

OPINION

From

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Regarding the dissertation work for awarding the educational and scientific degree "Doctor"

Author of the dissertation: Dr. Victoria Todorova Dimitrova, doctoral student of self-preparatory form at the Department of Operative Dentistry and Endodontics, FDM Plovdiv

Dissertation project topic: Biomechanical problems in endodontically treated teeth after removal of separated instruments

Scientific specialty: 03.03.01

Research supervisor: Assoc. Prof. Dr. Silvia Dimitrova, PhD

The dissertation is written on 223 pages and includes 87 figures, 4 tables and 3 appendices. Structurally, the proportional relations between the main parts of the dissertation have been observed.

The literary reference includes 245 sources, of which - 4 in Cyrillic and 241 in Latin.

The literature review meaningfully and in detail examines problems that are related to the main idea of a dissertation work. My opinion is that as a mandatory part of a dissertation work it fully meets the requirements for it. It concludes with 7 unsolved problems, critically selected by the PhD student.

Purpose and tasks: The goal, proposed on the basis of the analysis of the literature review and the defined, unsolved problems according to Dr. Dimitrova, is correctly formulated. The methodical implementation of the set six tasks, the discussion of the obtained results and their analysis, naturally and objectively achieve the implementation of the formulated goal.

Materials and methods: The material for all six tasks is sufficient, carefully selected according to strict criteria and correctly distributed. The criteria for the selection of dental material for the in vitro experiments and of patients for the clinical study are well specified. The statistical methods are precisely and skillfully selected for processing the obtained results.

The first task is divided into two subtasks. One is a survey with the aim of establishing different aspects of the problem with separated endodontic instruments (SEI) among the dental community in Bulgaria. The second subtask is a paraclinical retrospective cross-sectional study on the frequency of visualizing SEI on radiographs. As a result of the received



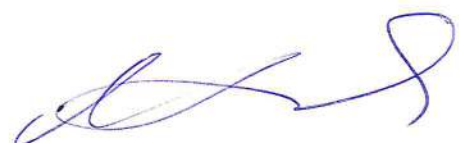
and statistically processed data, the author formulates 4 conclusions. The most common site for fracture of endodontic instruments appears to be the MV canal of mandibular molars. Surveyed dentists prefer segmental radiography for analysis of a clinical case with a separated instrument. The use of CBCT is part of the practice of only 10 percent of clinicians, but none measure the thickness of the dentin in the area of the fractured instrument, which is a major criterion for planning the resection approach.

The second task is a comparative in vitro CBCT analysis of changes in the volume and design of the root canal, before and after removal of SEI by ultrasound technique. The results lead the author to several conclusions. A frequent complication of the ultrasound technique when removing nickel-titanium segments with a length ≥ 4.5 mm is the re-fracture of the segment, and the application of the lasso technique (statistically significantly minimally invasive compared to the ultrasound technique), under the conditions studied, leads to a reduction in the risk of re-separating the main segment. The application of the lasso technique also results in a reduction of the total ultrasound exposure time in the root canal under "dry conditions".

A third task is a comparative, in vitro study of minimally invasive removal of a separated steel endodontic instrument with and without the use of a static endodontic guide (SED). The author critically brings out the advantages and disadvantages of using a static endodontic guide and formulates three conclusions. The use of CEV when creating access to the segment leads to the removal of twice the amount of dentin compared to the ultrasound technique. The achieved centered, rectilinear access to the face of the segment prevents a number of complications. This approach again leads to a reduction in the overall "dry time" for ultrasound in the root canal.

The fourth task focused on investigating changes in the structure and composition of dentin after sonication in "dry conditions", at different power settings and different time intervals. It is divided meaningfully and methodically into two subtasks. One is an in vitro SEM study of changes in dentin structure after application of ultrasonic technique in "dry conditions", and the second is elemental analysis with an energy dispersive spectrometer of changes in dentin composition after application of ultrasonic technique in "dry conditions". Dr. Dimitrova created an original author's scale for evaluating damage to the dentine wall according to qualitative criteria in four grades. The SEM images proposed for analysis are a wealth for the scientific literature regarding the study of the influence of ultrasound in the removal of separated instruments, and in this sense I define them as an original scientific contribution of Dr. Dimitrova. Thanks to this research, the author is able to propose a scientifically based concrete and safe clinical protocol. Logically, the four conclusions formulated by the doctoral student are a direct reflection of the results - up to the third degree, there is no or the weakest degree of disability. The most significant degree of damage was registered at grade 7 and the duration of the ultrasound impact was more than two minutes. The composition of the dentin remains unchanged after applying the ultrasonic technique.

The fifth task is an in vitro study of temperature changes during the removal of separated endodontic instruments by ultrasonic technique with two different work protocols. Divided into three sub-tasks covering respectively the investigation of temperature changes occurring



on the surface of an ultrasonic tip, separated endodontic instruments and in three thicknesses of the dentin-cementum complex.

Based on the obtained results, Dr. Dimitrova offers a specific safe treatment protocol with the aim of prevention of thermal trauma and the occurrence of optimal thermorelaxation.

The conclusions reached by the author confirm the positive relationship between the power of the ultrasound device, the duration of the manipulation and the generated temperature - as the values of the first two values increase, the temperature generated by the ultrasonic tip increases and, accordingly, the heating of both the separated instruments and the complex dentin-cementum.

The sixth task consists in a comparative in vivo study of the possibilities for minimally invasive removal of separated endodontic instruments with two different techniques.

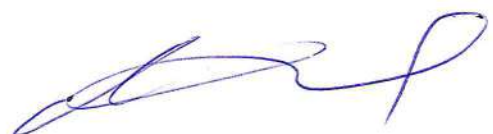
Dr. Dimitrova confirms the fact that the pre-operative analysis of CBCT is indispensable for the qualitative assessment of key factors on which the choice of the optimal technique for the removal of a separated endodontic instrument depends in the specific clinical situation. The lasso technique, applied as indicated, showed a statistically significant advantage over the ultrasound technique, recording six times less volume of removed dentin in the group using the lasso technique. A "dry" sonication protocol consisting of a 2-minute work interval (alternating 10 seconds of ultrasound activation and 10 seconds off) and a 2-minute rest interval has been shown to be effective and safe in removing separated endodontic instruments. The introduced limit of 40 minutes of ultrasonication under "dry conditions" for a single root canal has been shown to protect tissues and instruments from overheating.

Contributions: I consider the self-assessment of the contributions from the developed scientific work to be correct - original and of a confirmatory nature. The summarized recommendations for the doctors of dental medicine are highly practical and therapeutically oriented.

In endodontic practice, the situation in which a decision to remove or not to remove a separated instrument is relatively common. Although there are algorithms supporting clinical thinking, there are certain contradictions, sometimes reaching completely opposite recommendations. The need for objectification through strictly selected scientific methodology is more than relevant. My opinion is that Dr. Victoria Dimitrova succeeds through the conducted in vitro experiments, paraclinical and clinical studies, the obtained results, to achieve objective conclusions and substantiated clinical recommendations when it comes to the removal of SEI. The proven clinical protocol for dry ultrasound is an invaluable contribution to both the science and practice of endodontics. I believe that the dissertation work fully meets the requirements - it was carried out entirely by the doctoral student under the guidance of his scientific supervisor, the results of the scientific development were popularized in 3 full-text publications and 5 scientific communications.

Conclusion

Dr. Dimitrova's dissertation work is complete and represents its and original contribution to science. The scientific work, as well as the publications on the subject, show that the doctoral student has the theoretical knowledge of the treated problem and the skills to independently conduct research. In-depth knowledge of the treated issues, good clinical professional skills



and an extremely good writing style are evident throughout the course of the dissertation project, in which theoretical literary data, own results and their interpretation are meaningfully and logically arranged, the most important conclusions and practical recommendations have been created. In this way and in this sense, I consider that the set goal has been fulfilled.

The derived results and conclusion are original and applied in nature.

My opinion is that Dr. Dimitrova and her dissertation have the necessary merits, meet the legal requirements and deserve to be evaluated positively. I will vote positively for the awarding of the educational and scientific degree of doctor to Dr. Victoria Todorova Dimitrova.

City of Varna

03.10.2024



/ Assoc. Dr. Maya Doychinova, PhD