A CEPHALOMETRIC EVALUATION OF DENTOSKELETAL AND SOFT TISSUE CHANGES FOLLOWING BILATERAL SAGITTAL SPLIT OSTEOTOMY FOR MANDIBULAR SETBACK-A CASE REPORT

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ABSTRACT

The aim of the case reportwas to evaluate the dentoskeletal and soft tissue changes following bilateral sagittal split osteotomy (BSSO) for mandibular setback using cephalometric composite analysis.Pre-surgical and postsurgical lateral cephalograms were digitized and the measurements were assessed with high quality digital imaging software.There was significant anteroposterior setback of the mandible. The mandibular body length decreased while mandibular ramus height increased postsurgically. Similarly anterior facial height increased, posterior facial height decreased and mandibular plane angle increased after the surgery. Thedistance from the dorsum of the tongue tothe roof of the mouth decreased.Similarly,the position of the tip of the tongue relative to lower incisors was also reduced postsurgically.BSSO with mandibular setback was successful in achieving drastic changes in linear and angular cephalometric measurements postsurgicallythereby improving the patient's facial profile and balanced occlusion.

INTRODUCTION

Skeletal class III malocclusion may either be associated with maxillary retrusion, mandibular protrusion, or a combination of the two[1].In young patients, growth modification is the treatment of choice and should be initiated before the pubertal growth spurt. They are treated with orthopaedic and class III functional appliances[2].Untreated patients with skeletal malrelation would eventually be treated surgically, which would be the only treatment option possible. Thus, treatment of skeletal Class III malocclusion in an adult requires orthognathic surgery combined with pre-surgical and postsurgical orthodontic treatment aiming to improve self-esteem, achieve normal occlusion and improvement of facial esthetics.[3,4]

Reconstruction of dentofacial defects by surgery has greatly developed since its invention in late 19thcentury[5]. Several surgical methods have been proposed for mandibular setback but at present Bilateral Sagittal Split Osteotomy (BSSO) is thecommonly used surgicalprocedure[6].BSSO was first proposed by Obwegezer and Trauner in 1957[7].Though BSSO has been a common and a very old surgical method of correcting a mandibular prognathism, the exact cephalometric changes need to be thoroughly understood as the surgeon and orthodontist requires predicting the post treatment changes accurately.

CASE REPORT

A 23 year oldfemale patient reported with a chief complaint of a prognathic lower jaw.Extraoral examination indicated a concave profile with an increased lower anterior facialheight accompanied by mandibular prognathism.There was lip incompetency andfacial asymmetry to the left. Intraorallyshe had 36, 37, 46missing. The upper midline was deviated to the right by 3mm and there was a unilateral posterior crossbite.The canines and incisors werein class III relation with reverse overjet of 1mm.

The cephalometric examination indicated that she had anorthognathic maxilla, prognathic mandible, vertical growth pattern and a class III skeletal base with upright incisors. The treatment objectives were to correct the anteroposterior and transverse skeletal disharmony, facial asymmetry, midline shift and crowding and to achieve ideal occlusal intercuspation with class I canine and incisor relation. So it was decided to treat the patient with pre-surgical and postsurgical fixed orthodontic treatment and BSSO mandibular setback surgery for the correction of mandibular prognathism and skeletal asymmetry.

MATERIAL AND METHOD

Pre-adjusted edgewise fixed appliances, 0.022"slot, Roth prescriptionwas used. The arches were aligned and levelled. Mild proximal stripping was done in the upper arch for alignment correction and the space of the missing teeth was used to level the lower arch.Following alignment correction, mock surgery was performed and a surgical splint was fabricated. Then the patient was referred to the Dept. Of Oralsurgerywith0.019"x0.025" stainless steel posted archwire for BSSO with mandibular setback. During the surgery, an asymmetric setback with 8mm on the right side and 5mm on the left side was performed to correct the facial asymmetry and midline and to get a stable occlusion.

Post surgically, the patient's profile improved. Sincethe surgical cuts were precise the use of postsurgical elastics were eliminated. A composite cephalometric analysis was derived to evaluate soft and hard tissue changes. Thepre-surgical and postsurgical lateral cephalograms were digitized using Epson perfection v700 scanner (version3.81 EN, Japan) and the measurements were assessed with high quality digital imaging software, Dolphin imaging (version 11.7, build 66, Chataworth, USA) (fig 1).

TREATMENT RESULTS

Anterioposterior and transverse skeletal disharmony was corrected and Class I skeletal relation was achieved with normal incisor relationship and Class I canine relationship. The unilateral posterior crossbite and facial asymmetry was also corrected resulting in an aesthetic and pleasing profile (fig 2).

The following measurements were considered and the dentoskeletal and soft tissue cephalometric changesafter the surgery were evaluated (Table 1). The pre-surgical and postsurgical changes in the tongue position were assessed using the Rakosi tongue analysis (Table 2).

Skeletal Changes (Table 1)

The mandible which was prognathic became orthognathic postoperatively as shown by decrease in N-B (|| HP) (-4.8mm), SNB (-7.4^0), S-N-Pog (-6.7^0), facial angle (-2.3^0) and increase in facial convexity ($+6.2^0$). The mandibular bodylength decreased (-10mm) while mandibular ramus height was increased (+2mm) postsurgically. Similarly, anterior facial height increased (+2.2mm) and posterior facial height were decreased (-0.1 mm) after the surgery. There was increase in mandibular plane angle($+3^0$) and gonial angle($+1^0$) due to downward rotation of mandible.

Soft Tissue Changes (Table 1)

The vertical height ratio (+0.02), lower face throat angle (Sn-Gn'-C $+10^0$), lip chin throat angle ($+3^0$) and soft tissue facial convexity (G-Sn-Pog' $+8^0$) were increased. Therewas also increase in lower lip thickness (+1mm)and lower lipprotrusion(+0.5mm). The upper lip protrusion (Ls-Eline -1.7mm) and cervicomental angle ($+7^0$) almost approached normal value. The lower pharynx width also approached normal value (+2mm) while there was decrease in upper pharynx width (-1mm) after surgery which showed slight constriction following the mandibular setback.

Dental Changes (Table 1)

L1-occlusal plane decreased (-10.1^0) and IMPAshowed only slight increase ($+1^0$) suggesting that the value remained unchanged after the surgery. Theoverbite wasimproved to nearly normal value (-2mm) and overjet changed from negative value to positive value (+3mm).

Changes in Tongue Position (Table 2)

The 7 measurements showed that the distance from the dorsumof the tongue to the roof of the mouth was decreased. Similarly, the position of the tip of the tongue relative to lower incisors was also reduced postsurgically.

Table 1: Skeletal, Soft Tissues, Dental Change

a) Skeletal Measurements

Linear Parameters	Pre-surgical	Post-surgical	Normal
ANS-Me	69.2	71.4	
Go-Pog	78	68	74.3+/-5.8
N-B (|| HP)	6.8	-2	-6.9+/-4.3
N-Pog (|| HP)	8	-3	-6.5+/-5.1
S-Go	79	78.9	80+/-5
Ar-Go	51.1	53.5	46.8+/-2.5

Angular Measurements	Pre-Surgical	Post-Surgical	Normal
N-A-Pog	-10	-3.8	2.6+/-5.1
N-Pog/FH	88.9	86.6	88.6
SNB	87.5	80.1	80
ANB	-5	-1.1	2
N-S-Gn (Y axis)	59.8	65.2	67
S-N-Pog	87.6	80.9	80.5
Go-Me/SN	33.4	36.4	32
Go-Me/FH	29	36	22+/.4
Ar-Go-Me	132	133	128+/-7
Upper Gonial Angle	58	58	52-55
Lowe Upper Angle	74	75	72-75

b) Soft Tissue Measurements

Linear Parameters	Pre-Surgical	Post-Surgical	Normal
G-Sn/Sn-Me'	0.98	1:1	1:1
Ls-E Line	-3.7	-5.4	4mm behind
Li-Eline	4.6	5.1	2mm behind
Ils/Pog'-Ls	1	1	5
Si to (Li-Pog')	5	6	4+/-2
Airway assessment Upper Pharynx width Lower Pharynx width	 18 8	 17 10	 15-20 11-14

Angular Parameters	Pre-Surgical	Post-Surgical	Normal
G-Sn-Pog'	2	10	12+/-4
N'-Pog'/FH	93	90	91+/-7
Sn-Gn'-C	114	124	100+/-7
Lip-chin-throat angle	127	130	90
Cervicomental angle	110	117	110-120

Soft Tissue Thickness

Linear Parameters	Pre-Surgical	Post-Surgical	Normal
Po-Pog'	13	13	10-12mm
Li-L1	17	18	12.5mm

c) Dental measurements

Dental Parameters	Pre-Surgical	Post-Surgical	Normal
Iii/A-Pog'	-3	1	1-3
L1-occlusal plane	77	66.9	72
IMPA	86	87	95
A-B(OP)	11.9	-0.1	0.4
OP-HP	5.1	3	7.1
Overjet	-1	2	2
Overbite	3	1	2

Table 2: Change in Tongue Position

Measurement	Pre-Surgical	Post-Surgical
1	3	2
2	3	1.5
3	1	0.5
4	2	1
5	2	1.5
6	0.5	0.5
7	17	9

Measurement 1: distance between the root of tongue and soft palate
Measurement 2-6: relationship of dorsumof tongue and roof of the mouth
Measurement 7: position of the tip of tongue relative to the lower incisors

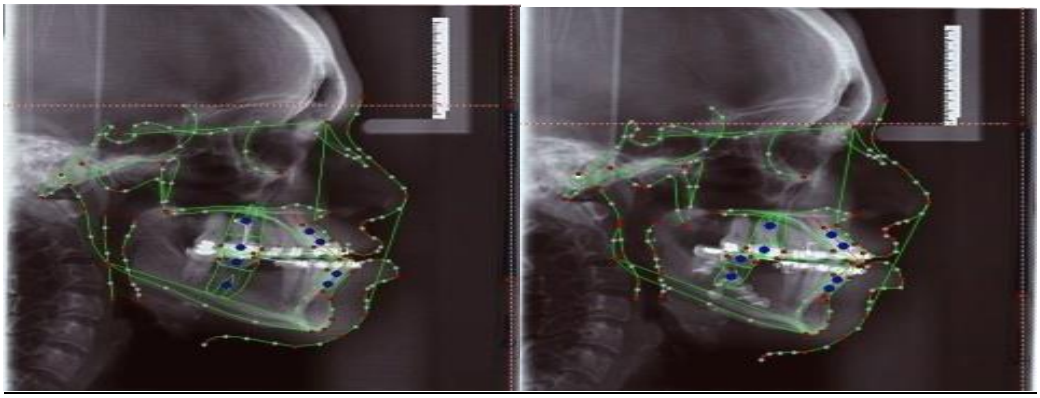

Fig. 1: Pre-surgical cephalometric landmarks; Post-surgical cephalometric landmarks

Fig. 2: a) Pre-surgical photographs

Pre-surgical intraoral photographs

b) Post-surgical photographs

Post-surgical intraoral photographs

DISCUSSION

In this case report, majority of the cephalometric variables showed significant changes between the preoperative and postoperative cephalo-metric values.

After the surgery the facial structures displayed changes in shape, posture and position. The muscle functions werealtered and dentoskeletal and soft tissue changestook place. The lower lip has become more procumbent (Ls-E line -1.7mm and Li-Eline+0.5mm) which was supportedby Karim et al[8] (-2.0+/-1.5mm in Ls –E line and +2.2+/-2.4 mm in Li-E line).The surgery did not cause deepening of sulcus in the lower lip. This finding was in agreement with Hans Gjorup and Athanasiou[9]. The vertical height ratio after the surgery was increased (G-Sn/Sn-Me' +0.02) which showed middle and lower third of face were proportional. This was supported by the study conducted by Yueh –Tse Lee et al[10](+0.03) and Shahla Momeni et al[5](+0.04+/- 0.10).The gonial angle was increased ($+1^0$) in our study. This result was opposed by the study conducted by Javad Yazdani[11] et al which showed a decrease in the gonial angle (-2^0) after the surgery. They stated that, previous studies conducted to evaluate gonial angle changes and its relapse rate concluded that the use of BSSO for mandibular setback caused a decrease in the gonial angle. The lower anterior facial height increased (+2.2mm) which was in contrary to the result by Shahla Momeni et al which showed a decrease in the lower anterior facial height (-0.67+/-2.27mm). They noticed mandibular movement along the maxillary occlusal plane as well as the posterior and superior movement of chin following BSSO surgery which resulted in a reduction in lower anterior facial height.

Many investigations support the idea that after surgical movement of the jaws, changes in the position of the tongue occurred which resulted in the narrowing of the pharyngeal airway space. The upper pharynx width exhibited slight decrease (-1mm) postsurgically, which suggested that the upper pharyngeal space reduced slightly. Most studies have reported a significant reduction of the upper airway[12].

Thedistance from the dorsum of the tongue to the roof of the mouth decreased. Similarly, the position of the tip of the tongue relative to lower incisors was also reduced postsurgically. These indicate that the mandibular setback has limited the existing tongue space. Vinay Darshan et al[13] also found similar result which displayed the positional change of the tongue with reduced space after setback.

CONCLUSION

Orthognathic surgeries on the basis of systematic monitoring of outcomesmay be regarded as a treatment modality to correct severe occlusal anomalies.BSSO was done for mandibular setback to treat the mandibular prognathism.There was dentoskeletal and soft tissue changes following the surgery. Some variables showed significant changes while some measurements remained unchanged. The treatment established a harmonious facial profile and a balanced occlusion.

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