

Improving Upper Limb Function after Chronic TBI through a Home-based Self-initiated Therapy

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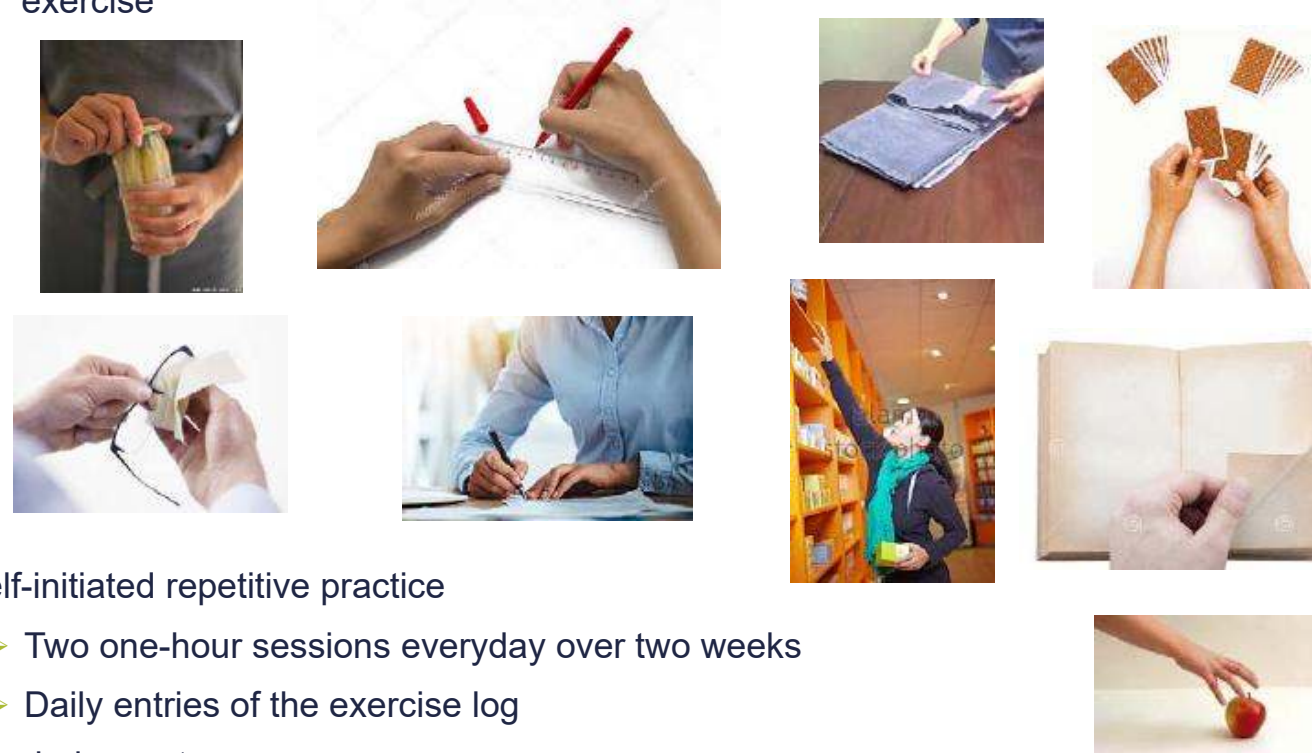


Introduction

- Upper limb dysfunction is common following moderate to severe traumatic brain injury (TBI), but its rehabilitation is currently under-investigated (Katz et al., 1998 *Arch Phys Med Rehabil.*; Walker & Pickett, 2007 *J Rehabil Res Dev.*) while the literature on the same topic for stroke survivors is extensive and detailed.
- Regaining upper-limb function after TBI takes considerable time and commitment from patients (Kimberley et al., 2010 *J Rehabil Med.*; Ross et al., 2016 *Br J Occup Ther.*) Beyond the one-to-one therapy time with therapists, patients are encouraged to practice as much as they can by themselves at home.

Home-based Arm and Hand Exercise (HAHE): Key Elements

- Person-centered outcome measures
 - Self-identified quantifiable goals (structured based on an established outcome measure such as the Wolf Motor Function Test)
 - Qualitative self-reports
- Individualized activities based on functionally relevant visuomotor tasks
 - Visuomotor tasks selected from a predetermined catalog
 - Activities learned and guided by an experienced therapist
 - Activity-related materials provided to the patient after one week of therapist-guided exercise



- Self-initiated repetitive practice
 - Two one-hour sessions everyday over two weeks
 - Daily entries of the exercise log
- Reminder system
 - Phone or text message every other day from the research team
 - Motion detector, a wearable device over the wrist of the more affected arm (Fong et al., 2013 *Clin Rehabil.*), reminding the patient to move if no movement is detected more than two minutes during a HAHE session.

Participants and Timelines

- All were right-hand dominant prior to injury. The more affected upper limb of each participant was the right upper limb.
- None received botulinum toxin injection treatment for spasticity within the past three months before study participation.
- They were assessed at baseline (T0), after therapy (T1) and one month after therapy (T2) with primary outcome measures including Box and Blocks Test, Wolf Motor Function Test (WMFT), and personal goals based on the WMFT.

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	Participant 1	Participant 2	Participant 3	Participant 4
Sex	Male	Female	Male	Male
Age (year)	61	56	36	53
Race/ethnicity	White	White	White	Asian
Years of education	16	15	14	16
Academic degree	Bachelor's	Associate's	Some college	Master's
Marital status	Single	Divorced or separated	Single	Divorced or separated
Years post injury	8.1	4.5	14.1	2.6
Cause of brain injury	Motor vehicle accident	Motor vehicle accident	Snowboarding accident	Occupational accident

Results

Compliant Participants --

- Participant 2 and 4 completed the HAHE protocol, responded to all the reminders, documented activities in the daily log, completed two one-hour sessions every day, and wore the motion detector during each session.
- Participant 2 and 4 achieved improvement in WMFT and personal goals.
- Participant 2 improved in grip strength while participant 4 improved on BBT scores.

Non-compliant Participants --

- Participant 1 did not complete any home-based session, or assessments at T1 and T2.
- Participant 3 did not use the daily log and was not responsive to reminders, but did complete assessments at T1 and T2.
- Participant 3 experienced minimal improvement in grip strength.

Participant ID number	Scale or assessment	Non-compliant		Compliant	
		1	3	2	4
Brunnstrum Stage	T0	4	3	4	3
	T1		3	5	4
	T2		3	6	5
Box and Blocks Test	T0	50	8	39	26
	T1		11	41	26
	T2		7	27	32
WMFT; time (in sec)	T0	1.37	6.20	3.00	4.25
	T1		8.37	2.31	2.81
	T2		7.25	2.72	2.31
WMFT; grip strength (in kg)	T0	20.93	1.80	8.67	3.13
	T1		1.57	15.33	6.63
	T2		5.20	17.90	3.87
WMFT-FAS	T0	69	30	53	45
	T1		37	62	60
	T2		33	68	61
WMFT-FAS of the 5 self-selected items	T0	21	9	11*	11*
	T1		8	14*	15*
	T2		8	16*	16*

(*Grip strength was selected but not scored)

Discussion

- The HAHE protocol demonstrates great potential in improving upper limb function in persons with chronic TBI.
- Results suggests that greater degree of adherence to the HAHE protocol was associated with greater improvement.
- Integrating strategies to encourage protocol adherence may be critical to implementation of home-based self-initiated therapy.