Case Study

ISW for the treatment of moderate crowding dentition with unilateral second molar impaction

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The objective of the treatment is for an adult with moderate crowding dentition and unilateral second molar impaction by ISW (Improved Super-elastic Ti-Ni alloy Wire, developed by Tokyo Medical and Dental University) will be discussed. An adult male (21y11m) came to our clinic with a chief complaint of maxillary protrusion, irregular dentition and midline deviation. Clinical examination revealed a moderate crowding with #25, #35 linguoversion and #37 impaction. With ISW leveling, crimpable stopper and open coil spring, we uprighted the lower left second molar. After that, toe-in and lingual torque was added to adjust #37 position. The protruded profile was improved by canine distal drive and anterior retraction. Treatment was completed within 33 months and a desirable occlusion with adequate overbite and overjet was achieved.

Key words: ISW, bimaxillary protrusion, skeletal Class II, linguoversion, molar uprighting, distalization, crown lingual torque, toe-in bend, intermaxillary elastic.

INTRODUCTION

Improved superelastic TiNi alloy wire (ISW; developed by Tokyo Medical and Dental University, Japan) (Iramane et al., 2004); (Miura et al.,1986) with low-stress hysteresis (LH) will be discussed in the treatment of adult moderate crowding dentition and unilateral second molar impaction case. The properties and characteristics of ISW are particular on their superelasticity, shape memory, and shock and vibration absorbing property.

In the past, treatment of second molar impaction was considered rather difficult in clinical orthodontic manifestation. Fixed orthodontic appliances or temporary anchorage device (TAD) can be used to correct the impacted second molar (Bondemark and Tsiopa, 2007); Shapira et al (2011) and Buchner (1973). However, with the use of ISW, impacted second molar and premolar regions can be corrected. Treatment becomes much more easier and unnecessary inconvenience to patients can be avoided. After 33 months of active treatment, a desirable outcome was achieved and patient was pleased with the treatment result.

History and Diagnosis

The 21y11m male complained about maxillary protrusion, irregular dentition and midline deviation. His lateral profile was convex, and the frontal view showed slightly facial asymmetry phenomenon (Figure 1). Clinical examination revealed right Class III and left class I molar relationship, right canine class I and left class II relationship, maxillary left second premolar palatoversion and lingually tipped mandibular left second premolar and molar linguoversion (Figure 2). Panoramic film showed #18, #28, #48 existence (Figure 3).

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 bimaxillary protruded skeletal class II jaw relationships (SNA:87.8° · SNB:83.8° · ANB:4.0°) and upper and lower incisors flare-out (U1 to FH plane:127.2° · L1 to mandibular plane:97.0° · Interincisal angle:114.0°). The impacted #18, #28, #37, #48 should be corrected. Moreover, the low angle skeletal pattern can be seen prominently in the polygon (Gonial angle:125.4°) and low mandibular plane angle (Mandibular plane:21.8 °) causing strong masticatory muscles made the torque control in tooth movement more difficult. (Figure 4 and Figure 5).

Therefore, the summary of diagnosis includes:
Figure 1: Facial photos before active treatment

Figure 2: Intraoral photos before active treatment

1. Skeletal(±): SNA: 87.8° → protrusive maxilla
   SNB: 83.8° → protrusive mandible
   Bimaxillary protrusion
2. Functional(-):
3. Denture(+): U-1 to FH plane: 127.2° → upper incisor flare-out
4. Dental(+): #18, #28, #37, #48 impaction
5. Discrepancy(+): upper: R’t: -2.0 mm/ L’t: -2.5 mm;
Figure 3: Panoramic film before active treatment

Figure 4: Lateral cephalometric film before active treatment

lower: R’t: -4.5 mm/ L’t: -2.0 mm

**Treatment Objectives**

Our treatment objectives were (1) to remove functional interference over left premolar and molar regions, (2) to improve facial profile, (3) to establish appropriate overbite, overjet and arch coordination, (4) to establish individualized occlusion. Due to the fact that the patient strongly refused the
possibility of orthognathic surgery. Therefore, treatment plan includes:
1. 
2. 
3. 
4. 
5. Open coil spring & crimpable stopper for #37 uprighting

**Treatment Progress**

On 2007.05.28, full mouth DBS and leveling with 0.016 × 0.022 ISW was proceeded and canine distal drive was performed by 100gf closed coil spring. (Figure 6)

On 2007.07.30, after two months of active treatment, for #37 uprighting, lower molar distalization and uprighting was performed. Distalization was performed by crimpable stopper and 150gf open coil spring. Meanwhile, #34 distalization (stopper + open coil spring) was also performed. (Figure 7)

On 2007.11.26, after six months of active treatment, for better torque control, #37 reinforced crown lingual torque on ISW was added. #37 rolled out after distalization and uprighting and crown lingual torque on ISW was added for better inclination. (Figure 8)

On 2008.07.28, after 14 months of active treatment, not-in-slot was set over #12~#22 for bite raising. ISW was also placed under the incisal wings of bracket to intrude 4 incisors. (Figure 9)

On 2009.06.17, after 25 months of active treatment, intrusion arch was set over #12~#22 for incisor intrusion. While not-in-slot was also set over #32~#42 for bite raising. (Figure 10)

**Treatment Results**

After 28 months of active treatment, for better finishing and detailing, intermaxillary elastics (IME) was set for better interdigitation, space closure and midline correction, while elastic chains were used for space closure and midline correction. (Figure 11)

On 2010.03.05, debonding of full mouth bracket was performed and circumferential retainer was delivered for the upper arch and Hawl ey retainer for the lower arch. (Figure 12)

For the total treatment time of 33 months, a stable occlusion was achieved and esthetic appearance was improved after the treatment. (Figure 13 and Figure 14)

After 33 months period of orthodontic active treatment, lateral cephalometric projection and panoramic x-ray films was taken, polygon and superimposition after active treatment was analyzed and denture pattern improved prominently (U1 to FH plane: 127.2° → 106.5° \( \rightarrow \) 106.5°, L1 to mandibular plane : 97.0° → 90.4°, interincisal angle :...
Figure 6: Period of active treatment: 0 month

Figure 7: Period of active treatment: 2 month
DISCUSSION

Treatment of second molar impaction case is a challenging scope of orthodontics. Sometimes, we have to use a level arm or TAD’s to correct the impacted second molar. However, we distalized and uprighted the impacted second molar with ISW archwire leveling and open coil spring, without any level arms or TAD’s. The treatment becomes much easier and we can avoid imposing too much inconvenience on the patients (Shapira et al., 1998; Becker et al., 1984; Andreasen et al., 1997; Evans, 1988; Venta and Schou, 2001; Uthman, 2007). After 33 months of active treatment, a desirable outcome was achieved.

#37 Uprighting

With ISW leveling, crimpable stopper and open coil spring for space creation and distalization, the lower left second molar was uprighted.

The second molar was uprighted 60°. A distal free end provided a track for #37 distalization and a resin ball was set distally to protected gingiva from getting hurt. (Figure 19).
**Not-in-slot and Intrusion arch**

Not-in-slot (ISW was placed under the incisal wings of bracket) can facilitate anterior intrusion for bite raising. Intrusion arch (bending by heat bender) can provide an intrusive force over anterior teeth for overbite reduction. (Figure 20)

**Overbite control**

Bite deepening often takes place during canine distal drive and anterior retraction. This patient is low angle, protrusive maxilla and mandible with flaring upper incisors. Therefore, the upper incisors are apt to lingually tipped during retraction and space closure phases, which ends with bite deepening. In this case, we used not-in-slot and intrusion arch to reduce the overbite instead of TAD’s or J-hook. (Figure 21)

**Profile change**

The mandible was slightly clockwise rotated due to lower
molar extrusion, resulting in an increase in anterior lower facial height. The incisors were retracted and the protrusive profile was improved. After orthodontic treatment, a desirable result was achieved. The profile changes were noted as follows: (Figure 22)

- An increase in the nasolabial angle
- An increase in anterior lower facial height
- A decrease in facial convexity

**Conclusion**

Treatment for the adult patient with moderate crowding dentition and unilateral second molar impaction by ISW
Figure 14: Intraoral photos after active treatment

Figure 15: Panoramic film after active treatment
Figure 16: Lateral Cephalometric film after active treatment

<table>
<thead>
<tr>
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<th>Before</th>
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Figure 17: Polygon after active treatment
(Improved Super-elastic Ti-Ni alloy wire, developed by Tokyo Medical and Dental University) was discussed in the article. Clinical examination found a moderate crowding with #25, #35 linguoversion and #37 impaction. With successful lower left second molar uprighting by ISW leveling, crimpable stopper and open coil spring, toe-in and lingual torque to the adjustment of #37 position and the protruded profile improved by canine distal drive and anterior retraction, the unilateral second molar impaction was corrected efficiently.

After 33 months of active treatment, a normal occlusion and a desirable cusp interdigititation were achieved. Therefore, adult patient with moderate crowding dentition and unilateral second molar impaction case can be treated
Figure 20: Not-in-slot and Intrusion arch

- Not-in-slot (ISW was placed under the incisal wings of bracket) can facilitate anterior intrusion for bite raising.

- Intrusion arch (bending by heat bender) can provide an intrusive force over anterior teeth for overbite reduction.

Figure 21: Overbite control
The mandible was slightly clockwise rotated due to lower molar extrusion, resulting in an increase in anterior lower facial height. The incisors were retracted and the protrusive profile was improved.

**Figure 22**: Profile change with ISW treatment.

**Conflict of Interests**

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

**REFERENCE**


