

ABSTRACT

Title: Neuromuscular control of motor units in strength and coordination dependent tasks for lower limbs.

Objective: To compare muscle activity on the level of motor units through decomposition of surface electromyography signal from vastus medialis during given strength and coordination oriented movement tasks and to describe eventual differences in the parameters of tracked motor units in regards to given movement tasks. To assess the quality of chosen method for describing the muscle activity control on the level of motor units for further possible applications in the research and clinical environment. To summarize relevant knowledge acquired through the decomposition method of surface electromyography signal regarding the control of movement, motor unit activation and other relevant informations for clinical environment.

Method: Theoretical part of the work presents the decomposition method, the process of its evolution and its constituent parts in the context of electromyographic evaluation of muscles along with selected chapters of neuromuscular kinesiology on the level of motor units. The experimental portion of presented thesis was carried out on 12 probands in the age of 23,2 (+- 5,3) years, who were instructed to perform the selected movement tasks of single leg squat in two different conditions, with and without a light touch. EMG activity of vastus medialis was tracked during the movement tasks using a special electrode able to provide the signal in high enough quality for the decomposition method. The acquired data were then decomposed into its constituent motor units through the software from Delsys Inc. (Boston, USA) and statistically described through statistical analysis methods.

Results: The maximal and mean firing rate, especially when comparing motor units by their recruitment threshold was significantly higher in the single leg squat with light touch variation for the earlier recruited motor units. The maximal and mean amplitude did not show a significant difference between the used movement variations. The data reported almost similar values of mean and maximal amplitude across the movement variations. The quality of data, obtained through the decomposition method used for anisometric cyclic contractions reached levels required for its application for this specific type of muscle contraction and offers a precise method for description of complex movements, such as single leg squats.

Conclusion: For the single leg squat with light touch, higher maximal firing rate can be seen in the observed motor units. Using the mechanism of the common drive, this observed result can be

explained as a possible modulation of the firing rate used by the common drive to provide a smoother, more coordinated muscle contraction in the presence of better proprioceptive input. These findings enrich the knowledge regarding the motor control part of neuromuscular system interactions, specifically during complex movement situations. It can also be concluded that the decomposition method provides a high quality insight for the description of complex movement. The present work is one of only five studies regarding this topic on the world.

Key words: electromyography, decomposition, motor unit, squat, coordination