

SUMMARY

The present thesis entitled "**Innovations in Dentistry: Biocompounds, Stability and the Safety Assessment of Dental Materials**" presents a synthesis of the scientific research activity that has been carried out since the time I finished my doctoral thesis until now and my academic and professional career.

The field of dental medicine is witnessing significant advances in biomaterials and compounds designed to improve both oral tissue regeneration and overall dental health. The optical properties and surface stability of dental materials are crucial factors influencing the success of dental restorations, especially in terms of their appearance and longevity.

The biocompatibility and safety of dental appliances are essential to ensure that the materials used in treatments do not cause adverse reactions in patients.

Thus, the first part of the thesis was subdivided into three distinct directions targeting the areas of interest mentioned above.

The first chapter examines the optical properties and surface stability of dental materials, investigating how factors like artificial aging, water absorption, and thermal cycling impact materials such as PEEK and thermoplastics. Studies show that PEEK has good color stability but can discolor when exposed to staining agents and degrade when subjected to water saturation and temperature fluctuations. The chapter also discusses how thermoplastic materials experience changes in surface topography due to water sorption and exposure to artificial saliva, which can affect their durability and esthetic appearance. These findings underscore the need for dental materials that can withstand the challenging environment of the mouth while maintaining performance and longevity.

Next, the thesis focuses on the biocompatibility and safety of dental appliances, particularly focusing on thermoplastic materials and antiseptic agents. Research shows that surface roughness in PETG dental appliances promotes bacterial growth, raising concerns about biofilm formation and oral infections. The safety of chlorhexidine digluconate, a common dental antiseptic, is also evaluated, showing that while effective, it can cause cytotoxicity and irritation at higher concentrations. Finally, the biocompatibility of clear aligners is assessed, revealing minor irritant reactions despite their overall safety. This chapter emphasizes the importance of thorough

safety screening and material refinement to ensure that dental appliances are both effective and safe for long-term use.

The final chapter explores cutting-edge advancements in biomaterials and compounds used in dental medicine, focusing on tissue regeneration, natural compounds, and synthetic materials. The potential of natural compounds such as polyphenols and essential oils in dental treatments is emphasized, particularly for their antibacterial and anti-inflammatory properties. Additionally, the chapter reviews the role of synthetic compounds in dentistry, discussing their mechanical strength, esthetic properties, and biocompatibility, while highlighting their durability and safety in dental applications.

The second part of this thesis is focused on academic achievements. I have developed a robust academic career in dental medicine, starting with my PhD in Medical Sciences from the "Victor Babeș" University of Medicine and Pharmacy in Timișoara (2016-2021). My research focused on oral health and hygiene promotion among primary school children, for which I received a doctoral grant. In 2016, I started as a University Assistant in the Discipline of Preventive, Community, and Oral Health Dentistry. I currently serve as a Lecturer at the Faculty of Dental Medicine, Victor Babeș University of Medicine and Pharmacy in Timișoara, a role I have held since 2021. In addition, I completed a residency in Orthodontics and Dento-Facial Orthopedics (2016-2019) and hold a Bachelor's Degree in Dental Medicine (2005-2011) from the same institution. Along the way, I have earned certifications in pedagogical training, entrepreneurial skills, project management, and IT skills.

I have been actively involved in research, participating in projects such as the Oral Health Pathfinder Survey in Romania (2018-2020) and a strategic partnership aimed at enhancing research quality in medical universities (2013-2015).

I have been honored with several awards, including a travel grant in 2017 for presenting my research at the European Association of Dental Public Health in Vilnius and a TDSA Award in 2011 for my research on dental prosthetics. I have presented my work at various national and international conferences, covering topics like dental health policy and ergonomics.

To further enhance my skills, I have completed numerous certifications, such as the Incognito Appliance System Certification and the Straight Wire Orthodontic Program. I am proficient in German and English, with certifications in both, and have an intermediate level of French.

My research spans several areas, including:

- Biopolymer composites for bone tissue regeneration
- Water absorption in dental restorative materials
- Effects of water sorption on thermoplastic dental materials
- Surface roughness and color changes in dental PEEK caused by staining beverages
- A clinical report on managing „mesiodens”
- The relationship between inflammation and oral health
- The application of chitosan in dentistry

Through my research, I strive to provide innovative, evidence-based solutions to advance the field of dental medicine and improve patient outcomes, focusing on material science, clinical research, and biomaterials in dentistry.

This combination of research, teaching, and professional development highlights my dedication to advancing dental medicine and orthodontics.

In parallel with the academic function, I also continued the medical activity, discussed in the third part. In addition to my academic role, I've been a Specialist Orthodontist since 2019, combining my clinical experience with teaching. I'm also pursuing a residency in General Dentistry, which I began in 2022, to expand my clinical knowledge. Since 2014, I've managed my private dental clinic, Dr. Anamaria Bica SRL, in Ghiroda. This has allowed me to offer a wide range of treatments, including preventive, restorative, and orthodontic care, while also handling the operational and administrative aspects of the practice.

My practice focuses heavily on orthodontics and dento-facial orthopedics, providing tailored solutions for misaligned teeth. I also treat patients with special needs or complex medical histories.

A key part of my approach is patient education. I believe that well-informed patients are more aware of the importance of maintaining oral health, so I take the time to educate them on preventative practices. Running my own clinic has also given me the opportunity to incorporate new technologies like digital radiography and intraoral scanners, improving both accuracy and patient comfort.

I have also participated in numerous national and international conferences to stay updated on the latest dental advancements, continuously improving my practice.

The last part addresses academic and scientific perspectives. My academic career development is built on three key pillars: research excellence, educational innovation, and international collaboration. I aspire to become a leading researcher in preventive dentistry, orthodontics, and public health, contributing to scientific advancements while preparing future dental professionals.

I plan to expand my research by launching interdisciplinary studies that address oral health from clinical and public health perspectives. My goal is to investigate behavioral, environmental, and social determinants of oral health, designing impactful interventions. Additionally, I will seek funding opportunities to support larger-scale projects, involving students in research and fostering collaborative partnerships with other universities and organizations.

On the educational front, I am committed to developing innovative teaching strategies and improving dental curricula by incorporating advancements in technology, digital health, and patient-centered care. I aim to create a dynamic learning environment that encourages critical thinking and practical application of research in clinical settings.

Mentorship is another key focus, where I plan to expand my role by guiding undergraduate and postgraduate students in their research and career development. I seek to nurture a generation of professionals who are both skilled practitioners and thought leaders.

To strengthen my international presence, I intend to engage in global research networks, contribute to international conferences, and collaborate on cross-border initiatives to solve global oral health challenges. Additionally, I aim to take on leadership roles within the academic community to help shape the strategic direction of the institution, advocating for research excellence and teaching innovation.

Overall, my career trajectory is dedicated to making meaningful contributions through research, education, and global engagement in dental medicine.