Author’s response to reviews

Title: Biomechanical evaluation of immediate stability with rectangular vs cylindrical interbody cages in stabilization of the lumbar spine

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PDF covering letter
Dear Sir/Madam,

We would like to thank the reviewer for raising very important questions, which, we are sure, will improve the quality of our submission. We have now made changes in the manuscript addressing all the points. The following is a more detailed explanation to the questions raised:

1. We fully agree with the reviewer that our method of testing was a constrained method, with all the known drawbacks associated with it. I also agree that application of a pure moment, with six degrees of freedom to allow the coupled motion, as suggested by Panjabi[1], offers a more physiological way to determine the range of motion (ROM) in the lumbar spine. I understand, the work by Lund et al[2], as well as many other reports in the recent literature were performed using a similar technique.

However, in order to apply a physiological load, most authors in the recent literature used static loads, by increments of around 2.5 Nm, and allowed the specimen to creep for 30 seconds or similar, before measuring the load-deformation. We have tried this method in our laboratory, as well as in the Texas Back Institute. In our experience, this testing method produced a large variation in the load-deformation curve and the ROM from the same specimen, when the tests were repeated. On the other hand, using cyclical load with a servo-hydraulic material testing machine, and recording the data from the third cycle, we could obtain almost similar load-deformation curve and ROM every time from the same specimen, when the tests were repeated. The smaller spread of data with repeat measurements ensures that even a small difference in flexibility of the specimen under different methods of stabilisation would be identified by the study. This is more important considering the fact that most of the biomechanical studies are conducted using a relatively small number of specimens.

An ideal method would be to use pure moment, with six degrees of freedom, and at the same time would apply a cyclical load, as described by Wilke et al.[3] Unfortunately, we do not have such facilities in our laboratory.

The test jig we used were made using a similar design as described by Chiba et al.[4] There are other examples in the recent literature of using a constrained testing jig.[5, 6] I had a personal communication with Dr. Panjabi following presentation of our technique of testing at the ISSLS annual meeting at Hawaii in 1999.[7] Dr. Panjabi commented that he would prefer to test unconstrained specimen using pure moment to determine the physiological ROM with a particular loading condition, but he accepted our method of testing as valid, as long as it is used for measuring the difference between the two different stabilization conditions.

The above limitations in this study have been included in the discussion section of the manuscript.

2. **The axis for axial torsion loading**: The axis for axial torsion testing was chosen at the midway between the centre and the posterior margin of the vertebral body in the sagittal
plane. This has been explained in the revised manuscript under the ‘measurement of flexibility’ section.

3. **Was the centre of the vertebral body aligned to the centre of the testing machine actuator?** – The midpoint between the centre and the posterior margin of the vertebral body was aligned to the centre of the actuator. This has been explained in the revised manuscript under the ‘measurement of flexibility’ section.

4. **Preload:** 200N compression load was applied as a preload both for axial rotation as well as during the flexion-extension and lateral bending tests. In the latter situations the preload was applied through a counterweight, as described in the testing jig used by Chiba et al.[4]

5. **Conclusion 4:** The range of lateral bending in the rectangular cage group, was only marginally different following additional posterior stabilization. Hence it was concluded that use of rectangular cage alone may provide as much stability in lateral bending, as would be expected following additional posterior fixation. However, it appears this conclusion may be inappropriate and misleading, and we have removed this point from conclusion section.

References: