Do Stroke Survivors Activate Their Muscles to Supplement the Hand Extension Robot Orthosis (HERO) Glove's Assistance?

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Do Stroke Survivors Activate Their Muscles to Supplement the Hand Extension Robot Orthosis (HERO) Glove’s Assistance?

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ABSTRACT

The Hand Extension Robot Orthosis (HERO) Glove enables stroke survivors with severe hand impairment to perform activities of daily living more independently. OBJECTIVE: To determine whether stroke survivors show voluntary activation of the forearm muscles while using the HERO Glove. METHODS: Three stroke survivors (Chedoke McMaster Stroke Assessment – Stage of Hand 1-3/7) performed maximum voluntary contractions (MVC), the box and block test and a water bottle grasp and lift task while using the HERO Glove and wearing the Myo Armband for muscle activity measurement. RESULTS: Three stroke survivors with severe hand impairment showed varied levels of muscle activation while using the HERO Glove. One participant with a Stage 3 Hand and strong grip strength (55N) showed generalized activation of the forearm flexor and extensor muscles (33% MVC) while grasping the blocks and water bottle, which supplemented the HERO Glove’s assistance. The participant relaxed the forearm muscles while releasing the blocks and water bottle. One participant with a clenched Stage 3 Hand and weak pinch strength (10N) showed generalized forearm muscle activation (30% MVC) that did not relax while releasing the blocks or water bottle. The participant with a Stage 1 Hand (flaccid paralysis) did not show muscle activation during either task. IMPLICATIONS: This analysis demonstrates that a variety of sensors, control modes and training strategies are required to detect the intent of users at higher and lower stages of recovery. This analysis provides support for using the HERO Glove as an assistive device for stroke survivors at lower stages of recovery and as a neuromuscular rehabilitation tool for stroke survivors at higher stages of recovery.

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