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CLINICAL REPORT

Orthodontic Microimplants Assisted Intrusion of Supra-erupted Maxillary Molar Enabling Osseointegrated Implant Supported Mandibular Prosthesis: Case Reports

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Abstract Loss of mandibular molars, when not replaced in time, are usually associated with overeruption of maxillary molars. To provide prosthetic replacement for missing lower posteriors, over erupted maxillary teeth have been intruded in past with great difficulty in adults with conventional orthodontics, along with associated problems of root resorption. Currently orthodontic microimplants provide stable intraoral anchorage, allow predictable maxillary molar intrusion enabling reestablishment of functional posterior occlusion with mandibular implant supported prosthesis, thereby reducing need for prosthetic crown reduction in maxillary arch. The added advantage of microimplant is it enables use of sectional appliance in area of concern instead of full arch bracketed appliance which an adult may not accept. The case reports demonstrates, overerupted maxillary molars were intruded using orthodontic microimplants to enable prosthetic rehabilitation of mandibular dentition by osseointegrated implant supported prosthesis. The second case report also demonstrates use of CBCT scan in planning and execution.

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Introduction

Creekmore [1], was the first to suggest that a small metal screw could withstand a constant force of sufficient magnitude and duration to reposition the entire anterior maxillary dentition without becoming loose, infected or pathologic. This led to the introduction of implants as orthodontic anchors.

Loss of lower posterior teeth is often accompanied with extrusion of maxillary molars, making rehabilitation of lower dentition difficult without extensive reduction of maxillary molars.

Supra erupted maxillary teeth have been intruded in the past with great difficulty in adults using *conventional orthodontics* as it was always associated with problems of extrusion of anchor teeth and even root resorption [2, 3].

Orthodontic micro implants provide stable intraoral anchorage and enable *predictable maxillary molar intrusion*. The main advantage of using micro implants is that it allows use of small sectional orthodontic appliance in the area of concern instead of full arch brackets and wires, which an adult patient genereally never accepts [4, 5].

The two case reports presented here demonstrate the intrusion of supra-erupted maxillary molars using orthodontic micro implants to enable prosthetic rehabilitation of mandibular dentition by osseointegrated implant supported prosthesis.

Case Report 1

A 42 year old female wanted replacement of missing lower right second molar (47). She had a fixed prosthesis in

Fig. 1 Case report 1-supraerupted maxillary second molar

maxillary arch up to first maxillary molar and her second maxillary molar (17) had over erupted freely in the absence of an opposing tooth (Fig. 1). The available crown height space for replacing lower mandibular molar was just 2.5 mm. To regain the lost interocclusal clearance in such situations, the use of orthodontic micro-implants is an ideal choice over endodontic intervention with crown reduction of supraerupted tooth. When the prosthesis planned is implant supported, the desirable inter occlusal clearance over an implant is suggested to be minimum 5–8 mm [6]. For this much amount of space requirement, a *segmental orthodontic appliance* assisted with two Orthodontic micro implants enables vertical intrusion of maxillary molar.

In this case report two orthodontic brackets were bonded on labial surface of right second maxillary premolar (15), right maxillary second molar (17) and a bondable molar tube on labial surface of right maxillary first molar (16). A sectional spring of 0.014 inch wire was made with a coil distal to right maxillary first molar (16). Spring's lever arm extended occlusally downward and palatally, to be engaged finally in bracket on labial surface of supraerupted right maxillary second molar (17).This segmental orthodontic appliance was made to control the vectors of intrusive force that will come via microimplants, such that the resultant vector will enable true intrusion along long axis without any undue buccal or palatal tipping.

Two self tapping micro implants[1] of size 1.3 (diameter) × 8 mm (length) were inserted on palatal and labial aspect between roots of right maxillary first molar (16) and right maxillary second molar (17) at an angulation of 45–50° on labial and 45° on palatal. An elastomeric chain was run over the occlusal surface of supraerupted right maxillary second molar (17), with support of a palatal bracket to prevent dislodging of elastomeric chain. The intrusive force via elastomeric chain was added on the same appointment of placement of microimplant (Fig. 2).

[1] Microimplants from Denticon, Dental Instrument Co, (DENTICON), 260/15, Sane Guruji Marg, Opp Kasturba, Hospital, Mumbai, India, Mumbai, Maharastra, India 400011.

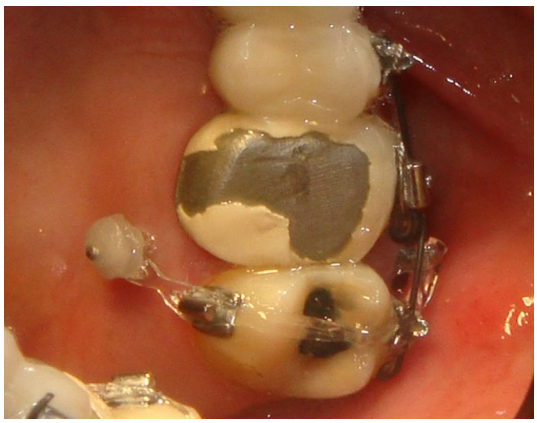

Fig. 2 Microimplant assisted intrusion using elastomeric chain & segmental buccal appliance

The intrusion force was kept low and recall was done every 4 weeks. After 3 months of intrusion, an osseo integrated titanium implant[2] was placed in region of mandibular second molar (47). Good maxillary molar intrusion was achieved in total 6 months period. Final prosthesis was cemented & orthodontic appliance was debonded (Fig. 3).

Case Report 2

An adult male, wanted replacement of left mandibular second molar (37). Left maxillary second molar (27) had already over erupted resulting in loss of crown height space (Fig. 4). A CBCT scan was done to plan the lower left second molar (37) implant and to also plan the angulation and required length of microimplant in upper jaw needed to intrude supraerupted tooth (Fig. 5).

Two micro implants of dimension 1.3 (diameter) × 8 mm (length) were placed at an angle of 45° after studying the angulation readout from CBCT scan. Two orthodontic brackets were bonded labial and palatal aspect of crown, the labial micro implant was connected to bracket with elastomeric chain and the palatal micro implant was connected to bracket with a nitinol -coil spring on the same appointment as delayed loading of microimplant offers no benefit (Fig. 6). The low intrusive forces were activated every 4–5 weeks. In this case mandibular implant of size 4.2 × 10 mm[3] was placed with flapless approach, as *CBCT data allowed precise selection of implant size and its placement.* The active intrusion of supraerupted tooth continued till the lower implant

[2] 4.2 × 11.5 tapered self thread implants from Hi-tec Implants, Main Office P.O. Box 2022, Herzlia, Israel, E-mail: sales@hitec-implants.com, www.hitec-implants.com.

[3] 4.2 × 10 mm Toureg implant from Adin, http://www.adin-implants.com.

Fig. 3 Posttreatment occlusion

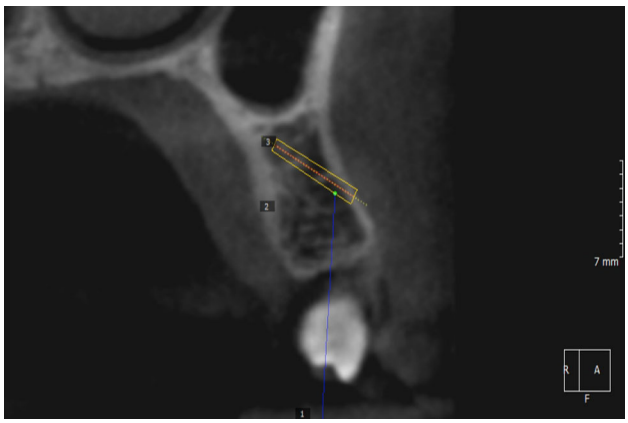

Fig. 5 Microimplant angulation readout from cbct scan

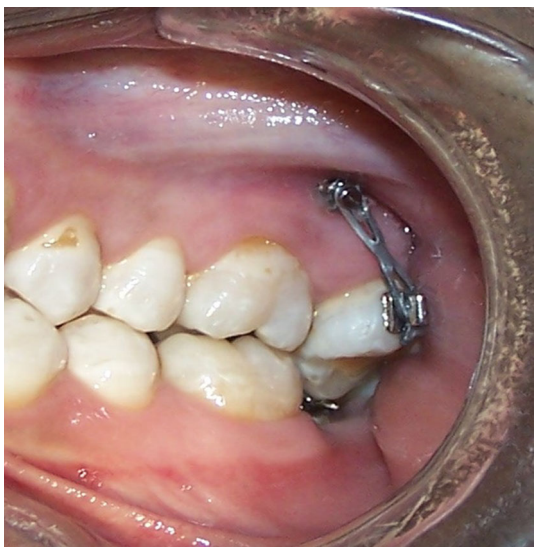

Fig. 4 Case report 2-supraerupted maxillary second molar

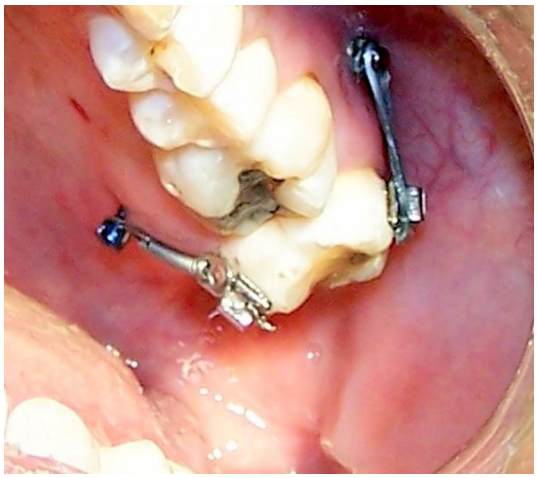

Fig. 6 Palatal and labial microimplant loaded for intrusion

osseointegrated for another 3 months. After the maxillary second molar (27) was in functional occlusal plane the mandibular left second molar (37) implant received the final prosthesis (Fig. 7).

Discussion

Delay in prosthetic rehabilitation for posteriors leads to overeruption of opposing arch molars, which then need extensive crown reduction if the lower posteriors are planned to be replaced by prosthesis [7]. Orthodontic intrusion has always been a biomechanical possibility but conventional Orthodontic mechanics for intruding molars has side effects like extrusion of the anchor teeth [2].

Orthodontic micro implants are the new answer to such supra erupted teeth. They are fixed by mechanical retention and subsequently are removed after desired movements are achieved. Orthodontic micro Implants are made of titanium alloy, Ti_6Al_4V, which provides sufficient strength to withstand insertion torque and orthodontic loading. They are classified as "self drilling" which do not require any pilot drill hole with sharp apex that can penetrate the bony cortex or "self tapping" type, which require a pilot drill to create point of entry in cortex before insertion [8–10].

In the cases presented "self tapping" type micro implant of titanium alloy, 1.3 mm diameter with 8 mm length were used, as palatal cortex is denser than labial. Higher success is generally observed in micro implants placed in maxilla than mandible, attributed to greater bone cell death occurring during implant insertion in mandible due to thick cortical bone. Higher success is also achieved if micro implant is placed in keratinized tissue, but attached gingiva is limited in maxillary molar region on buccal aspect [11, 12].

Poggio et al. [13] have demonstrated the safe zones of inserting micro implants and have suggested that micro implants must be placed 4 mm apical to alveolar crest,

Fig. 7 Final restoration

close to mucogingival junction. Patients oral hygiene is also an important concern in success .

Diameter of micro implant determines the stress generation, which reduces with increase in diameter [14]. Implants of more than 1.2 mm diameter are desirable. The reported cases had 1.3 mm diameter implants. The threads of micro implants should have good depth and the must have asymmetric design geometry to favour insertion while obstructing removal on orthodontic loading [15].

Biomechanical advantage of micro implants is that they allow for direct application of force for desired tooth movement with not much concern for reciprocal side effects. The centre for resistance for intruding molar is generally in centre of occlusal table, slightly palatal for maxillary molar. Two micro implants are recommended in mesial and distal inter-dental areas, with one placed bucally and other lingually. In cases for bucally tipped crowns a segmental appliance can be used for redirecting the force vectors. The cases presented show use of two micro implants to maintain an intrusion force right through the centre of resistance of maxillary molar. A segmental appliance for redirecting force vectors was used in case report 1.

During placement, to avoid damage to adjacent tooth roots implants are placed obliquely, 45-60^{o} insertion angle to long axis of tooth is recommended [16, 17]. In the case report 2, guidance provided by CBCT scan was used to angulate implant so as to engage the cortical plates. The loading of orthodontic micro implant must be immediate, as delayed loading gives no benefit, the same was done in both the cases [18]. Implants placed on posterior palatal slope of must be mesial to second molar to avoid damage to greater palatine artery and palatine nerve exiting the greater palatine foramen, in both the case reports the palatal micro implant was placed between first and second molar roots [19]. Optimal force for intrusion has been researched by various workers, Umemori et al. [20] recommended an initial force of 500 g. Melson and Fiorelli [21] suggested 50 g buccolingually to intrude maxillary molars in adults. In the cases reported around 200 g of low continous force was used to obtain intrusion of 0.5–1 mm per month without any notable root resorption.

Misch [6, 22] has suggested that minimum crown height space required is the distance between occlusal plane and crestal bone and must be 8 mm for fixed restoration. This gave us a clear guidelines as to the level up to which intrusion was needed after evaluating pretreatment available space.

Conclusion

Patients with loss of interocclusal clearance due to overeruption of maxillary teeth in posterior dentition have been demonstrated wherein micro implants assisted orthodontic intrusion helped in creating sufficient crown height space, to allow prosthetic rehabilitation of mandibular posterior dentition with osseointegrated implants .

Orthodontic Microimplants (see footnote 1) were 1.3 mm in diameter, 8 mm in length. Lower molars were replaced with titanium osseointegrated implants (see footnotes 2, 3) followed with porcelain fused to metal crown prosthesis.

Microimplants are an additional tool in an Orthodontists armamentarium enabling more Interdisciplinary interactions between the Orthodontist and Prosthodontist. They allow predictable intrusion and can also be used to upright tilted natural abutments to enable prosthetic rehabilitaion.

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