

REPARATIVE PROCESSES PROMOTION IN SPORT INJURIES WITH BONE LESIONS

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INTRODUCTION

Bone injuries in the maxillofacial region as a result of traumas in sport are not uncommon. The implantation of apatites containing glass-ceramic materials (AGM) in form of granules has been suggested for promotion of reparative processes and rehabilitation of athletes with bone defects (Nakamura, 1985; Gross, 1985; Sela, 1981).

The aim of this work is a comparative study of the osteoinductive characteristics of AGM and a composite material based on collagen sponge with 80% AGM (CSAGM).

Biositall (Russia), developed by members of the Hospital Orthopedic Dentistry Chair of our Institute together with workers of the Scientific Research Institute of Glass, was used as AGM.

Biositall is produced from calcium-phosphate glasses. Its crystalline phase contains in addition hydroxylapatite (HA) and wollastonite.

Hydroxylapatite possesses no toxic effects, it has high biocompatibility and marked osteogenic potential, as well as an affinity for bone tissue. It doesn't induce a rejection reaction. However, HA has the high water solubility and high rate of its resorption in tissue culture (Hamraev, 1994), with is not so good for implantation material.

The injection of chemoresistant phase of wollastonite into Biositall reduces the solubility and the rate of resorption in tissue culture and this improves the quality of implantation material.

Biositacol (Russia) was used as CSAGM. The composite material CSAGM includes Biositall (80%) and collagen sponge.

METHODS

To study the osteoinductive characteristics of the implantation material we used Biositall in granules of 250-300 micron and collagen sponge.

The experiment was made on 18 rabbits (3 groups). In the first and the second groups the material have been implanted into perforated holes with a diameter 1,5-2 mm and 5 mm in depth, located in the mandible along the alveolar ridge between incisors and posterior teeth. One group was used as a control (perforated hole was filled with blood clots). Samples of implanted materials were taken after 3 and 7 days and than after 2, 4, 6, 8 weeks after implantation. Osteoinductive characteristics have been investigated by a histomorphologic technique according to osteoblast formation rate and site, their maturation into osteocytes which further formed bone trabeculas with bone plates construction.

RESULTS

In the control group of animals whose mandible perforations had been allowed to fill with blood clots, histologic examinations showed acute inflammation reactions in the periphery of the bone defects after seven days, After 2-4 weeks

the reproduction of fibroblasts and formation of connective tissue in the bone defect were observed. By the sixth week, the jaw bone defect was filled in with well formed mature connective tissue, and by the eighth week isolated bone tissue growths were observed as anastomosing to one another bone trabeculas.

In the first study group during Biositall granules (AGM) in the early stage of the experiment, 3-7 days after implantation, acute inflammation with lymphohistocytic reaction around the AGM granules was recorded. At the same time, by the second week multinucleated cells of foreign bodies appeared in all test groups. By the fourth week, lymphohistocytic infiltrates disappeared, and the multinucleated cells of foreign bodies had appeared to resolve the AGM granules. Surrounding the AGM granules, a great number of osteocytes had formed young conjunctive tissue which encapsuled almost every granule. By the sixth week, the histological preparations showed the formation of bone tissue in the periphery of the defect. Regenerated bone spicules in the process of mending developed the spongy structure of bone tissue. In the process the part of Biositall granules is resolved by foreign bodies giant multinuclear cells, and the part of granules is encapsulated by connective tissue and newly - formed bone trabeculas. The primary mineralization is characterized by both active formation of cells and the presence of calcifying calcospherite structures. An accumulation of the sulphatilated glycosaminoglycans that gives metachromasie during toluidine blue staining with pH - 3,2, has been noted in the young bone tissue.

By the eighth week, the process of osteogenesis around the AGM granules was far advanced everywhere. By this time the most of the Biositall granules are encapsulated with connective tissue and newly-formed bone trabeculas. In this case the quantity of the bone tissue in bone defect region is larger than in the intact regions of jaw bone cancellous area. This indicates an intensive osteogenesis around each Biositall granule.

In the second study group during the implantation of composite materials - Biositacol (CSAGM) at the third day the extensive osteoclastic response along defect borders has been noted, which nearly stops by the 7-th day and changes to a chronic one. Osteoblast proliferation along the defect borders comes in parallel with proliferation of young connective tissue cells by the 7-th day.

From the 7-th day to two weeks single osteoblasts appeared and proliferation of immature cells of collagen tissue was observed. Between implantate granules chronic inflammatory reaction has been shown with young connective tissue cells proliferation with forms fibroblast net between Biositall granules by the end of the second week. By the second week fibroblast net between AGM granules as well as single new-formed collagen fibers and single bone trabeculas at the defect borders appear. During the 4-th week the defect periphery was filled with bone trabeculas with their partial growth towards the centre. By the 6-th week osteogenesis was marked all over the defect.

Thus, the use of composite materials CSAGM, involving Biositall (80%) and collagen sponge, for implantation increases the rate of osteogenesis process.

CONCLUSION

Both AGM and CSAGM implantation promotes the reparative processes in bone injuries compared to the control group. In CSAGM implantation the histomorphological pattern of bone tissue formation appears two weeks earlier than in AGM implantation. The difference in direction of reparative processes in

bone has been observed: throughout the defect in the zone of AGM implantation and at the defect borders in CSAGM implantation.

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