Evaluation of a Novel Virtual Rehabilitation Program for Service Members Post ABI: A Feasibility Study

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Abstract

The purpose of this analysis was to assess the clinical acceptance of the BrightBrainer Virtual Rehabilitation (BBVR) program, developed by Bright-Cloud International, using participant and Occupational Therapist (OT) self-reports. Participants (n=16) completed experimental treatment in a large military hospital's outpatient clinic. Treatment lasted for 6 weeks, with participants and OTs completing measures of clinical acceptance at 3 and 6 weeks. Overall levels of usability and enjoyment were high (72-85%), and these perceptions were maintained from 3 to 6 weeks of treatment.

Introduction

From 2000 to 2016, approximately 357,000 service members were diagnosed with traumatic brain injury (TBI) [1]. Symptoms and functional deficits associated with TBI are heterogeneous in nature and include a combination of cognitive, emotional, behavioral, and motor deficits. Training intensity, repetition, duration, and participant motivation/engagement have been identified as variables that affect the success of acquired brain injury (ABI) rehabilitation [2].

BrightBrainer Virtual Rehabilitation (BBVR)

Features:

- Bimanual tasks to increase cognitive load
- High number of repetitions
- Mild upper extremity exercise that adapts to the participant
- Scalable difficulty

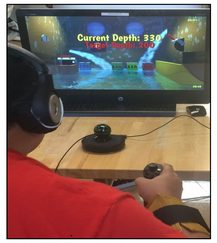

Figure 1. BBVR system features Razer Hydra magnetic motion-sensing hub that simultaneously tracks two controllers in three dimensional space.

The purpose of this analysis was to determine if participant and OT perceptions of the effectiveness, ease of use, and enjoyment of the BBVR system remained consistent from mid-treatment (MP) at 3 weeks to end of treatment (EP) at 6 weeks. This analysis was done as part of a larger study assessing the feasibility and clinical value of implementing the BBVR system within the outpatient clinic of a large military hospital. Assessment of the BBVR system's clinical outcomes will be presented elsewhere.

Participants

All study procedures took place in the outpatient clinic of a large military hospital, and all participants were military health care beneficiaries. Participants were eligible for inclusion if they were between the ages of 18 and 67 and had sustained an ABI at least 6 weeks prior to consent. A total of 16 participants had completed all experimental treatment sessions and assessments at the time of this analysis. These 16 participants were included in this report.

Design

The adaptable nature of the system allows the supervising therapist to adjust game difficulty, controller sensitivity, trigger use, etc. as necessary, based on participant ability and range of motion. Treatment took place three times a week, over the course of 6 weeks (18 sessions total). During the first 3 weeks of therapy, participants worked one-on-one with a research OT. During the last 3 weeks of treatment, the OT worked with 2 participants simultaneously.

Week	OT Support	Time (mins)	Wrist Weight (lbs)	Hands	Games
1	OT	30	None	One	Breakout 3D, Card Island, Kite, Pick & Place, Treasure Hunt, Tower of Hanoi
2	OT	35	0.5	Two	Week 1 + Submarine Rescue
3	OT/COTA	40	1.5	Two	Week 2 + Arm Slalom
4	OT/COTA	40	2.0	Two	Week 3 + Xylophone
5	OT/COTA/RA	40	3.0	Two	Week 4 + Avalanche
6	OT/COTA/RA	40	3.0	Two	Week 5 + Musical Drums

Table 1. Progression of OT involvement, gameplay time, wrist weight use, uni– versus bi-manual training, and games available throughout the course of treatment.

Perceived effectiveness, participant enjoyment, and ease of use were measured at 3-weeks and 6-weeks using four self-report Likert questionnaires:

- Participant USE Questionnaire
- Participant Feedback Questionnaire
- OT/COTA USE Questionnaire
- OT/COTA Feedback Questionnaire

Results

A two one-sided test (TOST) procedure was run comparing MP and EP scores for each questionnaire. No meaningful difference was found between MP and EP scores at a 90% confidence interval (CI) for the Participant Feedback Questionnaire [(max. score=77) (x_{MP}=61.500, SD_{MP}=7.510, x_{EP}=62.063, SD_{EP}=9.015, MD=6, CI=[-5.541, 4.416], p=0.037)], OT Feedback Questionnaire [(max.=84) (x_{MP}=68.091, SD_{MP}=6.818, x_{EP}=67.364, SD_{EP}=6.652, MD=15, CI=[-4.226, 5.681], p<0.001)], and OT USE Questionnaire [(max.=133) (x_{MP}=114, SD_{MP}=6.678, x_{EP}=113.091, SD_{EP}=7.395, MD=10, CI=[-4.273, 6.091], p=0.003)]. The Participant USE questionnaire demonstrated no statistical significance at a 90% CI with an MD of 6; therefore more data is needed to determine whether or not there is a meaningful difference between the MP and EP scores for this questionnaire.

Discussion

Results indicate participants and OTs found high levels of usability and enjoyment in the BrightBrainer™ system (72-85%) from midpoint to endpoint, suggesting perceived benefits did not wane over the treatment span, nor did they decrease after OTs transitioned from working with participants one-on-one to working with two participant simultaneously. Finding that one OT could simultaneously supervise two participants indicates the potential for increased access to care at reduced costs. This program may be an efficient, long-term rehabilitation treatment option.

References/Disclosures

1. Defense and Veteran Brain Injury Center. 2016. DoD Worldwide Numbers for TBI. http://dvbic.dcoe.mil/dod-worldwide-numbers-tbi
2. Turner-Stokes, L., Disler, P., Nair, A., et al. (2005). Multi-disciplinary rehabilitation for acquired brain injury in adults of working age. *Cochrane Database Syst Rev., 20*(3): CD004170.

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