

Technical and tactical actions of representatives of different styles of play in table tennis

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Purpose: The aim of this work was to identify the combinations and strokes that players representing different styles of play used most often to score, and to identify the differences between them.

Methods: A total of 146 games and 6565 winning actions of 7 champions, table tennis players representing different playing styles were analyzed. The study used the modified Wu Huanqin game analysis method. It consists of complex observing the game, counting the winning actions of a given player, sorting and identifying them, depending on the accuracy of the observation. Three levels are included, with increasing detail in assessing players' actions. For all variables, percentage win rates were calculated. Comparative analyses were performed. Due to the specificity of the database, chi square tests and fraction tests were used.

Results: The most important differences between analyzed players were identified, which are the basis for classifying them into different playing styles. These differences, as shown in the work, relate to tactical actions in different phases of the game: service actions, returns or in the so-called stalemate phase. They are related to the use of different strokes and their combinations to score points by players of different styles of play.

Conclusions: The research carried out made it possible to identify the most important strokes and their combinations with which table tennis players score points and to identify differences between the playing styles. The results obtained in the work can be valuable information for coaches and players, regarding the possibility of applying effective tactical actions in the game, the direction of development of a particular style, or even, as a consequence, the possibility of taking specific actions in the game against specific styles.

Keywords: notational analysis, playing strategies, tactics, table tennis, performance analysis

Introduction

Table tennis is a very complex game in which victory is determined by many factors related to technique, tactics, the mentality and the motor skills of the players and their opponents^{1,2}. Zhang et al.³ claimed that techniques and tactics are the key to winning matches and are widely studied factors in table tennis research. Individual players use different techniques and tactics, which are limited by their fitness and mental capabilities. The proportions of techniques and tactics used by the player in the game make it possible to distinguish and define his style (or strategies and types)^{4,5}. The literature lists and classifies a variety of playing styles with different criteria and levels of detail. Classifications of various styles have been presented for quite a long time. Geske and Mueller² list two styles ("game types") - dominant forehand and dominant backhand, depending on which side is used more often to hit the ball and score points. Many authors distinguish two dominant styles - offensive and defensive styles, depending on which techniques and tactics are used in greater numbers. Martin et al.⁶ and Miloni et al.¹ list defensive, offensive and all-round styles. These authors emphasize that the differences between these styles result in different speed of play, duration of exchanges, application of techniques, and also involve the use of different types of equipment, such as sandwich, anti-topspin, long and short pimples rubbers, different sponge backings under the rubbers used, etc. This also results in differences between styles regarding sources of energy and physiological

parameters of exercise¹. Some authors have studied the use of different tactics, distinguishing three basic styles: attack (a game dominated by short and fast attacks, up to 1 m from the table), attack from half-distance (dominated by attacks from 1 to 2 m away from the table) and defense (mostly defensive plays from more than 2 m away⁷). Differences have also been found between men and women, resulting from, among others, differences in physical fitness, different use of attacking and blocking strokes, forehand counterspin and footwork^{8,9}. Undoubtedly, the racquet grip, which can be either shakehand or penhold, determines the player's playing style. With this criterion in mind, Yuza et al.¹⁰ listed the following dominant styles of play: "both-sides" topspin attack at half distance, "one-side" topspin attack, fast penhold attack, defense (chopper).

Further classifications of playing styles can be found in Wu Huanqun¹¹, who lists 4 types of play in table tennis: fast attack, topspin attack, fast attack combined with topspin attack, and chop defense. Within each of these types, he lists penhold grip and shakehand grip styles, both-side or on-side, with different ways of attacking and defending. Accordingly, Wu has identified 18 of the most common table tennis styles. In his classification, Wu¹¹ recognizes the long pimples attack style of play as a fast attack. However, it would seem that in Wu's breakdown of the 4 types of play presented lacks a combo attack type, which would include players using a backhand technique in the form of a cushioned block (such as the style of 1985 World Championships medalist Lo or Commonwealth Champion, 2021 Batra).

Within this type, a large group of combo-attack styles can be identified - shakehand grip, penhold grip, one-side, both-sides, etc. Therefore, considering the previous Chinese studies¹²⁻¹⁶ and some others¹⁷, eight major styles can be identified. One of them involved players from the 1960s and 1970s (penhold grip defense), and at the world level in table tennis, currently such players are not found, so the seven most common ones are currently listed. The playing styles, as adopted in this paper, include:

- Chop defense (Joo Sehyuk, Ding Song, Chen Xinhua or Han Ying);
- Fast attack with a penhold grip (Jiang Jialiang, Liu Guoliang or Shan Xiaona);
- Fast attack with a shakehand grip (J. Huang, Teng Yi, Zhan Yining, M.Falk or Mima Ito);
- Combo-attack (Deng Yaping, Fukuhara, He Zhuojia, and Ni Xialian);
- Topspin attack with a penhold grip. (Guo Yaohua, Cao Yanhua, Ma Lin, Ryu Seungmin);
- Topspin attack both-sides with a shakehand grip (Jonyer, Klampar, He Zhili-Koyama or Li Xiaoxia).
- Topspin attack-forehand (fh) and fast attack backhand (bh) with a shakehand grip (JO.Waldner, Persson, Wang Tao, Wang Liqin or Ma Long).

The name of the style determines the main technical and tactical actions undertaken by players during the game. Of course, to a lesser extent, players of a given style use actions or strokes used by other players of a different style. This is undoubtedly related to the complexity and diversity of table tennis. To the extent of the authors' knowledge there is no research in the available literature, on the identification and evaluation of the tactics most often taken by players representing a particular, precisely defined style of play. The available studies mostly describe the world's top athletes, without pointing out specific differences between styles¹⁸⁻²³. Some research address gender differences^{24,25} or differences between winners and losers²⁶. The available studies mostly consider "three-phase evaluation method" for analyzing the technical strength of table tennis players. According to the length of each rally in a game, three phases are classified (attack after service, attack after receiving, and stalemate), the usage and scoring rate of the phases are calculated^{11,14,23}. This division allows the authors to determine the technique, ball placement or type of footwork, etc., used by the player^{18,23,27}. However, there is no research that differentiates the type of combinations and strokes used in terms of their application to a particular style of table tennis play, especially identifying those that are directly related to scoring. Drawing from the previous research results as well as theoretical studies on the discipline, we can assume that there are significant differences in the techniques and tactics of players playing different styles of the game. Identifying specific technical and tactical winning actions of master-level table tennis players and the differences between them in terms of playing style can help in the process of personalizing training in this sport. It will also allow us to identify the most important elements of the game, requiring training in the development of a particular style of play. This knowledge may allow for accurate, purposeful practice of the most important combinations on a larger scale. Determining the detailed elements of the game that characterize a particular style can also improve the process of selecting players for the sport and further training within a particular style. Therefore, the purpose of this work was to identify the combinations and strokes that championship-level table tennis players of the different styles of play used most

often to win points, and to identify the differences between the winning techniques and tactics of players representing different styles of play.

Methods

Participants

In our work, we assumed that championship-level players are the best examples for analyzing individual technical and tactical actions, of course subject to and understanding the phenomenon of individualization. Therefore seven table tennis champions representing seven most often existing styles based on literature were chosen (one player per style). Each style representative represented a professional level in table tennis and was a medalist at the Olympics and World Championships. A total of 146 games and 6565 winning actions were analyzed, out of which 293 different types of winning strokes and combinations of strokes by players representing different styles of play were identified.

The players were:

1. Joo Sehyuk - "chop defense" style - Olympic Vice-Champion 2012; World Vice-Champion 2003; 18 games analyzed;
2. Ma Lin - "topspin attack with penhold grip" style - Olympic Champion 2008, 19 games analyzed;
3. Liu Guoliang - "fast attack with penhold grip" style - Olympic Champion 1996; World Champion 1999; 16 games analyzed;
4. Deng Yaping - "combo-attack fast shakehand" style - 2 x Olympic Champion 1992, 1996; 2 x World Champion 1995, 1997 - 16 games analyzed;
5. Zhang Yining - "fast attack with shakehand grip" style - 2 x Olympic Champion 2004, 2008; 2 x World Champion 2005, 2009 - 20 games analyzed;
6. Li Xiaoxia - "topspin attack with shakehand grip" style - Olympic Champion 2012; World Champion 2007, 16 games analyzed;
7. Ma Long - "topspin attack-fh and fast-bh shakehand grip" style - 2 x Olympic Champion 2016, 2020; 3 x World Champion 2015, 2017, 2019 - 40 games analyzed.

The Institutional Ethics Committee approved the research.

Design and Methodology. The study used the Wu Huanqin game analysis method in modification of Grycan et al.²⁸ It consists of observing the game from the visual playback (video, Youtube and others), counting the winning actions of a given player, sorting and identifying them, depending on the accuracy of the observation. The original method of Wu involved determining and counting the player's technical and tactical actions that generate points. Grycan et al's modification additionally identifies individual actions with greater precision, indicating the exact shots and their combinations that bring points. There are three levels of these observations. Observation and counting at level, as a first step, is the identification of winning combinations (there are 10 of them, Tab. 1), taking into account "three-phase evaluation method" (1st and 3rd ball, 2nd and 4th ball, and all longer actions). These are winning strokes (last stroke in the action) or a combination of the two (last) strokes.

Then, within the identified combinations, the type of the first stroke from the combination and their number are determined - this is level 2 (total 61 types, Stroke+Counterattack). The last, most detailed level - level 3 is to determine and count the last strokes in the combination - Stroke+Stroke, there are over 400 possible combinations). The detailed description

Table. 1. Observation sheet – Level 1

Level 1		
Phase	Combination	Number of combinations
1 st -3 rd ball	1. Serve	
	2. Serve+Counterattack	
2 nd and 4 th ball	3. Return	
	4. Return+Counterattack	
Longer actions	5. Attack+Counterattack	
	6. Block+Counterattack	
	7. Push+Counterattack	
	8. Attack-against-chop+Counterattack	
	9. Chop+Counterattack	
	10. Others	

of the observational method used in this study is available in literature²⁸, and the observational sheet is attached as the Supplementary files. The reliability of the method used in present study (measured with Cronbach’s alpha) was established on levels 0.7 - 0.99, depending on the level of observation and is available in the literature²⁸.

Statistical Analysis. For all variables at each level, percentage win rates were calculated. Comparative analyses were performed in an Excel spreadsheet. Due to the qualitative nature of the variables and the specificity of the database, chi square tests and fraction tests were used. The significance of the differences between the distributions of events (described as percentages for each of the 7 players) was analyzed using The Maximum-Likelihood Chi-square test. Then, after showing significant differences in the distributions, the significance of the differences between the fractions was compared (fraction test), with the correction for multiple comparison. The assumed level of significance was alpha = .05. The alternative hypothesis tested was non-directional, hence, a bilateral critical area was adopted for the comparison of fractions. In the case of these tests, p<.025 meant the statistical significance of the observations at the adopted significance level of alpha = .05. The chi square test had the value df=6. In some analyses, too small numbers of observations made it impossible and illogical to conduct significance tests and were omitted.

Results

The distribution of winning actions of representatives of each style of play was found different from all others in the present work. Each player (representing given style) has its own distinct specificity, consisting in different proportions of the use of combinations and strokes. The different use of combinations and shots by individual players is visible at every level of observation.

The results of the analyzed Level 1 are presented in Table 2.

The greatest use of the examined Serve actions for scoring was achieved by Liu and Deng. The highest use of

Serve+Counterattack was achieved by Ma Lin, Liu and Ma Long. The most points by Return were scored by Liu.

The highest use of Return+Counterattack we found in Ma Lin, Ma Long and Deng. We found differences between the high use of this combination by Ma Lin and Ma Long, and the lower use by Joo, Liu, Zhang and Li.

Percentage-wise, Li and Zhang won the most Attack+Counterattack..

With Block+Counterattack Zhang, Deng and Liu scored the highest percentage of points.

The most points scored with Push+Counterattack were found in Joo, Ma Lin and Ma Long.

The highest percentage of examined Attack-against-chop+Counterattack actions for scoring was achieved by Li.

The use of Chop+Counterattack actions was highest for Joo, the other players did not use this type of action at all.

Other type of action scored the lowest percentage of points.

The results of the analyzed Level 2 are presented in Table 3.

Liu and Ma Long scored most often using Serve fh sidespin. Serve fh backspin-nospin in large proportion won scores for Li, Deng, Ma Lin and Zhang. Serve bh sidespin was shown in high percentage in Joo’s style.

The highest percentage use of Serve fh sidespin+Counterattack actions studied for scoring we observed in Liu and Ma Long. Serve fh backspin-nospin+Counterattack won the highest scores for Li, Deng, and Ma Lin. Joo won points through the combination of Serve bh sidespin+Counterattack.

Push fh to win points as Return was used most by Ma Lin and Joo. Liu and Deng used Attack fh most frequently in this regard. Joo was found to have the highest use of Push bh. Return Flick bh was most common for Zhang, Ma Long and Li. The highest use of winning topspin bh return actions was found in Zhang, and Li. Deng playing chop on the bh side, was the only one to effectively use Block bh as a return. Joo, a defensive player, was the only table tennis champion to use the Chop bh return.

Push fh+Counterattack was most often scored by Ma Lin, Joo and Ma Long. The highest use of Push bh+Counterattack winning return actions was found in Liu and Ma Long. Attack

Tab. 2. Number and use (in percentage) of won actions by the analyzed players at Level 1

	a	b	c	d	e	f	g	chi ² test
	Joo Sehyuk	Ma Lin	Liu Guoliang	Deng Yaping	Zhang Yining	Li Xiaoxia	Ma Long	P value
Number of won actions	723	935	685	782	864	813	1763	
1. Serve (%)	6 ^{b,c,d,g}	10 ^{c,f}	14 ^{e,f,g}	12 ^{e,f}	8 ^{c,d}	7 ^{b,c,d}	9 ^{a,c}	≤.01
2. Serve+Counterattack (%)	16 ^{b,g}	25 ^{d,e,f,g}	21	19 ^b	18 ^b	19 ^b	20 ^{a,b}	≤.01
3. Return (%)	9 ^{a,b,c,d,e,f,g}	14 ^a	17 ^{a,f}	15 ^a	14 ^a	13 ^{a,c}	15 ^a	≤.01
4. Return+Counterattack (%)	11 ^{b,d,g}	17 ^{c,e,f}	12 ^f	15 ^a	12 ^{b,f}	13 ^{b,f}	16 ^{a,c,e,f}	≤.01
5. Attack+Counterattack (%)	10 ^{b,c,d,e,f,g}	15 ^{e,f,g}	18 ^{a,c,f}	17 ^{a,e,f}	22 ^{a,b,c,d,f}	25 ^{a,b,c,d,f}	18 ^{a,b,e,f}	≤.01
6. Block+Counterattack (%)	2 ^{b,c,d,e,f,g}	6 ^{a,c,d,e,f,g}	13 ^{a,b,f,g}	14 ^{a,b,f,g}	15 ^{a,b,f,g}	8 ^{a,b,c,d,e}	8 ^{a,b,c,d,e}	≤.01
7. Push+Counterattack (%)	10 ^{b,c,d,e,f,g}	7 ^{a,c,d,e,f}	3 ^{a,b,g}	3 ^{a,b,g}	3 ^{a,b,g}	3 ^{a,b,g}	7 ^{a,c,d,e,f}	≤.01
8. Attack-against-chop+Counterattack (%)	1 ^{b,d,e,f,g}	6 ^{a,f}	0	5 ^{a,f}	6 ^{a,f}	9 ^{a,b,d,e,g}	5 ^{a,f}	≤.01
9. Chop+Counterattack (%)	32	0	0	0	0	0	0	
10. Other (%)	2 ^d	1	2 ^d	1 ^{a,c,f}	1	3 ^d	1	.02

Note: a,b,c,d,e,f,g - significant difference (P≤.025) with particular player, chi² test is significant if P≤.05

fh+Counterattack in large percentages was shown in Deng and Liu. Flick fh+Counterattack was most often used by Liu. Flick bh+Counterattack was most often won by Zhang. The greatest use of Topspin bh+Counterattack return action was demonstrated by Li and Zhang. Joo.

The most winning combination among tactics of Attack+Counterattack was Topspin-fh+Counterattack, which was used most often by Joo, Ma Lin and Ma Long. Fast attack bh+Counterattack was used by Zhang, Deng and Ma Long. Li distinguished the level of application of this tactic from Joo, Ma

Tab. 3. Number and use (in percentage) of won actions by the analyzed players at Level 2

	a	b	c	d	e	f	g	chi ² test
Action/Player	Joo Sehyuk	Ma Lin	Liu Guoliang	Deng Yaping	Zhang Yining	Li Xiaoxia	Ma Long	P value
1. Serve	43	93	98	90	71	58	166	
1.1. Serve fh sidespin (%)	21 ^{b,c,g}	43 ^{a,b,e,f}	100 ^{a,b,d,e,f,g}	38 ^{b,c,e,f,g}	17 ^{b,c,e,f,g}	21 ^{a,c,d,e,g}	90 ^{a,c,d,e,f}	≤.01
1.2. Serve fh backspin-no-spin (%)	14 ^{b,c,d,e,f}	57 ^{a,c,f}		60 ^{a,c,f,g}	49 ^{a,b,c,d,f,g}	79 ^{c,d,e,g}	9 ^{c,d,e,f}	≤.01
1.3. Serve bh sidespin (%)	42 ^d			1 ^a				
1.4. Serve fh reverse (%)	23 ^g				20 ^g		1 ^{a,e}	
1.5. Serve bh backspin-no-spin (%)					14			
1.6. Serve fh squat(%)				1				
2. Serve+Counterattack-attack	119	225	141	145	154	156	356	
2.1. Serve fh sidespin+Counterattack (%)	48 ^{b,c,d,e,f,g}	33 ^{a,c,d,f,g}	96 ^{a,b,d,e,f,g}	20 ^{a,b,c,g}	23 ^{a,b,c,f,g}	13 ^{a,b,c,d,e,g}	86 ^{a,b,c,d,e,f}	≤.01
2.2. Serve fh backspin-no-spin+Counterattack (%)	8 ^{b,c,d,e,f}	67 ^{a,c,d,e,f,g}	2 ^{a,b,d,e,f,g}	77 ^{a,b,c,e,f,g}	55 ^{a,b,c,d,f,g}	87 ^{a,b,c,d,e,g}	10 ^{b,c,d,e,f}	≤.01
2.3. Serve bh sidespin+Counterattack (%)	25 ^d			1 ^a				
2.4. Serve fh reverse+Counterattack (%)	18 ^{e,g}				8 ^{a,g}		3 ^{a,e}	
2.5. Serve bh backspin-no-spin+Counterattack (%)				1 ^e	14 ^d			

2.6. Serve fh hook+Counterattack (%)		2	2					
3. Return	62	131	117	115	124	105	257	
3.1. Push fh (%)	45 ^{c,e}	51 ^{a,c,d,e,f,g}	15 ^{b,d,e,f,g}	30 ^{a,b,c}	27 ^{b,c}	32 ^{b,c}	36 ^{b,c}	≤.01
3.2. Topspin and Fast attack fh (%)	8 ^{b,c,d,f,g}	21 ^{a,c,d,e,f,g}	48 ^{a,b,d,e,f,g}	34 ^{c,e,f}	12 ^{a,c,d,g}	20 ^{a,c,g}	25 ^{a,c,e}	≤.01
3.3. Push bh (%)	27	18	13	9	15	15	14	.051
3.4. Flick bh (%)	2 ^{f,g}	6 ^{c,d,e,f,g}			20 ^{b,c,e,f,g}	15 ^{a,b,c,d}	16 ^{a,b,c,d}	≤.01
3.5. Flick fh (%)		4 ^c	23 ^{a,b,d,e,f,g}	3 ^c	8 ^c	4 ^c	7 ^{a,c}	≤.01
3.6. Topspin and Fast attack bh (%)		1 ^{d,e,f}	1 ^{e,f}	4 ^{a,b,c,e,f}	19 ^{a,b,c,d,g}	13 ^g	4 ^{e,f}	≤.01
3.7. Block bh (%)			1 ^d	20 ^c				
3.8. Chop-bh (%)	16							
3.9. Chop-fh (%)	2							
4. Return+Counterattack	78	149	81	88	112	106	274	
4.1. Push fh+Counterattack (%)	59 ^{c,d,e,g}	64 ^{c,d,e,f,g}	25 ^{a,b,d,e,f,g}	28 ^{a,b,e,g}	28 ^{b,c,f,g}	45 ^{b,c,e,g}	59 ^{a,b,c,d,e,f}	≤.01
4.2. Push bh+Counterattack (%)	21	20	31 ^{d,e,f}	11 ^c	16 ^c	16 ^c	26 ^{d,e,f}	.04
4.3. Topspin and Fast attack-fh+Counterattack (%)	13 ^{c,d}	7 ^{c,d}	26 ^{a,b,e,f,g}	28 ^{a,b,e,f,g}	13 ^{c,d,g}	13 ^{c,d,g}	7 ^{c,d,e,f}	≤.01
4.4. Flick-fh+Counterattack (%)		3 ^{c,e}	14 ^{a,b,d,e,f}	3 ^c	8 ^{a,b,c,g}	4 ^{c,g}	3 ^{c,e}	≤.01
4.5. Flick bh+Counterattack (%)		3 ^{c,e}		1 ^d	22 ^{a,b,c,d,f,g}	7 ^{a,c,f,g}	3 ^{c,f}	≤.01
4.6. Topspin and Fast attack-bh+Counterattack (%)	3 ^{e,f}	3 ^{e,f}	1 ^{e,f}	4 ^f	13 ^{a,b,c,g}	15 ^{a,b,c,d,g}	4 ^{e,f}	≤.01
4.7. Chop-bh+Counterattack (%)	5							
4.9. Blok-bh+Counterattack (%)			4					
5. Attack+Counterattack	73	138	120	140	193	205	324	
5.1. Topspin-fh+Counterattack (%)	84 ^{c,d,e,f,g}	75 ^{c,d,e,f,g}	28 ^{a,b,d,e,f,g}	19 ^{a,b,c,f,g}	10 ^{a,b,c,d,f,g}	33 ^{a,b,d,e,g}	52 ^{a,b,c,d,e,f}	≤.01
5.2. Fast attack-bh+Counterattack (%)	3 ^{d,e,f,g}	1 ^{d,e,f,g}	1 ^{d,e,f,g}	36 ^{a,b,c,f}	43 ^{ab,c,f,g}	22 ^{a,b,c,d,e,g}	33 ^{a,b,c,e,f}	≤.01
5.3. Fast attack-fh+Counterattack (%)	14 ^{b,c,d,e,f,g}	1 ^{a,c,d,e}	67 ^{a,b,d,e,f,g}	44 ^{a,b,c,e,f,g}	32 ^{a,b,c,d,f,g}	5 ^{a,c,d,e}	5 ^{a,c,d,e}	≤.01
5.4. Topspin-bh+Counterattack (%)		16 ^{a,c,d,e,f,g}	4 ^{b,d,f}		8 ^{a,b,d,e}	35 ^{a,b,c,d,e,g}	7 ^{b,d,f}	≤.01
5.5. Flick-Fh+Counterattack (%)		6 ^{a,c,d,g}	1 ^b		4 ^d	3 ^d	2 ^b	.01
5.6. Flick-bh+Counterattack (%)		1			2	1	2	.35
6. Block+Counterattack	17	52	89	110	128	67	140	
6.1. Block-bh+Counterattack (%)	18 ^{b,c,d,e,f,g}	67 ^{a,c,e,g}	93 ^{a,b,d,e,f,g}	76 ^{a,c}	81 ^{a,b,c}	70 ^{a,c}	83 ^{a,b,c,f}	≤.01
6.2. Block-fh+Counterattack (%)		23 ^{a,c,g}	7 ^{b,d,e,f}	24 ^{a,c,g}	16 ^{c,f}	28 ^{a,c,e,g}	11 ^{a,b,d,f}	≤.01
6.3. „Fishing”-bh+Counterattack (%)		4			2	1	5	.09
6.4. „Fishing”-fh+Counterattack (%)	82 ^{b,c,d,e,f,g}				1			
6.x. Lob+Counterattack (%)		6					1	

7.Push+Counterattack	73	66	20	46	26	25	116	
7.1. Push-bh+Counterattack (%)	63 ^{d,g}	59 ^{d,g}	75 ^{d,g}	35 ^{a,b,c,f}	54 ^g	72 ^{d,g}	22 ^{a,b,c,e,f}	≤.01
7.2. Push-fh+Counterattack (%)	37 ^{d,g}	41 ^g	25 ^{d,g}	57 ^{a,c,f,g}	46 ^g	28 ^{d,g}	78 ^{a,b,c,d,e,f}	≤.01
8. Attack - against chop+Counterattack	9	53	0	43	52	71	92	
8.1. Aac-Topspin-fh+Counterattack (%)	100 ^f	96 ^{d,e,f,g}		81 ^{b,f}	73 ^b	56 ^{a,b,d,g}	86 ^{b,f}	≤.01
8.2. Aac-Topspin-bh+Counterattack (%)		2				3	9	.24
8.3. Aac-Attack-fh+Counterattack (%)		2 ^{d,ef}		19 ^{b,f,g}	19 ^{b,f,g}	38 ^{a,b,d,e,g}		≤.01
8.4. Aac-Attack-bh+Counterattack (%)					2	3		
8.3. -8.4 other (%)							5	
9.Chop+Counterattack	232	1	0	0	0	0	0	
9.1. Chop-bh+Counterattack (%)	74							
9.2. Chop-fh+Counterattack (%)	26	100						
10. Other	18	13	16	6	10	21	26	
10.1. 'Net' or 'edge' (%)	78	85	38	83	50	67	65	.09
10.2. Opponent's serve fault (%)	22	15	56	17	50	33	27	.15
10.3. -10.5 other (%)			6				8	

Note: ^{a,b,c,d,e,f,g} - significant difference ($P \leq .025$) with particular player; a blank line means no cases or numbers too small, χ^2 test is significant if $P \leq .05$

Lin, Liu, but at the same time significantly lower than Zhang, Deng and Ma Long. The highest percentage use of Fast attack fh+Counterattack was shown in Liu, Deng and Zhang.

Block bh+Counterattack actions were used the most by Liu, Ma Long, Zhang and Deng to score. Block fh+Counterattack tactic was used most often by Li, Deng and Ma Lin.

The results of the analyzed Level 3 are presented in Table 4.

The actions of Service and Return have no Level 3 in our observation. At Level 3 studied players differ much in use of the last stroke (Counterattack) to score the points. In this regard Topspin fh, but also Fast attack fh were the strokes most used by offensive players.

Discussion

The purpose of this study was to identify the combinations and strokes that players of the different styles of play use most often when scoring points, and to determine the differences between the winning techniques and tactics of players representing different styles of play. Finding these differences makes it possible to identify and distinguish playing styles. Thus, knowledge of the characteristics of a particular style can be helpful in laying out a training plan aimed at developing this style in a selected athlete towards shaping his so-called strong point, enabling him to score points. The research we performed showed the existence of the aforementioned differences between the tested athletes. It was possible to identify the most common techniques and tactics used to score by professional players, who were considered to represent specific styles.

Joo Sehyuk

Joo Sehyuk, as a master of the defensive style, in stark contrast to the other participants, scored the most points in the stalemate phase (using the three-phase evaluation method to describe it^{7,22}), as much as 58% of all his winning actions. Push+Counterattack and, seemingly understandably, Chop+Counterattack actions are the most applicable. Actions classified as Push+Counterattack account for 10% of all wins, this is the highest use of this tactic of the game comparing with all other styles. However, the highest usage among winning actions is Chop+Counterattack combinations (obviously the highest among all athletes). Joo's game, then, is mostly about giving away the initiative, which is natural for this style. The level 2 and level 3 analysis shows that Joo, of the Chop+Counterattack combination actions won, uses Chop bh+Counterattack, among these Counterattacks are Chop bh, attack-fh (mainly topspin-fh) and Chop fh. Chop fh+Counterattack actions win 26%; among these actions are Chop fh+Chop bh combinations, Push fh+Attack-fh combinations (mainly Topspin fh), and Chop fh+Chop fh combinations. The least points were scored directly with his serve (most often Serve bh sidespin) and Return, as well as Serve+Counterattack actions (as counterattack, Topspin fh is the most frequently won) and Return+Counterattack (most often Push+Chop and Push+Topspin fh). Thus, it can be confirmed that defensive players require less explosiveness in their playing actions compared to offensive players, but they must be able to adapt frequently to the change of pace, moving from defense to attack^{8,24}.

Thus, it can be said that Joo's game is definitely dominated by actions characterized by defensive strikes, and the game is based on less initiative in the game, rather waiting and patience. The

Tab. 4. Number and use (in percentage) of won actions by the analyzed players at Level 3

Action/Player	a	b	c	d	e	f	g	chi ² test P value
	Joo Sehyuk	Ma Lin	Liu Guoliang	Deng Yaping	Zhang Yining	Li Xiaoxia	Ma Long	
2.1. Serve fh sidespin+Counterattack	57	75	135	29	36	21	307	
2.1.1. Serve fh sidespin+Topspin fh (%)	56 ^{c,d,e}	60 ^{c,d,e}	30 ^{a,b,g}	17 ^{a,b,f,g}	14 ^{a,b,f,g}	43 ^{d,e,g}	54 ^{d,e,f}	≤.01
2.1.2. Serve fh sidespin+Fast attack bh (%)	2 ^{d,e,f,g}	0	3 ^{d,e,f,g}	17 ^{a,b,c}	31 ^{a,b,c}	19 ^{a,b,c}	21 ^{a,b,c}	≤.01
2.1.3. Serve fh sidespin+Topspin bh (%)	0	20 ^{c,g}	4 ^b	0	22 ^{d,g}	19 ^{d,g}	4 ^{b,e,f}	≤.01
2.1.4. Serve fh sidespin+Push fh (%)	7	5	3	0	8	10	8	.32
2.1.5. Serve fh sidespin+Block bh (%)	5	5	10	3	0	0	7	.23
2.1.6. Serve fh sidespin+Fast attack fh (%)	0	0	38 ^{a,b,f,g}	24 ^{a,b,g}	22 ^{a,b,g}	5 ^c	2 ^{c,d,e}	≤.01
2.1.7. Serve fh sidespin+Flick fh (%)	5	7	2	0	0	0	2	.20
2.1.8. Serve fh sidespin+Push bh (%)	12 ^{b,g}	1 ^{a,c,d}	8 ^{b,g}	14 ^{b,g}	3	0	1 ^{a,c,d}	≤.01
2.1.9. Serve fh sidespin+Chop bh (%)	12	0	0	0	0	0	0	
2.1.10. Serve fh sidespin+Block fh (%)	0	1 ^d	1 ^d	24 ^{c,b}	0	0	0	
2.1.11. Serve fh sidespin+Flick bh (%)	0	0	0	0	0	5	1	
2.2.. Serve fh backspin+Counterattack	10	151	3	112	83	135	37	
2.2.1. Serve fh backspin+Topspin fh (%)	40 ^e	62 ^{d,e,f}	0	33 ^{b,c,g}	13 ^{a,b,d,f,g}	33 ^{b,c,g}	59 ^{d,e,f}	≤.01
2.2.2. Serve fh backspin+Fast attack bh (%)	0	1 ^{d,e,f,g}	0	13 ^b	14 ^b	16 ^b	19 ^b	≤.01
2.2.3. Serve fh backspin+Topspin bh (%)	0	7 ^{d,e,f}	0	0	20 ^{b,d}	22 ^{b,d}	11 ^d	≤.01
2.2.4. Serve fh backspin+Push fh (%)	30 ^{b,e,f,g}	9 ^a	0	0	10 ^a	4 ^a	5 ^a	≤.01
2.2.5. Serve fh backspin+Block bh (%)	0	5	0	7	2	1	3	.19
2.2.6. Serve fh backspin+Fast attack fh (%)	0	4 ^{c,d,e}	33 ^{b,f,g}	34 ^{a,b,c,f,g}	12 ^{b,d,g}	8 ^{c,d}	0	≤.01
2.2.7. Serve fh backspin+Flick fh (%)	10	7 ^f	33 ^{f,g}	6 ^f	12 ^f	1 ^{b,c,d,e}	0	≤.01
2.2.8. Serve fh backspin+Push bh (%)	20 ^{b,d,f,g}	5 ^{a,f}	33 ^{d,f,g}	2 ^{a,c,e}	10 ^{d,f}	3 ^{a,b,c,e}	3 ^{a,c}	≤.01
2.2.9. Serve fh backspin+Flick bh (%)	0	0	0	0	6	10	0	
2.2.10. Serve fh backspin+Block fh (%)	0	1	0	4	0	1	0	.08
4.1. Push fh+Counterattack	46	106	20	33	31	48	161	
4.1.1. Push fh+Topspin fh (%)	22 ^{b,g}	54 ^{a,c,d,e,f}	15 ^{b,g}	9 ^{b,f,g}	19 ^{b,g}	33 ^{b,d,g}	50 ^{a,c,d,e,f}	≤.01
4.1.2. Push fh+Block bh (%)		17 ^{a,e}	30 ^a	21 ^a	35 ^{a,b,f,g}	13 ^a	14 ^{a,e}	≤.01
4.1.3. Push fh+Topspin bh (%)		13 ^{a,d}	5 ^d		19 ^{a,d,g}	21 ^{a,d,g}	7 ^{e,f}	≤.01
4.1.4. Push fh+Block fh (%)		6 ^g	15 ^{a,g}	9 ^{a,g}	3	10 ^{a,g}	1 ^{b,c,d,f}	≤.01
4.1.5. Push fh+Fast attack bh (%)		1 ^d	0	15 ^{a,b}		6	3 ^b	≤.01
4.1.6. Push fh+Fast attack fh (%)			20 ^{a,b,g}	24 ^{a,b,g}	10 ^{a,b}	10 ^{a,b,g}	2 ^{c,d,f}	≤.01
4.1.7. Push fh+Push fh (%)		3 ^g		6	6		12 ^{a,b,e}	≤.01
4.1.8. Push fh+Push bh (%)	4	5	15	9		2	4	.21

4.1.9. Push fh+Flick bh (%)				6	3	4	4	.25
4.1.10. Push fh+Flick fh (%)		2				3	2	.75
4.1.11. Push fh+Chop bh (%)	39							
4.1.12. Push fh+Chop fh (%)	35							
4.2. Push bh+Counterattack	16	30	25	13	30	17	70	
4.2.1. Push bh+Topspin fh (%)	13 ^g	40 ^c	12 ^{b,f,g}	15 ^g	23 ^g	41 ^c	50 ^{a,c,d,e}	≤.01
4.2.2. Push bh+Block bh (%)		20 ^g	32 ^{a,g}	8	23 ^{a,g}	24 ^{a,g}	4 ^{b,c,e,f}	≤.01
4.2.3. Push bh+Topspin bh (%)		17	12		13	6	6	.28
4.2.4. Push bh+Block fh (%)		7	12	15	7	6	3	.43
4.2.5. Push bh+Push bh (%)	6		4		7		7	
4.2.6. Push bh+Fast attack bh (%)	6	3	8	15	10		4	
4.2.7. Push bh+Fast attack fh (%)		7 ^d	20	38 ^{b,g}	10	12	4 ^d	≤.01
4.2.8. Push bh+Push fh (%)		7		8	3	12	16	
4.2.9. Push bh+Flick fh (%)					3		4	
4.2.10. Push bh+Flick bh (%)							1	
4.2.11. Push bh+Chop bh (%)	63							
4.2.12. Push bh+Chop fh (%)	13							
4.3. Topspin – Fast attack fh+Counterattack	10	11	21	32	11	13	18	
4.3.1. Topspin fh+Topspin fh (%)	60 ^{c,d,e}	82 ^{c,d,e}	10 ^{a,b,f,g}	9 ^{a,b,f,g}		62 ^{c,d,e}	83 ^{c,d,e}	≤.01
4.3.2. Topspin fh+Fast attack bh (%)	10 ^{d,e}		5 ^{d,e}	47 ^{a,b,c,e,f}	55 ^{a,b,c,f,g}	8 ^{d,e}	11 ^{d,e}	≤.01
4.3.3. Topspin fh+Block bh (%)			33 ^{a,b,d,e,f,g}	9 ^c			6 ^c	≤.01
4.3.4. Topspin fh+Topspin bh (%)						23		
4.3.5. Topspin fh+Fast attack fh (%)			33 ^{a,b,f,g}	31 ^{a,b,g}	18	8 ^c		≤.01
4.3.6. Topspin fh+Block fh (%)		18			9			
4.3.7. Fast attack fh+Fast attack fh (%)					18			
4.3.8. Topspin fh+Push bh (%)				3				
4.3.9. Fast attack fh+Block bh (%)			19					
4.3.10. Topspin fh+Chop bh (%)	30							
4.4. Flick fh+Counterattack	0	4	11	4	6	4	7	
4.4.1. Flick fh+Block bh (%)		25	64	25	17	25	14	
4.4.2. Flick fh+Fast attack fh (%)		25	27		50	25	29	
4.4.3. Flick fh+Fast attack bh (%)				50	33		29	
4.4.4. Flip fh+Topspin fh (%)		50		25		25	14	
4.4.5. Flip fh+Block fh (%)			9				14	

4.4.6. Flip fh+Push bh (%)						25		
5.1. Topspin fh+Counterattack	61	104	33	27	20	68	169	
5.1.1. Topspin fh+Topspin fh (%)	77 ^{c,d,e,f,g}	80 ^{c,d,e,f,g}	6 ^{a,b,e,f,g}	15 ^{a,b,f,g}	30 ^{a,b,c,f,g}	60 ^{a,b,c,e,g}	62 ^{a,b,c,d,e}	≤.01
5.1.2. Topspin fh+Fast attack bh (%)	5 ^{b,d,g}		3 ^{b,d,e,f,g}	22 ^{a,b,c}	15 ^b	9 ^b	13 ^{a,b}	≤.01
5.1.3. Topspin fh+Fast attack fh (%)	2 ^{d,e}	2 ^{c,d,e}	55 ^{b,d,e,f,g}	22 ^{a,b,c,f,g}	15 ^{a,b,c,f,g}	1 ^{c,d,e}	4 ^{c,d,e}	≤.01
5.1.4. Topspin fh+Topspin bh (%)		8 ^{a,f}			5 ^f	25 ^{a,b,c,d,e,g}	5 ^f	≤.01
5.1.5. Topspin fh+Block bh (%)	5 ^c	6 ^c	30 ^{a,b,f,g}	15 ^f	10	1 ^{c,d}	7 ^c	≤.01
5.1.6. Topspin fh+Block fh (%)		3 ^e	6 ^f		15 ^{a,b,d,f,g}		4 ^e	≤.01
5.1.7. Topspin fh+ Fishing' bh (%)		1	0	0	0	0	0	
5.1.8. Topspin fh+Push fh (%)		1 ^d	0 ^d	15 ^{a,b,c,f}		1 ^d	4	≤.01
5.1.9. Topspin fh+Chop bh (%)	8			4				
5.1.10. Topspin fh+Push bh (%)	2			7 ^{b,g}	10 ^{b,g}	1	1 ^{d,e}	≤.01
5.1.11. Topspin fh+Chop fh (%)	2							
5.2. Fast attack bh+Counterattack	2	1	1	43	83	45	107	
5.2.1. Fast attack bh+Fast attack bh (%)				30 ^{e,f}	54 ^c	53 ^c	55	.05
5.2.2. Fast attack bh+Fast attack fh (%)			100 ^g	56 ^{f,g}	45 ^g	29 ^{d,g}	5 ^{c,d,e,f}	≤.01
5.2.3. Fast attack bh+Topspin fh (%)	50 ^{d,c}			5 ^{a,g}		11 ^g	38 ^{d,e,f}	≤.01
5.2.4. Fast attack bh+Block bh (%)				7			2	
5.2.5. Fast attack bh+Block fh (%)					1	4		
5.2.6. Fast attack bh+Topspin bh (%)		100				2		
5.2.7. Fast attack bh+Push bh (%)				2				
5.2.8. Fast attack bh+Chop bh (%)	50							
5.3. Fast attack fh+CounterFast attack	10	2	80	62	62	11	15	
5.3.1. Fast attack fh+Fast attack fh (%)	90 ^{d,e,f}	100	84 ^{d,e,f}	40 ^{a,c}	56 ^{a,c}	36 ^{a,c}	67	≤.01
5.3.2. Fast attack fh+Fast attack bh (%)			1 ^{d,e,f}	29 ^c	31 ^{a,c}	45 ^{c,g}	7 ^f	≤.01
5.3.3. Fast attack fh+Block bh (%)			14	19	3	9	7	.10
5.3.4. Fast attack fh+Block fh (%)			1	8	5			
5.3.5. Fast attack fh+Topspin fh (%)	10			2	3	9	20	
5.3.6. Fast attack fh+Push fh (%)				2	2			
5.4. Topspin bh+Counterattack	0	22	8	0	16	72	23	
5.4.1. Topspin bh+Topspin bh (%)		5				53	4	
5.4.2. Topspin bh+Topspin fh (%)		77	0		13	44	39	
5.4.3. Topspin bh+Fast attack bh (%)			63		31	1	35	
5.4.4. Topspin bh+Fast attack fh (%)			13		50	1		

5.4.5. Topspin bh+Block bh (%)	9	25				13	
5.4.6. Topspin bh+Block fh (%)	9			6		4	
5.4.7. Topspin bh+Push fh (%)						4	
6.1. Block bh+Counterattack	3	35	83	84	104	47	116
6.1.1. Block bh+Block bh (%)		31 ^f	51 ^{d,g}	30 ^{c,f}	43	55 ^{b,d,g}	33 ^{c,f} ≤.01
6.1.2. Block bh+Topspin fh (%)		66 ^{a,c,d,e,f,g}	4 ^{b,g}	1 ^{b,f,g}	1 ^{b,f,g}	13 ^{b,d,e,g}	43 ^{b,c,d,e,f} ≤.01
6.1.3. Block bh+Fast attack fh (%)			40 ^{b,e,f,g}	35 ^{b,f,g}	23 ^{b,c,f,g}	6 ^{e,d,e}	2 ^{c,d,e} ≤.01
6.1.4. Block bh+Block fh (%)		3 ^{d,e,f}	5 ^{d,e,f}	18 ^{b,c}	24 ^{b,c,g}	19 ^{b,c}	9 ^e ≤.01
6.1.5. Block bh+Fast attack bh (%)	33 ^{b,c,d,e,f,g}			13 ^a	9 ^a		10 ^a ≤.01
6.1.6. Block bh+”Fishing” bh (%)	33		1				1
6.1.7. Block bh+Topspin bh (%)						6 ^g	1 ^f
6.1.8. Block bh+Push bh (%)							1
6.1.9. Block bh+Push fh (%)				4			
6.1.10. Block bh+Chop bh (%)	33						
6.2. Block fh+Counterattack	0	12	6	26	20	19	16
6.2.1. Block fh+Block bh (%)		25 ^{c,f}	83 ^{b,d,g}	27 ^{c,e,f}	60 ^{d,g}	63 ^{b,d,g}	19 ^{c,e,f} ≤.01
6.2.2. Block fh+Topspin fh (%)		50 ^{c,d,e}		8 ^{b,g}	5 ^{b,g}	26 ^g	63 ^{c,d,e,f} ≤.01
6.2.3. Block fh+Fast attack fh (%)		8	17	38 ^{e,f,g}	5 ^d		≤.01
6.2.4. Block fh+Block fh (%)		8		27	30	11	.06
6.2.5. Block fh+”Fishing” bh (%)							6
6.2.6. Block fh+Topspin bh (%)		8					6
6.2.7. Block fh+Fast attack bh (%)							6
7.1. Push bh+Counterattack	46	39	15	16	14	7	26
7.1.1. Push bh+Topspin fh (%)	59 ^c	69 ^{c,e,f}	7 ^{a,b,g}	31	36 ^b	29 ^b	46 ^c ≤.01
7.1.2. Push bh+Block bh (%)		13 ^a	33 ^a	25 ^a	21 ^a	14 ^a	31 ^a ≤.01
7.1.3. Push bh+Push bh (%)	4	5	13		7	0	0 .48
7.1.4. Push bh+Topspin bh (%)		3			7	14	12 .11
7.1.5. Push bh+Fast attack fh (%)		3 ^{c,d,f}	47 ^{a,b,e,g}	25 ^{a,b,g}	7 ^{a,c}	29 ^{a,b,g}	4 ^{c,d,f} ≤.01
7.1.6. Push bh+Push fh (%)		3					4 .08
7.1.7. Push bh+Block fh (%)		3			14	14	4 .08
7.1.8. Push bh+Fast attack bh (%)	2 ^d			19 ^{a,b,g}	7 ^{a,c}		.01
7.1.9. Push bh+Flick fh (%)		3					
7.1.10. Push bh+Chop bh (%)	22						
7.1.11. Push bh+Chop fh (%)	13						

7.2. Push fh+Counterattack	27	27	5	9	12	18	90	
7.2.1. Push fh+Topspin fh (%)	30 ^{d,g}	52 ^{e,f}	20	67 ^{a,e,f}	8 ^{b,d,g}	17 ^{b,d,g}	53 ^{a,e,f}	≤.01
7.2.2. Push fh+Block bh (%)		19	20		8	28	13	.12
7.2.3. Push fh+Topspin bh (%)		22 ^{a,f,g}			8		4 ^b	≤.01
7.2.4. Push fh+Block fh (%)	4				8	17	13	.21
7.2.5. Push fh+Fast attack bh (%)							2	
7.2.6. Push fh+Fast attack fh (%)			20 ^{a,b}	33 ^{a,b,g}	50 ^{a,b,g}	28 ^{a,b,g}	2 ^{d,e,f}	≤.01
7.2.7. Push fh+Flick fh (%)		4	20			6	2	.24
7.2.8. Push fh+Push fh (%)		4	20		8		6	.39
7.2.9. Push fh+Push bh (%)	15					6	3	.12
7.2.10. Push fh+Chop fh (%)	11				8			
7.2.11. Push fh+Chop bh (%)	37							
7.2.12. Push fh+"Fishing" fh (%)	4							
8.1. Aac Topspin fh+Counterattack	9	51	0	35	38	40	79	
8.1.1. Aac Topspin fh+Topspin fh (%)	100 ^{d,e,f}	69 ^{d,e,f,g}		46 ^{a,b,f,g}	37 ^{a,b,g}	20 ^{a,b,g}	86 ^{b,d,e,f}	≤.01
8.1.2. Aac Topspin fh+Fast attack fh (%)		20 ^{d,e,f}		40 ^{a,b,f,g}	53 ^{a,b,g}	73 ^{a,b,d,g}	9 ^{d,e,f}	≤.01
8.1.3. Aac Topspin fh+Push fh (%)		12		11		5	4	.12
8.1.4. Aac Topspin fh+Fast attack bh (%)						3	1	
8.1.5. Aac Topspin fh+Push bh (%)				3	8			
8.1.6. Aac Topspin fh+Block bh (%)					3			
9. Chop+Counterattack	171	0	0	0	0	0	0	
9.1.1. Chop-bh+Chop-bh	51							
9.1.2. Chop-bh+Attack-fh	26							
9.1.3. Chop-bh+Chop-fh	11							
9.1.4. Chop-bh+Attack-bh	4							
9.1.5. Chop-bh+'Fishing'-fh	5							
9.1.6. Chop-bh+Push-bh	3							
9.2. Chop-fh+Counterattack	61	1	0	0	0	0	0	
9.2.1. Chop-fh+Chop-bh	39							
9.2.2. Chop-fh+Attack-fh	30							
9.2.3. Chop-fh+Chop-fh	15							
9.2.4. Chop-fh+Push-bh	5							
9.2.5. Chop-fh+'Fishing'-fh	3							
9.2.6. Chop-fh+Attack-bh	5							

9.2.7. Chop-fh+Push-fh	3						
10. Other	18	13	16	6	10	21	26
10.1. 'Net' or 'edge'	78	85	38	83	50	67	65
10.2. Opponent's serve fault	22	15	56	17	50	33	27
10.3. other	0	0	6	0	0	0	8

Note: ^{a,b,c,d,e,f,g} - significant difference ($P \leq 0.025$) with particular player; a blank line means no cases or numbers too small, χ^2 test is significant if $P \leq 0.05$

dominant type of attack used in winning points is topspin fh.

Ma Lin

Comparing the structure of winning actions with the other champions, Ma Lin scored as much as 66% of his points in the first two tactics: Serve (S), Return (R), Service+Counterattack (S+C) and Return+Counterattack (R+C). This is the highest 'first four ball' efficiency. At the same time, this is the highest result of the S+C phase. This confirms the observations of other authors^{13,29} that Ma Lin's playing style was built around an excellent serve and serve and counterattack. This means a relatively low level of longer actions. In service actions (S, S+C), Ma Lin mainly used Serve fh backspin-nospin and Serve fh sidespin, which enabled direct scoring or attacking, mainly with forehand and which is characteristic of the style Ma represents¹³. These serves, played in various combinations, through their illegibility and the possibility of giving a large but also variable rotation (through also a penhold grip), give a great advantage to the player³⁰. Another attribute of Ma Lin is Return actions, in which he has scored many points. Among the actions with Return (R, R+C), the research showed high use of Push fh and various forms of attack, mainly with forehand. In longer actions, it is characteristic to use attacks with forehand advantage, but also to combine them with fh and bh blocks. Therefore, Ma Lin's game is considered a model game, but at the same time, a modern one when it comes to the traditional penhold style with inverted pimps lining¹³. It undoubtedly requires excellent footwork (great use of forehand attacks from all over the table), speed, and anticipation.

Liu Guoliang

Compared to other players, Liu, as another representative of the style with a penhold grip, but with a so-called bilateral game, has the highest efficiency of points won directly with a serve, and the highest efficiency of actions won directly with a return. Liu took 100% advantage in actions won directly with Serve side spin fh. Played in different variations, the serve allowed him to maintain an advantage over his rivals¹⁶. This player, as the most frequent winner of Return actions, used Fast attack fh, sometimes Topspin fh, and also Flick fh, thus fh attack techniques in the lead. Liu, known as a fast attack player, using short pips-out lining and reversed topspin bh in our research, used this play rarely to win a point, more often in combinations: Topspin bh+Counterattack. Playing this style must require excellent footwork, high speed (due to the use of forehand attacks to a large extent, combining attack with block, especially the bh side, and using pips-out lining, which promoted a change of pace in the game.

Deng Yaping

In addition to the relatively high efficiency of the game in the phases of the first 4 balls (S, R, S+C, R+C - 61%), Deng Yaping is particularly notable for the high use of Block+Counterattack. Notable in service actions is the high use of Serve fh backspin-nospin and Serve fh sidespin. In return actions one can find great use of Topspin and Fast attack fh and Push fh but also Block bh.

In the stalemate phase, the most common winning combination was Block+Counterattack. These were Block bh+Counterattack advantage actions. The last strike after the block was usually Attack fh (most) and Block bh as well as Block fh. In summary, the Deng Yaping style was based on fast play close to the table (hence the necessary speed and dynamics to play this style), difficult, unreadable serves, using fh attack strokes, but often in combinations with Push and Block bh. This last strike, performed with a long-pips-out lining, favored a change of pace in the game, required quick adaptation to the situation, and undoubtedly required good footwork and anticipation.

Zhang Yining

Compared to other masters of their styles, Zhang is characterized by a slightly lower (compared to other subjects) use in winning actions of serve and Serve+Counterattack (S, S+C), perhaps due to the imperfections indicated in the literature related to giving rotation to the ball during the serve³¹. However, she scored many points with Return+Counterattack, also Attack+Counterattack and Block+Counterattack. The highest number of directly won points with a serve as well as won R+C actions was found as a result of the player's use of Serve fh backspin-nospin primarily, but also Serve fh Sidespin and Serve fh reverse. The most common counterattacks in R+C actions were Block bh, Topspin fh and Topspin bh. In the stalemate phase, Zhang most often used action using Fast attack fh and Fast attack bh, often in combinations categorized as Fast attack+Fast attack, with both sides or Block+Fast attack. Also characteristic of Zhang are the game actions used against the defensive game (Attack Against Chop) - these were usually Topspin+Topspin or Topspin+Fast attack actions. Zhang's style requires a lot of speed and anticipation (she plays most of it close to the table), and because of the relatively small advantage in service actions - it also requires patience and confidence in keeping the ball on the table. A large number of Fast attacks and Block is often used, especially in women's table tennis, as other authors also point out^{8,24,31,32}.

Li Xiaoxia

Compared to all other athletes of her style, Li, who plays a bilateral topspin attack, achieved the highest percentage of attack+counterattack in her game. The most common combinations were Topspin bh+Counterattack, Topspin fh+Counterattack and Fast attack bh+Counterattack. The most common counterattack after Topspin fh was found Topspin fh and Topspin bh, after topspin bh - topspin bh and topspin fh. This player was found to have a relatively small percentage of actions won directly by serve, while more were won by Serve+Counterattack. Most often, it was Serve fh backspin-nospin; less often, Serve fh sidespin, in combination with Topspin fh and bh as a counterattack. In the studied athlete, there was a high percentage of wins directly with return R and in R+C actions, with the most frequent return being Push fh, Topspin fh and Push bh, counterattack after Return - most often

Topspin fh, also, in lesser quantity - Topspin bh. In summary, the style of play with bilateral topspin that Li Xiaoxia was found to represent is relatively long actions, definitely more use of topspin strokes, with only slightly more plays from the fh side. Although this style requires the use of more force (topspin plays) than fast attack based play, it is possible that the length of the action and the relatively high proportion of bh plays in Li Xiaoxia are related to the lower ability to generate force, speed and rotation of topspin strokes than in men, which is also evident from other studies^{8,24,31,33}.

Ma Long

Compared to the other athletes, Ma Long seems to have a very harmonized and balanced game, characterized by playing mostly technical-tactical actions. It was found that Ma Long won the most points, mainly in the first phases of the so-called "first phase" 4 balls (S, S+C, R, R+C). He mainly uses varieties of Serve fh sidespin, after this serve, he usually wins using Topspin fh, but also Topspin bh. Winning R and R+C actions account for as much as 31% of all points won. As a return, the most common winning play is Push fh, also Push bh, Topspin fh, and in smaller numbers Flick. After receiving, the most common winning stroke is Topspin fh, but also Topspin bh or Block. In actions in the stalemate phase, Ma Long uses the winning combinations Topspin fh+Topspin fh, as well as Topspin fh+Fast attack bh, and to a lesser extent Fast attack bh+Fast attack bh, and Fast attack bh+Topspin fh. After hitting Block bh very often wins, taking the initiative, Topspin fh. In summary, Ma Long is characterized by high use of Topspin fh, Fast attack bh, uses mainly Serve fh sidespin, but also effectively operates Push fh and Block fh, after which he is able to win with topspin impact. The style presented is also a high and stable level of a large number of technical-tactical elements, which, with regard to Ma Long, is emphasized in the literature³⁴.

The results obtained in the present study perfectly illustrate how varied table tennis is in terms of ways of scoring points - winning individual actions. Undoubtedly, this differentiation is also fostered by a high degree of individualization. At the same time, the game itself requires players to have a wide variety of solutions, and "a player who always responds in the same way to a sequence is bound to lose in the long term, even if his technique is perfect"³⁵. Nevertheless, when observing a game, it is possible to distinguish a certain set of technical-tactical actions used most often by a given player, which defines his style of play^{4,13,16}. These styles may differ from one another, as demonstrated in detail in this paper. These differences relate to the serves used, the receives, the use of winning single strokes and combinations of plays, the average number of rallies (i.e., the duration of the action), the preferred side (bh, fh) and are sometimes related to the distance from the table where the player most often uses his winning shots. These differences may be due to a number of factors. For example, the penhold racket grip is associated with high use of service and pickup actions in scoring points. Players playing mainly fast attack also use service actions, which are usually short, ending in the first four balls (S, R, S+C, R+C). Both-sides attack (topspin or Fast attack) usually refers to players whose most winning actions are also the first four balls, which most likely must be related to the player's speed and excellent footwork. Topspin attack players play more long actions than fast attack players. The longest attack actions are played by bilateral players. The combo-attack equipment used most likely causes the game of such a player to boil down to many exchanges, in which he uses block and counterattack relatively most often.

The defender's winning actions largely rely on the use of long

actions, in which Push+Counterattack and Chop+Counterattack combinations are most often important.

The literature emphasizes that gender, to some extent, determines playing style^{18,21}. The research done in this work confirms these claims. The use of Fast attacks to a greater extent, consequently playing in the first zone - close to the table, longer exchanges, Block+Fast attack combinations - these are observations that mainly concerned selected female representatives of several styles of play. Therefore, our observations can be taken as some recommendations for choosing a style of play for women. Arguably, the defensive style described in the paper on the male table tennis representative, but given the length of the action and the less marked need to use force in the game, could also be recommended for women.

The observations made in this paper can also give some clues about the selection of players for a particular style of play and further training to improve their chosen style. By following the details from our work on individual masters of various styles, it is possible to direct the coaching in the area under discussion. For example, a player with an effective serve and possible opportunities to develop serving skills may base his game largely on a one-side (fh) attack of balls after the serve. A player with great skills in the so called certain game, well-applying tactics and playing at different distances from the table can be improved to develop a defensive style. A combo-attack athlete who has an effective pips-out (or other) lining block must be equipped with second-side (fh) attacking skills, etc., to become a high-level player. The present work can be a starting point for further statistical analyses comparing the tactical actions of the greatest table tennis champions within a given style of play, as well as works indicating how to play optimally against different types-styles of play.

The research done in our work also has its limitations. First, we analyzed the play of only players coming from the Chinese training system. The classification and determination of the athlete's style made in our work, although uncontested in some cases, is our subjective assessment and division. Another limitation is that the evaluation and determination of tactical actions, although made throughout the research process by the same person and with a great deal of experience in observing the game, may be subject to the error of subjectivity in a small number of cases. It would also be important to remember that the method used applies to statistics related only to the winning technical-tactical actions of the player not bringing. Additionally, in our work, we analyzed the winning technical and tactical actions of one champion of a given playing style. However, we should be aware of the possibility of winning points in a slightly different way, remembering the phenomenon of individualization. One should approach the results of our research with caution then and it's not about copying the best, but about creatively developing the player's skills. However, keeping in mind the direction of development and the winning methods used by the best champions.

Practical applications. The paper can be useful for coaches and players to have the key information about the most winning strokes and combinations needed for each of the main particular playing style, according to specific talents. Studying the statistical models of the best champions representing each of the styles can be applied to creating a "small world" in any training group in any table tennis center. This is "the must have" in developing adaptability to any playing style, and making simulation training possible.

Conclusions

Observation of table tennis champions allows us to identify the best solutions they use to score points, which can be adopted and developed individually. The research carried out in the study made it possible to identify strokes and their combinations with which high-level table tennis players of different playing style score points. These also allowed the identification of the most important differences between players, which are the basis for classifying them into different playing styles. These differences, as shown in the work, relate to tactical actions in different phases of the game and to the use of different strokes and their combinations to score points. For example, players with the penhold racket grip use service and return actions in scoring points. Players using mainly fast attack also score points in actions, which are usually short, ending in the first four balls. The defender's winning actions largely rely on the use of long actions, in which Push+Counterattack and Chop+Counterattack combinations are most often important. Topspin attack players play more long actions than fast attack players. The longest attack actions are played by both-sides players. The combo-attack equipment used most likely causes the game of such a player to boil down to many exchanges, in which he uses block and counterattack relatively most often. The observations made in this paper can also give some clues about the selection of players for a particular style of play and further training to improve their chosen style. For example both-sides attack (topspin or fast attack) usually refers to players whose most winning actions are also the first four balls, which most likely must be related to the player's speed and excellent footwork. The results obtained in the work can be valuable information for coaches and players, regarding the possibility of applying effective tactical actions in the game, the direction of development of a particular style, or even, as a consequence, the possibility of taking specific actions in the game against specific styles.

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