

Title:

Influence of bone marrow characteristic and trabecular bone morphology on bone remodelling process with FSI approach

Journal:

Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications, Volume 236, Issue 8, August 2022.

Document Type:

Article

Authors:

AAR Rabiatal,
Devi Rianti,
SJ Fatihhi, mohdalfatihhi@unikl.edu.my
Amir Putra Md Saad,
Zulfadzli Zakaria,
Anita Yuliati,
MN Harun,
MRA Kadir, Andreas Öchsner,
Tunku Kamarul,
Khalid M Saqr,
Ardiyansyah Syahrom.

Full text link:

Publisher : <https://journals.sagepub.com/doi/abs/10.1177/14644207221080115>

Scopus preview:

<https://www.scopus.com/record/display.uri?eid=2-s2.0-85125525290&doi=10.1177%2f14644207221080115&origin=inward&txGid=efe58c569aee908d07ad8eea16cb7c6>

Abstract:

While doing daily physiological activities, the trabecular bone will experience a certain amount of deformation which leads to the bone marrow movement. The movement can affect the bone remodelling process and the properties of the bone itself. The bone marrow plays a role as a hydraulic stiffening of the trabecular structure. However, previous studies analysed on trabecular bone and bone marrow separately, which is not considered as the actual condition. Thus, it is crucial to consider combine analyses of the bone marrow with the trabecular structure simultaneous. The aim of this study is to investigate the effect of bone marrow on the mechanical environment and the structure of trabecular bone during normal walking loading. Hence, this study used the Fluid-Structure Interaction (FSI) approach as a finite element method to discover the effect of bone marrow to the trabecular structure and vice versa. The findings show the shear stress value along normal walking phase was found in a range of 0.01–0.27 Pa which is sufficient to regulated cell response minimally. This study provides insight into understanding the related mechanobiological responds towards supply of nutrients onto bone cells.