Author's response to reviews

Title: Improvement of walking speed and gait symmetry in older patients after hip arthroplasty: a prospective cohort study

Authors:

Walter Rapp (walter.rapp@sport.uni-freiburg.de)
Torsten Brauner (torsten.brauner@tum.de)
Linda Weber (linda.weber@tum.de)
Stefan Grau (stefan.grau@gu.se)
Thomas Horstmann (t.horstmann@medicalpark.de)

Version: 3
Date: 13 July 2015

Author's response to reviews: see over
We would like to thank the reviewers for their additional comments. We believe that the quality of our manuscript has further improved by implementing the suggestions and comments received. Please find our response to the comments below. Comments by the reviewers are shown in quotation marks, our responses are shown below each comment in regular font and the line numbers where these changes can be found in the text are shown below.

Reviewer 1
“The authors have addressed a number of my initial concerns however I still find the paper difficult to follow. The methods section is still missing some important. The results involve many different statistical tests and the reporting is not done in a systematic manner again making it difficult to follow. Finally there are some errors, mislabel items in the figures and tables. All points are major compulsory revisions.”
Thank you for your feedback. We have included additional information in the methods section and restructured the results for greater clarity.

Methods:
“Ln123: “ The line connecting these two points defined the forward......” What are the two points that are referred to? I assume they are from the calibration files but not clear.”
The vector pointing from the sensor location in the upright position to its position in the forward lean position defined the forward direction. We have revised this sentence accordingly.
Lines 124-126
“The parameter calculation remains difficult to follow. It’s still not clear what portion of the signal is being analyzed in each autocorrelation calculation, i.e. how many data points? I should be able to reproduce the analysis based on the methods section of the paper.”
As generally known, autocorrelation describes the correlation of a function or signal with itself at an earlier time point. The acceleration signal for 10 strides (10 steps per side) was normalized to 2000 data points so that each step was represented by 100 data points. The entire acceleration signals (2000 data points) were used for computing autocorrelations. We chose to time normalize the signals because we were interested primarily in signal amplitudes and patterns. In this study, we used only the amplitude of the cranio-caudal acceleration signal for determining gait symmetry. The time normalized signal was overlayed and shifted right, and P1 and P2 were computed. P1 and P2 were used for further analysis because only neighboring steps of the same and contralateral legs were used for determining gait symmetry. We have revised the description in the Methods section accordingly.
Lines 147-154 and 160-168
“The figure caption implies that a single data trial (all 20 steps) is normalized to 200pts. However the text suggests that a single stride of data was normalized to 200 pts and it goes from 50 ms before the max cranio-caudal signal to the next time this max happens in the time series. Are these strides then concatenated together to create a data file for the auto correlation with 2000 points. This needs to be clarified. It would be helpful to have a figure with showing the autocorrelation data with arrows indicating the P1 and P2 points.”
We have revised the figure caption to reflect that a single stride of data was normalized to 200 points and that steps are then concatenated together to create a data file for the auto correlation with 2000 points. We have included an additional Figure showing the auto-correlation data with arrows indicating P1 and P2.

Figure 1

Results:
“The results reporting with respect to the statistics are not logical. The stats are very complex for this project because of the number of comparisons made. It remains difficult to follow the results. What was the primary outcome (change over time?)? Which are the secondary analyses (comparison to ref group?, sex changes over time?)? Which statistical tests were used for which comparisons? Did you account for multiple comparisons?”

We have consulted a statistician for this project. He confirmed our statistical analysis. The primary outcome was change in walking speed and gait asymmetry in patients compared to healthy subjects. Sex was a fixed factor. We used a linear mixed model with factors time (within subjects) and sex and group (between subjects). Independent Student’s t-tests and Least Significant Difference (LSD) tests were used for posthoc analyses. The level of significance for all statistical tests was set a priori to P<0.05. We have revised the text for greater clarity.

Lines 172-178

“Line 186 “Walking speed differed between sexes (P=0.005) and time points “ belongs with the first paragraph. Lines 186 -190 seem to repeat the information from 183-185.”

We have restructured the results section to improve clarity.

Lines 182-218

“Paragraph label of “step and stride regularity” introduces new terms that were not introduced in the methods. These would be helpful to include with the parameter calculation section.”

We have revised the subheadings in the results section to reflect the data presented in this manuscript.

Lines 196-218

“Ln 206-210: is the correlation between the ipsilateral steps affected by the time normalization process? If each stride is time normalized to the same number of point this may eliminate the variation here.”

Thank you for raising this point. You are right that the data were time normalized. However, the results reported do not refer to the time aspect within steps but to the time with respect to test days. We have revised the text for clarification.

Lines 209-218 and throughout manuscript.

“Discussion: is there a relationship between walking speed and asymmetry?”

The reviewer raises an interesting point. It may be speculated that gait asymmetry is greater for slow walking speeds than faster walking speeds in healthy subjects. However, because of pain and functional limitation in patients, these two parameters are presumably independent in patients with a unilateral orthopaedic condition. We found that male patients achieved normal walking speed but no normal gait symmetry after the intense rehabilitation program suggesting that these parameters may be independent of each other and represent different aspects of gait function. Analyzing this aspect in detail was not within the scope of this study.

Figures and Tables:
“Table 2: Walking speed units are currently m/s^2. Please correct to m/s. The mean values for walking speed are very fast? It’s not possible to walk at 5.75 m/s. Please check the data.”
Thank you for noting this oversight. We have corrected the unit to m/s.

“Table 2: what do the italicized numbers indicate?”
Thank you for noting this oversight. We have formatted all number correctly.

“Figure 3; The labels on the figure are confusing. Are walking speed graphs on the right and symmetry index on the left? Which are male and which are female?”
We have reformatted Figure 3 to clarify which data is presented in each of the four subfigures.

**Reviewer 2**

“The authors have addressed the majority of concerns raised in the initial review. However, the statistical analysis remains a concern and unclear and I recommend that the authors consult with statistician for the analysis and interpretation if that has not already been done.”
Thank you for your feedback. We have consulted with a statistician and revised the description of the statistical analysis and restructured the results presentation.

Lines 170-218

“...In the statistical analysis section, the authors first state that they use a two-way ANOVA (sex x time), where I am taking this to mean a mixed-model with a within subject of time and between subject of sex. This does not account for groups so I am not sure how this analysis achieves that aims if this study.

In the analysis, it is not clear what interactions were tested. Were groups considered in the interaction analysis? In the event that there was no interaction, the authors should report main effects. This would mean in the presence of a significant main effect of time, the groups are collapsed into one and are evaluated as a whole at different time points (men and women are collapsed into a single group). In the presence of a main effect of sex, the time points are collapsed. That does not appear to be the case in this analysis.”

The reviewer is correct that we used a mixed linear model with factors time (within subjects) and sex and group (between subjects). We have revised the description of the statistical analysis and restructured the results presentation.

Lines 170-218