Removable Prosthodontics at a Glance

Dr James Field

BSc(Hons) BDS PhD MFGDP RCSEng MFDS MPros FDTFEd RCSEd CertClinEd MA(Ed) FAcadMEd PFHEA

Senior Specialist Clinical Teacher in Restorative Dentistry & Consultant in Prosthodontics

National Teaching Fellow and Principal Fellow, HEA

Miss Claire Storey

BDS MSc MRes CertEd MFDS FDS RCSEng

Consultant and Specialist in Restorative Dentistry

WILEY Blackwell

This edition first published 2020

Registered Office(s)
John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Office
9600 Garsington Road, Oxford, OX4 2DQ, UK

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Library of Congress Cataloging-in-Publication Data

Names: Field, James, 1979- author. | Storey, Claire, author.
Title: Removable prosthodontics at a glance / James Field, Claire Storey.
Description: Hoboken, NJ : Wiley-Blackwell, 2020. | Includes bibliographical references and index.
Identifiers: LCCN 2019056770 (print) | LCCN 2019056771 (ebook) | ISBN 9781119510741 (paperback) | ISBN 9781119510710 (adobe pdf) | ISBN 9781119510697 (epub)
Subjects: LCSH: Dentures. | Prosthodontics.
Classification: LCC RK656 .F495 2020 (print) | LCC RK656 (ebook) | DDC 617.6/92—dc23
LC record available at https://lccn.loc.gov/2019056770
LC ebook record available at https://lccn.loc.gov/2019056771

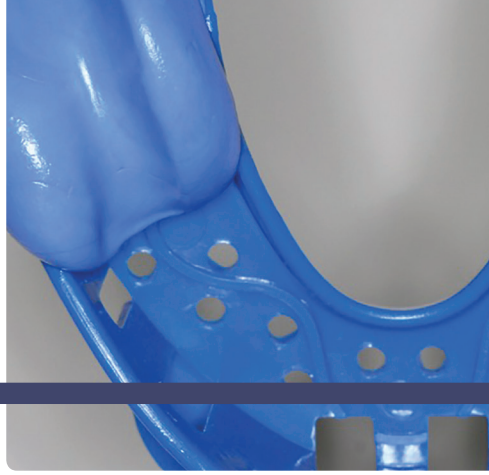
Cover Design: Wiley
Cover Image: Courtesy of James Field

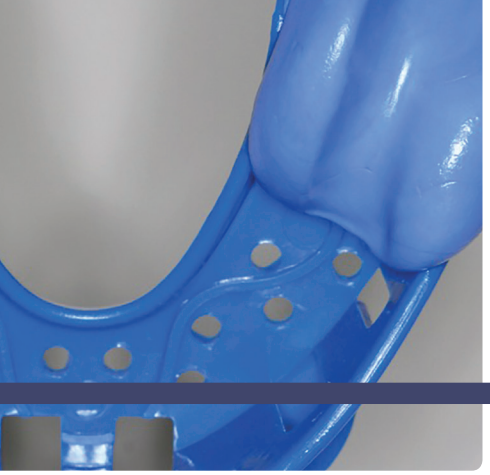
Printed and bound by CPI Group (UK) Ltd, Croydon, CR0 4YY

Set in Minion Pro 9.5/11.5 by Aptara Inc., New Delhi, India

10 9 8 7 6 5 4 3 2 1

Contents





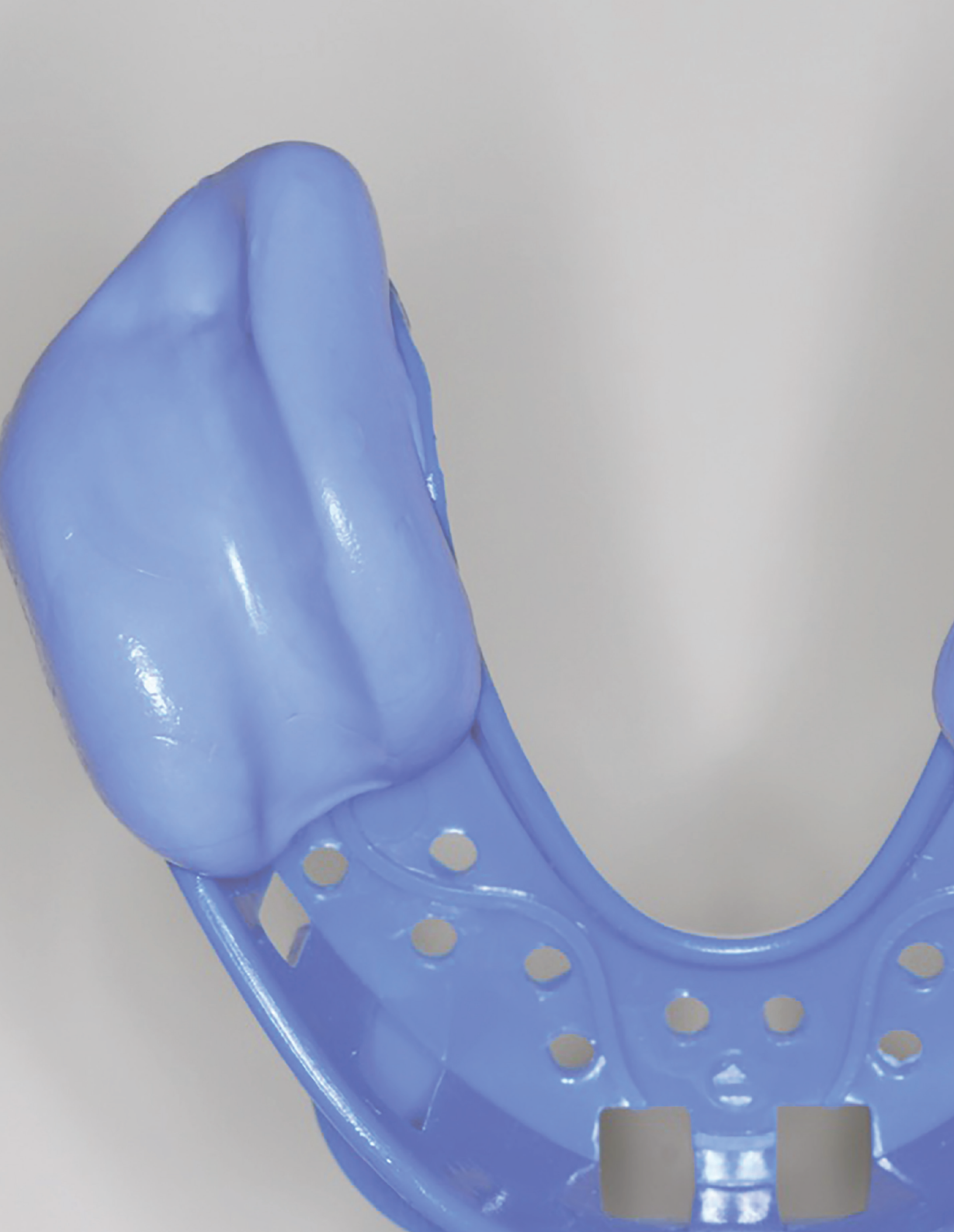
About the companion website

This book is accompanied by a companion website:

The website includes:

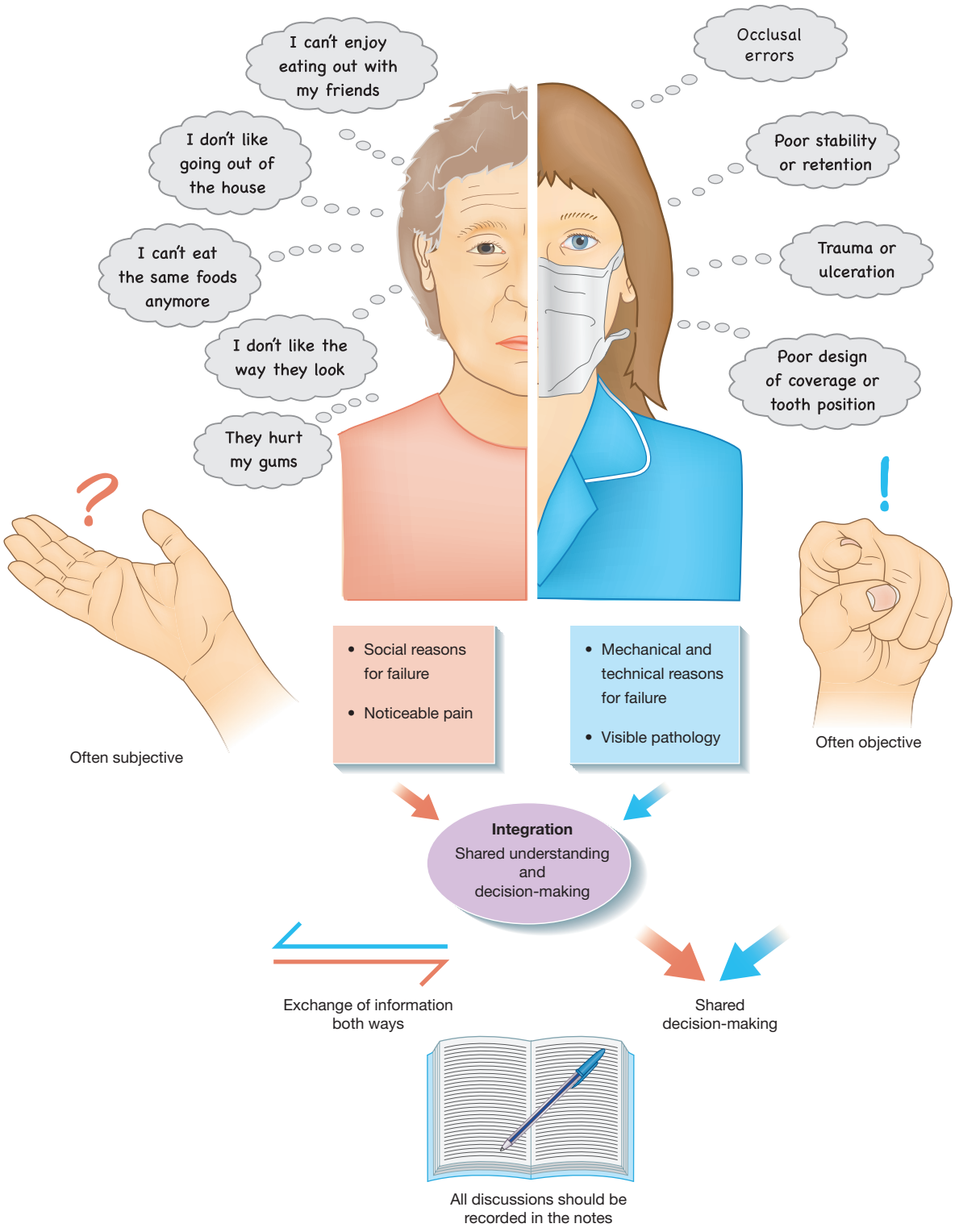
- Quiz questions
- Assessment forms for download

www.wiley.com/go/field/removable



1 Introduction

Figure 1.1 Assessment processes



Removable prosthodontics is often described as a 'black art' – the Marmite of dentistry; practitioners tend to either love it or hate it. Fortunately, we love it – and with some simple guidance, hopefully you will too. Like most operative interventions, success depends on:

- The skill of the dentist
- The technical difficulty of the case
- The patient's perceptions, ideas and expectations

Providing prostheses that are satisfactory to the patient is a challenge – and there are many reasons why patients can be dissatisfied with the finished result. Many relate to social aspects of patients' lives – how they are able to interact with others, particularly when eating and speaking. Common reasons include:

- Unacceptable aesthetics
- Inability to chew food properly
- Inability to enjoy the same foods as before
- Problems with speech
- Discomfort or persistent pain
- Disagreements over time and cost

Despite the diversity of complaints, there is often a common thread running through them all – lack of information exchange and an inappropriate level of patient expectation. We would therefore argue that the most important skill when making satisfactory removable prostheses is that of *communication*.

Communication and expectations

Effective communication takes *time*. As clinicians we often start looking for mechanical reasons to explain why patients might be having difficulties with their existing prostheses – excessive movement, trauma or ulceration, poor retention, or design of coverage. On that basis, we often agree to make a new prosthesis. In reality, patient tolerance relates to very much more than just mechanics and physical function. It is crucial that the treatment you provide is driven by *patient-perceived need*. This means that patients need to understand and buy into the clinical rationale, including risks and benefits, of the proposed treatment. Similarly, we need to understand the patient's rationale for wanting a prosthesis. Given enough time, it is highly likely that these requirements can be met.

Often, the process of making removable prostheses begins with a primary impression. Try and break that habit, and implement these simple steps first:

1 Set aside at least 5 minutes to talk to your patient
2 Sit in front of your patient – do not stand in front of your patient with a stock tray in your hand!
3 *Invite* your patient to explain why they would like you to make a denture – what are they hoping it will provide?

Crucially, your patient needs to feel that they can talk freely and comfortably about their tooth loss. This will not happen if they feel rushed, or feel that you are not actively *listening* to them.

This incredibly important part of the process is *investigative*. It should determine the choice of treatment that will follow. If the patient has an existing prosthesis, ensure that you ask what they think might change with a new one? What would they *like* to change?

It is at this early stage that you can begin to modify your patient's expectations if you feel that they are unrealistic. It is always better to begin this way, than back-tracking later and trying to reduce high expectations at the try-in or the fitting stages.

It is also a good opportunity to provide your honest thoughts on the likely outcome. We would caution against promising patients that their new prosthesis will be any better than the one that is being replaced, even if you can identify significant technical flaws. Instead, it is beneficial to ensure that you:

- Reiterate why you think the patient would like a new prosthesis
- Describe any technical features that you believe you can improve upon
- Estimate how many visits, including retries and review appointments, you expect may be needed
- Explain the fact that when the new prosthesis is fitted, even if it is technically better, it will still take a period of acclimatisation (up to 6 months, and longer in some cases) before the patient is able to function optimally
- Generate an understanding that during this time, the patient will need to adapt *slowly* to their new prosthesis, even if it appears to function comfortably – and this is particularly important in relation to complete denture patients

The clinical process

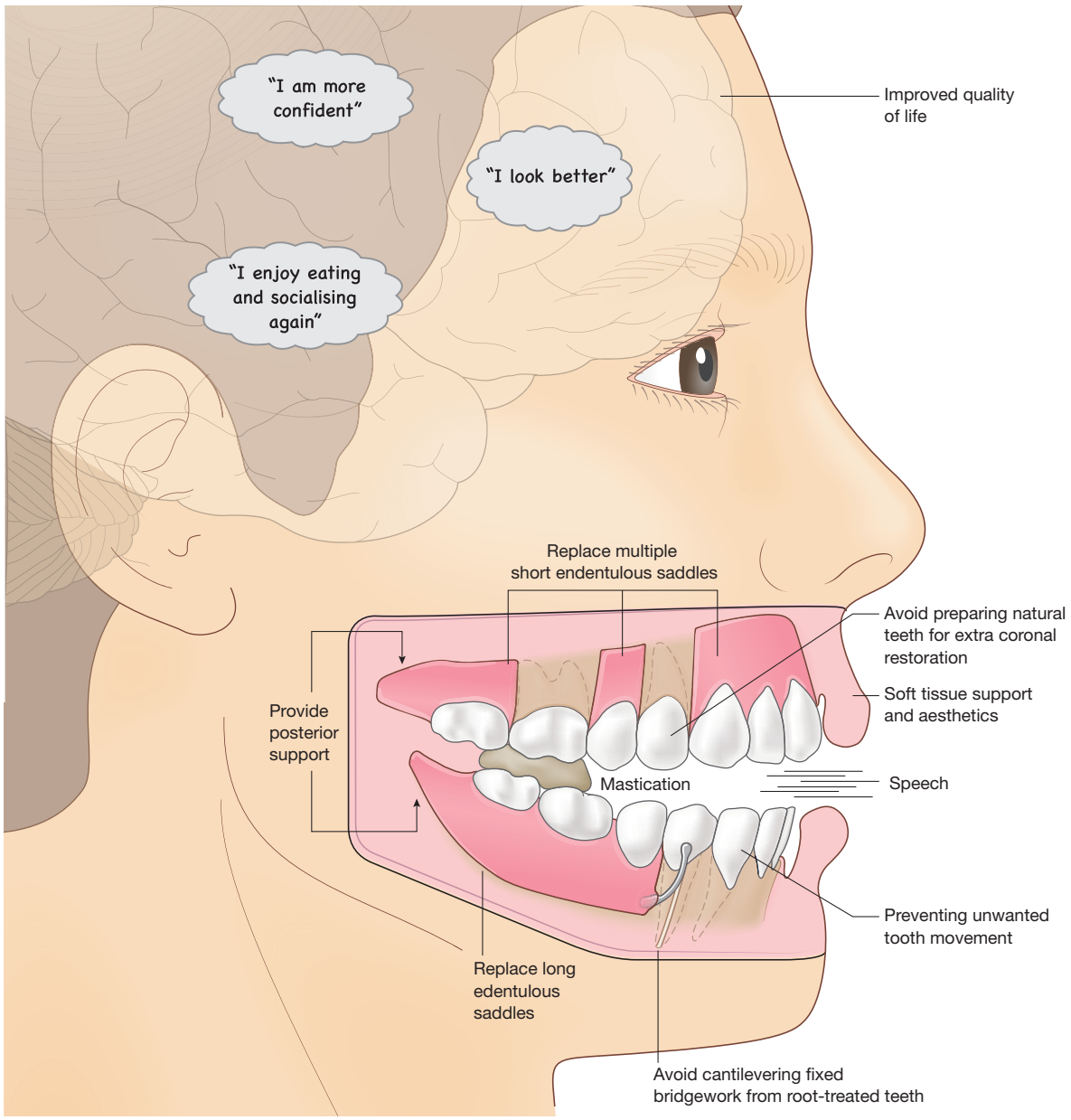
Communication aside, the process of making removable prostheses is more manageable than it may seem at first. There are often simple approaches that can yield excellent results, without expensive materials or equipment. In the main, technical success is about attention to detail and knowing which materials work best in your hands.

The aim of this at-a-glance guide is to provide advice on how to achieve optimal outcomes at each clinical stage of the process. Our opinions are based on decades of combined experience teaching at undergraduate and postgraduate level, and routinely treating a wide range of cases. We have provided recommended reading for each chapter in case you wish to read more about the technical stages, or to understand better the theory and evidence base that underpins the fabrication of removable prostheses.

Educationally, we use the term 'bricolage' (tinkering) when we are teaching our students about new materials in the clinics. If it has been a while since you have used some of the materials in this book, then get hold of some of them, and have a play!

2 The function of removable prostheses

Figure 2.1 The function of removable prostheses



Improved transition to edentulism

- Partial prostheses can help to acclimatise the patient in anticipation of wearing more extensive or complete prostheses

Function

It is often assumed that the function of a prosthesis relates only to 'mastication' – but there are many other functions that removable prostheses can serve. As clinicians, we are often good at recognising technical reasons why dentures should be constructed – but often the social aspects from the patient's perspective are overlooked.

Be mindful that the prosthesis must serve a function as perceived by the patient. If we are constructing a prosthesis that has a clear clinical rationale, but the reasons are less obvious to the patient, then we must spend time explaining how we intend the prosthesis to help. Unless the patient understands and believes the rationale for their construction, they are unlikely to wear them regularly.

That said, it is remarkable what patients *will* tolerate in order to achieve a desired outcome. For example, a patient might wear their prostheses whilst they are out of the house in order to facilitate a more normal social life – even if it is painful – but it is likely that they will take them out once they enter the house again – especially if they live alone. This is probably not dissimilar to us kicking off a pair of shoes that have been rubbing – but made us look good. Many patients living alone also take their dentures out in order to eat – so do not always think that the primary function of your lovingly constructed dentures is to help your patient to chew!

It is important to remember that replacement of all of the patient's missing teeth is often unnecessary. That said, it is still critically important that denture bases are extended into the full denture-bearing area in order to maximise stability and retention – and this will be discussed further in the following chapters.

Removable prostheses are indicated primarily for the following *clinical* reasons (Figure 2.1):

- Restoring masticatory function
- Restoring appearance
- Restoring speech
- Restoring soft tissue bulk and providing soft tissue support
- Acclimatisation during the transition to becoming edentulous

Removable prostheses are often indicated for the following *technical* reasons:

- Restoring long edentulous saddles
- Restoring multiple short edentulous saddles
- Providing posterior stability and improving occlusal load distribution
- Preventing undesirable tooth movements
- Rehabilitating to an increased vertical dimension
- Facilitating functional anterior guidance
- In order to prescribe diastemata between prosthetic teeth
- To avoid preparing abutment teeth for fixed prostheses
- To avoid cantilevering from root-treated teeth
- To aid planning and diagnosis, especially prior to implant placement

Finally, but by no means least, our patients may well request removable prostheses in order to:

- Improve aesthetics
- Restore social confidence
- Improve their eating experience

Restoring vs improving

Notice that most of the clinical rationale is based around *restoring* or *rehabilitating*, whilst patient requests often centre around *improving*. This important subtlety can easily be lost when negotiating informed consent. Correcting technical deficiencies and restoring clinical function does not necessarily result in a patient-perceived improvement. Again, moderating patient expectations is critical at each stage of treatment.

Quality of life

One of the most profound moments as an undergraduate was when Professor Janice Ellis (Newcastle) asked us whether we would rather lose a leg, and have a prosthetic replacement, or lose all of our teeth and wear a denture? At the time this seemed like a ridiculous comparison to make – but actually as clinicians we do become desensitised to seeing edentulous patients or partially dentate patients. The bottom line is whether we *really* sympathise with our patients or not. By working on a daily basis with edentulous patients who are struggling to cope, it is relatively easy to sympathise with the condition – even if we are unable to fully empathise. However, if we converse with denture-wearers less frequently, then there is a chance that we forget about what Professor Ellis termed the 'edentulous plight'. This reiterates why it is important that we take the time to *listen* to what our patients want, and that they feel comfortable enough to tell us.

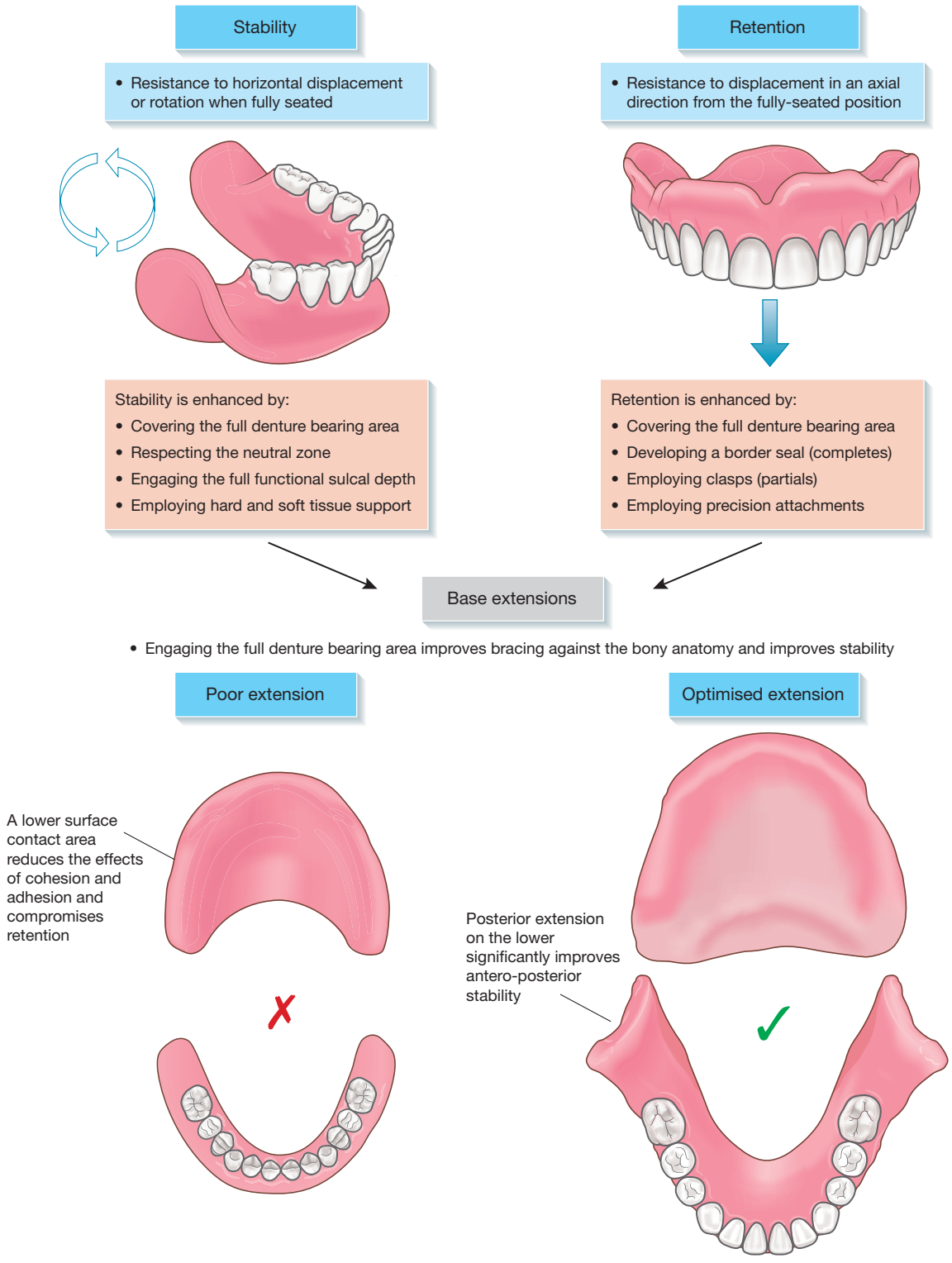
Risks of removable prostheses

One of the most significantly overlooked aspects of denture provision is the potential negative impact on the hard and soft tissues. Primarily this relates more to the provision of partial prostheses – and patients should be made aware as part of the planning process (through informed consent) of the risks and benefits of receiving dentures. Do not assume that because your patient is already wearing dentures that there is no need to reiterate the potential risks.

Whilst the jury is probably out in terms of the impact on periodontal disease, there is clear evidence of an increased risk of plaque accumulation, gingivitis and root caries for patients wearing partial prostheses. Many well-conducted studies show that the key to minimising soft and hard tissue damage whilst wearing dentures is to maintain an optimal level of oral hygiene, and to attend regular review and maintenance appointments; this is very much a shared responsibility between clinician and patient. The patient must understand this, and the discussion should be well documented in the case notes.

3 Stability and retention

Figure 3.1 Stability and retention



Stability and retention are fundamental principles for the construction of removable prostheses – consequently, problems with retention and stability often underpin the patient's perception of the prostheses.

Stability

This can be defined as the resistance to horizontal displacement or rotation – in complete dentures, or around large saddles, this is often determined by the underlying anatomy and ridge form; this is primarily assessed in terms of the cross-sectional profile of the ridge, and how much support the ridge is able to provide before it distorts or displaces.

From time to time you will notice ridges that present with fibrous aspects, which have a tendency to displace on palpation and loading. You may notice these presentations being referred to as flabby ridges, but this expression is not so well received with patients! Fibrous elements can affect the whole aspect of the ridge, or just the crestal tissues. The impact this has on denture stability will be determined by which anatomical features are affected and is discussed further in Chapter 17.

When considering shorter or bounded saddles, elements of stability will be derived from the way in which the denture base contacts the hard tissues (either acrylic or cobalt chrome) and engages undercuts. This is largely determined by the 'path of insertion' (POI) and is discussed further in Chapter 32. To a degree, the stability of the prosthesis is therefore dependent on how effectively the neighbouring teeth can support lateral loading. This is known as 'bracing'. If there is inadequate bony support for the abutment teeth then they will also move pathologically, and cause denture instability. This will cause further damage, possibly resulting in secondary occlusal trauma. These aspects will be discussed further, later in the book, in relation to partial denture planning.

Retention

This can be defined as the ability of the prosthesis to withstand removal in an axial direction – with complete dentures or areas over large saddles, this is often determined by the degree of coverage (employing cohesive and adhesive contact forces) and whether a border seal can be achieved. It is also important to consider the extensions of the prosthesis when assessing retention – whilst the prosthesis might be stable when fully seated, overextension may cause a lack of retention in function, as the functional sulcus shortens and displaces the denture base. When considering partial dentures and implant-supported overdentures (ISOD), retention becomes a much more active concept, through the use of direct clasps and retentive abutments. ISODs are considered further in Chapter 41.

Stability vs retention

I am often asked whether a denture can be stable yet unretentive – and vice versa. The simple answer is yes – to both. The technical challenge comes in ensuring that the prosthesis demonstrates both stability *and* retention. The key here is that the prosthesis covers the full denture bearing area – and accommodates functional movements within the periphery – the functional sulcus.

We will revisit the full anatomy of the maxillary and mandibular denture bearing areas (DBA) later – but some important anatomical and functional considerations for stability include:

- The form of the edentulous ridge and palate
- The degree of support offered by the ridges
- The position of the polished surfaces in relation to the neutral zone (Chapter 24)
- The degree to which the maxillary tuberosities are fully captured
- The degree to which the disto-lingual anatomy is captured

Patients tend to learn how to improve the stability of dentures by improving muscle tone, tongue control and chewing habits. Whilst edentulous patients often have a habit of improving retention by holding dentures up with the posterior dorsum of the tongue, this appears to be a very patient-specific skill.

Important anatomical aspects for retention include:

- Full coverage of the DBA
- Developing an adequate border seal
  - Fully capture the maxillary tuberosities
  - Fully capture the lingual anatomy
  - Accounting for the insertion of buccinators into the retromolar pad
- Ensuring that the denture is adequately extended, but not overextended, in function

Whilst the DBA and its extensions are very important, the position of the teeth is also critical, particularly in relation to the labio-lingual position of incisors on a lower complete denture. The concept of the neutral zone is very important and this will also be discussed later in Chapter 24. As well as the neutral zone, and impressions to record it, there are other prosthodontic techniques that can be employed to overcome challenges with fibrous ridges – such as:

- The RPI design principle
- The Altered Cast technique
- Various mucostatic or mucocompressive impression techniques

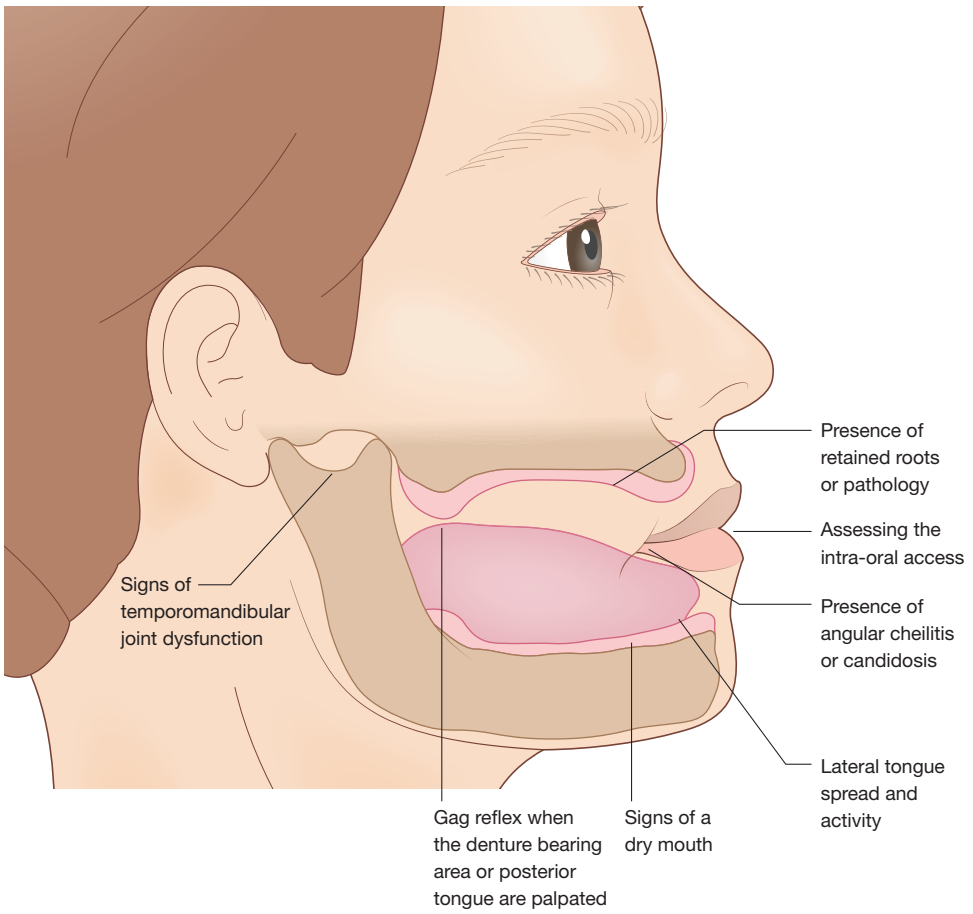
These will be discussed further later in the book.

The gag reflex

This is discussed in more detail in Chapter 46 – however, it is worth mentioning at this early stage that the vast majority of patients presenting with a gag reflex are anticipating movement or loss of retention of their prosthesis. It may be that their current prosthesis *is* stable and retentive – however, most often I find that this is not the case. It is important to take the time to explain to patients that the best outcome is achieved if a stable and retentive denture is created first, which can then be used as a predictable tool for overcoming a gag reflex. Even in patients where counselling is required in order to overcome psychosocial triggers, a well-fitting prosthesis is necessarily the starting point.

4 Patient assessment for complete dentures

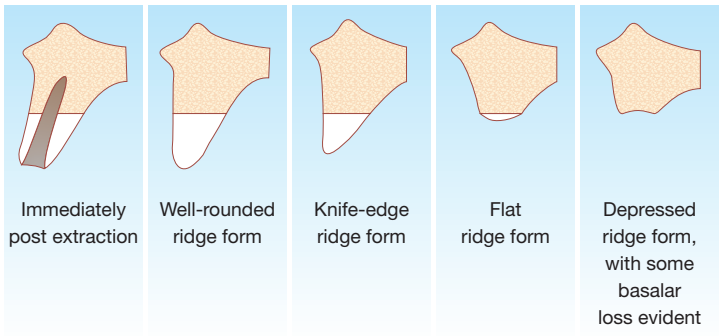
Figure 4.1 Assessing the edentulous patient



Why not visit the example complete denture assessment sheet in Appendix 1?

Assessing edentulous ridges

Here, the maxillary arch is used as an example



Arguably one of the most important elements of your patient assessment, is about taking the time to understand what the patient wants and why. It is also about making a judgement about how likely you are to succeed with your endeavours – there are a number of risk factors that can alter your chances of success and these should be discussed and recorded before the active elements of treatment begin. The majority of these factors are outlined below, largely as bullet point questions, but please do visit the recommended reading section for details of other academic texts which explore some of these concepts in further detail. Please also see the sample Complete Denture Assessment Proforma in Appendix 1.

The patient and the rationale for treatment

- Why does the patient want new or improved dentures?
- Is there any difficulty chewing or speaking?
- Do the dentures cause pain or nausea?
- Do the dentures cause gagging, and if so, is it immediate?
- Are the dentures of a satisfactory appearance?
- Have any of these problems got worse recently?

Prosthodontic history

- What type of denture is the patient currently wearing?
- How old is the prosthesis and where was it/they made?
- For how many years has the patient been edentulous?
- How many prostheses has the patient received before?
- Is the patient willing to attend for the necessary appointments, including review appointments?

Clinical examination

Before considering removable complete prostheses, it is important to carry out a full and comprehensive extra- and intraoral assessment. The following aspects can then be considered (Figure 4.1).

- *Intraoral access* – Can the full denture-bearing anatomy be palpated easily, and can the existing prostheses be easily inserted and removed from the mouth?
- *Tongue* – Does this occupy a normal space, or does it exhibit lateral spread? Is there a habit of using the tongue to retain the upper denture posteriorly?
- *Gag reflex* – Can the full denture-bearing area be palpated without eliciting a gag reflex? If not, where are the trigger zones? These are most often the dorsum of the tongue, or the posterior palate.
- *Ulceration* – Are there any existing signs of ulceration, and do they correspond to the extensions of a prosthesis?
- *Temporomandibular disorder (TMD)* – Are there currently any signs of muscle pain or temporomandibular joint (TMJ) derangement?
- *Candidosis and angular cheilitis* – How old are the prostheses and what is the patient's current hygiene regime? Does the patient seem to be over-closed? Is there a high carbohydrate intake throughout the day, nutritional deficiency or a dry mouth?
- *Dry mouth* – Does the patient complain of a dry mouth? Is this medication-induced? You can grade a dry mouth using the Challacombe scale (see recommended reading).
- *Tori or significantly undercut ridges* – If present will these interfere with the denture extensions or path of insertion?
- *Retained roots* – Could these be retained as overdenture abutments?
- *Any suspicious lesions*, particularly for at-risk patients, that should be investigated or monitored alongside treatment?

Ridge assessment

Manual palpation is very important in order to assess the ridges adequately. This includes the ridge form (Figure 4.1) (well-formed, atrophic, rounded, flat, knife-edge, fibrous, undercut) and the proximity of the frenal attachments to the crest of the ridges.

Assessment of existing prostheses

The *stability* (resistance to horizontal or rotational displacement when fully seated) and *retention* (resistance to vertical displacement) of each prosthesis should be assessed in turn. It is easier to do this individually rather than having both prostheses in at the same time. The upper should be seated from in front of the patient, and whilst holding the molar units, should be rotated in a horizontal plane. It can then be displaced vertically, ensuring that the patient is not holding the denture in place with their tongue, to assess retention. The lower should also be seated from in front of the patient, ideally with the patient in a seated position. Stability can be assessed as above, but also in an antero-posterior direction by pinching the lower incisors between thumb and forefinger and moving the denture lingually and labially.

The denture *extensions* should then be considered – labial, buccal and posterior aspects – but also coverage of the tuberosities on the upper and disto-lingual extension on the lower. The anatomy of the denture-bearing area is considered in Chapter 10. It is important to assess the extensions systematically to look for under- or overextension. Direct vision is possible for the lower but it can be more challenging on the upper. Retracting the sulcus with your index finger parallel to the arch means that as you seat the denture, you can feel whether the sulcus is 'pulled in' towards the prosthesis. If this is the case, the denture is overextended in this area. It is also possible to take a wash impression in silicone or alginate to assess the denture extensions at this stage.

In terms of *aesthetics* – lip support, incisal plane and buccal space should be noted. These are considered further in Chapter 20.

Finally, in relation to the *occlusion*, it is important to note whether the intercuspal position is stable and whether there are any heavy contacts. Is the intercuspal position coincident with the retruded arc of closure – and if not, what are the characteristics of the slide? Finally, assessment should be made of the freeway space between the dentures – although at this stage an estimate can be made by listening to the 'speaking space' available – sibilant sounds will sound sharp and whistle-like if the freeway space is restricted, and hollow or absent, if it is excessive.

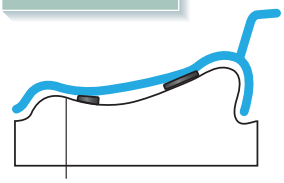
At this point, a diagnosis can be made with a suitable prognosis (and justification), and your patient's expectations can be discussed in an informed way. A treatment plan can be devised relating to the fitting surface, the occlusal surface and aesthetics (polished surfaces).

13 Special trays

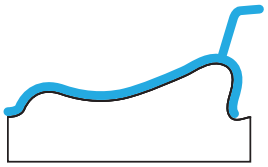
Figure 13.1 Special trays

Special trays

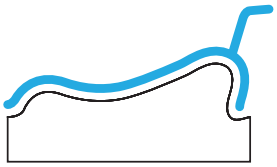
- Should have the amount of spacer prescribed, with or without tissue stops



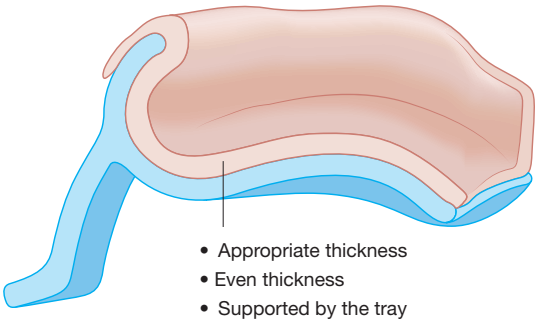
Tissue stops, particularly useful in palate vault and tuberosity



Close fit



Classic spaced



- Appropriate thickness
- Even thickness
- Supported by the tray

Spacer size

Zinc Oxide Eugenol (ZnOE) 0.8 mm (for complete dentures only)

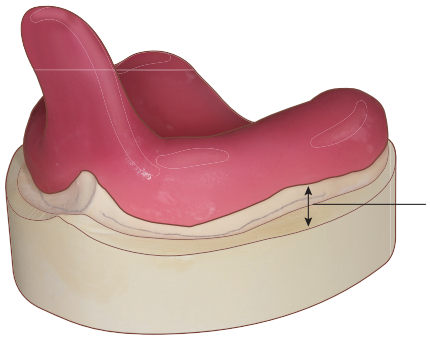
Light bodied silicone 1.0 mm

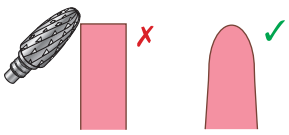
Medium bodied silicone (with or without perforations) 2–3 mm

Alginate or polyether (with perforations) 3 mm

Extensions

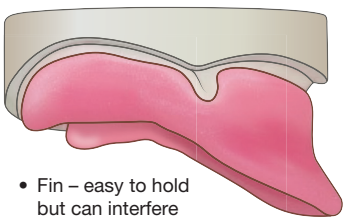
- Accuracy depends on the primary impressions
- May require trimming
- Check in the mouth not on the casts



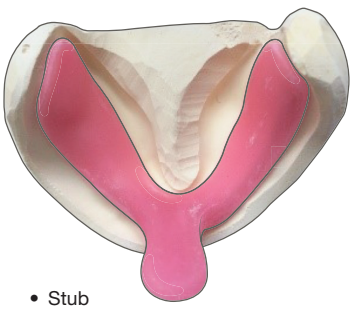


Handles

- Stubbed, fins, or rests



- Fin – easy to hold but can interfere with tissue moulding

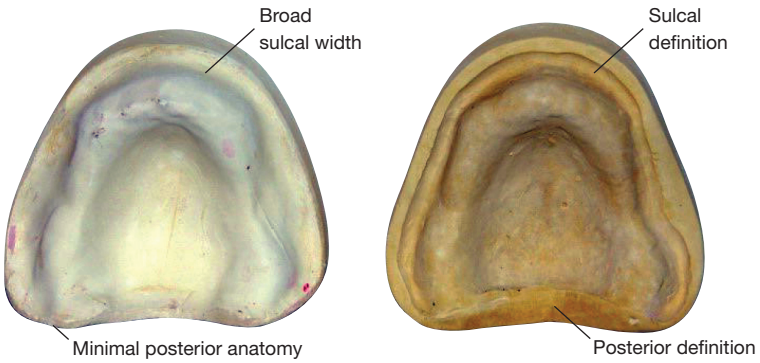


- Stub
- Vertical stubs are preferred in order to prevent tissue restrictions during border moulding

18 Denture bases

Figure 18.1 Denture bases

Primary cast (left) in comparison to a working cast (right) for a complete denture – note the differences in sulcal width, depth and definition



Advantages of a permanent base

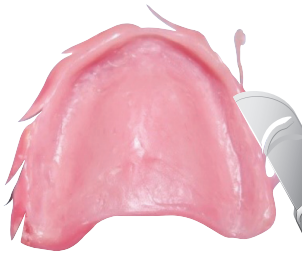
- Able to definitively check comfort, stability and retention
- Able to make definitive permanent changes
- More stability and accuracy when recording jaw relations
- Able to remove wax down to the base without distortion or collapse

Advantages of a temporary base

- Avoids the problem of heel clash
- Able to scribe your own post-dam on the master cast
- Greater flexibility when inter-arch space is limited

Take care with excess wax at the periphery

- Excess wax on a permanent base should be trimmed away to prevent displacement and incorrect tissue support

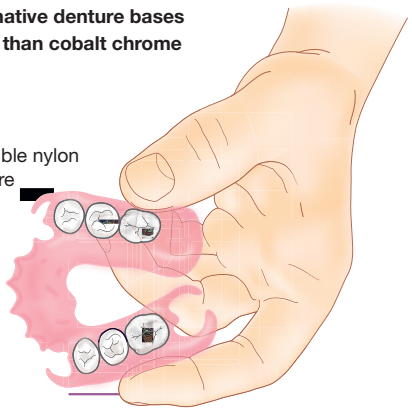


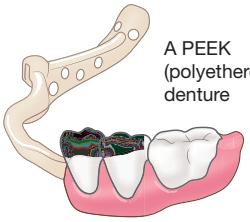
Trimming the excess wax at the periphery. Sometimes this can be significant!

- On temporary bases, excess wax that is removed at the extensions will re-appear at the finish stage when the denture is processed!

Alternative denture bases other than cobalt chrome

A flexible nylon denture





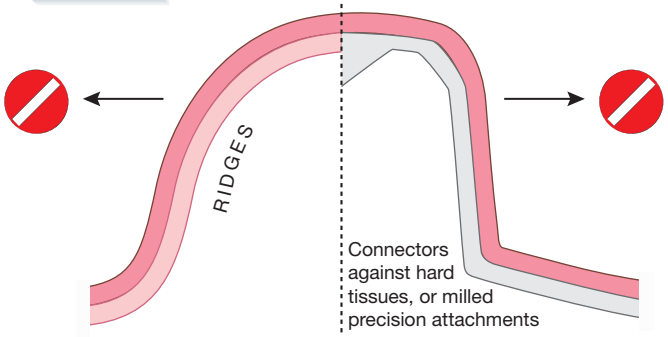
A PEEK (polyetheretherketone) denture

31 Connectors and bracing

Figure 31.1 Connectors and bracing

Bracing

- Resistance to horizontal displacement when the prosthesis is fully seated



Where does bracing come from?

- Palatal vault ✓
- Good sulcular extension on free end saddles ✓
- Guide planes and precision or milled surfaces ✓
- NOT from clasp arms ✗

Connectors

Major

- A design principle, considering:
  - How the denture engages the hard and soft tissues
  - Indirect retention, bracing, rigidity, hygiene and patient tolerance

Minor

- Framework elements in close proximity to the hard tissues
- Connects smaller elements to the main substructure

Upper

- Solid – rigid; good cohesion and adhesion

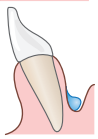
- Ring – reduced palatal coverage; less bracing; less rigid

- Strap – minimal palatal coverage; less rigid

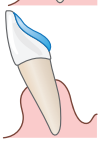
- Horseshoe – no palatal coverage; good tolerance; poor bracing; poor rigidity

Lower

- Lingual bar – hygienic; well tolerated



- Sublingual bar – hygienic; well tolerated; rigid; requires adequate sulcus depth



- Dental bar – hygienic; good indirect retention

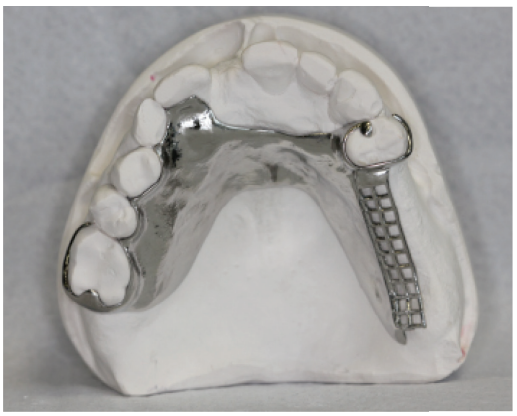
- Lingual plate – rigid; good indirect retention; mucosal coverage

- Labial bar – good indirect retention; useful to help avoid lingual tori

- How do my framework elements connect together?
- How will the major connector ‘reach’ the rests or clasps?
- Is it a robust connection?

33 Designing frameworks – case examples

Figure 33.1 Designing frameworks – case examples



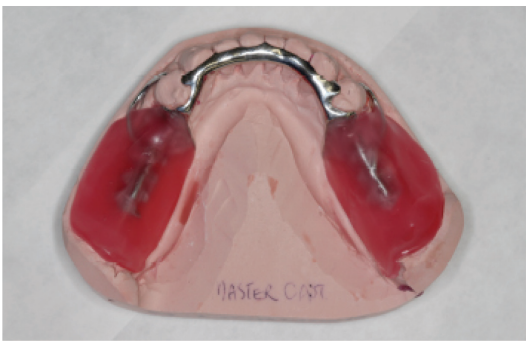
1

2

3

4

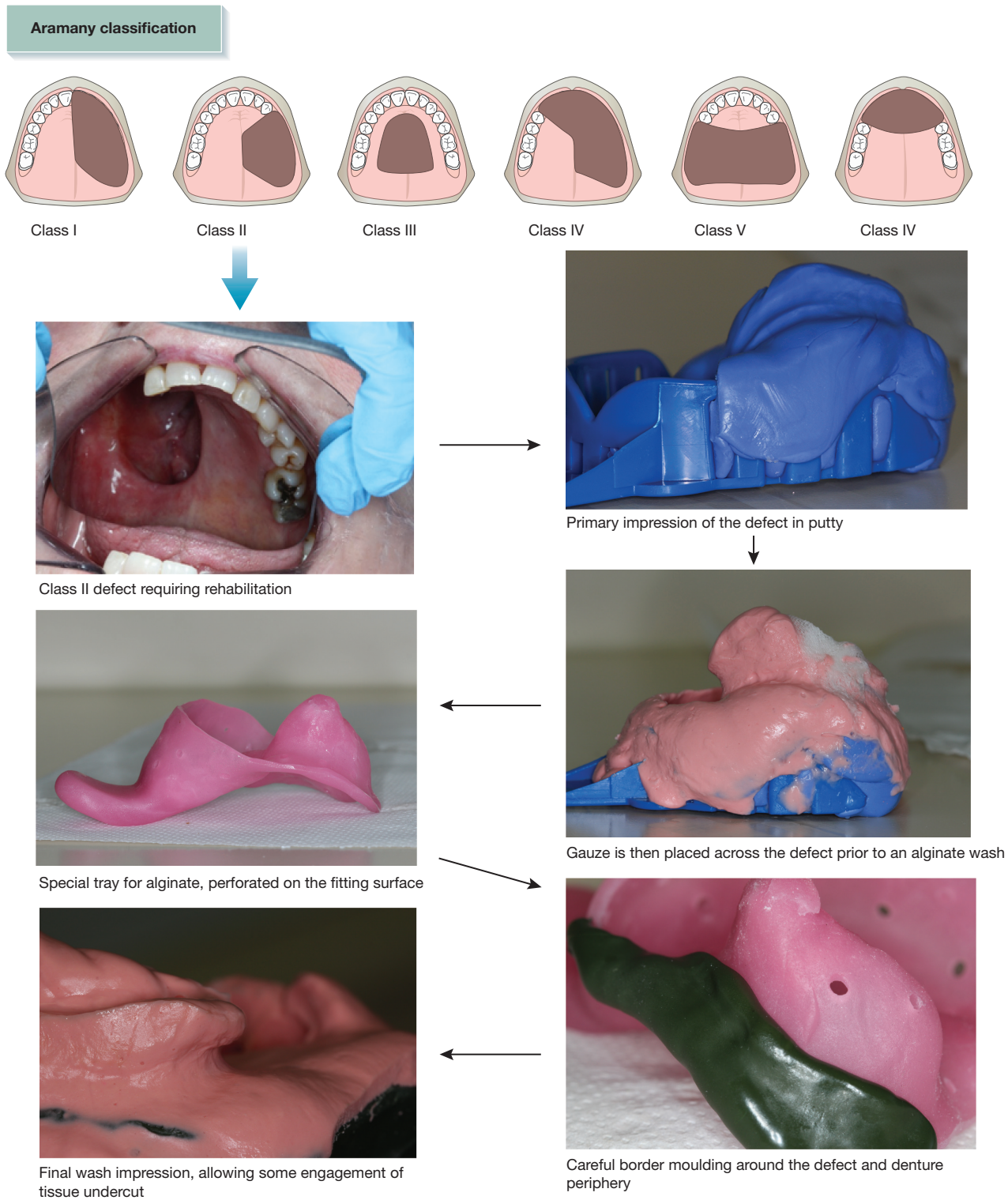
5



6

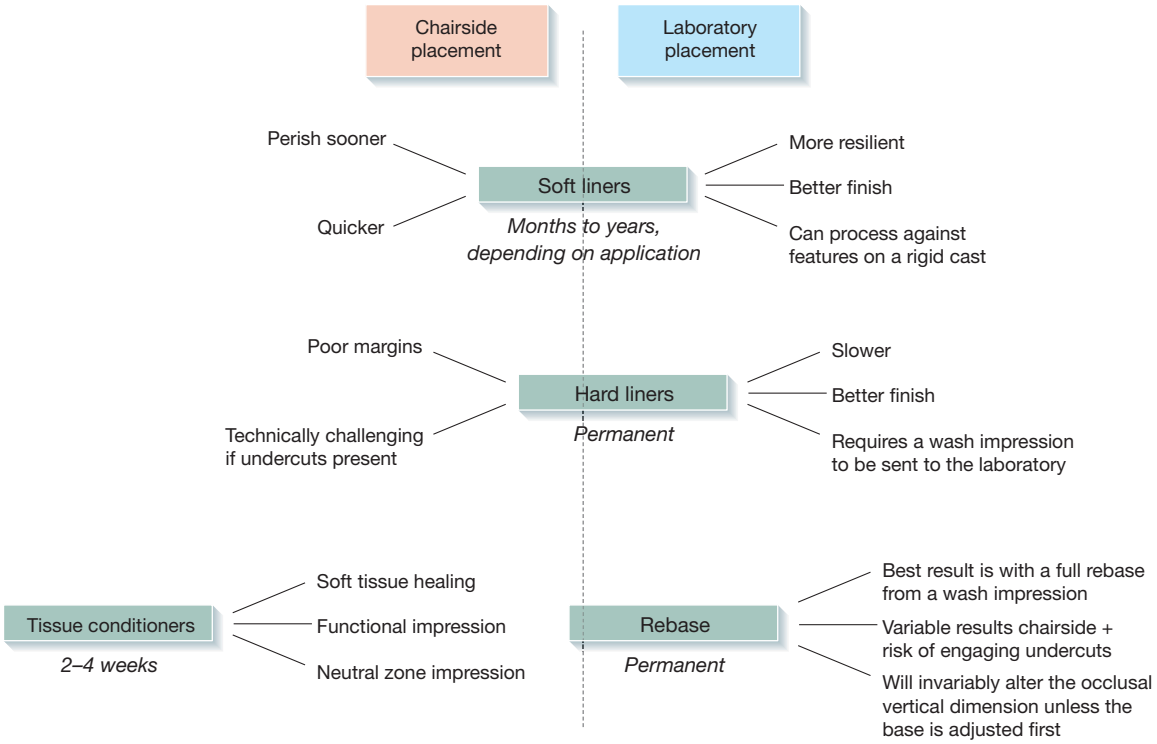
42 Principles of restoring maxillary defects

Figure 42.1 Principles of restoring maxillary defects



43 Tissue conditioners, liners and re-basing

Figure 43.1 Tissue conditioners, liners and rebasing



An example of a laboratory placed soft liner. Often a well extended lower complete impression will engage minor undercuts around the lingual shelf. Engaging with a soft liner rather than under-extending or adjusting the base can help to maintain a border seal and reduce lingual trauma