

# The Kinematic Analysis of the Tkatchev Motion on the Horizontal Bar

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The purpose of this study is to investigate the kinematical variables of the Tkatchev motion on the horizontal bar and the effects of kinematical variables of 1 phase on 2, 3, 4 phases and the effects of kinematical characteristics of every phase on motion the air and re-grasping. The subjects Tkatchev motion were filmed with S-VHS camera at the speed of 60 fields per second and each field is digitalized to 5 fields from the sum of handstand motion to landing.

The Kwon 3D 2.1 version program is employed to obtain 3-dimensional data. Based on the results of this study, the following conclusions are drawn.

1. In the Down swing phase, the maintenance of great vertical downward velocity is an important variable to achieve large angular velocity of body center and it is also proved that the fast downward motion gives advantage in spreading body joints to get great motion power in the next Whip swing motion.
2. In the Whip swing phase, fast upward velocity and fast angular velocity of hip joint will positively affect upswing movement in the phase. To shorten the distance between horizontal bar and body center helps effective upward motion as well. These also work beneficially in the next phase.
3. In the Releases phase, fast vertical upward velocity until pull back after curving shoulder joint and hip joint at the whip swing and large change of position of body center are important variables to perform high and long flight duration.
4. In the Re-grasp phase, the maximum spread of shoulder joint and hip joint and the spread of body center to the opposite direction of it helps body center to stay in higher place and to perform large circular flight motion with extended length of time. This ultimately makes effective re-grasping motion happen and connects next motion smoothly.