Rehabilitation

AS-0550

PLAYING THE GOBLIN POST OFFICE VIRTUAL REHABILITATION GAME AT HOME

Andrew J. Murphy [1,*] Mohammad Al-Amri [2] Malcolm B. Hawken [3] Gabor J. Barton [3]

[1]Biomedical Engineering, University of Strathclyde, Glasgow, [2]School of Healthcare Sciences, Cardiff University, Cardiff, [3]Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom

Introduction and Objectives: Cerebral Palsy (CP) may be considered "the most common physically disabling condition seen and managed by child health professionals" [1]. Children suffering from CP often display diminished control of trunk and pelvis movements, which can reduce their ability to achieve well controlled movement of the lower limbs and ultimately have a negative effect on activities of daily living [2,3]. Previous work has highlighted that it is possible to monitor trunk-pelvis coupling and core movement in children, and to enhance movement patterns via the use of a virtual reality gaming application (Goblin Post Office, GPO) in laboratory based training [2,3]. The primary aims of this study were to establish the feasibility and acceptability of conducting such training in CP children's homes, and to quantify the short term effect of GPO training.

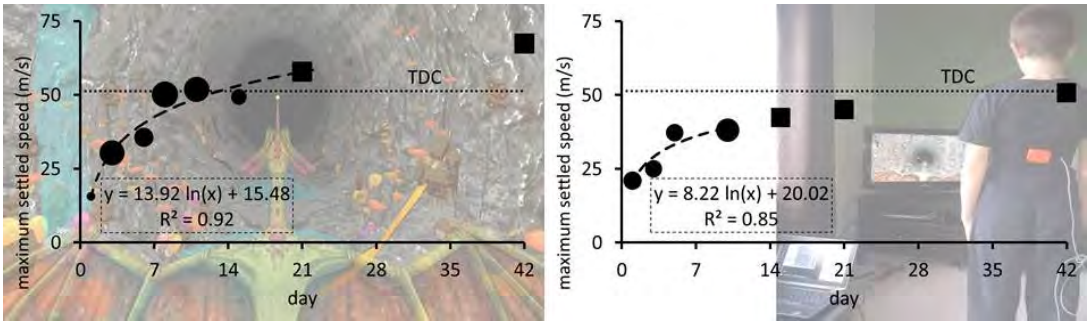
Methods: Ethical approval for this study was granted by the University of Strathclyde Ethics Committee. Two children with Cerebral Palsy (CPC1 and CPC2) volunteered (Table 1). One typically developing child (TDC) also participated by playing a single session of the game in order to provide data against which CPC performance could be compared. All children and their parents provided informed consent.

Figure 1 illustrates the setup used in children's homes. Full detail of the adaptive algorithm that drives GPO may be found by consulting previous work [2,3], however, briefly, the aim of GPO is to use rotations of the trunk and/or pelvis to navigate a virtual dragon through a virtual cave and, using the horn protruding from the dragon's head, to "burst"/hit targets that contain virtual letters (Figure 1). Forward speed of the dragon's flight is continuously moderated based on a bespoke adaptive algorithm and thus over a training session it is possible to extract a "maximum settled speed" (MSS) which is representative of overall game performance.

On training days the investigators visited CPC's home, attached a laptop to the children's television using a VGA cable and attached a single Xsens-MTx-sensor (Xsens Technologies, The Netherlands) to CPC's trunk using a semi elastic Velcro strap; this sensor measured trunk tilt and rotation and thus navigated the flying GPO dragon shown on the television screen. CPC conducted 1-3 training sessions per training day (Table 1).

Results: All testing was conducted safely and easily; from a technical perspective all that was required of participants' homes was a television set with a VGA input. Anecdotal evidence suggested that all children and parents enjoyed the experience and did not find the process disruptive to their normal routine; further, as the days progressed the investigators' notes included comments such as "showing motivation and competition", "better controlled stance", "less sporadic arm movements". Figure 1 shows the results of data analysis.

Figure:



Caption: Maximum settled speed achieved by CPC1 (left) and CPC2 (right). Data is shown for the duration of the training period (circles) and as projected according to a logarithmic fit for up to six weeks of training (squares). Data points are scaled according to the duration in minutes of GPO gameplay that was conducted on each training day. The baseline data for TDC is shown by the horizontal dotted line. Semi-transparent background images show the game interface and home setup used.

Conclusion: It is acknowledged that in order to provide satisfactory evidence of the effect of GPO in the home a larger study must be carried out. However, anecdotal feedback supported the suggestion that GPO training in the home is a feasible and acceptable form of therapy for children with Cerebral Palsy and also that the investigators' subjective assessment of performance, balance and control showed improvement over the training period. Data analysis also suggested improvement in game performance; indeed CPC1 ultimately (marginally) exceeded the baseline performance of TDC. Further work is merited.

Table:

	CPC1	CPC2	TDC
age	8 years	8 years	10 years
gender	male	male	male
diagnosis	spastic hemiplegia	spastic diplegia	na
GMFCS level	GMFCS I	GMFCS II	na
posture during training	standing	high-kneeling	standing
# training sessions (mean±SD duration)	16 (9.2±1.7 min)	9 (9.6±1.1 min)	1 (16.6±na min)
# training days (mean±SD total duration)	6 (23.0±8.1 min)	4 (18.0±3.3 min)	1 (16.6±na min)
duration of training period	15 days	10 days	1 day

Caption: Participant and training data

References: [1] Morris C., Condie D. Recent developments in healthcare for Cerebral Palsy, 2008.

[2] Barton et al., International Conference on Virtual Rehabilitation, 2011.

[3] Barton et al., J NeuroEng Rehab, 10-15, 2013.

Disclosure of Interest: None Declared