Reviewer’s report

Title: Less than full circumferential fusion of a tibial nonunion is sufficient to achieve mechanically valid fusion - Proof of concept using a finite element modeling approach

Version: 2
Date: 2 August 2014
Reviewer: William Lack

Reviewer’s report:

Major Compulsory Revisions:

The use of finite element analysis to study the necessary degree of bridging necessary to achieve a stable union is interesting and the authors demonstrate significant technical expertise. However, the clinical question, whether minimally invasive grafting can be used to achieve union is not addressed with the methods employed. The FE analysis answers a different question: if localized bridging occurs, could this be expected to produce a stable union. Successful minimally invasive grafting is several steps beyond this and implies that localized bone grafting is as successful as open bone grafting in achieving localized or greater union. This is not demonstrated by the data presented, but the background and conclusions insinuate that it is. The articles cited by the authors that support localized grafting are small case series with poor inclusion criteria. In fact, I would interpret the authors findings in an opposite way with respect to the articles presented. If only localized bridging is required (which I believe the authors are correct in stating), then perhaps the patients in these studies that mostly consisted of only limited bone defects were going to heal anyways - these are not randomized studies with critical sized bone defects.

In this way the conclusions are not supported by the data. However, the data remains intriguing and useful. I would recommend that before publication the authors reframe the findings in the setting of defining union. This study supports recent clinical findings (article below) that only unicortical bridging is necessary on early radiographs to predict final union (a stable tibial fracture construct only require partial bridging).

Any Cortical Bridging Predicts Healing of Tibial Shaft Fractures.
Lack WD1, Starman JS2, Seymour R3, Bosse M3, Karunakar M2, Sims S2, Kellam J4.

Further, the data support that limited bone defects likely don’t need to be bone grafted - because if the fracture bridges where there is bone contact, that defect doesn't matter.

Minor Essential Revisions:
English is not the authors’ primary language. Their command of the language is much better than my command of their primary language, but the article needs to be reviewed by professional writer to improve the grammatical errors. I have included the grammatical issues that I noted below.

1. The authors use both present and past tense for verbs (are and were) in the article. The tense should not switch between past and present and I believe past tense (using was and were) is more appropriate in this case.

2. The word extend is used in multiple locations when I believe "extent" should be employed.

3. Line 70: remove "basically"

4. Line 74: biomechanics should be replaced with "biomechanics"

5. Line 99: reword

6. Line 102: recommend changing an under critical to "subcritical"

7. Line 200: remove "In"

8. Line 275: remove "a"

Discretionary Revisions:

1. I believe the description of open autologous bone grafting is biased - very critical of this generally well tolerated procedure.

**Level of interest:** An article of importance in its field

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

**Statistical review:** Yes, but I do not feel adequately qualified to assess the statistics.

**Declaration of competing interests:**

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No

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Do you have any non-financial competing interests in relation to this paper?
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