

REVIEW

by Assoc. Prof. Dr. Asya Zaharieva Krasteva-Panova, MD, PhD
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according to order No. R-109-418/03.10.2023

REGARDING the dissertation work of

Dr. Konstantin Stoychev Kostadinov – doctoral student
at the Department of "Periodontology and Dental Implantology,"
Faculty of Dental Medicine - Varna,

on the topic "Multimodal Imaging Documentation in Dental Medicine,"
submitted for the acquisition of the educational and scientific degree of "Doctor"
in the doctoral program "Therapeutic Dentistry" with a scientific supervisor:

Prof. Dr. Stefan Vassilev Peev, DSc.

Relevance of the Topic

Dental medicine is advancing at an exceptionally rapid pace, and one of the main reasons for this is the integration of digital technologies into its various spheres. Examples of such collaboration include intraoral scanners (as an alternative to conventional impression techniques and materials), digital sensors (as an alternative to analog plaque films), as well as the increasingly widespread use of CBCT scanners for the everyday needs of dental practice.

In everyday practice, conventional methods, materials, and techniques are still widely used. Due to technological progress up to the present moment, various intraoral scanners are increasingly found in the market.

The accuracy of the model is of exceptional importance in certain areas of dental medicine where deviations exceeding 200 microns are clinically significant, as is the case in implantology. Integrated implants are firmly anchored in the alveolar bone, and inaccuracies in the impression of the implant can compromise the fit of the implant prosthesis, leading to biological and mechanical complications. Hence, there is a growing use of digital models as an alternative to conventional ones.

With the advent of cone-beam computed tomography (CBCT), the capabilities for diagnosis, planning, and treatment are expanding across all fields of dental medicine. This modality overcomes the limitations associated with conventional imaging studies, such as two-dimensionality (overlapping anatomical structures) and image distortion. The primary advantage of CBCT studies lies in the ability to observe the area of interest in three planes—axial, coronal (frontal), and sagittal—without overlapping anatomical objects.

By using volume rendering/visualization programs, it is possible to construct 3D models (surface models) from imported sets of CBCT data through the application of an algorithm, typically unique to each program. The resulting 3D reconstructions (3D volume rendering) enable actions such as marking landmarks, performing measurements, moving bone fragments, and conducting virtual osteotomies. Therefore, the accuracy of the obtained model is of paramount importance not only for diagnostic purposes but also for treatment planning and its outcomes.

3D visualization enhances diagnosis and communication with patients, finding applications in various fields of dental medicine. Despite the advantages of this modality, it still does not see as widespread use in everyday practice.

The choice of the topic is relevant, as the application of 3D-generated models of this kind is still a subject of discussion and research. While literature provides data regarding their accuracy under various experimental conditions, there is a lack of information that generalizes their real-world application in clinical settings.

Understanding the Problem

The doctoral candidate examines literature data characterizing the qualities of impressions and impression materials and techniques, as well as the factors influencing their accuracy. In another subsection, Dr. Kostadinov provides detailed information on intraoral scanners. He also discusses literature data on cone-beam computed tomography, the generation of 3D models, and the factors influencing their accuracy.

Structuring the dissertation

The analysis of data in the literature review reflects the doctoral candidate's excellent awareness of the problem, providing the foundation for accurately formulating unresolved issues and defining the objectives and tasks of the dissertation. The subsequent sections include the objectives, tasks, and research methods, as well as the results and their summarization.

Research Methodology. Objective, Tasks, Materials, and Methods

The objective of the dissertation is formulated in response to the lack of data in Bulgarian literature regarding the accuracy of tooth reconstruction based on generated 3D models from

CBCT and intraoral scanning, as well as on gypsum models from conventional impression materials.

The four formulated tasks logically follow the main idea, enabling the execution of the study.

The materials and methods are appropriately selected and aligned with the objective and tasks of the dissertation.

The statistical methods used are well-chosen, allowing for a correct analysis of the obtained data and their presentation.

Results and Discussion

The results and discussion are presented accurately and in detail, once again reflecting the doctoral candidate's in-depth understanding of the problem.

Conclusions and Contributions

Sixteen conclusions have been formulated, reflecting the results of the tasks set in the dissertation, with particular importance for practice placed on conclusions 2, 3, as well as 5 and 6.

Contributions of the dissertation have also been formulated, highlighting the innovations in the dissertation work:

For the first time in Bulgaria, an in vivo study is conducted, generating 3D reconstructions of a mandibular tooth after scanning with cone-beam computed tomography.

For the first time in Bulgaria, the accuracy of 3D reconstructions of a mandibular tooth after scanning with cone-beam computed tomography is compared with those from intraoral scanning, A-silicone impression, and polyether impression

Conclusion

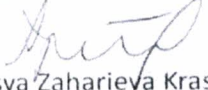
The selected and developed problem by Dr. Konstantin Stoychev Kostadinov is relevant for contemporary medical science and practice. Dr. Kostadinov demonstrates familiarity with specialized contemporary literature and exhibits qualities and skills for independent scientific research. The scientific development is well-structured, with appropriately chosen methods and reliable results. The dissertation is evidence that the candidate possesses in-depth theoretical knowledge and professional skills in the field of Dental Medicine. Furthermore, the candidate has competencies for conducting independent and collaborative scientific research.

The dissertation contains original and affirmative contributions, and I consider the data from the obtained results and their interpretation, as well as the related publications presented, as the personal work of the author.

The development meets the criteria for a dissertation and complies with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and the specific requirements adopted in connection with the Regulation for the Implementation of LDASRB and the Regulation of the Medical University - Sofia.

In conclusion, I give a positive assessment to the dissertation on the topic "**Multimodal Imaging Documentation in Dental Medicine**", and I will vote "YES" for Dr. Konstantin Stoychev Kostadinov to be awarded the educational and scientific degree of "Doctor" in the scientific specialty of "Therapeutic Dental Medicine."

Sofia, December 16, 2023.
MD, Phd


Assoc. Prof. Dr. Asya Zaharieva Krasteva-Panova,