PRINCIPLES AND PRACTICE of Implant Dentistry

Preface

Goal Of The Book

Our purpose in writing *Principles and Practice of Implant Dentistry* is to bring implant dentistry to everyone in the profession who can and should be involved in the insertion phase, the restoration phase, or both. The book is for undergraduate, graduate, postgraduate, and continuing education students, as well as for practitioners who are students of implant dentistry in the broader sense, who wish to deepen their knowledge and expand their scope of treatment. Whereas most implant dentistry literature tends to focus on complex cases, this book meets the need for instruction that focuses on the safe and predictable cases that compose the majority of what the typical implant practitioner encounters in practice.

There are several keys to becoming involved with implant dentistry. First is being able to recognize mainstream cases, defined in this book as those that can be treated safely and predictably. Second is knowledge that several implant modalities and systems have been proven safe and effective for the treatment of mainstream cases. Third is learning how to treat such cases step by step, from diagnosis through final restoration. *Principles and Practice of Implant Dentistry* provides you with these keys. As in all areas of study, first we walk, then we run. One need not be able to remove a bony impacted third molar to remove an anterior tooth conventionally. In the same way, one need not be able to perform subantral augmentation or nerve repositioning before learning how to recognize and treat predictable, mainstream implant dentistry cases.

Widespread involvement on the part of both experts and general practitioners alike is required to bring implant dentistry to the public on an appropriately large scale. One hundred twenty million Americans are candidates for implant dentistry—40% of our population. Today, more than 50% of all Americans are older than age 50, and the number of senior citizens is sharply increasing. Thus, the fastest growing segment of the population is the wealthiest, and occupies the age group that presents the greatest need for implant dentistry.

Approximately 85% of oral surgeons and periodontists and 30% of prosthodontists insert implants, representing 7000 to 8000 implant insertion practitioners. At the same time, estimates of the number of general practitioners who perform implant insertion range from 3.9% to 9.0%, representing another 6000 to 10,000 practitioners. Taken together, fewer than 20,000 practitioners serve the 120 million people in the United States who are candidates for implant dentistry treatment. Obviously, the demand far exceeds the supply. Increased involvement by general practitioners in mainstream cases will result in a greater number of referrals of the more atypical, challenging cases that implant dentistry experts can and should be treating. In other words, implant dentistry is ready to incorporate the established, traditional, mutually beneficial relationship between general practitioners and the experts to whom they refer complex cases.

General practitioners are the true heroes of dentistry. They are the ones who treat the population at large. Most general practitioners have the requisite skills and ability to perform mainstream implant insertion and restoration, and only require the knowledge and confidence to do so. Practitioners who perform tooth extractions, gingival trimming, and suturing can comfortably learn to insert dental implants in mainstream cases. Practitioners who choose to become involved only with the restorative aspects of implant dentistry will find that this book is valuable because it teaches the specifics of mainstream implant dentistry restoration and familiarizes such readers with the insertion phase so they can maintain diagnostic control of the case and interact with an implant insertion practitioner in an informed way.
Because of the predominance of the root form modality, we have devoted three times more chapters to root forms than to any other implant modality. Nonetheless, other beneficial implant modalities increase the scope of treatment. Therefore, this book covers the indications and treatment procedures of all safe and effective modalities with mainstream applications. It is especially important to become familiar with modalities not used in one’s practice. They certainly will be encountered, either when a new patient previously treated elsewhere appears in the office, or when another practitioner calls to refer a patient. It is of vital importance to be able to evaluate a functioning implant properly, so as not to subject the patient to unnecessary hardship either by removing a healthy implant or by allowing an implant with an irreversible complication to remain in function.

Whatever your present or future level of education in dentistry, you can be sure that implant dentistry will affect your practice profoundly. *Principles and Practice of Implant Dentistry* shows you how.

**CONTENT AND ORGANIZATION**

The book is organized to present a logical progression of information to the reader. A unique feature of the book is the inclusion of teaching cases, which describe step-by-step surgical procedures of the mainstream applications of accepted implant modalities. Through the teaching cases, readers learn not only how to perform each treatment step but also what to be thinking while the step is being performed, all clearly illustrated. The book also discusses what to do in cases thought to be mainstream but that subsequently involve a minor complication, maintenance procedures, how to recognize and treat reversible and irreversible complications, when to refer, legal considerations, and implant dentistry practice management. The clinical and scientific bases of oral implantology are delineated, with emphasis on their direct applications to the advocated clinical protocols, to enable the reader to truly understand exactly why we do what we do.

It is important to understand that the step-by-step procedures presented herein are not advocated as being the only acceptable way to achieve the treatment goals. What is presented is known to be safe, effective, and practical. However, valid variations in sequencing, timing, and technique exist. Throughout the step-by-step procedure chapters, common variations are represented either in the body of the chapter itself or in a separate section at the end entitled “Variations and Alternatives.” Options not noted in the text may nonetheless be valid, especially in our rapidly evolving discipline, in which new technologies and research are continually influencing how we approach and perform our work. It is wise to keep abreast of developing trends.

Section One, *Fundamentals of Implant Dentistry*, details the essential clinical and scientific information required to provide dental implant treatment.

- Chapter 1, *How to Recognize a Mainstream Case*, provides the reader with tools to recognize mainstream cases, those that can be treated safely and predictably and that compose the majority of what one encounters in practice.
- Chapter 2, *Implant Dentistry Nomenclature, Classification, and Examples*, sets the vocabulary that is used throughout the book.
- Chapter 3, *Evaluation of Available Bone*, describes the theory and practice of measuring and evaluating the bone that is used in implant treatment.
- Chapter 4, *Implant Materials, Design, and Fabrication*, discusses biocompatibility, the interrelationships between implant material, design, and method of fabrication, and how these factors influence clinical use.
- Chapter 5, *Implant Insertion and Healing*, discusses how to recognize a compromised host site, heat production during osteotomy preparation, natural oral defense mechanisms that combat infection and facilitate normal healing, the type and distribution of tissues around
implants as they heal, the relationship between healing and case sequencing, and the
manner in which both soft and hard tissues heal in an implant host site environment.

- Chapter 6, *Tissue Integration at the Implant Interface*, defines the types of tissue integration
  around different types of abutment-providing implants and discusses their applicability, how
  they are achieved, their physiology, and biomechanical considerations.

Section Two, *Evidence-Based Validation of Safety and Efficacy*, contains chapters that discuss
research in implant dentistry.

- Chapter 7, *Scientific and Clinical Acceptability of an Implant Modality*, discusses the
  scientific criteria (i.e., that which constitutes proof that an implant is safe and effective) that
  must be fulfilled for an implant modality or system to gain professional acceptance, as well
  as the clinical criteria that determine whether an implant modality or system is practical for
  general use.
- Chapter 8, *Seminal Studies of the Safety and Efficacy of the Abutment-Providing Implant
  Modalities*, takes a look at data regarding the comparatively higher bone loss in
  unimplanted alveolar ridges than in implanted ridges to highlight the preventive aspects of
  implant treatment, and examines the studies that demonstrate the safety and efficacy of the
  modalities and systems used in the step-by-step procedure chapters that appear later in
  the book.

Section Three, *Clinical Practice of Mainstream Implant Dentistry*, contains chapters that detail the
clinical aspects of implant dentistry treatment.

- Chapter 9, *Considerations Common to Mainstream Dental Implant Treatment Protocols*
  discusses those aspects of treatment that are the same regardless of the implant modality
  or system used.
- Chapter 10 discusses *Root Form Implants: Treatment of Total Mandibular Edentulism
  Diagnosed for an Overdenture*.
- Chapter 11 discusses *Root Form Implants: Treatment of Posterior Partial Edentulism
  Diagnosed for a Fixed Prosthesis*.
- Chapter 12 discusses *Root Form Implants: Treatment of Anterior Single-Tooth Edentulism
  Diagnosed for a Fixed Prosthesis*, including the insertion of an implant into an immediate
  extraction site, conservative ridge expansion to increase the volume of available bone, and
  control of the esthetic result by creating a proper emergence profile.
- Chapter 13 discusses *Plate/Blade Form Implants: Treatment of Posterior Partial
  Edentulism Diagnosed for a Fixed Prosthesis With Natural Co-Abutments*.
- Chapter 14 discusses *Unilateral Subperiosteal Implants: Treatment of Partial Edentulism
  With Severe Alveolar Ridge Resorption Diagnosed for a Fixed Prosthesis With Natural Co-
  Abutments*.
- Chapter 15, *Bone Enhancement: Increasing the Volume of Available Bone*, discusses the
  types, methods, and physiology of various grafting materials; ridge expansion; nerve
  repositioning; and distraction osteogenesis.
- Chapter 16, *Choosing the Appropriate Implant Modality*, discusses the various
  considerations related to the selection of the most appropriate implant modality in cases in
  which more than one may be applicable.
- Chapter 17 discusses *Diagnosis and Treatment of Reversible and Irreversible Implant
Complications, including how trouble can be recognized, how to determine whether the implant can be treated conservatively or must be removed, and how to perform such treatment or removal.

- Chapter 18, Examples of Intermediate and Advanced Cases, shows examples of more advanced cases that can be treated when mainstream treatment has been mastered, or that can be referred to an expert.

Section Four, Non–Abutment-Providing Modalities, contains chapters that teach the indications and use of procedures that are not designed to provide abutments for restorative dentistry.

- Chapter 19 discusses Endodontic Stabilizer Implants: Tooth Root Extension for Improved Prognosis.
- Chapter 20 discusses Intramucosal Inserts: Increased Retention and Stability of Maxillary Dentures.

Section Five, Practice Management, provides the reader with useful information for running a successful practice that has incorporated implant dentistry treatment.

- Chapter 21, Diagnosis, Formulation, and Presentation of Goal-Oriented Treatment Plans, discusses how to assess the physical and psychologic fitness of a patient to undergo an implant procedure, what to do in cases in which the patient does not want or cannot afford optimal care, how to interact with patients, how to understand them, how to motivate them to want the best possible care, certain types of challenging patient types, and common questions and answers that arise when presenting implant dentistry treatment plans.
- Chapter 22, Referring and Referrals, describes the solo and team approaches to implant treatment, resources for the referring practitioner, and the ideal relationship between the participants in a referral relationship.
- Chapter 23, Legal and Insurance Considerations, discusses the legal components of accountability for treatment rendered, and provides an overview of the growing role of insurance in the practice of dentistry.

Finally, a comprehensive glossary provides definitions of the common and uncommon terms used in implant dentistry.

SPECIAL FEATURES

Several special pedagogic features found in this book facilitate use by the reader. Immediately following this preface, a comprehensive flowchart shows the course of events recommended in this book for the treatment of a patient with multimodal implant dentistry, from consultation through aftercare. Controversy boxes highlight points of common disagreement in the field and show both sides of these issues. The step-by-step procedure chapters contain two types of text formatting—regular text that tells the reader “what the hand is doing” and italicized text set against a yellow screen that tells the reader “what the mind is thinking”—to teach more thoroughly not only how steps are performed but also why they are performed in that way, or in that order. Finally, terms that are defined in the glossary are in boldface type on first appearance in the book.
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We also wish to express our gratitude to the following persons for their assistance and support throughout the years that we have devoted to writing this book: Professor Jack Lemons, for his thorough scientific review of the book and glossary; Dr. Shankar S. Iyer, for his contributions to the bibliographies and review of the glossary; and Mr. Sang Kim for his skillful assistance with the graphics.
PERSONAL ACKNOWLEDGMENTS

I sincerely appreciate those who have given me their love and support throughout the years. I particularly want to express my respect and admiration for the sheer strength of character and intelligence exhibited by the pioneers of implant dentistry, with many of whom I shared exciting experiences during the development of our field. All of you, collectively, represent a national treasure. The dental profession is in your debt.

My wife, Phyllis, has been personally involved with implant dentistry for more than three decades and has assisted in thousands of implant surgeries. Few people, as the years have unfolded, have experienced more joy and more angst with implant dentistry than she. I am forever grateful for her steadfastness, loyalty, and love. The love and support of our children has been a mainstay of my life. To Joanne, Catherine, Caroline, Anastasia, Adam, and Benjamin, I return your love and support with every fiber of my body. There is no way to express the depth of my feelings toward each of you. I am blessed. To our grandchildren Aaron, Michael, Ian, Christian, Alexander, Alexandra, Zoe, Eliza, Benjamin, Carolina, Alfredo, and Kai, I return your love and pledge to be there for you in every way that I can.

I am fortunate to have been able to co-author this book with my son, Adam. He taught me so much—a love for the English language, the importance of being precise and accurate, respect for the written word. The joy of having worked on this project, of all the hours together, of getting to know him, is real. I am so very proud of him.

Shankar Iyer, his wife Preeti, and daughter Easha are also part of our family. They are a constant source of support, pleasure, and love.

Herbert Meeker is the brother I always wished I had. I cannot think of him without smiling. Leonard Linkow—what can I say? We’ve come to know and understand each other well in recent years. We are friends. Solely because of Leonard Linkow, implant dentistry is 20 years ahead of where it would have been without him. I wish him every happiness.

Katsura Omura, Bruce Blanket, and Felipa Magundayao are dear and trusted friends. I am lucky to have known them for so many years. Simon Heifetz, who is brilliant, straight, and articulate, taught me more than I can say. I thank him. James Matarese, whose vital contributions to the fabrication of titanium implants are not generally known, has been a pivotal figure in my life.

Although I do not know him personally, I want to acknowledge the very meaningful contributions of PerIngvar Branemark to our field.

In my early years of practice, I focused on the then-emerging field of dental practice administration. Al Purinton, L.D. Pankey, Otto Reiser, and Roy Gam shared gifts of knowledge for which I remain grateful every day.

How fortunate I am to have made so many friendships in implant dentistry. Some of those who have especially and positively influenced my life and thinking include Burton Balkin, Gianvincenzo Bartoli, Ken Beecham, Raul Beraha, Sidney Berger, Perry Bingham, Valentine Block, Robert Buhite Sr., Joseph Buttacavoli, Raphael Chercheve, Angelo Chiarenza, C. Benson Clark, Max Clark, Craig Cooper, Norman Cranin, Ronald Cullen, Gustav Dahl, Mark Davis, Triny De Franco, Pierre Doms, Dean Doyle, Fran DuCoin, Ronald Easic, Alfred Feigel, Aaron Gersh-koff, Harris Goldman, Kim Gowey, Richard Guaccio, Gintas Gumbelevicius, Jack Hahn, Boyd Harris, Gerhardt Heidelbach, Alfred Heller, Yasunori Hotta, Noriharu Ikumi, Marilyn Jackson, Harold James, Choul Jin-Rio, Paul Johnson, Jean-Marc Jullet, Toshitaka Kaketa, Robert Katz, Haryuki Kawahara, Kenneth King, Walter Knouse, Eiichi Kojima, Tatsuro Komuro, Frank LaMar Sr., Isiah Lew, Sebastiano LoBello, Leonerd Machi, Max Malin, Charles Mandell, Dan Manelli, Emile

Through the years, my greatest professional joy has been my dental practice. I cannot wait to get to work each morning. After so many years, it is rare that I encounter something clinically that I have not treated before, and when that happens it is exciting. But what is exciting every day are the patients. They are all different, and I take pleasure in each of them. They become like an extended family, and each day brings happy reunions that far outweigh the problems we all experience. However, my “real” professional family is my staff. I could never have written this book without them, and they have enabled me to do more than I could have imagined. Ionie Yvonne Dacres is my surgical assistant. I spend more hours with her than with almost anybody. Operating with her is like being in a ballet: everything moves and is timed and coordinated beautifully. She is skilled and intuitive, and offers me valuable advice and guidance every day. Also, she is a pleasure to be around. I am also thankful to David Gonzalez, my trustworthy and sharp-minded financial consultant and confidant; Dianne Polite, my extremely capable and personally excellent office manager; Lisa Miller, my thoroughly professional and valued new hygienist; and Latoya Ford and Laura Rivera, high school students in our office on a special program, both obvious winners personally and in terms of their natural abilities. You are a wonderful staff, and I know how lucky I am to have you. Also, I express my appreciation to Boris Abayev of Advanced Dental Laboratory, New York, for his caring and excellence in all he undertakes.

I also want to acknowledge the American Academy of Implant Dentistry (AAID) and its specialty board, the American Board of Oral Implantology/Implant Dentistry (ABOI/ID), and the wonderful staff of each. The contributions of this academy and board to our profession are boundless. Most of the advances of the past 50 years have been made by members of the AAID and ABOI/ID. The year 2001 marks the fiftieth anniversary of the AAID, something the entire profession can celebrate.

Charles M. Weiss

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Foreword

Congratulations on your decision to read this book. Although implant dentistry has been a part of the dental profession for many years, information on the subject that is both easily understood and pragmatic has been difficult to find. This book provides you with information that is simple and can be easily implemented into your practice.

Implants have been a part of my prosthodontic practice for most of my 40 years in the profession, and the surgical aspects of implant dentistry have become a major part of my practice over the past 15 years. Now, it is discouraging to remember the dentistry of the relatively recent past, when the additional support for prosthodontics afforded by dental implants was not available.

Implant dentistry is a very dynamic and therefore exciting area of dentistry. Techniques, materials, devices, and clinical and research knowledge about the subject change daily. Staying fully informed about the most recent developments in implant dentistry is wise, but with the subject matter expanding so rapidly this endeavor can become all-consuming. To fully understand and appreciate the latest cutting-edge developments in the field, and the implications of the changes that take place every day, one must first have a firm grasp of the underlying surgical, biomechanical, and physiologic principles of mainstream treatment.

To that end, this book is an excellent contribution to your fundamental knowledge of implant dentistry. Most restorative- and prosthodontics-oriented practitioners begin by learning the prosthodontic aspects of implant dentistry, and some, but not all, continue to become educated about the surgical aspects. Periodontists and oral surgeons, on the other hand, usually learn the surgical aspects only, and relatively few learn the fundamentals of the prosthodontic phase, which in fact is the point of implant insertion—to provide support for restorative dentistry. It is certainly beneficial to practitioners involved with either aspect of implant dentistry to gain a practical understanding of the entire process, from diagnosis through restoration through home care, to better serve their patients. This book provides invaluable step-by-step information about the comprehensive implant dentistry process, from recognizing safe and predictable cases, to differential diagnosis among the various implant systems and modalities, to surgical insertion, to prosthodontic restoration, to aftercare.

Principles and Practice of Implant Dentistry is a great educational resource for students and practitioners at all levels of implant dentistry knowledge, from the true beginner to the seasoned veteran. The easily understood step-by-step mainstream procedures are well illustrated and provide essential guidance. No aspect of the field is left uncovered.

I know you will enjoy increasing your knowledge and improving your clinical skills in implant dentistry.

GORDON J. CHRISTENSEN, DDS, MSD, PhD, ScD
Diplomate, American Board of Prosthodontics
Foreword

I am most honored to provide a foreword for Principles and Practice of Implant Dentistry. My comments are separated into sections: a historical perspective and evolution of the discipline of implant dentistry, an overview of the book itself, and some aspects of interactions I have had with the authors.

HISTORICAL PERSPECTIVE AND EVOLUTION OF IMPLANT DENTISTRY

Dental practitioners realize that new laboratory methods and chairside techniques have been introduced by individuals with interests central to improving clinical treatments and outcomes. These new methods and techniques have come from basic research and applications, often conducted by practicing clinicians.

Dental schools have always included coursework on the uses of surgical and restorative materials and associated procedures, including the extended applications of synthetic biomaterials for surgical implant devices, as a formal part of professional and specialty training. From the outset, therefore, implant dentistry evolved as a multidisciplinary activity. Most important, the literature associated with this process over the past decades has documented an ever-improving and expanding success for functional prostheses based on surgical implant reconstructions of partially and fully edentulous patients.

My involvement with biomaterials research, which started in the 1960s, led to interactions with a number of expert dental implant practitioners plus specialists from dentistry, medicine, and engineering. Interactions also existed with talented and knowledgeable laboratory-, industry-, and affiliated discipline–based individuals. One of the first series of lectures that I attended that was specific to implant dentistry was given by Charles M. Weiss, DDS. Many of the positions and concepts presented in that first lecture in 1970 have withstood the test of time and have been woven into the fabric of this clinically oriented, evidence-based “mainstream” book.

OVERVIEW

This book is divided into five sections with a total of 23 chapters whose main theme is clinical implant dentistry and its underlying science. The book provides in-depth descriptions of the step-by-step procedures for mainstream treatment, including criteria for patient selection and treatment planning, surgical and restorative rationales and methods, longer-term maintenance and care, and professional office and practice management. Each of the teaching sequences is referenced to published literature and strongly supported by diagrams, schematics, radiographs, and color photographs. Section Two, which discusses the related research, provides an unusually broad-based review of the relevant literature, including investigations in which Dr. Weiss participated. This section is also supported by graphics, radiographs, and photographs ranging from precise intraoral views to detailed histologic and electron microscopy images. The overall collection of information in this book represents an extremely valuable record supporting a multimodal approach to implant dentistry.

THE AUTHORS

Dr. Weiss has been continuously involved with the multiple aspects of implant dentistry through decades of participation at local, national, and international meetings. In this regard, the information and references in this book provide a broad and extensive testimony to the scope and breadth of his involvement. While maintaining a central position, Dr. Weiss has always welcomed an exchange of opinions; been willing to provide written and referenced documentation of ideas, concepts, and results; and been eager to debate and actively define his positions. This book reflects many of those experiences and follows a central concept of promoting a multimodal
approach to mainstream oral rehabilitation partially or totally supported by dental implants with evidence-based validity.

I also congratulate Adam Weiss, son of Dr. Weiss, and co-author of this book, for synthesizing multiple sources of information with outstanding clarity while maintaining a balance to facilitate readers’ assimilation of the material. His grasp of organization and logical flow of information substantially enhances the value of this book.

The authors make two important points specific to the practice of implant dentistry—that professional treatment and satisfaction of the patient is one of the most critical issues, and that collectively, the use of multiple implant modalities and techniques provides the broadest base of options, which in turn expands the longitudinal scope of patient treatment. The rationale for this approach is supported and reinforced by a significant number of other dentists whose primary practice is the surgical placement and prosthodontic restoration of dental implants. Collectively, this group represents a significant asset—a sizable pool of invaluable, long-term experience. The book includes detailed discussions on the basic developmental background, shorter-term experiences during clinical trials, longer-term experiences specific to restorative techniques, and summary outcomes from consensus conferences presented at professional meetings. Overall, a balance is provided by including information and options on multiple modalities, with significant and substantial content on currently popular root form systems.

A most important aspect of this book is that it assembles, documents, and presents Dr. Weiss’ lifetime of involvement in implant dentistry as a clinician, inventor, researcher, and supplier of a wide variety of implant systems. This lifetime involvement has focused on the use of surgical implants to provide abutments for early support and functional intraoral prostheses for partially or totally edentulous individuals. Writing this book represents a significant commitment of time, energy, and resources, for which the authors, their associates, and their families are to be congratulated.

I recommend *Principles and Practice of Implant Dentistry* to students at every level, as well as to established dental practitioners, as an in-depth, basic guide to multimodal techniques, and as a resource of important concepts and related technical and scientific information within the discipline of implant dentistry.

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