

Author's Accepted Manuscript

A novel fracture mechanics model explaining the axial penetration of bone-like porous, compressible solids by various orthopaedic implant tips

Sloan A. Kulper, KY Sze, Christian X. Fang, Xiaodan Ren, Margaret Guo, Kerstin Schneider, Frankie Leung, William Lu, Alfonso Ngan



PII: S1751-6161(18)30029-8
DOI: <https://doi.org/10.1016/j.jmbbm.2018.01.025>
Reference: JMBBM2664

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

Received date: 31 August 2017
Revised date: 9 January 2018
Accepted date: 23 January 2018

Cite this article as: Sloan A. Kulper, KY Sze, Christian X. Fang, Xiaodan Ren, Margaret Guo, Kerstin Schneider, Frankie Leung, William Lu and Alfonso Ngan, A novel fracture mechanics model explaining the axial penetration of bone-like porous, compressible solids by various orthopaedic implant tips, *Journal of the Mechanical Behavior of Biomedical Materials*, <https://doi.org/10.1016/j.jmbbm.2018.01.025>

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.

A novel fracture mechanics model explaining the axial penetration of bone-like porous, compressible solids by various orthopaedic implant tips

Sloan A. Kulper¹, KY Sze², Christian X. Fang^{1*}, Xiaodan Ren³, Margaret Guo⁴, Kerstin Schneider⁵, Frankie Leung¹, William Lu¹, Alfonso Ngan²

¹Department of Orthopaedics & Traumatology, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China

²Department of Mechanical Engineering, Faculty of Engineering, The University of Hong Kong, Hong Kong, China

³School of Civil Engineering, Tongji University, Shanghai, China

⁴Stanford University School of Medicine, Stanford, USA

⁵Schulthess Clinic Zurich, Zurich, Switzerland.

* **Corresponding Author:** Dr. Christian Fang, FRCS, Clinical Assistant Professor, Department of Orthopaedics and Traumatology, Queen Mary Hospital, The University of Hong Kong, Tel.: +(852) 22554581, fax: +(852) 28174392, cfang@hku.hk

Abstract:

Many features of orthopaedic implants have been previously examined regarding their influence on migration in trabecular bone under axial loading, with screw thread design being one of the most prominent examples. There has been comparatively little investigation, however, of the influence that implant tip design has on migration under axial loads. We present a novel fracture mechanics model that explains how differences in tip design affect the force required for axial penetration of porous, compressible solids similar to trabecular bone. Three tip designs were considered based on typical 5 mm diameter orthopaedic locking screws: flat and conical tip designs, as well as a novel elastomeric tip.

Ten axial penetration trials were conducted for each tip design. In order to isolate the effect of tip design on axial migration from that of the threads, smooth steel rods were used. Tip designs were inserted into polyurethane foam commonly used to represent osteoporotic trabecular bone tissue (ASTM Type 10, 0.16 g/cc) to a depth of 10 mm at a rate of 2 mm/min,

Download English Version:

<https://daneshyari.com/en/article/7207153>

Download Persian Version:

<https://daneshyari.com/article/7207153>

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