Implant Placement and Guided Tissue Regeneration in a Patient with Congenital Vitamin D–Resistant Rickets

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Key Words

Implant services
Vitamin D–resistant rickets
Guided tissue regeneration

There continues to be increased expansion of implant services corresponding to the public's increased awareness of implant-borne prostheses as a regular part of treatment planning. This rise in public awareness as practitioners expand their skills will lead to the consideration of an implant option for growing groups of patients whose medical histories may have previously contraindicated implantology. This presentation is one such case.

Introduction

A 34-year-old man was missing tooth 11 that had been extracted 1 year previously. He had a history of congenital vitamin D–resistant rickets. A literature review found no articles relating to guided tissue bone grafting and dental implant placement for patients with this medical history. A large buccocortical defect was revealed at the time of surgery. An implant was placed using osteotome site preparation but was complicated by a long bony defect. A guided tissue bone graft was performed. Six months later, the graft had eliminated the defect and increased the canine eminence dimension by over 3 mm. Forty months later, the soft tissue and bone appeared to be healed.

Fat-soluble vitamin D is necessary for normal skeletal development and mineralization in infants and children and for maintenance of normal bone remodeling in adults. A significant deficiency leads to poorly mineralized osteogenic bone, a condition known as osteomalacia.[1] Vitamin D–resistant rickets has marked effects on the teeth and supporting structures. Characteristically, these rickets lead to widespread formation of globular dentin clefts and tubular defects occurring in the region of the pulp horns. In addition, these pulp horns are often elongated enough to reach the dentinenamel junction. Because of these defects, microorganisms commonly invade the pulp. Following this, there often is periapical involvement of grossly normal-looking deciduous or permanent teeth. The lamina dura around the teeth is also reported to be frequently absent or poorly defined on x-ray, and the alveolar bone pattern may be abnormal.[2,3] A literature search was done on the subject of guided tissue regeneration and dental implants in patients with familial vitamin D–resistant rickets, and articles covering this subject were not located.

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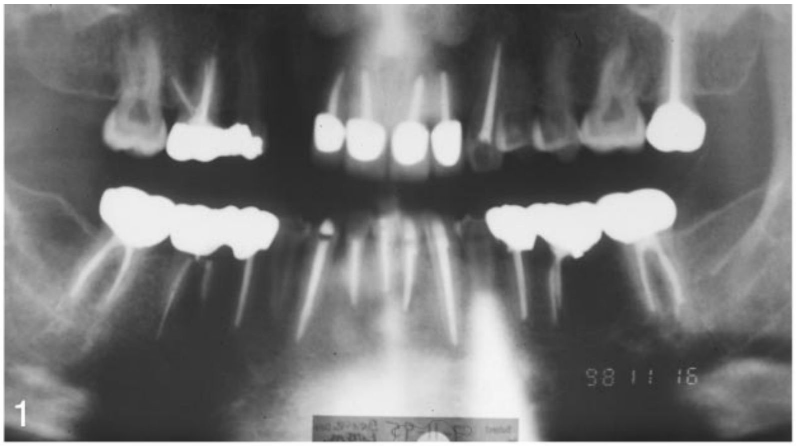

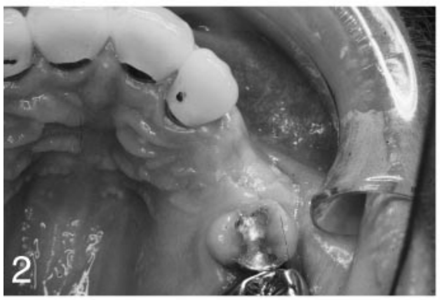

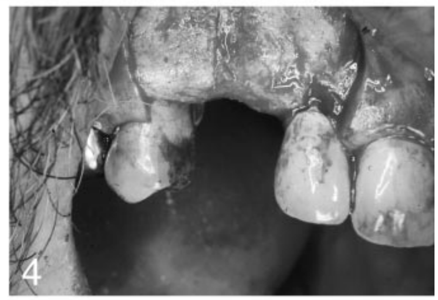

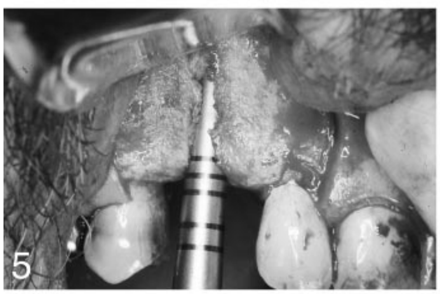

FIGURE 1. Preoperative Panorex demonstrating missing tooth 11 with large bone defect.

FIGURE 2. The planned operative site showing a flattened canine eminence.

FIGURE 3. The planned operative site from another view showing a compromised ridge.

FIGURE 4. The incisions were made well beyond the planned operative site.

FIGURE 5. A Summers osteotome was being used to enlarge the deficient host site. The dramatic paucity of bone is clearly delineated.

FIGURE 6. Most of the labial surface of the implant is exposed secondary to the deficient bone quantity.

FIGURE 7. The graft material was overcontoured to permit for resorption.

FIGURE 8. The TefGen membrane is stabilized with the implant cover screw.

FIGURE 9. Closure was achieved in a tension-free environment.

FIGURE 10. After 6 months of observation, acceptable healing was noted.

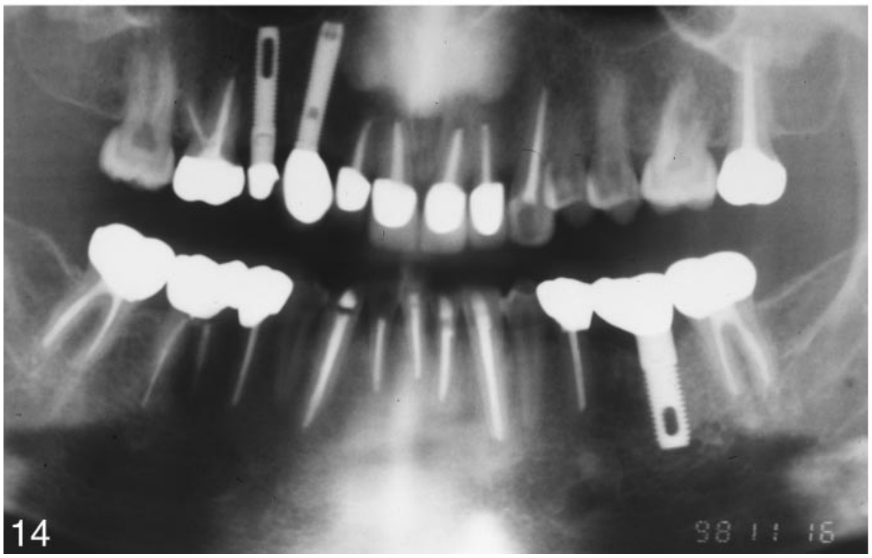

FIGURE 11. The host site had mineralized successfully, with complete coverage of the implant. From this site, a small specimen was removed for biopsy.

FIGURE 12. The completed prosthesis indicated the corrected contours.

FIGURE 13. The completed prosthesis also indicated aesthetic improvement of site.

FIGURE 14. Postoperative Panorex indicates the restoration of contour and function at the treated site.

CASE HISTORY

The patient was a 34-year-old man with confirmed diagnosis of familial vitamin D–resistant rickets inherited as a sex-linked dominant trait. As would be expected, the patient had numerous surgical procedures performed during his earlier years to correct the associated deformities. These included epiphysial corrections of the long bones using iliac crest wedge grafts to correct their bowing. Also present were the usual problems of shortened stature and a history of associated pseudofractures as a youngster.

On oral examination, the dental abnormalities in this individual as an adult were unnoticeable except for the higher-than-average percentage of teeth with crowns. However, analysis of the Panorex (Fig 1) revealed an unusually high percentage of teeth with root canal therapy, as would be expected as a result of microorganism invasion. The patient previously had endodontic therapy on tooth 11, followed by post and crown placement. One year before initial consultation, the root fractured. It was surgically removed, and an interim removable prosthesis was put in place.

The patient was concerned about using his anterior teeth as abutments for a fixed prosthesis. He continued to wear the removable appliance, and a second examination was performed approximately 1 year after the extraction. This examination revealed adequate attached gingiva, left-sided group function, and sufficient interarch space for reconstruction. Palpation revealed the presence of a cortical plate defect at the tooth 11 site and a loss of the canine eminence (Figs 2, 3).

The Panorex revealed a greater than 20 mm distance to the floor of the nose as well as a confirmation of the buccocortical plate defect (Fig 1). Implants were discussed with the patient as an option, along with the need for guided tissue bone regeneration. The patient was also informed that, because of his medical history, the results would be unpredictable. Nonetheless, the patient consented to have surgery.

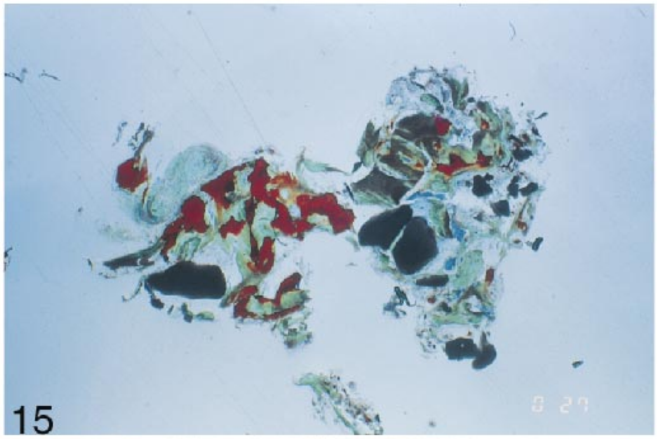
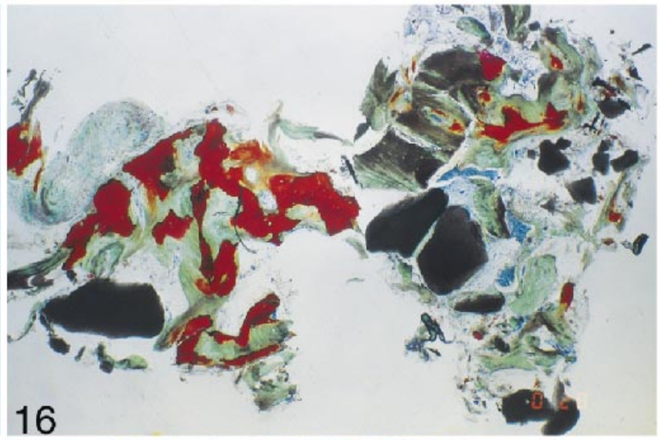
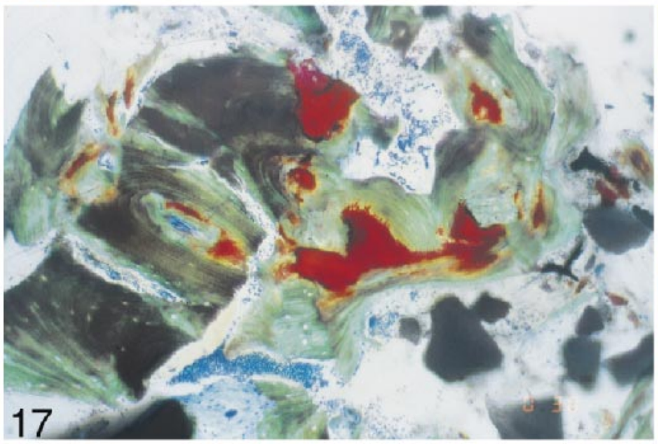
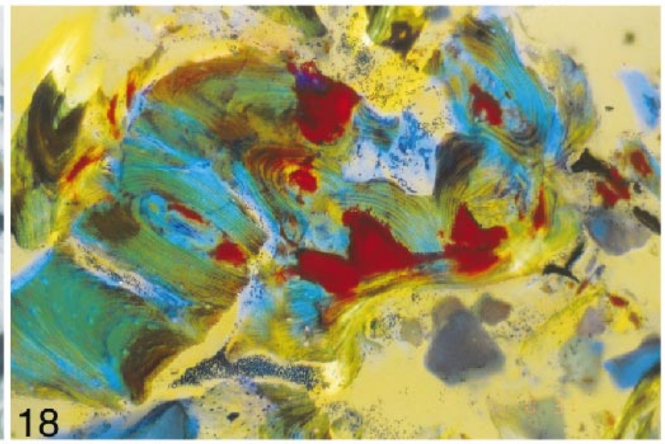

FIGURE 15. This section shows a mixture of HA and DFDBA becoming mineralized. The HA does not seem to be incorporated into the newly forming bone.

FIGURE 16. At slightly higher magnification, the DFDBA just above the two large pieces of HA are the least remineralized.

FIGURE 17. High-power magnification of the area undergoing remineralization. This area is near the particles of HA but does not incorporate them into the bone.

FIGURE 18. Polarized view of the remineralization area, emphasizing that the DFDBA is becoming remineralized rather than being remodeled.

MATERIALS AND METHODS

The patient was instructed to use 2 cc (0.5 oz) chlorhexidine twice a day before surgery. One gram penicillin V potassium and 800 mg ibuprofen were administered 2 hours before surgery. A sterile field was placed in preparation for surgery.[4]

An incision was made 4 mm palatal to the midcrest, with releasing incisions at the mesiobuccal of tooth 12 and distobuccal of tooth 10, extending into the vestibule and past the mucogingival junction. A full-thickness trapezoidal flap was raised, revealing a large vertical buccocortical defect (Fig 4). The available bone was expanded with a Summers osteotome[5] to a length of 18 mm after removal of all soft tissues in the defect (Fig 5).

A 4 × 18–mm externally hexed Restore implant (Lifecore Biomedical, Chaska, Minn) was placed. A vertical bony defect exposing 13 threads was present (Fig 6). The buccocortical plate was decorticated with a number 2 round bur using a method advocated to initiate osteoblastic activity into the graft site. The decortication consisted of numerous small cortical perforations mesally, distally, and apically adjacent to the original defect. There was visible bleeding from these miniature osteotomies (Fig 6).

The graft material consisted of a mixture of freeze-dried demineralized bone[6] (200–400 μm; Pacific Coast Tissue Bank, Los Angeles, Calif) mixed one to one with OsteoGraf/N-300 microporous resorbable hydroxyapatite (CeraMed/Dental Products, Lakewood, Colo).[7] The bone graft was placed to fully cover the defect and to recontour the canine eminence with an initial overbuilding to compensate for anticipated bone remodeling and shrinkage of the graft (Fig 7).

A high-density 0.25-mm polytetrafluoroethylene (PTFE) membrane of medium thickness (TefGen-USA, Sacramento, Calif) was trimmed to the correct shape and placed with a coronal attachment to the implant cover screw (Fig 8). This membrane is considered cell occlusive and nonresorbable. The periosteum was scored horizontally above the flap extensions to allow for a relatively tension-free closure (Fig 9).

Second-Stage Surgery

Becker *et al*[8] suggest that when barrier membranes are used, extended healing periods should be permitted for up to 6 months before loading. Experience with cell-occlusive high-density PTFE membranes[9] has shown minimal tissue inflammation throughout prolonged regeneration periods. At second-stage surgery, the membrane, due to its texture, is simply removed with a slight tug, allowing it to extrude in an unchanged state. This design feature is important because it maintains the integrity of the newly formed graft and preserves the improved soft-tissue contours.

At second stage (Fig 10), a crestal incision was made, a full-thickness buccal envelope flap was made, and the membrane was removed after removal of the screw. Complete coverage of the 13 exposed threads was achieved; in addition, an additional 3 mm of ridge restored canine eminence (Fig 11).

A comparison of the postsurgical photo (Fig 10) with the presurgical photo (Fig 2) shows the dramatic improvement in bony- and soft-tissue contours. The bone graft was hard to the touch, appeared to be mineralized, and had a glossy surface. A small specimen was harvested for histology. Figures 15–18 demonstrate the dramatic formation of new bone. An aesthetic contour 6-mm healing abutment from Restore (Lifecore Biomedical) was placed for 6 weeks to further enhance the gingival contours. After 6 weeks, a matching 6-mm pick-up post was placed, and an impression using polyether and the open tray technique was made. A soft-tissue model was poured. A custom abutment was fabricated maintaining the gingival contours on the soft tissue model. A crown was then seated with permanent cement (Figs 12, 13). As can be seen in the illustrations, the canine eminence was recreated and normal soft-tissue contours were restored. The postoperative radiographs (Fig 14) demonstrate the excellent level of bone at the operative site.

Conclusion

As this case demonstrates, what might have been considered a possible contraindication[2] to dental implantation was managed successfully.

Forty-two months after the surgery, the prosthesis was functioning and the patient was very satisfied. This operation will, I hope, expand the potential pool of patients who regard implants as acceptable and allow more patients to enjoy the benefits of dental implants and their restorations.

Acknowledgment

Dr Debra Ettle deserves credit for her excellent photography.

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