Peculiarities of performing a throw uchi-mata under the conditions of a competitive battle

UDC 796.012

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Abstract

Objective of the study was to conduct a biomechanical analysis of the throw Uchi-Mata in conditions of high-level competitions.

Methods and structure of the study. To analyze the throw, a video was taken from the Internet, containing fragments of the fights of the Olympic champion in judo Toshihiko Koga. Next, the model was determined, due to which the throw was performed.

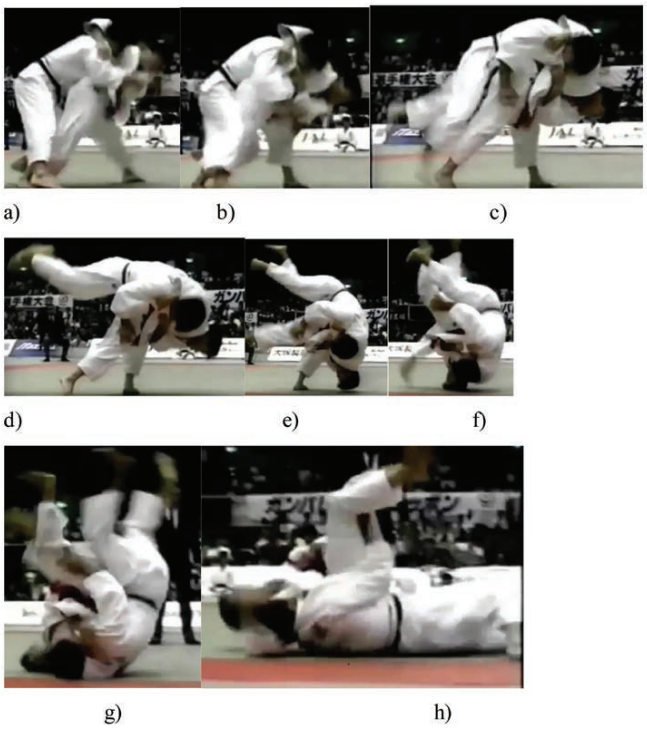
Results and conclusions. In the course of the analysis of the throw Uchi-Mata, the authors calculate the speed of the center of gravity modulo for both athletes, the changes in the speed of the center of gravity modulo, as well as the projections of these values on the coordinate axes. Based on the intervals of the values of the velocities of the centers of gravity, the projections of the velocities, it is concluded that in the process of preparing and performing the throw, the opponent accelerates in the horizontal plane. The trajectory of the center of gravity of the attacked athlete indicates his preliminary swinging in the vertical plane before the throw. The results of the study can be used in the wrestling training process at the stage of sports specialization.

Keywords: *Uchi-Mata, judo biomechanics, technical and tactical training.*

Introduction. Today we can note the growing popularity of wrestling. Judo, Greco-Roman wrestling, freestyle wrestling are firmly entrenched in the program of the Olympic Games. New directions and schools appear and develop. Tough competition is already evident at the level of youth tournaments. However, there is still a lack of research related to the biomechanics of this type of motor activity.

Objective of the study was to conduct a biomechanical analysis of the throw Uchi-Mata in conditions of high-level competitions.

Methods and structure of the study. To analyze the throw, a video was taken from the Internet, containing fragments of the fights of the Olympic champion in judo Toshihiko Koga. he analyzed part of the video recording, containing the execution of the catch throw, was divided into separate photographs – cyclograms. Next, the model was determined, due to which the throw was performed [1]. For each cyclogram, the coordinates of the center of gravity of both athletes were calculated. The distance that the athlete's center of gravity passed was measured in arbitrary units (in the size of the athlete's image). The speeds of the center of gravity of both athletes were calculated modulo, the projections of the speeds of the centers of mass, the changes in speeds during the transition between cyclograms and the projections of changes in speeds. The speed was measured in c.u./s. Changes in speed were calculated as the difference in speeds between two cyclograms and were measured, respectively, also in c.u./s. The intervals of values of the calculated quantities were determined. The following designations are adopted in this work:



Picture 1. *Throw performed by Toshihiko Koga [2]*

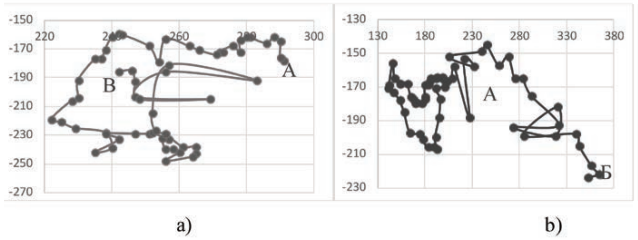
– projection of the speed of the athlete's center of gravity on the abscissa axis, – projection of the speed of the athlete's center of gravity on the ordinate axis, changes in the speed of the center of gravity modulo during the transition between cyclograms, – projection of the change in the speed of the center of mass on the abscissa axis, – projection of the change in the speed of the center of mass on the ordinate axis.

The athlete holding the hold was designated as Tori, the attacked athlete as Uke.

Picture 2. *Schematic representation of the models due to which the reception is performed: a) lever, b) mechanical block [2]*

Results of the study and their discussion. Picture 1 shows a throw performed by Toshihiko Koga in competition. This throw is a combination of a lever and a mechanical block. At the same time, it should be noted that in the process of performing the throw, the attacker changes the direction of movement.

Picture 3 shows the trajectories of the center of gravity for the attacking and attacked athletes.



Picture 3. *Trajectories of the center of mass of athletes in the process of performing a throw with a pickup. a) - the trajectory of the center of mass of Toshihiko Koga, b) - the trajectory of the center of mass of his opponent. A - the beginning of the trajectory, B - the end of the trajectory*

Picture 3 shows that in the process of preparing the throw, Uke's center of gravity makes oscillatory movements. In the video, you can see how Tori swings Uke in a vertical plane.

The table shows the intervals of the speeds of the centers of gravity by the module for both athletes, the projections of the speeds, the changes in the speeds by the module and the projections of the changes in the speeds.

It can be seen from the table that the length of the interval of velocities of the center of gravity is greater in modulus for Uke [0.00; 1.72] 1.2 times more than Tory's [0.04; 1.43]. This suggests that a process occurs with the center of gravity of Uke, as a result of which there are larger amplitude fluctuations in speed than those of Tori. The video footage shows Tori dispersing Uke before throwing, dragging him along or using his movement on himself. The interval of values of velocity projections on the Ox axis is larger for Uke [-1.71; 1.61] 3.32 c.u./s compared to Tori [-1.13; 1.08] 2.21 c.u./s., i.e. 1.5 times. This can be explained

Velocity intervals of centers of gravity modulo for both athletes, projections of speeds, changes in speeds, projections of changes in speeds

Athletes	v	v_x	v_y	a	a_x	a_y
Tori (T. Koga)	0,04;1,43	-1,13;1,08	-0,71;1,42	0,51;0,93	-2,21;1,17	-1,88;1,13
Uke	0,00;1,72	-1,71;1,61	-0,61;1,21	-1,01;0,94	-2,75;3,32	-1,61;0,96

by the fact that the attacking athlete makes more efforts in the horizontal plane, that is, he accelerates his opponent or stretches along the tatami.

The interval of values of projections of the velocities of the center of gravity on the Oy axis is larger for Tori [-0.71;1.42] 2.13 c.u./s than for Uke [-0.61;1.21] 1.82 c.u. e./s, that is, 1.2 times. This is explained by the fact that during the movement Tori had a relatively loose grip and Uke had the opportunity to partially control the movement of his center of gravity in the vertical plane. On video footage, he can be seen sliding down with Tori during the reception.

Intervals of change of speeds modulo at the transition between cyclograms by Tori [0.51; 0.93] 0.42 c.u./s, for Uke [-1.01; 0.94] 1.95 c.u./s. The length of the modulo speed change interval is 4.6 times longer for Uke. This also indicates that Tori is accelerating Uke in the process of preparing and delivering the move, or is using his effort.

The length of the interval of change of speeds in the projection on the axis Ox y Uke [-2.75; 3.32] 6.07 c.u./s, Tory's [-2.21; 1.17] 3.38 c.u./s, i.e. 1.8 times less. The length of the interval of speed change in the projection on the Oy axis y Uke [-1.61; 0.96] 2.57, Tori [-1.88; 1.13] 3.01 c.u./s.

Conclusions. The investigated throw belongs to the group of combined techniques. The considered pickup option is based on two models: a lever and a mechanical block. The trajectory of Uke's center of gravity indicates that before throwing, Tori swings him in a vertical plane. In the process of preparing and performing a technical action, the attacking athlete also accelerates his opponent. The intervals of values of the speed of the center of gravity and changes in the speeds of the center of gravity modulo during the transition between cyclograms are larger for Uke (1.2 times and 4.6 times, respectively). Moreover, the main contribution to acceleration is made by movement in the horizontal plane. The intervals of projections of velocities and projections of changes in the velocities of the centers of gravity along the abscissa axis are larger for Uke (1.5 times and 1.8 times, respectively).

Thus, it can be noted that in the training process in judo, as well as in any kind of wrestling or martial arts where throws are used, it is advisable to include in the preparation of the technique a preliminary swing of the opponent, acceleration in the horizontal plane, using the direction of the opponent's movement and changing the direction of movement during throw time. Swinging the opponent in the vertical plane, accelerating in the horizontal plane, changing the direction of movement require a sufficiently high level of physical and technical readiness and can be introduced into the training process not earlier than the stage of sports specialization.

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