

# Removable Partial Dentures and Strategic Implant Placement

**Charlotte Stilwell** assesses the strategic use of implant overdenture abutments with removable partial dentures

**M**issing teeth have an enormous impact on psychosocial and physical wellbeing. As dentists, we have an important role in helping afflicted individuals improve their quality of life.

Conventional fixed and removable prosthodontic solutions are increasingly assisted by the strategic advantages that implant therapy can offer. There has been consensus agreement since 2002 (Feine et al, 2002) that a complete denture retained by two implants should be regarded as the minimum standard of care for the edentulous mandible. Equally, for replacement of a single anterior tooth with adjacent virgin teeth neighbours in an otherwise sound dentition, an implant-supported crown is considered the evidence-based option of choice (Pjetursson and Lang, 2008).

These two examples represent the extremes in the edentate spectrum. They also represent fairly clear-cut indications in favour of implant assistance. This is not always the case.

Prosthodontic treatment planning is a multifactorial exercise in addressing and satisfying the wishes and needs of the individual patient. The best option in some cases may therefore not be a choice between conventional and implant assisted options. It could also include a combination of options. A particular and emerging example of such prosthodontic combinations is the indication for the strategic use of implants in the prosthodontic area of removable partial dentures (RPDs).

This article will discuss the treatment planning principles for RPDs in general and the advantages that may be offered by combining RPDs with implant therapy.

## **RPDs: A grey area in dentistry**

RPDs are traditionally associated with lower patient satisfaction and a potential negative impact on oral health.

The biological risks to the remaining dentition in general and to abutment teeth, in particular with



Fig. 1a



Fig. 1b



Fig. 1c

Figures 1a, 1b and 1c: Each partially edentulous dentition is unique and represents its own professional challenge for an effective RPD solution



Figure 2: This dentition has only one pair of occluding premolars. This opens a prosthodontic choice between rehabilitation by upper and lower RPDs and a shortened dental arch concept with replacement of the missing three pairs of premolar units

ensuing tooth loss, is extensively documented in the literature.

RPDs also represent a particular professional challenge. Each partially edentulous dentition is unique (Figures 1a-c) and requires bespoke design and construction for the RPD to be really effective and acceptable.

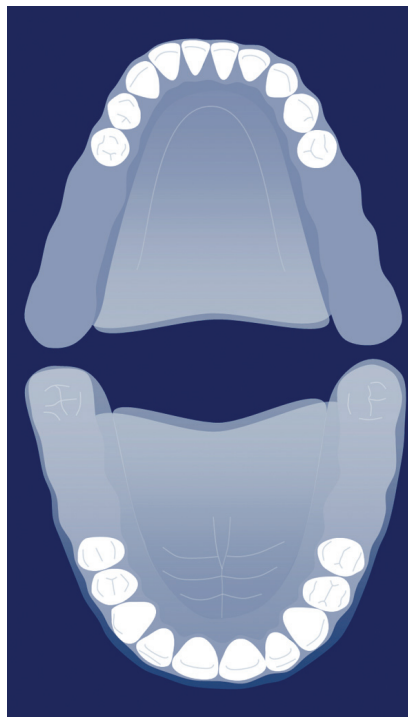
In the RPD situations with free-end saddles it also requires an understanding (on the part of both clinician and dental technician) of how best to compensate for missing strategic tooth support.

The difference in resilience between teeth and soft tissues must be reconciled to achieve a functional and stable RPD. RPDs may be seen as the economical prosthodontic solution, but they remain a mainstay of prosthodontic care for partially edentulous patients. If appropriately designed, they can be a comprehensive, effective and successful prosthodontics rehabilitation (Lynch, 2012).

### RPD indications

A literature review from 2005 (Wostman et al, 2005) concluded that there were no evidence-based indications per se. The published literature only offers limited treatment planning principles to assist clinical decision making for RPDs.

Figure 3: The shortened dental arch concept is illustrated here with 10 upper and 10 lower teeth and a posterior occlusion made up by the four pairs of opposing premolars



In support of choosing RPDs, the literature lists the presence of sound abutment teeth and/or the need for lower cost prosthodontic solutions.

Against RPDs are the presence of individual risks factors for biological complications, caries and periodontal disease, and lack of patient acceptance.

A particular contraindication for RPDs is the presence of – or potential for (Figure 2) – a sound and stable shortened dental arch occlusion (SDA) (Kaeser, 1989) (Figure 3).

In patient cases where an SDA configuration will provide adequate aesthetics and function, the SDAs have been shown to perform well and last in excess of 27 years (Gerritsen et al, 2013).

Additional replacement of missing posterior teeth with free-end saddle RPDs is not recommended for these cases.

### Prosthodontic advantages of conventional RPDs

In spite of the limited literature support for RPDs, there are undoubtedly clinical situations where RPDs are both indicated and able to offer significant advantages over other options. Based on empirical experience these include (Stilwell, 2010):

1. **Design versatility.** In the presence of teeth with a guarded prognosis the RPD can be designed with addition of these in mind. Equally, in the event of mobile teeth, the RPD can serve as a semi-permanent splint. This is illustrated in Figure 4.
2. **Replacement of lost hard and soft tissue contours.** A carefully constructed and tinted RPD acrylic flange can make up for missing volume in the alveolar process. This also allows the RPD teeth to emerge in harmony with the remaining natural teeth as seen in Figure 5. This is a non-invasive and, in some cases, more predictable alternative to surgical hard and soft tissue augmentation procedures

3. **Strategic use of overdenture abutments.** For teeth that have an unfavourable crown to root ratio a reduction to gingival level can improve their prognosis. As overdenture abutments they will still provide valuable support and thereby be of strategic value to avoid free-end saddles. They can also provide retention for the RPD; an example is seen in Figure 6.

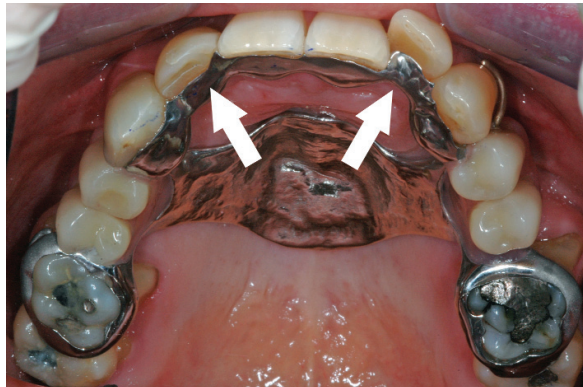


Figure 4: A cast framework has been designed to act as a semi-permanent splint for the upper anterior teeth and also provide future means of addition of the two upper lateral incisors



Figure 5: A carefully constructed and tinted RPD acrylic flange can make up for missing volume in the alveolar process. It also allows the RPD teeth to emerge in harmony with the remaining natural teeth

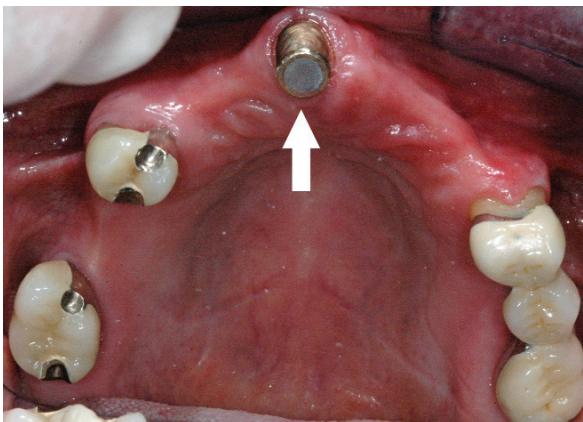


Figure 6: The upper right central incisor had an unfavourable crown to root ratio. Reduction to an overdenture abutment has turned it into a strategic point of both support and retention for an upper RPD

Figure 7: A bilateral free-end saddle situation in a mandible where placement of an implant in the molar regions can offer strategic support and or retention for an RPD

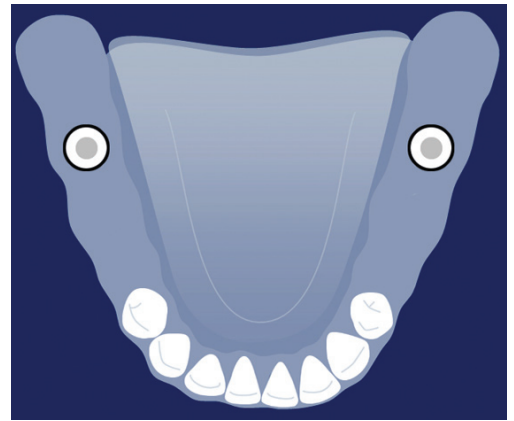


Figure 8: A single implant acting as an overdenture abutment for a unilateral RPD saddle can offer significant support for an RPD and a simple, effective and economical prosthodontic solution overall



Figure 9: A single strategic implant in the upper left canine site provides strategic retention for the patient's RPD. There is also an aesthetic advantage in the retention being hidden under the denture saddle

## Combining implants and RPDs

Similar to the support and retention that can be offered by teeth converted to overdenture abutments, there is emerging evidence that strategic implants can serve the same purpose.

Two separate literature reviews (Shamiri and Atieh, 2010; de Freitas, 2012) have evaluated the effect of this type of implant assistance for uni- and bilateral free-end saddle RPDs (Figure 7).

The reviews looked at patient satisfaction, implant survival rates and prosthetic complications and maintenance. Both reported limited but positive and promising evidence for a definite increase in patient RPD satisfaction.

The data also indicated high implant survival rates and complications and maintenance that were comparable to those of conventional RPDs in general.

As such, both reviews concluded that strategic use of implants for support and/ or retention has great promise as a valuable advantage for free-end saddle RPDs and as a simple, economical and less invasive prosthodontic treatment option for rehabilitation of the partially edentulous patient (Figure 8).

### Implant indications for RPDs

The implant indications can be divided into the assistance they lend specifically to RPDs and the advantages they can offer for forward prosthodontic planning.

- **RPD assistance**

This includes improvement of support, retention and aesthetics. An example of support is seen in Figure 8. A combined example of assistance with retention and aesthetics can be seen in Figure 9: a single strategic implant in the upper right canine site provides hidden but strategic advantages for the patient's RPD.

- **Forward prosthodontic planning**

This includes ridge preservation, single tooth replacement and gradual conversion to complete removable denture (CRD).

The loss of a natural tooth is followed by an atrophy of the related alveolar process (Van der Weijden et al, 2009). In turn this atrophy is likely to be further aggravated by the pressure of a soft tissue supported RPD saddle. The extent of this atrophy can be reduced if not arrested by early recognition and placement of an implant in the



Figure 10: Kennedy classification Class III with potential strategic tooth support in each corner provided by the two molars and two first premolars

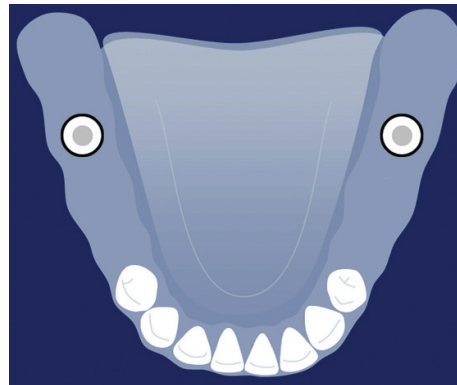


Figure 11: Kennedy classification Class I bilateral free-end saddle situation where an implant has been placed in each molar region to regain the strategic advantages of a class III configuration



Figure 12: Kennedy classification Class II unilateral free-end saddle situation where an implant has been placed in the left molar region to regain the strategic advantages of a class III configuration

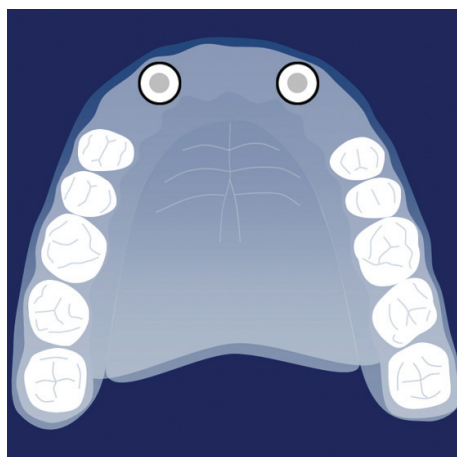


Figure 13: Kennedy classification Class IV anterior saddle situation where one or two implants would improve on the tooth configuration and provide specific anterior support and retention

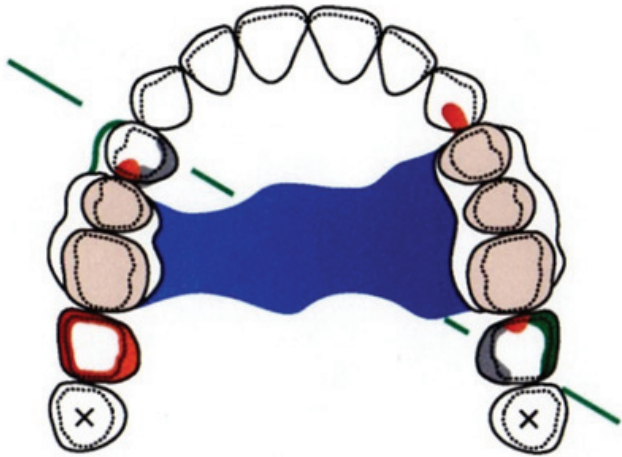


Figure 14: An example of an RPD for Kennedy class III situation. The RPD is supported in each corner of the design by rests (red). Clasps (green) are planned for the upper right premolar and upper left molar. Together they form a clasp axis (dotted line), which, in combination with anti-rotation provided by the other two corners of support, ensure overall effective retention of the RPD

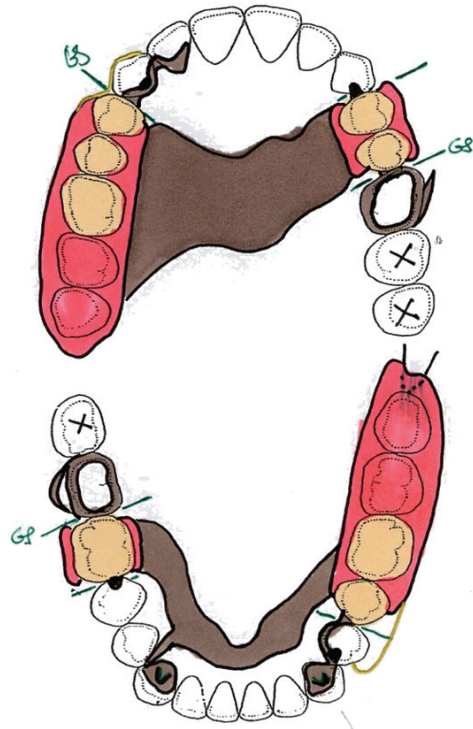


Figure 15: Hygienic design prescription demonstrating the desired RPD gingival clearance of both abutment and non-abutment teeth

tooth site. A delayed realisation may lead to a need for bone augmentation.

In a new patient the clinical situation may not yet be suitable for implant placement. If so, the option of future implant placement can be facilitated by either maintaining the tooth in the short term as an overdenture abutment or by performing a ridge preservation procedure at the time of tooth removal.

### **Strategic implant configurations for RPDs**

For the planning of implant assistance for RPDs it is helpful to consider the optimal RPD situation.

The Kennedy classification is often used to describe partially edentate configurations. The optimal choice in this classification is a class III where the RPD can derive support and or retention from a tooth in each corner of the design; this situation is illustrated in the diagram in Figure 10.

In the class I bilateral free-end saddle, class II unilateral free-end saddle and class IV anterior saddle seen in Figures 11-13, the implants would take the place of the missing strategic teeth and convert the three examples back into class III.

In planning for a gradual conversion to a CRD it would seem sensible to aim for the recommended minimum implant configurations for full edentulous arches. The current recommendations are a minimum of two implants in the mandible and four implants in the maxilla (Gallucci et al, 2014).

### **General considerations for implant therapy**

The general treatment planning principles for implant therapy in combination with RPDs also apply to these indications. These include:

- **Risk factors**

In common with treatment planning for implant therapy in general, the patient's social, medical and dental risk factors in remaining dentition should be considered. Risks posed to the outcome of implant therapy by, for example, smoking, diabetes



Figure 16: The denture teeth on either side of the natural upper left canine are shaped as bridge pontics. This allows clearance of the marginal gingiva of the adjacent teeth



Figure 17: The interdental space above the contact point between natural tooth abutment and first denture tooth allows insertion of an interdental brush. This assists effective cleaning of the distal aspect of the natural tooth

and periodontal disease may outweigh any strategic benefit.

History of previous implant complications with peri-implantitis or implant loss together with the patient's motivation and ability to care for the implant, remaining natural teeth and RPD are also important. Specific instruction and support may be needed for the elderly RPD patient.

- **Suitable conditions for implant placement**

The atrophy of the edentulous alveolar processes in most long-standing RPD patients preclude



Figure 18: A strategic implant replacing the upper right canine has been fitted with a resilient locator attachment

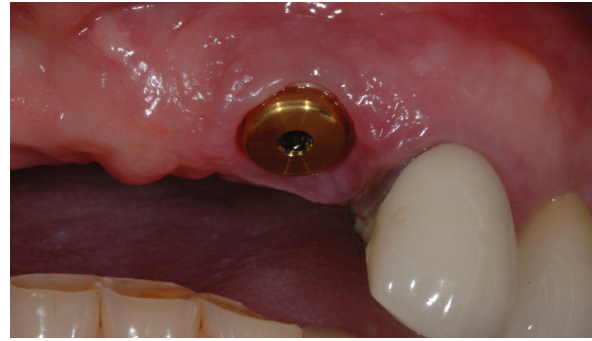


Figure 19: Strategic implant replacing upper left lateral incisor has an abutment with a blank for use with a magnet attachment

adequate bone volume for safe placement. Early recognition prior to or soon after loss of an abutment tooth is therefore important to ensure that adequate hard and soft tissue conditions still exist.

The continuing improvements in implant surfaces and alloys may allow use of reduced diameter and/or shorter implants for the RPD indications, but the evidence for these options is limited at present.

- **Hygienic and effective RPD design**

The literature support for biomechanical RPD principles is at best ambivalent. However, it would seem logical that an RPD design should take advantage of the scope for tooth support and retention. An example of this for a Kennedy class III configuration can be seen in Figure 14 with appropriate use of rests and clasps (Stilwell, 2010).

By contrast, there is definite evidence that open hygienic RPD design can be of benefit to long-term health of teeth and soft tissues (Owall, 2002; Rehmann et al, 2013).

The denture components need to be designed, as seen in Figure 15, to reduce risks of tissue injury as well as providing gingival clearance.

In the upper and lower RPD examples shown, the major connectors are kept away from both abutment teeth and non-abutment teeth and there is an interproximal space below the contact points between the first denture tooth and the neighbouring natural abutment tooth (Figure 16). The first denture tooth is shaped as a bridge pontic to mimic a natural interproximal space. This also allows access for interdental brushes even when the denture is in situ (Figure 17).

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Figure 20: Upper RPD with one unilateral using free-end saddle (class II). The RPD is a molar and the two canines for support and retention via crowns incorporating precision attachments



Figure 21: Strategic implants placed to provide for loss of the upper canine RPD abutments and upgrade the RPD abutment configuration overall to a Kennedy class III situation

- **Implant prosthodontic options**

A multicentre study (Wismeijer et al, 2013) reported significant improvement in patient satisfaction between a conventional Kennedy class I mandibular RPD and the same RPD supported by single strategic implants placed under each free-end saddle.

Initially, traditional healing caps provided the support. A further significant increase in patient satisfaction was recorded when the healing caps were replaced by retentive anchors (ball attachments).

There are a range of attachments available; these include other types of retentive anchors and magnets (Figures 18 and 19). The choice of attachment is determined by the same factors that apply to any overdenture situation: space requirement; degree of desired retention; ease of use and cleaning; cost.

### **Patient example**

A partially edentate patient was first provided with an RPD in 1979. At the time, she only had seven upper natural teeth of her own. The extensive tooth loss at the early age of 32 had both shocked and motivated her to adopt optimal oral hygiene and this was maintained forthwith.

The upper RPD had one unilateral freeend saddle (class II) and used a molar and the two canines for support and retention via precision attachments.

The RPD was successfully replaced in 1994 and after a further 16-year period replacement was considered again in 2010.

At this point, concerns were arising about the longevity of the upper three precision attachment abutment teeth.

Strategic implant placement was agreed to provide for eventual loss of the upper and lower RPD abutments and at the same time to carry forward the long-standing RPD abutment configuration. It was further agreed to also place an additional strategic implant in the upper left molar region to convert the upper RPD configuration to a class III.

The implant situation can be seen in Figures 20 and 21 at the five-year follow-up in 2015.

### **Summary and conclusions**

This article has addressed the specific indications for strategic use of implants to provide support and retention for RPDs.

There is emerging evidence that use of implants in this way offers positive functional and aesthetic benefits and a significant increase in patient RPD satisfaction. The literature also suggests that it is a simple, economical and less invasive use of the implant treatment modality.

The article suggests that the specific planning principle for use of strategic implants in combination with RPDs is to preserve or convert Kennedy class I, II and IV situations to more favourable class III configurations. The article also explains that conventional prosthodontic and implant planning principles and considerations still apply. ■

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