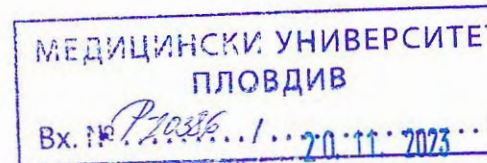


**REVIEW**

by

**Prof. Dr. Georgi T. Tomov, PhD**

**Department of Periodontology and Oral Diseases of the Faculty of Dental Medicine  
at the Medical University of Plovdiv**



Appointed by Order No. P-3317/15.11.2023 as a member of the scientific jury in the procedure for awarding **doctoral degree** in Professional Field 7.2. *Dental Medicine in Doctoral Programme Oral surgery – 03.03.04*

**Author:** *NIKOLAY DIMITROV KANAZIRSKI*

**Form of doctoral study:** self-study

**Department:** Department of Oral Surgery of the Faculty of Dental Medicine at the Medical University of Plovdiv

**Theme:** *ER:YAG LASER IMPLANT SITE PREPARATION FOR PLACEMENT OF DENTAL SCREW IMPLANTS: CLINICAL, HISTOLOGICAL AND MORPHOLOGICAL STUDIES*

**Academic supervisor:** *ASSOC. PROF. DR. DEYAN ZDRAVKOV NEYCHEV, PhD.*

**1. General Presentation of the Procedure and the Doctoral Candidate**

The review of the materials shows that the procedure for deregistering the PhD student and the procedure for announcing the defense have been followed. The documents have been prepared in accordance with the requirements set in the Academic Staff in the Republic of Bulgaria Act, its Implementation Rules and the Regulations on the Conditions and Procedure for Acquiring Scientific Degrees and Holding the position Academic Positions at the Medical University of Plovdiv.

**2. Biographical Notes of the Doctoral Candidate**

Dr. NIKOLAY DIMITROV KANAZIRSKI graduated with full honors from the Faculty of Dental Medicine at the Medical University of Plovdiv in 1986. In 1989, after a competition, he was appointed as a full-time assistant professor at the Department of Oral and Maxillofacial Surgery. He obtained specialty Oral Surgery in 1993, General Dentistry in 2005, and Dental Implantology in 2021. The candidate has published **3 full-text articles** related to the dissertation.

### **3. Significance of the Theme and Appropriateness of the Objectives and Tasks Set**

The significance of the theme addressed in the dissertation is indisputable.

The most commonly used technique for placing dental screw implants involves preparing a bone cavity using rotary drills of different diameters. During this procedure, low value of revolutions per minute and water cooling are used to avoid overheating the bone and denaturing its protein structures. However, this technique results in the formation of a smear layer, impacting the primary stability of the implant and the quality of subsequent osseointegration. Attempts to use an Er:YAG laser for alternative bone cavity preparation have revealed certain drawbacks, including prolonged treatment duration and inaccuracies in calibration of the osteotomy hole. The benefits of using an Er:Yag laser for bone cavity preparation are the proper decontamination of the tissues and the absence of a smear layer. These advantages of the laser provide opportunities for accelerated osseointegration and early prosthetic treatment. Whether the combination of conventional rotary techniques and laser biomodification demonstrates synergistic effects is a question that has not been answered in the global literature so far. It is this question that is central to the reviewed dissertation. In my opinion, the experimental and clinical tasks which have been formulated to find answer are appropriate.

### **4. Understanding of the Issue**

The literature review for the dissertation spans 38 pages and includes 232 publications, of which only three using the Cyrillic alphabet. The small number of Cyrillic publications is due to the limited research on the theme in the Bulgarian scientific periodicals. The literature review competently and thoroughly examines osseointegration, its nature and the various factors influencing it, such as the osteotomy bed preparation and the types of osteotomies, as well as the factors modulating the healing process after dental implant placement. The stability of dental implants (primary and secondary) is considered as a success criterion, and objective criteria for the healing process of implants have been defined. The review ends with a critical analysis of the unresolved issues of osseointegration, which is a multifactorial process dependent on a number of conditions. Some of them are anatomical, others are related to the characteristics of the implant, and still others are determined by the surgical technique used for implant placement. The analysis reveals that among the possibilities for influencing the various factors determining osseointegration mechanisms, the treatment possibilities of Er:YAG lasers are underexplored, and, in particular - the possibility to eliminate the smear layer from the bone cavity using an Er:YAG laser. This is a technique that has been used empirically by some clinicians, without serious research into the mechanisms that enhance osseointegration.

### **5. Methods**

The doctoral candidate's objective is to assess the dynamics of osseointegration after implant site Er:YAG laser treatment through clinical, histological and SEM studies. For this purpose, 4 tasks with several sub-tasks have been formulated. The methods and scheme of conducting the studies have been described comprehensively. The statistical methods used were selected correctly, ensuring the credibility of the conclusions drawn.

In Task 1, four groups of experimental mandibular osteotomies performed using calibrating implantology drills with and without laser cavity treatment were examined histologically and were compared (30 osteotomies in each group). Microscopy of the permanent slides from a bone cavity without laser treatment showed rough bone surface

with an irregular periphery along the incision edges. They were filled with bone fragments and soft tissue, collectively forming an amorphous layer covering the trepanation surface, with a thickness of 21.813  $\mu\text{m}$  to 222.13  $\mu\text{m}$ . The amorphous layer blocked Volkmann's and Haversian canals. With laser treatment, the surface had linear, distinct trepanation edges, free from bone and soft-tissue fragments. Volkmann's and Haversian canals were open. The amorphous layer was irregular, vague or fragmented, in some places completely absent.

Task 2 examines the surface morphology of bone cavities (with and without laser treatment) by means of SEM. The analysis confirms the results of the histological analysis.

Task 3 includes two subtasks. Subtask 1 is a clinical study in 30 adult patients, in who implants were placed after Er:YAG laser treatment of the bone surface of the cavity, according to the method developed by the doctoral candidate, as described in Task 1. The primary stability of the implant was assessed intraoperatively using the Penguin RFA device, by the method of resonance-frequency analysis. Exposure of the implant took place after three months. After removal of the cover screw, the secondary stability of the implant was examined, again by the method of resonance-frequency analysis, using the Penguin RFA device, after screwing the Smart Peg. If the secondary stability values are below ISQ 50, the implant has not integrated into the bone. High stability above ISQ 70 shows excellent osseointegration and excellent prognosis for orthopedic loading. For Task 2, the primary implant stability (in 15 patients) was assessed at days 10, 20 and 30. The requirements and preparation of patients for implantation were the same as in Subtask 1. The operative technique is different - the implants were placed using an open method to allow for additional stability measurements. The systematization, processing and analysis of the primary data in the form of quantitative and qualitative variables were performed with IBM SPSS Statistics (Statistical Package for the Social Sciences) v. 26. A significance level of  $\alpha = 0.05$  was used for all tests.

The objective of Task 4 is to develop an algorithm for placement of osseointegrable screw implants in bone beds whose surface is treated with an Er:Yag laser using the original method proposed by the author. As a result, a useful model "Modular Complex for Site Preparation for Placement of Spiral Dental Implants" was registered at the Patent Office of the Republic of Bulgaria (registration number 4368U1).

## **6. Characteristics and Evaluation of the Dissertation**

The dissertation spans 152 pages (including bibliography) and includes the following sections: abbreviations, introduction, literature review with two main sub-themes, critical analysis and unsolved problems, author's own research, distributed as follows – objective, tasks, material and methods, results, discussion, findings, conclusions, contributions – bibliography, and appendices. The dissertation features 25 tables, 38 figures, and 3 appendices.

The dissertation begins with a literature review on the problem, which is competently written and informative (the bibliography includes 232 titles). The review concludes with a critical analysis of the unsolved issues, which relates it to the objective and tasks as formulated by the doctoral candidate. After formulating the objective and the four tasks (task 3 has two subtasks), the doctoral candidate presents in sequence the material and methods used for the dissertation. The results of the experimental and clinical studies obtained during the implementation of the tasks have been correctly described and accompanied by well-structured tables and figures (some of which are photographs).

The results of the experimental and clinical studies demonstrate that elimination of the smear layer and surface modification of bone with an Er:YAG laser ensure higher primary implant stability. As a consequence of the reduction of the amorphous layer, the decrease in the implant stability between day 10 and 30 is minor. The measured implant stability at day 30 is close to or equal to secondary stability, which is a sign of rapidly developing osseointegration. Preservation of high stability until day 30 gives reason to consider early, even immediate, loading of the implants with prosthetic restorations, after the laser-assisted procedure. The high secondary stability measured by the resonance-frequency analysis method and recorded radiologically is proof of the excellent osseointegration of implants placed in bone beds prepared using a combination of the conventional method and surface conditioning with an Er:YAG laser.

I believe that during the development of the dissertation, significant results were obtained, the nature of which can be defined as an enrichment of the existing knowledge regarding the use of Er:YAG lasers as a method of biomodification of the bone bed for implantation, a method which has positive effects on screw implant osseointegration. The discussion of the results is synthetic and reveals the logical connection between them.

## **7. Contributions and Significance of the Dissertation for the Science and Practice**

The doctoral candidate has drawn 7 conclusions, reflecting the contributions of the work. I accept all four scientific and applied contributions, of which I consider number 3 to be the most significant, namely that the study demonstrates in an indisputable way the importance of the Er:YAG laser in terms of improving the process of osseointegration after screw implant placement.

The method presented in the dissertation was registered at the Patent Office of the Republic of Bulgaria, No. 4368 U1, under the name "Modular Complex for Site Preparation for Placement of Spiral Dental Implants".

## **8. Assessment of Publications Related to the Dissertation**

Dr. N. Kanazirski has published three full-text articles in English, related to his dissertation, one of them in a journal with an impact factor (J Funct Biomater). As the articles were published in 2023, there is no evidence that they have been cited and their impact is yet to be assessed, but given the significance of the theme, I suppose that they will attract the attention of the specialist audience.

## **9. Personal Involvement of the Doctoral Candidate**

The personal involvement of the doctoral candidate in the work, the results obtained and the contributions formulated is beyond any doubt.

## **10. Author's Summary**

The Author's Summary synthesizes the structure and content of the dissertation.

## 11. Critical Comments and Recommendations

Since the doctoral study has certain time constraints that do not allow to observe and analyze the patients included in the study for a longer period of time, some conclusions may undergo corrections. Dr. N. Kanazirski is recommended to continue observations on the same patients and periodically publish updated data.

## 12. Recommendations for Future Use of Dissertation Contributions and Results

I believe that the doctoral candidate N. Kanazirski, who, in his dissertation, has demonstrated a really good knowledge of the basic methodological tools needed for the analysis of such a theme, can and should continue his future research in this direction. The significance of the theme is beyond any doubt, moreover, this is the first Bulgarian work on this serious clinical issue. Proactive sharing of information with colleagues, such as through lectures or practical courses under the continuing education program of the Bulgarian Dental Association is essential for the promotion of this work, which is important for dental implantology.

## CONCLUSION

The dissertation, its scientific and applied results, represent ***an original contribution to science and meet all requirements*** outlined in the Act for the Development of the Academic Staff in the Republic of Bulgaria, its Implementation Rules and the Rules of the Medical University of Plovdiv. The presented materials and dissertation results are in full compliance with the specific requirements of the Medical University of Plovdiv.

The dissertation shows that the doctoral candidate NIKOLAY DIMITROV KANAZIRSKI **possesses** in-depth theoretical knowledge and professional skills, **demonstrating** competences for conducting independent research.

Consequently, I confidently express my ***positive opinion*** on the conducted research, presented by the above-reviewed dissertation, author's summary, achieved results and contributions, and ***I propose to the esteemed scientific jury to award doctoral degree*** to NIKOLAY DIMITROV KANAZIRSKI under the doctoral programme Oral surgery.

17 Nov 2023

Reviewer: .....  
Prof. Dr. Georgi T. Tomov, PhD

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