Online physiotherapy delivered using video games

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Background: Recovery after stroke is significantly improved with intense and challenging physiotherapy. It is impossible to deliver supervised physiotherapy in rural and remote areas of Australia. Online physiotherapy, comprising a cloud-based management platform and video games, can deliver expert therapy programs, undertaken unsupervised in the home.

Aim: To determine if there is a positive relationship between duration of therapy and outcome for patients with hemiplegia after stroke undertaking online upper-limb physiotherapy unsupervised in their home.

Subjects: Ethical approval and informed written consent were obtained. 80 patients (55 males), mean age 63 years, range 33-84 years were recruited, 41 within 4 weeks of stroke (Acute), mean time from stroke 2.3 weeks, range 0.9-4 weeks; 39 in the Chronic phase, mean time from stroke 1.8 years, range 0.5-9.7 years.

Methods: Patients undertook online physiotherapy unsupervised in their own home over 12 weeks. Physiotherapy was delivered using the video game Circus Challenge, professionally produced specifically for upper limb rehabilitation and controlled by 100 different bimanual movements. The time performing these therapeutic control movements (not simply playing the game) is automatically recorded.

Upper limb function was evaluated using the Fugl Meyer Upper Extremity Assessment (FMUEA) and the Chedoke McMaster Arm and Hand Activity Inventory (CAHAI), assessed at baseline and 12 weeks. A MANOVA was performed for Acute and Chronic patient groups—*Dependent variables*: Change in FMUEA and CAHAI scores; *Fixed factors*: Sex, Hemisphere of stroke; *Covariates*: Therapy Dose—total time performing therapy moves, Baseline scores, Age, Time from stroke.

Results: (mean ± SE) *Baseline Scores*—FMUEA, Acute: 41±3.0, range 12-59; Chronic: 39.9±2.3, range 13-60. CAHAI, Acute: 32.4±2.3, range 11-51; Chronic: 31.5 ±2.2, range 11-58.

Therapy Dose—Acute: 182±35 minutes; Chronic: 337±57 minutes.

Change in Scores—FMUEA, Acute: +13.7±2.5 ($p<<0.001$); Chronic: +5.3±0.8 ($p<0.001$). CAHAI, Acute: +16.6±2.4 ($p<<0.001$); Chronic: +4.3±0.8 ($p<0.001$).

MANOVA revealed a main effect for Therapy Dose: Change in FMUEA; Acute $p<0.001$, Chronic $p<0.05$; Change in CAHAI; Acute $p<0.001$. For acute patients there were also main effects for Age, $p<0.04$ and Time from Stroke $p<0.02$.

Conclusion: Patients aged up to 84 years play therapeutic video games, unsupervised in their own home. Time spent performing therapeutic control actions significantly predicted improvement in upper limb function. This positive dose-response relationship was observed in both acute and the chronic patients, indicating benefit can be gained even several years after stroke.