Effects of age on intermuscular coherence in a cyclical upper-extremity motor task

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Synchronous activity between electromyography (EMG) signals at high frequencies (>7 Hz), i.e., intermuscular coherence, is thought to reveal shared neural input to muscles. As such it may be able to quantify 'synergies of neural origin'. As an essential step towards clinical utility of intermuscular coherence in neurorehabilitation, we extended Laine et al. (J Physiol, 2021) and contrasted alpha-band neural drive strength between four neurotypical young adults (23–29 years) and four neurotypical older adults (51–58 years—within the age range in the population of stroke survivors). Using their right arm, participants rotated an ergometer while surface EMG was measured from seven muscles including the upper trapezius, triceps (lateral head), biceps (short and long heads), and deltoid (anterior, middle, posterior). EMG data were high-pass filtered using a fourth-order Butterworth filter with a cutoff frequency of 250 Hz and then the signals were rectified. Magnitude squared coherence was estimated across all muscle pairs (21 comparisons), and a mean coherence per participant was estimated as the mean of the maximum coherence in the alpha-band (8-16 Hz) per muscle pair. A corresponding grand mean was estimated for each group (young adults vs. older adults). These preliminary data show that the average coherence per participant for young adults vs. older adults was 0.0262 ($\pm$ 0.0068) vs. 0.0363 ($\pm$ 0.0195), which were not statistically different ($p = 0.14$). Each group mean was significantly above the coherence threshold of 0.006. This preliminary study of the previously unexplored age-dependent nature of coherence during cyclical reaching movements suggests that aging does not affect mean coherence across all muscles and phases of the cycle. These preliminary results encourage further study of this lack of age-dependent coherence up to 58 years of age, and beyond. If this result is further validated, it would provide a rigorous biomarker baseline against which to compare motor impairment in adults after neurological injuries, such as stroke.

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