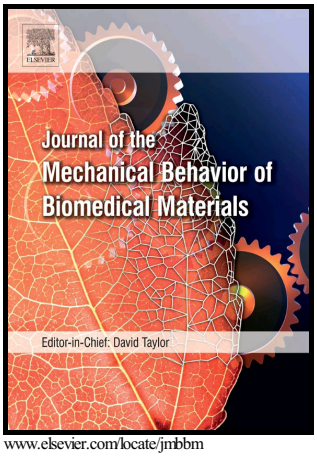
A novel use of 3D printing model demonstrates the effects of deteriorated trabecular bone structure on bone stiffness and strength

Meir Max Barak, Margaret Arielle Black



www.elsevier.com/locate/jmbbm

PII: S1751-6161(17)30545-3
DOI: https://doi.org/10.1016/j.jmbbm.2017.12.010
Reference: JMBBM2613

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

Received date: 6 September 2017
Revised date: 24 October 2017
Accepted date: 6 December 2017

Cite this article as: Meir Max Barak and Margaret Arielle Black, A novel use of 3D printing model demonstrates the effects of deteriorated trabecular bone structure on bone stiffness and strength, *Journal of the Mechanical Behavior of Biomedical Materials,* https://doi.org/10.1016/j.jmbbm.2017.12.010

A novel use of 3D printing model demonstrates the effects of deteriorated trabecular bone structure on bone stiffness and strength

Meir Max Barak[a*] and Margaret Arielle Black[a]

a. Department of Biology, Winthrop University, Rock Hill, SC 29733 USA

* Corresponding author:

Meir Max Barak

Department of Biology

Winthrop University

Rock Hill, SC 29733 USA

Phone: 1-803-323-2111 ext. 6433

Fax: 1-803-323-3448

E-mail: barakm@winthrop.edu

E-mail addresses:

Margaret A. Black blackm10@mailbox.winthrop.edu

Abstract

Trabecular bone structure is crucial to normal mechanical behavior of bones. Studies have shown that osteoporosis negatively affects trabecular bone structure, mainly by reducing bone volume fraction (BV/TV) and thus increasing fracture risk. One major limitation in assessing and quantifying the effect of this structural deterioration is that no two trabecular structures are identical. Thus, when we compare a group of healthy bones against a different group of bones that experienced resorption (i.e. decreased BV/TV) we only discover an "average" mechanical effect. It is impossible to quantify the mechanical effect of individual structural deterioration for each sample, simply because we never have the same sample in both states (intact and deteriorated structure). 3D printing is a new technology that can assist in overcoming this issue. Here we report a preliminary study that compares a healthy 3D printed trabecular bone model