Age related changes in corticospinal excitability and motor function

A.T. Weier, R.M. Daly and D.J. Kidgell, School of Exercise and Nutrition Sciences, Deakin University, Burwood, VIC 3125, Australia. (Introduced by S.A. Warmington)

Introduction: Ageing is associated with deteriorating performance in functional tasks, and this is likely due to age-related changes within the central nervous system. The aim of this study was to firstly determine age related differences in measures of neurological function, and then to examine the relationships between neurological function and performance in a visuomotor tracking task.

Method: Single- and paired-pulse transcranial magnetic stimulation was used to assess corticospinal excitability and short-interval intracortical inhibition in 12 "old" (70 ± 5.46 years) and 11 "young" (25 ± 5.64 years) participants. They also performed a plantarflexion/dorsiflexion visuomotor tracking task with tracking error recorded after the first five seconds, and at the end of a 30 second bout. Resting (RMT) and active (AMT) motor thresholds were determined, and active recruitment curves (RCs) were constructed to determine values for the slope of the curve, V50 and peak height. SICI was assessed using a sub-threshold (0.8×AMT) conditioning stimulus, followed 3 ms later by a supra-threshold test stimulus (at an intensity required to achieve 20% maximum M-wave; MMAX). All motor evoked responses except RMT were taken during low level contraction (10% of maximal root-mean-square EMG) and normalized to the maximal M-wave.

Results: Older adults required a significantly higher stimulation intensity to achieve both RMT and AMT, and a significantly higher test-stimulus intensity to achieve 20% MMAX ($P < 0.001$). Corticospinal excitability was significantly higher in young adults compared to older adults at 1.8×AMT, 2×AMT and peak height of the RC ($P < 0.05$), however there was no age related difference in SICI ($P > 0.05$). Young adults also had significantly less error in the visuomotor tracking tasks ($P < 0.05$), and tracking performance was significantly correlated to measures of corticospinal excitability (stimulus intensity for RMT and AMT, and peak height of the RC; $P < 0.05$).

Discussion: These findings provide evidence of age-related changes in neurological function, particularly of a reduction in corticospinal excitability with advancing age. Given that there were no differences in SICI between groups, these findings suggest that the ability to activate corticospinal cells with TMS is reduced in older adults and this reduced excitability resulted in reduced motor function. Further studies are required to determine the training related effects of targeted exercise on neurological function and motor outcomes in older adults.