Neurorehabilitation of the Hand in Chronic Stroke

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Background

- Approximately 60% of Persons with Stroke (PWS) experience long lasting hand function impairments; significantly impacting activities of daily living and quality of life (Nichols-Larsen et al., 2005, Nowak 2008 & Raghavan 2007)
- Currently there are several engaging approaches to promote rehabilitation through virtual reality (VR), robotics and electrical stimulators that provide low to moderate grade evidence in their ability to improve upper limb impairment and function. (Pollock et al., 2014).
- In this study, a novel and passive hand function training (HFT) device (MyHand™ System) was used to train hand function in individuals' post-stroke, with movement feedback being provided in the form of a computer game.
- The objectives of this study is to test participant engagement during gamified hand function training sessions and to measure functional change, as a result of 4-week HFT program using the MyHand™ System.
- *The primary outcome measure for this research study is game-play engagement and cognitive load during the course of hand function training. These findings are presented in a separate publication.*

Methods

- Ten subjects who sustained stroke ≥5 months prior to the start of the study were recruited.

INCLUSION CRITERIA	EXCLUSION CRITERIA
• Ages 30-80 • Single first stroke ≥ 5 months before starting the program • Chedoke McMaster Stroke Assessment (CMSA) Score for the hand and shoulder pain ≥ 3 • Capacity and Ability to consent	• Botox injection in the upper limb within three months of study commencement • Severe contractures impacting hand function • Any type of other severe neurological or musculoskeletal conditions that impairs sensory motor function of the hand • Participating in any other hand function therapy

- All participants participated in fifteen 30-minute/sessions over a course of one month. Participants were trained on pincer, tripod, quadripod and spherical grasp finger strengthening/coordination exercises on the MyHand™ System.
- Each session, participants would rotate through one of seven different formats of visual feedback (six different games and one basic bar graph model).
- Each session was timed to indicate total amount of time used on the device inside the 30-minute session.
- Participants were assessed prior to start of study, and on completion of the HFT programme.
- The primary functional outcome measure was Jebsen Taylor Hand Function Test (JTHFT).

Results

- All participants completed 15 training sessions over 4-weeks, and the pre- and post-assessment sessions.
- Mean participation time on device increased during treatment sessions from 23.13 minutes to a maximum of 29.67 minutes.
- The Friedman test was used to analyze within subject change in the fine motor, gross motor and total score of the JTHFT.

	PRE	POST	Change	P – value
JTHFT – Fine	391.82±162.55	390.13±161.02	1.69±19.99	0.5
JTHFT – Gross	289.80±136.74	278.36±141.44	11.44±30.89	0.042
JTHFT - Total	681.62±299.18	668.5±298.9	13.13s±25.14	0.046

Table 1. Values are Mean ± SD. All values are presented in seconds except for the p-value.

- Gross motor and Total score were statistically significant at $p<0.05$ (table 1).

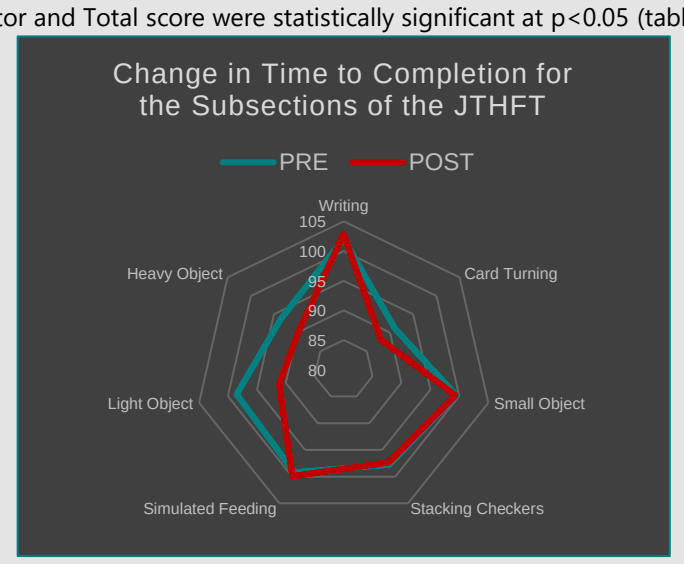
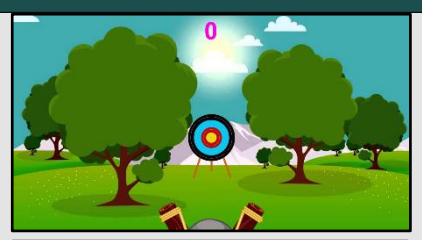


Figure 1. Mean Change in time of completion for subsections of JTHFT.

Device Information

Figure 2: MyHand™ System MK 2.4.5



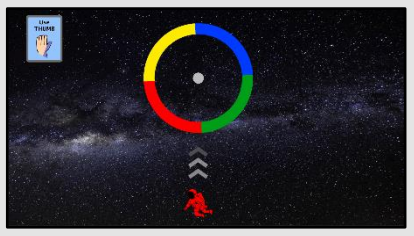


Figure 3 & 4: examples of two of the games played throughout the study

Figure 5: How the hand is placed in the MyHand™ System. Each finger is placed in separate finger cups and adjusted accordingly

Discussion/Conclusion

- The results of this study provide a promising trend of an improvement in hand function in chronic PWS following HFT with a novel device. These findings are consistent with other studies investigating hand function in chronic PWS (Shin et al., 2016, Saleh et al., 2017).
- The results from this study, seem to indicate that the JTFHT was not sensitive to estimate baseline finger and hand function changes in 6 out of 10 participants.
- Results also demonstrate improvement on the gross motor function section of the JTHFT although the intervention focused heavily on training fine motor skills. This could be a reflection of the short intervention time (6.9±0.41 hours over 4 weeks).
- Further studies should investigate using a larger sample size, longer session duration and a longer intervention time.

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