Abstract

The aim of my thesis work is the application and validation of an electromyographic biofeedback (EMG-BF) system in post-stroke rehabilitation setting. The absolute number of strokes is expected to dramatically increase in coming years, thus suggesting a need for strategies to improve post-stroke assistance and rehabilitation. The electromyogram (EMG) signal has shown good perspectives in the analysis of movements and motor impairment and the introduction of closed loop rehabilitation strategies revealed an increase of patient self-consciousness and motivation. Results are promising but a lack in the optimization of the devices for the application in the clinical context has been revealed. The device and the related software employed in the present research have been specifically conceived with this purpose. The device has been optimized during a clinical pilot study and then, a complete clinical trial has been started to investigate the characteristics of post stroke patients eligible for a rehabilitation therapy with the device, and the short-term clinical effect of the therapy on the recovery of the hand functionality. A statistical analysis has been performed on the dataset collected for 3 months. The data analysis included both clinical data and data collected from patients with the device during the execution of the experimental protocol. The preliminary results of the data analysis have confirmed the suitability of the system for its intended use and highlighted that the patient ability of controlling the EMG-BF based device is related to the degree of impairment with minimum p-value<0.001, depending on the patient clinical picture and on the exercise performed. Moreover, according preliminary results observed on four patients that received a 15 hours therapy for 3 weeks, the improvement of the parameters related to the hand and fingers motor function, suggests the efficacy of the therapy. Finally, aspects related to the analysis of continuous motions of the wrist performed during the therapy have been investigated and the relevance of the temporal information in the interpretation of this type of movements has been revealed ($p << 0.01$).