

## MUSCLE ACTIVATION AND THREE-DIMENSIONAL KINEMATICS OF UPPER EXTREMITY IN SNATCH WEIGHT LIFTING

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**KEY WORDS:** snatch, electromyography, kinematics.

**INTRODUCTION:** Previously, there was little weightlifting research focused on biomechanics of the elbow and the shoulder joints (Bartonietz, 1996). Therefore, the purposes of this study were to evaluate the kinematics of upper extremity on sagittal plane during 1st pull, transition from the 1st to the 2nd pull, 2nd pull, turnover under the barbell, catch phase, and rising from the squat position phases of snatch weight lifting and to examine upper-limb muscles activity during snatch weight lifting. The EMG signals were analyzed using the normalized linear envelopes.

**METHOD:** Four weightlifters (2 female and 2 male), 15 to 20 years old, were recruited in this study. Electromyographic (EMG) waveforms of major upper limb muscles were collected by using Noraxon EMG telemetric unit with a sampling frequency of 1500 Hz. Qualisys Motion Capture System was used to gather subjects' kinematic data with a sampling frequency of 100 Hz. Subject's kinematic data were recorded simultaneously with EMG data in order to examine the relationship between body movement and the EMG activity. Snatch weight lifting was measured with a weight of 50 kilograms.

**RESULTS:** From the beginning of 1st pull to the end of transition phase, there was a significant decrease in the shoulder flexion angle. After that there was a significant increase in the shoulder flexion angle from the beginning of the 2nd pull to the end of the turnover phase. After the beginning of catch phase, athlete kept the shoulder joint nearly fully extended. In the elbow joint, joint angular curve decreased to 100 degree flexion from the beginning of 2nd pull and it increased again before the end of turnover. After the catch phase, athlete kept the elbow joint at nearly fully extension. Besides, at the end of snatch, the elbow slightly moved toward hyperextension. In addition, the sequence of muscle recruitment was as follows: latissimus dorsi, pectoralis major and bicep brachii, deltoid, and triceps brachii.

**DISCUSSION:** Before the half way point of the shoulder full flexion, the contracting muscle is the bicep brachii and pectoralis major. After the half way point of the shoulder full flexion, the contracting muscle is the deltoid. After the turnover phase, the triceps contract to keep the arm straightened.

**CONCLUSION:** EMG findings combined with the kinematic measurements could be used to provide insight into possible motor coordination during snatch weight lifting.

### REFERENCES:

Bartonietz, K. E. (1996) Biomechanics of the snatch: toward a higher training efficiency. *Strength and Conditioning*, 18, 24-31.

### Acknowledgement

We would like to thank weightlifting coach, Kao Ming-Feng, for providing technical support and professional knowledge of weight lifting.