

Analysis of the technical difference between speed skating and speed roller skating

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Keywords: Speed skating; speed roller skating; difference; comparative analysis

Abstract: This article compares the technologies of speed skating and speed roller skating to analyze the differences between speed roller skating and speed skating between technology and posture. In terms of comparative analysis, summarize the differences in speed skating and speed roller skating, as well as problems that are easy to occur in teaching, training and competitions in two items, so as to put forward some methods and suggestions to provide a reference for improving the level of speed skating and performance.

1. Introduction

On July 31, 2015, my country successfully obtained the right to host the 2022 Winter Olympics, and Ice and Snow Sports opened a new page in my country. The State General Administration of Sport wants to carry out the "rotation ice" activity, and through this plan to achieve the selection and talent reserves of the athletes on the ice sports [1]. In order to be able to successfully hold the Beijing Zhang Dongdang Olympics as an Olympic event that has attracted much attention, under the call proposed by General Secretary Xi, "300 million people on the ice and snow", my country began to vigorously promote the development of ice and snow sports[2]. Zhangjiakou, as the Winter Olympics, The main stadium has proposed that by 2022, the overall target of the city's participation in ice and snow sports will reach more than 5 million, which is also a major promotion of the Zhangjiakou ice project [3]. Speed roller skating and speed skating are very similar in the form of expression, but there are large differences in the technology used by the two, so it is particularly important to understand the similarity and differences between the two. Complement each other, promote the improvement of teaching and training, and then make meager suggestions for speed skating training [4].

After long -term research and practice, speed skating has gradually evolved the speed roller skating. Due to the climate and temperature, speed skating training can be performed in winter, and speed roller skating training is performed in summer [5]. Therefore, the training status of speed skating and speed roller skating complement each other. However, there are some technical differences in the two. Therefore, exploring the technical differences between speed skating and speed roller skating will help accurately understand the technical and differences of the two. The coaches arranged the training methods and means reasonably during the training, and strived to

complement the advantages in practice, and promoted the improvement of teaching and training in the classroom, so as to provide a certain theoretical basis for speed skating and speed roller skating[6].

2. Research object and method

This paper takes the difference analysis between speed roller skating and speed skating as the main research object. By consulting the library of Zhangjiakou University and the Zhangjiakou Education and Sports Bureau's written materials on speed roller skating and speed skating. Interviews were conducted with teachers who teach ice sports in schools and society, and questions about ice skating and roller skating were asked about professionally trained athletes. Obtaining relevant guidance from experts is of great practical significance to the research of this paper.

3. Results and Analysis

3.1 Differences in technique and posture between speed skating and speed roller skating

Due to the different venues, seasons and equipment of the competition, speed skating techniques and postures are more standard and precise than roller skating. Comparing the techniques and postures of the two, the requirements of speed skating are not as strict as those of speed skating [7]. Therefore, even if there are slight deviations in the movements and techniques of speed roller skating during the competition, it will not affect the skating speed and sports performance too much. Therefore, the basic technique and posture of speed skating will be ignored during training. Not only that, but some techniques are the key factors affecting performance in speed skating, but they are not important in speed skating, so the differences between speed skating and speed skating techniques are far beyond our understanding.

3.2 Analysis of the starting technique and posture of speed skating and speed roller skating

3.2.1 Technique and posture of speed skating start

Usually, the starting technique of speed skating is divided into two types, one is open standing start, and the other is squatting start. Experienced competitive athletes will take the first option. This method can quickly enter the sliding state from a static state, and the application of action techniques is more reasonable[8]. Starting technique is particularly important to improve the performance of short and middle distance events. The key point of the starting technique is to use the front foot as a fulcrum of force, put all the inner edges of the back foot on the ice, keep the distance between the two feet wider than the shoulders, and look forward. The squat position is slightly higher than the other starting positions, and the center of gravity should be placed a little in front of the line between the two feet[9]. When starting, athletes need to raise their thighs high, keep their upper body leaning forward with all their heart, and focus on cutting the ice tightly when the skates hit the ice, and don't slip in the first few steps.

3.2.2 Technique and posture of speed roller skating start

The main starting technique of speed roller skating is to firstly require the athlete's upper body to lean forward at an angle of about 30 degrees, and look 10-12 meters ahead. Players should draw their shoulders slightly inward, the back of the whole body should relax naturally, the knee joints of both legs should be in a bent and half-squat state, the hips should be slightly backward, and the coordination of arms and legs should be consistent. In the process of gliding, push your feet on the

ground to increase the speed of gliding. That is, sliding while pedaling. But we must pay attention to one thing, that is, the faster the skating speed, the more outward the direction of our players' pedaling on the ice, so that the pedaling can fully exert force. When doing the leg retraction movement: the thigh must drive the calf, so that the knee joint can be fully bent and the calf can be relaxed; the leg retraction movement should be fast, and the leg retraction along the shortest route. Finally, it is necessary to consider that the movement of the center of gravity must be consistent with the movement of the body's center of gravity, so that the three points of the head, knees, and ankles just fall on a vertical line.

3.2.3 Similarities between speed skating and speed roller skating starting techniques and postures

Both speed skating and speed roller skating have variable speed capabilities including start, sudden acceleration, lunge and wheel sprint techniques, etc. However, starting is the beginning of a race and one of the key factors in determining performance. Speed skating and speed roller skating have similarities in starting posture and starting technique, so they both need to move their center of gravity forward, look forward, and keep their feet shoulder-width apart or is slightly wider than the shoulders.

3.2.4 Differences in starting technique and posture between speed skating and speed roller skating

Speed skating still has certain differences in starting technique and posture. There are two types of starting techniques in speed skating, one is the open vertical starting method, and the other is the crouching starting method. Although the starting process of speed roller skating is also evolved through speed skating, the standing postures of the two at the start are still different. The starting posture of speed skaters is obviously higher than that of speed skating, mainly to avoid slippage. Therefore, the starting posture of speed skating is low, and four-point support can be used, while the starting posture of speed skating is high, and sole support must be used to increase stability.

3.3 Technology and posture analysis of speed skating and speed roller skating straight

3.3.1 Technique and posture of speed skating straight

In the process of speed skating on straightaways, skaters must maintain a relaxed state at all times. Only by keeping their mind and body relaxed can they optimize their skating performance. However, while being relaxed, the skaters must still maintain a bent back posture and lower their body position while keeping their head up and looking forward.

3.3.2 Technique and Posture for Speed Roller Skating on Straightaways.

The main points of force for speed roller skating are the knee, ankle, and hip joints. Therefore, during the process of roller skating on straightaways, athletes must quickly and accurately adjust their center of gravity, with stable and continuous arm movements. They must maintain consistency with the upper body and push off the ground at an angle of approximately 50°. All parts of the body should exert balanced force, with a smooth and rhythmic motion for optimal speed roller skating performance.

3.3.3 Similarities between speed skating and speed roller skating straight track technique and posture

The most important thing in straight skating is to grasp the center of gravity. Speed skating and speed roller skating rely on the movement of the center of gravity to complete the straight. The technical principles of the two are completely consistent. The kicking (ground) angles of speed skating and speed roller skating are similar, and the sliding range between them is the same; the speed and strength of leg retraction are also the same; the direction of arm swing is side to back.

3.3.4 Differences between speed skating and speed roller skating straight track techniques and postures

The pedaling rhythm of speed skating is very fast, while the pedaling (ground) rhythm of speed roller skating is slow, and the direction and angle are also different, but the difference is not very obvious. The pedaling power of speed skating is significantly greater than that of speed roller skating and other places; the straight line trajectory of speed skating is poor and requires manual adjustment, while the linearity of speed roller skating is stronger than that of speed skating; the blade of speed skating is inside the ice, and the fulcrum is very firm. The fulcrum of the speed roller skating wheel is not firm on the ground; this leads to a lower posture in speed skating than in speed roller skating. Because this phenomenon can be explained by the principle of mechanics, and the posture and technical development of straight skating mainly come from the promotion of mechanics, which can ensure that athletes use the least force to obtain the maximum speed during the competition. It can be seen from this that there are differences between speed skating and speed roller skating in terms of pedaling rhythm, strength, sliding trajectory and height of the center of gravity.

The rhythm of the stride in speed skating is significantly faster than that of roller skating, and there are differences in direction and angle. However, the differences are not very distinct. The power exerted in speed skating is significantly greater than that of roller skating, and the skating trajectory in speed skating is less straight, requiring manual adjustment, while roller skating has a straighter trajectory than speed skating. The blades of speed skates are firmly rooted in the ice, providing a secure pivot point, whereas the wheels of roller skates are on the ground, resulting in a less secure pivot point. This leads to the fact that the posture of speed skaters is lower than that of roller skaters when skating straight. This phenomenon can be explained by the principles of mechanics, and the development of posture and technique in straight skating is mainly driven by the promotion of mechanics. This ensures that athletes can achieve maximum speed with minimal effort during competition. Therefore, it can be seen that there are differences between speed skating and roller skating in terms of the rhythm, power, skating trajectory, and center of gravity during the stride.

3.4 Technology and posture analysis of speed skating and speed roller skating curves

3.4.1 Technique and posture of speed skating curves

Speed skating on curves and straightaways are two fundamentally different techniques and postures. Due to centripetal and centrifugal forces, tilting occurs in curves. The posture and technique of athletes during curve skating are subject to varying degrees of change due to the effect of these forces. To adjust their center of gravity, athletes must modify their body tilt angle. The posture in curve speed skating is lower than that in straightaway speed skating, and the athlete's body will experience greater tilt. At high speeds, it is crucial to control the change in center of gravity. The head and body should be in a straight line, maintaining a uniform degree of tilt. During

curve speed skating, inertia can only be controlled through body posture, and the pivot point underfoot must be constantly adjusted. Athletes typically use the traditional technique of bringing the entire hip joint close to the inside of the curve, controlling the size and distance of centrifugal and centripetal forces while maintaining dynamic balance. The main condition that needs to be satisfied is the relative magnitude of the two forces. Therefore, the conclusion can be drawn that curve technique is achieved through active control of the hip joint.

3.4.2 Technique and posture of speed roller skating curve

The steps for speed skating on curves mainly consist of pressing to the left, pushing off the ground with the right leg, but it is crucial to grasp the timing. After retracting the leg, it is necessary to land in front of the left foot's left side. Pushing off with the left foot towards the back, retracting the leg, and landing along the front left side of the right foot. The same action is then repeated. To achieve centripetal force while skating on a curve, the body must lean towards the inside of the curve, shortening the distance between the body and the inner curve. This is primarily because the centripetal force of the hip joint decreases, and the body's tilt angle can be reduced, which can prevent the wheels from slipping, the detailed comparison results are shown in Table 1.

Table 1 Comparison of technical differences between speed skating and speed roller skating curves

Name	Short Track Speed Skating	Speed Roller Skating
sliding position	“ 《”side bend	The center of gravity is tilted into the arc
Pedal Ice/Ground Angle	45 ~30 °	45 ~30 °
Pedal ice/ground direction	Side-to-front push on the ice	Sideways pedal

3.4.3 Similarities between speed skating and speed roller skating cornering techniques and postures

To achieve proficiency in cornering techniques for skating, it is necessary to master the coordinated movement of the entire body, as well as the coordination between the legs. The angle of pushing off the ice or ground in both speed skating and inline skating is generally between 45 and 30 degrees, and the basic techniques for pushing off the ice or ground are similar. The arm swing technique is also similar. Therefore, there are significant similarities in cornering techniques between speed skating and inline skating.

3.4.4 Differences between speed skating and speed roller skating cornering techniques and postures

Due to the lower center of gravity in speed skating compared to inline skating, the centripetal force generated by speed skating in a turn is significantly greater than that of inline skating, while the centrifugal force generated by inline skating is smaller than that of speed skating. There are also differences in the pushing direction between the two, as the pushing force in speed skating is much greater than that in inline skating. In addition, pushing off with the front of the blade in speed skating is more conducive to generating power, while pushing off with the side and back of the wheel in inline skating is more conducive to stability. These differences result in disparities in the position of the blade/wheel during turns between speed skating and inline skating. Therefore, there are certain differences in the technique and posture for turns between speed skating and inline skating with respect to the direction and angle of the pushing force.

3.5 Analysis of the difference between speed skating and speed roller skating

From Table 2, we can observe that there are significant differences in the angles of squatting, weight transfer, lateral push-off timing, duration of push-off, and angular velocity of the leg and knee joint during push-off between speed skating and inline speed skating. Thus, it can be seen that the technical and postural difficulty of speed skating is relatively higher than inline speed skating. Moreover, the different techniques used in these two sports lead to different outcomes. Some force techniques are used to improve skating speed, while others are used to alter weight distribution. Additionally, the force angles, timing, and duration differ between speed skating and inline speed skating. Therefore, during learning and training, it is important to pay attention to these differences.

Table 2 Comparison of the differences between speed skating and speed roller skating

Projects	Center of gravity and power side stirrups/ time	Legs forcefully support the center of gravity/ time	Pedal ice force time/ms	Articular angular velocity %s
speed skating	later	longer	240	473
speed roller skating	sooner	shorter	209	376

3.6 Difference analysis of equipment used in speed skating and speed roller skating

The blades of speed skating shoes are made of hard materials and connected to the shoes through high-strength materials. The blades are designed as detachable, elongating the distance of the push, allowing athletes to better master sliding techniques. The extended sliding distance provided by the blades improves the technical performance of sliding. To precisely control the direction and speed of sliding, speed skating athletes require the blades to create grooves in the ice surface to prevent slipping. In contrast, inline speed skating utilizes the rolling of wheels on the ground. The support points of the inline skates are four points, and the support points change relative to the ground continuously as the four wheels rotate, thereby reducing friction and increasing speed. Consequently, different venues require different equipment, which is the fundamental difference between the equipment used in speed skating and inline speed skating.

4. Conclusions

The Differences in Starting and Skating between Speed Skating and Speed Roller Skating. The differences in starting between the two sports mainly manifest in factors such as standing posture, starting method, force exertion, and direction. The differences in straightaway skating between speed skating and speed roller skating mainly manifest in terms of the rhythm and power of the push-off, the trajectory of the glide, and the height of the center of gravity. The straightaway skating is primarily affected by the posture and center of gravity, while the curved skating is mainly due to the track layout. The differences in force exertion and equipment usage between speed skating and speed roller skating mainly manifest in the angle of force exertion during crouching, the timing of center of gravity and lateral force exertion, and the angle and timing of knee joint force exertion during push-off, which mainly stem from adjustments to the center of gravity.

In the training process of speed roller skating and speed skating, they complement each other, but the technical differences between the two should be noted. Whether it is the coach's "teaching" or the athlete's "learning", it is necessary to have a clear understanding of the differences between the two, and to strictly distinguish between them in training, conducting systematic learning. In the summer, speed roller skating can be used as an auxiliary training method for speed skating, but it

should not be used as the main training content. Otherwise, it may cause technical movements and skating posture of speed skating to deform, which will have a counterproductive effect.

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