Author's response to reviews

Title: Effects of Stemmed and Nonstemmed Hip Replacement on Stress Distribution of Proximal Femur and Implant

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Version: 2
Date: 4 July 2014

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Version: 1 Date: 21 April 2014
Reviewer: Zong-Ping Luo

Discretionary Revisions

In this study, two major generic hip implant designs named stemmed system and non-stemmed system were quantitatively evaluated using finite element analyses. The method and results were well presented. The conclusion was straightforward and understandable. The study computationally proved that non-stemmed implant have similar load-transferring pattern to intact hip, better than stemmed one. However, some limitations needed to be clarified. Validation step of hip finite element model should be presented to assure the reliability and accuracy of the model.

1. Thank for the reviewer's comments. The validation steps of this finite-element model have been described in the previous study of the current authors [36] (page 9, lines 3-4).

Specific comments:

Page 8 line 15: Since this model is quasi-static model, the meaning of the micro-motion analysis at bone-cup interfacial in this study was limited; it was suggested to conduct during walking. Moreover, micro-motion of implant could happen in three dimensions due to varied loading forces.

1. Thanks for the reviewer's suggestion. The gate cycle of normal walking can be divided into two phases: swing and stance. During swing phase, the instrumented hip is not subjected to body weight and ground reaction. After heel strikes, the articular loads of the instrumented hip reach the maximum at the mid-stance phase that another foot is swinging in the air. This study assumed the worst case of the bone-cup separation occurs at the mid-stance phase and used the vertical micro-motion as the separation index. Consequently, the hip loads at the swing phase were excluded from the finite-element simulation of this study.

Page 12 line 24: Optimization design analysis of non-stemmed implant could be more informative for readers in the future study.

1. Thanks for the reviewer’s remind. The predicted results aimed to evaluate the biomechanical properties of the non-stemmed hip prostheses. The results demonstrated the biomechanical superiority of the non-stemmed hip prosthesis significantly over the stemmed counterparts. The optimization design of the non-stemmed hip prosthesis is not the major topic of this study. Besides, the
long-term stability of the femur-prosthesis construct is one of the critical issues for the non-stemmed design. This involves some factors such neck-cup shape and cup-stabilizing mechanism and is not evaluated in this study. In terms of the numerical and experimental methods, optimization design analysis and long-term stability of non-stemmed hip prostheses have been the on-going issue of the current authors.

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests: all
Minor Essential Revisions:

The author didn't mention the risks of using hip resurfacing replacements. He can cite a lot of studies which show the risks of this kind of prosthesis.

1. Thanks for the reviewer's suggestion. The inherent risks of such hip resurfacing replacement have been described in the revised Introduction section (page 4, lines 6-10).

The author didn't explain why he used the v.Mises stress to indicate which prosthesis is better. although he could use the strain energy density as an index to compare the effect of different prosthesis on bones, as a lot of scientific papers concluded.

1. Thanks for the reviewer's comments. This study used the principle stress to predict the fatigue cracking that is the major mode of long-term failure for the metallic prostheses. The von Mises stress involves the compressive stress into the computation and serves as an equivalent indicator of strain energy. The compressive stress inhibits the initiation and prorogation of fatigue cracks, thus is not chosen to evaluate the failure risk of the different prostheses.

In describing the model the author didn't speak about the friction coefficient he used, although it is very important to modelling the contact condition.

1. Thanks for the reviewer's comment. The friction coefficients of the bone-cup and cup-screw interfaces have been given in the revised content (page 8, lines 1-2).

Another point in describing the model is that the author didn't mention the density of the bone material he used.

1. Thanks for the reviewer's comment. This study incorporated two types of cortical and cancellous bones to evaluate the biomechanical properties of the bone density and porosity. The values of the bone qualities were cited from the literature studies [30-33] and described in the Material and Method section (page 7, lines 23).

Level of interest: An article of importance in its field

Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.