Case Report: Implants as anchorage for molar uprighting and intrusion

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Orthodontic tooth movement is often limited by the anchorage available. Force is required to move teeth, and every appliance that exerts force on a tooth must exert an equal and opposite force on another object.[1,2] Fortunately, there are many instances where the opposite force can be applied to a tooth or teeth that should also be moved (e.g., closure of a midline diastema when both teeth need to be moved the same amount). Unfortunately, there are also many instances where the opposite force cannot be made to produce desired, or even tolerable tooth movement. In these situations, the clinician can adopt strategies to reduce the movement of the anchor teeth, but in all too many cases the desired tooth movement must be limited to avoid movement of the anchor teeth.

One movement that is particularly difficult to accomplish without untoward effects is molar uprighting with intrusion. The most common sequela to molar uprighting is elevation of the molar.[3] Controlling the elevation of the molar is most critical when the patient has deficient overbite, a long lower face height, and/or excessive lip incompetency. For these patients, allowing the molar to elevate would make their other problems worse. When an objective of treatment is to increase the overbite, it would be ideal to actually intrude the molar as it is being uprighted. An intrusive force on the molar can only occur when an extrusive force is placed elsewhere,[1,2] usually on the premolars. Extrusion of these teeth would also decrease the overbite, increase the lower face height, and increase lip incompetency (all of which are negative sequelae), thus it is rare to be able to actually intrude a molar as it is being uprighted. The desired tooth movement must often be compromised due to inadequate anchorage.

Ankylosed teeth and dental implants could provide ideal anchorage for tooth movement because they are incapable of movement within the bone. Ankylosed teeth occur infrequently, and they are rarely prescribed by the orthodontist, thus dental implants are more commonly used for anchorage. Animal studies have demonstrated that endosseous implants in dogs can be reliably used as anchors for horizontal (mesiodistal) orthodontic tooth movement.[4,5] Human trials have also demonstrated the successful use of implants as anchorage for horizontal forces.[6,7] Intruding teeth from implant anchorage has been studied in animals and in humans. Southard et al.[8] demonstrated in mongrel dogs that implants are superior to dental anchorage for producing intrusion. Odman et al.[9] and Roberts et al.[7] both reported on implants used in human patients, in conjunction with dental anchorage, to successfully intrude posterior teeth.

A recent review of the use of implants in orthodontics recommended that their use be considered "experimental at best" due to the limited research available.[10] There have been no reports of intruding molars in conjunction with uprighting.

Figure 1A-H
Pretreatment photographs.

Figure 1A

Figure 1B

Figure 1C

Figure 1D

Figure 1E

Figure 1F

Figure 1G

Figure 1H

The purpose of this paper is to report on the treatment of a patient with mesially tipped second molars, where the objective of treatment was to upright the molars and intrude them.

Case report

This 25-year-old Caucasian male presented to the Graduate Clinic, University of Kentucky, with a chief complaint of anterior and posterior crossbites. His medical history was noncontributory, but he was under treatment for mild jaw joint pain, headaches (averaging 7 per week), and clenching and grinding of his teeth. His facial appearance was normal except that he demonstrated mildly deficient facial convexity and mild anterior divergence (Figure 1A-C). His chin was not deviated from the midsagittal plane. The intraoral examination (Figure 1D-H) revealed an anterior crossbite, with his left maxillary lateral incisor positioned lingually to his mandibular teeth, and his overbite was less than ideal (measured at 2 mm). The left posterior teeth were in a maxillary-palatal crossbite, and the maxillary arch demonstrated a transverse asymmetry (the left side was bowed in the premolar area). The mandibular first molars were missing bilaterally. The radiographic examination was noncontributory (Class I skeletal, normal incisor angulation, normal vertical relations).

Treatment plan

After consultation with an oral and maxillofacial surgeon and a discussion of treatment options, the patient selected a treatment plan that incorporated orthodontics and the use of osseointegrated implants. The third molars would be extracted and the implants would be placed. At least 12 weeks would be allowed for healing before orthodontic forces would be applied to the implants. During the healing period, the orthodontic appliance would be placed and the teeth aligned. A transpalatal bar would be placed between the maxillary first molars to assist in their transverse expansion, rotation, and


Figure 2A


Figure 2B


Figure 2C


Figure 3A


Figure 3B


Figure 3C


Figure 3D


Figure 3E


Figure 3F

to provide anchorage for widening the arch in the left premolar area. Following healing, the implants would be uncovered, orthodontic appliances would be attached, and the mandibular second molars would be tipped distally and intruded slightly to improve the posterior occlusion and to allow the placement of single tooth prostheses bilaterally. At the completion of orthodontic therapy, the final prostheses would be placed, and the patient would be placed in retention. Treatment was predicted to take approximately 24 months.

Treatment progress

The third molars were extracted and initial orthodontics proceeded as planned for approximately 1 year. The implants were placed and allowed to heal undisturbed for 7 months. Orthodontic alignment of all teeth except the mandibular molars was begun. After the healing period, the implants were uncovered, abutments were placed, and custom-made bands with brackets were placed (Figure 2). Due to space constrictions, the caps were diminutive in diameter and a single-wing bracket was placed. Space for placement of an archwire between the implants and the second molars was minimal, making it difficult to achieve a low-load/deflection appliance. Uprighting was begun 11 months after implant placement with distally inserted springs (Figure 2). A number of spring designs, including open coil springs and T-shaped loops, were placed, along with the occasional use of an occlusal splint to eliminate temporary occlusal contacts. The left molar was intruded slightly and moved lingually 2-3 mm to improve the occlusion and the buccal overjet. At the completion of orthodontic treatment, temporary crowns were placed on the implants and Hawley retainers were placed. The final crowns were subsequently placed.

Figure 2A-C Implants placed, ready for banding.

Figure 3A-F Posttreatment photographs.

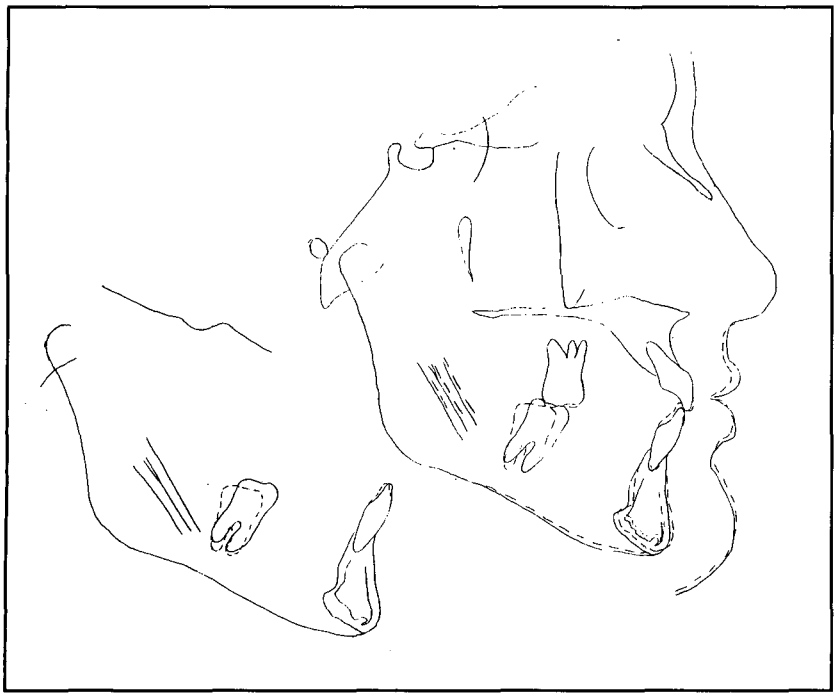

Figure 4

Figure 4
Cephalometric superimposition demonstrating molar uprighting and intrusion.

Results

Active treatment took 32 months, 8 months longer than predicted. The difficulty encountered in placing a low-load/deflection spring may have contributed to this delay in completion. The final occlusion is without crossbites and prostheses have been placed (Figure 3). The cephalometric superimposition shows uprighting and intrusion of the molars (left molar shown on tracing–Figure 4). The overbite increased slightly as the mandible rotated in a counterclockwise direction, probably due to both the correction of the crossbite and the intrusion of the molars. The patient has worn maxillary and mandibular Hawley retainers nearly full-time for 6 months. The retention plan is to begin decreasing wear gradually.

Discussion

Patients presenting with a need for molar uprighting in the face of minimal overbite present a special set of challenges for the orthodontist. It is not uncommon to have extrusion of either the molars or of the anchor unit, usually the premolars, with conventional orthodontic therapy. This case demonstrates tooth movement facilitated by implant use.

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