DOI: 10.2478/tperj-2013-0013

Notational Analysis of the Volleyball Serve

Andrea CIUFFARELLA[1], Luca RUSSO[2], Francesco MASEDU[3], Marco VALENTI[4], Riccardo Edgardo IZZO[5] and Marco DE ANGELIS[6]

Abstract

The aim of the present study was to investigate the serving techniques in male top level volleyball, especially the tactical and spatial behavior of the servers and receiving opponents focusing on the pros and cons of the different serving techniques. An analysis was made of 4552 serves from 28 matches played during the 2008-2009 regular season of the Italian volleyball male Top League. Serving techniques were categorized into Jump Serve (JS), Float Jump Serve (FJS) and Float Serve (FS), and for each serve several parameters were recorded: role of the server (Setter - S, Hitter - H, and Middle Blocker - MB), kind of serve (JS, FJS, FS), number of players defending the serve (Defense), difficulty in receiving the serve (RS), evaluation of serve outcome (EV), and defensive court zone where the ball was directed (FZ). The results confirmed the largest use of the JS (69.9%), followed by the FJS (26.9%) and the FS (3.3%). There were significant relationships between the serve technique, the EV, the Defense and the FZ where the serves were directed (Chi-Square $p = 0.000$). The zone absolutely most hit was the posterior/central, followed by the left/posteriors. There were significant differences in the RS difficulty for the JS respect to FJS ($p = 0.001$) and FS ($p = 0.000$) and also for the defensive strategies performed: a defense strategy with 2 defenders showed significant and better score during the reception respect to that with 3 ($p = 0.000$). No statistical relationship was found between the role of the server and other parameters. These results are consistent with previous studies in which JS showed to be the most powerful technique in terms of increasing defensive difficulties but, at the same time, with a fairly high percentage of errors. This issue must be taken into consideration in crucial phases of the game, and the serving techniques must be used strategically. JS can be very useful for increasing the defensive "conflict zones" with the aim to score a direct ace or to make the offensive maneuver difficult after reception. FJS can be useful when there is the need to aim a specific FZ and prepare the team for the next defense action. Scouting or match analysis procedure of the serving statistics should be performed during the game to better indicate the serve strategy to choose.

***Key words**: Match analysis, Notational analysis, Volleyball, Serve technique.*

Rezumat

Scopul studiului de față a fost investigarea tehnicilor de serviciu la voleibaliștii de top, de sex masculin, în special comportamentul tactic și spațial atât al jucătorilor la serviciu cât și al jucătorilor care realizează preluarea din serviciu, cu focus asupra "pro și contra" în ce privește diferitele tehnici de serviciu. A fost realizată o analiză a 4552 de servicii din 28 de meciuri jucate în cursul sezonului normal de Voley masculin al Italiei din 2008-2009, Liga întâi (de elită). Tehnicile de serviciu au fost grupate în: Serviciu din săritură - Jump Serve (JS), Serviciu din săritură planată - Float Jump Serve (FJS) și Serviciu planat - Float Serve (FS). Pentru fiecare tip de serviciu au fost

[1]PhD, Department of Applied Clinical Sciences and biotechnology, Human Movement and Sport Science Faculty, L'Aquila University, L'Aquila, Italy
[2]PhD, Department of Applied Clinical Sciences and biotechnology, Human Movement and Sport Science Faculty, L'Aquila University, Sport Science Faculty, Urbino University "Carlo Bo", Urbino, Italy
[3] PhD, Department of Applied Clinical Sciences and biotechnology, Human Movement and Sport Science Faculty, L'Aquila University, L'Aquila, Italy
[4] Professor, MD, Department of Applied Clinical Sciences and biotechnology, Human Movement and Sport Science Faculty, L'Aquila University, L'Aquila, Italy
[5] Professor, School of Sport Science, Urbino University "Carlo Bo", Urbino, Italy, *e-mail: izzore@yahoo.it*
[6] MD, Associate Professor, Department Sport Science Faculty, Urbino University "Carlo Bo", Urbino, Italy

înregistrați o serie de parametri: rolul jucătorului la serviciu ((coordonator de joc – Setter (S), atacant – Hitter (H), Jucător de blocaj la centru – Middle Blocker (MB)), tip de serviciu (JS, FJS, FS), numărul de jucători la preluare, (Apărarea – Defense), dificultatea preluării serviciului (RS), evaluarea rezultatului serviciului (EV), și zona de apărare din terenul advers unde a fost direcționată mingea (FZ). Rezultatele confirmă utilizarea majoritară a serviciului din săritură (JS) – 69,9%, urmat de serviciul din săritură planată (FJS) – 26,9% și de serviciul planat (FS) – 3,3%. S-a găsit o relație semnificativă între tehnica de serviciu, apărare și zona terenului advers în care a fost direcționată mingea (chi-patrat p=0.000). Zonele cele mai solicitate au fost 6 și 5. S-au găsit diferențe semnificative în ce privește preluarea servicului (RS) la serviciul dein săritură (JS) față de serviciul din săritură planată (p=0.001) și serviciul planat (p=0.000) cât și pentru strategiile de preluare a serviciului. O strategie de apărare cu 2 jucători la preluare a prezentat un scor semnificativ mai bun decât cel realizat cu 3 jucători (p=0.000). Nu a fost găsit nici un raport statistic semnificativ între rolul jucătorilor în echipă aflați la serviciu și alți parametri. Rezultatele acestea sunt în concordanță cu cele raportate de alte studii, care au arătat că serviciul dein săritură este cea care creează cele mai mari dificultăți la preluare, dar în același timp și tehnica care generează cele mai multe greșeli. Acest lucru trebuie luat în considerare în fazele cruciale ale jocului, tehnicile de serviciu trebuind să fie utilizate în mod strategic. Serviciul din săritură poate fi foarte util în creșterea „zonelor de conflict" defensiv în scopul înscrierii directe de „ași", sau pentru a îngreuia jocul ofensiv ce urmează preluării serviciului. Serviciul din săritură planată poate fi util atunci când se tintește în mod special o anumită zonă a terenului advers în scopul pregătirii unei acțiuni defensive următoare. Observarea, respectiv procedura de analiză a meciului în ce privește statistica serviciilor ar trebui făcută în timpul jocului în scopul alegerii celor mai bune strategii de serviciu.

***Cuvinte cheie**: analiza meciului, analiza înregistrării în joc, volei, tehnica serviciului*

Introduction

Volleyball is one of the most popular and commonly played team sport [1, 2] with complex athletic, technical and tactical demands involving short and intensive physical efforts, such as jumps or powerful movements, during training and competi-tion [3-8].

Modern volleyball is very quick, and in recent years sport scientists have begun to concentrate their studies on such game-related events defined to be "keys" to success or "performance indicators" by statisticians and researchers [9, 10]. In volleyball it is well know that the three main performance indicators are: the spike, the serve and the block [11]; it has been statistically proven that attack is a better predictor of success than defense [12]. Because serving is one of the most important attack actions [13] and it is the first offensive action of each rally [14], coaches give great importance to this technical fundamental.

The main goals of serving are: to score an ace or to make the opposing team's receiving and attack more difficult [14], compatibly to the skills of the opponents [10]. Three different techniques of serving could be categorized: float serve (FS, where the ball is hit with no spin and with both feet on the ground), float serve with jump (FJS, where the ball is hit with no spin in the air through a vertical jump) and jump serve (JS, where the ball is hit with much pace and topspin in the air through a great vertical jump); the last one has become increasingly relevant in high–level volleyball [13]. JS has a higher failure percentage than other service styles: 1 out of 5 JS goes to the net or out of play, while the ratio for the other modest serves is about 1 out of 12 [15,16], but it seems that the best teams tend to accept this high-risk strategy of serving [11, 13] because the percentage of JS stricken back attacking in the first *tempo* is fewer than the other kind of serves [16].

There is the need to study how the serve is used during a match by the high level teams. Several studies have investigated this issue describing the serve modalities in high level competitions [16-18], but the lapse of time between those data and today is too long; moreover, most of the matches and competitions studied were held before the current Rally Point System rule. Recently, a study [13] compared the three serving techniques in terms of effectiveness and ball speed, but the analyzed sample was very small (4 teams using only 377 serves in 4 games), so the aim of the present study was to better investigate the effectiveness of serving modalities in a larger sample of serves, to describe in detail the tactical and spatial behavior of the servers and receiving opponents, indicating the pros and cons of each serving technique.

Methods

Sample

An analysis was made of 4552 serves, categorized in Jump Serve (JS), Float Jump Serve (FJS) and Float Serve (FS). The whole sample was composed of all the 28 matches played on 4 days of competition (1st, 5th, 14th and 18th day of competition), 2 matches in the first phase and 2 in the second one during the 2008-2009 regular season of the Italian volleyball male Top League. The procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 1983. The study, that used only public and free video tapes of public matches, was designed as a descriptive survey of non-sensitive measures, not involving individuals, so approval by the ethical committee was not requested.

Instrumentation

Matches were analyzed through the video analysis software Dartfish Team Pro 5.5 (Dartfish, Fribourg, Switzerland) and data were stored electronically.

Protocol

A protocol of Notational Analysis [19] for Event Recording [20] was carried out during each serve, the parameters recorded were: role of the server (Setter - S, Hitter – H, and Middle Blocker - MB), kind of serve (JS, FJS, FS), number of players defending the serve (Defense), difficulty in receiving the serve (RS), evaluation of serve outcome (EV), defensive court zone where the ball was directed (FZ). For the analysis the defensive court was divided into 10 zones (Figure 1), each zone identified the spatial outcome of the serve. The evaluation of the RS was similar to the Italian Top League one [13], but slightly modified: 1) serve out, no RS; 2) optimal RS, the opponent setter can easily play the ball; 3) sufficient RS, the opponent setter cannot easily play the ball; 4) insufficient RS, the opponent setter does not play the ball; 5) negative RS, a free-ball returns to the server's court; 6) indirect ace; 7) direct ace. The EV depended on the RS scale and was categorized into: "negative" when RS scored 1; "neutral" when RS scored 2 or 3; "useful" when RS scored 4 or 5; "positive" when RS scored 6 or 7.

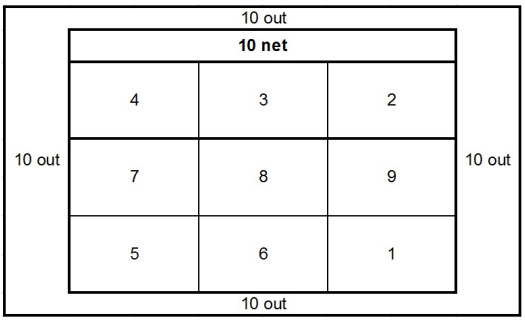

Figure 1. Field zones of the defense (FZ)

Video analysis methods and observer reliability [21] were tested through an intra-observer percent-tage of agreement [20] and an Interclass Correlation Coefficient (ICC). Two analyses of the same match with an interval of one week between the observations[20] were performed and, on the basis of the very high percentage of intra-observer (92%) and ICC (99%) agreements, the methods and observer can be considered reliable.

Data analysis

The statistical analysis used frequencies tested through a Chi-Square method; and to test the difference between such parameters, an ANOVA design was performed. Statistic significance was set at $p < 0.05$.

Results

JS covered most of the analyzed serves (69.9%), followed by FJS (26.9%) and FS (3.3%). The Chi-Square test showed a significant relationship (p = 0.000) between the type of serve and the EV categories (Table 1). At the same time, JS resulted as the serve with the highest percentage values both in "negative" (21.7%) and "positive" (7.3%) EV respect to the other serve modalities. Regarding the "neutral" EV, the FS showed the highest value (95.9%) within the serves, but since the "neutral" FS number is very low, this serve covers only 4.4% within the EV. The FJS showed a very large value in "neutral" EV (86.9%) and small values in "useful" EV (4.5%), the greatest value in this item was recorded by the JS (8.0%).

Table 1. Crosstab: Serve modalities vs serve outcome evaluation

			Serve outcome evaluation (EV)				
			NEGATIVE	NEUTRAL	USEFUL	POSITIVE	Total
Serve	JS	Count	690	2007	253	231	3181
		% of kind of serve	21.7%	63.1%	8.0%	7.3%	100%
		% of serve EV	89.4%	62.5%	81.1%	90.2%	69.9%
		% of Total	15.2%	44.1%	5.6%	5.1%	69.9%
	FJS	Count	80	1063	55	25	1223
		% of kind of serve	6.5%	86.9%	4.5%	2.0%	100%
		% of serve EV	10.4%	33.1%	17.6%	9.8%	26.9%
		% of Total	1.8%	23.4%	1.2%	0.5%	26.9%
	FS	Count	2	142	4	0	148
		% of kind of serve	1.4%	95.9%	2.7%	0.0%	100%
		% of serve EV	0.3%	4.4%	1.3%	0.0%	3.3%
		% of Total	0.0%	3.1%	0.1%	0.0%	3.3%
Total		Count	772	3212	312	256	4552
		% of kind of serve	17.0%	70.6%	6.9%	5.6%	100%
		% of serve EV	100%	100%	100%	100%	100%
		% of Total	17.0%	70.6%	6.9%	5.6%	100%

Serve modalities and number of opponents defending the serve (Table 2) showed a significant relationship (Chi-Square p = 0.000), with most serves played against a 3 player defense (81.3%), followed by the 2 defender (16.4%) and 4 defender strategies (2.3%). In 96.8% of the cases the JS was defended by 3 players, the 2 player strategy was most used against FS (83.8%), while the strategies chosen to defend the FJS were balanced between 2 and 3 defenders (50.8% and 48.9%, respectively).

Taking into account just the serves directed into the field and excluding wrong serves, the sample was 3780 serves. The Chi-Square test showed a significant relationship (p = 0.000) between the type of serve and the FZ where the serves were directed (Figure 2): the zones most hit were the FZ 6 (32.1%), the FZ 7 (14.4%), the FZ 5 (14.3%), the FZ 1 (13.8%) and the FZ 8 (13.7%). In the most hit zone (FZ 6) the serve distribution showed 83.5% for JS, 14.2% for FJS and 2.3% for FS. The total amount of aces was 256, divided into 114 direct aces and 142 indirect aces. The most aces were performed in FZ 6 (35.5%), FZ 5 (18.4%) and FZ 1 (16.4%).

The ANOVA test showed significant differences in the mean values registered in the RS scale (Figure 3) for the JS respect to FJS (p = 0.001) and FS (p = 0.000). The difference between FJS and FS was not significant (p = 0.062). The same statistical results were shown also using the sample of 3780 serves directed into the field (Figure 4).

The mean values in RS scale were significantly different also for the defense strategies performed (Figure 5): defense "2" showed significant and better RS values respect to defense "3" (p = 0.000); no more differences were found in defense strategies, maybe cause the few number of cases in defense "4" strategy. No statistical relationship was found between the role of the server and other parameters.

Table 2. Crosstab: Serve modalities vs serve outcome evaluation

			Defense			Total
			2	3	4	
Serve	JS	Count	2	3078	101	3181
		% of kind of serve	0.1%	96.8%	3.2%	100%
		% of kind of defense	0.3%	83.2%	96.2%	69.9%
		% of Total	0.0%	67.6%	2.2%	69.9%
	FJS	Count	621	598	4	1223
		% of kind of serve	50.8%	48.9%	0.3%	100%
		% of kind of Defense	83.1%	16.2%	3.8%	26.9%
		% of Total	13.6%	13.1%	0.1%	26.9%
	FS	Count	124	24	0	148
		% of kind of serve	83.8%	16.2%	0.0%	100%
		% of kind of Defense	16.6%	0.6%	0.0%	3.3%
		% of Total	2.7%	0.5%	0.0%	3.3%
Total		Count	747	3700	105	4552
		% of kind of serve	16.4%	81.3%	2.3%	100%
		% of kind of Defense	100%	100%	100%	100%
		% of Total	16.4%	81.3%	2.3%	100%

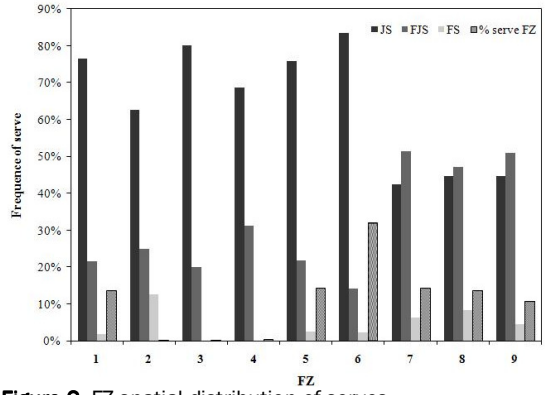

Figure 2. FZ spatial distribution of serves

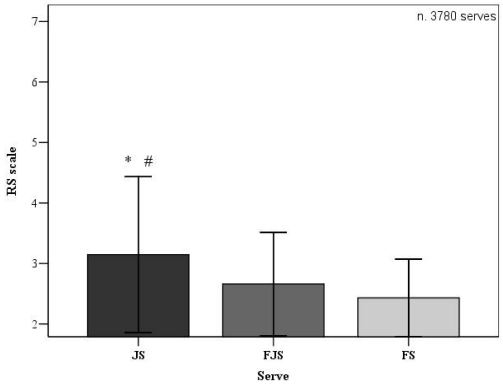

Figure 4. ANOVA differences between serves directed into the field: * JS vs FJS; # JS vs FJS

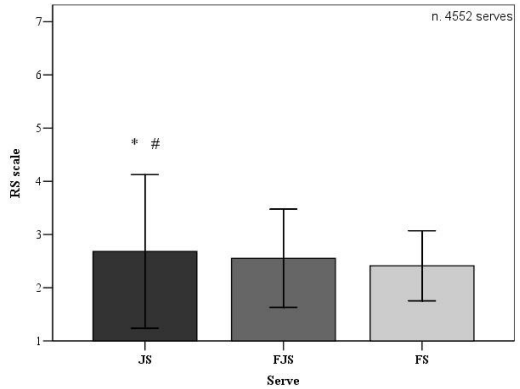

Figure 3. ANOVA differences between all serves: * JS vs FJS; # JS vs FJS

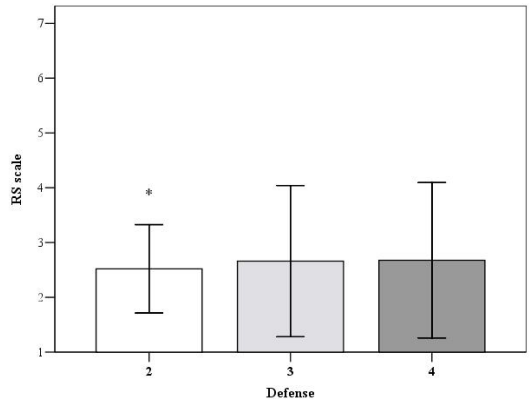

Figure 5. ANOVA differences between defense strategies: * Defense 2 vs Defense 3

Discussion

The study has investigated the serving techniques used in high level male volleyball competitions. Several authors have previously taken this issue into consideration but with a much smaller sample [13] or without the actual rule of Rally Point System [16]. Results show that at the considered level of competition, that is fairly high, the most used serve is JS (69.9%) respect to the FJS (26.9%) or the FS (3.3%). These values are coherent with the study of Moras et al. [13], in which the same classification of serving technique has been used, although the percentage of JS in the present study is lower than in that of Moras et al. [13].

Similarly to the studies[15,16] JS seems to be the most risky one, showing 21.7% of "negative" EV respect to 6.5% of FJS and 1.4% of FS The defense strategy with 3 players is the most used one respect to the 2 or 4 player strategy (81.3%, 16.4%, 2.3% respectively), but the ANOVA test shows that a defense strategy with 2 players allows better results for the reception; moreover, although no currently data are available this strategy could minimizes the "conflict zones" between the defenders and increases the individual responsibility. A 4 defender strategy is used only for the JS (96.2%) either to contrast the server when he scores consecutively or to defend against a very strong server. The most involved FZ in receiving a serve are FZ 6, FZ 5 and FZ 7 on the left posterior corner of the field. JS is directed principally toward the baseline zones (FZ 1, FZ 6, FZ5) respect to the FJS and FS that are directed toward the middle court zones, in fact most of the aces, both direct and indirect ones, are scored in FZ 6 (35.5%), FZ 5 (18.4%) and FZ 1 (16.4%). It must be underlined that very few serves (only 35) touched the first line zones (FZ 2, FZ 3, FZ 4), just because they first touched the net and then dropped into the first line zones. Regarding the differences between serves, the results suggest that JS is the most effective one in increasing the difficulty of RS respect to FJS and FS, both for the entire sample of the serves and for the serves directed into the field. JS seems to be the most effective serve. Its relatively high percentage of failure (21.7%) is well balanced by a similar percentage (15.3%) of cases in which the opponent's defense goes in crisis; moreover, the JS shows the lowest percentage (63.1%) of "neutral" serves. These findings confirm the potential of the JS in terms of increasing the defensive's errors [13, 16], but it must be underlined that in this study respect to Moras et al. [13] the evaluation of the serve's outcome differs for the calculation methods ("neutral" EV is given to all the serves that do not offer significant difficulties in reception by the defenders).

Conclusion

Although it is obvious that the defense and opponent's receiving skills greatly influence the serve outcome JS is doubtless the most powerful technique in terms of increasing difficulties for the defense, but its relative high percentage of errors must make coaches reflect on using this serve strategically, most of all because there are no relationships between the role of the server and the serve's outcome. JS could be very useful against teams that use a large number of defenders because, as shown in the results, this defense organization increases the "conflict zones" during reception. JS could be also useful against poor defenders with the aim to score an ace or make the offensive maneuver difficult after reception: this hypothesis is borne out from the percentage of direct and indirect aces (90.2%) and from the total amount of increased difficulty in reception (81.1%) registered by JS. On the other hand, FJS could be useful against teams having good defenders with weak attackers, with the aim of reducing the serve's failure possibility respect to the JS as shown in the results, while at the same time preparing for the next defense. FS is used so rarely that it seems to serve only for game-specific employment. For this reason it is important that each team use a scouting or a match analysis procedure of the serving statistics during the game to indicate the best serve strategy to choose.

Acknowledgements

The authors are very grateful to the Italian Series A Volleyball League for the special permission they granted for the use of the videos of the matches.

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