ANS ($P=0.000$). A non-significant decrease was observed in ANS-Me ($P=0.100$) . Contrary to these findings AOI showed significant increase in its mean value ($P=0.001$). Observing the soft tissue nasal parameters, we found non-significant decrease in the NDpth ($P=0.792$) and significant decrease in NTP ($p=0.000$).NLA showed a non-significant increase in the mean value ($P=0.046$) and a significant increase was seen in the LNLA ($P= 0.001$).

Table: 1 shows the descriptive data for all pre-treatment and post-treatment vertical facial skeletal and nasal soft tissue parameters.

Variable	Pre-operative	Post-operative	Mean Difference	p*- Value
Vertical Skeletal parameters				
GoGn-SN	8 34.50±6.2	4 30.65±4.8	- 3.84±3.24	.000 (S)
S-Go	4 75.57±6.1	9 74.68±7.9	- 0.89±4.05	.349 (NS)
N-Me	46 121.44±9.	.35 115.63±10	- 5.81±5.99	.001 (S)
N-ANS	5 50.23±4.3	4 44.94±5.3	- 5.28±3.57	.000 (S)
ANS-Me	8 73.47±6.0	8 71.68±7.3	- 1.78±4.49	.100 (NS)
SN-PP	5.47±2.91	3.63±4.31	- 1.84±2.94	.014 (S)
AOI	9 90.76±4.3	1 93.65±4.8	2.89±3.2	.001 (S)
Nasal soft tissue parameters				
N Lth	0 46.00±5.0	7 44.73±5.0	- 1.26±0.86	.048 (S)
N Dpth	8 15.65±2.1	0 15.76±1.8	0.10±0.6	.792 (NS)
NLA	92.77±14.	98.68±13.	5.910±0.	.046

	12	07	56	(S)
UNLA	24.92±10. 38	22.57±8.6 5	- 2.34±0.87	.060 (NS)
LNLA	66.76±11. 97	77.78±7.7 2	11.02±0. 28	.001 (S)
NTP	82.60±8.3 8	76.05±8.2 5	- 6.55±0.76	.000 (S)

4. DISCUSSION

Recently more importance is given to soft tissue changes in the nasolabial region that accompanies Le Fort 1 maxillary osteotomy, especially changes in the nasal morphology. Lack of understanding of the pre-operative nasal morphology, improper handling of soft tissues and failure to appreciate the influence of the direction of maxillary movement on the nose are aspects that contribute to unfavorable postoperative nasal esthetics.

Pre-treatment evaluation of skeletal and soft-tissue nasal morphology changes:

Mandibular Plane Inclination

The mean value for this parameter was 34.5° which indicates vertical maxillary excess. This finding was similar to the findings explained by Schendel[4].

Total Facial Height

In the present study the mean value for the given sample was 121.4mm, which indicates an increased total facial height due to downward and backward rotation of mandible in Long face syndrome.

Upper Facial Height

Our study results showed the average value of 50.2mm, indicating that there was decrease in the upper facial height, which might be due to the inclination of palatal plane, tipped up anteriorly.

Lower Anterior Facial Height

In our study the mean value for this parameter was 73.4 mm, indicating increased lower anterior facial height. Arnett and Bergman[5] stated that, increased lower one- third height is frequently found with vertical maxillary excess.

Inclination of Palatal plane

This angle is reduced in the pre-treatment sample indicating the anticlockwise rotation of palatal plane, which is a salient feature in vertical maxillary excess patients[6].

Nasal Length

In the present study the nasal length showed a positive and significant correlation with Upper facial height and posterior facial height and negative correlation with Angle of inclination (AOI). These findings are comparable to the results obtained in the study of NehraK[7] and Gulsen et al[8] and was in contrary to the study done by Robinson et al[9].

Nasal Depth

Our study value showed an average of 15.6mm, which was showing normal nasal projection. This finding was similar to study by Arnett and Bergmann[5].

Nasolabial Angle

In the present study, NLA had a positive correlation with total anterior facial height (N-Me) and lower facial height (ANS-Me) similar to the study of Franklin D.Lo et al[10].LNLA showed a positive correlation with upper anterior facial height, Lower anterior facial height, total facial height and inclination of palatal plane and negative correlation with angle of inclination similar to the results obtained in the study conducted by Nehra K et al[7].

Nasal Tip Angle

This angle demonstrates negative correlation with inclination of palatal plane and positive correlation with Angle of inclination. These results were in harmony with the study conducted by Nehra K et al[7].

Post-treatment evaluation of skeletal and soft tissue nasal morphology changes compared with pre-treatment group:

Changes in Mandibular Plane Inclination

These results were supported by studies conducted by Bishara SE et al[11]. In his study the mandibular plane angle (Go-Me:S-N) decreased after Le Fort 1 impaction.

Changes in Anterior Facial Height

A decrease in the anterior facial height was noticed in the post-surgical group (Group 2). These results were similar to the other studies done by Steinhauser S et al[12], Bishara SE et al[11] and Swinnen K et al[13].

Changes in Upper Facial Height

A significant decrease in the upper facial height was seen in Group 2 (post-surgical).These results were supported by Bishara SE et al[11], Swinnen K et al[13] where they interpreted the changes in facial height after superior fixation of maxilla.

Changes in Lower Facial Height

In the present study, the results showed decrease in lower facial height (ANS-Me) in Group 2 when compared to Group 1, which was not significant statistically. Schendel SA et al[14], Swinnen K et al[13] reported the same in their study.

Changes in Inclination of Palatal plane

A significant mean decrease was observed in this value from pre-treatment (Group1) to post treatment (Group2).The above results were not in accordance with the study conducted by Swinnen K et al[13]. Their study showed a clockwise rotation of palatal plane after maxillary impaction and increase of SN-Pp angle.

Changes in Angle of Inclination

An increase in the Angle of inclination (AOI) was noticed post surgically (Group 2) indicating the anticlockwise rotation of palatal plane. These results were supported by the studies conducted by Bishara SE et al[11].

Changes in Nasal Length

There was a significant decrease in the nasal length post-surgically. This finding was in accordance with the studies conducted by Park SB et al[15].

Changes in Nasal Depth

There was no significant change in the nasal depth. Since the value was showing no significant mean difference, we can assume that the sagittal nasal depth was not affected by Le Fort 1 impaction.

Changes in Nasolabial angle

A mean increase in the nasolabial angle was noted in Group 2 which was statistically significant. These results were consistent with those reported by Hunt NP and Rudge SJ[16] and Radney and Jacobs[17]. Though there was decrease in the upper nasolabial angle, the total nasolabial angle (NLA) was increased. There was statistically significant increase in Lower nasolabial angle, indicating that there was retraction of upper lip.

Changes in the Nasal Tip Angle

There was a highly significant mean decrease in the Nasal tip angle. These findings were in accordance with the study conducted by Radney LJ and Jacobson JD[17].

Relationship between AOI and UNLA:

Post surgically there was weak negative correlation between AOI and UNLA. This explanation was supported by the results obtained in the study conducted by Mommaerts MY et al[18]. He stated that the palatal plane rotation had a significant influence on the nasal tip projection but not on nasal tip elevation.

CONCLUSION

The knowledge of potential soft tissue changes that may result from the Le Fort 1 osteotomy is essential to plan a better soft tissue treatment outcome. The present study showed a positive correlation between A.O.I and UNLA in patients with vertical maxillary excess which revealed that increased A.O.I of the palatal plane was associated with increased UNLA and can be considered as a diagnostic criteria. But post-surgically after Le fort 1 osteotomy, a weak negative correlation between these two parameters revealed that, even though the palatal plane tipped upwards, there was a decrease in the Upper nasolabial angle.

REFERENCES

1. Riedel R. Esthetics and its relation to orthodontic therapy. *Angle Orthod* 1950; 20:168-78.
2. Holdaway RA. Changes in relationship of points A and B during orthodontic treatment. *Am J Orthod* 1956; 42:176-93.
3. Subtelny JD. A longitudinal study of soft tissue facial structures and their profile characteristics defined in relation to underlying skeletal structures. *Am J Orthod* 1959; 45:481-507.
4. Schendel SA. The long face syndrome: Vertical maxillary excess. *Am J Orthod* 1976;70:398-408.
5. Arnett GW, Bergmann RT. Facial keys to orthodontic diagnosis and treatment planning- part II. *Am J Orthod* 1993; 103: 395-411.
6. Proffit WR, Fields HW, Sarver DM, editors. *Contemporary Orthodontics*, 4th Edition, Mosby, 2007: 117.
7. Nehra K, Sharma V. Nasal morphology as an indicator of vertical maxillary skeletal pattern. *J Orthod* 2009; 36:160-166.

8. Gulsen A et al. The relationship between craniofacial structures and the nose in Anatolian Turkish adults: a cephalometric evaluation. *Am J OrthodDentofacialOrthop* 2006; 130: 131.e15-e25.
9. Robinson JM et al. Relationship of skeletal pattern and nasal form. *Am J OrthodDentofacial Orthop*1986; 89: 499-506.
10. Franklin D.Lo. Changes in nasolabial angle related to maxillary incisor retraction. *Am J Orthod* 1982; 82: 384-391.
11. Bishara SE, Chu GW, Jakobsen J. Stability of the LeFort I one-piece maxillary osteotomy. *Am J OrthodDentofacial Orthop*1988;94:184-200.
12. Steinhäuser S et al. Profile changes following maxillary impaction and autorotation of the mandible. *J OrofacOrthop* 2008; 69: 31-41.
13. Swinnen K et al. Skeletal and dento-alveolar stability after Surgical-Orthodontic treatment of anterior open bite: A retrospective study. *Eur J Orthod* 2001; 23:547-557.
14. Schendel S A et al. Superior repositioning of maxilla: Stability and Soft tissue osseous relations. *Am J OrthodDentofacial Orthop*1976;70:663-674.
15. Park SB et al. The evaluation of the nasal morphologic changes after bimaxillary surgery in skeletal class III malocclusion by using the superimposition of cone-beam computed tomography (CBCT) volumes. *J Craniomaxillofac Surg.* 2012 Jun;40(4):e87-92.
16. Hunt NP and Rudge SJ. Facial Profile and Orthognathic Surgery. *Br J Orthod* 1984;11:126-136.
17. Radny LJ, Jacobs JD. Soft tissue changes associated with surgical total maxillary intrusion. *Am J of OrthodDentofacialOrthop* 1981; 80:191-212.
18. Mommaerts MY et al. Nasal Profile Changes After Maxillary Impaction and Advancement Surgery. *J Oral MaxilloSurg* 2000; 58:470-475.