

To the Chairman of the Scientific
Jury Designated by Order № P-1442/07.09.2021
of the Rector of the Medical University – Plovdiv.

REVIEW

of Prof. Dr. STEFAN IVANOV SIROMASHKI, PhD

of Dissertation for awarding the educational and scientific degree "Doctor", professional
direction: Dental medicine, Doctor's program: "Prosthetic Dentistry",

on the topic:

**„Comparison of two types of press ceramics with different composition of the crystalline
phase”**

Of Dr. Elena Kostadinova Vasileva

Assistant professor at the Department of Prosthetic Dentistry, Medical University -
Plovdiv

Scientific Supervisor: **Prof. Angelina Vlahova, DMD, PhD**

Dr. Vasileva presents all the necessary administrative documents according to the rules
for awarding educational and scientific degree "Doctor" (PhD), doctor's program "Prosthetic
Dentistry".

The review was prepared in accordance with the requirements of the Law on the Development
of the Academic Staff of the Republic of Bulgaria and the Regulations for the Development of
the Academic Staff of the Medical University - Plovdiv.

Dr. Vasileva presents Dissertation on 230 pages as follows:

Content - 4 pages	Used abbreviations - 1 page
Introduction - 2 pages	Literary review - 55 pages
Analysis of literary review - 2 pages	Purpose and tasks - 1 page
Materials and methods - 32 pages	Results and discussion - 70 pages
Conclusion - 4 pages	Conclusions - 3 pages
Inferences - 2 pages	Tables and appendices - 16 pages
Publications and participations – 2 pages	Bibliography – 36 pages

Citations – 291 of them – 33 in Cyrillic and – 258 in Latin.
 The dissertation is illustrated with 68 figures and 10 tables.
 The application contains: Questionnaire, 3 Diagrams and 24 Tables.

Short CV data of d-r Elena Kostadinova Vasileva

She was born on 07.07.1985 in Asenovgrad. She graduated “Vasil Levski” High School in Smolyan with biology, chemistry and German language in 2004. In 2010 she graduated Dental Medicine in MU - Plovdiv. She was working in private dental practice from 2012 till now. She is a member of BDA.

In 2016 Dr, Vasileva starts working as an Assistant Professor in the Department of Prosthetic Dentistry, FDM, MU – Plovdiv.

Literature review

Dr. Vasileva with great competence performs an in-depth historical review of ceramic materials from the dawn of humanity to the present day. In different epochs of human history, aesthetics in its various forms has occupied an important place in the lives of our ancestors. At the beginning of the literary review, Dr. Vasileva made an extensive review of ceramic materials. The first type of ceramics known to mankind dates back two millennia ago in China.

In Europe, Johann Böttger in 1709 was the first to obtain and bake porcelain. In 1774, Duschateau tried to obtain artificial teeth from porcelain, but failed. Nicolas Dubois de Chemant manages to bake porcelain teeth for the first time. Great progress was made by Fonzi, who in 1808 offered a whole range of porcelain teeth in 26 colors, which were colored with the help of various metal oxides.

At the beginning of the 20th century, electric porcelain furnace was first introduced. The method for vacuum firing of dental porcelain restorations was introduced in 1940. In 1991 appears in dental practice reinforced with leucite crystals IPS Empress Ceramic, which is processed under pressure - press technique. The great variety of dental ceramics had to be systematized with the help of classifications. Modern classifications are structured on one or more features; composition, melting temperature, structure, processing technology, etc.

Dr. Vasileva describes in detail the properties of a number of dental ceramics; feldspar, aluminum, polycrystalline, zirconium dioxide, glass ceramics, glass ceramics for casting, glass ceramics for CAD / CAM – processing and etc. In 2013, a new class of hybrid ceramics appeared in dental practice. This class of ceramics combines two different materials — ceramics and polymer. VITA ENAMIC (Vita Zahnfabrik, Germany). This ceramic has a ceramic reticulated structure (86%) in which a polymer reticulated structure (14%) is infiltrated.

The first leucite crystal-reinforced press ceramics are presented in 1991 under the name IPS Empress Ceramic, known in the literature as IPS Empress 1. With the development of pre-engineering and ceramics Empress 1 marks the beginning of the development of a new group of glass ceramics. The new product has increased fracture toughness. Its abrasion resistance, chemical stability and optical properties fully meet the required standards. This is due to easy laboratory protocol, occlusal accuracy, better marginal integration, translucency, good mechanical properties and reduced porosity. The different types of press ceramics are described in great detail; Leucite press ceramics, lithium disilicate and lithium silicate, and their mechanical and optical properties.

Characteristics of the material's surface

The gloss and roughness of the surface of a prosthetic restoration depend on the type of material, the applied technology and a number of other factors. By polishing, the surface roughness is reduced and the fracture resistance of the ceramic is increased. A number of studies claim that polishing can achieve a smoothness as close as possible to that of natural teeth. The average value of the surface roughness must be less than 0.2 μm . This ensures minimal bacterial retention. It has been found that laboratory polished ceramic restorations have better mechanical and strength properties.

Optical properties of natural teeth

The color of a natural tooth depends on a combination of internal and external colorimetric effects. The processes of reflection, refraction and absorption of light, interference, fluorescence, opalescence (opal effect), metamerism play an important role in determining and reproducing the color of an object.

The determination of color by the human eye is subjective and to avoid this it is better to do it through specially designed devices (colorimeters and spectrometers).

Profilometry

The surfaces of the dental restorations are not perfectly smooth. There are protrusions and depressions with a certain height and shape at random or in a certain order. There are various techniques for assessing the relief of a surface. Instruments that measure the deviations of details from the correct geometric shape and examine the roughness and undulation of surfaces are called profilometers. Profilometry is a method for determining the relief of a surface in a plane. The causes that lead to the formation of roughness are varied and are related to the type of surface treatment. The roughness of the surfaces has a strong influence on the properties of dental restorations. In practice, the measured profile, called a profilogram, is most often handled. Devices designed for this purpose are called profilometers or profilographs. The scanning electron microscope (CEM) is a type of electron microscope that is used to study surfaces. The object is scanned (crawled point by point) by an electron beam.

Analysis of the literature review

The analysis of the literature review reveals controversial, well-known, debatable and resolved opinions. In addition to these opinions, insufficiently studied questions were found about the properties of zirconia-reinforced press ceramics with a crystalline phase of lithium silicate. This scientific gap in the prosthetic dental discipline directs Dr. Vasileva to formulate the aim and tasks in this dissertation.

Aim and tasks of the dissertation

The aim is to make a laboratory comparative evaluation of the press ceramics with crystalline phase of lithium disilicate and lithium silicate.

The implementation of this goal is carried out with the help of five tasks

The purpose and tasks for its implementation are well formulated. The methodologies and apparatuses used in the scientific research are at a high modern level, giving the opportunity to obtain objective and reliable results.

Task 1. Questionnaire survey of dentists' awareness about the indications and application of different types of ceramic materials.

Task 2. Development of a method for determining the compressibility of press ceramics.

Task 3. Laboratory study of the optical properties of press ceramics.

Task 4. Two-dimensional (2D) study for polishing of lithium disilicate and lithium silicate press ceramics with a classical profilometer

Task 5. Three-dimensional (3D) study for polishing of lithium disilicate and lithium silicate press ceramics with an atomic force microscope and a scanning electron microscope.

Materials and methods

Task 1. A study was conducted on the awareness of 106 dentists who voluntarily participate in the survey. The topic of the survey is the indications and the application of different types of ceramic systems. The study was conducted in the period 01.04.2018 - 01.12.2018 during various scientific forums of the Bulgarian Dental Association. The collected information is coded, entered into a computer database and processed with the help of the specialized statistical product SPSS, version 17. Microsoft Office products are used for tabular and graphical processing. The collected information was statistically processed with the following methods; Nonparametric analysis, descriptive analysis, variation analysis and graphical analysis.

Task 2. An own methodology for laboratory testing and evaluation of compressibility of two types of glass ceramics with different composition of the crystalline phase - lithium disilicate (IPS e.max Press by Ivoclar Vivadent, Lichtenstein) and lithium silicate (Celtra Press by Dentsply Sirona, USA). After the end of the thermal regime, the compressibility of both types of glass-ceramics is assessed.

Task 3. A laboratory study of the processes of absorption and reflection of light and the refractive index of test samples of the two types of press ceramics with different composition of the crystalline phase is performed. The study was conducted at the Institute of Organic Chemistry - BAS Sofia. An M-2000 Spectroscopic Ellipsometer was used to determine the refractive index of light. The measurement of the absorption and reflection of light with different wavelengths was performed at BAS Sofia. The measurement of light absorption was performed with a UV spectrophotometer Lambda 25 from the company Perkin Elmer, USA.

Task 4. Research of the possibilities for polishing of 20 test specimens of lithium disilicate and lithium silicate press ceramics with a classical profilometer. The elaboration of the experimental bodies was performed in the Department of Prosthetic Dentistry at the FDM - Plovdiv with the creation of its own methodology. The study was conducted at the Faculty of Mechanical Engineering of the Technical University - Sofia. The measurement is performed using a diamond needle with a tip size of 5 micrometers. Each surface of the test samples was measured in six profiles. The analysis and evaluation of the surface profile of the experimental bodies included 6 roughness parameters.

Task 5. A study of the surface of processed prototypes of both types of press ceramics at the microscopic level with atomic force and scanning electron microscopes. The degree of smoothness depends on the size of the bur's crystals. The type of crystalline phase and the size of the crystals affect the polish ability of the ceramic materials. Polishing with a polishing kit and diamond paste results in a smoother surface than polishing with a polishing kit alone. A maximum smooth surface can only be obtained by adjusting the corrected ceramic surface. The polishing process improves the aesthetic, mechanical strength and biological properties of prosthetic restorations.

Conclusions

Dr. Vasileva, after completing her dissertation, scientifically synthesizes 15 conclusions, which will inevitably find an application by dentists, which will lead to the improvement of their practice.

Dissertation's abstract

The content and quality of the abstract completely fill all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria. It contains 60 pages, 44

figures, 14 of which have 2 photos, 8 diagrams and 6 tables. The abstract is presented with great precision and high scientific competence, duplicating the dissertation in an abbreviated form.

The critical notes I had I passed on to Dr. Vasileva in my review.

Publications and participations related to the dissertation

Full-text publications: 4 issues, Participations: 3 issues

Completed University project - NO - 10/2020 at MU - Plovdiv on the topic: "Comparative assessment of the polishability of press ceramics systems with lithium disilicate and lithium silicate crystal phase".

Contributions

Current contributions

1. For the first time in Bulgaria was conducted a survey among the dentists about the different types of ceramic materials and their use, establishing a deficit of knowledge related to the indications and their application.
2. For the first time in our country is created a method for determining the compressibility of glass-ceramics processed by pressing.
3. For the first time in our country the properties of two types of press ceramics with different composition of the crystal phase are compared.
4. For the first time in our country was made a study of some of the properties (optical, mechanical) of press ceramics with crystalline phase of lithium silicate, reinforced with 10% zirconium dioxide.

Confirmatory contributions

1. The claim that the polishing of the ceramic surface after correction cannot achieve the smoothness of the glazing is confirmed.
2. It has been proved that the particle size in the composition of the ceramic material has an effect on its properties.
3. It has been proven that LDSC and LSC have excellent optical properties to recreate aesthetics.

Applied-scientific contributions

1. It is proven that LSCs have better polishing capabilities than LDSCs.
2. A method for assessing the compressibility of ceramic materials has been developed.

3. It is proved that polishing with the use of diamond paste in LSC and LDSC makes the ceramic surface smoother

Conclusion

The dissertation is an original contribution to science and responds to all the requirements of the law for the development of the academic staff in the Republic of Bulgaria. In the dissertation Dr. Vasileva considers for the first time in our country some little known, unexplored in prosthetic dentistry properties of **press ceramics**. She was the first dentist to reveal the unknown properties of these aesthetic materials by creating scientifically differentiated methods using the most modern instruments and microscopes.

Conclusions and contributions important for clinical practice and theory have been made. Dr. Vasileva undoubtedly has in-depth theoretical knowledge and skills for independent research. The conclusions that she presents have scientific and applied significance for dental practice and theory.


The dissertation is mostly a personal work. She works in collaboration with specialists in the field of technology at BAS. The dissertation responds to all the mandatory conditions of the science criteria for awarding the title "**Philosophy Doctor (PhD)**".

Due to the above, I confidently give my **positive assessment** of the research and scientific contributions in the field of dentistry. As a member of the esteemed jury, I will vote convincingly "**YES**" for the award of educational and scientific degree "**DOCTOR**" to **Dr. Elena Kostadinova Vasileva**

05.10.2021

Plovdiv

Reviewer:


/Prof. Stefan Siromashki, DMD, PhD/