Reviewer's report

Title: Stress and Stability Comparison between Different Systems of High Tibial Osteotomy

Version: 2 Date: 23 January 2013

Reviewer: Thomas Gardner

Reviewer's report:

General Comments to Authors

Overall, the paper is well written, though there are a number of minor grammatical errors throughout the paper, which have been noted in the Minor Essential Revisions and Discretionary Revisions sections. The results provided are presented in a clear and easy to understand manner. However providing stress maps would also be useful. The clinical relevance of the findings of the study are meaningful, but are somewhat limited by basing all the simulations on a healthy individual rather than performing several sets of simulations on pre-surgical CTs of actual patients. Therefore, no assessment can be made of how sensitive the results for the different plate constructs are to patient geometry, bone condition and wedge size. These factors may have a minimal effect, but no effort was made to support this by the literature. In addition, no experimental validation studies of the FEA were performed.

Major Compulsory Revisions

Discussion

a) a discussion of the limitations of this FEA study needs to be included, such as that no experimental validation was performed, as seemingly easy task using biomechanically equivalent Sawbone® models, a loading device and either a DVRT or extensometer placed at the opening of the wedge to measure micromotion.

b) Why was only one volunteer used? Why were pre-surgical CTs from actual patients who underwent correction of medial compartment osteoarthritis not used instead of a volunteer without disease?

c) Given the above questions, how would one assess the sensitivity of the theoretical analysis performed to variations in bone geometry, bone composition (cortical versus trabecular bone thickness) and bone properties (e.g. individuals with osteopenia)?

d) The use of actual patient CTs would most likely require different size wedges to account for differences in the actual anatomy. Different wedge sizes may impact the results found in this study. Why were not different wedge sizes simulated to assess the robustness of the theoretical approach used in this
study?

Discretionary Revisions

Suggest changing the title to …”Different Systems for High Tibial Osteotomies”

Background
Line 81: change to “systems is of bioengineering significance and was the motivation of this study. Using:

Minor Essential Revisions

Abstract
line 28: change “tibia as a highly” to “tibia a highly”
line 29: change “screws as the” to “screws to be the potential sources for mechanical failure.”
line 41: change “wedge tip” to “wedge tip the zone of tension and thus have been reported to”
line 45: change “…heavily” to ”heavy load demands and”

Background
line 52: change “literatures” to “literature”
line 54: change “included” to “include”
line 58: change “…were used for…” to “… to maintain…”
line 59: change “stabilizing” to “stabilize”
line 63: change “that shorter” to “that a shorter”
line 66: change “high rate” to “a high rate”
line 77: change “fashion” to “screws”
line 79: change “shaped” to “shape”

Materials and Methods
Tibia-plate-screw Models
lines 90 and 91: delete the apostrophes
line 98: change “simulate high” to “simulate a high”
line 99: change “in-between” to “between”
line 103: change “fashion” to “design”
line 106: change “plates were shown” to “plates are shown”
lines 107&108: change to “The aim of this study was investigate the effect of plate design on construct behavior, thus modeling of the screw threads was omitted to simulate a rigid-bond at the tibia-screw interface.”

Finite-element Analysis
line 112: change “based on the” to “base on a”
line 120: please clarify what is meant by “criterion for delimiting adherence from friction”
line 124: change to “of the two other configurations. Two types of loads were applied to the”
line 125: change “within” to “during”
line 129: change “intervened” to “intervention-induced compressive”
lines 130 & 131: change to “two times body weight (70 kgf) to simulate the compressive”
line 133: change to “plateaus, respectively”

general questions:
a) please provide the material property values used for the cortical and trabecular bone.
b) what was the approximate width of the opening wedge?
c) how was the interface between the cortical and trabecular bone modeled, or were different regions of the mesh just assigned different bone material properties?
d) please provide the sizes of the locking and non-locking screws, were the screws the same size for each hole and for every construct?
e) please provide the size and thickness of the plates.

Results
line 158: change “bone were” to “bone are”
lines 159 & 160: change to “opening highly stresses the implants, thus causing some screws and plate holes to become potential locations for failure by yielding and cracking.”
line 169 & 170: change to “The difference in bone stress between the four plate-bone constructs was similar to that of the differences between the stresses in the plates” if my interpretation is correct
line 177: change “were” to “are”
line 182: change to “can decrease micromotion by 76.9% compared to that of the T construct.”
line 183: change to “On average, this can reduce wedge-tip micromotion by 92.3% in”

general questions:
a) how do stresses compare between locking and non-locking screws in the screws, the plate and the underlying bone?
b) why are there no figures showing the stress distributions in the plates?
c) how did the shear stresses compared between the different constructs?
Discussion
line 190: change “situation” to “condition”
lines 193 through 198: suggest moving this to the “Results” section
line 206: state what type of screw was used in the Seide study
line 228: change to “failure at that location.”
line 232: is it supposed to be “>”?
line 234: change “the adequate” to “adequate”
line 242: change “On the other side” to “On the other hand”
line 243: what is “opponents” suppose to mean?
line 246: change “ensure that” to “ensure”
line 250: change “If the” to “If”
line 254: change to “the effects of stress-shielding.”
line 257: change “about” to “for”
line 258: change to “provide a stable”
line 260: change to “for patients with a heavy load demand”
lines 261 & 262: change to “the two-leg system may result in stress-shielding in the region around the wedge”

**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 with respect to the manuscript that I reviewed.