REVIEW

Of: The dissertation work of **Dr. Viktor Yordanov Hadzhigaev**, self-preparation PhD student in department of Prosthetic Dentistry in Faculty of Dental Medicine, Medical University of Plovdiv, on subject "Application of Endocrowns as Bridge Retainers" for the awarding of the educational and scientific degree "Doctor" for Dissertation for PhD Degree "Doctor" in the higher education field of 7."Health and Sports", in the professional field 7.2 "Dental Medicine" and scientific specialty "Prosthetic Dentistry".
Scientific superviser – Assoc. Prof. Dr. Stefan Zlatev, PhD

From: **Prof. Dr. Mariana Yordanova Dimova-Gabrovska, PhD, Doctor of Sciences**, Department of Prosthetic Dental Medicine, Faculty of Dental Medicine, Medical University – Sofia, elected a member of the scientific jury

General presentation of the procedure and the PhD student

The presented set of documents is in accordance with the regulations of MU-Plovdiv. Dr. Viktor Yordanov Hadzhigaev was enrolled as an independent doctoral candidate in the Department of Prosthetic Dental Medicine at the Faculty of Dental Medicine, Medical University – Plovdiv, by order No. R-1455/26.05.2023 of the Rector of Medical University – Plovdiv, with with scientific supervisor Assoc. Prof. Dr. Stefan Zlatev, PhD. On 07.02.2024, **the PhD student** was deducted with the right to defense his dissertation and a decision of readiness for defense of the dissertation was made (Department Council Protocol No. 2 from 01.02.2024 and Rector's order No. R-532/12.02.2024).

Short CV data of the PhD student

Dr. Viktor Hadjigaev was born in Plovdiv on 04.06.1980. In 1998, he graduated his secondary education at the French Language High School "Antoine de Saint-Exupéry" in Plovdiv. In 2004, he graduated from the Medical University – Plovdiv with a degree in Dental Medicine. Since 2006, he has been an assistant in the Department of Prosthetic Dental Medicine at the Faculty of Dental Medicine, Medical University – Plovdiv. He is a regular member of the Bulgarian Dental Association.

General Characteristics of the Dissertation

The presented dissertation is written on 157 pages. It contains 28 figures, 6 tables, 17 charts, and 4 appendices. The bibliography cites 244 literary sources, of which 16 are in Cyrillic and 228 in Latin script.

The dissertation is properly structured. It includes an introduction (2 pages), a literature review (34 pages), aims and objectives (2 pages), materials and methods (36 pages), results and discussion (39 pages), conclusions (4 pages), bibliography (30 pages), and appendices (5 pages).

Relevance and Significance of the Dissertation

The chosen topic is current. Its significance is determined by the increasing integration of CAD/CAM technologies into prosthetic dental practice, accompanied by the development of new materials. Their clinical application necessitates the updating of some treatment approaches, including certain preparations of the prosthetic field. A topic of scientific interest, for example, is the expanded use of endocrowns. It is known that their use has advantages in terms of the time frame for fabrication compared to the clinical time required in the classical prosthetic approach—from cast post and core to full coverage crowns.

In the dissertation presented for review, the aims and objectives are based on an extensive literature review that outlines the debated and unresolved issues related to the preparation design of endocrowns and their application as bridge retainers. The literature analysis includes the materials currently known to be suitable for the fabrication of endocrowns. A significant scientific contribution of the dissertation is the detailed **literature review**, presented in three sections, focused on the restoration of severely damaged endodontically treated teeth and metal-free bridge constructions. The author defines the relevance of the topic and directs the analysis towards the necessity for further research on the appropriate preparation for endocrowns when they are to be used as bridge retainers.

Aim and Tasks of the Dissertation

The aim is clearly and precisely formulated – to investigate the reliability of the endocrown usage as a bridge retainer in fixed dental prosthetics through computer simulation, laboratory, and clinical studies.

To achieve this objective, **4 tasks** and **2 sub-tasks** have been set:

1. To study, using a survey method, the awareness of dental practitioners about the application of endocrowns in dental practice.
2. To investigate the area of the prepared surface (bonding area) in two preparation designs – conventional and endocrown with a circumferential shoulder. The second task includes two sub-tasks: to create, test, and validate a method for measuring the area of a complex geometric object and to examine the differences in the adhesive bonding area in the two preparation designs.
3. To study the fracture resistance of three-unit bridge constructions made of zirconium dioxide ceramics.
4. To conduct a clinical evaluation of metal-free three-unit bridge constructions with different distal retainers – conventional crown and endocrown.

For each task, sufficient **material** has been presented, and independent research has been conducted to achieve reliable results and objective conclusions.

The research **methods** are appropriately chosen and described in the following sequence: Through a survey, the awareness of dental practitioners about the application of endocrowns in dental practice is examined (task 1); using computer software in a virtual environment, a method for measuring the prepared area of endocrowns and conventional crowns, as well as prepared extracted natural teeth, is validated and tested (task 2); a laboratory study is conducted to investigate the fracture resistance of full-scale three-unit bridge constructions made from zirconium dioxide ceramics (task 3); metal-free bridge constructions made from laboratory composite reinforced with fiberglass are clinically examined (task 4).

The methodologies are adequately described, and the data are statistically processed.

Results and discussion

On the **first** task, the results of the survey are presented, according to which it can be summarized that dental practitioners in Bulgaria are not well acquainted or do not perform prosthetic treatments with endocrowns. Over 78% reported difficulties with preparation. A significant percentage (84%) of the respondents expressed a positive attitude towards including prosthetics with endocrowns in their treatment plans.

On the **second** task, the study of the prepared surface area in the two preparation designs – conventional and endocrown with a circumferential shoulder – demonstrated both reliability and accuracy of digital measurement. The evaluation of the differences in the adhesive bonding area between the two preparation designs favored the endocrown, with a 25% larger bonding area compared to the conventional crown. These differences were statistically significant.

On the **third** task, the author examined the fracture resistance of three-unit bridge constructions made from zirconium dioxide ceramics with different preparation designs of the distal bridge retainer. No statistically significant difference was found between the distal retainer being an endocrown or a conventional full coverage crown. The weakest point in bridge constructions with a distal endocrown retainer was the distal connection. Adhesive cementation of zirconium ceramic bridge constructions proved to be reliable, with no debonded constructions observed during the study.

On the **fourth** task, in a clinical study of metal-free bridge prostheses made from laboratory composite reinforced with fiberglass, the author found that the endocrown is a reliable alternative to the conventional full coverage crown. Chips in the laboratory composite are easy to repair in a clinical setting. The observed bridge constructions were at a higher risk of fracture after the second year of use. The highest percentage of complications were related to marginal discoloration.

The presented results are well illustrated with figures, charts, and tables, convincingly interpreted, and demonstrate that the dissertation work is the personal achievement of Dr. Viktor Hadzhigaev.

The **conclusions** are correctly formulated. There are 8 conclusions in total, and they correspond to the obtained results.

Main **contributions** of the dissertation:

I. Contributions of Original and Scientific-Practical Nature:

1. A digital protocol has been developed for determining the area of irregularly shaped objects such as teeth, tooth stumps, and prosthetic constructions.
2. A methodology has been created for measuring the differences in the cementation area between conventional crowns and endocrowns.
3. A methodology has been developed for producing uniform "macro" experimental samples – three-unit bridges – with the capability for controlled variation of a single parameter.
4. A clinical study has been conducted on the survival rate of metal-free bridge constructions with endocrown bridge retainers.
5. It has been established that the software program Blender version 2.8 with the Neuromorph toolset is applicable for surface area measurements of irregularly shaped objects in dental medicine.

II. Confirmatory Contributions

1. It is confirmed that metal-free bridge constructions made from zirconium dioxide ceramics have sufficient fracture resistance to be used in the distal area of the dental arch.
2. It is confirmed that the distal connection is the site of the most frequent fractures in metal-free bridge constructions.
3. It is confirmed that bridge constructions made from fiber-reinforced laboratory composites can be successfully used as long-term temporary constructions in the distal area of the dental arch.

Dr. Viktor Yordanov Hadzhigaev has presented three publications related to his dissertation and has participated in three scientific forums.

The summary of a PhD thesis is consistent with the dissertation work.

Conclusion

The dissertation of Dr. Viktor Hadjigaev titled "Application of Endocrowns as Bridge Retainers" is an original, complete scientific work that is the personal achievement of the author and possesses scientific contributions of original, scientific-applied, and confirmatory nature.

I highly value the work and the contributions of the dissertation and I will confidently vote with "**Yes**" for awarding the educational and scientific degree "**Doctor**" to **Dr. Viktor Yordanov Hadzhigaev**.

Sofia, 25.07.2024.

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Prof. Dr. Mariana Iordanova Dimova-Gabrovska, PhD, DSc