Author's response to reviews

Title: Association between sensory function and medio-lateral knee position during functional tasks in patients with anterior cruciate ligament injury

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Author's response to reviews: see over
Response to reviewers’ comments

Dear Editor,

Thank you for your response and for the reviewers’ comments and suggestions. Changes have been made in order to meet the criticism raised, and in cases where we have not made the suggested changes, our reasons for not doing so are given. We hereby submit the revised version of the paper, with marked changes, along with response to each of the specific comments provided by the reviewers.

Sincerely,

Anna Cronström

As you suggested, a professional language editing service has been used to improve the style of written English.

REVIEWER 1

Chris Whatman

REVIEWER COMMENT
I would specifically suggest avoiding use of the term “elucidate” – this is an unnecessarily elaborate term – replace with “evaluate” or “investigate” or similar throughout

AUTHORS RESPONSE AND ACTION
Changes have been made and the word “elucidate” is replaced with “evaluate” throughout.

Abstract

REVIEWER COMMENT
28 – the use of the term “influence” in the objective implies possible cause and effect which the study design obviously doesn’t allow – replace with “association” as an title

AUTHORS RESPONSE AND ACTION
Changes have been made and the word “influence” is replaced with “associated” (line 30)

REVIEWER COMMENT
40, 41 – add to the method that you analysed for male v female differences.

AUTHORS RESPONSE AND ACTION
The following sentence is now added to the abstract section (line 43): “Separate gender analyses were performed”.

REVIEWER COMMENT
43 – review and edit results after consideration of comments in results section
AUTHORS RESPONSE AND ACTION
Changes have been made and the result section now reads: “Worse TDPM was associated with a KMFP during the drop jump in men. Worse VPT at the toe and ankle was associated with a KMFP during stair descending and the forward lunge in women, but no associations were found in men.” (lines 47-49)

REVIEWER COMMENT
48 – review and edit conclusion after consideration of comments in results
Section below
AUTHORS RESPONSE AND ACTION
Changes have been made and the conclusion now reads (lines 52-55): “Worse kinesthesia, measured by TDPM, might be associated with KMFP during the drop jump in men with ACL injury while worse vibration sense, measured by the VPT, at the foot and ankle might be related to KMFP in women. Further studies are needed to confirm these results.”

Background

REVIEWER COMMENT
65 – both 3D and 2D motion analysis can’t be the gold standard – I suggest 3D is the gold standard for motion analysis – please edit.

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentence now reads (lines 70-74): “Three-dimensional (3-D) motion analysis equipment is the gold standard for measuring medio-lateral knee position, but two-dimensional (2-D) motion analysis and visual observation and scoring are also used. The latter has moderate to high reliability [1-5], is valid in 2-D [2], and is an inexpensive method that is easy to use in both clinical settings and in large-scale studies [1, 2].”

REVIEWER COMMENT
68 – the authors need to be more cautious in statements re the reliability and validity of visual ratings of knee position during functional tasks – some methods have been shown to be more reliable than others and acceptable clinical reliability is not well defined (the cited Örtqvist et al. study for example reported only moderate reliability) and validity is also variable depending on the study and type of validity investigated (the cited Ekegren study reported their technique did not have sufficient sensitivity and specificity to be considered valid) – please edit this statement to give a more balanced view or be more specific/justify this statement

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentences now reads (lines 70-74): ” Three-dimensional (3-D) motion analysis equipment is the gold standard for measuring medio-lateral knee position, but two-dimensional (2-D) motion analysis and visual observation and scoring are also used. The latter has moderate to high reliability [1-5], is valid in 2-D [2], and is an inexpensive method that is easy to use in both clinical settings and in large-scale studies [1, 2].”

Methods

REVIEWER COMMENT
103 – time since injury and reconstruction also look longer in men than women?

**AUTHORS RESPONSE AND ACTION**

We have done statistical tests (independent t-test and Mann Whitney U test as appropriate) for all demographic differences between men and women. P-values are now added to table 1. Statistical significant differences between men and women were found for age and BMI, i.e., men were older and had a higher BMI than women, p=0.024 and p=0.004, respectively.

**REVIEWER COMMENT**

111 – why barefoot for some tests and shoes for others? Please justify? Could this have influenced the proprioception, kinesthesia during the dynamic tasks? Is this a possible limitation of the study?

**AUTHORS RESPONSE AND ACTION**

Shoes are usually used during forward lunge and drop jump for shock absorption which is now added to the method part (lines 119-121). However, we have chosen to not include this in the discussion part as we believe that this would be purely speculative and out of the scope of the present study.

**REVIEWER COMMENT**

123 – please clarify which styloid process was used?

**AUTHORS RESPONSE AND ACTION**

Changes have been made and the sentence now reads (line 131-132): “To make the subject familiar with the biothesiometer, It was tested on the subjects’ processus styloideus ulna”, and the original reference is provided.

**REVIEWER COMMENT**

129 – please add the actual reliability (ICC or SEM) from the studies referenced.

**AUTHORS RESPONSE AND ACTION**

Changes have been made and the ICC values of 0.96-0.99 are added (line 139)

**REVIEWER COMMENT**

142 – how did subjects “indicate” when they felt movement?

**AUTHORS RESPONSE AND ACTION**

Changes have been made and the sentence now reads (line 150-151): “The subjects lay in a supine position with closed eyes and were told to indicate by raising their hand when any sensation of vibration was felt.”

**REVIEWER COMMENT**

144 – why use the median value? Please justify using median rather than mean.

**AUTHORS RESPONSE AND ACTION**

The median value has been used in all studies for this proprioceptive device [6-16]. The median value, and not the mean value, is used since extreme values in one of the three consecutive measurements may occur. An extreme value differs substantially from the other values, and is thus not considered a reliable value. This “problem” is handled in different ways in various tests (e.g., excluding an extreme value and using the mean value of the remaining values). We believe that it is
appropriate to use the median value of three consecutive measurements for this device. Also, this allows comparisons between studies on kinesthesia data using this specific device.

**REVIEWER COMMENT**

*Did you examine the reliability of the TDPM measure? Please include if you did—if not this is a further potential limitation needing acknowledgement.*

**AUTHORS RESPONSE AND ACTION**

The following is now added (line 154): “A higher value indicates poorer TDPM, and moderate reliability (ICC = 0.63–0.70) has previously been reported for this device [8].”

**REVIEWER COMMENT**

149 – were visual ratings made in real-time by the 2 raters independently? If so how were disagreements dealt with? Please provide more detail to clarify.

**AUTHORS RESPONSE AND ACTION**

Changes have been made and the sentences now read (lines 159-163): “Movement quality, in terms of postural orientation, was assessed by visual observation of a video recording of each trial. The raters were able to watch the video in slow motion and to review the movie as many times as needed. The position of the knee in relation to the foot was independently scored by two experienced assessors during four different functional tasks commonly used to assess medio-lateral knee position.” And (line 170-172) “Any disagreement was resolved by consensus discussion between the two raters. If required, the recording was viewed several times and/or in slow motion until consensus was reached.”

**REVIEWER COMMENT**

153 – “talocrural joint” – was this the mid-point of joint? or do you mean mid-point of the malleoli as has been reported previously? Please clarify.

**AUTHORS RESPONSE AND ACTION**

Changes have been made in order to clarify and the sentences now read (lines 165-170): “The knee position relative to the foot during the participant’s performance of each task was assessed on an ordinal scale from 0 to 2. If the mid-point of the patella was in line with or lateral to the second toe, a score of 0 = “good” was given for the movement quality. If the mid-point of the patella was medial to the second toe, a score of 1 = “fair” was given. Finally, if the mid-point of the patella was clearly placed medial to the first toe, a score of 2 = “poor” was given (Figure 2).”

**REVIEWER COMMENT**

153 – please clarify the definition for “fair” movement quality. Also how did you rate a subject if the knee moved lateral to the foot?

**AUTHORS RESPONSE AND ACTION**

Please see response to comment above. None of the subjects had a knee position where the knee was positioned lateral to the fifth toe.

**REVIEWER COMMENT**

*Did you examine the reliability of your movement ratings? If so please report—if not again is this a potential limitation?*
AUTHORS RESPONSE AND ACTION
The ICC values for each test are added (Line 173 and Table 3). For your convenience, the ICC values are provided here: Single limb mini squat (ICC=0.757), Stair descending (ICC=0.780), forward lunge (ICC=0.710) and drop jump (ICC=0.939).

Statistics
REVIEWER COMMENT
Why did you calculate correlations and differences in means, it seems they are just different ways of answering the same question? Why not just use the most appropriate for the study question? – please justify.

AUTHORS RESPONSE AND ACTION
After analyzing the results we noticed that in some cases there were very few values in 1 of the three groups (good, fair or poor) which may result in that the correlations in some cases were dependent on very few subjects in one of the groups. Since this is an exploratory study we therefore believe that conducting both correlations and difference in mean will provide more information.

REVIEWER COMMENT
Was there any basis for the sample size used in the study? Specifically did you have enough subjects to analyse men and women separately?

AUTHORS RESPONSE AND ACTION
Because this is an exploratory study, sample size calculations or multiple correlation corrections were not performed. To clarify this to the reader, we have made changes to the manuscript as follows (lines 191-193): “Because this is an exploratory study, we did not calculate sample size a priori, nor did we apply corrections for multiple comparisons”. We have also added (line 106): “A convenience sample” in the method section. In the discussion section, we discuss the sample size in relation to the few results found, (lines? 222-226) “A similar, but non-significant, correlation coefficient was found in women (r_s = 0.469, p = 0.106). To reach a significant correlation of r_s = 0.47 would have required at least 18 subjects in the analysis [17], but we had only 13 women in the present study. Thus, the non-significant correlation in women might be due to too small of a sample.”

REVIEWER COMMENT
164 – on what basis did you decide there was no relationship between demographics and knee position? Please clarify?

AUTHORS RESPONSE AND ACTION
We performed correlation analyses between all demographic and sensory variables and knee position score during each test in order to detect any variables that may influence the data. To clarify this, the sentence now read: “There were no statistically significant correlations between patient demographics and the medio-lateral knee position or sensory variables (p>0.05).” (Line 181)

REVIEWER COMMENT
Given you dichotomised the visual ratings why didn’t you just use a dichotomised rating in the study? Previous authors have suggested dichotomised ratings are the most reliable.

AUTHORS RESPONSE AND ACTION
We are aware of studies reporting that dichotomized ratings may be more reliable. To our knowledge, studies using dichotomized variables are mainly conducted in healthy individuals. However, previous studies in patients with ACL injury report variations in movement quality responding to “good”, “fair” and “poor” [1, 18]. Because we included subjects with ACL injury, we were thus interested in investigating proprioception in relation to these movement quality scores.

**REVIEWER COMMENT**
173 – what is meant by “exploratory character” – and is this justification for making multiple comparisons? – you should at least acknowledge this as a limitation so readers are aware. Would it be more appropriate to use ANOVA?

**AUTHORS RESPONSE AND ACTION**
To our knowledge, our study is the first investigating the possible association between sensory function and medio-lateral knee position. For this reason, it has an exploratory character. A clarification is added to the discussion (lines 289-291) “Finally, because this was an exploratory study we did not correct for multiple comparisons. Thus there is a risk that some of the findings in this study are due to chance, and further studies are needed to confirm our results.”

We have discussed the use of ANOVA vs t-tests with our statistical adviser. We were advised to keep the statistical analysis in its present form. If using the ANOVA, we would still need to correct for multiple comparisons.

**REVIEWER COMMENT**
Including confidence intervals and/or effect sizes for all your outcome statistics would significantly improve the reporting of results – I strongly recommend you at least consider the inclusion of confidence intervals given the question of adequate sample size.

**AUTHORS RESPONSE AND ACTION**
We have provided the confidence intervals and the mean differences for the difference in means (Table 6). However, after discussions with our statistical adviser, it seems to be quite uncommon to report confidence intervals for correlation coefficients. Therefore, we have not added any confidence intervals for the correlation coefficients.

**REVIEWER COMMENT**
Please include the threshold for statistical significance – if this is what you based your inferences on.

**AUTHORS RESPONSE AND ACTION**
Changes have been made and the following sentence was added to the statistics (line 193): “A p-value less or equal to 0.05 was considered statistical significant.”

**REVIEWER COMMENT**
179 – what test was used for making this inference? Your statistics don’t appear to include a suitable test for differences in categorical variables.

**AUTHORS RESPONSE AND ACTION**
This is now clarified (Line 190): “The Mann Whitney U test was used to detect any differences in medio-lateral knee position between men and women.”
REVIEWER COMMENT
179 – “functional task” versus “dynamic tasks” – please be consistent throughout with the terminology.

AUTHORS RESPONSE AND ACTION
“functional task” is now used throughout

REVIEWER COMMENT
183 – you report two correlations – one is statistically significant (based on p # 0.05) and one isn’t – this is confusing – please clarify? You should also include the p values in the bracket in the text e.g. (r=0.423, p=0.044)

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentence now read (line 202)” Worse kinesthesia was associated with a KMFP during the drop jump in men (r_s=0.423, p=0.044).”

REVIEWER COMMENT
Please also comment on the magnitude of these correlations – these are likely considered only moderate by most authors. Correlations and p values better presented to only 2 decimal places – please edit throughout.

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentence now read (line 274-279):” The correlations found in the present study were mostly moderate and indicated some association between sensory function and medio-lateral knee position. However, future studies are warranted to evaluate the role of sensory function as well as other possible contributing sensorimotor and biomechanical factors for medio-lateral knee position in patients with knee injury. Such knowledge will help in the design of training programs for these patients.”

To our knowledge, correlations and p-values are commonly presented with 3 decimals which gives the reader more information than for example p>0.01. Therefore we have decided to present the data with 3 decimals.

REVIEWER COMMENT
183 – edit to include underlined words that follow “….was associated with KMFP with descending…….”

AUTHORS RESPONSE AND ACTION
This is included and the sentence now reads (lines 203-206) “). In women, worse vibration sense at MTP1 and MM was associated with a KMFP during stair descending (r_s = 0.453, p = 0.034 for MTP1, and r_s = 0.626, p = 0.002 for MM), and worse vibration sense at MM was associated with a KMFP during the forward lunge (r_s = 0.544, p = 0.016) (Table 5).”

" 

REVIEWER COMMENT
184 – you report an association in women based on a correlation that ranges from –ve to +ve and a range of significant and non-significant correlations (based on p # 0.05) – this is confusing and seems poor interpretation of the findings –
please justify/review.

AUTHORS RESPONSE AND ACTION
Changes have been made and we have decided to only report statistical significant correlations in the result. The sentence now read (lines 203-206)” In women, worse vibration sense at MTP1 and MM was associated with a KMFP during stair descending ($r_s = 0.453, p = 0.034$ for MTP1, and $r_s = 0.626, p = 0.002$ for MM), and worse vibration sense at MM was associated with a KMFP during the forward lunge ($r_s = 0.544, p = 0.016$) (Table 5).”

REVIEWER COMMENT
188 – again your results don’t appear to support this stated difference in women – not all vibration sense measures in women during stair descent and lunge were significantly different (only 3 of 6 measures were) – you need to be more specific.

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentences now read (line 209-214)” Women with a KMFP during stair descending had significantly worse vibration sense at MTP1 and MM than those with a KOPF (mean difference = 2.43 and 95% CI = −4.84 to −0.02 for MTP1; mean difference = 2.98 and 95% CI = −4.91 to −0.84 for MM). Women with a KMFP during the forward lunge had significantly worse vibration sense at MM than those with a KOPF (mean difference = 2.69 and 95% CI = −4.63 to −0.74), but no such differences were found in men (Table 6 and Figure 3a-b).”

REVIEWER COMMENT
189 - please also state the difference not just the p values.

AUTHORS RESPONSE AND ACTION
Please see comment above

REVIEWER COMMENT
189 – I think you are referring to Figure 3, not Figure 2? – please check.

AUTHORS RESPONSE AND ACTION
Corrections are made and the text is now referring to Figure 3 (line 214).

REVIEWER COMMENT
191 – how did you calculate 40% worse kinesthesia? Needs more detail and clarification and please also clarify what you mean by borderline statistical significance

AUTHORS RESPONSE AND ACTION
To avoid confusion, this part is deleted from the results section.

REVIEWER COMMENT
192 – again I don’t think you should be referring to figure 2c-d? – confusing – needs checking.

AUTHORS RESPONSE AND ACTION
This figure is now deleted from the manuscript

REVIEWER COMMENT
Again I’m concerned re the lack of balance in the interpretation of the findings,
especially regarding non-significant results – while not statistically significant some subjects with KMFP performed better on the VPT and TDPM tests?

Authors Response and Action
Changes have been made in the result section to only report the significant correlations. (Line 202-214)

Discussion

Reviewer Comment
195 – do your results really support this statement? You have a significant correlation for men only (of moderate magnitude) and you don’t have a statistical difference between good and poor movement groups for men or women?

Authors Response and Action
Changes have been made and the sentence now read (line216): “These results indicate that worse kinesthetic acuity might be associated with KMFP during the drop jump—a test resembling a sports activity—in men with ACL injury.”

Reviewer Comment
197 – again I can’t see what this strong statement is based on – please justify based on your findings. You certainly haven’t analysed for “clear associations”- to do so you would need to report confidence intervals for you correlations.

Authors Response and Action
Changes have been made and the sentence now read (lines 217-219): “Worse vibration sense at the foot might be associated with KMFP during functional tasks resembling activities of daily living in women, but no such associations were observed in men.”

Reviewer Comment
200 – you found this correlation for men but there was no significant difference in TDMP for men with good or poor movement in the drop jump – please comment.

Authors Response and Action
The movement quality scores were dichotomized to add more information about the association between sensory function and KMFP. Because several subjects were not able to perform all tests, this likely had an effect on the statistical power. This is mentioned in the discussion (line 281-285). “Sixteen subjects were not able to perform all functional tasks, for example, 10 out of the 23 women were not able to execute the drop jump task. This resulted in a small sample for the drop jump in women and a small number of subjects in the good and poor knee-position groups during all functional tasks, and this might have contributed to the lack of significant findings.” Changes have also been made to lines 226-229 “Moreover, in absolute values, although not reaching statistical significance, both women and men with KMFP during the drop jump had approximately 40% and 50% worse kinesthesia, respectively, than those with KOPF. This finding justifies further studies on the possible importance of proprioceptive acuity for medio-lateral knee position.” “…Approximately 40% and 50%...”was calculated by dividing the mean value of KMFP with the mean value of KOPF.
REVIEWER COMMENT
206 – statistical significance cannot be interpreted as clinically relevant, suggest deleting this statement – to assess clinical relevance you need to report the magnitude of the outcome and the confidence interval, with appropriate interpretation – (you really need to report the confidence interval for the correlation so readers can appreciate the uncertainty in your outcome given the small sample size.

AUTHORS RESPONSE AND ACTION
The statement on clinical relevance is omitted. Please see also response to previous comment regarding confidence intervals for correlation coefficients.

REVIEWER COMMENT
215 – this paragraph refers to several studies investigating the ACL hamstring reflex – is there good rationale for how this reflex may influence medio-lateral knee position?

AUTHORS RESPONSE AND ACTION
To avoid confusing changes have been made in this paragraph (line 235-245) “Proprioceptive mechanoreceptors like the Golgi organ, free nerve endings, Pacinian corpuscles, and Ruffini endings are situated in the human ACL, capsule, menisci, and cartilage and are suggested to play an important role in the ability to detect movements and to sense where the joints are in relation to each other and to the environment [19, 20]. These receptors are also reported to be involved in muscle stiffness regulation via the gamma muscle spindle circuit and are thus also important for dynamic joint stability [20]. Consequently, damage to the ACL might lead to deterioration in these afferent sensory signals. The results from the present study indicate that ACL-injured individuals with worse proprioceptive acuity might have reduced ability to control medio-lateral knee joint motion during the drop jump. Future studies will reveal if this is true also for individuals without knee injury but who are at high risk of sustaining a knee injury such as high-level athletes.”

REVIEWER COMMENT
232 – some have suggested that slower movements such as the single leg squat and stair descent require more control.

AUTHORS RESPONSE AND ACTION
Because we do not have any assessment tool to assess demand in different functional tasks we have now chosen to delete this statement.

REVIEWER COMMENT
240 – again I don’t think your evidence strongly supports this statement – please review and justify.

AUTHORS RESPONSE AND ACTION
Changes have been made and the sentence now reads (line 251-253) “The possible associations between worse vibration sense and KMFP during stair descending and forward lunge in women in the present study could indicate some role of vibration sense for movement quality.”

REVIEWER COMMENT
242 – again your analysis doesn’t allow you to comment on how “clear” the associations were – please edit – or better add confidence intervals so readers can actually see the uncertainty in your findings.

AUTHORS RESPONSE AND ACTION
The word “clear” is deleted according to your suggestion.

REVIEWER COMMENT
250 – seems a little concerning that in high level athletes 9-16 months after injury so many still had a KMFP in these relatively simple tasks?

AUTHORS RESPONSE AND ACTION
We agree that this is an interesting finding but this is however beyond the scope of our study. To date there is not enough data to suggest whether these tasks are simple for this group of patients with regard to knee position relative to the foot. From the data in our study, we cannot make any assumptions regarding the demands of the different tasks.

Additional limitations:

REVIEWER COMMENT
Along with additional limitations noted above please also comment on multiple comparisons and the likelihood that some of the statistical correlations and differences are change findings.

AUTHORS RESPONSE AND ACTION
Changes have been made and these sentences have been added in the discussion (289-291): “Finally, because this was an exploratory study we did not correct for multiple comparisons. Thus there is a risk that some of the findings in this study are due to chance, and further studies are needed to confirm our results.”

REVIEWER COMMENT
Please also comment on the considerable variability in time since injury/reconstruction in the sample – could this have influenced the results?

AUTHORS RESPONSE AND ACTION
There were no correlations between time since injury/reconstruction and sensory function or movement quality scores during any of the functional tasks. Hence we do not believe this would have affected the results in the present study. However, the influence of time since injury is an aspect to assess in further studies.

Conclusions:

REVIEWER COMMENT
I don’t think your findings support such a strong conclusion – please review interpretation of results and edit conclusion to provide a more balanced summary of the findings.

279 – you didn’t test “hop” tests – please review.

AUTHORS RESPONSE AND ACTION
Changes have been made and the conclusion now reads (lines 294-299) “Our findings suggest that impaired proprioceptive acuity, measured as TDPM, might be associated with a medial position of
the knee relative to the foot during the drop jump in men with ACL injury. Decreased vibration sense at the foot and the knee might be associated with worse KMFP in women. However, further studies are needed to confirm these results and to determine the relative contribution of proprioception, vibration sense, and other aspects of sensorimotor function on KMFP.”

**REVIEWER COMMENT**

Tables and Figures:
Table 2 needs editing for grammar and please justify in the method why you used the second landing in the drop jump.

**AUTHORS RESPONSE AND ACTION**
The entire manuscript has been edited for grammar. A sentence has been added to Table 2: “Performed according to Hewett et al [21] but modified to use the second landing instead of the first landing, because the second landing may better represent the situation when an ACL injury occur [22].”

**REVIEWER COMMENT**

Tables 3,4,5 – please indicate significant findings with a * (and state threshold for statistical significance).

**AUTHORS RESPONSE AND ACTION**
Changes have been made and the statistical significant findings are now highlighted in bolds and the statistical significant threshold is provided (Table 1,4-6)

**REVIEWER COMMENT**

Figure 4 a-b is not referred to anywhere in the text of the paper?

**AUTHORS RESPONSE AND ACTION**
Changes have been made and Figure 4 is now deleted

**REVIEWER COMMENT**

Why are the VPT and TDPM findings in figures 3 and 4 presented as median and quartiles whereas the same findings in table 5 are presented as mean and SD?

**AUTHORS RESPONSE AND ACTION**
A box plot was chosen to illustrate the difference in sensory function between subjects with KMFP and KOPF and such plot is a common way to do that. It is unfortunately not possible to show mean and SD in box plots, but we believe that reporting both mean and SD as well as median and quartiles will add more information.

**REVIEWER 2**

Timothy Sell

Abstract (Conclusion):

**REVIEWER COMMENT**

What is the clinical relevance of the results?

**AUTHORS RESPONSE AND ACTION**
This is an exploratory study, and to our knowledge the first to assess the association between sensory function and knee position relative to the foot. We believe that further studies are required to confirm (or reject) our results. In the current study, and at this stage, we believe that it would be purely speculative to draw conclusions on the clinical relevance. However, to put the current study and its purpose in a larger perspective, the following is stated in the introduction of the manuscript (lines 76-77): “Possible contributing factors for medio-lateral knee position in patients with ACL injury are not well studied, but such data would be helpful in the design of training regimes”.

REVIEWER COMMENT
Line 55: Functional ability has other potential measures such as return to sport, return to activities of daily living. I would expand on this statement.

AUTHORS RESPONSE AND ACTION
A sentence has been added to the introduction (line 60)” Moreover, one third of these patients will never get back to their pre injury activity level.[23]” For your convenience, the first sentences of the background are provided here: “It is well known that patients with ACL injury have decreased functional ability as assessed by quantitative methods, such as reduced muscle strength or a shorter hop distance with the injured leg compared to the non-injured leg or.[24] Moreover, one third of these patients will never get back to their pre injury activity level. [23]”

REVIEWER COMMENT
Line 63: How was poor vs good defined in this task. Was it just based on position or was it correlated to function such as activities of daily living, return to sport, etc.

AUTHORS RESPONSE AND ACTION
Good or poor performance is based on the position on the knee relative to the foot in accordance to previous studies. This is described in the method section (lines 162-170). For your convenience, we have provided this part here: “Movement quality, in terms of postural orientation, was assessed by visual observation of a video recording of each trial. The raters were able to watch the video in slow motion and to review the movie as many times as needed. The position of the knee in relation to the foot was independently scored by two experienced assessors during four different functional tasks commonly used to assess medio-lateral knee position. The tasks included the single-limb mini squat [2], stair descending [25], the forward lunge [26], and the drop-jump [21] (Table 2). The knee position relative to the foot during the participant’s performance of each task was assessed on an ordinal scale from 0 to 2. If the mid-point of the patella was in line with or lateral to the second toe, a score of 0 = “good” was given for the movement quality. If the mid-point of the patella was medial to the second toe, a score of 1 = “fair” was given. Finally, if the mid-point of the patella was clearly placed medial to the first toe, a score of 2 = “poor” was given (Figure 2).”

REVIEWER COMMENT
Line 72 “not well studied”: There are a lot of studies looking at results following ACL injury. Perhaps these studies (kinematic analysis of gait, etc) are movement quality, but don’t they point toward issues with ACL rehabilitation, recovery, and return?

AUTHORS RESPONSE AND ACTION
We agree that “movement quality” is a broad term and that several measurements can be used to assess various tasks. In the present study we focus on movement quality in terms of postural orientation, specifically medio-lateral knee position. To our knowledge there is only one previous
study on association between contributing factors (Gender) and a knee medial to foot position in patients with ACL injury (Yamazaki, 2010) [27]. They reported that women with ACL injury had increased knee abduction compared to their male counterparts during single-limb mini squat. However, to clarify for the reader the sentence now reads “Possible contributing factors for medio-lateral knee position in patients with ACL injury are not well studied, but such data would be helpful in the design of training regimes.” (Line 76)

REVIEWER COMMENT
Line 85: I’d recommend Nagai (Journal of Athletic Training - 2013)

AUTHORS RESPONSE AND ACTION
The reference is included according to your suggestion. In the introduction section we have included the following sentences (lines 90-94): “Moreover, a previous study reported a relation between worse proprioception and reduced ability to control knee flexion during a single-leg stop jump task, in non-injured men, [28]. However, to our knowledge, the possible relation between sensory function and medio-lateral knee position during functional tasks has not been previously investigated.”

REVIEWER COMMENT
Last Paragraph of the Introduction: I would recommend adding a sentence explaining the clinical relevance if the hypotheses are met. What is the clinical application?

AUTHORS RESPONSE AND ACTION
This is an exploratory study, and to our knowledge the first to study the association between sensory function and knee position relative to the foot. We believe that further studies are required to confirm (or reject) the results. In the current study, and at this stage, we believe that it would be purely speculative to draw conclusions on the clinical relevance. However, to put the current study and its purpose in a larger perspective, the following is stated in the introduction of the manuscript (line 76): “Possible contributing factors for medio-lateral knee position in patients with ACL injury are not well studied, but such data would be helpful in the design of training regimes”.

Methods
REVIEWER COMMENT
Subjects: The subject characteristics are very broad. It is difficult to read Table 1 as the type/font is duplicating in each cell, but it appears as though the range of time from injury is very broad. The authors may want to comment since recovery would have an affect on function and likely proprioception

AUTHORS RESPONSE AND ACTION
We have run statistics in terms of correlation analysis between subject characteristics and sensory function and movement quality scores, and found no correlations for any variables in any functional task. This is stated in the statistics (lines 181-183) “There were no statistically significant correlations between patient demographics and the medio-lateral knee position or sensory variables (p > 0.05).” Hence we do not believe this would have an effect on the results in the present study.

REVIEWER COMMENT
Line 144: Please add reliability of the proprioception measure.
AUTHORS RESPONSE AND ACTION
The following is now added (line 154-156): “A higher value indicates poorer TDPM, and moderate reliability (ICC = 0.63–0.70) has previously been reported for this device [8].”

REVIEWER COMMENT
9. Line 149: What is the reliability (inter and intra rater) and validity of the movement quality measures.

AUTHORS RESPONSE AND ACTION
The ICC values of inter rater reliability for each test are added (Line 173 and Table 3). For your convenience, the ICC values are provided here: Single limb mini squat (ICC=0.757), Stair descending (ICC=0.780), forward lunge (ICC=0.710) and drop jump (ICC=0.939). The validity of visual rating of medio-lateral knee position is stated in the introduction (lines 70-74): “Three-dimensional (3-D) motion analysis equipment is the gold standard for measuring medio-lateral knee position, but two-dimensional (2-D) motion analysis and visual observation and scoring are also used. The latter has moderate to high reliability [1-5], is valid in 2-D [2], and is an inexpensive method that is easy to use in both clinical settings and in large-scale studies [1, 2].”

REVIEWER COMMENT
10. Line 166: Why was spearman’s rank chosen? Based on data assumptions?

AUTHORS RESPONSE AND ACTION
Spearman’s rank correlation was chosen because the analysis was based on ordinal data.

REVIEWER COMMENT
Was the data divided and then the correlations were processed. correlations in the 0 group and then correlations in the 1 group? Is it valid to correlate this way? Continuos variable versus categorical?

AUTHORS RESPONSE AND ACTION
The analyses were performed in the present order: First, correlations were made between the sensory measures and the movement quality scores which were assessed on a 3-point ordinal scale (0-2). Second, the scores were dichotomized into good (score of 0) and poor (scores of 1 and 2), and the independent T-test was used to assess for differences in sensory function between these two groups.(Lines 183-190)

REVIEWER COMMENT
11. Discussion: The discussion should include some language indicating the very low correlations even though they were significant. They appear to be weak correlations. The authors should also be careful to not link the data. There are relationships only and not cause/effect.

AUTHORS RESPONSE AND ACTION
The following sentence has been added (lines 174-179) “The correlations found in the present study were mostly moderate and indicated some association between sensory function and medio-lateral knee position. However, future studies are warranted to evaluate the role of sensory function as well as other possible contributing sensorimotor and biomechanical factors for medio-lateral knee
position in patients with knee injury. Such knowledge will help in the design of training programs for these patients.”

REVIEWER COMMENT
12. Lines 202 - 205: Please remove. The analysis was not significant and should not be suggested as being significant. It is just as likely that more subjects would have made the data non-significant.

AUTHORS RESPONSE AND ACTION
To our knowledge, which we have discussed with our statistical adviser, a larger sample size will lower the p-value without changing the r-value, provided the distribution is the same. Thus, the p-value is of less interest in correlation analysis than in for example t-tests. We have however modified the statement and the sentence now reads (line 225) “Thus, the non-significant correlation in women might be due to too small of a sample.”

REVIEWER COMMENT
13. Line 206: This is not a valid statement. Correlation does not mean clinically relevant.

AUTHORS RESPONSE AND ACTION
This statement is omitted

REVIEWER COMMENT
14. Line 232: Why would kinesthesia play a minor role in some tasks than others.

AUTHORS RESPONSE AND ACTION
We agree that we do not have data to suggest this. So, due to being too speculative we have now deleted this statement from the discussion

REVIEWER COMMENT
Would the authors suggest that feedback and feedforward control are only necessary for demanding movements? I would suggest adding references to support their argument.

AUTHORS RESPONSE AND ACTION
This is an interesting aspect but, in our opinion, beyond the scope of our study. Also, we do not have data (for example EMG) to discuss our results in relation to feedback and feedforward control. Therefore, the sentence in the conclusion is modified and now reads (line 294-296): “Our findings suggest that impaired proprioceptive acuity, measured as TDPM, might be associated with a medial position of the knee relative to the foot during the drop jump in men with ACL injury”

3. Örtqvist M, Mostrom EB, Roos EM, Lundell P, Janarv PM, Werner S, Broström EW: Reliability and reference values of two clinical measurements of dynamic and static knee position in


