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METHODOLOGICAL JOURNAL****MENTAL ENLIGHTENMENT SCIENTIFIC –
METHODOLOGICAL JOURNAL**<http://mentaljournal-jspu.uz/index.php/mesmj/index>**KINEMATIC COMPARISON OF THROWING TECHNIQUE HIGHLY
QUALIFICATIONS HANDBALL PLAYERS****Sherzod O. Boltabayev***PhD student**Namangan State University**Namangan, Uzbekistan**E-mail: Shera_max@mail.ru***ABOUT ARTICLE****Key words:** technique, kinematic, jump shot, performance, speed of step.**Received:** 01.05.24**Accepted:** 03.05.24**Published:** 05.05.24**Abstract:** In this article, the kinematic indicators of the upper parts of the body during the jumping technique of handball players, who have been playing handball for 8 years, are determined and compared on the basis of analysis.**INTRODUCTION**

Forming a healthy lifestyle in our society, creating conditions for the population, especially the young generation, to regularly engage in physical education and mass sports, strengthening the confidence of young people in their will, strength and capabilities through sports competitions, large-scale works aimed at developing courage and patriotism, feelings of loyalty to the Motherland, as well as systematic organization of selection of talented athletes from among young people, and further development of physical education and mass sports are being carried out [1].

As a result of the attention paid to physical education and sports in our country, handball is developing along with all other sports. This, in turn, requires special responsibility from handball experts.

Training of highly qualified handball players by controlling technical and tactical skills and studying the biomechanical structure of each technical movement is one of the most urgent issues [6].

In order to reach the level of highly qualified athletes, it is necessary to participate in a certain amount of training and competitions [8]. A handball player uses various technical actions to capture the goal [4]. In the technique of handball, after taking three steps, the

handball player should jump up vertically as much as possible to shoot the ball towards the goal by relying on his strong leg, and raise the hand throwing the ball as high as possible and shoot to the empty point of the goal. [9].

Nowadays, the kinematic analysis of various technical movements is considered important for every coach, and based on the results of the analysis, it allows to improve the performances of the athletes, to optimize the decisions of the coaches regarding their strengths and weaknesses. Therefore, the subject of the kinematic characteristics of the technical movements of jumping and throwing the ball at the goal in highly qualified handball players is considered one of the urgent problems of today.

Studying the biomechanics of handball players' movements and determining the kinematic basis is one of the urgent problems today. Among our local scientists, J. Akramov, among our local scientists, substantiated the methods of observation and analysis of the criteria for throwing the ball into the goal in the handball game [2], A. Mominov, the methodology of improving the technical training of qualified handball players based on the use of special exercises [7]. , R. Ismailov have conducted studies on increasing the effectiveness of improving the attacking technical movements of skilled handball players [5].

The purpose of the study. Analysis and comparison of the kinematic parameters of the bones of the shoulder and elbow joint during the technical movements of throwing a ball at the goal.

- to determine the kinematic parameters of the bones of the shoulder and elbow joint during the technical movements of throwing the ball at the goal;

- to compare the kinematic indicators of the bones of the shoulder and elbow joint during the technical movements of throwing the ball at the goal.

Materials and Methods. The research work was carried out at the "SPORTS 360° 3D MA biomechanical laboratory" at the Uzbek State University of Physical Education and Sports. 3D data is independent of illumination changes and is considered reliable for evaluating body skeletal systems [3]. 10 handball players who have mastered sports and are candidates for master of sports, who have been playing handball regularly for 8 years, participated in the championship of Uzbekistan (age 21.09 ± 3.05 years; 176.12 ± 8.33 cm; 72.65 ± 12.17 kg). At the beginning of the study, after signing the research participation document, they were given 15 minutes to warm up and understanding of how to shoot the ball into the goal and the features of 3D analysis. Subjects were instructed to jump as high as possible and throw the ball into the hoop and the landing phase after throwing the ball.

When comparing the kinematic indicators of the master of sports and candidate for master of sports handball players in the technique of throwing the ball into the goal by

jumping, the following differences were found in the process of performing the technical actions of throwing the ball into the goal by jumping.

Table 1**Running time indicators**

	Sport ustasi	Sport ustaligiga nomzod	Farqi
Parametr	Qiymati		
Tezlik [bir daqiqadagi qadamlar]	127.60 [ppm]	130.90 [ppm]	3.3 [ppm]
Ko'tarilish vaqti	0.48 [s]	0.67 [s]	0.19 [s]
Tayanish vaqti	0.19 [s]	0.16 [s]	0.3 [s]
Chap oyoq tayanish vaqti	3.15 [s]	5.98 [s]	2.83 [s]

According to the results obtained in the 3DMA laboratory, the speed of the steps of the handball players for the jump (steps per minute) is 127.60 ppm, the time of rising into the air during the jump is 0.48 s, and the resting time of the left leg is 3.1500 s. While performing the same actions, the handball players candidate for master of sports showed the result of the speed of steps for jumping (steps per minute) of 130.90 ppm, the time of rising into the air during the jump is 0.67s, the time of resting the left foot is 5.9833s.

The analysis of the obtained results shows that the parameters of the handball players (steps per minute) of the candidates for master of sports differed by 3.3 ppm, by 0.19s during ascent, and by 0.3s during leaning. It was found that the left leg performed movements in 2.83s during rest (Table 1).

We observed the following results regarding the volume of running in master of sports and candidate for master of sports handball players during the technical movements of jumping into the goal (Table 2).

Table 2**Running volume indicators**

	Sport ustasi	Sport ustaligiga nomzod	Farqi
Parametr	Qiymati		
Vertikal tebranish	583.07 [mm]	727.26 [mm]	143.19 [mm]
O'ng oyoqning yerga tushish masofasi	270.31 [mm]	245.87 [mm]	24.44 [mm]
Chap oyoqning yerga tushish masofasi	75.34 [mm]	197.39 [mm]	122.05 [mm]
O'ng oyoqning harkatlanish masofasi	-348.65 [mm]	-360.31 [mm]	11.66 [mm]
Chap oyoqning harkatlanish	-347.07	-372.44 [mm]	25.37 [mm]

masofasi	[mm]		
O'ng oyoqning yerga tayanish masofasi	682.87 [mm]	490.38 [mm]	192.49 [mm]
Chap oyoqning yerga tayanish masofasi	439.43 [mm]	242.29 [mm]	197.14 [mm]
O'ng oyoq barmoqlarining yerga tegishdagi X koordinatasi	-600.66 [mm]	-1095.05 [mm]	494.39 [mm]
O'ng oyoq barmoqlarining yerga tegishdagi X koordinatasi	787.35 [mm]	451.77 [mm]	335.58 [mm]

The vertical swing of the master of sports handball players was 583.07 mm, the landing distance of the right leg was 270.31 mm, and the landing distance of the left leg was 75.34 mm. While performing the same technical movements, the candidate for master of sports handball players registered a vertical swing of 727.26 mm, the distance of the right leg landing on the ground was 245.87 mm, and the distance of the left leg landing on the ground was 197.39 mm.

According to the analysis of the results obtained in the 3DMA laboratory, the results of the handball players in the master of sports category and the candidate for the master of sports handball players differ as follows. During the technical movements, it was observed that the handball candidates for master of sports had 143.19 mm more vertical swing, 24.44 mm less right leg landing distance, and 122.05 mm more left leg landing distance compared to master sports handball players. (Table 2).

Table 3

Kinematic summaries of the upper body (shoulder joint)

Yelkalar	Sport ustasi		Sport ustaligiga nomzod		Farqi	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
O'ng qo'lni ko'tarish (tepaga/orqaga)	88.97°	-41.40°	71.20°	-52.47°	17.77°	-11.07°
Chap qo'lni ko'tarish (tepaga/orqaga)	14.31°	-24.66°	32.17°	-69.56°	17.86°	44.9°
O'ng qo'lni ko'tarish vertikal holatda (tepaga/orqaga)	157.24°	-93.71°	37.86°	-69.89°	119,38°	23.82°
O'ng qo'lni ko'tarish vertikal holatda (tepaga/orqaga)	-17.77°	-36.75°	14.64°	-43.20°	-3.13°	6.45°
O'ng qo'lni ko'tarish (yon)	65.33°	-13.61°	63.08°	9.31°	2.25°	-4.3°

tomonga/avvalgi holatiga)						
Chap qo'lni ko'tarish (yon tomonga/avvalgi holatiga)	71.54 °	5.54 °	65.44°	28.48°	6.1°	22.94°

According to the kinematic conclusions of the upper parts of the body, during the technical movements of jumping and throwing the ball at the goal (Fig. 1), the indicators of the master of sports and candidates for master of sports handball players are as follows: lift (up/back) maximum 88.97° minimum -41.40°, left arm lift (up/back) maximum 14.31° minimum -24.66°.

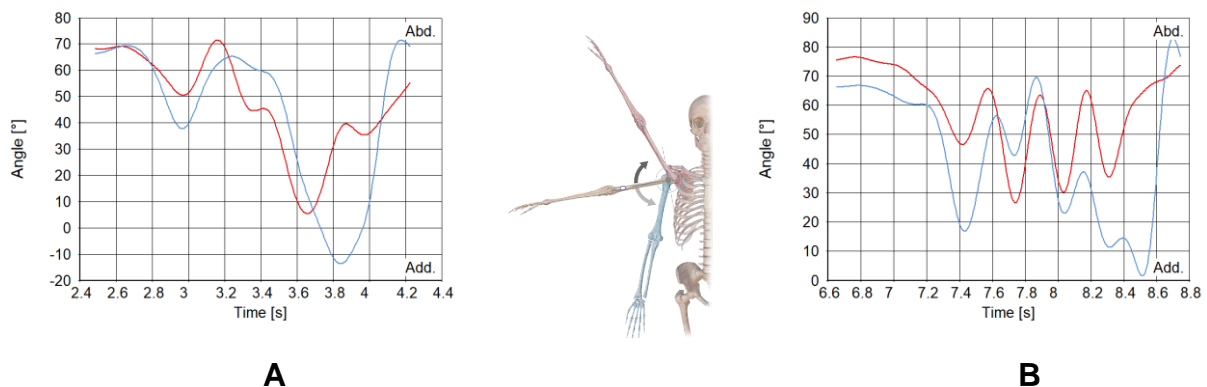


Figure 1. Dynamics of movement of the shoulder joint during the technical movement of throwing the ball at the goal. Dynamics of movements of handball players in the A-Sport master category. Dynamics of movements of handball players, candidates for B-Sport mastership.

Right arm lifting (up/back) maximum 71.20° minimum -52.47°, left arm lifting (up/back) maximum 32.17° minimum -69.56 ° the result was observed.

The analysis of the results obtained during the execution of this technical movement is as follows: handball candidates for master of sports handball players raise the right hand (up/back) by a maximum of 17.77° less, a minimum of -11.07° more, than the handball players of the master of sports category. lifting (up/back) performed 17.86° less at maximum, and 44.9° at minimum (Table 3).

Table 4

Kinematic summaries of upper body parts (elbow joint)

Tirsaklar	Sport ustasi		Sport ustaligiga nomzod		Farqi	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
O'ng tirsakni bukish,tushirish	93.94 °	49.86 °	119.04°	42.96 °	25.1°	6.9°
Chap tirsakni bukish,tushirish	93.16 °	63.00 °	116.09°	67.52°	22.93°	4.52°

The following differences were determined by the results of the analysis of the elbow joint of the candidate master of sports and master of sports handball players during the technical movements of throwing the ball into the goal by jumping (Fig. 2). It was found that candidates for master of sports handball players performed excessive movements in the process of performing a technical movement of the right elbow bending and lowering the maximum 25.1° less, minimum 6.9° more, bending and lowering the left elbow maximum 22.93° , minimum to 4.52° (Table 4).

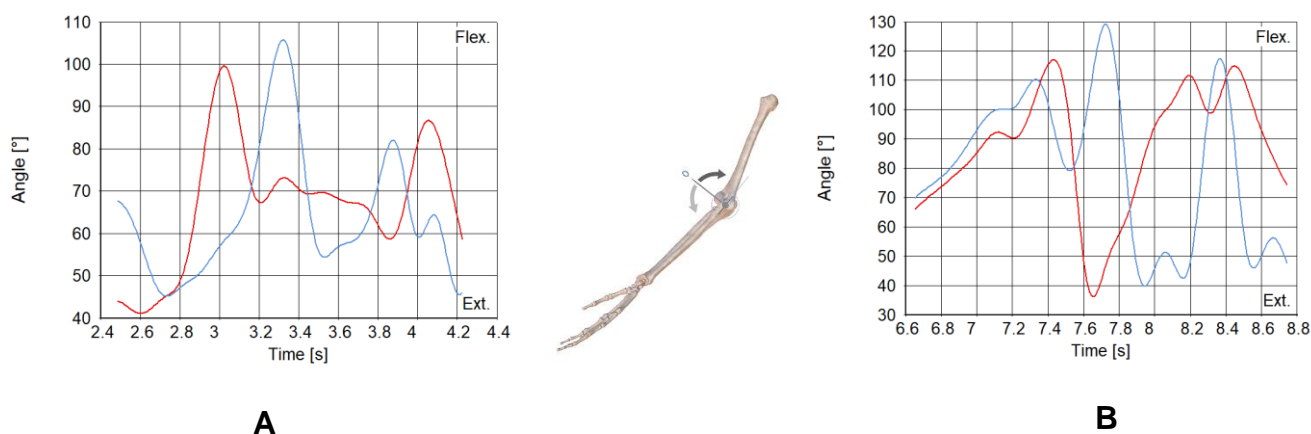


Figure 2. Dynamics of movement of the elbow joint during the technical movement of throwing the ball at the goal. Dynamics of movements of handball players in the A-Sport master category. Dynamics of movements of handball players, candidates for B-Sport mastership.

Summary. The following conclusions can be drawn from our research based on the 3D biomechanical analysis of handball players' attack technique:

1. The analysis of the research carried out by local and foreign scientists on the topic of the research revealed to us the need for kinematic analysis of the offensive technical movements of handball players of various sports categories.

2. The analysis of the obtained results shows that the parameters of the handball players (steps per minute) of the candidates for master of sports differed by 3.3 ppm, by 0.19s during ascent, and by 0.3s during leaning. It was found that the left leg performed movements in 2.83s during rest.

Taking into account the above, we can say that the kinematic analysis of the movements of handball players of different sports categories to improve the attack technique allows creating an optimal model of technical movements, and handball specialists will have the opportunity to use these results.

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