Reviewer's report

Title: Accuracy of a non-invasive CT-based measuring technique for cement penetration depth in human tibial UKA.

Version: 0 Date: 30 Aug 2018

Reviewer: Elise C. Pegg

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I believe this research study has been performed well; however, I am concerned that the approach detailed will not be feasible to use clinically. This is for two main reasons: 1) UKRs are not routinely CT scanned after surgery (at least to my knowledge not in the UK) and 2) the time it would take to scan and then process the scans would be prohibitive. The authors are correct that it would be beneficial to be able to measure the cement penetration depth accurately clinically, but I believe surgeons would require this to be measurable from standard X-rays in a quick and simple manner.

Furthermore, this research is based on the premise that loosening is a result of cementing technique. Although this can be true, there can be other causes of implant loosening, such as polyethylene wear particles causing osteolysis or excessive mechanical loads. These have not been mentioned in the manuscript.

I think the clinical need for this research and how the authors expect it to be used should be conveyed more clearly. Please note, I am unfamiliar with metal artefact reduction algorithms (I have just used software which applies them), so I cannot comment on the novelty of the artefact reduction approach used in this study.

The methodology used seems reasonable to me and the results are clearly presented, but here are some questions the authors may wish to consider:

- Is a sample size of 12 sufficient?
- For the CT scan a thresholding approach was used to identify the cement region, but for the cut surfaces a 'magic wand' algorithm was used (I assume this is based on region-growing). Would it not be more rigorous to use the same/similar algorithm for both techniques?
- Would the CT scan HU thresholding approach work reliably in a clinical environment on patients with a variety of bone densities?
- Although there was no significant difference found between the two measurement techniques, given the small sample size and high variability is it possible that this result is due to Type II error?
- Should Bland-Altman plots not have units on the axes?
- A radiographer, with practice, can attain X-rays which are in line with the UKR tray (I know this because I have seen this done reliably). From an aligned X-ray of a UKR, would it not be possible to measure the cement penetration depth to a resolution sufficient to make a clinical judgement?

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

Yes

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Yes

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes

**Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?**
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I am able to assess the statistics

**Quality of written English**
Please indicate the quality of language in the manuscript:

Acceptable

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