

## Molar Protraction and Uprighting (2<sup>nd</sup> Molar Protraction in the 1<sup>st</sup> Molar Missing Site and Uprighting an Impacted 3<sup>rd</sup> Molar)

### Abstract

Recently, with the help of TADs (temporary anchorage devices), substantial 2<sup>nd</sup> molar protraction has become possible in case of missing posterior teeth. Total 260 cases of U-6 (Upper 1<sup>st</sup> molar missing), L-6 (Lower 1<sup>st</sup> molar missing) and L-E (Lower E extraction with the 2<sup>nd</sup> molar missing, E: deciduous 2<sup>nd</sup> molar) were finished. After 2<sup>nd</sup> molar protraction, even a horizontally-impacted 3<sup>rd</sup> molar can be uprighted. This treatment will become very good treatment modality, replacing implants and bridges in cases of missing posterior teeth.

**Keywords:** Molar protraction, molar uprighting, third molar, 1<sup>st</sup> molar missing

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### Introduction

Till date, there has been a lot of attention given to molar distalization while molar protraction has been left out of the discussion for the most part. Molar protraction makes orthodontic closure of missing posterior teeth possible. Recently, with the help of temporary anchorage devices (TADs) or miniscrews, substantial molar protraction has become possible, and the scope of orthodontic closure of missing posterior teeth is widening.<sup>[1-9]</sup>

There are many kinds of missing posterior teeth: U-E (upper E extraction with the 2<sup>nd</sup> bicuspid missing) (E: deciduous 2<sup>nd</sup> molar), U-6 (upper 1<sup>st</sup> molar missing), and U-7 (upper 2<sup>nd</sup> molar missing) in the upper arch; and similarly, L-E (lower E extraction with the 2<sup>nd</sup> molar missing), L-6 (lower 1<sup>st</sup> molar missing), and L-7 (lower 2<sup>nd</sup> molar missing) in the lower arch. Lower arch cases are more difficult to treat because the bone is denser in the mandible than in the maxilla. Cases of U-E are extremely rare, and cases of U-7 and L-7 are not so difficult to treat because the 3<sup>rd</sup> molar easily erupts to the 2<sup>nd</sup> molar extraction space; therefore, only minor posterior teeth movement is necessary. Accordingly, U-6, L-6, and L-E cases comprise the main theme of this article due to their degree of difficulty as they need a large amount of 2<sup>nd</sup> molar protraction and control of the 3<sup>rd</sup> molar.

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After the 2<sup>nd</sup> molar protraction, even a horizontally impacted 3<sup>rd</sup> molar can be uprighted. The existing research about the 3<sup>rd</sup> molar has been about the natural 3<sup>rd</sup> molar development or its movement after 2<sup>nd</sup> molar extraction. This article is totally different because it deals with research after the 2<sup>nd</sup> molar protraction rather than extraction.

The number of cases that have been finished up to now is 260 (U-6 = 45, L-6 = 160, and L-E = 55). All of the cases presented have been treated solely by Dr. Un-Bong Baik, while the other author only contributed article writing.

If we can easily do molar protraction for closing missing posterior teeth spaces, this treatment will become very good treatment modality, replacing implants, and bridges. If we can use the 3<sup>rd</sup> molar, which used to be wasted, the significance of this treatment will become greater.

### Classifications of Molar Protraction

- Molar protraction can be classified as follows - by the missing area and by the amount of movement of the posterior teeth.

#### By the missing area

- U-6 [Figure 1a]
- L-6 [Figure 1b]
- L-E [Figure 1c].

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### By the amount of movement of the posterior teeth

- i. Pure retraction of anterior teeth: In practice, there are very few cases of pure retraction of anterior teeth because the mesiodistal length of the 1<sup>st</sup> molar is very long
- ii. Reciprocal traction [Figure 2a]: Many cases fall under this category
- iii. Pure protraction of posterior teeth [Figure 2b]: The missing 1<sup>st</sup> molar space is closed by pure protraction of the posterior teeth. If the 1<sup>st</sup> molar were intact, these cases could be treated by nonextraction. This is the most difficult type of teeth movement because the distance to be moved is the longest.

### Formation of Posterior Occlusion

In this article, the term “Class I molar relationship” has been used to describe the position of the 2<sup>nd</sup> molars that have been moved into the 1<sup>st</sup> molar location.

1. U-6 + L-NE (lower nonextraction): Class I molar relation [Figure 3]
2. U-6 + L-4 (lower bicuspid extraction): Class III molar relation [Figure 4]
3. U-6 + L-6: Class I molar relation [Figure 5]
4. U-NE + L-6: Class I molar relation [Figure 6]
5. U-NE + L-E: Class III molar relation [Figure 7]
6. U-4 + L-6: Class II molar relation [Figure 8]
7. U-4 + L-E: Class I molar relation [Figure 9].

### Cases

#### U-6

A 26-year-old male. Maxillary right 1<sup>st</sup> molar missing space closed completely. Root moved parallelly [Figure 10].

#### L-6

A 17-year-old female. Mandibular left 1<sup>st</sup> molar missing space closed completely. Root moved parallelly. Initially, the impacted 3<sup>rd</sup> molar did not develop well. At the time of debonding, the root of 3<sup>rd</sup> molar showed good development. After 7 years and 6 months, the missing space did not relapse [Figure 11].

#### L-E

A 16-year-old male. Mandibular right L-E space closed completely. The root of 1<sup>st</sup> and 2<sup>nd</sup> molar moved parallelly [Figure 12].

#### Uprighting of horizontally impacted 3<sup>rd</sup> molar

A 29-year-old female. Mandibular right 1<sup>st</sup> molar missing space closed completely. The root of 2<sup>nd</sup> molar moved parallelly. At the start of treatment, the 3<sup>rd</sup> molar was horizontally impacted. After protraction of 2<sup>nd</sup> molar and uprighting of 3<sup>rd</sup> molar, the axis of 3<sup>rd</sup> molar was arranged parallelly [Figure 13].

#### Uprighting of horizontally impacted 3<sup>rd</sup> molar

A 22-year-old female. Left 2<sup>nd</sup> molars showed scissor bite. Mandibular left 1<sup>st</sup> molar missing space closed completely. Initially, deeply impacted 3<sup>rd</sup> molar was arranged parallelly. This case was selected as case of the month of AJODO in March 2017 [Figure 14].<sup>[8]</sup>

#### Closure of long missing space (#35, 36 simultaneous missing)

A 22-year-old female. Mandibular left 2<sup>nd</sup> bicuspid and 1<sup>st</sup> molar were damaged. Those teeth were extracted simultaneously. Long missing space closed successfully and roots moved parallelly. After 1 year 11 months, the missing space did not relapse. This case was published in JCO in June 2017 [Figure 15].<sup>[9]</sup>

### Possible Problems and Biomechanics

Because the missing space of U-6, L-6, and L-E is long, the biggest problem is tipping. Meticulous traction and light force are important for parallel movement of the adjacent teeth.

Mesial rotation and swinging into the buccal side of the protracted molars is another problem during 2<sup>nd</sup> molar protraction [Figure 16]. It can create a posterior crossbite. To prevent this, a rigid lingual arch and a lingually placed miniscrew can be used. However, the lingual arch may not only cause discomfort to the patient but also interfere with any further movement of the protracting of the molars. In addition, the lingual arch

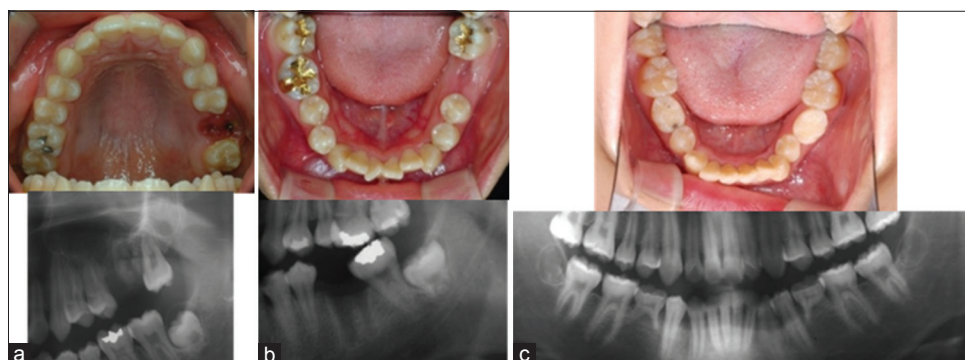


Figure 1: Three areas of missing posterior teeth. (a) U-6 (b) L-6 (c) L-E

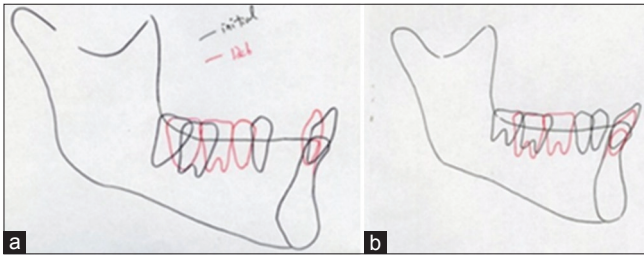


Figure 2: (a) Reciprocal traction. (b) Pure protraction of the posterior teeth



Figure 4: U-6 + L-4: Final occlusion should be molar Class III relationship (canine relation: Class I)



Figure 6: U-NE + L-6: Final occlusion should be molar Class I relationship (canine relation: Class I)

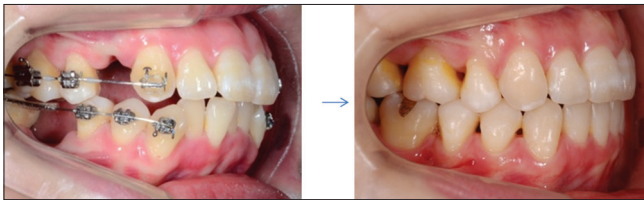


Figure 8: U-4 + L-6: Final occlusion should be molar Class II relationship (canine relation: Class I)

needs to be remade when it touches the lingual side of the anterior teeth. Lingual placement of the miniscrew is very difficult due to poor visibility and accessibility. Other methods are placing an elastic chain from the lingual side of the molars to a button on the canine, or a sliding band with a lingual arch. Among the cases I have personally encountered, this problem was minimized by inserting an anti-rotation bend in the posterior portion of the archwire.

During protraction, the extrusion of the posterior teeth is another problem. It causes an anterior open bite [Figure 17]. The entire arch rotates around the center of rotation of the dentition in the miniscrew retraction system. As a result, when the posterior teeth are protracted, the molars become extruded, causing an anterior open bite. To solve these problems, the following methods can be used: (1) A long hook can be attached to the second molar brackets to pass



Figure 3: U-6 + L-NE: Final occlusion should be molar Class I relationship (canine relation: Class I)



Figure 5: U-6 + L-6: Final occlusion should be molar Class I relationship (canine relation: Class I)



Figure 7: U-NE + L-E: Final occlusion should be molar Class III relationship (canine relation: Class I)

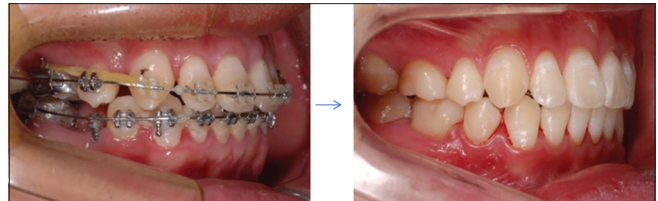


Figure 9: U-4 + L-E: Final occlusion should be molar Class I relationship (canine relation: Class I)

the protracting force near the center of rotation; (2) The maxillary and mandibular molar intrusion can be done by miniscrews. None of the presented cases showed these problems.

Among 260 cases of U-6, L-6, and L-E, 4 cases had failed. All of the failed cases were due to periodontal problems. Most of the cases did not exhibit tilting or an open bite, and only a few cases resulted in a buccal crossbite.

### Development of Lower 3<sup>rd</sup> Molar

There have been so many reports about the 3<sup>rd</sup> molar. Most of them have been about normal development or movement after 2<sup>nd</sup> molar extraction.<sup>[10-17]</sup> Meanwhile, there has not been sufficient research on the eruption of the 3<sup>rd</sup> molar after 2<sup>nd</sup> molar protraction. The reason is that TADs is essential for molar protraction, but they have only been utilized in the past 10–15 years.



Figure 10: (a) Initial, (b) during treatment, (c) debonding, (d) 2 year 3 months after



Figure 11: (a) Initial, (b) during treatment, (c) debonding, (d) 7 years 6 months after



Figure 12: (a) Initial, (b) during treatment, (c) debonding, (d) 2 years 4 months after

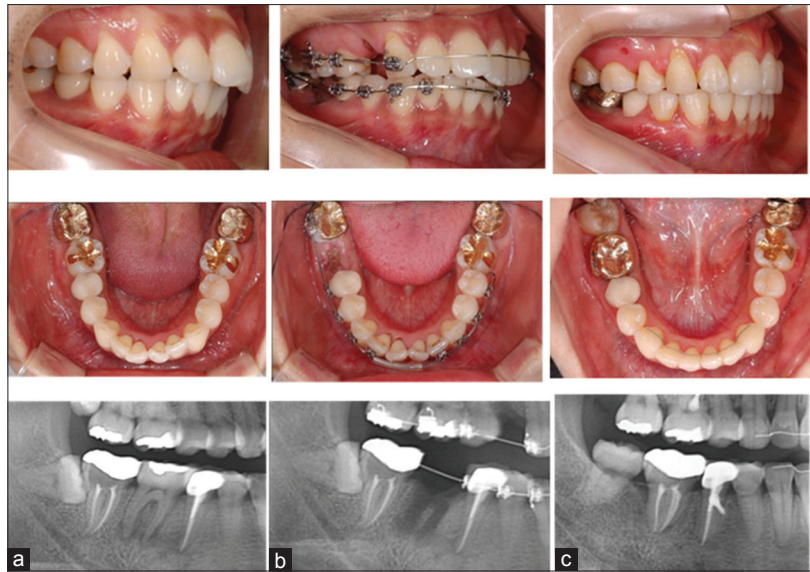


Figure 13: (a) Initial, (b) during treatment, (c) debonding

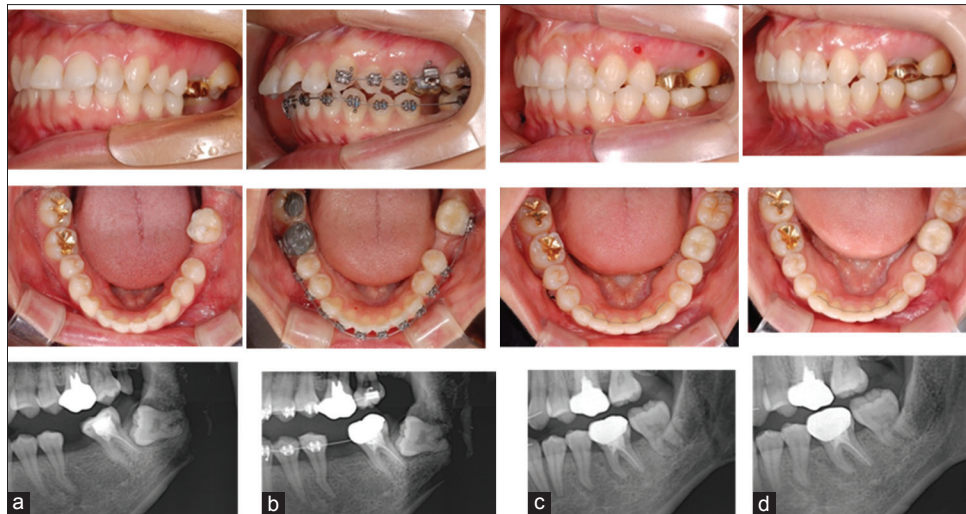


Figure 14: (a) Initial, (b) during treatment, (c) debonding, (d) 9 months after



Figure 15: (a) Initial, (b) during treatment, (c) debonding, (d) 1 year 11 months after

The number of cases of U-6, L-6, and L-E that have been finished up to now is 260. Among them, the number of cases that had an impacted 3<sup>rd</sup> molar at the time of the start of treatment was 100. Using these materials, many new research studies are possible. At first, studies about the vertical eruption patterns of impacted mandibular third molars after protraction of 2<sup>nd</sup> molars were done and published in Angle Orthodontists in 2016.<sup>[18]</sup> It showed most impacted mandibular third molars spontaneously erupt after 2<sup>nd</sup> molar protraction without any appliances, even in adults. Even in such cases where the root formation was slightly insufficient at the initial stage, the root developed well, and the tooth erupted [Figure 18]. Among the adults as well, after root development was complete, the 3<sup>rd</sup> molar also erupted well in most of the cases. In that research, age, gender, Nolla stage, and angle of the third molars did

not show significant correlations with the vertical change of the impacted third molars, whereas the depth of third molar impaction and available space showed significant correlations.

Now, more research is being done about angular change, horizontal movement, and alveolar bone changes.

A 17-year-old female. Mandibular left 1<sup>st</sup> molar missing space closed completely. Root moved parallelly.

### Evaluation

Till date, 260 cases of U-6, L-6, and L-E have been finished, out of which only four L-6 cases have failed. The reason for failure was mainly due to periodontal problems. In the future, more meticulous case selections and periodontal therapy will decrease the rate of failure.

When there are missing teeth, bridges or implants have been the traditional treatment method; however, orthodontic space closure is another good option. Some patients may choose orthodontic treatment despite the lengthy treatment time. If bridges or implants have been applied previously, orthodontic treatment becomes very complex and difficult. Accordingly, when there are missing teeth, orthodontic evaluation is the top priority.

Prosthodontic, endodontic, or periodontic doctors may have more chances to meet patients who have missing teeth than orthodontic specialists do. Therefore, not only orthodontists but also the other dental doctors should take this orthodontic treatment into consideration. Moreover, patients, as well as dentists, must be aware of various treatment options, including orthodontic treatment methods.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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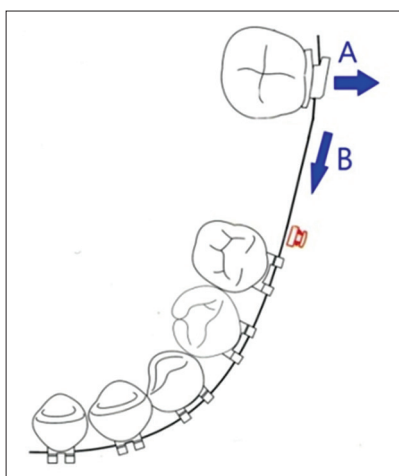


Figure 16: Protraction force (B) produced buccal force (A). This swung the posterior dentition into a unilateral crossbite

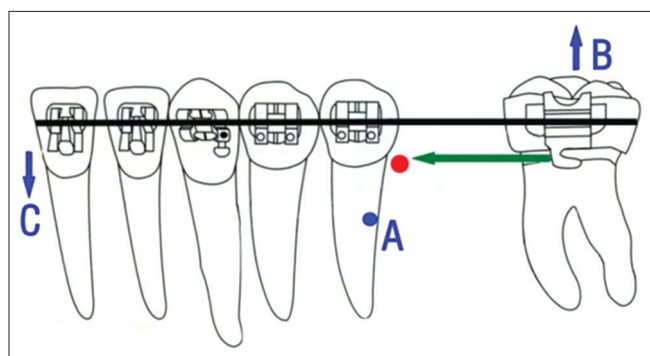


Figure 17: The center of rotation of the entire arch (A) is located under the TADS (red point). Protraction of the posterior teeth caused the extrusion of the posterior tooth (B) and intrusion of the anterior teeth (C)

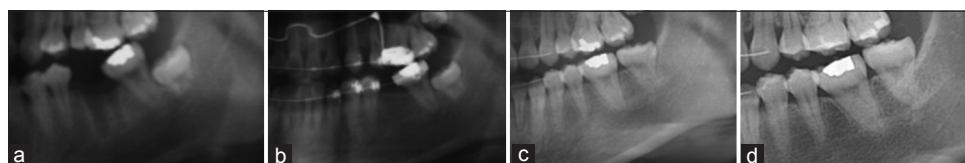


Figure 18: 18 years old female (a) Initial, (b) During treatment, (c) Debonding, (d) 5 years 8 months after

## Conflicts of interest

There are no conflicts of interest.

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