

# Acrylic Partial Dentures

A. DAMIEN WALMSLEY

**Abstract:** Acrylic removable partial dentures are routinely used in everyday clinical practice. However, there is concern that if they are not correctly designed that damage may result to the soft and hard tissues leading to tooth loss. This article reviews the potential damage that may occur from the use of acrylic dentures. Methods of improving the design features and construction of acrylic RPDs to minimize damage and improve longevity of the remaining teeth will be demonstrated.

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**Clinical Relevance:** Acrylic dentures may damage the teeth and supporting tissues. However, the combination of correctly designed dentures and the implementation of a rigorous maintenance regime may prolong the life of both the denture and oral tissues.

In this day of technological advances, there are many new techniques creating interest within the dental profession. However, in spite of such advances, there remain other, older techniques that are still required. One subject area, which is still commonly used in everyday dental practice, is the provision of removable partial dentures (RPDs) constructed from acrylic resin. Although many textbooks cover the provision of metal-framed dentures, the provision of a simple acrylic denture still outperforms in the number provided in everyday clinical practice. This is reflected in the number of acrylic and metallic RPDs provided by the NHS over the last 9 years (Figure 1). The figures obtained from the Dental Practice Board website<sup>1</sup> show

that, for every denture that involves a cobalt-chrome framework, there are five dentures that are made from acrylic. In the period 2000/1, the cost of metallic framework partial dentures to the NHS was just over £13 million, compared to over £41 million for the provision of acrylic dentures. Although it is not possible to obtain figures from the private sector in the UK, it is unlikely that such activity will be radically different. The results of a survey in Singapore showed that acrylic partial dentures were the preferred choice for RPD treatment. Furthermore, the work profile of those who had a postgraduate qualification in removable prosthodontics did not differ from that of the general dental practitioner.<sup>2</sup> In spite of the high clinical activity in this area, there is little literature on the provision of acrylic dentures. A recent textbook on partial denture design, where there is only one chapter dedicated to acrylic RPDs, typifies this situation.<sup>3</sup> Whilst the provision of

cobalt-chrome dentures is often seen as a superior treatment, it remains a clinical fact that dentists are providing more mucosal borne acrylic dentures. Why does this happen? The advantages of such treatment, together with the disadvantages of mucosal borne acrylic dentures, are shown in Table 1.

Providing acrylic dentures is a cheaper alternative to metallic dentures and they are relatively easy to manufacture in the laboratory. They are indicated for both immediate and transitional dentures, where the prosthesis may be of a temporary nature, with a life of around 6 to 12 months. If further teeth need to be extracted, or if a reline is indicated, then it is simple to bond acrylic to acrylic. Although there have been advances in acrylic to cobalt-chrome alloy bonding (Figure 2), such as the use of 4 META,<sup>4</sup> it is easier to utilize acrylic bonding wherever possible.

Acrylic dentures have many disadvantages associated with their use. Acrylic is a non-rigid material and its strength is improved by increasing its thickness. This leads to a bulky denture, which in turn will increase its potential to cause damage to the soft tissues of the mouth. Combined with an increased area for plaque accumulation, acrylic partial dentures may lead to periodontal breakdown with subsequent tooth loss. This is the biggest concern that is associated with the use of acrylic partial dentures and this potential for damage is inherent in all such prostheses.

The aim of this article is to review the

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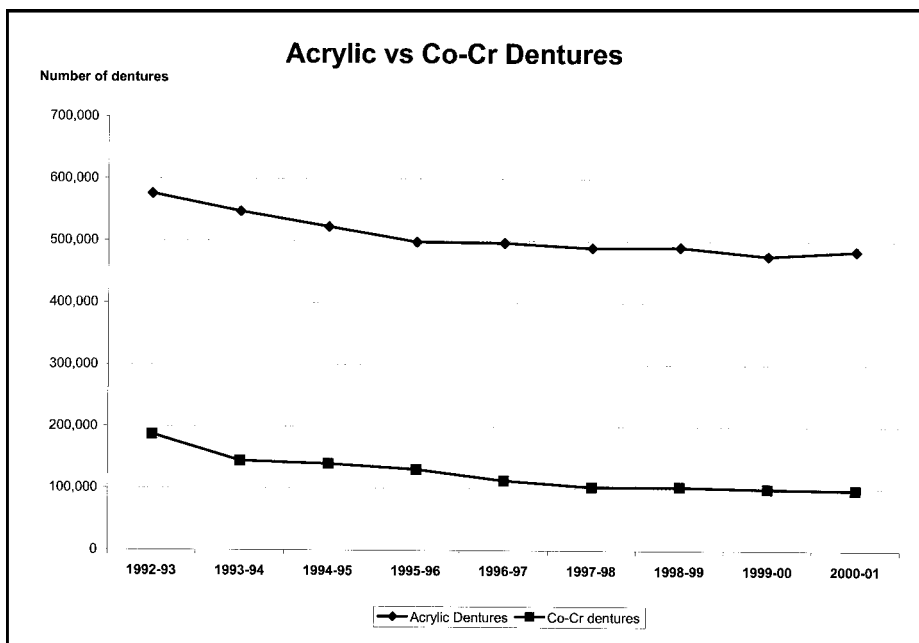


Figure 1. The number of acrylic and cobalt chromium partial dentures provided by the National Health Service from 1992-3 to 2000-1 (information from the Dental Practice Board, Eastbourne, UK).

potential damage that may result from the use of acrylic dentures and describe methods of improving the design features and construction of acrylic RPDs to minimize damage and improve longevity of the remaining teeth. The outcomes will be to inform clinicians of the potential damage caused by acrylic dentures and how to improve their design.

### DAMAGE TO THE MOUTH

A literature review<sup>5</sup> of damage caused to the mouth found that early clinical studies on RPDs reported extensive periodontal breakdown after insertion of the prosthesis, whilst later studies reported moderate or practically no harmful periodontal changes. There are three main factors which contribute to periodontal breakdown:

- plaque and oral hygiene;
- coverage of the marginal gingivae by the component parts of an RPD; and
- occlusal forces that are transmitted to the remaining teeth and their periodontal tissues by the prosthesis.

When patients who are provided with RPDs maintain good plaque control and are regularly maintained on a preventive programme, then the forces transmitted to abutment teeth do not induce periodontal breakdown. A four-year longitudinal study of dentogingivally-supported dentures<sup>6</sup> indicated that plaque control was the most important factor that reduces the occurrence of periodontal breakdown. A 25-year longitudinal study<sup>7</sup> was carried out on a number of patients fitted with removable partial dentures (RPDs) in 1969. Of the initial 30 patients in the study from 1969, 23 were still alive in 1994, all of whom were examined. The numbers of lost teeth, new decayed and/or filled surfaces and endodontically treated teeth were low. No apparent changes of the periodontal condition of these patients took place during the follow-up period. It was

concluded that, if good plaque control was established and maintained, the prosthetic treatment was carefully planned and a rigorous recall regime was in place, long-term RPDs were highly successful and resulted in minimal alteration to the teeth and the soft tissues.

The above studies assessed tooth-borne dentures constructed around a cobalt-chromium framework. The majority of acrylic RPDs are designed to be mucosal borne. Upper RPDs will benefit from the support gained from the palate. An area of 5 cm<sup>2</sup> in the centre of the palate does not resorb<sup>8</sup> and offers the support required. Where such support is not available, such as for a lower mucosal borne denture, then support from the teeth is important.<sup>9</sup>

### POTENTIAL CAUSES OF DAMAGE BY ACRYLIC DENTURES

Acrylic partial dentures have the potential to cause periodontal damage in the following ways:

- Physical stripping of the gingiva;
- Damaging lateral forces;
- Interdental wedges;
- Plaque formation on teeth.

Acrylic dentures, by the nature of provision, are mucosal borne and, as bone resorption occurs, they will slowly become ill-fitting. Subsequent trauma will result in the gingival tissues being physically stripped away from the teeth, leading to loss of attachment (Figure 3). The likelihood of such an occurrence will be increased if the denture is designed with no tooth support and the components contacting the teeth are finished below the survey line. The beautifully named

Advantages	Disadvantages
Cheap Relatively easy to construct Easy to modify (i.e. additions to denture)	Weak material Non-rigid Must be bulky for strength High potential for damage to soft tissues

Table 1. An outline of the advantages and disadvantages of the provision of acrylic partial dentures.



**Figure 2.** The use of 4 META acrylic allows bonding of acrylic to cobalt chromium alloy.

‘gum stripper’ is an example of such a damaging appliance where the gingiva is stripped away by contact with the acrylic denture by occlusal forces.

Any lateral forces on teeth in the presence of plaque will increase periodontal progression. It is a paradox that the use of wedges of acrylic, which fit interdentally, will provide some increased retention. However, their use should be avoided, as they will cause damage by leading to food packing and ‘gum stripping’. Furthermore, increasing the contact with the teeth leads to plaque accumulation with subsequent periodontal disease. Any RPD is an efficient plaque retainer, especially where there is contact of the acrylic with the tooth (Figure 4).

**DESIGN PRINCIPLES FOR A GOOD ACRYLIC PARTIAL DENTURE**

In a similar manner to an RPD design for a cobalt-chromium denture, the casts should be surveyed and, where appropriate, articulated to assist in the design. The design of acrylic dentures will follow the same principles involved with a cobalt chrome denture<sup>3</sup> and should consider the following:

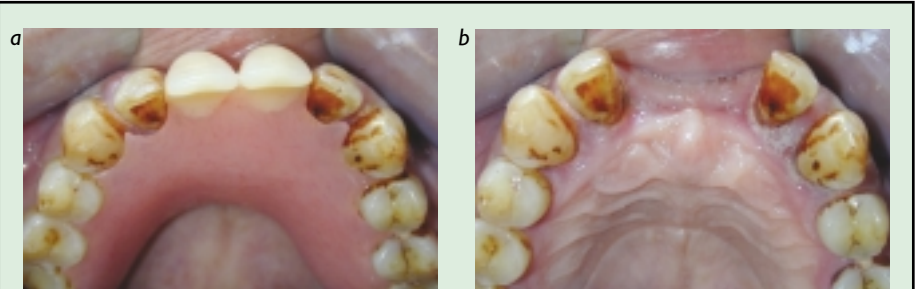
- Saddles
- Support
- Retention

- Bracing and reciprocation
- Connector
- Indirect retention
- Review of completed design.

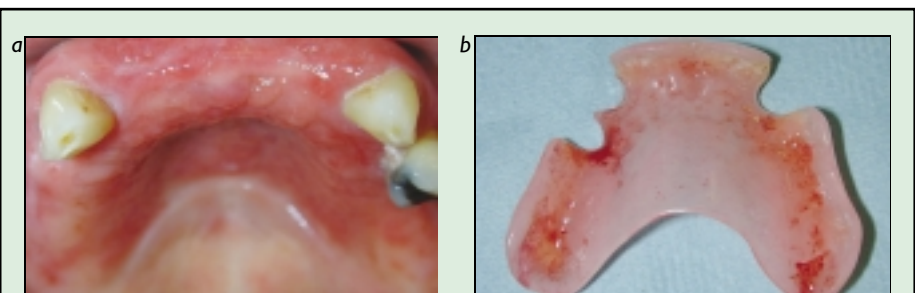
*Saddles* are designed to fill the edentulous space to be replaced. However, the saddle must be fully extended in the distal extension edentulous area. When designing the denture the clinician should look to increase the tooth borne *support* of the denture and not rely exclusively on mucosal support. This may be obtained by finishing the denture above the survey line in those places where the acrylic components contact the tooth (Figure 5). It is possible to avoid contact with the gingiva and obtain relief by blocking out the dentogingival junction,<sup>10</sup> although this is controversial. It has been found that deterioration in gingival health will occur whether relief is present or not.<sup>11</sup> *Retention* will generally be a wrought clasp, which will be attached to the acrylic and will require reciprocation. *Connection* will usually be acrylic or,

where strength and reduction in bulk is indicated, then a cast cobalt chrome framework is designed. In order to obtain indirect retention, the clasp must always be placed between the saddle and the indirect retainer. Finally, the completed design is reviewed against a checklist of the design principles

Wherever possible, any coverage of gingival margins should be avoided or reduced to an absolute minimum (Figure 6) and this is combined with a high level of oral hygiene. The patient should be instructed in the correct oral hygiene measures and advised on correct denture care, both at the insertion stage and review.<sup>11</sup> This should include disclosing of the denture on review appointments and indicating where the denture is not being cleaned properly. The use of a suitable denture cleanser is advocated. If there are metallic components associated with the denture, such as clasps, then these should not be placed in the cleanser. Avoidance of *candida albicans* growth within the denture will prevent denture stomatitis. The



**Figure 3.** (a) The upper acrylic denture covers the palatal gingival margins and has been finished below the survey line. It is an example of a ‘gum stripper’. (b) The gingival margins are inflamed. It is interesting to note that oral hygiene instruction did not feature highly on the treatment planning for this patient!



**Figure 4.** (a) The oral mucosa exhibits inflammation owing to candidal infection and there is plaque retained around the teeth. (b) Disclosing of the denture shows that compliance with denture hygiene instruction is required to remove the plaque.



**Figure 5.** The acrylic has been finished above the survey line in order to obtain support from the remaining teeth.

subsequent inflammation and swelling of the tissues will lead to an ill-fitting denture (Figure 4).

### Processing of RPDs

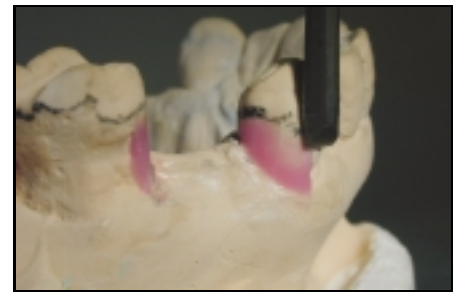
A simple, but often overlooked, technique to provide well-fitting acrylic dentures is to ask the technician to block out undercuts, including any interdental spaces prior to processing. First, the cast is surveyed to the path of insertion (which is generally vertical to the occlusal plane). The undercuts on the master cast are blocked out with wax (Figure 7) or plaster and a duplicate cast is obtained. The denture is then processed on this duplicate cast. If such a simple but effective technique is not done, then the acrylic denture will only fit once the undercuts are removed. This process takes place by the chairside and may often turn out to be a lengthy procedure. As the clinician attempts to fit the denture, excessive acrylic is often removed, leading to the denture not contacting the hard and soft tissues. This has the potential to increase damage, which this article has

sought to reduce or eliminate.

### THE 'EVERY' TYPE ACRYLIC PARTIAL DENTURE

An acrylic denture, which is well accepted as adhering to good design principles, is the 'Every' denture. This was first described in an article by Every in 1949 and was later described in a subsequent article by Dyer.<sup>12</sup> Thirty years later the six principles advocated by Every for an upper RPD with bounded saddles still hold true (Table 2). An example of a design sheet drawn up for an Every denture is shown in Figure 8.

Natural teeth have a buccally placed contact with each other and this point contact is copied between adjacent standing and artificial teeth. To maintain this point contact throughout the arch, 'distal stabilizers' are used to contact the distal surface of the last standing tooth (Figure 9). These are not clasps but are used to maintain the point contact and prevent the last standing tooth from drifting distally, so maintaining contact along the arch. An Every denture should have wide embrasures (between contiguous standing and artificial teeth). This reduces gingival contact and reduces plaque accumulation. This principle is reinforced in the requirement to uncover the gingivae wherever possible. Palatally, the acrylic should be at least 3 mm from the gingival margins. The term 'free-occlusion' refers to the requirement to prevent any occlusal interference, which may result in damaging lateral forces. A free occlusion has no tendency for the



**Figure 7.** The undercuts are blocked out with wax prior to obtaining a duplicate cast.

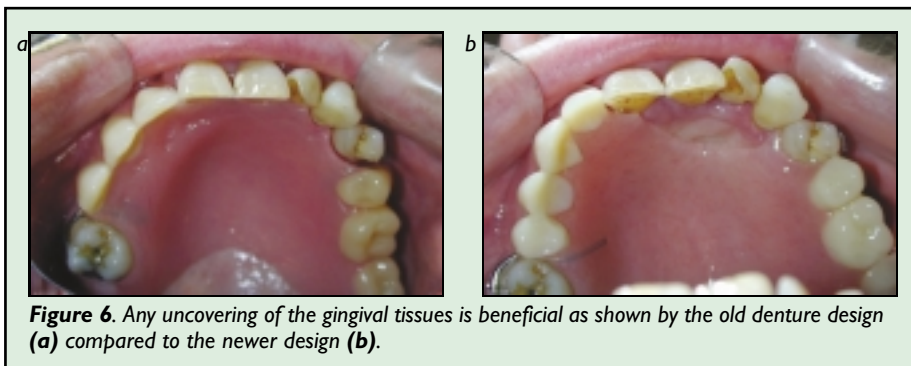
- Point contact between adjacent standing and artificial teeth;
- Wide embrasures (between contiguous standing and artificial teeth);
- 'Free-occlusion';
- Uncovered gingivae;
- Distal stabilizers contact of the denture with the distal surface of the last standing tooth;
- Maximum retention following the principles employed in complete denture construction.

**Table 2.** The six design features required for a successful Every denture.

upper and lower cusps to interlock or hinder movement. Finally, maximum retention is obtained by following those principles normally employed with complete denture construction. This includes extending the denture base to cover as large an area as possible. The fit of the denture should be accurate and the polished surfaces should be shaped to assist muscular forces.

### SUMMARY AND CONCLUSIONS

Acrylic dentures will continue to be a successful form of treatment for the restoration of edentulous spaces. Good design principles will lead to a well-supported denture that reduces any possible harm to the soft and hard tissues. However, to retain this success the RPD must be designed to reduce the potential for plaque accumulation and annual maintenance of the patient is required to reinforce this plaque control.



**Figure 6.** Any uncovering of the gingival tissues is beneficial as shown by the old denture design (a) compared to the newer design (b).

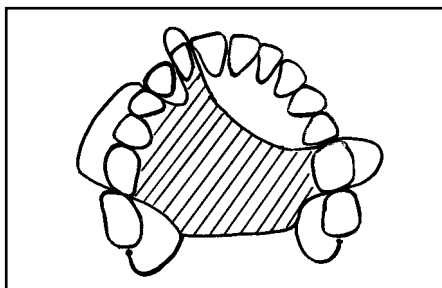


Figure 8. A design sheet drawn up which displays the principles of an Every denture.

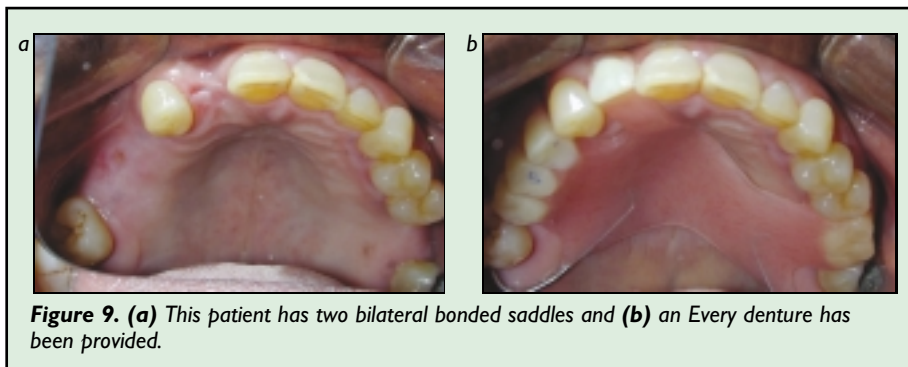


Figure 9. (a) This patient has two bilateral bonded saddles and (b) an Every denture has been provided.

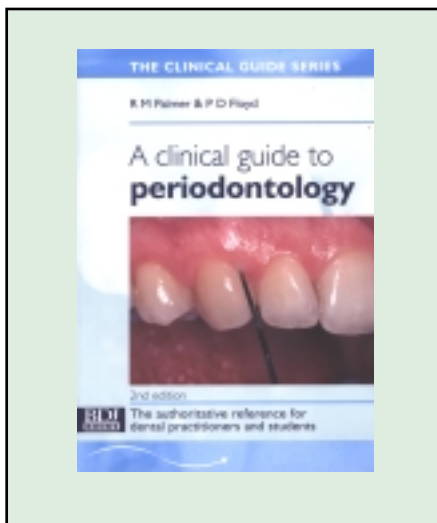
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BOOK REVIEW

**A Clinical Guide to Periodontology**, 2nd edn. By R.M. Palmer and P.D. Floyd. BDJ Books, 2003. ISBN 0-904-588-750.

This is the second edition of the BDJ book on clinical periodontology that was first published in 1996. This new edition is divided into 12 chapters with new sections on the pathological basis of periodontology and the important topic of patient motivation. The book takes the reader through periodontal diagnosis and the pathological basis of periodontology, non-surgical and surgical therapy and finishes with a chapter on implant therapy. There is also a useful further reading section to guide



more in depth study. The book is written in an easily comprehended style, supplemented by

numerous high quality clinical photographs. The text is also interspersed with numerous boxes that contain bullet-pointed lists that highlight the salient features of a topic. This style should be readily recognized by any regular reader of the BDJ and will certainly prove useful for revision purposes.

The book is advertised as the 'authoritative reference for dental practitioners and students' and it achieves this aim remarkably well in less than 100 pages. I have no hesitation in thoroughly recommending this book for both undergraduates and general practitioners as it covers the subject matter in an easily digestible manner.

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ABSTRACT

LEARN WITH (OR FROM?) YOUR TEAM

Sterilization and Disinfection of Dental Instruments – A Synopsis. A. Wright. *British Dental Nursing Journal* 2003; **62**: 15.

The cleaning and sterilization of dental instruments is the responsibility of the

principal of every dental practice, but it is almost always a delegated responsibility. This article sets out simple guidelines which would be a valuable reference article in staff training. Cleaning of instruments manually, ultrasonically, and in a washer-disinfector are addressed, together with methods of surface disinfection, full instrument sterilization, the place of single use devices and advice on hand-washing. The

importance of recording all procedures is stressed.

The subject is not covered in depth, but every reader will learn something. The author also includes some useful references for further and deeper reading. However, this is a journal which will probably be in every practice. When did you last look at it?

**Peter Carrotte**  
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