

Analysis of competitive exercise technique for shot putters of different qualifications

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The article provides a comparative analysis of the shot put technique performed by athletes of different qualifications in sports competitions. Specific errors in the shot put technique using the spin technique by less qualified athletes, which can affect the results, have also been identified. The work established that higher sports performance, as well as an effective increase in the level of technique by young shot putters, can be achieved by using sports equipment of various weights during training.

Keywords: shot put, rational technique, technical training, young athletes, initial sports specialization, track and field, sport competitions.

В статье проведён сравнительный анализ техники толкания ядра, выполняемой спортсменами разной квалификации в условиях спортивных соревнований. Также определены конкретные ошибки в технике толкания ядра способом «Кругового маха» у менее квалифицированных спортсменов, которые могут влиять на эффективность показанных результатов. В ходе работы установлено, что более высоких спортивных показателей, а также эффективного повышения уровня технической подготовленности юных толкателей ядра можно добиться путём использования в процессе тренировки спортивных снарядов различного веса.

Ключевые слова: толкание ядра, рациональная техника, техническая подготовка, юные спортсмены, начальная спортивная специализация, лёгкая атлетика, спортивные соревнования.

Introduction. Long-term training of track and field athletes is a long process of training and competitive activity, covering a number of stages, including: the stage of initial training; initial sports specialization; in-depth sports specialization; sports improvement and the stage of higher sports mastery [1].

In the training process of track and field athletes (including shot putters) at the stage of initial and advanced sports specialization, a number of specialists [2]–[5] point to the need of using a training methodology that will contribute to the achievement of high sports results by young athletes at subsequent stages.

It is well known that at these stages, during the educational and training process of young athletes, the coach should devote a large amount of time to the development of all components of sports training (physical, psychological, tactical, etc.). However, it should be noted that, due to the significant influence on the competitive result of the rational technique of performing the shot put, as well as the current level of development of sports achievements and the observed high competition in this type of throwing [6], their technical skills are of particular importance in the educational and training process of young shot putters.

The analysis of scientific and methodological literature indicates the high relevance of work related to improving technical readiness in athletics throwing. According to a number of authors [7]–[8], the effective solution of problems aimed at improving the technical readiness of throwers will be facilitated by a comparative analysis of the shot put technique performed by athletes of different qualifications in sports competitions, as well as the identification of specific technical errors that affect the effectiveness of the results shown.

The purpose of our research is to conduct a comparative analysis of the shot put technique (using the rotational technique) performed by mass athletes and qualified athletes in sports competitions.

Research results and discussion. Analysis of the sports results shown by Belarusian and foreign athletes at major international forums in recent decades [9] allows us to confidently assert the predominance of the rotational technique over the glide shot put technique in the process of performing competitive attempts. In our opinion, this fact is the reason that most trainers and teachers currently use the rotational technique when training young shot putters.

In order to determine the main errors in the shot put technique using the rotational method, which affect the effectiveness of the results, we carried out a comparative analysis of the technique of this exercise performed by athletes of different qualifications in sports competitions. In total, 27 athletes took part in our study, among whom 10 have youth sports categories (from the 2nd to the 1st youth category); 8 people – adult categories (the 3rd adult category – 1 athlete, the 2nd adult category – 3 people and the 1st adult category – 4 athletes); 7 athletes who have the rank of candidate of master of sports and 2 people who have the title of master of sports of the Republic of Belarus.

The analysis of the technique was carried out using the «InShot» video editor, which is similar in parameters to desktop video editors and allows you to edit various photo and video materials [10]. In total, more than 96 video materials of competitive attempts performed by athletes at regional and republican athletics competitions in 2021–2022 were analyzed. After processing the data obtained, we selected and summarized in Figures 1–12 the most common technical errors that occur in young athletes and, in turn, are absent in qualified shot putters.

For a comparative analysis of a competitive exercise performed by athletes of different qualifications, we identified the most important elements of the shot put technique using the rotational technique, described in the scientific literature [11]–[13]. Starting from the starting position, the thrower sequentially goes through the following phases.

Double-support-initial phase – in this phase the athlete performs preparatory movements before turning – «swing». The weight of the athlete's body is slightly transferred to the right leg, which touches the surface of the circle with the entire foot, the left leg moves to the front of the foot. The movement of the arm without the core is performed freely and smoothly, with rotation of the shoulder girdle. As a result of these movements, by the end of the «swing» the thrower's body takes on a «twisted» position with good stable support (Figure 1, frame 1) [14], [15]. In addition, based on the analyzed data, it should be noted that when performing a «swing» in the two-support initial phase, some athletes can observe a position in which a very short swing is performed, practically without twisting the torso (Figure 1, frame 2).

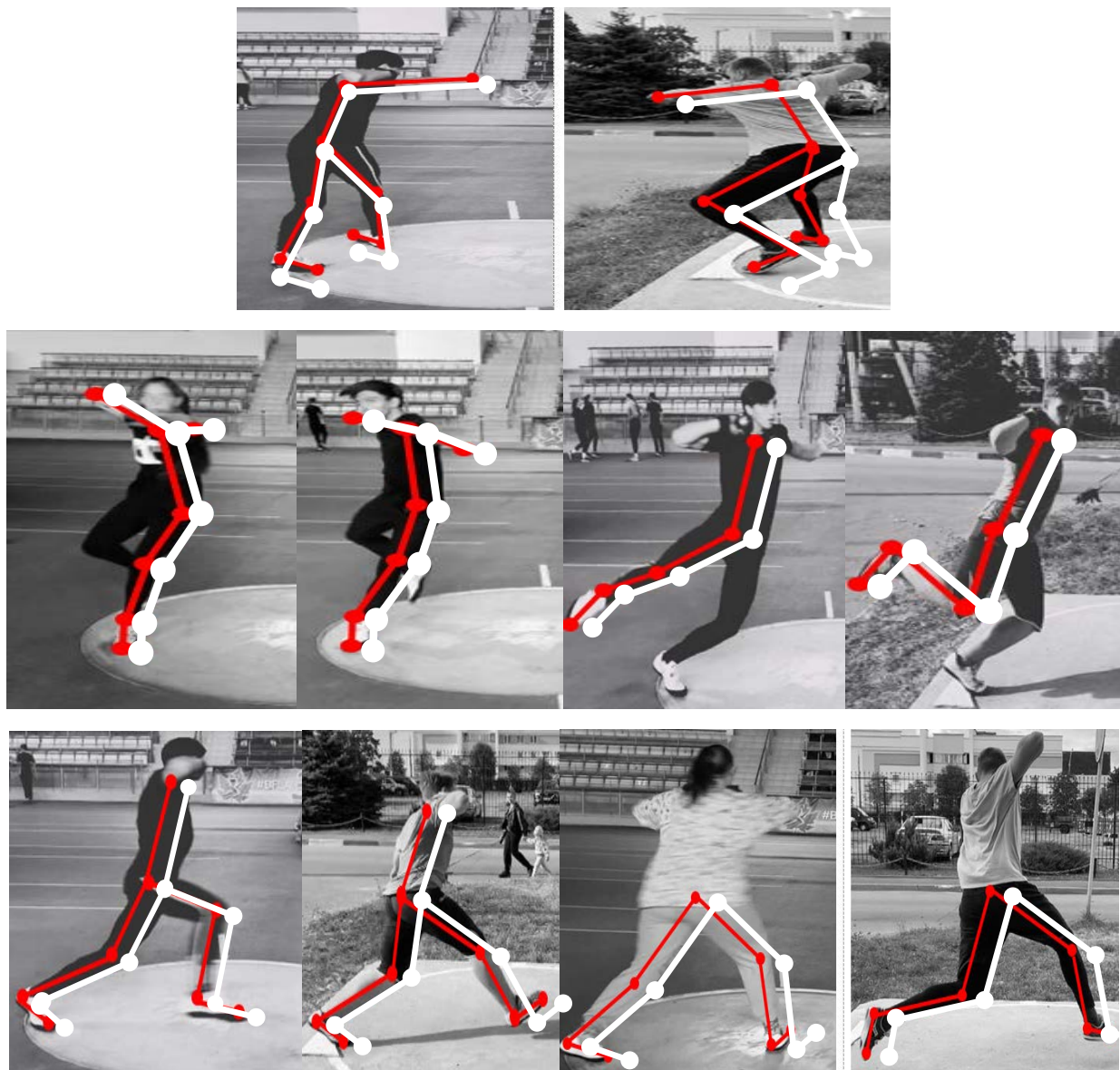


Figure 1 – Typical mistakes and rational execution of movements in the two-support initial phase, the single-support phase on the left leg, the unsupported phase

Single-support phase on the left leg – in this phase the athlete transfers the body weight to the left leg, followed by turning the foot on the toe box. When the foot moves, the left knee also rotates outward. The shoulders and the arm holding the shot lag behind, and the left arm is pulled back without crossing the transverse axis of the shoulders. After this, the athlete lifts his right leg from the surface of the circle and, with a circular swing motion (along an arc), moves his slightly bent right leg forward towards the landing area. In this phase, the following mistakes can be noted among young shot putters. Thus, due to their insufficient technical preparedness, when performing movements when the athlete begins to transfer body weight to the left leg, followed by turning the foot on the toe (Figure 1, frame 3), one can observe the abduction of the arm without a projectile beyond the transverse axis of the shoulders.

Qualified athletes do not make mistakes when performing this movement (Figure 1, frame 4). Also, when performing a circular swing movement with the right leg, the rational position is considered to be one in which the athlete maintains a vertical position of the body and moves the right leg, slightly bent, in an arc (Figure 1, frame 5) [16]. Typical errors observed in young athletes are deviation from this position, as well as lagging movement of the right strongly bent leg while the athlete performs a turn (Figure 1, frame 6).

It was noted [17] that the rational position when performing the movement, when the right leg is brought forward towards the push (Figure 1, frame 7), is a position in which the athlete continues to maintain a vertical position of the body, while the right, slightly bent leg finishes your movement through the greatest amplitude with an «attacking» movement of the knee forward. Based on our practical experience, this movement is the most difficult for young athletes to master. When performing it, they often lack a vertical position of the body during the turn, and there is also a delayed movement of the right leg (the leg remains behind the athlete) or a complete absence of an «attacking» position with the knee forward (Figure 1, frame 8).

From the time the left foot takes off from the far part of the throwing circle until the moment the right foot is placed on the surface of the circle, the **flight phase** begins. Despite the fact that this phase is the most passive, young athletes still experience errors when performing it, most often consisting of a sufficiently long duration (due to the movement of the hip of the right leg or pushing the left leg up) of the unsupported phase or its absence (moving on straight legs, Figure 1, frame 9), while qualified athletes strive to reduce the duration of the unsupported phase (Figure 1, frame 10) to a minimum.

Figure 2 shows typical technical errors when performing movements in the single-support phase on the right leg, the double-support-final phase and in the stopping phase, observed in competitive attempts by young athletes, which, in turn, were not recorded in qualified athletes.

When performing the shot put using the rotational technique, the **single-support phase on the right leg** begins with placing the right foot approximately in the center of the circle. The rational implementation of this phase is to maintain a vertical position of the body, a circular movement of the right leg is performed along a larger diameter, with the smallest fulcrum (foot on toe). Movements with the left leg should be performed with a smaller amplitude, followed by a quick and rigid placing of the leg at point-blank range, so that the turn in the lower parts of the body is ahead of the turn in the upper parts (Figure 2, frame 1). The straight position of the body, placing the right leg on the entire foot and a large amplitude of movement of the left leg when performing these movements will be errors (Figure 2, frame 2) in this phase.

After turning in a circular motion on the right toe, the athlete takes a position with his back to the toe board. In this position, young athletes (Figure 2, frame 3) have an excessive tilt of the torso forward (in the opposite direction from the toe board), which leads to the fact that in the next movement the duration of placing the left leg with the entire foot forward to the toe board of the circle will be longer, in comparison with qualified athletes (athletes try to maintain speed at the moment of rotation, being on the toe of their right foot, as well as the vertical position of the body (Figure 2, frame 4)).



Figure 2 – Typical mistakes and rational execution of movements in the single-support phase on the right leg, double-support-final phase, stopping phase

When placing the left leg on the surface of the circle, the athlete assumes **a two-support position** (two-support-final phase), in which his legs are slightly bent at the knees, the knees are spread apart, the position of the body is vertical and «closed» relative to the sector. A technically correct two-support position (Figure 2, frame 5) contributes to the preservation of the rotational movement, the accumulated energy and its further transfer to the projectile in the final strike [18]. The main mistake of young athletes in this position is the lack of a «closed» body position relative to the sector (Figure 2, frame 6). This error does not fully allow the necessary muscle groups to be used to perform a rational final strike. In addition, young athletes very often observe a deviation from the vertical position of the body, which can also affect the final result and its reduction, or even lead to a violation of the rules of the shot put competition (spade or landing of the projectile outside the sector).

Having reached a two-support position, the athlete begins to perform the final effort: extending the right leg, simultaneously rotating the pelvis, the left arm actively moves back (without falling below shoulder level), stretching the muscles of the chest and abdominals. After this, the muscles of the upper shoulder girdle are included in the work, which move the right shoulder forward, and at the same time the right arm at the elbow joint also extends, transferring the accumulated energy to move the projectile.

Young athletes' irrational movements can be observed when performing these movements (Figure 2, frame 7): the right leg is immediately straight; there is practically no rotation of the body around the vertical axis, passing through the foot of the left leg and the left shoulder, and there is also no rotation of the pelvis in combination with these rotational movements; by the time the shot is released, the line of the shoulders is not brought to the same plane as the pelvis. The left arm, with the left leg planted, should be smoothly and quickly retracted to the left, ahead of the rotation of the shoulder girdle (which is very often not observed by the young shot putters) – this action contributes to greater efficiency of the final effort [19]. The qualified athletes do not perform these errors (Figure 2, frame 8). It is also important to emphasize that placing the foot of the left leg in this phase can be done on the toe or on the entire foot. And, despite the emerging disagreements among leading experts on this issue, athletes use both options with equal success.

It should also be noted that when performing movements in the two-support-final phase, young athletes exhibit incorrect positions of the legs, pelvis, torso, arms and hands with the apparatus (Figure 2, frame 9). While the movements made by qualified pushers, with the timely activation of the muscles of the upper shoulder girdle, which move the right shoulder forward, at the same time extending the right arm at the elbow joint and thereby transferring the accumulated energy for the movement of the projectile, are considered the most rational (Figure 2, frame 10). Also, rational elements include the vertical position of the torso and the position of the hand, in which the hand is directed with the thumb down. In addition, qualified athletes continue to move their right leg and pelvis towards the release of the projectile, which is not observed in young shot putters.

After the projectile is released, the **body stopping phase** begins, in which qualified athletes stop the rotation by jumping from the left leg to the right leg, continuing the rotational movement of the body (Figure 2, frame 11). Young shot putters often neglect the rational execution of movements in this phase, which, in turn, can negatively affect the results of competitive attempts (Figure 2, frame 12).

Failure to comply with the identified rational movements in all phases of the shot put using the rotational technique can be regarded as typical errors in technique, which significantly reduce the final result of young shot putters when they perform full competitive attempts.

Conclusion. Our research allowed us to identify a number of errors in the technique of performing competitive attempts by shot putters of various qualifications, which can affect the effectiveness of competitive results by technically less prepared athletes.

There is no doubt that a lot of repetition of the competitive exercise, as well as its individual elements during training sessions in the process of many years of preparation, will contribute to a significant improvement in the technique of shot put using the rotational technique by young athletes. However, according to a number of experts [20]–[21] and our practical experience, higher sports performance, as well as an effective increase in the level of technical readiness by young shot putters, can be achieved by using sports equipment of various weights during training.

At the same time, questions regarding the use of changing the weight of the implements in the training process, which contributes to the qualitative improvement of the athlete's technical readiness parameters, still remain open, which, in turn, requires further research in this direction.

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