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Fund “Nauka” Project № 16019 Resume – Competition-Based Session 2016:

“Research of the dynamics of the healing processes in peri-implant tissues through scintigraphy with 99mTc-MDP (methylene diphosphonate)”

Project leader: Prof. Borislav Georgiev Chaushev, MD, PhD

Treatment with intraosseous osseointegrable dental implants is a modern therapeutic method that achieves complete rehabilitation by fully restoring the patient's masticatory function and aesthetics. The success of implant application is associated with the process of osseointegration.

Osseointegration is the process of bone formation between the alloplastic material and the surrounding biological environment. Achieving primary stability during implant placement is of paramount importance for this complex multi-stage recovery period.

This research project aims to evaluate the application of single-photon emission computed tomography (SPECT) with 99mTc-MDP (methylene diphosphonate) of peri-implant bone in the healing period after placement of intraosseous, osseointegratable implants.

The tasks set aim to:

1. Examination of the peri-implant bone tissue in the recovery period after the placement of intraosseous osseointegrable dental implants using single-photon emission computed tomography (SPECT) with 99mTc-MDP;
2. Examination of bone density in the implantation areas using CBCT (Cone Beam Computed Tomography). Comparison of results obtained from single-photon emission computed tomography (SPECT) with 99mTc-MDP with bone density before implantation;
3. Evaluation of osseointegration in the third month after placement of intraosseous osseointegrable dental implants with the help of resonance-frequency analysis. Comparison of the results obtained from the SPECT study with those of resonance-frequency analysis period after placement of intraosseous, osteointegrable implants.

The subject of the study are male and female patients over 18 years of age, in good general health: no concomitant diseases, no systematic medication intake, which

may affect the surgical manipulation of implant placement and disrupt the process of osseointegration. The examined patients have extracted teeth in the upper and/ or lower jaw and the presence of sufficient bone volume to ensure the placement of implants without the need for bone augmentation.

The used methods include:

1. Clinical and paraclinical assessment;
2. CBCT of the upper and lower jaw before implantation;
3. Preliminary preparation and rehabilitation of the oral cavity;
4. Choosing the place of implantation;
5. Single-photon emission computed tomography on the 30th and 90th day after implantation,
6. Implant stability measurement in all patients by resonant frequency analysis (RFA).

Results:

Theoretical contributions:

1. For the first time in Bulgaria one-photon emission computed tomography with radiopharmaceutical 99mTc-MDP is applied to assess the osteoblast activity in the peri-implant bone tissue in the healing period after placement of intraosseous osteointegrable dental implants;
2. For the first time in Bulgaria the osteoblast activity was compared to one-photon emission computed tomography with 99mTc-MDP radiopharmaceutical according to sex and age;
3. For the first time in Bulgaria the relationship between bone density in edentulous areas of the jaw and osteoblast activity in these areas after implantation is studied;
4. For the first time in Bulgaria a comparative assessment was made between the values of the resonant frequency analysis and the single-photon emission computed tomography on the 3rd month after the placement of intraosseous osteointegrable dental implants;

Practical contributions:

1. It is confirmed that different paraclinical methods (sector radiography, resonance-frequency analysis, single-photon emission computed tomography) are used to assess osseointegration, as they complement each other;

2. Confirmation that the application of SPECT with 99mTc-MDP (99mTc-Methylene diphosphonate) is a reliable method for assessing osteoblast activity in periimplant bone during the healing period after placement of intraosseous osteointegrable dental implants;
3. SPECT is confirmed to be a non-invasive test method that can predict and evaluate at an early stage the outcome of implant treatment;
4. Bone density in the implantation area can be usefully determined through CBCT;
5. The resonant frequency analysis and the SPECT study are successfully used to assess the process of osseointegration;

Contributions of an original nature to the world:

For the first time, a software algorithm for determining the mean values of Hunsfield units in a predetermined bone volume has been developed to determine the bone density of CBCT.