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Biomechanics

BIOMECHANICAL ANALYSIS OF SNATCH MOVEMENT AND VERTICAL JUMP: SIMILARITIES AND DIFFERENCES*

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Abstract

The aim of this study was the investigation of the relationship of kinematic and kinetic characteristics of movement snatch with the vertical jump. Eight elite weight lifters performed snatch and vertical jump (CMJ) movements. Kinematic, electromyographic (EMG) and ground reaction force data were simultaneously collected. The results showed non-statistical differences ($p > 0.05$) in all kinematic variables between the two movements. Any differences that were observed in certain phases were not statistically significant and did not after the observation that there was a resemblance of the two movements in angle and angular velocity values. A high relationship was observed between the two movements in the vertical GRFs and the EMG activity of rectus femoris. The present study showed that the second pull of the snatch movement could resemble a vertical jump with extra load, and may be beneficial in improving power.

Key words: Strength training, Olympic weight lifting, biomechanical assessment, electromyography, vertical jumping ability

*An extended Summary Plus English version is freely available at www.hellenicjsport.com

Introduction

The vertical jump (VJ) is a complex multi-joint movement that requires maximal strength exertion, explosive power and muscle coordination. Several investigations indicated that the movement pattern of Olympic weight lifting (OL) movements (snatch, clean and jerk) is similar to that of a VJ (2, 4, 7). As such, OL movements have been proposed as effective exercises for the development of vertical jumping ability (8). However, little is known about the similarity of two movements and the effects of weight lifting techniques on vertical jump development. The aim of this study was the investigation of the relationship of kinematic and kinetic characteristics of movement snatch with the vertical jump.

Method

Eight weight lifters (national level) performed snatch and vertical jump (CMJ) movements. The evaluation of the kinematic and EMG- characteristics of the two movements was performed with the Ariel system. Ground reaction forces were recorded using a Kistler plate at 1000 Hz. For motion analysis, two video cameras (Panasonic AGI88 Tokyo, Japan, frame rate 60 Hz with a high-speed shutter) and a video recorder (Panasonic S500) were used. Bipolar surface electrodes (Motion Control, IOMED Inc., voltage range: ±4 to ±12V) were used to record the EMG activity of Rectus Femoris (RF), Biceps femoris(BF) and Medial Gastrocnemius (MGAS) muscles. The two movements were divided in 5 equal length periods, of each movement. For each variable, movements were compared with analysis of variance with repeated measurements

Results

The results showed non-statistical differences ($p > 0.05$) in all kinematic variables between the two movements. Any differences that were observed in certain phases were not statistically significant and did not after the observation that there was a resemblance of the two movements in angle and angular velocity values. A high relationship was observed between the two movements in the vertical GRFs and the EMG activity of rectus femoris.

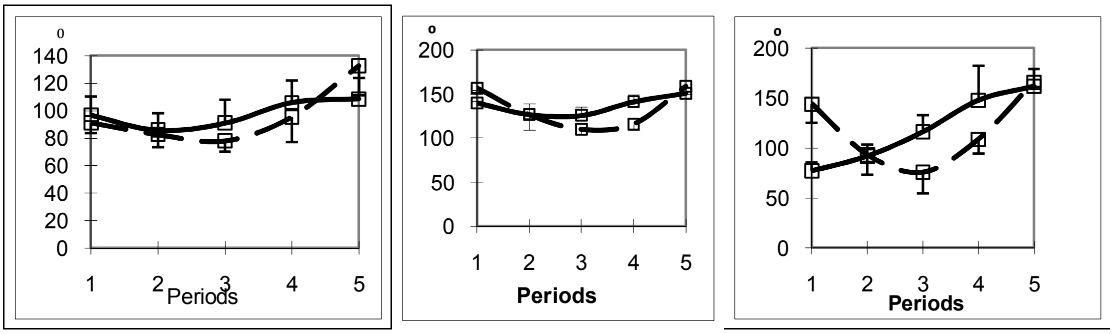
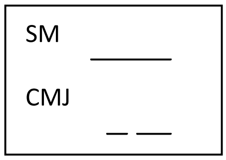


Figure1: Angle displacements of Ankle, knee and hip(left, center and right, respectively), as assessed through snatch movement (SM), as well as in countermovement jump (CMJ)



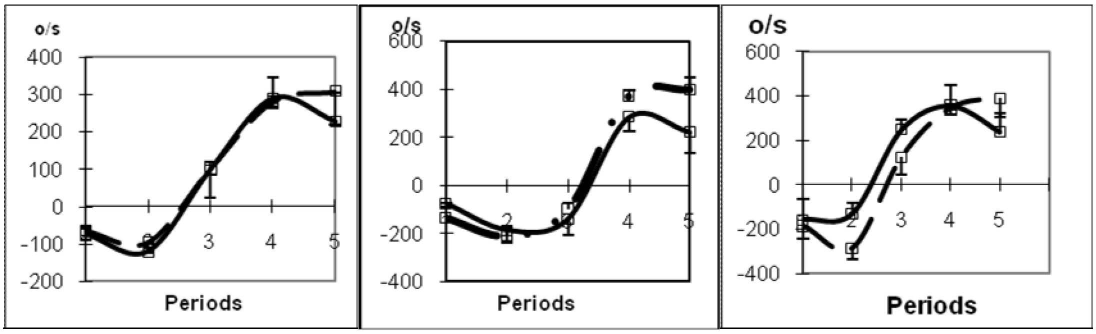


Figure 2: Angle velocities of ankle, knee and hip (left, center and right, respectively), as assessed through snatch movement (SM), as well as in countermovement jump (CMJ)

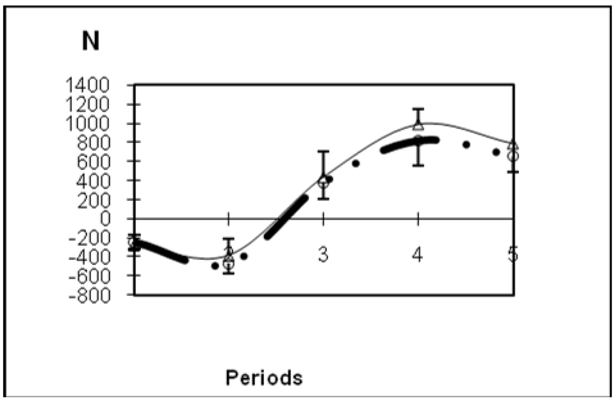


Figure 3. Ground reaction forces (GRFs) as assessed through snatch movement (SM), as well as in countermovement jump (CMJ)

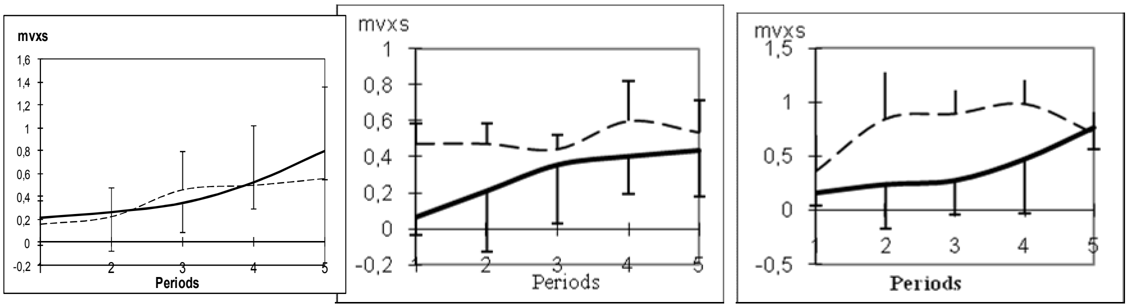


Figure **4:** EMGs graphs of Rectus femoris(RF), Biceps femoris, and M. gastrocnemius(MGAS) (left, center and right, respectively), as assessed through snatch movement (SM), as well as in countermovement jump (CMJ)

Discussion

The results of this study indicated that there are qualitative and quantitative similarities between the snatch movement and CMJ. According to previous studies, the angular displacement of the two movements follows the same time- sequence: from proximal to distal direction, the hip joint muscles are activated first, followed by the knee joint while the ankle is activated last (1). The CMJ and the second pull in snatch lift may be performed rapidly enough to store recoverable elastic energy and to release to the following concentric contraction of knee and hip joint extensor muscles (2). These results indicate that movement sequence in snatch in combination with the fast development of force and the intense activation of rectus femoris, allow snatch to be equally effective with jump for the improvement of jumping ability. In conclusion, the present study showed that the second pull in snatch is described as vertical jump with extra load, and may be beneficial in improving power (3).

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