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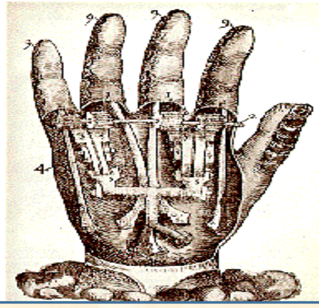

ROBOTICS

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ROBOTICS IN PHYSIOTHERAPY

Physiotherapeutic Robotics (PR), the use of mechanical devices for rehabilitation and clinical/functional assessment, is one of the faster growing branches in physiotherapy science. Although we can trace the use of mechanical devices in the health sciences back to Hippocrates's pulleys and traction machines for bones and muscles, PR is today a much more complex field which includes not only medical mechatronics and related supporting technologies, such as cognitive neural prosthetics, but also extends to the high-tech areas of monitoring systems, assistive devices, virtual reality, or the new research frontier of medical nanotechnology. PR is of major importance for physiotherapy both for the improvements it facilitates in motor impairments and for its contribution to the understanding of mechanisms underlying motor recovery after an injury or stroke. The impact of robotics in physiotherapy has not only a clinical dimension, but also legal, ethical and economic aspects which are directly addressed by Health Technology Assessment (HTA), a multidisciplinary research area for policy analysis which systematically addresses the properties and effects of health technology.

Robots are being used extensively in the rehabilitation of stroke, spinal cord injury and multiple sclerosis patients, as well as with children with central gait impairments. Robots automate labor-intensive training techniques providing longer repetitive assistance thus freeing the physiotherapist for a better observation of the recovery evolution, facilitating further assessment and decisions. However, the goal of rehabilitation robotics is to optimize care and augment the potential of individual recovery, not simply to automatize current rehabilitation practices which, for the most part, lack scientific evidential basis, primarily due to the lack of tools to properly assess the practices themselves [Krebs, 2012], a deficiency which the robotic tools can help to overcome by providing more accurate mappings of physiological parameters and the use of more refined conceptual tools for the understanding of the complex motor functions.

One major issue in PR is the contrasting neuromechanical complexity of upper extremity reaching and grasping versus lower extremity locomotion. The complex structure of human hand, which allows us to perform high dexterity and precise tasks, is a hindrance for the development of useful hand exoskeletons. Nonetheless, therapeutic devices for the hand continue to evolve, with new actuators and materials promising even greater gains in the ratio power to weight [Kamper, 2012], allowing a more efficient implementation in clinical and everyday scenarios.

A major PR field within the rehabilitation area is assistive robotics, whose aim is the production of exoskeletons that have sufficient mechanical control for the performance of everyday activities by the elderly or the physically impaired. However, the exoskeletons produced by assistive robotics face still some major difficulties in relation to their wearability, energy consumption, stability, accessibility for daily use, besides being unnatural in shape, noisy, and slow running [Viteckova et al. 2013]. The interface with these machines is being adapted to the impaired patient needs and ranges from audio control to a wide variety of body gestures, even the wincing of an eye [Chen et al. Web]. The implementation of versatile and flexible interfaces has led to the development of cognitive neural prosthetics that will allow the severely impaired patient the control over different kinds of assistive robots. Cortical neural prosthetics seek to help paralyzed patients by recording their thoughts directly from the brain and decoding them to control external devices such as computer interfaces, robotic limbs and muscle stimulators [Pesaran, 2006]. By using activity from several different parts of the brain and decoding several cognitive variables, like speech or the emotional centers, a neural prosthetic can provide a patient with the maximum access to the outside world [Andersen et al., 2004].

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Events

Robotics Conference.
Minneapolis Marriot Northwest
Minneapolis. USA
September 16th, 2014.

"Robots are being used extensively in the rehabilitation of stroke, spinal cord injury and multiple sclerosis patients, as well as with children with central gait impairments."