学位論文内容の要約

学位論文題目

Assessment of bone forming ability of apatite-coated collagen scaffold prepared by a precursor-assisted biomimetic process

（前駆体を利用した生体模倣プロセスにより作製されたアパタイト被覆コラーゲンスキャフォールドの骨形成能の評価）

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Abstract

Three-dimensional collagen scaffold (CS) coated with low-crystalline apatite via a precursor-assisted biomimetic process reportedly enhanced cellular responses and blood vessels formation. In this study, Osteogenic properties of apatite-coated collagen scaffold (Ap-CS) were examined by in vitro cell culture tests and rat bone forming tests.

After oxygen plasma treatment, CS was alternately dipped in $CaCl_2$ and $K_2HPO_4 \cdot 3H_2O$ solutions to be pre-coated with CaP. Subsequently, the CS was immersed in a supersaturated CaP solution to be coated with apatite. The resulting Ap-CS was characterized by observation using a scanning electron microscope (SEM), and assessments of water absorption, Ca ion release, protein adsorption and enzyme resistance. Cytotoxic tests and real-time RT-PCR were carried out using MC3T3-E1 osteoblastic cells. In addition, bone forming ability of Ap-CS was histologically evaluated after implantation onto the rat skull.

SEM observation revealed that the surface of Ap-CS was covered with nanostructured deposition. It is considered that a layer of low-crystalline apatite was formed on CS through the precursor-assisted biomimetic process as reported previously. Ap-CS significantly increased water adsorption, Ca ion release, cationic protein adsorption and resistance to collagenase enzymatic effect, compared with CS. In cell culture studies, Ap-CS decreased the cell proliferation, however, the expression of bone formation markers, such as bone sialoprotein and osteocalcin, was promoted compared with CS. Ap-CS significantly promoted new bone augmentation of rat skull. Furthermore, residual scaffold was slight when compared to CS. In conclusion, Ap-CS exhibited bone forming activity to be beneficial for bone tissue engineering therapy.