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# PROSTHODONTICS™

## NEWSLETTER

SUMMER 2005

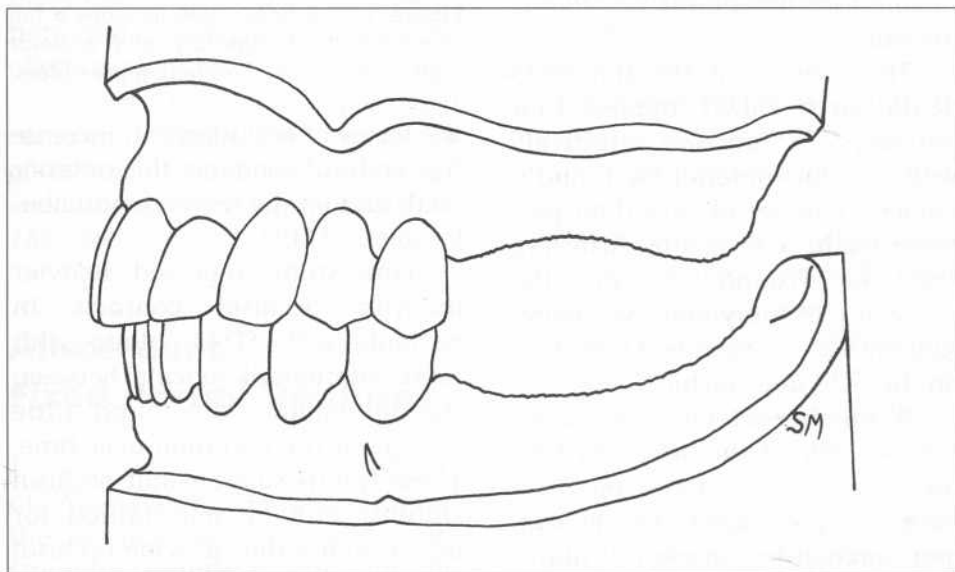
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The shortened dental arch treatment approach assumes that patients can function adequately with less than a full complement of teeth. (See *The Shortened Dental Arch*, inside.)

## Clinical Prosthodontics: A Literature Review

Half of today's knowledge base related to science and health care did not exist 10 years ago. With this rapid introduction of new information, it has become extremely difficult for dental practitioners to remain current. A comprehensive literature review article published in a peer-reviewed dental journal provides a concise source of knowledge on a specific topic that can be assimilated efficiently. This issue of *Prosthodontics Newsletter* examines a group of literature review articles related to clinical prosthodontics.

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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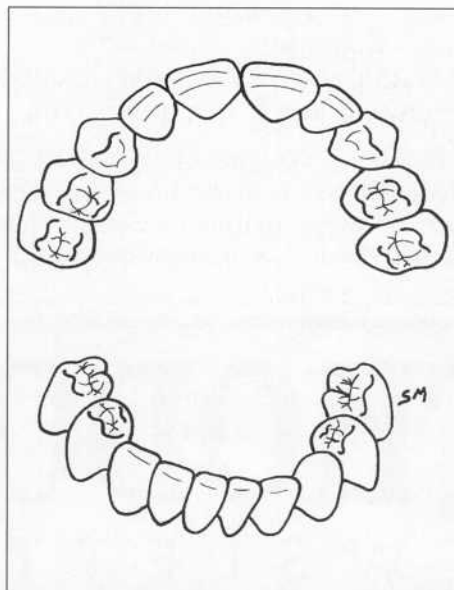
## The Shortened Dental Arch

The goal of prosthodontic treatment is the restoration of masticatory ability and efficiency, with the added requirement of preserving the health of the oral and cranio-facial tissues. Dentists commonly replace missing posterior teeth with artificial substitutes to improve masticatory function. Although the literature indicates that masticatory ability is directly related to the number and distribution of teeth, the minimal number of teeth required for acceptable function is unclear.

The concept of the shortened dental arch (SDA) implies that patients can function effectively with 12 intact anterior teeth and a reduced number of occluding posterior teeth. A review by Armellini and von Fraunhofer from the University of Maryland, Baltimore, summarized the pertinent literature on this SDA approach.

A number of clinical studies have evaluated the effects of progressive loss of posterior teeth on masticatory efficiency. Results suggest minimal impairment of mastication when 4 pairs of occluding premolars remain along with a full complement of anterior teeth (Figure 1). When there are <20 uniformly distributed occluding teeth, masticatory efficiency becomes compromised.

Masticatory efficiency is not the only factor when determining the optimal number of posterior teeth. Occlusal stability is another consideration. With loss of teeth, the remaining teeth are subject to migration and supra-eruption. Also, reduced posterior support to resist



**Figure 1.** The classic SDA includes a full complement of maxillary and anterior teeth with 4 pairs of occluding premolars.

the forces of occlusion can increase the occlusal load on the anterior teeth and on the temporomandibular joints (TMJs).

One study reported heavier anterior occlusal contacts in patients with SDAs, along with more interdental spacing between the premolars, but found little change in the occlusion over time. These results suggest that occlusal stability can be maintained for intact arches that provide occlusal support with 4 occluding pairs of premolars.

A study on the effects of SDAs on the TMJs reported a higher prevalence of joint sounds in patients with unilateral posterior occlusion and those who lacked all posterior teeth. Also, increased wear of the remaining teeth was observed in patients with SDAs compared with control patients. A finite element model analysis on forces directed to the teeth and TMJs in patients with SDAs suggested that occlusal forces on the teeth increased with loss of

molar occlusion, and forces on the TMJs decreased.

The authors of this literature review concluded that SDA therapy should be considered as a treatment option for patients with missing posterior teeth. They also suggested that this concept is especially well suited for implant prosthodontics when placement of posterior implants is impractical and for high-risk patients, such as those who are immunocompromised.

### Comment

The final factor in the applicability of the SDA for patients with missing posterior teeth is the comfort and well-being of the individual patient. The SDA will usually reduce the cost of treatment while providing adequate masticatory function. However, many patients display all or most of the facial surfaces of their maxillary first molars during normal smiling, and this factor alone may prompt patients to request artificial replacements at least to the first molars.

One study summarized in the literature review involved a questionnaire administered to dentists in the United Kingdom. This study suggested that patient satisfaction with SDA therapy was high but not universal. In the survey, 88% of the responding dentists reported the use of SDA therapy over a 5-year period, but 37% of these respondents who prescribed SDA therapy indicated that they were required to extend the length of the dental arches for some of their patients.

*Armellini D, von Fraunhofer JA. The shortened dental arch: a review of the literature. J Prosthet Dent 2004;92: 531-535.*

## Orofacial Pain and Occlusion

The dental profession's understanding of the relationship between occlusion and facial pain has improved over the last few decades. Many terms have been used to describe orofacial pain and dysfunction of the masticatory system. Commonly, the term temporomandibular disorders (TMD) is used to denote a group of signs and symptoms related to facial pain and stomatognathic dysfunction. At one time, occlusion was regarded as a primary causative factor for TMD.

Racich, a private practitioner from Vancouver, Canada, has published a literature review on the link between orofacial pain and occlusion. The article reviewed the classification as well as the anatomy and pathophysiology of pain. Evidence for the relationship between occlusion and TMD was also discussed. The author indicated that occlusion is an important consideration for quality restorative dentistry, prosthodontics and stability of the masticatory system.

The author also suggested that occlusion can contribute to TMD, although occlusal influences are not likely to represent primary causative factors. Because TMD is a multifactorial, musculoskeletal problem, other causes of facial pain should be ruled out before assuming that the occlusion is the primary etiologic agent.

### Comment

The author concluded that "occlusion can be a potential variable in orofacial pain, including TMD." However, he recommended that patients with orofacial pain

receive a multidisciplinary treatment approach.

Epidemiological studies have reported a correlation among some abnormal occlusal findings and TMD. Signs and symptoms of TMD have been positively associated with: (1) unilateral cross bites, (2) extreme horizontal overlap of the anterior teeth and (3) slides between centric occlusion (the occlusal contact relationship of the teeth when the mandible is in centric relation) and maximal intercuspal position (the best interarch fit of the occlusal surfaces of the teeth) that exceeded 2 mm. Nevertheless, these results only represent associations and do not prove a cause-and-effect relationship.

*Racich MJ. Orofacial pain and occlusion: is there a link? An overview of current concepts and the clinical implications. J Prosthet Dent 2005;93:189-196.*

## All-ceramic Fixed Partial Dentures

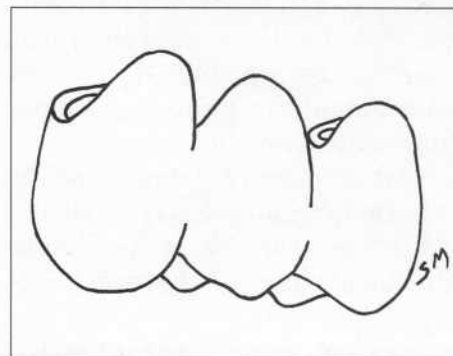
Raigrodski from the University of Washington, Seattle, reviewed the current literature related to high-strength ceramic systems for all-ceramic fixed partial dentures (FPDs). Systems discussed included: (1) lithium-disilicate glass (Empress II), (2) glass-infiltrated alumina (In-Ceram Alumina), (3) densely sintered high-purity aluminum oxide (Procera AllCeram), (4) glass-infiltrated alumina with 35% partially stabilized zirconia (In-Ceram Zirconia) and (5) yttrium tetragonal zirconia polycrystalline (Y-TZP) ceramics.

Improved esthetics would be the primary reason for selecting an all-ceramic system for the fabrication of an FPD; nevertheless, the conven-

tional metal-ceramic FPD has a documented long history of success as a durable and esthetic restoration. FPDs made entirely of ceramics have the potential to more closely mimic tooth structure, producing restorations with natural vitality and translucency.

The author reviewed a number of in vitro and in vivo studies on the various ceramic materials and concluded that there are no long-term studies of the clinical success of all-ceramic FPDs. The strongest material available to date is the Y-TZP-based ceramic material; however, some of these Y-TZP ceramic systems lack translucency, potentially defeating the advantages of an all-ceramic system.

The author concluded that there are many limitations to the all-ceramic FPD and suggested proceeding with caution until well-documented long-term clinical studies are available. Problems with most systems include the need for large connectors between pontics and retainers (Figure 2) and highly technique-sensitive clinical procedures, such as adhesive bonding of the FPDs. The newer Y-TZP ceramic systems can often be cemented with



**Figure 2.** Fracture in the connector area is a common cause of failure of an all-ceramic FPD. Connectors must be of sufficient dimension to provide strength to the FPD while providing a gingival embrasure.



conventional cementing procedures, simplifying the clinical application, and this feature of these Y-TZP systems appears to be a major advantage.

## Comment

The literature suggests that the strongest available material for all-ceramic FPDs is the Y-TZP-based ceramic core material. Perhaps these new ceramic systems will prove useful as frameworks for all-ceramic anterior 3-unit FPDs or perhaps posterior 3-unit FPDs replacing first premolars. However, additional clinical studies are needed.

*Raigrodski AJ. Contemporary materials and technologies for all-ceramic fixed partial dentures: a review of the literature. J Prosthet Dent 2004; 92:557-562.*

## Evidence-based Treatment Planning for Dental Implants

Dental implants have altered our approach to treatment planning, but implant-supported prosthodontics is not trouble-free. A review article that summarized the variables that may affect the success rate of dental implant treatment has been published by Wood and Vermilyea from Ohio State University, Columbus.

An analysis of systemic factors that could influence success of the osseointegration process for dental implants suggested that clear evi-

dence does not exist relative to absolute contraindications to implant dentistry.

When habits were considered, the literature indicated that smoking has been identified as a significant contributing factor in implant failure. Research has suggested that the impact of smoking is greater with maxillary implants compared with mandibular implants. One study recommended a protocol for implant placement in smokers whereby patients should cease smoking at least 1 week before implant surgery and for at least 8 weeks after implant placement.

Studies related to local host factors indicated that the most important predictor of success was the quality and amount of residual bone at the implant site and that the nature of the soft tissues at the implant site was less important.

When prosthetic design features were reviewed, the authors stressed the importance of treatment planning to ensure a biomechanically sound restoration. Because knowledge extracted from rigorous scientific studies of implant prosthodontics is lacking, often the dentist must rely on empiric principles extrapolated from experiences encountered with the restoration of natural teeth.

The authors made suggestions for future research and indicated that there was a lack of long-term studies of commonly used treatment techniques for various clinical situations.

## Comment

The osseointegrated implant system developed by Brånemark was brought to North America in the early 1980s. After approximately 20 years of application, this treatment method has been used for countless patients, and materials and techniques have improved dramatically.

Nevertheless, clear answers relative to the best materials and techniques for implant treatment are not yet available. When providing implant prosthodontic care, dentists must often use a common-sense approach combined with traditional prosthodontic methods that have been used successfully with conventional prosthodontics. Thorough knowledge, skill and understanding of traditional prosthodontic principles, together with comprehensive, multidisciplinary treatment planning, appear to be the best predictors of success for patients treated with implant-supported prostheses.

*Wood MR, Vermilyea SG. A review of selected dental literature on evidence-based treatment planning for dental implants: report of the Committee on Research in Fixed Prosthodontics of the Academy of Fixed Prosthodontics. J Prosthet Dent 2004;92:447-462.*

### NEXT:

- Ferrule configuration and fracture resistance of pulpless teeth
- Survival of various types of core restorations
- Implant strain associated with implant-supported FPDs

*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.*