



To the Vice Rector of Science and Research Activities
of Medical University – Plovdiv
Prof. Dr. Maria Tokmakova, MD, PhD

REVIEW

regarding

Dissertation for awarding the educational and scientific degree “Doctor” on the topic:
“Biomechanical problems in endodontically treated teeth after separated instruments
removal”

Author: Dr. Viktoria Todorova Dimitrova

Doctoral program: Therapeutic Dental Medicine

Form of doctoral studies: full-time

Scientific supervisor: Assoc. Prof. Dr. Silviya Dimitrova, PhD

Written by: Prof. Dr. Neshka Manchorova-Veleva, PhD, MSc

Specialty: Operative Dentistry and Endodontics

Institution: Department of Operative Dentistry and Endodontics,

Faculty of Dental Medicine, Medical University – Plovdiv

Internal member of the scientific jury by Order No. P-2572/26.07.2024

selected to prepare an opinion with protocol No.1 (05.08.2024)

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General presentation of the procedure and the doctoral student

The set of documents presented by the doctoral student are in accordance with the requirements specified in the procedure for the acquisition of PhD degree at MU - Plovdiv of the Regulations of MU - Plovdiv. She is enrolled as a full-time doctoral student in the Department of Operative Dentistry and Endodontics with scientific supervisor Associate Professor Dr. Silviya Dimitrova, PhD by Order No. P-704/17.05.2021. She was discharged with the right of defense for up to one year by Order No. P-2492/23.07.2024.

Brief biographical data

Dr. Viktoria Todorova Dimitrova was born on September 30, 1993 in Burgas. She graduated from the "Georgi Stoykov Rakovski" High School for Romance Languages in 2012 with a major in English and

French. In 2018, she graduated from Medical University – Plovdiv and graduated with excellent success as a doctor of dental medicine. From 2021, she is a full-time doctoral student at the Department of Operative Dentistry and Endodontics, Faculty of Dental Medicine. She is currently a specialist in "Operative dentistry and endodontics". Since 2020, Dr. Viktoria Todorova Dimitrova has also been working in her own clinical practice, developing her interests in the field of microscope-assisted endodontics. During the period 2021-2023, Dr. Viktoria Todorova Dimitrova also participates in the teaching work, by: teaching students according to an established curriculum in Bulgarian and English, participating in the lecture program as a lecture assistant, conducting continuous and ongoing control of the theoretical and the practical training of students, participates in the conduct of semester exams.

Dr. Viktoria Todorova Dimitrova has a number of additional competencies. She is highly proficient in word processing and graphics software, such as: Microsoft Office (Word, Excel, PowerPoint) and works great with Science Direct, Scopus, Mendeley, PubMed databases.

Dr. Dimitrova is a member of the Bulgarian Dental Union, Union of Scientists in Bulgaria, Bulgarian Scientific Society of Dental Medicine.

Relevance of the topic

The fracture of endodontic instruments is a common complication during endodontic treatment. Removal of the fragment is associated with dentin sacrifice, significant changes in root canal shape and anatomy. The most popular technique to deal with this clinical problem is the application of ultrasound. However, the impact of the increased temperature and the generated vibrations on the hard dental tissues is a precondition for the formation of microcracks. When they propagate, they can complicate and lead to root fractures, which worsens the prognosis of the tooth. There is a need to introduce alternative approaches for fragments removal from the root canal system, which are minimally invasive, do not have harmful thermal effects and do not lead to a change in the structure and composition of dentin. In this sense, the lasso technique and the application of static endodontic guides are promising techniques. The applied technique for removal of the separated element changes to varying degrees the mechanics of the distribution of masticatory pressure, and hence the biomechanical behavior and functionality of the treated tooth.

The presented reasons confirm the topicality of the subject of the dissertation.

Knowledge of the problem

The thesis contains 150 typewritten pages, illustrated with 87 figures and 4 tables. The bibliography includes 245 literary sources, of which 4 are in Cyrillic. The research from the dissertation was carried out at the Department of Operative Dentistry and Endodontics, Department of Prosthetic Dentistry, Department of Imaging, Dental Allergology and Physiotherapy, Faculty of Dental Medicine, Medical University - Plovdiv, Department of Medical Physics and Biophysics, Faculty of Pharmacy, Medical University - Plovdiv, Institute of Physical Chemistry "Laboratory of Electron Microscopy and Microanalysis", Bulgarian Academy of Sciences, Sofia.

Literature review

The literature review is structured in 6 sections: Fracturing of endodontic instruments - essence, risk factors, mechanisms; Fracture frequency of endodontic instruments; Imaging-diagnostic

methods for visualizing segments of fractured endodontic instruments; Critical analysis of techniques for removal of separated endodontic instruments; Biomechanical problems after removal of separated endodontic instruments; Unresolved issues.

The presented and critically analyzed literary data enable the doctoral student to formulate the purpose of the doctorate and justify the tasks used.

Aims and tasks

The objective is clearly stated: **to analyze biomechanical problems after removal of separated endodontic instruments with different techniques and to explore possibilities for their prevention.**

6 main tasks have been formulated: **Task 1.** Study of the frequency of endodontic instruments fracture during endodontic treatment of dental medicine doctors in Bulgaria. **Subtask 1.1.** Survey among dentists in Bulgaria regarding fracturing of endodontic instruments in the root canal system. **Subtask 1.2.** A retrospective, cross-sectional study on the frequency of visualization of separated endodontic instruments on radiographs from three types of imaging studies - segmental radiographs, OPG and CBCT. **Task 2.** Comparative in vitro CBCT analysis of changes in root canal volume and design before and after separated endodontic instruments removal by ultrasound technique with and without lasso technique. **Task 3.** Comparative in vitro study of minimally invasive removal of a separated steel endodontic instrument with and without the use of a static endodontic guide. **Task 4.** Study of changes in the structure and composition of dentin after application of ultrasonic technique in "dry conditions", at different power settings and different time intervals. **Subtask 4.1.** In vitro SEM study of changes in the structure of dentin after application of ultrasonic technique in "dry conditions". **Subtask 4.2.** Energy dispersive spectrometer elemental analysis of changes in dentin composition after application of ultrasonic technique in "dry conditions". **Task 5.** In vitro study of temperature changes during removal of separated endodontic instruments by ultrasonic technique with two different working protocols. **Subtask 5.1.** In vitro study of the temperature changes of an ultrasound tip using two different working protocols. **Subtask 5.2.** In vitro study of the temperature changes in separated steel and nickel-titanium endodontic instruments using two different working protocols. **Subtask 5.3.** In vitro study of temperature changes in three thicknesses of the dentin-cementum complex. **Task 6.** Comparative in vivo study of the possibilities of minimally invasive separated endodontic instruments removal with two different techniques.

The formulated tasks are sufficient and skillfully chosen to realize the goal of the doctorate.

Research material and methodology

The research material and methods are correctly selected, analyzed and tracked in order to obtain reliable results and conclusions.

Results and discussion

The results are statistically processed, analyzed and interpreted correctly and thoroughly. The doctoral student applies a creative approach to the interpretation of complex scientific information with the necessary criticality and analysis. The conclusions presented are drawn logically, summarizing the most significant findings. This gives Dr. Viktoria Dimitrova reason to prepare

recommendations for dentists. Dr. Dimitrova skilfully and critically presents her most important conclusion in a complex order, arguing the practical effectiveness and clinical success in removing separated endodontic instruments.

Publications and projects

Dr. Viktoria Todorova Dimitrova has 3 full-text publications and 5 scientific announcements in Bulgaria and abroad, all on the topic of the dissertation.

Dr. Viktoria Todorova Dimitrova is a leading researcher in an intra-university project in the direction "Doctoral and postdoctoral projects", No. ДПИДП - 03/2022, on the topic: "Biomechanical problems in endodontically treated teeth after separated instruments removal" with supervisor Assoc. Prof. Dr. Silviya Dimitrova, PhD.

Abstract of the dissertation

The abstract reflects the content of the thesis in 64 pages, including 3 tables and 63 figures.

Critical comments and recommendations

All critical comments suggested by the preliminary reviewers and department members have been discussed, considered and incorporated into the final dissertation format. I recommend Dr. Viktoria Todorova Dimitrova to continue publishing her results in full-text journals with an impact factor. I consider it useful to promote the results of her thesis among dental medicine doctors, residents and specialists.

I wish her creative drive in her work with her inherent diligence and attention to detail, I wish her personal and professional prosperity.

Conclusion

The dissertation on the topic: "**Biomechanical problems in endodontically treated teeth after separated instruments removal**" with author: Dr. Viktoria Todorova Dimitrova and scientific supervisor Assoc. Prof. Dr. Silviya Dimitrova, PhD is an up-to-date scientific development of importance for dental practice. It was carried out through well-defined tasks that fully realize the goal. The chosen methods are modern and skillfully combined. The clinical study creates the necessary connection with the dental practice and together with the experimental setups builds the integrity of the subject.

The dissertation fully complies with the criteria for the acquisition of the educational and scientific degree "Doctor", according to the Academic Staff Development Act, the Regulations for its application and the Regulations of the MU - Plovdiv. **This gives me a reason to give a positive assessment of the dissertation and I confidently propose to the scientific jury to award Dr. Viktoria Todorova Dimitrova the educational and scientific degree "DOCTOR" in the scientific specialty "Therapeutic Dental Medicine".**

29.09.2024
Plovdiv

Prof. Dr. N. Manchorova, MSc

