

**To the Chairman of the Scientific council,  
appointed by order of the  
Rector of Medical University - Varna,  
№P-109-115/31.03.2021.**

### **STATEMENT**

**By Assoc. Prof. Dr. Tsvetelina Iliyanova Borisova-Papancheva, DMD, PhD,  
Medical University “Prof. Dr. Paraskev Stoyanov”- Varna, Faculty of Dental Medicine,  
Department of Conservative Dentistry and Oral Pathology**

member of a Scientific council, included by order №P-109-115 / 31.03.2021 of the Rector of MU-Varna.

**About:** Dissertation for the award of educational and scientific degree "Doctor" in the scientific specialty "Therapeutic Dentistry" in the field of higher education 7. Health and sports in professional field 7.2. Dental Medicine; in the Department of Conservative Dentistry and Oral Pathology, FDM, MU-Varna.

**Topic: “Problems Associated with Photopolymerization in Dentistry”**

**Author:** Dr. Georgi Plamenov Georgiev, assistant at the Higher School, Medical University “Prof. Dr. Paraskev Stoyanov”- Varna, Faculty of Dental Medicine, Department of Conservative Dentistry and Oral Pathology.

**Scientific advisors:** 1. Prof. Eng. Tsanka Dikova, D.Sc.  
2. Prof. Dr. Vladimir Panov, D.Sc.



**Form of doctoral studies:** Independent.

**Biographical data about the doctoral student:**

Dr. Georgi Plamenov Georgiev was born in 1988 in the city of Varna. He completed his secondary education at 5<sup>th</sup> Language School "Yoan Ekzarch" in Varna in 2007. He received a higher education in Dental medicine at the Medical University of Varna "Prof. Dr. Paraskev Stoyanov" in 2013. Since 2014 he has been a full-time assistant at the Department of Conservative Dentistry and Oral Pathology, FDM, MU-Varna. He teaches second- to fifth-year students Bulgarian and English language training in the disciplines Propaedeutics and Clinics of Conservative Dentistry. He speaks English.

**General presentation of the procedure and the doctoral student:**

The dissertation presented for my opinion contains 197 standard pages and is illustrated with 24 tables and 45 figures. The bibliography consists of 178 sources, of which 4 in Cyrillic and 174 in Latin. The dissertation includes an introduction, literature review, aim and tasks, material and methods, results and discussion, summary and conclusions, contributions, bibliography and applications, and meets the statutory requirements for obtaining the educational and scientific degree "Doctor".

The presented abstract reflects the structure of the dissertation and the most important results and contributions. The results of the study are reflected in a list of 3 publications and 3 participations in international scientific forums in which Dr. Georgiev is the first author. This proves that the research is made by the author.

**Relevance of the topic:**

The introduction of light cured resin based composites (RBCs) is a revolutionary step in restorative dentistry because it allows clinicians to determine the beginning of the polymerization process. The reason for their wide application in everyday practice are on the one hand the increased aesthetic requirements of patients, and on the other hand the disadvantages of the



amalgam such as bad aesthetics, galvanic current flow and corrosion, staining of hard dental tissues, soft tissue tattoos, release of mercury vapor and others. During the last decade there have been a lot of hard work on the improvement of light cured RBCs. Evidence of this is the improved properties of conventional composites, the creation of universal flowable composites with a high filler content and bulk fill composites, which allow up to 5 mm layer thickness.

In order to carry out the process of photopolymerization of dental composites, a source of blue visible light with a wavelength in the range of 400-520 nm is required. Modern LED light curing units (LCUs) have very good characteristics and have a number of advantages over other types of LCUs such as the ability to polymerize composites using all types of photoinitiator systems; high light intensity; availability of compact wireless models with an exceptional battery life; affordable price; small heat generation. Due to the many advantages and virtually no disadvantages, LED LCUs have established themselves as the most reliable and preferred polymerization devices by dentists around the world.

Despite the daily placement of composite restorations and the presence of LCUs in any dental practice, the level of knowledge of dentists about the main factors of the photopolymerization process - light intensity, irradiation time, layer thickness, distance and direction of the LCU's tip, etc., is not high. The poor awareness of the work with LCUs and light polymerization factors can lead to an incorrect curing protocol, which in turn can lead to an incomplete polymerization of the material with all the adverse consequences: increased risk of restoration fracture, reduced hardness and wear resistance, elution of residual monomers, reduced adhesive bonding strength and faster color change.

The introduction leads us to the problem. It was found that poor awareness of the work with LCUs and photopolymerization factors can lead to incorrect curing protocol, which in turn leads to incomplete polymerization of the material with all the adverse consequences: increased risk of fracture of the restoration; reduced hardness and wear resistance; elution of residual monomers; reduced adhesive bonding strength and faster color change of the filling.

**The aim of the dissertation is: To study the problems associated with light curing in dentistry, by studying and analyzing the factors influencing the process of photopolymerization of dental composites.**

There are 4 tasks through which the study was conducted:





1. To investigate the relationship between the light intensity of wireless LED LCUs and their battery charge
2. To investigate the light intensity of LED LCUs after a different period of use and to establish the relationship between the time of use of the devices and their light intensity.
3. To study the influence of the factors of the photopolymerization process - light intensity, irradiation time and layer thickness on the hardness of dental composites from three different groups:
  - a. Universal nanohybrid light cured composite;
  - b. Bulk Fill light cured composite;
  - c. Universal flowable light cured composite with a high filler content.
4. To optimize the parameters of the process of photopolymerization of the studied dental composites:
  - a. To develop recommended light curing modes of the studied dental composites;
  - b. To make recommendations for efficient polymerization for each of the studied composites.

**The results and discussion** are presented with tables and diagrams. **The conclusions** correspond to the obtained results.

The self-assessment of **the contributions** related to the dissertation includes 10 contributions with original and 1 contribution with confirmatory character.

### **Scientific and applied contributions**

#### **Original:**

1. An inverse relationship has been established between the service life of LED light curing units and their light intensity - the longer and more intensively a unit is used, the lower its intensity is.
2. The importance of the factors of the photopolymerization process has been established - light intensity, irradiation time and layer thickness on the hardness of three types of dental composites.
3. The parameters of light curing have been established - light intensity, irradiation time and layer thickness, which provide maximum/minimum hardness of the studied composites.



4. Uneven hardness of UC *Evetric* has been found for a 28-day period of time - increase by 9-20% by day 7, maintaining higher hardness by day 21 and decrease to the initial values on day 28.
5. Optimization by regression analysis of the parameters of the photopolymerization process has been made - light intensity, irradiation time and layer thickness of the studied dental composites.
6. A program has been developed for calculating the hardness and thickness of the layer of dental composites according to the set light intensity and irradiation time.
7. Light curing regimes have been calculated and established, which guarantee maximum hardness of the composites at the respective layer thickness.

**Confirmatory:**

1. It has been confirmed that BC *Filtek One Bulk Fill Restorative* has the highest hardness (65 +/- 4 HV), followed by UC *Evetric* (56 +/- 4 HV), and FC *G-aenial Universal Flo* with the lowest (47 +/- 4 HV).

**Applied contributions**

**Original:**

1. It have been found that not all light curing units have a stable light intensity - in some of them the intensity is lower than specified by the manufacturer, and the discharge of the battery leads to its reduction.
2. It has been established that the instructions for light curing of the manufacturers do not always guarantee the optimal hardness for the studied dental composites.
3. Tables with recommended light curing regimes have been created for the three types of tested composites, which guarantee the necessary hardness and are designed to facilitate the work of dentists.

There are no omissions in the documentation attached by the doctoral student Dr. Georgiev. It meets the requirements of ZRASRB, PPZRASRB and the Regulations on the terms and conditions for obtaining scientific degrees and holding academic positions at the Faculty of Dental Medicine, Medical University "Prof. Dr. Paraskev Stoyanov" - Varna.



**Conclusion:** The dissertation of Dr. Georgi Plamenov Georgiev: "Problems associated with photopolymerization in dentistry" **is its own contribution to science and meets all the requirements** of the Law for the Development of Academic Staff in the Republic of Bulgaria (ZRASRB), The Regulations for application of ZRASRB and the Regulations of MU-Varna. For these reasons, **I propose to award Dr. Georgi Plamenov Georgiev the scientific and educational degree "DOCTOR"** in the field of higher education 7. Health and sports in professional field 7.2. Dental Medicine.

10.05.2021.

Varna

Prepared the statement:  .....

(Assoc. Prof. Dr. Tsvetelina Borisova-Papancheva, DMD, PhD )

