The profound modifications in the properties of bone, muscle, and tendon dramatically affect motor output as humans age. There is also increasing evidence to suggest that age-related changes occur in the central nervous system, underlying in part the observed changes in the control of motor units and whole muscles. Imaging and EEG studies reveal a general reduction in motor cortical inhibitory processes in old adults [1, 2], resulting in an increased demand for neural resources during the execution of even the simplest motor tasks compared with young individuals. The purpose of this presentation is to review how such an age-related increase in demand for cortical resources may shape the mechanisms of motor control with a special emphasis on the balance between agonist and antagonist muscles. One manifestation of the altered movement control with age is that old compared with young individuals execute voluntary movements with enhanced agonist and antagonist muscle coactivity [3]. Old adults seem to execute single joint movements such as simple finger, elbow, knee, and ankle movements as well complex tasks, including gait and downward stepping with increased agonist and antagonist co-activation. Magnetic brain stimulation studies suggest that one specific mechanism involved in the age-related changes in antagonist muscle function is the decrease in cortical reciprocal inhibition. When a peripheral conditioning nerve stimulus to the median nerve at the wrist is paired with an appropriately timed magnetic stimulus to the motor cortical area of the antagonist wrist extensors, old adults show an absence or reduced amount of cortical reciprocal inhibition compared with young adults [4]. During a wrist flexion task, the magnitude and timing of the cortical responses to magnetic stimulus targeting the antagonist wrist extensors also change with age. Complementing the magnetic stimulation data in simple motor tasks, coherence analysis of EMG activity from pairs of agonist and antagonist leg muscles during gait also suggests age-related changes in cortical and perhaps spinal control of locomotion. There are indications that advancing age may differently alter the coherence, the correlation in frequency between EMG signals from agonist and antagonist muscles in the alpha band of 10-20 Hz, indicating mostly spinal control, and in the beta band of 20-40 Hz, indicating primarily cortical control. We plan to link such altered control between agonist and antagonist muscles to the age-associated reorganization of joint torques in gait [5].


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