

ISPR8-0431

Is spasticity or spastic cocontraction of the elbow flexors associated with the limitation of voluntary elbow extension in adults with acquired hemiparesis?

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Introduction/Background Muscle overactivity, including spasticity and spastic cocontraction, is an involuntary motor unit recruitment participating in the spastic paresis syndrome after cerebral injury. Spasticity is defined as velocity-dependent increase in tonic stretch reflexes. Spastic cocontraction refers to increased antagonist muscles recruitment triggered by the volitional command of agonist muscles. This study aimed to clarify the association between spasticity and spastic cocontraction of elbow flexors and to study their contribution to the limitation of active elbow extension in hemiparetic adults.

Material and method Ten adults with acquired hemiparesis and ten healthy participants were included. Surface EMG recorded from elbow muscles during elbow isometric extension contractions was used to compute the index of cocontraction (ICC) for each participant, while spasticity, limitation of active elbow extension, and upper extremity Fugl-Meyer Assessment (FMA-UE) score were obtained in hemiparetic participants. Non-parametric Spearman correlations were performed to investigate the relationship between ICC and (i) limitation of active elbow extension, (ii) elbow flexors spasticity and (iii) FMA-UE.

Results Our results showed significant ICC in three hemiparetic participants compared with healthy participants, and significant associations between cocontraction and (i) active elbow extension limitation ($r_s = 0.81$, $P < 0.001$) and (iii) Fugl-Meyer Assessment score ($r_s = -0.53$, $P = 0.017$) in hemiparetic participants. No significant correlation was found between spasticity and active elbow extension limitation.

Conclusion Our results are the first to show that spastic cocontraction directly contributes to elbow extension deficit in adults with acquired hemiparesis, and further confirm that spasticity and spastic cocontraction have different functional repercussions with regards to impaired motor function. Our findings support the conclusion that spastic cocontraction, rather than spasticity, has significant functional repercussions on impaired active motor function in hemiparetic adults. Therapeutic innovations should be directed toward reduction of spastic cocontraction to improve motor function in acquired hemiparesis.

Keywords Upper limb; Muscle hypertonia; Hemiplegia

Disclosure of interest The authors have not supplied their declaration of competing interest.

<https://doi.org/10.1016/j.rehab.2018.05.1020>

ISPR8-1600

Validation of joint angle measurements: Comparison of a novel low cost marker-less system with an industry standard three-dimensional marker-based system



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Introduction/Background Human motion tracking is widely used for assessment of movement dysfunction in orthopaedic patients. Currently, most clinical motion analysis centres use marker based three-dimensional systems as they are deemed to be the most accurate method. However, due to space, costs and logistics they are not available in many clinical settings. This study compared joint angles measured in functional tests using the novel low-cost Microsoft Kinect Perfect-Phorm marker-less system with the established marker based Nexus VICON system.

Material and method Ten unimpaired volunteers were fitted with 16 retroreflective markers in the positions specified by the Plug-in-Gait (PiG) lower limb marker set. Participants were asked to make three movements: standing, a squat action and a hip abduction action. The two measurement systems were used simultaneously to measure changes in joint angle. The collection of data from each participant was synchronised manually between each system. Average values for left and right knee flexion (for the squat task) and left hip abduction (for the hip abduction task) were obtained from each system as the average across the steady state, and the relative change between the standing and task sections used as the basis of comparisons of system performance.

Results When measuring right and left knee flexion, the average difference between the VICON and Perfect-Phorm measurement was 13.2%, with a SD of 19.6. Both overestimation and underestimation of the joint angle was recorded in different participants. Although the average percentage difference during hip abduction tests was lower at -3.9%, the range of error was far greater (SD = 75).

Conclusion From this, it can be concluded that the level of accuracy presented in the new low cost Perfect-Phorm marker-less system is not yet suitable for clinical assessments. However, for general tests of performance, and for tracking cases where absolute accuracy is less critical, future versions of this software may have a place.

Keywords Motion capture; Movement analysis; System performance

Disclosure of interest The authors have not supplied their declaration of competing interest.

<https://doi.org/10.1016/j.rehab.2018.05.1021>

ISPR8-2338

Knee function deficiencies evolves as osteoarthritic radiographic severity increases

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Introduction/Background Previous studies shown that mechanical factors can be valuable biomarkers to help as a diagnostic aid, risk indicator of osteoarthritis (OA) progression and to be useful in guiding and monitoring treatments. Since the relationship between radiographic Kellgren-Lawrence (KL) grades and knee biomechanics and is not well understood, the study aims at assessing how knee kinematics differ with increasing KL grade.

Material and method This cross-sectional study was carried out in Quebec, Canada primary care clinics. Knee OA patients with KL grade ≥ 2 and with pain $\geq 4/10$ were recruited. Sociodemographic

