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## Effectiveness of 3D-printed Upper Extremity Device for Chronic Neurological Impairment


Joe Kardine, MBA, MS, OTR/L, CBIS  
*Thomas Jefferson University, joe.kardine@jefferson.edu*

Mikael Avery, MS, OTR/L  
*Thomas Jefferson University, mikael.avery@jefferson.edu*

Alessandro Naopli, PhD  
*Thomas Jefferson University, alessandro.napoli@jefferson.edu*

Namrata Grampurohit, PhD, OTR/L  
*Thomas Jefferson University, namrata.grampurohit@jefferson.edu*

MaryJane Mulcahey, PhD, OTR/L  
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*Thomas Jefferson University, MaryJane.Mulcahey-Hershey@jefferson.edu*

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## Authors

Joe Kardine, MBA, MS, OTR/L, CBIS; Mikael Avery, MS, OTR/L; Alessandro Naopli, PhD; Namrata Grampurohit, PhD, OTR/L; MaryJane Mulcahey, PhD, OTR/L; and Mijail Serruya, MD, PhD



## Abstract

**Background:** Cerebral palsy, stroke, spinal cord injury, muscular dystrophy, and other neurological conditions frequently cause debilitating upper extremity (UE) motor impairments that are retained well beyond rehabilitation discharge. People with moderate to severe UE neurological impairment frequently exhibit limited active movement in their paretic elbow and little to no active movement in their paretic wrists and fingers. Pilot data demonstrating that an integrated myoelectric system could restore independent function both in clinical and naturalistic community settings will lay the foundation for extramural funding to support a future prospective, randomized comparative effectiveness study with the hope that results can lead to new standard-of-care guidelines, thereby enhancing their participation in everyday life across home, school, work, community and virtual environments, and increasing, their overall well-being.

**Design:** Pre-test and post-test design

**Setting:** Outpatient rehabilitation research center

**Participants:** Participants were referred to the research study coordinator. Participants were deemed appropriate having met inclusion criteria and no exclusion criteria; and consenting to trial. 5 participants have completed the study at this time.

**Interventions:** Don and doffing of the device, teach-back of safety mechanisms to use the device independently, joystick control with grasp and release activities, inertial measurement unit powered grasp and release activities, functional instrumental activities of daily living and self-care tasks, and bi-manual activities for everyday function.

### Main Outcome Measures:

- Canadian Occupational Performance Measure (COPM):** Semi-structured interview measuring subjective performance and satisfaction with client-centered goals. Data in the table (right) supports the effectiveness of this device as functional improvement was recorded for each participant.
- Box and Blocks Test (BBT):** Assessment used to evaluate manual dexterity in having participants pick up and transport 2.5 cm wooden blocks over a 15.2 cm partition. There was a significant improvement for participants in these assessments without the device and with the device comparing pre and post-test.
- Action Research Arm Test (ARAT):** Assessment used to evaluate upper limb function by observing performance in a variety of tasks

**Conclusions:** Five adults with UE mobility impairment due to stroke learned to use a lightweight, customized, powered hand orthosis. Although the orthosis can only achieve one type of hand open-close motion, participants were able to use it to perform desired activities in their home and community settings. Feedback from the therapists and participants in this trial can inform the design of an improved device that could one day become a widely available tool for physicians or therapists to provide (with training) to all those who may benefit.

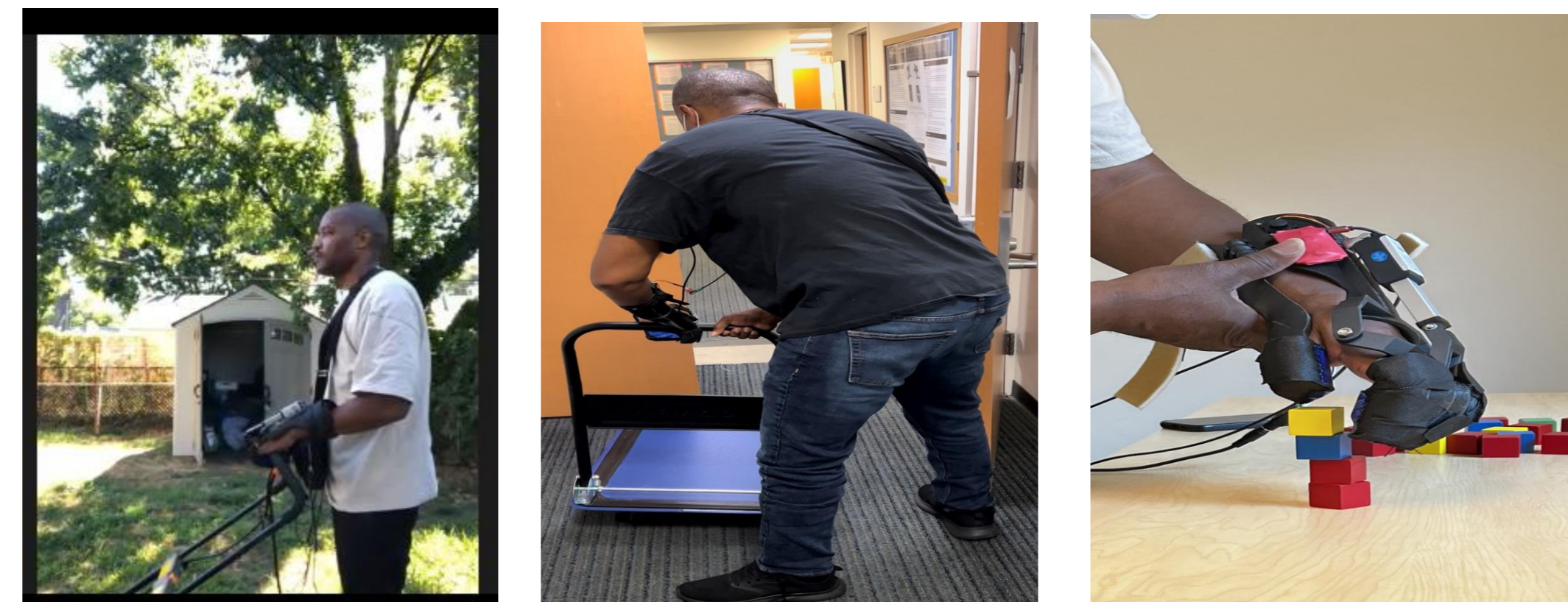
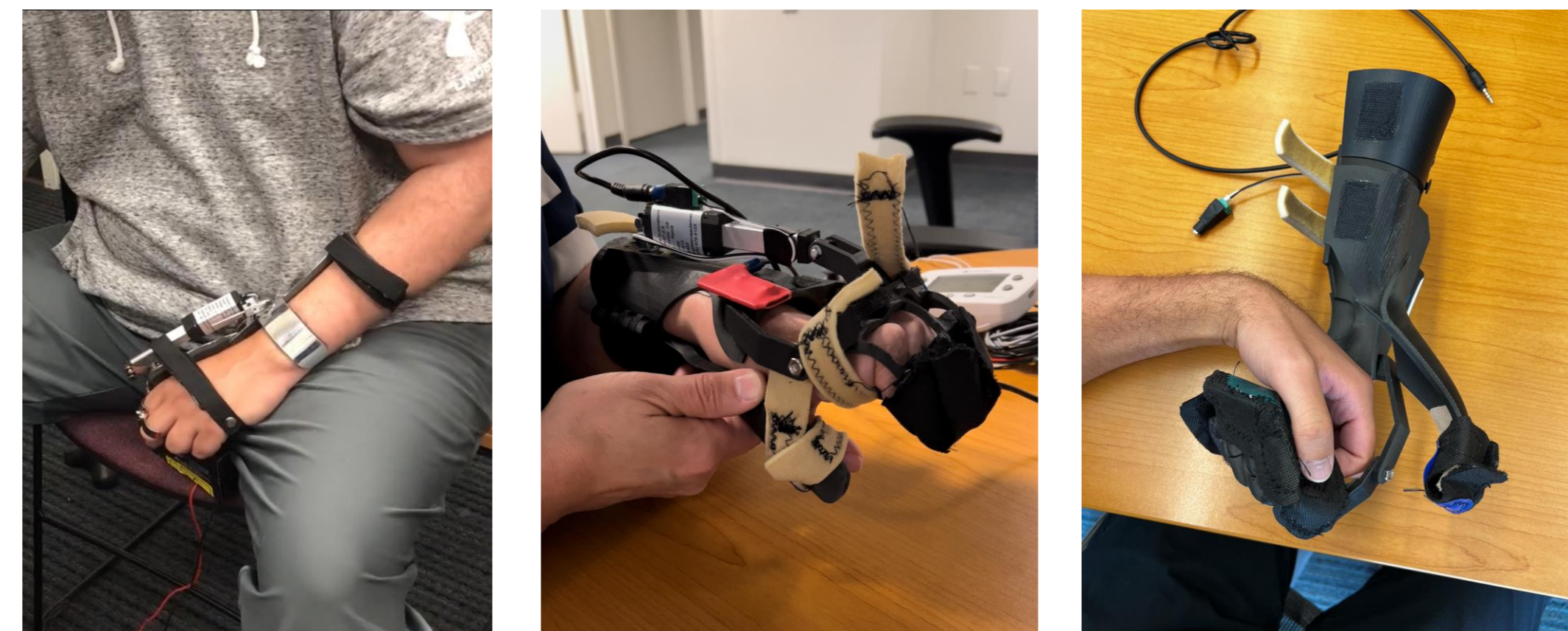
**Author(s) Disclosures:** No disclosures

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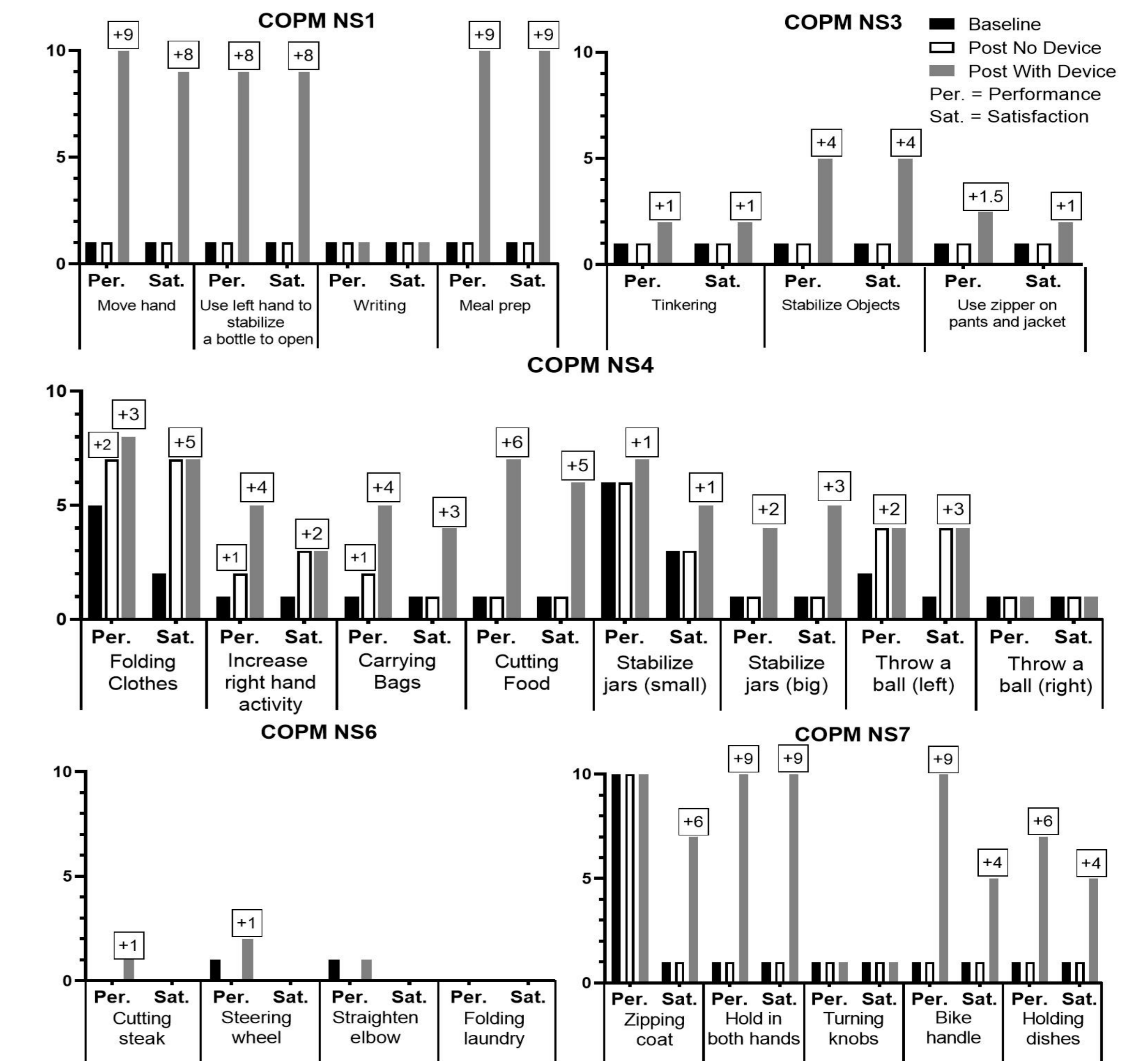
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## 3D Printed Device Function and Usage



## Results



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