Author's response to reviews

Title: The reliability of postural balance measures in single and dual tasking in elderly fallers and non-fallers.

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Author's response to reviews: see over
The Reliability of Postural Balance Measures in single and dual tasking in Elderly Fallers and Non-Fallers.

Editor
We would also request that you add more context information into your abstract.

Referee 1

*Major compulsory revision
1) Methods: the duration of each trial is only 20 s which is a very short time compared to common clinical practice in quantitative posturography, even after Le Clair and Riach. Also, all previous reliability studies dealt with trial durations ranging from 30 to 120 s. Authors should provide arguments and better defend this choice.
This is an important comment. We agree with the reviewer that a 20 seconds trial for the assessment of postural control per condition is quite short. However, we did not derive our conclusions from a 20 seconds test per subject and per condition. Every subject was expected to repeat the assessment 4 times consecutively per condition, making a total assessment time of 80 seconds per condition. The rationale for this procedure was primarily based on the fact that the duration of a trial in quiet standing has to be of limited length because of fatigue particularly for pathologic elderly (Lafond et al. 2003). On the other hand we know from literature that the optimum test-retest reliability for our protocol could be obtained with 20- and 30-s trial durations (Le Clair & Riach, 1996). We added this rationale to the text.

*Minor essential revisions
1) Variables names: authors should try, when possible, to use the names mostly commonly used in the literature, in order to facilitate the immediacy and comparison of their results with previous authors.
We changed the text, so that it contains the most commonly used abbreviations: “The COP coordinates, which enables the calculation of the maximum displacement in the anterior-posterior and medial-lateral direction (Max-AP : Max-ML), the root-mean-square amplitude in anterior-posterior and medial-lateral direction from the centroid in x-axis and y-axis (RMS-AP ; RMS-ML), the mean velocity (MV) and the area of the 95th percentile ellipse (AoE).

2) I then have to raise some general concerns mostly related with the readability of the paper that, in my perspective, should be improved. Specific comments are listed in the following.

Specific comments
Note: line numbers cited below always starts at the beginning of the section or subsection being reviewed.

Abstract
Methods:
3) After checking if these are in fact the measures which were computed (e.g. compare with Prieto et al., Measures of postural steadiness: differences between healthy young and elderly adults. IEEE Trans Biomed Eng 1996;43:956–66), my proposal is to change the second sentence as follows: “A forceplate was used for registering postural variables: the maximal and the root-mean-square amplitude in medio-lateral (Max-ML, RMS-ML) and antero-posterior (Max-AP, RMS-AP) direction, mean velocity (MV), and the area of the 95% confidence ellipse (AoE).” Of course the name of the variables should be then changed all the way through the manuscript accordingly.

Thank you for this comment. We changed the text in the abstract and the manuscript according to the referees’ suggestion. The change was consistently applied in the complete manuscript.

4) Last sentence of this section is not clear and hard to read. Consider rephrasing.

Thank you for this comment. We rephrased this sentence and hope it became clearer.

Results:

5) Line 2: ‘correlation coefficients’ should be ICC.

Thank you for this comment. We corrected this in the manuscript.

6) Lines 2-4: “The SDD values were for variable …, for MV …, and for AoE …”

We changed this in the manuscript.

Background
This section is complete and useful. Only, there are some flaws in the description of the state of the art about postural measures (first paragraph).

7) Lines 5-7: “Generally the root mean square (RMS) of COP amplitudes … is used [3,4,5]”.
This sentence is not very precise, both because other COP-based measures are often used and I’m
not sure which is the most popular, and because not in all cited references this is used. E.g., in ref. [3] Corriveau and colleagues use the RMS of the difference (COP-COM) which is not the same variable.
The reviewer is correct; we rephrased this sentence for more clarity.

8) Page 1, Last but one paragraph: reference [15] is omitted and is nowhere else cited in the manuscript.
Thank you for this comment. Here we made a slip of the pen. We added this reference 15 in to the sentence: “However, since one-third of community-dwelling people over 65 years of age experience one or more falls each year, it seems important to include elderly fallers in reliability studies [11,12,13,14, 15, 16]. “

Methods
This section needs some reorganization. In fact, even after several readings, and before reading the Results section, some information is missing and some others are hard to interpret.

9) Specifically, I do believe it is necessary to anticipate the presentation and to reorganize the content of Tables 1 and 2. This is because more information are needed in the Methods about the participants, including their base-of-support area that is now missing but should be reported, as it was freely chosen from subjects. Hence Table 2, except the bottom part related with the results of the group score, could become Table 1 and be included in the Methods. Also, the content of Table 1 is needed to understand the Cognitive Difficulty Score that is presented in this section. This could become Table 2 in the revised manuscript.
We would like to thank the referee for this opportunity to improve our manuscript. We feel that the comments, indeed, make sense and we changed the manuscript following the suggestions.
[1] We reorganised table 1 and 2. Table 1 is moved to the Method “Cognitive task” section for a better understanding of the calculations we performed. In table 2 we added information on the BOS and the hip with of the participants.
[2] We added in the “Equipment procedure” section the description how we measured the BOS and Hip width; “Maximal BOS width and hip width measured at the major trochanter femoris were recorded with an anthropometric calliper (Lafayette Instrument Company, Lafayette, IN).”

10) The titles of some subsections are not precise or exhaustive. Hence, I would propose the following headings: ‘Equipment’ could become ‘Experimental procedure’, incorporating also the content of the current ‘Measurement design’ subsection; ‘Vision’ could become ‘Visual conditions’. In the following I will refer to the current headings of the manuscript.
Thank you for this comment. We changed the headings in accordance to the suggestions.

Equipment:
11) Page 3, first para: acronyms are missing: ‘These provide the COP coordinates…in the anterior-posterior and medial-lateral direction (Max-AP, Max-ML),…’
We added the missing acronyms.

12) Page 3, first para: definition not clear: ‘…from the centroid in x-axis’?
We made the definition clearer by adding the missing: “and y-axis”

Cognitive task:
13) Page 4, first para: the starting number for counting backward (range 80-99 or 121-199) was somehow included in the GS? Also, the procedure by which the CDS was estimated should be made clearer. The score was obtained by growing or decreasing numerical complexity of the trials?
   The starting number was not included in the GS.
   We attempted to describe the procedure by which the CDS was estimated in more clearer terms by adding the sentence: „With increasing numerical complexity the CDS is increasing.”
   Additionally we moved table 1 to this section

Vision:
14) Page 5: authors say that participants were instructed to look at a cross (1m x 0.5 m) at 1.5 m of height. Which was the alignment of the cross arms? Included information on the visual vertical or not? What does (1m x 0.5 m) mean? The height was fixed regardless the participants’ height?
   Please, clarify and comment possible limitations and concerns.
   We made this paragraph clearer. „The horizontal arms of the cross were 1 meter long. The vertical arms were 0.5 meter long. The cross was located in the middle of a screen (1.5m x 1.5m), which was positioned 2 metres in front of the forceplate.”

Results
This section is concise and well written. Tables 3 and 4 are the heart of this manuscript and particular attention should be paid to their completeness (some measurement units are missing, where are the data about the fallers sub-population?) and readability, even in their preprint.
   This is an important comment. We added these results to the new table 4.
   For a better general view we splitted Table 4 in a table summarising the interrater results (the new Table 4) and in a Table 5 where the test-retest results are summarised. Additionally we changed the design of the tables for better readability.

Reliability parameters:
15) Page 7, line 5: ‘correlation coefficients’ should be ICC.
   We corrected this in the manuscript.

Why just the results in the AP direction are reported here?
   All the results are reported in the revised version of our manuscript.

Discussion
This section is clear but some issues are maybe not adequately discussed.

16) Page 8, line 3: “This study showed good reliability parameters for the fallers although in the non-fallers group the values were higher (see Table 3)”. Not clear if and where the reliability results for the fallers are presented in this manuscript.
   We added the results expressed for the total group and for the fallers and non-fallers separately to the tables 4 & 5.
17) Page 8, line 12: “Our participants … a predetermined stance position of pelvis width”. This statement might be stronger if you were able to report the BOS of your subjects, and how far they were from pelvic width. We added these results to the table 2 (as in your question 9)

Also, either I missed the point or the arguments provided to justify the different results obtained from Corriveau et al (2001) seem not completely sound. Arguments that explain for the different results obtained are provided in the discussion section.

18) Issues that I would suggest to consider for further discussion: deeper comparison of the reliability results obtained in different conditions (single- vs dual-task; vision vs no-vision); differences among parameters; differences between AP and ML directions. Deeper comparison of the reliability results obtained in different conditions (single- vs dual-task; vision vs no-vision); differences among parameters; differences between AP and ML directions were considered for further discussion and were added to the manuscript.

Tables

19) Table 2, legend: BOS is mentioned but does not appear in the lines of the table. Group Score results could be moved to a new, separate table for the Results section. Thank you for this suggestion, we added the BOS width into table 2 and created a new table 3 with the results of the Group Scores.

References

1) Ref. [12] is essential? I think it may be hard to retrieve for a common reader of the manuscript while it’s redundant. We removed the Ref. [12]
Referee 2

General Comments:
This paper attempts to investigate the determine the reliability of protocol used to measure postural balance using a force or a balance plate within a group of fallers and non-fallers. This study employed a single and dual-task (with and without vision) based simple methodology. The results show a good reliability and no specific systematic errors in the protocol to measure postural balance. While the methodology is simple and straightforward, the reported investigation concentrates on the protocol. Given that there are several technologies available for CoP and balance measurements (for example: force platform, pressure platform other balance boards) a discussion on this topic will add value to the paper.

Specific Comments:

Background: Given the comments, consider including a succinct paragraph on technologies available for “posturography” or posture assessment.
Thank you for this suggestion, we added information about clinical assessments and available technologies in the first paragraph.
“Many different balance tests and measurements have been developed and presented to obtain appropriate information of balance capabilities during standing. Functional balance scales are easy to perform and suitable for daily clinical use, but not always accurate enough. Laboratory systems with new technologies may give more detailed information about postural balance, however, should preferably combine the more detailed information with ease of use in a clinical setting. The foregoing illustrates that the selection of a suitable method generally depends on the goals and results aimed at.”

Methodology:
Consider providing a couple of sentences on the interview; the approach and type of questions.
We added a Reference that we used for gathering information on falls for the interview, as suggested by the referee.

Did you use all 20 seconds data (for CoP) or did you take the middle 10 seconds as in many other studies? This needs to be mentioned.
We used the total 20 seconds. We entered this information in the “Measurement Design” section: “The total 20 seconds of the trail was used for the calculations.”

Discussion: You include a statement on predictive values of CoP.
If you would like to include this in the discussion, you should provide a critical analysis of the area and link your results to this concept. In my opinion, this paper doesn’t look at this and this reference could be removed.
The referee is right, we removed this statement.