

Implants and Orthodontics for the General Practitioner: A Case Report Describing Multidisciplinary Treatment

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“Clinical Showcase” is a series of pictorial essays that focus on the technical art of clinical dentistry. The section features step-by-step case demonstrations of clinical problems encountered in dental practice.

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In general dentistry, the option of single endosseous implants to restore single-tooth edentulous spaces has become common. Patients are now requesting these implants, recognizing the value of restoring a space to function without drilling adjacent virgin or minimally restored teeth. This case report details a multidisciplinary treatment using implants and orthodontics to restore a single-tooth edentulous area in the posterior mandible.

Case Report

A 33-year-old man presented with a single-tooth mandibular edentulous space. Tooth 36 had been extracted in childhood because of severe caries. Tooth 35 was virgin, and tooth 37 had a small occlusal amalgam and was tipped mesially (Fig. 1). Mesial tipping of both this tooth and tooth 38 had resulted in a space compromise of the edentulous area. The patient’s first molars ranged in width (mesial to distal, as determined by intraoral assessment with a periodontal probe) from 11.5 to 13 mm. The edentulous space was 7.25 mm wide before treatment. As such, between 4.25 and 5.75 mm of space had been lost through the mesial tipping of teeth 37 and 38. The patient’s medical history was noncontributory.

Treatment options and considerations for restoring the gap (Table 1) were dis-

cussed. The patient elected to undergo placement of a single implant at the edentulous site, extraction of teeth 38 and 28, uprighting and distally moving tooth 37 with simple orthodontics (using the implant as an anchor) and restoration of the implant with a crown.

One hour before his appointment, the patient took an oral sedative. After local anesthesia of the mandibular left quadrant had been achieved, a buccal envelope flap extending from tooth 35 to beyond the distal surface of tooth 38 was elevated. A 5.0 × 10.0 mm titanium implant (Nobel Biocare Select Tapered implant, Gothenburg, Sweden) was placed (Figs. 2a to 2d) and covered with a 6.0 × 5.0 mm healing abutment (Fig. 3).

In determining appropriate implant placement, consideration was given to the



Figure 1: Initial diagnostic panoramic radiograph showing the edentulous space at position 36 and mesial tipping of teeth 37 and 38. The calibration measurement system of the digital Sirona panoramic and cephalometric x-ray machine (on implant mode) indicated a 7.25-mm gap from the distal aspect of tooth 35 to the mesial aspect of tooth 37.

Table 1 Options and considerations for restoring 36 edentulous area

Option	Considerations
(1) Fixed bridge from tooth 35 to tooth 37	<ul style="list-style-type: none"> • Excessive tapering of abutment teeth needed to accommodate draw of prosthesis • Probable root canal treatment of tooth 37 if occlusal-mesial reduction encroaches on mesial aspect of pulp chamber • Minimal number of appointments (2 or 3): preparation of abutments, possible root canal treatment, temporizing of abutments and cementing of permanent bridge • Concern for long-term periodontal health, with abutments locked in bridge; flossing under pontic essential to maintain periodontal health
(2) Fixed bridge from tooth 35 to tooth 37 with semiprecision attachment (male component on distal aspect of tooth 35 abutment and female locking component on mesial aspect of tooth 36 pontic)	<ul style="list-style-type: none"> • Less invasive; would avoid root canal treatment for tooth 37 as excess tapering of the tooth would be eliminated • Cost-effective • Same periodontal considerations as option 1
(3) Single implant and crown for tooth 36	<ul style="list-style-type: none"> • Less invasive than options 1 and 2 as abutments would not be prepared • Hygiene (flossing) would be easier in area of the teeth 35 and 36 implant and tooth 37 • More costly than a bridge • Multiple visits over extended time frame of several months: initial implant placement, periodontal healing period, placement of implant abutment, impression-taking and insertion of crown • Tipping of tooth 37 would remain
(4) Single tooth 36 implant, extraction of teeth 28 and 38, orthodontic uprighting of tooth 37 followed by restoration of implant with crown	<ul style="list-style-type: none"> • Same invasiveness and hygiene considerations as option 3 • Most costly option (because of orthodontics and extractions) • Longest time frame for treatment (regular monthly orthodontic visits for 8 months) • Most comprehensive option, with ability to restore the patient's dentition to "ideal" occlusion by regaining the space for the first molar that was lost because of tipping of teeth 37 and 38

angulation of the implant relative to the angulation of the root of tooth 35. Ideal implant position involved placing the implant parallel to the root of tooth 35 and perpendicular to the occlusal plane. A series of drills 10.0-mm in length and of increasing width (2.0 mm, 3.8 mm, 4.3 mm and 5.0 mm) were used. At each incremental step, a "direction indicator" was placed in the prepared site or the drill was left in place and radiographed to determine proper angulation. Another method of ensuring correct angulation and placement of the implant consists of fabricating a plastic stent with a guide made from a plaster model replica of the edentulous area. Initial stability of the implant was good (torqued to 45 N). Tooth 38 was extracted, as uprighting and distally moving tooth 37 would have been extremely challen-

ging without extraction of this tooth. To prevent future supra-eruption of tooth 28 (now that opposing tooth 38 was extracted), tooth 28 was also extracted. The implant site was sutured with chromic gut sutures around the healing abutment. Because of time constraints and the level of discomfort during the initial appointment, the patient rescheduled the extraction of the supra-erupted tooth 18 for another appointment (**Fig. 1**).

A steroidal anti-inflammatory drug (dexamethasone sodium phosphate; 1.5 mL of a 4 mg/mL solution) was injected in the mandibular left masseteric area, and an ice pack was placed extraorally. A week-long course of antibiotics was prescribed along with anti-inflammatories and painkillers. A 1-week postsurgical appointment revealed normal healing.



Figure 2a: An initial 2.0-mm-wide test drill was used to a depth of 10.0 mm; this 2.0-mm-wide direction indicator was placed to verify the angulation and position of the implant space.



Figure 2b: A 3.8-mm-wide drill was then used at 10.0 mm, and another radiograph was obtained to verify the implant space. Note the attempted parallel positioning between the implant drill and the root of tooth 35.



Figure 2c: The 4.3-mm-wide implant drill is worked to 10.0 mm. This radiograph was used to verify the presence of adequate interproximal bone mesial and distal to the implant space. Following this imaging, the final 5.0-mm implant drill was taken to 10.0 mm.



Figure 2d: A Nobel Biocare Select Tapered implant (5.0 × 10.0 mm) was then put into place.



Figure 3: Close-up of panoramic radiograph shows the implant and the healing abutment (6.0 mm wide × 5.0 mm long) screwed on. The distal occlusal edge of this implant healing abutment was close to the mesial occlusal edge of tooth 37. Therefore, enameloplasty (0.5 mm) of the mesial marginal ridge was performed to ensure that the healing abutment would fit. Teeth 28 and 38 were then extracted.



Figure 4: The 6.0 × 5.0 mm healing abutment was removed, and a 6.0 × 0.5 mm Easy abutment was placed on the implant. The gingival cuff that has formed is due to placement of the large mushroom-shaped healing abutment. This space is adequate to allow placement of a temporary crown without irritating the gum tissues.

A period of 4 weeks was allowed for the gingival tissue to stabilize. The healing abutment was then removed, and a 6.0 × 0.5 mm Easy abutment (Nobel Biocare) was placed (Fig. 4). This abutment was fitted with an acrylic crown form (lined with Jet acrylic trim, Lang Dental Mfg. Co., Wheeling, Ill.), which had an orthodontic bracket bonded onto the buccal surface (Fig. 5). Tooth 37 was also bracketed, an orthodontic wire (nickel-titanium 0.016-inch round wire) was fitted between the 2 brackets (Figs. 5 and 6), and a coil spring was placed on the wire between the 2

brackets to assist in moving tooth 37 distally. The coiled-spring orthodontic wire was then single-tied into place on both brackets. Initial uprighting of tooth 37 created a gap between the temporary crown and tooth 37. To prevent the tooth from relapsing (if the bracket came off or if the wire slipped out), the temporary crown was removed, its distal end was roughened with a carbide bur, the crown was acid-etched and bonded, and composite was added and cured (Fig. 7). To emphasize and expedite the uprighting process, the tooth 37 bracket was placed at a moderate angle (tilted



Figure 5: An Ormco Optimesh (Orange, Calif.) lower first molar bracket (slot 0.018 inch and torque -22 degrees) was bonded onto the provisional temporary crown of the implant and on tooth 37, respectively. A nickel-titanium 0.016-inch round wire was placed between the 2 brackets and single-tied into place.



Figure 6: Close-up of panoramic radiograph shows the Easy abutment on the implant. The temporary crown has acrylic trim and is radiolucent. However, the bracket bonded to the temporary crown is also visible, as is the 0.016 wire extending to the tooth 37 bracket.



Figure 7: One month later, a 1.0-mm gap between the temporary crown and tooth 37 was noted. This space was restored with composite (the radiopaque material distal to where the radiolucent temporary is positioned). This restored the interproximal space that had been opened by the initial uprighting of the tooth (**Fig. 6**).



Figure 8: Continued uprighting of tooth 37. The roots of the tooth are moving mesially and are straightening out to become more parallel with the implant, and the coronal portion of tooth 37 is moving distally. The distal marginal ridge of tooth 37 has moved from its original interproximal location between teeth 26 and 27, as in **Fig. 1**, to the mid-mesial cusp of tooth 27; approximately 3.0 mm occlusal space has been gained thus far.



Figure 9: A 1.0-mm gap has developed between the temporary crown and tooth 37 as the uprighting of tooth 37 continues.



Figure 10: Porcelain-fused-to-metal crown in place. Overall, 4.25 mm of occlusal space was gained from uprighting tooth 37.

mesiogingivally) rather than at the conventional bracket position for a second molar. Consistent with a tooth undergoing orthodontic traction, tooth 37 was slightly mobile to the touch; however, the patient reported no pain. After 2 more monthly checkups, the 0.016 round wire was replaced with a nickel-titanium 0.016 × 0.022 rectangular wire. **Figures 8 and 9** show the progress of tooth movement into 5 months of treatment.

At every monthly checkup, the occlusal space gained for tooth 36 was measured by a periodontal probe and confirmed with measurement on the implant mode of the digital Sirona panoramic and cephalometric x-ray machine (Charlotte, N.C.). Once an 11.5-mm gap had been achieved (about the average size for the patient's first molars), the temporary crown was taken off, the Easy abutment impression guide was placed on

the implant abutment, and a conventional hard-body polyvinylsiloxane (PVS) triple-tray impression was obtained. Along with the impression, a replica of the implant abutment, impression coping and a bite registration were sent to the dental laboratory. One week later a porcelain-fused-to-metal crown was inserted (Fig. 10).

Discussion

The ability of implants to osseointegrate^{1,2} makes them ideal for intraoral orthodontic anchorage. Proffit and Fields³ have defined anchorage as resistance to unwanted tooth movement or resistance to reaction forces that is provided by other teeth or by structures outside the mouth. The planned movement of a tooth or group of teeth causes reciprocal movement of the anchor teeth, and anchorage control is therefore essential to successful orthodontic treatment.^{3,4} Rigid dental implants are superior to dental anchors because they allow unidirectional movement of other teeth and withstand reciprocal reactive forces.⁵⁻⁷ Furthermore, implants “avoid issues of impracticality of extraoral orthopaedic anchorage appliances (headgears) and require minimal compliance and do not compromise esthetic considerations.”¹

Because of the rigidity and initial stability associated with implants, they are ideal for service as orthodontic anchors. Studies^{1,3} have shown that the force loading with orthodontic traction is horizontal and continuous and is at such a low level (20–40g to a few hundred gravity) that it does not interfere with or compromise the initial stability of implants. Therefore, a single implant that has good initial stability is a perfect candidate for anchorage. There are many applications for implants involving orthodontic anchorage, including retracting and realigning anterior teeth with posteriorly positioned implants, closing edentulous spaces with retromolar implants, intruding or extruding teeth and eliciting palatal expansion with implants placed in the palate.

When temporary implants are used for orthodontic anchorage, their angulation is not highly critical. However, if an implant is to serve a dual role as anchorage and as final restorative abutment, angulation is important (in the clinical case reported here, the pretreatment circumstances allowed for the implant to serve as both an orthodontic anchor and an adjunct to restoration). The implant should be “parallel [to the adjacent tooth or parallel to the anticipated new position of the

tooth being moved] and perpendicular to the occlusal plane to ensure proper insertion of the future prosthesis.”² It is important to note that toward the posterior of the mandible there is a slight natural mesial inclination of the posterior teeth, probably due to the initial mesial angulation of the developing tooth buds of the molars.⁸ In this regard, the angulation of implant placement to achieve proper prosthetic rehabilitation after orthodontic treatment must be carefully considered.

Lessons to be Learned

This case report has demonstrated that a single titanium endosseous implant serving as a final prosthetic post for a crown can also act as an anchor for orthodontically uprighting and distally moving an adjacent mandibular second molar. When considering the ideal treatment for a patient, general dentists should consider a multidisciplinary approach. ♦

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Acknowledgement: The author thanks Dr. Paul Witt for his advice and consultation regarding this case and Dr. Zoltan Kerezstes for his advice regarding the sequence of treatment.



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The author has no declared financial interests in any company manufacturing the types of products mentioned in this article.

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