

Case Report

ISW for the Treatment of Angle Class III Malocclusion with Facial Asymmetry Combined with Orthognathic Surgery

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Abstract

The objective of the case study is for the treatment of Angle Class III malocclusion with facial asymmetry combined with orthognathic surgery case by ISW (Improved Super-elastic Ti-Ni alloy wire, developed by Tokyo Medical and Dental University). An adult male (21 years old) came to our clinical with a chief complaint of the mandibular protrusion and facial asymmetry. Clinical examination found Class III malocclusion with anterior cross-bite and the mandibular prognathism with left hemi-mandibular elongation resulting in facial asymmetry. In order to relieve crowding and to correct upper anterior tooth angulation, we decided to extract #14 #24. For better arch coordination, we also extracted #31. After decompensation, this patient received orthognathic surgery (BVSRO, Bilateral vertical sagittal ramus osteotomy) and advancement genioplasty. IMF (Inter-maxillary fixation) was conducted with a wafer lingual splint. Finishing and detailing were performed for post-surgical orthodontic treatment. Treatment was completed within 29-months, a stable occlusion and a desirable esthetic outcome were achieved and the patient was pleased with the treatment result after the active treatment.

Key words: ISW; Angle class III malocclusion; Orthognathic surgery; The mandibular setback by BVSRO (bilateral vertical sagittal split ramus osteotomy); Atypical finish; Facial asymmetry correction; Inter-maxillary elastics(IME).

INTRODUCTION

Facial asymmetry may be associated with class I malocclusion, but is more frequently associated with class II and III occlusions. The etiology of facial asymmetry is, however, still unknown. Facial asymmetry can be summarized and divided into three main categories, (1) congenital; (2) developmental; and (3) acquired. The developmental type of facial asymmetry is idiopathic and non-syndromic in nature and is rather commonly seen in general population. There is one developmental reason causing facial asymmetry is habitual chewing on one side, which is responsible for increased skeletal development on the ipsilateral side.¹ Persistent sleep on one side may also have a similar influence. Haraguchi et al² suggested that the etiology of facial asymmetry can be divided between those with genetic origins and those with environmental origins.² Nevertheless, facial asymmetry can be classified into dental, skeletal, soft tissue and functional components. Common causes of dental asymmetry include early loss of deciduous teeth, a congenitally missing tooth or teeth, and habits such as thumb sucking. Skeletal asymmetry may involve one bone such as the maxilla or mandible, or it may affect

a number of skeletal structures on one side of the face. When one side of osseous development is affected, the contralateral side will most inevitably be influenced resulting in compensational or distorted growth. Facial asymmetry affects the lower face more frequently than the upper face. Severt and Proffit reported frequencies of facial laterality of 5%, 36% and 74% in the upper, middle and lower thirds of the face.³ The lower part of the face deviates more frequently and at greater distances than the upper and middle parts. One explanation is that the period of growth of the mandible is longer. Chew et al reported asymmetry in 35.8% of 212 patients with dentofacial deformities, with the majority of cases in patients with class III occlusal deformity.^{4,5} He suggested that special attention is paid to class III patients to detect any asymmetry. Class III is more common in Asians than in Caucasians, so is a reasonable assumption that there are more patients with facial asymmetry among the normal population in Asia than in Western countries.⁶⁻¹⁴

HISTORY AND DIAGNOSIS

An adult 21-year-old male came to our clinic with a chief complaint of

the mandibular protrusion and facial asymmetry. His lateral profile was concave with mandible slightly shifted to the right side (Figure 1). Clinical examination revealed bilateral Class III molar relationship, labially-tipped upper and lower incisors with anterior cross-bite and right side canine cross-bite, upper left second premolar bucco-version, along with lower anterior teeth crowding (Figure 2). The panoramic film showed #18, #28, #38, #48 missing and upper left first molar fixed partial prosthesis and previous root canal treatment received (Figure 3).

Figure 1. Facial Photos before Active Treatment



Figure 2. Intraoral Photos before Active Treatment



Figure 3. Panoramic Film before Active Treatment



The radiographic methods of the research include intraoral photos, lateral cephalometric projection and panoramic x-ray films. Also, the cephalometric analyses before and after the treatment were presented in this case. The cephalometric analysis showed a skeletal Class III jaw relationships (SNA: 82.6°, SNB: 84.9°, ANB: -2.4°) and dental compensation (U1 to FH plane: 127.0°, L1 to The mandibular plane: 83.7°, Inter-incisal angle: 113.6°). The high angle skeletal pattern can be

seen prominently in the polygon (Gonial angle: 137.9°) (Figures 4-6).

Figure 4. Lateral Cephalometric Film before Active Treatment

2010.09.23

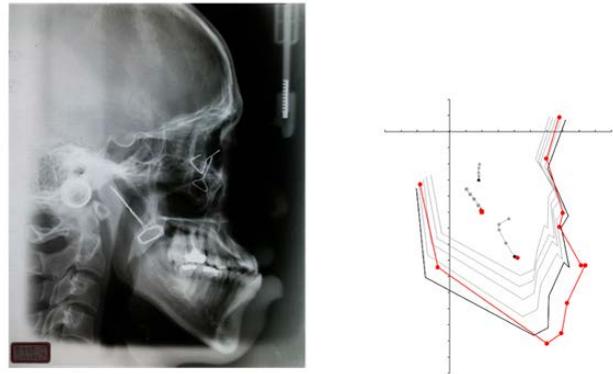


Figure 5. Posteroanterior Cephalometric Film before Active Treatment

2010.09.23

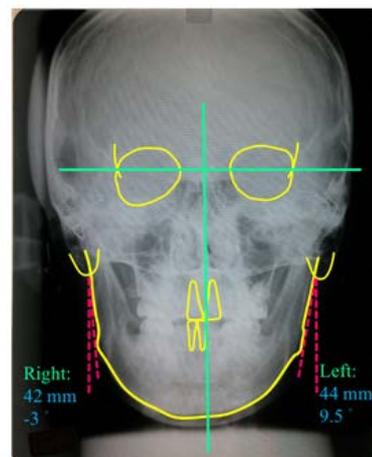


Figure 6. Polygon before Active Treatment

Polygon- before active treatment

	Value	Mean.	S.D.
Facial angle	90.7	85.07	5.76
Convexity	-1.1	5.60	4.33
A-B plane	5.2	-5.10	3.28
★ Mandibular plane	35.6	26.25	6.34
Y-axis	63.4	65.71	3.27
Occlusal plane	6.5	9.52	4.01
★ Interincisal	113.6	129.66	8.99
L-1 to Occlusal	22.8	21.69	6.03
★ L-1 to Mandibular	83.7	94.67	7.21
U-1 to A-P plane	13.0	7.86	2.31
FMA	60.7	58.98	6.69
FH to SN plane	7.6	5.98	3.35
SNA	82.6	81.82	3.09
SNB	84.9	78.61	3.14
★ SNA-SNB diff.	-2.4	3.28	2.66
U-1 to N-P plane	12.6	9.91	2.78
★ U-1 to FH plane	127.0	108.94	5.62
U-1 to SN plane	119.5	103.06	5.53
Gonial angle	137.9	119.38	5.83
Ramus inclination	77.6	87.36	4.14

Therefore, the summary of diagnosis includes:

- a) Functional (-): anterior cross-bite
- b) Skeletal (+): SNA(82.6°), SNB(84.9°), ANB=-2.4°, skeletal Class III
- c) Denture (+): U1 to FH plane(127.0°), L1 to the mandibular plane (83.7°)
- d) Dental (-): #18 #28 #38 #48 missing and #26 fixed partial prosthesis
- e) Discrepancy (+) : upper: R't: -4.0 mm / L't: -5.0 mm
lower: R't: -5.0 mm / L't: -3.0 mm

TREATMENT OBJECTIVES

Our treatment objectives were (1) to improve facial profile, (2) to establish appropriate overbite, overjet, and arch coordination, (3) to establish individualized occlusion. Due to the fact that the patient accepted the treatment alternative as orthognathic surgery combined with orthodontic treatment. Therefore, the treatment plan includes:

- a) Extraction of #14, #24, #31.
- b) Full mouth DBS (Direct-Bonding System) & leveling.
- c) Orthognathic surgery (BVSRO, Bilateral vertical sagittal ramus osteotomy) and advancement genioplasty.
- d) Finishing and detailing.

TREATMENT PROGRESS

Treatment was started from 2011.01.03. with upper and lower arch DBS and leveling with 0.016 x 0.022 ISW. #13 and #23 canine distal drive was performed with 100gf closed coil-spring and #41, #32 reciprocal space closure with the elastic chain was also carried on (Figure 7).

Figure 7. Period of Active Treatment: 0-Month



For the upper space closure part, 23 months of active treatment was taken and closed coil-spring, elastic chain was used (Figure 8).

For the lower space closure part, 23 months of active treatment was taken, the regional expansion effect of ISW was seen and elastic chain was also used for space closure (Figure 9).

Figure 8. Upper Space Closure



Figure 9. Lower Arch Space Closure



On 2012.06.29, the mandibular setback by BVSRO (bilateral vertical sagittal split ramus osteotomy) was performed and as a result of the skeletal Class III malocclusion, the mandibular prognathism and left hemi-mandibular elongation phenomenon, The mandibular setback by BVSRO (2012.06.27) was performed. Right side setback for 10.0 mm and left side setback for 11.5 mm was carried on and advancement genioplasty was also included (Figure 10). Intraoral photos of before and after orthognathic surgery was shown and anterior cross-bite was improved significantly (Figure 11).

Figure 10. The mandibular Setback by BVSRO

Mandibular setback by BVSRO
(bilateral vertical sagittal split ramus osteotomy)

Diagnosis:	Treatment:
Skeletal Class III malocclusion Mandibular prognathism Left hemi-mandibular elongation	Mandibular setback by BVSRO (2012.06.27) R't setback 10.0mm & L't setback 11.5mm advancement genioplasty



Figure 11. Before and after Orthognathic Surgery



Figure 14. Facial Photos after Active Treatment



TREATMENT RESULTS

After 28 months of active treatment, on 2013.05.29, root parallelism was checked and re-bonding of teeth for ideal root parallelism, IME (inter-maxillary elastics) were used to achieve better cusp inter-digitation. #16 to #27 elastic chain was used for space closure and #33 to #36, #43 to #46 elastic chains for space closure (Figure 12).

Figure 12. Period of Active Treatment: 28-Months

2013.05.29



Figure 15. Intraoral Photos after Active Treatment



On 2013.06.28, de-bonding of full mouth brackets was performed and a circumferential retainer was delivered for the upper arch and Hawley retainer for the lower (Figure 13).

Figure 13. Period of Active Treatment: 29-Months



Figure 16. Panoramic Film after Active Treatment



For the total treatment time of 29-months, a stable occlusion was achieved and esthetic appearance was improved after the treatment (Figures 14&15).

After 29 months period of orthodontic active treatment, lateral cephalometric projection and panoramic x-ray films were taken, polygon and superimposition after active treatment was analyzed and denture pattern improved prominently (U1 to FH plane: 127.0°→111.5°, L1 to The mandibular plane: 83.7°→85.2o, Inter-incisal angle: 113.6°→129.3°). And the change of skeletal pattern was also considerable noticed after active treatment (SNA: 82.6°→81.4o, SNB: 84.9°→79.7°, ANB: -2.4° →1.6°) (Figures 16-20).

Figure 17. Lateral Cephalometric Film after Active Treatment

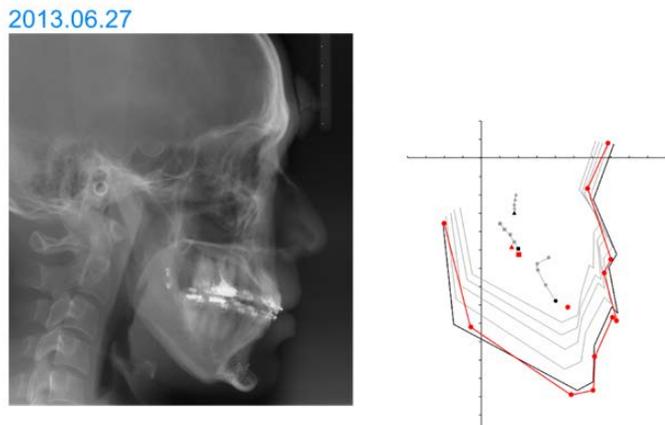


Figure 18. Posteroanterior Cephalometric Film after Active Treatment

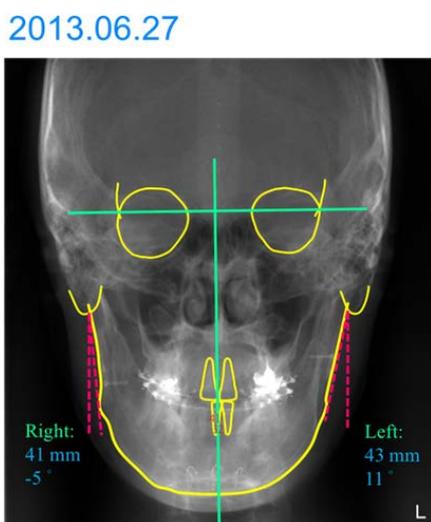
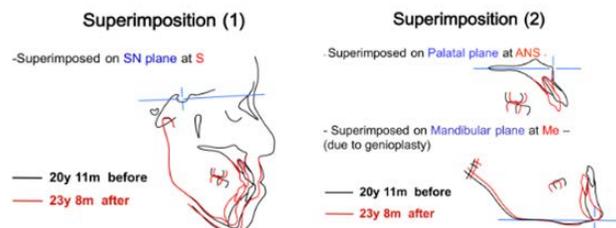


Figure 19. Polygon after Active Treatment

Polygon - after active treatment

	Value	after	Mean.	S.D.
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U-1 to SN plane	119.5	104.8	103.06	5.53
Gonial angle	137.9	137.9	119.38	5.83
Ramus inclination	77.6	76.0	87.36	4.14

Figure 20. Superimposition after Active Treatment



DISCUSSION

This case showed both skeletal and dental problems with a maxillary protrusion and the mandibular prognathism. In this case, we corrected upper anterior tooth inclination and facial asymmetry by the use of ISW arch-wire combined with orthognathic surgery and advancement genioplasty. After the treatment, a desirable outcome was achieved and the patient was pleased with the treatment result.¹⁵⁻²⁰

Anterior Tooth Inclination

For the upper teeth lingual tipping mechanism, we used closed coil-spring and elastic chain to close upper extraction space and to adjust anterior tooth inclination (U1 to FH plane: 127.0° à 111.5°). And for the lower teeth flaring out mechanism, we used ISW arch-wire to correct anterior cross-bite by leveling (decompensation) and orthognathic surgery. (L1 to The mandibular plane: 83.7° à 85.2°) (Figure 21).

Figure 21. Anterior Tooth Inclination



Atypical Finish

We can regard this case as atypical finish due to #31 extraction. There are some factors being taken into account is as follows:

- For lower arch de-crowding and leveling, extraction of #31 was feasible.
- After the treatment, we achieved harmonious arch coordination due to the mandibular setback.
- Dental midline was compromised due to 31 missing (3 incisors finish) (Figure 22).

In this case, facial asymmetry was corrected by the setback of the mandible. Through P-A (Posteroanterior cephalometric) view, we found that mandible was shifted to the left side for 0.5°. In the end, facial

Figure 22. Anterior teeth were greatly improved (Figure 23).

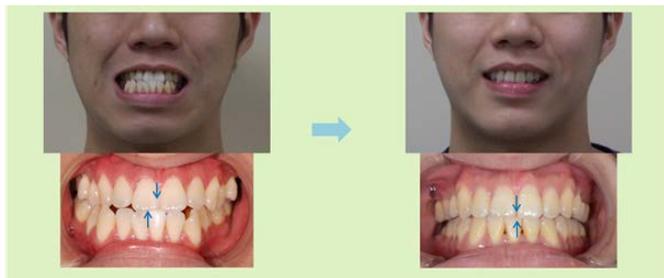
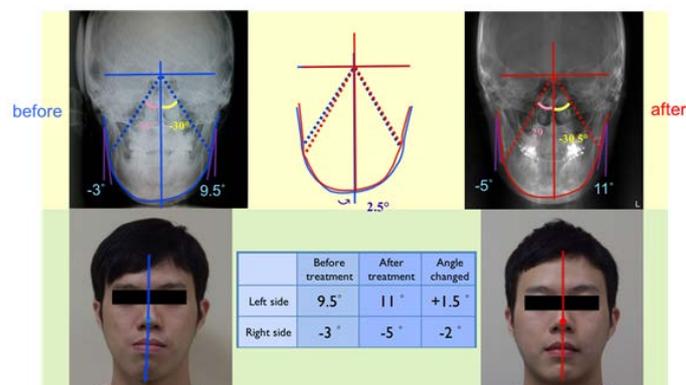


Figure 23. Facial Asymmetry Correction

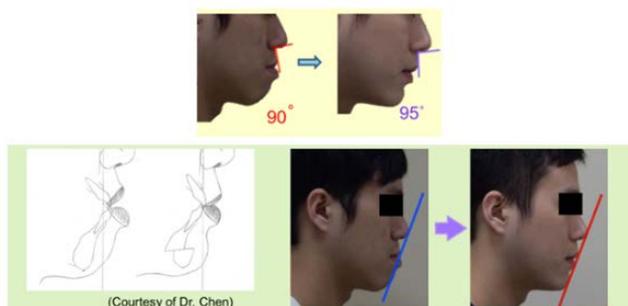


Facial Profile Change

There are two aspects of consideration for the facial profile change which includes the profile change and advancement genioplasty. The profile was desirable after the treatment and the following esthetic changes were noted:

- Increase in the nasolabial angle.
- The apparent increase in the labio-mental sulcus.
- Advancement of Me-point and reduction of symphyseal height (Figure 24).

Figure 24. Facial Profile Change



CONCLUSION

Treatment of Angle Class III malocclusion with facial asymmetry combined with orthognathic surgery case by ISW (Improved Super-elastic Ti-Ni alloy wire, developed by Tokyo Medical and Dental University) was discussed in the article. With successful the mandibular setback by BVSRO (bilateral vertical sagittal split ramus osteotomy and advancement genioplasty, ISW leveling and space closure mechanism, anterior tooth inclination was improved and anterior cross-bite was corrected. Inter-maxillary elastics (IME) were also used for inter-digitation during the treatment. After 29 months of active treatment, a stable occlusion and a desirable esthetic outcome was achieved and the patient was pleased with the treatment result after the active treatment.

To conclude, Class III malocclusion with anterior cross-bite and the mandibular prognathism with left hemi-mandibular elongation resulting in facial asymmetry can lead to compromised dental and facial aesthetics and therefore requires appropriate treatment, but adult patient case with Angle Class III malocclusion with facial asymmetry can be treated with ISW treatment.

CONFLICT OF INTERESTS

The author declares no conflict of interests.

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