Author’s response to reviews

Title: Improving the Sensitivity of the Hop Index in Patients with an ACL Deficient Knee by Transforming the Hop Distance Scores

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October 20, 2005

Dear Eva Ageberg and Jon Karlsson:

Thank you for your careful review of the research article entitled “Improving the Sensitivity of Hop Index in Patients with an ACL Deficient Knee by Transforming the Hop Distance Scores”.

We have addressed your comments by revising our manuscript accordingly and providing a point-by-point response to indicate where and how it has been revised (see below). Furthermore, we have ensured that the revised manuscript conforms to all of the formatting requirements as outlined by the journal.

As you are aware, this manuscript outlines the limitations associated with the sensitivity of the one leg hop index in the detection of functional limitations in the ACL deficient patient and explores the statistical merits and implications of a data transformation in order to improve its sensitivity. We believe the detailed and sound methodology discussed will serve as a platform for future validation studies of such functional status measures and therefore is interesting and relevant in its field.

We would like to take this opportunity to thank you for your time and interest. Looking forward to hearing from you.

Sincerely,

Siobhan O’Donnell
Reviewer’s report

Title: Improving the sensitivity of the hop index in detecting functional limitations in the anterior cruciate ligament deficient by transforming the one leg hop for distance scores

Version: 1 Date: 19 September 2005

Reviewer: Eva Ageberg

Reviewer’s report:

General
This is a pilot study on improving the sensitivity of a commonly used functional performance test (the one-leg hop test for distance) by transforming the data. The study is interesting and relevant in its field, however, I believe that considerable re-writing is required before the manuscript can be considered for publication.

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

Background
1. Necessary information and rational for the study is included in the background. However, considering the high number of pages (5 pages) it needs to be shortened and held more concise. Some parts may be moved to the Discussion. Response: The background has been re-worked to ensure a more concise introduction to the study (currently 2.25 pages long).

2. Page 5, paragraph 2, line 3 f.b.: “… the opposite limb can be used as a control.” Various methods of assessing neuromuscular function have shown that both legs are affected after a unilateral ACL injury (see for example Gauffin et al, Int J Sports Med 1990, Lysholm et al, Scand J Med Sci Sports 1998, Roberts et al, J Orthop Res 2000, Urbach & Awiszus, Int J Sports Med 2002, Wojtys & Huston, Am J Sports Med 2000, Zätterström et al, Am J Sports Med 1994). In addition, if a patient hops a very short distance (e.g., 10 cm) in both legs, the limb symmetry index will show a normal value, although the hop distance is abnormal in relation to reference values of a control group of uninjured subjects (a discussion on this latter is to some extent included on page 14). For these reasons, limitations in using a limb symmetry index, where the uninjured leg is used as control, should be included in the Introduction and/or Discussion. Response: The limitations associated with the use of the hop index scores have been built into the Discussion section (see pg. 14).

3. Page 8, lines 6-8: “... and ultimately its clinical utility in determining and individual with an ACLD knee readiness to return to sports and/or need for reconstructive surgery.” It is well known that not just one test can be used to determine whether a patient needs surgery or not, or to determine readiness to return to sports. This decision is made based on several variables (objective and subjective variables) and varies depending on for example individual factors and country. See also comment on limitations on limb symmetry index above. Therefore, I believe that this part of the sentence should be rephrased or omitted. Response: We agree and therefore have omitted this part of the sentence.
Methods
More information is needed on subjects and test procedure:
4. Include information on subjects’ age and activity level (before injury and at test occasion in the patients). **Response:** The suggested population characteristics have been added to the Results section (see pg. 9).
However, to fully validate our methodological approach we have recommended that future trials include both men and women (see bottom of pg. 14).

6. Page 9, line 2: 6 weeks post injury seems to be a rather short time period after the injury. Was this time period considered to be ethically acceptable (i.e., the risk of sustaining an injury while performing the hop test)? **Response:** Including ACL deficient patients at least 6 weeks post injury was considered ethically acceptable given that symptoms related to the acute stage of injury would have for the most part resolved and that the criteria for inclusion consisted of fully positive ACL laxity tests indicating a chronic ACL tear. Furthermore, all participants were educated on the purpose of the study, testing procedures, potential risks and the option to withdrawal at any time without consequence to their care (see pg.7).

7. Page 9, line 5: "...confirmed at time of surgery.” Does this mean that the injury was confirmed after the study was performed? Were more patients included at first, and excluded after surgery due to the inclusion criteria, i.e., isolated, complete ACL injury? In addition, injury to the ACL is often associated with other lesions, which probably means that several patients were excluded after the injury was confirmed. More information on the design of the study is required. **Response:** The inclusion of the ACL deficient patient was dependent upon them having a grade 2 or 3 ACL ligamentous laxity on manual testing and the absence of other ligamentous involvement. Since all ACL deficient subjects were scheduled to undergo reconstructive surgery after testing we took the opportunity to confirm our clinical findings. In all cases the clinical diagnosis was confirmed arthroscopically.

8. Hop test: Were trial hops allowed? How was the hop distance measured, e.g., toe to heel? **Response:** All subjects performed a total of three hop trials on each limb. Rest periods of approximately two minutes were interspersed between hop trials to minimize the effect of fatigue. Practice trials were not permitted however, patients warmed up on a stationary bicycle for 5 minutes prior. The hop distance was determined by measuring the distance traveled from heel to heel from the beginning to final standing position. (see pg. 6-7).
Results
9. The results section should be kept more straightforward and concise. Provide only answers to the questions you have posed. The results currently contain parts that should be included in the discussion, i.e., interpretation of results and in relation to other studies (e.g., page 12 first paragraph), or in the method section (e.g., page 12, paragraph 2). Please change throughout the Results. Response: Revised as suggested.
10. Pages 11 and 12: Do not include references in the results. The results of your study in relation to other studies should be discussed in the Discussion. Response: Revised as suggested.

Discussion
The main findings of the study are well summarized. However, the Discussion needs to be extended. Response: Discussion section revised taking into consideration comments outlined below (comment # 11, 12 and 13).
11. Some parts in the Introduction may be moved to the Discussion (see comment above).
12. Parts in the Results, where the results are interpreted and discussed in relation to other studies, should be included here (see comment above).
13. Include a discussion on limitations of the method (see comments above).

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Background
14. Page 4, line 7: What is meant by “dynamic function”? Do you mean tests that stress dynamic (or functional) joint stability? Do you mean tests on the activity/participation level, according to the International Classification of Functioning (ICF) (http://www3.who.int/icf/icftemplate.cfm)? Please clarify and use an accurate term (see for example Williams GN et al, JOSPT, 2001). Since measures of impairment, such as range of motion, proprioception, and muscle strength, are also of importance, I suggest that the sentence be changed to: “... physical impairments to also include test of...” Response: We intended to describe the one leg hop as a test that stresses dynamic joint stability and have clarified this point throughout the paper. We omitted the first paragraph of the background section that described the relative value of physical impairment outcomes and tests that stress dynamic knee stability in order to provide a more concise background summary.
15. Page 7, paragraph 2, lines 5 and 9: Please include a reference on transformation of data and how it is used, after these sentences. Response: The sentences mentioned have been referenced appropriately and moved from the Background to the Discussion section (see pg. 13).

Methods
16. Page 10, paragraph 1: Are scatterplots, associations, and relationships an established method of assessing sensitivity? Please provide a reference, if possible. Response: The scatterplots and Pearson Product Correlations were used to explore the potential impact that limb differences in distance hopped had on the hop index therefore, no specific reference is available.
17. Page 10, paragraph 2: Are the interpretations of correlation coefficients based on previous studies or clinical considerations? Please provide a reference or an explanation for these cut-offs. Response: The interpretations were based on what the literature typically defines as a weak, moderate and strong association however, we decided to delete
these cut-offs from the methods section in order to provide the relevant information in a concise manner.

Results
18. Page 10, line 1: Move this information to the method section/subjects. 

Response: The range in time post injury can be found under the subheading ‘Study Population Characteristics’ within the Results section. (see pg. 9).
19. Page 10. Include a table containing hop distance scores for both legs and both groups, including means (SD), mean difference (SD).

Response: We have provided descriptive statistics within the Results section under the subheading ‘Hop Distance Scores’ (see pg. 9) as well as in Table 3 on the hop distance scores and chose not to present the raw data to ensure that the Results section focuses on addressing the objectives posed. However, should the reviewer’s feel strongly that this data would enhance the reader’s understanding of the matter we are happy to accommodate.

20. Page 10, line 2 f.b.: What is “average limb performance”? Average of the right and left legs? Please clarify.

Response: The average limb performance has been defined within the revised version of the manuscript. The sentence above now reads as follows: “Furthermore, a comparison of the hop distance on the non-injured limb of the ACLD with that of the average limb performance (dominant + non-dominant hop distance / 2) in the Controls demonstrated a comparable performance (mean difference = 0.03m; p=0.67)” (see pg. 9).

Discussion
21. To determine an abnormal performance, a single test is not sufficient. Include a discussion on this subject.

Response: A brief discussion on this subject has been included within the Discussion section (see top of pg. 15).

22. A discussion on the need for further study is currently included in the conclusions. I suggest that this is moved to the Discussion.

Response: Revised as suggested

Conclusions
23. Please see comment above in “Discussion”.

Figures
24. Figure legends, Figure 1, lines 1 and 3: Remove “… moderate-strong…” and “very strong”, since these are interpretations of the results (which should be included in the discussion).

Response: Revised as suggested.

25. Figure legends, Figure 2, lines 1-2: Remove “… moderate-strong…” (see above).

Response: Revised as suggested.

26. Figure 1: Please use different line styles for the regression lines for the two groups, in order to make it clearer.

Response: Revised as suggested.

Tables
27. Please be consistent in using headings in Tables 1-3 (Table 1: ACLD Knees, Normal Knees Table 2: ACLD, CONTROLS, Table 3: none)

Response: Revised as suggested.

28. Table 4: Please present data according to standards, e.g., mean (SD).

Response: Revised as suggested.

Discretionary Revisions (which the author can choose to ignore)

Title
29. Since patient first language is usually recommended, I suggest that the title is changed to: Improving the sensitivity of the hop test index in detecting functional limitations in patients with ACL deficiency by transforming the one leg hop for distance scores.

Response: The title has been revised and currently reads as follows: “Improving
the Sensitivity of Hop Index in Patients with an ACL Deficient Knee by Transforming the Hop Distance Scores”

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest:
An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No

Declaration of competing interests: I declare that I have no competing interests.
Reviewer’s report

Title: Improving the sensitivity of the hop index in detecting functional limitations in the anterior cruciate ligament deficient by transforming the one leg hop for distance scores

Version: 1 Date: 22 September 2005

Reviewer: Jon Karlsson

Reviewer’s report:
Comments to the authors.

Title
The title is too long. Please rewrite to a shorter and more distinct title. The word knee is missing; it should read”…. In the ACL deficient knee, by transforming….” Response: The title has been revised and currently reads as follows: “Improving the Sensitivity of Hop Index in Patients with an ACL Deficient Knee by Transforming the Hop Distance Scores”.

Abstract
1. In general terms, the Abstract is well written and describes the results adequately.
2. Please do not use abbreviations in the Abstract. Some of the abbreviations are not even explained. Please revise. Response: Abbreviations removed.
3. Please define “hop index” in the Abstract. Response: The abstract has been revised to include a definition of the hop index (i.e. the ratio or percentage of limb performance).
4. The authors should make it clear that the sensitivity is low. Even after the arithmetic transformation, the sensitivity was low. The authors do not really emphasise this in the Abstract. Response: Revised as suggested.
5. The authors only mention the 90% hop index in the Abstract, they should mention the 85% hop index as well. Response: Revised as suggested.
6. The last sentence should be moved to the Discussion section; it is obvious that the hop tests should be further explored in larger studies, preferably with better study design. Response: Revised as suggested (see pg. 2-3 for revised abstract)

7. The key words are relevant.

Introduction
Even though the introduction is mostly well written, it does not really come to the point, i.e. what is the background. In other words, which is the controversy, and why was it necessary to do this study? This is a central issue and should – in my opinion be directed to the important issue – the functional evaluation of the ACL-deficient knee. Please rewrite. Response: Revised as suggested

The description of the OLHD is sufficient and the correlation with the IKDC is good. However, the Introduction is far too long and for instance the second paragraph on page 5 should be deleted, this is common knowledge. Moreover, it is easy to shorten the Introduction further without losing any major scientific information, please rewrite. Also, the second paragraph on page 7 can be deleted. Response: Revised as suggested.

Why either 85% or 90% hop index should be chosen is not clear at all, please explain and discuss in further detail. Response: A normal hop index has been shown to be > 85%

Did the authors have any hypothesis? *Response: The paragraph that proceeds the objectives, and the objectives themselves capture this, and we believe to frame as a hypothesis would be redundant (see bottom of pg. 5).*

**Methods**

1. The subjects and test procedure are well described, but the hop test is really very simple.

2. Why did the authors use the longest hop and not an average of the three tests? How familiarization and warm-up was done is not described. *Response: The longest distance of the three trials for each leg (versus the average) was used to calculate the hop index for ease in computing as it has been shown that the different analysis strategies have no effect on the hop index.* [Kramer JF, Nusca D, Fowler P, Webster-Bogaert S: Test-retest reliability of the one-leg hop test following ACL reconstruction. *Clin J Sport Med* 1992, 2: 240-243] (see top of pg. 7).

Subjects warmed-up on a stationary bike for five minutes prior to performing three hop trials on each limb. Each subject received verbal instruction and a demonstration on how to perform the test however, practice trials were not permitted (see pg. 6).

3. I question the statistical methods, with such a limited sample. Was any sample size calculation done? *Response: This was a pilot study investigating the limitations associated with the validity of the OLHDL in detecting functional limitations in the ACLD. However, a sample size calculation was performed to ensure that the expected difference in the absolute hop distance between ACLD and healthy non-injured Controls would be detected with a power of 0.80 and probability of 0.05. The literature was examined for studies with similar populations, and descriptive statistics pertaining to the hop distance of the OLHDL were collected for this purpose. [Gauffin H, Pettersson G, Tegner Y, Tropp H: Function testing in patients with old rupture of the anterior cruciate ligament. *International Journal of Sports Medicine* 1990; 11(1): 73-77; Tegner Y, Lysholm J, Lysholm M, Gillquist J: A performance test to monitor rehabilitation and evaluate anterior cruciate ligament injuries. *The American Journal of Sports Medicine* 1986; 14(2): 156-159]. And the sample size required to detect a difference of 20 to 32 cm between ACLD and
Control group with a power of 0.80, at a probability of 0.05 was calculated to be eight to ten subjects within each group. We have acknowledged that our study is limited by our sample size and have recommended the employment of the methodology described in a larger, more diverse sample order to fully validate this approach (see pg. 14).

4. Calculation of sensitivity and specificity are not appropriate in this context, and should be deleted. Response: Other investigators have used the hop index to determine the sensitivity and specificity of the one leg hop test (and other single limb performance measures) for detecting deficits in lower limb function in patients with ACL deficiency. [Barber SD, Noyes FR, Mangine RE, et al: Quantitative assessment of functional limitations in normal and anterior cruciate ligament-deficient knees. Clin Orthop 1990, 255: 204-214; Noyes FR, Barber SD, Mangine RE: Abnormal lower limb symmetry determined by function hop tests after anterior cruciate ligament rupture. Am J Sports Med 1991, 19(5): 513-518.]. The underlying assumption in these studies, as well as in our study, was that detection of an abnormal hop index would indicate the presence of a functional deficit.


Results
1. Patients were tested between 5 and 60 months (6 years) after the ACL injury, in other words a very heterogeneous patient group. It can hardly be expected that the same muscular function can be expected after 5 months and 60 months. Response: While the time post injury was variable in this group of ACLD patients, one could view this as a strength of this study i.e. more generalizable results. Also, despite the varying lengths of time post injury, all patients were scheduled for reconstructive surgery, and had significantly reduced post injury activity levels, as a result of functional limitations associated with their ACL injury.

2. Please write 20 cm instead of 0.2 m, and 5 cm instead of 0.05 m. Response: Revised as suggested (see pg. 9).
3. In general terms the Results section is too long, at least half of the Results section can be moved to the Discussion. Response: Revised as suggested.
4. Sensitivity and specificity are not accounted for. I suggest the authors delete this information. Response: Please see response to comment #4 in “Methods”.

Discussion
1. Please start the Discussion with a short sentence…. “The most important finding of this study was…. ” Response: Revised as suggested (see pg. 11).
2. The Discussion section is very brief and does not include any real comparisons with previous studies. For instance, which tests should be used? Obviously the OLHD can not be recommended. **Response: Revised as suggested.**

3. I suggest the authors thoroughly discuss the limitations of the study, such as too limited sample and no sample size calculation. Moreover, what was the hypothesis, what did the authors expect to find? **Response: Revised as suggested (see pg. 14).**

4. Finally, please give a short and relevant conclusion to the present study. What is the clinical relevance? Any future perspectives? **Response: In order to provide a short and relevant conclusion that captures the main findings of the study we have discussed the clinical relevance and future perspectives within the Discussion section.**

**References**
The references are up to date and relevant.

**Figures and Legends**
The references are relevant and may be kept.

**Tables**
Tables 1-3 should be deleted. The information in these tables is common knowledge. **Response: We have deleted Table 1 however, have left in Table 2 and 3 as they present data related to the study and are therefore, not common knowledge.**

Table 4 can be kept.

**What next?:** Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** No

**Declaration of competing interests:**
'I declare that I have no competing interests'