# Video Game Training – upper extremity



| Author, Year<br>PEDro Score, Country | Sample size | Intervention | Outcome and significance:<br>(+) significant (-) not significant |
|---|---|---|---|
| Chen et al., 2015<br>PEDro score: N/A (quasi-experimental study design)<br>Country: Taiwan | 28 patients with chronic stroke | Nintendo Wii™ upper extremity training (n=9)<br>vs.<br>XaviX®Port upper extremity training (n=11)<br>vs.<br>Conventional upper extremity equipment (n=8)<br>*Treatment details*:<br>30-minutes/session, 3 times/week for 8 weeks.<br>*Nintendo Wii™*: bowling and boxing games.<br>*XaviX®Port*: bowling and ladder climbing games.<br>*Conventional upper extremity equipment*: Curamotion exerciser and climbing board and bar.<br>All groups also received conventional rehabilitation (physical therapy, occupational therapy) for 1 hour/session, 3 times/week for 8 weeks. | **At 8 weeks (post-treatment):**<br>(-) Fugl-Meyer Assessment<br>(-) Box and Block Test<br>(-) Functional Independence Measure<br>(-) Range of motion (UE - proximal, distal)<br>(+) Motivation and enjoyment interviewer-administered questionnaire*<br>* Enjoyment was significantly greater in the Nintendo Wii™ and XaviX®Port groups vs. conventional rehabilitation group. |
| Choi et al., 2014<br>PEDro score: 8<br>Country: Korea | 20 patients with acute/subacute stroke | Nintendo Wii™ upper extremity training (n=10)<br>vs.<br>Occupational therapy (OT) upper extremity training (n=10)<br>*Treatment details*:<br>30 minutes/session, 5 times/week for 4 weeks.<br>*Nintendo Wii™*: Wii Sports and Resort programs consisting of 12 games such as swordplay, table tennis, and canoe games performed with the affected UE.<br>*Occupational therapy:* goal-oriented and repetitive training of the upper extremity (e.g. stretching, range of motion, activities of daily living training, fine motor training, sensory motor recovery).<br>Both groups also received conventional rehabilitation (not occupational therapy), intensity not specified. | **At 4 weeks (post-treatment):**<br>(-) Fugl-Meyer Assessment – Upper extremity score<br>(-) Manual Function Test<br>(-) Box and Block Test<br>(-) Grip strength (dynamometer)<br>(-) Korean version of the Mini-Mental State Examination<br>(-) Visual and Auditory Continuous Performance Tests<br>(-) Korean version of the Modified Barthel Index |

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| da Silva Ribeiro et al., 2015<br>PEDro score: 7<br>Country: Brazil | 30 patients with chronic stroke | Nintendo Wii™ (n=15)<br>vs.<br>Conventional physical therapy (n=15)<br>*Treatment details*:<br>60-minutes/session, 2 times/week for 2 months.<br>*Nintendo Wii™*: tennis, hula-hoop, soccer and boxing games were applied with increasing level of difficulty.<br>*Conventional physical therapy*: upper and lower limb stretching, muscle strengthening exercises, trunk mobilisation, balance, mobility and transfers training. | **At 2 months (post-treatment):**<br>(-) Short-Form 36 (SF-36) – Total<br>(-) SF-36 – Physical functioning*<br>(-) SF-36 – Physical aspects<br>(-) SF-36 – Pain<br>(-) SF-36 – General health status<br>(-) SF-36 – Vitality<br>(-) SF-36 – Social aspects<br>(-) SF-36 – Emotional aspects<br>(-) SF-36 – Mental health<br>(-) Fugl-Meyer Assessment (FMA) – Total<br>(-) FMA – Passive motion and pain<br>(-) FMA – Sensitivity<br>(-) FMA – UE motor function<br>(-) FMA – UE coordination<br>(-) FMA – Lower extremity (LE) motor function<br>(-) FMA – LE coordination<br>(-) FMA – Balance<br>* Results in favor of conventional physical therapy vs. Nintendo Wii™. |
| Givon et al., 2016<br>PEDro score: 7<br>Country: Israel | 47 patients with chronic stroke | Upper extremity video game training (n=23)<br>vs.<br>Conventional exercises (n=24)<br>*Treatment details*:<br>1-hour session, 2 times/week for 3 months.<br>*Video game upper extremity training*: provided in group of 6-8 participants; all games were played in pairs while standing; 3/5 of the following video game consoles were used alternatively each session: Microsoft Xbox Kinect, | **At 3 months (post-treatment):**<br>(-) 10 Meter Walk Test<br>(-) Grip strength (Jamar Dynamometer) affected/unaffected hand<br>(-) Number of steps walked per day (hip accelerometer, Acticial Minimitter Co.)<br>(-) Action Research Arm Test<br>**At 6 months (follow-up):**<br>(-) 10 Meter Walk Test |

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| | | Sony PlayStation 2 Eyetoy, Sony PlayStation 3 MOVE, Nintendo Wii Fit and SeeMe VR system.<br>*Conventional exercises*: provided in groups; consisted of exercises and functional activities adopted from the Fitness and Mobility Exercise Program, the Graded Repetitive Arm Supplementary Program, and task-oriented training for upper and lower extremities. | (-) Grip strength (Jamar Dynamometer) affected/unaffected hand<br>(-) Number of steps walked per day (hip accelerometer, Acticial Minimitter Co.)<br>(-) Action Research Arm Test |
| Kong et al., 2016<br>PEDro score : 5<br>Country: Singapore | 105 patients with acute stroke | Nintendo Wii™ upper extremity training (n=35)<br>vs.<br>Occupational therapy upper extremity training (n= 35)<br>vs.<br>No additional upper extremity training (n=35)<br>*Treatment details*:<br>60-minutes/session, 4 times/week for 3 weeks.<br>*Nintendo Wii™ upper extremity training:* Wii Sports and Wii Sports Resort software games such as boxing, bowling, tennis, golf, baseball, table tennis, basketball, cycling, Frisbee disk, sword play and airplane flight control using the affected UE.<br>*Occupational therapy upper extremity training:* stretching, strengthening, range of motion, and task-oriented therapy.<br>All groups received c*onventional rehabilitation* (physical and occupational therapy) for 1-hour sessions, 5 times/week for 3 weeks. | **At 3 weeks (post-treatment):**<br>(-) Fugl-Meyer Assessment (FMA – UE)<br>(-) Action Research Arm Test (ARAT)<br>(-) Stroke Impact Scale (SIS – UE)<br>(-) Functional Independence Measure (FIM)<br>(-) Upper extremity pain - Visual Analogue Scale (VAS)<br>**At 1 month (follow-up):**<br>(-) FMA – UE<br>(-) ARAT<br>(-) SIS – UE<br>(-) FIM<br>(-) Upper extremity pain (VAS)<br>**At 3 months (follow-up):**<br>(-) FMA – UE<br>(-) ARAT<br>(-) SIS – UE<br>(-) FIM<br>(-) Upper extremity pain (VAS) |

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| McNulty et al., 2015<br>PEDro score: 8<br>Country: Australia | 41 patients with subacute/chronic stroke | Nintendo Wii™ upper extremity training (n=21)<br>vs.<br>Modified-constraint induced movement therapy (mCIMT, n=20)<br>*Treatment details*:<br>60 minutes/session over 10 consecutive weekdays.<br>*Nintendo Wii™ upper extremity training:* Wii Sports games of golf, boxing, baseball, bowling, and tennis performed with the affected hand. Training sessions were augmented by progressively increasing home practice.<br>*mCIMT*: wearing a mitt on the less-affected hand for up to 90% of waking hours; shaping training and use of the affected hand for 15-20 minutes. | **At 10 days (post-treatment):**<br>(-) Wolf-Motor Function Test (WMFT) – timed tasks<br>(-) WMFT – maximal strength<br>(-) WMFT – submaximal strength<br>(-) Motor Activity Log - Quality of Movement (MAL-QOM)<br>(-) Fugl-Meyer Assessment – Upper Extremity subscore (FMA-UE)<br>(-) Box and Block Test (BBT)<br>(-) Grooved Pegboard test<br>(-) Range of Motion (ROM) – shoulder (flexion/extension/abduction)<br>(-) ROM - elbow (flexion)<br>(-) ROM – wrist (flexion/extension)<br>(-) ROM – digit I and II (flexion)<br>(-) Modified Ashworth Scale (MAS)<br>(-) Self-perceived improvement (standardized questionnaire)<br>(-) Satisfaction (10-point Visual Analogue Scale)<br>**At 6 months (follow-up):**<br>(-) WMFT – timed tasks<br>(-) WMFT – maximal strength<br>(-) WMFT – submaximal strength<br>(-) MAL-QOM<br>(-) FMA-UE<br>(-) BBT<br>(-) Grooved Pegboard<br>(-) ROM – shoulder (flexion/extension/abduction) |

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|---|---|---|---|
| | | | (-) ROM – elbow (flexion)<br>(-) ROM – wrist (flexion/extension)<br>(-) ROM – digit I and II (flexion)<br>(-) MAS<br>(-) Continued therapy activities (n)<br>(+) Increased physical activity (n)<br>(-) Decreased physical activity (n)<br>(-) Falls (n)<br>(-) Decreased medication (n)<br>(+) Cross-over uptake (n)*<br>* In favor of mCIMT vs. Nintendo Wii upper extremity training (where more patients from the mCIMT group accepted a post-trial cross-over to the alternate therapy).<br>Note: n = number of participants. |
| Rand et al., 2014<br>PEDro score: 4<br>Country: Israel | 29 patients with chronic stroke | Upper extremity training using video games (n=15)<br>vs.<br>Conventional rehabilitation (n=14)<br>*Treatment details*:<br>1-hour/session, 2 times/week for 3 months.<br>*Upper extremity training using video games:* XBOX Kinect, Sony PlayStation 2 EyeToy, Sony PlayStation 3 MOVE, SeeMe VR system; performed individually and in groups whereby participants switched between partners and consoles every 25 minutes.<br>*Conventional rehabilitation:* UE movements, functional tasks using therapeutic aids, performed in groups and supervised by an occupational therapist. | **At 3 months (post-treatment):**<br>(-) Fugl-Meyer Assessment – Upper Extremity score<br>(-) Non-purposeful movements – active*<br>(-) Non-purposeful movements – passive*<br>(+) Purposeful movements – active<br>(-) Purposeful movements – passive<br>(+) Movement acceleration – affected upper extremity (accelerometer)<br>(+) Intensity – affected upper extremity (accelerometer)<br>(-) Movement acceleration – unaffected upper extremity (accelerometer) |

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|---|---|---|---|
| | | | (-) Intensity – unaffected upper extremity (accelerometer)<br>* Significantly greater in conventional rehabilitation vs. video game training. |
| Saposnik et al., 2010<br>PEDro score: 5<br>Country: Canada | 22 patients with acute/subacute stroke | Nintendo Wii™ upper extremity training (n=11)<br>vs.<br>Recreational therapy (n=11)<br>*Treatment details*:<br>8 sessions, 60 minutes/session, over a 2-week period.<br>*Nintendo Wii™ upper extremity training*: Wii Sports (bowling, tennis) and Cooking Mamma packages.<br>*Recreational therapy*: leisure activities such as playing cards, bingo, Jenga games.<br>Both groups received conventional rehabilitation. | **At 2 weeks (post-treatment):**<br>(-) Wolf-Motor Function Test (WMFT) – abbreviated version<br>(-) Box and Block Test (BBT)<br>(-) Stroke Impact Scale (SIS) – hand function<br>(-) SIS – composite score (strength, hand function, mobility, activities of daily living/instrumental activities of daily living)<br>(-) SIS – perception of recovery<br>(-) Grip strength (dynamometer)<br>**At 1 month (follow-up):**<br>(+) WMFT – abbreviated version<br>(-) BBT<br>(-) SIS – hand function<br>(-) SIS – composite score (strength, hand function, mobility, activities of daily living/instrumental activities of daily living)<br>(-) SIS – perception of recovery<br>(-) Grip Strength (dynamometer) |
| Saposnik et al., 2016<br>PEDro score: 7<br>Country: Canada | 141 patients with acute/subacute stroke | Nintendo Wii™ upper extremity training (n=71)<br>vs.<br>Recreational therapy (n=70)<br>*Treatment details*:<br>60-minutes/session, 5 times/week for 2 weeks. | **At 2 weeks (post-treatment):**<br>(-) Wolf-Motor Function Test (WMFT) – abbreviated version<br>(-) Box and Block Test (BBT)*<br>(-) Stroke Impact Scale (SIS) |

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|---|---|---|---|
| | | *Nintendo Wii™ upper extremity training*: Wii Sports and Game Party 3 activities.<br>*Recreational therapy*: playing cards, bingo, Jenga or ball game. | (-) Functional Independence Measure (FIM)<br>(-) Barthel Index<br>(-) Modified Rankin Scale<br>(-) Grip strength (dynamometer)<br>**At 4 weeks (follow-up):**<br>(-) WMFT – abbreviated version<br>(-) Box and Block Test<br>(-) Stroke Impact Scale<br>(-) Functional Independence Measure<br>(-) Barthel Index<br>(-) Modified Rankin Scale<br>(-) Grip strength (dynamometer)<br>* Results in favor of recreational therapy vs. video game training. |
| Simsek & Cekok, 2016<br>PEDro score: 7<br>Country: Turkey | 44 patients with acute/subacute stroke | Nintendo Wii™ balance and upper extremity training (n=22)<br>vs.<br>Bobath neurodevelopmental treatment (n=22)<br>*Treatment details*:<br>45-60-minutes/session, 3 days/week for 10 weeks.<br>*Nintendo Wii™ upper extremity training*: Wii Sports and Wii Fit packages; games included tennis, punchout, tightrope tension, tilt table and heading.<br>*Bobath neurodevelopmental treatment*: upper extremity activities, trunk/sitting/ standing/walking exercises, balance training, lower extremities training. | **At 10 weeks (post-treatment):**<br>(-) Functional Independence Measure<br>(-) Nottingham Health Profile |

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|---|---|---|---|
| Sin & Lee, 2013<br>PEDro score: 6<br>Country: Korea | 40 patients with chronic stroke | Xbox Kinect upper extremity training + conventional occupational therapy (n=20)<br>vs.<br>Conventional occupational therapy alone (n=20)<br>*Treatment details*:<br>30-minutes/session, 3 times/week for 6 weeks.<br>*Xbox Kinect:* bowling, boxing, rally ball, 20 000 leaks, and space pop, performed with the affected UE.<br>*Conventional occupational therapy*: passive and active range of motion exercises, muscle strengthening, therapeutic stretching of the shoulder, elbow, wrist and fingers, and ADLs training. Provided for 30-minutes/session, 3 times/week for 6 weeks. | **At 6 weeks (post-treatment):**<br>(+) Range of Motion (ROM) – shoulder flexion<br>(+) ROM – shoulder extension<br>(+) ROM – shoulder abduction<br>(+) ROM – elbow flexion<br>(-) ROM – wrist flexion/extension<br>(+) Fugl-Meyer Assessment – Upper Extremity score<br>(+) Box and Block Test |
| Yavuzer et al., 2008<br>PEDro score: 7<br>Country: Turkey | 20 patients with subacute/chronic stroke | Playstation EyeToy upper extremity training (n=10)<br>vs.<br>Sham video game training (n=10)<br>*Treatment details*:<br>30-minutes/session, 5 times/week for 4 weeks.<br>*Playstation EyeToy*: Kung Foo, Goal Attack, MrChef, Dig, Home Run.<br>*Sham video game training* involved watching the games, but not participating physically.<br>Both groups received *conventional rehabilitation* that comprised physical, occupational and speech therapy for 2-5-hours/session, 5 times/week for 4 weeks. | **At 4 weeks (post-treatment):**<br>(+) Brunnstrom Stages – hand*<br>(+) Brunnstrom Stages – upper extremity*<br>(+) Functional Independence Measure (FIM) – self-care items*<br>**At 3 months (follow-up):**<br>(-) Brunnstrom Stages – hand<br>(-) Brunnstrom Stages – upper extremity<br>(+) FIM– self-care items*<br>***** Reflect change scores from baseline to post-treatment; and from post-treatment to follow-up. |