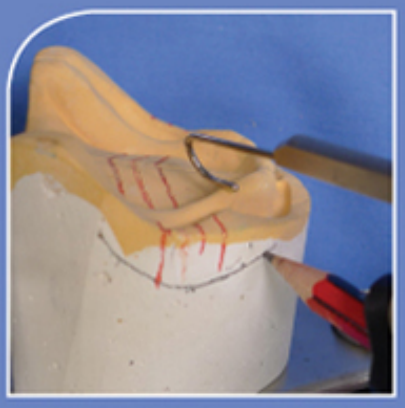
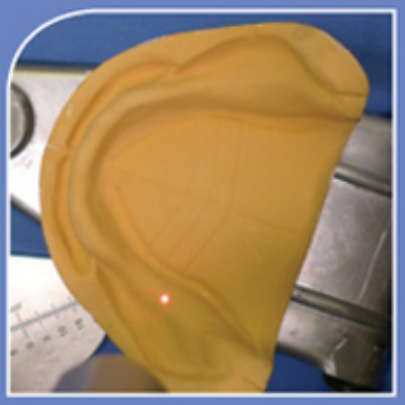
TECHNIQUES IN COMPLETE DENTURE TECHNOLOGY





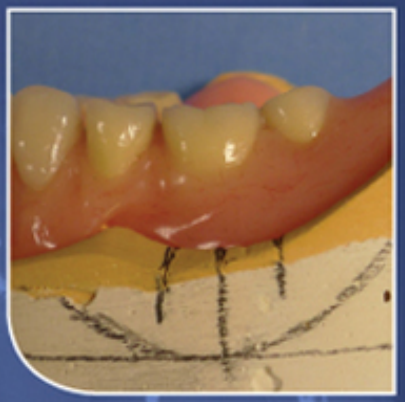


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Table of Contents

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Preface

As the dental profession becomes more successful in delaying complete edentulism in patients until much later in their lives, it also brings with it greater problems in providing these older patients with satisfactory complete dentures. More understanding of all aspects of complete denture provision will be needed to achieve satisfactory outcomes for these patients.

The technical aspects of complete denture provision are very often given brief consideration in publications relating to complete denture provision. This side of complete denture provision, however, often has a major impact on the success or failure of the dentures.

This book is intended for all student dentists and technicians, clinicians, clinical dental technicians and technicians who have an interest in complete denture provision, with the hope that it may stimulate new ideas and improve technique when considering the technical aspects of denture construction.

We would like to thank the following people who either provided or modelled for the pictures that appear in this text. First we thank Mr Peter Bridgwood for kindly allowing the use of his image and Dr Hannah Barnes for providing clinical pictures. We also appreciate the help given by David Wildgoose, Eleanor Stone, Laura Peacock, Sebastian Wilkins, Micheal Spencer, Daniel Leung, Lisa Smith, Christopher Povey and Anna Burrows.

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Chapter 1

INTRODUCTION

This text will set out the ideal properties of complete dentures, and provide you with techniques for achieving these when carrying out any stage in the production process. Dentures should function well and look good. The denture wearer may value function over aesthetics or vice versa, but failure to establish a minimal requisite will lead to disappointment.

What do we mean by function well? Dentures should be comfortable, retentive, stable when biting together in any position, and restore the speech.

What do we mean by look good? Dentures should replace the teeth and the resorbed bone, resulting in natural looking anterior teeth, support of the soft tissues and restoration of any loss in vertical dimension.

Establishing function and aesthetics may be challenging in some cases, this text aims to provide the solutions to ensure the reader understands and can provide the various elements that are essential for optimum denture provision. This text will help the reader evaluate, design and provide the following requirements.

Fit:

This is a result of impression technique, impression materials, model materials, processing method, denture base material and final fitting.

Retention:

This results from fit and forming a border seal. Providing retention may prove difficult for lower dentures where stability and muscular control must be optimised to compensate.

Stability is Dependent upon Fit and Occlusion.

Establishing a balanced occlusion is key to maintaining stability and in turn the border seal. Lower dentures are particularly vulnerable to instability as a result of poor retention. Here the occlusal table should be designed to provide optimum load distribution in order to seat the denture.

Occlusion of the Denture Teeth

may be established as a conventional balanced occlusion or as a lingualised scheme, each should result in multiple tooth contacts around the denture, providing stability in any position.

Muscular Control

provides long-term retention of the denture and is aided by the positioning of the teeth in the neutral zone and by the considered shaping of the polished surfaces of the denture.

Aesthetics

of dentures are undoubtedly subjective, however examples from nature provide simple rules to follow where no record of the natural teeth exist.

Materials

used for the production of artificial teeth exhibit a range of mechanical properties and as such should be chosen to suit the patient requirements and the desired working life of the denture. Denture base material should also be chosen to suit the required strength and aesthetics.

Chapter 2

PRE-PROSTHETIC TREATMENT

What's Wrong with the Old Denture?

Fulfilling the requirements of function and aesthetics is challenging enough, so why not make use of the clues that exist before commencing work? Take a look at the existing denture.

Assess the denture's Retention

- Has it gradually deteriorated?
- Is the extension of the denture correct?
- Is there a continuous border seal?
- Is there any mobile mucosa?

Is It Stable?

- Is the occlusal table optimally designed?
- Are the teeth in the neutral zone?
- Are there any premature contacts on closing?
- Is the patient functioning from centric relation?
- Is there a balanced occlusion?
- Is there stability in protrusion?

How does It Work Aesthetically?

- Should the anterior aesthetics be duplicated?
- Is there significant wear?
- Has the patient ever liked it?

- Is there a record of the natural teeth?
- Is the vertical dimension correct?

How Well does It Function?

- Is the patient comfortable, stable and functioning from centric relation?
- Is the vertical dimension correct and will any increase be tolerated?

When assessing an existing denture, some features will be simple and quick to assess, confirm or even correct. Others may require further investigation prior to undertaking the task of producing a denture.

Modifying the Denture

Modifying an existing denture to correct basic errors, test new positions or dimensions may be possible even if a number of problems exist. Alternatively, a copy of the existing denture can be made and the modifications tried out on this.

The following simple adjustments can be tried to diagnose problems with retention, stability, function and aesthetics.

Retention

- Extend the denture base to cover the entire denture-bearing area chairside using light-curing material such as Triad VLC. Figure 1a shows an inadequately extended denture and Figure 1b shows extension provided with autopolymerising polymethyl methacrylate (PMMA) resin.
- If the the extension is satisfactory it can be relined either chairside or via the laboratory.

Figure 1

Stability

- Remove premature contacts and establish balanced occlusion. Premature contacts are easily removed chairside; establishing a balanced occlusion may require a check-record procedure on an articulator.
- Decrease the occlusal table by removing the most posterior teeth. This will help in several ways. First, there are fewer tooth contacts to establish, making the dentures easier to adjust. Second, there is less risk of the masticatory contacts being over the slope of the alveolar, which may be acting to dislodge the denture. As shown in Figure 2, leaving off the last molars that would be placed over the sloping parts of the lower ridges will improve stability. Finally, the contacts are further away from the condyles, which allows a greater tolerance when adjusting contacts (i.e. less accuracy is required).

Figure 2

Function

- Increase the vertical dimension on existing dentures. This may serve two purposes. First, it may allow muscles to relax and the condyles to seat optimally in centric relation. If a patient has been posturing forwards, the lateral pterygoid muscle may shorten and allow the disc to fill the space behind the condylar head. Second, if a large increase in vertical dimension is required, the ‘new’ dimension may be tested prior to commencing treatment.
- Use self-curing acrylic on the occlusal surfaces of the teeth (premolar and molar only) to create an open bite. This could also be corrected using copy dentures. In Figure 3a, worn posterior teeth have created an over closed appearance. A trial temporary vertical dimension can be provided using autopolymerising PMMA resin placed onto the premolar and molar teeth as shown in Figure 3b,c.

Figure 3

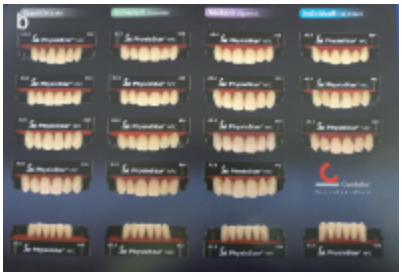
Aesthetics

- Use modelling wax. It is difficult to show a patient what can be achieved with a denture without actually making a trail denture. The effect of increase in vertical dimension and additional lip support or tooth length can be demonstrated with the addition of modelling wax to the existing denture, but the results are limited.
- Have mould guides available. Having mould guides available in conjunction with a good-quality working mould guide as shown in Figure 4 may help. A three-dimensional mould guide provides the clinician and patient with the best opportunity to select the correct teeth required and seeing the various mould options arranged in different ways can be very helpful for both patients and clinicians when deciding upon the aesthetics required. Remember that pictures of the teeth options shown in mould guides (Figures 4b,c) are

useful but never as good as looking at a set of the actual teeth in a working mould guide (Figure 4a). The best demonstration is to have some case studies available for the patient to see.

- Identify any presenting problems at an early stage, discussing the limitations will help set realistic expectations for the final dentures.

Figure 4



Chapter 3

ACHIEVING A GOOD WORKING MODEL

Can I Work with Primary Models?

Primary impressions in stock trays always cause overextension of the denture-bearing area because the impression material is displaced into the sulci. Figure 5 compares an overextended primary model (right) and a correctly extended (left) working model of the same mouth from an impression taken in a custom-made tray. Accurate recording of the functional sulcus is essential to define the denture extension and resulting retention and stability. Retention depends on the denture extending to fill the sulcus and thus creating a seal; if the denture is overextended, stability is compromised and the muscles may be displaced.

Figure 5

The excessive thickness of the material used in primary impressions results in poor accuracy both because of the amount of contraction on setting and over time and because

of distortion resulting from the differing thickness of the material over the impression.

To achieve a good-quality working impression, it is essential to use a well-designed customised tray in conjunction with the appropriate impression material. This chapter explores the factors that govern choices in the design of tray and impression materials used.

Designing a Customised Impression Tray

A customised impression tray should:

- allow easy control of the impression material;
- guide the impression material to the mucosa;
- support the impression material to provide even contact with the oral tissues;
- enable pressure on selected areas of the denture-bearing area;
- provide an even layer of impression material;
- support the set impression material;
- be rigid and retain its shape throughout the impression procedure and during the pouring of the model.

The design of the tray should ensure that:

- the tray is rigid;
- the entire denture-bearing area is included;
- the periphery of the tray finishes such that impression material can flow into the buccal and labial sulci without causing displacement of the soft tissues;
- the tray is spaced appropriately for the amount of undercut present;
- the handle is designed to avoid displacing the lips;
- the tray allows free movement of any muscle attachments.

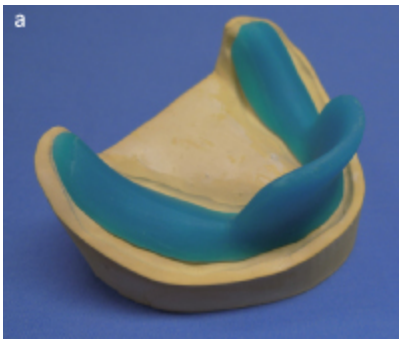
Selecting an Impression Tray and Material

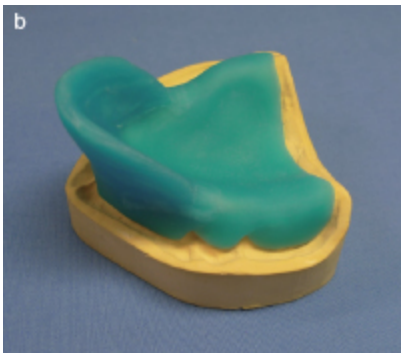
In selecting an impression tray and material, the primary considerations are the amount of undercut present and whether any areas of the mucosa are mobile or unsupported.

Close-Fitting Trays

Where the majority of the denture-bearing area is free from large undercuts, close-fitting trays should be used (Figure 6a,b). These are ideal because they allow pressure to be exerted on the denture-bearing area during the impression-taking procedure. Compressing the mucosa and ‘adapting’ the relaxed mucosal tissue closely to the underlying alveolar bone helps in that the resultant fitting surface of the denture mirrors that of the mucosa under load during function. This allows the masticatory forces acting on the denture to be transmitted directly and comfortably to the alveolar bone.

Figure 6





The impression materials used with these trays are mucostatic in nature, however when used in thin section with close-fitting trays, the impression technique produces mucocompressive impressions. In addition, close-fitting trays allow a thin, uniform layer of impression material to be used. Thin sections of material are beneficial as shrinkage on setting or over time is minimal.

As there are only small amounts of undercut present, close-fitting impression trays such as those seen in Figure 6 may be used with impression materials that are non-elastic or rigid once set, typically zinc oxide and eugenol paste. Where these are unavailable, a medium-bodied silicone material may be used.

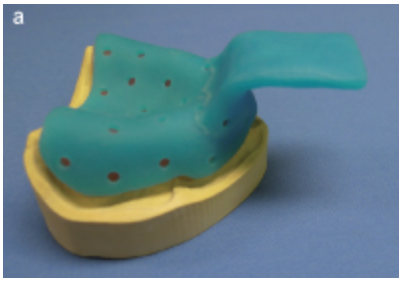
Spaced Trays

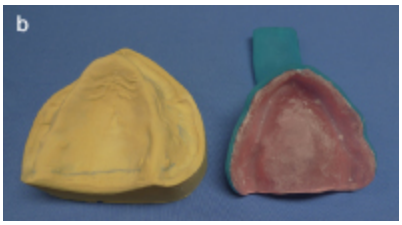
Large undercut areas prohibit the use of close-fitting trays as removal from the mouth without causing distortion would be difficult and removal from the cast model would cause fracture of the cast. The spacing between the tray and the tissues should be increased according to the depth of undercut, tear strength and elastic limit of the impression material. In short, the greater the depth of the undercut, the more likely the material is to tear or exceed its elastic limit on removal.

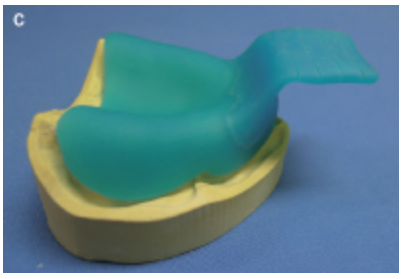
The solution is to provide greater spacing where large undercuts are present. Similarly a weak material such as alginate requires greater thickness than a tough material

like silicone. Figure 7a shows a perforated spaced tray for use with alginate impression material and Figure 7b the wax spacer used to provide room for the impression material between the impression tray and the mouth. The amount of spacer required depends on the tear strength of the impression material being used: the weaker the material the thicker the spacer required. Figure 7c shows a spaced tray for use with silicone type impression material. No perforations are needed for this type of impression material.

Figure 7







One further consideration is the viscosity of the unset impression material (Table 1); if it is very high, additional spacing is necessary to allow seating of the tray without using excessive force. The use of such high-viscosity

materials is rarely indicated in complete denture prosthetics.

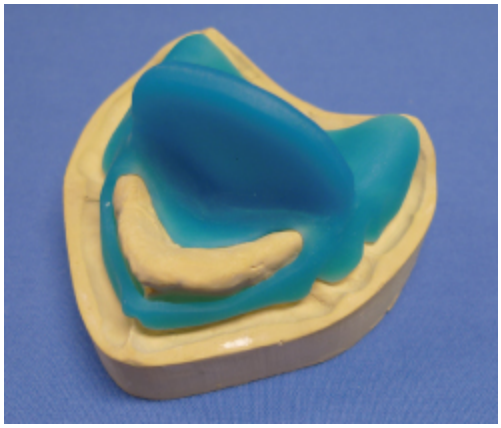
Table 1 Space requirement for impression materials

Impression material	Space required
Zinc oxide and eugenol paste	No spacer wax (0.5–1 mm)
Silicone (medium bodied)	1.5–3 mm (one layer of wax)
Alginate	3 mm (two layers of wax)
Silicone (heavy bodied)	3–4.5 mm (three layers of wax)
Impression plaster	4.5 mm (three layers of wax)

Windowed Trays

Where fibrous ridges are present, impression techniques must be adapted to ensure that the mobile tissue is not displaced during the recording procedure. In this circumstance, the impression is taken in two stages using a customised tray designed such that there is a ‘window’ over the fibrous ridge as shown in Figure 8.

Figure 8



First, a close-fitting impression is taken over the denture-bearing area in a modified tray using a zinc oxide/eugenol impression material. Once set, a second mucostatic material can be used to record the mobile area. Impression plaster is ideal as it can be applied without causing distortion and

readily adheres to the impression tray. Alternatively, low-viscosity silicone may be used.

Producing Customised Trays

Identifying the Peripheral Extension

The extent of the customised tray should be determined with the patient present and recorded on to the primary impression. The simplest method is to mark the extension with an indelible pencil on the alginate impression, which subsequently ‘tattoos’ onto the primary model (Figure 9); use a permanent marker pen on silicone materials. If convenient, the required peripheral outline may be drawn directly onto the model.

Figure 9

An approximation of the peripheral extension may be made using the primary model. The simplest method is to identify the deepest part of the sulcus, then draw the proposed periphery relative to this, taking into account the thickness of the impression material. This allows room for the material to wrap around the periphery of the tray.

For a 1.5-mm spaced tray, draw the extent of the tray 1.5 mm toward the alveolar ridge from the deepest part of the sulcus as shown in Figure 10. The tray periphery should be made slightly short of the required denture extension to allow room for the impression material being used. Draw the

extension to avoid any muscle attachments here and double the space for the impression material on each side of the attachment.

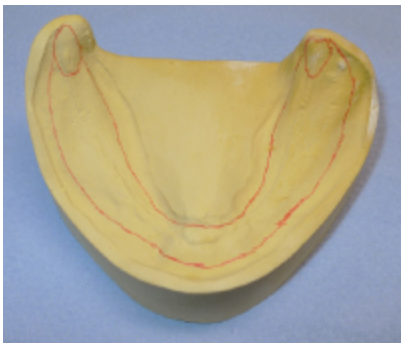
Figure 10

For the maxillae, identify the junction between the hard and soft palate (foveae palatine) and use this landmark as the periphery of the tray, ensuring that the entire tuberosities are included. As shown in Figure 11, the distal extension of maxillary impression trays should extend to the foveae palatine and extend beyond the tuberosities to the hamular notches.

Figure 11

For the mandible, include the retromolar pad and extend into the lingual sulcus such that the periphery is just short of the mylohyoid ridge and buccally to be just short of the external oblique ridge, as shown in Figure 12.

Figure 12



Prescription Information

Any prescription should include the following information.

- The type of impression material that will be used for the working impression.
- The type of tray required.
- The amount of spacer wax required.
- An indication of the peripheral extension of the tray, taking into account the thickness of the impression material to be used.
- Any special features required (outline window tray positions and whether a variable thickness of spacer wax is required).
- Type of handle required (intraoral, extraoral, finger stops, stepped or not and where the handle for a windowed tray should be placed).

Design of a Close-Fitting Tray

This type of tray is used with zinc oxide/eugenol impression paste low-viscosity impression materials. The close fit allows the fluid impression materials to be controlled in a thin layer and to locate precisely against the ridge.

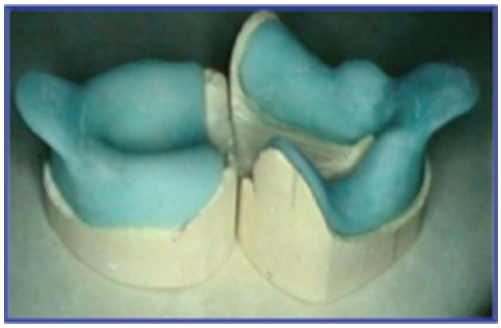
Care should be taken to ensure that the tray extends to the required depth of the sulcus; where short, the mechanically weak impression materials will be unsupported and susceptible to distortion. Figure 13, for

example, shows an inadequately supported impression. It has become detached from the tray and would be likely to distort during model preparation.

Figure 13

If overextended, the tray will displace the muscle insertions and lead to an inaccurate impression. The customised impression trays shown in Figure 14 are obviously overextended and will lead to inaccurate impressions if not extensively adjusted by the clinician.

Figure 14



Close-fitting trays should be thin at the periphery to prevent the sulcus becoming overloaded with impression material and to allow room for the impression material to fully mould around this area of the tray without the tray ‘pushing’ the material away during impression taking (Figure 15a,b).

Figure 15