Author's response to reviews

Title: The effects of the Mulligan Sustained Natural Apophyseal Glide (SNAG) mobilisation in the lumbar flexion range of asymptomatic subjects as measured by the Zebris CMS20 3-D motion analysis system.

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Author's response to reviews: see over
Dear Dr. Ashleigh Manning

We would like to thank you as well as the two reviewers for the constructive feedback concerning our submitted manuscript. All comments have been carefully studied and changes have been incorporated in the revised manuscript. As suggested in your email, a competing interests and acknowledgements section have now been included in the revised manuscript. Consent form by the participant who appears in the photos has been given and a copy of it has been attached with the present re-submission.

Below are the responses to the reviewers.

Regarding **Reviewer 1**, 
The manuscript has now been corrected for grammar and has been extensively edited by an English-speaking colleague. We hope it is now readable and comprehensible. Also, we have attached the manuscript as a Word document for Reviewer 1 to ‘track changes’ (as suggested).

Regarding **Reviewer 2**, 
Please see each of your comments addressed below (in the same order to your report).

1. The acronym for the SNAG technique has been defined in the title and abstract as indicated.
2. The first and second paragraph of the methods section have been reviewed for grammar and all verbs have been transformed in the past tense
3. The manuscript has been corrected for grammar and has been extensively edited by an English-speaking colleague.
4. The manual therapist’s clinical experience has been defined (first sense of section on ‘Application of the manual interventions’). The way the technique was described in the manuscript has been corrected as it was indeed done according to Mulligan’s recommendations (by applying manual pressure through the ulnar border of the hand).
5. Regarding the amount of the manual force, the manual therapist performing the SNAGs applied a ‘substantial’ amount of force. However, this cannot be quantified since we have not used any objective methods to measure the applied force. Following this comment, we have reported this (within the section on ‘Application of the manual interventions’) and we have added a comment in the limitations of the study (discussion section).
6. Yes, the end position during the SNAGs’ application was sustained. We have also reported this within the section on ‘Application of the manual interventions’.
7. The seated position (for applying the SNAGs) was chosen because during our pilot study we found that it was more comfortable for the participants and the manual therapist felt it provided better stabilization and control for her (whilst the subject was performing the movement). We agree that the standing position is more aggressive and could have provided a different outcome. Should we have used patients, we would have given the option to the therapist to chose the subject's position (reflecting clinical practice). If Reviewer 2 based on his expertise feels that the chosen position could have precluded a significant outcome, we are happy to add a comment in the limitations section of the study.

8. It has now been clearly stated that the 2min break was after the application of the intervention and before taking the second sets of flexion measurements with the zebras (we apologise for the confusion). The sets and repetitions of the technique in each spinal level have also been clearly clarified.

9. The section indicated at this point has been removed (as suggested)

10. The section indicated at this point has been removed (as suggested)

11. Table legends have been improved.

12. In the pilot study, the participants’ arms were an issue taken into consideration. Mulligan has the patients’ arms being supported by their thighs; however as asymptomatic subjects have large ranges of lumbar flexion, we found (in the pilot) that the arms were in the way of the movement. We therefore tried the SNAG without the arms touching the thighs and during the pilot all subjects felt more with ease by doing it this way. We felt that this made sense since arms were not impeding flexion ROM and also because our asymptomatic sample wouldn’t probably need the extra support. Therefore, we decided to use the arm position (indicated in the photo) when reaching full flexion range. The quality of the photos is now improved (we used a professional graphic designer’s program for omitting the ‘busy’ background). However, at the time the pictures were taken the hand of the manual therapist was placed for the photo to be taken (no technique was applied at that time). So we apologize for the quality of this photo. If Reviewer is not happy, we will have to re-take it & present lumbar SNAG clearer.

We would like to again thank you for the valuable comments made. Please contact us regarding any further comments or questions.

Kind regards,

Evdokia Billis
(corresponding author, on behalf of all the authors in the manuscript)