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An Analysis of Kinematic Difference between Successful Hurdle Step and Baulk in 3m Springboard Diving

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INTRODUCTION:

In springboard diving, which is one of the diving competitions, a certain approach called hurdle step must be performed. Although the baulk in which the stop of jumping due to incorrect performance of hurdle step by divers happens often, a clear kinematic difference between successful hurdle step performance and baulk has not yet been identified. The purpose of this study was, therefore, to identify the difference between successful hurdle step performance and baulk.

METHODS:

Ten finalists for the 3m springboard at the National Sports Festival (age: 23.4 ± 3.4 yrs.; weight: 64.9 ± 5.6 kg; height: 170.1 ± 5.8 cm; Career: 10.6 ± 2.4 yrs) participated in this study. The motions to be analyzed were limited to those with a difficulty level of 3.0 or higher, and baulks motions were compared with hurdle step motions performed in trials with a skill score of 7.5 or higher. The hurdle step motions were recorded using six video cameras (sampling rate: 60Hz). To set the spatial coordinates, DLT camera calibration was performed around the springboard. 14 body joint points were digitized using the Kwon 3D XP (Visol, Korea) program. In this study 4 events were set for analysis (E1: hurdle step contact, E2: maximum springboard depression, E3: hurdle step take off, E4: highest jump point). A paired t-test was conducted to compare the kinematic differences between two groups and the statistical significance level was set at $\alpha = .05$.

RESULTS:

The results showed that the difference in CoM velocity between two groups was statistically significant at E3: the backward velocity in the baulk (-0.01 ± 0.07 m/s) was faster compared to that in the successful hurdle step (0.12 ± 0.04 m/s). They also showed that the difference in the take off angle between two groups was statistically significant at E3: the take off angle in the baulk ($-7.74 \pm 1.44^\circ$) was bigger compared to that in the successful hurdle step ($-6.55 \pm 1.55^\circ$), showing the non-perpendicular jump angles.

CONCLUSION:

Since the hurdle jump performed immediately after the hurdle step is a forward jump, it is estimated that the take off angle greatly deviating from the perpendicular and the backward movement of the CoM have a negative effect on the successful performance of the technique. Therefore, the divers that recognized the backward movement of the CoM during the hurdle step are likely to commit baulk without connecting hurdle step to jump in the hurdle step.

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