Cognitive task difficulty modulates visual control of upright posture in adolescents (#36872)

BASIC REPORTING

- It is strongly recommended to do an orthographic and grammatical review before it is printed. This is necessary not only to improve the quality of the manuscript, but also to avoid misinterpretations.

- The introduction should explain some topics in more detail (I have made several recommendations below, see the PDF-Data). The final part of the introduction should be restructured in order to present a more logical and clear sequence of ideas until the hypothesis is reached.

-Figure 2 and 3 should provide more information (see details in PDF)

EXPERIMENTAL DESIGN

- The research question is definitely an issue of relevance. However, in many situations -probably due to language limitation- it is not possible to identify important methodological issues, such as the hypothesis of the study.

- Some aspects about the methods were asked (see PDF attachment) in order to provide sufficient details and information for a future replication.

VALIDITY OF THE FINDINGS

- The choice of the statistical tests is correct. However, regarding the Bonferroni correction, some information needs to be offered (see PDF attachment)

- Regarding the interpretation of the result, I believe it is correct, but it has been extrapolated. I made some comments about in order to help you and avoid problems with wrong comprehension.

GENERAL COMMENTS

The authors investigated the influence of cognitive tasks on balance control (quasi-static balance) in adolescents, when performing with eyes open and eyes closed. This is definitely an issue of relevance, since there are controversies in the literature about dual task balance tests performed during eyes-open and eyes-closed conditions. Despite presenting numerous methodological and language problems, the study has good potential. In this way, I would like to contribute with some suggestions.

Dear Authors,

I have read your manuscript and generally, the study was sufficiently adequate for publication taking into consideration aspects like experimental design and validity of the findings. However, I have made several recommendations in order to make this study clearer and to improve its quality. Furthermore, there are some questions I would like to see answered related to the study. I would also like to recommend the reorganization of some information according to each section (I have made several recommendations below for each specific section). Additionally, it is also strongly recommended to do an orthographic and grammatical review before it is printed. I have also noted some sentences or phrases that should be rewritten. This manuscript is short and to the point but I believe the discussion could be better structured.

Specific comments:

TITLE

After reading the manuscript, I would suggest to change the "visual control" of the title (e.g. visual information, visual inputs, visual conditions). The problem is that the title can induce a false understanding of the study to the reader. The impression I had before reading the article was that the balance tests were controlled by a kind of visual feedback (visual control of Upright Posture). If you change the title, please check is necessary to change this point in the entire manuscript (e.g. in the abstract).

ABSTRACT

Background:

-"The maintenance of upright stance balance depends on not only sensory information from proprioceptive, vestibular, cutaneous, and visual sources but also cognitive resources" should read: "The maintenance of upright stance balance depends not only on sensory information from proprioceptive, vestibular, cutaneous, and visual sources but also on cognitive resources"

- I would suggest to remove "to provide a theoretical basis for improving the stability of their upright posture." and adding your hypothesis of the study.

Methods:

- Since the subtracting task is a known task, I believe you can find a more elegant and direct way to describe it. For example: ….performed calculation by subtracting three or 18 from a random three-digit number continuously as fast as possible, for the simple cognitive task or the difficult cognitive task respectively.

- "Each task calculation was completed within 10 s." Does it mean that the balance trial lasted 10 s?

Results:

- Statistic descriptions should be presented in the Methods section. "Two-way repeated measures ANOVAs with post hoc Bonferroni corrections were conducted to evaluate the effects of cognitive tasks and visual control on the RMS and MV values of the upright posture movement trajectory."

- The following sentences should be revised (English) or changed (E.g. "The RMS ($p < 0.01$) and MV ($p < 0.01$) values …. eyes were closed." should read The RMS ($p < 0.01$) and MV ($p < 0.01$) values of upright posture sway were lower when participants performed no cognitive task and their eyes were open than when their eyes were closed.)

Conclusion:

- Here again I worry about the misinterpretation of your study when you use "visual control of the upright posture". (Maybe "reduced the importance of visual inputs")

INTRODUCTION

- Line 112 "interference between the ability to perform a cognitive task and to simultaneously process visual information is because of competition between of the two procedures for common central processing resources" You are right, when you mentioned it is possible that some competition between process information can occur during dual task. However, this depends of the type of dual task and, consequently, where the information of this task will be processed. Can you

provide in the text more details about the physiological aspects regarding the process information of both visual and calculation task?

- Line 113: Sentence is unclear ("of" seems to be wrong). Hence, it is hard to understand what the Multiple Resource Theory actually means/postulates.

- About the hypothesis of your study:

1) The hypothesis is presented in two moments (Line 121 and 132) and it is not necessary. In fact, from here to the end, the text seems to be divided and not as a consequential text until the hypothesis.

2) “the visual control of upright posture will be more disrupted”. Your hypothesis does not show a direct expectation regarding the behavior of the analyzed parameters. Additionally, “we hypothesized that performing a difficult cognitive task would show clear inhibition of visual control of upright posture among these adolescents.” What are consequences for “inhibition of visual control of upright” regarding balance? Is it more or less stable?

MATERIALS AND METHODS

There are some information placed in the wrong or not trivial place. For example: in “2.3 Experimental equipment and materials” you should only describe the used equipment, however, here you describe practically the performed test: Line 164 “To perform the visual and non-visual … participants closed their eyes.”

- Line 138: 1) mean and standard deviation. 2) Please change “boys” and “girls” to ”males” and “females”. 3) How about ethics when testing subjects younger than 18?

-Line 147: Visual control? More like visual conditions. How would you control visual control of posture?

- Line 150: Please provide the parameters in a more detailed and complete manner. Did you analyze root mean square (RMS) and the mean velocity (M) of what? (For example: From AP sway, ML sway, total sway, COP excursions). Based on which parameter did you calculate the Romberg quotient?

- Line 154: quasi-static

- 158 “in the center of gravity”. Using force sensor you will not obtain center of gravity data. I think you measured a projection of the center of gravity (vertical force) or CoP.

- Line 180: As I already mentioned above, I believe you may find a more elegant way to describe the task.

-Line 188: In your pilot study you measured the differences in difficulty. What was the parameter, in other words, how did you measure the difficulty? Time to finish the task, balance, ...?

- Line 217: There are different ways to consider or to perform the Bonferroni’s correction. What kind of Bonferroni’s correction did you apply (according to what?). If you did a Bonferroni correction, why was your level of significance 0.05?

-Line 222: “The threshold for statistical significance was $p < 0.05$.” It should read $\alpha < 0.05$ and not p. Alpha is the level of significance (is the probability of rejecting the null hypothesis) and p is the result of statistical tests (Anova, t-test, etc…).

- How many trials did the participants perform per analyzed condition?

RESULTS

- Line 228: You presented methodological aspects in the sentence “The visual factor…..ANOVA” and it is not necessary for results.

- Line 233, 235 and 238: Please check the language and the construction of those sentences.

- “The MV of the upright posture sway is the length of the body sway trajectory per unit time, and a smaller value (slower sway) indicates better balance”: 1) Who said slow speed means better balance? Can you provide a reference? 2) Notes concerning the interpretation of results (better or worse) should be placed in the discussion. 3) Did you analyze which velocity of sway, from AP direction, ML direction or from total excursion sway?

- Line 255: 1) “The RQ…1976).” This information should be provided in the methods section. 2) Who states that if the RQ value is high, vision plays a more important role? Why is this so? Please, provide better explanation about it.

Figure 2: Didn´t you measure MV for the AP and ML direction (similarly as you did with the RMS)? Delete vertical x-axis ticks.

-Line 256: “The higher…Posture control.” Notes concerning interpretation of results should not be place in the results.

-Line 257: “We conducted a one-way ANOVA …. conditions (Fig. 3).” You do not need to provide explanations regarding statistical procedures once again.

- Figure 3: 1) You did not mention which RMS you analyzed, please provide ML information on the figure. 2) Why did you present the RQ only for sway in ML direction? What about the consideration of AP / ML directions? 3)Delete x-axis ticks.

- Line 259 until 263: Please check the language and the construction of those sentences.

DISCUSSION

Line 266-272: The visual importance is merely assessed by means of the RQ value. Hence, the sentence: "performing a cognitive task reduced the visual control of the upright posture" should be re-written in a more careful manner. Also: The problem is that not all parameters showed your results ("Increasing the difficulty of the cognitive task further decreased the visual control").

Line 276/277: The results are only true for the ML direction. Please go more into detail, and explain what might be the reasons.

Line 287: I guess "ontological" means another aspect.

Line 292-293/294: Again, this result is too generally formulated: First, you don´t have differences in the AP direction with eyes open. Second, you don´t have differences in any parameters of the eyes closed conditions. Therefore, be careful when using the word "even". You also need to re-consider this when discussing the literature.

Line 313-317: You already mentioned this further above (section 4.1). Then, all of the sudden (starting in line 317), you start with cognitive tasks which was already mentioned above (lines 292 and following). It would be beneficial to more clearly separate/order the issue of each section.

Line 320-322: Please re-write this sentence, it is a bit confusing.

Line 324-326: These results were not evident for RQ of MV. Why?

Line 330-332: If "the effects of cognitive tasks on the stability of upright posture would be different under visual and non-visual conditions", why didn´t you find differences comparing both cognitive tasks with each other considering eyes open versus eyes closed?

Line 332-334: This sentence is (partially) wrong: 1) Again, you do not have differences for the AP direction. 2) "and body sway was even greater with the more difficult cognitive task" ... this sentence is completely wrong, please check your figures.

- Since you wrote "According to this theory, the effects of cognitive tasks on the stability of upright posture would be different under visual and non-visual conditions." and your results did not fully support this, please provide more details about how your findings support the Multiple Resources Theory

Line 337/338: Again, check your data and figures: For the difficult cognitive task, there is no increased amplitude compared to the easier cognitive task.

Line 339 and following: You are right about the complexity of the measurements regarding balance control. However, your results do not always support this. For example, for eyes closed, you do not obtain differences when comparing cognitive tasks versus no cognitive task.