THE CLINICAL APPLICATION OF A MYOELECTRIC TRAINING TOOL FOR UPPER LIMB AMPUTEES

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ABSTRACT

The capabilities of commercial myoelectric devices have been steadily improving; however, the process of training and evaluating amputees in using the technology remains challenging especially as the level amputation or complexity of the technology increases. In order to achieve a successful fitting a balance must be struck between providing a device that is as functional as possible yet not so complicated that amputees have difficulty learning or using it. To help find this balance, an interdisciplinary team from the University of Alberta and Glenrose Rehabilitation Hospital (GRH) developed a Myoelectric Training Tool (MTT) that has similar functionality to commercial prostheses. The MTT includes a desktop robotic arm with 5 degrees of freedom, an electromyography (EMG) acquisition system, an embedded controller, and a laptop with a graphical user interface for fine tuning EMG parameters such as gains and thresholds. In 2015 the MTT was successfully translated to the GRH where it has been used for training of muscle control signals. It is also used for potential myoelectric users try the technology and align their expectations to the current state of the technology before fitting them with an actual device. The clinical team use the MTT to assess the number of degrees of freedom the patient can reliably control, to explore control strategy options, and to start training the patient earlier with tasks closer to what they would be able to do with their final prostheses. In this presentation we will describe the occupational training protocol that we have developed for the MTT along with representative case studies. The protocol includes a number of movement and grasping tasks with graded difficulties that are appropriate for training patients with various numbers of muscles sites including those at the transradial or transhumeral level as well as those that have undergone targeted reinnervation surgery. We have developed a method for finding the best EMG sites using the 8 EMG channels available on the MTT. For patients that lack anatomical landmarks a splint or liner material can be used to improve electrode placement consistency as well as provide compression of the electrode into the muscle belly to improve signal output. Future work will focus on further refining the protocol and including more training options for advanced controllers that use pattern recognition.