International Journal of Pharmacy and Technology, 2016, vol.8, N4, pages 24261-24271

The evolution of the trabecular bone at a constant combined loading

Shigapova F., Gerasimov O., Sachenkov O.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016, International Journal of Pharmacy and Technology. All rights reserved.This paper deals with the mathematical model of restructured bone tissue under the influence of external forces. The mathematical model has been formed on the basis of Wolff law in the Cowin mathematical formulation. The paper considers a number of model problems: all-around compression with single-direction weakening, the problem of torsion and the problem of uniform compression with stress tensor rotation at a predetermined angle. We have calculated the relative change in the solid volume and the components of the structure tensor (tissue tensor), the solution was considered the convergence of asymptotic behavior of the strain tensor components to the value of - 0.0015, which meant lazy zone. It was noted in the problem of all-around compression that the bone microstructure comes in homeostatic balance regardless of the size and sampling of the parameter of weakening. It was noted in the problem of torsion that an increase in the tangential components of the structure tensor results in significant variation of the behavior of the solid volume and the components of structure tensor. In the problem of stress tensor rotation, the components of structure tensor change first, which is consistent with Wolff law – the bone tissue is rearranged along the lines of principal stresses.

Keywords

Biomechanics, Evolutionary tissue restructuring, Orthotropic biological structures, Structure tensor