Evaluation of the relationships between spasticity, motor deficit, kinematics and function, during a reaching movement in hemiparetic patients

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Objectives.— This study aims at evaluating the relationships between motor deficit, spasticity and kinematics of the upper limb in hemiparetic patients during reaching movements. The principal aim is to determine whether the velocity of reaching movements involving elbow extension is mainly determined by spasticity or the motor deficit. The secondary aim is to quantify the relationship between elbow flexor and extensor torque and elbow angular position relative to angular velocity. The long-term aim is to evaluate which of these variables are the most predictive of functional capacity.

Methods.— Twelve patients with spastic hemiparesis, troublesome elbow flexor spasticity and active range of elbow extension of at least 30° will be included. Patients with bilateral brain damage, severe apraxia and/or aphasia, cerebellar syndrome, or another cause of stiff elbow will be excluded. Evaluations consist of a physical examination including use of scales (Fugl-Meyer, Action Research Arm Test, Motor Activity Log). Activation and control of the elbow flexors and extensors will be evaluated using an isokinetic dynamometer that records torque produced during passive stretching and concentric isokinetic torque at different velocities as well as isometric torque. The kinematics of reaching movements will be evaluated using three-dimensional motion analysis. Spontaneous and maximal reaching velocity to two targets (65° and 90° of the upper limb length, in line with the shoulder) will be assessed. Surface electromyography will be recorded for each of the instrumented evaluations.

Results.— The relationship between elbow extension angular velocity in the reaching task, and stretch reflex threshold and flexor/extensor torque during passive and active isokinetic movements will be analysed using correlations.

The relationship between flexor and extensor torque produced during concentric isokinetic movements, angular position and elbow extension angular velocity will also be analyzed.

Discussion et conclusion.— This identification technique with ultrasound system is simple and allows us to consider highly selective and safe injections of finger flexor muscles. Patients with moderate spasticity, this technique allows a precise anatomical location of the flexor superficialis and profundus muscles. However, for patients with high spasticity this technique requires an assistant’s help.