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Research on the Comparative Analysis of Techniques and Tactics of Ma Long and Fan Zhendong at Tokyo Olympic Game Table Tennis Men's Singles Final

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Abstract: Ma Long defeated Fan Zhendong 4-2 in the men's singles final of table tennis games of the 32nd Olympic Games in 2020, defending the men's singles title and becoming the world's first "Double-round Grand Slam" player. This paper systematically analyzes and summarizes the technical and tactical use and scoring characteristics of Ma Long and Fan Zhendong in the men's singles finals of the Tokyo Olympic Games by using literature review, video observation and mathematical statistics. It was found that Ma Long, with the help of his experience, gave full play to his highly stable and varied technical and tactical characteristics and was slightly better in the overall play. Although Fan Zhendong lost the match, he showed his high-quality and fast-paced technical and tactical characteristics after gradually adapting to the game in the latter part of the match. The study recommends that table tennis players in prime stage of careers should strengthen their "first three strokes" scoring ability, improve their holding stability, improve their mental conditioning ability through a large number of matches, and give full play to the role of "pre-match prediction and post-match review". Table tennis players in later stage of careers should rationalize the distribution of physical strength during matches, make full use of their years of experience to design high-value technical and tactical strategies, and conduct appropriate physical training to alleviate somatic functional aging during training.

1. Introduction

Table tennis is the "national ball" of China. Looking back on the past half century, the Chinese table tennis team has experienced breakthroughs, advances and glory years [1]. In the 1960s, Rong Guotuan got China's first gold medal of World Table Tennis Championships in Dortmund, Germany, which was also the first world champion in Chinese sports; in the 2008 Beijing Olympics, the world witnessed the unprecedented sight of three five-star red flags being raised at the same time; as of today, a total of 10 Grand Slam players have been born in the world, 9 of them are from China. The

reason why China has been able to dominate the world of table tennis for a long time is inextricably linked to the long and painstaking research and continuous breakthroughs in table tennis techniques and tactics by national and provincial team coaches and athletes at all levels and even by the majority of private table tennis enthusiasts.

On July 30, 2021, Chinese table tennis player Ma Long won the men's singles gold medal of table tennis games of the 32nd Summer Olympic Games in Tokyo with a score of 4:2 over Fan Zhendong, also from China, and became the world's first "Double-round Grand Slam" player. The former is the long-time captain and big brother of Chinese Table Tennis Team for many years and has entered the end stage of his career with dozens of world table tennis tournament titles to his credit. The latter is the new generation leader of Chinese Table Tennis Team and is in the golden stage of his career and physical function, and is highly expected by the majority of fans at home and abroad. Moreover, the Olympic Games is the highest-level game of table tennis in the world, and the two athletes entering the men's singles final represent the top-level players of table tennis in the world today. Therefore, through the statistics and description of the technical and tactical use of Ma Long and Fan Zhendong in the men's singles finals of table tennis games of the Tokyo Olympic Games, systematically analysing and summarizing the scoring characteristics of the two athletes can provide guiding suggestions for the design and adjustment of the technical and tactical strategies of the men's horizontal racket table tennis players who are in their prime age and in the late stage of careers in China.

2 Research Objects and Methods

2.1. Research Objects

The technical and tactical use of 2 athletes, Ma Long and Fan Zhendong, in the men's singles final of table tennis games of the Tokyo 2020 Olympic Games was used as the research object, and the results of the match are shown in Table 1.

Table 1: Statistics of Ma Long vs. Fan Zhendong in the men's singles final of table tennis games of the Tokyo 2020 Olympics Games

Name	First game	Second game	Third game	Fourth game	Fifth game	Sixth game	Total Score
Ma Loon	11	10	11	11	3	11	4
Fan Zhendong	4	12	8	9	11	7	2

2.2. Research Methods

2.2.1. Literature Review Method

Through the library of Shandong Sport University, we searched many databases such as CNKI and Weipu Database, using "Ma Long", "Fan Zhendong", "table tennis" and "technical and tactical analysis" as keywords. The keywords "technical and tactical analysis" were searched, and more than 100 journal papers on table tennis technical and tactical analysis were collected from home and abroad in recent years, 11 of which were selected, and the literature was summarized and organized to lay a solid theoretical foundation for this research.

2.2.2. Video Observation Method

Watch the video of the men's singles final of table tennis games of the 32nd Olympic Games through Tencent Video platform, and statistics and analyze the technical and tactical use of two athletes, Ma Long and Fan Zhendong, in the match.

2.2.3. Mathematical Statistics Method

Based on the "double-three-part statistical method", the evaluation indicators such as score, loss of points, scoring rate, conceded score rate and utilization rate are used to describe and analyze the overall process of the game and the specific details of the technical and tactical strategies and play of the athletes in different parts of the game from the horizontal and vertical dimensions of "game" and "part". This method describes and analyzes the overall process of the game and the specific details of the player's technical and tactical strategy and play in the field. Based on the characteristics of the time sequence of table tennis matches, the double-three-parts statistical method divides a complete table tennis match into three "games": opening game, middle game and end game; based on the characteristics of the points scored and lost by the players in the match, the match is divided into three "parts": serve-then-aggress part, receive-then-aggress part and rally part [2]. In addition, in order to analyze the specific technical and tactical means used in each part, the author summarized the specific technical and tactical aspects of serve-then-aggress part and receive-then-aggress part, and set "forehand pull/attack" and "backhand pull/attack" and other offensive and control technical and tactical indexes on the basis of the "double-three-part statistical method".

The formula for calculating the explicit evaluation indicators is as follows.

Part scoring rate = Total part score / (Part score + Missing score) × 100%

Part losing rate = Total part loss/ (Part score + Losing score) × 100%

Part usage rate = (Part score + Part loss of points)/ (Total score + Part loss of points) × 100%

Referring to the "three-part indicators evaluation method" [3] and taking into account the current technical and tactical style and development trend of table tennis, the level and range of evaluation indicators were divided, as shown in Table 2.

Table 2: Reference scale of evaluation indicators

Evaluation Level	Serve-then-aggress part		Receive-then-aggress part		Rally part	
	Scoring rate (%)	Usage rate (%)	Scoring rate (%)	Usage rate (%)	Scoring rate (%)	Usage rate (%)
Excellent	[70, 100]	[25, 30]	[50, 100]	[15, 25]	[55, 100]	[45, 55]
Good	[65, 70)		[40, 50)		[50, 55)	
Passing	[60, 65)		[30, 40)		[45, 50)	
Failure	[0, 60)		[0, 30)		[0, 45)	

3. Results and Analysis

3.1 Analysis of Techniques and Tactics in Double-three-part

We can see from Tables 3 and 4 that Ma Long scored significantly higher than Fan Zhendong in opening game of the match, while they scored at the same rate in middle and ending games. This indicates that Ma Long was more prepared before the match and mobilized his body faster to enter the match. Fan Zhendong also showed some ability to adjust the game when he was behind, but he did not find a targeted tactical strategy to hit Ma Long's weaknesses, so in middle and ending game of the match, Fan Zhendong only showed a comparable confrontation with Ma Long from the field.

Influenced by the disadvantage of the score in opening game of the match, finally, Fan Zhendong was still unable to come back. Secondly, we can also see that Ma Long has a losing score in serve-then-aggress part, an excellent score rate in receive-then-aggress part, and a good score rate in rally part, while Fan Zhendong has a losing serve-then-aggress part, a good score rate in receive-then-aggress part, and a passing score rate in rally part. The above results show that receiving and holding skills are the main tools for both players to compete for the score, but Fan Zhendong's offensive scoring ability is still a little bit inferior compared to Ma Long. By looking back at the game video, we can find that Ma Long has good stability, variable hitting routes and landing points, although his hitting speed and power are average, while Fan Zhendong likes to rely on his attacking style of high hitting power and fast ball speed to create threats to the opponent, but due to excessive pursuit of ball quality, Fan Zhendong often makes frequent errors during the process of holding. In addition, both Ma Long and Fan Zhendong, it is difficult to take the score through the implementation of the technical tactics of serve-then-aggress part, and the number of errors in the use of the part is high, the analysis of the reason is that Ma Long and Fan Zhendong in the team or in the open championships hundreds of times, very familiar with each other's technical and tactical characteristics, so both players in advance of the match designed tactical strategies that limits the opponent's direct scoring [4]. It is also worth noting that the usage rate of Ma Long's receive-then-aggress part techniques and tactics is significantly lower than Fan Zhendong's, which largely limits Ma Long's ability to score directly using his high-quality receive-then-aggress part technique.

Table 3: The scoring rate, losing rate and usage rate of Ma Long in opening, middle and ending games

Parts	Evaluation indicators	Opening game	Middle game	Ending game	Total
Serve-then-aggress part	Score	6	3	8	17
	Loss of points	1	6	9	16
	Scoring rate (%)	85.7%	33.3%	47.1%	51.5%
	Losing rate (%)	14.3%	66.7%	52.9%	48.5%
	Usage rate (%)	29.2%	37.5%	28.3%	30.6%
Receive-then-aggress part	Score	4	4	8	16
	Loss of points	2	3	7	12
	Scoring rate (%)	66.7%	57.1%	53.3%%	57.1%
	Losing rate (%)	33.3%	42.9%	46.7%	42.9%
	Usage rate (%)	25.0%	29.2%	25.0%	25.9%
Rally part	Score	5	5	15	25
	Loss of points	6	3	13	22
	Scoring rate (%)	45.5%	62.5%	53.6%	53.2%
	Losing rate (%)	54.5%	37.5%	46.4%	46.8%
	Utilization rate (%)	45.8%	33.3%	46.7%	43.5%
Total	Score	15	12	30	57
	Loss of points	9	12	30	51
	Scoring rate (%)	62.5%	50.0%	50.0%	52.8%
	Losing rate (%)	37.5%	50.0%	50.0%	47.2%

Table 4: Scoring rate, losing rate and usage rate of Fan Zhendong in opening, middle and ending games

Parts	Evaluation Indicators	Opening game	Middle game	Ending game	Total
Serve-then-aggress part	Score	2	3	8	13
	Loss of points	4	4	7	17
	Scoring rate (%)	33.3%	42.9%	53.3%	46.4%
	Losing rate (%)	66.7%	57.1%	46.7%	53.6%
	Usage rate (%)	25.0%	29.2%	25.0%	25.9%
Receive-then-aggress part	Score	1	6	9	16
	Loss of points	6	3	8	17
	Scoring rate (%)	14.3%	66.7%	52.9%	48.5%
	Losing rate (%)	85.7%	33.3%	47.1%	51.5%
	Usage rate (%)	29.3%	37.5%	28.3%	30.6%
Rally part	Score	6	3	13	22
	Loss of points	5	5	15	25
	Losing rate (%)	54.5%	37.5%	46.4%	46.8%
	Losing rate (%)	45.5%	62.5%	53.6%	53.2%
	Usage rate (%)	45.8%	33.3%	46.7%	43.5%
Total	Score	9	12	30	51
	Loss of points	15	12	30	57
	Scoring rate (%)	37.5%	50.0%	50.0%	47.2%
	Losing rate (%)	62.5%	50.0%	50.0%	52.8%

3.2 Analysis of Techniques and Tactics in Serve-then-aggress Part

Table 5: Statistics of technical and tactical indexes in serve-then-aggress part

Players	Technique	Score	Loss of points	Scoring rate (%)	Losing rate (%)	Usage rate (%)
Ma Long	Forehand pull/attack	2	0	100.0%	0.0%	6.1%
	Backhand pull/attack	6	1	85.7%	14.3%	21.2%
	Side pull/attack	3	1	75.0%	25.0%	12.1%
	In-desk picking/screwing	1	0	100.0%	0.0%	3.0%
	Total rush attack	12	2	85.7%	14.2%	42.4%
	Control	1	13	7.1%	92.9%	42.4%
	Serve direct score	4	1	80.0%	20.0%	15.2%
	Total	17	16	51.5%	48.5%	
Fan Zhendong	Forehand pull/attack	1	0	100.0%	0.0%	3.6%
	Backhand pull/attack	5	9	35.7%	64.3%	50.0%
	Side pull/attack	0	0	0%	0%	0.0%
	In-desk picking/screwing	2	0	100.0%	0.0%	7.1%
	Total rush attack	8	9	47.1%	52.9%	60.7%
	Control	4	7	36.4%	63.6%	39.3%
	Serve direct score	0	0	0.0%	0.0%	0.0%
	Total	12	16	42.9%	57.1%	

We can see from Table 5 that Ma Long's scoring rate in serve-then-aggress part is higher than Fan

Zhendong's, and the losing rate is lower than Fan Zhendong's. The most used techniques and tactics of Ma Long in serve-then-aggress part were control ball, backhand pull/attack, serve direct score, side pull/attack, and the success rate of direct score through rush attack tactics was more than 70%, and the two techniques and tactics with lower usage rate of forehand pull/attack and in-table pick/screw also had a hundred hits [5,6]. "This may be due to the fact that Ma Long often chose to use control technique passively due to the opponent's fierce attack in serve-then-aggress part. This can be verified by watching the match video. Although Ma Long scored directly through the "first three strokes" of serve-then-aggress part, the quality of the sustained situation fluctuates, and once the quality of the ball is reduced, Fan Zhendong has the opportunity to cause a great threat to Ma Long or even directly kill the match through his excellent forehand and backhand pulling technique. The same problem also happened to Fan Zhendong, but compared to Ma Long, use rate of control technique of Fan Zhendong in serve-then-aggress part is only half of Ma Long, analysis of the reason is that the 22-year-old Fan Zhendong is at the age of the most abundant physical function, whether hitting explosive force or reaction speed is significantly more than Ma Long, and with their own original very hard style of play, which will help Fan Zhendong can through a strong attack[7,8]. This helps Fan Zhendong to make up for the lack of serve or attack quality through strong attacking technique. In addition, by observing the usage rate of Fan Zhendong's technical and tactical tools in the serve-and-attack part, we found that only two techniques, namely backhand pull/attack and ball control technique, had a high usage rate, while the usage rate of the other four techniques were less than 10%, of which the usage rate of both side pull/attack and direct score was 0. This reflected that Fan Zhendong's technical and tactical tools in the serve-and-attack part were too single and lacked variation, which made it difficult to exert a big enough threat to Ma Long. This reflects that Fan Zhendong's technical and tactical methods in the serve-and-attack part are too single and lack of variation, so it is difficult to exert a big enough threat to Ma Long, so Ma Long can often take the initiative in the second and fourth strokes of the serve-and-attack part with the help of variable attacking methods to grab the score.

3.3 Analysis of Techniques and Tactics in Receive-then-aggress Part

Table 6: Statistics of technical and tactical indicators in receive-then-aggress part

Players	Technique	Score	Loss of points	Scoring rate (%)	Losing rate (%)	Usage rate (%)
Ma Long	Forehand pull/attack	2	1	66.7%	33.3%	10.7%
	Backhand pull/attack	2	3	40.0%	60.0%	21.2%
	Side pull/attack	1	1	50.0%	50.0%	7.1%
	In-desk picking/screwing	1	0	100.0%	0.0%	3.0%
	Total rush attack	9	5	64.2%	35.8%	31.0%
	Control	7	7	50.0%	50.0%	50.0%
	Total	16	12	57.1%	42.9%	
Fan Zhendong	Forehand pull/attack	4	2	66.7%	33.3%	18.2%
	Backhand pull/attack	5	6	45.5%	54.5%	50.0%
	Side pull/attack	1	1	50.0%	50.0%	6.1%
	In-desk picking/screwing	3	4	42.9%	57.1%	21.2%
	Total rush attack	14	12	53.8%	46.2 %	42.4%
	Control	2	4	33.3%	66.7%	18.2%
	Total	16	17	48.1%	51.5%	

Table 6 shows that Ma Long still scores more points than Fan Zhendong and loses less points than Fan Zhendong in receive-then-aggress part. According to the threat level of ball handling, the

receiving tactics are divided into two categories, namely, attack and control, and the attacking techniques can be divided into two categories, namely, in-table attack and off-table attack, according to the position of the hitting point relative to the table. Comparing the scoring rates of both players under different techniques and tactics, Fan Zhendong is not as good as Ma Long in both receiving and controlling the ball. From the perspective of attacking tactics, Fan Zhendong is not inferior in the use of off-table ball attacking tactics, except for the side attack which was equal to Ma Long's, and the scoring effect of forehand and backhand attacking was significantly better than Ma Long's. This shows that the foci of Fan Zhendong's inefficiency in the overall attacking tactics in receive-then-aggress part were most likely concentrated in the use of on-table attacking. The data in Table 6 proves this point very well. Although Fan Zhendong's attempts to score directly by using in-table steals were nearly twice as many as Ma Long's, the actual score rate was less than 50%, while Ma Long seized only 4 opportunities. In terms of control, Ma Long's usage rate for this technique was nearly three times higher than Fan Zhendong's, and his scoring rate was also much higher. Compared with the attack, the control ball technique is more used for excessive or passive defense, and the threat this technique can cause to the opponent is very limited. In addition, Ma Long has stable and high-quality backhand defense ability, especially his personal backhand side-cutting technique [9], and with the constant change of the route and landing point of the ball, he often has a high-quality backhand defense when Fan Zhendong finishes an attack [10-12].

3.4 Analysis of Techniques and Tactics in Rally Part

Table 7: Statistics of technical and tactical indicators in rally part

Cases	Ma Long scored	Fan Zhendong scored	Scoring rate (%)	Losing rate (%)
Ma Long starts with a forehand	4	4	50.0%	50.0%
Fan Zhendong starts with a forehand	4	3	57.1%	42.9%
Ma Long starts with a backhand	5	5	50.0%	50.0%
Fan Zhendong starts with a backhand	12	10	54.5%	45.5%

Note: The abscissa is the games of the match, and the ordinate is the score of the stalemate

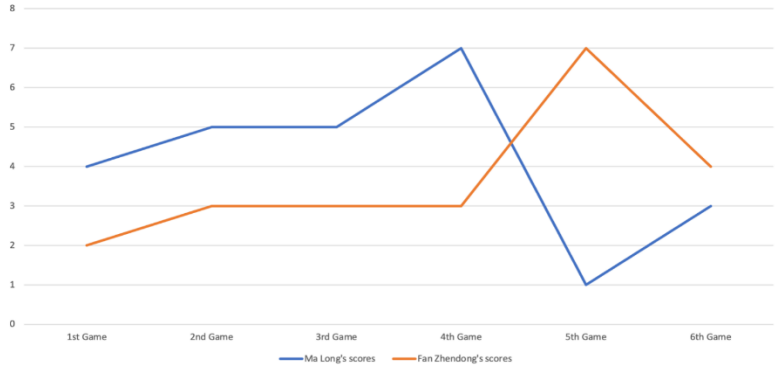

Figure 1: The change of Ma Long and Fan Zhendong's scores in rally part of different games

Table 7 shows that Ma Long scores slightly better than Fan Zhendong in rally part. Specifically, the scores of both players were too close, no matter who attacks first, whether it is a forehand or backhand attack. The number of times Fan Zhendong used the backhand ball to enter rally part was

much higher than the other three cases, which indicates that Fan Zhendong prefers to use the backhand attack technique to start the ball, but from the point of view of the scoring rate, the quality of Fan Zhendong's backhand ball is not high, and the technical and tactical effects used in rally part after starting the ball are not effective, and cannot effectively turn the attack into points. Looking at both players in Figure 1, Ma Long's score in the first 4 games of the holding period continued to improve as the match progressed, with a short sharp drop in the 5th game and a rebound in the last game. Fan Zhendong's score in the first 5 games of the match showed a gradual upward trend and only dropped in the last game. Comparing the scores of both players in each game, Ma Long scored higher than Fan Zhendong in the first 4 games, while Fan Zhendong overtook Ma Long in the last 2 games. The author, with the help of his many years of table tennis training and coaching experience and combined with the game video analysis, believes that Ma Long had participated in the Olympic finals before and had a certain psychological advantage over Fan Zhendong, so Ma Long was clearly in a better state than Fan Zhendong in opening game when dealing with the ball-holding technique. At the same time, many years of experience in the game drove Ma Long to make sufficient analysis of Fan Zhendong's techniques and tactics before the match, catching Fan Zhendong's weaknesses of excessive pursuit of ball quality and low stability in rally part, and the single route and landing point of the ball, which helped Ma Long to play more freely in the first four games of rally part, often through the large angle of rally part movement and can be fast or slow rhythm control to increase Fan Zhendong's mistake [13]. But then, Ma Long's age and lack of physical strength disadvantage was exposed, while Fan Zhendong, who is in the prime age of the body's motor function, gradually improved with the game, which led to a "one-sided" situation in the 5th game, where Fan Zhendong overpowered Ma Long in rally part. It is also because Ma Long realized that his own physical strength is not enough, if the game will be dragged to the deciding game, the game will be dominated by Fan Zhendong, therefore, from the 6th game on the first ball, Ma Long began to reduce the quality of rally part hitting, continue to maintain stability, just as the opponent Fan Zhendong final inexperienced, still excessive pursuit of quality, resulting in too many unnecessary errors, and finally lost the game.

4. Conclusions and Recommendations

4.1. Conclusions

4.1.1. Conclusion of Analysis of Techniques and Tactics in Double-three-part

Throughout the match, Ma Long was slightly better than Fan Zhendong in both scoring and on-table performance. Ma Long's scoring rate was much higher than Fan Zhendong's in opening game of the match, and equal to Fan Zhendong's in middle and ending game. Fan Zhendong's scoring rate was lower than Ma Long's, whether in serve-then-aggress part, receive-then-aggress part or rally part.

4.1.2. Conclusion of Analysis of Techniques and Tactics in Serve-then-aggress Part

Ma Long and Fan Zhendong both played poorly in serve-then-aggress part of the match. Ma Long scored more points than Fan Zhendong in serve-then-aggress part. Ma Long was not effective in using ball control techniques in serve-then-aggress part, while Fan Zhendong was not effective in using backhand snatch and ball control techniques. Both Ma Long and Fan Zhendong tried to use forehand attack and in-table attack techniques to score directly in serve-then-aggress part, and Fan Zhendong did not use side attack and direct score in serve-then-aggress part.

4.1.3. Conclusion of Analysis of Techniques and Tactics in Receive-then aggress-Part

In receive-then-aggress part, Ma Long performed better than Fan Zhendong. Fan Zhendong did

not play well in controlling the ball and tried to use his side stealing technique to score directly less frequently. In addition, the frequency and effect of other techniques and tactics used by both players in receive-then-aggress part were reasonable.

4.1.4. Conclusion of Analysis of Techniques and Tactics in Rally Part

Ma Long scored slightly more than Fan Zhendong in rally part after Fan Zhendong's active forehand or backhand. Ma Long not only ensured the stability of his shots, but also realized the changes of ball speed, rotation, route and landing point during the hold process with Fan Zhendong.

4.2 Recommendations

4.2.1. Recommendations for Table Tennis Players in Prime Stage of Careers

First of all, the quality of the "first three strokes" should be improved. In serve-then-aggress part, enrich the variation of serve form, spin and drop point, and improve the scoring efficiency of the third stroke by actively using the forehand and side pulling and attack. In receive-then-aggress part, strengthen the threat of backhand on-table twisting and pulling technique, and strengthen the connection between the second and fourth strokes. Secondly, the stability of the ball holding should be improved. In rally part, you can improve your ability to score by reasonably adjusting the quality of the ball and improving the control of the speed, power, rotation, route and landing point changes. In addition, you should improve your psychological quality and your ability to adjust to the field. After each match, you should review the match in time, summarize the shortcomings of the technical and tactical adjustments in the field, and prepare a few extra sets of backup plans to limit the implementation of the opponent's targeted technical and tactical strategies in the next pre-match technical and tactical design, in response to the opponent's possible prediction of his technical and tactical characteristics.

4.2.2. Recommendations for Table Tennis Players in Later Stages of Careers

First of all, the players should reasonably arrange the distribution of their physical strength in the game according to their own condition, and appropriately adjust the design of technical and tactical strategies. When physical strength is abundant, it is recommended to use variable holding techniques, make full use of the player's experience in rally part, and hit the opponent's weaknesses precisely; when physical strength is decreasing, it is recommended to strengthen the threat of the "first three strokes", take the score quickly through high-quality attacks in the first and third strokes or the second and fourth strokes, and avoid entering the extremely. It is recommended that these players should strengthen the threat of the "first three strokes" when their physical strength tends to decline. In addition, it is recommended that these players increase their physical fitness practice in their daily training, so as to slow down the natural aging process of physical fitness through reasonable physical training and prolong their career as much as possible.

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