Author's response to reviews

Title: Isometric force production parameters during experimental low back pain

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Author's response to reviews: see over
Dear editorial team,

Please find included a revised version of the manuscript entitled «Isometric force production parameters during experimental low back pain». All language and grammatical corrections were made following the suggestions of the reviewer. The revised manuscript now includes a more precise description of the painful electrical stimulation. The introduction, as suggested by the reviewer, now includes an alternative explanation for pain induced changes in motor control of the trunk.

We would like to thank you and the reviewers for the numerous helpful comments. We believe the changes made to the manuscript have allowed clarifying it. We hope these changes will satisfy your concerns and those of the reviewer. We have included a point by point response to the comments made by the reviewer.

Yours Sincerely,

Martin Descarreaux
Point by point response to the reviewer

All minor points were addressed in the revised version of the manuscript.

MAJOR REVISION

1. In the methods and discussion, the authors must better justify electrical stimulation as their choice for the experimental pain protocol. Although they make a statement that the site of the L3 spinous process would prevent any direct muscle stimulation, there can still be such an effect via the current spread over the soft tissue. The stimulus voltage must be relatively high to elicit a painful sensation in the range of 75 to 85% of the maximum possible pain. Therefore, the spread of current is likely. How did the authors verify that there was no direct stimulation of muscles? It seems that the saline injection protocol is free of such confounders.

We agree with reviewer 1 that, even though no muscular contraction were felt by the subjects or observed by the experimenters and even if the painful stimulus consisted of a focal electrical stimulus with very limited current spread, the possibility of unperceivable muscular activations via the current spread over the soft tissue still remains. The saline injection protocol to induce experimental pain might not give a straightforward answer to the mechanisms underlying the changes observed in the present experiment. In fact, it has recently been reported that hypertonic saline injections decrease the firing rate of motor unit potentials in the muscle in which the solution has been injected (Farina et al. 2004). This observation supports the pain model by Lund (1991) but the physiology of this reduction in motor unit firing remains unclear. Alternatively, the results presented in this ms show that subjects overestimated the learned level of force under the experimental pain condition, suggesting a mismatch between the image of the motor command and the actual motor command sent to the trunk muscles. The physiological mechanisms underlying such mismatch can not be elucidated from the present experimental procedures, but it is unlikely that the use of a different experimental pain methodology would be helpful to resolve this issue. This would hold true particularly for a methodology that is known to decrease the firing of the motor units of the muscle in which the hypertonic injection is performed.
To address this question a new paragraph was added to the discussion in order to mention to possible limitation of our study.

2. Specify the range of voltage that was used to elicit the desired pain level. This information will allow the reader to judge how likely the direct muscle stimulation was.

The range of voltage use was between 135 and 140 Volts. Using the Beckman electrodes (1 cm diameter), this stimulation created a focal painful stimulus with very limited current spread. This information was added to the manuscript.

3. Discussion, last paragraph: There is another explanation of pain-induced changes in motor control that was not touched upon by the authors. Through a series of works, Simo Taimela and his colleagues have suggested impairment in central processing due to pain. I believe this to be a likely possibility that should be explored in the discussion, if not presaged earlier in the introduction.

We do agree with reviewer 1 that there are other possible explanation of pain-induced changes in motor control and that the work of Satu Luoto and Simo Taimela and colleagues is very important in our field of research. These authors hypothesized and demonstrated that motor control changes observed in low back pain patients can result from impairments in central processing. Luoto et al. proposed that low back pain (chronic) hampers the functioning of short-term memory which decreases the speed of central information processing. There theories and results are now included in the manuscript (discussion).


4. Abstract is missing.
An abstract was added to the manuscript.

MINOR ESSENTIAL REVISION

6. Page 6, last line: At about which point was the trunk moment (torque) measured? In general, the authors should be precise in their terminology of force or moment. On page 4, they refer to torque data being filtered, while on page 5, they state that 50 and 75% of maximum isometric force was used. The results on page 6 are again expressed as torque. I suggest the use of the term “moment” (or torque, if the authors prefer), but it must be specified at what point the moment was calculated/measured.

Testing was done in a neutral standing posture (no trunk flexion or extension). The data force data used throughout the manuscript are moments (torque) and the data acquisition software directly calculated these torques as we used a constant moment arm determine by the testing apparatus (Loredan Biomedical, West Sacramento, USA). As suggested by the reviewer, terminology was clarified across the manuscript and the term “torque” was used instead of “force” where appropriate.

9. Page 11, line 14: The terms “less precision” and “more variability” are synonymous. I suspect that the authors meant “less accuracy and more variability”.

We do agree with the reviewer’s comment and the term less precision is inappropriate (and an inaccurate translation of a french word). It was replaced, as suggested by the reviewer by the term less accuracy.
DISCRETIONARY REVISIONS

10. Page 3, line 3 and 4: I would separate the references between those that used electrical or mechanical stimulation and those that used saline injections and place them immediately after the corresponding statements.

The references were positioned in order to clearly separate the study that used electrical or mechanical stimulation and those that used saline injections.

11. Page 9, line 5 from bottom: The sentence starting with “Numerous authors…” should mark the beginning of a new paragraph. This paragraph is also a repetition of the ideas described in the introduction. Consider shortening it.

As suggested a new paragraph was formed in the discussion. Although there is a repetition of the ideas described in the introduction, the authors feel that these concepts can help the reader compare the results and hypothesis with the current body of knowledge.