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Article

SOFT AND HARD TISSUE CHANGES FOLLOWING MANDIBULAR SETBACK SURGERY IN SKELETAL CLASS III PATIENTS

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ABSTRACT

Skeletal class III patients are often treated with surgical and orthodontic treatment to balance the facial profile and improve facial aesthetics. According to previous studies, the primary motivation of patients for orthodontic treatment along with jaw surgery has been to improve their aesthetic condition. Therefore, improving the patient's profile is one of the important goals of surgical treatments. Here, 16 skeletal class III patients were orthodontically and surgically treated. In addition, lateral radiograms performed at the beginning and end of treatment were compared to get information regarding soft tissue modification. According to the results of this study and its comparison with the literature, changes in the soft tissue are related to the amount of mandibular setback: the higher the setback, the greater changes occur in the profile. This fact has a significant impact on aesthetics and patients' expectation.

KEYWORDS: *mandible, osteotomy, profile, aesthetic, expectation*

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INTRODUCTION

Skeletal class III patients are often treated with a combination of surgical and orthodontic treatment to balance the facial profile and improve facial aesthetics (1). Given the advances in orthognathic treatment techniques over the past decades, these combination therapies have been widely used to correct moderate to severe skeletal problems (2). According to previous studies, the main motivation of patients for orthodontic treatment along with jaw surgery has been to improve their aesthetic condition (3, 4). Therefore, improving the patient's profile is one of the important goals of surgical treatments, and the treatment plan for skeletal class III patients should not only consider the function but should also include considerations related to facial aesthetics (5, 6).

Unlike orthodontic treatments, which cause gradual changes in the patient's appearance, combined orthodontic and surgical treatments cause sudden and drastic changes that require rapid and immediate psychological adjustment of the patient's self-perception to these changes (7-9). Therefore, in treating these patients, the clinician should be able to analyze and predict soft tissue changes after surgery with different methods (10-12). Conventional use of normal values of two-dimensional cephalometry can guide practitioners in diagnosing and treating these cases and predicting the results of hard and soft-tissue after surgery (13). Numerous studies have evaluated hard and soft tissue changes after mandibular setback surgery in skeletal class III patients that are conflicting in their findings (14-17).

The aim of this study is to evaluate soft tissue changes after mandibular setback based on cephalometric radiography performed before and after surgical treatment of class III patients.

MATERIAL AND METHODS

The study was conducted according to the guidelines of the Helsinki Declaration of 1975, revised in 2013. The approval code of the present cross-sectional study was obtained from Tekovo University (n. 1381). All the participants signed approved written consent.

Sixteen patients (13 females and 3 males) referred to the orthodontic department were selected according to the following criteria: skeletal class III based on lateral cephalometry and clinical examination; no history of previous orthodontic treatment and presence of any syndrome.

Presurgical lateral cephalometry, orthopantomography, photographs and dental cast were collected. The following measures were recorded:

LS-SIE (*labial superior-superior incisal edge*) and LI-IIE (*labial inferior-inferior incisal edge*) in soft tissue;

the lower third of the facial height (S.N-PT), mandible length (Go-Gn) in hard tissue;

SNA, SNB, and NLA angles; and

Soft tissue thickness: A-Sn, U.L.L. (*Upper Lip Length*), LLL (*Lower Lip Length*), and chin thickness were measured.

Pre-orthognathic surgery procedures (levelling, aligning, and functional compensation) were performed with 0.022 slot edgewise appliances up to 0.019 * 0.025 stainless steel archwire to prepare the patients. Then, bilateral sagittal Osteotomy was carried out by the surgeon. Finally, postsurgical orthopantomography and lateral cephalometry (after 6 months) were done.

Statistical analysis

The collected data were analyzed by T-test, Paired T-test, using Statistical Package for the Social Sciences software version 19 (Chicago, IL, USA). A P-value of less than 0.05 was considered significant.

RESULTS

In 16 skeletal class III patients there had the following changes after mandibular setback:

- regarding soft tissues modification, LI-IIE (labial inferior-inferior incisal edge) index increased by 0/2 degree (14/6%) (P<0/005), whereas LS-SIE (labial superior-sup incisal edge), did not change significantly (Table I);
- regarding hard tissue modification, the lower third of the facial height increased by 0/1 mm (P<0/2); the mandible

length (Go-Gn) was reduced by 0/7 mm (P<0/001) (Table II);

- as regards angles' change, the mento-labial (ML) angle had a significant reduction of 8/7 degrees (P<0/01), as well as the angle of SNB decreased by 3/3 degrees (P<0/001), whereas the SNA angle raised 0/8 degrees without reacting a statistically significant p-value (Table III);
- as regards soft tissue thickness, the chin soft tissue shrinkages for 0/03 mm postoperatively (without significant p-value), while ULL (Upper Lip Length) increased by 0/1 mm (P<0/007) and the LLL (Lower Lip Length) decreased by 0/2 mm (P<0/01) (Table IV).

Table I. *Soft tissue changes pre- and post-operatively (in mm) in Class lll malocclusion*

	LS-SIE Mean ± SD	LI-IIE Mean ± SD
Pre-operatively (mm)	1/8 ± 0/3	1/6 ± 0/3
Post-operatively (mm)	1/7 ± 0/3	1/8 ± 0/3
The difference (%)	0/5%	14/6%
P-value	0/01	0/005

Table II. *Hard tissue changes pre and post operatively (in mm) in Class lll malocclusion*

	Sn.PT*(lower third facial height)* Mean ± SD	Go.Gn Mean ± SD
Pre-operatively(mm)	6/9 ± 0/8	8/2 ± 0/8
Post-operatively(mm)	7/1 ± 0/8	7/5 ± 0/8
The difference (%)	1/6%	8/4%
P-value	0/2	0/001

Table III. *The angle's changes pre- and post-operatively (in degrees) in Class lll malocclusion*

	NLA *(nasolabial angle)* Mean ± SD	SNA Mean ± SD	SNA Mean ± SD
Pre-operatively (degrees)	117 ± 10/5	83/7 ± 3/9	78/5 ± 20
Post-operatively (degrees)	113/1 ± 13/9	80/4 ± 4/4	79/3 ± 20
The difference (%)	3/3%	4%	1%
P-value	0/2	0/001	0/6

Table IV. *The changes of the soft tissue thickness pre and post operatively (in mm) in Class lll malocclusion*

	A.Sn Mean ± SD	L.L.L Mean ± SD	U.L.L Mean ± SD	U.L Thickness Mean ± SD	A-Sn/PT-Pog[1] Mean ± SD	Li-IIE/PT-Pog Mean ± SD	Ls-SIE/PT-Pog Mean ± SD
Pre-operatively (mm)	1/67 ± 0/4	2/3 ± 0/3	2/2 ± 0/3	16/7 ± 2/9	1/8 ± 0/6	1/6 ± 0/3	1/89 ± 0/5
Post-operatively (mm)	1/73 ± 0/4	2/1 ± 0/3	2/1 ± 0/25	17/1 ± 3/4	1/9 ± 0/5	1/9 ± 0/5	1/86 ± 0/5
Difference (%)	2/4%	8/6%	4/5%	2/4%	5/5%	18/8%	2/1%
P-value	0/7	0/01	0/007	0/7	0/2	0/002	0/7

1PT-Pog: soft tissue thickness of chin

DISCUSSION

Although significant advances have been made in predicting hard tissue changes following orthognathic surgery, this is not true regarding soft tissue predictability. The response of soft tissue to hard tissue movements following surgery varies among patients.

Changes in soft tissue compared to hard tissue were studied for the first time by McNeill et al. (13). Soft tissue response after orthognathic surgery may be influenced by preoperative variables such as deformity, soft tissue thickness, and muscle tonicity (14, 15). The thicker the soft tissue, the less it is affected by hard tissue movements (15, 16). Other factors include degree of dissection, hematoma, edema, incision suture, scar formation, and tissue contraction (17, 18). Some of these factors are controllable, which can lead to more predictable outcomes after surgery. However, due to postoperative oedema, soft tissue results should be evaluated at least 6 months after surgery (19, 20).

This study evaluated soft and hard tissue changes following the mandibular setback in skeletal class III patients. The mento-labial angle was reduced by 7.8 degrees, meaning that the mento-labial sulcus's concavity was increased, and the sulcus became deeper. This finding, according to presurgical decompensation of lower incisors, seems rational, and it is consistent with the study of Kim et al. (10).

Hu et al., (14), declared that the soft tissue thickness of the chin related to hard tissue was increased by 0.7 in men and 0.6 mm decreased in women following mandibular setback. According to our findings, the LI-IIE index increased 0/2 degree (14/6%), while Jensen, et al. reported a 5/3 mm change (21). In addition, the ULL increased by 0/1 mm significantly, and the LLL decreased by 0/2 mm significantly based on our study, and these results were similar to the results obtained by others (21, 22).

We found that upper and lower soft tissue thickness did not change significantly; Gjørup et al. (23), explained that changes in upper and lower lip soft tissue thickness are related to initial preoperative thickness, and it is closely correlated with the amount and direction of hard tissue movement after mandibular surgery.

In the present study, the lower third facial height (Sn-Pt) did not change significantly following mandibular setback surgery, while Gaggl et al (24). reported a 0.2 increase in lower third facial height after mandibular setback. However, the soft tissue response does not follow rigid rules, and only general conclusions can be drawn; more research will be needed due to the variety of individual variations and influencing factors (25, 26). Further research may focus on the understanding of chewing movements in Class II patients after surgery (27) using artificial intelligence whose potentiality will be increased in the next future (28, 29).

CONCLUSION

According to the results of this study and its comparison with the literature, changes in the soft tissue are related to the amount of mandibular setback: the higher the setback, the greater is change occurring in the profile, which has a significant impact on aesthetic and patients' expectations.

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