

# STATEMENT

## From

Assoc. Prof. Hristina Ivanova Arnautska, DMD, PhD,  
Head of Department of Orthodontics, Faculty of Dental Medicine,  
Medical University "Prof. D-r Paraskev Stoyanov" – Varna  
Chairman of the Scientific Jury in accordance with the Rector's order № № P-109-599/2020

## Regarding

A dissertation for conferment of the educational and scientific degree "Doctor of Philosophy" (PhD) in the scientific specialty "Orthopedic Dentistry", entitled: **"3D Printed Prototypes of Cast Metal Denture Frameworks Fabricated by Laser Stereolithography Printer"**

## to

**Dr. Preslav Plamenov Penchev**, PhD student at the Department of Dental Materials Science and Propaedeutics of Prosthetic Dental Medicine, Faculty of Dental Medicine, Medical University – Varna with Scientific Supervisor Assoc. Prof. Stoyan Georgiev Katsarov, DMD, PhD

## Information about the candidate:

Dr. Preslav Penchev was born on 30.04.1991 in Ruse. In 2010 he graduated from the High School of Mathematics "Baba Tonka" – Ruse. In 2016 he graduated from the Medical University "Prof. D-r Paraskev Stoyanov" – Varna, specialty "Dental Medicine". He started working as an Assistant Professor at the Department of Prosthetic Dental Medicine in 2016. Since 2018 he has been working as an Assistant Professor at the Department of Dental Materials Science and Propaedeutics of Prosthetic Dental Medicine. Dr. Preslav Penchev started his education in the PhD training program of the Medical University of Varna in 2019.

## Evaluation of the thesis topic aim and tasks.

The presented scientific study is focused on topical issues in dental medicine. The additive manufacturing technologies have become commonly used in dental laboratory practice during the past few years. By integration of the additive technologies in the conventional casting process, the manual labour is reduced and also intricate structures and high accuracy can be achieved. At the same time there are fundamental issues which still remain unsolved.

## Structure and evaluation of the dissertation

The dissertation is written on 160 pages and is illustrated with 78 color figures and 2 tables. The bibliography contains 180 sources, as 26 are in Cyrillic and 164 in Latin. The majority of the publications included in the reference list are published during the last 5 years. The dissertation has proper structure and volume.

**The literature review** is purposeful, provides useful information and at the same time includes enough contemporary authors who examine the problems connected with the tasks of the dissertation. The analysis of the review formulates the aim of the dissertation.

**The main goal** of the research is to explore the manufacturing opportunities for fabrication of cast metal dentures by 3D printed prototypes by laser stereolithography printer. The aim is a logical consequence of the precise analysis of the literature review. The tasks are properly formulated and allow a detailed presentation and discussion of the study aim.

The **methods** of the experiment are properly selected to provide objective and reliable results and at the same time they also guarantee the experiments reproducibility. A huge number of objects made of stereolithography resins are examined under identical to the practice conditions, as well as the specimens of each single group are tested simultaneously. As a result, the objectivity of result is guaranteed. At the same time two new approaches concerning the casting process are suggested.

The achieved **results** are well presented and analyzed. They are also supported by suitable photos, figures and tables.

For the **first task** of the study the temperature related changes of the examined objects made of different materials are observed. The results are comprehensively presented. The large amount of the illustrations is noticeable, as it provides authentic and clear results.

For the purpose of the study of the **second task** factors that affect 3D printing accuracy such as orientation of the built objects, their structure and also the prescribed post-curing process are observed. The detailed measurement of the specimens is remarkable. All the data achieved is analyzed by statistical methods.

For the purpose of the **third task** the process of thermal elimination of invested specimens made of two types of stereolithography resins is observed and evaluated. The relation between the structure of the invested object and the presence of mold fractures is proven. As a result, a specific object structure is suggested in order to achieve a successful result of the casting process.

The **fourth task** presents two innovative approaches which incorporate the digital technologies into the conventional casting process. The main advantages and disadvantages of the newly suggested approaches are reported and evaluated.

The nine conclusions which were made are a logical consequence of the obtained results. They are presented with scientific accuracy

### **Contributions**

The contributions are divided in scientific and applied nature( five of original nature and three of a confirmatory nature

From the contributions of applied nature I want to emphasize on the two newly created methods:

1. A method for digital planning and 3D printing of a sprue system, made in accordance to the parameters of prefabricated casting ring and casting cone, is suggested.
2. It is developed a new method for digital planning of a sprue system, casting ring and casting cone and further 3D printing as a single object.

### **Publications related to the topic**

Three publication related to the dissertation are presented. Two of them are published in foreign journals and one in Bulgarian. Dr. Penchev is a single author of one of them, and a co-author of the rest.

**The abstract** is written in 64 pages and is properly structured. Meets the requirements of the law for the development of academic staff.

### **Conclusion**

The dissertation of d-r Preslav Penchev entitled "*3D Printed Prototypes of Cast Metal Denture Frameworks Fabricated by Laser Stereolithography Printer*" fulfills all the requirements of Law Act for Development of the Academic Staff in Republic of Bulgaria, the Rules of applying the Law and the Rules of MU-Varna. The thesis presents some very significant and valuable results such as the examined temperature related changes in different materials for pattern fabrication, determining the influence of variety of factors to the 3D printing accuracy and the suggested methods for casting process optimization.

Because of the above, I am convinced to give a positive evaluation of the research presented by the dissertation and I offer to the Honorable Scientific Jury to confer a PhD degree in the scientific specialty" Orthopedic Dentistry " to d-r Preslav Plamenov Penchev.

22.01.2021

Varna, Bulgaria

Reviewer:



/Assoc. Prof. Hristina Arnautska, DMD, PhD/