

CARMEN SCHELLER-SHERIDAN

Basic Guide to
**DENTAL
MATERIALS**



 WILEY-BLACKWELL

Basic Guide to Dental Materials

To my dear husband Padraig and sweet daughter Abigail, without whose love and attention I would have finished this book in half the time.

BASIC GUIDE TO DENTAL MATERIALS

Carmen Scheller-Sheridan

C.D.A., R.D.N., Dip. Ad. Ed., M.A.

Dental Nurse Tutor

Dublin Dental School and Hospital

Trinity College Dublin

Republic of Ireland



WILEY-BLACKWELL

A John Wiley & Sons, Ltd., Publication

This edition first published 2010
© 2010 Carmen Scheller-Sheridan

Blackwell Publishing was acquired by John Wiley & Sons in February 2007.
Blackwell's publishing programme has been merged with Wiley's global Scientific, Technical,
and Medical business to form Wiley-Blackwell.

Registered office
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ,
United Kingdom

Editorial offices
9600 Garsington Road, Oxford, OX4 2DQ, United Kingdom
2121 State Avenue, Ames, Iowa 50014-8300, USA

For details of our global editorial offices, for customer services and for information about how to
apply for permission to reuse the copyright material in this book please see our website at
www.wiley.com/wiley-blackwell.

The right of the author to be identified as the author of this work has been asserted in accordance
with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or
transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or
otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the
prior permission of the publisher.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in
print may not be available in electronic books.

Designations used by companies to distinguish their products are often claimed as trademarks. All
brand names and product names used in this book are trade names, service marks, trademarks or
registered trademarks of their respective owners. The publisher is not associated with any
product or vendor mentioned in this book. This publication is designed to provide accurate and
authoritative information in regard to the subject matter covered. It is sold on the understanding
that the publisher is not engaged in rendering professional services. If professional advice or other
expert assistance is required, the services of a competent professional should be sought.

Library of Congress Cataloging-in-Publication Data

Scheller-Sheridan, Carmen.
Basic guide to dental materials / Carmen Scheller-Sheridan.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-1-4051-6746-8 (pbk. : alk. paper) 1. Dental materials. I. Title.
[DNLM: 1. Dental Materials. WU 190 S322b 2010]
RK652.5.S34 2010
617.6'95-dc22
2009037333

A catalogue record for this book is available from the British Library.

1 2010

Contents

<i>Preface – How to use this book</i>	vii
<i>Acknowledgements</i>	ix
1 Introduction	1
2 Dental materials’ properties	13
3 Temporary restorative materials	19
4 Non-aesthetic restorative materials	29
5 Aesthetic restorative materials	43
6 Acid etchant, bonding agents and fissure sealants	63
7 Liner and bases	79
8 Dental cements	111
9 Endodontic materials	139
10 Periodontal dressings	169
11 Dental impression materials	175
12 Gypsum materials	221
13 Dental waxes	239
14 Material safety data sheets	249
15 Introduction to four-handed dentistry	261
<i>Index</i>	273

Preface: How to use this book

This guide is a supplemental resource to use alongside practical training and experiences. It works well in conjunction with *Basic Guide to Dental Instruments* (Scheller, 2006), which is also available in the Basic Guide series. Many instruments are referred to but not pictured, as the focus of this text is dental materials.

Basic Guide to Dental Materials has been written for anyone working or studying within the dental profession, particularly aimed at dental care professionals. It may be used as a study aid or within the dental surgery as a reference guide. It is not meant to be a comprehensive resource and needs to be used alongside study notes and other more comprehensive texts where appropriate.

Dental materials have been categorised by their usage in this text, and as many materials have multiple uses they are featured in multiple chapters. The first two chapters contain essential background information on dental materials, and all other chapters should be read as required in relevant circumstances. Each chapter follows the same format, with definitions, material properties, advantages, disadvantages, trade names, manipulation instructions, manipulation photos and mixing, working and setting times. It is important that the reader understands that although every effort was made to produce manipulation instructions and mixing, working and setting times, these properties may vary between manufacturers. It is the responsibility of the dental professional to consult manufacturer's instructions to ensure a comprehensive understanding of specific material properties.

This book is a UK publication where intraoral duties including the placement of dental materials have not yet been introduced as a skill of the dental nurse/dental assistant at the time of publication. In the event that these duties are introduced or in those areas of the world where they are practised, the individual must consult other references for information in relation to the clinical placement of dental materials.

Dental instrument and materials set-ups are included in each chapter. They only encompass what is required for the manipulation of the dental material and are not meant to be comprehensive for each procedure. Comprehensive procedure set-ups may be found in *Basic Guide to Dental Instruments* (Scheller, 2006).

Dental materials are ever changing. Continued professional development is essential to maintaining the most current knowledge of available products.

It is the responsibility of each member of the dental team to continuously review and update the knowledge required to work with the dental materials in the surgery. **It is imperative to follow the manufacturer's instructions when working with any dental material.** It would be impossible to create a text with every material by every manufacturer, so one material has been highlighted for manipulation and photography purposes. The author does not endorse using any specific dental material.

It is essential that good health and safety, and infection control standards are practiced when working with dental materials. Where possible, these have been mentioned throughout the text. If you have any queries in relation to these areas consult your surgery policies or legislative bodies for appropriate regulations and legislation in your area.

REFERENCE

Scheller, C. (2006) *Basic Guide to Dental Instruments*. Oxford: Blackwell Publishing Ltd.

Acknowledgements

I would like to thank the many people who helped with the editing and development of this guide to dental materials including: Professor Robert Ireland, Ms. Tina Gorman, Dr. Frank Quinn, Dr. Osama Omer, Dr. Owen Fleetwood, Ms. Joan Brennan, Mr. Declan Byrne, Dr. Richard Pilkington, Ms. Helen Phipps and Ms. Catherine Waldron. Thanks to Mr. Mark Thompson for taking many of the pictures within this text and to the following for helping to gather materials and allowing me to photograph them: Louise Boyd, Madonna Bell, Daniel Doyle and Rebecca Hayden.

I would also like to thank the following companies who supplied photographs and/or dental materials for photography purposes:

3M ESPE
Bosworth
Heraeus Dental
Kerr
Keystone
Premier Dental Products Company
Promed
Pulpdent Corporation
SDI
Waterpik
Whipmix

Chapter 1

Introduction

THE DENTAL TEAM

Dental materials are used daily in the dental surgery. It is imperative that the dental team is knowledgeable in relation to a variety of dental materials and their distinguishing characteristics. Biocompatibility, durability, aesthetics and cost must all be taken into account when choosing a dental material. New dental materials are introduced to the market continually, and it is the responsibility of the dental team to keep their knowledge base up to date through Continual Professional Development (CPD) opportunities.

Loss of, or damage to tooth structure requires the use of a variety of dental materials to repair and/or replace the missing structure. Missing tooth structure may be as a result of trauma, caries (decay) or various other causes. Dental materials are often categorised by their usage, as they will be in this text.

THE DENTAL NURSE

The role of the dental nurse in relation to dental materials is important. The dental nurse must be knowledgeable in the areas of instrument set-up, armamentarium (complete set-up for treatment), mixing, manipulation, proper disposal of used instruments and materials, material constituents, material storage, stock maintenance and health and safety in relation to the materials.

In areas of the world where dental nurses or dental assistants have intraoral responsibilities including the placement of dental materials, their knowledge must be expanded to include the comprehensive understanding of material placement, which is not included in this text.

DENTAL MATERIALS – DISPENSING, MANIPULATION AND APPLICATION

Dispensing

Dental materials are dispensed in various forms as shown below:

- A. Two-paste systems (Figure 1.1a and 1.1b)
- B. Powder and liquid form (Figure 1.2)
- C. Capsule form (Figure 1.3)
- D. Compule form (Figure 1.4)
- E. Syringe form (Figure 1.5)



(a)



(b)

Figure 1.1 Two-paste system.



Figure 1.2 Powder and liquid form.



Figure 1.3 Capsule form.



Figure 1.4 Compule form.



Figure 1.5 Syringe form.

Both two-paste systems and powder and liquid forms are manually manipulated, whilst the capsule form is preloaded with the exact ratios of materials and is mechanically manipulated. The compule and syringe forms are preloaded and ready to be dispensed with no mixing required (trituration may be required).

Mixing

Manual manipulation requires using a mixing spatula and some type of mixing surface.

Various mixing spatulas, which will be referred to within this text, are depicted in Figure 1.6.

- A. Wooden-handled spatula
- B. Weston spatula
- C. Broad-bladed spatula
- D. Plastic spatula
- E. Fishtail spatula
- F. Plaster spatula

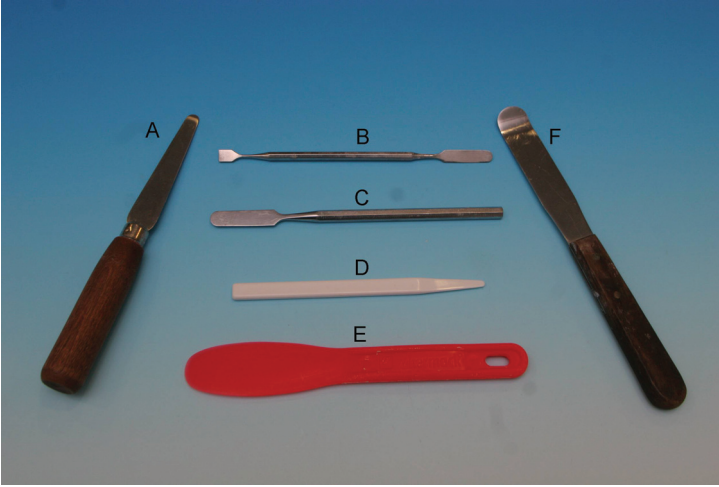


Figure 1.6 Mixing spatulas.

Mixing surfaces

Figure 1.7 depicts various mixing surfaces, which will be referred to within this text.

- A. Dispensing well (can be used in conjunction with an amber shield that slides over the wells to shield light-sensitive materials from the light)
- B. Glass dappen dish
- C. Waxed paper pad (available in various sizes)

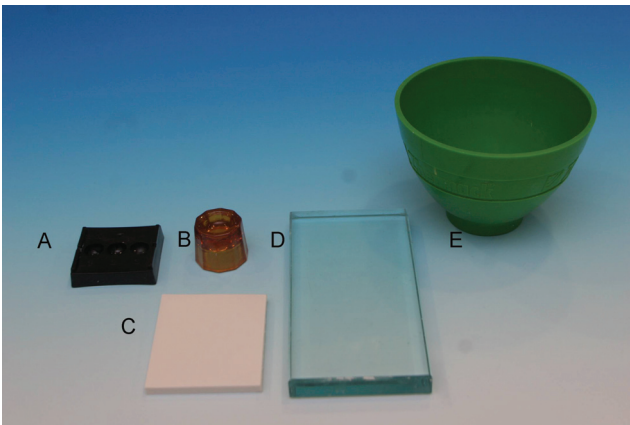


Figure 1.7 Mixing surfaces.

- D. Glass slab
- E. Flexible mixing bowl

Applicators

Figure 1.8 depicts various applicators, which will be referred to within this text.

- A. Disposable brush
- B. Disposable applicator
- C. Calcium hydroxide applicator
- D. Teflon-tipped flat plastic
- E. Flat plastic
- F. Amalgam carrier

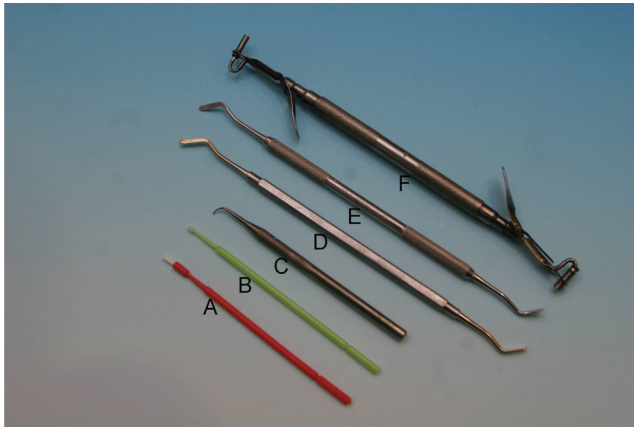


Figure 1.8 Applicators.

DISPENSING POWDER AND LIQUID

The powder and liquid forms of dental materials require the dental nurse to take care when dispensing, ensuring the correct amount of material is dispensed following the manufacturer's instructions.

Altering the ratios of dispensed materials will adversely affect the final mix, properties and behaviour of the dental material.

When dispensing powder that is supplied with a powder scoop

- Always fluff the powder prior to dispensing by shaking the bottle with the lid intact
- Dispense using the supplied powder scoop following the manufacturers instructions
- If the bottle has a ledge, use this to level the powder in the scoop. (Figures 1.9a–1.9d)
- If the bottle does not have a ledge, use a sterile spatula to level the powder in the scoop. (Figures 1.10a–1.10d)
- Replace the cap on the bottle immediately

When dispensing liquid

- Do not dispense until ready to use
- Hold the bottle perpendicular to the mixing surface (Figure 1.11)

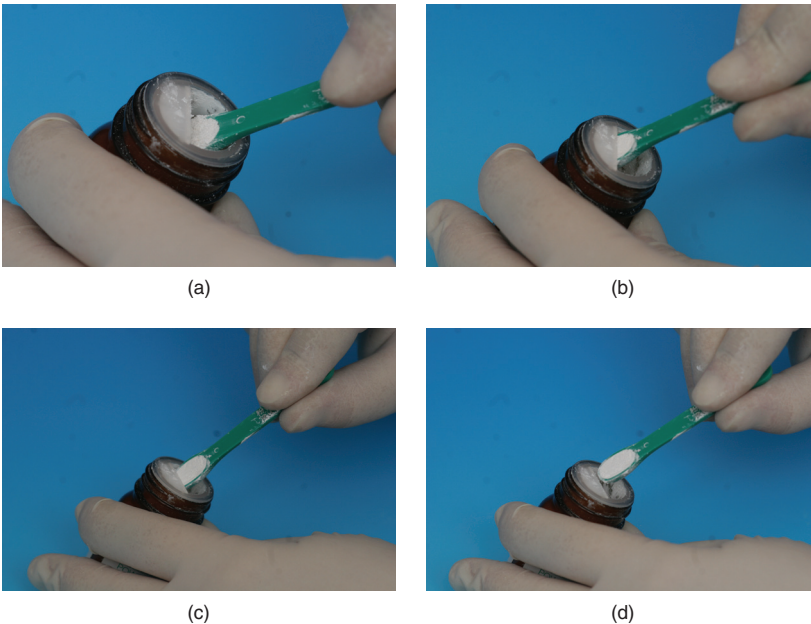


Figure 1.9 Using the bottles ledge to level powder with the dispensing scoop.

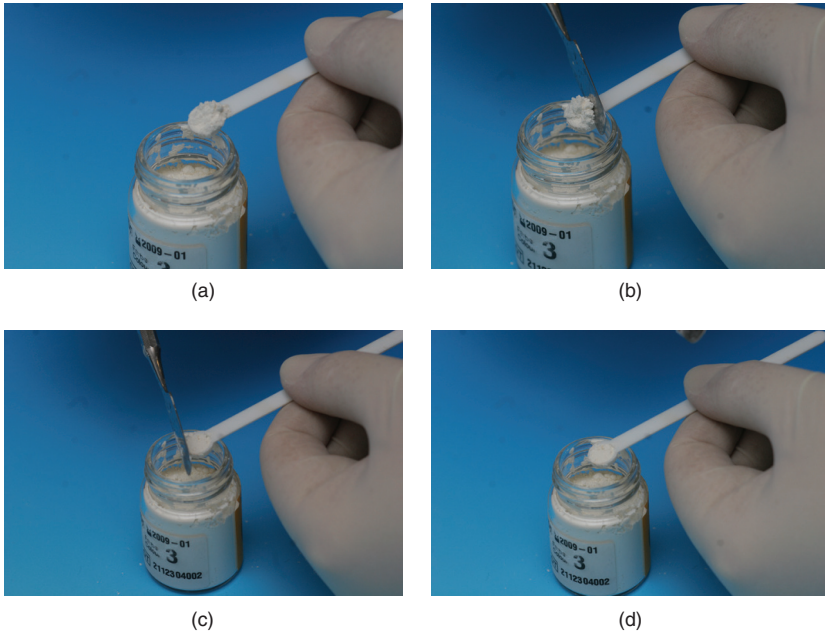


Figure 1.10 Using a sterile spatula to level the powder with the dispensing scoop.

- Depending on the dispensing system, the dental nurse will gently squeeze the bottle until one drop is released, then release the pressure and repeat the process until the desired amount of drops are dispensed. For calibrated dispensing systems, hold the bottle vertically until a drop is released from the bottle (Figures 1.12a–1.12d)
- Replace the cap on the bottle immediately



Figure 1.11 Holding bottle perpendicular to the mixing surface.

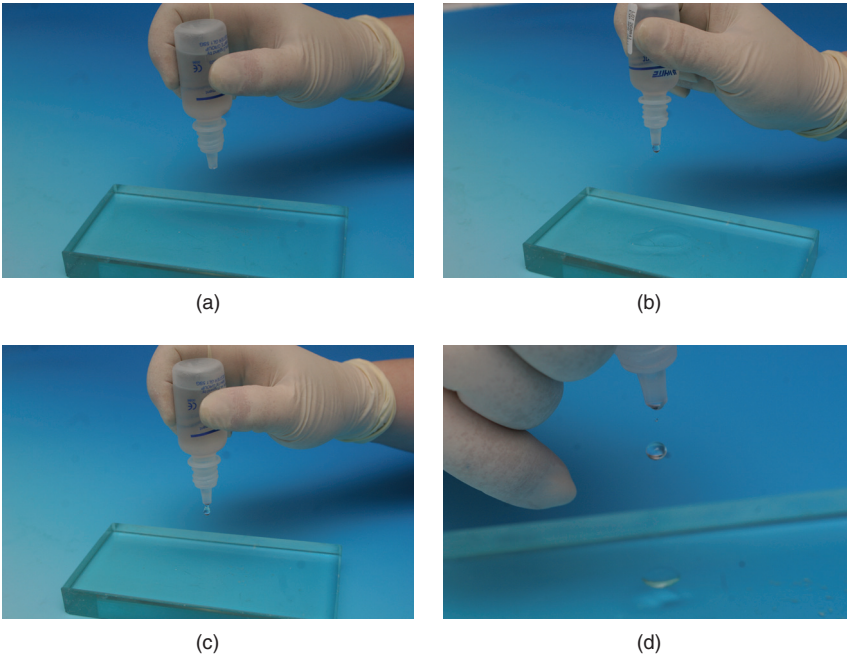


Figure 1.12 Dispensing liquid.

INVENTORY AND STORAGE OF DENTAL MATERIALS

It is important that the dental nurse takes care when ordering and storing dental materials. Dental materials must be stored as per the manufacturer's instructions, some may require refrigeration, etc. It is often the responsibility of the dental nurse to maintain the stock within a surgery. Dental nurses must familiarise themselves with the amounts of specific materials consumed and keep an adequate supply. 'Overstocking' should be avoided as it costs money and increases waste. Dental materials have an expiry date, and if they are not used within this time, they must be discarded. There should be a list kept of items that need reordering, and it is imperative to restock a supply when it is close to depletion. Running short or out of dental materials is unnecessary with proper planning, management and stock control. When new stock is received into the dental surgery, it is often the responsibility of the dental nurse to ensure that the order is complete, to check that the amount charged is correct and to put the stock in its place. When putting away dental materials, ensure that the stock is rotated and that the dental materials with the longest expiry date are placed to the back. This is to ensure that the dental materials with the shortest expiry date are used first.

TYPES OF RESTORATIONS

Before discussing the various types and properties of individual dental materials, it is useful to discuss the various types of restorations that will be referred to within this text in relation to dental materials.

A **direct restoration** is a restoration prepared for immediate placement in the mouth of the patient and does not require any external fabrication; they are frequently referred to as ‘fillings’. Direct restorations require a sufficient amount of tooth surface to support the filling material and can be undertaken quickly and relatively inexpensively. Amalgam or resin composites are the materials most often used for direct restorations.

An **indirect restoration** is one that is processed and fabricated outside of the oral cavity, most often in a dental laboratory. This type of restoration requires an adhesive and/or a type of thin dental cement (luting material) to allow it to be retained in or adhere (stick) to the prepared tooth structure; examples are gold or porcelain inlays or onlays.

A **fixed restoration** or **fixed appliance** is one that is intended to remain in the mouth and is not routinely removed by the patient. It may be for an indefinite period of time, such as a crown or a bridge, or for a defined period of time, such as a space maintainer or a fixed orthodontic appliance.

A **removable appliance** or **prosthesis** is a dental appliance that is used to perform a specific function; for example, to replace teeth – a full denture, or a Hawley orthodontic appliance, which is used to prevent the movement of teeth and can be removed on a routine basis by the patient for cleaning or by the dentist or orthodontist for adjustment.

An **inlay** is an indirect restoration that is made to fit into a prepared cavity. It restores one or more surfaces of a tooth and may possibly include one or more cusps: it is usually made of gold, porcelain, or resin composite.

An **onlay** is an indirect restoration that replaces one or more cusps and adjoining occlusal surfaces of a tooth: it is usually made of gold, porcelain, or resin composite.

A **crown** is an indirect restoration that may be referred to by some patients as a ‘cap’. It can cover the entire tooth or part of the coronal portion of the tooth. A crown is often indicated when the shape, function, or appearance of a tooth needs to be improved. Crowns that are not visible at the back of the mouth are often made of metal to provide adequate strength; those at the front of the mouth are usually made of porcelain or metal with porcelain bonded to the outer (visible) surface for aesthetic reasons.

A **bridge** or ‘**fixed partial denture**’ is an indirect restoration that functions to replace one or more missing teeth. It is cemented to one or more adjacent teeth. The portion of the bridge that replaces some or the entire coronal portion of the supporting natural tooth is termed the *retainer*; the tooth to which the retainer is cemented is called the *abutment tooth*, and the part of the bridge that replaces

the missing tooth is termed the *pontic*. Each pontic and retainer is termed a *unit*. It is the combination of the pontics and abutments that constitutes a bridge. Bridges can be fabricated from a variety of dental materials, and there are many different designs.

A **veneer** is a restoration that most commonly replaces the facial aspect of anterior teeth to improve the aesthetic appearance. Veneers may be fabricated indirectly in the laboratory and these are most often made of porcelain, or they can be fabricated directly in the mouth and these are made of resin composite.

A **denture** is a removable, indirect appliance whose function is to replace one or more teeth. Dentures may be classified as partial or complete. A **partial denture** replaces one or more teeth, and is retained in position by contact with the patient's natural teeth and supporting tissues. The frame of a partial denture may be made from acrylic, metals (chromium, cobalt and nickel) or a combination of both. Clasps may provide additional retention and can be used to anchor the partial denture to the patient's natural teeth. A **complete** or **full denture** is indicated when the patient has no teeth (edentulous) in one or both arches. The action of the patient's muscles and the surrounding tissue structure maintain the complete denture in place. An **overdenture** is a denture, usually a complete denture, that is fabricated to rest over dental implants or retained roots of natural teeth.

A **dental implant** is a replacement for the root of a natural tooth. It is placed within the jawbone. Dental implants can be fabricated from a variety of materials, such as titanium and titanium alloy. An implant is used to support a crown, bridge or denture to replace one or more missing teeth.

As summarised above, there are many different types of restorations and appliances that are indicated to restore the masticatory function and appearance of the patient. Each situation will dictate the need for a specific dental material to be used. It is the responsibility and duty of all members of the dental team to understand the implications, properties and appropriate manipulation of these dental materials in order to deliver the best oral health care to the patient.