

Review of the Swinglock Removable Partial Denture

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The author's experience with the swinglock removable partial denture concept is described. This infrequently utilized technique allows the use of undercuts that are unapproachable with other partial denture designs. Indications include missing or weakened key abutment teeth, tooth mobility, aesthetics, economic considerations, and the presence of certain ablative defects following oncologic surgery. The clinician must consider lip position, facial sulcus depth, position of frena, and the periodontal health of potential abutment teeth when considering a swinglock removable partial denture. Specific instructions for blackout, relief, and position of hinge and clasp assemblies should be part of the written laboratory instructions. *Int J Prosthodont* 1991;4:80-88.

The swinglock removable partial denture was first described and documented by Simmons¹ in 1963. The technique addressed particular partially edentate situations in which conventional partial denture designs were inadequate. The concept was recommended for maximizing stability and retention by gaining access to many more tooth surfaces with the unique clasping mechanism offered by incorporation of the lock, hinge, and gate assembly, allowing all remaining teeth to become primary abutments.

Indications²

The indications for a swinglock removable partial denture include:

1. *Situations in which a key abutment tooth (eg, a canine) is lost and the adjacent tooth (eg, the lateral incisor) becomes the terminal abutment* (Fig 1). Such a tooth offers poor support for the prosthesis, and the placement of rests and

clasps is often compromised. The inability to use a rest can easily lead to soft-tissue trauma from displacement of the prosthesis, especially a distal extension base. Clasps may compromise aesthetics and/or produce potentially damaging forces to the periodontium from the increased forces. The use of less rigid clasping designs/materials such as wrought wire often do not provide adequate retention.

2. *Circumstances in which tooth mobility is causing functional embarrassment to the patient.* A long-term questionable prognosis during or after periodontal therapy may be treated using a swinglock prosthesis for tooth replacement and/or splinting (Figs 2a to 2c). The removable splint allows optimum access for interdental cleaning by the patient. Continued periodontal therapy is unhindered, the assessment of individual teeth is facilitated, and progressive mobility of a single tooth can be recognised. The loss of a tooth does not compromise the prosthesis, as the design allows the addition of teeth.
3. *Therapy for oncology patients who have undergone ablation surgery and have few remaining teeth* (Figs 3a and 3b). Loss of palatal tissue in the hemimaxillectomy patient and the distortion of residual tissues in the mandibu-

A portion of this material was used as a table clinic presentation before the American Dental Society of London, London, April 1989, and a portion was used in a presentation to the Consultants in Restorative Dentistry Group, London, October 1989.



Fig 1 Loss of a canine leaves a vulnerable lateral incisor as terminal abutment.



Fig 2a This patient had difficulty in mastication as the result of tooth mobility following periodontal therapy.



Fig 2b (Left) Swinglock partial denture gains maximum support with the major connector.

Fig 2c (Above) Gate with an acrylic resin veneer allowed splinting of the remaining teeth (functional for 9 years).



Fig 3a Hemimaxillectomy patient offers compromised support and stability for a conventional prosthesis.

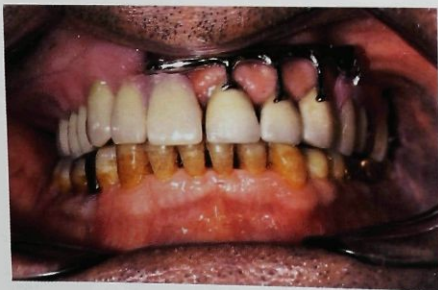


Fig 3b Swinglock partial denture maximizes the tissues available for support and stability.

lectomy patient necessitate maximizing retention and stability. The swinglock prosthesis design may avoid the need for the placement of implants.

4. *Treatment following the loss of strategic abutment support when the patient has great functional demands* (Figs 4a and 4b).
5. *Economic considerations.* The swinglock partial denture provides the ability to splint teeth without fabricating castings with fixed connectors. This offers considerable financial savings, even though the cost of fabricating the swinglock framework is greater than that of a conventional removable partial denture framework.

Treatment Planning³

When the swinglock removable partial denture is considered, the position of the lips during smiling is recorded and transferred to the primary diagnostic casts. A facial sulcus depth of 6 to 8 mm is recommended for placement of the retentive gate element. A high frenal attachment and/or shallow sulcus requires surgical correction prior to making a working impression (Figs 5a and 5b). Periodontal

health is a prerequisite to therapy unless the prosthesis is considered an interim measure for the informed patient or is used as a provisional/definitive prosthesis as periodontal therapy is provided. The diagnostic cast is surveyed to plan further tooth preparation, including guide planes and rest seats, and to establish clasp placement. The major departure from the conventional prosthesis is the access to the maximum available undercut provided by the opening of the gate of the swinglock prosthesis.

The desired tooth modifications may be achieved by reshaping the teeth or, when castings are indicated, by incorporating the desired contours into the restoration(s). Following mouth preparation, a working impression is made.

Irreversible hydrocolloid in a selected rimlock stock tray has often proved adequate. Mobile teeth indicate the use of reversible hydrocolloid to avoid any tooth displacement.

Conventional laboratory procedures are followed. The cast is poured with a compatible vacuum-mixed dental stone. A wax occlusal rim with an acrylic resin base can be fabricated on the working cast, a facebow transfer and occlusal registration record are obtained, and the casts are mounted on a semiaadjustable articulator. The tooth mold and



Fig 4a Unilateral loss of teeth with edentulous areas opposed by teeth in a patient with great functional demands.



Fig 4b Maxillary swinglock partial denture allowed for the necessary stability for this functionally demanding patient.



Fig 5a (Left) Shallow sulcus necessitated a sulcus deepening procedure.

Fig 5b (Right) One week after placement of free gingival graft. The palate was the donor site.

shade are selected, and the trial arrangement is clinically evaluated (Figs 6a and 6b). A repeat of the interarch registration record will reveal any inaccuracies in the previous record(s), and the casts are remounted if necessary.

A silicone putty index of the tooth and flange

positions can be made on the cast (Fig 7a). This index will ensure that the framework will not extend beyond these contours and not compromise tooth position or result in traumatic ulceration of the oral mucosa as a result of the placement of the hinge and lock (Fig 7b). The positions of the hinge and

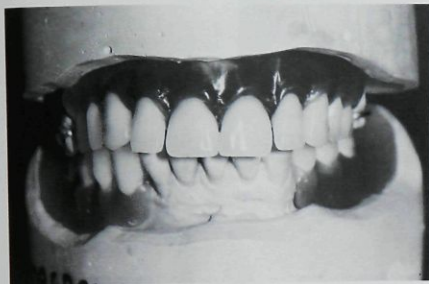


Fig 6a Teeth are arranged for clinical evaluation.



Fig 6b Position of teeth and border extensions are established.

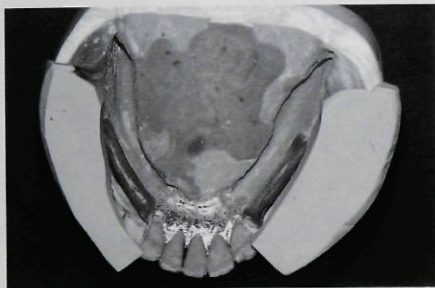


Fig 7a Silicone indices record tooth and border position.

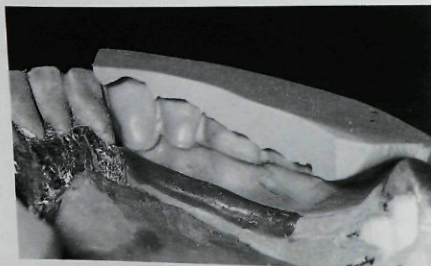


Fig 7b Lingual view of silicone index demonstrating tooth and border extension position.

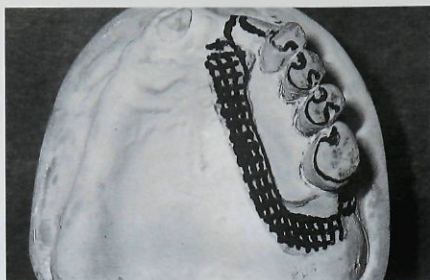


Fig 8a Laboratory work authorization for framework design on the diagnostic cast.

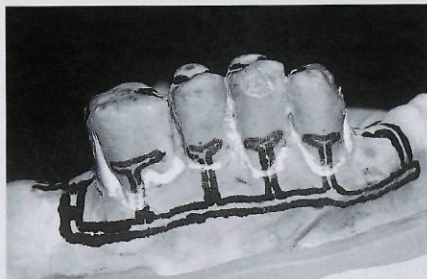


Fig 8b Drawing of desired design on the cast demonstrates the position of gate and retentive elements.

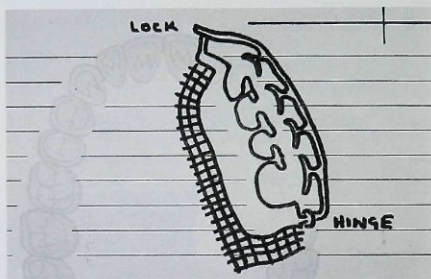


Fig 8c Work authorization for framework design.

lock are established according to the patient's preference to use a finger/thumb of the left or right hand.

Framework Fabrication⁴

The laboratory work authorization must include three elements for fabricating the framework: (1) the design drawn on the primary diagnostic cast with reference survey lines recorded (Figs 8a and 8b); (2) drawing of the design of the swinglock framework (Fig 8c); and (3) a written authorization, specifying the following instructions:

- a. Place 28-gauge wax relief under the tissue portion of lingual plate (mandibular prosthesis).
- b. Place 0.01-mm tinfoil relief under tissue portion to be covered by labial/buccal gate.
- c. Place 28-gauge wax relief under the retention mesh site for edentulous ridge(s).
- d. Block out undercuts related to rigid compo-

- ments of major and minor connectors and reciprocal elements.
- e. DO NOT block out undercuts to be engaged by retentive clasps.
- f. Place hinge and lock, as indicated, one tooth away from terminal abutment teeth within established contours dictated by the silicone index.
- g. Ensure that the inferior border of the facial gate arm does not extend below the drawing on the cast.
- h. Place retentive elements as drawn on the cast.
- i. DO NOT place stress distributors (hinges) in wax-up.
- j. Please return wax-up on refractory cast and blocked-out master cast for evaluation before proceeding with casting.

It has been the experience of the author that unless all the above information is included, problems easily arise, especially when working with a

commercial laboratory. Quality control has improved considerably when the waxed refractory cast has been seen. This is strongly recommended for all partial denture frameworks (Figs 9a to 9c).

Preformed wax patterns of the hinge and lock assemblies are commercially available (Chaperlin and Jacobs Ltd, Sutton, Surrey, England). The precast

elements are then coated with a graphite suspension before incorporation into the framework wax-up. Four 3-mm sprues are attached to the wax-up—two directed to the thickest portions of the major connector and two to each end of the gate to ensure a complete porosity-free casting (Fig 10).

The wax-up is invested and, after the investment

Fig 9a Working cast with blockout wax overextended as a result of the technician's lack of understanding of the function of a swinglock design removable partial denture.



Fig 9b Predictable result with retentive elements only engaging conventional undercuts of 0.015 inches. Appraisal of the blocked-out master cast would have avoided this costly error.

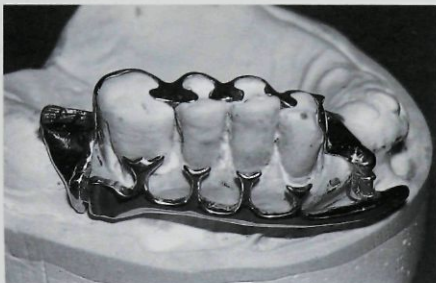


Fig 9c Remake of framework with the correct placement of retentive elements.

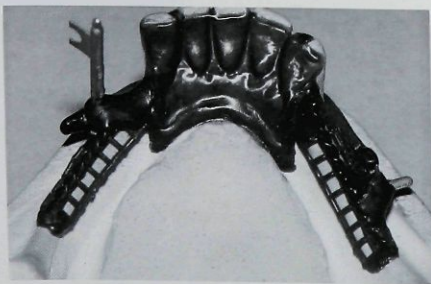


Fig 10 Completed wax-up.

is set, the casting ring is placed in a cold oven. The temperature is slowly raised to 950°C in 2.5 hours and the casting ring is heat soaked for 30 minutes.

The casting is made using a base metal alloy of the clinician's choice, following the manufacturer's instructions. The author prefers to use a cobalt-chromium-molybdenum alloy (Wisil, Krupp Medizintechnik GmbH, Essen, Germany) in an atmospheric high-frequency melting and centrifugal casting unit (Galloni Castellini, Milano, Italy) for consistent results (Fig 11).

It is necessary to remove the casting ring from the oven 80 to 90 seconds prior to melting the alloy to allow a drop in temperature before completion of the casting process. Failure to follow these instructions will result in welding of the molten alloy to the precast components of the hinge and lock assemblies in spite of the use of graphite, and the gate assembly will not be operable.

The author presumes that early removal of the casting ring from the oven allows a greater temperature differential between the precast components and the molten metal, preventing fusion. When this is done, the use of graphite was found to be unnecessary.

Framework Evaluation

The fit of the casting is checked on the cast with the gate open and closed (Fig 12a). The casting is tried in the patient's mouth, and necessary adjustments are carried out using a disclosing medium (Occlude, Pascal Co, Bellevue, Washington) and diamond burs in a high-speed handpiece (Fig 12b). Altered cast impression trays are then attached to the retention mesh element if there is a distal extension base, and the altered cast impression is made (Figs 13a and 13b). The altered cast then allows for occlusal rims to be made for repeat of the interarch relationship record. The teeth are arranged for a clinical try-in and confirmation of the registration. The prosthesis can finally be conventionally processed.

Prosthesis Placement

At the placement appointment, pressure relief cream (Sybron/Kerr, Romulus, Michigan) is applied to the tissue surfaces of the acrylic resin bases to adjust any areas of excess pressure. The accuracy of the adaptation can be confirmed by the intimate contact of the framework to the teeth. If there is a distal extension base, the author prefers to repeat the recording of the retruded mandibular position and remount the prosthesis for refinement of the occlusal contacts. Shimstock (12- μ m plastic foil, Artus Corp, Englewood, New Jersey) is used to evaluate and aid in establishing good holding contacts between opposing natural teeth and light holding contacts of the denture teeth on the distal extension segment. Final confirmation of these contacts is made in the mouth.

The patient is given verbal and written instructions in caring for the prosthesis. The placement and removal of the prosthesis is demonstrated. Cleaning instructions must include the names of effective cleaning agents that will not cause tarnishing of the framework. The gate must be in the closed position when the prosthesis is cleaned to avoid distortion of the framework. If the patient has poor manual dexterity, eg, arthritic hands, a customised rectan-

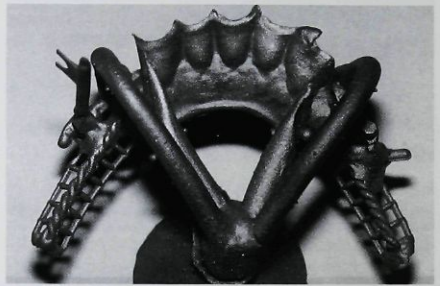


Fig 11 Satisfactory casting.

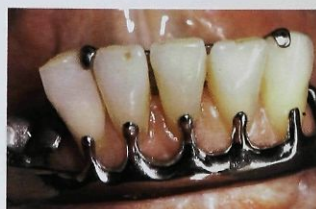


Fig 12a (Left) Casting related to master cast with gate open.

Fig 12b (Right) Clinical trial of casting revealing seating of incisal rests and correct placement of retentive elements.

gular orthodontic wire loop with an acrylic resin handle may be provided (Fig 14a). Alternatively, a 2-mm screwdriver (electrical screwdriver, Ceka Works Ltd, Pwllheli, Gwynedd, Wales, United Kingdom) may be used (Fig 14b). Optimum plaque control is reinforced, and a neutral pH fluoride mouthwash can be prescribed. Review appointments are scheduled for any necessary adjustments. Once the patient is comfortable, routine recall maintenance appointments are arranged.

A longitudinal clinical study of 53 patients from a pool of 78 patients treated over a 5-year period has been reported.⁵ No compromise to the periodontium was evident after using swinglock partial dentures for 13 to 75 months. The patient acceptance was good. A high caries incidence and need for relines of the distal extension bases reinforced the need for proper recall. An equal number of carious lesions associated and not associated with the framework were reported. This suggests that the presence of the prosthesis does not influence the incidence of carious lesions. Dietary counseling and

the daily use of fluoride mouthwash should reduce the incidence of new carious lesions. Tissue impingement was only recorded with earlier designs that did not incorporate rest seats. Therefore, rests are now always incorporated, no matter how few teeth may remain.

Summary

A review of the use of the swinglock removable partial denture, including clinical indications and treatment planning, has been presented. The laboratory authorization requires detailed instructions. Framework evaluation and subsequent placement necessitates adherence to basic prosthodontic principles. Longitudinal clinical studies confirm the efficacy of this treatment.

Conclusion

There is a small group of partially edentate patients whose loss of teeth/tissue causes severe



Fig 13a Altered cast impression of bilateral distal extension areas.

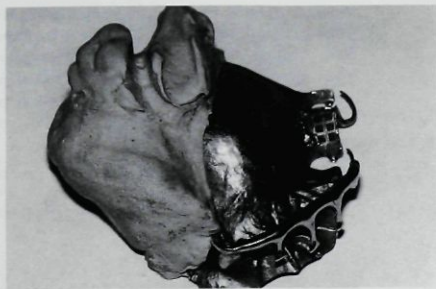


Fig 13b Altered cast impression of hemimaxillectomy defect.



Fig 14a Wire loop used to open gate.

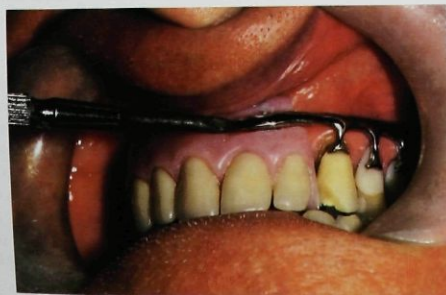


Fig 14b Small screwdriver used to open gate.

compromise to the support and stability of conventionally designed removable partial dentures. The swinglock prosthesis offers a solution for these functionally demanding clinical situations.

Acknowledgment

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2. Bolender CL, Becker CM: Swinglock removable partial dentures: Where and when. *J Prosthet Dent* 1981;45:4-10.
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Literature Abstracts

A Comparison of Glass-Ionomer Cements Used to Repair Cast Restorations

Scanning electron microscopy was used to examine the integrity of margin interfaces between gold castings and one traditional and two silver-containing glass-ionomer cements. These micrographs were also compared to those previously obtained for margin interfaces between gold castings and composite resin, high-copper amalgam, and direct-filling gold. Although there were visible differences in the surface micromorphology of the different cements, all of the glass-ionomer cement repairs appeared to remain well-adapted to the gold casting after thermocycling. **The adaptation of all the glass-ionomer cements was superior to that demonstrated by amalgam and resin in a previous study.** The adaptation of the direct gold was found to be equal to or better than that found for any other material. **The authors believe that direct gold is the material of choice for casting repair** because of its adaptability, similar composition, polishability, and documented longevity. The exceptions to using direct gold are related to concerns for esthetics and inconvenience of making appropriate preparations.

Carlson T.J, Naguib EA, Cochran MA, Lund MR. *Oper Dent* 1990;15(5):162-166. **References:** 5. **Reprints:** Dr T.J. Carlson, Indiana University School of Dentistry, 1121 W Michigan Street, Indianapolis, Indiana 46202.—Richard R. Seals, Jr, DDS, MEd, MS, University of Texas Health Science Center at San Antonio, San Antonio, Texas

Effect of .12% Chlorhexidine Rinses on Incidence of Alveolar Osteitis Following Extraction of Impacted Mandibular Third Molars

The occurrence of alveolar osteitis (AO) after extraction of impacted mandibular third molars is reported to be between 15% and 20%. Local disturbance in fibrinolytic activity caused by oral microbes may be a mechanism, since the incidence of AO has been successfully reduced using oral and systemic antibiotic therapy. The study included a randomized double-blind evaluation of 0.12% chlorhexidine mouth rinse and a placebo mouth rinse (not described). One hundred thirty-four patients with bilateral impacted third molars were randomized to the two groups. A finding of AO was defined as pain in association with: (1) pain increasing over 3 to 5 days, (2) necrotic tissue in the extraction site, and (3) exposed bone or loss of clot within the extraction site. **There were 12 findings of AO in 144 extraction sites in the chlorhexidine group and 28 in 134 extraction sites in the placebo group** ($P = 0.0174$). It is concluded that 0.12% chlorhexidine mouth rinse used twice a day for 7 days following extraction of impacted third molars can significantly reduce the incidence of alveolar osteitis.

Larsen PE. *J Oral Maxillofac Surg* 1990;48(suppl 1):123-124. **References:** 2. **Reprints:** Dr Larsen, The Ohio State University College of Dentistry, Department of Oral and Maxillofacial Surgery, 305 W 12th Avenue, 2131 Postle Hall, Columbus, Ohio 43210.—Rhonda F. Jacob, DDS, MS, M.D. Anderson Cancer Center, Houston, Texas

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