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Combine the Orthodontic-Orthognathic Surgical Correction on Class II Division 2 Malocclusion

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This Case Report is brought to you for free and open access by Taiwanese Journal of Orthodontics. It has been accepted for inclusion in Taiwanese Journal of Orthodontics by an authorized editor of Taiwanese Journal of Orthodontics.
This case report illustrates a combined orthodontic-orthognathic surgical treatment option for correction of Class II division 2 malocclusion. A 31-year-old female patient, presenting a chief complaint of gummy smile and backward position of anterior teeth, came to seek for treatment. She had skeletal Class II with hypodivergent facial type and mild asymmetric face. Intraoral examination revealed a severe deep bite with 13 mm overbite. The pre-surgical orthodontic treatment consisted of proclination of the maxillary incisors and increased in overjet to provide space for surgical advancement of mandible; the mandibular curve of Spee was partially leveled and maintained some parts of deep overbite. The surgeries included the 2-pieces LeFort I to torque upper anterior teeth further, bilateral sagittal split osteotomies and genioplasty. During surgery, the increased overjet has guided the body of mandible forward, and the remaining deep overbite created clockwise rotation of distal segment, moved pre-existing strong chin forward and downward to a proper position and also increased the lower facial height. The post-operative orthodontic treatment continued to correct the remaining deep bite and detail the results. The maintenance of a deep bite prior to surgical correction with optimal setback and/or vertical lengthening genioplasty could be the treatment strategies of the hypoplastic mandible with a strong chin. The treatment had successfully improved the smile arc, the masticatory functions and favorable dental alignment of the patient. The vertical control during the post-surgical tooth movement is an important factor to maintain the ideal results of surgical outcome. (Taiwanese Journal of Orthodontics. 29(4): 213-223, 2017)

Keywords: surgical orthodontics; Class II deep bite; Class II division 2 malocclusion; decreased lower facial height.

INTRODUCTION

Class II division 2 malocclusion is characterized by retroclination of the maxillary anterior teeth, resulting in normal or even obtuse nasolabial angle, deep overbite and deficient mandible, corresponding to decreased lower anterior facial height. Nevertheless, prominent chin can be examined in the anterior position of the chin itself. The
presentation of deep labiomentonal fold caused by the thin and curled lower lip positioned behind the upper lip, is a consequence of deep bite and prominence of effective chin projection. Several etiologic theories of this malocclusion have been discussed in previous studies. Peck et al had identified the generalized tooth-size reduction as an associated feature of the Class II division 2 malocclusion, which reasonably came with retroclination of the maxillary incisors and deep overbite. The postero-vertical mandibular growth and basal bone growth at symphysis persisted simultaneously even though the forward growth of the dentoalveolar segment of the mandible would be restrained by the deep overbite. Thus, they illustrated one possible pathway caused by a pattern of small teeth in well-developed jaws which leading to the ontogenetic expression of the Class II division 2 deep bite phenotype. The local genetic factors could also be hypothesized as a crucial role in the etiology of this type of malocclusion. Lapatki et al provided the evidence that the individuals with Class II division 2 malocclusion have significantly higher resting lip pressure on the maxillary central incisors than those with Class I malocclusion to support this theory. They also discussed about the high lip line feature being a factor related to elevated resting lip pressure; in other words, lower-lip pressure is generally higher than the upper one. This interrelationship could change the area of equilibrium of maxillary incisors especially incisal third area into relatively lingual position, resulting in severe retroclined maxillary incisors in Class II division 2 malocclusion.

The transformation of Class II division 2 into division 1 by proclination of maxillary incisors could be the strategy to correct a Class II division 2 malocclusion. The subsequent overjet reduction might be reevaluated to correct by bicuspid extraction or whole maxillary arch distalization. Generally, a non-extraction approach was recommended, due to some specific morphologic characteristics including retroclined incisors, reduced tooth size in well-developed jaw size, extremely deep bite, and short facial height with strong chin. Furthermore, the orthodontic therapy usually corrects the deep bite by extrusion of posterior teeth, intrusion of lower incisors, and clockwise rotation of the mandible due to the deep overbite and brachycephalic facial pattern. A combined orthodontic and surgical approach is often necessary for adult patients with skeletal Class II relationship to obtain an efficient treatment outcome with good dentition, optimal function and harmonious facial esthetic. The surgical decision for Angle’s Class II malocclusion with a deep bite configuration usually confuses the dentists, especially in individuals with deficient mandible. Would the mandible relocate forward after overbite correction? Would the chin move forward beyond the ideal esthetic line after correction of the Class II malocclusion and skeletal relationship? Would the correction be stable? This case report illustrates a treatment option for correcting this malocclusion and facial type.

CASE REPORT

A 31-year-old woman complained about her shark-like smile, which came from her gummy smile along with significantly retroclined maxillary incisors, sought for orthodontic treatment. The patient was in good general health and had no history of major systemic disease. The patient had convex facial profile with mild asymmetric face. Her chin deviated to the left side together with left-sided upward lip commissure cant. Her lip incompetence and muscle strain were not presented. However, her upper incisor display at rest was 7 mm which was quite excessive. She could control her posed smile well. However, her gum exposure at spontaneous smile exceeded 7 mm. The retrusive position of the maxillary and mandibular anterior teeth contributed to unaesthetic retrusive lip posture together with deep labiomentonal fold.
Diagnosis

Intraorally, unilateral Class II molar and canine relationships on the left side were demonstrated. The overbite was extremely excessive of 13 mm. According to her facial midline, upper dental midline was 1 mm shift to the right side, while lower was 1 mm shift to the left. The maxillary arch was asymmetric square-shaped. Left maxillary lateral incisor was undersized. The mandibular arch was in asymmetric U-shaped and had mild crowding in the incisor and premolar segments. The Bolton’s analysis revealed anterior ratio was higher than norm (Figure 1).

Lateral cephalometric analysis showed both maxilla and mandible had normal anteroposterior dimension with an ANB angle of 6° and a brachycephalic facial pattern, as shown in SN-MP angle of 24°, and UFH/LFH ratio of 47/53 (Table 1, Figure 2). All parameters in dental part were not in normal ranges, represented that both upper and lower incisors were retroclined and retrusive (Table 1). The postero-anterior cephalometric examination showed left-sided upward of occlusal plane cant and 1.5 mm of chin deviation to her left side.

According to all the findings and analysis, the patient had a skeletal Class II with hypodivergent facial type, and dental Classification II division 2 malocclusion.

APPENDIX

Part I: Figure appendix

Figure 1. Pre-treatment facial and intraoral photographs showing typical characteristics of Class II division 2 malocclusion.
Table 1. The comparison of cephalometric analysis between initiation and completion of treatment.

<table>
<thead>
<tr>
<th></th>
<th>Norm</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (°)</td>
<td>79.8–83.2</td>
<td>83.0</td>
<td>80.0</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>75.7–78.7</td>
<td>77.0</td>
<td>78.5</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>3.2–5.0</td>
<td>6.0</td>
<td>1.5</td>
</tr>
<tr>
<td>SN-MP (°)</td>
<td>33.8–38.4</td>
<td>24.0</td>
<td>31.0</td>
</tr>
<tr>
<td>UFH/LFH (%)</td>
<td>45/55</td>
<td>47/53</td>
<td>45/55</td>
</tr>
<tr>
<td>U1-NA (mm)</td>
<td>4.3–8.1</td>
<td>-3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>U1-SN (°)</td>
<td>103.85–108.75</td>
<td>76.0</td>
<td>99.0</td>
</tr>
<tr>
<td>L1-NB (mm)</td>
<td>5.4–10.2</td>
<td>-1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>L1-MP (°)</td>
<td>93.4–99.2</td>
<td>84.0</td>
<td>92.5</td>
</tr>
<tr>
<td>E-LINE : Upper</td>
<td>0.7–3.1</td>
<td>-2.0</td>
<td>-3.5</td>
</tr>
<tr>
<td>E-LINE : Lower</td>
<td>0.2–3.4</td>
<td>-3.0</td>
<td>-6.5</td>
</tr>
</tbody>
</table>

Figure 2. Pre-treatment panoramic and cephalometric radiographs with cephalometric tracing demonstrating Class II skeletal relation with hypodivergent facial pattern, and the severe retroclination of maxillary incisors.
Correction of Class II/2 Malocclusion

Treatment objectives
The aims of treatment for this patient were to: (1) enhance the esthetic appearance of her smile by proclination of the maxillary incisors, and to reduce her excess gingival display; (2) obtain functional and healthy dental occlusion; (3) improve vertical facial proportion and chin esthetics.

Treatment alternatives
The following treatment options were considered and well explained to the patient.
1. Orthodontic treatment correction
The non-extraction treatment collaborated with maximum anchorage from bone screws in bilateral sides of maxillary arch. The maxillary incisors were proclined, then retracted and intruded by the anchorage from bone screws in order to achieve dental Class I relationship with proper overbite and overjet.

The limitations of conventional orthodontic treatment were discussed with the patient including the correction of severe retroclined maxillary incisors teeth of about 30-degree out of normal range, extreme deep overbite (cover bite) of 13 mm, and large unaesthetic gummy smile. The esthetic improvement of her smile would not be adequate by the limitation of tooth movement in conventional orthodontic approach.

2. Orthodontic combined with orthognathic surgery
The pre-surgical orthodontic treatment consisted of proclination of the maxillary incisors, increased in overjet, which further strengthened the surgical advancement of the mandible. Meanwhile, the occlusal lines in both arches were partially leveled to decrease the curve of Spee and correct the occlusal plane cant. Some parts of deep overbite were still remained.

The 2-jaw orthognathic surgery with genioplasty was combined with orthodontic treatment in order to accomplish Class I skeletal and dental relationship, straighten facial profile, and also reduce labiometal fold. Moreover, the surgical approach can increase the capacity of treatment by eliminating the limitations of the conventional orthodontic treatment, which had been previously discussed. The surgical correction included 2-pieces LeFort I with anterior segment osteotomy, and bilateral sagittal split advancement osteotomies with vertical lengthening genioplasty. The large overjet created by labial crown torque of upper front teeth would guide the body of mandible moving forward. The remaining deep overbite and curve of Spee from pre-surgical phase could open the jaw by clockwise rotation during mandibular advancement. There were several advantages of this strategy: correction of retrognathic mandible while keep chin point in the proper position, and increase of anterior facial height.

Treatment progress
The treatment options were well explained and discussed thoroughly with patient. She preferred combined orthodontic and orthognathic surgical correction. The treatment began by pre-operative orthodontic treatment with sequential bonding of .022 x .028-in brackets, started from maxillary arch. After the maxillary dental arch was leveled, the maxillary incisors were intruded and proclined by several procedures. To elucidate this, the .016 x .022-in stainless steel utility intrusion arch was first used to open the cover bite until the mandibular arch could be completely bonded with .022 x .028-in brackets. Two mini screws (1.5 mm in diameter) were placed at higher position in the inter-radicular spaces at maxillary anterior region. The maxillary and mandibular incisors were intruded and proclined by using bimaxillary utility arches. Later the .016 x .016-in stainless steel continuous arch wires collaborated with bilateral intrusive cantilever arms were also applied and directed force to the mini screws. The mandibular dental arch was incompletely leveled, leaving some curve of Spee uncorrected. As part of the preoperative orthodontic preparation, a 1.5 mm
Figure 3. Pre-operative facial and intraoral photographs.

Figure 4. Pre-operative panoramic and cephalometric radiographs with cephalometric tracing.
spaces were created distal to each maxillary lateral incisor (Figure 3, Figure 4).

The maxillary 2-pieces LeFort I included the anterior segmental osteotomy with lingual root torque. The maxillary arch was impacted with raw and yaw correction. The mandibular arch was done by bilateral advancement osteotomy, produced clockwise rotation of the distal segment in order to reduce the deep overbite, and increase the lower vertical facial height. The genioplasty with vertical lengthening was performed to increase the vertical chin height and reduce the labiomento fold. The bony segments were set in the position by using the double occlusal splints technique, and fixed by rigid internal fixation.

At one-month post-operative follow up appointment, the overall results of soft tissue and facial profile were good. However, some deep overbite persisted. Therefore, another 8-month post-operative orthodontic treatment was aimed at reducing the overbite, closing the remaining spaces, and coordinating the dental midline.

**Treatment results**

In terms of soft tissue and facial appearance, the following changes could be achieved, including the straight facial profile, harmonized facial proportion, and correlated facial midline. Furthermore, gingival exposure on smiling was reduced, the bilateral excess buccal corridors were improved, and ideal display of the maxillary anterior teeth with patient’s smiling was achieved to enhance more pleasant appearance (Figure 5).

Intraorally, Class I canine and molar relationships was achieved with good-interdigitated occlusion, optimal

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**Figure 5.** Post-treatment facial and intraoral photographs.
overbite, overjet, and curve of Spee. Bimaxillary dental arches were in symmetric U-shaped and well-coordinated with each other.

The post-treatment cephalometric analysis and the superimposed cephalometric tracing demonstrated significant improvement in the skeletal measurements after treatment (Figure 6). In addition, significant intrusion and proper proclination of the maxillary incisors were established. There was no significant change in vertical dimension of both maxillary and mandibular molars. The maxillary molars were more upright after treatment. The panoramic radiograph showed good roots parallelism, and significant improvement of the chin axis which was coordinated with clinical facial midline after treatment.

**DISCUSSIONS**

The morphological and dental characteristics of Class II division 2 malocclusion were typical and unique. When compared with Class II division 1 malocclusion, the facial appearances of division 2 group had shorter lower anterior facial height, acute gonial and mandibular angle.
The orbicularis oris and mentalis muscles are usually hyperactive. The chin prominence would be accentuated when combined with the reduced vertical facial height. The hypoplastic mandible with a strong chin was such an esthetic challenge. Once the bimaxillary occlusal lines were completely leveled in the pre-operative treatment phase, the mandible would move straight forward during surgery along the occlusal plane. As a consequence, esthetic problems were raised by forward the pre-existing prominent chin point beyond the ideal anteroposterior position. Therefore, as maintaining some curve of Spee in the mandibular arch prior to surgery, the mandible could be advanced forward and downward to increase the lower facial height. The forward of the chin prominence would be less by directing the mandible with some vertical vector. This advancement with clockwise rotation, resulting in temporary lateral open bite at the buccal segments. In the post-surgical phase, the curve of Spee would be leveled by extrusion of premolars and molars. The extrusion of the teeth helped to maintain the lower vertical facial height and chin esthetics.

The deep labiomental fold in Class II division 2 was also another esthetic problem. The variations of mandibular jaw growth rotation had been explained by Björk and Skieller in their longitudinal growth study series. The hypothesis was that the rotational growth of the mandible would be resulted from the condylar growth pattern. Forward mandibular rotation in Class II division 2 malocclusion was responsible for many of the discrepancy’s distinctive traits, such as strong chin with deep labiomental fold, hypodivergent facial pattern and deep restrictive overbite. Peck et al had another theory that the generalized small-size teeth in maxillary arch would be associated with features of Class II division 2 malocclusion. The smaller size incisors in a well-developed maxillary jaw would cause retroclination of front teeth. The forward growth in the dentoalveolar part of mandible would be restrained by the retroclined upper incisors and deep overbite. If the mandible persisted the forward growth, as the dentoalveolar part were restrained while the bony symphysis, chin and basal bone of mandible kept forward, the specific traits of this malocclusion occurred.

Several methods had been suggested by previous studies to manage the problems of deep labiomental fold. Rosen demonstrated in his study that the sagittal movement with vertical lengthening genioplasty did not only correct vertical facial proportion, but also harmonized the pre-existing deep fold. Therefore, in this case report, the chin segment was vertically repositioned and stabilized by using interposition autogenous bone graft, which was harvested from the medial surface of the mandible during a sagittal split ramus osteotomy procedure.

When compared the lateral facial profile between post-operative and post-treatment time points on this patient, the chin became more prominent at completion of treatment (Figure 8). The overall superimposition of lateral cephalometric radiographs indicated some loss in vertical dimension. The regional superimposition demonstrated that the genioplasty contour was almost not changed, corresponding with Kim et al in their long term observation of the stability in vertical lengthening genioplasty. On the other hand, the regional superimposition revealed intrusion of mandibular incisors in the post-operative orthodontic treatment phase (Figure 9). We expected the remaining curve of Spee could be corrected totally by extrusion of posterior teeth. However, some mandibular incisors intrusion occurred due to strong masticatory force, that induce counterclockwise rotation of mandible and vertical dimension loss.

**CONCLUSION**

The maintenance of a deep bite and curve of Spee prior to surgical correction could increase the facial height during mandible advancement. With optimal setback and/or vertical lengthening genioplasty, the deep mentolabial
Figure 7. Superimposition of lateral cephalometric tracings. Black line, before treatment; red line, after treatment.

Figure 8. Lateral facial profile of post-operative versus post-treatment showing chin became more prominent during this time interval.

Figure 9. Superimposition of lateral cephalometric tracings. Blue line, post-operative tracing; red line, completion of treatment.
fold could be reduced significantly in patients with typical Class II division 2 malocclusion. The treatment had successfully enhanced the smile line, the masticatory function and favorable dental alignment of the patient. However, vertical control in the post-surgical tooth movement is an important factor to maintain the ideal results of surgical outcome.

REFERENCES