Author's response to reviews

Title: Reliability and reproducibility analysis of the Cobb angle and assessing sagittal plane by computer-assisted and manual measurement tools

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Version: 6 Date: 16 January 2014

Author's response to reviews: see over
Dear Editors and Reviewers:

Thank you for your letter and for the reviewers’ comments-concerning our manuscript entitled “Reliability and reproducibility analysis of the Cobb angle and sagittal plane assessing by computer-assisted and manual measurement tools” (MS: 106127025 6104840). Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have revised the paper according to yours and reviewers’ instructions, and detailed corrections are listed below point by point. The revised paper has been rewritten and improved according to the suggestions of the reviewers. Revised portion are marked in red in the paper. We hope it can make reviewers and you satisfied.

The manuscript has been resubmitted to your journal. We look forward to your positive response.

Responds to the reviewer’s comments:

**Reviewer:** Bernard Cortet

1. **Response to comment:** The title of the manuscript should be modified accordingly.

   The other possibility is focusing on Cobb angle only.

   **Response:** Thank you for your valuable suggestion. We have modified the title in the revised version as follows: *Reliability and reproducibility analysis of the Cobb angle and assessing sagittal plane by computer-assisted and manual measurement tools.*

2. **Response to comment:** The other measured several relevant coefficients, particularly ICC. Also, they should assess reproducibility for the 2 methods by measuring the coefficient of variation with paired measurements for all the measured parameters.

   With the measurements done, they can calculate the CV.

   **Response:** Thank you for your valuable suggestion. Although the main purpose of the study was to assess the reliability of SurgimapSpine measurement, the CV was not displayed in the results. According to your suggestion, the ranges of variation for each
method and each parameter were assessed in the Results section of the revised version.

3. **Response to comment:** The authors indicate that the differences of the 2 methods are very small. This point should be emphasized and the conclusion of the discussion should be modified accordingly.

**Response:** Thank you for your valuable suggestions. The conclusions in the Discussion section have been modified as: Although the differences in the two methods are very small, the results of the present study indicate that the SurgimapSpine measurement is an equivalent measuring tool to the traditional manual in coronal Cobb angle, but is markedly advantageous in spino-pelvic measurement especially in T2-T5 and PT.

4. **Response to comment:** Summary: The authors should add several details regarding the values of the reproducibility and they should also give several p values. The conclusion of the summary should be modified according to my third major comment.

**Response:** Thank you for your suggestions. We have added several data and $P$ values to Summary section and the conclusions have been modified accordingly in the revised version; for example, we modified the conclusion as: Although the differences between the two methods are very small, the results of this study indicate that the SurgimapSpine measurement is an equivalent measuring tool to the traditional manual in coronal Cobb angle, but is advantageous in spino-pelvic measurement in T2-T5, PT, PI, SS, and LL.

5. **Response to comment:** Methods: The authors should indicate (flowchart) how many radiographs they screened to finally analyze 68 of them. Also, they should indicate why they chose to study 68 radiographs.
Response: Thank you for your suggestions. From February 2011 to January 2013, radiographs meeting the following conditions would be included in this study: Cobb angle not above 90º because large Cobb angle is often associated with vertebral superimposed image, no obvious thoracic kyphosis, T2, T5, and pelvis being seen clearly. A total of 68 radiographs were chosen in 100 patients’ radiographs with scoliosis. We have detailed the above information in the revised version.

6. Response to comment: Figures: The quality of the first figure is really poor. The authors should provide another radiograph. For Figure 2, the authors should show a figure of the different measured angles with the SurgimapSpine software with a high quality (the figure provided is really too small). Also, the authors should clearly indicate that they used analogic radiographs.

Response: Thank you for your suggestions. We have deleted Figure 1; the different measured angles were displayed with SurgimapSpine measures in the revised version (Figure 1 A-F); and the processes of the SurgimapSpine software measures process were shown in Figure 2. We verified that we used analogic radiographs.

7. Response to comment: Discussion: The discussion should be shortened and particularly the second paragraph that begins with: “In some cases..” should be deleted.

Response: Thank you for your suggestions. We have restructured the discussion and deleted the second paragraph.
Reviewer: Sami KOLTA

1. Response to comment: Everybody is not familiar with the software used (the SurgimapSpine). The authors should give more details on how this software works. Does it measure the different angles automatically, with recognition of the spine and pelvis? Is it a semi-automatic calculation (the operator positions the lines and the software just calculates the angles?), etc.

Response: Thank you for your suggestions. The SurgimapSpine tool is a semi-automatic calculation (the operator positions the lines and the software just calculates the angles). The details about its works are illustrated in Figure 2 in the revised version.

2. Response to comment: The paper, especially the Discussion section, should be restructured in order to be clearer.

Response: Thank you for your suggestions. We have rewritten the Discussion section and edited according to the reviewer’s suggestion.

3. Response to comment: The English language of the paper should be checked, as some grammatical errors exist and some sentences are difficult to understand and therefore need reformulation.

Response: Thank you for your suggestions. The revision was edited by a native English speaker.

4. Response to comment: Introduction section, line 10: "such as manual and iphone." The authors should probably not use brand names, but generic names as "smart phone,"
for example.

Response: Thank you for your suggestion. We have changed “such as manual and iphone” to “such as manual and smart phone.”

5. Response to comment: Introduction section, line 18: "Therefore the aims of the current study is .."Please change to "Therefore the aims of the current study are ..".

Response: Thank you for your suggestion. We have changed it to “Therefore, the aims of the current study are…” in the revised version.

6. Response to comment: Materials and Methods section, line 2: "These radiographs were chosen because of good quality." Please indicate the total number of radiographs evaluated in order to select these 68 radiographs. Did you exclude 10% or 50%? How many radiographs were considered of "bad quality"? What were the criteria of "good quality"?

Response: Thank you for your suggestions. From February 2011 to January 2013, radiographs satisfying the following conditions were included in this study: Cobb angle not above 90º because large Cobb angle is often associated with vertebral superimposed image, no obvious thoracic kyphosis, T2, T5, and pelvis being seen clearly. A total of 68 radiographs were chosen in 100 patients’ radiographs with scoliosis. Materials and results in the revised version have introduced information in detail.

7. Response to comment: Materials and Methods section, line 8: "Informed consent for data analysis was obtained from all subjects and/or the families." Please change to
"Informed consent for data analysis was obtained from all subjects and/or families."

Response: Thank you for your suggestions. We have changed the sentence in the revised version as per your suggestion.

8. Response to comment: Materials and Methods section, line 12: "(manual measurement on x-ray radiographies .." please change to "(manual measurement on radiographs .."

Response: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

9. Response to comment: Materials and Methods section, line 21: "All radiographies were blinded." Please change to "All radiographs were blinded."

Response: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

10. Response to comment: Results section, line 4: "Table 3". Do they mean "Table 2"?

Response: Thank you for your suggestion. We have reordered the tables, Table 3 is changed to Table 2, and changes are made in both the Results section and Tables section.

11. Response to comment: Results section, line 10: "the ICC of the intra-observer reliability was ranged from 0.75 (0.63-0.84) of the T2-T5 angle and 0.98 (0.97-0.99) of the LL angle." Please change to "the ICC of the intra-observer reliability ranged from 0.75 (0.63-0.84) for the T2-T5 angle to 0.98 (0.97-0.99) for the LL angle."
Response: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

12. **Response to comment:** Results section, line 14: "measures of sagittal plane parameters with a low of 0.66 for determining the T2-T5 angle to a high of 0.96 for determining the LL; And with SurgimapSpine tool, the intra-observer reliability of LL was the best as same as manual tool and of PT was the worst." Please change to "measures of sagittal plane parameters with as low as 0.66 for determining the T2-T5 angle to as high as 0.96 for determining the LL. With SurgimapSpine tool as well as the manual tool, the intra-observer reliability of LL was the best and that of PT was the worst."

Response: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

13. **Response to comment:** Results section, line 18: "was obviously better than those of manual tool." Please change to "was obviously better than the manual tool."

Response: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

14. **Response to comment:** Results section, line 19: "intra-rater reliability" do the authors mean "intra-observer"? If yes, please use "intra-observer" for consistency throughout the paper.

Response: Thank you for your suggestion. The intra-rater reliability means
intra-observer reliability. We have changed it to intra-observer throughout the paper.

15. **Response to comment:** Discussion section: First sentence is not clear; please change the formulation of the sentence.

**Response:** Thank you for your suggestion. The first sentence has been modified as “Treatment methods in patients with scoliosis depend on the Cobb angle in coronal plane and morphology of the sagittal planes.”

16. **Response to comment:** Discussion section, line 5: "Although Cobb angle measurement in the coronal has been." please change to "Although Cobb angle measurement in the coronal plane has been ."

**Response:** Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

17. **Response to comment:** Discussion section, line 7: “..manual measurement errors and difficulty visualizing." please change to "., manual measurement errors and difficulty in visualizing."

**Response:** Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

18. **Response to comment:** Discussion section, line 14: please define what is "PACS".

**Response:** Thank you for your suggestion. We have restructured the discussion according your suggestion. In the revised version, the word PACS has been deleted.
19. **Response to comment:** Discussion section, line 14: "However, many clinicians still allow for patients from rural ..." The sentence is not clear, please reformulate it.

**Response:** Thank you for your suggestion. We have rewritten the discussion according to your previous suggestions. In the revised version, the sentence has been deleted.

20. **Response to comment:** Discussion section, line 18: "In these cases, Owe to SurgimapSpine software could open the forms existing ..". The sentence is not clear. Please reformulate it and give more details. Do the authors mean that plain radiographs are photographed or scanned then the digitized image file is analyzed with the SurgimapSpine software?

**Response:** Thank you for your suggestions. We have rewritten the discussion according to your previous suggestions. In the revised version, the above sentence was modified as Computer-based SurgimapSpine measurement technique can open plain radiographs photographed or scanned, which form the digitized image.

21. **Response to comment:** Discussion section, line 27: ". as well as imagines is formatted by photos but not films". The whole sentence is not clear. Please reformulate. "imagine" Do the authors mean "images"?

**Response:** Thank you for your suggestions. The sentence has been reformulated as “SurgimapSpine measurement technique has some advantages such as the following: rapid comparison between radiographs taken at different times of a patient, cheap storage, and images formatted by photos not films.” We have changed “imagine” to "images".
22. **Response to comment**: Discussion section, line 28: "In the present study, comparing the intra and inter-observer reliability under the definition of end vertebrae in a manual.". The whole sentence is not clear. Please reformulate.

**Response**: Thank you for your suggestions. The sentence has been modified as “In the present study, we found no significant difference in the intraobserver and interobservers’ reliability between the manual and the SurgimapSpine methods in the coronal Cobb’s angle measurement.”

23. **Response to comment**: Discussion section, line 36: "is more reliably in Cobb angle measurement." Please change to "is more reliable in Cobb angle measurement."

**Response**: Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

24. **Response to comment**: Discussion section, line 69: "In the present study about AIS radiographic measurement with manual, the reproducibility." Please change to "In the present study about AIS radiographic with manual measurement, the reproducibility."

**Response**: Thank you for your suggestions. We have changed the sentence and AIS has been defined as adolescent idiopathic scoliosis in the revised version, as per your suggestion.
25. **Response to comment:** Discussion section, line 76: "The other study carried out in AIS patients found." The sentence is not clear. Please reformulate.

**Response:** Thank you for your suggestions. The sentence has been modified as “Another study focusing on reliability of manual measures in AIS patients found intraobserver (0.22–0.83) and interobserver for T2–T5 (0.33–0.47) reliability was generally poor. However, other sagittal parameters were excellent.”

26. **Response to comment:** Discussion section, line 81: "demonstrated well to excellent correlation." Please change to "demonstrated good to excellent correlation".

**Response:** Thank you for your suggestion. We have changed the sentence in the revised version as per your suggestion.

27. **Response to comment:** Discussion section, line 81: "Those may be correlation with the small magnitude of the measures." The sentence is not clear. Please reformulate.

**Response:** Thank you for your suggestions. The sentence has been modified as “Causes for poor reliability of T2–T5 and PT Cobb angle may be related to the overlying density of the upper thoracic rib cage and scapula and femoral head.”

28. **Response to comment:** Discussion section, line 87: "SurgimapSpine software produces a reliable measurement of the sagittal profile." Please change to "SurgimapSpine software produces a reliable measurement of the sagittal plane."

**Response:** Thank you for your suggestions. We have changed the sentence in the revised version.
29. **Response to comment:** Discussion section, line 88: "It adjusts image contrast and brightness which will enable the superior identification." Please change to "It adjusts image contrast and brightness, which will enable a better identification."

**Response:** Thank you for your suggestions. We have changed the sentence in the revised version as per your suggestion.

30. **Response to comment:** Discussion section, line 91: "SurgimapSpine measurement is an equivalent measuring tool to the traditional manual measurement in coronal Cobb angle, but is markedly advantageous in spina-pelvic measurement especially in T2-T5 and PT." Please change to "SurgimapSpine measurement is an equivalent measuring tool to the traditional manual measurement in coronal Cobb angle, but is markedly advantageous in spina-pelvic measurement especially in T2-T5 and PT."

**Response:** Thank you for your suggestions. We have changed the sentence in the revised version as per your suggestion.