„CAROL DAVILA” UNIVERSITY OF MEDICINE AND PHARMACY,

BUCHAREST, DOCTORAL SCHOOL

DENTAL MEDICINE

INNOVATIVE APPROACHES IN PROSTHODONTICS IN THE CONTEXT OF THE PROGRESS OF DIGITAL TECHNOLOGY, BIOMECHANICS, AND ARTIFICIAL INTELLIGENCE

ABSTRACT OF THE HABILITATION THESIS

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ABSTRACT

The habilitation thesis, titled **"Innovative Approaches in Prosthodontics in the Context of the Progress of Digital Technology, Biomechanics, and Artificial Intelligence,"** was developed and written in accordance with the standards and criteria for obtaining the title of doctoral supervisor and the habilitation certificate, as stipulated by the Order of the Minister of National Education and Scientific Research No. 6129/2016.

This thesis consolidates the results of the educational, professional, and scientific work conducted by the candidate following the defending the doctoral dissertation titled **"Contributions regarding the study of factors involved in the development of denture stomatitis,"** which led to the awarding of the Doctoral Degree in Medical Sciences (OMECTS No. 6149/7.11.2012) from the Faculty of Dentistry of the "Carol Davila" University of Medicine and Pharmacy in Bucharest.

The current work emphasizes the research themes pursued during the postdoctoral period and details the professional activities undertaken by the candidate since their promotion to the position of Senior Lecturer in the Discipline of Complete Denture (currently Dental Prosthetics) at the Faculty of Dentistry, in October 2021, by Decision No. 2735 of 01.10.2021.

The habilitation thesis is structured into four main chapters, followed by the bibliographic references.

The first part of Chapter 1 presents **the candidate's scientific achievements in line with the habilitation criteria**, focusing on proshodontics, an area that has experienced significant technological advancements. The candidate's research primarily addresses complete denture treatment, examining functional, aesthetic, and oral health aspects in patients using removable prostheses. A key objective of the research was optimizing the biomechanics of complete dentures by efficiently distributing masticatory forces and improving the stability of prosthetic components. In this regard, the candidate explored digital technologies for precise fitting, computer simulations, advanced materials (such as resilient acrylics and 3D printing), and the analysis of prosthesis-tissue interaction through passive infrared thermography.

The second part of Chapter 1 outlines **the doctoral research** conducted by the candidate, aimed at the prophylaxis of the supporting soft tissues and improving the oral health and quality of life of patients with removable dentures. Notable contributions include the development of an etiological algorithm for Candida-associated denture stomatitis, addressing the challenging and often poorly controlled progression of this condition both locally and systemically. This research highlights the high morbidity and even mortality risks for elderly, fragile, or immunocompromised individuals, emphasizing the need for rigorous prophylactic measures to prevent and manage infectious-inflammatory conditions associated with removable prostheses. The research also demonstrated the capacity of infrared thermography—a passive, non-invasive imaging diagnostic method—to detect superficial inflammatory and infectious conditions at the oral mucosa supporting the denture. It was shown that, using this technology, affected areas of the mucosa in contact with the inner

denture surfaces could be identified, and that materials used in the prosthesis bases absorb and store heat, thus contributing to the creation of a thermal barrier beneath the denture base.

The third section of Chapter 1 is dedicated to **the candidate's main research directions during the postdoctoral period,** resulting in several publications in ISI Web of Science (WoS)-indexed journals and international databases (BDI). These studies are structured around five primary research topics:

The first research topic **"Modern Strategies for Managing Supportive Tissues: Preventive Solutions and Perspectives for Removable Prosthesis Wearers,"** which encompasses 9 publications (6 WoS-indexed ISI articles and 3 indexed in BDI). This work delves into thermal dynamics in the oral cavity of edentulous patients, its impact on salivary flow, and the oral microbiome composition in prosthesis users—factors influencing the design and durability of complete dentures.

The second research theme, **"The digital revolution and artificial intelligence: transforming prosthodontics through advanced technologies and clinical workflow optimization",** brought together 8 scientific publications (4 ISI articles indexed in WoS and 4 BDI), reflecting technological advancements in dental prosthetics in clinical practice, with the candidate addressing essential aspects of modern prosthetic restorations, such as the comparative evaluation of the functional parameters of metal-ceramic and all-ceramic restorations, the perception of dental professionals regarding the digital workflow in the fabrication of complete dentures, the CBCT technology in prosthetically guided implant planning, as well as the analysis of the marginal adaptation of E-Max crowns manufactured through printing, pressing, and milling methods. Furthermore, the use of artificial intelligence in dental prosthetics was explored through a complex analysis highlighting regional differences in the application of this technology and opportunities for innovation.

The third research theme, **"Innovations in Abutment Tooth Preservation: The Path to Long-Term Prosthetic Success,"** includes 8 publications (3 ISI articles indexed in WoS and 5 BDI articles), focusing on optimizing endodontic and restorative treatments for the long-term preservation of abutment teeth. In collaboration with interdisciplinary and multidisciplinary teams, the candidate analyzed stress and dentinal deformations during curved canal preparation using finite element analysis, assessed the impact of direct coronal restorative materials on fracture resistance through scanning electron microscopy, investigated the evolution of gutta-percha and nickel-titanium alloys in endodontics, explored modern irrigation techniques, identified causes of endodontic instrument fractures, and contributed to the development of bioceramic sealers.

The fourth research theme, **"Dental Education in the 21st Century: Perspectives of Students and University Faculty in the Era of Environmental Change and Pandemic Challenges,"** reflects the candidate's vision on the profound transformations and challenges in dental education. The 3 published ISI articles indexed in WoS highlight the impact of the pandemic on the training of future dentists, the difficulties in transitioning to online education, and the urgent need to adapt teaching methodologies. The research also examines how health restrictions have affected the development of practical skills and proposes solutions for optimizing learning in crisis conditions. Furthermore, it addresses the issue of sustainability in

dentistry, emphasizing the importance of eco-friendly practices and the integration of sustainability principles and elective courses into dental education to prepare future generations of professionals.

The fifth research theme, **"Radiographic Overview of Romania's Oral Health: Inequalities and Challenges Among Vulnerable Populations,"** underscores the candidate's concern regarding disparities in oral health, as reflected through the publication of 4 ISI articles indexed in WoS, analyzing the challenges faced by patients with chronic illnesses requiring long-term hospitalization, institutionalized elderly individuals, and vulnerable age groups in terms of prevention, such as adolescents. Through this research direction, the candidate highlighted the need for integrated strategies to improve oral health in at-risk groups, stressing the importance of health education, preventive interventions, and prosthetic solutions tailored to specific needs. This work demonstrates the candidate's vision for an inclusive and accessible approach to dentistry.

The 1st Chapter further presents **the impact and recognition of the candidate's scientific research** by showcasing **HIRSCH index** indicators in the most reputable databases: 10 (WoS), 9 (Scopus), and 10 (Google Scholar), along with citation counts: 183 (WoS), 155 (Scopus), and 322 (Google Scholar). The awards received by the candidate within the UEFISCDI framework through the Research Results Awards program are also documented, along with formal recognition of contributions from prestigious national and international publications. These include participation in editorial boards of internationally indexed national journals, invitations as a peer reviewer, involvement in promoting international publications, and contributions to enhancing the visibility of the Faculty of Dentistry.

At the end of this chapter, **the candidate's active involvement in major national and international scientific events in dentistry** is highlighted through oral and poster presentations. Collaborating with colleagues from the discipline and interdisciplinary teams, the candidate has contributed to disseminating recent advancements in dentistry and promoting research findings within the scientific community.

The 2nd Chapter details **the candidate's didactic activity,** highlighting key areas of involvement in student and resident training. It describes coordination and practical mentoring activities for students and residents, as well as supervision of undergraduate theses. The teaching activities for fifth-year students, including elective courses and postgraduate residency courses in Prosthodontics, are also outlined. Another important aspect is the continuous evaluation of students' academic performance through theoretical and practical exams, along with active participation in training and professional development sessions. Additionally, this chapter highlights the candidate's contribution to the development of innovative teaching materials for students, residents, doctoral candidates, and specialists in dentistry.

The candidate's participation as a member in numerous selection committees for occupying didactic and auxiliary didactic positions within the "Carol Davila" University of Medicine and Pharmacy, constant involvement in the supervision committees for admission and licensure exams at the Faculty of Dentistry, as well as serving as a member of the Council

of Department I of the Faculty of Dentistry and the Evaluation Committee for the Awarding of the Merit Grade of the same department, represent important pillars of their activity.

The 3rd Chapter presents **the candidate's medical career trajectory**, chronologically documenting the period from graduating from the Faculty of Dental Medicine in 2002 to obtaining the title of Primary Dentist in Prosthodontics in 2019 (confirmed by OMS No. 1270/14.07.2019). With 23 years of clinical experience, the candidate has maintained a steady presence in private practice, focusing on complex prosthetic rehabilitations. The refinement of clinical skills and continuous knowledge updates through participation in numerous postgraduate courses and workshops have significantly contributed to strengthening the candidate's expertise in dental prosthetics and interdisciplinary patient management.

The 4th Chapter of the habilitation thesis outlines **the candidate's long-term development directions in two essential areas: scientific research and academic activity**. In scientific research, the candidate aims to deepen investigations into innovative and relevant topics in dental prosthetics. These include studies comparing modern CAD/CAM technologies with conventional techniques, evaluating the impact of these technologies on patients' perceptions of prosthetic aesthetics and functionality, and investigating the effectiveness of innovative materials in prosthetic treatments. The candidate also plans to explore the relationship between students' psychological well-being and academic performance, as well as their perceptions of sustainability through the development of multicenter studies, reflecting a continuous commitment to the holistic development of future dental professionals.

In professional practice, the candidate intends to continue evolving within the elite academic community of "Carol Davila" University of Medicine and Pharmacy, with a clear openness to interdisciplinary and multidisciplinary collaborations. A sustained commitment to increasing the international visibility of research conducted at UMFCD through publications, participation in research project teams, dissemination of scientific results at scientific events, and the implementation of the latest technologies and treatments remains a priority. This openness to complex partnerships will facilitate the exchange of expertise and the application of innovative approaches, directly impacting progress in prosthodontics and, at the same time, dental education in Romania.