Reviewer’s report

Title: Biomechanical comparison of anterior lumbar interbody fusion: stand-alone interbody cage versus interbody cage with pedicle screw fixation

Version: 1 Date: 14 December 2012

Reviewer: Fabio Galbusera

Reviewer’s report:

The authors performed a numerical comparison between standalone ALIF with integrated screws and a normal cage supplemented by posterior fixation. The paper is relatively well written and the study is rather solid. However, there are some points which must be better described and discussed, and simulations may need to be re-run with different material properties and loading conditions, as described in the following.

Major Compulsory Revisions

1. Table I, about the material properties: I see nonlinearities only for the ligaments, whereas it is known that the annulus fibers have a clear nonlinear response. This is probably a reason for which the nonlinear response of the model could not be captured (as acknowledged on page 11, Discussion). The authors should discuss this point in a much more detailed way.

2. on the same topic, Fig. 2: it would be better to show the moment-rotation curves instead of a histogram. This would better show if the model is able to capture the real nonlinear behavior of the spine. Results should be compared with in vitro data and not with other FE calculations (e.g. Chen et al.). The authors should consider to refine the model and re-run the simulations if the nonlinear response is not correctly captured.

3. Methods: what is "an elasticity modulus of 0.8"? A Young modulus? Units?

4. Methods, loads and boundary conditions. From the text, it looks like that a load-controlled protocol was used. Based on Results and Figures, it seems that a hybrid or displacement-controlled protocol was applied. The authors should clarify this point, and explain the reasons which drove this choice. This is extremely important for the evaluation of the effects on the adjacent segments.

5. Methods, loads and boundary conditions. How was the 400 N compression load applied? On a long spine segment (L2-L5), it cannot be applied as a pure compressive load or pressure, or it would result in a rotation in extension. Did the compressive load result in a rotation of the spine segments?

6. Methods, load sharing. To calculate the load, the pressure should be integrated on the application area (sum of (pressure*area of the element)), not just summed. Was this done?
7. Results, peak pressures. Are these real pressures or stresses? From the Materials and Methods, it seems that they are von Mises stresses. In this case, such values (>4 MPa) would probably lead to failure of bone and therefore cage subsidence. The authors should comment on this aspect.

8. on the same point: why was the von Mises stress selected as a result? Bone is not a ductile material and may fail in pure hydrostatic compression or tension.

Minor Essential Revisions

1. Methods: “Finite element model (FEM) of a normal lumbar” the word "spine" is missing at the end. This applies also to the following sentences.

2. Methods: PATRAN is a pre-postprocessing program, not a before-after processing program.

3. Results, load sharing. 89% for the anterior spine in healthy conditions seems a little too high. Can the authors provide a reference which support this finding?

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.