



## Case Report

# “Surgery First Approach” - Skeletal Class II Correction Combined with Temporary Anchorage Device — Case Report

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### ABSTRACT

“Surgery First Approach” (SFA) is a growing trend that provides an immediate facial change. The SFA protocol utilizes the dentoalveolar compensations as an advantage to effect immediate facial changes, which in conjunction with the Regional Acceleratory Phenomenon enhances the tooth movement thereby reducing the total treatment duration. The post-surgical orthodontic phase is often complicated by rapid accelerated tooth movement producing a non-predictable nature of tooth movements. With the combined application of temporary anchorage devices these movements are made predictable in three dimensions. This case report illustrates the treatment of a skeletal Class II patient with a combination of the SFA protocol and TAD-aided orthodontic treatment. A 19-year-old female presented with proclined upper anteriors and retrusive lower jaw. Clinical examination revealed a severe lip incompetency, mandibular deficiency, Class II skeletal malocclusion, severe bimaxillary incisor proclination, severely crowded mandibular arch on a low mandibular plane angle. The SFA protocol involving BSSO advancement and genioplasty was performed, followed by an orthodontic phase involving TADs. The total treatment time was 14 months, following which excellent facial change and stable occlusion was achieved. A three year follow up is also presented.

**KEYWORDS** - Surgery First Approach, Temporary Anchorage Devices, Orthognathics, Rapid Acceleratory Phenomenon, Class II Skeletal Malocclusion, Case Report.

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## **INTRODUCTION**

“Surgery First Approach” (SFA) is a growing trend toward implementing a treatment plan that provides immediate facial change and has revolutionized the orthognathic approach<sup>[1,2]</sup> In “Surgery First” treatment protocols, the primary objective involves surgical correction of jaws using the dentoalveolar compensations to our advantage thereby, the presurgical orthodontic treatment phase is eliminated or reduced.<sup>[3,4,5]</sup> Since 1991, Brachvogel proposed this SFA approach as there prevails metamorphism in the orthognathic approach and promotes rapid improvement in facial esthetics, thereby, enhancing psychosocial benefits, and dramatically reducing the treatment time.<sup>[6]</sup>

The SFA approach decreases the treatment duration by increasing bone turnover resulting in the regional acceleratory phenomenon. The post-surgical orthodontics phase is often complicated because of the non-predictable nature of movements of the anchoring segments due to rapid accelerated tooth movement. The aid of Temporary anchorage devices (TADs) such as titanium miniscrews facilitates maintenance or alterations of arch length. Furthermore, it enables the predictable three-dimensional movement of the entire dentition in nongrowing patients.<sup>[7,8]</sup> This case report illustrates the treatment of a Skeletal Class II patient with the combination of Surgery first treatment protocol and TAD aided orthodontic treatment.

## **CASE REPORT**

### **DIAGNOSIS & TREATMENT PLAN**

A 19-year-old female presented with the chief complaint of proclined upper anteriors and retrusive lower jaw. Clinical examination revealed severe lip incompetency, mandibular deficiency, Class II skeletal malocclusion, severe bimaxillary incisor proclination, severely crowded mandibular arch on a low mandibular plane angle (Figs.1a, b). The upper dental midline was shifted 2mm to the right of the upper facial midline. Dentoalveolar cant was evident in the upper arch with the right upper quadrant more visible than the left on the smile. Moderately constricted lower arch presented lingually displaced lower first premolars and an accentuated curve of Spee. The lower facial-height deficiency along with 10mm overjet and the mild anterior deep bite was complicated by the incompetency of the lips. Soft tissue examination revealed short upper lip and everted lower lip displaying lip trap. Cephalometric analysis comparing the patient’s craniofacial morphology with norms for Indian adult females indicated a short face tendency and a high saddle angle, reduced SNB and SND values pointing towards mandibular deficiency caused by posterior positioning of the mandible in relation to the cranium (Tables 1 & 2). The maxilla was orthognathic with proclined upper and lower anteriors. The vertical and the sagittal skeletal problems, particularly the mandibular deficiency, indicated the need for orthognathic surgery.

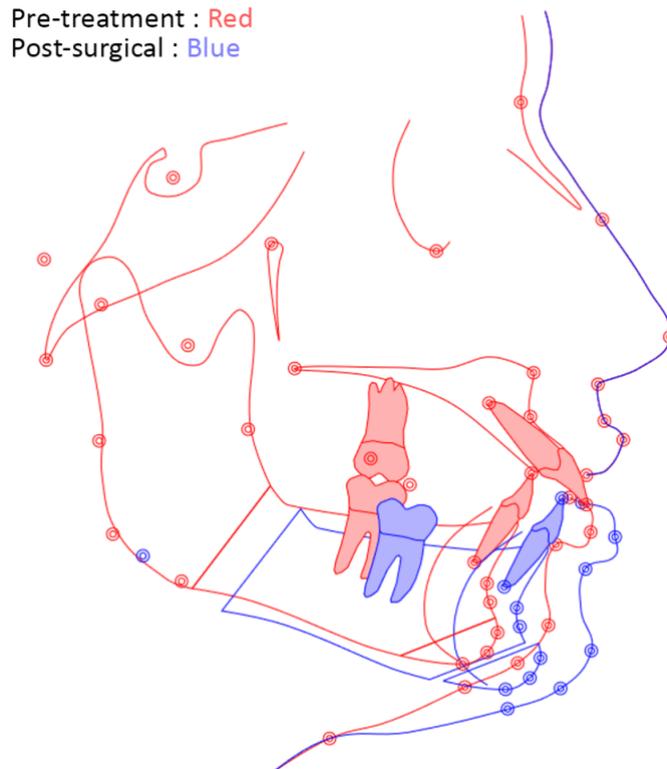


*Figure 1a : Pre-treatment diagnostic records comprising of extraoral, intraoral photographs and radiographic acquisitions.*



***Figure 1b: Pre-treatment models.***

Computerized cephalometric predictions were used for treatment planning (Fig.2). The cephalometric analysis (Table. 1 & 2) and Wits appraisal indicated the need for 7mm of mandibular advancement by bilateral sagittal split osteotomy and genioplasty of 4mm for the deficient chin. Though the upper incisors which were severely proclined indicated upper first premolar extractions, but the presence of a mild acute nasolabial angle and short upper lip proposed to consider upper second premolar extractions. Considering the severe lower anterior crowding, lower first premolars were opted for extraction. Since the plan was to subject the patient to the “Surgery First” protocol, the extractions could be performed during surgery avoiding the need for a separate procedure thereby, hastening the space closure.



**Figure 2: Two-dimensional prediction of expected skeletal and dental treatment changes.**

An alternative treatment plan of orthodontic camouflage was also given to the patient which would require extractions of upper first and lower second premolar extractions which in this case is not ideal due to the above-mentioned reasons. Additionally, extraction would cause the face to cave in making the profile more convex due to the underlying mandibular deficiency. Moreover, the patient and her family though initially hesitant were able to understand the benefits of the orthognathic approach after the procedure was explained to them in detail with the help of computer prediction as visual aids.

### **TREATMENT PROGRESS**

Two days before orthognathic surgery, .022" preadjusted brackets were bonded to all the teeth except the maxillary second premolars and mandibular first premolars. The bracket placements were modified keeping in mind the dentoalveolar cant in the upper arch. The maxillary and the mandible teeth were ligated passively to prevent any bracket loss during surgery. No wire was inserted as it would create mild to moderate movement in the teeth which would compromise the fit of the splint.

Model surgery was performed according to the cephalometric prediction (Fig 3). A surgical splint was fabricated to cover the occlusal surfaces and ensure optimal positioning and stabilization of the mandibular model. The surgical splint was modified with a ball end clasp to a removable mandibular occlusal splint, which was used to stabilize the jaw position and masticatory function for 6 weeks until the bone healing is completed.<sup>[9]</sup>

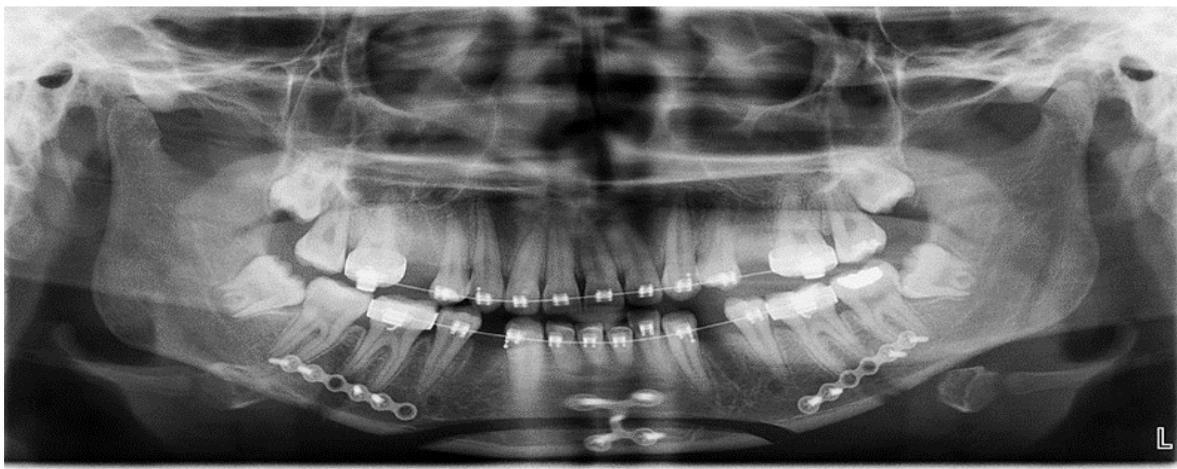
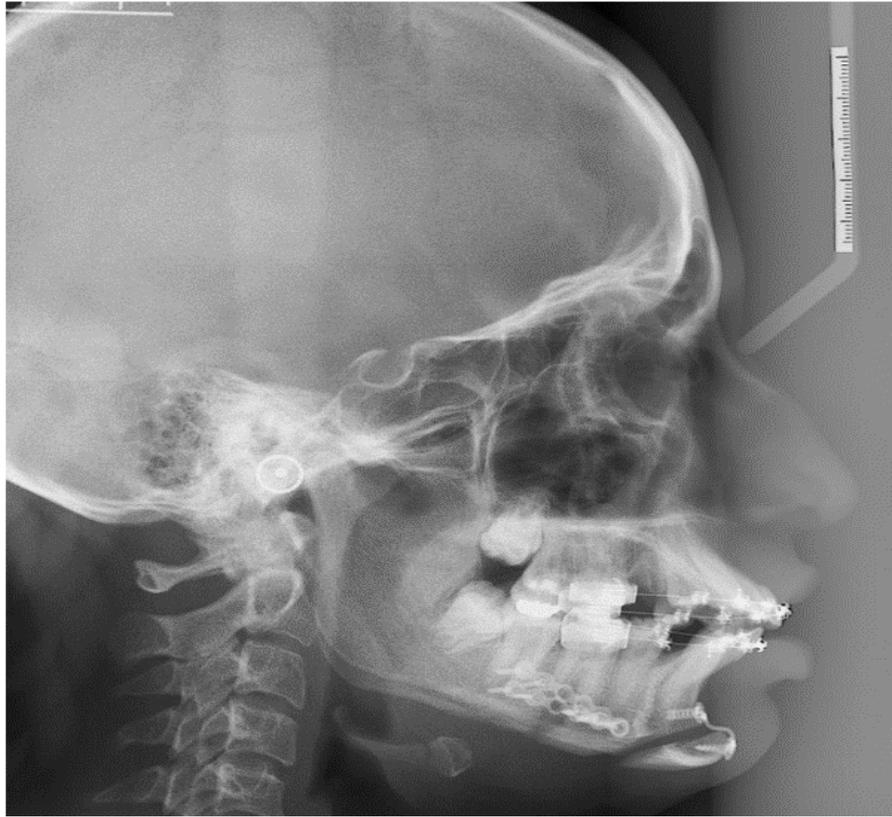


**Figure 3: Model surgery and Surgical splint fabrication with planned mandibular advancement.**

Extraction of upper second premolars and lower first premolars were performed on the table before the orthognathic procedure. Bilateral sagittal split ramus osteotomy was then performed to achieve the required mandibular advancement followed by genioplasty. Acrylic positioning splint was used to precisely position the mandible. Titanium plates were used for rigid internal fixation. Immediately after surgery, the patient demonstrated a Class I profile and a Class I occlusal relationship with bimaxillary protrusion owing to the compensated anteriors which were not addressed pre surgically.



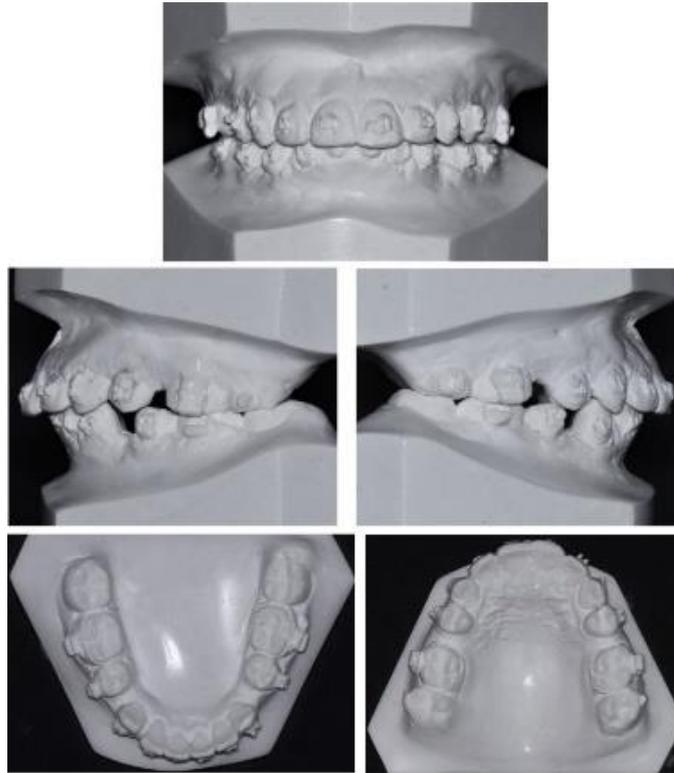
**Figure 4a: Initiation of leveling and alignment 10 days post-surgery.**



**Figure 4b. Immediate Postsurgical cephalogram and OPG.**

Ten days post-surgery 0.014 NiTi wire is inserted in the maxillary and mandibular arches, to promote hastened postsurgical orthodontic alignment. The orthodontic treatment progressed further with alignment, levelling, and space closure (Fig. 4a,b, 5a). Micro screws were placed between maxillary first and second molar during space closure. Temporary anchorage devices are mandatory in the upper arch as the transient disocclusion, caused due to the surgery often results in rotation and anchor loss in the maxillary first molars. Mandibular space closure was carried out using frictional mechanics along with class II elastics (Fig.5b). The coordination of the maxillary and mandibular arches was followed by finishing and detailing. Following a total treatment time of 14 months, all brackets were debonded, and the titanium miniscrews were removed under local anesthesia. A wraparound

retainer was placed in the maxillary arch, and a lingual retainer was bonded in the mandibular anterior segment (Figs.6a, b, c).



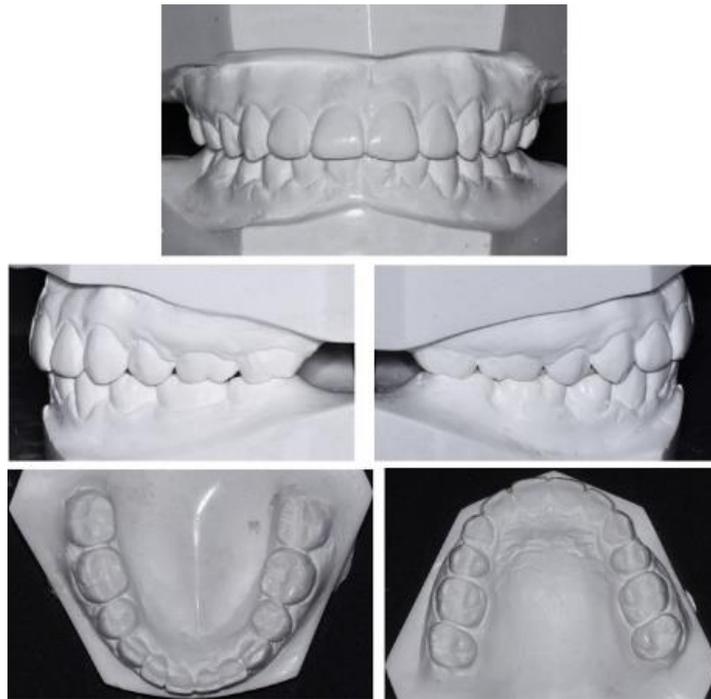
**Figure 5a : Pre-retraction models.**



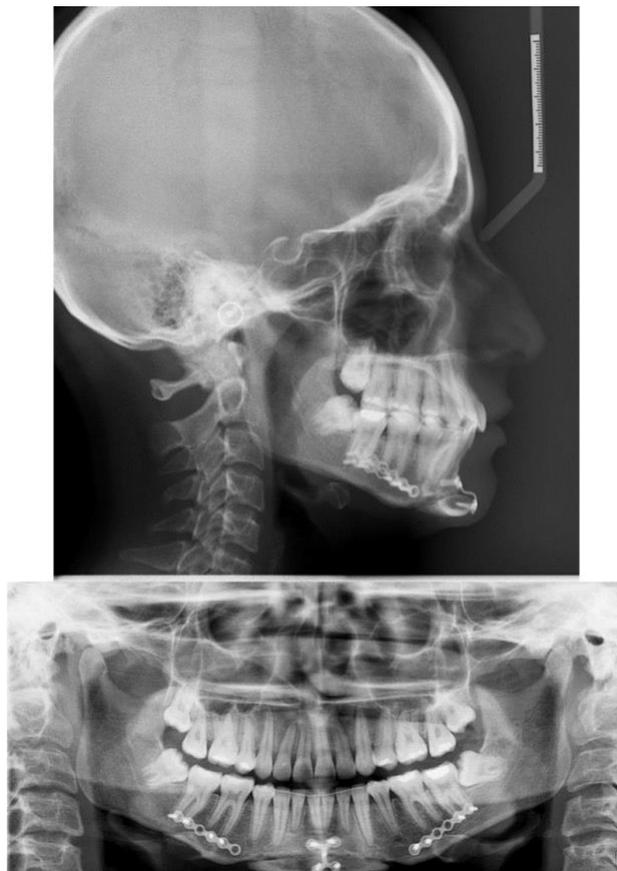
**Figure 5b : Initiation of retraction in maxillary and mandibular arches. Retraction in upper arch was supplemented with micro screw anchorage.**



Figure 6a: Post-treatment results verified after 14 months.



**Fig 6b: Post-treatment models.**



**Figure 6c. Post treatment cephalogram and OPG.**

## TREATMENT RESULTS

Post-treatment records showed improved facial balance, with a symmetrical chin and enhanced lip posture (Fig. 6). Class I canine and molar relationships were achieved, along with a levelled maxillary and mandibular occlusal plane and ideal overjet and overbite.

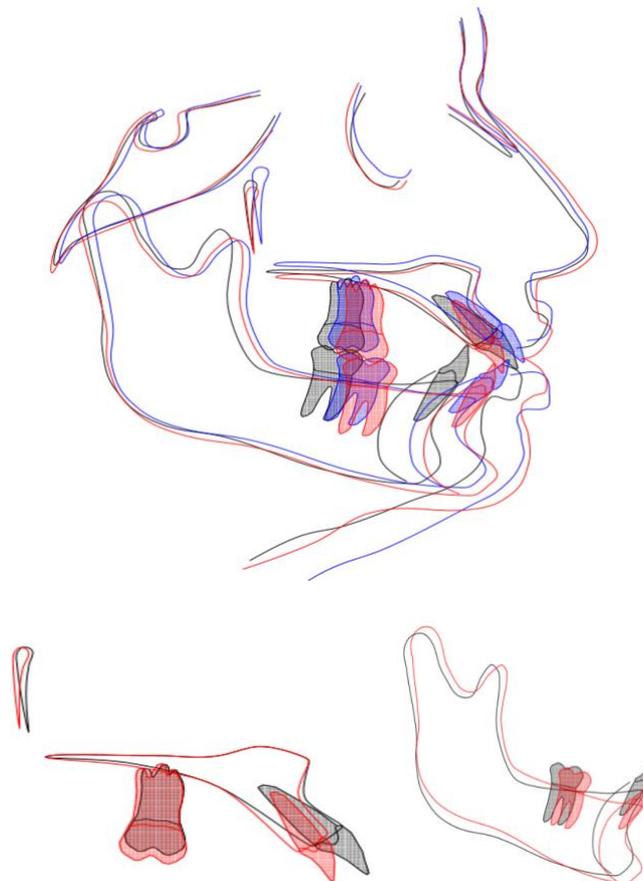
Analysis of the cephalometric data (Tables 1 & 2) revealed a proportional improvement at skeletal, dental and soft tissue levels at every stage from pre-treatment to post-treatment. Superimposition of pre- and post-treatment cephalometric tracings confirmed the improvement in mandibular positioning and lower-lip posture after the mandibular advancement surgery and genioplasty (Fig.7). Further, it has been proved that the computerized prediction model (Fig. 2) was also helpful in predicting an almost accurate outcome when compared to the actual end result (Figs. 6b & 7). Though multiple cases will have to be examined to verify its efficacy for general use in the future.

Three years post-treatment records obtained showed stable results in soft tissue, skeletal correction, and occlusion (Fig. 8).

Pre-treatment: Black

Post-surgery: Blue

Post-treatment: Red



**Figure 7: Superimposition of pretreatment, post-surgical and post-treatment tracings.**



**Figure 8: Treatment results verified post-three year period demonstrating excellent stability.**

**Table 1: Analysis of BSSO & Orthodontic Treatment**

VARIABLE	PRE-TREATMENT	POST-SURGICAL	CHANGE (Pre to Post Surgical)	POST-TREATMENT	CHANGE (Pre to Post Treatment)	NORMAL
<b>Skeletal &amp; Soft Tissue</b>						
SNA	82°	82°	0°	81°	-1°	82°± 3
SNB	74°	78°	+4°	78°	+4°	79°± 3
ANB	8°	4°	-4°	3°	-5°	3°± 1
SN to maxillary plane	14°	14°	0°	14°	0°	8°±3
Wit's appraisal	7 mm	-0.6 mm	-7.6mm	+1 mm	-6mm	0 mm
MM angle	19°	20°	+1°	20°	+1°	27°± 5
Upper anterior face height	49 mm	49 mm	0 mm	49 mm	0 mm	
Lower anterior face height	54 mm	55 mm	+1 mm	57 mm	+3 mm	
Face height ratio	52.4%	52.8%	+0.4 %	53.7%	+1.3 %	55%
Nasolabial Angle	81°	84°	+3°	101°	+20°	90-110°
Lower Lip to Ricketts E-plane	+1mm	+1.7mm	+0.7mm	-2mm	-3mm	-2 mm

<b>Dental</b>						
Upper incisor to maxillary plane angle	129°	129°	0°	112°	-17°	108°± 5
Lower incisor to mandibular plane angle	112°	114°	+2°	96°	-16°	92°± 5
Interincisal angle	105°	101°	-4°	130°	+25°	133°± 10
Lower incisor to Apo line	+5 mm	+3 mm	-2 mm	+2 mm	-3 mm	0-2mm

**Table 2: Additional Analysis of Changes in Mandible**

VARIABLE	PRE-TREATMENT	POST-SURGICAL	CHANGE (Pre to Post Surgical)	POST-TREATMENT	CHANGE (Pre to Post Treatment)	NORMAL
SND*	72°	76°	+4°	76°	+4°	76°
N-A-Pg**	12°	2°	-10°	2°	-10°	2.27° ± 2.80°
B-Pg**	4.5 mm	8mm	+3.5mm	8mm	+3.5mm	5.47 ± 4.05
Go – Me***	69 mm	77mm	+8mm	77mm	+8mm	71 ± 5
N-S-Ar***	135°	135°	0°	135°	0°	123° ± 5

Sources for Normal values:

\* Steiner CC - Cephalometrics for you and me. Am J Orthod 1953;39:729-755

\*\* Yadav AO et al - Cephalometric norms for Central Indian population using Burstone and Legan analysis- Indian J Dent Res 2011;22:28-33

\*\*\* Bjork A – “The Face in Profile” - Berlingska Boktryckeriet, Lund;1947D point – Center of bony symphysis

Pg – Pogonion, Me – Menton, Go-Gonion

## DISCUSSION

“Surgery first” technique is a complicated procedure that requires a collaborated team approach consisting of an experienced orthodontist and oral surgeon. Skeletal relapse caused by occlusal instability is partially overcome with rigid fixation.<sup>[7]</sup> Hence, rigid fixation of the bony segments is the key to broad implementation of the “surgery first” approach. With the rigid fixation and class II elastics, the disocclusion caused during surgery no longer limits the potential surgical correction or orthodontic tooth movement. In this patient, cephalometric prediction indicated the need for an average of 7mm of mandibular advancement to obtain favourable esthetic results. This surgical movement resulted in Class I skeletal malocclusion.

The “surgery first” treatment has several advantages, including a notable reduction in treatment time. Wilcko and colleagues reported that corticotomy could enhance tooth movement by increasing bone turnover and decreasing bone density.<sup>[10]</sup> Similarly, bone turnover after orthognathic surgery significantly accelerates orthodontic tooth movement over the first three to four months due to the regional accelerated phenomenon, as in accelerated osteogenic orthodontic treatment.<sup>[11,12]</sup> Another advantage lies in the normalized relationship between the jaws

and orofacial muscles, which contributes to effective tooth movement and further expedites the postsurgical orthodontic phase.<sup>[13]</sup> If a surgical error or skeletal relapse occurs, compensation can be made with orthodontic mechanics. In conventional treatment, because the decompensation is completed before surgery, it is difficult or impossible to recover from a surgical error during post-surgical orthodontic treatment. The post-surgical orthodontic movement does not interfere with compensatory biological responses. This phenomenon may also be a factor in reducing total treatment time.

On the other hand, the “surgery first” approach in class II skeletal malocclusion also has some disadvantages that must be taken into consideration. Initial worsening of the profile is observed in the correction of skeletal class II profile in Surgery first approach. This occurs because the optimal skeletal corrections are achieved after the surgery but the persisting compensated incisors result in the transient worsening of profile.

Secondly, the ITM (intended transitional malocclusion) created after the surgery results in upper molar anchor loss which has to be prevented by advocating the use of skeletal anchorage devices.

## **CONCLUSION**

With recent developments in cone-beam computed tomography, virtual model surgery, three-dimensional visualized setups, and computer-aided wafer fabrication,<sup>[14,15]</sup> “surgery first” techniques have become even more accurate and predictable. Although initial worsening of the profile is observed in correcting skeletal Class II profile using surgery first approach, it is corrected much faster and effectively by accelerated osteogenic orthodontic treatment due to RAP phenomenon. Moreover, Post-surgical orthodontic movement does not interfere with compensatory biological responses. We believe these advantages substantially outweigh any disadvantages, and more surgery first protocols in the correction of Skeletal Class II malocclusion may become a standard clinical option soon. Since “surgery first” protocol combined with TAD in Skeletal class II is a new concept in surgical orthodontic treatment, further studies in assessing the accuracy of treatment prediction and long-term stability will be needed.

## **SOURCE OF FUNDING**

Not applicable.

## **CONFLICT OF INTEREST**

The authors have no conflict of interests to declare.

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