EFFICIENCY OF OSSEOINTEGRATION PROPERTIES MANIFESTATION IN DENTAL IMPLANTS WITH HYDROXYAPATITE PLASMA COATING

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Aim of study:
to identify the efficiency of osseointegration properties manifestation in dental implants with hydroxyapatite plasma coating.

Despite the progressing computerized radiological and ultrasound diagnostic methods, experimental studies have not lost their relevance yet and are still widely used in applied and clinical sense [8, 9]. Treatment of dental arches defects using intraosseous implants is a modern and effective method allowing rehabilitation of dental patients through different age periods, which is due to high prevalence of carious process [4]. Given the current progress in the dental practice, dental implants is rather a common way to restore dentition, which is of interest to specialists and is rather attractive for patients. Teeth are replaced in view of individual specifics per each dental system [3, 10, 11, 12]. Besides, special attention is paid to the shape and size of the dental arches [1,2,5]. Modern methods for examination of dental arches have been proposed, while the faults of the already available methods for biometric analysis have been taken into account [6, 7]. Reparative bone regeneration relies on the processes of osseoinduction and osseoconduction, which determine the healing of bone wounds by primary and secondary intension, and is regulated at the system level. Bone tissue, just like any material object, possesses certain strength and elasticity properties and is subject to morphological change, which requires morphological research.

MATERIALS AND METHODS

Three experimental animals (young mongrel dogs, 1.5–2 years old), had 6 smooth cylindrical implants with a bioceramic coating installed after the removal of the first molars.

The animals were taken out of the experiment after 3 and 30 days, taking into account the generally accepted requirements regarding working with laboratory animals. The respective bone fragments were cut out together with the installed implant. Both macro- and micro-status were evaluated. After decalcification, histological specimens stained with hematoxylin-eosin were made, after which studies were carried out with a light microscope.

RESULTS AND DISCUSSION

The experimental study showed that an inflammation phase was underway during the first three days after the implants were installed. At that time, various cells, including macrophages, were noted in the surgical area, with phagocytosis of the dead cells identified. The rough surface of hydroxyapatite, an apatite layer was detected, which did not differ from biological apatite. Clusters of preosteoblasts, which differentiated into osteoblasts, were observed, as well as their migration to the bone tissue defect and to the implant surface carrying hydroxyapatite particles. Osteoblasts on the hydroxyapatite surface developed osseous tissue.

On day 30 into the study, a layer of fibroblasts and osteoblasts was to be observed on the hydroxyapatite surface. The bone formation had occurred up until the entire bone defect was recovered.

One of the important properties of hydroxyapatite was its resorption. The study found that hydroxyapatite is not osteoinductive, yet does prove so when replacing defects. The development of bone tissue began from the defect edge and passed along the hydroxyapatite surface, while the development of a bridge between the bone tissue and hydroxyapatite was observed.

CONCLUSION

The above suggests that the complex studies outcomes prove the efficiency of osseointegration properties manifestation in dental implants with hydroxyapatite applied through the plasma coating method.

REFERENCES

1. **Borodina V.A., Domenyuk D.A., Veisgeim L.D., Dmitrienko S.V.** Biometry of permanent occlusion dental arches – comparison algorithm for real and design indicators. Archiv EuroMedica, 2018; Vol. 8; 1: 25–26. https://doi.org/10.35630/2199-885X/2018/8/1/25
2. **Dmitrienko S.V., Domenyuk D.A., Kochkonyan A.S., Karslieva A.G., Dmitrienko D.S.** Interrelation between sagittal and transversal sizes of maxillary dental arches. Archiv EuroMedica, 2014; Vol. 4; 2: 10–13.
3. **Dmitrienko S.V., Davydov B.N., V.V. Shkarin, Domenyuk D.A.** Algorithm for determining the size of artificial teeth by the morphometric parameters of the face in people with full adentia. Dentistry. 2018; 97(6): 57–60.
4. **Domenyuk D.A., Vedeshina E.G., Dmitrienko S.V.** Efficiency evaluation for integrated approach to choice of orthodontic and prosthetic treatments in patients with reduced gnathic region. Archiv EuroMedica, 2015; Vol. 5; 2: 6–12.
5. **Domenyuk D.A., Shkarin V.V., Porfiriadis M.P., Dmitrienko D.S., Dmitrienko S.V.** Algorithm for forecasting the shape and size of dent arches front part in case of their deformations and anomalies. Archiv EuroMedica, 2017; Vol. 7; 2: 105–110.
6. **Domenyuk D.A., Vedeshina E G., Dmitrienko S.V.** Mistakes in Pont (Linder-Hart) method used for diagnosing abnormal dental arches in transversal plane. Archiv EuroMedica, 2016; Vol. 6; 2: 23–26.
7. **Domenyuk D.A., Lepilin A.V., Fomin I.V., Dmitrienko S.V., Budaychiev G.M-A.** Improving odontometric diagnostics at jaw stone model examination. Archiv EuroMedica, 2018; Vol. 8; 1: 34–35. https://doi.org/10.35630/2199-885X/2018/8/1/34
8. **Korobkeev A.A., Domenyuk D.A., Shkarin V.V., Dmitrienko S.V.** Types of facial heart depth in physiological occlusion. Medical news of North Caucasus. 2018. – Vol. 13. – № 4. – P. 627–630. (In Russ., English abstract). DOI – https://doi.org/10.14300/mnnc.2018.13122
9. **Lepilin A.V., Fomin I.V., Domenyuk D.A., Dmitrienko S.V.** Diagnostic value of cephalometric parameters at graphic reproduction of tooth dental arches in primary teeth occlusion. Archiv EuroMedica, 2018; Vol. 8; 1: 37–38. https://doi.org/10.35630/2199-885X/2018/8/1/37
10. **Shkarin V., Domenyuk D., Lepilin A., Fomin I., Dmitrienko S.** Odontometric indices fluctuation in people with physiological occlusion. Archiv EuroMedica, 2018; Vol. 8; 1: 12–18. https://doi.org/10.35630/2199-885X/2018/8/1/12
11. **Korobkeev A. A., Domenyuk D. A., Shkarin V. V., Dmitrienko S. V., Mazharov V. N.** Variability of odontometric indices in the aspect of sexual dimorphism. Medical News of North Caucasus. 2019;14(1.1):103–107. DOI – https://doi.org/10.14300/mnnc.2019.14062 (In Russ.)
12. **Dmitrienko T.D., Domenyuk D.A., Porfyriadis M.P., Arutyunova A.G., Kondratyuk A.A., Subbotin R.S.** Connection between clinical and radiological torque of medial incisors at physiological occlusion. Archiv EuroMedica, 2019; Vol. 9; 1: 29–37. https://doi.org/10.35630/2199-885X/2019/9/1/29