

KINEMATIC ANALYSIS OF JUMP FORWARD FRONT KICK BY OUTSTANDING WUSHU ATHLETES

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INTRODUCTION

Jump forward front kick is one of the hardest leap actions under the new rule of martial art (B degree of difficulty)[1]. High performance of this action is the significant factor to decide the difference of merits of the final results. Therefore, in order to provide important reference for athletes to further enhance competition and for coaches to guide scientific training, we use three-dimensional camera to record actions done by excellent athletes, and analyze to reveal the characteristics and kinematic laws of motion.

METHODS

Analytic method of three-dimensional camera—we set two DV cameras in the women's shadowboxing final scene at China's 10th National Games, and main axis of two cameras to each other is 75°. Before the game, we divided the stadium into six average regions, and set scale for recording and analyzing. Two fixed-point cameras simultaneously recorded the entire women's shadowboxing process of the final 6 athletes. We adopted American "Peak" moving picture resolution measurement system to do three-dimensional analysis of vacated kicking, and then cut-off frequency of 6Hz to do smoothing by digital filtering obtained data.

RESULTS AND DISCUSSION

First, during run-up phase, the average center of gravity horizontal velocity of six athletes is 0.90 ± 0.14 m/s, similar to the velocity of same Jump forward front kick. The achievement of the action is not affected much by acquired level of center of gravity after run-up phase does not affect achievement, but by the power of lower limbs and flexibility.

Second, during take-off stage, one of distinct characteristics of this action is: when right foot touchdown, upper body is apparently retroverted to active hip, right leg straightened as far as possible, and left leg sway backward appropriately.

Third, the center of gravity horizontal velocity and center of gravity height declined to some extent, the declined values are 0.034 ± 0.06 m, and 0.26 ± 0.19 m/s.

Fourth, during the stretch period in the take-off phase, when right leg was off the ground, the average angle of right knee of 6 athletes was $165.72 \pm 6.61^\circ$, and the average center of gravity vertical velocity was 2.88 ± 0.14 m/s. During this period, the extensor is larger, the action was done completed, and the center gravity vertical velocity is larger. At the mean time, the average angle of swaged left knee of six athletes was 117.92 ± 69.18 rad/s. Arm swing acceleration and braking, and the co-ordination of left leg up-swing can enhance vertical velocity of center gravity when right leg is off ground.

Fifth, during vacated period, the key point to achieve this Jump forward front kick is that right straight leg accelerates to swag up, left leg goes down fast, props up head, stands waist, upper body keeps straight, and two arms flats to the two sides.

Sixth, during the period of touch down, right fore sole of athlete touches ground first, and then quickly pass to the whole sole bracing. At the mean time, upper body appropriately inclined forward, and arms around the longitudinal center line of the body spread flat. It is significant to adjust the body center of gravity, and to keep body balance. The center of gravity of some particular athlete is so low that the time for buffering is short, and appears shake and jump to some extent.

CONCLUSIONS

First, the more thorough the right foot braking is, the greater loss of horizontal velocity has.

Second, we suggest that during athlete training to enhance leg muscle strength development. The key technology to achieve the vacated kicking is that in the take-off and stretching phase, the body extends straightly, right leg extends fast, and both arms and left leg accelerate to swag and brake.

Third, during vacated period, the key point to achieve this Jump forward front kick action is that right straight leg accelerates to swag up, left leg goes down fast, props up head, stands wrist, upper body keeps straight, and two arms flats to the two sides.

REFERENCES

1. Wushu administration center of the state sport general administration, Competitive rule of wushu routine, The state sport general administration, Beijing, China, 2008.