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Surgery First Approach for Correcting a Skeletal Class II Malocclusion with Impinging Deep Bite

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Abstract
This case report illustrates a surgery-first treatment for surgical correction of Class II malocclusion. A 54-year-old female, presenting a chief complaint of deep bite and gum biting, came to seek for treatment. She had skeletal Class II and dental Class II malocclusion with 11 mm excessive overjet. Intraoral examination revealed large mandibular curve of Spee. Treatment was performed with a surgery-first approach, moving the dentition towards edge-to-edge bite, followed by extruding mandibular posterior teeth and normalizing the overjet and overbite. Finally, good interdigitation was achieved, as well as the improvement of masticatory function. The patient was satisfied with the facial profile.

Keywords
Surgery-first approach; Skeletal Class II malocclusion; Impinging bite

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CASE REPORT

Surgery First Approach for Correcting a Skeletal Class II Malocclusion with Impinging Deep Bite

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ABSTRACT

This case report illustrates a surgery-first treatment for surgical correction of Class II malocclusion. A 54-year-old female, presenting a chief complaint of deep bite and gum biting, came to seek for treatment. She had skeletal Class II and dental Class II malocclusion with 11 mm excessive overjet. Intraoral examination revealed large mandibular curve of Spee. Treatment was performed with a surgery-first approach, moving the dentition towards edge-to-edge bite, followed by extruding mandibular posterior teeth and normalizing the overjet and overbite. Finally, good interdigitation was achieved, as well as the improvement of masticatory function. The patient was satisfied with the facial profile. Taiwanese Journal of Orthodontics 2021;33(2):60–67

Keywords: Surgery-first approach; Skeletal Class II malocclusion; Impinging bite

INTRODUCTION

The dentofacial anomaly of skeletal Class II malocclusion is based on two components, excessive growth of the maxilla and deficient growth of the mandible. Surgical-orthodontic treatment is aimed to correct these jaw deformities; however, it still presents some challenges in both diagnosis and facial esthetics concerns. In traditional presurgical orthodontic phase, dental decompensation and removal of dental interference are planned. Chewing function might become compromised and there is a progressive deterioration of lateral profile preoperatively.

In 2009, Nagasaka1 presented surgery-first approach combining skeletal anchorage system for skeletal Class III malocclusion correction. Skeletal anchorage was emphasized to compensate surgical error or skeletal relapse. By this technique, patients might improve facial esthetics and occlusal function early in the treatment. Thus, swallowing and speech functions would largely improve right after the surgery.2 Among all the advantages, the most important benefit of surgery-first approach is efficient orthodontic tooth movement. It shortens the overall treatment time to 1 or 1.5 years.3 This was reported as the regional acceleratory phenomenon (RAP) in orthodontic treatment by Wilcko et al., in 2001.4 Tissue reactions including cellular activities and alveolar remodeling were accelerated during healing process. Lee5 also mentioned that porosity of cortical bone was increased during surgery, which led to decreasing resistance of tooth movement and increasing blood supply. Hence, bone turnover was facilitated. Consequently, biologically orthodontic tooth movement was more favorably performed after the surgery.

In this case report, we present a skeletal Class II malocclusion case with deep impinging bite and excessive overjet treated with surgery-first approach. Bilateral sagittal split osteotomies (BSSO) were performed for mandibular advancement and clockwise rotation. Post-operative orthodontics included curve of Spee relief, transverse dimension correction, and finishing and detailing.

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CASE REPORT

A 54-year-old female was complained of deep bite, gum biting and snoring. She had past medical history of depression under medication.

Clinical findings

Her frontal view revealed an asymmetric profile (Figure 1). Her left face was larger than the right face with chin slightly deviated to the right. The corner of mouth was drooped at rest position with deep mentolabial sulcus. Short lower facial height and large Sn-St to St-Me ratio was noted. No gummy smile was shown. In three-quarter view, normal infraorbital prominence was revealed. And in lateral view, we noticed her straight profile with acute nasolabial angle and prominent chin. Her dental manifestation presented Angle's Class II canine and molar relationships on both sides, with an excessive 11 mm overjet and 9 mm overbite. The upper dental midline was coincident to facial midline, while lower dental midline was deviated to her left by 2 mm. Both arch forms were tapered. She had five prostheses in the upper arch, and three metal crowns in the lower arch.

The panoramic radiograph showed intact bilateral condyle cortex (Figure 2). The lateral cephalometric radiographic analysis revealed a skeletal Class II malocclusion and low mandibular plane angle (SNA 82°, SNB 77°, ANB 5°, and SN-MP 32.5°) (Table 1). Her upper incisors were retroclined (U1-SN 100.5°), and lower incisors were proclined (L1-MP 102°).

Diagnosis

The patient had a skeletal Class II jaw relationship with low mandibular plane angle. Dental manifestation presented Angle's Class II malocclusion with retroclined maxillary incisors and proclined mandibular incisors. Deep overjet and impinging bite were noted. In soft tissue aspect, she had a straight profile with retrusive lower lip.

Treatment objective

(1) Leveling and alignment
(2) Establish normal overjet and overbite
(3) Finish in bilateral Class I canine and Class II molar relationship in orthodontic camouflage treatment; Class I molar relationship would be obtained in surgical-orthodontic treatment.
(4) Achieve solid inter-digitation and stable occlusion
(5) Improve facial profile

Figure 1. Pre-treatment facial and intraoral photographs.
Treatment plan

From the treatment diagnosis and objectives, together with patient's expectation, we provided two treatment options.

1. Orthodontic correction

Single arch extraction with bilateral maxillary maximum anchorage from miniscrews was proposed for maxillary anterior retraction. Selection of first premolar is a conventional option for maximizing anterior retraction. However, tooth 15 was chosen to be extracted, rather than tooth 14 due to extensive amalgam restoration. In order to compensate the curve of Spee, mandibular incisors would be proclined and intruded combined with relatively extrusion of the premolars. Finally, Class I canine and Class II molar relationship could be achieved.

2. Orthodontic treatment with orthognathic surgery

Non-extraction, surgery first, one-jaw orthognathic surgery was suggested. The surgery included BSSO for mandibular advancement followed by post-surgical orthodontic treatment and retention.

Treatment progress

The treatment options and benefits were explained thoroughly to the patient. She preferred orthodontics combined with orthognathic surgery. Before orthodontic treatment started, all the crowns were changed into interim prostheses. After full mouth banding and bonding, presurgical preparation was done including bite turbo placement over lower premolars to facilitate mandibular repositioning. Bilateral sagittal split osteotomies were performed for mandibular advancement and asymmetry correction. The mandible was advanced 6 mm by measuring at the mandibular incisal edge (Figure 3).

The total treatment duration was about 16 months. Post-surgical orthodontic treatment plan included: upper arch expansion and distalization, correct left side down occlusal plane canting, correct overbite and interdigitation. One month after the surgery, since there was only tripod occlusion, we used upper LH wire and lower 0.014-inch nickel-titanium arch wire to align the teeth and level curve of Spee. Thus, we asked the patient to wear vertical intermaxillary elastics. We changed wire sequentially to upper copper nickel-titanium wire and 0.016 stainless steel arch wire in the following month (Figure 4). Two lever arms in the upper arch were used for expansion. At the same time, maxillary arch wire was expanded with cross-elastics over the right side to enhance upper right arch expansion. TPA was also used to expand the upper arch. In the 6th month, we added upper right TAD for distalizing 1st quadrant with a sliding jig, and upper left TAD for canting correction. Finally, we extruded upper anterior teeth for esthetics and to achieve normal overbite when detailing. After finishing and

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Figure 2. Initial lateral cephalometric and panoramic radiographs.
detailing, full mouth fixed appliances were debonned with wraparound retainers delivery.

**Treatment result**

Posttreatment records showed favorable facial esthetics and occlusal results (Figure 5). Normal overbite and overjet with canine and molar Class I relationship were achieved. Upper and lower dental midlines were coincident. The patient was satisfied with her facial profile. Post-treatment panoramic radiograph showed good bone healing and acceptable root parallelism (Figure 6). From the initial and post-treatment superimposition (Figure 7), ANB angle was maintained due to mandibular clockwise rotation (Table 1). The mandibular plane angle was increased 6.5°, whereas the angle of mandibular incisors was maintained (L1-MP: 102°). The maxillary incisors were uprighted and extruded 2.5 mm, U1-SN changed from 100.5° to 96°. Final results showed balanced facial esthetics.

Snoring problem was solved after orthognathic surgery, according to the patient's report. The minimum axial area changed from 228 to 325 mm² (Figure 8), which means pharyngeal airway increased especially the area above the epiglottis.

**DISCUSSION**

For correcting skeletal Class II problem in adult, two different treatment modalities are camouflage orthodontic treatment by retracting maxillary incisors and uprighting mandibular incisors, and orthognathic surgery. According to her lateral profile and cephalograph, she had Class II jaw relationships with large dental overjet and prominent chin. Camouflage treatment with single arch extraction and mandibular incisors intrusion was proposed to her for correcting large dental overjet and overbite. The routine extraction pattern to facilitate anterior retraction was first premolars extraction. However, atypical extraction pattern was given when considering periodontal-endodontic problem, compromised tooth structure, impacted or ankylosed individual tooth. In this case, large restoration was noted on the distal-occlusal side of tooth 15. The chosen extraction pattern in the maxillary arch changed to second premolar on the
right side (tooth 15) and first premolar on the left side (tooth 24).

While considering maxillary anterior teeth retraction, soft tissue change should also be included. Relationship between anterior teeth retraction and upper lip retraction has been discussed as well as pre-treatment lip morphology and ethnicity. Several studies have evaluated the change of lip position in response to incisors movement. Patients with thin lips undergo more significant soft tissue change than those with thick lips, while white females had little change in lip thickness with incisors retraction when compared with the males. Overall, lip procumbancy improves after premolar extraction and anterior teeth retraction. The ratio of maxillary incisors retraction to upper lip retraction in Class II division I was reported to be 1.44:1–2.9:1 in Caucasians, whereas relatively large 1.5–1.75:1 in African Americans. In the study of Japanese, the ratio presented to be 2.22:1, which was similar to Caucasians. Furthermore, it was speculated that nasolabial angle would also be increased, with an average of 10.5° increase when maxillary incisors are retracted 6.7 mm. While in this case, dental compensation is indicated with 2 upper premolars extraction for maxillary anterior retraction. Lower incisors should be proclined, which is not favorable to this patient due to compromised periodontal condition. Further proclination of lower incisors might also result in severe gingival recession if no preliminary periodontal surgery planned. The patient denied additional teeth extraction during orthodontic treatment. Moreover, snoring was one of her issue. We believed that mandibular advancement treatment could increase her airway, also to increase her lower face height. The aging effect of deep mentolabial sulcus would be solved, too. Benefits and risks of surgery in each treatment options were well-explained to her.

In order to maintain the convexity of upper lip, to relieve the labiomental groove and to increase airway volume, surgical plan was proposed. Dramatic change of facial appearance may cause social difficulty at her age. Maxillary osteotomy was not indicated due to no infraorbital area dish-in and acceptable esthetics above the upper lip. Thus, upper occlusal plane canting could be corrected by pure orthodontic treatment. Therefore, one-jaw BSSO surgery was planned for mandibular advancement and overjet correction.

Traditionally, orthodontic-first surgery approach emphasized on the importance of leveling and alignment, eliminating dental interference, and arch coordination for decompensation. It was evident that maxillary anterior teeth retraction should be considered.
that only minor crowding and minor transverse discrepancy was observed in this patient. The guideline proposed in 2011 also showed that well-aligned to mild crowding, mild to flat curve of Spee and normal to mild compensation of incisors inclination were indications for surgery-first approach.\(^3\) With less than a molar width of transverse discrepancy on each side, arch coordination could also be achieved postoperatively. Moreover, in skeletal Class II patient with low mandibular plane angle, deep impinging bite and excessive curve of Spee, heavy occlusal force originated from strong muscle was expected. Deprogramming the muscle by orthognathic surgery could be accomplished by surgery-first approach. As Behrman et al.\(^1\) proposed, teeth would be settled into a better position by surrounding soft tissue after the surgery since musculature structures had been adopted to skeletal discrepancy for a long time. As a result, it was reported to substantially reduce total treatment time,\(^12\) which may be potentiated by regional acceleratory phenomenon.

When mandibular advancement was planned, lower anterior face height should be evaluated. In this case, low mandibular plane angle and strong chin were noted. Therefore, intentional clockwise rotation of the mandible to increase lower face height and decrease the chin prominent while advancing mandible should produce more esthetic result. In these short anterior face height and vertically overclosed deepbite patients, it is better to level the curve of Spee after mandibular advancement by adopting the mandibular “tripod” advancement method.\(^13,14\) By maintaining initial deep curve of Spee, we advanced the mandible to an edge-to-edge incisors contact, along with the bilateral most posterior teeth occluded, to form a tripod occlusion, which ensured to maximize lower anterior face height during orthognathic surgery. However, if curve of Spee was leveled presurgically, lower anterior face height would not be increased naturally and more bone grafting for vertical lengthening genioplasty is needed and the contour of the chin may not be as natural. As a consequence,
no attempt was done to level the curve of Spee before surgery. Although this forward movement and clockwise rotation of the mandible resulted in temporary buccal lateral open bite, it could be resolved by extruding mandibular premolars and molars for leveling curve of Spee in the post-surgical phase.

Post-surgical changes include mandible backward movement and counterclockwise rotation. Her pogonion moved backward 2 mm (Figure 9). Displacement of the condyles and change of muscle/soft tissue tension are suspected to be two of the main reasons for these changes. The muscle has been lengthened and stretched during BSSO due to mandible forward movement and clockwise rotation. However, the patient had low mandibular plane angle with heavy occlusal force from the beginning, indicating that her masticatory muscle strength and tone were relatively high. Furthermore, the relief of post-operative swelling over the condylar head and the use of intermaxillary elastics for premolars extrusion may also give rise to the alteration of condylar position. Therefore, overcorrection of mandible position during surgery was performed due to the aforementioned reasons.

CONCLUSION

This case showed favorable results of anterior deep bite correction by surgery-first approach followed by posterior teeth extrusion and transverse correction within short treatment time. The facial profile, occlusion, and oral function were concomitantly improved. Pleasing outcomes were achieved with patient’s psychosocial satisfaction.
Conflict of Interest Statement

The authors declare no conflicts of interest.

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