The Swing-lock Removable Partial Denture in Clinical Practice

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Abstract: The authors of this article consider that the swing-lock partial denture has a useful place in contemporary clinical dental practice and offers many advantages compared with conventional removable partial dentures in terms of retention and stability, especially in the extremely compromised dentitions. Here they describe the concept of the swing-lock removable partial denture, together with the indications, contraindications, technical and clinical considerations.

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Clinical Relevance: The swing-lock concept offers a way of maximizing the retention and stability of a removable partial denture and may be very useful in restoration of the extremely compromised dentition. It offers a practical solution to very challenging clinical situations.

Missing teeth can often be successfully replaced with removable partial dentures (RPD) over relatively long periods of time, as confirmed by longitudinal clinical studies. However, a significant proportion of patients do not wear the RPD that have been constructed for them. A variety of reasons have been proposed for this, although failure to wear RPD is commonly related to lack of retention and stability, discomfort or appearance—especially where there are few remaining teeth, in distal extension situations and where anterior teeth are not being replaced.

In many cases patients can function satisfactorily without replacement of all their missing teeth even when an extremely shortened dental arch of only 10 functioning pairs of teeth remains. It may be preferable not to attempt to replace all missing teeth in patients at high risk of continuing periodontal breakdown and carious attack. However, drifting and over-eruption of teeth may result in occlusal interferences, trauma to soft tissues and food impaction. Combination syndrome may occur, in which a few natural lower anterior teeth destabilize a maxillary complete denture and cause accelerated alveolar resorption in the premaxillary area.

An alternative approach to conventional RPD design was first published by Simmons, who described the swing-lock removable partial denture. Multiple applications have been described but the concept has not been widely adopted. The aim of this paper is to evaluate the place of the swing-lock removable partial denture (SLRPD) in contemporary clinical dental practice, describing the construction and successful clinical application.

**Figure 1.** Mandibular SLRPD retained by I shape struts locked into the labial undercut of remaining anterior teeth. (a) Try-in of metal framework just before closure of latch. (b) The completed prosthesis in place.
considerations). They should be placed on sound enamel or metallic restorations if possible, although where dentine is exposed it is recommended that a T shape be used to spread the contact with the tooth surface and avoid undue tooth wear. The number of struts will depend on the number and quality of remaining teeth. Fewer struts can be used to improve aesthetics as it is not essential to contact every tooth (Figure 3). The arc of closure of the labial bar requires consideration with respect to the interferences that can occur in long bars as and where teeth are imbricated. The lingual plate should extend above the survey line of the abutment teeth for increased stability and load distribution, although coverage may be reduced to a minimum of those teeth contacted by the labial retentive struts (Figure 3). Ideally the hinge and latch mechanisms should be placed one tooth distal to the terminal abutments to allow placement of the first prosthetic teeth and their effective masking within the acrylic denture base (Figure 4), although this is not always possible due to the potential for interferences with the arc of closure of the labial bar.

In other respects the basic principles for RPD design should be followed: these include a rigid major connector, support from occlusal/cingulum or incisal rests and bracing from the teeth that are contacted by the prosthesis. Guide planes are important, especially on the tooth surface adjacent to the edentulous areas. In a distal extension situation full extension of the base over the denture-bearing area should be achieved. Rotational forces should be limited by gaining good support from the edentulous ridge using an altered cast technique. Tooth support should be obtained where possible in order to avoid soft-tissue impingement, despite early reports to the contrary.

**INDICATIONS**

The SLRPD may be used in a number of situations.

**Missing Key Abutment Teeth**

The device is useful if key abutment teeth are missing, for example when the loss of a canine tooth leaves a lateral incisor as the terminal abutment. The SLRPD may be used in these large free-end saddle situations to maximize the potential for retention and stability of the few remaining teeth (Figure 1). The labial bar/lingual plate design can use all the remaining teeth more effectively than conventional RPDs which commonly have inadequate retention and stability and are prone to overload the abutments or soft tissues in these circumstances.

**Reduced Bone Support**

Where the available abutment teeth have reduced bone support as a consequence of periodontal disease they may not be able to support a conventional RPD but after effective periodontal therapy it may be possible to use a SLRPD. This can stabilize the remaining teeth and distributes loads to all of them, rather than to just a few vulnerable abutments. This represents a kind of ‘halfway house’ between a conventional RPD and a complete overdenture. It may hence be possible to avoid extractions, endodontics and overdenture construction or complete dentures indefinitely in some cases.

**Unfavourable Tooth Contour**

If terminal abutment teeth have unfavourable contours that do not allow a retentive RPD to be constructed it is possible to use a SLRPD that engages the undercuts of abutment teeth further away from the edentulous saddles. Embrasure undercuts may be used as well as the more conventional buccal undercuts.

**Unilateral Abutments**

Where only unilateral abutments remain it can be very difficult to construct a retentive and stable RPD due to the rotational forces exerted on the prosthesis. A swing-lock design overcomes this problem.

**Gingival Recession**

In cases of treated periodontal disease there is often a significant degree of gingival recession. The ability of an SLRPD to incorporate an acrylic labial veneer may be used to mask the gingival recession effectively and improve appearance (Figure 5).

**The Retching Patient**

In patients with an exaggerated retching reflex, use of an SLRPD may allow excellent retention and stability despite having minimal palatal coverage of the maxillary major connector (Figure 6).
Maxillofacial Defects
In the rehabilitation of patients with maxillofacial defects the SLRDP can be used very effectively to gain the required retention and stability, especially after ablative surgery for neoplastic disease (Figure 7). In these cases significant hard and soft tissue of the maxilla and mandible may be lost and the remaining tissues considerably distorted.

Economics
The cost of a complex conventional fixed restoration or an implant-assisted prosthesis may be prohibitive for many patients. An SLRDP compares favourably with these options although it is relatively more expensive than a conventional RPD.

Provisional Prosthesis
During a period of re-evaluation after the initial phase of treatment the SLRDP may be useful where the fate of some teeth are uncertain, as it is relatively easy to add teeth to it if further extractions are required.

RELATIVE CONTRAINDICATIONS
However, the SLRPD is not of value in all cases, as demonstrated by the following situations.

Poor Oral Hygiene
Patients who do not respond to oral hygiene instruction and do not achieve reasonable levels of oral hygiene are poor candidates for restorative treatment in general—and certainly for the extended tissue coverage which forms part of the design for a SLRDP.

Poor Manual Dexterity
Patients with very poor manual dexterity may have problems in opening and closing the lock mechanism. However, with practice most patients manage well—and for those with continuing problems it is possible to make a custom-opening device from an orthodontic wire loop embedded in any acrylic resin handle (Figure 8).

Soft-tissue Limitations
Such limitations may occur where a shallow buccal sulcus exists. It is generally considered that a distance of 6 to 8 mm is required between the sulcus reflection and gingival margins. Problems may be encountered where there is a lack of attached gingiva and high frenal attachments as these may impinge on the labial bar. A variety of soft tissue procedures may, however, be carried out to deepen the sulcus or to graft attached mucosa into the area and hence facilitate the successful application of a SLRDP. Alternatively, where space is limited for a bar and sufficient clearance of the marginal gingiva, an acrylic veneer may be used.

High Smile Line
A high smile line that displays a large amount of gingiva or tooth may result in an unaesthetic prosthesis, the metallic struts being visible. Although an acrylic veneer may be attached to the labial bar to improve the appearance in most cases, it may still be difficult to achieve good aesthetics if there is interference with the arc of closure of the veneer.

Certain Malocclusions
In some malocclusions, such as a severe class II division 2, it may not be possible to make a maxillary palatal plate. The increased overbite and minimal overjet may mean that interocclusal space is inadequate to place a plate without interfering with the occlusion.

Alveolar Limitations
Alveolar limitations may be found where there is a very prominent labial and buccal alveolar ridge (e.g. canine eminence) with no undercut to provide room for the labial bar without making the prosthesis obtrusive.

CLINICAL AND TECHNICAL CONSIDERATIONS

Planning Phase
The planning phase for an SLRDP is similar to that required for a conventional RPD. A thorough history and examination should be carried out and impressions taken for diagnostic casts to be prepared—which should be articulated appropriately. A useful test of a patient’s tolerance to a labial retentive bar may be carried out by placing soft ribbon wax in the labial and buccal sulci for a few minutes. It is also helpful to observe the level of the lips while the patient is speaking and smiling and to mark this on the study casts to record the extent of the aesthetic zone (and hence ensure that any display of metal is avoided). The articulated study casts should then be surveyed and tripoded to record the orientation of the casts, and the most appropriate design both scribed on the cast and recorded on a laboratory work card. It is instructive to carry out any planned tooth
preparations on the diagnostic cast before moving into the mouth. Every effort should be made to prepare positive occlusal/cingulum rest seats on the abutment teeth.

The Working Impression

It is critical to obtain an accurate working impression, especially in the labial and buccal sulcus area, to allow acceptable placement of the labial retentive bar. Care should be taken not to displace any mobile teeth during impression taking; this will result in a poorly fitting casting. Mobile teeth may be stabilized temporarily by tacking the teeth together with acid-etch retained composite: if the labial incisal third of upper anterior teeth and the lingual incisal third of the lower anterior teeth are utilized this should not interfere with the occlusion or critical areas required in the impression. Functional border moulding of the lingual sulcus should also be carried out during impression taking to ensure proper extension of the lingual plate and flanges. A rigid custom tray should be used with occlusal stops, together with a relatively fluid impression material such as a regular body polyvinyl siloxane (or alginate if the working cast is poured immediately).

Trial Wax-ups

The resulting master models may be used to make temporary bases and wax rims to record the jaw relationships and articulate the working casts. A trial wax-up can be tried to confirm the best tooth position for aesthetics and function. The tooth position may be recorded by indexing with silicone laboratory putty; this allows the technician to construct the framework with respect to the optimum tooth positions, especially as they relate to the latch and hinge.

Construction

The construction of a SLRPD is more complex than that of a conventional RPD.\(^\text{12}\) It is important that the labial dental undercuts where the retentive strut terminals are to be sited are not blocked out at all. Other areas of the cast are blocked out as usual before duplication. The denture design is scribed on the refractory master cast and the framework waxed up in the usual way—except for a rather full lingual plate extended to within 3 mm of the incisal edges. The hinge and latch may be cast separately from prefabricated plastic patterns or purchased in an already cast form. They are secured to the wax-up of the main framework, being placed in the same horizontal plane and parallel to the alveolar mucosa. The labial bar is waxed from a half round pattern and the labial struts from prefabricated patterns. A careful casting technique is required\(^\text{13}\) to avoid welding of the molten alloy to the precast hinge and latch components; if this occurred it would destroy the mechanism.

Evaluating the Metal Framework

The completed casting should be carefully checked before trying in the mouth. The design and fit on the cast should be assessed and the action of the hinge-lock mechanism should be positive. When evaluating the metal framework in the mouth it should be fully seated before attempting to close the gate, the labial retentive struts must contact the surface of the teeth—and this must be passive and not causing trauma to the soft tissues (Figure 1).

Once the framework is judged to be satisfactory, an altered cast impression may be taken in the free-end saddle situation to gain maximum support and limit rotation. The usual stages of jaw relationship registration, wax try-in and insertion of a RPD are then followed to produce the finished SLRPD.

Insertion

The patient will require careful instruction and demonstration of how to insert and remove the device. It is usually most convenient for patients to place the index finger on the lingual plate and the thumb of the same hand on the labial bar.

![Figure 6. A maxillary SLRPD with reduced palatal coverage in order to manage a patient with an exaggerated retching reflex successfully. The hinge mechanism is on the right of the figure and is carried by a bar that crosses the occlusal surface.](image)
in the midline and then to squeeze the latch distally until it locks shut. The latch is best opened by placing the nail of the thumb or index finger under the small extension of the labial bar and pulling it outwards.

**DISCUSSION**

A clinical evaluation of SLRPD patients followed over periods of 13 to 75 months did not demonstrate any further periodontal breakdown despite most patients having favourable periodontal support at the outset. Patient acceptance of the dentures was good; however, some patients experienced further carious lesions which required restoration and there was a need for relining of the free-end saddles. Another study found that the dentures were worn successfully and without clinically significant changes to the supporting structures of the abutment teeth over a two-year period. These studies confirm the authors’ experience of the efficacy of the SLRPD prosthesis, although the level of recall and maintenance care required to maintain oral health will be significant. A careful preventive regime is advised for patients who have experienced high levels of dental caries and periodontal disease, in terms of dietary management, fluoride treatment and hygiene support. This has already been established for patients with conventional RPD prostheses and overdentures.

It may be seen that the swing-lock removable partial denture has a useful place in contemporary clinical dental practice and offers many advantages over conventional removable partial dentures in terms of retention and stability. Although the technique is more complex and demanding than that for provision of conventional RPDs, it is especially useful in the extremely compromised dentition. We consider that the retention of a few natural teeth with their supporting alveolar bone to anchor a movable prosthesis is advantageous, even in an environment in which implantology may feature.

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