PEER-REVIEWED

Molar Uprighting for Single-Unit Implant Therapy

Limited orthodontic treatment with a partial fixed appliance opens restorative space

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A common yet unfortunate side effect of delayed treatment following extraction is mesial tipping of the tooth distal to the edentulous space. This tilting places the tooth in a compromised situation that can lead to an increased risk of periodontal problems due to plaque accumulation, difficulty in placing a prosthetic restoration, and the creation of occlusal forces in a nonideal direction. Regarding molars, pseudopockets often form as the bone and soft tissue remodel around the inclination, with frequent loss of the papilla. Under normal circumstances, the roots are perpendicular to the occlusal plane, which allows the vertical occlusal forces to be absorbed by the numerous oblique fibers of the periodontium that resist them. A partial fixed appliance for adjunctive orthodontics can provide a predictable modality to upright a malpositioned molar in preparation for a definitive restoration.

Because the permanent first molar has the longest exposure in the oral cavity due to the nature of its eruption, it also experiences the highest risk for developing caries. Therefore, this tooth is at an increased risk of being lost when compared with other erupted permanent teeth.[1] Modern dentistry offers many solutions for single tooth replacement. In the case presented here, repositioning of the second molar to allow for implant placement provided many benefits; however, the total options to be considered during a treatment planning sequence include space closure and repositioning for fixed or removable restorations. Space closure is typically indicated for mild cases in younger, healthy patients with adequate bone quality. However, these cases can be lengthy and difficult to treat for most adult patients. Space closure for spaces that exceed 6 mm mesiodistally is not ideal.[2] In the case presented, distal tipping of the second molar allowed for a number of treatment options with a single-unit implant. When teeth are extracted and the space is not restored in a timely fashion, implant placement can become more difficult because the alveolar bone resorbs quickly. As its name suggests, alveolar bone exists to support the tooth and when the tooth is removed, atrophic changes occur at the site, and it has been reported that anywhere from 4 mm to 6 mm of horizontal bone loss can occur, with 50% of this happening during the first 3 months following extraction.[3]

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Case Report

A 34-year-old male patient presented who had been missing his mandibular right first molar for 5 years. His chief complaint was that his second molar had mesially tilted into the space, making the placement of an implant impossible. The patient opted for a single-unit implant instead of a bridge for better hygiene and to preserve natural tooth structure. A preoperative panoramic radiograph (Provecta® S-Pan, Air Techniques) revealed adequate bone support for implant placement. Prior to the surgery, the patient would undergo limited orthodontic treatment with a partial fixed appliance in order to gain adequate space. It has been reported that the lateral biologic width of an implant is 1.3 mm and that encroaching on this can cause damage to surrounding tooth structures.[4] Therefore, clinical guidelines dictate that the average space between an implant and a natural tooth at the cementoenamel junction should be 1.5 mm and that the distance between two implants should be approximately 3 mm.[4]

Orthodontic Treatment

The materials for the partial fixed appliance included a molar band (.022 2nd Molar Band, Roth) as well as stainless steel brackets (Tip-Edge PLUS®, TP Orthodontics) on the lower bicuspids and cuspid. The brackets were chosen because their design offers efficient tooth movement with light forces and versatility as well as deep tunnels for supplemental wires and other components if required. The prescription of the brackets on the premolars had a direction of tip built in; therefore, a lower premolar clockwise bracket was chosen to prevent any distal tipping into the edentulous space. During placement, the molar band was microetched with 90-µm aluminum oxide powder for increased retention[5] and then cemented.

To bond the brackets, the teeth were first cleaned with plain pumice and then etched with 35% phosphoric acid for 20 seconds (Ultra-Etch, Ultradent). A bonding agent (Assure Plus, Reliance Orthodontic Products) was then applied and air thinned for 5 seconds. In order to avoid inadvertently moving the anchoring teeth, the brackets were placed in a passive alignment, as opposed to their "ideal" placement. The first wire placed was a straight .016 nickel titanium archwire, which would accomplish some preliminary leveling and permit the patient to acclimate


FIG. 1

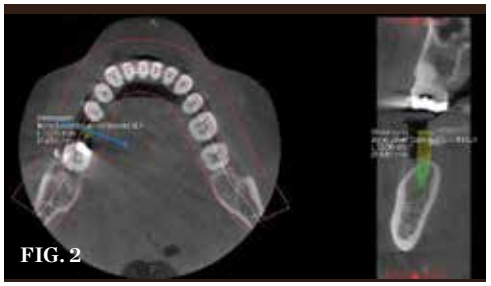
FIG. 2


FIG. 3


FIG. 4


FIG. 5


FIG. 6


FIG. 7

FIG. 8

(1.) Illustration of omega loop and bracket placement for anchor teeth. **(2.)** The preoperative planning included 2D radiography and 3D CBCT imaging for arch analysis and surgical assessment. **(3.)** Lingually placed crestal incision. **(4.)** Alignment and depth check for implant position. **(5.)** Fixture mount and implant placement at 35 Ncm initial stability. **(6.)** Placement of healing abutment and primary closure with chromic sutures. **(7.)** Before and after panoramic radiographs with the latter taken at the 12-month osseointegration check appointment. **(8.)** Close-up view of the stable restoration at the 3-year postoperative appointment.

to the new appliance. The wire was then transitioned to a .016 stainless steel archwire that was bent in the shape of an omega loop. To facilitate the intended tooth movement, this configuration had the mesial component bent taller than its distal component (Figure 1). The archwire was ligated with steel ligature ties, and a subtle sweep was placed in it to follow the archform to prevent unwanted rotation of the molar. After approximately 5 months, a rubber sleeve was placed to maintain the space and prevent relapse.

Implant Restoration

Preoperatively, a 3D cone-beam computed tomography (CBCT) scan was performed to measure for the appropriate implant size and visualize important anatomical landmarks (Figure 2). To place the bone level tapered implant (4.8 x 12 mm Roxolid® SLA®, Straumann), first, a crestal incision was performed to visualize the area surgically (Figure 3). After proper preparation of the fixture site, periodic alignment and depth checks were performed to confirm accuracy (Figure 4), and the implant was placed and torqued to 35 Ncm (Figure 5). An appropriate healing abutment was placed, and primary closure was achieved with chromic gut sutures (Figure 6).

After a healing period of 12 weeks, the patient was seen for an osseointegration check involving both radiographs and reverse torque testing, which was successful (Figure 7). A final impression was acquired, and the screw-retained restoration was placed and torqued to 35 Ncm. The access hole was blocked with PTFE tape and restored with a composite material (OMNICHROMA®, Tokuyama), which provided excellent concealment of the access. The patient has had the restoration for 3 years now with no additional procedures required (Figure 8).

Conclusion

The protocols described involved a multidisciplinary approach to restoring a common clinical scenario. By utilizing the fundamentals of tooth movement and digital concepts in the overall workflow to suit the patient's needs, one can provide predictable, long-lasting results.

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