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Middle and lower facial soft tissue changes after maxillary advancement through conventional or high Le Fort I osteotomy

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ABSTRACT

Introduction: Maxillary advancement is applied extensively for malocclusion class III correction. This procedure is done using one of the two methods, Conventional or High. Maxilla moves in both vertical and horizontal and only in the horizontal directions in Conventional and High method respectively, so expecting a difference in facial soft tissue changes. In present study is a case series that describes this issue.

Materials and Methods: The cases included 30 patients with class III malocclusion due to maxillary deficiency, whom underwent Le Fort I osteotomy for maxillary advancement in Shahid Beheshti Hospital in Babol, Iran during 1995 to 1995. According to surgical technique, the cases were placed in group 1 (Conventional) or group 2 (High). Maxillary advancement and changes in hard and soft tissue of the middle and lower facial regions where measured through tracing on the lateral cephalometry. Intra-group and inter-group statistical comparisons were done using SPSS20 software at significance level as 0.05.

Result: The pre-surgical mean size of SNA, SNB, nasolabial and mentolabial angles was similar in two groups. In all patients, after surgery, SNA angle size was increased and SNB، nasolabial and Mentolabial angles size were decreased. The mean value of these change was similar in two groups. In group 2, the displacement of point A '(mean difference: 1.30 mm) and Labrale Superius (mean difference: 1.40 mm) were significantly more than group 1. The amount of displacement of SN (mean difference: 1.30 mm), Labrale Inferius (mean difference: 0.88 mm) and Pogonion (mean difference: 0.23 mm) points in group 2 was higher than that of group 1, but this difference was not statistically significant.

Conclusion: It is needed strong evidence for decision about selecting High or Conventional approach maxillary advancement in terms of facial aesthetic aspects. So, further studies with larger sample sizes and cohort or quasi-experimental design is suggested.

Keywords: Esthetics; Conventional Le Fort I osteotomy; Face; High level Le Fort I osteotomy; Maxillary advancement.

Introduction

Skeletal Malocclusions occur in approximately 4% of the population. The most prevalent conditions are severe class II, class III, and the vertical skeletal discrepancies in patients without growth [1]. Orthognathic surgery procedures are used to treat developmental and acquired deformities of the midface and mandible, as well as for the treatment of airway disease [2]. In this operation, using various techniques, the elements of the facial skeleton are manipulated to restore normal anatomy and function [3]. When the correction of dentofasial deformities is not achievable by alone orthodontic treatment, repositioning of the maxillomandibular complex is the best treatment choice [4]. The maxillary advancement, mandibular setback or combination of both techniques, depending on the cause of the class III malocclusion, is used by surgeons [5].

Total Maxillary Advancement is operable through Le Fort I maxillary osteotomy, a widely used procedure in elective orthognathic surgery. This osteotomy is performed rapidly and efficiently by maxillofacial surgeons [6]. Le Fort I maxillary osteotomy is a preferred treatment option for class iii malocclusion in terms of jaws alignment and facial symmetry [7]. Also, this technique allows for maxillary movement in all three planes, so is used to treat class II malocclusions, as well as vertical maxillary excess and hypoplasia [6]. In order to perform the maxillary osteotomy for moving maxilla in the anterior-posterior direction, Conventional and High methods are common. The conventional Le Fort I osteotomy line is drawn 4 to 5 mm about the root apices of the maxillary canine and the first molar. The horizontal osteotomy line is drown parallel to the occlusal plane. Le Fort I osteotomy cuts were made in the lateral sinus wall, medial sinus wall, nasal septum and, finally, the pterygomaxillary junction [8].

In High method, the horizontal osteotomy line is drawn parallel to the occlusal plane. However the osteomy line is superior to that in conventional method. Its osteotomy is positioned just below the infraorbital foramen and passess through the zygoma area [8]. However, in today's modern societies and because psychosocial effect, the concern of these patients about the beauty aspects of severe malocclusion is greater than physical problems [9]. For many patients an unpleasant aesthetic appearance is the reason for undergoing surgery, in addition to functional problems [10]. In the same way, the maxillofacial surgeons consider a threefold goal of achieving functional efficiency, structural balance, and aesthetics to correct the dentoskeletal malocclusions [9]. Actually, they reposition the maxilla and mandible to achieve the best possible occlusal relationship and good post-operative facial appearance [11]. Skeletal changes caused by the surgery, can alter the positions and traction of the overlying soft tissues, resulting in change facial soft tissue measurements [7,12]. Maxillofacial literature includes numerous documents about soft tissue and esthetic changes in patients undergoing orthognathic surgery. Some researchers have pointed to the optimal soft to hard tissue ratio as the most important goal of this surgery [13,14]. Comprehensive comprehension of how soft tissues response in relation to hard tissue changes, optimize the prediction of facial profile changes after surgery. It helps the maxillofacial surgeons in treatment planning and patient consultation [11,19]. Furthermore, 'aesthetic-centered' approach toorthognathic treatment planning has recently been observed more than earlier 'occlusion-centered' approaches [16]. According to prior researches, the size of the skeletal movement and the details of employed surgical technique such as the amount of soft tissue dissection, position of the osteotomy cuts are some factors that influence the soft tissue response following orthognathic surgery [17]. Maxillary advancement, induced by Le Fort I osteotomy, has major effects on hard and soft tissues of nasal structures, upper lip and paranasal areas [17].

By operating the Le Fort I osteotomy, bony segments of the maxilla movable become in three directions, leadings to soft tissue movement [15]. In the Conventional approach to maxilla advancement, the maxilla moves in two horizontal and vertical directions, but in High approach, it moves merely in the horizontal direction. So, soft tissue changes are expected to vary in both approaches. As a clinical example, for individuals with malar deficiency, the High approach is preferable to Conventional, since its soft tissue effects are further extended to the lateral areas of the face [8]. In this case series, we have described and compered Conventional and High approaches to Le Fort I Maxillary advancement in terms of middle and lower facial soft tissue changes.

Materials and Methods

In this case series study, two methods of Conventional Le Fort I osteotomy and High Le Fort I osteotomy for maxillary advancement were compared for soft tissue changes in the middle and lower facial areas. The study has been independently reviewed and approved by the local ethical committee of Babol University of Medical Sciences (code IR.MUBABOL.REC.1397.040). The study samples were among adult patients with indication of Le Fort I osteotomy for anterior repositioning of the maxilla whom underwent surgery and were followed in the clinical department of oral and maxillofacial surgery in Shaheed Beheshti Hospital, affiliated Babol University of Medical Sciences, in Babol, Iran during 2016 to 2018.

Thirty cases whom their clinical and paraclinical records were compatible to including and excluding criteria. The inclusion criteria were having malocclusion class III due to maxillary deficiency. The exclusion criteria were age>40 years, Maxillofacial Malformation, Cleft lip, Cleft palate, Maxillofacial fracture due to trauma, History of rhinoplasty, indication of maxillary impaction, systematic diseases and dermatologic disorders affecting facial tissue and appearance. Written personal consent was received from patients during hospital registration. Furthermore, our research team, after providing information about study, obtained the written consent to participate in the study from patients. In addition to routine, protocol-based clinical work up, lateral cephalometry was provided.

All cases underwent orthodontic treatment prior to surgery and confirmed by a written orthodontist to prepare for surgery, under the surgery of Le Fort I osteotomy. All cases had orthodontic treatment prior to surgery and had orthodontist's confirmation that they were ready to undergo Le Fort I osteotomy. All surgeries were operated by a similar surgical team through general anesthesia. The surgical technique was similar for patients in each of the study groups. For maxillary osteotomy, at first from the right first molar to the left first molar on the maxilla bone is cut (circumvestibular incision), about 3 to 5mm apical to the mucogingival junction line. In the following, after the removal of the periosteum and bilateral muscular connections, the surgical region is limited to orbital nerve in the upper area, to the pterygomaxillary suture in the posterior and to the Piriform Aperture in the anterior area.

Then the basal nasal mucoperiosteum is raised bilaterally from the front to the posterior side, and the connection of anterior nasal spine is also removed from the caudal part of the cartilage nasal septum. In High Le Fort I osteotomy, the osteotomy line bilaterally extends from Piriform Aperture edge to Zygomatico-maxillary Buttress extends, at a distance of 5mm from the infraorbital foramen and parallel to the occlusal surface of maxillary teeth, then through a vertical bony cut with an approximate length of 5 mm, it connects to the posterior region. The posterior bony cut is connected to the ptrygomaxillary suture with a minimum of 5mm distance to the apex of the teeth in that area. For Conventional Le Fort I osteotomy, a bony cut extends from Piriform Aperture edge to the pterygomaxillary suture suture at a distance of 5mm from the root apex of the canine and molar teeth. The osteotomy is performed by a hand piece saw in the anterior region to the pterygoid suture and pterygoid area is separated from the lateral joints through a curved osteotome. Other steps including osteotomies of lateral nasal wall, maxillary pterygoid sutures and nasal base as well as internal fixation (with four 4-foramen L plates) were similar in both methods. For all patients, cinch suture with nylon thread 2-0 and V-Y repair of vestibular cut with vickrel thread were done. Postoperative care included ice compress, analgesics, anti-inflammatory drugs and prophylactic antibiotics. For all cases, panoramic radiographs and lateral cephalometry with the same X-ray machine were provided. The imaging were done in two times: less than one week until surgery and at least 4 months after surgery. In order to investigate soft tissue response to hard tissue movement, the landmarks were defined through two dimensional tracing on cephalometry. The considered points and angles their definitions are presented in Table 1.

To assess changes, the SN line was considered as the horizontal reference and the SN-perpendicular line at the N point as the vertical reference. To assess maxillary advancement, the horizontal displacement of the points A was measured relative to the vertical reference line in millimeters. This variable shows the extent of skeletal movement due to orthogonal surgery. Displacement of soft tissue points of A, Sn, Li and Ls, relative to the vertical and horizontal reference lines, as well as changes in sizes of rates of angles of SNA, SNB, Nasolabial and Mentolabial were measured and recorded.

Statistical Analysis

Data were described and analyzed using SPSS version 20.0 software. The results of plotting histogram and normal curve and performing the Kolmogorov Smirnov test showed that, apart from maxillary advancement data, other data were not normally distributed. Quantitative data was described as mean ± standard deviations and median (inter quartile range). Qualitative variables of the surgical method and gender were described using percentages and frequency distribution. Inter-group and between groups comparisons of pre and post-surgical changes were analzsed using Paired-Samples T Test, Wilcoxon Two-Related-Samples Test, Independent T Test and Mann-Whitney U. The statistical significant level was set as 0.05.

Results

This study was performed on 30 patients with class III malocclusion treated with combination orthodontic treatment and Le Forte 1 osteotomy maxillary advancement surgery. Patients were divided into two groups of Conventional (n=15) and High (n=15) according to surgical approach. Male to female ratio was 5/10 and 6/9 in the Conventional and High group respectively. Based on Chi-square test, the frequency distribution of gender variables was similar between two groups. The description and analysis of the maxillary advancement variable is presented in Table 2. The mean value of maxillary advancement was similar in both groups (P-value=0.333).

Table 3 shows changes inSNA and SNB angles before and after maxillary osteotomy. The pre-surgical mean values of SNA angle were similar between the two groups (P-value=0.767). In both Conventional and High group the mean value of SNA angle was significantly different between the pre- and postoperative periods. In both groups and in all patients, maxillary advancement significantly increased the size of the SNA angle. The amount of this incremental change was similar between the two groups. The pre- surgical mean values of SNB angle were similar between the two groups (P-value=0.710). Both Conventional and High procedures significantly reduced the size of the SNB angle between the pre-and postoperative periods. There was no statistically significant difference between two procedures in terms of value of SNB angle change. Table 4 presents changes innasolabial and mentolabial angles before and after maxillary osteotomy.

The mean value of pre-surgical nasolabial angle were similar between the two groups (P-value=0.560). In both study groups as well as in all patients, the maxillary advancement significantly reduced this angle. The mean value of this decrease was similar in both Conventional and High approaches. The average of mentolabial angle was similar in two study groups of Conventional and High (P-value=0.092). While the High surgical technique significantly reduced the size of this angle, there was no significant pre-post-surgical difference in patients with Conventional surgery. It should be noted that in total patients, surgical intervention reduced the size of mentolabial angle. The average of decrease size was similar between groups.

Table 5 shows changes of soft tissue landmarks of point A, point SN, labrale Superius, labrale Inferius and pogonion. As seen in Table 5, the mean value of point A movement in the High group was significantly greater than the Conventional group as 1.30 millimeters.

In all patients, the SN point was repositioned with an average of 4.71mm. Despite the clinical difference of 1.30mm, the mean value of this variable was statistically similar between two Conventional and High surgery procedures.

Totally, the labrale Superius point was repositioned with an average of 4.71mm. The cases whom underwent High procedure had greater movement of labrale Superius than Conventional one's with mean difference of 1/40 millimeter (P-value=0.007). In all patients, the labrale Inferius landmark was repositioned with an average of 1.46mm. The cases of High procedure had greater movement of labrale Inferius than Conventional one's as 0/40 millimeter but this clinical difference was not statistically important. Totally, the soft tissue pogonion point had movement with an average of 0.48 mm. Although the mean of this movement was greater in High procedure as 0/23 millimeter, but it was not statistically significant.

Landmark	Definition
SNA Angle	The angle between Sella - Nasion - A point
SNB Angle	The angle between Sella - Nasion - B point
Nasolabial Angle	The angle between Columella- Subnasale- Upper Lip
Mentolabial Angle	The angle between Lower Lip- Soft Tissue B Point- Soft Tissue Pogonion
A point	Most anterior point of the maxillary apical base.
B point	Innermost curvature from chin to alveolar junction
SN point	Subnasal point, transition from the bridge of the nose to the upper lip
Labrale Superius	Most anterior point on the convexity of the upper lip
Labrale Inferius	Most anterior point on the convexity of the lower lip
Pogonion	Most anterior point on the contour of the chin

Table 1. Middle and lower Facial Soft and Hard Tissue Landmarks.

Maxillary Advancement (millimeter)	All	Conventional	High	P-value*
		Mean±SD	Mean±SD	
	4.73±1.1	4.53±1.0	4.93±1.1	0.333

*Independent T Test.

Table 2. Description and comparison of maxillary advancement in all cases and study groups.

		Conventional	High	P-value*
		Mean±SD	Mean±SD	
SNA (°)	Preop	79.00±1.4	78.78±1.4	0.767
	Postop	82.07±0.8	81.87±0.9	0.676
	P-value**	0.001	0.001	
SNB (°)	Preop	81.47±0.9	81.47±1.4	0.710
	Postop	80.73±0.7	80.93±1.1	0.724
	P-value**	0.016	0.021	
SNA change (°)		3.07±1.3	3.00±1.3	0.983
SNBchange (°)		-0.73±0.9	-0.53±0.7	0.804

*Mann-Whitney U Test.

**Wilcoxon Two-Related- Samples Test.

Table 3. In-group and intergroup SNA and SNB angles evaluations.

		Conventional	High	P-value*
		Mean±SD	Mean±SD	
Nasolabial Angle (°)	Preop	98.20±6.0	100.60±8.7	0.560
	Postop	96.87±2.2	99.33±5.5	0.313
	P-value**	0.115	0.331	
Mentolabial Angle (°)	Preop	127.60±3.1	115.40±15.8	0.092
	Postop	126.40±1.5	111.53±16.5	0.103
	P-value**	0.194	0.019	
Nasolabial Angle change (°)		-1.27±4.5	-1.27±4.8	0.691
Mentolabial Angle change (°)		-2.47±2.0	-3.20±2.1	0.521

*Mann-Whitney U Test.

**Wilcoxon Two-Related- Samples Test.

Table 4. In-group and intergroup Nasolabial and Mentolabial angles evaluations.

Movement (in millimeter)		Conventional	High	P-value*
		Mean±SD	Mean±SD	
Soft Tissue Landmarks	A	4.16±1.4	5.46±1.5	0.022
	SN	4.36±1.5	5.06±1.4	0.198
	labrale Superius	4.20±1.4	5.60±1.5	0.007
	labrale Inferius	1.06±1.0	1.86±1.1	0.061
	Pogonion	0.37±0.38	0.60±0.50	0.056

* Mann-Whitney U Test.

Table 5. Inter-group evaluations of soft tissue responses of point A, point SN, labrale Superius, labrale Inferius and Pogonion.

Discussions

Today, for modern treatment of orthognathic deformities, planning for treatment by orthognathic surgeons is essential. In this regard, aesthetics outcomes of therapeutic procedures are important and thus changes in facial soft tissues in response to changes in corresponding hard tissues must be considered [18]. In this study, two methods of High Le Fort I and Conventional, used for Le Fort I osteotomy for maxillary advancement, were compared in terms of middle and lower facial soft tissue changes. According to our findings, the mean value maxillary advancement in two groups of High and Conventional was similar and was 4.73mm in all patients. Ghassemi et al. conducted a cohort study on 53 patients with class III malocclusion whom underwent orthognathic surgery to evaluate the effects of various values of maxillary advancement on soft tissue changes. The mean value of maxillary advancement was 5/4 millimeter.They suggested maxillary advancement≥6 for treatment plans, given the desirable and significant facial soft tissues changes in nasolabial and submental areas and following aesthetic outcomes [18]. In the study of Hoffman et al. the effects of clinical variables on skeletal stability after one-piece Le Fort 1 osteotomy were investigated. They concluded that variable of maxillary advancement has no effect on postoperative skeletal stability [19]. In the other study, Kostaw et al, in the field of bimaxillary surgery, stated that application of absorbable screw and plaque for fixation is safe only in cases that maxillary advancement is up to 5 millimeters [20].

Liebregts et al. evaluated the diagnostic accuracy of 3D simulator software designed to predict soft tissue changes following bimaxillary osteotomy. The average of maxillary advancement, measured based on Labrale superius was 7.2 millimeters. The strength of prediction was correlated with size of maxillary advancement [21]. According to above-mentioned documents, it seems that amount of maxillary advancement has a pivotal role in the planning of orthognathic surgery in terms of predicting facial soft tissue changes and aesthetic outcomes as well as selecting the type of fixation to maintain the maxillary skeletal stability. It is noted that in our study the mean value of maxillary advancement similar between to groups. So, there was no difference of facial soft changes due tounequal maxillary advancement. The size of the SNA angle indicates the degree of backward or forwardness of maxilla relative to skull base. A decrease in SNA angle is a criterion for definitive diagnosis of skeletal Class III malocclusion [22,23].

In this study, the size of SNA angle was similar in two groups add lower than normal range. Following surgery, this size was increased 3 that was similar in groups. For all patients the final degree of SNA angle was in normal range. The size of the SNB angle shows the anterior-posterior position of mandible relative to the skull base. An increased SNB angle indicates to mandible overgrowth and class III malocclusion and its reduction represents growth deficiency of mandible and class II malocclusion [22]. In this study, the size of SNB angle was similar in two groups and was in normal range. Following surgery, this size was decrease about 1 that was similar in groups. For all patients the final degree of SNB angle was in normal range. These two findings indicate to the success of both methods of Conventional and High to forward repositioning of maxilla. Ghassemi et al through a study in 96 patients with skeletal malocclusion III (mean age of 25 years old), investigated facial soft and hard tissue changes after bimaxillary osteotomy. In final evaluation, in many cases, the size of SNA or SNB angle was not in normal range but acceptable aesthetic outcome for lip and nose profile was funded.

They stated that for orthognathic surgery planning it is preferable to consider soft tissue changes and aesthetic indexes and do not emphasize only normal size for the SNA or SNB angle [24]. Navarro et al mentioned that in Class III malocclusion patients, acute cranial base angle, lower cranial base length and a more posterior N point is observed. Therefore, measurements using the cranial base as reference such as the SNA and SNB angles cannot be the only cephalometric assessment for this orthognathic deformity [25]. Nose is exposed tomorphological and dimensional changes following Le Fort I surgery. The size of the nasolabial angle is an indicator for evaluating changes in nasal soft tissue. Narrowing of this angle has a negative effect on aesthetic results of orthognathic surgery [10]. The results of this study showed that in all patients as well as in each group of High or Conventional Le Fort osteotomy, the size of nasolabial angle was decreased significantly. The value of reduction (with an average of 1.27 degrees) was similar between groups. There is contradictory evidence evidences about changes of nasolabial soft tissue following maxillary advancement. The cephalometric results of Nagori et al and Marsan et al Studies indicated a reduced of nasolabial angle following Le Fort I maxillary advancement [26,27]. A similar finding was reported by Vasudhavan et al through direct anthropometry [28]. On the other hand, Freihofer et al concluded that the size of this angle is increased after maxillary advancement and removal of anterior nasal spine attenuate this effect [29].

Besides, Mansour et al stated that change of nasolabial angle after maxillary surgery is unpredictable [30]. Similarly, Gassmann et al.mentioned that specific prediction of morphological changes in nose following Le Fort I osteotomy is difficult [31]. It seems that factors such as race, age, and gender, as well as duration of post-operation period, contribute to evidence about nasolabial angle size following Le Fort 1 osteotomy [32]. Rosen et al. recommended final post-operative evaluation after complete removal of the left edema and full back movement of the upper lip that will be at least 12 months after maxillary repositioning [33]. In this study, in all patients, surgical intervention reduced the size of mentolabial angle. A significant similar change was seen in the High group. In the Conventional group, there was no significant difference of mentolabial angle between pre-surgical and post-surgical conditions. Also, the mean value of reduction was similar between two groups of study.

Tiwari et al, using three-dimensional CT scan, investigated perioral soft tissue changes for various types of orthognathic surgery in 10 patients with sleep apnea. They reported both increases and decreases for the size of mentolabial angle following mandibular advancement and decreases following mandibular setback. They concluded that there was a significant correlation between mentolabial angle, as a soft tissue landmark, to movement of its corresponded underlying hard tissue but not to the method of orthognathic surgery [32]. On the other hand, in the study of Marsan et al, an increase for mentolabial angle after maxillary advancement was reported. The study samples were 44 women (mean of age: 28 years) with class III malocclusion whom underwent bimaxillary surgery. The assessment tool was lateral cephalogram before and 30 months averagely after surgery [27]. Riveiro et al. measured sizes of soft tissues for facial profile sizes in 212 individuals aged 20-18 years using standard photographic imaging and digital analysis. They recommended cautious evaluation of mentolabial angle due to its high variability and high percentage error in measurement methods [34]. Similarly, Rustemeyer and Martin who investigated facial soft tissue response to orthognathic surgery through photography and cephalometry stated that the size of mentolabial angle shows the most variability among the measurements [35].

In current study, the mean value of movement of soft tissue A point following High procedure was as high as 1.30 millimeters more than conventional procedure. Ragaey and Van Sickels compared skeletal stability between two surgical procedures of maxillary or bimaxillary osteotomy for maxillary advancement. The stability status was evaluated by measuring point A movement and changing the palatal plane. Results showed that the difference of initial displacement of point A (comparison between the two pre and immediately postoperative times) was significant between two surgical procedures [36]. Koerich et al. conducted a pilot CBCT study about three-dimensional soft-tissue and soft tissue changes following bimaxillary advancement surgery using Voxel-based matching technique and a new technique of the iterative closest point. Results showed soft tissue A point was displaced averagely 1/88 millimetre. A significant correlation was found between the displacement values of the soft tissue and hard tissue point A [37].

In our study, some cases with 6-8 mm displacement of soft tissue A point. Regular follow up of these patients seems necessary for checking maxillary stability. In the present study, forward movement of Labrale Superius and Laberale Inferius following the High Le Fort I osteotomy was more than Conventional technique. In Martin and Rustemeyer's study, in patients with class II malocclusion, the labrale inferius responded to corresponding hard tissue change in a horizontal direction with ratios of a of 0.88: 1 (cephalometric evaluation) and 1.09: 1 (photogrammetric evaluation). These ratios for class III patients were reported to be 0.03: 1 and 0.56: 1, respectively. It is noted that the surgery procedure was bimaxillary osteotomy including maxillary advancement or maxillary impaction and BSRRO [35].

Lo et al. investigated the relationship between soft and hard tissue movements in 10 different facial regions through three-dimensional cone-beam computed tomography (CBCT). They reported very strong (r=0.92) and strong ($R2$=0.78) relationship in superior lip region by correlation and regression statistical tests respectively. They also reported a positive linear relationship between maxillary incisor tip–labrale superius and mandibular incisor tip–labrale inferius following facial skeletal surgeries. Furthermore, Lo et al indicated to variable average ratios for facial soft to hard tissue movements in different studies due to were due to population bio characteristics and methodology of researches. They pointed out that CBCT scans were provided at least 9 months after the surgery to avoid the effects of surgical edema. They also stated that he predicted results are not the true post-operative outcomes, which is due to the disagreement between surgical changes and individual changes resulting from skeletal relapse and post-operative orthodontics [11].

In our study, the mean value of soft issue pogonion movement, i.e. chin forward movement, was measured as 0.48mm and no statistically significant difference was found between the two surgical methods. In Jeroen Liebregts et al's research, soft issue pogonion had significant forward movement 3.5mm averagely. The samples were 60 patients who underwent bimaxillary osteotomy. Data were gathered through 3D soft tissue simulator [21]. Soft to hard tissue changes of pogonion were also studied by Yu-Chuan Tseng et al. The participants were 27 patients with mandibular prognathism who underwent single mandibular setback surgery with sagittal split ramus. In view of final change (comparison between before and six months after surgery), there was a significant correlation between displacement values of soft and hard tissue of pogonion (PogS/Pog ratio=1.05:1).

They concluded that excessive soft to hard tissue ratios propose relapse of jaw bone instability. A possible reason can be unstable and uncomfortable occlusion following unsuccessful presurgical orthodontic treatment that forces the patient to adjust the occlusion. Therefore, accurate prediction soft to hard tissue ratios in chin area is important [38]. Rustemeyer and Martin compared the two methods of cephalometry and 2-dimentional photogrammetric in terms of the ability to predict soft tissue changes. Patients with class II and III skeletal malocclusion were underwent orthogonal surgery and bimaxillary osteotomy.Also in class II (28 patients) with cephalometric measurements, soft tissue pogonion had the most horizontal displacement. In both class II and III groups and with both methods, the correlation between soft tissue changes and pogonion hard tissue was found in the horizontal plan.In the vertical plan, and for patients in class II, only in photogrammetric evaluation, the correlation between soft and soft tissue pogoniun was found. In patients with grade III, with both cephalometric and photogrammetric evaluation methods, there was a significant correlation between the displacement of the vertical pogonium movements of hard and soft tissue. These researchers concluded that the ability to predict the vertical displacement of hard and soft tissue pogonins in the mandible bone is acceptable and satisfactory when combined with cephalometric and two-dimensional photogrammetry.

They also stated that the prediction of hard and soft tissue motion ratios should be assessed on a case-by-case basis, and at least to a degree dependent on the surgeon's experience and how it works on maxilla during bimaxillary surgery. In addition, different types of surgeries as well as the morphology of anatomical structures should be considered in anticipation of surgical outcomes [35]. Variables such as race and ethnicity, age, gender, application of V-Y closure and post-surgical time elapses in predicting the soft-tissue soft tissue response to bone changes induced by orthognathic surgery. It is suggested that similar studies be carried out with a larger sample size so that it is possible to examine the extent and severity of the effects of the mentioned variables on the soft tissue response [21,32]. A multicentre study provides a large sample size for examining the possible effect variables associated with therapeutic and paraclinical conditions.

It is recommended to check the soft tissue response to severe tissue changes in the body several times after surgery. This recommendation is due to cases such as surgical edema, differentiation of hard tissue changes from surgery to hard tissue changes due to recurrences of skeletal disorders and orthodontic treatments [11]. In this regard, it seems that by performing a multi-center trial with a longer follow-up period, face-aging processes and the effect of age-related changes in soft tissue response of the face can be considered [32]. Our studies had some limitations including small sample size and research conduction in only one hospital with a limited number of maxillofacial surgeons. Also, this study is a seriest that is contained in the lower levels of the pyramid of evidences. Considering the issue of surgery and observance of ethics in medical research, including non-damage to patients and the necessity of implementing a standard treatment protocol for them, the implementation of a similar study with cohort design or with the design of a semi-experimental trial should be proposed. Despite the limitations mentioned above, this study is clinically important and its results for designing future analytical studies and the provision of a clinical practice guide for deciding whether to choose the conventional or high method for maxillary advancement surgery with Le Fort I osteotomy The beauty of the face is beneficial.

Conclusion

The results of thirty patients with Class III skeletal malocclusion with Le Fort I osteotomy for maxillary advancement using two conventional or high surgical techniques show that these two techniques, in terms of optimal response, have angular parameters of hard and soft tissues of the face Including an increase in the angle of the SNA and a reduction in the angles of SNB, nasolabial and mentolabial have the same status. The displacement of the soft tissue points of A 'and LS is significantly higher with the High technique. Also, the response rate of SN and Land soft tissue markers LI and Pogonion were higher with the High technique, but were not statistically significant. Further studies with high sample size and cohort or semi-experimental design for obtaining strong scientific evidence for comparing these two techniques for performing maxillary advancement in patients with class III malocclusion are suggested.

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Conflict of Interest

There is no conflict of interest to declare.

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