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OF FDM-VARNA IN A PROCEDURE FOR
AWARDING THE EDUCATIONAL AND
SCIENTIFIC DEGREE PhD**

REVIEW

by

PROF. DR. METODI ZAHARIEV ABADZHIEV, DSc
MEDICAL UNIVERSITY "PROF. DR. P. STOYANOV" – VARNA, FACULTY
OF DENTAL MEDICINE, DEPARTMENT OF "DENTAL MATERIALS
SCIENCE AND PROSTHETIC DENTAL MEDICINE"
ON A DISSERTATION WORK FOR AWARDING THE EDUCATIONAL AND
SCIENTIFIC DEGREE Ph.D.

Doctoral Program: "Prosthetic Dental Medicine"

Professional Field: 7.2. Dental Medicine

Field of Higher Education: 7. Healthcare and Sports

Author: Dr. Yordanka Donkova Shekerova

**Full-time PhD Student at the Department of "Dental Materials Science and
Prosthetic Dental Medicine", FDM, MU-Varna**

Topic: *"Rehabilitation of Edentulous Patients with Complete Dentures Fabricated
via Digital Protocol – Possibilities, Advantages, Disadvantages"*

Scientific Supervisor:

Assoc. Prof. Dr. Desislava Atanasova Konstantinova, PhD

ANALYSIS OF THE CANDIDATE'S CAREER PROFILE

Dr. Yordanka Donkova Shekeroва was born on April 18, 1990, in the city of Targovishte. She graduated from the Faculty of Dental Medicine (FDM) – Plovdiv in 2015. Since 2018, she has been a part-time, and later a full-time assistant lecturer in the Department of "Clinic of Prosthetic Dental Medicine". She participates in practical exercises in the clinic of prosthetic dental medicine at FDM-Varna for both Bulgarian and English-language training. Dr. Yordanka Donkova Shekeroва is a full-time PhD student at the Department of "Dental Materials Science and Prosthetic Dental Medicine", FDM, MU-Varna.

ANALYSIS OF THE DISSERTATION WORK

The dissertation submitted to me for review by Dr. Yordanka Donkova Shekeroва contains 232 standard pages and is illustrated with 70 tables, 119 figures, and 5 appendices. The literature review includes 337 reference sources, of which 13 are in Cyrillic and 324 in Latin scripts. The structure of the dissertation complies with the requirements of the Regulations for the Development of the Academic Staff of Medical University – Varna, possessing all essential elements of the universally accepted structure for presenting a dissertation in Bulgaria.

RELEVANCE OF THE TOPIC

Complete edentulism is the most severe pathology in prosthetic dental medicine. Regardless of whether the treatment of complete edentulism is carried out through digital or analog methods, research in this direction will always remain relevant. We are aware that impairment of masticatory function and aesthetics can lead to social disintegration due to psycho-emotional stress. Following the rapid integration of digital technologies into prosthetic dentistry over the last decade, high priority was given to fixed prosthetics. However, there are still significant limitations related to intraoral digital impressions in complete edentulism. One of the main difficulties is reproducing functional borders. It is precisely toward solving these problems that the PhD candidate has focused. The doctoral thesis analyzes and optimizes existing digital protocols with clearly pronounced clinical applicability.

The introduction of the dissertation states that despite data showing higher precision and reproducibility of digital approaches, their capabilities in fully edentulous patients are still insufficiently studied. The main problems accompanying modern treatment of fully edentulous patients using digital methods

and tools are briefly and accurately outlined. Furthermore, initial guidelines for optimizing the fabrication design are provided.

The literature review thoroughly examines all aspects related to the issues of digital clinical protocols in the treatment of complete edentulism. Works of numerous authors are cited, and an in-depth analysis is conducted on the anatomical-morphological features of edentulous jaws, two- and three-dimensional diagnostic imaging methods, impression materials, conventional and digital impression techniques, as well as modern digital protocols for complete denture fabrication. Both additive and subtractive CAD/CAM technologies are reviewed, along with the possibilities of digital modeling, 3D printing, and milling in the rehabilitation of fully edentulous patients. Based on the gathered information, Dr. Donkova Shekerovalogically derived the aim and formulated the tasks in her scientific work, which fully correspond to the topic and content of the dissertation.

AIM OF THE DISSERTATION WORK

Based on clinical, experimental, and statistical studies, to investigate the possibilities, advantages, and disadvantages of using additive technologies in the rehabilitation of complete edentulous patients, improving efficiency and precision through the development and introduction of an enhanced digital protocol based on morphometric analysis, experimental design of an individual tray, and a shortened clinical workflow algorithm.

To achieve this **goal**, **5 objectives** were set and completed, which are precisely and clearly formulated and fully correspond to the set goal:

1. Study of the dimensional characteristics and morphological features of the denture foundation area in fully edentulous patients through the analysis of 3D diagnostic imaging.
2. Clinical evaluation of complete dentures fabricated via digital protocol using additive technologies.
3. Development and validation of an experimental model of an individual impression tray aimed at optimizing the digital clinical-laboratory protocol for the fabrication of complete dental dentures.
 - 3.1. Legal protection of the created model through industrial design patent registration.
 - 3.2. Investigation of certain physicochemical and biological properties of the experimental impression tray.
4. Assessment of time efficiency during functional impression taking from upper and lower fully edentulous jaws using various materials and techniques.
5. Development and implementation of an algorithm for reducing stages in the partial digital protocol for prosthetic rehabilitation of fully edentulous patients, based on the results of an experimental study.

MATERIALS AND METHODS

The materials and methods are systematically arranged in a separate chapter and by tasks. The methodology is objective, fully aligned with the execution of the set tasks, and guarantees the objectivity and reliability of the results. This dissertation presents a comprehensive analysis of the capabilities of digital technologies in the prosthetic rehabilitation of fully edentulous patients, integrating morphometric, clinical, and statistical approaches.

For **Object 1**, a morphometric analysis of cone-beam computed tomography (CBCT) scans was conducted. Sagittal and vestibulo-oral dimensions of the maxilla and mandible were measured along predetermined reference lines. The obtained data were processed to identify morphological relationships and develop standardized landmarks for digital planning of complete dentures.

For **Object 2**, a clinical evaluation of 60 complete dentures fabricated via digital protocol using additive technologies was performed. Retention, stability, peripheral adaptation, comfort, phonetics, and aesthetics were analyzed.

For **Object 3**, an experimental model of an individual impression tray ("Occlutray") was developed and validated, intended for simultaneous functional impression taking and intermaxillary registration.

For **Object 3.1**, an industrial design patent was registered.

For **Object 3.2**, a microbiological study of 3D-printed trays made of PLA and ABS was conducted by evaluating microbial contamination after a disinfection protocol.

For **Object 4**, the time efficiency of various functional impression techniques and materials was analyzed.

For **Object 5**, an algorithm for optimizing and reducing clinical stages in the partial digital protocol was developed.

Statistical processing of the results was carried out using specialized statistical software SPSS v.20.0 using descriptive statistics, comparative analysis, independent samples t-test, Mann–Whitney U test, Kruskal–Wallis test, χ^2 analysis, and Spearman rank correlation analysis. Statistical significance was established at $p < 0.05$.

RESULTS AND DISCUSSION

The results obtained across all tasks are reliable, illustrated with figures, and well analyzed. In practical terms, the study results demonstrate that digital technologies represent a promising tool in modern prosthetic dental medicine, but their optimal application requires integration with clinical techniques, especially during the functional border molding of the denture foundation. The obtained results show that the digital protocol provides good aesthetic and phonetic

outcomes, but remains limited regarding functional indicators such as retention, stability, and peripheral adaptation.

The discussion of the results is conducted properly.

The conclusions are logically formulated, emphasizing the contributions of the dissertation. Based on the obtained results, the PhD candidate formulated the following key conclusions:

1. A two-component morphometric algorithm was developed to determine the size and shape of the custom impression tray using CBCT in combination with CAD/CAM.
2. In case of discrepancy between parameters, the use of modified or hybrid constructions is substantiated.
3. The sagittal dimension of the mandible (Ls) is of significant importance for denture stability.
4. Age and gender do not have a statistically significant influence on morphometric parameters.
5. The digital prosthetic protocol increases treatment accuracy and reproducibility.
6. Clinical adaptation remains a mandatory step despite digital standardization.
7. The "Occlutray" tray allows for the development of a parametric digital model.
8. A differentiated approach is required for the maxilla and mandible.
9. The integrated design represents a biomechanically sound solution with digitally controlled geometry.
10. PLA and ABS are suitable materials for 3D-printed impression trays.
11. Microbiological safety depends primarily on the sterilization protocol, and 3D-printed trays can be safely used in clinical practice.
12. The "Occlutray" tray significantly reduces clinical time without compromising accuracy.
13. The digital method is the fastest, but has lower predictability.
14. Conventional methods are more age-dependent.
15. The tested protocol is effective, reproducible, and clinically applicable.

CONTRIBUTIONS

The candidate has categorized the contributions as scientific-applied (original and confirmatory) and applied.

1. Contributions of Scientific-Applied Character

Original Character:

It has been proven that the fully digital prosthetic protocol provides high efficiency regarding aesthetic and phonetic parameters, but remains limited in

functional parameters (retention, stability, and peripheral adaptation), necessitating clinical optimization and a hybrid approach.

An original structural model of the impression tray "Occlutray" was developed, protected as an industrial design at the Patent Office of the Republic of Bulgaria: Reg. No. BG - 9363, intended for functional impression taking and intermaxillary relationship registration within a digital protocol for fully edentulous patients.

A two-component morphometric algorithm ($U_s + U_f$) was created for determining the size and shape of custom impression trays, applicable under digital prosthetic planning conditions.

Morphological proportionality between maxilla and mandible dimensions was established, with practical importance for parametric CAD design of complete dentures.

The concept of an anatomically differentiated digital approach in impression tray design for maxilla and mandible was substantiated.

Differentiated clinical efficacy of fully digitally fabricated complete dentures was established, proving the superiority of maxillary constructions in functional parameters and higher variability in mandibular dentures.

Empirical foundations for parametric CAD design of the experimental "Occlutray" tray were established as part of the digital prosthetic protocol.

Confirmatory Character:

It was proven that age and gender do not exert a statistically significant influence on the morphometric parameters (U_s , U_f , L_s , L_f) used in digital prosthetic planning.

The stability and age-independence of morphometric parameters as reliable landmarks in the rehabilitation of fully edentulous patients were confirmed.

The clinical applicability and reproducibility of the digitally assisted protocol in a heterogeneous patient population were confirmed.

It was proven that the microbiological safety of 3D-printed impression trays depends primarily on the sterilization protocol rather than the material used (PLA/ABS).

2. Applied Contributions:

Clinical guidelines were formulated for optimizing the digital protocol, including the necessity of a hybrid approach during functional border molding.

A partially digital protocol (CBCT-CAD-3D printing) was introduced and optimized for the rehabilitation of fully edentulous patients with complete dentures while maintaining result reproducibility.

The clinical efficacy of the experimental "Occlutray" tray was proven as a time-saving alternative to conventional techniques without compromising accuracy and stability.

The feasibility of safe clinical use of 3D-printed impression trays within the digital protocol was confirmed.

Advantages time savings, standardization, predictability and limitations need for clinical adaptation, variability in certain methods of the digital protocol in complete prosthetic rehabilitation were identified.

PUBLICATION ACTIVITY

Dr. Donkova Shekeroва presents 3 publications related to her dissertation work. From discussions with the PhD candidate regarding her assigned topic and from personal impressions, I am convinced that the research in the dissertation work is entirely her own personal achievement.

The Dissertation Abstract is prepared according to the requirements of the Development of Academic Staff Act, contains 97 pages, is illustrated with numerous photos, figures, and tables, and fully presents the main structural components of the dissertation work.

CONCLUSION

The dissertation work of Dr. Yordanka Donkova Shekeroва titled *"Rehabilitation of Edentulous Patients with Complete Dentures Fabricated via Digital Protocol – Possibilities, Advantages, Disadvantages"* is an up-to-date scientific study with a number of original and scientific-applied contributions. The results are valuable for clinical practice, student and postgraduate training, and can serve as a foundation for future research. The problems presented in the topic have been examined extremely thoroughly, analytically, and in detail, and the methods for their solution are exhaustively presented and structured. Dr. Yordanka Donkova Shekeroва demonstrates the qualities and skills to conduct independent scientific research. I confidently give my entirely positive assessment and vote enthusiastically with "YES" for awarding the educational and scientific degree PhD to Dr. Yordanka Donkova Shekeroва.

02.08.2026
City of Varna

Prepared the Review:

Prof. Dr. Metodi Zahariev Abadzhiev, DSc

Заличено на основание чл. 5, §1, б. „В“ от Регламент (ЕС) 2016/679
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