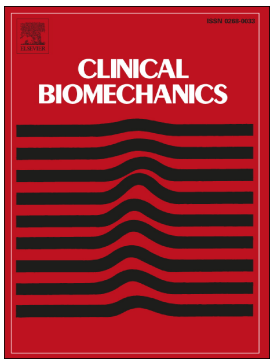

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PII: S0268-0033(18)30389-9
DOI: doi:10.1016/j.clinbiomech.2018.09.009
Reference: JCLB 4598

To appear in: *Clinical Biomechanics*

Received date: 1 May 2018
Accepted date: 4 September 2018

Please cite this article as: B. Santos, C. Quental, J. Folgado, M. Sarmento, J. Monteiro , Bone remodelling of the humerus after a resurfacing and a stemless shoulder arthroplasty. Jclb (2018), doi:10.1016/j.clinbiomech.2018.09.009

Bone remodelling of the humerus after a resurfacing and a stemless shoulder arthroplasty

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Declarations of interest: none.

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Abstract

Background - New implant designs, such as resurfacing and stemless implants, have been developed to improve the long-term outcomes of the shoulder arthroplasty. However, it is not yet fully understood if their influence on the bone load distribution can compromise the long-term stability of the implant due to bone mass changes. Using three-dimensional finite element models, the aim of the present study was to analyse the bone remodelling process of the humerus after the introduction of resurfacing and stemless implants based on the Global C.A.P. and Sidus Stem-Free designs, respectively.

Methods - The 3D geometric model of the humerus was generated from the CT data of the Visible Human Project and the resurfacing and stemless implants were modelled in Solidworks. Considering a native humerus model, a humerus model with the resurfacing implant, and a humerus model with the stemless implant, three finite element models were developed in Abaqus. Bone remodelling simulations were performed considering healthy and poor bone quality conditions. The loading condition considered comprised 6 load cases of standard shoulder movements, including muscle and joint reaction forces estimated by a multibody model of the upper limb.

Findings - The results showed similar levels of bone resorption for the resurfacing and stemless implants for common humeral regions. The regions underneath the head of the resurfacing implant, unique to this design, showed the largest bone loss. For both implants, bone resorption was more pronounced for the poor bone quality condition than for the healthy bone quality condition.