COMPARATIVE EXPERIMENTAL-MORPHOLOGIC STUDY OF THE INFLUENCE OF CALCIUM-PHOSPHATE MATERIALS (CHRONOS, CEROSORB, COLLAPAN, OSTIM) ON REPARATIVE OSTEOGENESIS ACTIVIZATION

Berchenko G. N., Kesyan G. A., Urazgil'deev R. Z., Arsen'ev I. G., Mikelaishvili D. S.
CITO named by N.N. Priorov, Russia, Moscow

Introduction.

Plastic replacement of bone defects is one of the most urgent problems of modern traumatology and orthopedics. In recent years, are widely used for filling bone defects and activation of osteogenesis of various calcium phosphate materials. However, no works on the comparative study of the influence used in the clinic of various calcium phosphate materials for reparative osteogenesis. In the present study conducted a comparative experimental morphological study of the effect of some calcium-phosphate materials - ChronOS, Ostim,

Materials & Methods

We investigated the following calcium-phosphate materials: Cerasorb - granules of ß-tricalcium-phosphate ceramics («Curasan», Germany); ChronOS - granules of ß-tricalcium-phosphate ceramics («Mathys Medical Ltd» Switzerland); Ostim - synthetic hydroxyapatite of ultrahigh dispersity in the form of paste («Osartis», Germany); CollapAn - biocomposite material, containing synthetic nanohydroxyapatite, collagen, and antibiotic («Intermedapatit», Russia);

Cerasorb

ChronOS

Ostim

Collapan

The study was conducted on 75 male rats.The test materials were implanted into the metaepiphyseal defect (diameter and a depth of 3.5 mm) of the tibia (Fig.№ 1). In the control group of animals bone defect heal on their own, in the second group, ChronOS pellets were implanted into the defect, in the third - Cerasorb granules, in the fourth - Ostim paste, in the fifth - CollapAn granules. Material from the area of the bone defect was histologically examined at 30, 60 and 90 days after surgery.

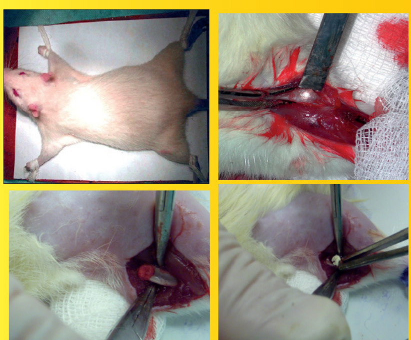

Fig. 1. Implantation of biomaterials studied in the metaepiphyseal defect of the tibia.

Results & Discussion

30 days after surgery

When implanted ceramics Chronos, in its pores to this term of study was determined the active growth of loose connective tissue (Fig. 2a). Only in some areas on the surface of the ceramic pore walls are formed immature bone trabeculae. When implanted ceramics Cerasorb, in its pores also was detected the growth of loose connective tissue, and only in some peripheral areas - the newly formed trabeculae of immature bone (Fig. 2b). When using paste Ostim, in the bone defect were found numerous gaps of various sizes, filled with this paste (Fig. 2c). These gaps were surrounded by thin trabeculae of newly formed bone. The newly formed bone, osteoid type was formed directly on the surface of the paste Ostim. When implanted composite material CollapAn in bone defect was defined an array newly formed bone, bone marrow hematopoietic elements. The bone osteoid type was formed directly on the surface CollapAn. Inside the newly-formed bone remained resorbable particles CollapAn (Fig. 2c).

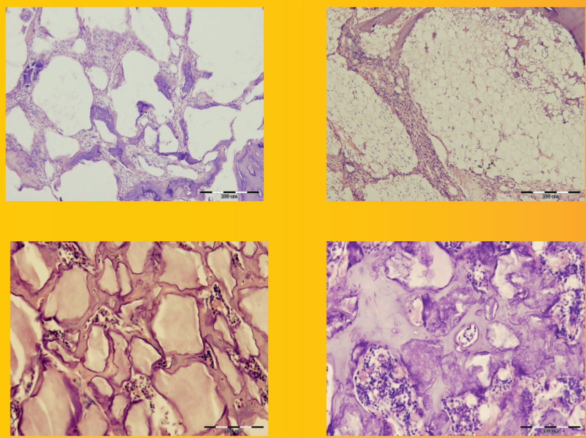

Fig. 2. 30 days after implantation of biomaterials: a) Formation trabeculae (BT) inside the pores of ceramics Chronos. H&E, x200; b) Formation of loose connective tissue (CT) and single immature bone trabeculae (BT) within the pores and on the surface of ceramics Cerasorb. H&E, x200; c) In the bone defect can see numerous gaps filled with gel Ostim, which are formed on the surface of immature bone trabeculae (CT). H&E, x400; d) Formation reservoir newly bone trabeculae (BT) in which the particles are determined CollapAn (Col). H&E, x400.

60-90 days after surgery

In the second and third groups of animals is a further gradual substitution of ß-tricalcium-phosphate ceramics by newly formed bone. At the same time inside the pores of ceramics chronos, compared with C erasorb are found more numerous newly formed bone trabeculae (Fig. 3a.b). In the fourth group of animals in the newly formed bone revealed large cavities filled with gel Ostim (Fig. 3c), which, apparently, inhibits the formation and maturation of bone. In the fifth group of animals in the area of bone defect is determined by the most mature newly formed bone, which is characterized by a lamellar structure and formation of osteons (Fig. 3d). In some areas determined by the fine particles resorbable CollapAn.

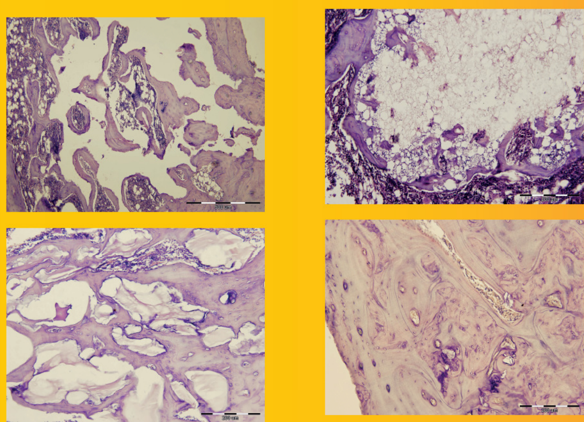

Fig. 3. 90 days after implantation of biomaterials: a)Formation of newly formed bone trabeculae and bone marrow elements within the pores of ceramics Chronos. H&E, x 100. B)Formation of newly formed bone trabeculae within the pores of ceramics Cerasorb. H&E, x 200. C) In the bone defect remain large gaps filled with gel Ostim. H&E, x 200. D) In the newly formed bone, characterized by lamellar structure and formation of osteons, revealed some small

Surface structure implanted CollapAn defines selective absorption on the surface of non-collagenous extracellular matrix proteins - fibronectin, vitronectin, osteocalcin, bone sialoprotein, endogenous bone morphogenetic proteins and osteogenic and others that contribute to the subsequent adhesion of precursor cells of osteoblasts and their proliferation, differentiation and synthetic activity of osteoblasts .

Conclusions

All the studied materials contributed to the formation on their surface of newly formed bone. The most prominent activation of the reparative osteogenesis observed after implantation of a biocomposite material CollapAn and less marked at paste Ostim implantation. The least pronounced formation of newly formed bone was observed after implantation of ceramics Chronos, and especially Cerasorb.

Futher information: berchenko@cito-bone.ru

TERMIS World Congress Vienna, Austria September 5-8, 2012