Reviewer's report

Title: Characterization of a rat osteotomy model with impaired healing

Version: 1 Date: 30 June 2008

Reviewer: Sandra J Shefelbine

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Review: Characterization of a rat osteotomy model with impaired healing

This manuscript details the mechanics and histomorphometry of a rat tibia osteotomy as a model for impaired fracture (delayed union).

General comments:

1. Distinction needs to be made between what was done particularly for this study and what has been done before. For example, it seems as if the closed tibial fracture methods and results have been published elsewhere. Comparison to the fracture method should by all means be discussed in the Discussion. However, since the results are already published, this study does not belong in the Methods and Results section. Is there anything new from the fracture model that has not been published before? If not, keep it in the Discussion.

2. There are a lot of figures. Some of the figures do not add much (ex. Fig 7,d and e). Some might be better represented as tables.

3. There is currently some discussion about whether torsional testing of bones (especially at low strain rates) is appropriate and realistic. In this paper, at least it is being used comparatively (between groups differences), but the question is still worth asking – to what does torsional strength relate? Torsion testing is often favored because it produces constant stress along the length of the shaft. However, this is only true for cylinders. The tibia is quite curved. How does this affect results? What do the results mean? What errors might occur?

4. I am not sure that the evidence supports the claim that delayed healings were due to persistent early infection, or if it is so is this a useful experimental model of early non-union?

Specific comments: (page,line)

Abstract;

1. (1,18) Is the new bone really trabecular bone or more accurately woven bone? Same throughout manuscript.

Background

2. (2,8) ‘it is practised to verify their efficacy’ is poor English. Perhaps, ‘it is necessary to verify . . . .’
3. (2,23) The description of intramembranous and endochondral ossification does not fit here. The previous description of healing phases is endochondral (callus formation). In your work you just have endochondral. Do you even need to mention intramembranous?

4. (2,26) ‘also:’ change to ‘also called’

5. (2,30) ‘are termed as vital’ this phrase is unclear. What is vital? Hypertrophic non-unions?

6. (3,1) The interaction ‘of the latter’ refers to what? movement and blood supply? ‘Latter’ refers to only blood supply.

Methods
7. (5,29) ‘corticalis’ is German? Perhaps ‘cortical bone’

8. Questioned whether description of fracture model is needed. (See above comment)

9. The technical description of the biomechanical testing is a little vague, and a diagram displaying the test set up might be useful or helpful.

Results:
9. (7,15) These values would be much more clear in a Table format rather than in the text. You could indicate in the Table which were statistically significant (and delete the figures).

10. (7,20) Did the closed tibial fracture animals really achieve 125% and 174% of the contralateral unfractured strength? Is this an anomaly due to torsional testing?

Discussion
11. (10,18) Fixateur externe = external fixator in English

12. (11,5) ‘Desmal formed trabecular bone’ – How do you know it is intramembranously formed if there is also cartilage present. Is it really trabecular bone?

13. (11,24) Delete ‘it has to be borne in mind’ and rephrase as ‘Tibial osteotomy has a higher chance of infection than closed fracture.’

14. (11,27) Delete ‘But’

15. (11,30) All animals were stabilized with a pin, however animals did not necessarily have the same stability. Fracture fragments may serve to add stability. This could be tested quite simply in vitro. Was it? If not, why not? This could deliver pertinent information about the mechanics of the fracture at the very beginning.

16. (12,3) Does more cartilage mean more instable? I think it depends on the
context. How do you know your fracture is more instable?

**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.