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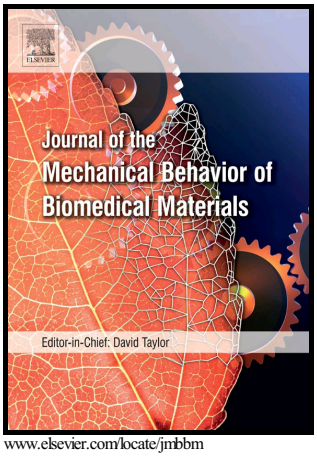

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Impact response and energy absorption of human skull cellular bones

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Abstract

A skull fracture, due to a composition of typical lightweight cellular structures, is the most common type of traumatic brain injury. This paper presents a systematic investigation on the failure mechanism and energy absorption of skull cellular bones under low- and medium-velocity impact loadings. Non-destructive three-dimensional micro-computed tomography (Micro-CT) is utilized to scan samples of human skull cellular bones, and relevant structural parameters are obtained to reconstruct a finite element (FE) model of these bones. Micro-structures, mechanical properties, and failure process analysis of human skull cellular bones under impact loadings are investigated. The effects of some typical parameters, such as impact velocity and angle, impactor shape and density, and various reconstructed sections on the impact behavior of human skull cellular bones are investigated. Their impact properties and energy absorption are summarized. The present work will be of great significance in understanding the mechanical mystery of human skull cellular bones under impact loading.

Keywords: Cellular structure; Skull bone; Energy absorption; Failure mechanism; Impact

1. Introduction

Human skull bone is an inhomogeneous biomaterial and it plays an important role in the safety of human life. The impact of foreign objects in accidents, wartime shrapnel, or building collapses is a common cause of skull trauma. A comprehensive

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