

Histological Response and Clinical Evaluation of Heterograft and Allograft Materials in the Elevation of the Maxillary Sinus for the Preparation of Endosteal Dental Implant Sites. Simultaneous Sinus Elevation and Root Form Implantation: An Eight-month Autopsy Report

In the mid- to late Seventies, Tatum (1977) reported on a procedure of sinus elevation to enable dental implants to be placed in the maxilla where insufficient bone was present due to sinus enlargement. Clinically, this procedure has shown some promise. To date, Lozada and James (1988) have been able to report on tissue recovered with a trephine from a sinus elevation site at the time of implant placement. This report investigates the response to resorbable hydroxylapatite **OSTEOGEN**[®] (HA Resorb)[®], Impladent Ltd., Holliswood, NY) combined with freeze-dried demineralized cortical bone powder (Southern California Neuroskeletal Tissue Bank, San Bernardino, CA) implanted during a sinus elevation and carried out simultaneously with root-form dental implantation.

Case Report

A seventy-nine-year-old white male, with a health history of a heart murmur, high blood pressure,

chest pains, and an episode of carotid artery occlusions some six years previously, presented for dental reconstruction. It was decided to place four root-form implants in the areas of teeth #2, #3, #14, and #15. It was predicted that the root forms would perforate the sinus, so a simultaneous sinus elevation was to be performed.

Procedure

The patient presented ambulatory, alert, with mild apprehension, and in a stable condition. He was prepared for a sterile procedure by facial and intra-oral Betadine scrub and was draped in a sterile manner. Local anesthesia was attained with regional blocks and infiltration. An incision was made palatal to the crest of the ridge, extending from the tuberosity to the cuspid, with a releasing incision to the buccal. A full-thickness flap was raised to expose the crest of the ridge and the buccal wall of the maxilla.

An antrostomy for the sinus elevation was per-



Figure 1. Gross sample of maxilla.

formed, and the sinus mucosa was elevated. The osteotomies for the root form implants (Denar Corp., Anaheim, CA) were performed so that the perforation of the bone through the floor of the sinus was observed, and the implants were placed. Graft material—consisting of demineralized, freeze-dried, cortical bone powder, resorbable hydroxylapatite, and penicillin reconstituted with 0.9% saline—was placed in the elevated space inferior to the sinus. The flaps were repositioned and sutured with monofilament 000 nylon.

At the time of the six-month recall, it was learned that the patient had been hospitalized for metastatic cancer to the lung, and in the eighth month after surgery, death occurred. With the approval of the relatives, the maxilla was recovered, fixed in 10% buffered formalin, and submitted for examination (Fig. 1).

Histological Examination

On examination of the gross specimen, it was noted that the roof of the sinus had been dislodged during the autopsy dissection, and the apical portion of the anterior implant could be observed covered with sinus mucosa (Fig. 2). The gross sample was photographed and radiographed from an occlusal view, sectioned down the mid-line suture,

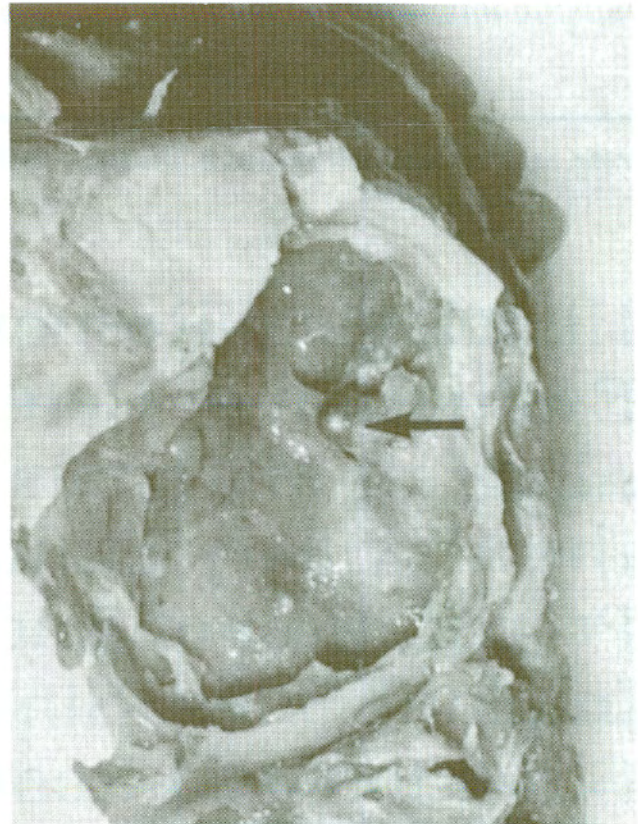


Figure 2. Superior view of the maxilla with maxillary sinus roof removed. Observe the apical area of the implant covered with sinus mucosa.

and radiographed again from the lateral view. The right hemisection was sectioned in the frontal and sagittal planes, as *per* Figs. 3 and 4. Samples #2E and #2F are reported herein (Fig. 5).

The portion containing the implant #2E was fractionally dehydrated, embedded in Epon, and cut with a diamond saw to a section of 0.030 inch for light microscopy. The portion of tissue lateral to the implant (#2F) was submitted for light microscopy, with use of H and E and trichrome stains.

Examination of the tissue surrounding the implant in section #2F revealed osseointegration, with remnants of resorbable hydroxylapatite and grafted bone close to the implant (Fig. 6).

Examination of the tissue lateral to the implant (section #2F) revealed the crest of the ridge, the new floor of the sinus, and the lateral wall of the maxilla in the area of the antrostomy for the sinus elevation, along with the remnants of the graft material. The sinus mucosa and the oral mucosa appeared to be normal, and the response to the graft appeared to be without inflammation. In fact, the demineralized, freeze-dried, cortical bone powder had an inductive effect on bone formation. Fig. 7

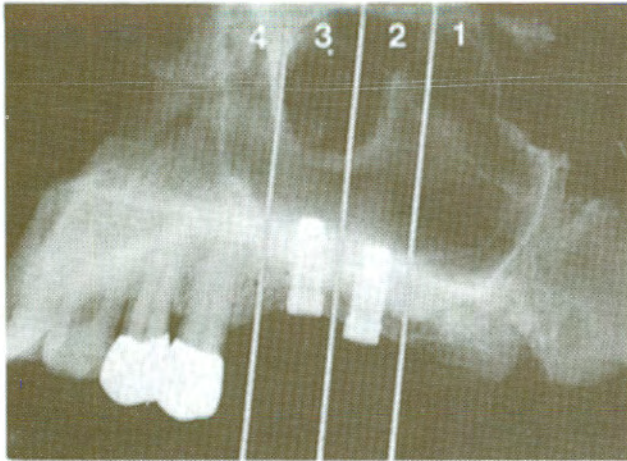


Figure 3. Radiograph of hemisectioned maxilla.

shows a sample of bone in the area of the sinus elevation. Note that the upper left area of the sample shows graft bone (identified by the absence of cell nuclei), and the right portion shows new bone composed of nucleated cells. The absence of prior osteoclastic activity at the interface between these groups of cells shows uncoupled bone formation, which is consistent with osteo-induction.

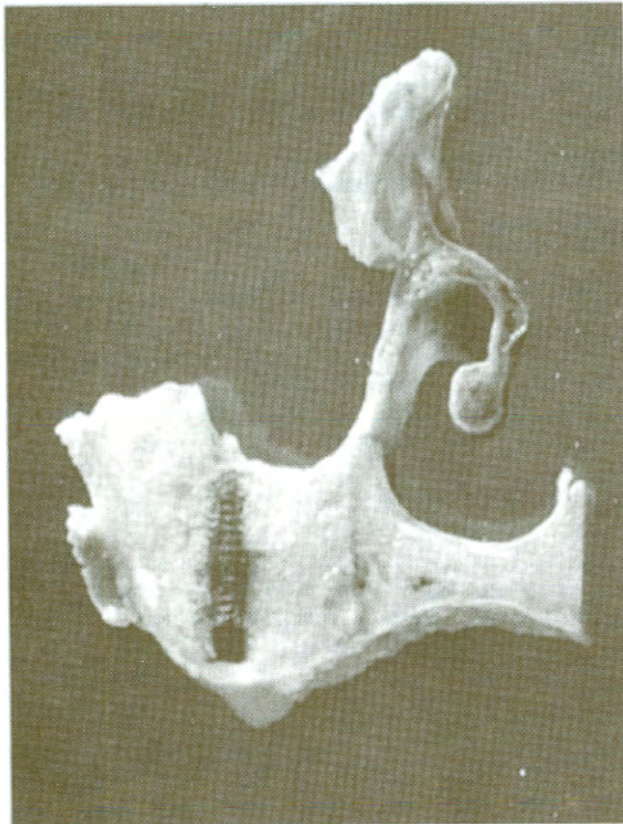


Figure 5. A frontal section of the maxilla with implant *in situ*. Note the graft material lateral and apical to the implant.

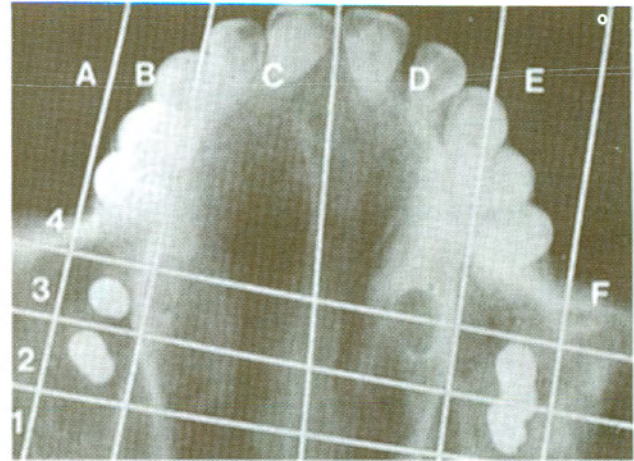


Figure 4. Radiograph of the maxilla with lines to demonstrate how the maxilla was sectioned. Note: Sections 2E and 2F were examined.

Fig. 8 shows a resorbing crystal of **OsteoGen**[®] hydroxylapatite surrounded by normal bone, demonstrating the conductive effect of this material, since there is formative bone concurrent with resorption of the graft.

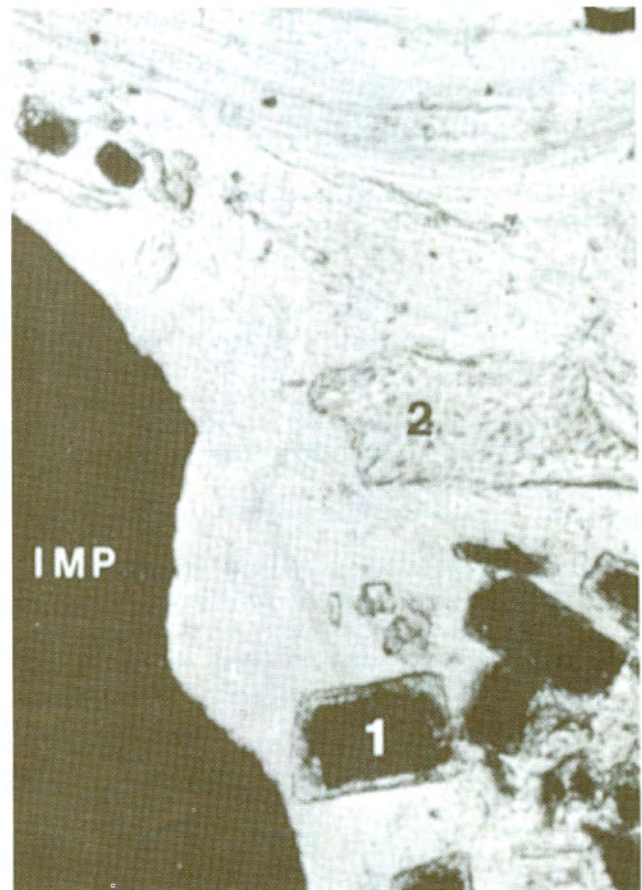


Figure 6. Apical end of implant with remnants of (1) hydroxylapatite crystal and (2) graft bone. IMP = Implant.

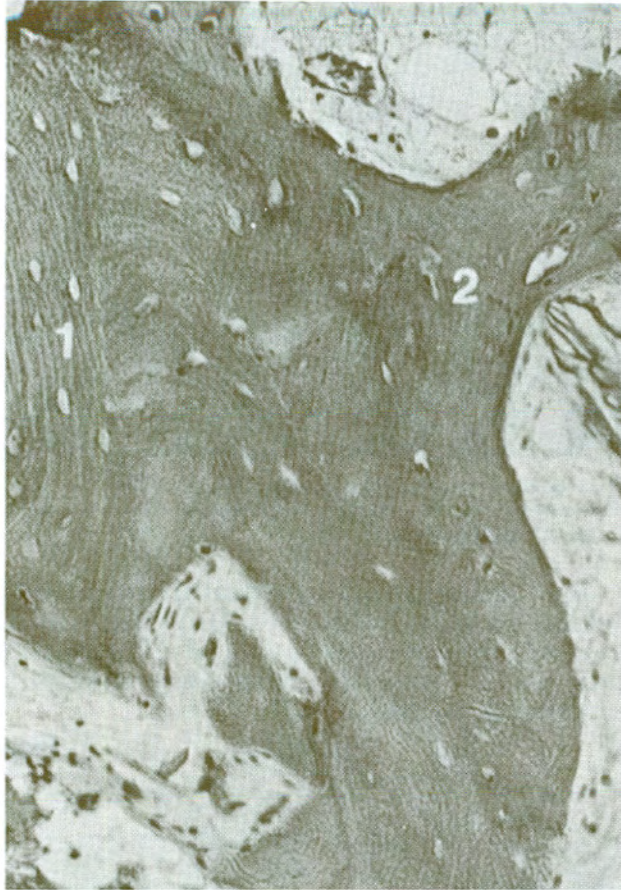


Figure 7. (1) Non-nucleated graft bone. (2) Nucleated normal bone.



Figure 8. Resorbing crystal of OsteoGen® hydroxylapatite surrounded by normal bone.

Conclusion

A *post mortem* recovery of a maxilla upon which bilateral sinus elevation and simultaneous root-form implant procedures had been performed revealed:

- (1) osseointegration of the root-form implant, both in the area of the original bone and in the graft material;
- (2) the conductive effect of resorbable hydroxylapatite; and
- (3) the inductive effect of demineralized cortical bone powder on bone formation in a sinus elevation procedure.

[This response appears to be similar to that reported by Lozada and James (1988).]

References

- LOZADA, J. and JAMES, R.A. (1988): Clinical Evaluation of Maxillary Sinus Elevation and Grafts for the Preparation of Endosteal Implant Sites. In: **Bone Grafting III**. San Diego, CA, p. 201 (Abst.).
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The authors are members of the faculty of The School of Dentistry, Loma Linda University, Loma Linda, CA 92350.



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