Author's response to reviews

Title: Comparison of isometric trunk rotational strength of adolescents with idiopathic scoliosis to healthy adolescents: an observational study

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Author's response to reviews: see over

We would like to thank all the reviewers for their comments. Our response to each comment is listed below. We feel that we have addressed the concerns of the reviewers to the best of our ability and understanding of the comments. If we did not address an issue or did not properly understand the point of a certain comment, please help clarify and we will respond again.

Sincerely,

Kevin McIntire PhD

Reviewer 1

Minor Revisions

1. We have now clarified the issue of where the HG participants were enrolled.

2. Thank you for your suggestion. We have now included additional information about how lean body weight was calculated.

Reviewer 2

Major Revisions

1. Thank you for brining up an important question. The main curve direction defined in our study is based on either the thoracic or thoracolumbar curve direction, not the high thoracic curve (even it may be larger) direction. Thus, subject 3022 should not have been listed as having a left side main curve because her thoracic curve has right apex. We have switched this subject to the right curve direction and changed all results and figures accordingly. The conclusions remain the same.

A description of our classification of curve types and main curve direction has been added in the Method section, along with the rationale behind the classification.

2. Range of trunk rotation was not measured in the current study. The most rotated testing position, i.e. 36°, was selected so that none of the participants had any difficulty being positioned in the pre-rotated positions. However, you made an excellent suggestion as regarding to position the trunk based on certain percent of the range of motion. This would be an interesting future direction.

3. The purpose for random order of movement was to minimize the effect of the order on the measured trunk strength, especially in our comparison of side difference. In this regard a random order is definitely better than any fixed order. Random order is a commonly used procedure in strength measurements with strong statistical rationale behind it. We are not aware of any other better way of ordering the testing movements than the random order.

4. We agree that the vertebral rotation might affect the torque output. In response to your question the rotation at the apex was measured for all but three of the ISG participants using Perdriolle's method. The range was 0-20° with an average of 10 ± 5.5°. There were no correlations between the vertebral rotation and absolute difference between convex and concave torque values, absolute side difference (percentage), or directional side difference, in the neutral position. This has been added to the discussion.

5. Discussions on other factors for the measured trunk peak torque have been added in the discussion.

Minor Revisions

1. The degrees of trunk rotation were selected based on previous work. The references have been added to the text.

2. The random order was generated using a "random number" function in Microsoft Excel.

3. The term "window" refers to a moving average window. The moving average window approach is used quite often in strength measurement and data analysis. The details of data processing were provided in our previous reliability study. We have added the word "average" and the reference of our previous paper to the text.

4. An explanation for the opposing muscle ratio was clarified in the text and included in Figure 3 caption.

5. Abbreviations in the figure and table captions have been revised to better explain their meaning.

6. We thank the reviewer for this editorial 'catch'. The 'CG' should indeed be 'HG'. This has been changed.

Discretionary Revisions

1. We have changed the title to reflect the results as this would be a good way to attract attention.

2. The abstract has been edited for more brevity.

3. The Results section does involve a large amount of numerical information. We intended to include the most data possible for people who might want more details. Additionally, we reported results that did not show a particular pattern to avoid the duplication of the same data by other groups.

4. Gravity was not an influence on the torque output. This is due to the design of the testing device and protocol.

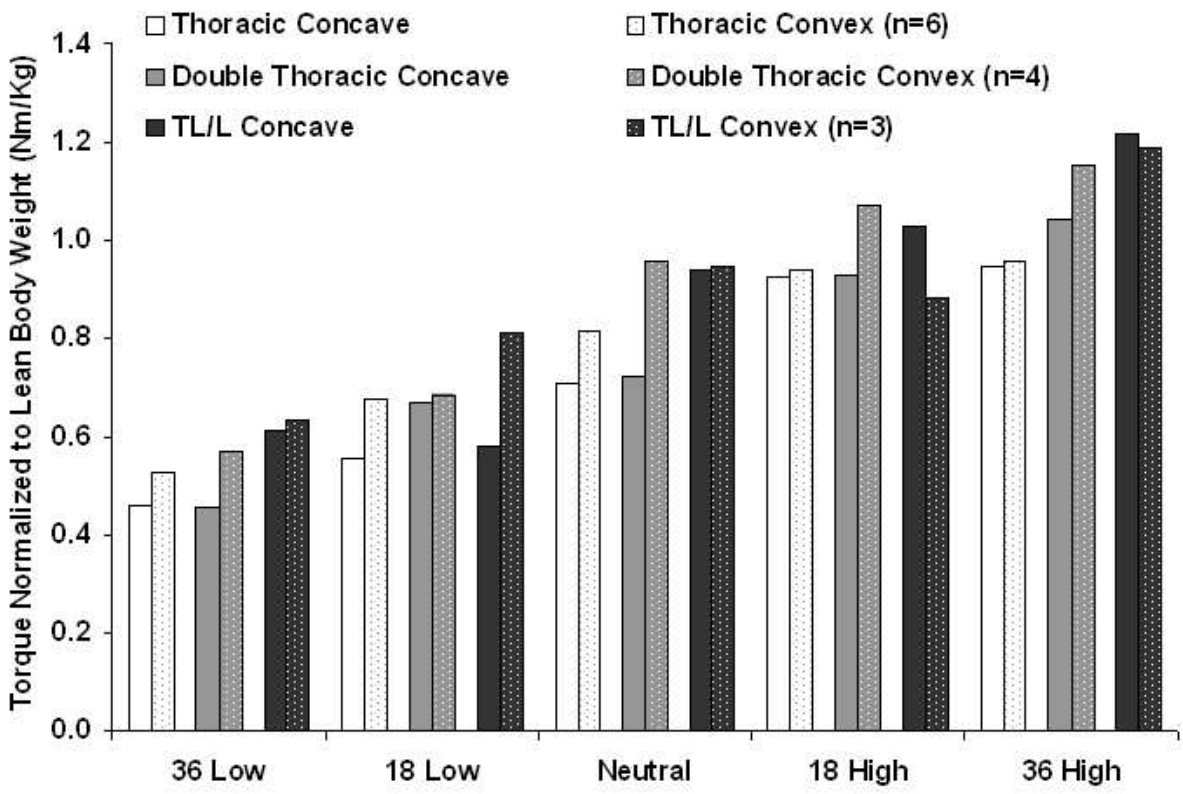
Reviewer 3

Major Revisions

1. It is true that the comparison between the HG and the ISG was not in the similar vertebral position and structure due to the spinal deformation. In fact, it is impossible to place the ISG participants in a 'neutral' position that is comparable to the HG in terms of all vertebral position and structure. We defined in the current study the neutral position in relation to the relative position between shoulders and pelvis. It was defined as the shoulders being 'square' with the pelvis. We have included a description of this in the text.

2. The reasons for the strength asymmetry in the neutral position could come from trunk biomechanical factors. This has been addressed in the discussion.

3. We agree fully with the reviewer that the high thoracic curves might influence the torque output. Although, we did not have enough patients to allow a reliable analysis by curve pattern, we did analyze the three curve pattern groups (Thoracic, Double Thoracic, and Thoracolumbar/Lumbar) for strength asymmetry as was suggested (Figure below). This showed that for thoracic and double thoracic curves, torque in the concave direction is less than torque in the convex direction in all trunk positions. Although for thoracic curves, this difference was most pronounced in the 36 low, 18 low, and neutral positions whereas for the double thoracic group the difference was seen in all positions except for the concave 18 low position. Thoracolumbar/lumbar curves appeared to be somewhat symmetrical in the 36 low, 36 high, and neutral positions, and asymmetrical in the 18 low and 18 high positions. Interestingly, the concave direction torque was smaller in the 18 low position but larger in the 18 high position. None of these findings approached significance; the subgroups were small and the standard deviations large. Further investigation of the relationship of curve pattern to strength asymmetry is warranted.



Minor Revisions

1. The negative sign is used for pre-rotation to the right as has been used in previous work. The ISO standard is Z transverse, Y coronal, and X sagital with vertebral body rotation to the right being defined as negative.