REVIEW

By: Assoc. Prof. Dr. Veselina Kondeva - Glavinkova, PhD, Department of Pediatric Dental Medicine, Faculty of Dental Medicine, Medical University of Plovdiv, member of the Scientific Jury, designated by Order No. P-1277/ 03.08.2020 of the Rector of the Medical University of Plovdiv

In regard with: Dissertation themed *SUPERNUMERARY TEETH – EPIDEMIOLOGICAL, CLINICAL AND RADIOLOGICAL STUDIES* for awarding doctoral degree in a doctoral program in Oral Surgery, professional field 7.2. Dental Medicine, sphere of higher education: 7. Healthcare and sports.

Author: Dr. Radka Borisova Cholakova, self-training PhD student at the Department of Oral Surgery of the Faculty of Dental Medicine at the Medical University of Plovdiv.

Academic supervisor: Assoc. Prof. Dr. Deyan Zdravkov Neychev, PhD

1. General presentation of the procedure and the doctoral candidate

The presented set of materials in paper form is in accordance with Art. 115 (1) of the Procedure for Awarding Doctoral Degrees set in the Regulations of the Medical University of Plovdiv.

The doctoral candidate enclosed four publications related to the theme of the dissertation, published in a Bulgarian journal ("Scientific Works of the Union of Scientists in Bulgaria – Plovdiv") and one article in a foreign journal („ES J Dent Sci") as well as participations at international scientific forums (Annual assembly of IMAB, Varna, 2016 and 11th BaSS Congress, Sarajevo, May 11-14, 2006) and congresses in our country (Scientific session, Medical University - Faculty of Dental Medicine - Plovdiv, October 30, 2008 and International Conference of Young Scientists at the Union of Scientists in Bulgaria – Plovdiv, 18-19 June 2009).

2. Biographical notes of the doctoral candidate

Dr. Radka Borisova Cholakova was born in 1978. She graduated from the Faculty of Dental Medicine at the Medical University of Plovdiv in 2001. She worked in a private dental practice in the city of Plovdiv for one year. In 2002, she was admitted for specialization in oral surgery at the Department of Oral Surgery of the Faculty of Dental Medicine - Plovdiv, and acquired specialty in January 2006. In 2005, she was appointed as an assistant professor at the same department. Dr. Cholakova is in charge of Educational Activities and Quality of Education at the Department of Oral Surgery. Since 2019, she is a self-training PhD student in doctoral program of Oral Surgery at the same department.

2. Significance of the theme and appropriateness of the objectives and tasks set

The theme chosen is significant from both a clinical and a theoretical point of view, due to the fact that problems with supernumerary teeth affect different age groups and cause complications which impair the masticatory function and esthetics in the maxillofacial region. Treatment planning requires a multidisciplinary approach for addressing these disorders in patients. This pathology was analysed in different ethnic groups living in Plovdiv Region, directing our attention to the affected groups, for timely diagnosis and prevention. The objective was stated clearly, the tasks were selected correctly and were implemented using modern research methods.

3. Knowledge on the problem

In her dissertation, Dr. Radka Borisova Cholakova demonstrates in-depth theoretical knowledge of the theme on the diagnosis and treatment of supernumerary teeth and skills for conducting independent scientific research. The exposé was written in a strictly scientific style. The doctoral candidate made a detailed and in-depth review of the literature. A study on the frequency of hyperdontia among the population of Plovdiv was carried out. The possible etiological factors for the development of supernumerary teeth were studied. The work addresses the possible complications of untreated hyperdontia, the challenges in the diagnosis and localisation of supernumerary teeth, the adverse outcomes of surgical treatment of this pathology. A detailed analysis of the methods for diagnosis of hyperdontia using modern techniques - cone-beam computed tomography (CBCT) and laser Doppler flowmetry (LDF) - is presented. The optimal time for surgical treatment of supernumerary teeth depending on the development of the adjacent teeth and the psycho-emotional condition of the patients was determined. Having made a critical analysis of the literature, the author formulated the solved, partially solved and unsolved problems. Accordingly, the objective of the dissertation was set – "to study the frequency of supernumerary teeth and their effect on the dentition and to develop an algorithm for management of hyperdontia". In order to accomplish the objective, four main tasks and two subtasks (under task 2) were formulated appropriately, which were implemented correctly using modern methods.

4. Methods

In the section Material and Methods, Dr. Cholakova describes in detail the methods used, which are required to obtain statistically credible results:

For Task 1, 1,000 dental patients seeking medical attention at the Faculty of Dental Medicine in Plovdiv were studied. The participants in the study were divided into seven age groups: 4-10 years of age; 11-20 years of age; 21-30 years of age; 31-40 years of age; 41-50 years of age; 51-60 years of age; over 61 years of age. Each patient underwent a clinical examination and a case report card was filled out. Where erupted supernumerary teeth were found, they were described according to the following parameters: their location in the jaw bones (mesiodens, parapremolar, paramolar, distomolar, others), morphology (excess, rudimentary, tuberculate, infundibular, molariform, odontomas), location relative to adjacent teeth (vertical, horizontal, inverted, ectopic), orientation (buccal, palatal/lingual, transverse). In addition, radiological methods were used to determine these parameters correctly.

For Task 2, 106 patients diagnosed with hyperdontia were studied.

For Subtask 2.1, (1) the stage of eruption of the permanent teeth in the area of the supernumerary tooth, and (2) the arrangement of the teeth in the dental arch were determined. To determine the stage of eruption of the permanent teeth in the area of the supernumerary tooth, the estimated eruption times according to Peneva were used. The present teeth (primary and permanent) at the time of the examination were recorded in a specially designed card and an assessment based on the calendar age of the patient was made. The examination of the arrangement of the teeth in the dental arch was performed sequentially for the frontal and for both lateral sections. Changes in the arrangement of the teeth were reported as present or absent. An examination was performed for the presence of teeth crowding. Crowding can manifest as rotation, inclination, translation. An examination for excess space in the respective dental segment was also performed. Excess space manifests as diastemas and tremas. The radiological method used was segmental radiography (Dieck) - to determine the cause of the delayed eruption and the direction of the permanent tooth upon patient's admission. The eruption status of the permanent teeth adjacent to the supernumerary tooth was determined using the diagnostic radiographs by the method of Liversidge and Molleson. The position of the tip of the incisal edge of the adjacent tooth relative to the horizontal plane was determined in the following stages:

Stage 1. Above (in the maxilla) or below (in the mandible) the alveolar ridge;

Stage 2. At the level of the alveolar ridge;

Stage 3. Half between the alveolar ridge and the occlusal level;

Stage 4. Reached the occlusal level.

CBCT was performed only in patients with delayed eruption of a permanent tooth in order to measure the width of its crown so that to determine whether there was enough space for eruption.

For Subtask 2.2, the root dilaceration of the teeth adjacent to the supernumerary tooth was examined. Patients underwent orthopantomography and/or periapical radiography (Dieck, Santana, Consolaro and Tavano) and were classified into one of three groups depending on the angle formed between the axial axis of the tooth and the root (mild, moderate, severe), involvement of the root length (cervical, medial and apical) and direction of deviation of the root (medial, distal, buccal or lingual). Root resorption was also studied on segmental radiographs (Dieck) and orthopantomograms, and was reported using radiographic features - location and type (oblique, horizontal) by the method of Ericson and Kurol:

Grade 1 - no resorption (intact root surface).

Grade 2 - mild resorption (affects up to ½ of the thickness of the dentin layer adjacent to the pulp).

Grade 3 - moderate resorption (affects more than ½ of the thickness of the dentin layer adjacent to the pulp, but the pulp is not affected).

Grade 4 - severe resorption (the pulp is affected by the process).

Changes in the blood supply of the pulp in erupted teeth adjacent to the supernumerary tooth were examined on order to identify changes in blood flow due to hyperdontia. Measurements were performed using the system moorVMS LDF2 (785 ± 10 nm, maximum power 2.5 mW) (Moor Instruments Ltd. Millwey Axminster Devon EX13 5HU, UK) and needle probes as per the manufacturer's instructions, and were processed by the use of specialized software (moor VMS-PC, V 3.1 for Vascular Monitor System). After the measurement, the obtained results were analysed using specialized software and, if values were lower than those mentioned in the table, reduced pulp perfusion was recorded.

Caries and its complications on the adjacent teeth were diagnosed using clinical methods and routine X-ray examinations.

For Task 3, supernumerary teeth of 32 patients were extracted due to indications. A radiographic method (Demirjan) was used to determine the degree of development of the adjacent permanent teeth. The condition of the teeth adjacent to the supernumerary tooth was classified into one of six groups, according to the criteria set. The following parameters are assessed pre- and postoperatively: changes in the pulp blood supply to compare the microcirculation in the permanent teeth adjacent to the supernumerary tooth, for which LDF was performed preoperatively, on day 15, and at postoperative months 3 and 6; eruption status of the non-erupted permanent tooth, which was determined clinically and, in case of non-eruption of the permanent tooth at month 6 after the operation, segmental radiography (Dieck) was performed; arrangement of the teeth in the dental arch in the supernumerary tooth segment without orthodontic intervention, six months after the extraction. Anesthesia and surgical procedure, assessment of anxiety during extraction of supernumerary teeth on the FLACC scale, severity of pain during the injection and extraction by Wong-Baker FACES scales as well as early postoperative complications (subjective complaints and objective complications) were recorded.

For Task 4, an algorithm was developed based of the conducted observations and research.

The study found that supernumerary teeth are a dental abnormality, which is found relatively rarely in our population, affecting predominantly the maxilla, in males, and its frequency is higher in Bulgarians among the ethnic groups living in the Republic of Bulgaria. The proportion of orthodontic changes caused by supernumerary teeth is greatest in early childhood and, therefore, their removal should be performed under local anesthesia as soon as possible after diagnosis.

Various original methods were used to implement the tasks set. The volume and the methods used allow for the reliability of the obtained results and the conclusions made.

5. **Characteristics and evaluation of the dissertation**

Dr. Cholakova's dissertation work is properly structured and contains all the main components of a dissertation: introduction, literature review, objective and tasks, material and methods, results and discussion, conclusions, bibliography and appendices.

The dissertation was written on 191 pages. The literature review is presented on 30 pages: objective and tasks - 1 page, material and methods - 22 pages, own results and discussion - 65 pages, conclusions - 1 page, contributions - 1 page. It is illustrated with 12 tables, 34 figures, 57 diagrams and 37 appendices. The bibliography includes 176 references, 7 of which are in Cyrillic.

The results are comprehensively and correctly described, analyzed and interpreted and critically discussed in the light of similar studies. The dissertation finishes with conclusions based on the results, and the discussion and the summaries made are naturally resulting from them.

6. Contributions and significance of the dissertation for the science and practice

I accept the contributions presented by the doctoral candidate in the author's summary.

7. Assessment of publications related to the dissertation

Four publications were presented, reflecting the results of the dissertation, which meet the legal requirements quantitatively and qualitatively. The doctoral candidate is the first author of two of the publications.

8. Personal involvement of the doctoral candidate

The research and observations of patients and the resulting conclusions and contributions of the dissertation are personal work of the author.

9. Author's summary

The author's summary has been prepared in accordance with the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria and the regulations of the Medical University of Plovdiv. It consists of the following sections: introduction, objective and tasks, material and methods, results, discussion, conclusions, contributions and publications related to the theme of the dissertation. The author's summary reflects the results achieved in the dissertation.

10. Critical comments and recommendations

I have no remarks on the materials provided.

CONCLUSION

The problem addressed is significant, and the presented dissertation, completed according to the legal requirements, contains original scientific and applied contributions, which meet the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, its Implementation Rules and the regulations of the Medical University of Plovdiv.

The dissertation shows that the doctoral candidate Dr. Radka Borisova Cholakova possesses in-depth theoretical knowledge and professional skills in the scientific specialty Oral Surgery, demonstrating competences and skills for conducting independent research.

After the analysis made, I confidently give my positive opinion on the dissertation themed *Supernumerary Teeth – Epidemiological, Clinical and Radiological Studies*, and I will cast my **positive vote** for awarding **doctoral degree** in the scientific speciality **Oral Surgery** to **Dr. Radka Borisova Cholakova**.

06 Aug 2020

REVIEWER:

(Assoc. Prof. Dr. Veselina Kondeva - Glavinkova, PhD)