Complex analysis of movement in evaluation of flat bench press performance

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1. Introduction

Informations about the way of motor action (sport) are also necessary in its analysis. Informations are obtained by experienced teacher or coach with visual observation. Collecting of informations requires from teacher certain abilities of observation of motive actions courses. Observation is not objective method, therefore perform recording or measurement of different parameters are used in scientific investigations of motor actions. Motor actions are estimated by using of number of accessible biomechanical methods. The complex methodology of investigations was applied several times by us to study of movement’s structure in weight lifting [1]. Cognition of both external (kinematics and kinetics) and internal (the bioelectric activity of muscles) structure of snatch was achived by simultaneous application of force platform, electromyography, inclinometers, other special devices and video camera. The technique of the performed movements was described based on the results of using methods. We focused on the mistakes as well as changes in structure of movement as a result of load variation.

Nowadays very popular is video technique (i.e. Simi, Vicon, BTS, Qualisys) synchronized with other measuring methods, which permits on complex analysis of movement.

In this work we have checked usefulness of multimodular measuring system (SMART - E, BTS company, Italy) in studying the structure of flat bench press and we also have compared results of two measurement methods.

2. Methods

Sixteen healthy men with diverse sport level (results one of them presented below) took part in our investigation. Multidimensional movement analysis was made with the measuring system Smart-E (BTS, Italy) consisted of: six infrared cameras (120Hz) and the wireless module to measurement of muscle bioelectric activity Pocket EMG (1kHz, passband 10-500Hz, 16 channels). Level of activity of the pectoralis major, the anterior deltoid, the lateral head triceps brachii, and the latissimus dorsi during flat bench press, EMG activity was monitored by surface electrodes placed over the motor activation points of these muscles during the eccentric and concentric phase of each chest exercise. Modelings in 3D space as well as calculations of parameters were performed with help Smart software (Smart Capture, Smart Tracker and Smart Analyzer, BTS, Italy). The set of passive markers permissive on delimitation of chosen parameters of barbell and subjects were applied.

3. Results

It all measurements and results were synchronized was in time, using central individual. It the example results of flat bench press were showed was on Fig. 1 and 2.

![Graph](image)

Fig. 1. Vertical velocity of the barbell’s midpoint [m/s] for flat bench press with 70, 80, 90 and 100 % of the 1repetition maximum lifted [1RM]
The level of activity the pectoralis major and the anterior deltoid during the flat bench press with 70 % of the maximum weight lifted was largest latterly of the eccentric phase (Fig. 2a). The largest level of activity of both muscles in test with weight 100% maximum weight lifted was registered on beginning of concentric phase(Fig. 2b). Increasing the weight of the barbell resulted also in increases in activity for the lateral head of the triceps brachii. During the whole bench press with all (every) loads the activity of the latissimus dorsi was the least.

4. Discussion

The results demonstrated that during the flat bench press the greatest activity level was recorded for the pectoralis major and the anterior deltoid. Welsch et al. [3] concluded that the both muscles appeared to reach approximately the same peak activation level during the concentric phase of this exercise.

The modern measuring methods (SMART with Pocket EMG) in spite one’s large complexity offer the complex measurement external how and the internal structure of movement. For automatic process of data handling, the result for simple movement was it been possible to get almost immediately. It’s very important during teaching of movement, because in shot time the competitor or coach receives the “feedback” about executed task as well as mistakes, which were committed. Software Smart Analyser permits on creation of database regard which will compare chosen parameters (for example: novice competitors in comparison to technique of advanced or master competitor).

References