John Ley, DDS, Editor

Root Form Implants

"Immediate Loading of Implant-fixed Mandibular Prostheses: A Prospective 18-month Follow-up Clinical Study—Clinical Report," by L. Colomina. Implant Dent 10:23–27, 2001.

This paper examined the results of immediately loading mandibular root form implants using fixed, hybrid prostheses. Thirteen consecutively enrolled patients received 2 to 7 implants in the anterior mandible. Two of the prostheses were partials and the others were complete prostheses. Patients who had systemic disease, were smokers or bruxers, or had inadequate bony architecture were excluded. Six patients had implants placed immediately after tooth extraction, and the remainders had the implants placed at least 2 months after extraction. Implant abutments were connected prior to wound closure, and transfer impressions using either the existing denture or surgical template as the impression tray were taken after sutures were placed. Temporary acrylic prostheses were fabricated by either converting the existing prosthesis into a fixed prosthesis or by fabricating a new prosthesis. Most prostheses were delivered in 10 days or less. If the prosthesis was not passive, it was corrected prior to connection. All prostheses had cantilever extensions from 5 to 15 mm in length. The temporary prostheses were replaced by definitive prostheses in 4 to 14 months' time. The health of the implants was registered using radiographic and clinical parameters during the 18-month follow-up period. The results indicated that 2 of the 61 implants placed failed; both were in the same patient. This resulted in a 96.7% implant survival. The prosthesis survival rate was 92.3%, as the patient that lost the implants had the denture converted to a removable type. Of the remaining implants, 2 of the 59 demonstrated bone loss greater than 1 mm. Prosthetic complications included screw loosening (23%) and fracturing of the cantilevered sections (15%). These results support the work of others, which suggests that implants can be immediately loaded predictably in the anterior mandible in certain patients.

"Histologic Evaluation of Threaded HA-coated Root Form Implants After 3.5 to 11 Years of Function: A Report of Three Cases," by P. Proussaefs, J. Lozada, and M. Ojano. Int J Periodont Rest Dent 21:21–29, 2001.

This was a histologic study of hydroxyapatite (HA) implants retrieved from patients after functioning for several years. Four implants were retrieved in 3 patients using a 4-mm trephine bur. One of the 4 implants was removed because it had fractured. The remaining implants were removed because of excessive bone loss coronally. Two of the implants were threaded HA-coated root form implants, and the other two were press-fit HA-coated root form implants. Radiographs were taken prior to removing the implants. Probing depths around the implants were 5 to 7 mm with bleeding on probing, and there was no mobility detected. The percentage of implant that was in bone upon retrieval was between 50% and 75%. Histologic evaluation of the implants revealed that there was intimate contact between the HA and the remaining surrounding bone. One implant did, however, demonstrate a lack of bone contact on 1 side of the implant. The HA coatings displayed no evidence of dissolution or resorption. There were some areas where the HA was lacking on the tips of the implant threads and some detached particles of HA were observed in the surrounding bone. These particles were in intimate contact with the bone. A comparison of the HA thickness on the implant surface and the thickness given by the manufacturer demonstrated that no change in the thickness of the HA coating had occurred. The results of this study suggest that in the areas of bone-implant contact around HA implants, no resorption or dissolution of the HA coating occurs.

"Freestanding and Multiunit Immediate Loading of the Expandable Implant: An Up-to-40-month Prospective Survival Study," by Y. K. Jo, P. Hobo, and S. Hobo. J Prosthet Dent 85:148–155, 2001.

This study examined the efficacy of immediately loading the Sargon dental implant (Sargon Enterprises, Beverly Hills, Calif). The Sargon implant can be expanded a variable degree at its apex by rotating an expansion screw. Two hundred eighty-six Sargon implants were placed into fresh extraction sites or healed ridges in 75 patients. Provisional restorations were placed at the time of implant placement (immediate loading). In some implant sites where bone quality was deemed poor, healing collars were placed and loading was delayed for 3 months (delayed loading). Expansion of the implants was undertaken via a set protocol at the time of placement and, if needed, at 7-day intervals for the first 21 days postplacement. Any implants that were immediately loaded and could not be stabilized by expansion had the provisional restoration removed and replaced with a healing collar for 16 to 18 weeks. The restorations varied from single teeth to multiunit prostheses. The implants were followed for up to 40 months, during which clinical and radiographic records were taken. The immediately loaded implants had a survival rate of 96.3%. The delayed loading implants had a survival rate of 90%. The survival rate of implants placed into fresh ex-

traction sites was 98.9% vs 93.9% survival in healed sites. Single-tooth implants had a survival rate of 94.5%, and multiple unit cases had a survival rate of 96.9%. The survival rate was 96% in the maxilla and 94.8% in the mandible. In the immediately loaded implants there was 100% survival in the maxilla and 96.7% survival in the mandible. Complications included fistula formation, crestal bone loss, and mobility. In those that were mobile, some implants were saved by expanding the implant. These results suggest that an expandable implant may aid in immediately loading implants.

"A Multicenter 12-month Evaluation of Single-tooth Implants Restored 3 Weeks After 1-stage Surgery," by L. Cooper, D. Felton, C. Kugelburg, and S. Ellner. Int J Oral Maxillofac Implants 16:182–192, 2001.

This prospective study examined the survival rate of implants that were loaded shortly after placement. The 52 patients in the study met strict inclusion and exclusion criteria. All the patients were missing 1 or 2 maxillary anterior teeth. All implants (Astra Tech, Lexington, Mass) were inserted into the edentulous site using the manufacturer's protocol, with healing collars placed to allow 1-stage healing. Three weeks postoperatively, the healing collars were replaced with an abutment and a temporary crown. At 10 to 12 weeks, final crowns were permanently cemented onto the abutments. All implants and crowns were evaluated radiographically and clinically using pre-established criteria at set intervals up to 12 months after placement of the provisional restoration. Five of the patients were excluded from the study, 4 because of smoking and 1 because of a deviation in loading time. Of the 53 remaining implants, 1 implant failed at 3 weeks postplacement and 1 failed at the time of placement of the final crown, for a survival rate of 96.2%. Plaque scores decreased as the study progressed, and related gingival inflammation also decreased. There was a noted increase in papilla length over time (0.61 mm), and there was a gain in buccal gingiva of 0.34 mm. Bone loss for the majority of implants was 1 mm or less (0.4 mm mean), with the exception of 8 implants that had 1 to 2 mm of loss and 2 implants that had greater than 2 mm of loss. These results suggest that this implant system can be successfully loaded early after placement in the anterior maxilla.

"Horizontal Osteotomy for the Reconstruction of the Narrow Edentulous Mandible," G. Raghoebar, R. Batenburg, H. Meijer, and A. Vissink. Clin Oral Implant Res 11:76–82, 2000.

This study examined the results of using a horizontal osteotomy as a source for bone in order to augment narrow edentulous mandibles. Seven patients were included in the study. Each had an edentulous mandible that was sufficient in height but deficient in width to receive root form implants. Augmentation of the narrow ridge consisted of a horizontal cut made from the molar region on 1 side to the molar region on the contralateral side. The ridge was at least 2.5 mm wide at the site of the osteotomy and at least 5 mm above the mental foramen. The harvested bone was then sectioned into 2 parts and fixated to the buccal of the new ridge using titanium screws. After a 3-month period, the ridge was uncovered and implants were inserted. Subsequently, bar overdentures were fabricated. The results indicated that prior to grafting, the ridge crests were 1.3 ± 0.3 mm and 5.6 ± 0.2 mm immediately after fixation of the grafts. At the time of implant placement, the ridges had a slight amount of resorption ($0.5 \text{ mm} \pm 0.3$ mm), but all were sufficiently wide to place implants. Surgical complications of the grafting were limited to 1 exposed titanium screw. No sensory disturbances were noted. After loading the patients were followed from 14 to 68 months. Bone loss was not noted around 17 of the 18 implants. The 1 implant with bone loss was limited to a loss not exceeding one-third of the implant length. Gingival indices were within normal limits. The conclusion of the study was that this is a reliable procedure for augmenting the narrow edentulous mandible.

Basic Science and Research

"Collagen Membrane Resorption in Dogs: A Comparative Study," by K. Owens and R. Yukna. Implant Dent 10: 49–56, 2001.

This study compared the resorption rates of 3 membranes—BioGide (BG; Osteohealth, Shirley, NY); Alloderm human-derived (A-H; Lifecell, Branchburg, NJ); and Alloderm porcine derived (A-P; Lifecell)—in a dog model. BG is a porcine-derived bilayer membrane of dermal collagen. A-H is an acellular membrane derived from human skin. A-P is a porcine-derived version of A-H. All membranes were randomly placed into the palates of 12 mongrel dogs. Punch biopsies of the membranes and surrounding soft tissues were performed at 1, 2, 3, and 4 months postinsertion. Specimens were then examined histologically using light microscopy. Normal dog palate and unused membranes were used as comparison samples. The membranes from each specimen were assigned a score based on their level of degradation. The results indicated that all of the dogs except 2 healed uneventfully after membrane insertion. The 2 dogs with complications suffered necrosis of the palate at the surgical site. Membranes were later reinserted into these dogs, which demonstrated normal healing subsequently. The BG samples demonstrated moderate degradation at 2-months' time and severe degradation at 3-months' time. At 4 months, several of the BG samples demonstrated complete degradation. The A-H samples demonstrated moderate degradation at 2 months (with the exception of 1 membrane, which was intact) and se-

vere to complete degradation at 3 and 4 months. The A-P samples suffered moderate to severe degradation at 2 months and severe to complete degradation at 3 and 4 months. All samples demonstrated no signs of inflammation. The results of this study suggest that all of these membranes suffer significant breakdown after 1 month. These results lead the authors to question the ability of these membranes to function beyond 1-month's time.

"Effect on Bone Healing of Bone Morphogenetic Protein Placed in Combination With Endosseous Implants: A Pilot Study in Beagle Dogs," by J. Fiorellini, D. Buser, E. Riley, and T. Howell. Int J Periodont Rest Dent 21:41–47, 2001.

This study evaluated the effects of recombinant human bone morphogenetic protein-2 (rhBMP-2) on early bone healing within perforations in endosseous titanium implants in the dog model. Two beagle dogs had bilateral extractions of the mandibular premolars. Three months following this, specially designed press-fit root form pure titanium implants were inserted into these sites. Each implant had 2 through and through 1 mm diameter perforations into which the rhBMP-2 was placed. In a randomized fashion, implants and the osteotomy sites were treated with a mixture of rhBMP-2 in a methylcellulose gel (MCG) or MCG alone prior to placing the implants in the osteotomy sites. The dogs were sacrificed at 21 days, and the bony specimens were subjected to histologic and histometric analysis. A total of 19 implants were utilized in this study. Ten had the rhBMP-2/MCG mixture and 9 had the MCG alone placed into the perforations in the implants. At 21 days, 100% of the rhBMP-2 sites had bone ingrowth into the perforations compared with 48% in the control implants. The total length of bone ingrowth and percent of fill in the perforations was significantly greater in the rhBMP-2 sites when compared to controls. Analysis of the rate of bone growth also demonstrated a significantly greater rate of formation in the rhBMP-2 sites. These results suggest that rhBMP-2 in combination with titanium implants increases the rate and extent of early bone formation in the dog model.

SUBPERIOSTEAL IMPLANTS

"Osseointegration of Subperiosteal Implants Using Bovine Bone Substitute and Various Membranes," by M. Aaboe, E. Hjorting-Hansen, M. Helbo, and D. Vikjaer. Clin Oral Implant Res 11:51–58, 2000.

This was an experimental study to examine whether the use of a bovine bone substitute, Bio-Oss (Geistlich Pharma, Wolhusen, Switzerland), and a variety of membranes could effect osseointegration of subperiosteal implants. Nine rabbits were used in the study. Using a 2-stage impression technique, titanium subperiosteal implants were fabricated and placed in each tibia. Subsequent to placing the implants, the cortical bone was fenestrated and the implants were then covered with the Bio-Oss. The implants and Bio-Oss were then covered with either a nonresorbable expanded polytetrafluoroethene (ePTFE) membrane, a degradable polygalactin 910 mesh membrane, or a degradable bilayer collagen membrane in a random fashion. The implant and the membrane were fixated using 5-mm screws. After 12 weeks the animals were sacrificed and the tibia sections containing the implant were analyzed. The results indicated that all implants were osseointegrated in primarily woven bone at the time of sacrifice. The ePTFE membrane demonstrated more bone growth compared with the biodegradable membranes, which showed signs of collapse onto the implants. The results of this study indicate that in the rabbit model, subperiosteal implants can be osseointegrated when combined with an osteoconductive bone substitute and occlusive membranes. ■