Sensor-driven four-channel stimulation of paretic leg: Functional electrical walking therapy

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References:


Abstract:

This study introduces a Functional Electrical Therapy (FET) system based on sensor-driven electrical stimulation for the augmentation of walking. The automatic control relates to the timing of stimulation of four muscles. The sensor system comprises accelerometers and force-sensing resistors. The automatic control implements IF-THEN rules designed by mapping of sensors and muscle activation patterns. The new system was tested in 13 acute stroke patients assigned to a FET group or a control (CON) group. Both groups were treated with a standard rehabilitation program and 45 min of walking daily for 5 days over the course of 4 weeks. The FET group received electrical stimulation during walking. The Fugl-Meyer (FM) test for the lower extremities, Barthel Index (BI), mean walking velocity (vmean) over a 6-m distance, and Physiological Cost Index (PCI) were assessed at the entry point and at the end of the treatment. Subjects within the FET and CON groups had comparable baseline outcome measures. In the FET group, we determined significant differences in the mean values of all outcomes between the entry and end points of treatment (p < 0.05), contrary to the CON group where we found no significant differences (p > 0.05). We also found significant differences in the changes of FM, BI, vmean and PCI which occurred during the 4 weeks of treatment between the FET and CON groups (p < 0.05). The statistical strength of the clinical study was low (<70%), suggesting the need for a larger, randomized clinical trial.

Keywords:

Walking, Automatic control, Electrical stimulation, Neuro-rehabilitation, Stroke