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Older adults with a history of falling exhibit altered cortical oscillatory mechanisms during continuous postural maintenance

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Ref.: Ms. No. JCTRes-D-22-00031
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Dear Ms. Scurry,

Two experts in the field have now commented on your paper. One reviewer recommended a major revision, and the other a reject and resubmit. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers' comments are appended below.

One major concern that the editorial board has is that the conclusions are not per se supported by some of the data. Both reviewers allude to the same. When preparing a revision, please ensure that this matter is conscientiously addressed as it is a key precondition for further processing of your manuscript.

If you decide to revise the work, please submit a list of changes or a rebuttal against each point which is being raised when you submit the revised manuscript. Also, please ensure that the track changes function is switched on when implementing the revisions. This enables the reviewers to rapidly verify all changes made.

Your revision is due by May 31, 2022.

To submit a revision, go to https://www.editorialmanager.com/jctres/ and log in as an Author. You will see a menu item call Submission Needing Revision. You will find your submission record there.

Yours sincerely

Michal Heger
Editor-in-Chief
Journal of Clinical and Translational Research

Reviewers' comments:

Reviewer #3: General comments:
1. The present study measured postural dynamics while fall history (FH), never fallen (NF), and young adult (YA) groups performed continuous postural maintenance. In addition, EEG activity was recorded while participants performed upright postural stance to examine any group differences in cortical areas involved in postural control. As might be expected, the FH participants showed poorer postural stability, as evidenced by the increase in the trip, compared to the NF and YA groups.

2. In the introductory part, the author writes clearly in English with plenty of appropriate and specific words to express. However, there are too many kinds of equipment with too many assessment parameters in the methods and results section. In addition, too many parameters are combined, and these parameters are not directly linked together. This makes it difficult to read and understand the representative findings from this study.

3. Authors can reduce assessment parameters and focus on some findings with significant differences. For example, a focus on the EEG and COP would be preferable.

Specific comments:
1. Too many abbreviation: sound-induced flash illusion (SIFI); Montreal Cognitive Assessment (MoCA); Temporal Order Judgment (TOJ); stimulus onset asynchronies (SOAs); point of subjective simultaneity (PSS); temporal binding window (TBW); timed up and go test (TUG); Falls Efficacy Scale - International (FES-I); fear of falling (FoF); Visual Analog Pain Scale (VAPS); Qualisys Track Manager (QTM); eyes open (EO); eyes closed (EC); verbal inhibition (VI); stop signal delay (SSD); Center of Pressure (CoP); intrinsic mode functions (IMF); anteroposterior (AP); mediolateral (ML); Electroencephalography (EEG); electrooculography (EOG);
2. There are only two equations. Then why is it called Eq.4.1 and Eq.4.2? Please double check this.
3. Eq.4.1 ExcAP is Excursion amplitude was calculated as the average of instantaneous amplitudes or anteroposterior (AP)? Why do the authors need to get the Excursion amplitude?
4. Eq.4.2 RMS is the root mean square of CoP velocity? If yes, RMS is a comment equation. The authors cited the reference and did not need to list them in this paper.
5. Peripheral channels (TP8, TP8h, C6, TH8, T8, FT8, FT8h, F6, F8, F5, F7, FT7, FT7h, C5, T7, T7h, TP7, TP7h) suggest using an illustrated figure to express the location of the subject.
6. Specifically, the Frontal ROI comprised 13 channels (FFC2, F2, AFF2, AFF4h, AFz,

AFFz, Fz, FFCz, FCz, FFC1, F1, AFF1, AFF3h) need to use an illustrated figure to express the location of the subject.
7. The Motor ROI was comprised of 16 channels (Cz, C2h, C2, C4h, C4, FC4, FC4h, FCC2h, FCC2, FCC1h, FCC1, FC3, FC3h, C1, C1h, C3h) need to use an illustrated figure to express the location of the subject.
8. The Parietal ROI was comprised of 21 channels (P1, CPP3, PPO3, PPO5, PO3h, PPO1, Pz, PPOz, POz, PO4h, PPO2, P2, CPP4, PPO4, PPO6, P8, P6, CPP6h, CPP5h, P5, P7) need to use an illustrated figure to express the location of the subject.
9. The occipital ROI has 9 channels (PO11, PO1, POO5, POOz, Oz, OIz, POI2, O2, POO6) that must use an illustrated figure to express the subject's location.
10. Why does the author list the findings in the Methodology section? (i.e., For VI tasks performed during both EEG and CoP data collection, there was no statistical difference between groups for the amount of successful….)
11. If there is a significant difference in Figure 5, it should include letters to mark significant differences in a bar graph.
12. Page 22, line 17 (ps ≥ .18). what is ps?
13. Page 22, Line 50: (rs ≥ .5). What is rs?
14. Page 22, Line 57: (rss ≥ .57, ps < .05). What is rss? What is ps?
15. Figure 7: the legend does not clearly illustrate the figure's black line, dotted line, and dashed line.

Reviewer #4: This is interesting and exciting work attempting to uncover mechanisms of postural stability and potentially factors that could predict likelihood of falling in older adults. The paper is well-written and most parts offer a very clear explanation of the multi-step analyses that set up each variable. Given the complexity of these variables, I wonder if a figure offering a schematic of each of these variables could help the reader keep track of all measurements. In lieu of a diagram for reference, in places like P.13 L.4, reiterating what the three postural tasks are (EO, VI, EC) would be helpful, as would brief reminders later in the paper that eyes open, visual inhibition, and eyes closed conditions are the levels of difficulty in this task.

My primary concerns / confusions in the paper come in sections 3.3-3.6:

- What is the relationship between Fig 4. and Fig. 5? Why, in Fig. 4, does the FH group look so vastly different from NF, but this is not represented in Fig. 5?

- Figure 5 also does not seem to match up with the explanation given on P.19 L.34, where the text indicates that FH values for FH were larger than NF, but this is not what the figure depicts (overall or for the EC condition, specifically).

- Showing the data for RMS velocity would be helpful, even if there are no significant differences between groups. The differences between trial types could help confirm the validity of other claims. The RMS data is also revisited on P.27 L.46, but the claims are difficult to support or interpret without the data.

- In section 3.6, the claim made in the title section (increase occipital power for NF and YA, not FH during EC posture) does not appear to be well-supported? The analysis reported on P.21 L.47 does not support this, and it is unclear what additional information is being

provided by the next analysis, P.22 L.4. Figure 6 also does not support the claim, as NF and FH graphs appear nearly identical, and yet the text above suggests that there was a significant effect of task for NF but not FH? This claim is again repeated on P.29 L.50 without sufficient evidence or explanation given what is presented in Fig 6 and results.

- The following section on correlations are then difficult to interpret, given the lack of evidence for group differences in the measures being tested. In the intro, it may also be useful to describe the logic of correlating these two sets of measures, taken at different times and under different circumstances.

- In both Fig. 7 and Fig. 8, the FH group patterns appears to be more similar to the YA group than the NF are to the YA, and yet the claims being made suggest that it is the FH group who has the specific inhibitory control deficit, not the NF? A similar claim is repeated in the conclusion, P.32 L.7, but the evidence for this claim is not clearly presented.

Authors' affiliation

Response to Reviewers

Thank you for your time and effort in reviewing our manuscript. Changes we made to the manuscript are substantial and therefore they are not tracked. We address reviewers' comments below.

Reviewer #3: GENERAL / MAJOR

2. In the introductory part, the author writes clearly in English with plenty of appropriate and specific words to express. However, there are too many kinds of equipment with too many assessment parameters in the methods and results section. In addition, too many parameters are combined, and these parameters are not directly linked together. This makes it difficult to read and understand the representative findings from this study.

Authors can reduce assessment parameters and focus on some findings with significant differences. For example, a focus on the EEG and COP would be preferable.

Thank you for your comments. We have removed tables 1-5 as many of the correlations were insignificant after multiple comparison correction. Following your suggestions, we now focus on results that showed significant differences.

SPECIFIC / MINOR

1. Too many abbreviation: sound-induced flash illusion (SIFI); Montreal Cognitive Assessment (MoCA); Temporal Order Judgment (TOJ); stimulus onset asynchronies (SOAs); point of subjective simultaneity (PSS); temporal binding window (TBW); timed up and go test (TUG); Falls Efficacy Scale - International (FES-I); fear of falling (FoF); Visual Analog Pain Scale (VAPS); Qualisys Track Manager (QTM); eyes open (EO); eyes closed (EC); verbal inhibition (VI); stop signal delay (SSD); Center of Pressure (CoP); intrinsic mode functions (IMF); anteroposterior (AP); mediolateral (ML); Electroencephalography (EEG); electrooculography (EOG);

Thank you for your comment. The authors have removed any acronym that was used less than 5 times including MoCA, TOJ, SSD, PSS, EMD, IMF, FOF, SIFI, VAPS, and ICA.

2. There are only two equations. Then why is it called Eq.4.1 and Eq.4.2? Please double check this.

Thank you for noting this. The authors have corrected the equation number.

3. Eq.4.1 ExcAP is Excursion amplitude was calculated as the average of instantaneous amplitudes or anteroposterior (AP)? Why do the authors need to get the Excursion amplitude?

Thank you for your comment. Excursion was calculated as the difference of the instantaneous center of pressure position on the force plate. These differences were then divided by the number of total data points or elements collected to get an absolute average excursion value. The authors have removed the AP and x subscripts from Eq 1 to better show that this function was used for both anteroposterior and mediolateral center of pressure data. In addition, the authors have changed the description of Excursion in the 2nd paragraph of section 2.5 (p. 13): "Excursion amplitude was calculated as the absolute average of the differences between two consecutive points on the CoP path" to better clarify how the function operates. To address your second question, excursion amplitude is needed for the complexity index data, as the excursion data are the input into the function. The authors have added the following sentence to the last paragraph of section 2.5: "Multiscale entropy was calculated on the excursion amplitudes."

4. Eq.4.2 RMS is the root mean square of CoP velocity? If yes, RMS is a comment equation. The authors cited the reference and did not need to list them in this paper.

Thank you for your comment. RMS was calculated on the center of pressure position and then the RMS velocity was calculated as the difference between each RMS value element and then divided by the sampling frequency to get an instantaneous RMS velocity value. These instantaneous RMS velocity values were then divided by the total number of data points to get an average RMS velocity value. Equation 2 has been changed to include COP_n to show that RMS was calculated on the center of pressure position. Furthermore, the description of RMS and RMS velocity has been updated in Section 2.5 of the methods (p. 13): "...while RMS velocity was calculated from the square root of the average squared velocity across a 26-element range, and then rectified by square rooting the data at each time point within the time series (Eq. 2)."

5. Peripheral channels (TP8, TP8h, C6, TH8, T8, FT8, FT8h, F6, F8, F5, F7, FT7, FT7h, C5, T7, T7h, TP7, TP7h) suggest using an illustrated figure to express the location of the subject.

6. Specifically, the Frontal ROI comprised 13 channels (FFC2, F2, AFF2, AFF4h, AFz, AFFz, Fz, FFCz, FCz, FFC1, F1, AFF1, AFF3h) need to use an illustrated figure to express the location of the subject.

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9. The occipital ROI has 9 channels (PO11, PO1, POO5, POOz, Oz, OIz, POI2, O2, POO6) that must use an illustrated figure to express the subject's location.

Thank you for your comments. The authors have added a figure to illustrate the channels included for each ROI (new Figure 3).

10. Why does the author list the findings in the Methodology section? (i.e., For VI tasks performed during both EEG and CoP data collection, there was no statistical difference between groups for the amount of successful….)

We have corrected this section.

11. If there is a significant difference in Figure 5, it should include letters to mark significant differences in a bar graph.

We did not include letters to mark significant differences in Figure 5 (now Figure 6) is because we have a main effect of task (which applies to both AP and ML directions) and a significant interaction between direction and group with group differences significant only at AP direction.

12. Page 22, line 17 (ps ≥ .18). what is ps?

We have changed ps to p values.

13. Page 22, Line 50: (rs ≥ .5). What is rs?

We used r_s to refer the Spearman's rank correlation coefficient. It is now specified in section 2.9. (p. 18): "Within each group, spearman rho correlation (r_s) analysis was conducted to examine relationships between CoP and gamma/alpha power".

14. Page 22, Line 57: (rss ≥ .57, ps < .05). What is rss? What is ps?

We have corrected these accordingly (see response to comment #12 and 13).

15. Figure 7: the legend does not clearly illustrate the figure's black line, dotted line, and dashed line.

We have replotted the figure 7 (now Figure 9) with improved legend.

Reviewer #4 GENERAL / MAJOR

This is interesting and exciting work attempting to uncover mechanisms of postural stability and potentially factors that could predict likelihood of falling in older adults. The paper is well-written and most parts offer a very clear explanation of the multi-step analyses that set up each variable. Given the complexity of these variables, I wonder if a figure offering a schematic of each of these variables could help the reader keep track of all measurements. In lieu of a diagram for reference, in places like P.13 L.4, reiterating what the three postural tasks are (EO, VI, EC) would be helpful, as would brief reminders later in the paper that eyes open, visual inhibition, and eyes closed conditions are the levels of difficulty in this task.

Thank you for your suggestion. We have reiterated the three postural tasks in various sections and figure captions.

SPECIFIC / MINOR

My primary concerns / confusions in the paper come in sections 3.3-3.6:

- What is the relationship between Fig 4. and Fig. 5? Why, in Fig. 4, does the FH group look so vastly different from NF, but this is not represented in Fig. 5?

Thank you for your comment. The initial plot was the average trajectory of all participants within each group. We realized that all participants have different starting and end points, as well as having different CoP paths entirely. Therefore, plotting the average CoP is problematic and is not the best way of illustrating the CoP dynamics of each group. In the revised manuscript, we instead plotted the CoP stabilograms of a representative subject of each group (i.e., those who had excursion values closest to the mean of their group). The CoP paths in Figure 5 (was Figure 4) now visually represent the Excursion data in Figure 6 (was Figure 5).

- Figure 5 also does not seem to match up with the explanation given on P.19 L.34, where the text indicates that FH values for FH were larger than NF, but this is not what the figure depicts (overall or for the EC condition, specifically).

Thank you for pointing out our mistake. This has been corrected in section 3.3 (p. 22).

- Showing the data for RMS velocity would be helpful, even if there are no significant differences between groups. The differences between trial types could help confirm the validity of other claims. The RMS data is also revisited on P.27 L.46, but the claims are difficult to support or interpret without the data.

Thank you for your comment. The authors have added a figure for RMS velocity (Figure 7).

- In section 3.6, the claim made in the title section (increase occipital power for NF and YA, not FH during EC posture) does not appear to be well-supported? The analysis reported on P.21 L.47 does not support this, and it is unclear what additional information is being provided by the next analysis, P.22 L.4. Figure 6 also does not support the claim, as NF and FH graphs appear nearly identical, and yet the text above suggests that there was a significant effect of task for NF but not FH? This claim is again repeated on P.29 L.50 without sufficient evidence or explanation given what is presented in Fig 6 and results.

We have replaced Figure 6 with a bar plot to better display the alpha power (Now Figure 8). The occipital power during EC posture was not significantly increased in the FH group – the adjusted p was not significant potentially due to small sample size in this group. This limitation is noted in discussion (p. 31) and conclusion (p. 32).

- The following section on correlations are then difficult to interpret, given the lack of evidence for group differences in the measures being tested. In the intro, it may also be useful to describe the logic of correlating these two sets of measures, taken at different times and under different circumstances.

We have deleted correlations tables and reported the null results in section 3.7 (p. 27).

- In both Fig. 7 and Fig. 8, the FH group patterns appears to be more similar to the YA group than the NF are to the YA, and yet the claims being made suggest that it is the FH group who has the specific inhibitory control deficit, not the NF? A similar claim is repeated in the conclusion, P.32 L.7, but the evidence for this claim is not clearly presented.

We have removed Figure 8 and replotted Figure 7 (now Figure 9). We have also modified section 3.8 to clarify the relationship between postural control and multisensory temporal processing (p. 27).

2nd Editorial decision
14-Jun-2022

Ref.: Ms. No. JCTRes-D-22-00031R1
Older adults with a history of falling exhibit altered cortical oscillatory mechanisms during continuous postural maintenance
Journal of Clinical and Translational Research

Dear authors,

I am pleased to inform you that your manuscript has been accepted for publication in the Journal of Clinical and Translational Research.

You will receive the proofs of your article shortly, which we kindly ask you to thoroughly review for any errors.

Thank you for submitting your work to JCTR.

Kindest regards,

Michal Heger
Editor-in-Chief
Journal of Clinical and Translational Research

Comments from the editors and reviewers: