Management of Tipped and Impacted Mandibular Second Molars

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INTRODUCTION

Mesial tipping of mandibular second molars are caused by the following factors, including: (1) loss of the mandibular first molar after eruption of mandibular second molars; (2) early loss of the mandibular first molar before eruption of mandibular second molars at a young age, and without placing any space maintainer; (3) mandibular second molar impaction with mesioangulation.\(^1\)

Impaction of tooth was defined as failure of tooth eruption caused by a physical obstacle in the eruption path or the abnormal position of the tooth.\(^2\) Impaction teeth occur most commonly in third molars. Impaction of mandibular second molars are rare with an incidence of 0–2.3\%.\(^3,4\) Fu et al in 2002, reported an incidence of 0.65\% of mandibular second molars impaction in Taiwan.\(^2\) Impacted second molars are commonly mesially inclined.\(^5,7\) The etiology of impaction is related to some disturbance of physiological mandibular growth and tooth development. The space for second permanent molars is obtained by resorption of the bone at the anterior border of the mandibular ramus and mesial migration of the first molar into the leeway space. The tooth bud of the second permanent molar develops with some mesial
axial inclination and the ability for natural self-correction manifests as the remodeling changes occur. Inadequate mandible growth may lead to disturbances of this natural process and cause the impaction which was mainly associated with an arch length deficiency. The second molar needs the distal root of the first molar as the guide for proper eruption. Therefore, excess space between the developing second molar and first molar may also result in impaction. Sometimes the second molar gets impacted spontaneously, which is probably related to the third molar position.

On the other hands, impaction of lower second molars also develop during orthodontic treatment, when: (1) banding on 36 or 46, that may cause unerupted 37 and 47, progressively tipping mesially instead of erupting; (2) distalize 36,46 in mixed dentition also increases risk of 37, 47 impaction; (3) lip bumper or lingual arch therapy that may prevent the mesial shift of the first permanent molars.

The best time to treat impacted mandibular molars is between 11 and 14 years of age, when the second permanent molar roots is still undergoing development.

**CASE REPORT**

This is a 12Y11M female with both mesial tipped left and right mandibular second molars. She came to our hospital with her parents for orthodontic consultation due to crowding of teeth. She denied any major systemic disease and drug allergy. She had received dental care at local dental clinics, and she has good oral hygiene.

The findings of clinical examination are as followings: (1) extraoral findings: convex profile with facial symmetry, normal facial height proportion, no lip incompetence, no mentalis muscle strain, no occlusal canting, nasolabial angle 98°, upper incisor show is 50%; (2) intraoral findings: Class I molar relationship on both side, lower midline shift to left 2.5 mm, overjet 2.5 mm, overbite 2 mm, crowding of upper and lower anterior teeth, 13, 23 blocked out and 47, 37 are mesial tipped impaction. Figure 1 presents the initial models of this patient.

![Progress Record](image)

*Figure 1. Initial models and photographs. The mandible right and left side second molars were mesially tipped.*
The panoramic film showed 47, 37 impaction with mesial tipping. The cephalometric analysis demonstrated that the SNA=86°, SNB=83°, ANB=3°, U1-SN=115°, L1-MP= 105°, U1-L1=111°, upper lip to E-line was 1.5 mm, lower lip to E-line 4 mm (Figure 4a, Table 1). Space analysis demonstrated space discrepancy of 3 mm in the upper arch, and -4 mm in the lower arch.

**Diagnosis and treatment**

The diagnosis was dental and skeletal Class I malocclusion with bimaxillary protrusion, upper and lower anterior crowding and 37, 47 are mesial tipped impaction. The treatment goal is to upright the mesial tipped and impacted 37, 47, to relieve crowding of upper and lower anterior teeth, to retract proclined upper and lower incisors. The treatment plan was four 1st premolars extraction due to crowding of both arches, and using the uprighting spring to correct mesial tipped and impacted 37, 47.

The orthodontic treatment started with full mouth 0.022x0.028 slot pre-adjusted OPA-K bracket system. After 7 months of preliminary alignment and leveling, 16x22 stainless steel wire was inserted in lower arch. In the same time 17x25 TMA wire-bended lever arm was applied on 47, and a prefabricated Memory Titanol® upright spring was applied on 37. The memory Titanol upright spring consist of a 16x22 Ni-Ti wire on the posterior part that is connected by means of a climbable tube to a 17x22 stainless steel wire on the posterior part (Figure 2a). After placing the auxiliary uprighting springs on both side for 4 months, 37 and 47 were uprighted. Figure 2b presented the progress of treatment. We can also see the result of 37, 47 well uprighted in the panoramic film (Figure 3b).

**Table 1. Cephalometric analysis in initial and treatment progress stage.**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Norm</th>
<th>Pre-Tx</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skeletal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNA (°)</td>
<td>79.8 ~ 83.2°</td>
<td>86°</td>
<td>86.5°</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>75.7 ~ 78.7°</td>
<td>83°</td>
<td>84°</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>3.2 ~ 5°</td>
<td>3°</td>
<td>1.5°</td>
</tr>
<tr>
<td>SN-MP (°)</td>
<td>33.8 ~ 38.4°</td>
<td>29°</td>
<td>27°</td>
</tr>
<tr>
<td><strong>Dental</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U1 to SN (°)</td>
<td>4.3 ~ 8.1</td>
<td>4.5</td>
<td>1</td>
</tr>
<tr>
<td>U1-NA (mm)</td>
<td>103.85 ~ 108.75°</td>
<td>115°</td>
<td>110°</td>
</tr>
<tr>
<td>L1 to MP (°)</td>
<td>5.4 ~ 10.2</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td>L1-NB (mm)</td>
<td>93.4 ~ 99.2°</td>
<td>105°</td>
<td>95°</td>
</tr>
<tr>
<td><strong>Soft tissue</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U lip - E line (mm)</td>
<td>0.7 ~ 3.1</td>
<td>1.5</td>
<td>0</td>
</tr>
<tr>
<td>L lip - E line (mm)</td>
<td>0.2 ~ 3.4</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
Figure 2. 

a, A self-bending lever arm uprighting appliance of 0.017 × 0.025 TMA wire was bended and placed on 47 (right). A prefabricated Memory Titanol® upright spring was placed on 37 (left). 

b, With auxiliary uprighting springs placing on both side for 4 months, both impacted second molars were uprighted. 

c, Intraoral photos in finishing and detailing stage.
Figure 3. a, initial panoramic film; b, progressive panoramic film; c, panoramic film in the finishing stage.
The patient is still undergoing the final detailing stage of orthodontic treatment. The extraction space of 14, 24, 34, 44 have been closed, Class I molar relationship is still maintained; proper overjet, overbite and interdigitation is almost achieved. The mandibular dental midline coincided with maxillary and facial midline (Figure 2c). Figure 3c, Figure 4a, right demonstrated the panoramic film and cephalometric film after molar uprighting. Compared to the initial cephalometric film (Figure 4a, left), the mandibular second molars were uprighted. The following are initial and progressive cephalometric analysis (Table 1). The progressive cephalometric analysis demonstrated SNA=85°, SNB=84°, ANB=1.5°, U1-SN=110°, L1-MP= 95°, U1-L1=128°, upper lip to E-line was 0 mm, lower lip to E-line 2mm. Figure 4b showed superimposition of the Initial (blue line) and progressive (red line) cephalometric tracing.

The patient is still in growth, overall superimposition showed vertical skeletal and soft tissue growth. Maxillary superimposition presented the upper incisor crown lingually tipped 8°, and extruded 1 mm. The upper first molar mesially moved 4.5 mm. The lower incisor crown tipped linguallly by 6°, retracted 3 mm and intruded 1 mm. The lower first molar extruded 2 mm, mesially moved 2.5 mm. The lower second molar uprighted distally by 48°.

**Figure 4.** [4a] initial and progressive cephalometric films; [4b] superimposition of the initial and progressive cephalometric tracing, overall superimposition (left), maxillary superimposition (right upper), and mandibular superimposition (right lower).
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**DISCUSSION**

In order to correct impacted/tipped molars, one should tip the tooth posteriorly and then upright it. Use a pure couple force system with a high moment-to-force ratio is to secure a pure rotation of molar uprighting. A long cantilever gives a high moment-to-force ratio, which results in a clinical effect that very close to a pure rotation. The moment of 800–1500 g/mm has been suggested to rotate a molar. The main effects of cantilever on the tooth is distal crown tipping and the molar extrusion. A long cantilever delivers less extrusion than a shorter one.

Several methods for different severity of the mesial-tipped impacted mandibular second molars are discussed as followings:

1. **When the second molar is mild tipped and the first molar is missing.**

   Simply use a flexible 17x25 A-NiTi single wire to complete the necessary uprighting is suggested. Or a braided rectangular steal wire could be considered, but it requires frequent removal and reshaping. During the process of mandibular molars uprighting, it is essential to remove the occlusal interference to prevent excessive tooth mobility and increases treatment duration.

2. **When the second molar is impacted and mild tipped.**

   Insert a separator between the second and first molars is suggested. Or a brass wire penetrating beneath the contact point between two teeth could be used.

3. **When the second molar is severe tipped/impacted.**

   An attachment must be bonded to the second molar. Placing a segmental auxiliary NiTi wire from the auxiliary tube on the first molar to the tube on the second molar is an easier way to upright the second molar. Using a continuous wire to upright the molar will cause side effects on the position and inclination of the second premolar. Therefore, we may carry out a sectional uprighting spring to generate the effect of distal crown tipping. Use a stiff 19x25 steel wire maintains the relationship of the teeth in the anchor segment and an auxiliary uprighting spring to upright the second molar. The best choice of the segmental auxiliary spring is 16x22 M-NiTi wire which provides a light force to align the second molars. A sectional cantilever uprighting spring by using 17x25 beta-Ti (TMA) wire without a helical loop or 17x25 SS wire with a loop for more springiness, is also an option to upright the tipped/impacted molar. Inserted distal arm of spring into the second molar tube, and the uprighting spring is activated by lifting the mesial arm and hooking it over a stabilizing wire between the canine and premolar brackets.

The uprighting spring is a cantilever which produces effects of distal crown tipping and molar extrusion. The forces acting on the tipped second molar is of the same magnitude as, but in opposite direction to the forces acting on the stabilizing wire. Thus, the couple of force would rotate the second molar distally. There is a commercially available prefabricated Memory Titanol® upright spring, which has similar mechanics with the traditional uprighting spring for clinical convenience.

There are other methods for molar uprighting:

1. **Miao’s method:** use a double or triple push spring bended from 18 SS wire, and solder it onto the lingual surface of the band of the tipped molar. Activated the spring by compressing the spring to engage the lingual button on the tipped molar.
2. **Kuang’s Method:** Molar uprighting with AIPS (Anterior Insertion Pushing Spring). AIPS is a double helix push spring, which is made of a 17x25 TMA wire. Inserted the mesial segment into the auxiliary tube of the first molar mesially, and engage to the distal hook over the lingual button on the impacted molar. Tie the mesial helix with the hook of the adjacent molar to activate the spring.
3. **Liaw’s method:** a modification of Kuang’s method, which changed the wire to 16x22 NiTi, without wire bending.
4. **Richard Bach’s method:** Insert a 14x25 CuNiTi wire between the 2 molars. Followed by bending the wire to the occlusal surface of the adjacent first molar and
secure the wire over occlusal surface with light cured composite resin. For open bite cases, this technique should be avoided.14

(5) Tip back cantilever technique: combined the cantilever and the mechanics similar to Richard Bach’s method with a 16x22 TMA wire.15

(6) Lin’s method: Use a 14 or 16 Ni-Ti wire and place an open coil spring between the tubes of the 2 molars.14,16

(7) using a lingual holding arch with distal extension as an anchorage is also a treatment option to upright the tipped molars.

4. In cases of very deeply impacted molars.

Inserting a miniscrew over the ascending ramus, may upright the molar in a short period of time. Surgically exposure the impacted molar, bond a button on it, and pull it up with elastic chains.1,14 Once enough exposure achieved, bond a buccal tube and use a NiTi wire to keep uprighting the impacted molar.1,7,14,17 The miniscrew can also be inserted at the area anterior to the impacted molar and use the mini-screw assisted uprighting spring (MAUS).18,19

Surgical uprighting and autotransplantation are also discussed in the literature.24,25,26 Generally, surgical methods bring a higher risk of complications, such as pulp necrosis, ankylosis, or root resorption.10,20,21

In our case, the second molars are mild to moderate mesial tipped and impacted. We use a cantilever lever arm uprighting appliance by a 17x25 TMA wire on the right mandibular second molar, and a prefabricated Memory Titanol® upright spring with 16x22 stainless steel main wire as anterior anchor unit. Both sides of mesial tipped and impacted molar were uprighted within four months.

There are several benefits after uprighting of the mesial tipping and/or impaction mandibular molars, such as reducing risk of dental caries and periodontal problems, avoiding adjacent teeth root resorption, and easier prosthetic rehabilitation. As to the periodontal benefit, studies have indicated the mesial pocket depth of the mesial tipping mandibular molars could significantly reduce, and the bony morphology of angular defect could be altered.22-25 The microorganisms such as B.f, B.g, B.i, A.a, also diminished in the mesial pocket of the mesial tipped molar reporting in the previous studies.22,26,27

CONCLUSION

By using simple biomechanics, one may easily correct the tipped molars. In this case report showed that the two appliances, hand-bending and prefabricated upright spring, have similar treatment effects. Proper orthodontic analysis, diagnosis, and treatment planning are important keys to correct the tipping molars. If the mandibular first molar was lost after the second molar eruption, the space should be maintained by space maintainer for further fixed bridge or implant prosthesis in the future.1,28

If the patient loss the best timing to maintained the space and the molar already mesial tipped, using the uprighting mechanics is suitable for treatment. Uprighting the mandibular tipped molars is beneficial for oral hygiene care, occlusion and chewing function, and the condition for prosthodontic rehabilitation as well as quality of life for the patients.

REFERENCE


