Stimulation map for control of functional grasp based on multi-channel EMG recordings

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References:

Abstract:
Transcutaneous activation of muscles with electrical stimulation has limited selectivity in recruiting paralyzed muscles in stroke patients. However, the selectivity could be increased by the application of smaller electrodes and their appropriate positioning on the skin. We developed a method for selecting the appropriate positions of the stimulating electrodes based on electromyography (EMG). The EMG activity maps were estimated from signals recorded with two electrode arrays and two 24-channel wearable amplifiers positioned on the nonparetic and paretic forearms. The areas where the difference between the EMG maps obtained from the nonparetic and paretic arms was significant were identified as the stimulation sites. The stimulation was applied through array electrodes with magnetic holders and two wearable stimulators with four output channels each. The measures of functionality included joint angles measured with goniometers (hand opening) and grasp force measured with a multi-contact dynamometer (grasping). The stimulation protocol comprised co-activation of flexors and extensors to stabilize the wrist joint and prevent pronation/supination.

Keywords:
Multi-pad electrode, EMG mapping, Upper extremities, Electrical stimulation