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Effects of Robot-Assisted Hand Training on Upper Extremity Performance in Patients with Stroke: A Randomized Crossover Controlled, Assessor-Blinded Study

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Abstract : Background: Upper extremity functional impairment that occurs after stroke includes hemiplegia, synergy movement, muscle hypertonicity, and somatosensory impairment, which result in inefficient and inaccurate movement. Robot-assisted rehabilitation is an intensive training approach that is effective in sensorimotor and hand function recovery. However, these systems mostly focused on the proximal part of the upper limb rather than the distal part. The device used in our study was Gloreha Sinfonia, which focuses on the distal part of the upper limb and uses a dynamic support system to facilitate the whole limb function. The objective of this study was to investigate the effects of robot-assisted therapy (RT) with Gloreha device on sensorimotor, and ADLs in patients with stroke. Method: Patients with stroke (N=25) participated AB or BA (A = 12 RT sessions and B = 12 conventional therapy (CT) sessions) for 6 weeks (60 min at each session, twice a week), with 1-month break for washout period. The performance of the patients was assessed by a blinded assessor at 4 time points (pretest 1, posttest 1, pretest 2, posttest 2) which including the Fugl–Meyer Assessment-upper extremity (FMA-UE), box and block test, electromyography of the extensor digitorum communis (EDC) and brachioradialis, a grip dynamometer for motor evaluation; Semmes–Weinstein hand monofilament and Revision of the Nottingham Sensory Assessment for sensory evaluation; and the Modified Barthel Index (MBI) for assessing the ADL ability. Result: RT group significantly improved FMA-UE proximal scores ($p = 0.038$), FMA-UE total scores ($p = 0.046$), and MBI ($p = 0.030$). The EDC exhibited higher efficiency during the small block grasping task in the RT group than in the CT group ($p = 0.050$). Conclusions: RT with the Gloreha device might lead to beneficial effects on arm motor function, ADL ability, and EDC muscle recruitment efficacy in patients with subacute to chronic stroke.

Keywords : activities of daily living, hand function, robotic rehabilitation, stroke
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