Can partial dentures work in patients with a depleted dentition?

**Background**

The swing-lock denture is an excellent design for use in patients with a depleted dentition. Conventional partial dentures are often unretentive because claspig and bracing capabilities are limited, which results in an inability to resist rotational forces. The swing-lock design allows multiple teeth to be clasped, but this can lead to an unesthetic display of metal.

Partial dentures are designed to resist movement along a specific path of displacement (conventionally taken as perpendicular to the occlusal plane). In most cases, clasps, guiding planes and frictional contact of abutment teeth with the saddles will provide resistance to rotational displacement of the denture. However, in a patient with a depleted dentition and molar teeth on only one side, conventional claspig will often not prevent rotation and displacement of the denture away from the tissues.

The swing-lock denture provides retention and stability in clinical situations where the number of remaining teeth is insufficient for a conventional partial denture or the teeth are mobile. Swing-lock dentures may stabilize the remaining mobile teeth, but whether this effect lasts over the long term is unknown.

In view of the increased masticatory loads that are applied to the depleted dentition with a swing-lock denture, the remaining teeth should lack excessive mobility. No large-scale, long-term studies have investigated the success of the swing-lock design, but reports so far available indicate that most patients find this a well-tolerated and successful design.

**Management of the Issue**

A 61-year-old patient complained of inability to eat and continual discomfort with her present dentures. The patient had a history of heart and circulatory problems, including a leaky heart valve, and the anticoagulant warfarin had been prescribed. Oral examination revealed that only an upper left canine, premolar and molar were present (Fig. 1). These teeth were not mobile but had undergone severe periodontal bone loss (Fig. 2). A conventional cobalt chromium denture had been constructed, but it lacked retention and
The denture had caused visible dam lines in the palate. The patient smoked tobacco and was advised to stop.

The treatment options were discussed with the patient. One option was implant therapy, but the patient’s physician strongly advised against any surgery, and this option was therefore discounted.

Another option consisted of placement of a milled gold crown on the molar tooth and precision attachment on the canine crown to support a partial denture. In this way, parallel vertical surfaces would be provided to resist vertical and rotational displacement. However, the periodontal condition of the teeth was considered inadequate to support the additional masticatory load. This left the swing-lock denture as the only viable treatment option (Fig. 3).

Summary of Features (Table 1)

<table>
<thead>
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<th>Benefits</th>
<th>Contraindications</th>
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<tbody>
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labial sulcus or poor manual dexterity. Each of these conditions can affect the optimal design, the insertion of the denture or the rotational movement of the bar. It can be difficult to assess a patient’s manual dexterity, but inquiries about whether any of the patient’s hobbies require manual skills can give some indication. Prominent, fleshy frenal attachments can also limit placement of the bar. The swing-lock denture can be time-consuming to construct, and therefore expensive, but may be cheaper than implant therapy. As with any prosthodontic treatment, long-term success depends on good oral hygiene. Regular recall for maintenance (e.g., relining) and preventive advice is essential.

**THE AUTHOR**

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**Further Reading**


Do occlusal schemes and occlusal loading affect the survival of dental implants?

Background

The scope of prosthodontic treatment has been broadened considerably through the widespread application of osseointegrated dental implants. The predictable and stable anchorage for prosthetic tooth replacements afforded by implants has increased treatment options but has also made treatment planning and execution more complex.

The concepts about occlusion that underpin the use of implant-supported restorations have largely been extrapolated from natural-tooth or complete-denture occlusion because no convincing scientific or empirical theories of occlusion specific to implant-supported restorations have been proposed.

The literature relating to complete-denture occlusion indicates that various materials and various occlusal forms and arrangements have been used over the years, but the superiority of one particular occlusal form or arrangement has not been scientifically proven.

Management of Occlusion

Many authors have stated the need to avoid applying nonaxial forces to implants supporting prostheses. The absence of a periodontal ligament to support the implants and the observation that nonaxial forces will create areas of high stress concentration instead of uniform compression along the bone–implant interface are the main reasons for this concern.

However, the shape and surface texture of cylindrical endosseous implants make it impossible for a vertically applied load to be transmitted to the bone exclusively through compressive loading. It should also be recognized that occlusal forces are rarely vertical. Mastication is a side-to-side action that does not lend itself to axial loading of teeth or implants in the jaws.

Nonaxial loading of a mechanical device assembled with screw joints, such as an implant-supported prosthesis, puts those components at greater risk of failure through fatigue or recurrent loosening of screws. These mechanical failures can be observed clinically (Fig. 1) and have been reported in the literature, but the limited evidence available does not demonstrate any detrimental effect of nonaxial loading on the osseointegrated interface between the bone and the implant surface.

Numerous authors have written about the concept of progressive occlusal loading of dental implants, but the available evidence does not support this idea. Several studies have indicated that the type of occlusal material used does not affect the force transmitted through the prosthesis or implant to the surrounding bone. There is no published evidence that modifying the dimensions and occlusal contacts or anatomy of provisional restorations reduces loading of implant prostheses.

Full occlusal loading of an integrated implant at the time of abutment connection does not seem to be a problem. In fact, in some animal studies, purposeful overloading did not generate any deleterious effects on initial function. Extreme differences in tactile sensibility between natural teeth and implants, due to the lack of periodontal...
ligaments surrounding implants, have been demonstrated. Nonetheless, patients seem to have adequate masticatory function without the benefit of periodontal proprioceptive nerve endings around implants. Perhaps the presence of such nerve endings in the periosteum, the muscles of mastication, the oral mucosa and the temporomandibular joints compensates for those that are missing around dental implants (Figs. 2a and 2b).

Conclusions
There is little evidence to support a direct cause-and-effect relationship between occlusal factors and deleterious biological outcomes for osseointegrated implants. Evidence supporting specific occlusal theories for implant-supported prosthesis consists of expert opinion, in vitro studies and animal studies. In spite of a general lack of knowledge about the loading of dental implants, they have a high survival rate. *

Further Reading

On behalf of members of the Canadian Academy of Restorative Dentistry and Prosthodontics (CARDP), I would like to extend a cordial invitation to all dentists to attend this year’s annual meeting, from September 28 to 30 in Halifax, Nova Scotia. This year’s meeting will take place at the Halifax Marriott Harbourfront Hotel, a spectacular venue located adjacent to the Historic Properties in downtown Halifax.

Once again, CARDP will showcase its commitment to education and professional development. Dr. Michael Roda has assembled a comprehensive and stimulating scientific program with international status. There will be another strong showing from our sponsors, along with interesting topics in our table clinic program.

A hands-on, digital photography course featuring Rita Bauer, a senior medical photographer and educational media specialist at the University of Toronto, will be offered. This particular course has received rave reviews in the past.

The meeting’s social program includes a welcoming reception and buffet at the Maritime Museum of the Atlantic, the oldest and largest maritime museum in Canada; golf at the world class Glen Arbour golf course; a tour of Citadel Hill, Canada’s most visited natural historic site; a tour of the world’s second largest natural harbour; and a Lobster Ceilidh at Pier 21, a national historic site located on the Halifax waterfront. The President’s Gala will provide an elegant evening of fun on Saturday night to conclude the meeting.

Please come and enjoy yourselves at our annual meeting in Halifax. Visit our website for further details at www.cardp.ca.

Dr. Gorman Doyle
CARDP president

Dr. Thomas D. Taylor is professor and head of the department of oral rehabilitation, biomaterials and skeletal development, University of Connecticut School of Dental Medicine, Farmington, Connecticut. Email: ttdtaylor@ionline.uchc.edu.

Dr. Taylor’s session at the CARDP meeting is titled “Occlusion and dental implants: where’s the science.”

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JCDA is pleased to feature CARDP program speakers in this month’s “Point of Care” section. See pages 401, 403 and 405 for articles by Drs. Thomas Taylor, Clark Standford and Robert Roda.
What factors must be considered in planning placement of a crown supported by a single-tooth implant?

**Background**

The placement of dental implants has become a standard method for replacing missing teeth. Dentists considering this treatment modality should understand the vital role that planning plays in achieving predictable outcomes, especially in areas of the mouth where esthetic considerations are important. Various factors should be considered when planning for a crown to be supported by a single-tooth implant, and the potential for success with alternative therapies should be considered and discussed with the patient.

**Criteria**

Evaluation should start with a careful assessment of gingival health and architecture (both biotype and position), proximal contacts and tooth position (Fig. 1a). The volume of bone at the implant site must also be considered. Because peri-implant bone is continuously turned over by the body, at least 1.0 mm of cortical bone is needed on both the facial and the lingual sides of the implant to maintain hard- and soft-tissue function and esthetics. This often means that the implant is placed slightly to the palatal aspect of the ridge, especially in the case of an extraction socket. In addition, 2.0 mm of bone is typically required between the alveolar crest and the root apices on each side. The presence of resorptive clefts, undercuts or other bony or soft-tissue features could necessitate pre-implant osseous or soft-tissue grafting. Furthermore, in evaluating the existing dentition, be aware that it tends to be positioned more facial relative to the central axis of the alveolar ridge. Thus, the implant surgeon and restorative dentist should discuss the need for pre-implant site development.

Bone volume and resorption of the facial plate can also affect the type of crown (screw-retained or cement-retained) used for restoring the implant. For example, to create access in the cingulum area for a screw-retained crown on a central incisor implant, the implant must be placed in a more vertical direction than if a cemented crown is planned. If the facial plate of bone is resorbed, the apex of the implant could perforate the remaining cortical plate, which could necessitate osseous grafting before or at the time of implant placement. Consequently, removal of natural teeth before implant placement requires techniques to minimize the loss of the facial plate of bone.

Soft-tissue evaluation is critically important, especially for patients who show their teeth and gingival tissues while at rest or during speech produc-
tion. Patients with thick periodontal tissue biotypes typically have thick, flattened osseous plates that offer higher resistance to recession than is the case for patients with thin tissue biotypes. The size, shape, zenith and colour of the interdental papilla on adjacent and contralateral teeth are important. Surgical approaches that save or enhance tissue papillae, such as orthodontic extraction, peri-otome-based tooth removal and flapless implant placement, are preferred. Gingival response following tooth extraction and implant placement can be difficult to predict and should be discussed with the patient before treatment. In situations that pose a high risk for gingival recession, a screw-retained crown rather than a cemented crown may be considered. A screw-retained crown can be removed later and the contours modified without remaking the entire crown. In patients with thin biotypes, a ceramic abutment (e.g., yttria-stabilized tetragonal polycrystal zirconia) (Fig. 1b) or scalloped titanium abutments should be considered to facilitate ease of margin placement relative to the contours of the presenting gingival architecture (Figs. 1c and 1d).

The patient’s occlusion and occlusal scheme must also be evaluated. In maximum intercuspsation, the occlusal contacts should direct vertical loading down the long axis of the implant. Large lateral sliding contacts may create elevated bending or torsional loads that can lead to premature failure of the abutment or crown components. Patients who exhibit bruxing must be cautioned about the associated risks.

Limited vertical opening could pose a problem. The patient should be able to open 35.0 mm or more to allow access for surgical instruments during osteotomy otherwise implant placement location and angle could be in jeopardy.

Mesiodistal tooth size (and the size of the edentulous space) is an additional factor. The space size may need to be altered (for esthetic reasons) through pre-implant prosthodontic treatment. Care in evaluating the mesiodistal space of the central incisors (70% of the incisogingival dimension) and the presence of balanced and symmetric lateral incisors assist in obtaining a predictable result (Figs. 2a and 2b).

There may also be anatomic limitations, such as the location of the maxillary sinus or the contents of the neurovascular bundle. Some of these limitations can be altered through preimplant surgery.

Conclusions

The use of restorations supported by single-tooth dental implants has expanded dentists’ ability to provide predictable replacement teeth without resorting to conventional fixed prostheses. The ultimate outcome — the best possible functional and esthetic result — is determined by careful assessment of the patient and teamwork among the restorative dentist and his or her surgical colleagues.

Further Reading


How large should the apical diameter of the root canal preparation be?

**Background to the Issue**

The ideal endodontic preparation is a cleaned and disinfected continuously tapering funnel with the apical diameter kept as small as possible to prevent root-filling materials from entering the periradicular tissues. Not only should the canal be cleaned, but it must have a shape appropriate to receive the root-filling materials. Although there is significant disagreement among endodontic specialists about the ideal apical diameter of the root canal preparation, there is universal agreement that the ideal size of the apical preparation coronal to the apical constriction varies from tooth to tooth and depends on anatomic, microbiological and mechanical factors.

Understanding the anatomy of the root end of the tooth is critical to answering this question. The apical foramen is at the mouth of a wide funnel that tapers inward toward the apical constriction, which is commonly described as being located at the cementodentinal junction. Most canal preparation techniques describe the target working length (i.e., the apical opening) as extending to the apical constriction, but the apical constriction can be difficult to find as a landmark and in some cases does not exist as a discrete entity. The position of the apical opening is usually within 0.1 to 1.2 mm of the radiographic apex of the root (Figs. 1a and 1b), and the diameter of the opening will be a factor in determining the ultimate size of the apical preparation. The apical opening varies in diameter between 0.25 and 0.40 mm, which is the size of a #25 to #40 ISO tip instrument, such as a K file. Also, in many cases the apical opening is oval rather than round. Thus, to ensure removal of as much pulp tissue and remnants as possible, the apical extent of the canal should ideally be mechanically cleaned to the equivalent of at least a size #35 instrument. This seems to agree with research indicating that mechanical cleaning with larger files is better for removing bacteria from canals than cleaning with smaller instruments, although this finding has been disputed.

Overall, the literature consensus favours larger apical preparation sizes over smaller ones.

**Management of the Issue**

The use of irrigants, notably 6% sodium hypochlorite, is critical to the cleaning and disinfection of the canal space. Proponents of a smaller diameter for the apical canal frequently state that even if there has been no mechanical cleaning of the apical area, irrigants will clean the canal, thus permitting use of smaller file sizes. To allow for penetration of irrigants into the apical end (1 to 2 mm) of the preparation, however, an apical preparation diameter of 0.35 mm is needed, and increasing taper only seems to enhance cleaning when at .10 which is many times too large for curved canals. Thus, it seems that the minimum acceptable size for the apical preparation is that of a #35 K file (Figs. 2a and 2b).

Apical gauging has been advocated for determination of apical preparation size. This technique involves placing .02 taper nickel–titanium instruments with progressively larger tip diameter to the working length and then pushing them slightly beyond the constriction. The first file to bind at working length is considered to represent the apical diameter and, according to this technique, should be the final apical preparation size. One disadvantage of this technique is the potential for pushing infected debris from the canal into the periradicular tissues. As a technique for measuring apical

**Figure 1a:** Radiograph showing a working length file extending to the radiographic apex and apparently contained within the root canal.

**Figure 1b:** Photograph showing that the file in Fig. 1a actually extends beyond the apical foramen; the canal exits distant from the anatomic root end.
diameter, apical gauging may be inadequate if the canal apex widens abruptly just coronal to a very narrow constriction or if there is a significantly ovoid shape to the apical opening. Necrotic pulp remnants and bacteria may remain in an adequately gauged canal.

Instrumentation to apical size #35 and larger can be a difficult task in thin, severely curved roots, since many stainless steel hand instruments of that size cannot be placed to the apical extent of the canal without causing damage to the tooth (e.g., ledge formation or perforation). Several studies agree with the findings of the Toronto Study that there is no difference in clinical treatment outcomes between large and small preparation sizes. This congruence of results may relate to the use of hand instrumentation in all of these studies; the greater risk of canal aberrations with larger sizes could outweigh any positive effects of enhanced apical cleaning. This problem can usually be overcome by skilled application of one of many hybrid techniques using a combination of hand and nickel–titanium rotary instrumentation (Fig. 3).

It seems clear that the diameter of the apical preparation in any given case will vary with patient-specific factors, but it should probably never be smaller than a #35 instrument and in many instances should be larger. *

**THE AUTHOR**

Dr. Robert S. Roda is an adjunct assistant professor in the department of endodontics, Baylor College of Dentistry, Dallas, Texas. Email: azendo@aol.com.

Dr. Roda’s session at the CARDP meeting is titled “Keeping the tooth!: Endodontic possibilities vs. probabilities”.

**Further Reading**


