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Letter to the Editor

Response to Letter to the Editor for Manuscript "Muscle material properties in passive and active stroke-impaired muscle"

We would like to thank you for the opportunity to respond to the issues raised in Dr. Wu's letter and to clarify aspects of our methodology related to these concerns. We would also like to thank Dr. Wu for the interest in our paper and the efforts for expressing concerns.

In the letter to the editor, Dr. Wu notes that paresis influences the ability of the patient to isolate contraction of elbow flexors and control the percentage of maximum voluntary contraction of the biceps brachii muscle. We agree that stroke survivors may have difficulty isolating the contraction of the elbow flexors and that co-activation of the triceps may be present. It is critical to recognize and emphasis the importance of analyzing the electromyographical data, and not the torque data. It is difficult to distinguish the contributions of all the muscles that cross the elbow joint to the joint torque. Thus, we used electromyography data taken from the same muscle that shear wave ultrasound data was quantified (biceps brachii). Moreover, we fit the data with a first order power equation and shear wave velocity values were extrapolated at the different levels of activation using those equations. This allowed us to compare between the paretic and non-paretic side, as well as control subjects, for a given activation level. With regards to the subjects controlling the activation, subjects had to reach the given torque level within 5% or the trial would be repeated. In addition, although torque feedback was given to the subjects during each trial, the electromyographic data was used to establishing the power equation describing the relationship between shear wave velocity and activity level.

Dr. Wu expressed concern that no severity of paresis was evaluated. We acknowledge that no test for paresis was conducted and note it may be useful to include such test, in addition to the current clinical tests conducted (Tardieu, Fugl-Meyer, Modified Ashworth) in the future.

Dr. Wu also commented that the standardized posture of shoulder abduction of 45° will induce axillary pain to most patients, and that this pain will further induce spasticity. For all our subjects, we ensured that all participants were able to be in the standardized position comfortably, without any pain for all trials. In addition, as all trials were randomized, passive trials were interspersed and EMG was monitored in real-time and analyzed after to ensure no muscle activity was detected during the trial.

It is apparent that we share similar long term goals with Dr. Wu to seek potential methods to diagnose and improve treatment of stroke-impaired muscle.

Respectfully,
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