The purpose of this study was to examine whether there is a relationship between the degree of muscle weakness, co-contraction and activation failure of the knee flexors and extensors and functional performance.

Maximal voluntary isometric torques of knee extensors (MVTe) and flexors (MVTf) (60° knee and 100° hip angle) were obtained in 14 stroke patients (bilaterally) and 12 healthy control subjects. Simultaneous measurements were made of agonist torque and surface EMG from agonist and antagonist muscles. Supra maximal triplets (3 pulses at 300Hz) were evoked with electrical stimulation on resting muscle to assess the maximal triplet response and superimposed on MVTe to estimate the degree of voluntary activation and maximal torque generating capacity (MTC) of the knee extensors. Patients performed 7 tests of functional performance: Rivermead Mobility Index, Timed get-up-and-go test, 10meter walk test, Berg Balance Scale, Motricity Index, Functional Ambulation Categories-score and Brunnstrom Fugl-Meyer.

Both MVTe and MVTf were lower in the contralateral (paretic) leg (CL) (61 ± 47.9Nm and 10 ± 16.1Nm, respectively), compared to the ipsilateral leg (IL) (152 ± 54.8Nm and 56.1 ± 26.8Nm) and in controls (223 ± 47.8Nm and 90 ± 29.0Nm). Besides, MVTe and MVTf of IL were also lower than controls. The effect of stroke on muscle torque appeared to be more pronounced for knee flexors than extensors. Furthermore, MTC was lower in CL (129 ± 45.0 Nm) than in controls (225 ± 40.1Nm) and triplet torque was lower in CL (56 ± 26.28Nm) compared to both IL (94 ± 25.6Nm) and controls (99 ± 12.6Nm). Maximal voluntary activation was reduced in both CL (58 ± 24.6%) and IL (75 ± 7.3%) compared to controls (94 ± 4.1%) and it was lower in CL than in IL. EMG of all extensors was lower in CL compared to IL and controls during extension. During flexion EMG of CL was lower than controls for all muscles and was lower than IL for all muscles except the vastus lateralis. High significant correlations (absolute r ranging between 0.570 and 0.858) were present between both MVTf and MVTe of CL with all tests of functional performance. The results of this study suggest that impaired voluntary activation may, at least partly, underlie the weakness of the contralateral as well as the ipsilateral leg in stroke patients, whereas differences in co-contraction seem less important.

Furthermore, the reduced MTC (47% of controls) as well as the lower triplet torque (57% of controls) of the contralateral limb both indicate that independent of the patient’s effort, intrinsic muscle strength of the contralateral (but not of the ipsilateral) knee extensors is reduced after stroke. From these results, it is recommended to investigate the role of isometric strength training of knee flexors and extensors of both legs during rehabilitation from a stroke, since this training might improve the strength of CL, which parameter correlated very well with overall functional performance.

Keywords: Paresis, Strength, Rehabilitation