Management of Partially Impacted Mandibular Molars Using Temporary Anchorage Devices

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Partially impacted mandibular second permanent molars are a common clinical condition, with an incidence of .06-.3%. A number of uprighting techniques have been described, ranging from simple leveling archwires and open-coil springs to more complex uprighting springs.

Temporary anchorage devices (TADs) have simplified the handling of such difficult cases, minimizing adverse effects such as extrusion of the uprighted molar, intrusion of the anterior segment, and protraction of the teeth mesial to the tipped molar. Recent articles have proposed using miniscrew anchorage for correction of mesially tipped mandibular molars. This case series demonstrates the versatility and usefulness of TADs in uprighting impacted molars using various biomechanical systems.

Case 1

A 16-year-old female, who had already undergone orthodontic treatment, presented with a partially impacted lower right second molar. Endodontic treatment of the first molar was needed initially because of a periapical lesion.

A tube was bonded to the buccal surface of the impacted second molar, and an 8mm-long self-drilling, self-tapping miniscrew* was placed buccally between the lower right first molar and

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Fig. 1 Case 1. A. 16-year-old female patient with partially impacted lower right second molar. B. Biomechanical scheme, with .018" × 022" Memory Titanol** cantilever attached between molar tube and buccal miniscrew.*

Fig. 2 Case 1. New miniscrew inserted after one month of treatment.

Fig. 3 Case 1. After five months of treatment (complete treatment required seven months).
second premolar (Fig. 1). An .018" × .022" superelastic Memory Titanol** cantilever, preactivated for both uprighting and intrusion, was attached between the miniscrew and the molar tube. After one month of loading, the miniscrew failed due to an incorrect angle of insertion, and a new one was placed between the lower right first and second premolars (Fig. 2). The cantilever was reactivated at each appointment for seven months, until complete uprighting of the second molar had been achieved (Fig. 3).

This biomechanical scheme can be used as long as a sufficient amount of crown is exposed to bond a molar tube to the impacted tooth.

Case 2

A 12-year-old male presented with an impacted lower left second molar. The technique employed in Case 1 could not be used in this patient because he had hypertrophic soft tissue and insufficient crown exposure of the tipped tooth.

Our alternative was to bond brackets to the lower left first and second premolars and a button to the impacted second molar (Fig. 4). The adjacent third molar was extracted, and two 8mm-long miniscrews* were inserted buccally between the first and second premolars and between the second premolar and the first molar. The miniscrews were used to obtain maximum anchorage of the first and second premolars, which were connected with a stainless steel ligature wire to avoid mesiodistal or extrusive movements. An .017" × .025" stainless steel sectional archwire was bent to form a loop distal to the impacted tooth, and the uprighting force was provided by a coil spring from the button to the loop (Fig. 5). After three months, the crown had been exposed enough to bond a tube and insert a nickel titanium leveling archwire. Treatment was completed in 12 months.

This approach is suggested when a tube cannot be bonded to the buccal surface of the tipped tooth. The miniscrews anchor the mesial dental unit and thus prevent mesiodistal and vertical side effects during the molar uprighting.

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Case 3

A 33-year-old male presented with an impacted lower right third molar. The patient had previously undergone orthodontic treatment for which the upper right first molar and lower right first premolar had been extracted.

A miniscrew was inserted between the lower right first and second molars, and a tube was bonded horizontally to the distal surface of the third molar (Fig. 6). An .016" stainless steel sectional wire with a nickel titanium open-coil spring was inserted into the holes in the neck of the miniscrew and attached to the tube. Four months later, with the buccal surface of the third molar exposed, new tubes were bonded to this tooth and the second molar, and an .016" × .022" superelastic nickel titanium sectional wire was inserted (Fig. 7). Another three months later, an .019" × .025" beta titanium sectional wire with a V-bend was placed to complete the uprighting (Fig. 8). In this second phase, the miniscrew served as indirect anchorage to stabilize the lower first and second molars, using a stainless steel
rection of the third-molar position, we connected the first and second molars to the miniscrew as an anchorage unit.

Case 4

A 35-year-old female was referred by her general dentist for uprighting of a mesially tipped lower right second molar.

An oral surgeon extracted the adjacent third molar and placed a 1.5mm-diameter, 8mm-long miniscrew‡ between the lower right first and second premolars (Fig. 9). After positioning the miniscrew, we bonded a tube to the buccal surface of the second molar. An .016" × .022" superelastic nickel titanium wire was activated both vertically—using a small amount of force and thus exploiting the length of the cantilever to produce the moment required to upright the molar—and horizontally, as a spring for distalization of the molar. After
five months of treatment, the molar had been uprighted (Fig. 10). Treatment was finished by bonding a tube to the buccal surface of the first molar and brackets to the first and second premolars, with an .016” × .022” superelastic nickel titanium sectional wire used for leveling and alignment. Orthodontic treatment was completed in eight months. For retention, we bonded lingual buttons to the lower right first and second molars and attached them with .012” stainless steel ligature wire‡‡ (Fig. 11).

This biomechanical system simultaneously applies a distal force, a counterclockwise moment, and a light extrusive force, without requiring brackets on any other teeth until almost the end of treatment.
Case 5

A 51-year-old female presented with mesial tipping of the lower right second and third molars due to earlier extraction of the first molar (Fig. 12). The treatment plan was to extract the third molar, upright the second molar with miniscrew anchorage, and insert an implant in place of the first molar.

Five months after the third-molar extraction, a 1.5mm × 9mm miniscrew§ was placed in the retromolar area on the crestal ridge (Fig. 13). A stainless steel button was bonded to the mesial surface of the second molar crown, and an elastomeric chain was attached to the miniscrew over the molar’s occlusal surface. This is a simplified version of the mechanics proposed by Greco and colleagues to obtain distal movement around the center of rotation of the tooth and simultaneous intrusion from the vertical force of the elastomeric chain.9 The chain was replaced and the miniscrew stability and occlusal contact points were checked every two weeks, with selective abrasion if necessary. After four months, the second molar had been uprighted enough for placement of a first-molar implant, while extrusion of the lower right second molar had been controlled (Fig. 14). A stainless steel ligature wire was added to maintain the vertical and distal positions. In another two months, the implant was inserted; four months later, the first molar was replaced with a prosthetic crown.

This approach avoids the unwanted distal rotation, lingual tipping, and extrusion that may occur when conventional fixed appliances are used. The biomechanical system is a simple alternative for molar uprighting when the patient has adequate space and good quality of posterior bone

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§Leone S.p.A., Sesto Fiorentino, Firenze, Italy; www.leone.it.
††Registered trademark of Ormco Corporation, Orange, CA; www.ormco.com.
§PSM Medical Solutions, Tuttlingen, Germany; www.psm.ms.
and soft tissue. The point of application of the chain creates an efficient distal rotation moment and ensures vertical control of the entire tooth.

**Case 6**

A 44-year-old male was referred by a general dentist for uprighting of the lower right third molar (Fig. 15). His lower right first and second molars had been previously extracted because of periodontal and orthodontic problems, including crowding. The treatment plan was to upright the third molar using two buccal miniscrews and then insert implants in place of the first and second molars.10

Two 1.6mm × 7.5mm miniscrews§ with .022" slots were placed in the edentulous area. An .019" × .025" TMA sectional wire with a running loop activated 60° was connected between a tube on the lower left third molar and the miniscrews, which were bonded to the wire with composite. The aim

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**Fig. 14 Case 5. A. After four months of treatment. B. First-molar implant in place after six months of treatment. C. Prosthetic crown in place four months later.**

**Fig. 15 Case 6. A. 44-year-old male patient with mesially tipped lower right third molar and space needed for future implants. B. Two miniscrews§ inserted in edentulous area. C. Biomechanical scheme, with .019" × .025" TMA sectional wire and running loop activated 60° and connected to miniscrews.**
of this phase was to rotate the tooth with mesial root movement and opposite crown movement. After five months, an .019” × .025” stainless steel wire was placed with 1st-, 2nd-, and 3rd-order bends to complete three-dimensional positioning of the lower right third molar (Fig. 16). After 10 months of treatment, the molar was positioned correctly, and the implants were inserted.

This case illustrates the use of two miniscrews with a sectional wire and running loop to upright a molar when there is insufficient space distal to the impacted molar. The biomechanical approach avoids undesirable forces on adjacent teeth.

**Discussion**

The biomechanics for uprighting molars using TADs have proved to be efficient and easy to perform at the chair. As shown in Case 1, adverse effects such as mesial tipping or intrusion of the anchorage unit can be avoided by applying the force directly from the miniscrew head. In case of instability or loss of the screw, the side effects are minimal, resulting mainly in interruption of the desired orthodontic movement. On the other hand, if the miniscrew is used for indirect force applica-

### REFERENCES