

**McCRACKEN'S
REMOVABLE
PARTIAL
PROSTHODONTICS**

**DAVIS HENDERSON
VICTOR L. STEFFEL**

FIFTH EDITION

McCRACKEN'S

REMOVABLE PARTIAL PROSTHODONTICS

DAVIS HENDERSON, B.S., D.D.S., F.A.C.D.

Professor and Assistant Dean, Department of Removable Prosthodontics, University of Florida College of Dentistry, Gainesville, Florida; formerly Chairman, Department of Prosthodontics, University of Kentucky College of Dentistry, Lexington, Kentucky; Fellow, Academy of Denture Prosthetics; Member, American Prosthodontic Society; Member and Past President, Southeastern Academy of Prosthodontics; Member, American College of Prosthodontists; Charter Member and Past President, Carl O. Boucher Prosthodontic Conference; Diplomate, American Board of Prosthodontics; Captain, DC, United States Navy (Ret.)

VICTOR L. STEFFEL, D.D.S., F.A.C.D., F.A.D.P., F.I.C.D.

Professor Emeritus and former Chairman, Division of Removable Partial Prosthodontics, The Ohio State University College of Dentistry, Columbus, Ohio; Past President: The Ohio Dental Association, Academy of Denture Prosthetics, American Prosthodontic Society, and The Federation of Prosthodontic Organizations; Executive Director-Treasurer, The American Prosthodontic Society; Honorary Sponsoring Fellow, Carl O. Boucher Prosthodontic Conference; Recipient, The Ohio State University Centennial Achievement Award (1970); Past Supreme Grand Master, Psi Omega Fraternity; Honored Recipient, The Annual Steffel Lectures in Dentistry, founded February, 1974

FIFTH EDITION

with 726 illustrations

THE C. V. MOSBY COMPANY

Saint Louis 1977

FIFTH EDITION

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Previous editions copyrighted 1960, 1964, 1969, 1973

Printed in the United States of America

Distributed in Great Britain by Henry Kimpton, London

The C. V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data

McCracken, William L.

McCracken's Removable partial prosthodontics.

First-3d ed. published under title: Partial denture construction.

Bibliography: p.

Includes index.

1. Partial dentures. I. Henderson, Davis

II. Steffel, Victor L., 1897- III. Title

IV. Title: Removable partial prosthodontics.

[DNLM: 1. Denture, Partial, Removable. WU515 M132 M132p]

RK656.M3 1977

617.6'92

76-57180

ISBN 0-8016-2141-0

To those dentists
who have so unselfishly shared
their knowledge and experience
that others may learn

PREFACE

to fifth edition

Scientific progress and the rapid rate of development in all aspects of scientific endeavor make it necessary that a textbook covering any discipline be revised regularly. Furthermore, with the present-day emphasis on prevention in dentistry and the excellent results being achieved in the saving of many teeth that would otherwise have been lost, the demand for removable partial dentures is the greatest ever—ample justification for this fifth edition of *Removable Partial Prosthodontics*.

A critical perusal of this fifth edition will disclose our earnest efforts to present an up-to-date philosophy of mouth reconstruction through the medium of removable partial dentures (predominantly extracoronal retainers). The contents of the book extend from initial diagnosis to post-placement service, including relining procedures and even repairs. Steps are progressively covered in normal sequence; when simplification could be effected, this has been done; redundant and obsolete materials and references have been eliminated as far as feasible; clarity in all aspects has been striven for; and terminology has been standardized throughout to encourage unanimity in the usage of terms for clearer communication. To be fair to students, it is especially important that universally used terms and nomenclature be employed in the writing of examination questions.

The greatest possible number of clinical skills and related factors come into play in removable partial denture construction. With all due respect for the importance of the other disciplines in dentistry, it may be unequivocally stated that the science

of removable partial dentures involves *all* the basic sciences—the laws and effects of leverages, consideration of supports, occlusal contacts, direction of stresses, and relative health of all oral structures (to name only a few)—to a far greater extent than does any other oral health service. (Note: Specifically involved in function are soft tissues, supporting bone, circulation, periodontal ligaments, occlusion of both natural and artificial teeth, individual restorations, crowns, fixed partial dentures, and biomechanics.)

We have emphasized the fact that *fundamentals* do not change—only materials (improved), methods, and technical procedures change—always hopefully to better complement those things which are basic. Thus the science of removable partial dentures cannot ever be considered static. Constant revising and updating are necessary to keep the study dynamic.

In this edition the now popular and clear-cut line drawings have replaced the sometimes blurred photographic illustrations to a great extent. This will hopefully enhance the useful appeal of the text. We have especially endeavored to uphold the original objectives of the late Dr. William L. McCracken. It was his intention that the book, although encompassing both *clinical* and *laboratory* aspects, should distinctly and understandingly supply the undergraduate, postgraduate, graduate (student), and practicing dentist with basic principles and practical, time-tested procedures, thus helping all to avoid pitfalls in providing therapeutic and functional removable partial dentures.

At a glance it can be readily noted that the chapter on principles of removable partial denture design has been greatly enhanced by the addition of *biomechanical considerations*. This treatise shows and describes the classes of levers and clarifies types of leverages—both favorable and unfavorable.

An important plus for this edition is the continued contributions of Drs. Sharry, Costich, and White in revising their material contained in the fourth edition. We welcome the contributions of Dr. Samuel B. Low who has revised the section on periodontal preparation.

In summarizing, *The Glossary of Prosthodontic Terms* has been accepted as a reasonable guide throughout this fifth edition. Different techniques and broad references to the works of others provide

the dentist with alternative routes to accomplish the same end. Again, chapters are arranged in an orderly sequence of learning; guide planes and their importance have been emphasized; the bibliography has been thoroughly revised, especially to include contemporary references; and, as previously, the chapter on work authorizations should prove to be a very valuable and useful inclusion.

Grateful acknowledgment is expressed to those who offered constructive criticism of the fourth edition. Many of the changes made in the fifth edition resulted from their suggestions. We are most appreciative and flattered by the general acceptance of this textbook.

Davis Henderson

Victor L. Steffel

PREFACE

to first edition

Although I welcomed the invitation to author a textbook on the subject of partial denture construction, I realized from the outset that such a book would follow closely in the wake of several excellent textbooks on this subject. I therefore approached the task with a sense of great responsibility. However, I would not have accepted the challenge had I not felt sincerely that I could add something to what had already been written and thus produce a text in this field which is sorely needed and which provides the dental student, the dental practitioner, and the dental laboratory technician with the information necessary to produce a partial denture that is in itself a definitive restorative entity. It is my sincere hope that this textbook will be used not only by teachers of prosthetic dentistry but also by practicing dentists and dental technicians, and that in this book the dentist and dental technician may find a common meeting ground for better solution of the problems associated with the partially edentulous patient.

I am deeply grateful for the opportunities that I have had to combine private practice with teaching and for the knowledge that has evolved from this experience. Although I have attempted to present various philosophies and techniques in order that the reader may select that which to him seems most applicable, it is inevitable that certain preferences will be obvious. These are based upon convictions evolved through experience both in private practice and in the teaching of clinical prosthodontics. It is only logical, then, that I should therefore state my own personal beliefs, which are as follows:

1. I believe that the practice of prosthetic dentistry must forever remain in the hands of the dentist and that he must therefore be totally competent to render this service. In the fabrication of a partial denture restoration, the dentist must be competent to render a comprehensive diagnosis of the partially edentulous mouth and, utilizing all of the mechanical aids necessary, plan every detail of treatment. He must either personally accomplish whatever mouth preparations are necessary or delegate to his colleagues such specialized services as surgical, periodontal, and endodontic treatment. In any case, primary responsibility for adequate mouth preparations remains his alone. He must undertake whatever impression procedures are necessary and must be primarily responsible for the accuracy of any casts of the mouth upon which work is to be fabricated. He must provide the laboratory technician with an adequate prescription in the form of diagrams and written instructions and with a master cast which has been completely surveyed with a specific design outlined upon it. He must be solely responsible for the accuracy and adequacy of any jaw relation records and must specify all materials and, in many instances, the exact method by which occlusion is to be established on the finished restoration. Finally, he must be competent to judge the excellence of the finished restoration or recognize its inadequacies and must assume the responsibility for demanding a degree of excellence from the technician that will continually raise rather than lower the standards of dental laboratory service.

2. I believe that the dental laboratory

technician has a responsibility to his profession to demand a quality of leadership from the dentist which he can respect and follow without question. The responsibility for providing adequate prosthetic dentistry service to the patient must be shared by both dentist and technician, and each has not only a right to expect that the other do his part competently but also an obligation to demand a quality of service from the other that will not jeopardize the finished product. The technician therefore would do dentistry a great service if he would reject inadequate material from the dentist and respectfully suggest whatever improvements are necessary for him to produce an acceptable piece of work. As long as the technician accepts inadequate material from the dentist and the dentist is willing to place an inadequate product in the patient's mouth, the quality of removable prosthetic appliances will continue to be, as it all too frequently is, a far poorer service than the dentist and technician together are capable of rendering.

I believe also that dental laboratories should always be willing to adopt newer techniques and philosophies developed by the dental profession and being taught to dental graduates. Too often the commercial dental laboratory insists upon using stereotyped techniques that suit its production methods and actively attempts to discourage the recent graduate from putting into practice modern methods and techniques that were painstakingly taught to him in dental school by instructors whose knowledge of the subject far exceeds that of the laboratory technician who depreciates it.

3. I believe that any free-end partial denture must have the best possible support from the underlying edentulous ridge and that the design of the abutment retainers must apply a minimum of torque to the ad-

jacent abutment teeth. I believe that some kind of secondary impression is necessary to obtain adequate support for the denture base, both through tissue placement and from the broadest possible coverage compatible with biologic requirements and limitations.

4. I believe in the functional, or dynamic, registration of occlusal relationships rather than in relying upon intraoral adjustment of an established centric occlusion or upon the ability of an instrument to simulate articulatory movements. I believe that the occlusion on a partial denture, be it fixed or removable, should be made to harmonize with the existing adjusted natural occlusion, and that this can best be accomplished by the registration of functional occlusal paths. For this to be done adequately, occlusion on the partial denture must be established upon either the final denture base(s) or upon an accurate substitute for the final base(s). The practice of attempting to submit jaw relation records to the technician prior to the fabrication of the denture framework is therefore, with few exceptions, strongly condemned.

5. I believe that a partial denture, when properly designed, carefully made, and serviced when needed, can be an entirely satisfactory restoration and can serve as a means of preserving remaining oral structures as well as restoring missing dentition. Unless a partial denture is made with adequate abutment support, with optimal base support, and with harmonious and functional occlusion, it should be clear to all concerned that such a denture should be considered only a temporary, treatment, or interim denture rather than a restoration representative of the best that modern prosthetic dentistry has to offer.

W. L. McCracken

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CHAPTER 1

TERMINOLOGY

Significant strides have been made in prosthodontic terminology in recent years, eliminating much confusion created by conflicting terms. An updated *Glossary of Prosthodontic Terms* is available to the profession through the continuing efforts of the Academy of Denture Prosthetics.* Then, too, the second edition of a glossary of accepted terms in all disciplines of dentistry, *Current Clinical Dental Terminology*, has been recently published.† Both these glossaries provide excellent bases for dignified and efficient spoken and written communication in prosthetic dentistry.

Many conflicting or indefinite terms in common usage in prosthodontics require definition and clarification. Many of these are used synonymously; even today others are used incorrectly. Whereas the following is not meant to be a complete glossary of removable partial denture terminology, some definitions will be given, based on available reference material.

A *prosthesis* is the replacement of an absent part of the human body by some artificial part such as an eye, a leg, or a denture. *Prosthetics*, then, is the art or science of supplying missing parts of the human body.

When applied to dentistry, the term *prosthetics* becomes *prosthodontics* and de-

notes the branch of dental art or science that treats specifically with the replacements of missing dental and oral tissues. The term *prosthodontics* is somewhat preferable to the term *prosthetic dentistry*. The former is defined as "that branch of dentistry pertaining to the restoration and maintenance of oral functions, comfort, appearance, and health of the patient by the replacement of missing teeth and contiguous tissues with artificial substitutes" (Federation of Prosthodontic Organizations).

The replacement of missing teeth in a partially edentulous arch may be accomplished by a fixed, or cemented, prosthesis or by a removable prosthesis. The former may be in two pieces, with a locking joint between, or all in one piece and is not designed to be removed by the patient. This type of restoration is a *fixed partial denture*. On the other hand, a *removable partial denture* is designed so that it can be removed conveniently from the mouth and replaced by the patient.

A *complete denture prosthesis* is entirely supported by the tissues (mucous membrane, connective tissues, and underlying bone) to which it is attached. A *removable partial denture* either may be entirely tooth supported or may derive its support from both the teeth and the tissues of the residual ridge. The denture base of a tooth-borne removable partial denture derives its support from abutment teeth at each end of the edentulous area. The tissue that it covers is not used for support. A tooth-tissue-supported removable partial denture has at least one denture base that extends anteriorly or posteriorly, terminating in a denture base portion that is not tooth supported. Such a base extending

*This glossary first appeared in the March, 1956, issue of *The Journal of Prosthetic Dentistry* (published by The C. V. Mosby Company, St. Louis, Mo.). The latest reprint, published in 1977, may be obtained from the Educational and Research Foundation of Prosthodontics, 211 E. Chicago Ave., Chicago, Ill. 60611.

†Boucher, C. O., editor: *Current clinical dental terminology, a glossary of accepted terms in all disciplines of dentistry*, ed. 2, St. Louis, 1974, The C. V. Mosby Co.

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posteriorly on a removable partial denture qualifies the restoration as a *distal extension denture*.

Sufficient points of difference exist between the tooth-supported and the tooth-tissue-supported removable restorations to justify a distinction between them. Principles of design and techniques employed in construction may be completely dissimilar. The points of difference are as follows:

1. Manner in which the prosthesis is supported
2. Impression methods required for each
3. Types of direct retainers best suited for each
4. Denture base material best suited for each
5. Need for indirect retention

A distinction between these two types of removable restorations is adequately made by an acceptable classification of removable partial dentures.

The term *appliance* is correctly applied only to a device worn by the patient in the course of treatment, such as splints, orthodontic appliances, and space maintainers. A denture, an obturator, a fixed partial denture, or a crown is properly called a *prosthesis*. The terms *prosthesis*, *restoration*, and *denture* generally will be used synonymously in this book to avoid tiresome repetition of the single word *prosthesis*.

An *interim denture* is a dental prosthesis to be used for a short interval of time for reasons of esthetics, mastication, occlusal support, and convenience or for conditioning of the patient to the acceptance of an artificial substitute for missing natural teeth until more definite prosthetic dental treatment can be provided.

A *transitional denture* is a removable partial denture that serves as a temporary prosthesis to which teeth will be added as more teeth are lost and that will be replaced after postextraction tissue changes have occurred. A transitional denture may become an interim denture when all the teeth have been removed from the dental arch.

A *treatment denture* is a dental prosthesis used for treating or conditioning the tissues that are called on to support and retain a denture base.

Use of the term *acrylic* as a noun will be avoided. Instead, it will be used only as an adjective, such as *acrylic resin*. The word *plastic* may be used either as an adjective or a noun; in the latter sense it refers to any of various substances that harden and retain their shape after being molded. The term *resin* will be used broadly for substances named according to their chemical composition, physical structure, and means for activation or curing, such as *acrylic resin*.

The term *denture base* will be used to designate the part of a denture, either of metal or of a resinous material, that supports the supplied teeth and/or receives support either from the abutment teeth, the residual ridge, or both. The word *saddle* is considered objectionable terminology when used to designate a denture base.

The structures underlying the denture base will be mentioned as the *residual ridge* or *edentulous ridge*, referring to the residual alveolar bone with its soft tissue covering. The exact character of this soft tissue covering may vary, and it includes the mucous membrane and the underlying fibrous connective tissue.

Resurfacing of a denture base with new material to make it fit the underlying tissues more accurately will be spoken of as *relining*. *Rebasing* refers to a process that goes beyond relining and involves the refitting of a denture by the replacement of the denture base with new material without changing the occlusal relations of the teeth.

Perhaps no other terms in prosthodontics have been associated with more controversy than have *centric relation*, *centric occlusion*, and *centric position*. All confusion could be terminated by acceptance of one definition of centric relation and one definition of centric occlusion and then using these respective positions as references for

other horizontal locations of the mandible or other relationships of opposing teeth. The following definitions, which are given in the *Glossary of Prosthodontic Terms*, are selected as meaningful:

“*centric relation*: The most retruded relation of the mandible to the maxillae at a given degree of vertical opening.”

“*centric occlusion*: The relation of opposing occlusal surfaces which provides the maximum planned contact and/or intercuspation.”

“*centric position*: The position of the mandible in its most retruded relation to the maxillae.”

For complete dentures, centric occlusion should be made to coincide with centric relation for that patient. In adjusting natural occlusion, the objective may be to establish harmony between centric relation and centric occlusion. On removable partial dentures, the objective is to make the artificial occlusion coincide and be in harmony with the remaining natural occlusion. Ideally, the natural occlusion first must have been adjusted to maximum contact at centric relation and be free of eccentric interference before establishing a similar occlusion on the partial denture.

In describing the various component parts of the partial denture, conflicting terminology must be recognized and the preferred terms defined. A *retainer* is defined as “any form of attachment applied directly to an abutment tooth used for the fixation of a prosthetic restoration.”* Thus the attachment may be either intracoronal or extracoronal and may be used as a means of retaining either a removable or a fixed restoration. A solder joint also may be considered to be an attachment. The term *internal attachment* will be used in preference to precision attachment, frictional attachment, and other terms to describe any mechanical retaining device that depends on frictional resistance between parallel

walls of male and female (key and keyway) parts. Precision attachment is discarded because its usage implies that all other types of retainers are less precise in their design and fabrication.

Clasp will be used in conjunction with the words *retainer*, *arm*, or *assembly* whenever possible. The clasp assembly will consist of a *retentive clasp arm* and a *reciprocal* or *stabilizing clasp arm*, plus any minor connectors and rests from which they originate or with which they are associated. *Bar clasp arm* will be used in preference to Roach's name to designate this type of extracoronal retainer and is defined as a clasp arm that originates from the base or framework, traverses soft tissue, and approaches the tooth undercut area from a gingival direction. In contrast, the term *circumferential clasp arm* will be used to designate a clasp arm that originates above the height of contour, traverses part of the suprabulge portion of the tooth, and approaches the tooth undercut from an occlusal direction. Both types of clasp arms terminate in a retentive undercut lying gingival to the height of contour, and both provide retention by the resistance of metal to deformation rather than frictional resistance of parallel walls.

A *continuous bar retainer* is a component of the partial denture framework that augments the major connector and lies on the lingual or facial surface of several teeth. It is most frequently used on the middle third of the lingual slope of lower anterior teeth. If attached to the lingual bar major connector by a thin, contoured apron, the major connector is then designated as a *linguoplate*.

Any thin, broad palatal coverage used as a major connector is called a *palatal major connector* or, if of lesser width, a *palatal bar*. A palatal major connector may be further described according to its anteroposterior location on the palatal surface, for example, an anterior palatal major connector or a posterior palatal bar. The term *anatomic replica* will be used to designate cast metal palatal major connectors that

*From Academy of Denture Prosthetics, Nomenclature Committee: *Glossary of prosthodontic terms*, St. Louis, 1968, The C. V. Mosby Co.