John Ley, DDS, Editor

Endosseous Implants

"Influence of Implant Taper on the Primary and Secondary Stability of Osseointegrated Titanium Implants" by D. O'Sullivan, L. Sennerby, N. Meredith. Clin Oral Implants Res, 15:474–480, 2004.

This paper compares the stability of tapered and straight screw-shaped implants in a rabbit model. Three types of implants were studied: an experimental implant with a 1° taper with 6- and 10-mm lengths (EXP1), an experimental implant with a 2° taper with a 6-mm length (EXP2), and standard Branemark implants (Nobel Biocare, Gothenborg, Sweden) with 6- and 10-mm lengths (controls). All implants were commercially pure titanium with the same surface finish and 4-mm diameter. A total of 36 implants were placed into the tibial metaphysis and femoral condyles of 6 rabbits. The rabbits were sacrificed at 6 weeks postinsertion. The implants were compared for insertion torque, removal torque (after 6 weeks), and stability by using resonance frequency analysis (RFA) at insertion and after 6 weeks. The results indicated that the insertion torque was higher for the EXP1 implants compared with the controls. The difference was only significant for implants placed into the femur. No significant difference was between the EXP2 implants and the control implants for insertion torque, and no significant difference was between all implants with removal torque. The RFA stability tests demonstrated a significant difference at insertion between only the 6-mm EXP1 implants and the controls placed in the tibia. The EXP2 implants failed to insert fully and thus may have suffered in stability because of exposed threads. When tibia and femur data were combined, a significant difference was noted between the EXP implants and the controls. At 6 weeks, no significant difference was between the EXP1 and the controls, whereas the EXP2 implants were significantly more stable. The authors conclude that 1° of taper results in improved primary stability compared with the control, straight-walled implants. All implant types gained stability after 6 weeks of healing.

"Hard-Tissue Alterations Following Immediate Implant Placement in Extraction Sites" by D. Botticelli, T. Berglundh, J. Lindhe. J Clin Periodontol, 31:820–828, 2004.

This study examines the bone healing that occurs after immediate implant placement. A total of 18 patients with a total of 21 teeth that were scheduled for extraction were included. The teeth were extracted with full-thickness mucosal flaps and by an atraumatic technique. The implant osteotomy was then prepared, and 4.1-mm ITI solid screw implants were placed. A cover screw was placed, and the position of the surrounding bone and the size of the bone defect adjacent to the implants was recorded. The flaps were sutured such that the top of the implant was exposed during healing. No bone grafts or membranes were used. After 4 months, the implants and bone were exposed with full-thickness flaps, the bone levels were recorded, a healing collar was placed, and the flaps were sutured. The results indicated that at the time of placement there were 52 vertical defects exceeding 3 mm of depth surrounding the implants. Twenty-one of the defects were on the buccal aspect of the implants, 17 were at the lingual aspects, and 14 were at the mesial-distal aspects. After 4 months of healing, buccal bone experienced a mean horizontal resorption 1.9 ± 0.9 mm (56%), whereas the lingual bone experienced a mean resorption of 0.9 ± 0.6 mm (30%). The mean vertical crestal bone loss was 0.3 ± 0.6 mm on the buccal, 0.6 ± 1.0 mm on the lingual, 0.2 ± 0.7 mm on the mesial, and 0.5 ± 0.9 mm on the distal. The vertical defects present at the time of installation were reduced. Of the 52 defects exceeding 3 mm of depth, 8 had depths greater than 3 mm at reentry. The authors conclude that the gaps between an implant and the surrounding bone in an extraction socket may heal predictably with a combination of new bone formation on the inside of the defect and bone resorption on the outside of the ridge.

Implant Prosthodontics

"Does Excessive Occlusal Load Affect Osseointegration? An Experimental Study in the Dog" by L. J. Heitz-Mayfield, B. Schmid, C. Weigel, et al. Clin Oral Implants Res, 15:259–268, 2004.

This study examines the effect that excessive occlusal loading has on the osseointegration of root-form implants in a dog model. Six dogs had their mandibular premolars and first and second molars extracted bilaterally. After 3 months of healing, 4 root-form implants were placed on each side in a 1-stage fashion. Two of the implants had titanium

plasma-sprayed surfaces and the other 2 had sandblasted and acid-etched surfaces. After 6 months of healing, 1 side of the implants was restored with crowns in a supraocclusal contact with an increased vertical dimension of at least 3 mm. The contralateral implants were left unrestored. The implants were monitored both clinically and radiographically. Eight months after loading, the dogs were killed and their mandibles were harvested and subjected to histologic and histomorphometric analysis. The results indicated that 3 implants were lost in the initial healing phase. Clinically and radiographically, no significant differences were between the test and the control implants after 8 months of loading. Histomorphometric analysis revealed a bone-to-implant contact of 72.6% for the control implants and 73.9% for the test implants. These differences were not significant. No significant differences were noted in mineralized bone density between the test and the control implants, and no significant differences were noted between test and control implants when comparing alveolar bone height. These results suggest that excessive occlusal load does not affect osseointegration in the dog model.

"Single Tooth Immediate Provisional Restoration of Dental Implants: Technique and Early Results" by M. Block, I. Finger, P. Castellon, D. Lirettle. J Oral Maxillofac Surg, 62:1131–1138, 2004.

This paper describes a technique to immediately restore a single-tooth implant at the time of implant placement. The authors caution that this technique should be used only in certain patients with adequate bone quantity and quality; sufficient space and occlusion to allow a nonfunctional, anatomic restoration; and patient compliance with a soft diet for up to 8 weeks postplacement. The technique described in this paper is illustrated with a case report. By using preoperative study models and radiographs, an implant analog is placed into the study model at the anticipated level of the alveolar bone. An abutment is attached to the analog and prepared to allow the prosthetic shoulder at the gingival crest and also allow 1 to 2 mm of interarch occlusal space. A provisional crown is fabricated over the abutment that is not in occlusion and has an occlusal hole to allow access to the abutment screw. Open contacts are provided at both the mesial and the distal to allow for flexibility at the time of implant placement. A surgical template is fabricated that has a guide channel exactly in line with the implant analog on the study model. At the time of surgery, the root-form implant is placed in a position as close to the study model analog as possible. The abutment is then placed and occlusal clearance is confirmed. After hand tightening the abutment screw, the temporary crown is cemented and the gingiva is sutured. The patient is instructed to have a soft diet for 8 weeks. After the healing period, the final restoration can be fabricated. The authors describe the results of this technique for 74 implants placed in 63 patients. Four of the 74 implants failed before final restoration. With a 1- to 5-year follow-up, no implants failed after final restoration. Several complications were cited at the time of implant placement: implant angulation was different from the study model, therefore requiring provisional adjustment, and both the abutment and the provisional crown needed to be adjusted to allow occlusal clearance and loosening of the crown after cementation because of short abutment height. The authors conclude that this is a viable technique to allow immediate restoration of implants if specific criteria are followed.

Basic Science and Research

"Long Term Bone Response to Titanium Implants Coated With Thin Radiofrequent Magnetron-Sputtered Hydroxyapatite in Rabbits" by S. Mohammadi, M. Esposito, J. Hall, et al. Int J Oral Maxillofac Implants, 19:498–509, 2004.

This study examines the bone response of various surface treatments of root-form implants in a rabbit model. Screw-shaped root-form implants 4 mm long and 3.75 mm wide were fabricated from pure titanium rods. Four different hydroxyapatite coatings were applied by radiofrequency magnetron sputtering: heat-treated 0.1 μm thick, crystalline (group A); heat-treated 2.0 μm thick, crystalline (group B); non–heat treated 0.1 μm thick, amorphous (group C); non–heat treated 2.0 μm thick, amorphous (group E). A fifth group (group D) was noncoated and served as controls. In a randomized fashion, 64 implants of each type were inserted into the legs (tibial metaphysis and femoral condyle) of 40 rabbits. After 9 months, the animals were killed and the tissues were subjected to histologic analysis. The results indicated that the crystalline coatings achieved the greatest bone-to-implant contact. The amorphous-coated implants had a similar response as the uncoated controls. No advantage was attributed to the thicker

coating. No adverse tissue reactions were observed. The authors conclude that the ultrathin (0.1 μm) crystalline coating improved bone-to-implant contact compared with the noncoated or the amorphous-coated implants and may be advantageous because of the absence of coat-fragment-induced inflammation, which may occur with thicker coatings.

CASE REPORT

"Fracture and Displacement of Lingual Cortical Plate of Mandibular Symphysis Following Bone Harvesting: Case Report" by L. Cordaro, C. Rossini, E. Mijiritsky. Implant Dent, 13: 202–206, 2004.

This paper describes an unusual complication that occurred at a donor-bone site. The patient underwent bone harvesting from the mandibular symphysis for the purpose of bilateral sinus augmentation. The bone was harvested with an 11-mm diameter trephine drill. Three cylinders of bone were harvested with this trephine. At the time of surgery, the lingual cortex appeared to be intact and the defect was filled with a hemostatic sponge. After sinus augmentation and implant placement, the patient had an uneventful healing course with the exception of a chin hematoma. Six months after surgery, routine postoperative computerized tomography scans were taken to assess the maxillary sinuses. These scans revealed that the lingual cortical plate was fractured and displaced posteriorly at the level of the harvest site. The bone fragment was 1 × 3 cm and had a width of 2 to 4 mm. The patient did not display any functional impairment or experience any pain. The fragment could not be palpated. No treatment was used and the patient was observed for 22 months postharvesting with no complications. The authors postulate that the bone was displaced by traction of the geniohyoid muscle and may have occurred because of the amount of bone removed and the strength of this patient's musculature.

BONE GRAFTING

"Localization of Osteogenic and Osteoclastic Cells in Porous ß-Tricalcium Phosphate Particles Used for Human Maxillary Sinus Floor Elevation" by I. Zerbo, A. Bronckers, G. de Lange, E. Burger. Biomaterials, 26:1445–1451, 2005.

This paper examines the nature of the tissues surrounding porous ß-tricalcium phosphate (TCP) particles that were placed into the maxillary sinus for the purpose of augmentation. Sinus floor augmentation was performed with a porous ß-tricalcium phosphate (Cerasorb, Curasan, Kleinostheim, Germany) alone, and the sinus was allowed to heal for 6 months. At the time of implant placement, a portion of the grafted material was harvested with a trephine drill. Tissues from 12 patients were examined. Nine of the harvested specimens were subjected to Goldner and tartrate-resistant acid phosphatase staining, which detects osteoclast-like cells. Goldner staining detects bone and unmineralized osteoid. The specimens from 3 of the patients were subjected to immunohistochemistry and histomorphometry tests. The results indicated that bone growth occurred primarily between TCP particles. A marked amount of soft connective tissue (SCT) was among the TCP. Immunohistochemistry demonstrated that the SCT cells had an abundance of osteoblastic and preosteoblastic cells. There was evidence of TCP degradation. The authors found evidence that the TCP degrades primarily by chemical dissolution. Osteoclastic activity was not found to play a major role. The authors conclude that the material infiltrating the grafted TCP was osteogenic and that TCP acted as an osteoconductive scaffold that was gradually degraded by chemical dissolution.