DIFFERENT APPROACH TECHNIQUES IN VOLLEYBALL SPIKE

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INTRODUCTION

In volleyball spikes the impact height of hand and ball is a relevant parameter for success (Tillman et al., 2004). A higher ball impact location allows more possibilities for technical and tactical variation. Therefore, the optimisation of jump height (JH) is in the focus of research.

In the literature coherencies between different parameters of lower limb to the JH were analysed (e.g. Coutts, 1982). However, most of the published studies have been performed under laboratory conditions.

The purpose of this study was to analyse if a coherency to JH could be found in selected parameters of the lower limb (e.g. foot angle at take off) in top-level athletes under contest conditions.

Figure 1. Different foot angles at take off. Angle (left) and Parallel (right).

METHODS AND PROCEDURES

Four digital high speed cameras (3x Basler, 1x Vosskühler), sited around the court, were used for the motion analysis with a frame rate of 100 Hz. Those cameras were controlled and triggered by “SIMI Motion-Capture” software.

Spike movements performed by players of the national teams of Croatia, Estonia, Germany and the Netherlands were recorded during European league tournament. Since the favourite spike-position used by international top level teams is position four (Kuhlmann et al., 2008) only diagonal spikes from this position have been considered. All subjects performed a step-close technique, identified by Coutts (1982). Another criterion was the flight angle of the ball after impact from 110° to 145° to the net. From the sum of all recorded spikes achieving those criteria, 10 spikes from 10 different attackers were chosen in a randomised order. No difference was made with respect to the national team. The average weight of the selected subjects was 92.0 ±5.35 kg, the average height was 198.8 ±4.4 cm.

Analysed parameters were foot angle at take off, closing time, ground contact time and running speed at the approach. Also the arm movement has to be considered when examining dependence of the approach to the JH of a volleyball spike. Statistical analysis was made with SPSS 14.0.

RESULTS

In the arm swing, the lower reversal point has to pass along with the lower reversal point of the centre of mass (COM). Otherwise, there would be a negative effect between these two impulses. The mean time difference was calculated with 10 ± 10.5 ms. The mean time difference from the arm block to the last frame with ground contact was calculated.
with $5.4 \pm 5.1$ ms (left arm) and $5.7 \pm 3.5$ ms (right arm). The time difference of the maximum angular velocity to the last frame with ground contact was calculated with $13.8 \pm 2.7$ ms (left arm) and $13.2 \pm 4.1$ ms (right arm).

The JH of the sample was $63.2 \pm 6.2$ cm. The closing time was $18.7 \pm 3.9$ ms. Over all ground contact time (both feet) was $34.4 \pm 7.2$ ms. The average foot angle at take off was $16.03 \pm 16.62^\circ$. When calculating Pearson’s correlation test, no relationship between the parameters foot angle, ground contact time and closing time to JH was detected.

**DISCUSSION**

The arm movements of the examined subjects were nearly similar. Therefore, an inhomogeneous influence can be neglected for this sample.

Concerning the parameters ground contact time, closing time and foot angle at take off, no apparent effect on JH could be detected. From a biomechanical point of view, no specific benefit of one technique can be postulated for maximum jump height in volleyball spikes. These results lead to the assumption that the technique of spike jumps seems to be highly individual in top level athletes. This is in line with Tokuyama et al. (2005), who showed in a laboratory-study, that intra-individual variation was significantly smaller than inter-individual variation for female attackers. These results raise the question, if educating young players by traditional techniques lead to an optimal individual performance for the spike. The approach of differential learning showed that better and more continuous results in performance were reached when motion was taught with a big range of variability in contrast to a conventional method. An overview on some experimental studies concerning differential learning with similar results in different disciplines was given by Frank et al. (2008). According to these authors this method could support athletes to find their specific motion pattern for maximum performance, which could differ from the conventional one.

**SUMMARY**

In this study 10 top level athletes were analysed during international competition. No apparent effect on JH was detected in the analysed parameters of the lower limb although the sample was considered to be homogeneous with regard to the performance ability. This could be an indication for highly individual technique in top level sports. It prompts the question if methods like e.g. the approach of differential learning could be useful to gain higher individual performance. It may be easier for athletes to find their specific technique, when using methods with different variation of motion.

**REFERENCES**


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SIMI Reality Motion Systems GmbH.