ELECTROMYOGRAPHIC AND KINESIOLOGICAL ANALYSIS OF THE KAYAK STROKE: COMPARISON OF ON-WATER AND ON-ERGOMETER DATA ACROSS EXERCISE INTENSITY.

Fleming Neil, Donne Bernard, Mahony Nick
(Trinity College Dublin, Ireland)

Kinesiological electromyography (EMG), the study of muscle recruitment patterns associated with movement, is a useful tool for biomechanical analysis (Clarys & Cabri, 1993) and EMG patterns of unique movements can be used to compare biomechanical differences within sports (Nowicky et al., 2005). The aims of this study were to assess the accuracy of a kayak ergometer's simulation of the kayak stroke by comparing EMG patterns on-ergometer and on-water, and analyse the effect of increasing exercise intensity on these EMG patterns.

Elite male flatwater kayakers (n=14) performed matched exercise protocols on a kayak ergometer (Dansprint Ltd.) and on-water. EMG data were recorded from the anterior deltoid, triceps brachii, latissimus dorsi and quadriceps femoris. The exercise protocol on-ergometer and on-water consisted of 3 min bouts at heart and stroke rates equivalent to 75, 85 and 95% of VO2max (calculated from incremental kayak ergometer tests). During each exercise bout, EMG data were recorded via telemetry (ME6000, Mega Ltd.) and movement patterns videoed at 50Hz. Synchronisation of recordings via an audio trigger (MEGA Ltd.) facilitated analysis within each stroke cycle. Raw EMG data were integrated (resolution 20ms) for 10 consecutive cycles, and latency, duration, peak activity and timing of peak activity analysed, using a repeated measures ANOVA, post-hoc Fischer LSD quantified significant differences.

Analysis revealed a unique EMG pattern consisting of biphasic triceps and anterior deltoid, and monophasic quadriceps and latissimus dorsi activity within each stroke cycle. Significant differences in iEMG were observed comparing the two conditions. Peak deltoid phase 2 activity was significantly greater (19.6±2.6 vs. 7.6±1.1uVs; P<0.01), time of peak quadriceps activity was significantly earlier (125±12 vs. 193±15ms; P<0.01), duration of phase 1 triceps activity was significantly shorter (414±17 vs. 480±20ms; P<0.01) and overall duration of triceps activity as a percentage of stroke cycle was significantly greater (59±4 vs. 68±5%; P<0.05) comparing on-ergometer and on-water data. Increasing exercise intensity (75, 85 and 95% VO2max) had significant effects on peak activity in phase 1 triceps (14±0.9, 17.3±1.0 and 17.6±1.2 uVs; P<0.01), phase 2 triceps (11.0±0.9, 13.0±1.2 and 14.5±1.2 uVs; P<0.01) and quadriceps (3.4±0.2, 3.9±0.2 and 4.6±0.3 uVs; P<0.01), but no significant effect on peak activity in anterior deltoid or latissimus dorsi.

In conclusion, significant differences in EMG patterns were observed comparing kayak stroke iEMG data on-ergometer and on-water. The most notable, increased phase 2 peak deltoid activity was most likely resultant from the downward pulley force associated with the ergometer's loading mechanism. The varied effect of exercise intensity on peak activity may be due to each muscles unique role within the kayak stroke cycle.


Keywords: Electromyography, Kayaking, Biomechanics

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