Reviewer's report

Title: Validation of a measuring technique with computed tomography for cement penetration into trabecular bone underneath the tibial tray in total knee arthroplasty on a cadaver model.

Version: 3 Date: 27 June 2014

Reviewer: Matthew Teeter

Reviewer's report:

The ability to measure the cement mantle surrounding implants is of high importance to the field of arthroplasty, thus this article tackles a valid issue. The underlying ideas behind the methods are sound, but the execution does not appear optimal, and the organization of the article makes it more difficult to interpret.

Major Compulsory Revisions

1) The authors have provided an insufficient review of the literature. It seems unlikely that they are the first to use CT imaging to examine the cement mantle around implants in any manner (at least at other joints if not the knee). How do their methods compare? Some citations they offer are not really appropriate, e.g. Ho et al. used CT but not related to cement.

2) Similarly, the authors state their findings for the HU levels of various materials, but offer no comparison to literature values. This would be simple to add, and strengthen the validation of their findings.

3) For further validation purposes, the authors should provide information on how their CT scanner and/or scans themselves were calibrated, to provide greater confidence in their findings on HU levels. For example, was a phantom included in each scan with water and bone-mimicking material for calibration purposes?

4) The authors found no difference in the ROI of bone/cement with the implant in place. From experience I would expect the metal implant would have an effect on the surrounding bone/cement, with the effect dissipating further from the metal. It seems that the authors likely chose ROIs far away from the implant. It would strengthen the paper for the authors to examine multiple ROIs starting close to the implant and moving away, and compare values. How close or far can reliable cement information be measured?

5) In the introduction, the authors establish that the ideal cement mantle is 3-5 mm, but later in the results (e.g. Table 3) focus on a percentage. Since the clinically relevant value is the width of the cement, the authors should focus on this measurement.

Minor Essential Revisions
6) From Figure 2, it appears the authors focused on the axial plane (or at least its equivalent if this was in a human). Considering orthopaedic surgeons would be most familiar with A/P radiographs for looking at the cement mantle, I believe coronal views would be more instructive.

7) Considering the overlap in HU between bone cement and cortical bone, the authors should expand on the difficulties in segmenting the two materials and how this could affect clinical use of these methods.

Discretionary Revisions

8) It would be useful to discuss the meaning of the homogeneity values

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

**Quality of written English:** Needs some language corrections before being published

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

**Declaration of competing interests:**

I declare that I have no competing interests