

Case Report

ISW for the Treatment of Angle Class II Division 1 Combined with Unstable Mandibular Position

Kuo Li-Ling¹, Yu Chien-Chih², Wu Wei-Te³, Yu Jian-Hong^{1*}

¹Department of Orthodontics, China Medical University Hospital, Taichung City, Taiwan

²School of Pharmacy, College of Pharmacy, China Medical University, Taichung, Taiwan

³Department of Biomechatronics Engineering, National Pingtung University of Science and Technology, Pingtung County, Taiwan

***Corresponding Authors:** Yu Jian-Hong, Department of Orthodontics, China Medical University Hospital, No. 2, Yude Road, North District, Taichung City 404, Taiwan, R.O.C., E-mail: kenkoyu@hotmail.com

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Abstract

Introduction: This article presents a case of Angle Class II division 1 with completed treatment. We used improved super-elastic Ti-Ni alloy wire (ISW) and the modified multiloop edgewise arch wire (MEAW) technique to create space and to relieve anterior and posterior crowding in an adult female patient with poor dental alignment and facial asymmetry. Intermaxillary elastics were also used to improve the mandibular position and intercuspal interdigitation. The patient was treated by crowding relief, facial asymmetry correction, the MEAW technique, and overjet reduction.

Findings: The patient was treated successfully using ISW.

Conclusion: In this case, we rapidly corrected poor dental alignment by using ISW and the MEAW technique. Compared with conventional stainless steel wire treatment, ISW provides an efficient and easy approach to correct such malocclusion. Successful treatment outcomes were attained, and the patient was pleased with the treatment results.

Keywords: Angle Class II division 1; Facial asymmetry; ISW; MEAW

1. Introduction

A 28-year-old woman visited our clinic with a chief complaint of poor dental alignment and facial asymmetry. Clinical examination revealed Angle Class II division 1. We used improved super-elastic Ti–Ni alloy wire (ISW) [1, 2] and the multiloop edgewise arch wire (MEAW) technique to create space and to relieve anterior and posterior crowding. Intermaxillary elastics (IME's) were also used to achieve a more suitable mandibular position and intercuspal interdigitation. Finally, correction of arch coordination, space management, and bite control were achieved.

2. Case Report

This case report describes an adult female patient with poor dental alignment, facial asymmetry, and dental crossbite. The aforementioned problems were successfully treated using ISW and the MEAW technique.

3. Diagnosis and Etiology

A 28-year-old woman with a convex profile visited our clinic for an orthodontic consultation. The extraoral and frontal profile revealed adequate incisor exposure and an upper midline with no deviation from the facial midline (Figure 1). Clinical examination revealed Angle Class II division 1 and a lower right second premolar crossbite (Figure 2).

Panoramic radiography revealed the presence of #18, #28, and #48 wisdom teeth, an endodontically treated tooth (#47), and no unerupted teeth; however, signs of erosion were noted on the left mandibular condyle head (Figure 3). The cephalometric film indicated a skeletal Class II resulting from minor maxillary protrusion, a convex facial type (ANB: 6.1°), and a mandibular plane angle of 24.3° . Many parameters were not within ideal ranges. The posterior–anterior view revealed that the mandibular had shifted to the right. Clinical examination revealed no signs of bad habits (Figure 4, Figure 5 and Figure 6).

Facial photos



2016.10.14
28y 07m
Before active treatment

Figure 1: Pretreatment extraoral photos.



Figure 2: Pretreatment intraoral photos.

X-ray findings(1)

2016.08.19
Before active treatment



R 中國附醫總院牙科

#18 #28 #48 existence
#47 endodontically treated tooth
Erosion sign of left condyle head

Figure 3: Pretreatment panoramic radiograph.

X-ray findings(2)

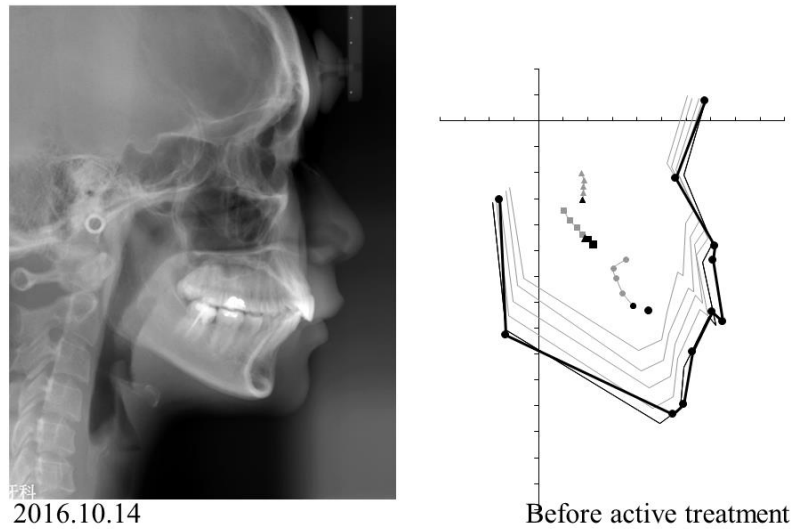


Figure 4: Pretreatment cephalometric radiograph with profilogram.

X-ray findings(3)

Before active treatment

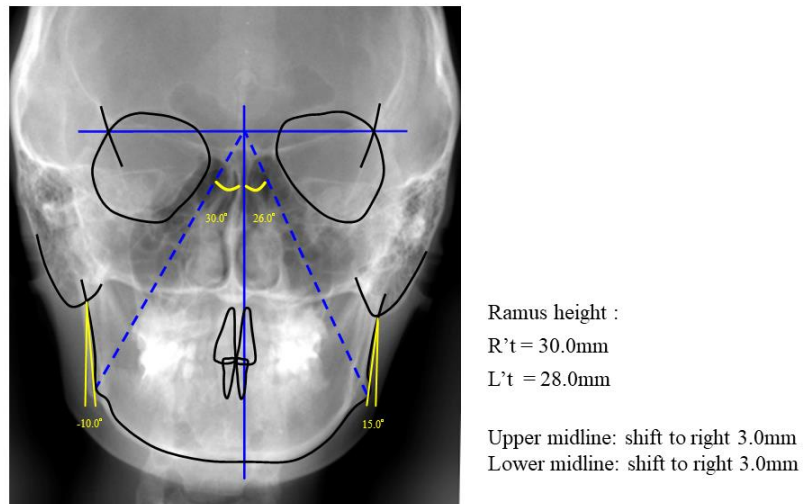


Figure 5: Pretreatment posterior–anterior radiograph.

Polygon- Before active treatment

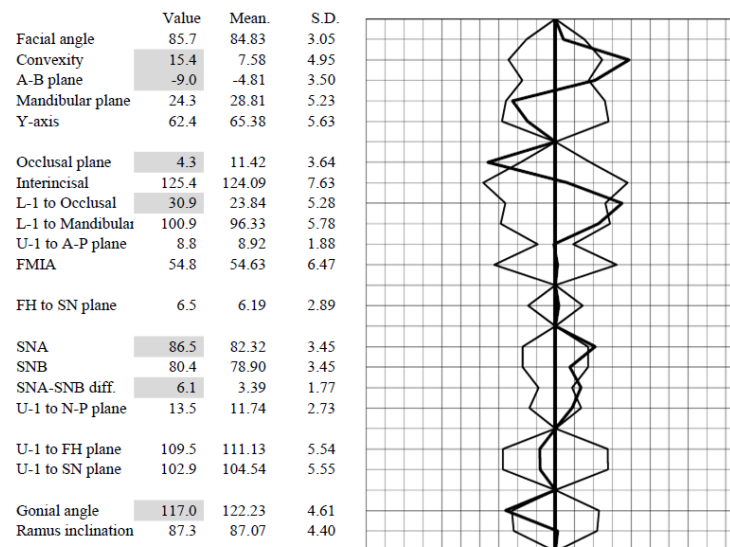


Figure 6: Pretreatment cephalometric polygon.

4. Treatment Objectives

The patient chiefly complained of poor dental alignment and facial asymmetry. The first priority was to address the chief complaint by achieving a molar Class I relationship and facial symmetry. Other objectives were to correct the crowding and the #45 crossbite, improve overjet and overbite, and obtain more suitable arch coordination and individual normal occlusion.

5. Treatment Plan

1. #18, #28, and #48 extraction
2. Full-mouth direct bonding system (DBS) and ISW leveling
3. Observation of mandibular response [3].
4. Use of the MEAW technique and IME's for improved interdigtation and achievement of a molar Class I relationship.

6. Treatment Progress

After a detailed explanation and discussion, the patient agreed to receive the aforementioned orthodontic treatment. ISW (developed by Tokyo Medical and Dental University, Japan) has super-elastic, shape memory, and shock and vibration absorption properties. This paper describes the experience in treating a patient with Angle Class II division 1 using ISW combined with IME's. This helped the patient gain an esthetically pleasing smile, with which she was satisfied. On November 28, 2016, we applied the DBS with 0.018×0.025 -inch brackets over the upper and lower arches. We used a 0.016×0.022 -inch ISW to level the teeth for 1 month; preliminary leveling and alignment were gradually achieved (Figure 7). On December 28, 2016, 1 month after commencing active treatment, the MEAW technique was used to correct the crossbite at #45.

MEAW was applied in the lower right at #46 and #47, and an open coil spring was used between #43 and #45 to create a space for #44 (Figure 8). On March 27, 2017, 4 months of active treatment, the crossbite at #45 was corrected. Lower right MEAW at #45, #46, and #47 and lower left MEAW at #36 and #37 were placed. The lower anterior teeth flared out because MEAW was used without IME's to reduce the overjet. An open coil spring was placed between #34 and #35 for midline correction (Figure 9).

On April 17, 2017, MEAW was placed in the upper posterior to achieve a molar Class I relationship. Class II IME was used for space creation to facilitate #12 and #22 derotation and to achieve an improved canine and molar relationship (R: #13–#45; L: #23–#35; Figure 10). On February 15, 2018, after 15 months of active treatment, #12 and #22 were appropriately positioned. To reduce the overjet, MEAW was placed in the upper posterior, and Class II IME was also used (R: #13–#45; L: #23–#35; Figure 11). On October 24, 2018, after 23 months of active treatment, a molar Class I relationship was achieved. IME's were used to improve cusp interdigitation and the canine relationship (Figure 12).

7. Treatment Results

After 23 months of active treatment, extraoral and intraoral appearance was improved. A straight profile, lower facial height, and correlated facial midlines were achieved (Figure 13). Intraoral Class I canine and molar relationships were also achieved with favorable interdigitation, normal overbite and overjet, and suitable curve of Spee. The patient's smile arc became more harmonious after treatment (Figure 13 and Figure 14). Post-treatment panoramic and cephalometric analyses (Figure 15, Figure 16 and Figure 17) and the superimposed cephalometric tracings (Figure 18 and Figure 19) demonstrated considerable improvement.

Pretreatment and post-treatment dental analyses revealed a change in the U1 to FH plane from 109.5° to 110.0° and a change in the L1 to mandibular plane from 100.9° to 115.0°; dental change were acceptable. At the end of the treatment, we provided the patient with a circumferential retainer for the upper arch, a Hawley retainer for the lower arch, and an auxiliary clear plastic retainer for retention [4]. The treatment outcome remained stable during several follow-up visits.

Start of active treatment

2016.11.28

Upper arch DBS, leveling with 0.016 x 0.022 ISW

Lower arch DBS, leveling with 0.016 x 0.022 ISW



Period of active treatment: 0 M

Figure 7: Start of active treatment involving upper and lower arch DBS and leveling with 0.016 × 0.022 ISW.

Crossbite corrected

2016.12.28

Lower right MEAW at #46 #47 and open coil spring between #43 and #45 to create space for #44



Period of active treatment: 1 M

Figure 8: Lower right second premolar crossbite at #45 was corrected using fully-engaged ISW and MEAW.

Midline correction

2017.03.27

Lower right MEAW at #45 #46 #47 and lower left MEAW at #36 #37.

Lower ant. teeth flared out due to MEAW effect without the usage of IME.

Open coil spring between #34 and #35 for midline correction.



Period of active treatment: 4 M

Figure 9: Lower midline correction.

To achieve Angle Class I molar relationship

2017.04.17

Upper posterior MEAW from 7 to 4. IME at $\frac{3}{5} \mid \frac{3}{5}$ for space creation so as to facilitate #12 #22 de-rotation, and to achieve a better canine and molar relationship.



Period of active treatment: 5 M

Figure 10: Achievement of an Angle Class I molar relationship.

To reduce the overjet

2018.02.15

Upper posterior MEAW. IME at $\frac{3}{5}$ | $\frac{3}{5}$ one for the right, and one for the left.



Period of active treatment:15M

Figure 11: Reduction of the overjet.

Finishing and Detailing

2018.10.24

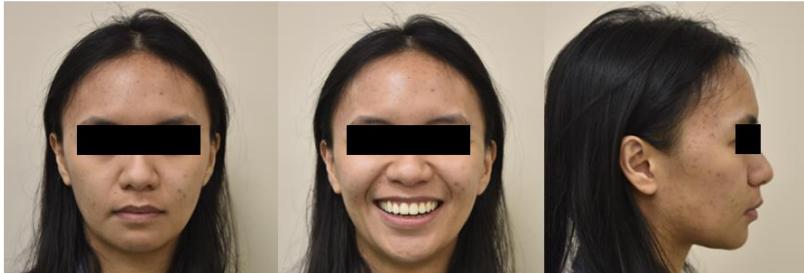
IME were used for better cusp interdigitation and canine relationship.



Period of active treatment:23M

Figure 12: Finishing and detailing.

Facial photos



2018.12.24
30y 10m
After active treatment

Figure 13: Post-treatment extraoral photos.

Intraoral photos

2018.12.24

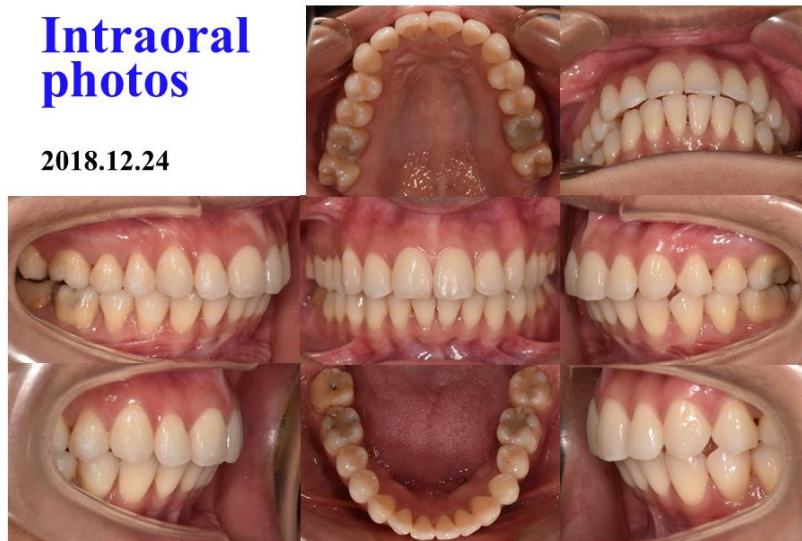


Figure 14: Post-treatment intraoral photos.

X-ray findings(1)

2018.12.24

After active treatment

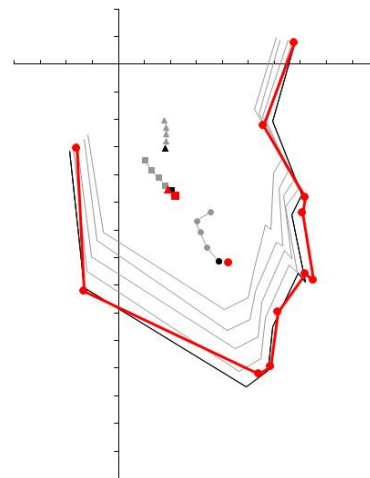


Figure 15: Post-treatment panoramic radiograph.

X-ray finding(2)



2018.12.24



After active treatment

Figure 16: Post-treatment cephalometric radiograph with profilogram.

Polygon- After active treatment

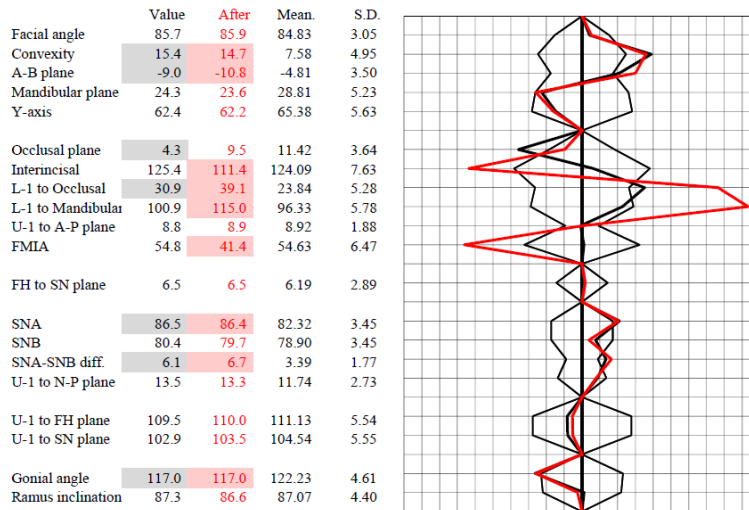


Figure 17: Post-treatment cephalometric polygon.

Superimposition (1)

- Superimposed on SN at S -

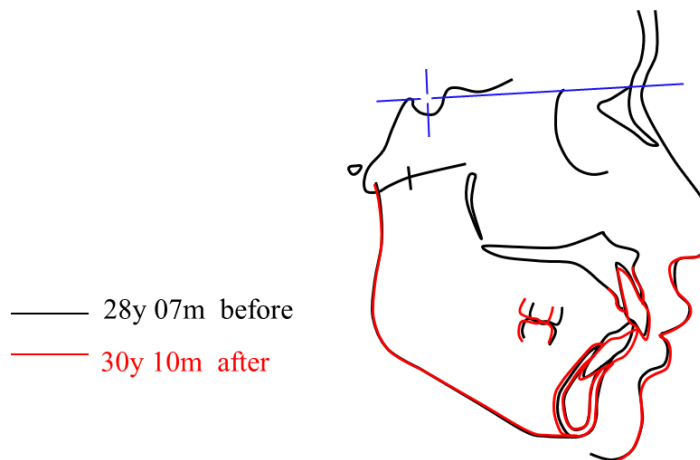


Figure 18: Superimposition of lateral cephalometric tracings. Black line = before treatment and red line = after treatment.

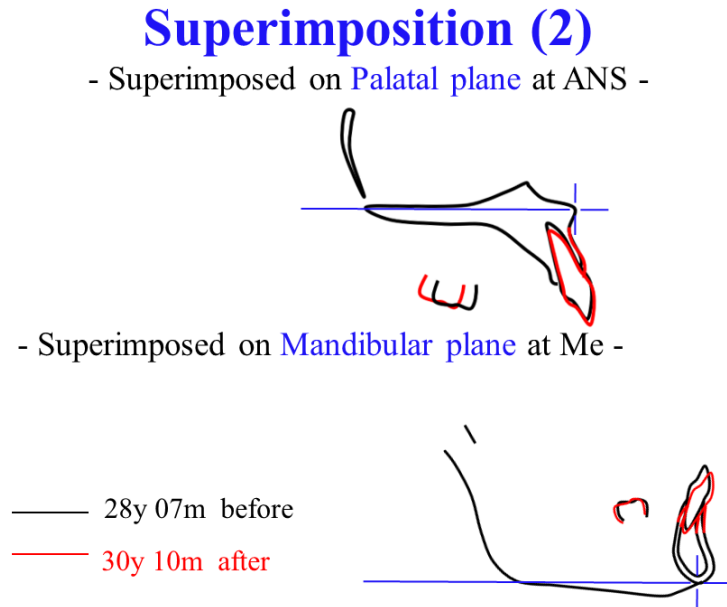


Figure 19: Maxillary and mandibular superimpositions.

8. Discussion

We used MEAW and flare-out for crowding relief. Crowding relief was achieved through five procedures: extraction, stripping, expansion and flare-out, MEAW, and distalization. The MEAW technique allows the posterior teeth to tip back and intrude. With anterior teeth flaring out, a space was created, correcting the position of the crossbite tooth. Some problems also required our attention. The MEAW technique may increase the risk of posterior teeth disocclusion. Profile protrusion and interarch coordination are potential side effects when anterior teeth flare out (Figure 20). Chia et al. indicated that asymmetries have pathological, traumatic, functional, or developmental causes [5]. Haraguchi et al. revealed that the etiology of facial asymmetry can be grouped into hereditary factors of prenatal origin and acquired factors of postnatal origin [6]. In this case, the patient's asymmetry likely resulted

from #45 crossbite, which is a functional problem. In the P-A view, we observed that her mandible was corrected to the left at 2°. Following treatment, her facial appearance greatly improved. We observed no symptoms of left condyle erosion, and no signs of its deterioration were noted during the orthodontic process; this may contribute to an increasingly stable occlusion [7] (Figure 21).

The characteristics of ISW simplify the MEAW technique. Serial step-up and tip-back bends were performed using a heat bender. The dentition must first be prepared for the use of this mechanism by eliminating all rotations, spaces, crowding, or poorly positioned brackets [8]. By using the MEAW technique, uprighting, distal tipping, and even relative intrusion for tooth control can be performed. In this case, we used the MEAW technique with IME to improve the molar and

canine relationship. We also used the MEAW technique without IME to flatten the curve of Spee. The tip-back degree of the lower first molar changed from 86° to 77° (9° of difference). The tip-back degree of the upper first molar changed from 82° to 72° (10° of difference; Figure 22). Overjet is measured from the labial surface of the most prominent incisor to the labial surface of the mandibular incisor; the distance is typically 2.0~4.0 mm (0.079~0.157 in). If the lower incisor is anterior to the upper incisor, the overjet is given a negative value [9]. In this case, we wanted to achieve a more favorable

overjet; therefore, overjet reduction was necessary. First, we used the MEAW technique without IME to allow the lower anterior teeth to flare out. Thus, the overjet was reduced from 6.0 to 3.5 mm within 14 months. Then, MEAW was placed on the upper posterior teeth with IME. The overjet decreased as a result of upper anterior teeth retraction and mandible protraction. The overjet decreased from 3.5 to 3.0 mm within 8 months. IME's were also used to improve the mandibular position and intercuspatal interdigitation [10, 11] (Figure 23).

Discussion (1)- Crowding relief

Several ways were used to relieve lower crowding(see table below). In this case, we **created space by MEAW and flare-out**, combined with open coil springs.

Method	Practical application	Problem
Extraction	Premolar or lower incisor extraction (Three incisor finish for some special occasions)	Loss of teeth, time-consuming
Stripping	0.25mm of tooth enamel removal at one time	Tooth sensitivity
Expansion & flare-out	Level and tip the teeth to a new position	Increase risk in profile protrusion and inter-arch coordination
MEAW	Tip-back & intrude teeth	Increase risk in posterior teeth dis-occlusion
Distalization	Might combine with open coil springs or mini-implants	High cost, possibility of root damage, stability is in question

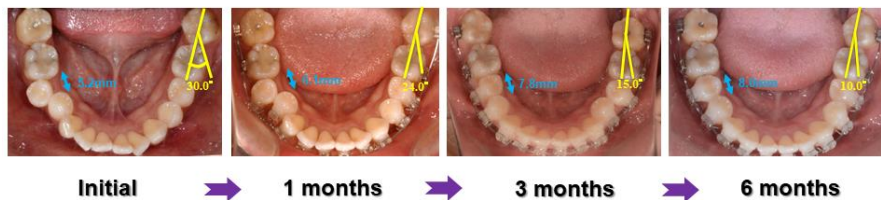


Figure 20: Crowding relief.

Discussion (2)-Facial asymmetry correction

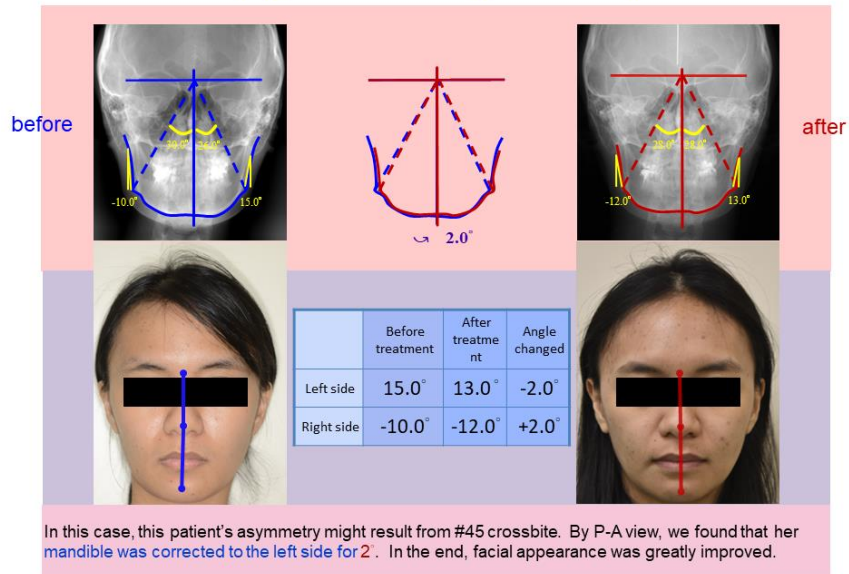


Figure 21: Facial asymmetry correction.

Discussion (3)-MEAW

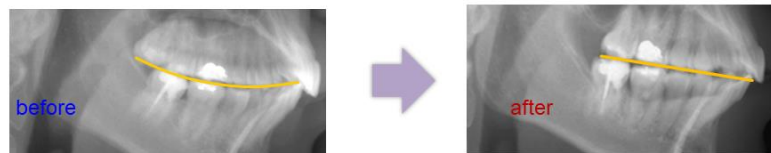
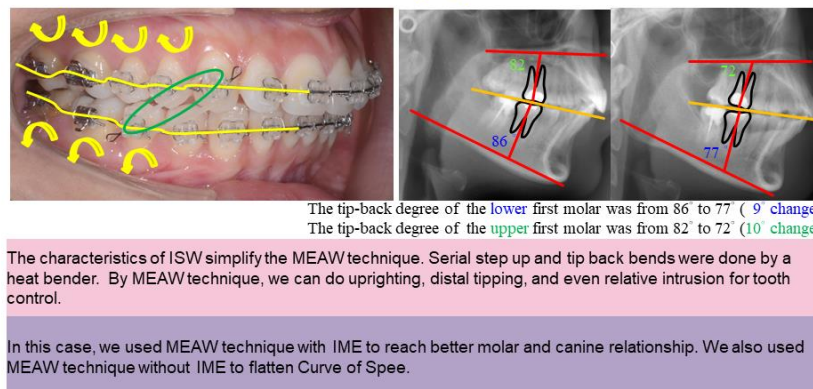


Figure 22: MEAW.

Discussion (4)- Overjet reduction

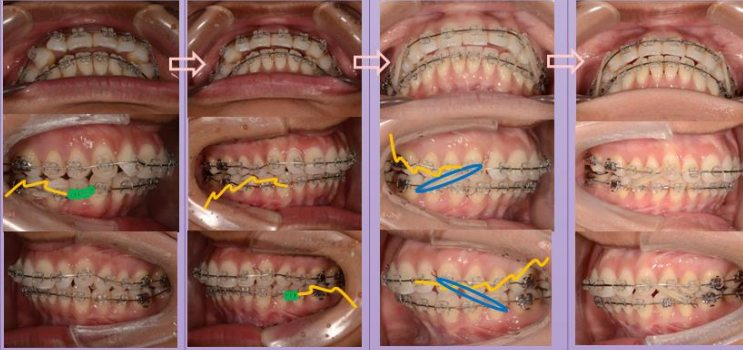
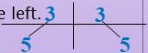
	2016.12.28 Overjet: 6.0mm	2017.03.27 Overjet: 4.0mm	2018.02.15 Overjet: 3.5mm	2018.10.24 Overjet: 3.0mm
Intra-oral Photos				
Treatment	Upper leveling. Lower right MEAW and open coil spring to create space for #45 decrowding.	Lower MEAW at both sides to relieve the crowding. Open coil spring was placed between #34 #35 to correct the midline.	Upper MEAW at both sides to achieve better canine and molar relationships. IME one for the right, and one for the left. 	Adequate overjet was achieved.

Figure 23: Overjet reduction.

9. Summary and Conclusions

We rapidly corrected poor dental alignment by using ISW and the MEAW technique. Compared with conventional treatment with stainless steel wire, ISW provides an efficient and easy approach to correct such malocclusion. Successful treatment outcomes were obtained, and the patient was pleased with the results.

Acknowledgement

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Availability of Data and Materials

The materials are available upon request.

Authors' Contributions

YJH was responsible for treatment planning. YJH was responsible for clinical patient treatment. KLL, YCC, WWT, and YJH drafted the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The procedures performed in this study were in accordance with the wishes of Ms. Ko. This case report and the treatment plan were approved by the chairman of the Department of Orthodontics, China Medical University.

Consent for Publication

Written informed consent was obtained from the patient for publication of this short report and any accompanying images.

Conflict of Interest

The authors declare that they have no competing interests.

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