SATURDAY ORAL SESSION II

MOVEMENT LEARNING AND PSYCHOPHYSIOLOGICAL DEVELOPMENT

111 ML K
Predictability, variability and individual styles in throwing

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Purpose: Sensorimotor control is often investigated in laboratory settings using controlled experimental paradigms and simple tasks involving a few degrees-of-freedom. Whether the control strategies uncovered in simple tasks are also valid to solve complex sensorimotor problems such as those encountered in many sports is an open question. Prediction and coordination of many degrees-of-freedom in naturalistic and unconstrained conditions may allow for potentially multiple solutions and different individual strategies. We aimed at characterizing how the predictability and the variability of throwing actions are related to individual styles.
Methods: We recorded whole-body kinematics from twenty non-expert participants performing unconstrained overarm throws at four different targets placed on a vertical plane. To characterize individual throwing styles and the spatiotemporal structure of the information embedded in the kinematics of the throwing action about the outgoing ball direction, we introduced a novel dimensionality reduction technique. To assess how variability in throwing affects performance we developed a novel method to identify different components of performance considering the individual distributions of ball release parameters.
Results: Throwing actions differed considerably across individuals and could be classified in a limited number of styles using a low-dimensional representation of whole-body kinematics. For most participants it was possible to predict the region where the ball hit the target plane, with an accuracy above 80%, as early as 400–500 ms before ball release. The spatiotemporal structure of throw predictability differed across individuals and the body parts that provided the most informative cues about the action outcome varied with the throwing style and during the time course of the throwing action. Throwing performance also differed considerably across individuals and could be related to individual choices of mean ball release parameters, noise, and alignment of the release parameter covariance with the local curvature of the performance function.
Conclusions: Novel analytical methods to compactly represent and classify whole-body actions and to assess the impact on performance of action variability allow to characterize predictability, variability, and individual styles in throwing.
Reference
Maselli et al (2017) Where are you throwing the ball? I better watch your body, not just your arm! Front Hum Neurosci 11:505

112 ML O
Motor unit conduction velocity at different joint angles

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Purpose: The aim of this study was to evaluate the dependence of motor unit conduction velocity (MUCV) on the length of the muscle.
Methods: Muscle length was modified considering three different ankle angles: 90°,110° and 130°. For each angle the maximal voluntary contraction (MVC) was measured during static ankle dorsiflexion. High-density surface electromyography (HD-sEMG, 128 channels) was recorded from the tibialis anterior muscle (TA) in six young individuals. Subjects executed a volitional effort in which the output tension changed in a trapezoidal ramp fashion (15 s transient and 40 s steady contraction). Two levels of steady contraction were investigated: 10% and 20% of MVC. Using a novel decomposition technique based on HD-sEMG processing (Negro et al. 2016), the individual MUCV values were estimated during the trapezoid steady part. The decomposition was performed at each ankle angle independently, and the MU action potentials were not tracked across different muscle lengths.
Results: MVC mean values at 90° and 130° were 91.78% and 78.77% of 110° value respectively. Considering that there was no statistical difference between the MUCV estimations calculated at 10 and 20% MVC, the values were grouped. The average CV was 4.00 ± 0.54 m/s for 90°, 3.88 ± 0.19 m/s for 110° and 3.77 ± 0.37 m/s for 130°. One-Way Anova analysis showed a weak effect between the three conditions ($P = 0.04$).
Conclusion: MUCV changes were weakly related to the different muscle lengths. Explanation of our results should consider that the muscle fiber can be approximated as a constant volume system and that, from the cable theory, the smaller the diameter the lower the CV is. On these bases, the reduction of muscle fibers transverse diameter during muscle elongation when the ankle angle increases from 90° to 130° could be a possible explanation for our results.
Reference
Negro F et al (2016) J Neural Eng 13(2):026027

113 ML O
The comprehension of grapho-motor skills, related to motor behavior, age and gender in school children

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Purpose: This study was aimed to evaluate the grapho-motor skills in school children with a technological device, and to correlate them with motor control, functional performance and motor behavior, taking into account the gender variable, the anthropometric characteristics and the sport participation.
Methods: We used a tablet pc to assess the figure-tracing skills (number of strokes, pressure of pen, average speed and oscillations of lines drawn with respect to the reference line), among 80 school-children of 2nd (25 females and 23 boys) and 4th grade (15 females and 17 males). We also assessed the motor coordination (with KTK