EMG MUSCLE ACTIVITY IN DYNAMIC ROWING EXERCISES – A COMPARATIVE STUDY OVER TWO PREDEFINED SHOULDER ABDUCTION JOINT ANGLES

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Introduction – The use of EMG has been widely extended to several fields of scientific research, suggesting that it may be correctly used as active muscle control biofeedback, thus enabling to further understand intermuscular activation patterns and interactions. However, in contrast with isometric muscle contraction assessment, EMG signal interpretation may prove harder when focussing on dynamic muscle contractions. Since much of the basic human activity is dynamic by nature and so rarely are isometric actions present in this context, this general fact seems to prevail over the previous difficulties inherent to this type of procedure, enhancing structural comparative muscle mechanics. A wide array of influence factors gather up in complex upper limb biomechanics regarding muscle force production. These are commonly stated as force arm momentum, muscle fibre pennation angle and segmental joint angle. Unfortunately rowing biomechanics lacks in performance variables that allow for a complete optimization model reconstruction which may guide us in extensive fields of research in sport. Our main goal was to assess EMG muscle activity in dynamic rowing exercises, over two different pre-defined elbow joint angles, in order to fully understand its specific muscle EMG activation pattern and correspondent selective electrical magnitude.

Methods – For this purpose we selected a sample of 6 male subjects. EMG signals of Brachialis Anterior, Biceps Brachii, Latissimus Dorsi, Trapezium (upper, middle and lower portions) and Deltoid (posterior portion) muscles were targeted for EMG preamplified recording, using surface bipolar EMG electrodes. The Average full wave rectified signal of each muscle as well as its integral, both isolated and over time, were selected as muscle activation magnitude defining terms. Subjects performed three times 1 maximal row test, in each of the selected shoulder abduction joint angles (0° and 90°). The two highest EMG bandpass filtered (10-600HZ) scores were selected and averaged as set variables. Throughout data analysis we focussed on the concentric muscle contraction phase. Elbow joint was kept at 90° flexion and wrist joint remained in neutral position (shoulder joint reference 0°), thus enhancing functional stability and comfort in the hand-forearm relationship. Descriptive mean and standard deviation statistics in association with mean difference independent samples t-test were used for activation amplitude comparative statistical analysis.

Results – Main results demonstrated a clear evidence of specific neuromuscular activation patterns over different shoulder girdle joint angles. Hence 0° shoulder abduction over emphasized normalized latissimus dorsi and biceps brachii muscles EMG activation, and in contrast 90° shoulder abduction results clearly presented selected trapezium and posterior deltoid emphasis.

Discussion and Conclusion – Our results indicated statistically significant differences in muscle activation EMG amplitude between 0° and 90° shoulder abduction angles. Witch clearly states the need to rigorously assess shoulder joint angle in rowing exercises, in order to fully optimize divergent exercising biomechanics, thus probably enhancing rowing effectiveness.

Keywords: Performance Diagnosis, Electromyography, Biomechanics

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