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Mini-implants as provisional anchorage for the replacement of missing anterior teeth: A clinical report

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This clinical report describes an adult patient referred for orthodontic treatment with mini-implants as anchorage to correct the root angulation of maxillary lateral incisors. The purpose of this report was to demonstrate the versatility of mini-implants placed in a vertical direction in esthetic areas. During orthodontic treatment, some aspects must be observed to preserve the interim restoration against the occlusal loads to avoid screw fracture. A fixed appliance was placed to correct the position of the maxillary anterior teeth and to complete the treatment. Acceptable esthetics and function were achieved. (J Prosthet Dent 2014;■:■-■)

The absence of permanent teeth as a result of agenesis or tooth loss can be followed by alveolar ridge reduction and migration, and by the angulation of adjacent teeth. A lack of root parallelism is undesirable in implant prosthodontics. Frequently, insufficient space is available to place the dental implant, or the space is not evenly distributed. Thus, many patients are referred for orthodontic treatment before rehabilitation.[1-3] When anterior teeth are absent, tooth positioning must be corrected and esthetics preserved during orthodontic treatment. Removable appliances with denture teeth constitute one option, but they are generally not well tolerated by patients because they can interfere with speech and expose the edentulous space when they are removed for eating or cleaning. Acrylic resin veneer with bonded brackets or even with a lingual arch wire also may be considered, and, as with removable appliances, they do not preserve gingival contour or thickness in the edentulous region. Bone preservation in the region requires careful analysis. Special care is required if the patient is still actively growing. In this situation, it is necessary to wait until adulthood for prosthetic restoration, including dental implant placement.[4]

Because of their biocompatibility and ease of insertion, mini-implants have proven to be useful as anchoring devices for various orthodontic movements. These mini-implants may be installed in different regions of the basal bones and alveolar maxillary and mandibular bones, and using them to correct various combinations of dental irregularities may be possible.[5] Although commonly inserted in a horizontal direction, mini-implants have been placed vertically to upright molars, to distalize maxillary molars, and to retain provisional restorations.[5-11] The mini-implants used in these reports have a button-shaped head with a hexagonal base design that allows interim placement to enhance esthetics in the anterior regions.[8-11]

CLINICAL REPORT

A 19-year-old woman who reported a history of avulsion of both central maxillary incisors as a result of trauma was referred for treatment. Attempts to reimplant the teeth after the accident were unsuccessful, presumably because the replantation procedures were delayed by more than 24 hours after the tooth avulsion (Fig. 1). A panoramic radiograph revealed a convergence of the maxillary lateral incisor roots, with insufficient space to place dental implants in the central incisor region. No pathology or bone loss was noted (Fig. 2). The main treatment goals were

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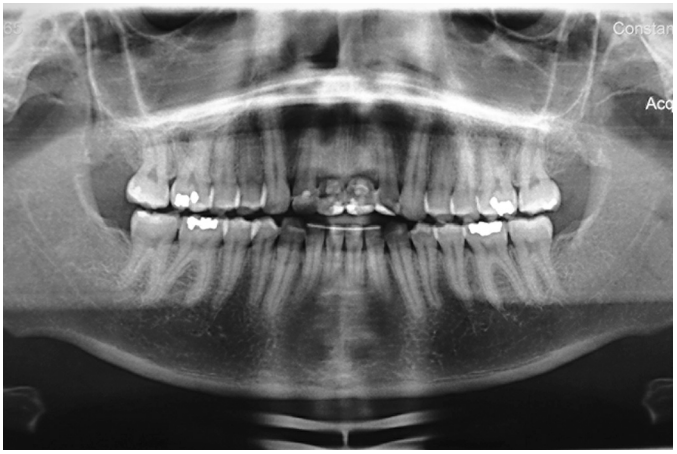
1 Pretreatment intraoral view.



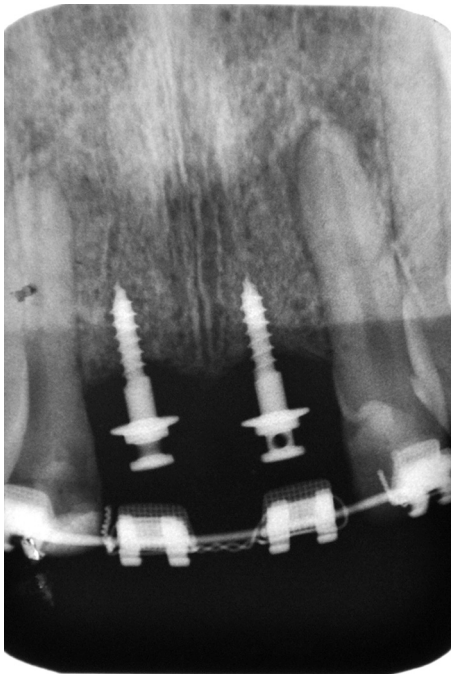
2 Pretreatment panoramic radiograph.

to correct the mesiodistal angulation of the maxillary lateral incisor roots to establish sufficient space for implants. Three treatment alternatives were proposed to allow for orthodontic movement while preserving esthetics. The first option was maxillary fixed appliances with the simultaneous use of a Hawley plate with denture teeth in the maxillary central incisor region. The second option was maxillary fixed appliances with brackets bonded to denture teeth and tied to the orthodontic wire, and the third was a maxillary fixed appliance with 2 mini-implants placed vertically in the alveolar ridge of the maxillary central incisors to support the denture teeth.

The patient opted for an interim restoration placed over 2 mini-implants. In addition to the esthetic advantages, this course of treatment eliminated the disadvantages associated with a removable appliance, such as patient compliance, speech changes, and risk of loss. This protocol also restored esthetics and function, facilitated cleaning, and attempted to preserve bone thickness and gingival contour in the edentulous space. Before the multidisciplinary treatment, to preserve esthetics, the patient's maxillary central incisor crowns were used as interim restorations. In the reported trauma history, after dental avulsion, the roots were cut off and then stabilized by bonding them to the lateral incisors and canines in the maxillary arch. Two 1.6 × 6-mm Modified Orthodontic Skeletal Anchorage System (Dewimed) mini-implants were placed (Fig. 3). The mini-implants were inserted in the palatal portion of the ridge, which thus allowed for greater buccal thickness and reducing the chances of occlusal contacts during mandibular movements. Denture teeth (central incisors) were attached immediately to the heads of the mini-implants with acrylic resin for use as interim restorations. After mini-implant placement, a control radiograph was made to examine the position of the bone site (Fig. 4). Straight-wire 0.022- × 0.028-inch slot Roth-prescription orthodontic brackets were subsequently bonded in the maxillary dental arch.

3 Intraoral view, showing collars and heads of mini-implants.

Mini-implant stability and occlusal clearance on the interim restoration were monitored at monthly appointments. Initial leveling and alignment



4 Periapical radiograph after insertion of mini-implants.

5 Gingival recontouring and interdental papilla observed immediately after removal of mini-implants.

6 Panoramic radiograph before definitive treatment.

7 Posttreatment intraoral view.

8 Intraoral photograph at 3-year follow-up.

were performed for 6 months. A panoramic radiograph made at the end of this phase showed increased space between the lateral incisor roots due to the corrected angulation. Because the spaces were adequate, the dental implants were placed at this stage. When the mini-implants were removed, papillae and gingival contour formation was observed in juxtaposition to the interim restoration over the mini-implants (Fig. 5). Fixed appliances were removed after 17 months of treatment, and ceramic crowns were then placed over the implants. Orthodontic treatment corrected the angulation of the maxillary lateral incisors and provided adequate space for placing dental implants in the maxillary alveolar ridge to restore smile esthetics, mastication, and speech. The root divergences provided sufficient interradicular space for the insertion of dental implants to replace the central incisors (Fig. 6). As seen in the intra- and extraoral photographs made 3 years after treatment and after ceramic crowns, good functional occlusion and a pleasing esthetic result were achieved, both intraorally and facially (Figs. 7, 8).

DISCUSSION

Placing vertical mini-implants in the alveolar bone of the edentulous ridge provides anchorage while promoting esthetics and normal speech, eating, and cleaning. Moreover, this type of treatment preserves osseous tissue in the alveolar area by stimulating bone maintenance.[8] Therefore, dental implants can be installed immediately after removing the mini-implants. A Modified Orthodontic Skeletal Anchorage System–type screw was selected for this patient because it has a horizontal collar as a base of the head before the transmucosal profile. This collar promotes gingival displacement and prevents soft-tissue inflammation if necessary to place partly in alveolar mucosa instead placed only on the firm attached gingiva. This type of screw was selected because its collar reduces the contact area between the pontic and the gingiva, thus reducing gingival irritation under the pontic and maintaining or even recontouring the gingival margin and interdental papilla (Fig. 5).

The mini-implants described in this clinical report were 6 mm in length. For the interim restoration to induce the gingival recontouring described above, the mini-implant should be inserted into the palatal aspect of the alveolar area. The greater thickness of

the palatal mucosa tissue in this region reduces the depth of screw insertion into the bone. In this clinical report, the mini-implant inserted in the left side (Fig. 4) was quite anteriorly positioned in relation to the palatal aspect because of technical limitations. However, before insertion an accurate positioning of the mini-implant in mesiodistal, buccolingual, and apicocoronal must be carefully considered when determining the placement direction of the mini-implant. Therefore, using 10-mm mini-implants is currently recommended because it avoids the increased chance of displacement associated with smaller screws. Moreover, by using a 10-mm screw, a 1:1 ratio is possible between the crown length and implant length, which also favors implant stability.[8]

After installing a mini-implant–interim-restoration combination, images must be obtained to check the screw location relative to the roots and other surrounding anatomic structures. Positioning the mini-implant in the palatal aspect of the alveolar ridge prevents fenestration of the cortical bone and helps adapt the provisional restoration to the gingival contour. Mandibular movements were checked for any incisal and/or occlusal contact interference with occlusal film (Accu-Film S053; Parkell) after adapting the denture teeth to the mini-implant heads and at every appointment thereafter. This precaution prevented mini-implant fracture and/or breakage of the denture teeth. Moreover, stripping the proximal surfaces of the denture teeth to provide space for the movement of adjacent teeth also is recommended. To facilitate orthodontic movement to correct root angulation, the spaces between the interproximal surfaces should be evaluated at all appointments.

Placing orthodontic mini-implants for provisional esthetics and functional rehabilitation in young patients with congenitally missing maxillary lateral incisors requires long-term assessment to maintain regularity in the alveolar ridge height after age-related bone remodeling. The follow-up visits should determine the need for provisional cervical recontouring and mini-implant repositioning. They can be unscrewed for repositioning, which can prevent changes in the height of the alveolar ridge relative to the adjacent teeth. Patients should be advised that the mini-implant is a short-term element and that, after orthodontic treatment, it must be replaced with a dental implant. In this patient, upon the completion of orthodontic treatment, the mini-implant was removed and the dental implant was placed during the same appointment. This treatment protocol helps maintain the gingival contour, and the mini-implant bone site can be used as a guide for the insertion of the dental implant.

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