Intrusion of an overerupted molar using orthodontic miniscrew implant: A preprosthodontic therapy

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Abstract
The purpose of this case report is to demonstrate the use of orthodontic miniscrew implant in the intrusion of overerupted molar as a preprosthodontic therapy. A 37-year-old woman with an overerupted maxillary right first molar encroaching on the opposing mandibular edentulous space was successfully intruded using a single miniscrew implant and partial fixed orthodontic appliance. The prostodontic clinician may adopt this conservative and cost-effective strategy in their routine practice and avoid clinical crown reduction.

Keywords: Adjunctive orthodontics, edentulous space discrepancy, miniscrew, miniscrew implant, molar intrusion, preprosthodontic therapy

Introduction
Prosthodontic rehabilitation of edentulous space is often complicated with overeruption of antagonistic tooth and often requires preprosthodontic intervention. In this context, orthodontic intrusion of the overerupted antagonistic tooth to facilitate prosthodontic rehabilitation is a desirable strategy. However, the task is formidable with routine orthodontic mechanics and control of anchorage is difficult. Recently, the introduction of miniscrew implants to the orthodontic armamentarium has widened the scope of intervention. Preprosthodontic intrusion of overerupted tooth with the aid of miniscrew implants is less invasive and simplistic.

Miniscrew implants are made from titanium alloy or surgical grade stainless steel and employ a conical or tapered screw design with asymmetric or symmetric thread pitch. Currently, these screws are manufactured by a number of commercial companies and the screw diameters range from 1.2 to 2.5 mm and the lengths range from 6 to 11 mm. They can be placed directly through the gingival tissue into bone in between the roots of individual teeth with a hand driver or hand piece. Placement is minimally invasive and often completed using only topical anesthetic. Miniscrew implants are unique because unlike restorative endosseous implants they do not require osseointegration. Instead, these devices rely on mechanical retention to maintain rigidity, which also makes their removal relatively simple and noninvasive. Ideally, they should be placed in areas with adequate cortical bone and with the head of the screw in attached alveolar mucosa. They may be loaded immediately, but biomechanical factors must be taken into consideration owing to the increased chance of loosening associated with the lack of integration and torque or rotational forces that may occur under loading. Once they have served their purpose, they are removed.

This case report will focus on preprosthodontic intrusion of an overerupted molar using a single miniscrew implant and partial fixed orthodontic appliance.

Case Report
A 37-year-old woman was seeking restoration of her right posterior occlusion. She presented with full complement of teeth except for mandibular right first molar that was extracted 3 years ago because of decay. As a result, the maxillary right first molar was overerupted and there was insufficient occlusal clearance [Figure 1]. The patient was medically fit and healthy and presented with Class I occlusion and normodivergent facial pattern. Minor maxillary and mandibular crowding was evident. Her gingival health was fairly good. Judging by the marginal ridge discrepancy, the maxillary first molar had overerupted 3 mm occlusally, encroaching upon the antagonistic missing dental space. The objective of the treatment was to intrude the overerupted molar utilizing miniscrew implant anchorage and subsequently regain the appropriate dental space for prosthesis.
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The palatal interradicular space between maxillary first molar and second premolar was selected for miniscrew implant insertion. A 1.3 mm by 8 mm miniscrew implant (S.K. Surgicals, Pune, India) was threaded 7 mm from the alveolar crest apically at an angle of about 30°-40° to the dental axis using self-drilling mechanism (finger tightening). Prior to miniscrew placement, a slight purchase point was made by drilling a small pilot hole with a round bur using slow-speed contra-angle hand piece. This facilitated accurate directional control when threading the miniscrew implant into the bone. Sterile saline irrigation and strict antiseptic protocols were followed.

A 0.019 × 0.021 inch titanium-molybdenum alloy (TMA) wire was bent to a “V” shaped attachment with the apex of the “V” formed to a coil to engage elastic thread or coil spring. The free ends of the “V” were bent to conform to the occlusal surface of the molar tooth and bonded with composite. The whole attachment was juxtaposed to the palatal surface of the tooth [Figure 2a]. An elastic thread (Tp Orthodontics Inc., La Porte, US) of sufficient length was tied between the head of the miniscrew implant and the coil in the “V” attachment to generate mild intrusive force of about 70 g. The calibration was done using dontrix gauge (ETM Corporation, Glendora, Calif). To avoid inadvertent palatal tipping and to favor a synchronous intrusion, a partial orthodontic appliance was fitted buccally to posterior dentition. The appliance set up consisted of a molar tube bonded off centered distally to the upper first molar, an edgewise bracket to first premolar and a 0.017 × 0.025 inch TMA helical spring. The spring was engaged between first molar tube and first premolar bracket and was activated to effect mild intrusive force of approximately 70 g [Figure 2b]. The first premolar was anchored to the canine and second molar with rigid bonded wires to minimize the counter extrusion and rotation. The elastic thread was later replaced by a nickel titanium (NiTi) push coil spring (Dentaurum, Ispringen, Germany) [Figure 2c].

After 5 months of treatment, approximately 2.5 mm of intrusion was achieved. Subsequently, the occlusal clearance was sufficient to rebuild the posterior occlusion by a prosthesis placed in the area of the missing antagonistic tooth. Because the intraoral strap-up was minimized, the patient was able to follow oral hygiene instruction and, furthermore, was pleased with the simplified mechanical devices. Due to financial reasons, the patient had opted for fixed bridge prosthesis. Final occlusion [Figure 3].

Discussion

The case exemplified an effective mechanism using a single miniscrew implant to intrude overerupted tooth in patients who seek restorative care. With the advent of miniscrew implants supported intrusion, the need for possible crown reduction as preprosthodontic modality can be eliminated. Furthermore, the current strategy largely avoided the placement of full strap up fixed orthodontic appliances. The set up did drastically reduce the financial burden on the patient as well. The prosthodontic clinician may adopt this conservative and cost-effective strategy in their routine practice.
Molar intrusion is a challenging task, and it is more so in adult patients with restorative concerns. Use of miniscrew implant in preprosthodontic management has drawn great interest in recent years among researchers and clinicians. It is a predictable option with fewer side effects. Recent studies have revealed that the average intrusion of maxillary molars is between 3 and 4 mm and a combination of single miniscrew implant and fixed appliance (partial) is a predictable and effective procedure to achieve maxillary molar intrusion. No definite consensus exists as to where the miniscrew implant should be placed (buccal or palatal) if a single screw is used for maxillary first molar intrusion. The placement of screw in the palatal side mesial to first molar avoids the greater palatine foramen and D4 bone. Placement in D4 bone is not recommended owing to the high failure rate associated with it (35–50%). Another approach is that, it can be placed in the buccal dentoalveolus between the second premolar and first molar at the mucogingival junction and a raised transpalatal arch will effectively counter the buccal tipping of the molar and help in intrusion. A miniscrew implant in the midpalatal area also can provide an effective intrusive force, but it should be combined with a rigid transpalatal bar to prevent the horizontal component of the force tipping the teeth. When tipping occurs the roots invariably move buccally. However, use of two screws on both buccal and palatal sides will effectively produce true intrusion. Nevertheless, on many occasions, the anatomic constraints dictate the placement site and the number of miniscrew implants. It is a prudent decision to minimize the orthodontic armamentarium for any adjunctive procedures favoring reduced financial burden and treatment acceptability by the adult patient. In the present case, the clinical situation demanded placement of a single miniscrew implant in the palatal side and minimal fixed appliance set up on the buccal side to produce an achievable optimum result in the shortest time period possible. The most critical factor for molar intrusion was the point of application of the intrusive force. To direct a force through the center of resistance of a molar, simultaneous buccal and palatal forces should be applied. In the present case, the buccal and palatal forces were generated by the TMA helical spring and the miniscrew implant, respectively. The low load deflection rate of TMA spring and the mild activation of NiTi coil spring provided a balanced force system biomechanically.

Controlling or minimizing the side-effects associated with implant placement, implant stability and counter moments with force application is the main concern. The potential complications include contact with adjacent tooth roots, implant loosening, implant breakage, and damage to anatomic structures. Orthodontic miniscrew implant placement site selection can be effectively managed by astute clinical observation and palpation. Radiographs and surgical three-dimensional guides may be required, although not mandatory for every case. Strictly adhering to the safe zone protocols would suffice for a clean placement. Implant loosening can be attributed to soft-tissue inflammation and improper insertion torque. Achieving primary stability is essential and the implant needs only to be tightened to a torque value of 7-10 Ncm, which is achieved with mild finger tightening.

Conclusion

Intrusion of overerupted molar using miniscrew implant as a preprosthodontic tooth movement is a predictable treatment strategy. Combination of a partial fixed appliance and miniscrew implant may provide a balanced force system for effective intrusion of molar. Miniscrew implant placement site selection and the design of the auxiliary appliance are the critical factors biomechanically.

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