Reviewer's report

Title: Osteoporosis Imaging: Effects of tissue preservation on MDCT-based trabecular bone microstructure parameters and finite element models

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Reviewer: Steven K Boyd

Reviewer's report:

The authors investigated the potential effect of bone preservation of up to 6 months by freezing samples or fixation in formalin on bone microarchitecture. Using MDCT, FEM, and mechanical testing the authors could not find a significant difference in bone microarchitecture, FEM results, and mechanically tested failure load within each preservation method or between the two. Thus, the authors conclude that both methods are suitable preservation methods for bone. This paper will be beneficial to readers considering the large number of studies performed of preserved bones.

Overall, it is generally well written. However, the Results and Discussion section are combined, which is unusual. It is recommended to separate those sections formally. Furthermore, there is specific information missing from the Results section, such as a table for failure load. Please add these details. Finally, the Discussion repeats introductory material and is unnecessarily long. Please write it more concisely.

SPECIFIC COMMENTS

The title could be more specific: e.g. “bone preservation” instead of “tissue preservation”.

Please add figure captions.

Considering the already low number of samples/donors why were the vertebrae harvested not the same for each cadaver? It is states that 4 vertebrae where harvested between the 5 and 12 thoracic vertebra. Why not always harvest the same one: e.g. 5-8?

Did all donors have osteoporosis? It is only stated that all bone diseases but osteoporosis were an exclusion criterion but not whether or not the donor actually had OP. Please indicate whether bones were from donors with OP.

I assume that uniaxial compression tests were performed. Please clarify.

There is a difference between spatial resolution and voxel size. I assume the 250x250x600µm3 is voxel size, not spatial resolution. Please clarify.

Please justify the ROI placement, and why the entire vertebral body not used? The reference to the study using this protocol is not sufficiently informative. Please give a brief reasoning for this decision. This is particularly important as the FEM was applied to the entire vertebral body while the other parameters were extracted from only that 15 slice ROI.
What is meant by “ROI were drawn in the phases of the calibration phantom”? Please clarify.

The German word “Probe” translates into “sample” and not “probe”.

There are a several grammatical mistakes in this paper. For example, in the Methods, page 5, line 17-20 is unclear. Thorough editing of grammar would be beneficial.

Several times context was not explained very efficient or even confusing. E.g. page 4, line 9 “…BMD values of patients with and without OP fracture overlap…” could be restated more elegantly.

Page 4, line 8: DXA measures 2D areal BMD (aBMD) while CT measures 3D volumetric BMD (vBMD). This is not distinguished in this paper, but should be.

Osteoporosis is characterized by a reduction in bone mass, which in turn reduces bone strength. This is not clearly defined on page 4, line 2 (as well as other locations such as the Abstract). Please clarify.

At several occasions the following reference is used: “These computational methods” which is clearly refereeing to more than one previously introduced method. However, the only method introduced prior to this statement is FEM. Please correct.

Preference is to use “mechanical testing” instead of “biomechanical testing”.

“Destructive biomechanical testing” could be rephrased as “mechanical testing to failure”.

Vertebral body vs. vertebra: It would be more accurate to state the ROI placement and Figure 2 (FEM) are in the vertebral body.

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