Functional Outcomes following the Use of Hand Mentor™ as Home Program with Adults Post Stroke: A Case Study

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BACKGROUND

In the United States, 600,000 to 730,000 people a year experience a cerebrovascular accident (CVA) (Archibald & Drum, 2007). A CVA results in impaired motor functions that include flaccidity and spasticity. Spastically often plagues motor to necessitate patterns usually causing shoulder subluxation and internal rotation, elbow flexion, wrist flexion, finger and thumb flexion and ulnar deviation. Rosenblum, Rodel, Tsha, Samuelov, and Alberts (2009) state patients with hemiparesis following a stroke present with decreased muscle strength, decreased coordination, and increased flexion tone. Grip and pinch function are significantly impaired.

The OT Practice Framework of the American Occupational Therapy Association (2008) lists motor control, sensory input, motor functions, and emotional regulation as client factors that affect functional performance. Such underlying factors influence the daily task requirements for activities of daily living and instrumental activities of daily living. Beyond the factors identified in the OT Practice Framework, various areas of occupation can also be impacted based on the individual’s identity and priorities (Frisoli et al., 2012).

HAND MENTOR™

The Hand Mentor™ is a robotic device that provides neurorehabilitation to patients with stroke or other brain injury. The device uses computer simulation to provide repetitive motion of the wrist and fingers.

PURPOSE

The purpose of this case study is to evaluate the effectiveness of a robot-assisted therapy home program using the Hand Mentor™ in adults with chronic CVAs.

RESEARCH QUESTIONS & HYPOTHESES:

Research Question 1: To what extent does a home program using the Hand Mentor™ improve UE movement in adults with chronic CVAs?

H1: The use of robot-assisted repetitive training home program with the Hand Mentor™ will increase the functional movement of the involved upper extremity in adults with chronic CVAs.

H2: The use of robot-assisted repetitive training home program with the Hand Mentor™ will increase the functional movement of the involved upper extremity in adults with chronic CVAs.

Research Question 2: To what extent does use of a home program with the Hand Mentor™ improve performance of daily activities that involve the use of the UE in adults with chronic CVAs?

H3: The use of robot-assisted repetitive training home program with the Hand Mentor™ will improve performance of daily activities that involve the use of the upper extremity in adults with chronic CVAs.

STUDY DESIGN

The study design was an ABA case study. Participants were evaluated at baseline, re-evaluated after using the home program for 4 weeks, and re-evaluated after an additional 4 week use of the Hand Mentor™ to assess changes in function.

PARTICIPANTS

Inclusion Criteria:
- Eligible-speaking adults of 21 or older admitted to inpatient stroke units
- Eligible for a home program evaluation
- Cognitive and visual abilities to follow instructions
- Ability to transport to and from home
- Spasticity in the affected hand
- Adequate English language skills
- Participation in an OT treatment plan
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Exclusion Criteria:
- Seizures
- Head injury
- Scleroderma
- Rheumatoid arthritis
- Osteoarthritis
- Diabetes
- Heart disease
- Lung disease
- Mental retardation
- Intellectual disability
- Substance abuse
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Participant Demographics:
- 29-year-old Caucasian female
- 3 years post-right-side brain hemorrhage
- Spasticity and functional impairment limitation of left upper extremity
- Previously non mobile and at risk for falls

ASSESSMENT TOOLS

- COPM- client-centered tool used to set goals and measure changes over time in participant’s perception of occupational performance
- SIS- evaluates participant’s perception of how the stroke has impacted 8 areas of their life: Strength, Hand Function, ADL/ADAR Mobility, Communication, Emotion, Memory & Thinking, and Participatory Role Function
- ARAT- standardized test of grip, pinch, and gross arm movement
- Activity Log- participant’s report of changes in physical and mental abilities
- Motor Activity Log- participant utilizes a rating form to track changes in motor and functional skills

RESULTS

After use of the Hand Mentor™ home program, the participant:
- Increased average scores of satisfaction and performance of goals on the COPM
- Increased overall ratings on the SIS
- Increased overall scores on the ARAT
- Reported incorporating left UE more often into functional tasks such as cooking, opening containers, and dressing
- Increased average scores of satisfaction and performance of goals on the COPM
- Increased overall ratings on the SIS
- Increased overall scores on the ARAT

STUDY PROCEDURES

- Pre-assessment of motor skills and function using the SIS, COPM, ARAT, pinch gauge, dynamometer, and videotaping
- Individualized home program developed
- Participant trained in donning and usage of the Hand Mentor™ device and home program
- After 4 weeks, re-evaluation of function using the SIS, ARAT, pinch gauge, and dynamometer
- Additional 4 weeks of home program and weekly phone contact using Motor Activity Log completed
- After 8 weeks, re-evaluation of motor skills and function was completed using the SIS, ARAT, COPM, dynamometer and videotaping

HOMEBASE

- Minimum of 1 hour/day at least 5 days/week
- For this participant, use of the Hand Mentor™ in the home was shown to be effective. Hand Mentor™ home program facilitated increased use of left UE in bilateral tasks and during daily activities.

CONCLUSIONS

For the participant use of the Hand Mentor™ in the home was shown to be effective. Hand Mentor™ home program facilitated increased use of left UE in bilateral tasks and during daily activities.

CLINICAL APPLICATIONS

- Use of Hand Mentor™ facilitates concepts of Motor Control Theory such as motor pattern frequency, repetition, generalization, and automation
- Use of Hand Mentor™ encourages UE engagement through virtual gaming
- Provides repetitive wrist flexion and extension, improving initiating of dorsal movement patterns
- Use of the tool in the home allows for personal scheduling
- Use of Hand Mentor™ home program would allow clinicians to focus on more complex tasks during intervention sessions

LIMITATIONS

- Use of one participant limits ability to generalize results
- 3 years since participant’s stroke may have made greater gains earlier on in recovery
- ARAT is not a sensitive tool for measuring functional change; thus limiting changes in scores as compared to the beneficial changes seen in the video-taped results

RECOMMENDATIONS FOR FUTURE RESEARCH

- Evaluate with larger sample size and variety of demographics (age, time post-stroke, gender)
- Determine recommended dosages of time for home program to achieve optimal results
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- Determine recommended dosages of time for home program to achieve optimal results

REFERENCES

1. Atchison, B. J., & Polatajko, H. J. (2004). Functional Outcomes following the Use of Hand Mentor™ as Home Program with Adults Post Stroke: A Case Study. \(\text{COPM Overall Pre and Post}\)

Average across all goals for both performance and satisfaction, decreased from post-test 1 to post-test 3, identified a 3-point increase in performance and a 3.5-point increase in satisfaction showing an overlap increase in both areas. Changes in scores of 2.5+ indicate clinically significant improvement on the COPM (Cascardo et al., 2004).

Participant demonstrated increased scores on gross movement and pinch subscale after use of the Hand Mentor™ home program resulting in a small increase in overall scores on the ARAT. No change on the grip subscale; minor decrease in scores on the grasp subscale.

Participant increased ratings in the following categories: typical activities, home and community mobility, the ability to use assistive hand, participation in meaningful activities, and overall stroke recovery.