Preface

The goal of this special issue is to provide material scientists and clinicians from dentistry with an appreciation of the fundamental aspects of dental biomaterials from materials science point of view, as well as their clinical applications in dentistry.

There is a wide range of dental biomaterials used for different dental applications used in dentistry, from metallic alloys to ceramics and from polymers to hybrid composites. Functional properties play an important role in discussions about their clinical applications and have a significant role in the evaluation of the clinical performance for different dental implants and prostheses. This special issue is focused also on the current strategies for dental tissue repair and regeneration. Based on the requirements of the modern biomedical technology, the novel research strategies in biomaterials field are nowadays directed toward biomaterials endowed with surface properties, controlled adhesion, and for the controlled release of active principles, especially against infections.

In this view, several research groups and clinicians from dentistry have been invited to contribute to this special issue with their original research papers that could stimulate efforts of comprehensive knowledge of new biomaterials and technology for dentistry.

This special issue is divided into two categories based on the following keywords: dental biomaterials and technologies, respectively clinical performance of dental applications.

In the category of dental biomaterials, metallic biomaterials have attracted a significant attention being widely used in manufacturing dental implants and prosthesis. Processing of the metallic dental alloys by alternative procedures conduct to various surface characteristics and this subject are discussed into a very interesting paper.

Bioceramics represent another new hot topic for development new dental applications. Inert bioceramics are used now in dentistry and this special issue presents a very interesting review about the zirconia biocompatibility in animal studies.

Also, a dedicated paper to present use and expectations related to the use of bioceramics in endodontics are part of this chapter. A variety of grafting materials are used for bone augmentation in modern dentistry. The use of graft materials and platelet rich plasma are very hot topic at this moment in oral surgery and one dedicated paper highlight the classification and indications of different bone grafting materials and barrier membranes for everyday clinical practice of contemporary work in the field of oral surgery and periodontology. Dentists are often faced with oral infections which untreated may cause systemic infections. Infections of the oral cavity such as tooth decay, periodontal infections, and infections of the oral mucosa are available illumination.

Photodynamic therapy (PDT) is particularly suitable for oral diseases because many of the microorganisms which are likely to cause oral infections are vulnerable to PDT and photosensitive agent in the presence of a suitable light source. There are many photosensitive agents that have been shown to be effective against microorganisms without harming the host tissue, and these aspects are described in a review paper of this special issue.

The second chapter of this special issue pays attention to the clinical performance of dental applications. According to this hot topic worldwide, this issue presents not just a general view about requirements for dental applications but also the experimental results obtained in clinical daily practice. Dental implants are still the most important aspect in modern dentistry. According this, one paper describes the current options of making implant supported prosthetic restorations to mitigate the impact of occlusal forces. The impact reduction of occlusal forces to the implant support represents a current problem for the implant prosthodontics especially in the case of full-arch implant-supported fixed prostheses. Even the existence of a cement layer between the prosthetic restoration and the implant abutment may have such a role, in the case of large fixed implant-supported prosthesis the high level of stress that can be harmful to the implant and the surrounding bone impose supplementary measures. If the use of resin materials with a lower modulus of elasticity for the implant supported prosthetic restorations veneering is a method already suggested from a while, in addition today we may also use materials based on high performance

polymers like PEEK instead of the rigid non-precious metal alloys for the framework of these prostheses. Moreover, the biological and mechanical properties of these polymers may be used to develop more suitable materials also for the intraosseous implants and the prosthetic abutments in order to obtain prosthetic restorations with a better biological and functional integration. Other important aspects are the stability of dental implant. Related to this aspect, the bone structure and properties are very important. In order to give more information on this topic, one paper from this issue shown some experimental results obtained after an in vitro study about the thermal changes of bone induced during drilling for dental implants placement.

New insight and future perspective about the magnification use for the additional root canals localization at the second maxillary molars are still interesting topic for clinicians because new challenges appear today resulted from clinical evaluation. According this study, only with the dental microscope we could identify the true root canal anatomy of upper second molars, revealing the existence of additional root canals. The possibility of achieving a correctly made access cavity without perforating its side walls or floor requires very good view under the microscope.

Understanding the fracture behavior of dental ceramics and its relation to different materials and restorations is important from a clinical point of view. Due to the lower opacity and translucency of many core materials, bilayer ceramic crowns were introduced to obtain sufficient veneer support and to improve aesthetics. Interfaces can have significant influence on the mechanical performance of layered structures. Veneer chipping and zirconia frameworks fractures are critical issues in all-ceramic restorations. One paper from this part of our special issue treat the failure analysis of bilayered all-ceramic molar crowns, evidenced by different type of fractures. The authors demonstrate that the ceramic materials show considerable variation in strength due to their extreme sensitivity to cracks. Understanding the fracture behavior of dental ceramics and its relation to different materials and restorations is important from a clinical point of view and failure analysis can be helpful in developing new materials and technologies for dental all-ceramic restorations.

Porcelain veneers are a conservative solution for patients in need for improvement of the shape, position and color of their anterior teeth without the removal of substantial amounts of tooth substance. Due to high aesthetic qualities, proven biocompatibility and a long term durability, porcelain veneers have become a routine restorative procedure for frontal teeth treatment. According to one paper from this part of our special issue, we cannot generalize them for all patients who need aesthetic correction and each case should be evaluated individually. But in generally, most of the cases demand some kind of tooth modification for superior aesthetics, like better color change without affecting the thickness of the veneer. Thus, a bigger accent on the concept of minimal preparation veneers compared to no preparation veneers is highly advocated.

Anyway, the continuous analysis and monitoring of the clinical results obtained after the use of the dental applications in clinical practice represent clearly a good way to establish new research directions and develop new solutions for the future dental biomaterials and technologies. Authors prove that the dental biomaterials and technologies for dentistry play not just an important role in the functionality of the dental applications but also in their effects on the human tissues.

By collecting these papers, we hope to enrich our readers and researchers in the field of dental biomaterials and technologies, in relationship with the clinical performance of dental applications.

We believe that novel dental biomaterials and technologies, together with the improved understanding of the interface between biomaterials and dental tissue, will be an important part of future dental biomaterials and technologies with better functionality in dentistry.

Acknowledgment

I would like to thank all the authors participating in the present Special Issue: Materials and Technologies in Dentistry: Defects, Processing and Characterization

Prof. Iulian Antoniac
Materials Science and Engineering Faculty, Biomaterials Group,
University Politehnica of Bucharest, Bucharest, Romania
antoniac.iulian@gmail.com