REVIEW

From Prof. Dr. Bozhidar Ivanov Yordanov, DMD, PhD
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Regarding a dissertation on the topic: **„Socket preservation – clinical, radiographical and histomorphometric evaluation"** for acquiring an educational and scientific degree **PhD** to Dr. Vasilena Vasileva Ivanova, Ph.D.student at the Department of Oral Surgery, MU, FDM-Plovdiv.

Supervisor: Assoc. Professor Ivan Lulchev Chenchev, DMD, PhD, Oral Surgery Department, Faculty of Dental Medicine – Plovdiv, Bulgaria

The dissertation work submitted for review is up-to-date, properly structured and contains the obligatory parts for dissertation development - literature review, purpose and objectives, material and methods, results and discussion of the results, and conclusions.

The dissertation is written on 256 pages, 4 of which are appendices. It is further illustrated with 36 figures, 33 diagrams and 26 tables. The bibliography contains 417 literary sources, of which 13 are in Cyrillic and 401 in Latin.

The distribution of the individual parts in the dissertation is as follows: 2 pages introduction, 58 pages literature review, 132 pages aim and objectives, research, results and discussion, 4 pages conclusion, and contributions.

There are 4 publications related to the topic of the dissertation – three in foreign scientific journals, one of which in a journal with an impact factor, one in a Bulgarian scientific journal. Four reports were prepared and presented at scientific forums abroad.

Brief biographical data

Dr. Vasilena Vasileva Ivanova was born in 1990 in the city of Plovdiv. In 2015 she graduated from the Faculty of Dental Medicine – Medical University - Plovdiv. She acquired a specialty in Oral Surgery in 2020.

Since 2015 Dr. Ivanova has been appointed as a full-time Assistant Professor at the Department of Oral Surgery, FDM, MU - Plovdiv. She conducts practical training and seminars in oral surgery for students majoring in dental medicine. Dr. Ivanova actively participates in the practical training of specialists in oral surgery. As an Assistant Professor at the Department of Oral Surgery, FDM, MU - Plovdiv, she conducts practical training of III, IV and V year students in Bulgarian and English language. Dr. Ivanova is a Memberof BDA and EAO (European Association of Osseointegration). She covers English and German languages.

The topic is determined by the modern requirements for optimum implant-prosthetic rehabilitation of patients with various types of edentulism. The most common cause of deformities in the alveolar ridge are dental extractions. The lack of functional stimulation after tooth extraction is the cause of localized trabecular atrophy and reduction of bone volume, which continue throughout life. Bone resorption leads to adverse changes in the basic parameters of the available bone - width, height, length and angulation. Socket preservation of the alveolar ridge is especially important when planning implant-prosthetic rehabilitation of the patient. The optimal positioning of the dental implants according to the pre-selected method of prosthetics is facilitated, and the manufactured prosthetic constructions have high functional and aesthetic qualities.

In the introduction, the author emphasizes on the preservation of the alveolar bone following tooth extraction and the application of various techniques to reduce bone loss when planning implant-prosthetic treatment.

The literature review clarifies a number of issues on the topic - the mechanisms of bone regeneration after tooth extraction, anatomical and morphological, structural and resorptive changes in the alveolar bone, classifications of bone resorption and bone density, techniques for socket preservation, types of bone graft materials, biologically active products, stem cells, clinical surgical approaches, etc. The analysis of the literature review formulates the current trends in the field of bone and tissue engineering.

The aim is a logical consequence of the precise analysis of the literature review - to make a comparative analysis of the quantitative and qualitative changes of the alveolar bone following socket preservation procedures and assessment of the implant stability.

The purpose and objectives, 5 in number, fully correspond to the topic and content of the dissertation. The formulated objectives are sufficient for presentation and detailed discussion of the problems related to the examination and evaluation of the alveolar bone and the application of modern techniques for socket preservation.

Sufficient material is presented on each of the tasks and research has been developed to achieve reliable results and objective conclusions.

The methods are appropriately selected and applied sequentially, in the following order:

1. Assessment of bone resorption in vertical and horizontal dimension on virtual models obtained with an intraoral scanner of Trios
2. Comparative histological and histomorphometric evaluation of the bone structure four months after socket preservation with cortico-cancellous allograft and PRF membrane, with PRF only, and in a control group.
3. Comparative radiological assessment of bone density in Hounsfield units on CBCT.

4. Comparative evaluation of the primary and secondary stability of dental implants with respect to the material used for socket preservation and analysis of the correlation: bone density - amount of newly formed bone – implant size.

5. Statistical parametric and non-parametric methods and programs for statistical processing.

The execution of the main objectives is as follows:

For the first objective of the study 90 patients were included and divided into 3 groups, 30 persons each. In the first group, the post extraction socket was filled with allograft (cortico-cancellous freeze-dried allograft with albumin coating) and a PRF membrane. In the second group, the post extraction socket was filled only with PRF. The first two groups were addressed as **test groups**. In the third group - a **control group** of patients, no filling of the post extraction socket was performed, but the surgical protocol remains the same.

The results of the first objective demonstrated that the horizontal bone resorption after tooth extraction is more pronounced than the vertical one. The results confirmed that socket preservation with bone substitutes or biologically active substances, as well as the combination of both significantly reduces the rapid processes of resorption of the alveolar bone in a period of a few months after tooth extraction. The post extraction socket, filled only with a blood clot, is subjected to a significantly greater resorptive alterations in the bucco-lingual and vertical dimension.

The second objective presents the results of the histological and histomorphometric assessment of the bone structure four months after socket preservation with allograft with PRF membrane, only with PRF and in the control group. Bone biopsy was harvested 4 months after tooth extraction. The results of the study in the second task show that the average values of the amount of newly formed bone after socket preservation with PRF as a sole grafting material (60.79%) are significantly higher than the average values in the control group (39.04%). In the presented study, cortico-cancellous freeze-dried bone allograft (FDBA) was used for socket preservation in the second test group, and 4 months after the procedure, the average amount of newly formed bone was 63.29%.

The third objective presents the results of the comparative radiographic evaluation of bone density in Hounsfield units, measured on CBCT, after socket preservation with bone allograft with PRF membrane, only with PRF and in non-preserved post-extraction sockets.

The results in the test groups are close and without a statistically significant difference - bone - 776.03, PRF - 721.86 HU. In the control group, the value for bone density was significantly lower (503.43 HU).

The fourth objective presents the values of the primary and secondary stability of the dental implants with respect to the material used for socket preservation and analyzes the correlation of bone density (HU), the amount of newly formed bone, and the size of the implants.

The mean value for the primary stability of dental implants placed 4 months after socket preservation with allograft was 70.50 ISQ. Secondary stability in the same group, measured 4 months later, was 78.00 ISQ. The primary stability of dental implants placed after socket preservation with PRF was 72.00 ISQ on the average. Their secondary stability, measured 4 months later, increased to IS.00 79.00. The primary stability of the implants in the control group was 61.00 ISQ on the average, and the secondary stability measured 4 months after implant placement was 70.50 ISQ on the average.

In the **fifth task**, based on the results of the study, an algorithm for predictability of success after socket preservation procedures was developed. The following parameters and their optimaum values are recommended for greater predictability and success of implant treatment: bone density ≥564 HU; amount of newly formed bone ≥52.48%; primary stability ≥65 and secondary stability ≥74.

The results obtained for all objectives are reliable and well analyzed.

The discussion of the results was performed correctly, presented as a discussion with other authors and a comparison with the results of their research.

The conclusions are formulated optimally, with an emphasis on the contributions of the author.

The most important **scientific and applied contributions** of the dissertation are original and include:

1. Application of an **intraoral Trios scanner** to assess changes in the alveolar bone in vivo.

2. A comparative **histological and histomorphometrical analysis** of the results obtained after socket preservation with allograft, PRF and control group was performed.

3. **A Program** for graphic processing of images with free access was used for evaluation of the constituent tissues in the three groups.

4. **A comparative three-dimensional** radiographic evaluation was performed to assess the bone density in the three groups

5. The optimum values, distinguishing more successful methods of treatment from less successful ones were determined.

Contributions of a confirmatory nature.

1. The results confirm the significant loss of alveolar bone after tooth extraction.

2. Socket preservation with bone graft materials or biologically active substances, as well as the combination of both significantly reduces the resorption of the alveolar bone in the early period of a few months after tooth extraction.

Abstract

The abstract fully corresponds to the content of the dissertation and is developed in accordance with the accepted academic requirements in our country. The tables, figures and diagrams presented in it give complete information about the conducted research and the obtained results.

Conclusion

The dissertation of Dr. Vasilena Vasileva Ivanova on "**Socket preservation – clinical, radiographical and histomorphometric evaluation**" for aquiring an educational and scientific degree PhD is a personal work of the author and represents a scientific development with a number of contributions of original scientific and applied nature.

I declare my overall positive assessment of the dissertation and I will vote confidently with "Yes" for assigning the educational and scientific degree PhD to Dr. Vasilena Vasileva Ivanova.

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Reviewer:

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