Article

Effect of motor imagery on upper limb motor performance using surface electromyography: A case study

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Introduction: The use of motor imagery (MI) is a relatively new therapeutic approach which has been shown to offer significant improvements in movement performance and can be applied in rehabilitation [1]. This case study explores the immediate effect of MI on a reaching task in a subacute stroke survivor.

Research Question: Can any immediate changes in upper limb motor performance during a reaching task be seen using surface electromyography (sEMG) and inertial measurement unit data as a result of MI in a subacute stroke survivor?

Methods: The reaching task consisted of the following: reaching for a cup placed at a distance of 30 cm from the tip of the middle finger, grasping the cup and moving the cup towards oneself and then returning it back to its original position. This movement was performed ten times before and after MI [1]. The effect of a single session of MI on the performance of the reaching task was assessed in a female subacute stroke survivor (72 years of age). Muscle activity from deltoid and triceps brachii were collected using sEMG (Delsys, inc.) and upper arm angular velocity data was recorded from an Inertial Measurement Unit sensor (Delsys, inc.). The EMG signals were processed using, remove mean, a 20 Hz high pass filter, and root mean square (RMS) [2]. The mean values and maximal values of the sEMG and angular velocity data were found before and after motor imagery and the difference expressed as a percentage.

Results: A decrease of 11% was seen for the biceps and triceps brachii muscles, and a 10% increase in angular velocity in the anterior-posterior direction was seen after the MI intervention. In addition, there was a decrease in the standard deviation.

Discussion: This study demonstrated an immediate decrease in upper limb muscle activity with an increase in extension angular velocity during the performance of a reaching task after MI training, and also showed greater consistency in the movement and muscle activity post MI training. These results suggest a learning effect during the execution of the movement and improved quality of movement as an effect of motor learning. This data would support the hypothesis that MI has an immediate effect on control and performance, however the longer-term changes in a larger cohort of stroke survivors is required to confirm these findings.

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