Citation for published version:

Publication date:
2014

Document Version
Early version, also known as pre-print

Link to publication

University of Bath

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
A NOVEL METHOD TO MEASURE THE MICROMOTION OF ACETABULAR CUP AFTER TOTAL HIP REPLACEMENT

E.A. Crosnier*, P. Keogh*, A.W. Miles*
* Centre for Orthopaedic Biomechanics, Department of Mechanical Engineering, University of Bath

Research Summary
The amount of initial stability is an important factor in determining the level of osseointegration press-fit cups will achieve. Most methods used to assess cup stability do not reproduce physiological loading conditions and use simplified spherical cavity models. The aim of this study was to determine whether using spherical cavities over-estimates the stability of the cup compared to a more anatomical, but still simplified model of the acetabulum. A secondary aim was to assess a novel method for measuring the micromotion of the cup.

Methods
The model tests M

Introduction
A press-fit cup was inserted into Sawbones foam blocks with two different cavity geometries: a spherical one and a more physiological one. The stability of the cup was assessed in two ways: a novel method of measuring the micromotion of the cup under physiological loading, and a uniaxial push-out test.

The results indicate that the micromotion was greater with the more physiological acetabular model. The push-out force is greater for the spherical model. Considering these results, it may be considered that acetabular models with a spherical cavity over-estimate the initial stability of the press-fit cup. These initial results also demonstrate the reliability of the novel method used to measure the micromotion of the cup under physiological loading.

Hypothesis
The aim of this study was to demonstrate that using simplified hemispherical cavities as an acetabular model over-estimates the stability of press-fit cups.

Methods
A press-fit cup (Trident, Stryker) was inserted into six reamed polyurethane foam blocks (Sawbones; density=0.48 g/cm³). Two acetabular cavity geometries were investigated: the first one was a spherical cavity and the second a more physiological geometry. The more physiological geometry modelled the pinching effect of the acetabular columns and the non-supportive areas of the acetabular notch and the radiolucent triangle (Fig. 1).

Discussion and Conclusion
The micromotions measured during cyclic loading are below 150 µm and are similar to published values from cadaveric studies [2]. The push-out forces are similar to published pull-out forces [3].

Differences in micromotion and in push-out forces show that acetabular geometry has an important effect on cup stability. As the more physiological model was validated in a previous study using cadaveric pelvis [4], the results obtained with this model are most likely the more physiological ones. Therefore, it may be considered that the spherical geometry over-estimates the stability of press-fit cups.

Significance
The novel measurement method used in this study, combined with a more physiological acetabular model, provides an insight into how a cup behaves in vivo. With further development, it could become a key method for pre-clinical testing.

Key References