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Biomechanical characteristics of movement phases of clean & jerk style in weightlifting performance

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Abstract

The purpose of this paper is to highlight the kinematic and dynamic characteristics of movement phases of Clean & Jerk style in weightlifting performance. This scientific approach has led to a study conducted during the European Junior Weightlifting Championships, Bucharest, 2011, on a group of 7 athletes, finalists of 56 kg class. The methodology of research focused on video recording, conversion of video capture into AVI format and the video biomechanical analysis of weightlifters' performances by means of a specialized program named Physics ToolKit. Bottom of Form

Each execution has shown the trajectories of the main joints involved in movement, highlighting the kinematic and dynamic characteristics of Clean & Jerk style phases. The comparative analysis of the biomechanical indicators of movement phases in terms of start, barbell drive to jerk, the jerk, getting under barbell, lifting from the rack, barbell catch over the head highlights the duration of phases, the execution speed and the force to overcome the resistance of the barbell. The study results revealed the kinematic and dynamic characteristics of movement phases of the Clean & Jerk style, especially the jerk, phases that had an influence on the performances achieved in competition.

Selection and peer-review under responsibility of the Sports, Education, Culture-Interdisciplinary Approaches in Scientific Research Conference.

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1. Introduction

The increase of performances in weightlifting, a phenomenon that we are continuously witnessing, is based on the improvement of technique and training methods. The modernization of training and competition materials and equipment (stage, platform, podium, barbells, arbitration and display equipment, computerized programs for conducting competitions) imposed the emancipation and selection of lifting styles, of arbitration rules and resulted in increased performance and spectacular events (***, 2009).

Learning the techniques used in various sport branches is generally characterized by the laws and phases of motor skills and actions, of course, with some differentiating, specific notes, determined by the particularities of sport branches. (Dragnea, 1996) The relations between technical elements and technical procedures are not present in all branches of sport, some of them having technical procedures only (weightlifting) (Dragnea, Mate-Teodorescu, 2002).

One of the major problems in weightlifting performance refers to the gradual training of the athletes for the execution of competition exercises in snatch and clean & jerk styles with a certain weight of the barbell, when the athlete's body condition must be maximal. The factor that ensures the optimal conditions for the solution of these problems is the reasonable sports technique (without violating the competition rules), by which the athlete uses efficiently his physical, functional and psychological traits and possibilities for lifting a barbell of maximal weight (Dvorkin, 2005).

The electronic development provided largely the objectification of sports training and competitions. Watching repeatedly, dozens of times, a freeze-frame of a loop-film or showing the images at normal speed can largely contribute to understanding some parts of the global execution of a technical procedure. Obviously, the specific character of each sports event or branch is given by the structure of technical elements, number, complexity, spectacular aspect, originality, frequency and efficiency in competition. The following biomechanical methods of research can be identified in the training field (Nicu, 1993): cinematographic method; stereography method; method dynamography; static-kinesimetry method (stabilometry); accelography method; electromyography method; goniography method.

The first researches in weightlifting field were biomechanical ones, using the dynamometric platforms for objectifying the reaction of the floor, the dynamographs and the tensiometers for measuring the force. More recently, the platforms have been connected to processors (AMIT- USA system, 1983, quoted by Epuran, 2005) polygraphs, kinematograms, video recording and slow motion images, etc. The recording on film has passed from genographic analysis to biomechanical complex analysis by studying the execution time and trajectories provided by the "marks" placed on athletes' joints. Subsequently, sensors have been applied instead of the marks; they recorded the electromyograms, heart rate and respiratory rate (Epuran, 2005).

Computerized technology based on the AviSynth software utilization objectifies the concentration characteristics and the attention concentration optimum time (Teodoru, Murăretu, 2013).

The purpose of this paper is to highlight the kinematic and dynamic characteristics of movement phases of jerk style in weightlifting performance.

Hypothesis of the paper. We consider that the biomechanical video analysis will reveal the kinematic and dynamic characteristics of movement phases in jerk style, especially the flipping phase and front squat jerk.