Orthodontic uprighting of severely impacted mandibular permanent second molar with TMA spring

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ABSTRACT
Treating impacted teeth is very challenging for an orthodontist. Although canine impactions are common, second molar impactions are also encountered in orthodontics. The fate of impacted second molar depends on various factors such as the degree of its inclination and position of third molars. A case of molar uprighting using a 0.017” × 0.025” titanium molybdenum alloy uprighting spring is discussed in this case report. Treatment included surgical exposure and crown lengthening along with orthodontically assisted eruption.

Key words: Molar uprighting, second molar impaction, TMA uprighting spring

INTRODUCTION
The impaction of mandibular second permanent molars is rather a rare condition. The incidence of second molar impaction revealed by panoramic radiograph studies has been reported to be around 0.03% of all impacted teeth. They gain space by resorption of bone at the anterior border of the mandibular ramus and mesial migration of the first molar into the leeway space. Disturbances in this natural process may lead to impaction and are associated with an arch length deficiency because of inadequate mandible growth.

There are various advantages of uprighting over extraction of an impacted second molar, especially in cases with unpredictable third molar position. In case of extraction of impacted second molar, unopposed teeth have a tendency to overerupt. Another benefit of molar uprighting is the elimination of pseudopocket in that area. We can also prevent damage to the distal root of the first molar due to the impacted molar.

The treatment possibilities depend on the degree of tooth inclination and direction of tooth movement required. A common treatment approach for severely inclined tooth is orthodontically assisted eruption with surgical uncovering. An attachment bonded to the surgically uncovered buccal or distobuccal surface will be used to deliver uprighting force by means of various techniques such as applying superelastic NiTi wire, NiTi-coil spring, uprighting springs, sectional arch wire, or titanium miniscrews in the retromolar area.

This case report discusses the orthodontic treatment of a severely impacted lower left second molar with a simple uprighting spring.

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A 19-year-old female patient reported with a chief complaint of irregularly placed front teeth. Clinically, the patient had Angle’s Class I malocclusion with proclined and moderately crowded upper and lower anteriors, cross bite of upper first permanent molars, and unerupted lower left permanent second molar [Figure 1].

Pretreatment radiographs revealed the presence of all permanent teeth and severely mesioangularly impacted lower left permanent second molar and developing third molars. The distal cusps of the lower left second molar were present under the distal bulge of the first molars very close to the mid portion of distal root of the first molar. The apex of the left permanent third molar roots was still incompletely formed and the tooth was located on top of the second molar [Figure 2].

Cephalometric analysis revealed a skeletal Class I relationship with normodivergent growth pattern and proclined upper and lower incisors. Based on the clinical and cephalometric analysis, extraction of four first premolars was planned to correct proclination and crowding. Correction of cross bite was planned with expanded transpalatal arch. Later, extraction of lower left permanent third molar followed by surgical exposure and uprighting of lower left permanent second molar was planned.

The treatment was carried out in two stages. In the first stage, initial alignment, correction of cross bite [Figure 3], and retraction of anterior teeth [Figure 4] were done. Space closure was completed prior to molar uprighting because of the following reasons.

1. As the second molar was mesioangularly impacted, with its crown locked under the distal bulge of the first molar, we cannot upright it by a pure rotation.
obtained by application of a pure couple force system with a high moment-to-force ratio (so that the center of rotation is very close to the center of resistance). The uprighting should produce a distalizing effect on the tooth so that there will be unlocking of impacted second molar from the distal bulge of the first molar. Later, we can apply force to obtain distal crown tipping and molar extrusion.

2. Also, if we start molar uprighting prior to space closure, anchor loss in lower left quadrant may occur because of the effect of uprighting force on lower left first molar.

In the second stage, molar uprighting was done. At first, extraction of the developing lower left third molar was performed 6 months prior to orthodontic uprighting, that is, when the patient was in retraction phase. This was done to allow bone formation and mineralization by the time uprighting starts, which provides stability and prevents mobility of tooth while uprighting [Figure 5a and b]. Surgical exposure was done after completion of retraction to uncover the distobuccal aspect of the impacted lower left permanent second molar and a second molar tube was bonded to the exposed surface with Transbond TM (3M Unitek, Monrovia, CA, USA) adhesive. Uprighting spring made with 0.017″ × 0.025″ titanium molybdenum alloy (TMA) wire was inserted into the second molar buccal tube from the auxiliary tube of first molar [Figures 5c, 6, 7a, and b].

The patient was followed up every 4 weeks to monitor control of anchorage and movement of the impacted tooth. The initial change was noticed 8 weeks after the application of the force. After 4 months, satisfactory distalization was achieved [Figures 5d, 7c-7f].

At this stage, crown lengthening of the impacted tooth was done for rebonding the molar tube in a more appropriate position, that is, more gingivally and mesially. Later, uprighting was continued with uprighting spring for distal crown tipping and extrusion of molar. Complete correction of inclination was obtained 4 months after rebonding [Figures 5e-5f, 8a-8f] and was confirmed on the posttreatment panoramic radiograph [Figure 9].
DISCUSSION

There are different treatment options for correction of impacted lower second molars. Surgical repositioning and transplantation has high risk of complications such as pulp necrosis, ankylosis, or root resorption. Extraction of the impacted tooth to let the third molar erupt also has some disadvantages because of long time interval between the extraction of the second molar and the eruption of the third molar. As a result, the third molar may become tipped and impacted. Sometimes, there may be injury to the third molar bud and distal root of first molar while extracting impacted second molar.\[10\]

However, Orton-Gibbs et al.,\[11\] in a study of eruptive path of mandibular third molars after mandibular second molar extraction, reported that none of these teeth became impacted and that all achieved the acceptable position, but suggested that this treatment option requires good case selection. Hence, before orthodontic therapy, the need for third molar extraction should be thoroughly evaluated.
This case report describes use of uprighting spring with advantages such as simple design, easy chairside fabrication, less time consumption, efficient, and ease in activation and reactivation. Molar uprighting usually presents difficulty in managing the unwanted reactionary force vectors associated, which if not taken care can produce deleterious effects on areas of dentition used for anchorage.[13]

Three-dimensional control of molar has been taken care by incorporating bends within the uprighting spring. The anchorage was secured with a rigid wire (0.021” × 0.025” stainless steel) and consolidation was done from the lower left first molar to the lower right first molar. Tip back bend of 15° was also given in the active arm of the uprighting spring for correction of inclination till satisfactory molar uprighting was achieved. As tip back bend also has a little extrusive effect over the molar in the direction of normal eruptive path, it helps in bringing the molar to the level of normal occlusal plane. As second molar is placed a bit more buccally, the active arm of uprighting spring is designed in such a way that a mild lingual tuck-in of second molar can be achieved.

**TREATMENT RESULTS**

A Class I molar and canine relationship was maintained, and ideal overjet and overbite were achieved with good alignment in both upper and lower arches. Uprighting lower left second molar was completed [Figure 10]. Decrease in the proclination of upper and lower anteriors was observed from posttreatment radiographs [Figure 9].

**CONCLUSION**

Second molar impaction is a very challenging disturbance that requires proper clinical, radiological, and biomechanical evaluation and a good appliance selection for successful treatment results.

**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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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**