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Neuroprosthesis: A tool for neurorehabilitation or functional compensation?

Techniques to treat central nervous disorders are based on: (1) replacement of lost neural activity; (2) retraining of the central nervous system by repetitive practice; (3) neuromodulation, i.e., artificial restoration of the balance of activities in affected regions of the central nervous system. We define neurorehabilitation as the integration of the three above listed techniques, that is, as the augmentation of diminished or generation of absent function by use of electrical, magnetic, and mechanical assistance of the neuromuscular system in parallel with the task oriented intensive voluntary exercise. The base for this approach are results from several studies where excitability of the human brain and spinal cord was documented when exposed to stimulation. Recent experiments at our and other laboratories suggest that patterned nerve stimulation of specific anatomical sites results in desired sensory-motor pathways activation, which elicits functional motor responses in patients with sensory-motor disability. An important element when considering which method would be the most beneficial are the type and level of impairment, but also the time of the application of the treatment after the onset of disability.