REVIEW

by Assoc. Prof. Dr. Elka Nikolaeva Radeva, DMD, PhD

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External member of the scientific jury for MU-Varna

(according to Order № P-109-470 / 05.11.2021 of the Rector of MU-Varna)

Of a dissertation for awarding the educational and scientific degree "Doctor", professional field: 7.2 Dental medicine, doctoral program: Therapeutic dentistry

Author: Dr. Slavena Svetlozarova Georgieva
Form of doctoral studies: full-time
Department: Conservative dentistry and Oral pathology, Faculty of Dental Medicine, MU-Varna
Topic: "Application of cone-beam computed tomography in the endodontic practice"
Scientific adviser: Assoc. Prof. Dr. Tsvetelina Borisova-Papancheva, DMD, PhD, Faculty of Dental Medicine, Medical University – Varna

General presentation of the procedure and the doctoral student

In connection with this procedure, the following documents have been submitted electronically:

Application to the Rector of MU-Varna for opening a procedure for defense of a dissertation for for awarding the educational and scientific degree "Doctor".

Dissertation on a paper and an electronic media.

Abstract on a paper and an electronic media.

Curriculum vitae European format signed by the doctoral student.

Copy of the diploma for completed education.

Enrollment order.

Protocols from the conducted examination for doctoral minimum in the specialty and in English.

Minutes of the Department Council for deductions and for the composition of the scientific jury.

Order of the Rector for deduction with the right of defense.

Declaration of originality.

List and files with the full text of 3 publications in connection with the dissertation.

Declaration of authenticity of the submitted documents.

Declaration for registration of profiles in scientific databases.

The presented materials are in accordance with the requirements of the regulatory framework and the Regulations of MU-Varna.

Dr. Slavena Svetlozarova Georgieva was born in the city of Varna on May 17, 1991. She graduated from the High School "Joan Exarch", Varna in 2009. In 2017 graduated from the Medical University „Prof. Dr. Paraskev Stoyanov ", Varna as a Master of Dental Medicine. From 19.09. 2017 is a part-time assistant at the Department of Conservative Dentistry and Oral Pathology. After winning a competition in March 2018 she became a full-time assistant in the Department of Conservative Dentistry and Oral Pathology.

On 01.12.2018 she begins specialization in Operative Dentistry and Endodontics with training base University Medical and Dental Center, FDM, MU-Varna.

On 01.02.2019 she was enrolled as a full-time doctoral student at the Department of Conservative Dentistry and Oral Pathology for a period of 3 years by order № P-109-20 / 01.02.2019 of the Rector of MU-Varna.

The doctoral student indicated a very good level of proficiency in German and English; and excellent command of Microsoft Office.

Structure of the dissertation

The dissertation is presented on 227 pages, contains 4 appendices, a list of 3 publications and 2 participations in scientific forums related to the dissertation.
The structure of the dissertation includes: introduction - 1 page, literature review - 52 pages, aim and tasks - 1 page, materials and methods for each task (from 1 to 4) - 24 pages, the results and discussion are presented together on the individual tasks - 102 pages, conclusions - 1 page, contributions - 1 page, bibliography - 28 pages, publications and scientific communications in connection with the dissertation - 1 page, applications - 7 pages.

Relevance of the topic

The presented dissertation examines a current problem related to the use of CBCT in the endodontic practice. Knowledge of the morphology of the teeth and the configuration of the root canal system is an important factor for the success of endodontic treatment.

At present, conventional radiographs are the most accessible method for diagnosis, choice of treatment, and monitoring of the periapical area. But due to the two-dimensional character of the images and the superimposition of the surrounding anatomical structures, they are sometimes difficult to analyze.

In recent years, CBCT is becoming more widespread in endodontics, creating an opportunity for three-dimensional analysis of the studied area. New CBCT scanners have been developed, especially adapted for endodontic practice, with which it is possible to obtain an image only of the desired tooth for examination. The images can be oriented according to the three main planes (axial, sagittal and frontal). CBCT is currently used primarily as an adjunct to diagnosis in certain clinical cases, or when difficulties during the endodontic treatment are present.

Knowledge of the problem

The literature review covers 52 pages. It is presented in chapters, and is related to the future experimental part of her own research. It is based on 376 literature sources, 5 of which are in Cyrillic and 371 in Latin (44% are from the last 10 years). Not many Bulgarian authors are cited who have publications related to the topic.

The literature review addresses the issues of the role of imaging in endodontics. The two methods (X-ray and CBCT) are compared with their advantages, disadvantages and limitations of application. The criteria of the European Association of Endodontics from 2014 for the application of a segmental CBCT scanner in endodontic practice are presented.

Literature data on the application of CBCT were analyzed: before the start of endodontic treatment to establish the morphology of the tooth and the configuration of the root canal system; diagnosis of periapical pathology - chronic periodontitis, cysts; root fractures - vertical and horizontal; root canal perforations - size and location; diagnosis of root resorption - external and internal.

In the review, the doctoral student also considers the application of imaging in the course of endodontic treatment to determine the working length, to detect calcifications in the pulp chamber and root canals.

After endodontic treatment, imaging is used to assess the quality of the root canal filling, the choice of a radicular post in case of loss of large amount of the clinical crown, as well as to assess the presence of a healing process in the treatment of large periapical lesions.

The literature review ends with a summary of the unsolved problems and motivation for the development of the dissertation topic.

Research methodology

Based on the analysis of the literature review, the purpose of the dissertation is formulated, namely: to study the possibilities of CBCT in the detection and diagnosis of anatomical variations of the endodontic space and the root canal system among the Bulgarian population.

The selected materials and methods correspond to the set 4 tasks to achieve the goal.

CBCT images, located in the database of the Department of X-ray Diagnostics at the University Medical and Dental Center, Varna, were analyzed and were not appointed in connection with the present study. A single method was used, namely the analysis of CBCT-images. The analysis was performed by two operators independently of each other.

Materials and methods for task 1. The study was conducted in 127 patients aged 18-69 years.

To establish bilateral symmetry in terms of number of roots, root canals and type of root canal system configuration, the study included: maxillary first and second molars (468), mandibular molars (446), mandibular canines (240), mandibular incisors (492), maxillary second premolars (230).

CBCT images were obtained after scanning with a cone-beam computed tomograph Planmeca ProMax 3D Max. The studied images are oriented and analyzed in relation to the axial, sagittal and frontal planes.

Materials and methods for task 2. The study was conducted in 127 patients aged 18-69 years.

To determine the frequency of available additional root canals and the type of root canal system configuration, the study was performed on endodontically untreated teeth - maxillary first molars (230), maxillary second molars (231), mandibular first molars (230), mandibular second molar (230), mandibular central incisors (248), mandibular lateral incisors (250), mandibular canines (250), maxillary second premolars (230).

Materials and methods for task 3. To determine the average working length by groups of teeth in the Bulgarian population, 140 patients are included.

The following were analyzed: maxillary and mandibular central incisors, lateral incisors, canines, first premolars, second premolars, first molars, second molars (230 teeth for each group).

Sagittal sections of CBCT images were examined in detail to determine the length of the root canal. Using the linear measurement option of the Planmeca Romexis image processing software, the working length was measured from the enamel-cement junction of the examined tooth (the level of the orifice) to the area of the apical foramen. 0.5 mm is subtracted from the value obtained in mm, which reflects the distance to the apical constriction zone.

Under **task 3.1**, the teeth included in the study (100) were single-rooted (mandibular incisors, mandibular canines, mandibular premolars) with fully completed root development and were observed in 70 patients, aged 18-69. In this task, the working length measured by electrometric method and by CBCT is compared. Single-rooted teeth of 70 patients aged 18-69 years were included for the clinical study. Apex ID (Kerr Dental) apexlocator was used for electrometric measurement of the working length. The working length is determined with K-file №15. The silicone stopper is placed in the highest part of the crown of the examined tooth.

Materials and methods for task 4. The study of the frequency for the presence of denticles was performed on 30 patients aged 18-69 years. Patients are divided into two age groups - 14 under 40 years of age and 16 at/over 40 years of age.

To study the frequency of root fractures that occurred after endodontic treatment, 241 CBCT images of 71 patients aged 18-69 years without clinical symptoms (152 molars and 89 premolars) were included. Indices - 0, 1 and 2 were used to evaluate the results.

The **statistical methods** used for data processing are descriptive analysis with graphical representation and t-criteria for two paired samples.

The **results** are illustrated with 103 figures and 115 tables. The discussion made according to other similar studies is presented together with the results.

Conclusions - 5 conclusions are presented, which are in correlation with the set tasks.

Some of them could be specified according to the obtained results (for example on tasks 3, 4, 5).

Characteristics and evaluation of the dissertation and contributions

It was found that bilateral symmetry regarding the number of root canals of symmetrical pairs of molars was found in 80.8% of the studied cases. In the mandibular molars - 86.5%, mandibular incisors - 97.2%, maxillary second premolars - 93%.

It was found that most often an additional root canal is found in the MB root of maxillary first molars with the most common configuration - Vertucci type IV (55.8%), type II - 39.9%, type V - 2.5 %. Less frequently, additional root canals are found in maxillary second (33.3%) and mandibular first molars (29.1%) with Vertucci type IV .

A second root canal in maxillary second premolars is found in (49.6%) of the cases with the most common Vertucci type II configuration (18.3%). In 25.8% of the cases studied, the mandibular central and lateral incisors had an additional second root canal with the most common configurations, Vertucci type II and Vertucci type IV, respectively.

Determining the working length of single-rooted teeth based on CBCT measurement is a method characterized by an accuracy comparable to that of the electrometric method. However, its application is limited due to the high radiation load, the high cost and the greatly reduced measurement accuracy with curved root canals.

Most denticles and calcifications are found in the group of molars (74%). A higher percentage of denticles is found in the pulp chamber - 57% compared to the root canals - 43%. As in patients over 40 years of age, calcifications in the root canal system predominate.

The CBCT test can be used in the diagnosis of root fractures of endodontically treated teeth.

As a result of the research conducted in this way, the contributions of the present dissertation are determined.

Confirmatory contributions:

- The advantages of CBCT application in the field of endodontics have been proven. The configuration of the root canals according to Vertucci has been determined.
- The high frequency of available additional root canals in maxillary and mandibular molars, maxillary second premolars and mandibular incisors has been confirmed.
- The accuracy of CBCT measurements when determining the working length has been confirmed.
- The possibilities of CBCT diagnostics for establishing the configuration of the root canals and the presence of denticles and calcifications in them have been confirmed.
- The role of CBCT diagnostics in helping to detect root fractures has been confirmed.

Contributions of original character:

- For the first time a comparative study of the accuracy of determining the working length by CBCT measurement and by electrometric method was performed.
- For the first time, the frequency of available additional root canals by groups of teeth among the Bulgarian population was established, using CBCT as a diagnostic tool.

- For the first time a CBCT study was conducted, aiming to establish bilateral symmetry between the number of roots, root canals and the type of configuration of the root canal system in symmetrical pairs of teeth among the Bulgarian population.
- For the first time a CBCT study was conducted, aimed at analyzing the configuration of the root canal system in each root by groups of teeth among the Bulgarian population.

I believe that the dissertation work developed and presented for evaluation is significant with the achieved results and confirms the possibilities of CBCT for diagnosis of anatomical features and variations in the morphology of the root canal system. The obtained results outline a broader characteristic of these variations for the respective geographical area and population and will be useful both in the teaching of students and postgraduates, as well as for dentists.

Evaluation of the publications and personal contribution of the doctoral student

Three full-text scientific publications in connection with the dissertation are presented in electronic form, 1 of them in a Bulgarian edition and 2 in a foreign journal. In all of them the doctoral student is the first author. The presented publications are only reviews and they do not reflect their own results in connection with the dissertation. Dr. Slavena Svetlozarova Georgieva has presented 2 scientific papers at national forums. As a technical error, I consider the presentation of only the titles, without the names of the authors.

I believe that the dissertation and its contributions are the personal work of the doctoral student, carried out under the guidance of her supervisor.

Abstract

The abstract is presented on 83 pages and includes 5 tables and 35 figures. The abstract in terms of content meets the requirements of the Regulations of MU-Varna and comprehensively reflects the results obtained.

Remarks and recommendations to the presented dissertation:

The literature review does not cite many Bulgarian authors who have publications related to the presented topic (cited only 5 sources in Cyrillic).

There is no working hypothesis.

Figures of own results are presented in the discussion, which should be in the results section.

In the discussion on task 3.1 and task 4 are not cited and no results are presented by other authors with which to compare their own.

Some of the presented conclusions could be concretized according to the obtained results (for example on tasks 3, 4, 5).

The presented publications in connection with the dissertation are only reviews and they do not reflect their own results obtained in connection with the topic.

As a technical error, I consider the presentation only of the titles of the participations in scientific forums, without the names of the authors.

Despite the remarks presented in this way, a sufficient amount of work was done and a large number of CBCT images were analyzed to establish symmetry, additional root canals, calcifications and root fractures. The material is sufficient for the development of the dissertation and the implementation of the set goal.

Conclusion

With this review I give my **positive assessment** of the research on **"Application of cone-beam computed tomography in the Endodontic Practice"** and propose to the members of the scientific jury to award the educational and **scientific degree "Doctor"** to **dr. Slavena Svetlozarova Georgieva** in a doctoral program in Therapeutic dentistry.

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Prepared the review:

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