Different muscle activation patterns, identified during walking, in people with spastic drop-foot

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Introduction
Upper Motor Neurone lesions result in a complex disorder of muscle activation including weakness and spasticity. Inability to effectively dorsiflex the ankle during the swing phase of walking is often a problem for people with spastic hemiplegia.

Subjects
Nine normal and fifteen hemiplegic subjects who had suffered a stroke at least six months prior to the study and had a drop-foot.

Method
Subjects were studied walking on a treadmill. EMG signals from the calf and anterior tibial muscles were recorded and force sensitive foot-switches enabled these to be related to phases of the gait cycle. Ankle movement was recorded using a Penny and Giles electrogoniometer. Normal activation periods for each muscle group were identified as percentiles of the gait cycle. Indices for muscle activation periods were then derived using ratios of integrated EMG during selected periods.

Results
The Index defining tibialis anterior activation during swing phase showed no significant difference between normal and hemiplegic subjects, but the EMG profile revealed loss of normal activity at initial floor contact. Two types of premature calf activation were identified and a significant correlation between this and response to passive stretch (correlation coefficient 0.582, p<0.05) No hemiplegic subjects demonstrated normal calf activity during push-off. There was a significant difference between normal and hemiplegic subjects (p<0.001).

Conclusion
The reasons for drop-foot are varied and complex. Indices defining different muscle activation patterns during walking may be useful for directing therapy such as botulinum toxin, muscle strengthening exercise or functional electrical stimulation.