Noninvasive Orthodontic Treatment for Class II Division 2 Adult Patient with 100% Deep Bite by Continuous Wire Mechanism

Yu-Hui Huang  
*Department of Orthodontics, Chi Mei Medical Center, Tainan City, Taiwan*

Chun-Liang Kuo  
*Department of Orthodontics, Chi Mei Medical Center, Tainan City, Taiwan; Center for General Education, Southern Taiwan University of Science and Technology*

I-Hua Liu  
*Department of Orthodontics, Chi Mei Medical Center, Tainan City, Taiwan*

Chun-Hsiu Yang  
*Department of Orthodontics, Chi Mei Medical Center, Tainan City, Taiwan*

Chung-Li Wang  
*Department of Orthodontics, Chi Mei Medical Center, Tainan City, Taiwan*

Follow this and additional works at: [https://www.tjo.org.tw/tjo](https://www.tjo.org.tw/tjo)

Part of the Orthodontics and Orthodontology Commons

**Recommended Citation**

Huang, Yu-Hui; Kuo, Chun-Liang; Liu, I-Hua; Yang, Chun-Hsiu; and Wang, Chung-Li (2021) "Noninvasive Orthodontic Treatment for Class II Division 2 Adult Patient with 100% Deep Bite by Continuous Wire Mechanism," *Taiwanese Journal of Orthodontics*: Vol. 33: Iss. 4, Article 6.  
DOI: 10.38209/2708-2636.1114  
Available at: [https://www.tjo.org.tw/tjo/vol33/iss4/6](https://www.tjo.org.tw/tjo/vol33/iss4/6)

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.
Noninvasive Orthodontic Treatment for Class II Division 2 Adult Patient with 100% Deep Bite by Continuous Wire Mechanism

Abstract
A characteristic of Class II Division 2 malocclusion is severe deep overbite and lingual inclination of the incisors. Deep overbite can be corrected by intrusion of anterior teeth, extrusion of posterior teeth, or a combination of both. Intrusion of the incisors should be the preferred treatment in nongrowing patients with anterior deep bites.

The patient is a 21-year-old female who had a skeletal Class II, hypodivergent facial pattern, Class II division 2 malocclusion, crowding dentition and traumatic 100% deep overbite. We extracted the two upper first premolars to relieve crowding, and the mandibular crowding was resolved by aligning the lower arch. Tip-Edge plus bracket were bonded on both arches. We corrected the deep overbite with an anchor bend and a reverse curve of Spee by proclining and intruding the upper and lower incisors. The posttreatment occlusion was significantly improved.

The treatment that frequently used to correct deep overbite includes invasive methods such as orthognathic surgery, or use temporary anchorage device (TAD) for adjunctive therapy. The most common noninvasive method is segmental intrusive arch, which was designed by Dr. Burstone. In our case, a continuous archwire with an anchor bend and a reverse curve of Spee that combine with cutting edge brackets can easily place an intrusive force on the incisors. Because of the cutting edge, when we place an intrusive force to the incisors, there are only point contact between the wire and the bracket without binding, and it can directly deliver an intrusive force to the incisors. This case showed successful treatment outcome with deep bite correction by the continuous wire mechanism.

Keywords
Class II Division 2 malocclusion; Deep overbite; Continuous wire mechanism

Creative Commons License
This work is licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 License.

This case report is available in Taiwanese Journal of Orthodontics: https://www.tjo.org.tw/tjo/vol33/iss4/6
Noninvasive Orthodontic Treatment for Class II Division 2 Adult Patient with 100% Deep Bite by Continuous Wire Mechanism

Yu-Hui Huang a, Chun-Liang Kuo a,b,*, I-Hua Liu a, Chun-Hsiu Yang a, Chung-Li Wang a

a Department of Orthodontics, Chi Mei Medical Center, Tainan, Taiwan
b Center for General Education, Southern Taiwan University of Science and Technology, Taiwan

ABSTRACT

A characteristic of Class II Division 2 malocclusion is severe deep overbite and lingual inclination of the incisors. Deep overbite can be corrected by intrusion of anterior teeth, extrusion of posterior teeth, or a combination of both. Intrusion of the incisors should be the preferred treatment in nongrowing patients with anterior deep bites.

The patient is a 21-year-old female who had a skeletal Class II, hypodivergent facial pattern, Class II division 2 malocclusion, crowding dentition and traumatic 100% deep overbite. We extracted the two upper first premolars to relieve crowding, and the mandibular crowding was resolved by aligning the lower arch. Tip-Edge plus bracket were bonded on both arches. We corrected the deep overbite with an anchor bend and a reverse curve of Spee by proclining and intruding the upper and lower incisors. The posttreatment occlusion was significantly improved.

The treatment that frequently used to correct deep overbite includes invasive methods such as orthognathic surgery, or use temporary anchorage device (TAD) for adjunctive therapy. The most common noninvasive method is segmental intrusive arch, which was designed by Dr. Burstone. In our case, a continuous archwire with an anchor bend and a reverse curve of Spee that combine with cutting edge brackets can easily place an intrusive force on the incisors. Because of the cutting edge, when we place an intrusive force to the incisors, there are only point contact between the wire and the bracket without binding, and it can directly deliver an intrusive force to the incisors. This case showed successful treatment outcome with deep bite correction by the continuous wire mechanism. Taiwanese Journal of Orthodontics 2021;33(4):198–207

Keywords: Class II Division 2 malocclusion; Deep overbite; Continuous wire mechanism; Tip-Edge plus

INTRODUCTION

The characteristics of Class II division 2 malocclusion are often severe deep bites and lingually inclined upper incisors. The mandibular incisors are also retroclined and crowded. Skeletal and dentoalveolar characteristics include shortened anterior lower facial height, low mandibular plane angle, parallel upper and lower occlusal planes, and deep curve of Spee.1–3 The palatal gingiva of the maxillary incisors can be subjected to trauma due to the deep overbite and the exaggerated curve of Spee.1 Deep impinging overbites can harm the maxillary palatal mucosa and can lead to the loss of maxillary incisors in extreme condition.2

The way to correct deep bite relies on the diagnosis and clear treatment objectives. There are many factors that should be considered, including esthetics, the occlusal plane, the vertical skeletal dimension, skeletal convexity, and the patient’s growth potential.3

Deep overbite can be corrected by genuine intrusion of the anterior teeth, extrusion of the posterior teeth, or a combination of both. Incisor intrusion is indicated in patients with a long anterior lower facial height, high mandibular plane, or with
gummy smile. In contrast, in a patient with a shortened anterior lower facial height, and a low mandibular plane angle, the deep overbite could be corrected and the facial esthetics would be improved by molar extrusion. Molar extrusion in growing patients will increase lower anterior facial height and allow favorable mandibular growth; the stability is fairly good. However, in adult patients, the mastication muscles and altered occlusion might move the extruded posterior teeth back to the original positions until equilibrium between the soft and hard tissues is obtained.

Our case is a 21-year-old female who had a skeletal Class II, hypodivergent facial pattern, Class II division 2 malocclusion, and 100% traumatic deep overbite. To open the bite and correct the torque were our treatment objectives. A continuous archwire with an anchor bend and a reverse curve of Spee (COS) combine with cutting edge brackets showed successful treatment effects.

CASE REPORT
Diagnosis

This patient, 21 years 4 months of age, came with chief complaint of crowded dentition. She was healthy with no specific medical problems. She had a convex facial profile with normal chin contour. In her frontal view, she had square and short face 3 mm gummy smile (Figure 1). Intraorally, a dental Class II division 2 malocclusion with 100% deep bite was noted. The maxillary and mandibular incisors were retroclined, resulting in mandibular incisor crowding and an increased interincisal angle. Occlusal view showed upper and lower square arch form with anterior crowding (Figures 2 and 3).

A panoramic radiograph showed that all the third molar were impacted (Figure 4). The cephalometric radiograph showed a Class II skeletal pattern (ANB angle, 6.4°) with a low mandibular plane angle (SN-MP, 29.2°) and retroclined maxillary and mandibular incisors (maxillary incisor to SN plane, 74.8°; mandibular incisor to mandibular plane, 87.9°) (Figure 5 and Table 1). The interincisal angle was obtuse (maxillary incisor to mandibular incisor angle, 168.1°).

Treatment objective and plan

The optimal treatment plan for this patient would be orthognathic surgery combined with orthodontic treatment to correct the sagittal skeletal discrepancies and hypodivergent facial pattern. Mandibular ramus surgery could rotate the mandible slightly forward and downward to correct the sagittal relation and increase lower anterior facial height. Although a surgical approach had better advantages in antero-posterior and vertical discrepancies over orthodontic treatment alone, the patient refused surgery.

Therefore, orthodontic camouflage treatment alternatives were considered. For this patient, we extracted upper bilateral first premolar to relieve crowding. In the lower arch, because the patient was a skeletal Class II relationship and with a short mandibular length, by non-extraction and leveling the crowding dentition, the lower incisors could be proclined to compensate the skeletal Class II relationship. Another alternative treatment approach would be the non-extraction treatment and use TADs for upper arch total distalization. However, considering the Class II molar relationship and the amount of crowding, the extraction therapy might be a better choice for the patient.

After discussion of all possible treatment alternatives, the definitive plan was listed as follows.

1. Camouflage treatment
2. Extraction of tooth 14.24 and impacted teeth 18.28.38
3. Full mouth bonding with fixed preadjusted bracket system
Stage I: Leveling and alignment
Stage II: 1. Close the extraction space
2. Correct the deep overbite
3. Correct upper and lower incisors retroclination
4. Midline correction
5. Achieve canine Class I and molar Class II relationship
Stage III: 1. Correction of torque and tip angles for each tooth individually
2. Detailing and finishing
Stage IV: Retention
1. Upper and lower wraparound retainer and fixed retainer

Treatment progress

At the beginning, Tip-edge Plus brackets (Tip-Edge®, TP Orthodontics, Inc., LaPorte, Indiana, USA) with 0.022*0.028-in slots were bonded on the maxillary arch and started to use 0.014-inch NiTi wires for leveling and alignment. After 2 months, the bite was gradually opening, and overjet increased. There had clearance to bond the lower dentition with Tip-edge Plus brackets (0.022*0.028-
in slots) and initiated leveling with 0.014-inch Niti wire (Figure 6).

After the arch form became rounded, the upper working wire change to 0.016-inch Australia wire with anchor bend mesial to the molar tube about 2 mm. The Class I elastic was used for canine retraction (Figure 7).

After both canines moved into proper position, upper wire changed to 0.016\*0.022-inch stainless-steel arch wire with COS; lower wire had reverse curve of Spee RCOS) to keep the bite opening. Used Class I and Class II elastic to retract upper anterior teeth (Figure 8).

In the 23 months, all the space was closed. During the finishing stage, final detailing of the occlusion was accomplished with bimaxillary 0.021\*0.025-inch stainless-steel arch wires for torque and angulation correction. And we placed anterior root torque (ART) spring for improving the upper incisors inclination (Figure 9).

After 33 months of orthodontic treatment, the brackets were removed. The 0.0175-inch tripleflex wire were bonded from canine to canine on the upper and lower arches. The wraparound removable retainers were also delivered to secure the stability of both arches.

Treatment result

The total treatment time was 33 months. Ideal overjet and overbite with Class I canine and Class II molar relationships were achieved, and the dental midline was in line with the facial midline (Figure 10). Her gummy smile was corrected. The square face was improved apparently with a clockwise rotation of the mandible (Figure 11).

The posttreatment panoramic radiograph showed acceptable root parallelism with no significant signs of bone or root resorption (Figure 12). The mandible rotated downward and backward, and there was a slight increase in the mandibular plan angle (SN-MP, 29.2°->29.8°). The maxillary incisor to SN angle increased a lot (U1-SN, 74.8°->91.7°), but was still retroclined. The mandibular incisors became proclined (L1-SN, 87.9°->109.9°). And the interincisal angle became normal (U1-L1, 168.1°->128.5°) (Figure 13 and Table 2). Superimposition of pre-treatment and posttreatment cephalometric tracings showed that the maxillary incisors and mandibular incisors were both protracted and intruded, and the molars were both extruded (Figure 14). The patient was satisfied with the functional and esthetic outcome.

DISCUSSION

A deep overbite can be corrected by genuine intrusion of the anterior teeth, extrusion of the posterior teeth, or a combination of both. Bite opening in growing patients with a hypodivergent pattern requires molar extrusion to allow clockwise rotation of the mandible. However, increasing the lower facial height by molar extrusion might not be stable in adults, because of muscle stretching.\(^1\) Incisor intrusion should be the preferred treatment in nongrowing patients with anterior deep bites caused by overeruption of the incisors. Because of the deep bite and supraeruption of the maxillary incisors, the gingival margins of the maxillary anterior teeth are malaligned.\(^3\) It was also proper to intrude the maxillary incisors because the patient had a gummy smile.

---

Table 1. Pretreatment cephalometric analysis.

<table>
<thead>
<tr>
<th>Skeletal analysis</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>82.5°</td>
<td>79.8–83.2</td>
</tr>
<tr>
<td>SNB</td>
<td>76.1°</td>
<td>75.7–78.7</td>
</tr>
<tr>
<td>ANB</td>
<td>6.4°</td>
<td>3.2–5.0</td>
</tr>
<tr>
<td>SN-MP</td>
<td>29.2°</td>
<td>33.8–38.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dental analysis</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 1 to NA mm</td>
<td>–4.6 mm</td>
<td>4.3–8.1</td>
</tr>
<tr>
<td>Upper 1 to SN'</td>
<td>74.8°</td>
<td>103.85–108.75</td>
</tr>
<tr>
<td>Lower 1 to NB mm</td>
<td>2.6 mm</td>
<td>5.4–10.2</td>
</tr>
<tr>
<td>Lower 1 to MP'</td>
<td>87.9°</td>
<td>93.4–99.2</td>
</tr>
<tr>
<td>Upper 1 to Lower 1</td>
<td>168.1°</td>
<td>121.3–135.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facial analysis</th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-line (mm)</td>
<td>Upper</td>
<td>2.1 mm</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>2.3 mm</td>
</tr>
</tbody>
</table>
Figure 6. Using 0.014-inch NiTi wires in both arches.

Figure 7. Maxillary 0.016-inch Australia archwire with anchor bend and bilateral Class I elastics for canine retraction.

Figure 8. The maxillary and mandibular 0.016 × 0.022-inch stainless-steel archwires were bented with COS and RCOS to keep the bite opening.

Figure 9. Bimaxillary 0.021 × 0.025-inch stainless-steel archwires with upper ART.

Figure 10. Posttreatment intraoral photograph.
The use of light constant forces enables the intrusion of teeth with minimal disruption of posterior anchor units. As the forces for intrusion are increased, more root resorption would occur but not necessarily relate to a greater rate of intrusive movement. The optimal force for intrusion is light and continuous. Intrusive arches are frequently used to correct the deep overbites. There are 2 basic designs of the intrusion arch: a relatively rigid anchorage unit for the teeth in the posterior segment, and an intrusion arch extending from an auxiliary tube to deliver intrusive force on the incisors (Figure 15A and B). The key to successful
intrusion is the control of force system. A particular consideration is to assure that the intrusive arch does not engage into the brackets of the incisors. Instead, the intrusion arch can be tied at any point along the incisor segment. When a continuous wire engages into the brackets, it generates binding force between the bracket and the wire, which would counteract the intrusive force (Figure 15C). On the other hand, intrusion is criticized for its complexity and time consuming. TADs were recently used as anchorage devices to intrude the incisors, it was reported to be effective for incisor intrusion with few side effects on other teeth (Figure 16). Furthermore, intrusion with TADs increases treatment efficiency with minimal
dependence on patient cooperation. However, proper surgical technique is required and the potential root damage would be considered. The possibility of swelling and mucosa irritation makes patients feel discomfort.

In our case, we used the Tip-Edge plus bracket, which is derived from Begg conception. It is known as its cutting edge design and low frictional resistance (Figure 17). The bracket removes opposite slot ends, and thus there is no biting force to deepen the bite. The wire and the bracket only have point contact, so it can provide 100% interbracket width, decrease the load deflection rate, and thus can achieve individual tooth movement. It could provide gentle force for effective distal movement and bite opening. This also provide maximum vertical and horizontal control. The force that generated from bended archwires could gently depress the anterior teeth and keep the molars upright. The amount of intrusive force applied on the anterior teeth is determined by the passive distance between the archwires and the anterior bracket slots (Figure 18-A, B). Because of the cutting edge design, there are only point contact between the wire and the bracket, it can directly deliver an intrusive force to the incisors without negating the binding force (Figure 18-C). In the upper arch, we placed an anchor bend in front of the molar tube, and used Class I elastic for canine retraction, the light force didn’t deepen the bite, and the anchor bend deliver an intrusive force on the incisor and extrusive force on the molar (Figure 19). In the lower arch, instead of...
anchor bend, we placed a continuous wire with RCOS, which may intrude the incisors, extrude the molars, and flare the incisors (Figure 19). Therefore, the bite was gradually opened simply by a continuous wire.

Another important consideration for patients with Class II division 2 malocclusion is the torque control. During the treatment, we had anchor bend to compensate the retraction force with Class II elastics. When using stainless-steel arch wires with COS, it provided a buccal crown torque. In the final stage, a nearly full size arch wire, 0.021*0.025-inch stainless-steel arch in 0.022*0.028-in slots, for torque correction. In addition, we used ART spring to provide a gentle and constant force for root correction.

The long-lasting challenge of deep overbite correction is the stability of tooth movements. The interincisal angle might play a critical role in the stability of deep overbite correction (Figure 20). Berg et al. suggested that the interincisal angle should be reduced to less than 140° after treatment for occlusal stability. Riedel et al. suggested that a large interincisal angle at the end of treatment was associated with relapse of deep overbite. Burzin and Nanda reported the long-term stability of intrusion in maxillary incisors. They indicated that an average of 2.3 mm incisor intrusion relapsed 0.15 mm insignificantly up to 2 years after treatment. In a 10-year post-retention study of deep bite correction, Simon and Joondeph reported that proclination of mandibular incisors and a clockwise rotation of the occlusal plane during treatment were factors associated with relapse. In cases of Class II division 2, proper palatal root torque of the
maxillary incisors plays an important role in maintaining a normal interincisal angle and establishing proper anterior occlusal stop. Orthodontic treatment in adult patients with Class II malocclusions with skeletal deep bite must include the labial tipping of the mandibular incisors to camouflage the skeletal discrepancy. Labial tipping over the basal bone can help to achieve an acceptable overjet and overbite. However, proclined mandibular incisors would need permanent retention to ensure long-term stability. In our case, the 0.0175-inch tripleflex wire were bonded from canine to canine in the lower arch for at least one year to ensure stable alignment. Hawley retainer with labial plate could also ensure arch stability but it requires patient's cooperation.

CONCLUSION

Treatment of Class II division 2 malocclusion in adults is always challenging. The keys to treatment success are bite opening and torque correction. Because of the characteristic of point contact between the wire and the bracket, a continuous archwire with cutting edge brackets can easily correct the 100% deep bite. By properly using the biomechanical concepts that were presented in the case regarding the archwire design with specific objectives, the clinician can achieve the desired goals for deep bite correction.

PATIENT CONSENT

Provided.

Conflict of Interest Statement

The authors declare no conflicts of interest.

REFERENCES