John Ley, DDS, Editor

Endosseous Implants

"Placement of Implants in Distraction Osteogenesis: A Pilot Study in Dogs," by Y. Nosaka, M. Tsunokuma, H. Hayashi, and K. Kakudo. Int J Oral Maxillofac Implants 15:185–192, 2000.

Distraction osteogenesis is a method of enabling new bone growth at a deficient site without the need for donor site surgery. The use of implants in recently distracted sites has garnered much attention lately. This study examines the level of osseointegration achieved when implants are placed in distracted sites in a dog model.

Four adult mongrel dogs were utilized for this study. A 14 mm distracted site was created in the left mandible of each dog by distracting at a rate of 1 mm/d over 14 days. Three weeks after completion of the distraction, root form implants were placed in the distracted sites. The implants were followed radiographically at 4-week intervals and clinically examined at 12 weeks post-implant placement. At 24 weeks the dogs were sacrificed and the distracted region was subjected to histologic evaluation.

Radiologic examination revealed that the distracted region displayed a generalized radiolucent pattern consistent with immature bone at the time of implant placement. These radiolucencies had vanished by 12 weeks, although the authors reported that the distracted site was less radiopaque than the surrounding bone even at 24 weeks. Clinically, the distracted sites appeared to be new bone at 12 weeks. Trephine cores harvested at the time of implant placement demonstrated immature woven bone. The 24-week segments demonstrated mature lamellar bone in contact with the implants.

These results suggest that placement of implants in immature distracted bone does not affect osseointegration. Shortcomings of this study were lack of controls and the low number of the dogs employed. The authors did not mention the differences between dog and human bone maturation rates.

"Immediately Loaded Mandibular Implant Bar Overdenture: A Surgical and Prosthodontic Rationale," by K. Rungcharassaeng and J. Kan. Int J Periodont Restor Dent 20:71–79, 2000.

This paper presents a protocol for immediately loading mandibular implants with bar overdentures. The criteria for immediately loaded mandibular bar overdentures are listed as completely edentulous in both arches, adequate bone between the mental foramina to allow four root form implants of at least 12 mm in length, bone quality better than Type IV, and no medical contraindications to implant placement. Presurgically, new dentures are fabricated and the mandibular denture is duplicated for use both as a radiographic and surgical template. Four implants are placed between the foramina such that the most posterior implants are 5 mm anterior to the mental foramina and the anterior two implants are 7 to 10 mm anterior to the posterior implants and equidistant from the midline. Abutments and sutures are then placed and plastic copings secured on the abutments. These copings are then luted together using autopolymerizing acrylic resin and plastic bars. The bars are placed parallel to the occlusal plane. After 20 minutes the plastic bar is removed and subsequently cast. The cast bar is placed on the abutments within 24 hours of surgery after its passivity is verified. The patients are instructed to not wear the mandibular denture for 2 weeks. At 2 weeks postsurgery the denture is relieved and utilized for a pick-up impression of the bar. The denture is then processed incorporating an attachment clip (EDS, Attachments International). The patient is then instructed to eat a soft diet for 2 to 3 more weeks.

The authors report using this technique on five patients, utilizing 20 implants with a 100% implant survival after 1 year of loading. The mean marginal bone loss is reported at 1.16 mm. They caution that if any implants fail in the early healing period the remaining implants should be left unloaded for the traditional healing period.

"Effect of Early Exposure on the Integration of Dental Implants in the Baboon: Part 1. Clinical Findings at Uncovering," by S. Severson, A. Vernino, R. Caudil, R. Holt, C. Church, and A. Davis. Int J Periodont Restor Dent 20: 163–171, 2000.

This paper reports on the effect of early exposure on two different root form implants placed in a traditional two-stage technique. Six baboons had a total of 48 root form implants placed in both the maxilla and mandible. Twenty-four of these implants were commercially pure titanium (CPTi) and 24 were an alloy of titanium, niobium (13%), and zirconium (13%) (Ti-13–13). All implants were placed with a two-stage technique. All animals were examined for exposure of the implants in the first 3 weeks. These were deemed early exposures. Mandibular implants were uncovered at 3 months and maxillary implants at 6 months. Bone levels were compared to levels at placement and Periotest readings were performed after abutment placement.

There were no significant differences between the implant types with respect to bone levels, incidence of exposure, and Periotest readings. The maxillary implants demonstrated no difference in bone levels between those that were exposed early and those that were not. Both types of implants had combined exposure rates of 29%. The

mandibular implants demonstrated a higher level of early exposure when compared with the maxillary implants (66% combined rate). The exposed mandibular implants suffered significantly more bone loss than the nonexposed implants at the distal, buccal, and lingual aspects of the implants. Periotest readings were classified as either good (−7 to −1), guarded (0 to +2), or poor (+3 to +27). All of the nonexposed implants were in the good category. Seventy percent of the exposed implants were classified as good. The remaining exposed implants that were not in the good category were rated as guarded.

The conclusions of this study was that there was no difference in success between the CPTi and Ti-13–13 implants, but that early exposure did result in increased bone loss and less stability of both implant types.

"Histologic Analysis of Implant Sites After Grafting With Demineralized Bone Matrix Putty and Sheets," by D. Callan, S. Salkeld, and N. Scarborough. Implant Dent 9:36–44, 2000.

This paper presents the results of grafting prior to implants using a demineralized bone matrix product, Grafton (Osteotech). Grafton is an allograft material available in three forms: gel, putty, and a flexible sheet (dubbed gel, putty, and flex). In addition to its improved handling properties, Grafton is said to be consistently osteoinductive because of its unique mode of manufacture, the ''d-min process,'' after which the demineralized bone matrix is mixed with glycerol. Eight patients were evaluated in this paper. All required bone grafting prior to implant placement. Graft was placed either in extraction sockets using putty or as an onlay using flex. Membranes of either CollaTape (Sulzer Calcitek) or AlloDerm (LifeCell) were used to cover grafted sites in areas without primary closure; the flaps were sutured and, if possible, covered with a periodontal dressing. At the time of implant placement, 4 to 5 months after grafting, cores of the grafted site were taken and subjected to histologic analysis. In all cases there were no infections or complications. The authors state that all graft sites exhibited excellent reconstitution of bony contours for a mean of 12.8 months postgrafting but did not provide any objective analysis of this. Histologic analysis demonstrated varying new bone formation in the graft areas with maturity (woven and lamellar) correlating to time *in situ.* Little remained of the graft material itself.

The conclusion of this report was that Grafton putty and flex are effective materials to augment alveolar bone prior to placing implants. Shortcomings of this paper are the lack of controls (positive and negative), the low number of patients, and the absence of any quantitative measurement of the amount of augmentation achieved.

IMPLANT PROSTHODONTICS

"Treatment Outcomes of Fixed or Removable Implant-supported Prostheses in the Edentulous Maxilla. Part 1. Patients' Assessments," by N. Zitzmann and C. Marinello. J Prosthet Dent 83: 424–433, 2000.

This study compared the effectiveness of fixed and removable implant-supported prostheses in edentulous maxillae using patient parameters. Twenty patients were included in the study. Ten patients received fixed and 10 received removable prostheses. The decision as to which prosthesis type was used was based on clinical parameters and assigned by clinicians. Therefore, protheses were not assigned randomly. The fixed group received 8 to 10 implants and the removable group received six to eight implants.

Prior to placement and restoration of implants, each patient answered a questionnaire based on a visual analogue scale (VAS) assessing the comfort, retention, function, taste, speech, and self-esteem of their existing dentition. This VAS was repeated 6 months after prosthetic rehabilitation and compared statistically. In addition to the questionnaires, a comparison was performed of the cost of the prostheses. It is interesting to note that 80% of the participants expected a fixed prostheses at the initiation of the study.

Statistical analysis demonstrated that in each parameter of the VAS there was a significant improvement when comparing the results before and after the treatment. Between the two groups, there was no significant difference in any of the VAS parameters. The cost analysis demonstrated that the removable option was a slightly cheaper route.

The results of this study suggest that from a patient perspective both fixed and removable implant-supported prostheses are equally effective in restoring the edentulous maxilla.

"Treatment Outcomes of Fixed or Removable Implant-supported Prostheses in the Edentulous Maxilla. Part 2. Clinical Findings," by N. Zitzmann and C. Marinello. J Prosthet Dent 83: 434–442, 2000.

This study compared clinical parameters of fixed and removable implant-supported prostheses in edentulous maxillae. Twenty patients were included in the study. Ten patients received fixed and 10 received removable prostheses. The decision of the prosthesis type was based on clinical parameters and was not assigned randomly. The fixed group received 8 to 10 implants and the removable group received six to eight implants. All implants used were Branemark root forms, the majority being 3.75 mm in diameter. Fixed prostheses were porcelain or acrylic fused to metal and screwed onto either standard or EsthetiCone abutments. Removable prostheses were of the bar type with either a milled bar or prefabricated elements (Hader, Dolder). Palatal coverage was removed. Patients were followed on a 6-month basis. At

these appointments, plaque and gingival indices, probing depths, gingival margin position, and soft tissue complications such as hyperplasia were examined. Prosthetic complications were recorded for each prostheses type. The time from prosthesis insertion to a complication (either implant or prosthesis) was recorded as ''time until retreatment.'' Periapical radiographs evaluated marginal bone levels and were recorded to 2 years prosthetic loading.

Statistical analyses revealed no significant difference between the groups in the frequency of complications and time until retreatment. The majority of these complications were managed chairside and no prostheses required to be remade. Thus all prostheses had a 100% survival rate. However, some of the complications for the fixed group (porcelain or acrylic fractures) may be deemed more troublesome than those of the removable group (attachment replacement). The implant success was 97.6% for the fixed group and 94.4% for the removable group. There was no significant differences in marginal bone levels between the groups. The mucosal indices did not show any significant differences. Hyperplasia was noted to be present under the bar in two of the 10 patients in the overdenture group. This was associated with bars that were not in close contact with the gingiva.

The conclusion of this study was that both treatment methods provide equally effective clinical results.

Basic Science and Research

"Qualitative and Quantitative Study of Human Osteoblast Adhesion on Materials With Various Surface Roughnesses," by K. Anselme, M. Bigerelle, E. Dufresne, D. Judas, A. Iost, and P. Hardouin. J Biomed Mater Res 49:155–166, 2000.

Osteoblast adhesion is a critical component of establishing a bone-implant contact. Surface topography has been shown to play a critical role in this process. This study examines the effect of surface roughness of titanium alloy (Ti-6Al–4V) on the adhesion of human osteoblasts using an *in vitro* model.

One hundred eighty disks of titanium alloy were processed either by sandblasting (two diameters of particles) or mechanical polishing (three grit sizes) and separated into five groups. Three separate parameters were studied: an analysis of surface roughness, an assessment of osteoblast adhesion and proliferation, and a comparison of the expression of adhesion proteins (by immunohistochemistry) expressed on these surfaces. Results indicated that cells were oriented in a parallel order on polished surfaces, whereas cells did not display an organized pattern on sandblasted surfaces. Cell adhesion and proliferation was significantly less on sandblasted surfaces. Less focal contacts between the cells and the substrate was also noted on the sandblasted surfaces. Immunohistochemistry demonstrated protein expression that correlated with the levels of cellular organization and adhesion found on each surface. The authors also calculated a roughness organization parameter (fractal dimension) that measured surface roughness. The fractal dimension parameters demonstrated that as the fractal dimension increases (which corresponds with increased surface roughness), the level of cell adhesion decreased.

These results demonstrate that in this *in vitro* study increasing surface roughness decreases human osteoblast adhesion to titanium alloy.

Case Report

"Maxillary Antral Mucocele and Its Relevance for Maxillary Minus Augmentation Grafting: A Case Report," by A. Garg, G. Mugnolo, and H. Sasken. Int J Oral Maxillofac Implant 15:287–290, 2000.

Paranasal sinus mucoceles present with a low incidence in the maxillary sinus in the United States and Europe. Mucoceles are benign, mucus-filled, cystlike masses. Mucoceles slowly enlarge over time and may cause headaches, facial numbness, painless cheek swelling, nasal obstruction, diplopia, visual impairment, dentition displacement, and enophthalmos. Early mucoceles often present with no symptoms. Mucoceles are differentiated from retention cysts by their ability to erode and expand surrounding bone. Radiographically, mucoceles appear spherical in contrast to retention cysts and pseudocysts that present with a dome shape. Mucoceles are caused by obstructions in sinus outflow, which results in a pooling of secretions and then cyst development. Causes of these obstructions include surgery (Caldwell-Luc), chronic infection, and variations in anatomy. In some cases the etiology is unknown.

This paper reports on a 62-year-old patient who was scheduled for maxillary sinus augmentation and implant placement. His medical history was negative with the exception of minor nasal stuffiness every morning. Preliminary records including CT scanning elucidated no pathologies. At the time of the sinus lift, a friable, perforated Schneiderian membrane was noted. Yellow tissue was present in the antrum and it was decided that an expansion of the antral window would facilitate its removal. Subsequent to this, a 2 × 3 cm mass along with several smaller masses were removed. The antrum was well curetted and irrigated and the flap was then closed. Pathologic examination identified the mass as a mucocele. The authors stated that it would be unwise to proceed with the augmentation surgery without removing the mucocele. They also stated that although magnetic resonance imaging would have elucidated this mass, it is unwarranted because of its rare nature. An omission in the paper are recommendations as to when the augmentation should be performed after the mucocele is removed and whether or not this patient was later treated with a sinus graft. ■