Intrusion of Overerupted Molars using Miniscrews and TMA Spring: A Case Report

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Over eruption of posterior tooth due to the loss of antagonist teeth causes occlusal and functional disturbances. To restore proper occlusion, intrusion of the overerupted tooth becomes essential before multidisciplinary reconstructive dental approaches can be initiated. Conventional orthodontic techniques do not intrude posterior teeth effectively, and almost all methods result in anterior extrusion rather than posterior intrusion. New absolute anchorages (miniscrews and miniplates) are said to make posterior tooth intrusion possible. This case report describes the treatment of a patient with supra-erupted maxillary right and left first molars intruded with titanium molybdenum alloy spring and miniscrew anchorage. The results showed that the biological responses of the teeth and the surrounding bony structures to the intrusion appeared normal and acceptable. Periodontal health and vitality of the teeth were maintained throughout the treatment.

Keywords: Miniscrews, Molar intrusion, Titanium molybdenum alloy spring

INTRODUCTION

An early loss of any molar, is bound to cause supra-eruption of opposing molar into that space. Overeruption of such molar can lead to occlusal interference, functional disturbances and cause great difficulty during prosthetic reconstruction.¹ To reconstruct the proper occlusion for the posterior dentition and to maintain periodontal health, an interdisciplinary and comprehensive dental treatment is necessary. Correction of the overerupted molar is a first and essential step before other procedures can be started.² Procedures such as orthodontic intrusion, prosthodontic reduction, and surgical impaction are required to deal with this kind of problem.¹

Prosthodontic reduction requires endodonic intervention and crown restoration at the expense of tooth vitality, whereas surgical impaction involves an aggressive segmental operation.² Restorative options for removing such interference include coronal reduction of molar crown with or without root canal therapy followed by crown placement.¹ Hence, a plausible procedure is orthodontic intrusion, which demands calibrated anchorage support from intraoral multi-unit teeth and from extraoral headgear wear.²

Conventional orthodontic techniques for intrusion require anchorage reinforcement by incorporating multiple teeth which depend heavily on patient cooperation and usually result in extrusion of other teeth rather than molar intrusion. To overcome these problems, new methods like skeletal anchorage system has become popular now. Skeletal anchorage, including surgical miniplates and miniscrews, is now growing because of its ability to provide absolute anchorage. However, miniplates have certain disadvantages like higher cost, limited area for insertion, and the need for two separate insertion and removal surgeries.¹

The development of mini-implants in the last few years has enabled efficient anchorage, requiring no tooth support, with no aesthetic compromise and minimal patient compliance. These devices have been used in the orthodontic office with increasing frequency in cases where an inadequate number of dental units stand in the way of an effective anchorage, or even only to simplify orthodontic mechanics and make it more predictable. Hence, absolute anchorages with miniscrews was used to make molar intrusion possible.³

Until date, the available literature for molar intrusion with skeletal anchorage devices, especially miniscrews, shows that teeth can be successfully intruded in variable rates ranging from 1.2 mm in Carillo et al.’s study⁴ to 5 mm in Umemori et al.’s study.⁵ Intrusion forces also ranged from 50 g in the former to 500 g in the latter. In some of these studies, elastomeric materials were used for delivering
intrusion forces, which may have several shortcomings like rapid force degradation, hygienic problems, and need for patient cooperation.\textsuperscript{1,3,5,6} Also, besides elastomeric materials, NiTi coil springs\textsuperscript{4,7,8} used in some other studies lack the ability to change force vector, which is sometimes needed for controlling molar crown torque during intrusion, and operators were obliged to use lingual or transpalatal arches or brackets on multiple teeth for correcting crown torque.\textsuperscript{6,10}

This case illustrates the solution of a complex dental and functional problem with an interdisciplinary approach through the use of orthodontic, periodontal, restorative and prosthodontic therapy. An adequate space is prepared for the missing lower molars by intruding the overerupted upper molar using titanium molybdenum alloy (TMA) spring and mini-implants for skeletal anchorage.

**CASE REPORT**

A 21-year-old female patient came to the Department of Orthodontics with the chief complaint of forwardly placed upper front teeth. She was mesocephalic and mesoprosopatic with a convex facial profile (Figure 1).

**Diagnosis and etiology**

This patient had a class II apical base relation with a vertical growth pattern. Intraoral examination revealed missing lower first and second molars on both sides. She had a class II canine relation on both sides with an overjet of 4 mm and an overbite of 1 mm. The maxillary right and left first molars were supra-erupted 3 mm occlusally, encroaching upon the antagonistic missing dental space and leading to the occlusal interference upon mastication. The maxillary right second premolar and left first and second premolar were root canal treated with a decayed crown (Figures 2 and 3).

**Treatment objectives**

1. Intrude maxillary right and left first molars.
2. Reduce the upper and lower anterior proclination.
3. Attain an ideal overjet and overbite.
4. Achieve optimal facial balance and esthetics.

**Treatment plan**

- Extraction of 15 and 25.
- Intrusion of upper right and left first molars with miniscrews and TMA spring.
- Leveling and alignment followed by space closure.
- Finishing and detailing.
- Prosthetic replacement of missing lower molars on both sides.

**Treatment progress**

The patient was treated using pre-adjusted edgewise appliance with 0.022 slot MBT prescription. Two miniscrews (8 mm in length and 1.3 mm in diameter) with bracket-type head were inserted: One in the mesiobuccal aspect and another in the mesiopalatal aspect of the selected tooth. The procedure was performed under local anaesthesia. The miniscrews were placed in the attached gingiva between the maxillary second premolar and maxillary first permanent molar. The angle of placement was between 30° and 45° to the occlusal plane. The position of the miniscrews were documented with an intraoral periapical. Post-operative antibiotics and analgesics were given to the patient.

After a 2-week interval for soft tissue healing, band was cemented on the tooth and the TMA (017” × 025”) springs
were fitted into the slot on the miniscrew’s head and ligated with molar tube. Other end of the spring was ligated to the lingual sheath that was welded on the band. Glass ionomer cement was placed on the head of palatal implant to prevent irritation to the tongue. Patient was recalled every 4 weeks for spring adjustments and observation of treatment progress (Figure 4).

RESULTS

The intrusion of the two molars were achieved by using a combination of a mini-implant and TMA spring. The results showed that the biological responses of the teeth and the surrounding bony structures to the intrusion appeared normal and acceptable. Periodontal health and vitality of the teeth were maintained throughout the treatment. The upper extraction spaces were closed and class I canine relationship with a normal overjet and overbite was attained. After debonding, the patient was referred for prosthetic replacement (Figures 5 and 6).

DISCUSSION

Loss of the mandibular first molar often results in overeruption of the opposing teeth, resulting in occlusal interference, functional disturbances, compromised periodontal health, and increased complexity of restoring the edentulous space. Prior to the advent of orthodontic miniscrews, leveling of the over erupted maxillary posterior teeth often entailed invasive prostodontic reduction with root canal treatment, surgical impaction, or demanding orthodontic therapy requiring extraoral headgear or full-arch braces.

Intrusion by conventional methods usually is accompanied by extrusion of the anchorage unit, based on the law of action and reaction. Preventing this side effect is the key of successful intrusion. In existing methods, many brackets have to be bonded or an extraoral appliance designed in order to reinforce the anchorage unit. However, despite these efforts, efficient intrusion of molars is still difficult to accomplish. To overcome these problems new methods like skeletal anchorage system has become popular now. Skeletal anchorage including, miniplates, and miniscrews, is now gaining popularity because of its ability to provide absolute anchorage. However, miniplates have certain disadvantages like higher cost, limited area for insertion, and the need for two separate insertion and removal surgeries.

The development of mini-implants in the last few years has enabled efficient anchorage, requiring no tooth support and with no aesthetic compromise whatsoever, with minimal patient compliance is required. These devices have been used in the orthodontic office with increasing frequency in cases where an inadequate number of dental units stand in the way of an effective anchorage, or even only to simplify orthodontic mechanics and make it more predictable. Hence, absolute anchorage with miniscrews was used to make molar intrusion possible.

We used a new, simple approach for molar intrusion with a 0.017 × 0.025-in TMA spring and bracket-type miniscrews, which had some advantages over other methods for posterior intrusion using miniscrews including:

- Lighter and more continuous force in contrast to elastomeric materials used for force delivery used in some studies.
- Excellent control of force vector by altering the horizontal extension of the occlusal arm of the spring.
- Perfect control of the labiolingual position of the tooth during intrusion by altering the force in buccal
or palatal springs, in contrast to others that are obliged to use extra devices like TPA, lingual arches, or conventional fixed appliances to control tooth buccolingual position.\textsuperscript{5,9,23} Active intrusion was carried on for a period of 5 months.

- Even though lots of benefits of technique we found some difficulty in ligating spring into the bracket head implants, which caused religating of spring again.

To avoid root resorption, intrusive force levels should be kept optimal. Although an optimal force has not yet been suggested for intrusion with miniscrews, forces greater than what is generally accepted for intrusion in conventional treatments are reported to be applied with miniscrews and miniplates.\textsuperscript{24} The amount of force used in other studies were; Yao \textit{et al.}\textsuperscript{6} used 150-200 g of force, Xun \textit{et al.}\textsuperscript{10} used 150 g of force, Park \textit{et al.}\textsuperscript{25} used 100 g of force. We have used approximately 100 g force (50 g per miniscrew) to intrude the molar on both sides.

In this report, we have demonstrated a simplified version of combining mini-screws with a TMA spring to intrude the maxillary first molars on both sides. Most importantly, the molar responded well to the intrusive forces throughout treatment, no root resorption was detected during follow-up and the vitality of the teeth was sustained after 6 months follow-up. The coordination of different specialties allowed us to gain optimal results in a shorter treatment time (Figure 7).

**CONCLUSION**

The case presented in this article demonstrates the intrusion of overerupted maxillary right and left first molars using TMA spring and mini-screws for skeletal anchorage. The favourable result obtained shows that the intrusion procedure is an acceptable treatment option for extruded molars that can be preferred instead of prosthodontic reduction or the extraction of the extruded tooth.

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How to cite this article: Prakash P, Nishanth K, Jasani N, Katyal A, Nayak USK. Intrusion of overerupted molars using miniscrews and TMA spring: A case report. IJSS Case Reports & Reviews 2014;1(1):4-8.

Source of Support: Nil, Conflict of Interest: None declared.