IRCOBI

International Research Council on the Biomechanics of Injury

To
A Chawla
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Zurich, 20.04.2010

2010 IRCOBI Conference

Dear Author:

Your draft manuscript "PREDICTION OF LUMBAR SPINE POSTURE FOR REPOSITIONING OF SPINAL FE MODEL" for this year's IRCOBI Conference has been reviewed. The reviewers' comments which are attached call for mandatory revisions. Due to the significance of the comments, you are required to include a letter with your revised manuscript explaining how the reviewers' comments have been addressed. The revised manuscript is due no later than **14 June 2010** since it requires a second review. Please be sure that the manuscript is formatted according to the instructions sent to you previously.

We look forward to receiving your revised paper by **14 June 2010** at the latest. I will inform you of your paper's final disposition shortly thereafter.

If you have any questions, do not hesitate to contact IRCOBI secretariat as indicated below.

Yours sincerely,

Kai-Uwe Schmitt
IRCOBI secretariat

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Comments:

Review 1:
This paper addresses an issue which is important to the impact biomechanics community. However, as currently structured, it is very difficult for the reader to interpret how useful the proposed method is, and how well it works. I therefore recommend substantial rewriting of this paper to address the following issues:

in the introductory sections it is stated that radiological techniques for posture estimation are based on extrapolation of individual vertebra, and that these methods cannot therefore be directly used in FE model repositioning for OOP simulations. However, it seems to me that the spline technique does much the same thing: after all, what you are doing is fitting a cubic order curve to some points and interpolating the values in between. Given the articulated nature of the spine, it is not clear to me that there is any real difference between interpolation between known vertebra and extrapolation from radiographs. I think this needs to be fully justified.

Figure 1a shows different mean and standard deviations of Cobb angle collected from the literature, as well as the Cobb angle predicted from the current study. I don't really understand what this graph is supposed to show: the literature data simply indicates that there is a large variation in mean Cobb angle, which reflects the fact that spinal deformations come in a large variety of shapes. I don't know what the value of plotting your own Cobb angle is in this case.
Presumably you are constructing one single real spine shape, but that spine has no correspondence to the spine's reported by the previous researchers. Surely if you are doing some kind of cubic spline fitting to known points, then you should take the method and apply it to a case where you know what the intermediate points (i.e. the remaining vertebrae not used as control points) are doing and then measure the level of error associated with your method. In figure 1b, the relative angles between adjacent vertebral pairs are given, but again, this is really a function of the different shaped scoliotic spines which were studied in the literature, rather than some way to assess your method.

In the text you state that the lumbar lordosis angle was 52.13° as predicted by your spline method - can this be compared to a clinical evaluation, or some other method?

In figure 2, are the comparisons of intervertebral angles with the work of Chen et al comparing the same actual spine ? or are you using one particular instance of a finite element spine and comparing it to previously published literature relating to a different spine shape ? I think this needs to be clarified. Furthermore, for this comparison I think that a table identifying the maximum difference in angles between the literature value and your own would be useful.

In your discussion, it is not at all clear to me how comparison with the sagittal motion of the lumbar spine reported in the clinical literature demonstrates the reliability of your method.

When you do your repositioning, it is not clear to me why no dynamic simulation is necessary, since surely ligaments and other biomechanical structures would be changed in length, and therefore, how would you achieve a new neutral position?

Perhaps I have misunderstood large aspects of your work, and if so, hopefully these misunderstandings can be eliminated in a future draft.

Minor points:

you should be careful of the use of the apostrophe when the plural of the word is intended. For example, the opening words of introduction are human body FE model's … this should be models, and the same error occurs a few times in the paper, please correct.

On page 1, I think the word predication should be replaced with prediction throughout the paper

on page one, the sentence which states : Earlier studies predicted intermediate posture by extrapolating between few known geometries - this sentence needs to be rewritten.

In the text, the Cobb angle seems to be defined as the angle between two adjacent vertebrae, but this is not what is shown in the figure, nor does it correspond to the definitions I am aware of. Please clarify

You should define the term OOP at least once before using the acronym

the pseudocode section would benefit from some comments for example it would be helpful to show that (c), (d) and (e) refer to position, slope and curvature continuity respectively.

How realistic is the assumption on page 2 that the thoracic portion of the spine was assumed to be rigid?

The text refers to figure 3, but I think you mean figure 2

Review 2:

The first paragraph should be more focused on the need for the lumbar spine posture rather than focusing on injuries such as cervical spine. This will allow more space for the Discussion. (1) The limitation of the proposed procedure (example, assumption of a rigid thoracic spine) and (2) methods to incorporate their procedure to current modeling techniques should be discussed. Since the Cobb angle is defined clearly in the text and is well known, I recommend removing figure 1. This should allow the authors to better discuss their methods, results, limitations, applications. On a smaller note, rescale figure 3a from 30 to 75 deg so that the plot is more readable.