

# THE RPD REDEMPTION: RENAISSANCE OF THE REMOVABLE PARTIAL DENTURE

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Modern RPDs need to redeem the unfavourable reputation of their predecessors. They need to be able to hold their own in terms of comfort, aesthetics and function while safeguarding oral health. To achieve this, RPDs require both considered prosthodontic treatment planning and careful design.

Most RPD frameworks are designed in the dental laboratory without the benefit of relevant clinical preparation, information or input (Schwarz and Barsby 1980, Basker et al 1988, Dullabh et al 1993, Lynch and Allen 2003). If the clinician is not in charge this is at best a biomechanical exercise; at worst a supervised route to further dental decline. To treat RPD design as a purely biomechanical exercise ignores the importance of making sure that the RPD follows hygienic principles to interfere as little as possible with plaque control, and does not damage the oral tissue (Öwall et al 2002).

The Adult Dental Health Survey (1998) (Kelly et al 2000) projects a decline in tooth loss but also a rise in partial edentulism. Where there is no aesthetic compromise a shortened dental arch (SDA) is an acceptable and functional option (Armellini and von Fraunhofer 2004). If an SDA is not possible, the first choice for both patient and dental professional is probably a fixed option (fixed partial denture, FPD). In most instances however, the FPD will probably come at a significantly higher cost and involve more complicated/invasive treatment. It therefore seems fair to suggest that the profession can expect a need for RPDs for many years to come.

RPDs are automatically less attractive by dint of being 'removable'. Unless they conform to open/hygienic principles in a well-maintained mouth they are also known to make the dentition more at risk from caries and periodontal disease

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## Sequence for planning and organising prosthodontic treatment

Finding the most appropriate restorative option:

1. Patient's wishes and needs (including preference for fixed or removable)
2. Teeth needed for function and appearance?
3. Clinical/radiographic observations about remaining teeth
4. Need for education and treatment to stabilise the dentition before a definitive restorative option can be finalised?
5. Need for diagnostic planning/treatment before a definitive restorative option can be finalised?
6. All restorative treatment options (eg no treatment – accept a SDA, partial/complete removable, conventional fixed bridge, fixed or removable implant retained)
7. Specific indications for one of these restorative options as a first choice?
8. Specific contra-indications against any of these restorative options?
9. Discuss options and recommendations with the patient.

Figure 1.

(Yeung et al 2000, Jacobson 1987). Even so, a large study of metal-framework RPDs concluded that the outcome of RPD treatment can be predictable (Vermeulen et al 1996) through simple design and regular surveillance of the patient at individually adjusted intervals.

Indications for RPDs: a literature review (Wöstmann et al 2005) concluded that evidence based indications and contra-



Figure 2: A 44-year-old woman with failing post-crowns on all upper front teeth.



Figure 3: Original mounted study casts. Class II div 2 with a cant of midline, gingival and incisal level.



Figure 4: Lower arch with demise of the occlusal scheme. Pronounced incisal wear. The bridge from  $\overline{5}$  to  $\overline{7}$  was loosened.  $\overline{5}$  was un-restorable.



Figure 5: Diagnostic wax-up. Casts mounted in centric relation. New occluding vertical dimension (OVD) set by restoring lower incisors to original height. Correction on midline cant and incisal level.

indications for prescribing RPDs are still lacking. However, consensus exists on major underlying principles for decision-making and design. And evidence does support the importance of focusing on hygienic principles in RPD design (Öwall et al 2002).

This and the two following articles seek to demonstrate how the 'removable' aspect can be disguised and the risks posed to the oral environment minimised through careful and considered open/hygienic design.

### Sequence for prosthodontic treatment planning

Any restorative treatment to replace a number of missing teeth requires careful planning and preparation, and to ensure acceptance it must address the patient's wishes and needs. A structured treatment planning process helps to ascertain the most appropriate restorative solution and to establish whether the patient's preferences can be met. A suggested sequence for prosthodontic treatment planning is set out in Figure 1.

The following case presentation shows an instance where

prosthodontic treatment planning in conjunction with the patient found RPDs to be the most appropriate solution to meet the patient's wishes and needs.

The second article in the series will describe the logical approach to denture design developed by Dr John Besford, which was used in the planning and design of the RPDs demonstrated in the case presentation. The approach includes a step-by-step sequence to create clear, realistic and colourful designs.

### Case presentation

A 44-year-old woman was fully aware of the advanced deterioration of her teeth. Several years of working in the third world had precluded access to adequate dental care. The frontal view (see Figures 2 and 3) suggested a dentition with a demise of the occlusion and the dental pantomogram showed numerous post-crowns and carious teeth.

Using the above sequence the prosthodontic treatment planning evolved as follows:

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**Figure 6:** Diagnostic changes including new OVD installed as temporary restorations. The midline cant and incisal level corrected. Cant in gingival level remains.



**Figure 7:** Palatal mirror view of upper remaining teeth. 5, 2, 12, 13 were kept as over-denture abutments (ODAs). The cast restorations on 7 and 7 had guide surfaces for passive ring rests. The anterior crowns had deepened rest seats using same path of insertion.



**Figure 8:** The remaining teeth. Note the lower incisal edges restored with composite filling material.



**Figure 9:** The upper RPD. The denture teeth were fitted directly to the ODAs and well-preserved alveolar ridges.

1. After years of repairs the patient was ready for a comprehensive and durable restorative solution. The solution had to be compatible with her continued work in the third world. She was not keen on a removable option. She had a financial budget that she would not be able to exceed.

2. She had two posterior occluding pairs. The rest were made up of a loosened and failed lower bridge (see Figure 4). She was concerned about the visible gaps on her lower right side. 1, 15, 16 and 15 were un-restorable and in need of removal. It was agreed to aim for a new occlusion of first right to second left molars; of these 6, 4, 6, 5 and 6 were already missing.

3. The remaining teeth were all firm with adequate periodontal support. The teeth with existing cast restorations all needed investigation. It was uncertain whether the teeth could qualify for new cast restorations or whether an alternative solution would need to be found.

The gingival level of the upper teeth was visible in the smile (see Figure 3). This posed a particular aesthetic challenge. There was a marked cant from the receded zenith of 3 to 3. There was also a marked cant of the 1/1 midline.

There was clear evidence of bruxism and a demise of the occlusal scheme. The three-unit bridge in the lower left quadrant was loosened. The crown on the opposing 6 was lost.

4. The patient was receptive to diet advice and keen to adopt improvements in daily oral hygiene. All the remaining upper teeth and four lower required investigation variously to remove caries, re-do existing root fillings and assess strength of residual tooth substance.

5. A diagnostic wax-up (see Figure 5) was commissioned on mounted study casts. The casts were mounted at a new vertical determined by replacement of the missing/worn incisal portion of the lower front teeth. The wax-up included a new occlusal scheme designed to established criteria (Guichet 1984) for a mutually protected occlusion. Smile design was used to improve the anterior aesthetics. The diagnostic wax-up served as the basis for introducing the new occlusion in the mouth. Provisional restorations (see Figure 6) were made using moulds of the wax-up. This also allowed for immediate replacement of the teeth to be removed. The lower anteriors were restored to original height and shape using a hybrid composite filling material. Note that the provisional restorations continued to be fixed at this point and the lower right quadrant was still short of an occluding unit. The diagnostic occlusion was left for observation over a three-month period to ensure acceptance and stability.

6. The possible restorative options were upper and lower RPDs (with either acrylic bases or cast frameworks), extensive conventional bridgework or a combination of conventional

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bridgework and implant-retained restorations. The investigations under point 5 revealed that four upper teeth (5], 2], 2 and 3] ) would not be able to retain new cast restorations with posts/cores. They could, however, be used as overdenture abutments (ODAs). The other upper teeth (7], 3], 1, 1, 4 and 7 ) were well distributed for use as RPD abutments. For a fixed solution, the three anterior teeth would not be suitable for cross-arch-fixed-bridgework, but an RPD could be designed to allow for failure/addition of any of these anterior teeth. The option of dental implants would require up to eight upper implants and four lower. Eight upper implants would ensure a 'fixed' future and would obviate the need to keep any dubious teeth. Implants would however present by far the most expensive route.

7. RPDs with cast frameworks in combination with a number of single unit cast restorations would represent the most cost-effective and versatile route to a definitive full-mouth rehabilitation. A spare RPD would go a long way to overcome potential difficulties with breakages. The RPD would not preclude an implant solution in the longer term.

8. Fixed conventional bridgework alone could not provide an adequate definitive occlusion and the patient was very apprehensive about the difficulties of servicing implants in the third world. She also felt that they were well beyond her budget at that time.

9. The patient developed realistic expectations through the treatment planning process. She arrived at the conclusion herself that the removable option was the most suitable solution for her. She did not have prior RPD wearing experience. She was concerned about the 'removable' aspect of RPDs. She was encouraged, however, by the stability of her 'removable' provisional restorations to believe that RPDs need not feel movable when in situ.

10. The RPDs were designed to combine open/hygienic principles with biomechanical considerations in order to conform with modern concepts of preventive dentistry (see Figures 7 to 16).

### Discussion

The planning sequence can help the patient understand the possible treatment options. The aim must be to allow the patient to make an informed choice. When a patient is set on a fixed solution the sequence can help explain why this may not be suitable. In this example the interim solution remained fixed. In other cases a well-planned temporary RPD may give the patient an opportunity to consider a removable option fairly.

Patients increasingly ask for implants straightaway. Is this because of the implants themselves or because of the benefits



Figure 10: The cast restorations on 4], 4] and 7] had milled seats/slots for the RPD rests and reciprocals.



Figure 11: The lower RPD. The combination of dental bar and sublingual gave maximum tooth support and RPD rigidity.

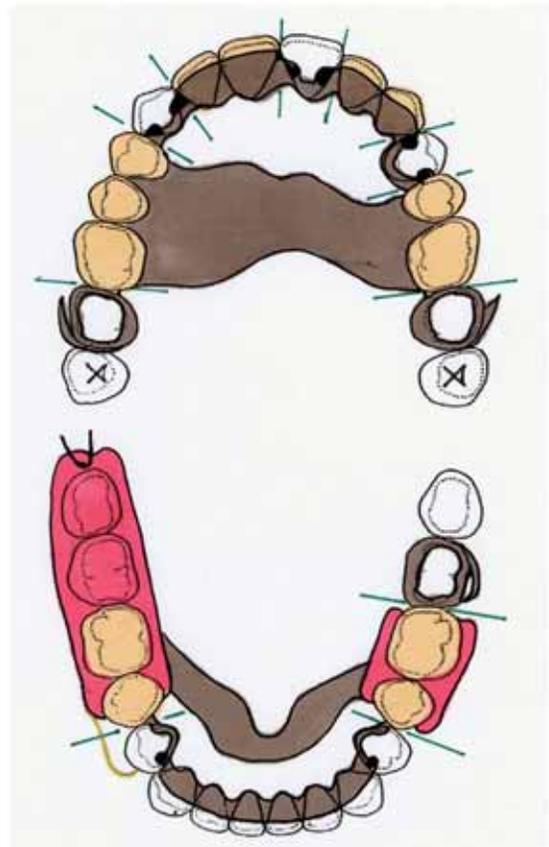


Figure 12: RPD designs conforming to hygienic principles.



*Figure 13: The restored lower arch. New cast restorations on 4, 4 and 7 and RPD with cast cobalt-chrome framework.*



*Figure 14: The restored upper arch. New cast restorations on 1, 3, 1, 4 and 1. RPD with cast cobalt-chrome framework. Note open/hygienic design and minimum coverage of gingival margins.*



*Figure 15: Frontal view of completed rehabilitation. The RPDs and their clasps were discreet*

the patient perceives them to deliver? Often it is the latter. It is the responsibility of the clinician to ensure that the patient is aware of any other restorative options that can offer the same benefits at lower cost and with less invasive treatment.

Not every missing tooth needs to be replaced to restore adequate function. The shortened dental arch (SDA) (Armellini and von Fraunhofer 2004) is a functional and acceptable solution. If the patient has four posterior occluding pairs and no aesthetic concerns there is probably no need to replace further posterior teeth. Many RPDs seem to be a mere gap filling exercise where teeth/saddles (superfluous to function) are added simply in order to meet an 'ideal count'. In contrast, it is rare to see bridges with similar unnecessary cantilever extensions.

Sound teeth that are strategically positioned as abutments strengthen the case for an RPD. Less favourable teeth should not be written off until they have been considered as over-denture abutments. An RPD can act as a stop-gap before future implant placement where teeth left as over-denture abutments maintain alveolar bone height and width (see Figure 17).

Does an RPD have a prophylactic role in holding a dentition together? The literature (Wöstmann et al 2005) finds this questionable. In my experience, a well-designed and

monitored cast RPD framework can (for example) act as a periodontal splint. A combined occlusion of some sound teeth, some mobile teeth and rigid implant-retained restorations can be very difficult to manage, and an RPD can be helpful in this type of situation. An RPD can also be designed to allow for future additions and modifications. The dental bar shown in the design example in Figure 18 is a very useful removable splint and a means of allowing additions.

Substantial bone loss is a very difficult challenge for the final aesthetic outcome. Carefully waxed up flanges, tinted to match the adjacent natural soft tissues, can be a very credible alternative to extensive bone augmentations (see Figure 19).

An interim RPD or part completed RPD can act as a 24/7 occlusal appliance to establish a centric occlusion in harmony with the chewing muscles and centric relation of the TMJs. This approach also allows a training period that can ease adaptation and acceptance (see Figures 20 and 21).

It is all too common to find mobile teeth in combination with badly designed and poorly fitting RPDs. The mobile teeth may appear to have a poor prognosis. It may indeed be tempting to give up on them. A surprising number of teeth will respond favourably to even minor improvements in fit and function of the existing RPD. The RPD in Figure 22 fits so badly around 13 that it is no surprise this tooth is loosened. If the fit

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Figure 16: New smile.



Figure 17: A failed three-unit bridge. Roots retained as ODAs. Avoids difficult longer span fixed bridge. Allows for a future implant solution

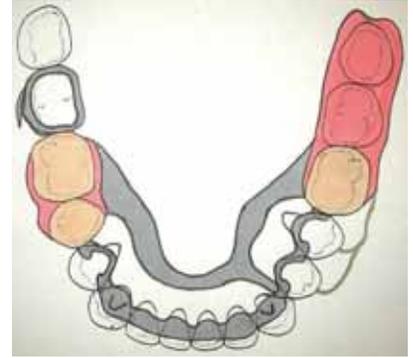


Figure 18: 4 and 5 marginal bone loss but stabilised with periodontal treatment. Some mobility remains. Dental bar from 4 to 5 used as periodontal splint. Both teeth remain stable after 10 years.

of the RPD against the denture bearing area and the four remaining teeth is improved the  $\bar{3}$  will probably tighten up quickly; an occlusal correction may be required once teeth and stable RPD work as one.

There is often a seeming urgency to start and finish treatment. This may be driven by the patient or by the business aspect of dentistry. It is not, however, helpful in achieving a

successful long-term outcome in prosthodontic treatment.

Prosthodontic treatment aims to restore aesthetics, form and function and many RPD situations are in fact full-mouth rehabilitations. In private practice, time to plan and prepare can be allowed for in the total cost of treatment. There is no excuse for bypassing such steps as mounted study casts, diagnostic wax-up/set-up, occlusal analysis, occlusal



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Figure 19: Flange tinted and contoured to blend in with natural gingival tissues. Extended necks and inter-dental spaces - and access for dental floss - adds to realistic appearance.

Figure 20: Cast lower RPD framework. Dental bar for maximum tooth support. Clear acrylic bases act as training bases to finalise comfortable peripheral extensions. Acrylic blocks used as occlusal appliance to determine the centric occlusion that coincides with centric relation.

Figure 21: Training phase for new lower bilateral RPD with optimum extension. Centric stops visible on the posterior blocks. A mutually protected occlusion on a free-end saddle RPD requires maintenance at regular individually assessed intervals.

Figure 22: Upper mucosa supported RPD. No evidence of prior clinical planning, design or preparation. The RPD fits badly around the teeth and rocks. The natural teeth each fight an individual battle. An acrylic RPD can also be designed to benefit from tooth support and guide surfaces.

appliance, interim RPD and provisional rehabilitation. Equally the treatment plan should allow periods of time for observation of improvement and stability before embarking on the definitive solution. Good 'provisional' restorations need only be so in name.

There is a medico-legal requirement to inform every patient of all the possible treatment options and to list arguments for and against each. There is also a professional duty to present all options in an objective way. Options should not be excluded because the clinician is uncomfortable with his/her own ability to provide them. Referral is always a possibility.

A clear winner may emerge from the planning sequence. Equally medical and social reasons may exclude others. If the patient has been taken through the sequence it is rewarding when the patient offers this first choice unprompted. With the maxim in mind that 'ideally treatment should be the minimum that will satisfy the patient's wishes and needs', it is

particularly rewarding if the patient comes for implants and decides on conventional removable!

Some patients continue to have unrealistic expectations whatever one does. In this case, a documentation of the planning sequence will prove that the patient was fully informed and forewarned.

## Conclusion

Any restorative solution requires careful planning, preparation, design and execution. Ideally it should be the minimum that will satisfy the patient's wishes and needs. It is my hope that this article will inspire other clinicians to consider modern RPDs favourably alongside other restorative options and to empower their patients to make an informed decision as to what will best suit them.

*References Available*