Author's response to reviews

Title: The gait pattern is not impaired in subjects with external snapping hip: a comparative cross-sectional study

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Version: 2 Date: 17 May 2013

Author's response to reviews: see over
Author's response to reviews

Manuscript title: The gait pattern is not impaired in subjects with external snapping hip: a comparative cross-sectional study

At first, we would like to express our thanks to the reviewers for their valuable comments and suggestions for improving the manuscript. We have to our best ability made changes accordingly. We have provided a copy of the original comments below with our responses in bold while in-text citations are in italics. Changes in the manuscript text are documented with track-changes.

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Version: 1 Date: 24 April 2013

Reviewer's report
Version: 1 Date: 18 January 2013
Reviewer: David Krause

1. Is the question posed by the authors well defined? Yes

2. Are the methods appropriate and well described? Methods are not well described. The power of the study appears to be an issue

3. Are the data sound? Kinetic data is presented but not discussed

4. Does the manuscript adhere to the relevant standards for reporting and data deposition? Yes

5. Are the discussion and conclusions well balanced and adequately supported by the data? It appears some conclusions are misleading with references to previous works a misleading. Further discussion is necessary to clarify. Conclusions are compromised by the methodology.

6. Are limitations of the work clearly stated? Yes

7. Do the authors clearly acknowledge any work upon which they are building, both published and unpublished? Yes

8. Do the title and abstract accurately convey what has been found? Conclusion is not clear

9. Is the writing acceptable? Yes
Author's response to review:

Discretionary Revisions
1. Design – a measure of leg length would be helpful.

   We have included a measurement of leg length; please see Table 1.

   \textit{Correction: “Leg length was measured by an experienced physiotherapist as the distance from the trochantor major to the lateral malleolus on both sides.”}

   \textit{Correction: “Table 1”}

Minor Essential Revisions
1. Background. 1st paragraph. Clinical experience indicates a high prevalence. This needs a reference.

   In the manuscript we write, that clinical experience indicates a high prevalence. Our clinical experience is that external snapping hip occurs often among our patients with lateral hip pain. However, to our knowledge no articles on prevalence have yet been published on this topic. Therefore we cannot include a reference. Therefore we have chosen to delete that part of the sentence.

   \textit{Deleted: “Clinical experience indicates a high prevalence of external snapping hip, and“}

   2. Background 2nd paragraph. Association has never been documented? Are you sure? I think safer to say you did not find the association reported.

   \textbf{We have rephrased the sentence.}

   \textit{Correction: “but the association has to our knowledge, never been documented with valid outcome measures in subjects with symptomatic external snapping hip.”}

3. Background. 2nd paragraph – Other factors such as leg length, ITB tightness, foot mechanics can contribute. Addition of leg length measurement would have been a good addition to your methods.

   \textbf{The sentence has been rephrased, and we have included the following: leg length, ITB tightness and foot mechanics.}

   \textit{Correction: “but previous studies have suggested that weakness of the hip abductors, leg length, tightness of the iliotibial band, foot mechanics, altered walking and hip instability may play a role in the development of the condition [3,6-9].”}

4. Background 3nd paragraph, 2nd sentence needs a reference.

   \textbf{The literature on the topic is sparse, and therefore we have built our hypotheses on literature on iliotibial band syndrome. We believe that external snapping hip is associated with increased hip adduction and increased knee rotation as it has been}
documented for iliotibial band syndrome. We have rephrased and included a reference.

Correction: “A consequence of the proximal and distal attachments of the tract may be that external snapping is associated with increased hip adduction and increased knee rotation as it has been documented in subjects with iliotibial band syndrome [15].”


5. Background 4th paragraph. This paragraph is not clear.

The paragraph has been rewritten.

Correction: “To our knowledge, only few published studies report the clinical symptoms of external snapping hip. One study on external snapping hip reported an increased hip adduction angle and increased valgus knee angle during walking [7]. Furthermore, bilateral subtalar over-pronation accompanied by an increased static valgus knee angle in a standing position was found in the same study. Another study by Jacobsen et al. [9] reported decreased eccentric hip abduction strength in subjects with external snapping hip, and Bellabarba et al. [6] reported a high prevalence of hip instability in subjects with internal snapping hip.”

6. Methods – who is making the diagnosis? Is it the same clinician for each subject?

What is their background

Our experienced hip orthopedic surgeons gave the diagnosis of external snapping hip, and this is the normal procedure in our institution. Furthermore, the corresponding author evaluated all subjects using the inclusion and exclusion criteria listed in the manuscript. The inclusion procedure it further discussed in the last paragraph of the discussion.

Correction: “The subjects were diagnosed by one of two experienced hip orthopedic surgeons and afterwards the inclusion and exclusion criteria were evaluated by JSJ on all subjects.”

7. Design and procedure – Explain in more detail the nature of parallel studies

The paragraph has been rewritten and the parallel studies explained, please note that the reference to the parallel study is included in the reference list, reference number 9.

Correction: “This study is a comparative cross-sectional study of walking in subjects with external snapping hip and healthy subjects. This study is one out of two parallel cross-sectional studies on the same subjects. The two parallel studies were designed simultaneously but with individual outcome measures and hypotheses. One evaluated hip muscle strength and patient-reported outcomes using a dynamometer and the questionnaire Hip dysfunction and Osteoarthritis Outcome Score (HOOS) [9]. This study evaluated
specific mechanical outcomes related to walking.”

8. Gait analysis – please describe electrode placement and skin prep.

A description of electrode placement and skin preparation has been added to the method section under “Three-dimensional gait analysis”.

Correction: “Skin preparation and electrode placement was conducted according to the SENIAM recommendations [22] in a bipolar derivation with Ag/AgCl electrodes (Ambu Neuroline 720 01-K/12; Ambu, Ballerup, Denmark) with 22 mm of centre-to-centre spacing. Prior to electrode placement the skin was shaved and cleansed with alcohol.”


9. Data processing- please provide a reference or justify your normalization procedure. Why did you not use MVIC?

The issue of usefulness of MVC is discursively discussed in the literature. We find dynamically recorded reference amplitudes sufficient, as we were only interested in relative amplitudes in different phases of the gait cycle. Further reasons for choosing a dynamic task inherent reference were that it may be difficult to define MVC instructions to differentiate between the various tracts of the gluteus, and that it is close to impossible to control if patients and healthy subjects execute such a reference movement correctly (Frigo & Crenna 2009).

We have added a reference describing our normalization procedure.

Correction: “The linear envelopes were normalized in amplitude to the maximum sEMG signal during walking found across all trials from one subject and expressed as percent-maximum amplitudes [23].”


10. Methods – please describe Beighton’s hyper mobility testing you used. It appears 6 subjects were hypermobile and 7 were not

We have included a sentence describing how the test was used, and in the result section we have written both numbers and percent on subject with general joint hypermobility.

Correction: “A subject had general joint hypermobility if five out of nine criteria were fulfilled [21].”

Correction: “In Beighton’s test of joint hypermobility six subjects with external snapping hip (46.2%) fulfilled the criteria of general joint hypermobility compared to one healthy

We have added a sentence describing how the test was used, and in the result section we have written both numbers and percent on subject with general joint hypermobility.

Correction: “A subject had general joint hypermobility if five out of nine criteria were fulfilled [21].”

Correction: “In Beighton’s test of joint hypermobility six subjects with external snapping hip (46.2%) fulfilled the criteria of general joint hypermobility compared to one healthy
subject (7.7%), the difference in prevalence was not significant (p=0.063).”

11. Gait analysis – No significant differences for dynamic valgus knee…… not reported?

We have extracted the valgus angle at touch-down and the range of movement during the stance phase. No between-group differences was observed (Table 4)

Correction: “Table 4, dynamic knee valgus”

12. Discussion - 1st paragraph – “This indicates that the patients do not…. In your study this is the case. Based on the number of subjects I do not think you can supports a sweeping statement.

We have rewritten the paragraph.

Correction: “However, we did observe a non-significant 10% reduction of the relative activity of the gluteus medius and the rectus femoris muscle among subjects with external snapping hip compared to the healthy subjects during stance. Some of the comparisons may be slightly underpowered but generally the differences between the groups were small, and therefore they may not be clinically relevant.”

13. Discussion – 2nd paragraph – You are stating rehab focus should be focused on hip abduction strengthening based on your findings and other studies. You did not find a significant difference. Other studies suggest motor control, not muscle strength, as the focus.

We acknowledge that the writing were a bit unclear. Therefore we have rewritten a larger part of the paragraph, please read below.

Correction: “Clinical implications
Based on our results it seems that subjects with external snapping hip does not have an altered walking pattern compared to asymptomatic individuals. Therefore gait retraining may not be a relevant treatment modality. A study by Jacobsen et al. [9], reported strength deficits of 16% in the hip abductors among subjects with external snapping hip compared with healthy subjects. They suggested that muscle strength training should play a role in the rehabilitation of subjects with external snapping hip. However, as no studies have yet performed clinical intervention studies on patients with external snapping hip no evidence-based treatment is available. “

14. Discussion – 3th paragraph - This paragraph contradicts the previous paragraph that strength is the focus. This suggests pain control should be the focus.

We have revised a larger part of the paragraph, please read the answer to comment 14.

15. Discussion – 5th paragraph – The study was straight forward – opinion. Reword.
We have rewritten the sentence.

Correction (Discussion – 7th paragraph): “Even though the design of this study was based on commonly accepted methods some limitations need to be discussed”.

16. Check references – In particular – capitalization

The references have been checked and changes have been made. Please read our corrections in the reference list of the manuscript.

17. Table 3 – this appears to stand alone – Minimal discussion in text.

We have included a new paragraph in the discussion.

Correction (Discussion – 4th paragraph): “Our results showed no significant differences between groups in the joint moments of the lower limb. Simonsen et al. [12] previously showed an association between joint moments and hypermobility indicating greater joint moments among subjects with hypermobility. Since almost half of our subjects with external snapping hip had general joint hypermobility it was expected, that the joint moments of the knee and hip in the frontal and sagittal plane would be increased. Surprisingly, this could not be confirmed, which from a patient point of view is positive as higher joint moments has been associated with pain in muscles and joints [16, 25].

18. Suggest referring to all subjects as subjects – not patients and subjects

We have changed according to your suggestion, and now we are referring to all subjects as subjects and not patients and controls.

Major Compensatory Revisions

1. Abstract - Conclusions – confusing. The sentence starting with ..The activation of the gluteus….. what does this mean? Activation is reduced but could not be confirmed?

We have rephrased the conclusion.

Correction: “No significant differences in the walking pattern were found between subjects with symptomatic external snapping hip and healthy subjects. This suggests that subjects with symptomatic external snapping hip does not have an impaired gait pattern.”

2. Background. 2nd paragraph. “If hip instability is present these muscles have to work even harder”. This reference is a pilot study. They did not state this. They found GM muscle activity did not increase with more challenging tasks suggesting a different strategy. How currently stated in the manuscript is misleading.

We have deleted the reference, and we are now using another reference, which reported increased hip abductor moment in the middle of the stance phase in subjects with generalized joint hypermobility compared with healthy subjects.
Correction: “If the joints range of motion is increased as in generalised joint hypermobility these muscles work even harder, and this may result in musculoskeletal pain problems [12].”


3. Methods 1st paragraph - The study is powered to detect a 3.5 difference between groups (hip adduction angle). Please explain why you hypothesize a 3.5 difference is meaningful. It appears the study is underpowered.

Our sample size calculation was based on studies of runners with iliotibial band syndrome made by Noehren et al. (2007), who found a statistical significant difference of 3.5 degrees for the hip adduction angle, and by Ferber et al. (2010) who demonstrated a statistical significant difference of 2.5 degrees for the hip adduction angle. We calculated our sample size based on the assumption, that a difference should be greater than 3 degrees to imply a clinical impact. On the same time the number of subjects had to be realistic, and if we wanted to test differences of 1 degree, we would have needed 163 subjects in each group.

Some of the comparisons may be slightly underpowered but generally the differences between groups were small, and may question if the small differences may be clinically meaningful.

Gait analysis results – Table 3? There is no discussion in the methods regarding this kinetic data presented in table 3. Why this included if is there is little discussion regarding this component of your study. Was this from the parallel study?

Our results are reported in Table 4 (Old manuscript Table 3). They are not from the parallel study, and we have now included a paragraph in the discussion. Please read answer to comment 18 of the Minor Essential Revisions.

4. Discussion – 4th paragraph – In the Bellabarba study patients presented with a painful snapping in the groin. They tested with traction under fluoroscopy. As presented it would appear to the reader your subjects were the same as subjects in the Bellabarba study. The remainder of the paragraph is speculation. While ligamentous laxity may allow the ITB to snap abnormally, several suggest ITB tightness is a contributing factor to ITB snapping. The Bellabarbara study was 5 cases. Cases are not cause and effect and to state a high prevalence based on 5 cases is misleading.

We understand that our text might have been slightly misleading. Now we clearly describe that the patients in the study by Bellabarba et al. were patient with snapping and pain in the groin. We have also written, that the hip instability was tested with traction under fluoroscopy. However, we believe that an association between
hypermobility and external snapping hip could be a relevant focus in a future study, and therefore we discuss the possibility. On the same time we also write that tightness of the iliotibial band is suggested to be a cause by other studies.

Correction (Discussion -5th paragraph): “Bellabarba et al. [6] reported hip instability defined as generalized ligamentous laxity in patients with pain and snapping in the groin tested with traction under fluoroscopy. They suggested that hip instability could play a role in the development of internal snapping hip as subclinical instability associated with ligamentous laxity may allow the iliopsoas to snap abnormally over structures just deep to it. In external snapping hip the iliotibial band snap over the trochantor major, which may cause an eccentric overload of the gluteals and the iliotibial band during movement as it was reported by Simonsen et al. [12]. However, other studies suggest that tightness of the iliotibial band is one of the main contributing factor to iliotibial snapping [3,5].”
Reviewer's report
Version: 1 Date: 9 April 2013
Reviewer: Wanda Forczek

General comments
The manuscript describes an experimental study with the objective of investigating the walking pattern and muscular activity of the hip muscles between patients with symptomatic external snapping hip and compare it with able-bodied. Authors concluded that no significant differences in the walking pattern were found between the groups, though they found some trend towards a reduction in the activation of the gluteus medius muscle in the presence of symptomatic external snapping hip. Some of the data may present interest for BMC Musculoskeletal Disorders readers interested in gait analysis, yet the paper needs some revisions.

Author's response to review:

Minor Essential Revisions

Methods
Participants
1. It is worth to put the information about the number of women and men in the text.

 We have followed your suggestion and the number of gender is now in the text.

 Correction: “Thirteen subjects with external snapping hip (six men and seven women) were recruited from the Division of Hip Surgery at the Department of Orthopaedics at Aarhus University Hospital, Denmark between 1 April 2010 to 1 November 2010.”

 Correction: “a control group of 13 subjects (six men and seven women) with no hip, knee, ankle or back problems were included from the social network of the subjects with external snapping hip and through the hospital’s intranet.”

2. For the future it would be good to provide (as one of the exclusion criterion) a question about pregnancy. It is known that during this period due to the increased level of relaxin (mainly) there is larger laxity of the joints and ligaments.

 We apologize that exclusion due to pregnancy has not been written as an exclusion criteria. We did not include any pregnant women and excluded one woman due to pregnancy (reported in the flow-chart of the inclusion process in the parallel study, reference number 9, Jacobsen et al. (2012)). Now pregnancy is added as an exclusion criterion as it was.

 Correction: “The exclusion criteria were: osteoarthritis in the hip joint, hip dysplasia, internal snapping hip, other intra-articular pathology, previous operations in the hip, knee or ankle regions, diseases or injuries affecting muscle strength in the legs, pregnancy, steroid injection in the hip region within the last month.”
3. The information about the participants are included in Table 1. For sure, while reading the text the reader should know where to find them. So the suggestion is to put the reference to Table 1.

We reference to Table 1 in the text about the subjects.

Correction: “Thirteen subjects with external snapping hip (six men and seven women) were recruited from the Division of Hip Surgery at the Department of Orthopaedics at Aarhus University Hospital, Denmark between 1 April 2010 to 1 November 2010 (Table 1).”

References
4. There are some positions that require corrections (e.g. 8, 21, 23).

We have corrected our reference list.

Tables
5. Table 2 and 3: the description sentence should start with the capital letter.

This has been changed. Please read the text of Table 3 and 4 (old manuscript Table 2 and 3).

Major Compulsory Revisions

Abstract
1. Some of the keywords are also present in the title.

We deleted the keywords that are also presented in the title and included new keywords.

Correction: “Iliotibial band, trochantor pain, healthy subjects, walking, electromyography, EMG.”

Methods
Participants
2. There is no information about subjects’ BMI at all. Was it within the range for normal body weight? There is evidence, that BMI affects the gait parameters, so this information has to be included in the Methods section.

We have included information about the subjects BMI. This is reported in Table 1. Both groups have a BMI of approximately 23, which is defined as a normal BMI in Denmark.

Correction: “Table 1, BMI is included”.

3. In Table 1 there is information about a dominant leg. How it was identified?

All subjects were asked what leg they would use if the should kick a ball. This was not a problem for the subjects. We have included a short sentence in the manuscript
explaining our method.

Correction: “Limp dominance was reported by asking the subjects which limp they would use if they were going to kick a ball.”

4. Bearing in mind that it reflects functional asymmetry it was worth to measure the length of the lower extremities since it prevents from the risk of asymmetry following from different length of lower extremities. That is why there should be included such information.

We understand your concern about asymmetry and leg length, and therefore we have included the leg length of the tested limp of both groups. We did not find any problematic asymmetry in any of our subjects. A few had small differences of approximately 1 cm, which we believe is normal and could also be measurement error. Furthermore, when no problematic asymmetry was found, we did not want to report leg length of all subjects on both limps. In our opinion this would had taken to much space. Leg length has been included in Table 1.

Correction: “Table 1, leg length).”

Correction: “Leg length was measured by an experienced physiotherapist as the distance from trochantor major to the lateral malleolus on both sides.”

5. There are missing information about the measurement protocol. What was the command given to subjects before they initialized each of the trial?

A section describing the measurement procedure has been added to the method section under “Three-dimensional gait analysis”.

Correction: “The force plate was covered with the same vinyl surface as the laboratory floor and not noticeable. Subjects were naïve to gait analysis, and they were not informed about the requirement of hitting the force plate. The start position was altered, if necessary, and marked after the subjects had executed a sufficient number of trials to hit the plate (3 – 12 familiarization trials). Once the walk up distance was defined the subjects were vocally addressed to get ready and start walking for data recording. We only experienced a small number of trials where the subjects did not hit the force plate, and the maximum number of test trials was 16 for the whole sample. Experience from previous investigations in the laboratory demonstrated a good repeatability in participants with relatively small restrictions in gait function.”

6. Where, on the walkway, was a force platform placed? Did the subjects know where it was? Were the subjects instructed to hit the force platform with the given foot? This kind of approach may be a risk to manipulate the step length and thus affect other parameters.

A section describing the use of the force platform has been added to the method section under “Three-dimensional gait analysis”. Please read above under comment 5.
7. How many cycles were recorded as a whole in each person?

**A section describing how many gait cycles we were recorded as a whole in each person has been added to the method section under “Three-dimensional gait analysis”.

**Correction:** “The linear envelopes were normalized in amplitude to the maximum sEMG signal during walking found across all trials from one subject and expressed as percent-maximum amplitudes [23].”


8. As to EMG – how the electrodes were placed on the muscles (according to which recommendation)?

**Electrode placement was conducted according to the SENIAM recommendations, and we have added a reference (number 22).**

**Correction:** “Skin preparation and electrode placement was conducted according to the SENIAM recommendations [22] in a bipolar derivation with Ag/AgCl electrodes (Ambu Neuroline 720 01-K/12; Ambu, Ballerup, Denmark) with 22 mm of centre-to-centre spacing. Prior to electrode placement the skin was shaved and cleansed with alcohol.”


9. The velocity, indeed, is a parameter that can affect the results. How was the constant velocity of the level gait achieved? In my opinion and experience it is very hard to obtain it especially having such a small sample. What was the mean velocity of each individual’s gait and its deviation?

**Correction:** “Centre of mass velocity was determined during the analysis and varied by maximum +/- 3.7 % in standard deviation.”

Results
Gait analysis
10. Providing the spatio-temporal gait data in table format would make the reading of the article an easier task.

**To make the reading of the article an easier task we have included a small table with the spatio-temporal gait data, and the data are deleted from the text in the result section.**

**Correction:** “No differences were found between the groups concerning speed and step length (Table 2).”

**Correction:** “Table 2 has been included to the manuscript.”
11. As to the kinematic data, Table 2 should be supported by the comment on the rationale of the periods when the joint angles were identified (clarify the inclusion criterion). The same refers to the kinetic data (Table 3).

The periods are standard phases used in gait analysis. In this case they mainly served as search limits when extracting the data using the matlab script. For example, the knee moment shows a distinct pattern with a minimum during weight acceptance and a second minimum later during stance. The magnitude of the first minimum was referred to as minimum during weight acceptance (double contact) and so on.

12. It would be valuable to compare the results between women and men. There are some investigations that revealed sex as a risk factor for snapping hip.

Since our data is not powered to compare results between men and woman, we have chosen not to report results between men and women in our manuscript. We did, however, conduct an analysis of the hip adduction angle and the knee rotation angle following your suggestion. Please refer to the results from this analysis below.

<table>
<thead>
<tr>
<th></th>
<th>Men n=6</th>
<th>Woman n=7</th>
<th>Difference</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip adduction</td>
<td>3.4 ± 2.5</td>
<td>5.4 ± 3.0</td>
<td>2.0 (-1.3, 5.4)</td>
<td>0.207</td>
</tr>
<tr>
<td>Knee rotation ROM</td>
<td>13.5 ± 4.5</td>
<td>10.8 ± 3.6</td>
<td>-2.8 (-7.7, 2.2)</td>
<td>0.244</td>
</tr>
</tbody>
</table>

There might be a small difference between genders, but the small non-significant difference can also exist due to chance alone since we only included 6 men and 7 women.

Discussion

13. There is quite a poor discussion section. This section should be improved by the analysis of the literature in this field.

We have rewritten and to our opinion improved the discussion section. We have that you find our correction sufficient.

Correction: “Discussion section”

Discretionary Revisions

1. As the authors noticed, there are plausible alterations of the pattern of gait when the velocity is changed. It would be interesting to compare the patterns of walking subjects with slower and faster velocity.

We also found it interesting to compare the velocity in the faster and slower walkers in the patient group. But since our data is not powered to compare results between faster and slower walkers, we have chosen not to report these results in our manuscript. We have carried out an analysis of the hip adduction angle and the knee rotation ROM angle following your suggestion. Please find the results of this post hoc analysis below.
There might be a small difference between the faster and slower walkers. Among the faster walkers three were women and four were men. However, we did not detect a significant difference in our study.

2. For the convenience of the reader it would be better to provide separate section ‘Limitations of the study’.

We thank you for your suggestion. We have made a separate section using your suggestion to a title.