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PROSTHODONTICS™

NEWSLETTER

SUMMER 2009

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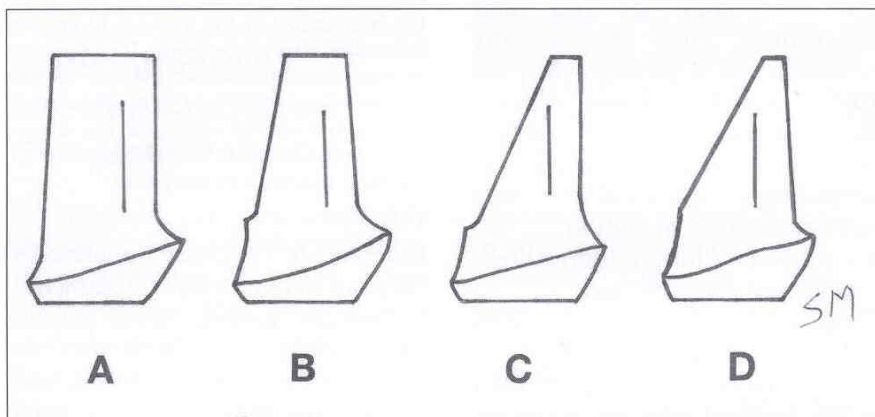
Effect of the Design of the Casting and Implant Abutment on Retention of a Cement-retained Crown

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An in vitro study investigated the effects of the design of implant abutments and the design of castings on the retention of the castings. An unmodified abutment (A) served as a control. Experimental abutments were milled along the buccal walls at 15° (B), 22° (C) and 30° (D). Two styles of castings were made for each abutment. One casting was made to engage the screw access channel, and one was made with the screw access hole blocked out. See *Effect of the Design of the Casting and Implant Abutment on Retention of a Cement-retained Crown*, inside.

New Ideas in Implant Dentistry

Osseointegrated implants were introduced to North America in the early 1980s. In a relatively short time, implant-supported prosthodontics has become an integral component of everyday prosthodontic practice. Nevertheless, many questions about materials, techniques and treatment outcomes remain unanswered. As research data become available, the profession's knowledge and understanding about this area of practice advances. This issue of *Prosthodontics Newsletter* reviews a series of articles related to implant-supported prostheses.

Effect of the Design of The Casting and Implant Abutment on Retention of a Cement-retained Crown

In the 1980s, implant-supported fixed restorations were commonly screw retained to ensure ease of removal, thus facilitating a solution to problems that might occur with the implants or the restorations.

With advances in knowledge and improved techniques, problems with implants and their restorations have dramatically decreased. As a consequence, the use of cement-retained restorations has become more popular. There are many advantages to cement-retained crowns and fixed partial dentures, including

- improved occlusal relationships,
- enhanced esthetics and
- ease of developing a passive fit with multi-unit prostheses.

An implant abutment is attached to the implant with an abutment screw. A screw access channel allows tightening or loosening of the abutment screw. When fabricating the casting to be cemented over the abutment, most dental laboratory technicians will block the hole to the screw access channel. A recently published article has suggested that developing a casting that engages this screw access channel will improve retention and resistance for the crown (Figure 1).

Naik et al from University College London, United Kingdom, conducted an in vitro study to evaluate the effects of preparing castings that entered the screw access channels of implant abutments.



Figure 1. The facial surface of the abutment has been tapered as a result of the angulation of the implant to ensure favorable crown contours. This amount of taper can reduce the retention of the cemented crown. It has been postulated that extending the casting of the crown into the screw access channel (arrow) will improve retention of the crown.

Four stock implant abutments (Replace Select Straight Abutments; Brånemark System, Nobel Biocare AB, Gothenburg, Sweden) were attached to their implant replicas, and the implant replicas were mounted in acrylic resin blocks.

One abutment was unmodified and served as the control. The other 3 abutments were milled to increase the taper of the buccal walls by 15°, 22° and 30° (see cover illustration). Two sets of castings were made for each abutment:

- 1 with an extension into the screw access channel and
- 1 without an extension.

Castings were cemented with temporary cement (Temp Bond; Kerr Italia S.p.A, Salerno, Italy). Castings were then removed from their abutments with a universal testing machine, and peak removal loads were measured. Extending

the casting into the screw access channel significantly increased the peak removal load.

Comment

In all cases, extension of the casting into the screw access channel improved retention, regardless of the taper of the abutment. Increasing the taper of the abutment decreased retention of the conventional castings on their respective abutments. Therefore, designing the casting to extend into the screw access channel can help to compensate for reduction in retention of the casting that will occur when an abutment must be modified with an excessive taper to ensure favorable contours of the cemented crown.

Naik S, Tredwin CJ, Nesbit M, et al. The effect of engaging the screw access channel of an implant abutment with a cement-retained restoration. *J Prosthodont* 2009; 18:245-248.

Bar Design of Implant-supported Mandibular Overdentures and Prosthetic Maintenance

Postinsertion maintenance of a bar-retained, implant-supported mandibular overdenture can be a considerable task. Additional visits to provide maintenance not only increase the treatment cost but also affect the dentist's and the patient's satisfaction with the treatment. Although round bars are popular for the retention and support of implant-supported overdentures, milled bars are also used. Overdentures rigidly supported by

4 implants and milled bars can prevent any rotational movements. These dentures may require less maintenance.

A randomized prospective trial conducted by Krennmair et al from the University of Vienna, Austria, investigated the differences in maintenance for mandibular implant-supported overdentures with 2 different retention methods. Fifty-one patients were enrolled in the study; all had 4 implants.

- One group (25 patients) received round bars with resilient anchorage.
- The other group (26 patients) received milled bars with rigid anchorage and metal reinforcement of the dentures.

All patients were followed for 5 years.

Forty-six patients were available at the 5-year follow-up. Prosthodontic maintenance requirements were significantly greater for patients with the round-bar design, especially during the first 2 years. Major prosthetic problems, such as overdenture fracture or bar fracture, were seen only in the dentures without metal reinforcement (round-bar group).

Comment

The cost to fabricate a custom-made milled bar and an overdenture with metal reinforcement is considerably greater than the cost of fabricating a nonreinforced overdenture that incorporates prefabricated round bars and retentive elements. However, in this study, round-bar overdentures required more than 3× as much maintenance as milled-bar overdentures. The initial increased cost of the milled-bar overdenture can be partially offset by the reduced cost for resolving postinsertion problems. Also, postinsertion maintenance is inconvenient

for both the dentist and the patient. Follow-up maintenance is disruptive to the dentist's schedule and requires that the patient take time from work or from the patient's daily routine to visit the dentist. Any reduction in the number of postinsertion visits would likely result in improved patient and dentist satisfaction with the overall treatment results.

Krennmair G, Krainhöfner M, Piehslinger E. The influence of bar design (round versus milled bar) on prosthodontic maintenance of mandibular overdentures supported by 4 implants: a 5-year prospective study. Int J Prosthodont 2008;21:514-520.

Conventional vs Implant-stabilized Complete Dentures

Implants are now commonly used to retain and stabilize mandibular overdentures. Although it has been assumed that patients with mandibular dentures that are retained and/or supported by implants are more satisfied and have a better quality of life compared with patients with conventional dentures, there is limited clinical evidence to support this assumption. A 2-part, prospective case-control study by Hobkirk et al from University College London, United Kingdom, compared the outcomes for patients treated with implant-retained mandibular overdentures and patients treated with conventional mandibular complete dentures.

Part 1 of the study reported on outcomes after 1 year; part 2 reported on outcomes after 7 years. Patients were drawn from a group of totally edentulous patients who had been referred to the UCL Eastman Dental Institute for specialist care

because their dentists felt that the patients' denture problems were beyond the scope of a general practitioner. Dentures that were considered clinically unacceptable by the specialists were remade using state-of-the-art techniques. If either the existing satisfactory dentures or the specialist-fabricated complete dentures provided inadequate results, implant-supported overdenture therapy was explored.

Patients who had been referred specifically for implant treatment were excluded from the study. To eliminate financial considerations as a motivating factor for the treatment modality and the outcome measures, all treatment was provided at no charge to the patients.

There were 30 patients in the implant group and 30 patients in the control group (conventional complete dentures). Patients in the implant group received 2 implants in the anterior portion of the mandible, along with implant-retained overdentures that occluded with conventional maxillary complete dentures.

All patients in the implant group were free of any local or systemic diseases that could affect the outcome of implant treatment. All implant patients had good oral hygiene, and all met commonly accepted criteria for implant treatment. Control patients were matched with regard to age, gender and socioeconomic class. Data collected included the length of treatment sessions, denture satisfaction with the original and newly fabricated dentures, and any treatment failures.

Year 1 Results

After 1 year, patients with implant-retained overdentures were more satisfied with their dentures than

the patients using conventional complete dentures.

- 47% of the patients with implant treatment reported problems with their dentures.
- 81% of the patients with conventional dentures reported problems with their dentures.

Patients with implant treatment were especially pleased with the subjective fit, lack of looseness and the chewing ability of their dentures.

The patients who received implant-retained overdentures required more treatment time (mean, 327 minutes for the implant group; 268 minutes for the control group). Both implants failed in only 1 patient; the investigators could offer no explanations for these 2 failures.

Year 7 Results

At the 7-year follow-up, differences between the 2 groups were less pronounced. Results of an oral health impact profile with 14 factors showed that patients in the implant group reported higher satisfaction with the quality of their diets, but there were no significant differences between the groups for the other 13 factors.

A denture complaint questionnaire and patient satisfaction questionnaire were also administered, both of which reported no significant differences between the groups. Assessment of the overall denture quality by 2 senior specialists noted significant differences between the 2 groups for mandibular denture dislodgement with mouth opening

and for movement of the mandibular midline as a result of rotational forces. All other factors showed no significant differences.

Comment

Only 31 of the original 60 patients were available for evaluation after 7 years (a 48% drop-out rate). It cannot be assumed that those who did not participate in the 7-year follow-up would have reported results similar to those who did, which is an important limitation of the study. Approximately 50% of the implant-retained dentures were remade. The artificial teeth for the implant group were more prone to wear, which could explain the high remake rate.

Fabrication procedures for the implant-retained overdentures required approximately 1 hour of additional chair time. Because of this additional chair time, as well as the surgical fee for implant placement and the cost of implant components, the cost to the patient would be substantially higher than the cost for a conventional complete denture. Many patients who would prefer implant treatment may choose a conventional denture because of these added costs. To avoid bias, the authors eliminated all financial considerations by providing treatment free of charge.

Results of this 2-part study suggest that patients are likely to be more satisfied with implant-retained dentures in the short term compared with patients treated with conventional dentures. With

time, differences between the 2 groups of patients could become minimal. It is likely that patients with well-made conventional dentures adapt with time and are able to more effectively manipulate their dentures to overcome initial problems. Thus, the quality of the dentures might be more important than the presence of implants in the long term. While this study evaluated patients with only 2 implants, results for patients with more implants could be different.

Hobkirk JA, Abdel-Latif HH, Howlett J, et al. *Prosthetic treatment time and satisfaction of edentulous patients treated with conventional or implant-supported complete mandibular dentures: a case-control study (part 1)*. *Int J Prosthodont* 2008;21:489-495.

Hobkirk JA, Abdel-Latif HH, Howlett J, et al. *Prosthetic treatment time and satisfaction of edentulous patients treated with conventional or implant-stabilized complete mandibular dentures: a case-control study (part 2)*. *Int J Prosthodont* 2009;22:13-19.

NEXT:

- Film thickness of cements
- Marginal fit of all-ceramic crowns
- Effect of post type and length on pulpless teeth

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.