especially in the esthetic zone, is illustrated in the final chapters with special emphasis on implant site development procedures utilizing both hard and soft tissues.

This atlas could be even better with additional information about the interrelationship of the prosthodontic diagnosis, treatment plan, and patient expectations with dental implant placement and associated surgical procedures. The influence of the opposing dentition is a critical diagnostic factor with its effects on interarch spacing for prosthetic materials, intertooth spacing, and occlusal loading. Information on mandibular flexion and implant placement and prosthetic splinting of implants would have also been helpful. Nevertheless, the atlas is an excellent resource for anyone who includes implant therapeutics in their clinical repertoire. It is particularly valuable for those clinicians beginning to place dental implants, as it describes the adjunctive surgical procedures necessary in a clear and concise method that can be readily translated into clinical practice.

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Dental Materials In Vivo: Aging and Related Phenomena

Editors: George Eliades, Theodore Eliades, William Brantley, David Watts. Quintessence Publishing Co. Inc., Chicago, IL, 2003: ISBN 0-86715-399-7, 20 contributing authors, 283 pages with index; 183 illustrations; price \$110.00, hardcover

This book is a comprehensive overview of the effect of the oral environment on the clinical per-

formance of dental biomaterials. There are several respected textbooks on dental biomaterials readily available, but none of those texts focus on how the biomaterials function in the biologic system over extended periods of time. As stated in the text's introduction, it is important to understand how dental biomaterials *live* and ultimately *die*, and to address that need, this book has thoroughly reviewed the current research findings to provide a better understanding of dental material behavior and failure. The text assimilates information covering both in vitro, and more importantly, in vivo, investigations, including especially useful retrieval studies offering excellent insight into oral environment degradation mechanisms.

The chief editors and 16 additional contributing authors have presented 15 chapters that provide complete citation of all references used throughout each chapter. The text is well organized into sections that integrate the aging of dental biomaterials into numerous applications and disciplines, including prosthodontics and implant dentistry, restorative dentistry, orthodontics, endodontics, oral and maxillofacial surgery, and periodontology. Brief introductions at the beginning of most chapters provide the groundwork and summarize the information to follow.

The first chapter provides a useful and logical introduction to general aspects of biomaterial interactions with biologic fluids. Both initial and prolonged biologic responses to dental biomaterials are discussed, including interesting information regarding cell attachment and organization mechanisms. The effect of the biomaterial surface properties and related pellicle formation is discussed, revealing the fact that significant pellicle compositional differences may exist at the tooth surface as a function of the specific material. This chapter also includes a review of the classification of dental implant materials as to bioactivity, composition, and their expected bone response.

Section II, which deals with prosthodontics and implant dentistry, presents an excellent chapter on the characterization of retrieved implants with an emphasis on the effects of the oral environment on the implant materials. In addition to covering both biologic and mechanical complications, the review of retrieved implant investigations provides failure analysis observations and reported changes in the implant materials after in vivo use, rather than only the histologic features associated with failed implants, which are typically presented. This section also contains chapters on the aging of prosthodontic casting alloys and ceramic behavior under different environmental and loading conditions. While these chapters thoroughly review the research literature, only laboratory investigations are presented, which may be indicative of the significant lack of clinical aging studies involving these materials.

The restorative dentistry section presents chapters on the aging of dental amalgam, glassionomer cements, and dental resin composites. The complex and synergistic effects of time, temperature, mechanical forces, and the oral environment on dental amalgam restorations are described by extrapolating information from both in vitro and in vivo research findings. SEM micrographs are included to illustrate some of the in vivo alterations in microstructure that occur in both low- and high-copper alloys. The chapter on glassionomers, in addition to reviewing the clinical degradation process of these restorative materials, points out the lack of evidence-based literature to support the concept of fluoride release and the associated anticariogenic behavior of glassionomer materials. Whereas the dental resin composite chapter presents a thorough description of the current understanding of wear and chemical degradation associated with the different components of these materials, the chapter ends with a thought-provoking statement: until all possible degradation mechanisms and the associated resultant degradation compounds are thoroughly known, it is not possible to be certain that these materials are completely safe.

Sections IV and V present chapters associated with orthodontics and endondontics, respectively. Retrieval studies of orthodontic wires and brackets provide information about corrosion and irreversible adsorption of proteinaceous matter associated with orthodontic alloy materials, in addition to fracture failure and staining of ceramic brackets. Again, the potential implication of leachable components from the numerous orthodontic materials is also addressed. Although the endodontic material presented covers failure mechanisms related to endodontic instruments, solid cores, and sealers, the chapter also points out that the information is resourced from laboratory studies, because in vivo studies of endodontic materials have been extremely limited.

The oral and maxillofacial surgery section contains chapters covering the aging of surgical implants and the leaching of metallic ions from plates and screws used in fracture fixation. Whereas research on corrosion behavior of orthopedic implants is extensive, the text indicates there is much less comparable literature related to oral and maxillofacial implants. The chapters also discuss the trend toward the use of titanium rather than stainless steel because of the favorable bone response and the concept of permanent implantation with titanium-based materials. However, the authors also question whether the performance of titanium is actually superior to stainless steel, because the literature indicates that fretting corrosion results in titanium release into surrounding tissue to the point of tissue saturation, and there is some debate whether dissemination will occur to distant sites and what the implications might be.

The final section, addressing periodontology, covers the effect of suture materials and wound healing, and the aging of bioactive glass bonegrafting materials. Literature to support the timehonored principle that wound healing is affected by the tension applied is presented, including interesting information on the important implications of stress-relaxing sutures in periodontal surgery. The chapter regarding bioactive glasses is extremely interesting, with a description of the promise of these materials to match the glass degradation rate with the new bone growth rate for each patient. This chapter closes with a challenging discussion of future research and biologic applications.

This text introduces a unique and significant approach to dental biomaterials. Although the information associated with the aging of dental biomaterials is complex, the text would be a most valuable resource for researchers and educators, and may be of interest to some clinicians from various specialties. A tremendous amount and variety of information has been compiled, organized, and presented in a style that is clear and concise.

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