# Management of skeletal class III malocclusion by surgery-first

## approach: A case report

Amir Hosein Mirhashemi<sup>1</sup>, Mohammad Sadegh Akhoundi<sup>1</sup>, Hannaneh Ghadirian<sup>1</sup>, Alireza Parhiz<sup>2</sup> Rashin Bahrami<sup>1</sup>, Seyyed Morteza Samimi<sup>1\*</sup>

1. Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

2. Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

ARTICLE INFO	ABSTRACT
Article Type: <b>Case Report</b> Received: 23 Jan. 2020 Revised: 28 Mar. 2020 Accepted: 2 Jun. 2020 *Corresponding author: Seyyed Morteza Samimi Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.	The purpose of Dentofacial Deformity Treatment is to achieve the proper aesthetic and function- al occlusion results. Conventional orthognathic surgery involves a long-term orthodontic phase before surgery for about 18 months, in which patients' facial appearance worsens and their mo- tivation decreases. In the SFA (surgery first approach) method, the surgery is performed before orthodontics and orthodontic therapy is performed to improve dental occlusion and final settle- ment. Two main advantages of this method are the reduction of the therapy period and the initial improvement in the patient's facial appearance. The SFA has certain benefits, especially in Class 3 malocclusion. In this case report, a 19-year-old girl with a relatively severe Class 3 malocclu- sion with skeletal discrepancy due to a mandibular prognathism and maxillary retrognathism, and asymmetrical face with chin deviation to left is presented with a unilateral posterior cross bite which was effectively treated using the SFA protocol. The SFA therapy was performed by removing orthodontics before surgery, followed by maxillary advancement surgery, and posterior maxillary impaction and postoperative orthodontic sets to dental alignment and settling the occlusion. De- spite the overall reduction in the orthodontic therapy period to less than 9 months, good results and functional occlusion were obtained.
	<b>Keywords</b> : Surgery first; Orthognathic surgery; Skeletal class III; Malocclusion; Orthodontic treatment.

*Tel:* +98-21-84902473 *Fax:* +98-21-84902473 *Email:* sms 1370@Yahoo.com

## Introduction

rthodontics is carried out to improve dental occlusion, functional objects, and smiling beauty. Among the malocclusions, the therapy with skeletal discrepancy is a combination of orthodontic methods coupled with surgery. Typically, during a therapeutic process involving dental align and leveling, decompensation and arch coordination are performed in the pre-surgery phase, orthognathic surgery followed by finishing in the orthodontic phase after surgery. This method has been started with high predictability and stability since 1960

and has been used as a routine method in treating skeletal disorders [1-3]. Despite all the advantages and efficiency of this method, it has some disadvantages, such as long-term therapy, the deterioration of patients during the pre-surgery period, the inadequate stimulation and cooperation of patients, and the discomfort caused by lack of occlusion stability in chewing patients [4-7]. Moreover, more rapid, efficient, stable dental movements, and similar results to conventional orthognathic methods and higher degrees of success have been reported to this method, which has made the orthodontists and patients to choose this method more. Given the difficulties in this method, it has been proposed to maximize the effect of accurate use of surgical models to design the right therapy as well as close consultation with the surgeon [15-17]. In this study, we investigate a skeletal class 3 malocclusion case that was successfully treated in a short period with the desired results using the SFA method.

## **Case Report**

A 19-year-old girl was referred with the chief complaint of poor appearance due to a prominent mandible. Clinical examination showed facial asymmetry with chin deviation to left. Besides, skeletal and dental class 3 malocclusion with posterior cross bite was observed in the left segment of the patients dentition. The evaluation of the patients profile showed that the mandibular prognathism, maxillary retrognathism, and the faded mentholbial salcus were evident. The patient had no medical, dental history, and oral habits.

#### **Extra-oral Examinations:**

Extra-oral examinations recorded a maximum opening of 45mm, and the condition of the TMJ and jaw muscles were assessed for any pathological conditions. The patient had no history of pain or joint issues.

#### Soft Tissue Assessment:

The lips in the rested position were together and the tension in the labial muscles was not obvious. The nasolabial angle was acute (80 degrees) and the soft tissue of the nose, upper, and lower lips were examined and reported in the normal range.

#### **Facial Proportions:**

From the frontal view, the patient had an asymmetrical face, especially in the mandible angle and chin area. The deviation of the chin to the left was quite clear. The patient's 1/3 facial proportions were recorded in the normal range. In the patients profile view, the appearance of the face was straight and the chin-throat angle was 90 degrees with a straight form. Also, the angle and slope of the mandibular plan were determined as flat.

#### Mini Aesthetics and Smile Analysis:

In the mini-static study, the midline shift was evaluated, which was considered to be 3mm for the middle line deviation to the left and maxillary midline was normal. The smile line was considered normal in terms of height and the smile arch was flat. The buccal corridor appeared to be moderate, and the upper tooth show at a smile was 10mm, while in other conditions was 0mm. Also, the lower tooth show at a smile was 2mm, while in other conditions was 0mm.

## **Intra-oral Evaluation:**

Periodontal examination recorded tissue health in terms of soft tissue lesions, BOP, and attached gingiva. The patients oral hygiene was well. In dental evaluations, superficial decay at the occlusal surface of some teeth (No. 5, 12, 15, 19, 21) was observed and consulted with a restorative specialist. Also, the root canal therapy and amalgam restoration were carried out on tooth No. 3, which was recorded at the desired level in terms of therapy quality. The patient lost teeth No. 14 and 30. The molar and canine relations were two sides of Class 3. The amount of overbite was 0, and the patients overjet was -1mm. A comparison of CO and CR illustrated the coordination between the two in the normal range, and there was no clear functional shift.



Figure 1. Pretreatment intraoral photographs.

#### **Radiographic Examination:**

Examination of the patient's panoramic confirmed the information from the intraoral assessments, including the fact that the third molar mandibular teeth on both sides were forming roots and their direction of growth was in the right direction. The patient didn't have maxillary third molar's bud. Also, due to the clear asymmetry in the mandible, an anterior-posterior cephalogram patient was prescribed, after which the information in the clinical examination was confirmed. Space and Bolton analyses were performed on dental models.

The list of patient problems based on Acroman Profit is as follows.

1- Facial asymmetry and chin deviation to left- Acute nasolabial angle-Mentholbial salcus has disappearedflat smile arch-Prominent chin-Mandibular dental midline shift to the left.

2- Teeth rotation No. 12,13,14,28,29- retroclination of

lower incisors and proclination of upper incisors.

**3**-Palatal Cross bite in teeth No. 12,13,14,15.

4– Class 3 Skeletal-mandibular prognathism and maxillary retrognathism-class 3 molar and canine relationship on both sides, edge to edge incisor relationship.

#### 5- Horizontal growth pattern.

After evaluating the patient's diagnostic evidence, the patient's diagnosis was made on the class 3 skeletal disorder with horizontal growth pattern, asymmetrical face, proclination of maxillary dental arch and retroclination of the mandibular dental arch. Also, the purpose of the therapy was determined based on the patient's diagnosis and the surgeon's consultation. Immediately after the surgery, the purposes included proper canine and molar relationships and 4mm overjet due to the patient's low IMPA. The ultimate therapeutic goals included aligning the maxillary and mandibular dental arch, improving the maxillary and mandibular incisor inclination, obtaining the ideal overjet and overbite, modifying the mandibular dental midline shift, obtaining the ideal functional occlusion, and ultimately improving the skeletal and soft tissue profiles.

Variable	Pre-treatment	End of Treatment	Variable	Pre-treatment	End of Treatment
SNA	81	82	Sn-GoGn	25	28
SNB	86	84	FMA	18	22
ANB	-5	-2	Y-axis	52	53
Max. Length	91	91	S-Ar	36	36
Man. Length	127	118	Basal Angle	26	26
Max- Man difference	36	27	Jarabak Index	66%	66%
A to NP	-1	+1	U1 – NA	34	29
Pog to NP	+12	+9	U1 – SN	113	110
Wits	-10	-6	U1 – FH	120	117
Sn to Maxillary plane	4	5	L1 – NB	18	18
Facial angle	95	93	IMPA	85	86
UAFH	52	49	FMIA	77	80
LAFH	70	67	Inter incisal angle	133	141
Saddle angle	123	123	Holdaway Ratio	1.5	3
Articular angle	143	134	Lu to E Line	-9	-2
Gonial angle	122	132	LI to E Line	-3	-1
Sum of Bjork	388	359			

Table 1. Pretreatment and posttreatment cephalometric measurements.





*Figure 2.* Pretreatment cephalometric and panoramic radiographs.

#### Treatment plan:

We planned the SFA treatment after the therapeutic purposes were assessed and according to patient's information, medical history and dental records, the lack of trauma history, consultation of the maxillofacial surgeon, and informed consent from the patient. This treatment consisted of two parts: leFORT 1 surgery for maxillary advancement and posterior impaction of 2 and 3mm, respectively, and mandible asymmetrical set back using the BSSO method to eliminate mandible asymmetry and prognathism of 6 and 3mm in the right and left, respectively. The treatment plan was confirmed after re-examination and re-evaluation using manual surgery model, cephalometric and dolphin software prediction, therefore, VTO is created for therapeutic purposes and achieve planned skeletal movements and it was easier to communicate with the maxillofacial surgeon. Finally, the surgical splint was made according to model surgery and the prediction of orthodontic movements.

The surgeon uses this splint in the operating room and delivers temporary postoperative occlusion for orthodontics to the orthodontist. 022 MBT system brackets were placed in an ideal situation before surgery and 16.22 stainless steel wire was formed inactive and it was engaged in brackets. In the operating room, at first, a surgical incision was made on the soft tissue of maxilla for better access. The leFORT 1 osteotomy was carried out according to a treatment plan which included 3mm of advancement and 5mm of posterior impaction on the right side and 3mm of posterior impaction on the left side using the temporary implant. Maxilla was fixed in preform using two L shape plates with four holes and four screws, then, the temporary splint was removed. Sagittal osteotomy of mandible was carried out and it was fixed on the final splint on either side by a plate with four holes and four screws. Zygomatic osteotomy and advancement were carried out in infraorbital nerve and with a distance of 5mm from the inferior orbital rim and it was fixed using plate and screws. Finally, the patient was discharged after a day of care with an elastic reminder and he was reached out for examination and removal the splint on week after surgery.

The patient referred a week after surgery with the good general condition and a reduction in pain and edema. Because of the increased overjet to correct the incisor angle and achieve other therapeutic goals, they were considered. Four weeks after surgery, the 16.22 stabilizer orthodontic wire was released as a base wire and NITI 14 wire was used with elastics to align and level the tooth arch. Afterward, the NITI 14, NITI 16, steel 16, and 16.22 steel wires were used for five months. After this period, the brackets were debonded and the removable retainer for mandible and fixed and removable retainer for maxilla were delivered to the patient. Finally, the patients treatment results were desirable and the results were very satisfactory due to the short time of treatment and overall patient satisfaction was very high.



Figure 3. Post-treatment facial photographs.





*Figure 4.* Post-treatment cephalometric and panoramic radiographs.

## Discussion

Orthodontic therapy with surgery has been considered as a method in patients with severe skeletal disorders. This method is routinely used in patients with Class 3 skeletal disorders and is assumed as a longterm therapy. This therapy using the SFA method in some patients can be very beneficial, as it reduces the overall period of therapy and improves the overall satisfaction of patients. According to the studies, the stability and the results of this therapy method are similar to the usual orthodontic-surgical methods [2,18].

Studies that were conducted on the SFA method in SFA reported a reduction in the overall period of therapy, which can reduce complications of the long-term therapy period, including dental decay, and periodontal problems, as well as reducing the level of patients> cooperation and satisfaction. Elimination of pre-surgery orthodontic, acceleration of dental movements in post-surgery following RAP phenomenon, high cooperation of patients due to relieving the original complaint and improving their facial appearance as well as aligning the type of facial movements with improved soft tissue and mouth environment, are among the effective factors in reducing the overall period of patients therapy [59,19-25]. The reduction of the therapy period is evident in our study so that the overall period difference in our study is less than half of the period in the typical 18-month method. This can lead to a high level of satisfaction in patients seeking to reduce the therapy period. The patient had the intention of migration and limited time, so this method followed by very high satisfaction. Considering the complexity of this method, the selection of this method can provide the maximum benefit that patient selection is conducted with care. Patients with the degree of the skeletal disorder are not so severe that mild and moderate dental misalignment can be considered acceptable criteria for this approach.

Moreover, due to the lack of stable occlusion after surgery and difficulty in predicting dental movements in orthodontics and the surgery model can be extremely helpful for patients and coworkers using computers for some patients. Also, due to the lack of stable post-surgery occlusion and the difficulty in the prediction of dental movements in orthodontics, performing a prediction and surgery model using a computer in some patients can be highly effective [26-28]. Despite all the constraints of this study, considering the cooperation and high experience between the orthodontist and the surgeon, and the detailed treatment plan and predictions made in the manual treatment plan and Dolphin software, the results were satisfactory in terms of beauty and occlusion in the shortest possible period.

## **Conflict of Interest**

There is no conflict of interest to declare.

#### Reference

- [1] Jeyaraj P, Chakranarayan A. Rationale, relevance, and efficacy of "surgery first, orthodontics later" approach in the management of cases of severe malocclusion with skeletal discrepancy. Annals of maxillofacial surgery. 2019; 9(1):57. DOI: 10.4103/ ams.ams\_272\_18.
- [2] Yang L, Xiao Y-d, Liang Y-j, Wang X, Li J-y, Liao G-q. Does the surgery-first approach produce better outcomes in orthognathic surgery? A systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery. 2017; 75(11):2422-9. DOI:10.1016/j.joms. 2017.06.002.
- [3] Proffit WR, White RP, Sarver DM. Contemporary treatment of dentofacial deformity: Mosby St. Louis; 2003.
- [4] Nurminen L, Pietilä T, Vinkka-Puhakka H. Moti-

vation for and satisfaction with orthodontic-surgical treatment: a retrospective study of 28 patients. The European Journal of Orthodontics. 1999; 21(1):79-87. DOI:10.1093/ejo/21.1.79.

- [5] Jeong WS, Lee JY, Choi JW. Large-scale study of long-term vertical skeletal stability in a surgery-first orthognathic approach without presurgical orthodontic treatment: Part II. Journal of Craniofacial Surgery. 2018; 29(4):953-8. DOI:10.1097/scs.00000000004433.
- [6] Sabri R. Orthodontic objectives in orthognathic surgery: state of the art today. World journal of orthodontics. 2006; 7(2).
- [7] Ko EW-C, Lin SC, Chen YR, Huang CS. Skeletal and dental variables related to the stability of orthognathic surgery in skeletal Class III malocclusion with a surgery-first approach. Journal of Oral and Maxillofacial Surgery. 2013; 71(5):e215-e23. DOI:10.1016/j.joms.2012.12.025.
- [8] Luther F, Morris D, Hart C. Orthodontic preparation for orthognathic surgery: how long does it take and why? A retrospective study. British Journal of Oral and Maxillofacial Surgery. 2003; 41(6):401-6 DOI:10.1016/s0266-4356(03)00163-3.
- [9] Choi JW, Lee JY, Yang SJ, Koh KS. The reliability of a surgery-first orthognathic approach without presurgical orthodontic treatment for skeletal class III dentofacial deformity. Annals of plastic surgery. 2015; 74(3):333-41. DOI:10.1097/ sap.0b013e318295dcce.
- [10]Chen Y-W, Wang H-C, Gao L-H, Liu C, Jiang Y-X, Qu H, et al. Osteoclastogenesis in local alveolar bone in early decortication-facilitated orthodontic tooth movement. PloS one. 2016; 11(4). DOI:10.1371/journal.pone.0153937.
- [11]Gandedkar NH, Chng CK, Tan W. Surgery-first orthognathic approach case series: Salient features and guidelines. Journal of orthodontic science. 2016; 5(1):35. DOI:10.4103/2278-0203.176657.
- [12] Huang C, Chen Y-R. Orthodontic principles and guidelines for the surgery-first approach to orthognathic surgery. International journal of oral and maxillofacial surgery. 2015; 44(12):1457-62. DOI:10.1016/j.ijom.2015.05.023.

- [13]Strohl AM, Vitkus L. Surgical orthodontics. Current opinion in otolaryngology & head and neck surgery. 2017; 25(4):332-6. DOI:10.1097/ moo.000000000000371.
- [14]Park K-R, Kim SY, Park H-S, Jung Y-S. Surgery-first approach on patients with temporomandibular joint disease by intraoral vertical ramus osteotomy. Oral surgery, oral medicine, oral pathology and oral radiology. 2013; 116(6):e429-e36. DOI:10.1016/j.0000.2011.11.038.
- [15]Peiro-Guijarro MA, Guijarro-Martinez R, Hernandez-Alfaro F. Surgery first in orthognathic surgery: a systematic review of the literature. American Journal of Orthodontics and Dentofacial Orthopedics. 2016; 149(4):448-62. DOI:10.1016/j. ajodo.2015.09.022.
- [16] Mahmood HT, Ahmed M, Fida M, Kamal AT, Fatima F. Concepts, protocol, variations and current trends in surgery first orthognathic approach: a literature review. Dental press journal of orthodontics. 2018; 23(3):36. e1-. e6. DOI:10.1590/2177-6709.23.3.36.e1-6.onl.
- [17] Sharma VK, Yadav K, Tandon P. An overview of surgery-first approach: recent advances in orthognathic surgery. Journal of orthodontic science. 2015; 4(1):9. DOI:10.4103/2278-0203.149609.
- [18] Kim J-W, Lee N-K, Yun P-Y, Moon S-W, Kim Y-K. Postsurgical stability after mandibular setback surgery with minimal orthodontic preparation following upper premolar extraction. Journal of Oral and Maxillofacial Surgery. 2013; 71(11):1968. e1-. e11. DOI:10.1016/j.joms.2013.07.004.
- [19] Joh B, Bayome M, Park JH, Park JU, Kim Y, Kook Y-A. Evaluation of minimal versus conventional presurgical orthodontics in skeletal class III patients treated with two-jaw surgery. Journal of Oral and Maxillofacial Surgery. 2013; 71(10):1733-41. DOI:10.1016/j.joms.2013.06.191.
- [20] Zhou Y, Li Z, Wang X, Zou B, Zhou Y. Progressive changes in patients with skeletal class III malocclusion treated by 2-jaw surgery with minimal and conventional presurgical orthodontics: a comparative study. American Journal of Orthodontics and Dentofacial Orthopedics. 2016; 149(2):244-52. DOI:10.1016/j.ajodo.2015.09.018.

- [21] Park H-M, Lee Y-K, Choi J-Y, Baek S-H. Maxillary incisor inclination of skeletal Class III patients treated with extraction of the upper first premolars and two-jaw surgery: conventional orthognathic surgery vs surgery-first approach. Angle Orthodontist. 2014; 84(4):720-9. DOI:10.2319/072113-529.1.
- [22] Wang T, Han JJ, Oh H-K, Park H-J, Jung S, Kook M-S. Comparison of orthodontics-first and surgery-first approach in positional changes of the condyle after mandibular setback surgery using three-dimensional analysis. Journal of Oral and Maxillofacial Surgery. 2016; 74(12):2487-96 DOI:10.1016/j.joms.2016.07.015.
- [23] Jeong WS, Choi JW, Lee JY, Kwon SM. Can a surgery-first orthognathic approach reduce the total treatment time? International journal of oral and maxillofacial surgery. 2017; 46(4):473-82 DOI:10.1016/j.ijom.2016.12.006.
- [24] Song H-S, Choi S-H, Cha J-Y, Lee K-J, Yu H-S. Comparison of changes in the transverse dental axis between patients with skeletal Class III malocclusion and facial asymmetry treated by orthognathic surgery with and without presurgical orthodontic treatment. The korean journal of orthodontics. 2017; 47(4):256-67. DOI:10.4041/ kjod.2017.47.4.256.
- [25] He X, He J, Yuan H, Chen W, Jiang H, Cheng J. Surgery-First and Orthodontic-First Approaches Produce Similar Patterns of Condylar Displacement and Remodeling in Patients With Skeletal Class III Malocclusion. Journal of Oral and Maxillofacial Surgery. 2019; 77(7):1446-56. DOI:10.1016/j. joms.2019.01.061.
- [26]Liao Y-F, Chiu Y-T, Huang C-S, Ko EW-C, Chen Y-R. Presurgical orthodontics versus no presurgical orthodontics: treatment outcome of surgical-orthodontic correction for skeletal class III open bite. Plastic and reconstructive surgery. 2010; 126(6):2074-83. DOI:10.1097/ prs.0b013e3181f52710.
- [27]Lee J, Kim Y-I, Hwang D-S, Kim KB, Park S-B. Effect of occlusal vertical dimension changes on postsurgical skeletal changes in a surgery-first approach for skeletal Class III deformities. American Journal of Orthodontics and Dentofacial

Orthopedics. 2014; 146(5):612-9. DOI:10.1016/j. ajodo.2014.07.024.

[28]Hernández-Alfaro F, Guijarro-Martínez R, Peiró-Guijarro MA. Surgery first in orthognathic surgery: what have we learned? A comprehensive workflow based on 45 consecutive cases. Journal of Oral and Maxillofacial Surgery. 2014; 72(2):376-90. DOI:10.1016/j.joms.2013.08.013. 10.1016/j. joms.2013.09.033.

*Please cite this paper as:* Mirhashemi AH, Akhoundi MS, Ghadirian H, Parhiz AR, Bahrami R,Samim M; Management of skeletal class III malocclusion by surgery-first approach: A case report. J Craniomax Res 2020; 7(3): 158-164

## J Craniomax Res 2020; 7(3): 158-164