



Feasibility of assessing alterations in paretic upper-limb movements after stroke in routine care: proposal and validation of a protocol using IMUs versus MoCap.

Intérêt des IMU en soins courants pour évaluer les altérations des mouvements du membre supérieur parétique après un AVC : validation versus MoCap.

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Introduction: Accurate assessment of upper-limb movement alterations is a key component of post-stroke follow-up. Motion capture (MoCap) is the gold standard for movement analysis even in clinical conditions, but it requires a laboratory setting with a relatively complex implementation. Alternatively, inertial measurement units (IMUs) are the subject of growing interest, but their accuracy remains to be challenged. This preliminary study aimed to investigate the capability of IMUs to assess upper-limb movement alterations after stroke in clinical practice, with intent to provide recommendations for IMUs calibration and data processing.

Methods: Five IMUs were placed on forearms, arms, and trunk of eight post-stroke hemiparetic subjects who performed fifteen repetitions of reach and/or grasp movements with the trunk either free or blocked. Duration, quality of movement (index of curvature, smoothness with number of submovements) and trunk contribution (%; from length) obtained from MoCap were compared with those from IMUs appropriately processed with implementation of short calibration steps.

Results: The relative measurement error between measures from MoCap and uncalibrated and unprocessed IMUs was very high (53% to 247%). Conversely, the relative (absolute) measurement error between MoCap and IMUs processed with the proposed method were lower than MoCap published minimal detectable change data: 4.73% (0.08s) for duration, 1.02% (0.01) for index of curvature, 14.92% (0.47) for smoothness and 2.79% for trunk length contribution.

Discussion: Our results provide strong evidence that using IMUs with the proposed short calibration and processing steps can successfully and accurately assess upper-limb movement alterations after stroke in clinical routine care conditions.