Author's response to reviews

Title: The Effect of Warm-up, Static Stretching and Dynamic Stretching on Hamstring Flexibility in Previously Injured Subjects

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Author's response to reviews: see over
Dear Editor

Thank you for allowing us the opportunity to submit a revised manuscript. We have attempted to address each of the reviewer’s comments, in a point-by-point format. Our own responses are immediately after each reviewers comment (underlined), and any relevant supporting quotations from the text are highlighted in italics. We have also highlighted the implications of the changes made where relevant.

Please do not hesitate to contact me for any further information.

Yours sincerely

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University of Limerick, Ireland
Reviewer: Ann Marie Swank

Reviewer's report:
Major compulsory revisions:
1. Provide a more detailed rationale for the statistical methods used including the reason for the separate one way ANOVA to analyse differences between groups and repeated measures ANOVA to find time and group by time interactions. I believe a one way repeated measures ANOVA with post hoc could be effective. Also provide rationale for using change scores rather than considering an analysis of co-variance (ANCOVA) given the group differences in baseline scores. We had performed the analysis using change scores as we believed this was an appropriate means to adjust for the slight baseline differences. However, we have now modified the statistical analysis in line with the reviewer’s recommendations. We have now performed a one way repeated measures ANOVA (with Bonferroni post hoc comparisons) to examine time, group, and time x group interactions. In addition, we have now used ANCOVA rather than the change scores. This has resulted in a more conservative estimate of the between-group differences, such that the between-group difference for PKEROM after static stretching is no longer statistically significant (p=0.05, previously p=0.019). This change in the comparison between-groups has been acknowledged throughout the text. The other changes to p-values have not affected their statistical significance.

2. When presenting results only present differences that are statistically different. Since you chose P < 0.05 a-priori you need to stay with this cutoff as your level for significance. In other words variables are either statistically different or they are not.
We have done this for results such as the between-group difference between warm-up and static stretching (p=0.095) which are no longer reported. We believe that the p-value for the between-group differences between baseline and static stretching should be reported since they are p=0.05. We have described these as being not statistically significant, since it is not p<0.05. We believe this value should be reported as it is relevant – assuming it’s significance is not overstated, which we believe we have achieved.

3. Make sure that all statements made in the conclusion section can be supported by your statistical procedures.
Statements in the conclusion of the abstract and the conclusion itself are now in line with the statistical procedures.
Abstract conclusion: “The effect of warm-up and static stretching on flexibility was greater in those with reduced flexibility post-injury, but this did not reach statistical significance.”
Conclusion: “The previously injured subjects demonstrated a greater increase in flexibility after warm-up and static stretching than the uninjured control subjects, however this did not reach statistical significance.”

In addition, the statement that the previously injured group were slightly less flexible at baseline has also been removed from the conclusion.

4. Label statistical differences in Table 1; be sure to clarify time effects, group effects and interaction effects.
   These have now been added. Note that we have not highlighted the (non-significant) difference between-groups after static stretching since (as discussed under point 2 above) the difference is not statistically significant.

5. Use either Figure 1 (with statistical differences labelled) or table 1, but not both as duplicative data is presented.
   We believe this refers to Figure 5, as this is the figure that represents the same data as Table 1. We have therefore removed figure 5.

Minor essential revisions:
1. Clarify on all tables, figures and in the text whether you are talking about between group or within group (time effect) differences.
   We hope this is now clearer, both in Table 1 and in the text. Some minor errors for the control group data in the original Table 1 have also been amended – these have not affected the results.

2. On page 11 consider adding a sub-title "Impact on performance"
   This has been added, although the overall section is now shorter (in line with comments of the other reviewer).

Reviewer: Arnold G Nelson
Reviewer's report:
Major Compulsory Revisions
1. The title needs to better reflect the intent of the research. In the abstract, the stated intent of the research is to “examine the short-term effects on hamstring flexibility of warm-up, static stretching and dynamic stretching in individuals with previous hamstring injury and matched healthy controls.” The title needs to indicate the injury portion of the research.
The title has been changed to reflect this.

1. Note: the phrase ‘on hamstring flexibility’ in the above sentence quoted from the Abstract should be repositioned after ‘dynamic stretching’. This has been changed.

2. In the Conclusion portion of the Abstract there is a sentence that claims the current research contrasts with the studies on the effects of dynamic stretching on performance measures. This sentence should be dropped. You did not do any performance measurements so you do not know if your work contrasts with previous performance-based research. This sentence has been deleted from the conclusion part of the abstract as requested by the reviewer. It has also been removed from the conclusion section of the main manuscript itself.

3. In the last sentence of the first paragraph of the Background you state that dynamic stretching is carried out in a slow controlled manner. I am not familiar with chiropractic literature, but this definition appears quite different from the ones with which I am familiar. The textbook Essentials of Strength Training and Conditioning by Baechle and Earle, states: “Dynamic stretching - also called mobility drills - places an emphasis on the movement requirements of the sport or activity rather than on individual muscles. This type of exercise can closely duplicate the movement requirements of a sport or activity; for example, a walking knee lift stretch mimics the knee lift of a sprinter. Essentially, one can think of dynamic stretching as actively moving a joint through the ROM required for sport.” While dynamic stretching may be done slower than the actual performance, it is not really that slow. Most dynamic stretches are limb swings or hops, skips, lunges etc. and these are done at less than maximal speed but not necessarily slow. I guess my main confusion arises from the description you provide in the Methods for the dynamic stretch. From the description the reader has no idea how many times during the 30 s the leg movement occurred. If the person just did one movement, I would argue that dynamic stretching did not occur. WITHOUT A CLEARER PICTURE OF WHAT WAS DONE IT IS DIFFICULT TO ASCERTAIN WHAT WAS ACTUALLY DONE.

We accept that the original description may have caused confusion. The description in the Background section has now been changed to “a smooth, controlled manner” rather than “slow”, which better reflects the stretch performed. We thank the reviewer for highlighting this potential source of confusion. In addition, more detail has been provided in the Methods section regarding what was actually done for the dynamic stretch. We
hope that it is now clear that the dynamic stretch consisted of repeated hip flexion/extension swinging movements.

“For the dynamic stretch (D), each participant was instructed to actively swing the leg to be stretched forward into hip flexion until a stretch was felt in the posterior thigh whilst keeping their knee extended and their ankle plantarflexed [35]. The leg was then allowed to swing back into slight hip extension. This was repeated for 30 seconds, such that the dynamic stretch consisted of repeated hip flexion/extension swinging movements (Figure 4). Both stretches were carried out for 30 seconds and repeated three times for each leg [28], to try to ensure that each individual carried out the same amount of stretching on both days”.

In addition, we have expanded on this in the limitations section of the manuscript to acknowledge the potential discrepancies between the stretching techniques.

“We attempted to have both groups perform a similar magnitude of stretching (3x30 seconds), however the nature of dynamic stretching means the dynamic group spent less time in a lengthened position. In addition, the number of repetitions of the dynamic stretch performed may have varied between individuals. Despite this, the amount of dynamic stretching was standardised to time to allow comparison with the static stretch, and to reflect the reality of using dynamic stretching in clinical practice. The alternative of asking each participant to perform a defined number of leg swings could have caused considerable variation in the duration of stretching performed, due to individual variations in the rate of leg swings performed”.

4. In the Background portion of the Abstract, in the last sentence of the second paragraph of the Background, and various other places the term ‘healthy’ is used. This is probably a poor term to use since I doubt a thorough exam was done on each person to verify that they were free from disease. A better term for your control subjects would be ‘uninjured’.

The term “healthy” has been replaced with “uninjured” throughout the text.

Also, since all subjects were at least one month post-injury, instead of ‘injured muscle’, ‘previously injured muscle’ would be better terminology.

This has been changed throughout the text.

Terminology adds further confusion starting on the bottom of the page and continuing on to the top of page 9. Here you refer to previously injured muscle as one group and injured muscle as the other group. What happened to the control?

This was an error on our part, and we thank the reviewer for highlighting it. The two groups were “previously injured” and “uninjured”, and the text now reflects this.
5. What is your rationale for limiting subjects to the 1-12 months post injury? Did this time frame having any influence on the results?

The following has been added to the limitations section of the discussion section to address this.

“Subjects with an injury in the past month were excluded as it was felt that natural recovery of ROM after injury in these subjects may have confounded the results. Similarly, those with no injury in the past 12 months were deemed to be less likely to display reduced flexibility.”

We acknowledge that this may have influenced the results, although it is difficult to estimate the degree to which this was a factor. The following has also been added to the manuscript.

“The fact that the severity of injury, or the exact duration since injury, is unknown complicates interpretation of the results. Further research in groups with more clearly defined injury histories may reveal more significant differences between groups.”

6. After stretching the subjects were seated for 15 minutes. Did you control how they were seated? Were they on a chair or floor? Were the knees bent at ~90 degrees or kept straight? Was any shifting of position allowed? Since position could influence ROM, more information is needed.

After stretching the subjects were asked to sit on a standard chair for 15 minutes. They were asked to remain still, but their leg position was not standardised. It is possible this may have had a small effect on the results, and this has been added to the discussion.

“All subjects were seated for 15 minutes on a standard chair with their feet on the floor after stretching, however their exact knee and hip angles were not standardised, which could have influenced the results after 15 minutes rest.”

7. I was disappointed in the discussion. I could find nothing in the discussion relative to the intent of the study, i.e., the effect on previously injured muscle. Just because there was no difference between injured and non-injured does not mean it should be ignore. There are questions to answer. For example was the lack of difference due to the length of time post injury? Was it related to the severity of the injury? This would be more pertinent to the study than covering the effect of stretching on other performance variables and possible future research. You should stick to things that are known, i.e., ROM. These other two topics need only be noted in single sentences in the Conclusion section.

We have now added a short paragraph specifically relating to “Differences between groups”. The depth of discussion on this point remains limited however because of the lack of other comparable trials looking at the effect of stretching in a population with previous hamstring injury. While we agree with the sentiment that “Just because there was no difference between injured and non-injured does not mean it should be ignored”, the other reviewer has specifically asked us to restrict our discussion to those differences which were significant - “differences are either statistically significant or they are not”. 
Therefore, we have chosen to discuss the potential reasons why this difference may not have been significant in this study - including consideration of factors such as length of time post injury, severity of the injury etc…, as well as the potential clinical significance of the findings from the current study.
- See paragraph on “Differences between groups”

We have removed the paragraph on future research as requested, and have simply noted these in the conclusion as suggested by the reviewer.

We have shortened the discussion on performance variables in line with the reviewer’s recommendations. However, we have not removed it as the other reviewer requested a separate heading for this information – “Impact on performance”, which has now been added. We also believe it is important for readers unfamiliar with the literature on stretching to understand that our results do not imply static stretching is automatically the best choice of stretching. We believe that without balancing our results against the known advantages of dynamic stretching on performance, a non-expert may misinterpret the study findings. This is particularly the case in a journal such as BMC Musculoskeletal Disorders where the open-access policy has the advantage of being freely available to the general public.

8. In Reference 61 the authors’ names are all in capital letters, and such treatment is not done for any others. Why?
This was an error, and this has been changed.