The Segmental Down Fracture for Vertical Bone Augmentation: Case Report

Burton Langer, DDS, MSD, DMD

ABSTRACT

The aim of this singular case report is to describe correction of a severe vertical bone and soft tissue deficiency in the maxillary esthetic zone. The defect was corrected by using a single stage segmental down fracture technique. Treatment results were followed for 9 years, revealing stable bone, soft tissue, and bone levels adjacent to the dental implants.

KEY WORDS: dental implant, distraction, distraction rods, down fracture, osteogenesis

The need for vertical bone augmentation is usually associated with insufficient bone to place implants. However, in conjunction with this problem is the need to create a stable bone and soft tissue environment for an esthetic prosthetic replacement. The available techniques are varied and many show satisfactory results in bone compromised areas. Some of the published reports involve the use of onlay bone grafts harvested from remote sites and use of barrier membranes and particulate bone particles.[1–5]More recently, distraction osteogenesis has been described with very impressive results.[6–9]

The purpose of this article is to present another approach to the problem of insufficient bone height using a technique commonly used in orthognathic surgery. The procedure is known as a segmental down fracture.[10,11] Although the approach is similar to that of distraction osteogenesis, the procedure is done in one visit rather than in various stages of incremental adjustments.[11–13]

CASE REPORT

A 48-year-old female patient was seen to evaluate whether a fixed esthetic solution could be accomplished using implants to reconstruct the area between the maxillary canines. The examination revealed extreme bone loss surrounding the maxillary central and lateral incisors (Figure 1, A and B). It was decided that four maxillary incisors should be extracted and replaced with a fixed partial denture from canine to canine. The patient was informed that, in order to correct the anticipated bone and soft tissue deficiencies, it might be necessary to perform an autogenous bone graft from a remote site or distraction osteogenesis. The patient was advised that a prosthetic replacement might involve pink porcelain at the gingival margin in order to create an esthetic result. Prior to the surgical procedure, a provisional fixed partial denture was made from the maxillary left to maxillary right canines.

SURGICAL PROCEDURE

The patient was anesthetized with an appropriate local anesthetic and four incisors were removed. In an attempt to reduce bone resorption, demineralized freeze-dried bone allografts were condensed into the extraction sockets. To control postoperative bleeding and to help contain the grafts, the sockets were sutured. The fixed partial (University of Miami Bone Bank, Miami, FL, USA) denture was adjusted to reduce pressure on the extractions sockets and recemented. The patient was given nonsteroidal anti-inflammatory medication for discomfort. After 2 weeks, the patient returned for postoperative evaluation. It appeared that the length of the pontics were esthetically unsatisfactory (Figure 2). The soft tissue followed the pattern of bone loss in a "U-shaped" configuration (Figure 3). The patient was informed that distraction osteogenesis as discussed preoperatively would be necessary.

Beth Israel Hospital, New York City, NY, USA

Reprint requests: Dr. Burton Langer, Beth Israel Hospital, 933 5th Ave., New York, N.Y. 10021; e-mail: Burtl2@AOL.com

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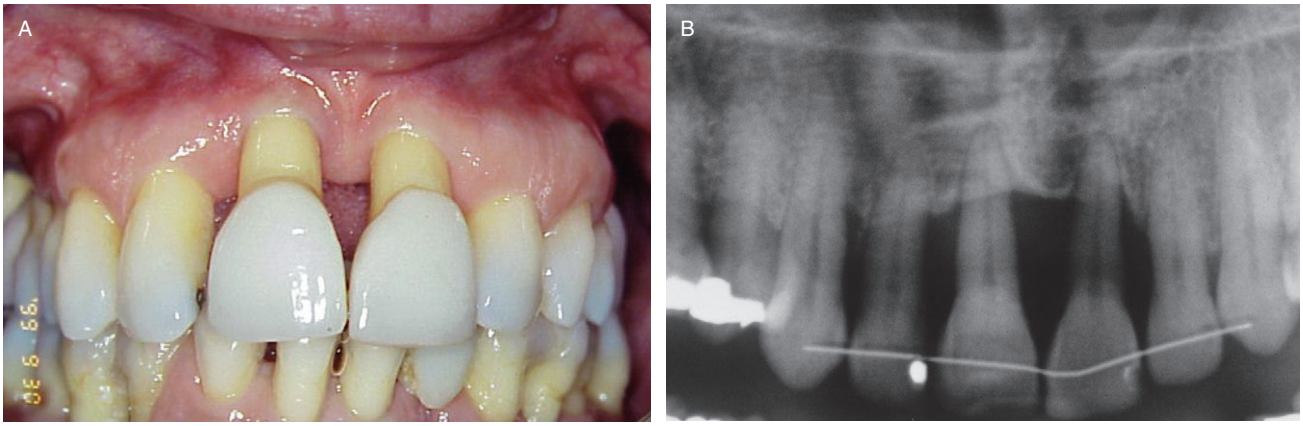

Figure 1 *A*, Preoperative view of the patient demonstrated severe recession between the maxillary central and lateral incisors. *B*, Radiograph showed severe bone loss around central and lateral incisors.

Surgical Correction

The provisional restoration was removed and an appropriate local anesthetic was administered. A partial thickness dissection was created at the level of the mucobuccal fold. A full thickness incision was made in order to access and visualize the alveolar crest. Two vertical incisions were made mesial to the right and left canines. The horizontal and rectangular incisions were joined together to allow the reflection of the labial tissue complex away from the alveolar bone. This flap was coronally reflected until the buccal aspect of the alveolar bone was visualized. The palatal tissue was not disturbed (Figure 4).

A reciprocal saw was used to create the osteotomy incisions.

A trapezoidal osteotomy was created in the bone with the narrower portion of the trapezoid being at the most apical part of the osteotomy. This allowed unimpaired movement of the bone block in an inferior direction. The osteotomies were released from the adjacent bone until the palatal soft tissue was encountered.

Two osteotomies were created through the crestal gingival tissue extending into the underlying bone and ending inferior to the base of the nose. Two metal base plates (Ace Surgical Supply, Brockton, MA, USA) were screwed into the bone above the apex of the osteotomy. Two transport rods (Ace Surgical Supply) were inserted thru the tissue at the crest of the alveolus into the bone in two locations and inserted into the base plates. The rods were placed in the maxillary right central and lateral incisor regions (Figure 5, A and B).

Figure 2 Provisional fixed partial denture was placed after the extraction of the central and lateral incisors. Note the extreme length of the pontics.

Figure 3 The fixed partial denture was removed and the tissue on the alveolar ridge had a U-shaped contour.

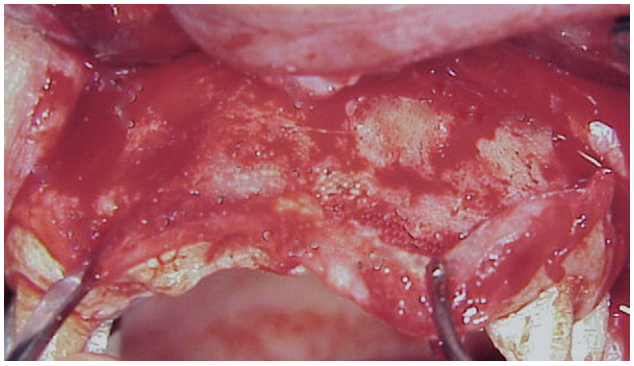

Figure 4 The flap was elevated in an apical coronal direction until the crest of the ridge was visualized. Care was made to avoid retracting the flap too far coronally as this might injure the palatal blood supply.

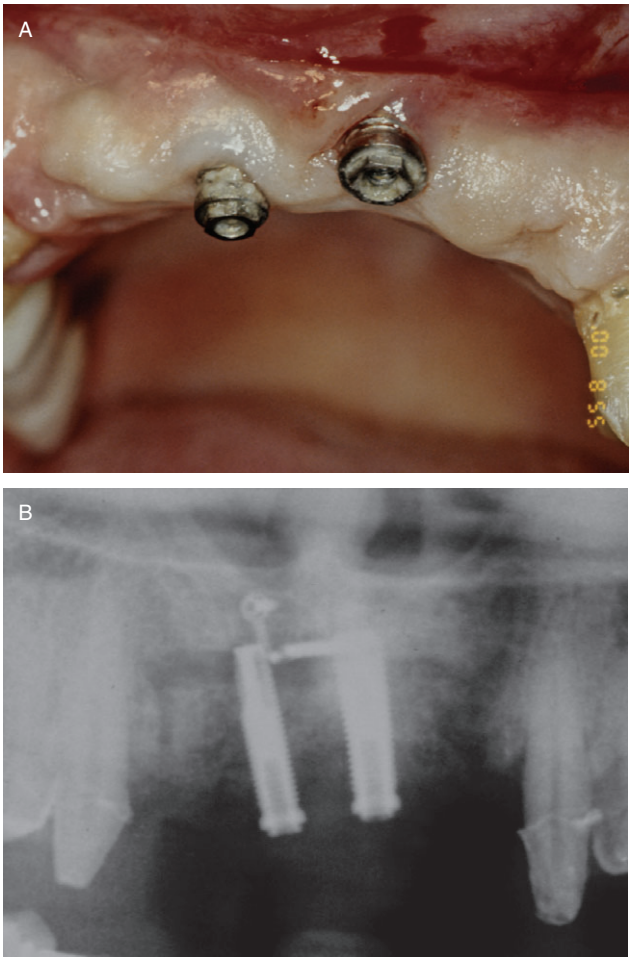

Figure 6 *A*, When the bone reached the desired position, each distraction rod was removed and replaced with a implant fixture. Note, one fixture was placed to the buccal in order to keep the bone in a labial position. *B*, Radiograph revealing the two stabilizing implant fixtures held the distracted bone in place.

The entire block of bone was distracted in a coronal direction until the desired amount of correction was accomplished. The transport rods and base plates were removed and two 4-mm-wide and 13-mm-long machined-surfaced implants (Nobel Biocare, Branemark Implants, Yorba Linda, CA, USA) were inserted into the location of the transport rods (Figure 6, A and B).

A void was present at the apex of the distraction site. Demineralized bone allograft was placed into the space created by the coronal movement of the bone block.[14] The soft tissue was sutured at the apical flap extension and vertical incision lines. The provisional restoration was modified to eliminate pressure on the stabilizing implants. At this stage, the amount of coronal augmentation was significant. The patient was placed on an

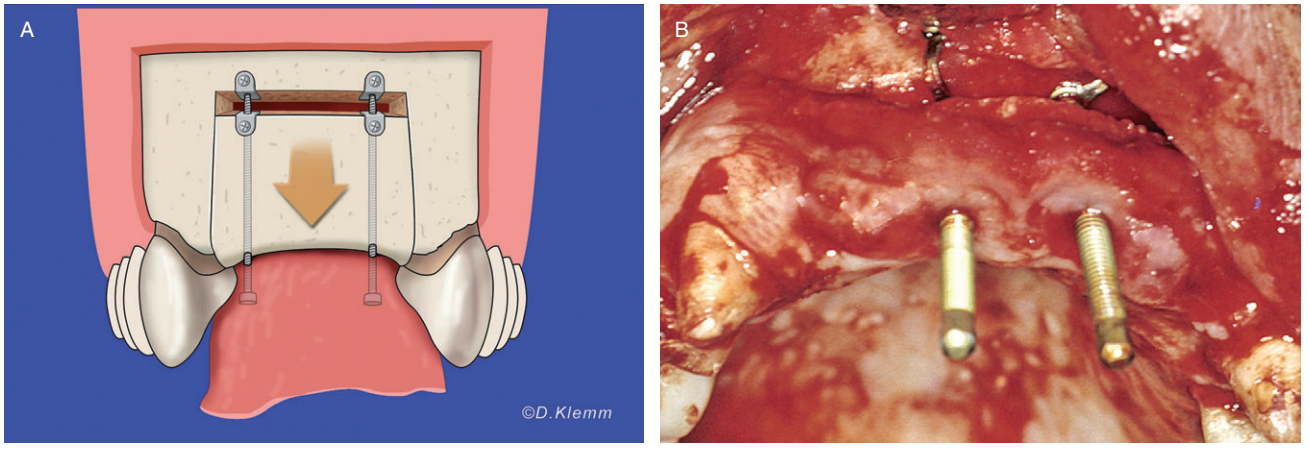

Figure 5 *A*, A horizontal osteotomy was made several millimeters inferior to the floor of the nose. Vertical osteotomies were made a few millimeters mesial to the existing canines. These cuts were made in the shape of a trapezoid with the narrowest portion at the apex. *B*, Two distraction rods and apical base plates were placed in the bone. The transport rods were rotated to move the trapezoidal bone block coronally.

Figure 7 Note the healed area with the provision restoration in place and an improvement in the length of the pontics.

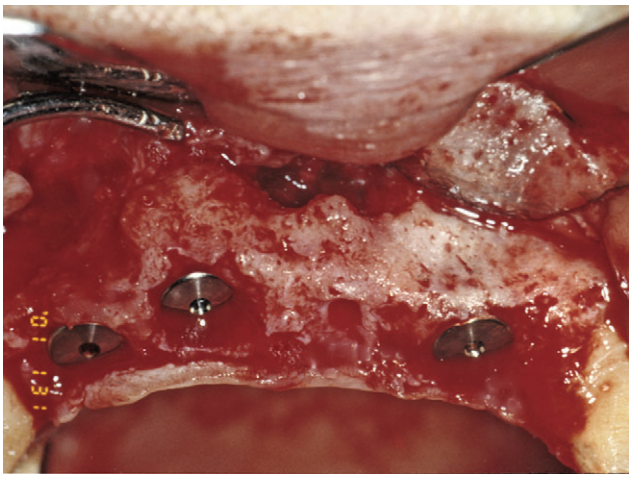

Figure 8 Three and a half months postoperatively, the original stabilizing implants were removed and permanent fixtures placed adjacent.

appropriate antibiotic and analgesic for 7 days. Ten days after treatment, the patient returned for a postoperative visit.

Clinically, there was a major improvement in esthetics (Figure 7). There was minimal facial edema and the patient reported minimal postoperative discomfort. No further treatment was performed and the patient was seen at a 2-week interval for the next month. The patient was rescheduled for a 3-month reevaluation. At this visit, the provisional restoration was removed and it was noted that one of the stabilizing implants was mobile. The patient was scheduled for replacement of the stabilizing implants with permanent implants.

At a subsequent visit, under local anesthesia, a crestal incision was made to visualize the buccal bone crest. The facial aspect of bone had completely healed. The two stabilizing implants were removed and three machined-surfaced implants, 4 mm wide and 13 mm long, were installed (Figure 8). Small voids in the bone resulting from removal of the stabilizing implants were filled with demineralized bone allograft. In these areas small connective tissue grafts were added to increase soft tissue height. The provisional restoration was replaced and the patient was placed on the same antibiotic and analgesic routine as in the original procedure. The patient was seen within a 2-week period.

At this visit, the healing was well-advanced and there were no untoward reactions. The esthetic outcome at this stage was very acceptable to the patient. We projected an uncovering stage at 5 months from the time of the final installation of the permanent implants. We elected to take follow-up radiographs at a 3-month interval to evaluate the status of the osseointegration.

The 3-month radiographs demonstrated good bone to implant contacts and the uncovering appointment was scheduled in two more months.

At the 5-month interval appointment, the three implants were uncovered. Radiographs revealed good bone-to-implant integration.

The patient was referred to her restorative dentist for completion of the final implant-supported prosthesis, and placed on periodic periodontal maintenance schedules. The patient was followed for 9 years and during this time, there are no esthetic changes and the crestal bone levels remained stable (Figures 9 and 10).

Figure 9 After an additional 7 months, the final restoration was placed.

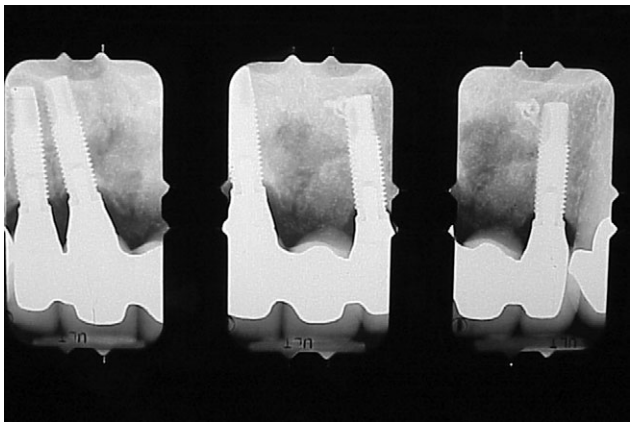

Figure 10 Nine-year postoperative radiograph demonstrates a steady state of bone. Note the change in the bone height from the initial 5–6 mm to the postoperative 15 mm. An excellent esthetic result had been achieved.

DISCUSSION

The technique described is similar to that which has been used in orthognathic surgery and has been employed successfully for many years.[15,16] The important factors required for successful results are adequate vascularity, good tissue management, and proper bone fixation. The healing elements seen in distraction osteogenesis rely on vascularity and the ability of the clot at the apex of the distracted bone block to develop into bone. This is not dissimilar to the clot formed at the apex of a bone block in distraction osteogenesis.

As long as the apical defect is covered with soft tissue and the clot is not disturbed, it will also form new bone. With the help of bone substitutes, the process may be enhanced. Although this case report did not use bone morphogenic proteins, these supplements may add a new dimension to this procedure. There is also the possibility that this technique will give the clinician the ability to position bone blocks in a more ideal position than seen in distraction osteogenesis.

CONCLUSION

The results as documented in this case report demonstrate that the down fracture technique can result in a vertical increase in bone height and an acceptable esthetic outcome. Studies are needed to verify the predictability of the procedure.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare. [Correction added after online publication 24 May 2010: Conflict of Interest Statement added.]

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