

The Effects on Hand Function with Robot-Assisted Rehabilitation for Children with Cerebral Palsy: A Pilot Study

Authors : Fen-Ling Kuo, Hsin-Chieh Lee, Han-Yun Hsiao, Jui-Chi Lin

Abstract : Background: Children with cerebral palsy (CP) usually suffered from mild to maximum upper limb dysfunction such as having difficulty in reaching and picking up objects, which profoundly affects their participation in activities of daily living (ADLs). Robot-assisted rehabilitation provides intensive physical training in improving sensorimotor function of the hand. Many researchers have extensively studied the effects of robot-assisted therapy (RT) for the paretic upper limb in patients with stroke in recent years. However, few studies have examined the effect of RT on hand function in children with CP. The purpose of this study is to investigate the effectiveness of Gloreha Sinfonia, a robotic device with a dynamic arm support system mainly focus on distal upper-limb training, on improvements of hand function and ADLs in children with CP. Methods: Seven children with moderate CP were recruited in this case series study. RT using Gloreha Sinfonia was performed 2 sessions per week, 60 min per session for 6 consecutive weeks, with 12 times in total. Outcome measures included the Fugl-Meyer Assessment-upper extremity (FMA-UE), the Box and Block Test, the electromyography activity of the extensor digitorum communis muscle (EDC) and brachioradialis (BR), a grip dynamometer for motor evaluation, and the ABILHAND-Kids for measuring manual ability to manage daily activities, were performed at baseline, after 12 sessions (end of treatment) and at the 1-month follow-up. Results: After 6 weeks of robot-assisted treatment of hand function, there were significant increases in FMA-UE shoulder/elbow scores ($p=0.002$), FMA-UE wrist/hand scores ($p=0.002$), and FMA-UE total scores ($p=0.002$). There were also significant improvements in the BR mean value ($p = 0.015$) and electrical agonist-antagonist muscle ratio ($p=0.041$) in grasping a 1-inch cube task. These gains were maintained for a month after the end of the intervention. Conclusion: RT using Gloreha Sinfonia for hand function training may contribute toward the improvement of upper extremity function and efficacy in recruiting BR muscle in children with CP. The results were maintained at one month after intervention.

Keywords : activities of daily living, cerebral palsy, hand function, robotic rehabilitation

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