

Estimation of apparent elastic moduli of trabecular bone considering biological apatite (BAp) crystallite orientation in tissue modulus

Abstract

This study presents a prediction of apparent elastic moduli of vertebral trabecular bone using the homogenization method. A micro-finite element (FE) model of trabecular bone was reconstructed from a sequential of cross-section micro-CT image by converting bone voxels to brick elements. Eight regions of interest (ROIs) were extracted from lumbar vertebra bone specimens of healthy and osteoporotic. The homogenization method and finite element method was employed to analyse the microscopic trabecular bone. Bone tissue property was modeled as orthotropy material considering the biological apatite (BAp) crystallite orientation. This research focuses on the effect of morphological different between healthy and osteoporotic bones to the apparent elastic moduli. The change of degree of anisotropy was also discussed. Comparison of the calculated Young's moduli in vertical axis with Keyak et al.'s experimental result showed good agreement and proved the reliability of the numerical model.

Keywords; Apparent Elastic Moduli, BAp Crystallite, Homogenization Method, Trabecular Bone