

BONE MECHANICAL PROPERTIES WITH CHITOSAN–HYDROXYAPATITE COMPOSITE IMPLANTS: A RAT MODEL

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Mechanical properties of bone are basic parameters which reflect the structure and function of bone. Bone has adaptive mechanisms which give the tissue the ability to repair itself, altering its mechanical properties and morphology in response to increased or decreased function. Bone fracture leads remodeling of whole bone tissue not only the fracture area. Several studies show that bone implants change mechanical properties of whole bone and bone-implant interface. But we can't find results about the bone hardness on implantation of the chitosan–hydroxyapatite composite biomaterials to the bone defect.

In this study a series of biocompatible chitosan/hydroxyapatite (ChAp) composites has been synthesized in an aqueous medium from chitosan solution and soluble precursor salts by a one-step coprecipitation method. For the in vivo tests, 48 laboratory rats 4 months old were used. Perforated defects, diameter 2 mm were made in a sterile operating room with a stomatological borer in the middle third of the right tibia of the animals. The 50/50 ChAp scaffolds were chosen for in vivo evaluation. In the experimental group of animals the cylindrical ChAp rods were implanted into the trauma; the diameter of the rods being equal to the width of the wound channel. The control group consisted of rats with analogous tibial defects not filled with the investigated material. The animals were taken out of the experiment 24 days after implantation. We evaluated bone microhardness (the tissue level), compressive and tensile strength of whole bone.

Our results suggested that bone tissue close to the defect has less microhardness in control group that show stimulating effect of the ChAp to the bone remodeling on bone-implant interface. Far from the defect our data also show positive effect on microhardness of bone tissue. Compressive and tensile strength significantly decrease on control group that show change of whole bone remodeling during the fracture healing. In the experimental group compressive and tensile strength significantly increase mechanical properties in comparison of control group. The present results support previous histologic findings that ChAp increase the bone healing rate and improves bone maturation and remodeling.