Effect of Intensive Training With a Spring-Assisted Hand Orthosis on Movement Smoothness in Upper Extremity Following Stroke: A Pilot Clinical Trial

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Background: A commercial splinting system is designed to permit quick training in opening and closing the affected hand in order to overcome the disadvantages of previous approaches. **Objective:** The purpose of this study was to assess the feasibility of intensive training using a spring-assisted hand orthosis on upper extremity in individuals with chronic hemiparetic stroke. **Design:** Five participants for the experimental group and 5 for the control group were recruited from a local rehabilitation hospital. Subjects in the experimental group participated in 4 weeks of training using a SaeboFlex orthosis for 1 hour per day, 5 times per week. Each subject in the control group wore the same orthosis for 1 hour per day without participating in upper extremity training. Outcome measures included the Fugl-Meyer Assessment, Box and Block Test, and Action Research Arm Test; kinematic parameters were collected using a 3-D motion analysis system. **Results:** The Fugl-Meyer assessment and the Box and Block Test score were increased significantly in the experimental group after the intervention. The resultant velocity of the wrist joint for the reach-to-grasp task decreased significantly, and the resultant velocity of the shoulder joint while performing a reach-to-grasp task at acromion height decreased significantly in the experimental group. **Conclusion:** A pilot clinical study of spring-assisted dynamic hand orthosis training is feasible in recovering the movement of the hemiparetic upper extremity. **Key words:** *hand orthosis, hemiparesis, resultant velocity, stroke, upper extremity*

Stroke is the leading cause of disability in adults and is the third leading cause of death in the United States.[1–3] Ninety percent of stroke survivors show permanent disabilities, and most of them develop hemiparesis or hemiplegia. Hemiparesis in the upper extremity is widely reported as the primary impairment in individuals after stroke. This impairment interferes with the movements required for basic daily activities and household chores as well as for work-related tasks.[4] Therefore, recovering voluntary movement in the upper extremity is the most important goal in rehabilitation and for research in these fields.

Various treatment approaches have been used for recovering the function of the hemiparetic upper extremity. However, previous studies have provided little or no evidence regarding the treatment effects of upper extremity training on muscle strength, muscle tone, dexterity, and activities of daily living.[5–7] Recently, task-oriented training has been shown to be a form of activity-dependent motor rehabilitation that facilitates the recovery process of upper extremity function.[8,9] This approach is based on the motor learning principles of practice and intermittent feedback and has the elements necessary for facilitating real-world activities.[10]

Constraint-induced movement therapy (CIMT) is a gold standard for recovering upper extremity function after stroke, and it is influenced by the task-oriented approach. It involves constraining

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