Footwork in Relationship with Strokes and Efficacy during the 29th Olympic Games Table Tennis Final

Malagoli Lanzoni Ivan[1], Lobietti Roberto[1-2], Merni Franco[1-2]

[1] Departement of Histology, Embryology and Applied Biology, University of Bologna, Italy
(Tel : +39051502712; E-mail: ivan.malagoli@unibo.it)
[2] Faculty of Exercise and Sport Science, University of Bologna, Italy

Abstract:

Introduction and Aim of the study: Table tennis literature displays many efforts about the study of both the development of the game technique and the match and notational analysis. However those works were principally based on the observation and survey of some of the most important aspects: the strokes, the direction of the movements and the efficacy (won, lose, mistakes, etc.). This study aims to elaborate another kind of analysis including the footwork technique (different kind of steps). The most important thing, considering the best player technique, is the best execution of the movement and steps, for reaching in the shortest time the right position, and playing the best stroke.
Methods:
1. Environment: 29th Olympic Games in China - Man's table tennis singles final
2. Population: the n°1 (W. H.) and the n°2 (M. L.) in the world ranking
3. Data collected: footwork technique (different kind of steps), strokes and efficacy.
4. Analysis: it has been analysed the contingency table about Footwork/Strokes and Footwork/Efficacy.
Results: The two considered   players use mainly the One step (30% and 29%) to return the services, W.H. uses very often the Turn step (17%) to hit the ball with Topspin or Counter topspin. On the other side M.L. prefers to use a more balanced footwork technique, using a combination of Chassè and Turn step (14% and 14%). W.H. uses more frequently the topspin (14%)and the Counter topspin (15%), M.L. prefers the Counter topspin (17%) followed by Topspin (13%). It is possible to notice that the players do not use one step (13%-11%) during the game phases and W.H. does not use one step in particular to hit the ball with a forehand Topspin (10%). The players use in particular the One step in a neutral way (without efficacy, 63% and 72%), W.H. uses the Turn step with good results (25%) but also in a negative way (21%). During the match M.L. is able to use with more positive results every different kind of steps. He shows negative performances using the Chassè (25%) and the Crossover (23%).

Keywords: Footwork technique, Strokes, Match analysis, Performance analysis, 29th Olympic Games

1. INTRODUCTION

Table tennis is one of the most popular and widespread sport in the world and it can be considered a very complex sport and its development is still in progress. Studies on Table tennis show that many factors are worth of consideration. These are technique, game plan joined with psychological and physical aspects. Table tennis literature shows several studies about the development of the game technique [1, 2]. Regarding the technique, different studies have been carried out: Qualitative game analysis [3] and Analysis on technique and tactics of one player [4]. Moreover, Ripoll H. [5] considered the strokes' psycho-motor aspects and Rodano R. [6] the biomechanics ones. Such studies were principally based on the observation of one of the most important technical aspect: the strokes. By observing the best player technique, it is clear the importance of the execution of movements, steps and shifts. Footwork skills are very important and it should be pointed out the importance of studying, training and developing them in order to obtain high performance results. It is important to notice that the best execution of movements is fundamental for reaching in the

shortest time the right position , and playing the best stroke [7].
This study is based on a standard step classification that has been shown during The 10th Anniversary ITTF Sport Science Congress 2007 [7] and on a previous pilot study about the comparison of the steps performed by international and national players [8].
Table tennis literature displays many studies about the match and notational analysis [3, 4, 10]. Such works were principally based on the study and the observation of some of the most important aspects: the strokes, impact position of the ball on the table, istant of the service and moment when the point finished, direction of the movements and efficacy (results and type of error). This study aims to elaborate a new type of analysis including also the footwork technique, analyzing different kind of steps in relationship with strokes and efficacy.

1. METHODS

The starting point of this work was the analysis of Man's table tennis singles final of the 29th Olympic games in China (video recorded from television). The players considered were the n°1 (W. H.) and the n°2 (M.

L.) in the world ranking and the data collected for every player are: footwork technique (different kind of steps), strokes and efficacy. This study is based on the analysis of the contingency table about Footwork/Strokes and Footwork/Efficacy.

2.1 Footwork

The following Steps' classification used to elaborate this study has been previously shown during The 10th Anniversary ITTF Sport Science Congress 2007 in which they have been introduced a study suitable to analyze the game technique at a high level to improve the training and, of course, the agonistic results [7, 9].

Steps' classification:
1. One step
2. Short and medium steps
   a. side to side or "chassé"
   b. slide step
   c. turn step
3. Crossover

This classification is based on a right hand player and it could be referred also to a left hand one in perfectly symmetric way [7].

One step: is a small step played starting from the ready position or during other game phases, keeping one foot still and moving the other one towards the ball. The foot that plays the movement should immediately comes back into the ready position.
One step footwork is used when the ball is played very quickly by the opponent and there is insufficient time to get into the right position for playing the stroke. This type of step is mainly played to return short services or balls played very close to the net [7].

Short and medium steps: all those movements played from the ready position or during other game phases and involving the movement of both feet. These steps allow players to cover short or medium distances, towards the ball for playing the strokes, with very high speed[7].
a. Side to side or "chassé": if the movement is on the right side, the left foot moves first and has to get close to the right one, which will move on the right side. So that, at the end of the movement the player will get back on the ready position[7].
b. Slide step: if the movement is on the right side the right foot moves first, followed by the left one which will slide in the same direction. So that, at the end of the movement the player will get back on the ready position[7].
c. Turn step: is the movement played by a player who wants to play a forehand stroke from the backhand corner. This step could be done following the chassé or slide step technique. It is especially useful for playing the forehand topspin from the backhand corner[7].

Crossover: is used when the player has to cover a long distance in a short time. Crossover footwork should not be used for short distances. The player is in the backhand corner waiting to cover most of the table with the forehand. The player initiates movement to the right by tacking a step with the right leg into a wide stance. The left leg crosses over in front of the right leg as contact is made. As the follow-through is completed the right leg is brought forward. At the end the right leg finishes in a wide position ready to push back to the left [1].

2.2 Strokes

Regarding the strokes, it follows the classification proposed by Tepper G. [1] without description.

Strokes' classification (forehand or backhand):
1. Service
2. Topspin
3. Push
4. Block
5. Topspin counter topspin
6. Flick
7. Smash
8. Drive
9. Lob

2. Effect of the strokes, efficacy

To evaluate the effect of the strokes 5 codices were used. Each stroke was classified and described in the following table:

Symbols	Description
#	perfect execution, winning stroke, assigns the point
+	good execution of the strokes, creating a favourable situation
0	neutral stroke, transition action, without advantages
-	negative execution of the strokes, creating a better situation for the opponent
=	error, mistake, losing stroke (out, net, etc.), assigns the point at the opponent

2.4 Methodological aspects

- During the match, each action has been classified by: step, stroke and result (efficacy).
- Only the last step before the stroke (or before the attempt to hit the ball) has been considered in this analysis.
- Data have been collected in a 15x7 table for every player, in which different types of steps (in columns) and strokes (in lines) have been taken into account.
- It has been also considered the efficacy of the strokes and the date have been collected into a 5x7 table for every player, in which different types of efficacy (in columns) and steps (in lines) have been

taken into account.

- Problems emerged because of the difficulty in recognizing and discerning "stroke without step", "step without stroke" and the last step before the attempt to hit the ball. This is made even more complex by the fact that often many quick steps' combination are involved.
- Another problem was to decide the different efficacy (+, 0 or -) of the strokes during the game actions, to relate the strokes with the success of it.
- Data have been collected looking at the match with the slow motion and looking at one player each time.

3. RESULTS

The first analysis of the data is based on the comparison of the footwork technique used by the two players taken into account (W.H. and M.L.).
The following table reports all the different steps' frequencies calculated in percentages:

Footwork/Player (%)	W.H.	M.L.
One step	30	29
Service	17	18
Turn step	17	14
Stroke without step	13	11
Chassè	11	14
Crossover	8	11
Slide step	4	3

The most frequent step is the One step, both the players perform the One step very often (W.H.: 30% and M.L.: 29%) to return the services. W.H. plays the Turn step with a frequency of 17%, whereas M.L. use it with the 14%. M.L., the winner of the match, plays Chassè 14% and W.H. plays it with the frequency of 11%. Analysing the Stroke without a step, both the athletes have high percentages (W.H.: 13% and M.L.: 11%). It is important to notice that the two players considered do a movement during the execution of the service and this step has been included into the analysis of the steps (W.H.: 17% and M.L.: 18%).

The second analysis of the data is based on the comparison of the strokes played during the match considered.
In the following table, the most important strokes' frequencies have been calculated in percentages and it has been added the lowest data (last line):

Stroke/Player (%)	W.H.	M.L.
forehand service	17	18
forehand Topspin	14	13
forehand Top counter Top	15	17
forehand push	9	14
backhand block	12	6
backhand Top spin	10	5
other strokes	23	27

The most frequent stroke is the forehand service (W.H.: 17% and M.L.: 18%). The second one is the forehand Topspin counter topspin (W.H.: 15% and M.L.: 17%) and it shows the offensive characteristics of their play. W.H. uses with the 14% forehand Topspin and M.L. the 13%. The most important difference is that M.L. uses in a balanced way the forehand push (14%) and the backhand block (12%); W.H. prefers to use the two strokes considered the 9% and the 6%. Another important difference is about the execution of the backhand Top spin (W.H.: 10% and M.L.: 5%).

The analysis of the data has been continued comparing the technical characteristics of the two athletes by the relationship between footwork and strokes. The most frequent step is the One step and both finalists use it to return the services with the forehand push but with big differences. W.H. returns in a more balanced way (forehand push:27% and backhand push: 24%); whereas M.L. prefers play the forehand push (47%) more than the backhand push (24%) after the execution of a One step. It is interesting to consider that the most used strokes is the Topspin counter topspin and both the players prefer doing it after a Turn step (W.H.: 45% and M.L.: 46%). The same stroke has been played after a Crossover step (W.H.: 31% and M.L.: 27%) and after a Chassè (W.H.: 14% and M.L.: 14%).

The last part of the analysis of the data is based on the relationship between footwork and efficacy (results) of the strokes.
In the following table all the different results' frequencies have been calculated in percentages:

Efficacy/Player (%)	W.H.	M.L.
#	4	3
+	16	11
0	63	72
-	1	2
=	16	13

This relationship shows that the most part of the movements or steps have been followed by neutral strokes (W.H.: 63% and M.L.: 72%). W.H. realized many steps with positive results (#: 4%, +: 16%) but at the same time he has done lot of mistakes (=: 16%). M.L. realized more steps followed by neutral strokes (O: 71%), he has been less efficient in the attack and counter attack game phases (#: 3%, +: 11%) but he has done less important mistakes (=: 13%).

The last phase of the analysis shows the importance of the game phases followed by positive (+) and very positive results (#). W.H. usually wins actions without a movement (36%) or with a Turn step (27%) and M.L. plays this kind of actions with a Crossover (43%) or with One step (29%). Considering the positive actions (+), W.H. has used a Chassè (31%) and a Turn step

(20%). M.L., the winner of the match, used in a more balanced way the different footwork techniques (Turn s.: 23%, one s.: 20%, Chassè-crossover and Stroke without a step: 17%). The same kind of analysis will be done about heavy mistakes (=), W.H. did many mistakes after a One step (28%), after a Turn step (23%) and after a Stroke without step (21%). M.L. did less mistakes of the opponent (M.L.: 34, W.H.: 43) and in a more balanced way considering the different kind of steps (Chassè: 24%, Crossover: 21%, Stroke without a step: 18%, One step and Turn step: 18%).

4. DISCUSSION AND CONCLUSION

The statistical results of the analysis are important to study in depth the technical aspects about Table tennis: steps and strokes. It is important to underline that both the players perform the One step very often, especially to return the services and it is possible to consider this step the most important one. The most frequent stroke is the forehand service and the second one is the Top spin counter Top spin. It is fundamental to notice the importance of the services and the footwork technique performed to return the services of the opponent. These data show also the offensive characteristics of the modern play.

The statistical results of the analysis carried out on the two finalists display inter individual differences in the characteristics of the step movements, strokes and efficacy. Analysing the data it is interesting to notice that W.H. returns the services in a more balanced way, using forehand and backhand push. Another important difference is about the execution of the backhand Top spin (W.H.: 10% and M.L.: 5%).

It is possible to consider the winner of the match (M.L.) more able to use in a balanced way the strokes and the footwork technique. The loser (W.H.) realized many steps and strokes with positive results but at the same time he did a higher number of mistakes. Probably this is the reason why he lost the final. W.H. did the most part of the mistakes with the use of a One step and Turn step, returning the services and playing forehand attacks after a Turn step.

Comparing different players' technique can also allow a deep analysis of the game plan and futher studies on a larger number of matches, using the same methods, will permit a better understanding of the technical aspects.

It will be fundamental to improve the knowledges about Table tennis studying and analysing footwork and the relationship between footwork and strokes.

Again another useful use of this study is could be represented by the tactical use that can be displayed starting from a deep knowledge of footwork and strokes. Knowing one's values and one's faults in performing the movements and the strokes is important to ameliorate one's technique, but it's even more important to know values and faults of the challenger from the tactical point of view in order to get better agonistic results.

REFERENCES

[1] Tepper G., *ITTF Level 1 coaching manual*, 2003, www.ittf.com

[2] Deniso P., Fruscione P., Quintiliani M., Tennistavolo, preparazione fisica , tecnica e didattica, Società stampa sportiva, Roma, 1992

[3] Leser R., Baca A., R., Kain H., Qualitative game analysis in table tennis, *Proceedings book of The 10th Anniversary ITTF Sport Science Congress*, 2007, p.99-103

[4] Hao Zhe, Cai Xue-Ling, He Fei, Hao Yu-Jiao, Analysis on technique and tactics of Ryu Seung-Min in men's singles table tennis final and semi final of the 28th Olympic games in Athens, *Proceedings book of The 10th Anniversary ITTF Sport Science Congress*, 2007, p.374-382

[5] Ripoll H., Comprendere ed agire: la soluzione del conflitto semantico-sensomotorio nello sport, *Scuola dello sport*. Parte prima: 1989, n° 17, p. 23-28. Parte seconda: 1990, n° 18, p. 38-43

[6] Rodano R., Del Rossi D., Manoni A., Del Leva P., Mallozzi L., Carvelli E., Cinematica nel Tennistavolo: applicazione di un sistema di elaborazione automatica dell'immagine televisiva ELITE alo studio della cinematica del tennistavolo, *Scuola dello sport*, 1991, n° 21, p. 50-56.

[7] Malagoli Lanzoni I., Lobietti R., Merni F., Footwork techniques used in table tennis: a qualitative analysis, *Proceedings book of The 10th Anniversary ITTF Sport Science Congress*, 2007, p.401-408

[8] Malagoli Lanzoni I., Lobietti R., A pilot study to compare footwork techniques used in Table tennis, P*roceedings book of The World Congress of Performance Analysis of sport VIII*, Magdeburg, Germany, 2008, p. 58-62.

[9] Ak E., The use of split-step by table tennis players in Turkey, *Proceedings book of The 10th Anniversary ITTF Sport Science Congress*, 2007, p. 312-315

[10] Wu X. Z., Escobar-Vargas J., Notational analysis for competition in table tennis (part I: based format analysis, p.104-108) (part II: non-format analysis, p. 109-118), *Proceedings book of The 10th Anniversary ITTF Sport Science Congress*, 2007.