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PROSTHODONTICS™

NEWSLETTER

WINTER 2008

IN THIS ISSUE:

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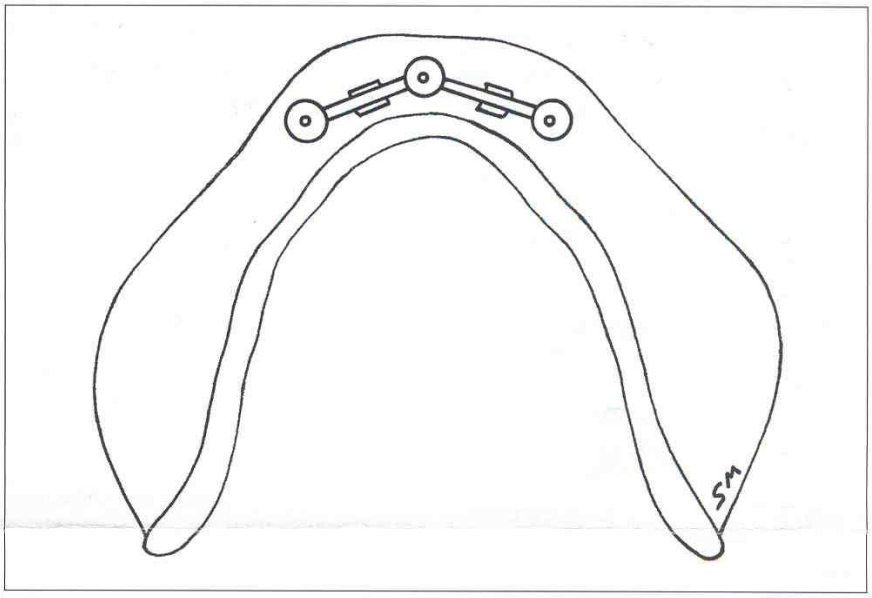

A study of immediately loaded mandibular overdentures supported by 3 implants and a gold bar showed impressive results. (See *Immediately Loaded Mandibular Overdentures,* inside.)

Implant-supported Prostheses: An Update

Implant-supported prostheses continue to be a major component of everyday dental practice. There are many controversies and unanswered questions, and the literature is replete with articles devoted to this topic. This issue of *Prosthodontics Newsletter* reviews a series of articles related to implant-supported restorations—2 clinical studies, 1 literature review and 1 in vitro study.

Immediately Loaded Mandibular Overdentures

Mandibular overdentures that are supported and retained by implants have become popular and have improved the quality of life of edentulous patients. Several clinical studies have shown that the loading of 4 splinted implants immediately after placement with an overdenture can produce survival rates of the implants that are comparable to those obtained with delayed loading.

Stephan et al from the Gaston Berger Center for Care and Research in Dentistry, France, conducted a clinical pilot study comparing the results of overdentures supported by 3 implants that were loaded 2 days after surgery and 3 months after surgery. Twenty-six patients were enrolled in the study. Seventeen patients received gold bars and definitive overdentures 2 days after surgery, and 9 patients (control group) received the bars and dentures 3 months after surgery.

Prior to implant surgery, all patients received 2 g of amoxicillin (Clamoxyl; SmithKline Beecham) 1 day before surgery and then for 7 days following surgery. Three implants (MK III TiUnite; Nobel Biocare AB) were placed in each patient's edentulous mandible. All implants measured 3.75 mm in diameter and 10–13 mm in length. All implants were placed with ≥30 Ncm of torque. One implant was placed at the midline of the edentulous ridge, and the other 2 were placed 12–15 mm distal to the midline on each side.

For the experimental group ($n = 17$), prosthetic abutments were placed with 35 Ncm of torque. After suturing, an impression was made and sent to the dental laboratory for fabrication of a cast gold bar (Ackerman-type, Model 55.01; Cendres+Métaux SA). The gold alloy bar was placed 24 hours after surgery (Figure 1). An impression was made to retrofit the bar to the existing denture, and the bar with overdenture was delivered the next day. (The cover illustration provides a view of the intaglio surface of the denture with the bar and clips.)

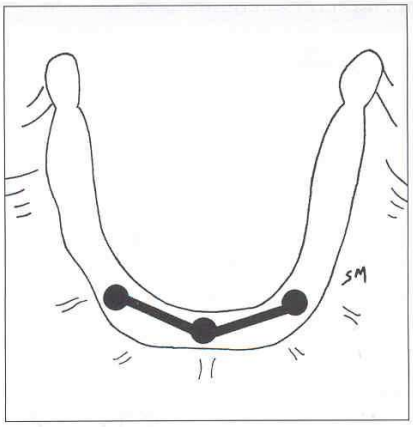

Figure 1. Gold alloy bar in place.

For the control group ($n = 9$), the implants were uncovered 3 months after placement. Fabrication of the bars and retrofitting of the dentures were accomplished in a manner similar to that used for the experimental group.

Recall examinations were conducted at 3, 6, 12, 18 and 24 months. Follow-up times ranged from 6–40 months (mean, 19 months). No implant failures were recorded in either group. There was no difference between the 2 groups with regard to bleeding index, plaque index and peri-implant probing depths, with the exception of the probing depths recorded at the 1-year period. At 1 year, mean peri-implant bone loss was 0.05 mm for the experimental group and 0.46 mm for the control group; these differences were statistically significant.

Comment

Although the gold bars were not delivered until 2 days after surgery for the experimental group, immediately after surgery the existing dentures were hollowed out and relined with a temporary resilient liner (Visco-gel; Dentsply DeTrey GmbH). Therefore, a true immediate loading protocol was used.

The authors suggested that less bone loss was observed with the experimental group because only 1 surgical procedure was performed for the patients compared with the 2-stage surgical approach used for the control group. However, these numbers should be viewed with caution. Measurements were made from panoramic radiographs, not standardized periapical radiographs. Inherent distortion of panoramic radiographs, including a nonuniform image enlargement of up to 25%, is well known and could easily explain these slight differences in mean bone loss.

The authors reported only on the survival of the implants and the profile of the peri-implant hard and soft tissues. No mention was made with regard to any prosthetic complications, such as loosening of clips or fracture of acrylic resin denture bases. It is very possible that the 2 groups experienced different prosthetic complication rates.

Stephan G, Vidot F, Noharet R, Mariani P. Implant-retained mandibular overdentures: a comparative pilot study of immediate loading versus delayed loading after two years. J Prosthet Dent *2007;97:S138-S145.*

Accuracy of Impressions Made with Angulated Implants

Impressions for implant-supported restorations can be made with an open tray technique or a closed tray technique. With the open tray technique, long screws are used to attach the impression copings to the implant platforms, and the copings remain within the impression when it is removed from the mouth.

With the closed tray technique, the impression copings remain attached to the implants when the impression is removed. The impression copings are removed, the implant analogs are attached to the impression copings and the impression copings are then inserted back into the impression. With nonparallel implants, it is possible that a closed tray impression could become distorted as it is removed from the mouth.

An in vitro study by Conrad et al from the University of Minnesota, Minneapolis, evaluated the accuracy of closed and open tray impression techniques with the angulation of the implants as the variable. Seven casts were made:

- **Control cast:** The control cast had 3 implant analogs (regular-diameter lab analogs; 3i Implant Innovations) substituting for implants, in a triangular pattern all parallel to each other and perpendicular to the plane of the cast. The analogs were designated as position 1, 2 and 3.
- **Experimental casts:** The 6 experimental casts had a center analog perpendicular to the plane of the cast. The other 2 analogs diverged from the center analog or converged toward the center analog by 5°, 10° or 15°.

Five open tray and 5 closed tray impressions were made of each cast with addition silicone impression material (Imprint II Garant; 3M ESPE). A cast was poured from each impression with the use of implant analogs. The position of the analogs was measured for the 7 definitive casts and the 70 duplicate casts with a fine-tip measuring stylus (FaroArm Silver; Faro Technologies). Computer software was used to align the data sets, and vector calculations determined the differences in degrees between the implant angulations on the definitive cast and the duplicate casts.

Results indicated no difference in angulation errors when the open and closed tray techniques were compared. There was an interaction between angulation and position of the analogs, and mean angulation errors were significantly different in the duplicate casts, but there appeared to be no predictable pattern of errors.

Comment

The literature is conflicting on this topic. Some studies have shown superior results with the open tray technique, while other studies have shown similar outcomes with both techniques. Results of this study suggest that either the open or the closed impression technique will produce comparable angulation errors for implants angled up to 15° from parallel. If implants diverge or converge 15° from each other, then the combined convergence or divergence angle would be 30°. At times, implants are more convergent or divergent than 30°, and the effect of the impression technique on the accuracy of the final cast might be different.

Conrad HJ, Pesun IJ, DeLong R, Hodges JS. Accuracy of two impression techniques with angulated implants. J Prosthet Dent *2007;97:349-356.*

Maxillary Implant-supported Overdentures

Sadowsky from the University of Southern California conducted a systematic review of clinical studies related to maxillary implant-supported overdentures. Topics covered included number, length and distribution of implants; splinted vs unsplinted attachment systems; maintenance; and patient satisfaction.

If a denture will be designed without palatal coverage (U-shaped), there was consensus in the literature that ≥4 implants are required. Some authors have recommended 6 implants as a safety factor against the possibility of an implant failure. With regard to implant length, 1 study reported 2–3× the failure rate of individual implants when shorter implants (7 and 10 mm) were used.

The distribution of supporting implants is also a factor that can influence implant survival. Broadly distributed implants have been shown to transfer stresses more favorably to the supporting bone when compared with a group of implants in the anterior portion of the maxilla supporting cantilevered bars.

Regarding splinted vs unsplinted implants, the literature suggests no difference in mean bone loss between unsplinted, ball-retained overdentures and splinted, bar-retained overdentures. Bars tend to require more space than individual attachment systems, such as ERA attachments (APM-Sterngold) and Locator attachments (Zest Anchors, Inc.), but bars have been reported to provide more retention. Lack of parallelism of the implants can compromise retention and functionality of solitary attachments. Patients ap-

pear to be equally satisfied with maxillary overdentures retained by bars and by solitary attachment; however, magnetic attachments in the mandible have been associated with lower patient satisfaction, which may be true of maxillary dentures as well.

Implant-supported maxillary overdentures tend to require more postinsertion maintenance compared with implant-supported fixed prostheses. The highest frequency of postinsertion complications occurs during the first year, and complications are more frequent with U-shaped dentures.

Patient satisfaction tends to be high with conventional maxillary complete dentures. One study reported difficulty recruiting patients for a clinical study on maxillary implant-supported overdentures. Only 7% of the patients were even inclined to participate because they were satisfied with their existing prostheses. Patients experiencing problems with their maxillary dentures are more likely to report increased satisfaction with implant-supported maxillary overdentures. Patients satisfied with their existing maxillary complete dentures have been reported to experience almost no significant improvement in their satisfaction with implant-supported dentures.

Comment

This comprehensive review of implant-supported maxillary complete dentures is a welcome addition. The author indicated that the literature is not conclusive on the best design for these dentures, and patient-mediated considerations should be used to direct treatment-planning decisions. It appears that the best candidates for implant-supported maxillary overdentures are those who are dissatisfied with their conventional dentures.

Sadowsky SJ. Treatment considerations for maxillary implant overdentures: a systematic review. J Prosthet Dent *2007;97:340-348.*

Crown-to-implant Ratio

When planning the restoration of natural teeth, a dentist will often consider the crown-to-root ratio. Classic texts in fixed prosthodontics have commonly suggested a minimal crown-to-root ratio of 1:1. Prospective studies on the longevity of teeth have correlated an unfavorable crown-to-root ratio with an increased risk of loss of a tooth.

It is not uncommon for dentists to apply classically taught principles of crown-to-root ratio to implant-supported prostheses; nevertheless, there is lack of clinical evidence to support this practice. A retrospective cohort study by Schulte et al from the University of Minnesota, Minneapolis, investigated the effect of crown-to-implant ratio on the survival of implants.

The study population was a group of 294 patients. The implants used were the Bicon system (Bicon Inc., Boston, Mass.). The lengths of each crown and implant were measured directly from radiographs for 889 single-tooth, implant-supported restorations. The follow-up times ranged from 0.1–7.4 years (mean, 2.3 years). Sixteen implants failed (success rate, 98.2%). The mean crown-to-implant ratio for successful implants was 1.3:1, and the mean crown-to-implant ratio for failed implants was 1.4:1.

Comment

Results of this study suggest that principles of crown-to-root ratio should not be applied to implant-supported restorations, and that higher ratios than commonly recommended are likely to produce acceptable results. However, there are a number of limitations to this study. The mean follow-up time was very short. Very few implants failed, preventing statistical analysis of the failures. Also, the biomechanics of the implant system studied are different from most other systems, and results should not be applied to any other systems. Common sense is recommended when planning implant-supported restorations.

Schulte J, Flores AM, Weed M. Crown-to-implant ratios of single tooth implant-supported restorations. J Prosthet Dent *2007;98:1-5.*

NEXT:

- Sixteen-year clinical study of porcelain veneers
- Fracture resistance of porcelain veneers
- Resin bonding to dental ceramics

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