

Robotic Rehabilitation with Exoskeleton and Electrostimulations in a Patient with Post-Stroke Hemiparesis (a Clinical Case Report)

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Abstract

According to the World Health Organization [3,5], stroke is one of the most frequent conditions, leading to a serious disability and reduced quality of life.

According to the White Book (2018), Rehabilitation is a functional therapy, based on a detailed functional assessment [4]. Neurorehabilitation (NR) is an interdisciplinary thematic field between Neurology, Neurosurgery, Physical and rehabilitation medicine [1]. Gait recovery is an important element in NR-clinical practice, essential for the independence of patients in activities in daily living (ADL) [1].

Our objective was to emphasize the potential of modern NR-methods: exoskeleton and robotic rehabilitation, in combination with the traditional for our country electrostimulation.

We present the clinical case of a post-stroke patient, female of 50 years, with Arterial hypertension and Diabetes mellitus. Patient arrives in our PRM-clinic 45 days after an ischemic cerebro-vascular incident in right arteria cerebri media. For functional assessment before rehabilitation, we applied detailed neurological and neurofunctional exam: she had a left central hemiparesis, motor functions grade III-IV according to Brunnstrom classification, spasticity ++; left hemihypoesthesia; muscular contractures for left extremities (flexion-adduction-pronation for the upper extremity = hemiparetic hand; extension-pronation for the leg). For treatment, a complex NR-programme with synergic combination of different natural and pre-formed physical modalities was created: physiotherapy with proprioceptive neuro-muscular facilitation; mechano-therapy; balance and gait training; electro-stimulations for the antagonists of the spastic muscles (for the hand and the ankle); ergotherapy (including ADL-training); and robotic NR with a powered Exoskeleton - a cyborg type robot with Hybrid Assistive Limb (HAL) of Cyberdyne systems (fig.1). After 30 days we observed a significant functional recovery: reduction of the muscle weakness, spasticity and contractures; amelioration of balance, gait (with crutches) and autonomy in ADL.

Authors explain some specific principles of balance and gait training, using modern devices [2].

Keywords: Exoskeleton, gait, neurorehabilitation, stroke, activities in daily living, autonomy

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Figure 1: Gait training with Exoskeleton.