

Research on the Training of Serving and Receiving Techniques for Table Tennis Players

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Abstract: *With the continuous improvement of the competitive level of table tennis, the role of serving and receiving techniques in matches has become increasingly prominent, which has a key impact on the technical level and competition results of athletes. Therefore, this article studied the training of serving and receiving techniques for table tennis players. This article delves into its theoretical foundation, training methods, influencing factors, and coping strategies. By elaborating on relevant principles, various training methods for serving and receiving serve are introduced in detail, which can enhance the serving and receiving abilities of table tennis players and provide theoretical and practical references for table tennis training.*

Keywords: *Table Tennis; Athletes; serve; Receiving and serving; Skill training*

1. Introduction

Table tennis, as a global sport, has a broad mass base and high competitiveness. In table tennis matches, serving and receiving serve are the beginning of every point competition, and the use of their skills directly affects whether athletes can take the initiative in the game, thereby affecting the outcome of the game. Serving, as an active scoring method in table tennis competitions, requires athletes to be proficient in various serving techniques. By changing the speed, rotation, and landing point of the ball, they can disrupt the opponent's rhythm and create favorable conditions for their own attack or defense [1]. And receiving the serve is to quickly make accurate judgments and take appropriate countermeasures after the opponent serves, turning passivity into initiative and laying the foundation for subsequent offense or defense. Therefore, training in serving and receiving techniques is crucial for table tennis players.

However, currently in the field of table tennis training, although there is some research and practice on serving and receiving techniques, there are still some problems. For example, the systematic and targeted training methods are insufficient, and the understanding of factors that affect training effectiveness is not comprehensive enough, resulting in unsatisfactory training results. Therefore, this study will delve into the training methods of serving and receiving skills for table tennis players, analyze various factors that affect training, and propose corresponding coping strategies, in order to provide more scientific and effective guidance for the training of table tennis players and improve their competitive level.

2. Theoretical basis of serving and receiving techniques in table tennis

2.1 Theoretical basis for serving skills

2.1.1 Principles of Mechanics

The generation and transmission of power are crucial when serving. This involves the principles of human motion mechanics, including muscle contraction, joint movement, and force transmission. For example, when serving with a forehand flat, athletes need to use leg kicks, waist rotations, arm swings, and other movements to transfer force from bottom to top and from inside to outside onto the racket, ultimately acting on the ball. The magnitude, direction, and point of application of force can affect the speed, rotation, and landing point of the ball [2]. According to Newton's second law, force is equal to mass multiplied by acceleration, and athletes can increase the speed of the ball by increasing the acceleration of the force exerted. Meanwhile, by adjusting the point and direction of force reasonably,

different rotational effects can be created. For example, when the racket rubs against the top of the ball, it will produce a spin; When the racket rubs against the side of the ball, it produces side spin.

2.1.2 Principles of Sports Biomechanics

From the perspective of sports biomechanics, the coordination and rhythm of serving movements are crucial for improving the quality of serving. The movements of various parts of the human body need to cooperate and coordinate with each other to form a coherent process of exerting force. For example, when serving, the kicking action of the legs should be closely coordinated with the rotation of the waist, the swing of the arms, and the exertion of the wrist to form a complete power chain. At the same time, the sense of rhythm in the movements is also very important. A reasonable rhythm can help athletes better control the timing and intensity of their power, and improve the stability and accuracy of their serve. For example, when sending a high throw serve, athletes need to accurately grasp the timing of the ball's drop and release it by quickly swinging their arms and shaking their wrists.

2.2 Theoretical basis for receiving and serving skills

2.2.1 Principles of Visual Perception and Judgment

When receiving a serve, athletes need to accurately perceive the information of the ball through the visual system, including the speed, rotation, and landing point of the ball. This involves the principles of visual perception and judgment. The visual system converts the received light signals into neural signals, which are transmitted to the brain for processing and analysis. Athletes need to improve their visual acuity and reaction speed through training in order to judge the incoming ball more quickly and accurately [3]. For example, by observing the opponent's movements, posture, and direction of force when serving, athletes can make preliminary judgments on the rotation and landing point of the incoming ball. At the same time, athletes also need to adjust their positioning and movements in a timely manner according to the flight trajectory and speed changes of the ball, and be prepared for receiving and serving.

2.2.2 Motion response and coping principles

On the basis of accurately judging the incoming ball, athletes need to react quickly and choose appropriate technical movements for receiving and serving. This involves the principles of motor response and coping. Motor response refers to the rapid response ability of the human body to external stimuli. Athletes need to improve their reaction speed and accuracy of movements through long-term training. For example, when receiving a fast topspin, the athlete needs to quickly pull the ball and use reasonable dribbling, hitting, and receiving movements to return the ball. At the same time, athletes also need to flexibly adjust their technical movements and power methods according to the rotation and landing of the incoming ball, in order to achieve the best receiving and serving effect. For example, when receiving a topspin, athletes can use rubbing or pulling to counterattack, but they need to pay attention to adjusting the angle of the racket and the direction of the force to counteract the rotation of the ball.

3. Training methods for serving skills of table tennis players

3.1 Basic serve technique training

In the training of basic serving skills in table tennis, both forehand and backhand flat serve training have their own key points.

When training for forehand flat serve, the preparation posture should be close to the side of the table, with feet slightly wider than the shoulders on both sides, knees slightly bent, center of gravity slightly to the right, and right foot slightly behind. Hold the clapper and naturally relax and place it in front of the right side, with the clapper face slightly vertical. If not holding the clapper, naturally bend it in front of the left side. In terms of action essentials, throwing the ball should be done gently upwards and at a moderate height, about 15-20 centimeters away from the table. At the same time, the body should turn right, the center of gravity should be shifted to the right foot, and the right arm should be used to trigger the racket; When hitting the ball, press your right foot on the ground, turn your body left, and shift your center of gravity to your left foot. Use your right arm to push forward and hit the middle and upper parts of the ball. The first landing point is in the center of the table. After hitting the ball, swing your arm along with the momentum and keep up with your center of gravity. The practice

methods include fixed-point serving, which involves repeatedly practicing with a fixed landing point to improve accuracy and stability; There is also playing against the wall, maintaining a distance of 2-3 meters from the wall, and practicing the rebound of the ball to familiarize oneself with the rhythm of the movement and improve ball control ability. Pay attention to throwing the ball smoothly, coordinating the hitting force, and controlling the hitting position and strength.

The preparation posture for backhand flat serve training is to keep your body close to the left side of the table, with your feet slightly wider than your shoulders and knees slightly bent. Your center of gravity is slightly to the left, with your left foot slightly behind. Hold your hands and naturally relax and place them in front of your left side, with the racket face slightly vertical. If you don't hold your hands, naturally bend them in front of your right side. The key to the action is to throw the ball at a moderate height, about 15-20 centimeters away from the table, while turning left, shifting the center of gravity to the left foot, and using the left arm to trigger the racket; When hitting the ball, press your left foot on the ground, turn your body right, and shift your center of gravity to your right foot. Use your left arm to push forward and hit the middle and upper part of the ball. The first landing point is in the left area of the table. After hitting the ball, swing your arm along with the momentum and keep up with your center of gravity. The practice method includes a backhand position fixed-point serve, which can improve the accuracy and stability of backhand serve; And practicing backhand diagonal serve can improve the ability to control the landing point of backhand serve. It is also important to pay attention to the stability of throwing the ball, the coordination of hitting force, and the control of hitting position and force.

3.2 Rotating serve technique training

In the training of spinning serve technique, both forehand spin and backhand spin have their own characteristics and requirements.

When training with a forehand spin, the key points of the action should be to throw the ball slightly upwards and forward, with a height slightly higher than that of a forehand flat serve. The body should turn right, the center of gravity should be moved to the right foot, and the racket should be pulled from the lower back of the right arm with the racket face tilted back later; When hitting the ball, place your right foot on the ground, turn your body left, and shift your center of gravity to your left foot. Use your right arm to exert force forward and downward, and rotate your wrist inward to rub against the lower part of the ball. The first landing point is in the center of the table, close to the net position. After hitting the ball, your arm and center of gravity follow suit. The main technique of exerting force is to rotate the waist to drive the arm and wrist to work together. The waist rotation should be rapid and powerful, the arm swing should have acceleration, and the wrist rotation should be appropriate. The practice method includes a spin ball serving practice that combines changes in landing points, improving control over landing points and rotations by adjusting the landing points; And the practice of counter attacking with topspin in coordination with peers to enhance practical application ability. Common errors such as excessive tilting of the racket face can easily cause the ball to fall into the net, requiring adjustment of the racket face angle, control of force, and degree of friction; If the force is not coordinated, it is necessary to strengthen coordination training.

The backhand topspin training has the characteristics of fast speed, strong rotation, and multiple changes in landing points. The ball flies with obvious topspin and rushes forward after touching the table. The key to the action is to throw the ball slightly upwards and backwards, turn left, shift the center of gravity to the left foot, and use the upper back of the left arm to trigger the racket with a slightly forward leaning racket face; When hitting the ball, place your left foot on the ground, turn your body right, and shift your center of gravity to your right foot. Use your left arm to exert force forward and upward, and rotate your wrist outward to rub against the upper part of the ball. The first landing point is in the left area of the table, close to the net position. After hitting the ball, your arm and center of gravity follow suit. The training method includes practicing topspin by adjusting the friction area and force to improve control over rotation and landing points; And practice spinning balls at different positions to enhance the ability to use them in different positions. The training points include paying attention to the coordination of force, controlling the angle of the racket and the friction area to produce an upward spin effect, as well as paying attention to the landing point and speed control of the ball, and adjusting it reasonably according to the opponent's situation.

3.3 High difficulty serve technique training

In the training of high difficulty serve techniques, the training of side spin and counter spin serve, as well as the training of combination serve techniques, all have their unique points and methods.

In terms of serving training for side spin and counter spin, side spin tends to deviate to one side during flight, making it difficult to determine the landing point; The combination of reverse spinning ball and various rotations makes the flight trajectory and rotation effect more elusive. When serving a side spin ball, such as a forehand side spin, after throwing the ball, the body turns right, the center of gravity moves to the right foot, and the right arm pulls the racket behind. When hitting the ball, the right foot hits the ground, the body turns left, the center of gravity moves to the left foot, and the right arm exerts force forward. The wrist rotates outward or inward to rub against the side of the ball, producing a side spin effect. After hitting the ball, the arm and center of gravity follow suit. The reverse spin ball serving action is complex, requiring the simultaneous use of wrist rotation and arm swing to create a complex rotation when hitting the ball. For example, the forehand reverse spin ball first uses wrist internal rotation to produce a back spin, and then uses wrist external rotation and arm swing to produce side spin at the moment the ball leaves the racket. The training methods include using auxiliary equipment to practice, adjusting equipment parameters for targeted training; Practice simulating competition scenarios to master the timing and methods of applying skills in practical situations. The training difficulty gradually increases. In the early stage, familiarize oneself with basic movements and rotation effects. In the middle stage, increase the difficulty and combine tactical awareness training. In the later stage, train and cultivate psychological qualities in competition situations.

When training in combination serving techniques, the design principles should be based on the characteristics of the opponent and the situation on the field. For example, when the opponent's backhand serve is weak, a combination of forehand and backhand serve should be designed to reach the opponent's backhand position. When the opponent is not proficient in handling the topspin, a combination of topspin and topspin serve should be designed, while paying attention to variability and suddenness. The first practice method is to develop different serving combination routines and repeatedly practice, familiarizing oneself with the coordination of movements and rhythm changes; The second is to flexibly use combination serving techniques in actual combat to improve application and adaptability. The training effect is evaluated by observing the accuracy, variability, and effectiveness of athletes' combined serving during practice and competition. Accuracy is assessed by whether they serve according to predetermined routines and landing points, variability is assessed by whether rotation, speed, and landing points are diverse and sudden, and effectiveness is assessed by whether they can disrupt the opponent's rhythm and create opportunities for attack and defense.

4. Training methods for receiving and serving skills of table tennis players

4.1 Judgment training for receiving and serving

The judgment training of receiving and serving mainly includes two important aspects: visual observation training and prediction thinking training, which play a key role in athletes' accurate response to incoming balls.

In visual observation training, there are various specialized methods used to enhance athletes' ability to observe the details of serving movements. Gaze practice requires athletes to be highly focused and carefully observe the key parts of the opponent's serve. For example, closely monitor the contact point between the racket and the ball, as this can directly reflect the rotation and strength of the incoming ball; At the same time, pay attention to the movements of the wrist, as the flipping and force application of the wrist contain information about the nature of the incoming ball. Through this gaze practice, athletes can capture more key information about the incoming ball. Tracking exercises emphasize that athletes need to observe the entire trajectory of the ball, from the moment of throwing the ball, to the process of hitting the ball, and then to the flight path of the ball, to fully understand the state of the ball's movement. In this way, athletes can more accurately determine important properties such as the direction of rotation, speed, and landing position of the incoming ball.

Predictive thinking training requires cultivation from multiple dimensions. On the one hand, it is necessary to make athletes deeply familiar with their opponents' serving habits, including common rotation types, speed preferences, and commonly used serving landing points. For example, some

opponents are accustomed to throwing spin balls and landing them mostly in the center of the table. After understanding these characteristics, athletes can prepare in advance to deal with them. On the other hand, based on the opponent's position on the table, it is also possible to make reasonable predictions about the direction of the incoming ball. Based on these predictions, athletes can plan corresponding receiving strategies in advance, such as selecting appropriate pushing, rolling, or pulling techniques for different incoming balls, in order to take the initiative in receiving and serving.

4.2 Training of technical movements for receiving and serving

The technical training for receiving and serving includes pushing, rolling, and pulling the ball. Each type of training has its specific technical essentials, applicable situations, practice methods, and other key points.

In push and serve training, the technical essentials require athletes to keep their bodies close to the table, stand with their feet parallel and knees slightly bent, naturally bend their arms and place the racket on their chest. When hitting the ball, they should use the strength of their arms and wrists to face the ball forward and block it back. At the same time, they should control the angle of the racket and the hitting position to cope with different incoming balls. This technique is suitable for dealing with fast balls and non spinning balls. When facing fast balls, it can quickly block them to maintain rhythm, while when facing non spinning balls, it can use the racket to control stable counterattacks. The practice methods include practicing different routes (such as straight and diagonal push blocks) to improve the ability to deal with balls coming from different routes, as well as combining strong and weak push blocks to master the changes in strength and control the speed and landing point of the ball. The training focuses on improving the accuracy, stability, and adaptability to incoming ball strength and rotation in pushing and blocking.

In terms of ball rolling and receiving training, the movement is characterized by slightly turning the body to the right, naturally bending the arm and guiding the racket to the lower right side of the body. When hitting the ball, the arm faces the ball to the front left and uses the strength of the wrist and fingers to rub the bottom or middle lower part of the ball, causing it to spin back. Its changing modes include slow rubbing, fast rubbing, spinning and non spinning rubbing balls, etc. Slow rubbing is used to control the rhythm, fast rubbing can disrupt the opponent's rhythm, and the combination of spinning and non spinning rubbing balls can increase the ball's variability. The first training method is to conduct landing point control exercises, allowing athletes to learn how to rub the ball to different landing points and adjust the opponent's position; The second is to practice the connection between ball rolling and other techniques (such as turning and pulling the ball after rolling, pushing and blocking the ball after rolling) to improve adaptability. A common problem is that improper force can cause the ball to spin insufficiently or land incorrectly. The solution is to strengthen wrist and finger strength training, and improve control over the hitting area and strength through repeated practice.

When training to pull and receive the ball, the technique requires the athlete to lower their center of gravity, spread their feet slightly wider than their shoulders, let their arms naturally hang down, and guide the racket to the back of their body. When hitting the ball, their legs press the ground, their body rotates forward and upward, their arms quickly swing forward and upward, and their wrists rotate inward. They use the racket to rub against the middle and upper parts of the ball and pull it up. The power technique is based on kicking the ground with the legs, transmitting force to the arms and wrists through body rotation to produce strong rotation and speed of the ball. The training methods include practicing pulling the ball with different rotations to help athletes adapt to receiving and starting various rotating balls, as well as practicing changing the rhythm of pulling the ball (such as combining fast and slow pulling) to improve rhythm control ability. When using the pull ball receiving and serving strategy in actual combat, the timing and method of the pull ball should be selected based on the opponent's serving characteristics and the situation on the field. For example, when the opponent makes a spin, the pull ball can be used to actively attack and disrupt the opponent's defensive rhythm.

4.3 Tactical awareness training for receiving and serving

The tactical awareness training of receiving and serving is crucial for athletes to gain an advantage in the game, mainly covering two aspects: tactical selection training and transitional tactical training.

In the tactical selection training of receiving and serving, different game situations require different tactics. When leading, active attacking tactics should be adopted, using the receiving serve to initiate attacks and expand the leading advantage. For example, by using aggressive techniques such as

dribbling, the opponent's rhythm can be disrupted. When falling behind, it is necessary to defend steadily, ensuring stable receiving and serving to reduce errors, and then seeking opportunities to counterattack, such as using techniques such as ball rolling to transition and waiting for the opponent's mistakes. When drawing, it is important to control the pace and disrupt the opponent's rhythm by cleverly pushing and rolling the ball, in order to find scoring opportunities. At the same time, it is necessary to choose tactics based on the opponent's serving characteristics and one's own technical advantages. If the opponent is good at making a topspin and pulling the ball well, then the ball can be pulled to attack. By simulating competitions and other training methods, athletes can improve their tactical selection ability in actual combat.

The training of connecting tactics after receiving the serve is equally crucial. After receiving the serve, cooperate with your partner and adjust flexibly according to the opponent's return of the ball. When controlling the ball to the opponent's weak area, it is necessary to cooperate in launching an attack in a timely manner, such as using cross positions and other methods to pressure the opponent in doubles. If the opponent's return quality is high, it is necessary to switch to defense, patiently wait for opportunities, maintain a good defensive posture, observe the opponent's loopholes, and decisively counterattack once there is an opportunity, such as pushing or rubbing the ball to defend first, and then finding opportunities to pull the ball and attack.

5. Conclusion

The training of serving and receiving skills for table tennis players is a complex and systematic project, involving multiple aspects such as theoretical foundations, training methods, and influencing factors. Scientific and reasonable training methods are the key to improving athletes' serving and receiving abilities. During the training process, attention should be paid to the training of basic skills, gradually improving the technical level, and targeted training should be carried out based on the individual characteristics and competition needs of athletes. In the future, we can further explore how to combine modern technological means with training methods to improve the accuracy and efficiency of training. At the same time, more personalized training research can be conducted for athletes of different age groups and levels, providing stronger support for the development of table tennis.

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