



## Exercise load research on common technical method in taekwondo training courses

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### ABSTRACT

*In the taekwondo competition, kicked technology is the most common and is also the main means of scoring. Its purpose is to hit target with the fastest speed, which making the opponent off guard and scoring. In order to achieve this purpose, distal part must get the greatest possible speed, which requires lower links attempt to hit the direction of movement, and the other part of the body must be coordination with certain features. Through the analysis of kinematics, this article reveal space motion rule and characteristics of each link in taekwondo horizontal kicking action, and through the analysis of the kinematics characteristics, exploring the influence of movement of each section of the body on the quality of the horizontal on taekwondo kicks. In order to help Taekwondo athletes and coaches do teaching and training.*

**Key words:** Taekwondo; horizontal-kicking; link; speed of angle; link

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### INTRODUCTION

Technical action in Taekwondo mainly lets in the leg, and of which horizontal kick is the most common in the game, and it is also the main means of scoring, especially in the international game, this is mainly because the kick technology is rapid and of less physical exertion, and is easier for athletes to use. The basic requirement of horizontal kicking action technology is fast, powerful and accurate indeed. One of the most important is through the cooperation of the whole body, make the end of attacking leg achieve maximum speed and strike force. Therefore in the process of action, cooperation between each link actions should be conducive to the end of a leg at achieve maximum speed and strike force, so as to improve the attacking effect.

This article reveals space motion rule and characteristics of each link in taekwondo horizontal kicking action, and through the analysis of the kinematics characteristics, exploring the influence of movement of each section of the body on the quality of the horizontal on taekwondo kicks. In order to help Taekwondo athletes and coaches do teaching and training.

### THE RESEARCH OBJECT AND METHODS

The research object the research object is the 13 Taekwondo athletes of Beijing team. And the vast number of them has won the champion in the provincial or national taekwondo competition. The research methods use infrared high-speed video and systematic analysis on the kinematics characteristics of the horizontal kicking motion of the Taekwondo athletes. Infrared high-speed camera Using of Swedish production QUALISYS-MCU500 and use Infrared long-range test system (six shots) to test Taekwondo kicking process. Shooting frequency is 240 frames per second.

### EXPERIENMENT PROCESS

To adjust the height, pitch Angle and focal length of the six lenses, in order to coordinate the frame position in each

lens in the lower middle, and the size of light suitable.

**Calibration for the tested space.** When determination, the experimenter in athletes, art movements could constantly shake hands in reaching calibration of space. The system automatically calculates calibration parameters of the six cameras, and to determine whether doing the calibration.

**Action technology test.** Subjects after the prepared activity should put place reflective marking point in the test body parts. To reduce the system error, all test should be performed by one person. Players who stick a landmark should first try to kick a few times, until can feel formal test. In the testing process, athletes should do their best to complete the technical movements. And the test should get at least three times or more satisfied of the athletes and marking the complete action.

#### VIDEO PARSING PROCESS

Because the maximum speed of ankle joint is the key indicators to measure horizontal kick technology, so in each ankle for selected, choosing the biggest speed one from the three sets of data analyzed. Part of the data gap is automatically Supplement by the interpolation methods in QTrc software.

### RESULTS AND ANALYSIS

This study only to study taekwondo horizontal kicking action process and the testing attacking leg is the right leg, so the research scope of action technology identified to: the 20 picture received when the right leg off the ground instantly and the ankle got maximum speed. The whole action process is divided into two phases according to the players' action form, when the attacking leg leaves the ground Instantly, it is the knee lifting stage, and when tapping leg knee buckling to the biggest and the offensive leg ankle arrived maximum speed, it is called bomb play stage. The first dotted line in the graph below identifies the instant of largest knee buckling, the second dotted line identify the maximum speed of attacking leg ankle.

In order to reveal the characteristic and the principle of the movement technology, in this paper, in addition to do statistical processing and technical analysis to the 13 subjects' movements technology indicators, and also do some analysis, comparison and discussion to the worst kicking speed of the athlete's technology among Zheng Fuli (male), Lu Tao (male), Song Xijiang (male), Yang Na (female) four athletes and the object athletes Shi Jun (male) and Zhou Jie (female)

#### THE MOVEMENT'S COOPERATION OF EACH ATTACKING LEG LINK

The purpose of taekwondo horizontal kicking action is to hit the target at the fastest speed, make the opponent off guard and score. In order to reach this end, lower extremity end link must achieve most possible speed, all these require each link of lower limb try their best to hit the direction, and the other part of the body must coordinate. So when doing taekwondo horizontal kicking action, the body forms of exercise of each link will show some characteristics certainly. As shown in figure 1 the whole process of knee movement of the attacking leg and knee joint.

Can be seen from the figure 1, the athletes of different level, there is no significantly different in their leg movement form. When the attacking leg leaves ground, first rely on the trunk reversing drives the attacking leg movement, and at the moment, the lower leg folds toward the direction of the thigh, the angle of the knee joint decreases, while the change of hip joint is not big. Except Shi Jun, others athletes' hip are all buckling starting from the stretch position to forward, and such a starting position can offer high pretension of the quadriceps muscle and is advantageous to the subsequent action. Carefully observe the five athletes' curve of hip flexion and extension, we can find that although from the same hip stretch position to do knee flexion, but Lu, Zheng and Yang stretch before bend hip, especially Yang, he is the most obvious. While Zhou and Song keep bending action from stretching hip, until the ankle get the maximum speed.

From the figure 1, we can see that most of the high level athletes' (Lu, Zheng, Song) attacking legs kept in knee flexion position forward swing phase, while the low level movement immediately when the knee flexion reached the maximum in extension. According to the moment of momentum theorem, the goal of folding the lower leg and thigh is to reduce the attack legs' rotating inertia of swinging forward, thus improving the swing speed and reducing swing time. Therefore appropriately keep the knee joint swung angle buckling position is good for the attacking legs get greater speed. Before the maximum folding of leg, hip started buckling and extended outside. At the same time the knee joint and the lower limbs achieve the speed to move in the direction of attack. And when the knee joints begin to stretch, hip still keep moving, until the ankle reach the maximum speed. So you can think, hip and knee flexion and rapid extension let the attacking leg and ankle achieve the forward speed. Athletes' action sequence of

each link of leg is - the knee flexion — hip flexion, outreach - knee extension, the movement of hip is the key and foundation to the ankle to obtain maximum velocity of movement. Link movement is in line with "whip" motion sequence where the big link drive small link.

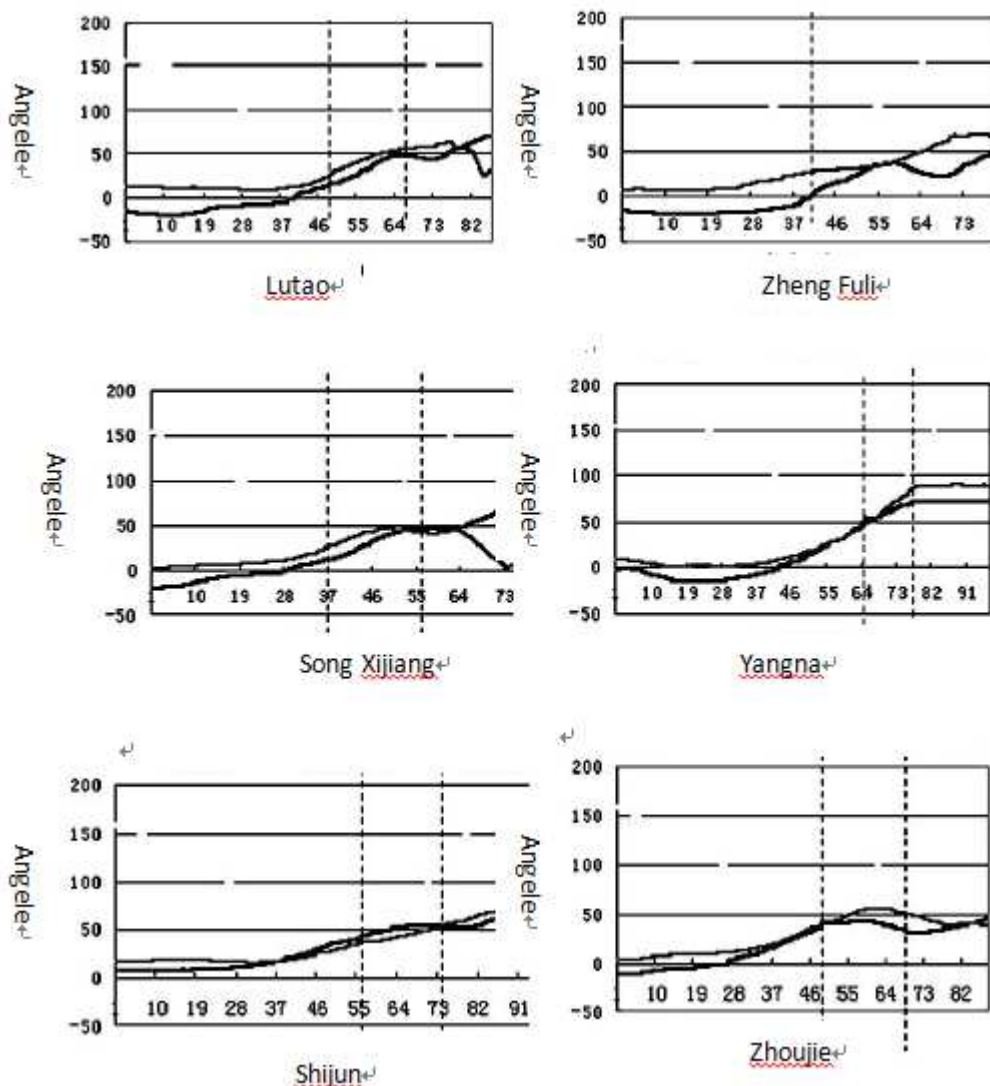


Fig. 1 leg hip and knee movement

### SPEED CHARACTERISTICS OF EACH LINK

The trunk translational and torsional make athletes' right hip get speed, so hip speed variation characteristics reflected the body movements. And the speed of the knee joint is the result of added of atop the torso and thigh motion; and the ankle speed is the comprehensive performance of torso, thigh and lower leg movement. According to the principle of kinematics, the object of study is relatively static to the coordinate system of motion is called absolute motion for sport, and the matching speed called absolute speed; Meantime, the research object relative to the movement coordinated known as the relative motion, and the matching speed is called relative speed; the motion of static coordinate system to the motivate one is called implicated motion, and the matching speed is called the transport velocity. From this, we can see that offensive leg blow speed is actually a composite speed. According to the structure characteristics of transverse kicking action, the recombination rate is the synthesis of two actions phase. At ground offensive leg knee movement stage, with legs ground, the body center of gravity move towards the direction of support legs, the thigh active around the axis of the hip drive crus movement, and obtain an action of initial velocity. As the torso move towards the left, the hip flexion is slow down, and crus complete its stretch. In the process of the action, the calf action for accelerate rotation on the basis of the first stage, obtaining the final blow speed. In the above two actions phase, all choose lower leg as the research object, and the movement of the thigh is implicated, calf movement is relative motion. Therefore, to improve the attacking leg's absolute speed, improving the thighs transport velocity in the first phase is necessary and also improves the relative speed in the second stage. According to this principle, it can improve the body blow speed (absolute speed). Key points in the process of the

whole movement speed changes.

As can be seen from the figure 2, the speed of three key points of different level of athletes is basically identical. And the Curve shows that Lu, zheng and Yang the three masters' level player, their hip movement speed is greater than the speed of knee, ankle in ground carry the knee stage, while the other three players knee, ankle speed is always greater than the hips. So we can think that the stretch of hip is not caused by glues after hip muscles contraction, but the result of the trunk start with early or late, making the torso motion ahead of the thigh move, make ham passively left behind, causing quadriceps rolled back shrinkage. From muscle mechanics theory: the trunk of the fast power not only is advantageous to the attacking leg's movement, but also can pull down the quadriceps muscle and hip and thigh, making the elastic potential energy and stored in the muscle produces stretch reflex. Both can improve the subsequent strength and speed of hip and knee flexion movement. Therefore, Lu, zheng and Yang, their movement is favorable and reasonable, while the other three players do not completely use the strength of large trunk muscle to drive lower limb movement, also do not have a good stock quadriceps pretension, so all these is not conducive to subsequent action for greater speed and power.

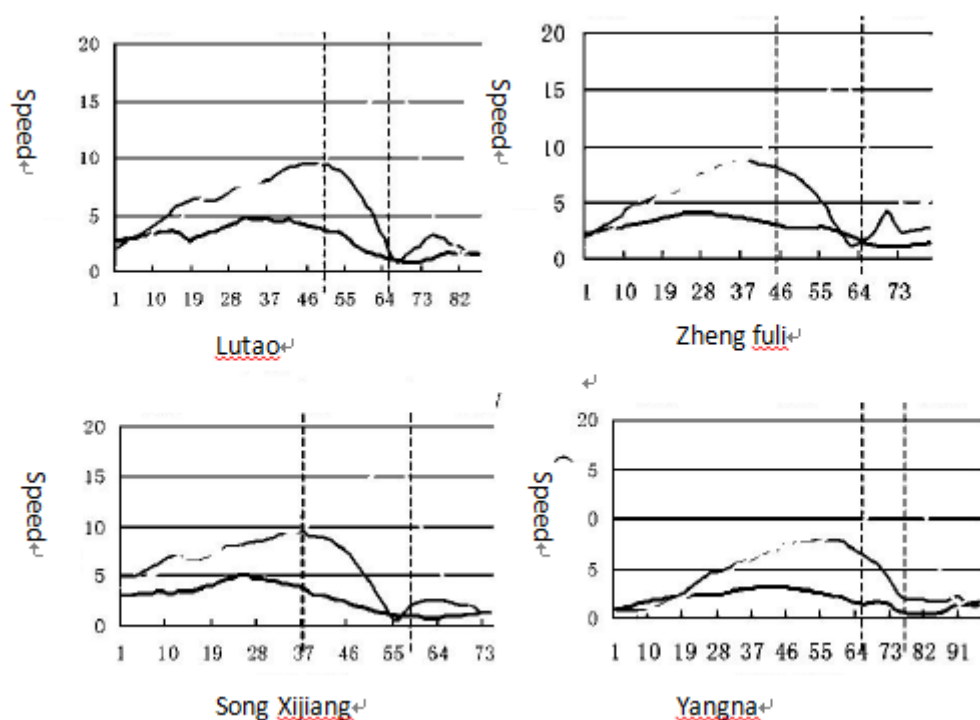


Fig 2. Speed of attacking leg joints movement

From figure 2 we can see: the speed growth curves of the whole knee, ankle joint action are basic coincidence, ankle's speed slightly below the knees. This is because in the ground movement of the knee stage, thigh drives the movement of calf, and the speed of ankle in this phase is slightly smaller than the knee joint.

Above all, the speed curve of hip, knee and ankle joint point shows that in taekwondo movement, the big link drive small link, and large and small segment acceleration and brake in turn, making the momentum transfer to the end of the link, it is the typical whip type. From this we can put forward to the evaluation index and the basis to measure the quality and effect of taekwondo transverse kicking action. One is the size of speed increased from large body joints to the small joints, the larger the increased value, the better the effect of momentum transfer of whip and the greater the speed of ankle. The other is narrowing the time of each joint's arrival in maximum speed.

## CONCLUSION

Sequence of each section of athletes' attacking leg action is knee flexion - hip joint flexion, outreach - knee extension, and among them the hip movement is the key and foundation for the ankle to obtain the biggest speed. Sports meet "Whip" movement sequence in which big link drive the small part.

When doing transverse kicking action, each link of the body in accordance with the large and small link according to time to accelerate and brake, making the momentum transfer to the end of the link. Transverse kicking action is the typical form of whip.

The speed of ankle obtained from the coordination of each part and reasonable, fast movement in the whole body movement, in the case of early action is not complete in high quality, relying on the last link of the process of knee stretching to increase the speed of transverse kicking is impossible. So athletes' training should emphasize on the torso and legs and so on big links' power and the technical training and also need each link of training techniques to cooperate.

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