

Prosthodontics

NEWSLETTER

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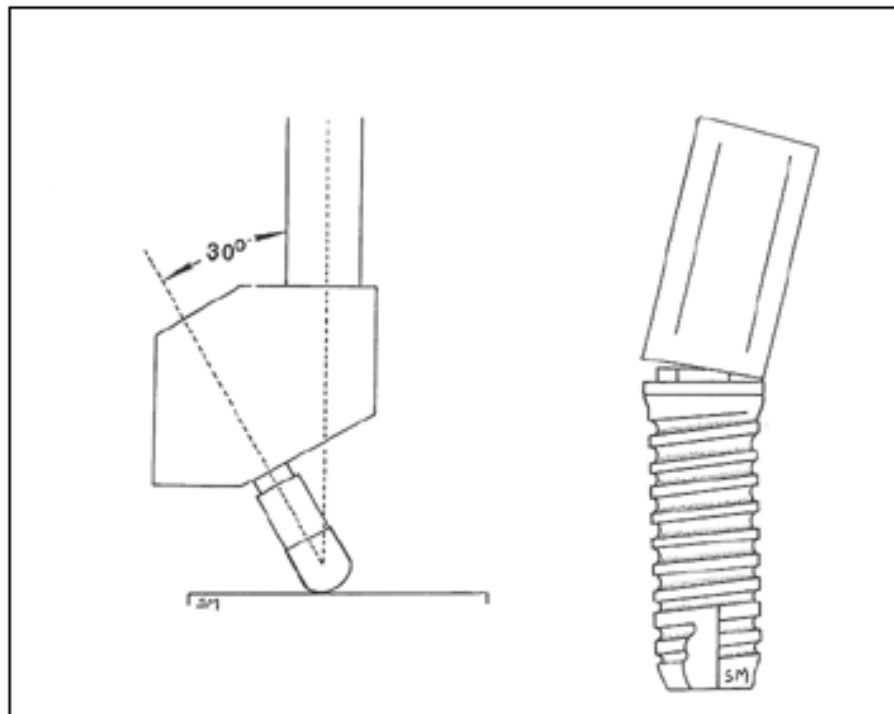
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A recent *in vitro* study investigated the influence of platform diameter on the integrity of the abutment/implant connection (see *Strength of the Abutment/Implant Connection*, inside).

Implant Problems: How to Cope

A number of papers have been published recently addressing problems and outcomes of implant prosthodontics. The collective knowledge and experience of the dental community, obtained from scholarly publications, can serve to improve our ability to cope with biologic or mechanical complications of implant prosthodontics and help us avoid outright failure. This issue of *Prosthodontics Newsletter* reviews several scientific papers related to this topic.

Strength of the Abutment/Implant Connection

Mechanical problems with implant-supported prostheses are more common than biologic complications. The durability of the interface between the implant and the prosthetic component has been recognized as one of the most persistent concerns, especially for single-tooth implant-supported restorations. Advances in the design of abutment/implant connections have improved the resistance to fracture and loosening of screws.

A recent *in vitro* study investigated the influence of platform diameter on the integrity of the abutment/implant connection. The authors used Maestro implants (BioHorizon Implant Systems, Inc., Birmingham, AL) with 4.25 mm and 5.25 mm diameter implant

platforms. The height of the external hex components for both styles of implant was 1 mm.

Abutments were tightened with 30 Ncm of torque and the assemblies were tested on a servohydraulic testing machine. The abutment/implant connections were loaded at a 30° angle until failure by using a special testing jig.

The results indicated that the wider-diameter implants sustained almost twice the load of the smaller-diameter implants when subjected to either static loads or cyclic dynamic loading. Failures occurred as deformation of the abutment screws with static loads and fracture of the screws when the assemblies were exposed to cyclic loading.

The authors also sectioned unloaded samples of the 2 styles of implants after connecting and tightening with 30 Ncm to evaluate the intimacy of fit. The sectioned specimens were examined under scanning electron microscopy (SEM). Complete adaptation of the inferior surface of the abutment and the implant platform occurred for all samples.

Comment

The traditional or "standard" implant designs usually incorporate a platform (or prosthetic table) that is 4 mm or 4.25 mm in diameter and a hex that is 0.7 mm in height. Most manufacturers are now supplying implants with wider-diameter platforms. Increasing the width of the platform improves the lever balance by helping to centralize forces over the supporting implant, thereby minimizing bending moments (see Figure 1 at left).

Improved leverage, combined with the taller hex found in the Maestro implant and the intimate contact of the abutment/platform interface that the authors reported, can substantially reduce the forces directed to the abutment screw. This implant design would be most advantageous for single implant-supported molar crowns.

Boggan RS, Strong JT, Misch CE, Bidez MW. Influence of hex geometry and prosthetic table width on static and fatigue strength of dental implants. J Prosthet Dent 1999;82:436-40.

Evaluation of Treatment Strategies for Failing Implants

A recent review article systematically evaluated over 200 published papers on the treatment of implant problems. The review was limited to articles discussing biologically related issues. Mechanical complications were not included.

In this particular review, failure was defined as "inadequacy of the host to establish or to maintain osseointegration." A failing implant was described as one that is "progressively losing its bone anchorage, but is still clinically stable." Biologic complications were designated as "soft tissue aberration without loss of supporting bone."

Implants with complications and those that are failing are potentially salvageable, but these conditions must be recognized and treated promptly. Treatment strategies reported in the literature appear to be based primarily on therapy commonly used for periodontal disease around natural teeth. Most of these papers relied on empiricism or trial-and-error approaches.

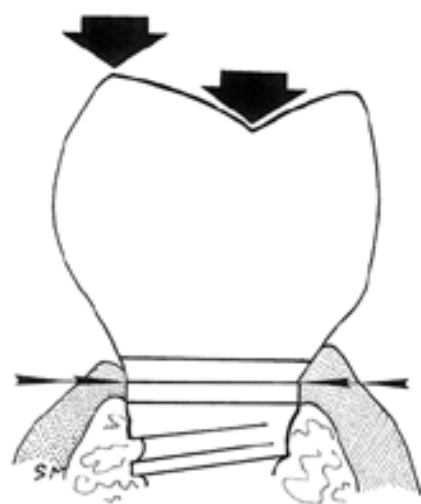


Figure 1. Superior surface of implant serves as the prosthetic platform (small arrows). Wider platform more effectively supports occlusal loads (large arrows) to minimize bending moments and reduce stresses on abutment screw.

The authors concluded that early diagnosis of the problem is critical. Patients should be encouraged to immediately report any symptoms, such as pain, swelling, pus or hypersensitivity. Once the most likely etiologic factors for the complication or failing condition have been identified, treatment should be instituted.

However, there appears to be no conclusive scientific evidence to support any treatment method. As a result, a common sense approach should prevail.

The reviewers also indicated that infected failing implants should receive aggressive intervention. Antibiotic therapy alone is not likely to produce long-lasting results, so surgical debridement is also recommended. Implants that do not improve after diligent therapy are candidates for removal.

Comment

Osseointegrated implants are highly successful with few failures and limited biologic complications. Therefore, most clinicians have little experience with the treatment of failing implants.

A well-defined therapeutic approach in this area would be welcome but, to date, there are insufficient data to make definitive recommendations. Multicenter cooperation that incorporates agreed-upon empirical methods to treat failing implants is highly desirable.

The results of these multicenter trials would substantially improve the profession's knowledge of the outcomes of treatment strategies when attempting to resolve biologic complications associated with implants.

Esposito M, Hirsch J, Lekholm U, Thomsen P. Differential diagnosis and treatment strategies for biologic complications and failing oral implants: a review of the literature. Int J Oral Maxillofac Implants 1999;14:473-90.

Effect of Washers on Implant Screws

Loosening of fixation screws is a common complication with implant-supported restorations. Methods to reduce the occurrence of screw loosening have not been totally effective. A new "conical spring washer" has been developed and was tested *in vitro* to evaluate its influence on screw loosening.

A 3-unit fixed partial denture (FPD) was fabricated and fastened to standard implant abutments with screws tightened to 10 Ncm by using a miniature load sensor attached to a Torque Controller handpiece. This device also allowed accurate measurement of the time and torque needed to completely loosen the fixation screws (see Figure 2).

Conical spring washers, 0.2 mm in thickness, were placed (a) on both implants, (b) on only the mesial implant, (c) on only the distal implant or (d) on neither implant. The results indicated that screws with conical spring washers underwent 35% more rotational displacement before complete loosening of the screws occurred.

Comment

It appears that these washers functioned as "lock washers," allowing the screw connections to withstand larger deformations without losing clamping force. The clinical relevance of this modification is unknown because the investigators did not simulate intraoral conditions. However, placement of these washers during screw connection is a relatively simple task that could substantially reduce the incidence of screw loosening for implant-supported FPDs and artificial crowns.

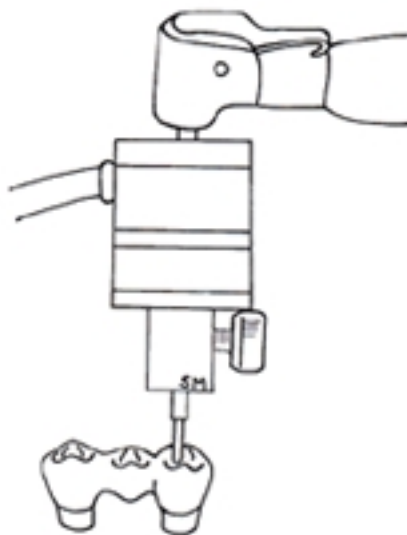


Figure 2. Miniature load sensor with Torque Controller handpiece used in the study.

Korioth TWP, Cardoso AC, Versluis A. Effect of washers on reverse torque displacement of dental implant gold retaining screws. J Prosthet Dent 1999;82:312-16.

Analysis of Smoking and Maxillary Sinus Grafts

Surgical grafting techniques have been used to compensate for pneumatized maxillary sinuses and to increase the osseous support for dental implants. This approach was first described in 1980, yet published research regarding the success of implants placed in grafted maxillary sinuses is limited.

The effects of smoking on the success rate of implants placed in maxillary sinuses was evaluated in a clinical study including a total of 60 patients. Sixteen patients in this study were smokers and 44 were nonsmokers.

Next:

- Fiber-reinforced inlays for FPDs
- Wear potential of veneering ceramics
- Anorganic bovine bone osseous grafts

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

The study included 70 implants for the smokers and 158 implants for the non-smokers.

The cumulative implant success rate for nonsmokers was 82.7%, while the success rate was only 65.3% for the patients who smoked. The failure rate for the smokers was not influenced by the number of cigarettes smoked per day.

Comment

Other studies of implant survival have reported unsatisfactory success rates for implants placed in patients who are smokers. However, most studies found a correlation between the number of cigarettes smoked per day and the implant success rates. As a general rule, heavy smokers experienced higher failure rates than light smokers.

The authors who studied implants placed in grafted sinuses found no difference in the failure rate for patients who smoked fewer than 15 cigarettes per day as compared to those patients who smoked 15 or more cigarettes per day. These results suggest that abstinence from smoking is highly desirable and will significantly improve the outcome of implant treatment when a sinus graft procedure is necessary.

Kan JYK, Rungcharassaeng K, Lozada JL, Goodacre CJ. Effects of smoking on implant success in grafted maxillary sinuses. J Prosthet Dent 1999;82:307-11.

Early Loading of Implants

The standard approach to implant prosthodontics includes an unloaded healing time for the implant of 3-6 months. This healing period is inconvenient for the patient because it postpones placement of the prosthesis.

An experiment conducted on dogs evaluated the effects of early loading of implants. Forty implants were placed in 4 beagle dogs. Ten of the 40 implants were coated with titanium plasma-spray (TPS) and the remaining 30 were equally divided among 3 different protocols of hydroxyapatite (HA) coatings. Implants of the 4 different surface types were randomly divided among the 4 dogs.

Free-standing gold crowns were attached to the implants 2 days after surgical placement of the implants. Crowns were placed without occlusal contact and occlusal loading was achieved by placing the dogs on a hard diet. The implants were monitored for 6 months.

There were no differences in bone loss among the surface types. Mean bone loss was 1.3 mm after 6 months. Only 1 implant (TPS coated) was lost in the study. All others remained immobile and functional for the duration of the experiment.

Comment

Previous studies have suggested that early loading of implants is possible when several implants are placed and the restoration provides splinting of the implants. Implants in this study were all free-standing. Direct occlusal contact with the opposing teeth was prevented. Nevertheless, the implants were loaded because the dogs were maintained on a diet of hard food. Early masticatory loading did not prove detrimental to these unsplinted implants.

These results suggest that early placement of a provisional crown is possible when a single tooth is replaced with an implant-supported restoration. Adjusting the provisional crown to avoid occlusal contact will allow only minimal loading of the implant similar to the parameters of this study.

Corso M, Sirota C, Fiorellini J, et al. Clinical and radiographic evaluation of early loaded free-standing dental implants with various coatings in beagle dogs. J Prosthet Dent 1999;82:428-35.

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.