

# Evaluation Of Vertical Height Changes In Anteroposterior Movement In Orthognathic Surgery: An Original Research

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## ABSTRACT

**Aim:** The purpose of our research was to assess the vertical height changes after orthognathic surgery during antero-posterior movement using cephalometric analysis.

**Methodology:** Immediate Postsurgical and one-year postsurgical lateral cephalograms of 10 adult patients (age group - 17 to 40 years, with a mean age of 22.2 years) who had been treated successfully by maxillary Le-Fort I osteotomy were obtained. Comparisons were made between T1-T2 to assess the changes following surgery and to evaluate the stability, one year following the surgery using 5 horizontal, 5 vertical linear and 2 angular measurement. A paired t-test was used to analyse the paired observations.

**Results:** The incisors extrusion was limited to an average of 1.2 mm and the molars showed a 0.2 mm movement. The upper incisor showed a significant posterior movement. The upper molar also showed a posterior movement but to a lesser extent when compared to the incisors.

**Conclusion:** There was a significant reduction in the facial height and significant anterior movement of maxilla after surgery. Even after one year of surgery, negligible amount of relapse was recorded except at the incisors.

**Keywords:** Bi-maxillary surgery, Long term relapse, Skeletal Class II malocclusion

## 1. INTRODUCTION

Long term stability as well as optimal facial aesthetics and relatively normal jaw movement are the main requirements for any orthognathic surgical outcomes.<sup>1</sup> In the case of long facial deformities, it is imperative to reposition the maxilla, which serves as the centre point for treatment strategies in these conditions and changing the position of this bone also ensures

stability of any corrections achieved during surgery. The maxilla nearly always has extreme vertical development, whereas the mandible may not be involved.<sup>2</sup> Currently stability as well as outcome of orthognathic surgeries is a hot topic of discussion amongst dentists. Proper planning of direction in which surgical movement needs to be carried out will in turn have an effect on efficient stability of the treatment.<sup>3,4</sup> According to Proffit WR, in the order of stability, the utmost stable orthognathic surgical procedure is the superior repositioning of the maxilla. Subsequent superior repositioning of the maxilla, the postural rest position of the mandible rotates upwards and forwards preserving the inter occlusal rest space. This physiological adaptation certainly has a major role in the stability.<sup>5</sup> Though many methods have been used in literature to evaluate cranio-facial deformities and respective treatment outcome i.e. computed tomograms, cephalograms, Magnetic Resonance Imaging (MRI), lateral cephalogram and panoramic films are still being used widely due to its, low radiation, universal acceptability, economical factor and easy availability.<sup>6,7</sup> During the last two decades, several cephalometric investigations have been described on the skeletal changes after maxillary surgical procedure with or without orthodontic treatment. Numerous studies have shown in the past highlighting the efficacy and the stability of the orthognathic surgical procedures.<sup>8-11</sup> Since its popularisation by Obwegeser in 1969 for the correction of maxillary deformities, the Le Fort I osteotomy has been considered a safe and versatile procedure in all 3 planes of movement.<sup>12,13</sup> However, more relapses and ischaemic complications have been reported with large anterior advancements,<sup>14-18</sup> particularly when they are anteroposterior.<sup>19</sup> Where maxillary advancement of more than 1 cm is required to achieve a class I occlusion, Hirano and Suzuki, and Herber and Lehman, recommended operating on both jaws at the same time. However, Eskenazi and Schendel reported no connection between the amount of advancement and relapse.<sup>20</sup> Other factors such as amount of mobilization, type of fixation and use of bone grafts are also thought to have an influence.<sup>21-23</sup> Stability of any surgical procedure when studied, the maximum changes have been noted in the initial one year hence forth the following observation can be considered as a valuable observation to further our knowledge.

#### *Aim Of The Study*

The purpose of our research was to assess the vertical height changes after orthognathic surgery during antero-posterior movement using cephalometric analysis and to assess relapse in the height after the surgical procedure.

## **2. METHODOLOGY**

A retrospective cross-sectional study was carried out between 10 patients with age range 17 to 40 years, who were treated effectively with Le Fort 1 down-fracture with vertical reduction in the maxilla. Their immediate post-surgical (T1) as well as one-year post-surgical cephalograms (T2) were analysed with two reference lines.

- Horizontal Reference Line (HRL): Sella-Nasion + 7°; A horizontal reference line was registered on Sella (S) and oriented 7° inferior to the SN line.
- True Vertical Line (TVL): TVL was perpendicular to the horizontal reference plane that passes through Sella (S).

All the measurements were repeated twice with two observer to rule out any intraobserver variability. The primary selection criterions were: (1) Non growing patients diagnosed for vertical maxillary excess with or without an anterior open bite; (2) All the patients were treated by Le Fort I osteotomy (3) No concomitant or previous nasal surgery; (4) No history of any congenital deformities and/or a genetic syndrome or whose deformities were related to trauma or disease. Comparisons were made between T1-T2 to assess the changes to evaluate

the stability, one year following the surgery using 5 horizontal, 5 vertical linear measurements. (point A horizontal, A point vertical, ANS horizontal, ANS point vertical PNS point horizontal, PNS point vertical, PNS point vertical, Upper incisor horizontal, Upper incisor vertical, Upper 1st molar horizontal and Upper 1st molar vertical)

Statistical analysis was done using Statistical Package of Social Science (SPSS Version 20; Chicago Inc., USA). Significance level was fixed at  $p < 0.05$ . The Student's t-test was used to analyse the variation in mean between two groups of a variable with a normal distribution

### 3. RESULTS

The mean difference in the variables from T1-T2 were compared to assess the changes brought about by the surgery and its stability one year following the surgery. The inter and intra-observer reliability ranged from 0.75 to 0.90. The mean differences between Postsurgical mean value and One-year post-surgical mean value of HRL to point A, HRL to point ANS, HRL to point PNS, HRL to point Is, HRL to point Um

showed that they were statistically non-significant. There was a minimal postoperative movement of the maxilla, all the values changed in a range of 1 to 1.5 mm. The incisors extrusion was limited to an average of 1.2 mm and the molars showed a 0.2 mm movement. (Table 1) The mean differences between Postsurgical mean value and one-year post-surgical mean value of TVL to point A, TVL to point ANS, TVL to point PNS, TVL to point Um showed that they were statistically not significant whereas, TVL to point Is was statistically significant approximately. 1 to 1.5 mm of posterior skeletal movement was seen at the anterior and posterior skeletal landmarks which was statistically insignificant. The upper incisor showed a significant posterior movement. The upper molar also showed a posterior movement but to a lesser extent when compared to the incisors. (Table 2e 2)

Table 1- Vertical parameters.

		T1	T2	T1-T2, p-value*, sig
<b>A Point</b>	Mean	43.0	44.1	-1.1, p=0.08 NS
	SD	1.8	2.3	
<b>ANS Point</b>	Mean	39.7	40.6	-0.9, p=0.09 NS
	SD	1.3	1.8	
<b>PNS Point</b>	Mean	40.9	41.4	-0.5, p=0.24 NS
	SD	4.7	3.8	
<b>Upper Incisor</b>	Mean	72.1	73.3	-1.2, p=0.20 NS
	SD	4.4	4.5	
<b>Upper 1st Molar</b>	Mean	66.8	67.0	-0.2, p=0.75 NS
	SD	3.3	4.5	

\* Student's paired t test

Table 2- Horizontal parameters.

		T1	T2	T1-T2, p-value*, sig
<b>A Point</b>	Mean	70.5	69.2	1.3, p=0.19 NS
	SD	4.4	4.4	
<b>ANS Point</b>	Mean	72.5	71.3	1.2, p=0.2 NS
	SD	3.9	3.7	
<b>PNS Point</b>	Mean	21.2	19.7	1.5, p=0.07 NS
	SD	3.3	3.3	

<b>Upper Incisor</b>	Mean	77.6	74.6	0.32, p=0.02 S
	SD	6.0	6.3	
<b>Upper 1st Molar</b>	Mean	51.0	49.2	1.8, p=0.07 NS
	SD	7.1	5.7	

\* *Student's paired t test*

#### 4. DISCUSSION

In the evaluation of cases for orthognathic surgery individuals are observed who display imbalance between the vertical and horizontal components of the facial skeleton and other parts of the face. Some of these cases include primary vertical dysplasia whilst in others vertical disproportion confounds horizontal and transverse abnormalities of growth. Ramus height must always be seen in combination with the pterygo-masseteric soft tissue investment. Where the soft tissue is deficient; correction is infrequently possible with stability, and the masseteric and pterygoid activity should be measured in the putative manner (muscular contraction by palpation, the presence or absence of antegonial notching, electromyography).

Literatures have revealed that the direction of movement, type of fixation used and the surgical technique that was used; affects stability after surgical repositioning of the jaws.<sup>24</sup> This study was aimed at determining the surgical changes brought about by superior repositioning of the maxilla by Le Fort I osteotomy and evaluate the stability of the surgical procedure one year following surgery to assist the Orthodontist in determining of the efficacy of this treatment procedures. The difference in the age group of the subjects and difference in the sexes were not considered pertinent in this study. This was reinforced by the study conducted by Bishara, Chu and Jakobson wherein they have stated that the amount of surgical corrections is not essentially related to difference in sample size between the sexes and the difference between younger (less than 20 years of age) and older patients were also not noteworthy.<sup>25</sup> The vertical maxillary proportions were compared between T1 and T2 found that there was a negligible postoperative movement of the maxilla which was statistically irrelevant. These findings were usually dependable with the observations of earlier investigators i.e. Hiranaka DK and Kelly JP.<sup>2</sup> Only 0.5 to 1.2 mm of relapse was seen through the posterior and anterior maxilla which was immaterial showing the better stability of the surgical procedure in the vertical plane. The postsurgical and One year postsurgical horizontal maxillary changes had revealed a relapse ranging from 1.2 to 3 mm. Noteworthy relapse values were noted only at the incisors. This can be because due to concluding of orthodontic treatment apparently accounts for much of the post fixation dental changes. The incisors typically are retracted. This perhaps reproduces the need to close some remaining extraction spaces which are frequently present in the maxilla. A comparable irrelevant posterior movement was observed by Schendel SA, Proffit WR and Bishara SE and associates.<sup>16</sup> With the arrival of better surgical devices and rigid fixation choices such as mini plates, biodegradable fixation, osteosynthesis screw fixation and also the novel bone grafting techniques, stability following Le Fort I osteotomy and superior repositioning of the maxilla can be certainly graded as outstanding in all the three dimensions. As with any study, there were limitations that must be conferred. Firstly, the parameters could be better recognized and the changes be recorded more precisely in a three-dimensional depiction like Cone Beam Computed Tomography (CBCT).

## 5. CONCLUSION

We observed that adequate changes as well as stability was achieved after surgery and in case of 1 year follow up by using Le fort I osteotomy procedure in maxilla, therefore validating the success of the procedure.

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## REFERENCES

- [1] Schendel S A. Superior repositioning of the maxilla: Stability and soft tissue osseous relations. *Am J Orthod Dentofac Orthop.* 1976;70:663-74.
- [2] Hiranaka DK, Kelly JP. Stability of simultaneous orthognathic surgery on the maxilla and mandible: A computer-assisted cephalometric study. *Int J Adult Orthod Orthognath Surg.*1987;2:193-14.
- [3] Aydil B, Ozer N, Marsan G. Facial soft tissue changes after maxillary impaction and mandibular advancement in high Angle class II cases. *Int J Med Sci.* 2012;9(4):316-21.
- [4] Maurya R, Gupta A, Garg J, Shukla C. Evaluate the influence of panel composition on facial attractiveness. *J Orthod Res.* 2015;3:25-29.
- [5] Proffit WR, Phillips C, Turvey TA. Stability following superior repositioning of the maxilla by Le Fort I osteotomy. *Am J Orthdo Dentofac Orthop.* 1987;92:151-61.
- [6] Singh A, Kulshrestha R, TandonR, Goel A, Gupta A. An orthodontic-surgical approach to class II malocclusion treatment with vertical growth pattern - A case report. *J Dent Oro Surg.* 2016;1(4):120-23.
- [7] Mishra H, Gowdra S, Maurya. Assessment of facial assymetry in various malocclusion- A comparative analysis. *J Ind Orthod Soc.* 2014;48:537-45.
- [8] Chaukse A, Jain S, Dubey R, MauryaR, Shukla C, Sthapak A. Computed tomographic analysis of condyle-fossa relationship in skeletal class I and skeletal class II vertically growing males. *J Orthod Res.* 2015;3:170-74.
- [9] Maurya R, Shukla C, Singh H, Balani RK, Ekka SB, Agarawal S. Comparative treatment response of craniofacial orthopaedics in unilateral cleft lip palate and non cleft skeletal class III patients. *J Clin Den Res Edu.* 2013;16:13-17
- [10] Bailey LJ, Collie FM, White RP Jr. Long-term soft tissue changes after orthognathic surgery. *Int J Adult Orthodon Orthognath Surg.* 1996;11:7-18
- [11] Gallego-Romero, D., Llamas-Carrera, J.M., Torres-Lagares D, Paredes V, Espinar E, Guevara E, et al., & Gutiérrez-Pérez, J. L. Long-term stability of surgical orthodontic correction of class III malocclusions with long-face syndrome. *Med. Oral, Patol. Oral Cir Bucal.* 2012;17(3):e435-e441.
- [12] Hoffman GR, Brennan PA. The skeletal stability of one-piece Le Fort I osteotomy to advance the maxilla; Part 1. Stability resulting from non-bone grafted rigid fixation. *Br J Oral Maxillofac Surg* 2004;42:221–5.
- [13] Dowling PA, Espeland L, Sandvik L, et al. LeFort I maxillary advance-ment: 3-year stability and risk factors for relapse. *Am J Orthod Dentofacial Orthop* 2005;128:560–7.
- [14] Kiely KD, Wendfeldt KS, Johnson BE, et al. One-year postoperative stability of LeFort I osteotomies with biodegradable fixation: a retro-spective analysis of skeletal relapse. *Am J Orthod Dentofacial Orthop* 2006;130:310–6.
- [15] Kramer FJ, Baethge C, Swennen G, et al. Intra- and perioperative compli-cations of LeFort I osteotomy: a prospective evaluation of 1000 patients. *J Craniofac Surg* 2004;15:971–9.

- [16] Hirano A, Suzuki H. Factors related to relapse after Le Fort I maxillary advancement osteotomy in patients with cleft lip and palate. *Cleft Palate Craniofac J* 2001;38:1–10.
- [17] Singh J, Doddridge M, Broughton A, et al. Reconstruction of post-orthognathic aseptic necrosis of the maxilla. *Br J Oral Maxillofac Surg* 2008;46:408–10.
- [18] Herber SC, Lehman Jr JA. Orthognathic surgery in the cleft lip and palate patient. *Clin Plast Surg* 1993;20:755–68.
- [19] Eskenazi LB, Schendel SA. An analysis of Le Fort I maxillary advancement in cleft lip and palate patients. *Plast Reconstr Surg* 1992;90:779–86.
- [20] Mehra P, Wolford LM, Hopkin JK, et al. Stability of maxillary advance-ment using rigid fixation and porous-block hydroxyapatite grafting: cleft palate versus non-cleft patients. *Int J Adult Orthodon Orthognath Surg* 2001;16:193–9.
- [21] Politi M, Costa F, Cian R, et al. Stability of skeletal class III malocclu-sion after combined maxillary and mandibular procedures: rigid internal fixation versus wire osteosynthesis of the mandible. *J Oral Maxillofac Surg* 2004;62:169–81.
- [22] Carlotti Jr AE, Schendel SA. An analysis of factors influencing stability of surgical advancement of the maxilla by the Le Fort I osteotomy. *J Oral Maxillofac Surg* 1987;45:924–8.
- [23] Welch TB. Stability in the correction of dentofacial deformities: a com-prehensive review. *J Oral Maxillofac Surg* 1989;47:1142–9.
- [24] Turvey TA, Phillips C, Zaytoun HS Jr, Proffit WR. Simultaneous superior repositioning of the maxilla and mandibular advancement. *Am J Orthdo Dentofac Orthop*. 1988;94:372-83.
- [25] Bishara SE, Chu GW, Jakobsen JR. Stability of Le Fort I one piece maxillary osteotomy. *Am J Orthdo Dentofac Orthop*. 1988;94:184-200.