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Spring 2022

Prosthodontics Newsletter™

Focusing on Dental Implants

Considerations in Implant Diagnosis and Treatment Planning

Over the past 4 decades, developments in dental implant therapy have significantly impacted the diagnoses and treatment planning of knowledgeable dental practitioners. Critical factors include local and systemic patient issues; surgery, both grafting and implant placement; prosthesis selection, design and manufacturing; materials used; and esthetically desirable outcomes. This issue of Prosthodontics Newsletter *reviews several key reports on a variety of factors to be considered during diagnosis and treatment planning at the front end of patient management.*

Dental Implants in Diabetic Patients

Patients with type 2 diabetes mellitus more often have advanced periodontal disease, along with alveolar bone loss, than does the general population. Bone loss progression in these patients occurs at a faster rate.

Glycemic control is measured by the level of glycated hemoglobin (HbA_{1c}) in the blood. The American Diabetes Association defines patients with an HbA_{1c} level of ≥6.5 as diabetic, and patients with levels <6.5% but ≥5.7% as prediabetic. It recommends maintaining an HbA_{1c} level of <7% to avoid glycemic risk. Studies of implant survival, marginal bone loss and peri-implantitis incidence in diabetic patients with high HbA_{1c} levels, including the influence of prosthesis type on marginal bone loss, have shown inconsistent results. To help rectify this problem, Lorean et al from Titu Maiorescu University, Romania, studied implant survival rates, marginal bone loss and the impact of prosthesis type among diabetic patients with high HbA_{1c} levels.

Medical records of 38 patients with HbA_{1c} levels of ≥6.9% at time of implant placement were reviewed. The patients were divided into 2 groups based on their HbA_{1c} levels 1 week before implant placement:

- **moderately controlled group:** patients with HbA_{1c} levels of 6.9% to 8.0%
- **poorly controlled group:** patients with HbA_{1c} levels of 8.1% to 10.0%

Bone loss was measured by comparing radiographs taken after implant placement with those taken at the last follow-up (minimum 5 years after implant placement). Implants presenting with mobility, symptoms of pain or active periodontal inflammation with exudate were judged as failures.

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Table 1. Marginal bone loss in patients with moderately controlled and poorly controlled HbA_{1c} levels.

	Mean bone loss (mm)	
	Moderate control	Poor control
Marginal bone loss	1.86	2.33
Patients with bone augmentation or sinus elevation	1.81	3.44
Patients without bone augmentation or sinus elevation	1.87	2.07
Patients with fixed restorations	1.73	2.13
Patients with removable restorations	2.64	2.79

Of the 357 placed implants, 6 failed, 3 in each group. A significantly greater mean marginal bone loss was found around implants placed in the maxilla than around implants placed in the mandible. Mean marginal bone loss was significantly higher in the poorly controlled group (Table 1). Implants restored with removable prostheses demonstrated significantly greater bone loss than did implants restored with fixed prostheses.

Comment

The results showed an excellent survival rate for implants placed in patients with moderately or poorly controlled type 2 diabetes mellitus. However, patients with poorly controlled diabetes presented with higher marginal bone loss values, while patients in both groups showed greater bone loss when receiving removable dentures, which should be considered when planning treatment for patients with diabetes.

Lorean A, Ziv-On H, Perlis V, Ormianer Z. Marginal bone loss of dental implants in patients with type 2 diabetes mellitus with poorly controlled HbA1c values: a long-term retrospective study. Int J Oral Maxillofac Implants *2021;36:355-360.*

Patient-related Risk Factors

Leung et al from the New York University College of Dentistry undertook a systematic literature review to identify patient-related risk factors that can lead to complications in maxillary sinus floor augmentation surgery and could impact surgical success.

Cardiovascular disease and anticoagulant drugs: Patients with cardiovascular disease are often treated with either anticoagulant or antiplatelet drugs or with both. Taking an anticoagulant drug, such as warfarin, is a well-established risk factor for major oral surgery procedures. Studies of patients who undergo simple implant placement while continuing antiplatelet therapy, such as aspirin and clopidogrel, show no relevant increase in the rate of postoperative bleeding. Since maxillary sinus augmentation qualifies as major oral surgery, consultation with the patient's treating physician and obtaining medical clearance is necessary.

Diabetes mellitus: Uncontrolled diabetes has been associated with an increased susceptibility to postoperative infection; diabetes has also been associated with postoperative swelling, mild postoperative bleeding, delayed wound healing, membrane exposure and flap dehiscence. Surgery should be scheduled only after medical clearance and patient achieving acceptable glycemic control.

Osteoporosis and antiresorptive drugs: While osteoporosis is not an absolute risk factor, antiresorptive drugs, often prescribed to osteoporotic patients, alter bone metabolism, making osteoporosis a relative risk factor for sinus augmentation procedures. Patients taking these drugs, especially those who have taken large doses over an extended period of time, are also at risk of medication-related osteonecrosis of the jaw, which may contraindicate sinus augmentation. Consultation with the patient's treating physician to obtain medical clearance is essential.

Organ transplant and immunosuppressive therapy: Sinus augmentation is usually contraindicated in these patients.

Cigarette smoking: Cigarette smoking is an established risk factor for complications, which tend to increase when simultaneous guided bone regeneration is performed. Smoking also creates an increased risk of subgingival infection, a higher membrane exposure rate, flap dehiscence and excessive pain. No clinical studies exist that assess the effect of electronic cigarette smoking; however, it seems probable that electronic cigarette smoking and conventional cigarette smoking would similarly influence the outcome of oral surgery.

Penicillin allergy: Azithromycin appears to be an effective alternative for patients with penicillin allergies.

Comment

In patients with preexisting conditions, treatment planning for maxillary sinus augmentation in conjunction with implant therapy requires consultation with the patient's treating physician. Pretreatment medical clearance is vital.

Leung M, Alghamdi R, Fernandez Guallart I, et al. Patient-related risk factors for maxillary sinus augmentation procedures: a systematic literature review. Int J Periodontics Restorative Dent *2021;41:e121-e128.*

Implant Survival In Private Practices

Schoenbaum et al from the University of California, Los Angeles, conducted a multicenter retrospective cohort study of patients who underwent implant placement at private practice dental clinics throughout the United States. Treatment was performed by oral surgeons, prosthodontists, periodontists and general dentists with >10 years of history placing implants across a group of 8 practices serving urban, suburban and rural populations. All follow-ups occurred where the implant surgery was performed. The outcome variable was implant failure measured by the time from placement to failure.

A wide range of demographic, oral and systemic health and surgical protocol variables were analyzed. Out of the 835 implants placed in 378 randomly selected patients, only 34 implants failed, including 12 due to mobility and 11 due to infection. Implant survival probability at 10 years, based on univariate modeling, was 90.1%. For patients with any history of smoking, the probability dropped to 72.3%; however, patients with a history of diabetes had a survival probability of 92.6% (Table 2). Unexpectedly, patients aged ≤70 years had a lower implant survival probability than did patients aged >70 years.

Comment

Several limitations to this study may have influenced its findings. The median follow-up time for implants was only 7 months, not long enough for many included variables to have an effect on survival. The finding that implants in patients aged >70 years were significantly less likely to fail may have any number of explanations; clinicians may decide that there is less reason to remove questionably healthy implants from older patients and may use more rigorous criteria when selecting patients for implant therapy. Experienced clinicians may make different choices when planning treatment for patients with known risk factors. Once patients aged >70 years were eliminated, the model predicted a 10-year implant survival rate of 86.4% for implants placed in private practices.

Schoenbaum TR, Moy PK, Aghaloo T, Elashoff D. Risk factors for dental implant failure in private practice: a multicenter survival analysis. Int J Oral Maxillofac Implants *2021;36:388-394.*

Table 2. Probability of implant survival.

	1 year	5 years	10 years
Overall survival	96.0%	92.0%	90.1%
Age			
<51 years	94.4%	85.1%	85.1%
51 to 60 years	93.5%	89.7%	89.7%
61 to 70 years	96.0%	89.8%	83.4%
<71 years	94.9%	89.2%	86.4%
Smoker	95.5%	86.7%	72.3%
Diabetic	92.6%	92.6%	92.6%

Impact of Crown-to-Implant Ratio

Practitioners may use short implants in regions with less vertical and horizontal bone to avoid the morbidity associated with bone augmentation surgery. Although short implants have a greater crown-to-implant ratio than do conventional implants, no consensus currently exists about the impact of crown-to-implant ratio on clinical outcomes. Pellizzer et al from São Paulo State University (UNESP), Brazil, conducted a systematic review and meta-analysis of the available evidence to determine the effect of crown-to-implant ratio in single crowns on implant survival rates and marginal bone loss.

The researchers found 5 studies that compared outcomes for short-implant–supported single crowns with a crown-to-implant ratio of either ≤1:1 and >1:1 or ≤2:1 and >2:1. Implant length was either 6 mm or 6.5 mm. All implants had an internal connection; both cement-retained and screw-retained retention systems were

included. Follow-up ranged from 12 to 60 months, with a mean of 36 months.

No significant differences in the implant survival rate were found between the restorations with crown-to-implant ratios of ≤1:1 and >1:1 or ≤2:1 and >2:1. However, marginal bone loss increased as the crown-to-implant ratio increased.

Comment

Compared with external connections, internal connections improve stress distribution across the bone tissue and minimize the risk for complications, which may be important when choosing short implants. The authors warned that the data on marginal bone loss was insufficient to conduct a meta-analysis, and thus those results need further study.

Pellizzer EP, Marcela de Luna Gomes J, Araújo Lemos CA, et al. The influence of crown-to-implant ratio in single crowns on clinical outcomes: a systematic review and meta-analysis. J Prosthet Dent *2021; 126:497-502.*

Natural Teeth vs Implants

Sadowsky from the University of the Pacific Arthur A. Dugoni School of Dentistry, California, and Brunski from Stanford University, California, conducted a mapping review to identify how teeth and implants respond to biologic and mechanical loads. They found 108 studies that investigated the microenvironment of the periodontal ligament and peri-implant interface.

The periodontal ligament primarily contains cells with specialized properties that allow them to differentiate into both cementoblasts and osteoblasts, and stem cells that can maintain and regenerate periodontal tissues, while modulating anti-inflammatory events and tissue repair, allowing for an increased blood supply in response to inflammation, along with a regenerative effect on periodontal ligament tissue in patients with periodontal disease. Other growth factors generated by the periodontal ligament increase bone formation and regulate essential cellular activities during tissue repair.

With no fibrous attachment to the connective tissue surrounding the implant, there is less protection against bacterial downgrowth and, thus, horizontal recession is accelerated. Also, the area surrounding the implant has a reduced blood supply and a diminished defense against inflammation, which, along with a lack of stem cells, can lead to the rapid progression of peri-implantitis.

Regarding mechanical response, implant restorations have demonstrated a mechanical superiority compared with tooth-supported prostheses. The periodontal ligament distributes loads across the contiguous alveolar bone, but higher loads increase stress in the periodontal ligament and can create an inflammatory response, which may then destroy collagen fibers of the periodontal ligament. At implant sites, however, strains generated by heavy loads may result in net bone gain in peri-implant bone. Although loss of osseointegration is theoretically possible when a load exceeds the biologic threshold, the level of load necessary has not been established and appears to be higher for peri-implant bone than for periradicular bone.

Comment

Evidence suggests that conserving teeth in periodontally compromised dentitions may be a preferred treatment for patients under careful recall and home care regimens. While teeth are superior in their ability to resist biologic challenges, implants are superior in managing higher compressive loads. Treatment choices must be tailored to individual patient's needs.

Sadowsky SJ, Brunski JB. Are teeth superior to implants? A mapping review. J Prosthet Dent *2021;126:181-187.*

In the Next Issue

Implant supported cantilever fixed partial dentures

Our next report features a discussion of this issue and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.

Do you or your staff have any questions or comments about **Prosthodontics Newsletter**? Please write or call our office. We would be happy to hear from you.