Dental implants have emerged as a significant tool for improving the prosthodontic foundation. Conventional removable partial dentures, like conventional complete dentures, suffer from functional instability and may contribute to the deterioration of the very foundation they so rely upon. Strategic incorporation of a minimal number of dental implants has been shown to benefit prosthesis stability, functional capacity, and patient comfort and satisfaction. This issue of Prosthodontics Newsletter takes a look at the evidentiary basis for potential prosthodontic foundation improvements that will assist practitioners in their treatment planning of dental implants to aid patients seeking removable partial denture therapy.

To achieve acceptable chewing and speech ability, along with adequate esthetics and patient comfort, practitioners must facilitate standardized and simplified protocols. Researchers have noticed a decrease in the use of complete dentures and an increase in the use of fixed partial dentures (FPDs) and removable partial dentures (RPDs).

To evaluate the long-term outcomes of implant-retained RPDs, Bortolini et al from the University of Modena and Reggio Emilia, Italy, presented an economical and effective treatment option. A group of 32 patients (18 men, 14 women) who already wore traditional RPDs received implant-retained RPDs and could therefore comment on the differences between the treatments. Each patient received 1 to 4 implants, for a total of 64. During the 8-year follow-up, 4 implants failed. Mean patient satisfaction (measured on a scale of 1 to 5) increased from 1.31 ± 0.43 at baseline to 4.59 ± 0.47 at 1 year.

The prosthetic and biomechanical characteristics of implant-retained RPDs include load distribution enhancement; posterior rotational (continued on next page)
Dental Implants to Retain Removable Partial Dentures (continued from front page)

axis; shorter distal extensions; rotational potential of distal extension; further enhancement of biomechanical system by use of guide planes and proximal parts of the framework; and ability to use different retention types.

During the 8-year study period, annual follow-ups were conducted to measure patient satisfaction, implant survival and prosthetic success. Overall, patient satisfaction systematically increased, while the implant success rate was 93.75% and the prostheses success rate was 100%.

Comment
While traditional RPDs are optimal for patients who refuse or cannot afford major surgery, implant-retained RPDs offer an intermediate solution that reduces economic and biologic costs while keeping the ease of RPD procedures and benefits of implant treatment.


Distal Implants For Removable Partial Dentures

The number of partially edentulous individuals has increased due to better preventive oral health policies and an increase in the average lifespan. The most commonly used prosthetic treatment for these individuals, removable partial dentures (RPDs), better maintains tooth structure and oral hygiene, replaces a larger number of teeth and is less expensive compared with tooth-retained fixed partial dentures (FPDs). Implant-retained and -supported RPDs provide vertical stabilization for the removable prosthesis and limited rotational movements.

Gonçalves et al from the University of Campinas, Brazil, evaluated patient satisfaction following the use of distal implants to retain and support RPDs. Among a group of patients scheduled to receive implant-retained FPDs in the mandibular arch, 12 volunteers (8 women, 4 men; mean age, 62.6 ± 7.8 years) agreed to receive an RPD supported by distal implants and ball attachments. Participants were required to be completely edentulous in the maxillary arch and partially edentulous in the mandibular, with only canines and incisors.

The patients completed a 13-item questionnaire assessing their satisfaction after 8 weeks of conventional prosthesis use. Implants were then inserted bilaterally into the mandibular posterior region; after 4 months, ball attachments were placed on the implants and on the acrylic resin base of the RPD. Clinical and image examinations were performed after 2 months of implant-supported RPD use. At that time, patients reported significant improvements (p < .05) in comfort, retention, masticatory capacity and speaking ability.

Comment
Although limited by the small number of participants and the short follow-up period, this study confirmed the effectiveness and feasibility of an implant-retained and -supported RPD option to improve prosthesis performance, increase patient satisfaction and offer a less-expensive option compared with an implant-supported FPD.


Nutrition and Implant-retained Removable Partial Dentures

Evidence suggests that removable denture wearers are at risk for nutritional imbalance. To address dental prosthesis concerns, patients often modify their diet in various ways. Little data exist describing the impact of oral rehabilitation on nutrient intake in partially edentulous patients.

To measure the swallowing threshold and nutrient intake in partially dentate patients, rehabilitated first by conventional removable partial dentures (RPDs) and then by RPDs over posterior implant retainers and ball attachments, Campos et al from the University of Campinas, Brazil, conducted a clinical study. Patients included in the study

➤ were totally edentate in the maxilla and partially dentate in the mandible
➤ displayed adequate bone volume and height for implant insertion in the mandibular molar region without bone augmentation
displayed no signs or symptoms of temporomandibular disorder or parafunctional habits. Due to exclusion factors, only 8 patients (2 men, 6 women; mean age, 60.2 ± 6.6 years) were included in the final sample. Following a 2-month adaptation period with the new prosthesis, patients underwent cone-beam computed tomography and were evaluated as to swallowing threshold parameters and nutrient intake. After 4 months of healing, standard ball attachment retainers (2.25 mm and 4.0 mm) were added to the implants and used for 2 months, at which time variables were measured again; patients showed an increased intake of energy, carbohydrates, protein, calcium, fiber and iron (Table 1). Implants with ball attachments retaining an RPD resulted in a smaller swallowed median particle size and improved nutrient intake.

**Comment**

This study may be considered limited due to a small sample size; thus, further studies with a larger cohort and longer-term evaluation are suggested. It is imperative to pair oral rehabilitation with nutritional counseling for healthier eating habits.


### Improving Oral Health For Edentulous Patients

For partially edentulous patients, complete or partial dentures are often required. Treatment options for dental rehabilitation include removable partial dentures (RPDs), fixed partial dentures (FPDs), and implant-supported crowns or FPDs. The major complaints associated with RPDs include problems with fit, mastication, retention and comfort. It has been hypothesized that using implants to retain RPDs may increase stability, provide support and maintain alveolar bone in a cost-effective manner.

Limited information exists about the impact of implant-retained RPDs on patients’ satisfaction and oral-health quality of life (OHQoL). Therefore, Gates et al from the University of North Carolina School of Dentistry conducted an open, prospective, time series clinical trial to evaluate the change in OHQoL 1 year after incorporating short implants with RPD therapy. The study included 17 patients (mean age, 61.5 years), each receiving conventional RPD treatment followed by implant-supported RPD conversion. OHQoL improved significantly over baseline 6 weeks after patients received conventional RPDs; it also significantly improved 12 weeks after receiving implant-supported RPDs. One 6-mm implant failed early and was replaced; the overall implant survival rate was 97%.

**Comment**

Despite being limited by a 2-year follow-up period, this study indicates that converting an RPD to an implant-supported RPD makes a

### Table 1. Dietary intake assessment of patients using conventional RPDs and RPDs retained by implants and ball attachments (*n* = 8)

<table>
<thead>
<tr>
<th></th>
<th>Conventional RPD</th>
<th>RPD retained by implants and BA</th>
<th>95% CI</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal/day)</td>
<td>1333.46</td>
<td>1746.86</td>
<td>1159.14–1712.81</td>
<td>1415.74–2484.56</td>
<td>.008</td>
</tr>
<tr>
<td>Fat (g/day)</td>
<td>31.99</td>
<td>45.74</td>
<td>27.45–44.92</td>
<td>33.76–61.31</td>
<td>.195</td>
</tr>
<tr>
<td>Carbohydrates (g/day)</td>
<td>175.00</td>
<td>270.73</td>
<td>141.17–229.67</td>
<td>223.43–356.26</td>
<td>.016</td>
</tr>
<tr>
<td>Protein (g/day)</td>
<td>75.38</td>
<td>88.42</td>
<td>62.37–86.95</td>
<td>73.40–120.06</td>
<td>.023</td>
</tr>
<tr>
<td>Calcium (mg/day)</td>
<td>227.24</td>
<td>481.25</td>
<td>212.63–331.19</td>
<td>364.84–553.15</td>
<td>.008</td>
</tr>
<tr>
<td>Fiber (g/day)</td>
<td>15.32</td>
<td>27.00</td>
<td>12.78–25.13</td>
<td>15.74–45.71</td>
<td>.016</td>
</tr>
<tr>
<td>Iron (mg/day)</td>
<td>6.50</td>
<td>8.40</td>
<td>4.73–8.31</td>
<td>6.55–12.04</td>
<td>.016</td>
</tr>
</tbody>
</table>

Wilcoxon signed rank test applied. BA, ball attachment; CI, confidence interval.

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significant and positive improvement on a patient’s OHQoL. When treating Kennedy class I and II patients, practitioners should consider an implant-supported RPD as a possible rehabilitation option.


Removable Partial Dentures: Dislodging Forces

High-quality prosthetic services are in high demand due to the increasing proportion of elderly individuals retaining their natural teeth. While conventional removable partial dentures (RPDs) offer an esthetic and comfortable option, implants can also offer various benefits.

An implant-assisted RPD may use conventional clasp systems for retention. To compare maximum dislodging forces of distal extension mandibular implant-assisted RPDs with 2 different attachments and 3 clasp designs, Gharehchahi et al from Mashhad University of Medical Sciences, Iran, conducted an in vitro study.

A simulated Kennedy class I partially edentulous mandible was prepared with 2 metal-ceramic crowns on distal abutments and 2 screw-type implants (3.75 mm × 12 mm) in the first molar regions. Five prostheses had a suprabulge (circumferential) clasp; 5 had an infrabulge (T-bar) clasp; and 5 had no direct retainer. Each clasp design was paired with either a Locator attachment or an O-ring attachment. A universal testing machine performed 4 types of retention pulls (main, anterior, posterior and unilateral) 5× on each specimen. The lowest recorded retentive values were found in the prostheses with O-ring attachment and no clasp (6.70 ± 1.02 lb), while the highest main-pull retentive values were recorded for prostheses with Locator attachment and suprabulge and infrabulge clasps (22.99 ± 6.10 lb and 21.38 ± 3.64 lb, respectively; Figure 1).

Comment

The results of this study suggested that the clinical success of mandibular implant-assisted RPDs may be affected by the precise selection of attachment and clasp assembly. The Locator attachment and infrabulge clasp offered the most predictable results.


In the Next Issue

Modern-day considerations for complete denture impressions

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.

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