

Autonomous use of the Home Virtual Rehabilitation System (HoVRS): a feasibility and pilot study.

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Abstract— This paper will describe the findings of pilot study designed to establish the ability of persons with strokes to use HoVRS, a system that integrates a Leap Motion controller, a passive arm support and a suite of rehabilitation simulations. For this study, we developed 3 simulations which include activities such as flexing and extending fingers to move a car, fly a plane with wrist movement and control an avatar running in a maze using reaching movements. Two groups of subjects, the enhanced motivation group and the unenhanced group used the system for eight weeks in their homes. Adherence to the Enhanced and Unenhanced protocols exceeded adherence to traditionally presented home exercise programs described in the stroke rehabilitation literature. Subjects demonstrated measurable improvements in upper extremity function in both groups. Intrinsic motivation levels were better for the EM group and maintained for the twelve-week protocol.

Keywords—Stroke, Upper extremity, gaming, tele-rehabilitation

I. INTRODUCTION

Adherence to home exercise regimens is poor across all diagnoses and particularly poor in persons with CVA; Low motivation levels are cited as a key barrier [1]. A game's rules, progression of play and system of rewards all contribute to the enjoyment associated with playing games, and therefore the amount of time spent playing them [2]. This study examines the impact of gaming mechanics on motivation, adherence to training and the effectiveness of our training approach.

II. METHODS

A. Subjects

Inclusion criteria; a) 40-80 years old, b) unilateral stroke, c) normal cognition d) normal proprioception e) Fugl-Meyer (FM) 36-58 f) no receptive aphasia and g) intact sensation. Exclusion criteria: a) upper extremity orthopedic issues b) central nervous system pathology c) neglect d) aphasia.

B. Treatment Protocol

Two groups, used the NJIT-HoVRS system to play three computer games to train arm and finger movement. Subjects practiced in their homes independently with in-person or on-line assistance as needed. Subjects were asked to perform the simulations as much as possible daily for twelve weeks. The enhanced motivation (EM) group trained using simulations that presented eight to twelve levels of gradually increasing complexity with changing graphics, scaled scoring and announced level changes. The unenhanced control (UC) group performed the same three simulations using an adaptive algorithm that increased difficulty based on performance. Graphics and scoring did not change.

III. RESULTS

8 subjects completed a 12 item IMI pre and post intervention. Four EM subjects demonstrated increased scores at post-intervention. Two UC subjects demonstrated stable post-test scores and one improved slightly. EM subjects averaged 95 ± 95 minutes of training per week, range was 40 - 276 minutes. UC subjects averaged 35 ± 31 minutes of training per week, range was 3 - 93 minutes. EM group subjects' UEFMA recovery ranged from 0.2 to 0.8. UC group recovery ranged from 0 to 0.4.

IV. DISCUSSION

This pilot study presents preliminary data that suggests that modest motivational enhancements may have an impact on adherence to a three-month rehabilitation program.

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