EVOLUTION OF KINEMATIC AND ELECTROMYOGRAPHIC PARAMETERS DURING THE DIFFERENTS PHASES OF A THROW - A PRELIMINARY STUDY

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INTRODUCTION

Discus throwing is a sport activity characterized by a complex technique (rotation and translation motion) which allowed to obtain the higher speed imparted to the discus at the release (Barlett, 1990). Athletes successful in this sport are able to rotate very fast in the throwing area (Barlett, 1990). To learn this complex technique, lots of coaches recommended doing the turn forward with an under mass discus. Nevertheless no data exists to know if the technique employed with an under mass discus (1.7 kg) is the same than with a competition discus (2 kg). The purpose of this study was to examine how mass of the discus influenced the kinematic characteristics and the activity of agonist muscles during throws using 3D videographic and surface electromyography (sEMG) techniques. Furthermore, in the discus literature, throwing technique is discussed mainly in relation with cinematographic data (Lindsay, 1991; Stepanek and Susanka 1986). Simultaneously videographic and sEMG techniques provide informations about the pattern activity and the level activation of the involved muscles during throwing.

METHODS

Seven high level athletes in throwing discus (aged of 23 ± 3 years, weight of 108 ± 19 kg, height of 190 ± 6 cm) participated in the study. All of them were engaged in national or international competitions (best personal performance of 57 ± 3 m). During one hour, subjects performed twelve throws in a netted indoor area for discus. Two different discus of 1.7 or 2 kg mass were presented in a random order. The throw distance calculated is a function of the implement's speed, the height and the angle at the discus release. Only the throws higher than 80 % of the best individual performance were taken in account for further analysis.

Three digitals camcorders (Panasonic AG-455, 50 Hz) were used to obtain 3-D kinematic parameters. These camcorders were located in front and behind of the subject (camera-subject distance = 3 m, located with a 120° angle between the three camcorders). A calibration frame was used for spatial reference. Kinematic approach allowed determining qualitative analysis (different phases of the throw: first double support phase [A]; first single support phase [B]; airborne [C]; second single support phase [D]; second double support phase [E]) and quantitative analysis (quantity of motion, discus velocity during the throw). sEMG activity of 9 right muscles (Biceps Brachii, Triceps Brachii, Deltoideus pars anterior and pars medialis, Pectoralis Major, Trapezius pars ascendens, Obliques Externus, Latissimus Dorsi, Vastus Lateralis, Biceps Femoris) and 2 left muscles (Lumbar Erector Spinae, Obliques Internus) was recorded using bipolar electrodes. sEMG signals were amplified and recorded to ME3000P8 muscle tester unit with 2 MB SRAM-Card (Mega Electronics Ltd, Kuopio, Finland). sEMG data were converted at 1000 Hz and stored on computer. sEMG signal was band pass filtered (10-500 Hz). For each throw, the sEMG activity as root mean square (RMS) amplitude was calculated for the different phases and for the entire throw.

RESULTS AND DISCUSSION

These preliminary results concerning only two subjects showed that throwing patterns were similar for the both conditions of mass discus. Kinematic analysis provides the same absolute and relative duration of the different phases. The timing and amount of sEMG (RMS) was the same for all analysed muscles; i.e., for Deltoideus anterior, higher RMS was always observed during phase [E] whereas for Deltoideus Medialis RMS was always observed during phase [B]. These results allow characterising muscle pattern activities in relation with throwing phases.

Consequently, these results suggest that lighter discus might be used for high level training without kinematic alteration of throwing. We assume that this allows decreasing mechanical stress and injury risk during technical learning periods, especially for beginners.

REFERENCES