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

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The HERO Glove enables stroke survivors with severe hand impairments to extend their fingers and thumb and create a tripod pinch grasp to perform rehabilitation exercises and activities of daily living more independently.

- The HERO Glove is portable, affordable ($160), lightweight (192g) and easy to use
- The HERO Glove was iteratively developed and tested with over 20 engineers, occupational therapists and stroke and spinal cord injury survivors

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OBJECTIVE: To determine whether stroke survivors show voluntary forearm muscle activation 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 electromyography 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 pinch strength (55N) showed generalized activation of the forearm flexor and extensor muscles (~33% MVC) while grasping the blocks and water bottle to supplement the HERO Glove’s force and relaxed these muscles while releasing the objects. One participant with a clenched Stage 3 Hand and weak pinch strength (10N) showed generalized forearm muscle activation (~33% MVC) that did not relax while releasing the objects. The participant with a Stage 1 Hand (flaccid paralysis) did not show muscle activation.

IMPLICATIONS: This analysis demonstrates that a variety of sensors, control modes and training strategies are required to detect the intent of users at different 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.

Chedoke McMaster Stage of Hand: 3
Range of Motion (ROM) 125°, Pinch Strength 55N

Chedoke McMaster Stage of Hand: 3
ROM 5°, Pinch Strength 10N, Clenched Hand

Chedoke McMaster Stage of Hand: 1
ROM 0°, Pinch Strength 0N, Flaccid Hand


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