Serve analyses of elite European table tennis matches

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Abstract

The purpose of this study was to analyze the serve activities of elite European table tennis players. Twenty matches (78 games, 1466 points) of semifinal and final German League and Europe TOP 16 in men’s (in the top 30 of ETTU Rank list) were analyzed. Differences in serving activities (type, stroke type, outcome and placement) were analyzed according results outcome of match, game, point, phase of the game and type of games.

Results showed that forehand short serve prevailed (76.9%) instead other types of serve, mostly placed in the middle of the table on the opponent’s backhand side. Percentage of point won directly with serve was 11.6%, points won with 3rd stroke - 22.4% and points won with 5th stroke after serve (10.9%). Lost points after serve mostly were after 3rd stroke (25.0%) and after 5th stroke (22.4%) and serve errors were noted in 1.5% of all analyzed points. In the 3rd phase of the game serve points were won mostly with 3rd and 5th stroke instead previous phases of the game.

Results of Pearson’s chi-squared test showed an association between match outcomes and serve type and outcome, serve type and outcome considering phase of the game and different type of games with serve type, outcome and placing zones.

Keywords: Activity Analyses, Notational Analyses, Player Performance

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Introduction

Table tennis is a complex sport with a large number of different types of strokes, which become even more specialized or individualized by the type of execution, the intensity, and the tactical goal (Tepper, 2003). However, the serve in table tennis affects the whole rally. The serve in table tennis is the strokes that puts the ball in play and is often referred to as one of the most important strokes in the game, influencing one’s scoring or losing tendency. In general, players should take maximum advantage of a service in order to score and this is regarded as the most important challenge for them (Molodzoff, 2008; Geske & Muller, 2010).

High performance table tennis requires observation and measurement to improve knowledge of performance, application of new knowledge to enhance performance (Hughes, Cooper, & Nevill, 2004), so collecting data of strategy and tactics is important, and can help coaches and players to better understand and prepare a strategy for the match (O’Donoghue, 2004; Padulo et al., 2016).

Serve activities already were reported as important indicators of performance in high-ranking table tennis players (Djokic, 2002a, 2002b, 2003; Katsikadelis, Pilianidis, & Mantzouranis, 2013; Zhang, Liu, Hu, & Liu, 2013; Malagoli Lanzoni, Di Michele, & Merni, 2014; Tamaki, Yoshida, & Yamada, 2017; Fuchs et al., 2018; Zhang, Zhou, & Yang, 2018).

Previous research has shown that 80% of rallies in the table tennis matches ends at the fifth stroke, and even if the rally continues, one player is usually in a winning position at that same stroke (McAfee, 2009). Besides, a more recent study confirmed that rallies become shorter (Leite et al., 2017; Djokic, Munivrana, & Levajac, 2016a, 2016b). The application of the most recent service rules as well as the use of new rubbers and plastic balls seem to decrease the efficacy of serve resulting in the shortening of the match (Djokic et al., 2019).

Considering all this as well as the serve impact on the game, there is strong need for permanent analyses and monitoring.

The aim of this study was to analyze the serve activities of elite European table tennis players.

Material and methods

Data sample

Twenty matches (78 games, 1435 points) of semifinal and final German League (season 2018/19 and Europe TOP 16 (2018) in men’s competition were analyzed. All players were in the top 30 of ETTU Rank list.

Variables

Performance indicators measured to provide information about the serve activities were:

Serve type:
1) FSHOSE - Forehand short serve (serve that, if allowed, ball would bounce twice on the far side of the table).
2) FLONSE - Forehand long serve (serve, with the second bounce off the table)
3) BSHOSE - Backhand short serve
4) BLONSE - Backhand long serve

Serve outcome:
5) SERDIR - Serve direct point
6) SER3WN - Serve point won after 3rd stroke
7) SER5WN - Serve point won after 5th stroke
8) SER7WN - Serve point won after 7th stroke
9) SER3LS - Serve lost point after 3rd stroke
10) SER5LS - Serve lost point after 5th stroke
11) SERROR - Serve error

Serve placement (Djokic, 2002b):
12) SOUTFH - Outside forehand zone
13) SMIDFH - Middle forehand zone
14) SMIDBH - Middle backhand zone
15) SOUTBH - Outside backhand zone

Figure 1. Serve placement zones
Differences in serving activities (type, outcome and placement) were analyzed according to the final results outcome of match, game and point. Also, we considered 3 score periods (phases) in game: from 0 to 4 points as the first phase (e.g. till 4:3), from 5 to 8 the second phase (e.g. from 5:4) and 8 to 11 the third phase (e.g. from 8:5) of the game with the aim to see does the serve activities differ in different part of the game. At the end, according to the game result we analyzed serve activities in three type of games: balanced (2 difference points (e.g. 11:9, 12:10), N = 464), unbalanced (3-5 difference points (e.g. 11:6-11:8), N = 826) and very unbalanced (6 and more difference points (e.g. 11:0-11:5), N = 174).

Procedure

Data were collected by videos of matches available on the official DTTB and ITTF website. The video material allowed the observers during the video analysis to clearly see the players, the table, and the playing area, which allowed a reliable verification of all events during the match. The observer analysed video of the matches in real speed, but in case of certain inconsistencies, they were re-wound and seen in slow motion (0.2 X). Kinovea, a free 2D motion analysis software (player) under GPLv2 license was used. All the data were registered in the specially prepared templates for the analysis of every match (by hand on paper), in which all the analysed variables were coded and after that, the data were input to a Microsoft Excel spreadsheet.

Reliability

In order to ensure a quality of reliability (O’Donoghue & Mayes, 2013), the matches were evaluated by means of intra- and inter-observers. For this research, two expert table tennis coaches were engaged for the role of observers. The intra- and inter-observer reliability is based on the analysis and re-analysis of 20 games randomly selected. Krippendorff’s Alpha was calculated to assess data collection reliability (Krippendorff, 2004). The intra-observer reliability analysis showed an Alpha value of 0.995. Inter-observer reliability was assessed reanalysing all the matches by the second analyst.

Statistical analyses

Descriptive statistical parameters (frequencies and percentages) were calculated for all analyzed samples with a consideration of result outcome (winners/losers). A Pearson’s chi-square test of independence was performed to examine the relation between serve activities and winning matches, with a level of significance of (α = 0.05). All the data were analyzed using SPSS 20.0 (IBM Corporation, USA).

Results

Results showed that short forehand serve is the most used kind of service. Complete results of analyses of serve type are shown in Table 1.

Table 1.
Results of analysis of serve type of all sample and according result outcome (winners/losers)

| Serve Type | ALL SAMPLE | WINNERS | LOSERS |
|------------|------------|---------|--------|
|            | Frequency  | %       | Frequency | %     | Frequency | %     |
| FSHOSE     | 1126       | 76.9    | 584       | 80.3  | 542       | 74.8  |
| FLOSNSE    | 254        | 17.3    | 102       | 14.4  | 152       | 20.3  |
| BSHOSE     | 62         | 4.2     | 32        | 4.6   | 30        | 4.5   |
| BLONSE     | 4          | 0.3     | 2         | 0.7   | 2         | 0.4   |
Based on the results of chi-square test we can state that there was a significant association between winning the match and serve type $X^2(2, N=1466) = 11.685, p < 0.20$).
The serve outcome in analyzed matches showed that most points were won with the 3rd ball after serving and directly with serve, while most often points were lost after 3rd and 5th stroke. Results of analyses of serve outcome are shown in Table 2.

| Table 2. Results of analysis of serve outcome of all sample and according result outcome (winners/losers) |
|---------------------------------------------------------------|
| **ALL SAMPLE** | **WINNERS** | **LOSERS** |
| **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Won points    |            |            |            |            |            |
| SERDIR        | 170        | 11.6       | 94         | 12.9       | 76         | 10.3 |
| SER3WN        | 328        | 22.4       | 170        | 23.3       | 158        | 21.5 |
| SER5WN        | 160        | 10.9       | 92         | 12.6       | 68         | 9.2  |
| SER7WN        | 90         | 6.1        | 60         | 8.2        | 30         | 4.1  |
| Total         | 748        | 51.1       | 416        | 57.1       | 332        | 45.1 |
| Lost points   |            |            |            |            |            |
| SER3LS        | 366        | 25.0       | 176        | 24.1       | 190        | 25.8 |
| SER5LS        | 328        | 22.4       | 126        | 17.3       | 202        | 27.4 |
| SERROR        | 22         | 1.5        | 10         | 1.4        | 12         | 1.6  |
| Total         | 716        | 48.9       | 312        | 42.9       | 404        | 54.9 |

| Table 3. Results of analysis of serve placement of all sample and according result outcome (winners/losers) |
|---------------------------------------------------------------|
| **ALL SAMPLE** | **WINNERS** | **LOSERS** |
| **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| SOUTFH        | 186      | 12.8       | 104      | 14.4       | 82       | 11.3  |
| SMIDFH        | 306      | 21.1       | 140      | 19.4       | 166      | 22.9  |
| SMIDBH        | 730      | 50.4       | 354      | 49.3       | 376      | 51.8  |
| SOUTBH        | 224      | 15.5       | 122      | 16.9       | 102      | 14.0  |

Based on the results of chi-square test we can state that there was a significant association between winning the match and serve outcome, $X^2(2, N=1466) = 34.229, p < .000$).

Most of the points after serve were finished after 3-5 stroke, and winners has a better percentage of winning points on serve directly and after 3rd and 5th stroke. The most used zone on the opponent's side of the table where serve were placed was middle, more in backhand side. Results of analyses of serve placement are shown in Table 3.

There was no significant association between winning the match and serve placement.

Analyzing serve activities and outcome instead of the phase of the game, it is noted that in last phase most points were won with 3rd and 5th stroke. Besides, involving the backhand serve was noted in 2nd and 3rd phase (Table 4).
Table 4.
Results of analysis of serve type and outcome in different phases of the match of all sample

| Serve type   | 1st PHASE | 2nd PHASE | 3rd PHASE |
|--------------|-----------|-----------|-----------|
| FSHOSE       | 79.9      | 73.9      | 77.5      |
| FLONSE       | 17.6      | 19.9      | 16.3      |
| BSHOSE       | 2.5       | 5.8       | 5.7       |
| BLONSE       | 0.0       | 0.4       | 0.5       |
| Total        | 100.0     | 100.0     | 100.0     |

| Serve type | Frequency | %  | Frequency | %  |
|------------|-----------|----|-----------|----|
| SERDIR     | 170       | 22.8 | 366       | 51.1|
| SER3WN     | 328       | 44.0 | 328       | 45.7|
| SER5WN     | 158       | 21.2 | 22        | 3.2 |
| SER7WN     | 90        | 12.0 | 96        | 13.7|
| Total      | 746       | 100.0| 716       | 100.0|

There was a significant association between phase of the game and serve type, $X^2(2, N=1464) = 16.669, p < .034$ and serve outcome $X^2(2, N=1464) = 22.591, p < .031$.
The analyses of all won and lost points were done from the aspects of serve type, outcome, placement and type. Results of analyses are shown in Table 5. Won points are mostly in the 3rd rally (44.0%) and 5th rally (21.2%), while lost in the 3rd (51.0%) and 5th (45.7%). Considering type of game, we analyzed differences in serve activities between balanced and unbalanced games (very unbalanced were excluded because they didn’t represent real game situation considering result. There was noted a significant association between serve type, X2(2, N=1290) = 12,588, p < .013), serve outcome, X2(2, N=1290) = 14,794, p < .022) and serve placement, X2(2, N=1290) = 81,362, p < .000). In balanced games players used more backhand serves, more points were won in 3rd stroke, fewer lost after 3rd stroke and serves were placed more in middle zones (especially forehand) compared to unbalanced games. All results are shown in Table 6.

### Table 6.
Results of analysis of serve activities for different type of game

| Serve type | Balanced Frequency | Unbalanced Frequency | Very unbalanced Frequency |
|------------|--------------------|----------------------|--------------------------|
| FSHOSE     | 346                | 634                  | 146                      |
| FLONSE     | 80                 | 154                  | 20                       |
| BSHOSE     | 32                 | 24                   | 6                        |
| BLONSE     | 2                  | 1                    | 2                        |

| Serve placement | Balanced Frequency | Unbalanced Frequency | Very unbalanced Frequency |
|-----------------|--------------------|----------------------|--------------------------|
| SOUTFH          | 54                 | 112                  | 20                       |
| SMIDFH          | 162                | 118                  | 26                       |
| SMIDBH          | 194                | 434                  | 102                      |
| SOUTBH          | 48                 | 150                  | 26                       |

**Discussion**

The objective of the research was to analyze serve activities in elite European players.

Regarding the serve type, the forehand short serve was dominant (around 80%) and as in some previous research there was a significant difference in the use of the forehand short serve in favour of the winners (Djokic, 2003). Winners are better at performing short serves than losers. Most points were won (and finished) in the 3rd ball and the rate of points won directly with serves is high – 11.6%, but still lower than before changes of the serve rules were applied – 14.3% (Djokic, 2003). The same results were found also in a recent study of Djokic et al. (2019).

There was a significant association between winning the match and serve outcome with point directly won with the serve and the winning point – after 5th and 7th ball. Zhang et al. (2013) indicated a
correlation between technique effectiveness and competition performance based exactly on these activities, which illustrates a difference between winners and losers.

In this study, percentage of won serve for the winners was 57.1%, and is in relation with previous researches of the best European players (53.1 – 61.6%) and best world players (59.3%) (Djokic, Munivrana, & Levajac, 2016a, 2016b, 2017).

The most used zone on the opponent’s side of the table where the serve were placed was middle, but more towards the backhand side, so players’ placement decisions are more or less the same as before (Djokic, 2003).

Analyzing serve type and outcome instead of the phase of the game, we found that as the game goes on in the second and third phases players start performing backhand serves as an alternative serve (because neither player hadn’t use a backhand serve in first phase of game). In the third phase, points were more often won with 3rd or 5th stroke, so, in this phase the server must have a high level of concentration on quality realization in short rallies.

A significant association between phase of the match and serve type was noticed, in fact, that the backhand, serve was in use in the 2nd and 3rd phase (not in 1st phase), probably as a choice by players to change something in the game. In addition, in the last phase, all players were trying to play a short serve in which game points usually were decided after 5th stroke.

Most of the points after the serve were won on the 3rd and 5th stroke (65.2%), which is higher than that reported in some previous research reported in European Championships (46.5%) and World Championships final (50%) (Djokic, Munivrana, & Levajac, 2016a, 2016b).

In balanced games, the backhand short serve was more frequently used, probably as a player’s attempt to change something and disturb the receiving opponent. Furthermore, in such matches there were more points won directly with the serve, and points won with 3rd stroke rather than in unbalanced ones. Accordingly, even if several table tennis rules intentionally reduced the advantage of the server (Djokic et al., 2019), the players do have the ability to make multiple types of services with identical motions, and so the service still has an important impact on a rally.

Conclusions

The results of the present study indicate that the quality of serve activities is an important differentiator between winners and losers in table tennis. The results of this research can be useful for coaches and players with regard to the identification of important aspects of serve activities, in order to design better training sessions. In addition, the findings can be seen as an advertisement for a particular model of performance analysis indicating a need for continuous systematic match observation in this sport.

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