

New Options in Metal-Free Partial Dentures

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Abstract:

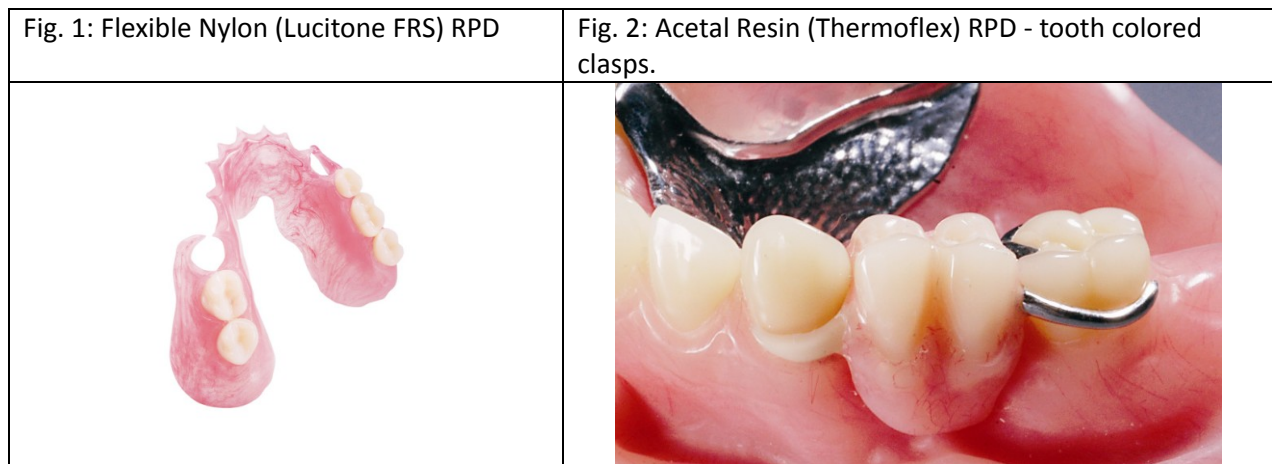
Removable partial dentures can be transitional, interim or long-term prosthetic devices. A variety of partial denture materials are available and satisfactory results can be achieved with most materials under the right conditions. Metal-free, flexible partial dentures are preferred by patients who cite "comfort" as the primary reason. The case reports here outlines methods of enhancing success with these patient preferred options.

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- **Background**

Functional and esthetic restoration of the partially edentulous patient includes a range of treatment options each with its own degree of invasiveness and reversibility along with risks and benefits. Especially for the patients suddenly faces partial edentulism, final treatment decisions and commitment takes time. In such cases steps toward final restoration can include an interim prosthesis. In addition to offering an esthetic preview, interim removable partial dentures (RPDs) should minimally impact future treatment. The use of interim metal-free RPDs is convenient for the dentist, relatively inexpensive, patient friendly and in often completely reversible.

While specific design criteria for interim RPDs remain much-discussed, manufacturers of metal-free flexible RPD polymers have established guidelines based on material properties. Laboratories familiar with the behavior of specific materials have additional insight regarding critical factors such as connector design and dimensions, clasps, and retention of artificial teeth to assure reliability. With the emergence of novel materials and strong patient demand for metal free RPDs, the distinction between interim and definitive prosthesis has become blurred. Survival of interim RPDs beyond the interim period resulted in clinical claims for long-term use of products which cannot be repaired, relined or clinically modified when needs arise. The purpose of this article is to assist laboratories and clinicians in material selection and design featuring two popular thermoplastic, flexible RPD products (nylon based Lucitone FRS, and acetal resin based Thermoflex, (Figs. 1,2) with unique advantages.



- **Thermoplastic Partial Denture Materials – Properties and Design Principles**

A major addition to the metal-free RPD market has been nylon, offered in various formulations. Depending on the carbon chains which carry the carboxyl and amino groups comprising nylon, physical properties vary. Specific product chemistry information may be proprietary and hard to obtain. Nylon chemistries are well tolerated biologically so nylon product selection is independent of allergy or toxicity concerns. The design of the prosthesis, however, should be based on an understanding of properties and behavior of the particular nylon chosen. Resiliency (stiffness) and strength differences suggest the importance of designing nylon RPDs in accordance with manufacturer recommendations and laboratory familiarity. As a class, all nylons demonstrate higher water sorption and creep than most dental polymers^{i, ii,iii}. In general, toughness (resistance to fracture), flexibility, design simplicity and exceedingly rare allergy response are the features supporting nylon RPD popularity.

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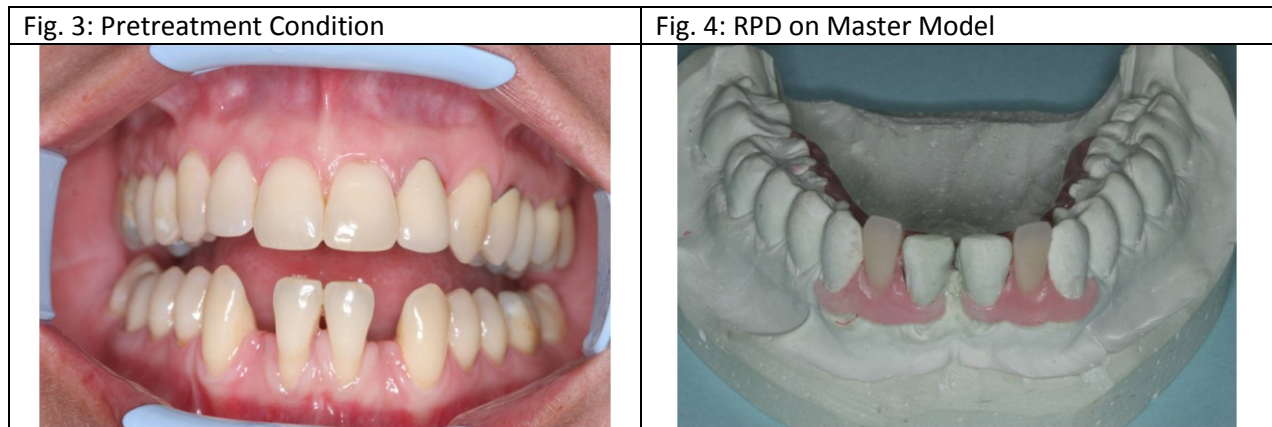
Another addition to the metal-free RPD market is polyoxymethylene (polyacetal) referred to simply as acetal resin in dentistry. Chemistry differences which may exist among acetal resin products are indeed subtle. All acetal resins meet ISO specifications limiting water sorption and all exhibit lower creep, superior abrasion resistance with higher surface luster than nylons^{iv,v}. The higher stiffness of acetal resin supports conventional clasp designs, connectors and other components with some compensation required. In one report comparing clasp flexibility and retention the author suggested acetal clasp dimensions should be 30% shorter with 40% greater cross-sectional area versus cast metal^{vi,vii}.

While these numbers indicate acetal framework bulkiness, some bulk reduction is possible by using portions of the major connector, minor connectors or even guide planes for direct retention. No formal design recommendations exist for deliberate engagement of undercuts using framework components other than clasps but the practice is common and has resulted in no problems identified by the authors. Certainly engagement of deeper undercuts than what would be possible using cast metal helps prevent food traps, improving hygiene and retention of the RPD. What's most interesting about acetal RPDs is that conventionally styled frameworks can be constructed with acrylic bases processed onto the frame. This offers advantages with respect to relining, repairing and retaining artificial teeth on the RPD^{vii}.

Following are short case reports highlighting a Lucitone FRS (nylon) and a Thermoflex (acetal) RPD with justification for material selection and prosthetic design.

- **Case 1: Use of a Nylon RPD**

Lacey, a new patient, made an appointment to discuss a short term solution to the problem her dentist was having securing a no-prep resin bonded FPD replacing congenitally missing teeth #23 & #26. After consultation with her regular dentist who confirmed Lacey's referral to a specialty practice for grafting and implant placement she asked what we could do to get her by for a few months. Committed to definitive treatment but needing time to get things in order, Lacey requested a metal-free interim RPD.

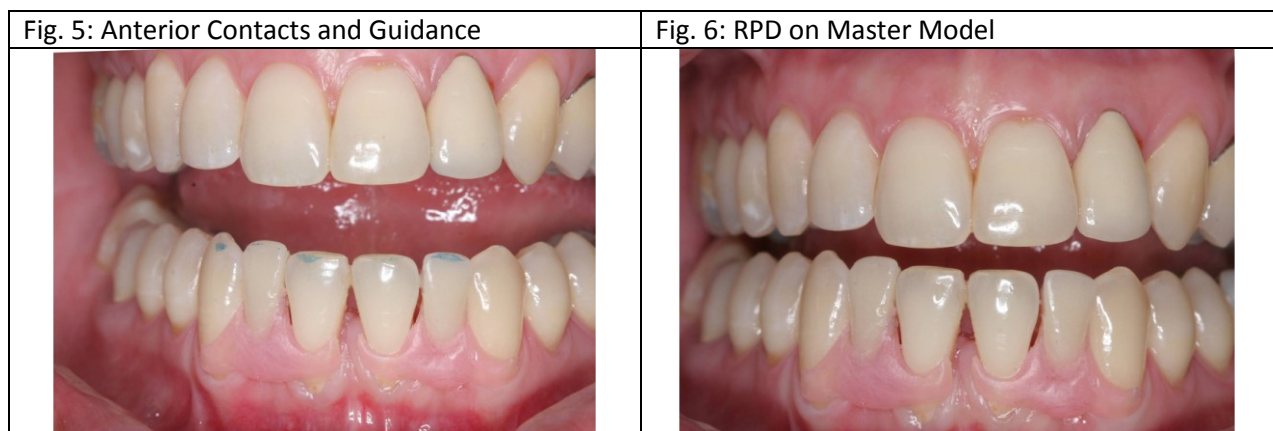


After treatment plan discussions with her general dentist and obtaining informed consent, alginate impressing for construction of a Lucitone FRS (Dentsply Prosthetics) RPD was completed. While explaining proposed treatment to Lacey and her dentist, concern was expressed that the interim RPD would be carefully monitored for soft tissue impingement which could complicate future treatment. As

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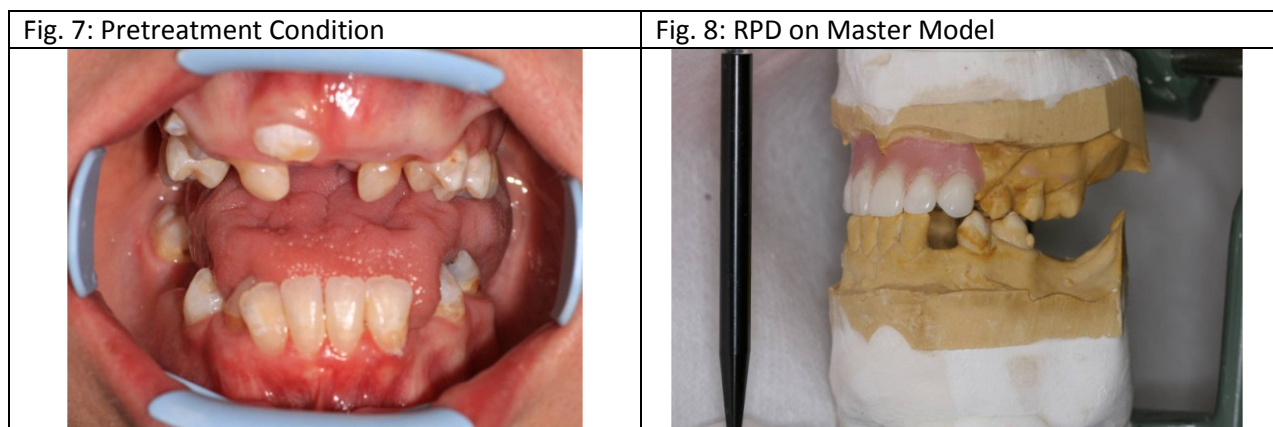
nylon exhibits much higher creep than conventional prosthodontic materials, rest seats on FRS partial dentures are ineffective. Lucitone FRS was chosen because of its unique nylon network which offers superior creep resistance with slightly higher stiffness than other nylons. Porcelain teeth were selected because nylon formulations can be challenging to bond to artificial teeth. Through-the-tooth diatoric retentions are required weakening acrylic teeth, especially incisors. A pinned porcelain tooth (Bioform, Dentsply Prosthetics) was the strongest option. Fig. 3 shows pretreatment condition, Fig. 4 shows the RPD on master model with sufficient height of artificial teeth to functionally balance anterior guidance incisal edge matching.

Fig. 5 shows anterior contacts and guidance. It is important at this time to confirm no movement of the denture base which could compress soft tissues accelerating gingival recession. Fig. 6 shows final result. Note how nylon's translucency contributes to gingival esthetics.



- **Case 2: Use of an Acetal RPD**

Jennifer, a very shy adult patient seeking only limited care, presented in a nearby public health clinic requesting removal of malposed, retained deciduous teeth C and G (Fig. 7).

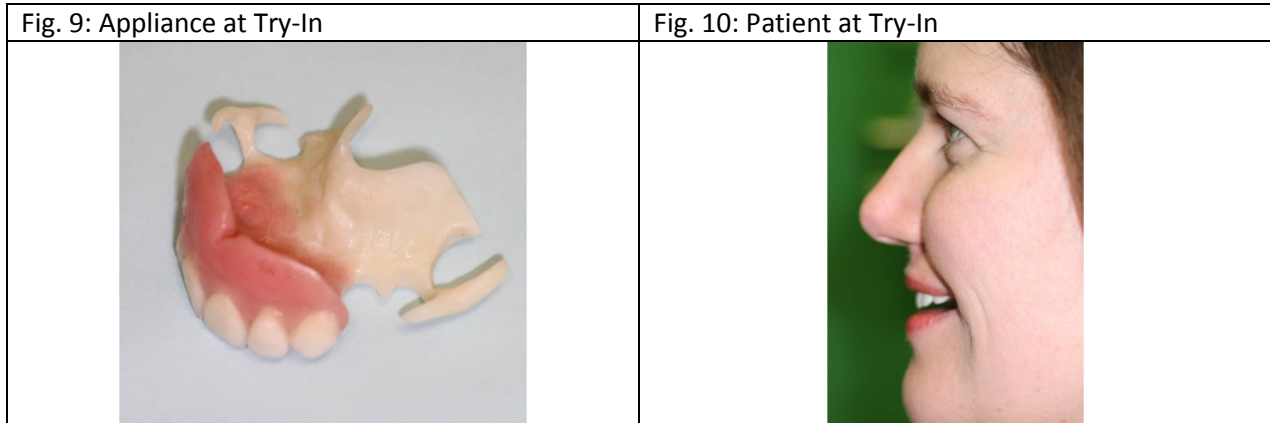


After review of a panoramic radiograph missing teeth #s 6, 7, 9, 10, & 11 were confirmed absent. Tooth #8 was vital and healthy but only partially erupted with underdeveloped root form. I asked the patient if she would consider wearing a partial denture resting atop tooth #8. Her reply came: "I'm not

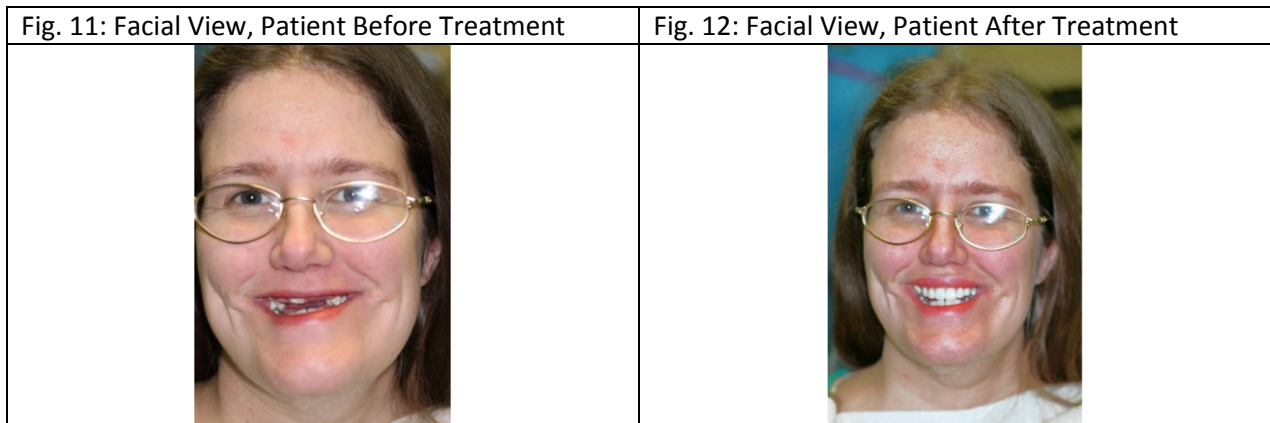
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a vain person". She was then asked her if she could bite a sandwich, and she replied "I cut things like sandwiches with a knife". After a prophylaxis and removal of the malposed deciduous teeth alginate impressions were made with a static maxillo-mandibular relation record.

Models were articulated and artificial teeth were assembled on a wax baseplate for try in (Figs. 8-10). Try-in confirmed esthetics resulting in a very surprised patient who cautiously asked "Can I take home a photo to show my husband?" When the patient returned with her husband both consented to treatment including an RPD. A cast framework partial was ruled out due to cost as well as patient reluctance to accept irreversible mouth preparation.



Acetal resin was then suggested for the framework with processed conventional acrylic base which could be relined. Products selected included Thermoflex (Dentsply Prosthetics) frameworks with Eclipse acrylic base and bonded Portrait IPN teeth. Delivery was without incident and the acrylic base was relined 12 weeks later when healing was complete. At that appointment the patient smiled and said "I now know how it feels to bite into a sandwich" (Figs. 11-12).



- **Summary:**

Removable partial dentures can be transitional, interim or long-term prosthetic devices. A variety of partial denture materials are available and satisfactory results can be achieved with most materials under the right conditions. Metal-free, flexible partial dentures are preferred by patients who cite

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‘comfort’ as the primary reason.⁸ An in-house comparison of distal extension Vitallium RPDs with Eclipse bases versus similarly designed Thermoflex RPDs with Eclipse bases, each worn for 90 days resulted in 29 out of thirty patients fitted with a total of 37 partial dentures, overwhelmingly preferring Thermoflex rather than Vitallium. Only one subject preferred his mandibular Kennedy Class 2, Mod 1 Vitallium/Eclipse RPD to his Thermoflex/Eclipse RPD. He was one of the seven subjects with both a maxillary and a mandibular RPD and he did prefer his maxillary Thermoflex/Eclipse RPD. Although subjects participating in this comparison are no longer being tracked most remain on recall. At the 5 year mark, one abutment tooth has been lost and two RPDs have been relined. No other repairs or problems have been reported or observed. There is growing evidence that Thermoflex/Eclipse longevity is comparable to Vitallium/Eclipse longevity in distal extension RPDs^{viii}.

For interim RPDs, especially if the patient is concerned about acrylic sensitivities, FRS with porcelain teeth is useful. While neither FRS nor Thermoflex clasps can be tightened, creep of nylon clasps and resultant loss of retention is a problem with long term use. Similarly, occlusal support provided by a creep-resistant occlusal rest is important for all definitive RPDs. Thermoflex occlusal rests show excellent dimensional stability but must be placed in locations free from opposing natural tooth contact. Thermoflex occlusal rests opposing denture teeth have shown no wear or signs of fatigue at the 5 year mark. Both nylon and acetal resin are materials worthy of consideration when treatment planning patients for RPDs. Thermoflex offers the advantage of a conventional styled framework with acrylic denture base materials whereas nylon offers excellent gingival esthetics and reduced allergy concerns compared to acrylic resins.

References:

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