Clinical Report

Orthodontic-prosthetic implant anchorage in a partially edentulous patient

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Abstract Three-dimensional planning of a dental-implant site is critical when implants are to initially be used as orthodontic anchor for tooth movement and to later serve as prosthetic abutments. The combined orthodontic and prosthetic implant restorative treatment of an adult patient with multiple missing teeth, an upper midline deviation, and malocclusion is described in this article. Plastic model bases combined with customized position plates allowed the precise transfer of the proposed implant position from the diagnostic arrangement to the original cast to avoid compromising subsequent orthodontic tooth movement.

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Introduction

During the past few decades, an increasing number of adult patients have sought orthodontic treatment with the demands of esthetics and function. Because adult patients are more likely to have previously experienced periodontal and other dental diseases, acquiring adequate support for orthodontic tooth movement can be a great challenge.

Dental implants inserted in an edentulous area to be used initially as orthodontic anchors for tooth movement and to later serve as prosthetic abutments for fixed restoration have become a valid treatment option.1–3 Interdisciplinary planning is mandatory in these patients to achieve the proper objectives, treatment sequences, and quality of the final result. Three-dimensional planning of the dental-implant location is exceptionally critical not to compromise subsequent orthodontic tooth movement.

The present clinical report demonstrates combined orthodontic and prosthetic implant restorative treatment in a partially edentulous patient. Dental implants were inserted in the edentulous area as orthodontic anchors and later served as fixed prosthetic abutments. We planned to move some teeth toward and others away from the

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implants during orthodontic treatment, which made it difficult to predetermine the exact locations of the implants. The importance of planning proper locations for preorthodontic implants and precise transfer of the positions from the diagnostic cast to the original cast are emphasized.

Case presentation

The patient was a 45-year-old man whose chief concern was significant decay of the maxillary right central incisor and many missing teeth. The patient had no reported health problems and had a well-proportioned facial pattern with a straight lateral profile. The maxillary right central incisor had a retained root (Fig. 1). The maxillary dental midline had deviated 3 mm to the right side. The maxillary right lateral incisor was in crossbite with the mandibular teeth. The maxillary second premolars and molars were missing. The mandibular teeth were crowded. The left mandibular first molar had inadequate periodontal support (Fig. 2) and had erupted into the maxillary edentulous space. The canine relationship was Angle’s Class III on the right side and Class I on the left side.

We proposed extracting the maxillary right central incisor and placing implants in the maxillary posterior alveolus as anchors for orthodontic correction of the maxillary dental midline and to later serve as prosthetic abutments. After sufficient space had been regained, an implant would be placed in the position of the maxillary right central incisor. The mandibular right first premolar, mandibular left first molar, and mandibular left third molar were to be removed. The mandibular anterior teeth were to be retracted and orthodontically aligned to achieve a Class I canine relationship. The patient preferred to have the mandibular left first molar restored with a conventional three-unit bridge. The patient refused to allow us to extract the mandibular left third molar.

Plastic cast bases (T3061-00; Leone, Firenze, Italy) combined with a position plate (T3062-0; Leone) were used to fabricate two sets of dental casts with identical tooth and base portions. One set of casts was used for diagnostic waxing, and the other initially served as a record of the existing tooth position and was later used to fabricate the surgical template. The position plate was customized with a transparent ruled grid trimmed and attached to its upper surface to allow correct transfer of the proposed implant position from the diagnostic arrangement to the original cast (Fig. 3).

Two 4.5-mm × 11-mm endosseous implants (FRIALIT®-2 implant system; DENTSPLY Friadent, Mannheim, Germany) were placed in the position of the maxillary left and right second premolars, and three 5.5-mm × 11-mm implants (FRIALIT®-2 implant system; DENTSPLY Friadent) were placed in the positions of the maxillary left and right first molars and left second molars. The implants were exposed,
and abutments were placed after 6 months of healing. Acrylic provisional restorations were constructed for these implant abutments and full-mouth fixed orthodontic treatment was initiated to achieve the proposed treatment objectives. The maxillary and mandibular dental arches were well aligned with full interdigitation, the dental midline was corrected, and adequate space was regained for the maxillary right central incisor after 14 months of orthodontic treatment (Fig. 4). One 4.5-mm × 13-mm endosseous implant (FRIALIT®-2 implant system; DENTSPLY Friadent) was then placed in the position of the maxillary right central incisor. Pretreatment and post-treatment extraoral photographs revealed correction of the maxillary dental midline (Fig. 5). A posttreatment

Figure 3  The proposed implant position on the diagnostic arrangement cast was transferred to the original dental cast with the help of a customized position plate with transparent ruled grids.

Figure 4  Intraoral photographs after 14 months of orthodontic treatment. Dental midline was corrected and adequate space was regained for maxillary right central incisor. One endosseous implants was placed in the position of maxillary right central incisor.
Discussion

Implants as orthodontic anchorage were found to facilitate superior preprosthetic tooth alignments. Two primary treatment objectives for the patient were to correct the maxillary dental midline and regain space for the maxillary right central incisor. The patient had a well-proportioned and balanced facial pattern with a straight profile. Expanding the maxillary arch and proclining the anterior teeth would have caused the patient’s appearance to deteriorate. Since the patient was missing the maxillary teeth distal to the first premolars, it was decided that implants would be placed in the maxillary posterior alveoli bilaterally as orthodontic anchors to correct the dental midline and later serve as prosthetic abutments.

The advantages of using implants for preprosthetic orthodontic anchorage are fully realized only when the implants are optimally located for the prostheses that will be placed after orthodontic treatment. Because the maxillary left central incisor, lateral incisor, and canine were to be moved toward the implants in the maxillary left posterior quadrant and the maxillary right first premolar was to be moved away from the maxillary right molar implants, a pretreatment diagnostic tooth arrangement was required to simulate the outcome of orthodontic tooth movements to obtain a proper implant position. After the position of the implants had been determined, this information was transferred to the original model for construction of the surgical template. It was necessary to fabricate two sets of dental casts with identical tooth and base portions: one for diagnostic wax arrangement and the other for surgical templates. The bases must be accurately replicated, so that the borders of the dental bases may be used as a reference to transfer the implant position. The proposed implant position may be transferred to the original cast using calipers by measuring the distance from same reference points on the bases of both the diagnostic arrangement cast and the original cast. In this
article, duplicates of the original diagnostic casts were fabricated with plastic cast bases and a customized position plate, which allowed easier transfer of the proposed pre-orthodontic implant position from the diagnostic arrangement cast to the original cast.

The combined orthodontic and restorative treatments of an adult patient with multiple missing teeth, an upper midline deviation, and malocclusion are presented. Osseointegrated implants were used as anchor units for preprosthetic orthodontic tooth movement. Careful treatment planning to determine the exact implant location using a convenient technique to duplicate the original dental casts and transfer it to the planned implant position was described. The final treatment result was satisfactory.

References