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# *CEPHALOMETRIC EVALUATION OF SOFT TISSUE PROFILE CHANGES FOLLOWING MANDIBULAR SETBACK IN EGYPTIAN ADULTS*

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*ABSTRACT*

*A prediction of postsurgical changes in the shape and position of the overlying soft tissue is an important part of orthognathic treatment planning. However, literature in soft tissue changes after mandibular setback in Egyptian adults is rare.*

*The aim of this study was to cephalometrically evaluate the soft tissue profile changes after a mandibular setback procedure in Egyptian adult patients.*

*This study included sixteen Egyptian adult patients, 8 males and 8 females, with mandibular prognathism who were subjected to mandibular setback surgery by bilateral sagital split ramus osteotomy (SSRO). The patients were subdivided according to sex in order to detect potential differences in the soft tissue response. Lateral cephalometric radiographs were taken presurgically, 6 months postsurgically to evaluate the changes from presurgery to postsurgery. The soft tissue profile changes after surgical setback of the mandible can be described as follows: Posterior movement of the mandibular incisor, point B, and pogonion was accompanied by posterior movement of 71% (male) and 82% (female) at*

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*labiale inferius; 88% (male) and 92% (female) at mentolabial sulcus; and 93% (male) and 103% (female) at soft tissue pogonion.*

*After surgical setback of mandible, the ratios of soft to hard tissue changes are somewhat different between male and female, especially at labrale inferioris (Li) and soft tissue pogonion (PoG). The ratios of Li:li and PoG:Pog for male were smaller than for female. This suggests that the clinician should pay more attention to the depth of labiomental sulcus and new position of soft tissue pogonion when making surgical predictions for Egyptian adults with mandibular prognathism*

## INTRODUCTION

Many studies have reported soft tissue changes after surgical setback of the mandible; few have specifically provided information regarding gender differences on the ratios of soft to hard tissue changes [1-5]. The soft tissue responses resulting from orthognathic surgery can be influenced by a number of factors, such as variability in soft tissue thickness, degree of deformity, and tonicity of the musculature. The thickness of the soft tissue covering the bone and dentition is highly variable. Consequently, soft tissue thickness affects not only the amount of lip protrusion but also the total facial profile. Thus, it becomes an important factor in determining soft tissue changes after orthognathic surgery [6,7].

Soft tissue facial profile Changes after mandibular setback surgery do not precisely follow hard tissue changes and have shown large variations at different sites and between different studies [8-18]. A prediction of postsurgical changes in the shape and position of the overlying soft tissue is an important part of orthognathic treatment planning [19-21]. However, literature in soft tissue changes after mandibular setback in Egyptian adults is rare.

The aim of this study was to cephalometrically evaluate the soft tissue profile changes after a mandibular setback procedure in Egyptian patients. The patients were also subdivided according to sex in order to detect potential differences in the soft tissue response.

**Patients and Methods**

This study included 16 Egyptian adult patients with skeletal class III malocclusion due to mandibular prognathism. The group of patients included 8 males and 8 females, whose mean was 21 years (18 to 33 years).

All patients were treated for the correction of mandibular prognathism by sagital split ramus osteotomy(SSRO) after preoperative orthodontic treatment. At each osteotomy site, the bony fragments were stabilized with 3 bicortical positioning screws. Postoperative maxillomandibular fixation was used and released one week after surgery. This period was followed by functional training with light guiding elastics. Postoperative orthodontic treatment was performed only for minimal period.

Lateral cephalometric radiographs were taken presurgically, 6 months postsurgically with the same cephalometer. The subject was standing upright in the cephalostat with the Frankfurt horizontal plane (FH) parallel to the floor with the lips in repose and the teeth in centric occlusion. The cephalometric analysis was done twice by the same researcher and the mean reading was tacked to evaluate the changes from presurgery to postsurgery.

The cephalometric analysis included landmarks and reference lines.(fig1) The specific hard and soft tissue measurements were selected to evaluate the changes from presurgery to postsurgery. Changes in the region of hard tissue structures were determined using the following reference points: The A point (A), incision inferior(Ii), the B point(B), the pogonion(Pog). Changes in the profile of the lower lip: labrale inferioris (Li), the inferior labial sulcus(SLI), and the soft tissue pogonion(PoG). Changes in the profile of the upper lip: the subnasale(Sn), and the labrale superioris(Ls). A *t*-test was used to compare changes between the presurgical and postsurgical sample.

Changes in the positions of the soft tissue reference points were compared to movements in the three hard tissue references: (Ii to Li), (B to SLI), and (Pog to PoG).

The patients were divided into 2 group according to sex, in order to acertain whether changes in the soft tissue profiles differed between males and females.

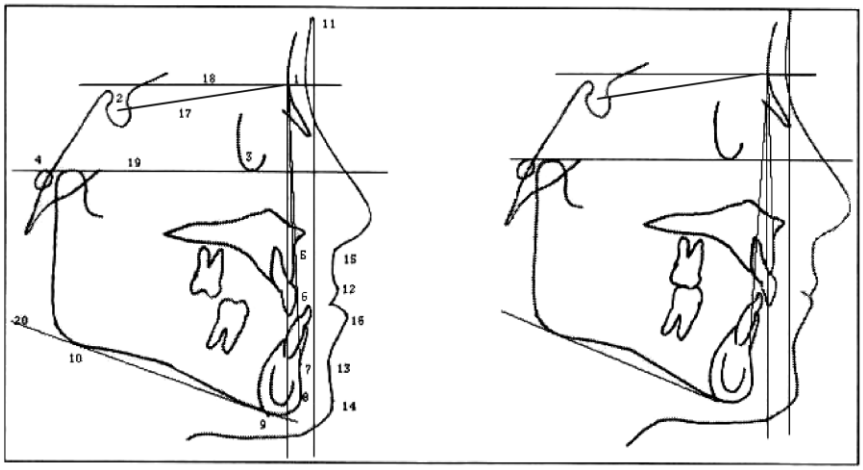


**Fig 1A:** Pretreatment cephalometric tracing **Fig1 B:** Posttreatment cephalometric tracing

**Figure 1:** Landmarks and reference planes used in this study.

1,Nasion(N); 2,Sella(S); 3,Orbitale (Or); 4, Porion (Po); 5,Subspinale (point A) 6,Incision inferioris(Ii); 7,Supramental(point B); 8,Pogonion(Pog); 9,Menton (Me);10,Gonion(Go); 11,Glabella(G); 12,Labrale inferioris(Li); 13,Inferior labial sulcus(SLI); 14,soft tissue Pogonion(PoG); 15,Subnasale(Sn); 16,Labrale inferioris(Li); 17, SN plane(SN); 18, Horizontal plane -7 degree to the SN plane-(HP) 19,Frankfort horizontal plane (FH); 20, Mandibular plane(MP)

## RESULTS

Soft and hard tissue profile changes after mandibular set back are shown in table (1). Significant differences of dental and skeletal parameters (overjet and ANB) reflected the surgical changes that occurred after surgical setback of mandibular prognathism. In addition, the mandibular plane showed a slight clockwise rotation with an increase of FMA.

Significant differences were found between males and females in the soft tissue measurements for lower face protrusion (G-PoG) and the soft tissue thickness or mandibular incisor (Ii-Li) and chin area (Pog-PoG).

For male, the mean setback of the mandible (point B) was 8.2mm, accompanying posterior movement of lower lip (Li) by 4.9mm, mentolabial sulcus (SLI) by 7.2mm, and soft tissue pogonion (PoG) by 8.1mm. For the female, the mean setback of mandible was 7.5mm, accompanying posterior movement of Li by 4.6mm, SLI by 6.9mm, and PoG by 8.3mm.

The setback procedure also had an effect on the upper lip, which became more retrusive. A slight posterior shift in the upper lip (Ls) of 2.2mm was found in both sexes.

After the operation, the mentolabial sulcus became more concave in the male sample. The soft tissue thickness of Pog to PoG was found to be increased in the men and to be reduced in the women. Since the relative posterior movement of the inferior labial sulcus was greater than the movements of the labrale inferioris and the pogonion, a deepening of the mentolabial sulcus occurred.

In table (2), the soft-to-hard tissue ratios are presented. There appeared to be a good relation between the magnitude of bony movement and amount of soft tissue changes, as well as a significant difference in the soft to hard tissue change ratio (Li:Ii and PoG:Pog) between male and female. The soft tissue profile changes after surgical setback of the mandible, can be described as follows: Posterior movement of the mandibular incisor, point B, and pogonion was accompanied by posterior movement of 71% (male) and 82% (female) at labiale inferius; 88% (male) and 92% (female) at mentolabial sulcus; and 93% (male) and 103% (female) at soft tissue pogonion.

**fig2 A** **fig2 B**

**fig2 A:** Preoperative photograph of a female patient with a mandibular pronathism.
**fig2 B :** Postoperative photograph after surgical setback of the mandible.

**Table1:** Changes in dental, skeletal and soft tissue parameters measured preoperatively and 6 months postoperatively used in this study.

| Variables | Males (n = 8) | | | Females (n = 8) | | | Difference between sites |
|---|---|---|---|---|---|---|---|
| | Preoperative M±SD | Postoperative M±SD | Changes M±SD | Preoperative M±SD | postoperative M±SD | Changes M±SD | |
| 1. Overjet(mm) | -3.5±2.7 | 3.1±1.2 | 6.6±2.9* | -3.0±2.4 | 2.7±1.9 | 5.7±2.7* | 0.5 |
| 2. N-Ii (mm) | 14.5±3.8 | 7.5±3.6 | 7.0±3.5* | 12.4±3.3 | 7.0±3.1 | 5.4±3.0* | 2.1 |
| 3. N-B (mm) | 8.3±3.3 | 0.4±3.5 | 7.9±3.1* | 7.1±3.0 | -0.2±3.1 | 7.3±3.3* | 1.2 |
| 4. N-Pog (mm) | 11.3±3.2 | 3.5±3.5 | 7.8±3.1* | 10.0±4.1 | 1.8±3.0 | 8.2±3.2* | 1.3 |
| 5. G-Sn (mm) | 8.8±3.0 | 7.1±2.9 | 0.8±2.5 | 7.1±2.7 | 6.3±2.5 | 0.8±2.1 | 0.9 |
| 6. G-Ls (mm) | 10.9±3.9 | 8.9±3.4 | 2.0±3.3♠ | 9.4±3.4 | 7.1±3.2 | 2.3±3.1♠ | 1.5 |
| 7. G-Li (mm) | 18.0±3.7 | 13.0±3.5 | 5.0±3.4* | 15.6±3.6 | 11.3±3.4 | 4.3±3.3* | 2.4 |
| 8. G-SLI (mm) | 11.4±3.4 | 4.3±3.3 | 7.1±3.1* | 9.3±3.3 | 2.4±3.2 | 5.9±3.1* | 2.1 |
| 9. G-PoG (mm) | 13.9±3.8 | 5.7±3.7 | 8.1±3.5* | 10.9±3.5 | 2.2±3.4 | 8.7±3.2* | 3.0♠ |
| 10. Ii-Li (mm) | 15.9±2.2 | 16.5±2.1 | 0.6±1.9 | 12.8±2.0 | 13.3±1.8 | 0.5±1.4 | 3.1♠ |
| 11. B-Si (mm) | 13.4±1.9 | 13.7±2.0 | 0.3±1.9 | 13.3±1.8 | 12.4±1.7 | 0.1±1.3 | 1.1 |
| 12. Pog-PoG(mm) | 13.1±2.1 | 13.9±2.1 | 0.8±1.5 | 10.1±2.1 | 9.5±2.0 | 0.6±1.5 | 3.0♠ |
| 13. ANB(degree) | -3.0±2.5 | 2.8±1.9 | 5.8±2.7* | -2.7±2.2 | 2.8±2.1 | 5.5±2.5* | 0.3 |
| 14. FMA (degree) | 30.3±4.3 | 33.7±4.7 | 3.4±3.2 | 28.1±4.1 | 31.5±4.6 | 3.4±3.3 | 2.2 |

♠ $P < .05$
* $P < .01$

**Table 2:** Soft-to-hard tissue ratios change at upper and lower lip after mandibular setback

| Landmark | Males (N=8) | | | Females (N=8) | | |
|---|---|---|---|---|---|---|
| | Soft tissue (Mean) | Hard tissue (Mean) | S/H change % | Soft tissue (Mean) | Hard tissue (Mean) | S/H change % |
| Upper lip | | | | | | |
| Sn : B (mm) | 0.8 | 8.2 | 9.7% | 0.7 | 7.7 | 10% |
| Ls : B (mm) | 2.2 | 8.3 | 26.5% | 2.2 | 7.7 | 28.5% |
| Lower lip | | | | | | |
| Li : Ii (mm) | 4.9 | 6.9 | 71%♠ | 4.6 | 5.6 | 82%♠ |
| SLI : B (mm) | 7.2 | 8.2 | 88%* | 6.9 | 7.5 | 92%* |
| PoG : Pog (mm) | 8.1 | 8.7 | 93%♠ | 8.3 | 8.0 | 1.03%♠ |

S/H, ratio of soft tissue change / hard tissue change.
♠ $P < .05$
* $P < .01$

## DISCUSSION

The aim of orthognathic surgery is to correct the malocclusion involving the stomatognathic function and to improve facial aesthetics. Therefore, it is important for the clinician to be able to forecast the soft tissue changes resulting from alteration of the hard tissues after the orthognathic surgery[5-9]. The purpose of this study was to cephalometrically evaluate the soft tissue profile changes after a mandibular setback procedure in Egyptian adult patients. The patients were also subdivided according to sex in order to detect potential differences in the soft tissue response. In this study, the soft tissue changes accompanying mandibular setback in Egyptian adults were analyzed at 6 months after surgery because the postoperative oedema interferes with the soft tissue profile manifested at the immediate postoperative period and a new muscular balance is believed to be established during the first 6 months period after surgery [16,17].

The skeletal movements occurring as a result of mandibular set back surgery were reflected on the significant differences of overjet an ANB. in addition, the mandibular plane showed a slight clock wise rotation with on increase of FMA, This is in accordance with other studies that have reported only small movements in the vertical plane,[7, 15, 21]

After mandibular setback in this study, the upper lip showed a slight posterior shift in comparison to the lower lip. This finding was reported also by other investigators [4-7].

In addition, the ratio of lower lip (Li) to mandibular incisor (Ii) change was 0.71:1 for men and 0.82:1 for women. The ratio of soft tissue pogonion (PoG) to hard tissue pogonion (Pog) change was 0.93:1 (male) or 1.03:1 (female). These soft tissue profile changes after mandibular setback were in agreement with the results described by other authors[1,4,5,9]. On the other hand, the ratio of mentolabial sulcus (SLI) to point B movement in the current study was 0.88:1 (male) or 0.92:1 (female). It is somewhat smaller than the results reported by other authers [3,4,7,9] . Variations between the findings of this study and data reported from earlier studies can be partially explained by differences in sample size, case selection, surgical procedure, method of fixation, and even the follow up period.

On the other hand, most previous cephalometric investigations did not separate the data by sex[11-14]. This is important because there is a clear difference in soft tissue thickness and amount of prognathism between male and female. In the current study the lower face protrusion and soft tissue thickness were found to be greater in the Egyptian male than in female.

This study showed that the ratios of soft to hard tissue change are somewhat different between male and female in this study, especially at labiale inferioris and soft tissue pogonion. These variations could be a reflection of the differences in the thickness of soft tissue between the Egyptian male and female subjects. The findings of this study showed that a greater thickness of soft tissue (Ii-Li, Pog-PoG) in men resulted in a smaller ratio of soft to hard tissue change after surgery. In general, the amount of soft tissue thickness has an influence on the soft tissue changes after orthognathic surgery. According to the data reported by previous studies[2,19,20], increased soft tissue thickness may have a tendency to absorb larger amount of skeletal movement without a perceptible change of soft tissue contour, and produce a smaller soft-to-hard tissue ratio after surgery.

In the current study, after surgical setback of the mandible, the depth of the mentolabial sulcus was slightly decreased, especially in women. In contrast, Most previous cephalometric studies [4,7,9] have found that the mentolabial sulcus became more concave after surgical setback of mandible. This variation could be due to the difference in the amount of soft to hard tissue change, because the ratio of SLI:B in this study was smaller than in the data reported by other authors. Moreover, the ratios of PoG:Pog and Li:Ii for women were greater than for men. This suggests that the clinician should pay more attention to the new position of soft tissue pogonion and the depth of the mentolabial sulcus when making surgical predictions of mandibular setback for Egyptian patients with skeletal class 3 malocclusion.

In this study, after surgical setback of mandible, the average ratios of soft tissue to hard tissue change appear to show a gender difference and resulted in different ratios of hard to soft tissue movement, which suggests the need for different ratios when predicting the results of mandibular setback surgery in Egyptian males and females patients.

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