Modulations of the human trapezius muscle H-reflex following eccentric exercise

By
Steffen Vangsgaard

The trapezius muscles form very important parts of the neck-shoulder region and are commonly involved in musculoskeletal disorders. Interestingly, the motor and sensory innervation to trapezius is divided into the accessory nerve and the C3/4 cervical nerve, respectively. It is thereby possible to evoke H-reflexes in the trapezius muscle with minimal influence of M-waves which may allow special insight into the spinal mechanisms of this muscle. However, only a few studies exist on these responses and none have investigated the effects from muscle soreness or strength training.

When performed at a high intensity, eccentric contractions can lead to delayed onset muscle soreness. However, when the intensity is progressively increased, eccentric training has shown promising results with regards to strength training and rehabilitation. Still, knowledge on neural adaptations at the spinal level following eccentric exercise is lacking. The overall aim of this thesis was therefore to provide new insights into the spinal mechanisms of the human trapezius muscles and its response to eccentric exercises. For this purpose, four studies, all involving percutaneous electrical stimulation to elicit trapezius muscle H-reflexes and M-waves, were performed.

In Study (I), outcome measures of the trapezius muscle H-reflex were reported. In Study (II), the absolute and relative reliability of these measures were investigated and found to be good enabling the assessments of physical interventions. In Study (III), a single session of high-intensity eccentric exercises resulted in a decrease in the H-reflex most likely reflecting presynaptic inhibition of the α-motoneurons. On the contrary, five weeks of eccentric strength training resulted in an increase of the maximal amplitude of the trapezius muscle H-reflex, reflecting an increase in the net excitability of the α-motoneurons (Study (IV)).

The present findings confirmed the separated sensory and motor innervation of the trapezius muscle. Moreover, this series of studies investigated and documented for the first time changes in the trapezius muscle H-reflex in presence of muscle soreness and following eccentric strength training.
To fulfill the requirements for the Ph.D. degree, Steffen Vangsgaard has submitted the thesis: Modulations of the human trapezius muscle H-reflex following eccentric exercise, to the Faculty Council of Medicine at Aalborg University.

The Faculty Council has appointed the following adjudication committee to evaluate the thesis and the associated lecture:

**Dr. Per Aagaard**  
University of Southern Denmark  
Denmark

**Dr. Guillaume Millet**  
University of Calgary  
Canada

**Chairman:**  
Associate Professor Jesper Franch  
Center for Sensory-Motor Interaction, Aalborg University  
Denmark

**Moderator:**  
Professor Pascal Madeleine  
Center for Sensory-Motor Interaction, Aalborg University  
Denmark

The Ph.D. lecture is public and will take place on:

**Friday 14 November 2014 at 13:00**  
Aalborg University – Room E3-209  
Fredrik Bajers Vej 7 E3  
9220 Aalborg East

**Program for Ph.D. lecture on**

**Friday 14 November 2014**

**by**

**Steffen Vangsgaard**

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Chairman:  
Associate Professor Jesper Franch

Moderator:  
Professor Pascal Madeleine

13.00 Opening by the Moderator

13.05 PhD lecture by Steffen Vangsgaard

13.50 Break

14.00 Questions and comments from the Committee

16.00 (No later than)  
Conclusion of the session by the Moderator

After the session a reception will be arranged