



Case Report

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ISW for Nonsurgical Treatment of Skeletal Class III Malocclusion Combined with Facial Asymmetry

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Abstract

Non-extraction treatment for skeletal Class III malocclusion combined with facial asymmetry and lower anterior crowding by ISW (Improved Super-elastic Ti-Ni alloy wire, developed by Tokyo Medical and Dental University) will be discussed. A 21-year-old female with a chief complaint of poor dental alignment came for orthodontic evaluation. Clinical examination revealed skeletal Class III relationship profile appearance. Facial asymmetry with crowding of lower anterior teeth was also noted. We used intermaxillary elastics (IME) to adjust intermaxillary relationship, and ISW MEAW technique to adjust midline. The active treatment took about 2 years and the improvement of appearance and dentition alignment were noticeable.

Introduction

Tokyo Medical and Dental University developed improved super-elastic Ti-Ni alloy wire (ISW). ISW is endowed with three superior abilities: super elasticity, shape memory, and damping capacity [1-3]. The wire can be engaged into crowding dentition, and provide early dental torque with ease.

A 21-year-old female with a chief complaint of poor dental alignment came for orthodontic evaluation. Clinical examination revealed skeletal Class III relationship profile appearance. Facial asymmetry with crowding of lower anterior teeth was also noted. Facial asymmetry can develop from occlusal interferences, and result in incorrect relative size of maxilla and mandible, thus leads to unstable intermaxillary relationship. By using ISW, we can resolve interferences and re-establish intermaxillary relationship. After 24 months of treatment, a desirable esthetic outcome was achieved. This patient was pleased with the final treatment result.

Diagnosis and Etiology

Pretreatment facial photographs showed convex profile and protruded lower lip. In the frontal view, the chin demonstrated a left deviation. The maxillary midline was coincident with the facial midline; the mandibular midline demonstrated a left deviation of 2.0 mm (Figure 1). Intraoral photographs showed bilateral Angle Class III malocclusion. Anterior crossbite and severe crowding was also noted.

A panoramic film radiograph showed impacted maxillary and mandibular third molars over left side. Initial lateral and anteroposterior cephalometric radiographs were taken in centric occlusion with closed lips (Figure 2). The cephalometric analysis demonstrated a Class III relationship (ANB angle, -3.0°), low mandibular plane angle (FMA angle, 22.0°), proclined upper incisor (U1 to FH plane angle, 120.5°) (Table 1).

The etiology of facial asymmetry can be divided into three main categories, includes congenital, developmental, acquired[4]. Genetics problems can lead to congenital facial asymmetry, like cleft lip and palate or multiple neurofibromatosis [5,6]. The developmental type of facial asymmetry is idiopathic, but can result from the presence of occlusal interferences such as malposed teeth, improper teeth size or inadequate maxillomandibular relationship [7]. Several acquired problems will also disturb the symmetry of face, like facial trauma, temporomandibular

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Figure 1: Pretreatment facial and intraoral photographs (21 years 3 months old).



Figure 2: Pretreatment panoramic, lateral, and anteroposterior cephalometric radiographs (21 years 3 months old).

jointankylosis or facial tumor [8]. In this case, we consider it as a developmental type of facial asymmetry.

Treatment objectives

In this case, Class III malocclusion and facial asymmetry was noted, and we would like to achieve an ideal occlusion of the bilateral

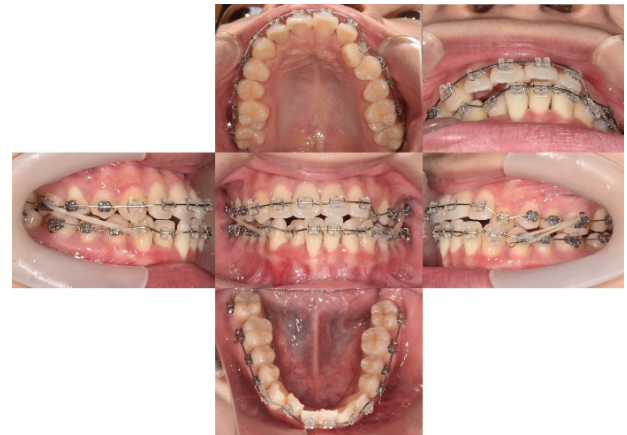


Figure 3: Progressive intraoral photographs (4 months).

Angle's Class I canine and molar relationship, as well as to correct mandibular position and midline deviation. Our treatment objectives were (1) to relieve crowding and eliminate the occlusal interference, (2) to manifest and adjust the mandibular position, (3) to the correct midline deviation, (4) to achieve better arch coordination and interditation.

Treatment alternatives

If patient would like to improve appearance, especially in patients with facial asymmetry, orthognathic surgery should always befirst considered. To decompensate the proclined upper incisors and to relieve anterior crowding, upper first premolar needs to be extracted. Le Fort I osteotomy over maxilla and bilateral sagittal split ramus osteotomy (BSSRO) over mandible can correct the sagittal and transverse skeletal discrepancy. Reduction of mandibular angle can also improve the appearance.

In non-surgery situation, we would apply non-extraction protocol. We would use ISW to relieve crowding and to eliminate interference. While mandibular position might be influenced by interference, by removing it, we could re-examine the mandibular position. Since then, we could further correct dental midline and anteroposterior jaw relationship. However, this approach will also compromise the facialappearance. Patient decline the surgery treatment, and choose the non-surgery treatment.

Treatment progress

Before orthodontic treatment, left bimaxillary third molars were extracted. Full mouth DBS was done with preadjusted edgewise metal brackets, Micro-arch, Roth type (Tomy company, Tokyo, Japan). Initial leveling progressed over bimaxillary arch with 0. 016-inch × 0. 022-inch ISW. At the same time, Class III IME (intermaxillary elastics) was applied for bite raising.

While the progress of leveling, we notice crossbite of 23 remained. To correct crossbite of 23, eliminating interference from the antagonistic teeth is substantially important. Not-in-slot technique can temporarily intrude the lower canine for this purpose. The phenomenon of crossbite was correct within four months (Figure 3).

With midline assumption, differential IME was used to correct the mandibular position. In this period, several tooth positions needed to be corrected for better interditation. Not-in-slot technique can simplify the way in manipulating tooth extrusion and intrusion. After adjusting the position of mandible for dental midline consistency, ISW MEAW was used to adjust lower anterior tooth inclination. Shallow bite can also be corrected by the molar intrusion effect from MEAW (Figure 4). As we can see, after MEAW technique was used, irregular marginal ridges will exist because of existence of step up

	Value	Mean	S.D.
Facial angle	90.5	84.83	3.05
Convexity	-10.0	7.58	4.95
A-B plane	5.5	-4.81	3.50
Mandibular plane	22.0	28.81	5.23
Y-axis	58.0	65.38	5.63

Occlusal plane	7.5	11.42	3.64
Interincisal	127.5	124.09	7.63
L-1 to Occlusal	14.5	23.84	5.28
L-1 to Mandibular	90.0	96.33	5.78
U-1 to A-P plane	5.0	8.92	1.88
FMIA	68.0	54.63	6.47

FH to SN plane	6.0	6.19	2.89
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SNA	80.0	82.32	3.45
SNB	84.0	78.90	3.45
SNA-SNB diff.	-4.0	3.39	1.77
U-1 to N-P plane	2.0	11.74	2.73

U-1 to FH plane	120.5	111.13	5.54
U-1 to SN plane	114.5	104.54	5.55

Gonial angle	122.5	122.23	4.61
Ramus inclination	78.5	87.07	4.40

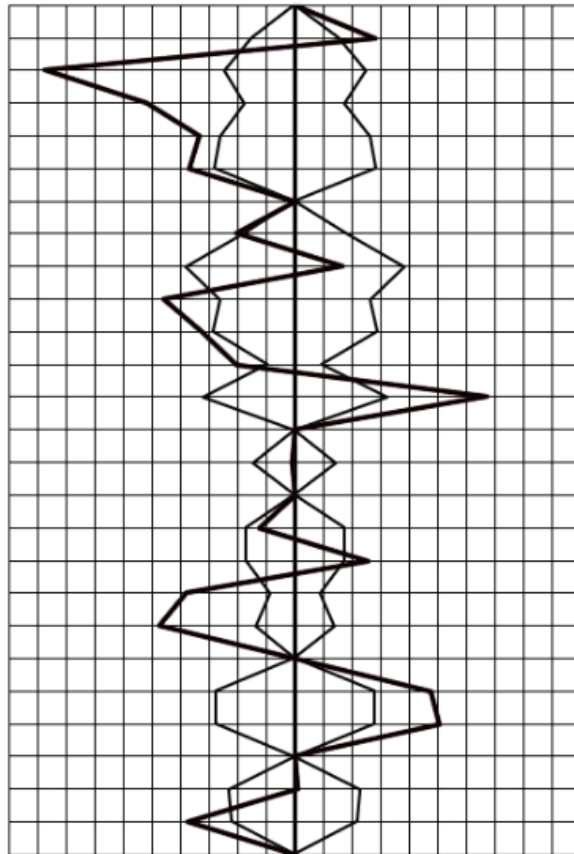

Table 1: Polygon- Before active treatment.

Figure 4: Progressive intraoral photographs (16 months).

Figure 5: Progressive intraoral photographs (20 months).

and tip-back bends. Therefore, we applied 0.018 x 0.025 ISW over the lower arch to do post-MEAW leveling. Elastic chain over anterior teeth and long Class III IME were also used to avoid lower tooth flaring out (Figure 5). After 24 months' active treatment, full mouth bracket was debonded. Circumferential retainer was delivered for the maxillary arch and Hawley retainer for the mandible.

Treatment Result

With the chief complaint of dental crowding, this patient came for our clinic. After two years of active treatment, the patient's chief complaint was resolved. The maxillary and mandibular midline coincided with facial midline. Bilateral canine and molar achieved

Class I relationship. Anterior crossbite was corrected to positive overjet (Figure 6).

The post-treatment cephalometric radiographs still showed several values out of normal range. Because patient refused to have invasive surgery, we can only correct the anteroposterior relationship with camouflage. Due to the bite raising effect by class III IME, mandibular plane angle was increased ($22.0^\circ \rightarrow 23.5^\circ$), and SNB, ANB angle was decreased (Figure 7,8) (Table 2).

Discussion

Several ways can be used to relieve severe lower anterior crowding, including extraction, stripping, leveling, expansion, ISW



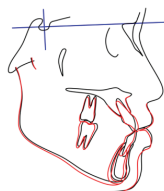
Figure 6: Post-treatment facial and intraoral photographs (23 years 5 months old).



Figure 7: Post-treatment lateral and anteroposterior cephalometric radiographs

Superimposition (1)

- Superimposed on SN at S -



Superimposition (2)

- Superimposed on Palatal plane at ANS -

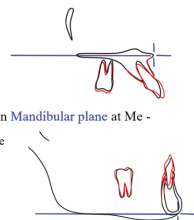


Figure 8: Superimposition of pretreatment and post-treatment.

MEAW technique and distalization (Figure 9). In this case, with initial leveling and expansion, anterior crowding was alleviated.

However, in Class III case, inclination control of lower anterior teeth is very important. Leveling and expansion may procline incisors out and deteriorate the condition. By stripping, Class III

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 got removed at one time	Tooth sensitivity
Leveling & expansion	Level and torque the teeth to a new position	Increase risk in profile protrusion and inter-arch coordination
MEAW	Tip-back & intrude posterior teeth	Increase risk in posterior tooth dis-occlusion and periodontal problems
Distalization	Might combine with open coil springs or mini-implants	High cost, possibility of root damage, stability is in question

Discrepancy (Lower anterior)

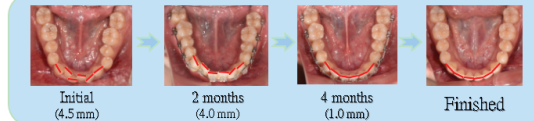


Figure 9: Method to relieve crowding.

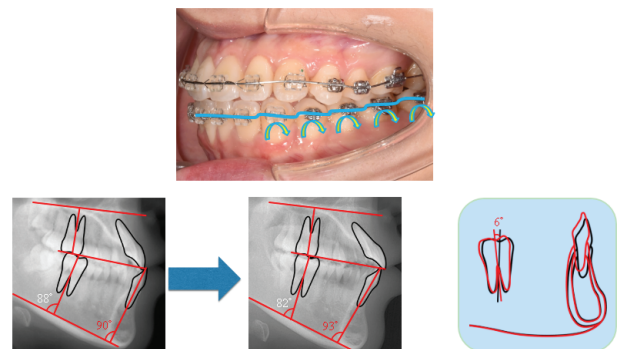


Figure 10: The tip-back degree of the lower first molar changed from 88° to 82° (6° change)

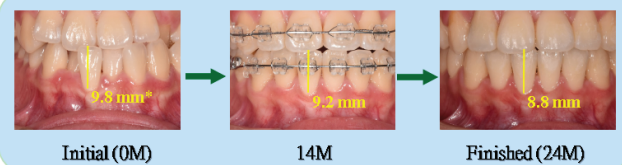


Figure 11: Gingival recession was improved by carefully correcting the position.

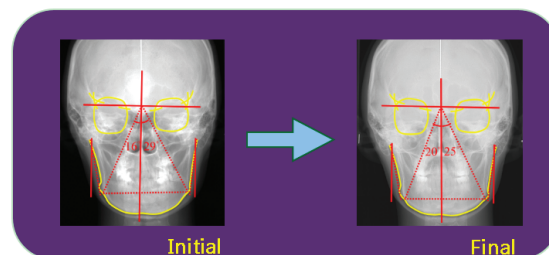
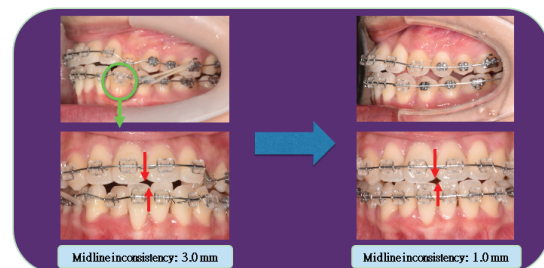


Figure 12: Facial asymmetry correction after crossbite correction and midline assumption.

	Before	After	Mean	S.D.
Facial angle	90.5	89.5	84.83	3.05
Convexity	-10.0	-7.5	7.58	4.95
A-B plane	5.5	2.5	-4.81	3.50
Mandibular plane	22.0	23.5	28.81	5.23
Y-axis	58.0	59.0	65.38	5.63
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FH to SN plane	6.0	6.0	6.19	2.89
SNA	80.0	79.5	82.32	3.45
SNB	84.0	82.5	78.90	3.45
SNA-SNB diff.	-4.0	-3.0	3.39	1.77
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U-1 to FH plane	120.5	130.0	111.13	5.54
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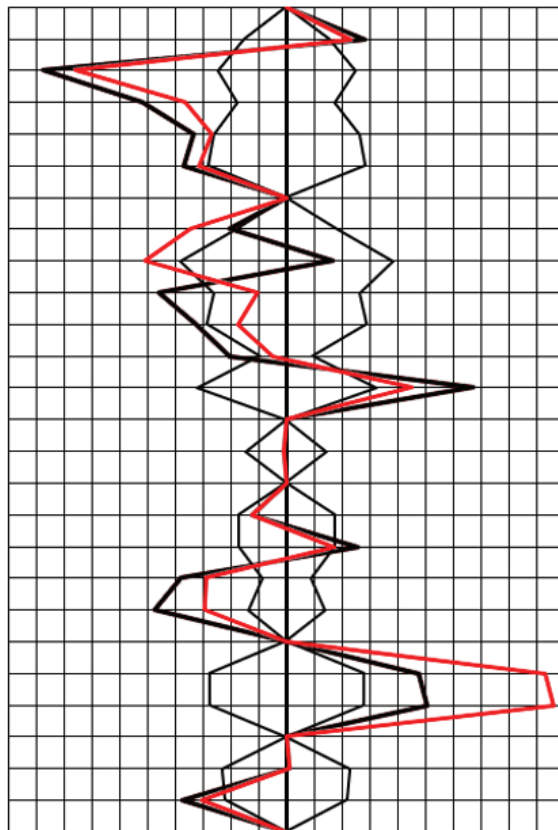


Table 2: Polygon- Before and after active treatment.

Factors of gingival recession needs orthodontic treatment	
Skeletal Class III malocclusion	Other possible factors
Retroclined incisor	Poor tooth inclination
Occlusal trauma (Due to premature contact of anterior tooth or anterior crossbite)	Malposition (Impaction, buccoversion)
Thrusting of mandible anteriorly	Dental crowding

Table 3: Factors of gingival recession needs orthodontic treatment.

IME and ISW MEAW, we can not only achieve better anteroposterior relationship, but also achieve a better control of the inclination changes of lower incisors (Figure 10).

In skeletal Class III case, there are several conditions leading to gingival recession (Table 3). In this case, we can observe crowding and crossbite at 41, while excessive functional stress and occlusal trauma worsened the gingiva condition. By carefully correcting the position and controlling the tooth inclination, gingival recession of 41 was much improved. According to Cario [9], under the circumstances of Recession Type I, we have much more confidence in gingiva regeneration by grafting. However, in this case, we have noted that after eliminating the factors from occlusal trauma, there are still some chances for gingival recession to be cured (Figure 11).

While treating facial asymmetry by orthodontic approach only, we need to adjust the mandibular position for symmetrical facial balance and for better arch coordination. Thus, we need to correct the problems with crossbite, which can be easily done by Not-in-slot technique. After crossbite was corrected, midline assumption should

be re-conducted. During this period, Not-in-slot technique for multiple teeth can re-establish occlusion, and differential IME can be used to guide her mandible to the right side. A rotational movement of the mandible can be achieved, which aids in correction of facial asymmetry and chin deviation (Figure 12).

Conclusion

To correct skeletal Class III combined with facial asymmetry case, not-in-slot technique and differential IME was used for mandibular position correction and for better interdigitation. MEAW can be used to adjust lower anterior tooth inclination. After 24 months of treatment, a desirable esthetic outcome was achieved. This patient was pleased with the final treatment result.

Acknowledgements

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References

1. Miura F, Mogi M, Okamoto Y. New application of superelastic NiTi rectangular wire. *J Clin Orthod* 1990 Sep;24(9):544-548.
2. Miura F, Mogi M, Ohura Y, Hamanaka H. The super-elastic property of the Japanese NiTi alloy wire for use in orthodontics. *Am J Orthod Dentofacial Orthop* 1986 Jul;90(1):1-10.
3. Iramaneerat K, Hisano M, Soma K. Dynamic analysis for clarifying occlusal force transmission during orthodontic archwire application: difference between ISW and stainless steel wire. *J Med Dent Sci*. 2004 Mar;51(1):59-65.
4. Cheong YW, Lo LJ. Facial asymmetry: etiology, evaluation, and management. *Chang Gung Med J*. 2011 Jul-Aug;34(4):341-51.
5. James PL, Treggiden R. Multiple neurofibromatosis associated with facial asymmetry. *J Oral Surg* 1975 Jun;33(6):439-442.
6. Noordhoff MS, Chen PKT. Unilateral cheiloplasty. In: SJ Mathes, ed. *Plastic Surgery*. 2nd ed. Philadelphia: Saunders Elsevier, 2006;4:165-215.
7. Haraguchi S, Takada K, Yasuda Y. Facial asymmetry in subjects with class III deformity. *Angle Orthod*. 2002 Feb;72(1):28-35.
8. Carlson ER. Pathologic facial asymmetries. *Atlas Oral Maxillofac Surg Clin North Am*. 1996 Mar;4(1):19-35.
9. Cairo F, Nieri M, Cincinelli S, Mervelt J, Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: an explorative and reliability study. *J Clin Periodontol*. 2011 Jul;38(7):661-666.