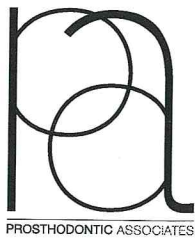


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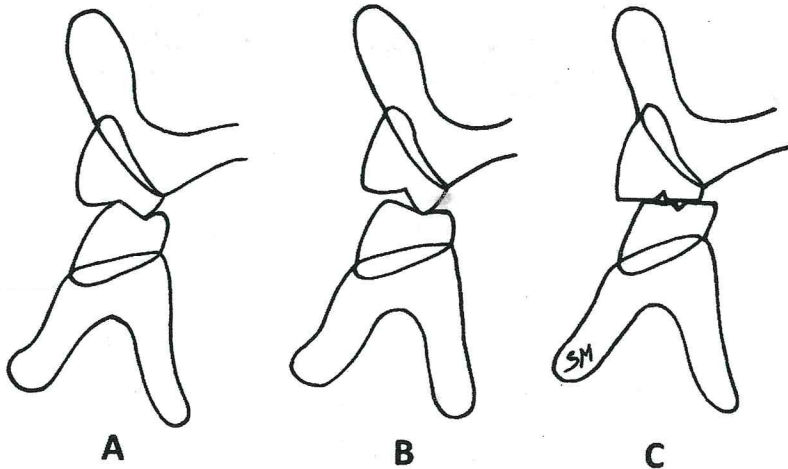
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Newsletter™



Based on the form and arrangement of the posterior teeth, 3 fundamental philosophical approaches exist for establishing complete denture occlusion: A, classical balanced occlusion; B, lingualized balanced occlusion; and C, monoplan occlusion. See **COMPLETE DENTURE OCCLUSION**.

The Treatment of Edentulism

Although the rate of edentulism over the last few decades has declined among the elderly, the number of patients in North America age >65 years has been increasing and will continue to increase for decades to come. Consequently, the absolute number of edentulous patients has remained steady and will likely grow over time. Treatment of edentulism will, therefore, remain an important aspect of prosthodontic practice for the foreseeable future. This issue of *Prosthodontics Newsletter* is devoted to recent articles related to the treatment of edentulism.

Muscle Activity with Implant-supported All-on-Four Fixed Dentures

Edentulous patients with extensive bone loss in the posterior regions of the maxillae or mandible can be treated with an All-on-Four prosthesis (Nobel Biocare AB, Göteborg, Sweden) commonly inserted immediately after implant surgery. The 2 anterior implants are placed perpendicular to the ridge crest, while the 2 posterior implants are placed with a 30° to 45° distal tilt. The distal tilt reduces the length of the fixed prosthesis's cantilevered segment and has been shown to be bio-

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- Outcomes of Edentulism Treatment



Muscle Activity with Implant-supported All-on-Four Fixed Dentures

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mechanically favorable. However, limited information is available on the neuromuscular adaptation of patients to these prostheses.

Dellavia et al from Università degli Studi di Milano, Italy, conducted an electromyographic investigation of the jaw muscles in patients with All-on-Four fixed implant-supported complete dentures. Ten patients were rehabilitated with mandibular All-on-Four implant-supported fixed complete dentures and maxillary conventional removable complete dentures. Eight patients were treated with maxillary and mandibular All-on-Four fixed complete dentures. Eight dentate patients with ≥ 28 natural teeth served as controls.

All patients underwent surface electromyographic analysis of their masseter and temporalis muscles ≥ 1 year after placement of the prostheses. Recordings were made during maximal voluntary tooth clenching and during unilateral gum chewing.

No significant differences were recorded for patients with the maxillary and mandibular All-on-Four prostheses and patients in the control group. However, standardized pooled muscle activity and standardized muscular activity per cycle were larger in patients with a maxillary conventional removable complete denture. These patients also displayed poor muscular coordination when compared with the dentate patients.

Comment

Results of this study suggest that patients treated with maxillary and mandibular All-on-Four prostheses can function as effectively as completely dentate patients. The distally tilted posterior implants do not appear to produce any clinically relevant problems.

Dellavia C, Francetti L, Rosati R, et al. Electromyographic assessment of jaw muscles in patients with All-on-Four fixed implant-supported prostheses. J Oral Rehabil 2012;39:896-904.

Implant-Bone Load Transfer with Implant-supported Fixed Complete Dentures

Two popular approaches to restoring a completely edentulous arch with an implant-supported fixed complete denture are the All-on-Four method (Nobel Biocare AB, Göteborg, Sweden) and the SynCone protocol (Dentsply Friadent, Mannheim, Germany). In the All-on-Four method, 2 vertically placed implants are located in the anterior region of the jaw, and 2 distally tilted (30° – 45°) implants are located posteriorly. In the SynCone method, all implants are vertically placed, and the restoration is designed with the platform-switching protocol.

With the All-on-Four method, the distal cantilever is shorter because of the tilted posterior implants, which may result in more favorable stress distribution. Baggi et al

from the University of Rome Tor Vergata, Italy, conducted a finite element (FE) analysis of complete-arch, implant-supported restorations designed with the All-on-Four concept and the SynCone method.

Three-dimensional numerical models of an edentulous maxillae and mandible were generated from computed tomographic images. Prosthetic bars supported by 4 implants were also generated with computer-aided design software (SolidWorks 9; Dassault Systemes, Concord, MA).

Bone-muscle interactions and temporomandibular joints were included in the mandibular model. The models were analyzed with linear elastic FE simulations of 3 different elastic loads:

- **Load 1:** complete-mouth loading—a uniformly distributed vertical load of 300 N
- **Load 2:** cantilever loading—a distal concentrated load applied to the end of the right cantilever
- **Load 3:** frontal loading—a concentrated load applied at the midspan of the central part of the bar between the 2 anterior implants

Load 2 produced the highest values of all stress measures at the right peri-implant interfaces. Except in the maxillae under load 3, the All-on-Four design produced stress patterns more homogeneous and of lower values when compared with those produced by the SynCone design. Tilted distal implants reduced compressive states at the distal bone-implant interfaces; nevertheless, depending on bone morphology and the type of load, high ten-

sile stresses could be generated at the distal bony crests.

Comment

The length of the cantilever, the implant positioning, and the bone's mechanical properties and morphology can affect load transmission and bone-overloading risks in complete-arch prostheses supported by 4 implants. Distally tilted implants tended to better distribute stress than did vertically placed implants, but in both designs the principal stress measures did not exceed physiological limits.

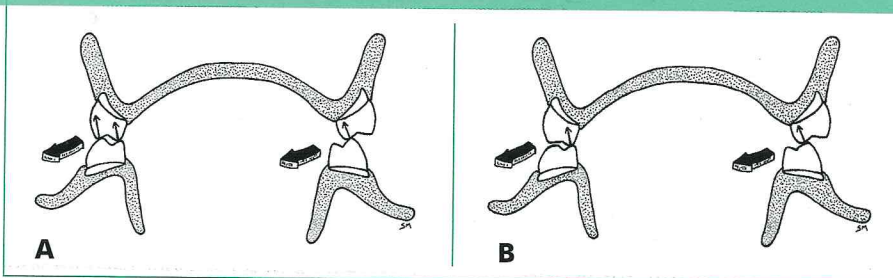
Baggi L, Pastore S, Di Girolamo M, Vairo G. Implant-bone load transfer mechanisms in complete-arch prostheses supported by four implants: a three-dimensional finite element approach. *J Prosthet Dent* 2013;109:9-21.

Complete Denture Occlusion

Classical balanced occlusion for complete dentures has been advocated for >100 years. With classical balance, anatomical posterior teeth are arranged with cross-arch and cross-tooth contacts of the posterior teeth in centric and eccentric positions (Figure 1A). It has been assumed that this occlusal arrangement will stabilize the dentures, distribute the occlusal load and enhance patient comfort. It has also been assumed that this type of occlusion with multiple contacts along inclined planes can contribute to masticatory efficiency.

Lingualized balanced occlusion for complete dentures incorporates cross-arch contacts in centric and eccentric positions but lacks

Figure 1. (A) Cross-arch, cross-tooth balance. (B) Balanced lingualized occlusion. Note the lack of contact of buccal cusps on the working side (compared with Figure A).



cross-tooth contacts. With lingualized occlusion, the maxillary and mandibular buccal cusps are not in function on the working side (Figure 1B). A third approach to the occlusion of complete dentures is monoplane occlusion, wherein flat teeth that lack inclined planes are arranged along a flat plane (cover illustration).

In addition to these 3 fundamental philosophies of complete denture occlusion, some dentists have advocated anterior tooth-guided occlusion, similar to that found in natural teeth. Currently, universal agreement on the best occlusal scheme for complete dentures is lacking. Arranging teeth to develop balanced eccentric contacts (either through classical balance or lingualized balance) is more time-consuming for the dentist and technician compared with arranging monoplane teeth along a flat plane, but is this extra effort worth the time required?

Abduo from the University of Western Australia conducted a systematic review of studies about complete denture occlusion. An electronic search of articles was conducted with the following combination of terms: "complete

denture," "occlusion," "balanced," "lingualized," "anatomic," "flat," "monoplane" and "canine."

The author retrieved 565 articles, but only 12 met the inclusion criteria. Most of the studies were cross-over trials, but a few were randomized or nonrandomized prospective trials. Methods of assessment were either subjective, objective or both. Eight studies evaluated the effects of posterior tooth form and arrangement. Four studies assessed the effects of lateral occlusal guidance.

Based on the review, the author concluded that anatomical teeth arranged in classical balanced occlusion or lingualized balanced occlusion were likely to produce superior results compared with monoplane teeth arranged on a flat plane. Balanced anatomical teeth were associated with enhanced esthetics and improved masticatory ability. Other advantages of anatomical teeth were reduction in cheek biting, improved speech, patient comfort and cleansability.

Four of the studies in the review evaluated anterior tooth guidance. In 1 of these studies, 50% of the patients preferred anterior tooth-



guided occlusion, 25% preferred lingualized balanced occlusion and 25% had no preference. In another study, the majority of the patients preferred anterior tooth-guided occlusion, primarily because of esthetics and chewing ability; however, loss of retention of the maxillary complete denture was a problem. In the other 2 studies, only a small minority of the patients preferred anterior tooth-guided occlusion, with the vast majority either preferring classically balanced occlusion or having no preference.

Comment

The author suggested that anterior tooth-guided occlusion should be used with caution for complete dentures. It is unclear why 2 studies found a preference for this occlusal scheme because loss of maxillary denture retention was a reported problem. Perhaps the esthetic outcome with the occlusal arrangement was the reason for this preference.

Abduo J. Occlusal schemes for complete dentures: a systematic review. Int J Prosthodont 2013;26:26-33.

Outcomes of Edentulism Treatment

Few areas of dental practice have evolved as dramatically as the methods and materials used to treat the edentulous dental arch. In the 1980s, implant-supported prostheses became a viable and reliable alternative to conventional removable dentures. With the many options currently available, treatment planning has

become more complex, and there is currently a lack of consensus on the best approach to treat edentulism.

Rohlin et al from Malmö University, Sweden, conducted a systematic review to evaluate the outcome of treatment methods used to rehabilitate adult patients with maxillary and/or mandibular edentulous arches. The review assessed

- treatment outcome after ≥ 5 years
- risks and adverse effects after ≥ 5 years
- cost-effectiveness of treatment after ≥ 5 years

The quality of the evidence was rated according to the Grading of Recommendations Assessment, Development and Evaluation guidelines as high, moderate, low or very low.

There were initially 2130 articles; the full-text versions of 488 publications were evaluated. After further screening, 10 studies with moderate study quality and 1 study of low quality were included in the review. Additionally, 3 other studies related to the economic aspects of treatment were included: 1 of moderate quality and 2 of low quality.

Low-quality evidence indicated a 95% survival rate for implant-supported fixed prostheses in the maxillae after 5 years. In the mandible, the survival rate of fixed prostheses was 97% after 10 years.

The survival rate of implant-supported overdentures was 93% after 5 years, but this evidence was also of low quality. The evidence further suggested that 70 of every 1000 implants placed for maxillary implant-supported fixed prostheses

were at risk of failure after 5 years; 44 of every 1000 implants placed for mandibular implant-supported fixed prosthesis were at risk of failure after 5 to 10 years. There was insufficient evidence to draw any conclusions concerning the economic aspects of treatment.

Comment

The authors concluded that the lack of high-quality evidence makes it difficult to draw meaningful conclusions from the data. Until further research of higher quality is published, definitive guidelines for treatment planning are difficult to establish.

Rohlin M, Nilner K, Davidson T, et al. Treatment of adult patients with edentulous arches: a systematic review. Int J Prosthodont 2012;25:553-567.

In the Next Issue

Important considerations in dental implant treatment planning

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.

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.

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