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A Study on the Development Trends of Table Tennis Receive Techniques Based on Video Analysis

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Abstract: This paper systematically examines the development and emerging trends of table tennis receiving techniques in international elite competitions over the past decade through the use of video analysis. By analyzing match footage from significant events such as the Olympic Games and the World Table Tennis Championships, and combining motion recognition with statistical methods, the study identifies changes in crucial aspects of receiving, including reaction time, stroke types, placement distribution, and tactical combinations. The results suggest that contemporary receiving techniques are characterized by increased speed, precision, variability, and consistency. Techniques like the backhand flick, short pushes, and long chops have become more prominent and are now integral to offensive strategies. The findings provide valuable data for athlete training and tactical improvement.

Keywords: Video Analysis; Table Tennis; Receiving Technique; Technical Development; Motion Recognition

Introduction

The receiving phase, where players respond to an opponent's serve, is a pivotal point in table tennis that significantly impacts the game's rhythm and match outcomes. As equipment and rules continue to change, receiving techniques have seen ongoing evolution. In this study, leveraging video data from international elite competitions over the past decade, we utilize computer vision and sports biomechanics to quantitatively analyze the frequency, spatiotemporal characteristics, and tactical efficacy of various receiving techniques. The objective is to discern underlying developmental trends and performance-influencing patterns, providing a theoretical basis for training and tactical innovation.
1 Overview of Table Tennis Receive Techniques

1.1 Fundamental Concepts of Receive Techniques

Receive techniques in table tennis are the technical actions a player performs in response to an opponent's serve, considering the ball's spin, speed, placement, and trajectory. As one of the five fundamental skills in the sport—alongside serving, pushing, attacking, and looping—the receive involves various methods such as short pushes, long chops, flicks, backhand or forehand \banana flips\ (wrist flicks with heavy topspin), quick blocks, and fast drives. Effective receiving requires not only acute perceptual judgment and rapid reaction but also precise control over racket angle, timing, and the direction of force application to counteract different types of spin (e.g., topspin, backspin, sidespin). In modern table tennis, the importance of the first three strokes is heightened, with the receive—being the second stroke—often determining whether a player gains the initiative or is forced into a defensive position. Thus, it has become a critical phase that combines defensive stability with offensive potential.

1.2 Strategic Importance of Receive Techniques in Competition

The receive is strategically vital in table tennis matches, acting as a bridge between defense and offense. It can determine the success of the server's pre-planned tactics and can also create immediate scoring opportunities or initiate attacks. With the introduction of the 40+ plastic ball, which has reduced speed and spin, receivers now have more time to assess and prepare counterattacks, increasing the tactical significance of this phase. At the elite level, serve-and-receive exchanges are often a \micro-cycle\ of strategic interplay, where the match outcome can depend on the quality of the receive. For example, a well-executed backhand flick to the opponent's backhand corner can limit their offensive options, while a precisely placed short push can neutralize an anticipated aggressive third-ball attack. The receive is a comprehensive test of technical skill, psychological composure, experience, and adaptability, making it a cornerstone of competitive success in modern table tennis.

1.3 Historical Evolution of Receive Techniques

In table tennis, the technique of receiving serves has evolved from the past passive and simple response to the opponent's serve to the current stage where one can actively utilize receiving serves to control the pace of the game, create offensive opportunities, and even score directly. Before the 1980s, due to the limitations of rubber technology and competition rules, players mainly used pushing and blocking, emphasizing safety and consistency rather than aggressiveness. By the 1990s, the popularity of the loop shot technique led to a greater use of topspin shots in receiving serves. Entering the 21st century, changes in rules, such as the ban on the use of organic glue and the introduction of 40-millimeter balls, have reduced the spin intensity and ball speed, making the competition for the first three strokes even more intense. Such an environment prompts wrist shake techniques, especially the backhand banana shot, to become the main receiving and serving method in high-level competitions. In recent years, receiving and serving strategies have become more refined, personalized and intelligent. Players can predict their opponents' serving habits and adjust their return strategies accordingly. Nowadays, table tennis receiving and serving have developed into a system integrating perception, reaction, precise control and tactical intention, promoting the progress of competitive table tennis techniques.

2 Application of Video Analysis Methods in the Study of Table Tennis Receive Techniques

2.1 The basic principles of video analysis methods

Video analysis methods involve collecting, processing and interpreting sports video data to extract the movement features, spatio-temporal parameters and tactical behaviors of athletes. The core principles include image acquisition, target recognition, pose estimation and motion trajectory reconstruction. By using high-speed cameras to obtain competition or training videos and then applying computer vision algorithms (such as OpenPose, DeepLabCut, etc.) to identify key points of the human body, indicators such as hitting time, body Angle, racket speed and center of gravity shift can be quantified. By integrating timestamps with tabular coordinate systems, researchers can analyze elements such as ball rotation recognition, distribution of return ball landing points, and reaction time. This method transforms subjective experience into objective data, providing a scientific basis for technical diagnosis and tactical optimization, and has been widely applied in the field of contemporary sports research.

2.2 Current Application of video Analysis methods in the research of table tennis receiving and serving techniques

In recent years, video analysis has gradually been applied to the empirical research of table tennis receiving and serving techniques. Scholars at home and abroad have collected videos from top competitions such as the World Table Tennis Championships and the Olympic Games, and have encoded and statistically analyzed the receiving and serving movements of outstanding players. The usage frequency, success rate and subsequent connection effect of various techniques (such as backhand picking, short push, long cut) were studied. Some studies have also combined eye-tracking technology with synchronous video to explore the mechanism by which players predict the spin of their serves. Other teams used 3D motion capture systems combined with video to reconstruct biomechanical models during the hair-receiving stage. Although most current research still focuses on qualitative description or small sample analysis, the development of artificial intelligence and big data technologies is driving this field towards large-scale, high-precision, and real-time analysis, through deep learning-based automated action recognition.

2.3 The advantages of video analysis methods in studying table tennis receiving and serving techniques

Compared with traditional observation methods or investigations, video analysis has obvious advantages in the study of hair extension techniques. Firstly, it can conduct non-intrusive data collection under real competition conditions, avoiding the possible interference that the laboratory environment may have on the natural performance of athletes. Secondly, it can precisely quantify technical details such as the Angle of the racket face, wrist acceleration and stride distance at the moment of hitting the ball, thereby enhancing the objectivity of the analysis. Thirdly, it supports both vertical comparisons (comparisons of the same player at different times) and horizontal comparisons (such as

comparisons between domestic and foreign players), revealing the patterns of technological evolution. Finally, by integrating databases and machine learning, it can build predictive models of skills and tactics, helping coaches formulate personalized training plans. These advantages make video analysis an effective tool for parsing complex, rapid and subtle hair-receiving behaviors.

3 Development Trends of Table Tennis Receiving and Serving Techniques

3.1 The trend of technological diversification

Modern table tennis serving techniques are clearly showing a trend of diversification. The previous single response approach, mainly based on push (or slice) tactics, has been replaced by a variety of technical means, including backhand flicking (banana shot), quick blocking, forehand flicking, short push, long cut and side cut, among others. Especially the popularization of the backhand flicking technique, particularly its application when receiving short backhand balls, has greatly expanded the offensive options in the receiving stage. In the forehand short ball area, players can now flexibly switch between delicate short balls and sudden powerful bouncy balls, thus creating tactical surprises. This diversity is not only reflected in the richness of hitting types, but also in the multi-dimensional adjustments within a single technique - such as changes in spin intensity, speed and landing point. Facing increasingly complex serving strategies, athletes must master various receiving methods and make dynamic adjustments according to their opponents' habits, break their opponents' tactical expectations, and strive for the initiative in the game.

3.2 The trend of technological refinement

Continuous equipment reform and stricter rules have made the "millimeter battle" in table tennis more intense, promoting the development of receiving and serving techniques to a higher level of refinement. Top players are now pursuing extreme precision in minute technical details, such as adjusting the Angle of the racket, controlling the touch points, and grasping the timing of force application. For instance, an effective short block must just cross the net without bouncing or being too long, and usually comes with a weak backspin to limit the opponent's offensive options. Similarly, a successful jump requires an accurate judgment of the spin of the incoming ball and coordination with the explosive power of the wrist. High-definition video analysis shows that top athletes demonstrate outstanding body coordination, more effective center of gravity transfer and higher consistency during the hair receiving stage. In addition, integrating slow-motion replay, 3D motion modeling and biofeedback systems into training has further promoted the standardization of techniques and the reduction of execution errors. This refinement is not only a sign of technological maturity but also a key factor in determining the outcome of top-level competitions.

3.3 The trend of the integration of technology and tactics

In modern table tennis matches, receiving the ball is no longer an independent technical move but a deeply integrated part of the overall tactical framework. High-quality catches are designed to prepare for the offensive sequence of the third or fourth board. For instance, a backhand flick that reaches the opponent's backhand corner can create space for a forehand smash for oneself. Alternatively, an accurate short push might limit the attacking power of the serving side, thereby leading to a controllable counterattack. Video analysis confirms that top players start implementing their tactical intentions from the receiving stage - the landing points, spins and rhythms they choose are all aimed at guiding their opponents' returns to the designated areas. This concept of "receiving the ball is organizing" reflects the high degree of coordination between technique and tactics, transforming receiving the ball from a passive response to an active tool for shaping the dynamics of the game. Therefore, in high-level modern table tennis competitions, receiving the ball has become the key fulcrum that determines the "first three strokes" battle.

4 Conclusion

In summary, the analysis of table tennis receiving techniques via video has shown a clear progression, shifting from basic, responsive methods to more sophisticated, diverse, and strategically integrated approaches. The significance of modern technology in enhancing sports performance has been underscored, as video analysis provides objectivity, precision, and reproducibility, forming a solid basis for quantitatively evaluating receiving actions and the effectiveness of various return strategies. Looking ahead, the integration of big data and sports sci-

ence is poised to further advance the field, fostering more personalized and scientifically rigorous athlete training and competitive strategies. Grasping these trends will not only boost athletes' performance but also contribute to the evolution of the theoretical foundations of table tennis technique and tactics.

References:

[1]Akın, M., & Yılmaz, E. (2022). Biomechanical analysis of table tennis forehand loop drive using 3D motion capture system. Journal of Human Kinetics, 81(1), 25–36. https://doi.org/10.2478/hukin-2022-0003

[2]Qian, J., Liu, H., & Lu, Y. (2020). Tactical patterns in elite table tennis matches: A video-based notational analysis. International Journal of Performance Analysis in Sport, 20(3), 495–509. https://doi.org/10.1080/24748668.2020.1755221

[3]Malagoli Lanzoni, I., Felici, F., & Di Michele, R. (2014). Temporal and spatial constraints on serve and receive strategies in high-level table tennis. European Journal of Sport Science, 14(sup1), S362–S369. https://doi.org/10.1080/17461391.2012.740504

[4]Zhang, Y., Zhang, C., & Wang, D. (2021). Application of deep learning in sports video analysis: A case study on table tennis stroke recognition. Sensors, 21(12), 4015. https://doi.org/10.3390/s21124015

[5]Kondric, M., Zagatto, A. M., Sekulic, D., & Rattanaprasert, T. (2013). Influence of playing level and opponent's quality on tactical behavior in table tennis. Perceptual and Motor Skills, 117(3), 823–838. https://doi.org/10.2466/05.10.PMS.117x29z3