0099-2399/98/2402-0145$03.00/0
JOURNAL OF ENDODONTICS

Printed in U.S.A.
VOL. 24, NO. 2, FEBRUARY 1998

Osseointegration Treatment of Transverse Root Fractures in the Region of the Alveolar Crest

Ramon E. Hernandez, DMD, and Thomas J. Balshi, DDS, FACP

A method of using osseointegrated implants as an alternative treatment modality for transverse root fractures near the osseous crest is presented. A 15-mm Branemark implant was placed immediately after extraction of a maxillary central incisor with transverse root fracture. Five months after stage I surgery, the implant was uncovered. Custom fabrication of a substructure core cast directly to the titanium single tooth abutment was necessary due to the palatal inclination of the fixture. An overcasting porcelain fused to gold crown was fabricated to avoid an unesthetic labial access for the abutment screw. This treatment indicates that the use of osseointegrated implants seems to provide an effective solution to replacing teeth with transverse root fractures.

The treatment of transverse root fractures, in which the fracture line lies 1 to 4 mm below the alveolar crest, presents the clinician with considerable difficulties (1, 2). The prognosis for this condition is generally considered poor. Problems include bacterial contamination and improper immobilization.

Bacterial contamination usually occurs because of the proximity of the fracture to the gingival sulcus. This contamination may be immediate, or it may follow the regressive changes occasioned by difficulty in immobilization. Immobilization of any fracture is important if calcific union is to be achieved. Optimal reduction of the fragment significantly enhances a more favorable prognosis (3). However, dislocation of the coronal fragment negatively influences the prognosis.

Where the coronal segment has not been lost, the treatment of fractured roots has been reported to be successful when the mobile segment is reduced and stabilized (4). When the fracture occurs in the middle or incisal third of the crown and there is adequate tooth structure available, the prognosis is favorable. Newer restorative techniques using composite resins are usually sufficient to restore form and function. Fractures occurring in the middle and apical third of the root have been shown to heal with: (i) calcified tissue; (ii) interposition of connective tissue; (iii) interposition of bone and fibrous connective tissue; or (iv) interposition of granulation tissue, which is considered to be an unfavorable response (3).

REVIEW OF TRADITIONAL TREATMENT METHODS

There are three traditional treatment methods commonly used to manage a fracture at or near the level of the alveolar crest:

1. Extraction of the remaining fractured tooth fragments and subsequent replacement with a fixed prosthesis—This prosthesis requires preparation of the abutment teeth for a variety of retainer mechanisms. The range of abutments can vary and might include full crown preparations, three-quarter crown preparations, pinledge preparations, or the use of minimally prepared lingual enamel to receive the retention wings for a resin-bonded fixed prosthesis.

2. Exposure of sound tooth structure by periodontal surgery (5, 6)—This procedure has been used to provide access to the apical segment of teeth with transverse fractures in the region of the alveolar crest. However, because this surgery generally involves the removal of alveolar bone, there may be damage to the supporting tissues of the neighboring teeth, and the esthetic result may be poor. In addition, maintenance of the palatal gingival tissues of such traumatized maxillary incisors is often difficult.

3. Forced eruption, or a combination of endodontic and orthodontic treatment (7–9)—Despite its value in alleviating problems resulting from corrective periodontal surgery, there are certain inherent clinical compromises with forced eruption. Posteruption restorative procedures require great finesse and comprehension by the restorative dentist and the laboratory technician. Tooth movement causes major coronal changes in the individual tooth. A smaller diameter root is generally positioned into the same mesiodistal space between the adjacent teeth. Selection of the surgical procedure must be seriously considered if an acceptable result is to be achieved. Recontouring the altered osseous crest must be part of the surgical procedure. The time interval between active tooth movement, stabilization, surgery, and the final restorative procedure is difficult to assess and can vary between 4 to 8 months until treatment is completed. Depending on the length of the remaining root that has been forcibly erupted, attention must be paid to the crown-root ratio and the occlusal scheme. Diminished root length may leave the tooth in a perpetual mobile condition.

AN ALTERNATIVE TO "TRADITIONAL" TREATMENT METHODS

This case report describes an alternative approach to managing transverse root fractures, using the highly predictable concept of osseointegrated implants. When fractures in the region of the

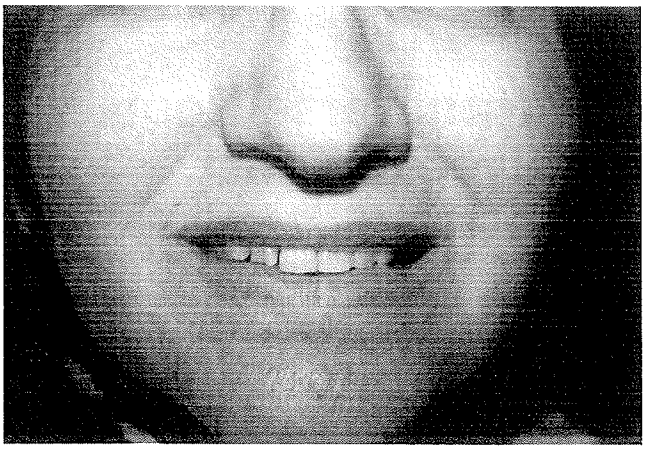

FIG 1. Preoperative "hesitant" smile.

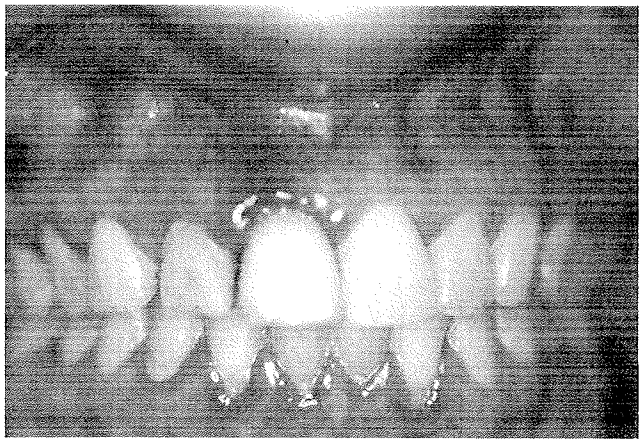

FIG 2. Severe inflammatory response associated with tooth 8.

alveolar crest occur, immobilization is difficult due to the dislocation of the fragments and the long-standing bacterial contamination. Such contamination leads to subsequent gingival inflammation and cervical bone resorption. These difficulties can be overcome by careful placement of implants into the extraction site.

After removal of the fractured root segments, the choice of either delayed or immediate implant placement depends on clinical judgment and experience. Excellent results have been achieved when the titanium fixtures are placed immediately after root removal (10).

Generally, a discrepancy in space exists between the elliptical socket and the circular form of the screw-shaped implant. For such situations, use of barrier materials have proven to be effective in preventing a fibrous tissue ingrowth into the remaining tooth socket (11, 12).

CASE REPORT

Because of severe dental phobia, a 41-yr-old female, who had suffered a blow to the maxillary central incisor, had not been seen for about 1 yr after her injury. Clinical and radiographic examinations disclosed a transverse root fracture, ~2 mm from the alveolar crest (Figs. 1 and 2). Marginal bone resorption was evident, and the coronal tooth segment was mobile (Fig. 3). There was obvious displacement of the two segments and bacterial contamination via the gingival sulcus. A treatment plan was developed

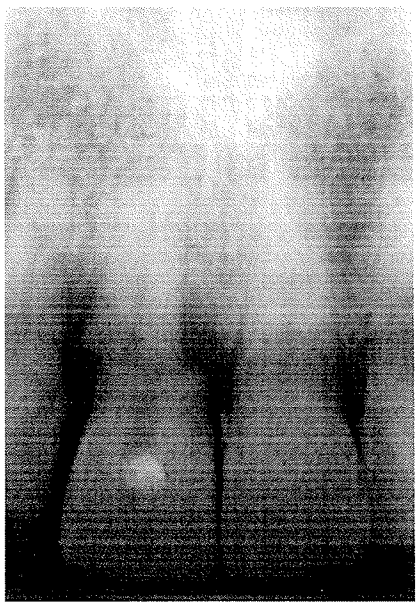

FIG 3. Preoperative periapical radiograph showing horizontal displacement of the fragments 1 yr after trauma.

that included the immediate placement of a Branemark implant into the extraction site to avoid residual ridge collapse and the future need for a conventional fixed prosthesis.

A surgical guide stent was fabricated preoperatively (13). The tooth was extracted under local anesthesia with minimal trauma to the surrounding bone, thereby preserving the integrity of the alveolar walls. The socket was then degranulated using currettes. A mucoperiosteal flap was reflected with vertical releasing incisions at the distal of the adjacent lateral and central incisor. This procedure created a larger flap base to maintain blood supply, and permitted sufficient mobility of the flap for future primary closure.

A 15-mm titanium Branemark implant (Nobel Biocare USA, Inc., Chicago, IL) was placed with minimal trauma using the manufacturer's prescribed surgical methods. The flap was repositioned, and primary closure was obtained by approximating the facial and lingual mucosa over the socket. Vicryl sutures were used to stabilize the flap securely. Postoperative medications included 250 mg penicillin V potassium (1 qid for 10 days) and 600 mg ibuprofen every 4 to 6 h for pain.

The patient wore a provisional removable partial denture during the healing period. The denture was relieved at the implant site to prevent pressure on the residual ridge or cover screw. Sutures were removed 10 days after implant placement. In addition to the patient's standard brushing and flossing, rinsing with 0.12% chlorhexidine gluconate (Peridex, Procter and Gamble, Cincinnati OH) was prescribed twice a day, after breakfast and before bed time, beginning 3 days postsurgery to control plaque.

SECOND-STAGE SURGERY

The abutment connection surgery was performed 5 months after implant placement. No signs of inflammatory reactions were seen around the implant. A single tooth impression coping was used to take the final impression.

The long axis angulation of the implant was inclined palatally. This produced a screw access hole to the labial, a condition frequently found with fixture placement in the maxillary anterior.

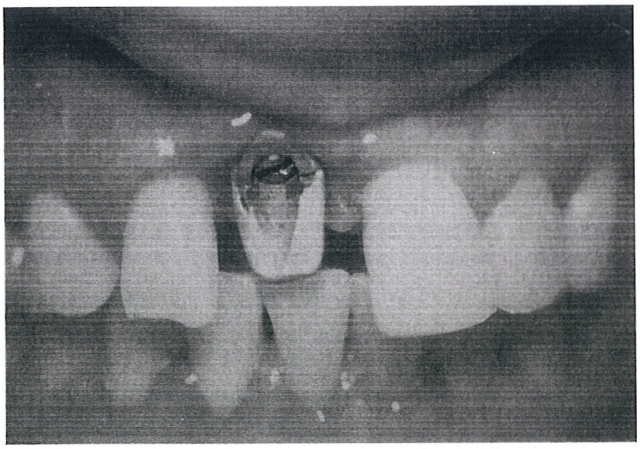

FIG 4. Custom gold substructure fastened to the titanium Branemark implant.

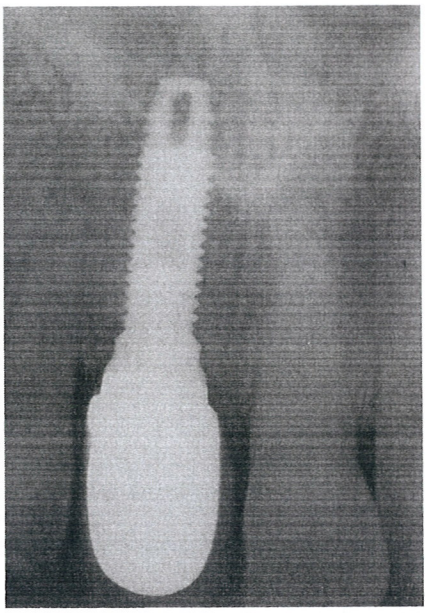

FIG 5. Periapical radiograph showing implant-supported porcelain fused to gold replacing tooth 8.

Prosthetic management of this condition required the fabrication of a custom substructure core cast directly to the Nobel Biocare titanium single tooth abutment (Fig. 4). After fabricating this custom substructure, an overcasting porcelain fused to gold crown was fabricated to avoid the unesthetic labial access to the abutment screw. The final crown was cemented to the custom abutment 3 wk after second-stage surgery (Figs. 5 and 6).

DISCUSSION

The use of a titanium implant offers a predictable option for the treatment of patients with transverse root fractures in the region of the alveolar crest. This treatment procedure is especially effective when long-standing bacterial contamination and the displacement of the fracture fragments presents difficulties in the treatment of such injuries by traditional methods. In this procedure, the marginal bone around the adjacent teeth is maintained without extensive surgery, thereby providing a sound basis for future periodontal health and stability of the implant.

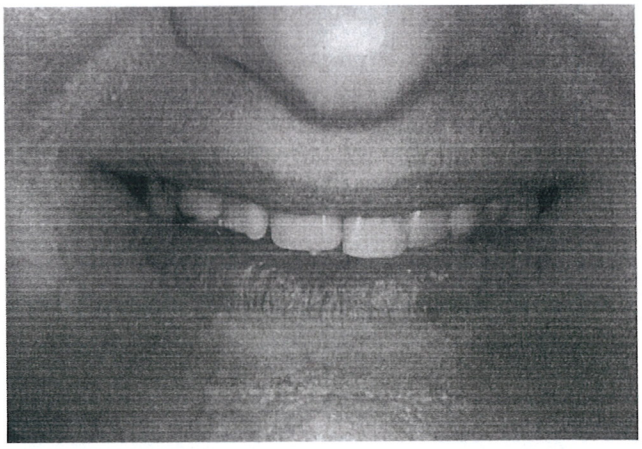

FIG 6. Postoperative clinical view of implant-supported crown replacing the right central incisor.

The treatment of transverse root fractures for maxillary anterior teeth can be effectively accomplished through the use of osseointegrated implants. The use of implants can be considered the treatment of choice, due to its highly predictable success rate. Furthermore, less stable forms of restorative treatment are avoided when forced eruption techniques are used. Avoiding preparation of the adjacent teeth for traditional fixed prosthodontics may also be considered the more biologically conservative approach. Because of the long axis angulation of the implants in the anterior maxilla, the use of modified components, or custom components, may be required.

Dr. Hernandez is affiliated with the Endodontology Department, Temple University, Philadelphia, PA, and he also has a private practice at Prosthodontics Intermedica, Fort Washington, PA. Dr. Balshi is director of the Institute for Facial Esthetics, and he is owner of Prosthodontics Intermedica (Fort Washington, PA), where he also has a private practice. Address requests for reprints to Dr. Ramon E. Hernandez, 467 Pennsylvania Avenue, Suite 201, Fort Washington, PA 19034.

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