A critical period of corticomuscular and EMG-EMG coherence detection in healthy infants aged 9-25 weeks - DTU Orbit (13/12/2018)

A critical period of corticomuscular and EMG-EMG coherence detection in healthy infants aged 9-25 weeks:
Corticomuscular and EMG-EMG coherence during early development

The early postnatal development of functional corticospinal connections in human infants is not fully clarified. We used EEG and EMG to investigate the development of corticomuscular and intramuscular coherence as indicators of functional corticospinal connectivity in healthy infants aged 1-66 weeks. EEG was recorded over leg and hand area of motor cortex. EMG recordings were made from right ankle dorsiflexor and right wrist extensor muscles. Quantification of the amount of corticomuscular coherence in the 20-40 Hz frequency band showed a significantly larger coherence for infants aged 9-25 weeks compared to younger and older infants. Coherence between paired EMG recordings from tibialis anterior muscle in the 20-40 Hz frequency band was also significantly larger for the 9-25 week age group. A low-amplitude, broad-duration (40-50 ms) central peak of EMG-EMG synchronization was observed for infants younger than 9 weeks, whereas a short-lasting (10-20 ms) central peak was observed for EMG-EMG synchronization in older infants. This peak was largest for infants aged 9-25 weeks. These data suggest that the corticospinal drive to lower and upper limb muscles shows significant developmental changes with an increase in functional coupling in infants aged 9-25 weeks, a period which coincides partly with the developmental period of normal fidgety movements. We propose that these neurophysiological findings may reflect the existence of a sensitive period where the functional connections between corticospinal tract fibres and spinal motoneurones undergo activity-dependent reorganization. This may be relevant for the timing of early therapy interventions in infants with pre-and perinatal brain injury.

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