Reviewer’s report

Title: Effect of tendon vibration during wide-pulse neuromuscular electrical stimulation (NMES) on muscle force production in people with spinal cord injury

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Reviewer: Jana Zschüntzsch

Reviewer's report:

The authors submitted a manuscript with the title „Effect of tendon vibration during wide-pulse neuromuscular electrical stimulation (NMES) on muscle force production in people with spinal cord injury“.

In this study, 9 patients suffering from SCI with different classes of severity were recruited after a strict protocol prior to enrolment concerning food/nutrition and exercise. The patients received after a familiarization experiment NMES only and on a second time point NMES + tendon vibration. Different readout parameters like peak evoked torque, torque-time integral, target fatigue and number of contractions were recorded or analyzed. As the main finding, peak evoked torque and torque-time integral (TTI) showed no differences between the groups (NMES and NMES + Vib). Only 4 patients out of 9 were so called positive responders to STim+ Vib. Possible modes of action are further discussed.

The study is interesting on behalf of optimizing training for SCI patients or to prevent them from harmful intervention.

The following points should be addressed:

1) With respect to the different severity classes, a further clinical evaluation like muscle mass or diameter would be helpful for the interpretation of the result. Do the authors have any information about the muscle diameter, e.g. determined by ultrasound? It is not completely clear, which of the patients did not show any of the muscle contraction. An additional information in the table would be helpful or an extension of the legend if I or C reflects the voluntary muscle contraction.

2) As mentioned in the text, the electrodes were placed approximately at their motor points. How could these points be detected? Was there any correlation to atrophy?

3) For a better understanding, a visualized STIM and STIM+Vib protocol with the corresponding timelines would be helpful.
4) The total number of patients (9) was further divided into subgroups (5 vs 4). A statistical analysis of 4 vs 5 is rather difficult. A number of 6 of each is recommended.

5) Fig 2: shows a difference between STIM vs. Stim + Vib for positive responders and a difference in the STIM+VIB group (pos vs. negative). The differences are marked with a * star. In contrast, the text says: "Thus, an additional comparative analysis of positive versus negative responders to tendon vibration was undertaken, where positive responders to tendon vibration were defined as those subjects who responded with a greater TTI in STIM+Vib when compared to STIM. This analysis revealed no statistical difference in TTI between STIM and STIM+Vib for positive or negative responders (Fig. 2). Please clarify that point.

6) "Also, no significant differences were found between the conditions (STIM and STIM+Vib) for total number of contractions, despite a trend being observed": Please add the graph or mention in the text that the graph is not shown.

7) "Submaximal twitch torque (\(\text{\texttt{tw,sub}}\)) declined to 40.4 ± 4.7% of baseline in STIM, \(\rightarrow\) the graph does not correspond to the text (rather the tw,sub declined by 40.4).

"and maximal force \(\text{\texttt{tw,p}}\)) declined to 27.0 ± 5.0% of baseline in STIM \(\rightarrow\) the graph does not correspond to the text

8) Is there a fig 4.3 as mentioned in line 43?

9) Normally, the time to fatigue would give more information about the endurance. The authors could include data which show the time to fatigue.

10) Wide-pulse-high-frequency neuromuscular stimulation has been shown to induce greater muscle fatigue compared with short-pulse-low-frequency electrical stimulation in a different subset of muscles. Could the authors discuss the different effects in more detail, e.g. with respect to different muscle fibers.

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

Yes

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Yes

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes
Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I recommend additional statistical review

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