

# Author's Accepted Manuscript

Drilling in cortical bone: A Finite element model and experimental investigations

Waqas A Lughmani, Kaddour Bouazza-Marouf, Ian Ashcroft



[www.elsevier.com/locate/jmbbm](http://www.elsevier.com/locate/jmbbm)

PII: S1751-6161(14)00342-7  
DOI: <http://dx.doi.org/10.1016/j.jmbbm.2014.10.017>  
Reference: JMBBM1306

To appear in: *Journal of the Mechanical Behavior of Biomedical Materials*

Received date: 22 July 2014  
Revised date: 29 October 2014  
Accepted date:  
31 October 2014

Cite this article as: Waqas A Lughmani, Kaddour Bouazza-Marouf, Ian Ashcroft, Drilling in cortical bone: A Finite element model and experimental investigations, *Journal of the Mechanical Behavior of Biomedical Materials*, <http://dx.doi.org/10.1016/j.jmbbm.2014.10.017>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## Drilling in cortical bone: A Finite element model and experimental investigations

Waqas A Lughmani<sup>a</sup>, KaddourBouazza-Marouf<sup>a</sup>, Ian Ashcroft<sup>b</sup>

<sup>a</sup>Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, LE11 3TU, Leics, UK

<sup>b</sup> Department of Mechanical, Material and Manufacturing Engineering, The University of Nottingham, NG7 2RD, Nottingham, UK

Corresponding Author: Waqas A Lughmani , email: W.A.Lughmani@lboro.ac.uk

Telephone: +44 (0) 1509227566

### Abstract

Bone drilling is an essential part of many orthopaedic surgery procedures, including those for internal fixation and for attaching prosthetics. Estimation and control of bone drilling forces are critical to prevent drill-bit breakthrough, excessive heat generation, and mechanical damage to the bone. An experimental and computational study of drilling in cortical bone has been conducted. A 3D finite element (FE) model for prediction of thrust forces experienced during bone drilling has been developed. The model incorporates the dynamic characteristics involved in the process along with geometrical considerations. An elastic-plastic material model is used to predict the behaviour of cortical bone during drilling. The average critical thrust forces and torques obtained using FE analysis are found to be in good agreement with the experimental results.

*Keywords: Bone drilling, Orthopaedic surgery, Finite element, Experimental testing, Yield surface*

Download English Version:

<https://daneshyari.com/en/article/7208495>

Download Persian Version:

<https://daneshyari.com/article/7208495>

[Daneshyari.com](https://daneshyari.com)