Preface

Computer and Information Technology have transformed society and will continue to do so in the future. An increasing number of dentists use a variety of computer technologies, including digital intraoral cameras and paperless patient records.

The topic of dental computing is related to the application of computer and information science in dentistry. Dental computing produces an increasing number of applications and tools for clinical practice. Dental computing support research and education, and improvements in these areas translate into improved patient care. Dentists must keep up with these developments to make informed choices. Dental computing present possible solutions to many longstanding problems in dental practice, research, and program administration, but it also faces significant obstacles and challenges. The dental computing experts in this book conducted literature reviews and presented issues surrounding dental computing and its applications.

The aim of the book is to gain insight into technological advances for dental practice, research, and education. We aimed this book at the general dental clinician, the researcher, and the computer scientist.

**ORGANIZATION OF THE BOOK**

The book is roughly divided into five sections:

*Section I: Software Support in Clinical Dentistry,* introduces the basic concepts in the use of computational tools in clinical dentistry. Chapter I starts with a brief introduction of geometric morphometric (GM) methods, including procrustes superimposition, principal component analysis. This chapter discusses the principles and guidelines of CT technology used in dentistry. Finally, the Viewbox software is described, a tool that enables practical application of sophisticated diagnostic and research methods in Orthodontics. Chapter II presents a toolchain including image segmentation, registration and 3D visualization that allows a time series analysis based on DICOM CT images. Chapter III describes the shrinkage concepts that will improve clinical understanding for management of shrinkage stress, and help design and assess polymerization shrinkage research. Chapter IV describes a computer-controlled systems for registration the position of the mandible.

*Section II: Software Support in Oral Surgery,* serves as a comprehensive introduction to computational methods supporting oral surgery. Chapter V discusses the requirement of an image analysis tool designed for dentistry and oral and maxillofacial surgery focussing on 3D-image data. Chapter VI shows how large improvements in image quality can be obtained when radiographs are filtered using adequate
statistical models. Chapter VII provides information related to 3D reconstructions from few projections in Oral Radiology.

Section III: Software Support in Tissue Regeneration Proceedings in Dentistry; provides examples of application supporting research in regeneration dentistry. Chapter VIII deals with overcoming the drawbacks of the currently available tooth replacement techniques by tissue engineering, the success achieved in it at this stage and suggestions on the focus for future research. Chapter IX introduces a cost-effective and fully automatic bacterial colony counter which accepts digital images as its input.

Section IV: Software Support in Dental Implantology, describes informatic tools and techniques which can serve as a valuable aide to implantology procedures. In Chapter X the author describes a new system for guided surgery in implantology. Chapter XI summarizes latest results on developing software tools for improving imaging and graphical modelling techniques in computerized dental implantology. Chapter XII covers published Finite Elements Analysis (FEA) literature on dental implant research in the material properties, simulation of bone properties and anatomy, mechanical behaviour of dental implant components, implant dimensions and shape, design and properties of prosthetic reconstructions, implant placement configurations, discussion on the limitations of FEA in the study of biological systems — recommendations for further research.

Section V: Software Support in Clinical Dental Management and Education, includes five chapters. Chapter XIII presents a systematic review about EDRs (Electronic Dental Records), describes the current status of availability of EDR systems, implementation and usage and establish a research agenda for EDR to pave the way for their rapid deployment. Chapter XIV describes the haptic dental simulator developed at the University of Illinois at Chicago. Chapter XV describes a digital Library for dental biomaterials. Chapter XVI provides insight into the implementation of rapid prototyping technologies in medical and dental field. Chapter XVII describes the background and the application of the characters for human dentition to the exchange, storage and reuse of the history of dental diseases via e-mail and other means of electronic communication. In Chapter XVIII, the authors focus on a virtual tooth drilling system whose aim is to aid dentists, dental students and researchers in getting acquainted with the handling of drilling instruments and the skills and challenges associated with cavity preparation procedures in endodontic therapy.

The book “Dental Computing and Applications: Advanced Techniques for Clinical Dentistry” contains text information, but also a glossary of terms and definitions, contributions from more than 36 international experts, in-depth analysis of issues, concepts, new trends, and advanced technologies in dentistry. While providing the information that is critical to an understanding of the basic of dental informatics, this edition focuses more directly and extensively than ever on applications of dental computing.

The diverse and comprehensive coverage of multiple disciplines in the field of dental computing in this book will contribute to a better understanding all topics, research, and discoveries in this evolving, significant field of study. This book provides information for both informatic researchers and also medical doctors in obtaining a greater understanding of the concepts, issues, problems, trends, challenges and opportunities related to this field of study.

In shaping this book, I committed myself to making the textbook as useful as possible to students and advanced researchers coping with the demands of modern medical research. I hope will make this book a helpful tool—not only for the student who needs an expert source of basic knowledge in dental informatics, but also for the advanced researcher who needs clear, concise, and balanced information on which to conduct his research.

Thanks to a very hard-working editorial advisory board of scientists, excellent authors who fulfilled our invitations, and a very efficient publisher providing clear procedures and practices for a quality
production, readers may now enjoy chapters on some of the major ideas that have concerned computing and its applications in dentistry.

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**REFERENCES**

