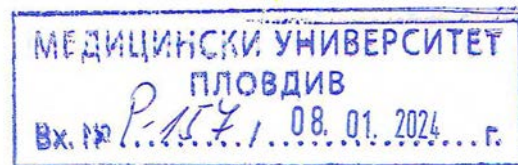


STATEMENT



by Prof. Dr. Emilia Goshova Karova, PhD
Department "Conservative Dentistry", FDM, MU - Sofia
as an external Scientific Jury member

on a dissertation topic:

"Effect of preparation of dental hard tissues with Er:YAG laser on the adhesive layer"

for awarding the educational and scientific degree "Philosophy Doctor"
in scientific specialty "Therapeutic Dental Medicine"
professional direction 7.2 Dental medicine
from the field of higher education 7. Health care and sports

Author: Dr. Nikolay Maksimov Simeonov

Form of doctoral studies: independent preparation

Department: "Operative Dentistry and Endodontics", FDM, MU - Plovdiv

Supervisor: Prof. Dr. Ivan Filipov, PhD,

Department of "Operative Dentistry and Endodontics", FDM, MU - Plovdiv

The statement was prepared in compliance with order No. R-3384/21.11.2023 of the Rector of the MU - Plovdiv Prof. Dr. A. Uchikov, DMSc and protocol No. 1/04.12.2023 of the Scientific Jury.

1. General presentation of the procedure and the doctoral student.

The presented set of materials is in accordance with the requirements of the Development of the Academic Staff in the Republic of Bulgaria Act (DASRBA), the Regulations for the implementation of the DASRBA and the Regulations for the conditions and procedures for acquiring scientific degrees and occupying academic positions at the MU - Plovdiv and includes: order No. R-613/17.03. 2023 for enrollment in independent form at the Department of Operative Dentistry and Endodontics, FDM, MU - Plovdiv with academic supervisor Prof. Dr. Ivan Filipov; transcript-excerpt from protocol No. 8/19.10.2023 from the meeting of the Department council with a positive decision on readiness for defense; order No. R-3277/10.11.2023 for deduction with right of defense within a period of one year; European CV format with the PhD candidate's signature; record of a successfully passed exam in the specialty (doctorate minimum); list and copies of publications and documents for participation in scientific forums related to the dissertation, signed by the

doctoral student; a copy of a diploma for the "master's" degree; a bound dissertation, a printed abstract and a declaration of originality and credibility of the presented results, their discussion and the contributions of the dissertation.

Dr. Nikolay Simeonov was born on May 3, 1991 in Lom. In 2010, he completed his secondary education at the High School of Mathematics "Academic Kiril Popov", and in 2018 - his Master degree at FDM, MU-Plovdiv. Since December 2018, he has been working as a full-time assistant at the Department of Operative Dentistry and Endodontics, FDM-Plovdiv and participates in the training of full-time students according to the curriculum approved for the faculty, including those on Erasmus + exchange. He is course supervisor for the 2021-2027 graduating class.

In November 2020, he was enrolled as a specialist at the Department of "Operative Dentistry and Endodontics", FDM, MU-Plovdiv. In 2021, he successfully completed his participation in a project from "Doctoral and postdoctoral projects", MU-Plovdiv on the topic: "Micromorphological assessment of the formed hybrid layer when applying adhesive systems containing 10-methacryloyloxydecyl dihydrogen phosphate on dentin treated with Er :YAG Laser'. In 2021 and 2023, participated in an Erasmus + exchange in the city of Montpellier, France and the city of Wroclaw, Poland, for the purpose of teaching and learning.

He speaks English at B2 level and German at a good level. His scientific activity is related to the publication of 4 articles (1 in refereed and 3 in non-refereed journals) on the subject of the dissertation and 1 – in a refereed journal, outside the development of the dissertation work. There are five scientific communications (posters and oral presentations), two of which are related to the dissertation.

2. Relevance of the topic

The chosen topic is suitable for a dissertation thesis, up-to-date and corresponds to the modern trends of using more high-tech tools for the diagnosis and treatment of dental caries, such as lasers. With its implementation, answers will be given to questions related to the qualities of the created bond between the Er:YAG laser treated tooth surface and self-etching adhesive systems, the possibilities for predicting the durability of direct composite restorations will be objectified. The results obtained and the conclusions drawn will be useful for clinical practice and will assist dental practitioners in creating appropriate application protocols.

3. Characteristics of the structure of the dissertation work

The dissertation of Dr. Nikolay Simeonov is structured correctly and has the necessary main sections of a dissertation, required by the Regulations for the

conditions and procedure for acquiring scientific degrees and holding academic positions at the MU - Plovdiv. The dissertation has a volume of 165 pages, of which 2 pages introduction, 31 pages literature review, ending with a summary of unsolved problems, 1 page goals and objectives, 26 pages material and methods, 70 pages results and discussion, 1 page of conclusions, 1 page of contributions, 1 page of publications and scientific communications, 9 pages of appendices, 19 pages of bibliography.

The material in the doctoral thesis is illustrated with 18 tables and 49 figures. The bibliographic references contain 192 sources, predominantly foreign and 10 - in Bulgarian. Ninety-four of the articles (48.96%) were published in the last 10 years.

4. Knowledge of the problem - a literature review

A brief presentation of the dental lasers used for the treatment of the hard dental tissues and of the existing adhesive systems, according to the ways of applying their elements to the treated structures, is made in the literature review. Special attention is given to "mild" self-etching adhesive systems and their ability to penetrate and bond with dentinal tissue and form an adhesive layer after routine burr treatment or Er:YAG laser treatment. The qualities of the functional monomer 10-MDP and its high binding potential and stability, as well as the ability of its molecule to interact with hydroxylapatite through a double adhesion mechanism, are highlighted.

The author examines the ways to evaluate the quality of the formed adhesive bond by applying various methods in laboratory and clinical studies – microleakage tests, tensile strength, shearbond strength, morphological and topographic studies. Special attention is given to the possibilities of the confocal laser scanning microscope and the energy dispersive X-ray spectrometer for in-depth study of the morphology of the hybrid layer and identification and quantification of the elements present in it. Data from researches investigating the possibilities of optimizing the adhesive layer by increasing the application time, double application or changing the composition of some of the components of the adhesive system or by using diode lasers are cited.

The summary in the final part of the review discusses the application of the Er:YAG laser in the preparation of hard dental tissues and the conflicting data in the literature related to the strength of the bond formed with the underlying dentin after the use of different adhesive systems. The author directs our attention to the need to conduct additional controlled laboratory and clinical studies, by which: to clarify the quality of the formed adhesive layer after applying a self-etching adhesive system containing 10-MDP on hard dental

tissues prepared with Er:YAG laser and the influence of time on its application; to investigate the chemical composition of dentin and the qualities of the adhesive layer after dentin preparation with classic rotary instruments or Er:YAG laser; to follow the quality and survival of direct composite obturations of vital teeth which were prepared with an Er:YAG laser and a self-etching adhesive system was applied. Clarification of the above-mentioned problems constitutes a sufficient basis for the development of this dissertation.

5. Aim and research tasks

The aim is short and clearly formulated – to study the interaction between an adhesive system containing 10-methacryloyloxydecyl dihydrogen phosphate and hard dental tissues prepared with an Er:YAG laser. The 5 research tasks are sufficient to achieve the goal and include a survey among dentists, 2 in vitro experiments, 1 clinical study and clinical recommendations. A micromorphological assessment and elemental analysis of the formed adhesive layer are planned using two modern research methods - a confocal laser scanning microscope and an energy dispersive spectrometer. Of interest is the author's desire to study in clinical conditions the quality of first class direct composite restorations in patients with different risk of caries development. Important for the practice of dentists are the planned clinical recommendations for the use of the Er:YAG laser in the preparation of hard dental tissues.

6. Research methodology

The research material is sufficient in volume to obtain reliable results and conclusions. Dr. Simeonov comprehensively describes the materials and research methods used for each of the research questions. Questionnaire, laboratory, clinical and statistical methods were used for the own studies. They are adequate to the set research questions and ensure objectivity and credibility of the obtained results. They are described in detail for each of the research questions.

The survey was conducted among 179 dentists from Plovdiv, Sofia and Varna regions with different years of experience and age. The laboratory experiments envisage the use of modern methods for morphological evaluation and analysis of the formed adhesive layer (confocal laser scanning microscope and energy dispersive spectrometer) after treatment of dental tissues with Er:YAG laser and application of self-etching primer 10-MDP. Clinical follow-up of the quality of composite restorations in 30 patients with first-class caries defects was performed without and under magnification with an operating microscope.

Experimental productions are very well illustrated with diagrams that facilitate the perception of the sequence of stages and the distribution by groups.

7. Characterization and evaluation of the dissertation work

The results of the completed research questions are presented comprehensively and are excellently illustrated in a large number of tables, figures and photos. Their analysis is based on objective statistical methods.

The in-depth and convincing interpretation of the obtained results for research questions 2 and 3, based on a good knowledge of literary sources, is impressive. The own data are skilfully presented, compared and discussed with those of a number of modern scientific groups. Studies related to the micromorphology of the dentinal surface after application of an adhesive system and the length of resin-tags penetrated into the dentinal tubules on surfaces treated with rotary instruments and the Er:YAG laser were analyzed. Using a confocal laser scanning microscope, it has been objectively proven that after application of a self-etching adhesive system, the length of resin-tags is significantly longer in samples treated with the Er:YAG laser compared to those in which rotary instruments were used.

The capabilities of energy dispersive spectroscopy were used and a difference in the chemical composition of dentine was found after routine treatment with burrs and preparation with Er:YAG laser. The values of Ca/P ratio on the surface of dentin prepared with Er:YAG laser or metal bur were not significantly different before and after application of the adhesive system.

The results of the clinical evaluation of direct composite restorations of Class I cavities of vital teeth prepared with rotary instruments and Er:YAG laser after application of a self-etching adhesive system are presented and discussed. The patients were followed up at 6 and 12 months and it was found that the applied clinical protocol in both groups of patients could be used successfully without significant risk of developing secondary caries, hypersensitivity or fracture of the restorations.

The discussion of the results is done in a very good scientific style and is based on the comparison of the own results with those of other modern scientific studies. The accurate interpretations of the PhD student and his critical attitude to the obtained data show a thorough knowledge of the main problems on the chosen topic and logically lead to the conclusions drawn after each of the research questions and to 8 generalized conclusions at the end of the dissertation work.

8. Contributions

The in-depth comparative analysis of the data from the conducted laboratory and clinical experiments provides answers to questions related to the

qualities of the bond between the Er:YAG laser treated tooth surface and the self-etching adhesive systems and contributes to the development of science and clinical practice. The importance of the dissertation work is summarized in 4 original contributions and 3 of a confirmatory nature. In his research, Dr. Nikolay Simeonov for the first time in our country:

- ✓ measured the length of the resin-tags in the dentinal tubules with the confocal laser scanning microscope after preparation with Er:YAG laser and application of adhesive system with 10-MDP;

- ✓ calculates the prognostic resin-tags length in dentin after preparation with Er:YAG laser and application of self-etching adhesive system with 10-MDP;;

- ✓ performs an elemental analysis on the dentin surface after preparation with an Er:YAG laser;

- ✓ follow up and evaluate with Ryge criteria and Cvar Class I composite restorations after preparation with Er:YAG laser.

9. Evaluation of the publications on the dissertation work and the personal contribution of the PhD student

In connection with the dissertation, 4 scientific publications were made - 3 in non-refereed journals in English and Bulgarian and 1 - in a refereed journal in English with an impact rank (SJR, Scopus). In 2 of the articles Dr. Simeonov is the first author. Participated with 2 oral presentations in scientific congresses, one of which was in English.

In connection with his dissertation and the study of the hybrid layer formed when applying adhesive systems containing 10-methacryloyloxydecyl dihydrogen phosphate on dentin treated with the Er:YAG laser, the PhD student participated in and successfully completed a research project funded by the MU - Plovdiv.

Dr. Simeonov works purposefully and persistently to carry out his scientific development. Independently and with the help of collaborators, performs the planned specialized experimental studies and clinical observations.

10. Abstract

The abstract, including 15 tables and 27 figures, corresponds to the content of the dissertation and complies with the requirements adopted by the MU - Plovdiv. On 56 pages, the unsolved problems, the objective, the research questions, the material, the research methods, the results and their discussion are presented. General conclusions, recommendations to dentists, contributions, publications and participation in scientific events related to the dissertation are included.

CONCLUSION

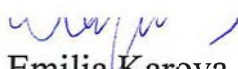
Dr. Nikolay Maksimov Simeonov presents an up-to-date dissertation with original scientific and applied results. Based on a sufficient volume of experimental and clinical material, he makes a thorough and critical analysis of the obtained results and reaches conclusions important and useful for the theory and practice of dental medicine.

The planned and completed experimental setups prove the capabilities of Dr. Simeonov to conduct successful scientific research independently or in a team. His ability to systematize, analyze and present the obtained results in a sustained scientific style is also reflected in the presented publication activity on the topic of the dissertation.

Evaluating the merit of the scientific development and complying with the criteria for obtaining the educational and scientific degree of Doctor of Philosophy specified in the Law on the Development of the Academic Staff, the Regulations for its Application and the Regulations of the MU-Plovdiv **I rate positively the dissertation thesis "Influence of the preparation of hard dental tissues with an Er:YAG laser on the adhesive layer" and confidently vote Dr. Nikolay Maksimov Simeonov to be awarded the educational and scientific degree of Doctor of Philosophy in the scientific specialty 03.03.01 Therapeutic Dental Medicine.**

Заличено на основание
Чл.5 §1, б."В" Регламент (ЕС)2016/679

10.12.2023


Prof. Dr. Emilia Karova, PhD