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Preliminary study for the implementation of the ”Servo-Volley Platform” innovative technology in view of improving the volleyball serve

Studiu preliminar privind implementarea tehnologiei inovative „Platforma Servo-Volley” în vederea perfecţionării serviciului în volei

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Abstract

Background. The use of a modern innovative technology conceived by us and denominated *Servo-Volley* may determine a new approach to specific training that targets the performance objectives and increases team effectiveness while increasing the efficiency of the volleyball serve.

Aims. To prove the efficiency of the innovative platform denominated *Servo-Volle*y during the training of the serve, including in official contests.

Methods. The research was conducted between 2012 and 2013 and included 10 senior players of the CSU Medicina team in Târgu Mures. The research tested the motor skills of the subjects and recorded the efficiency of the serve during the official contests in the preliminary tournament, after implementing the specialized program using the Servo-Volley Platform.

Results. Considering the average efficiency for each area (Z), the research revealed that the areas behind the 2nd line recorded higher values compared to the other areas of the court: 86% in Z5, 84% in Z1 and 82% in Z6. In the center of the volleyball court, the efficiency of each area was as follows: 53% in Z9, 47% in Z7 and 45% in Z8. The lowest efficiency was recorded in the area next to the net, namely in the 1st line, therefore the efficiency in Z2 was 11%, similar to the one in Z4, whereas in Z3, only 5 of the 100 hits were recorded, achieving an efficiency percentage of 5%. During the official contests, the efficiency recorded increased by 18% after the implementation of the program using the *Servo-Volley* platform.

Conclusions. The use of the innovative technology objectified in the *Servo-Volley* platform contributes to the improvement of the serve both during the training and the competition process.

Key words: volleyball, serve, *Servo-Volley* platform, innovative technology.

Rezumat

Premize. Utilizarea unei tehnologii moderne inovative conceputa de noi, denumită *Servo-Volley*, poate determina o nouă abordare a pregătiri specifice, care să urmărească obiectivele de performanţă şi să crească eficienţa echipei, prin creşterea randamentului loviturii de serviciu în volei.

Obiective. Demonstrarea eficienţei utilizării platformei inovative *Servo-Volley* în cadrul procesului de pregătire a serviciului, implicit în cadrul competiţiilor oficiale.

Metode. Cercetarea s-a desfăşurat în perioada 2012-2013 şi a cuprins 10 jucătoare senioare ale echipei CSU Medicina Tirgu Mureş. Probele cercetării au vizat un test motric si inregistrarea efcienţei serviciului în cadrul jocurilor oficiale din turul preliminar, ulterior implementării programului specializat, care utilizează platforma Servo-Volei.

Rezultate. Luând în considerare eficienţa medie pe zone (Z) se observă că zonele din spatele liniei a II-a au înregistrat valori superioare, comparativ cu celelalte zone ale terenului: 86 % în Z5, 84% în Z1 şi de 82% în Z6. La mijlocul terenului eficienţa pe zone a fost următoarea: 53% în Z9, 47% în Z7 şi de 45 % în Z8. Cea mai scăzută eficienţă s-a înregistrat în zona de lângă fileu şi anume în linia I-a, astfel în Z2 au fost 11% la fel ca şi Z4, iar în zona Z3 s-au realizat 5 lovituri din cele 100, realizându-se doar un procent de 5% eficienţă. În ceea ce priveşte eficienţa în cadrul jocurilor oficiale, aceasta a crescut cu 18%, după aplicarea programului care utilizează platforma *Servo-Volley*.

Concluzii. Folosirea tehnologiei inovative concretizată în platforma *Servo-Volley* contribuie la optimizarea serviciului, atât în procesul de pregătire, cât şi în cel competiţional.

Cuvinte cheie: volei, serviciu, platforma *Servo-Volley*, tehnologie inovativă.

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Introduction

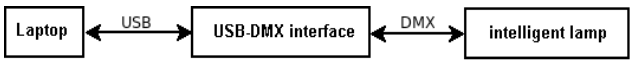
As a novelty of this research, to enrich and diversify the ways of improving the serve hit at senior level, a platform called *Servo-Volley* was conceived, which allows, through visual stimulation, the demarcation of a circular space in a specific area in which the serve hit is practiced.

The *Servo-Volley* platform is equipped, in addition to the rotating head device code PHS 710 that generates the light beam, with a specifically designed software that once installed in a computer, allows the coach to select a clearly delineated area where the beam will be projected and towards which the service will be conducted.

The device is placed on a stand at the level of the sports hall ceiling.

From a technological point of view, the system is made up of a hardware component and of control software. The hardware component consists of commercial equipment, easy to purchase on the market: an intelligent high-power (moving head) stage lamp FutureLight PHS 710, a USB-DMX interface EntTec USB PRO 512, a laptop with Windows operating system, and the wiring needed to interconnect the components.

The software is an application made in the programming language C#, running on the laptop and providing the user with a graphical control interface, and performing communication and thus control through the USB-DMX interface with the intelligent lamp.



Between the laptop and the USB-DMX EntTec interface, communication is carried out with the specific EntTec protocol through a virtual serial channel developed by the Windows driver, while between the interface and the intelligent lamp, communication is achieved with the standard DMX protocol.

Compared to the other ways of improving the serve hit, the innovative platform allows to practice and improve this hit both in a single delineated sub-area and by changing the sub-areas from one execution to another, which may increase the adaptability and responsiveness to changing game conditions.

The software attached to the *Servo-Volley* platform is conceived as follows: the court is divided into nine areas of 3/3 metres each which, in turn, can be divided into nine smaller areas of 1 sq.m. each, which are called sub-areas.

As the platform control is manually achieved from the computer, the coach is able to select the sub-areas that require to be worked on and to vary these sub-areas in different areas.

The visual stimulation of the volleyball players in order to improve the execution of the serve hit in a certain sub-area offers new opportunities to practice, correct and improve the technical execution as well as to increase individual efficiency.

The implementation of modern information technology in high performance sports allows the analysis of the players' performance, which determines the improvement of training, and implicitly, the efficiency of their performance in the training and competition process.

The current research on the analysis of volleyball matches focuses on the importance of team success and failure (Drikos et al., 2009).

Several studies are mainly focused on analyzing the sets associated with the variables of service, reception and attack (Palao et al., 2005; Amasay, 2008; Afonso & Mesquita, 2011; Castro et al., 2011).

Researchers have tried to find explanations in an attempt to identify the significant factors for high performance sports and particularly, how they relate to the increase of effectiveness, given the complex and dynamic nature of the match (Marcelino et al. 2011).

Getting points within the volleyball game at the higher sample level with a minimum of effort but high technical skills is the prerogative of the serve hit.

Success in sports is mostly influenced by how athletes prepare for the competition. High performance in volleyball is characterized by an equilibrium between the various complex actions and the game phases (Palao & Valadés, 2014).

Executing a serve hit with great technical skills may cause difficulty for the opponents and even if the first execution does not bring a point, it can lead to carrying out an effective attack since the taking over calls for a more careful mobilization under hampered conditions. Service efficiency is dependent on several physical, psycho-motor and technical factors (Horička et al., 2014; Grgantov et al., 2013).

Improving service has been a permanent concern for professionals, and technological innovation contributes to the optimization of the serve training process in volleyball.

Combining the *Servo-Volley* platform use in the training process with the data provided by the *Data-Volley Software* contributes to the optimization of the serve training process.

Match analysis, with an emphasis on team sports performance, has aroused the interest of many professionals and researchers who have aimed to identify the variables that best define the team and player training process (Hughes & Franks, 2004; Ortega et al., 2009; Shearer et al., 2007), due to the need to better understand the environment that promotes success in sports (Medeiros et al., 2014).

By introducing computer technology and specialized software for data collection, analysis and processing, a general overview as well as a particular player-focused image of the specific mathematical situation can be obtained during the volleyball game, which helps coaches in making the most appropriate decisions.

At the same time, if practicing new means of action or using a technological innovation regarding the improvement of a certain technical and tactical action is desired, innovative technologies and software allow to process and analyze the effects of these new ways of approach to training, during specific periods of time.

Regarding the specific field of the volleyball game, specialists in this and related areas are trying to develop innovative materials and equipment in order to facilitate the improvement of a certain individual technical action.

In volleyball, both the observation and the analysis of the game enable researchers to identify a great diversity of technical procedures in various situational contexts (Silva, 2013).

Nevill et al. (2008) reported that match analysis is an

important means to acquire profound knowledge of sports competition, being in this way an essential element of the coach's intervention throughout the training process in selecting the factors that lead to performance improvement and therefore, to success in sports (Martin et al., 2004; Marcelino et al., 2011).

Sports games are characterized by the variety and complexity of the technical and tactical situations and also, by the actions of the partners and opponents, requiring a continuous adaptation and efficiency of the entire motor behavior of the players (Badau et al., 2011).

Innovations in the fields related to high performance sports aim to increase individual and team performance by improving technical and tactical actions and by enhancing the spectacularity of performance, being in accordance with the trends and the evolution level of the volleyball game.

Hypothesis

In establishing the general hypothesis, we started from the assumption that the technical and efficiency level of the service actions specific to a volleyball game can be improved through the development and application of a specialized training program, through the use of an innovative platform called *Servo-Volley*, which also determines an increased efficiency during official matches.

Material and methods

We mention that according to the Helsinki Declaration, the Amsterdam Protocol and Directive 86/609/EEC, the approval of the Ethics Commission of the Department of Physical Education and Sports of the University of Medicine and Pharmacy Târgu-Mureş regarding research on human subjects was obtained and also, the subjects' consent for their personal participation in the research.

Research protocol

a) *Period and place of the research*

The training was conducted in accordance with the evolution during the game and the performance goals. In order to highlight the efficiency of the *Servo-Volley* platform use in the serve training process, the research was extended and a comparison was made between the team efficiency in the 2012-2013 championship return and in the 2013-2014 championship round.

Preliminary research was carried out as follows:

- Division A National Championship return 15.12.2012 - 27.02.2013, using the software attached to the statistics program called DataVolley;
- implementing the specialized serve training program by using the *Servo-Volley* platform 09.08 - 10.10.2013;
- motor testing - 25.09 - 10.10.2013;
- Division A National Championship round 12.10.2013 - 20.12.2013, using the software attached to the statistics program called DataVolley.

The location of the training and testing process using the *Servo-Volley* platform was the "Dr. Pongracz Anton" Sports Hall of the University of Medicine and Pharmacy of Târgu-Mureş.

b) *Subjects and groups*

The population sample subjected to the research consisted of 10 senior female players, with an average age of X±SDage=21.3±0.8, members of the CSU Medicina Tg. Mureş team.

c) *Tests applied*

The preliminary experimental research involves the study of certain parameters regarding the accuracy and efficiency of the service actions that will be subsequently monitored in the dynamics of the official matches of the senior players of the CSU Medicina Târgu-Mureş team, using the *Servo-Volley* platform for training and processing of the data provided by the *Data-Volley* software.

The software is unique, created for this project; it displays on the graphical interface the model of the sports court divided into 9x9 squares, and when selecting a square, it automatically places the beam light of the intelligent lamp on the equivalent square on the sports court. The application also provides light beam color changing that can be used for particular significances during training.

This research includes both *the independent variable,* which is a factor created by the experimenter and consists of a training program using the *Servo-Volley* platform in order to improve the service and to increase the execution precision in the directions of attack and their effectiveness, and *the dependent variable*, which is a factor modified by the independent variable after applying the experimental model developed.

The results of the preliminary research reveal that the game actions specific to the game structure no. I require improvements in technique and efficiency among all players, since these are defective.

The team's weekly training program was the following: 2:2:1:2:2:1; on Mondays, Tuesdays, Thursdays and Fridays there were two training sessions, while on Wednesdays and Saturdays there was only one training session. In order to improve their service, the players trained once a week, on Tuesdays, attending the morning training program for 120 minutes. After physical training, in the fundamental training part, only the specifically designed program using exclusively the *Servo-Volley* platform was applied and practiced.

The description of the serve training program was as follows:

- week 1-2 – training duration: once/week/120 minutes for specialized serve training in areas Z1 and Z5 – number of individual executions: 45 executions in each area (9 sub-areas x 5 executions);
- week 3-4 – training duration: once/week/120 minutes for specialized serve training in areas Z1, Z6, Z5 – number of individual executions: 30 executions in each area (9 sub-areas x 5 executions);
- week 5-6 – training duration: once/week/120 minutes for specialized serve training in areas Z1, Z9, Z8, Z7, Z5, Z6 – number of individual executions: 18 executions in each area (2 executions /sub-area/area);
- week 7-8 – training duration: once/week/120 minutes for specialized serve training in all areas Z1-Z9 – number of individual executions: 10 executions in each area

In order to improve the serve hit, considering the *Servo-Volley* platform conceived by us, the court was divided into nine areas of 3/3 metres each, which in turn were divided into nine sub-areas of 1/1 metres each.

Due to the intelligent lamp equipped with four different colored lights, by connecting to the computer software specific to the platform, changes in color depending on brightness in the hall or on the coach's option, as well as changes in the

radius diameter of the circle projected on the court areas or sub-areas can be performed. Thus, the volleyball court will have 9 areas and 81 sub-areas. This organization was made because the light beam has a range of about one meter under maximum beam brightness conditions.

In Fig. 1 we present the volleyball court graphics as it appears on the laptop monitor/software attached to the platform.

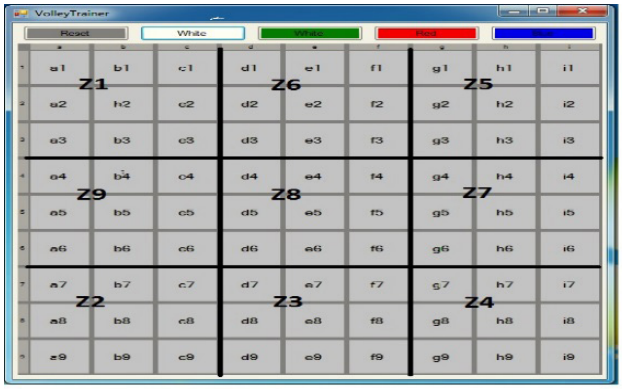


Fig. 1 – Areas and sub-areas according to the *Servo-Volley* platform software.

In this study, the evaluation included a motor test and a comparison of the serve efficiency during the official matches in the return prior to applying the experimental program and in the round subsequent to applying this program.

The motor test consisted of the execution of 10 float serve hits (S) or jump serve hits (SQ): for each area, the players performed 10 hits each in the opponents' court in the area chosen by the coach, which was lighted using the intelligent lights of the *Servo-Volley* platform (the lighted area was a circle with the radius of 1 sq.m.). The balls entering the lighted circle were considered valid points and were noted with + (plus), while the missed balls, i.e. the balls that did not enter the lighted circle, were noted with – (minus). After recording all the hits in each of the nine areas, efficiency was calculated using the following formula specific to the Data-Volley program:

efficiency % = successful executions / total number of executions x 100

This test was applied at the end of the preliminary research period, after the implementation of the specific program regarding the improvement of the serve hit using the innovative platform called *Servo-Volley*.

d) *Statistical processing*

For the statistical processing of the research data, we used the Data-Volley software and the SPPS program.

Results

Table I presents the centralized results for each of the nine areas of 3/3 m each, individually for each of the 10 team players.

For a better visualization of the results achieved by the players with regard to the serve hit efficiency in the court areas, a comparative graphical representation was made (Fig. 2).

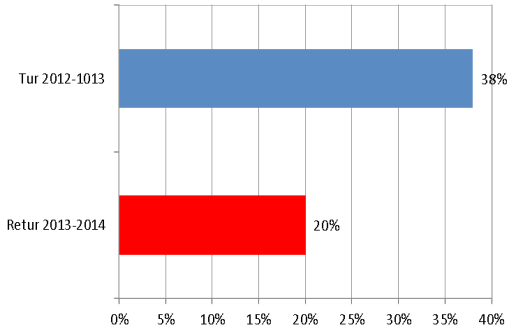


Fig. 2 – Comparative graphical representation of efficiency for the 2012-2013 championship return and the 2013-2014 championship round.

Discussions

In the motor test, the players achieved an average efficiency by areas of 47.11%.

By analyzing the results of the average efficiency, it can be noted that the highest rates were obtained by MC no. 12, playing as a main striker, with 53.33%, as well as TA no. 9, playing as a second striker (area 4).

The most inefficient were IF no. 8, playing as a striker, with an efficiency percentage of only 43.33%, preceded by FG no. 15, playing as a second striker in area 4, with 44.44%.

Out of the 10 players attending this test, 8 had an efficiency rate below 50%.

After the execution of 10 serve hits in a 3/3 m area (which is rather easy for the division A performance level), applied at the end of the specific training period, using the innovative Servo-Volley platform, the following results were recorded:

- in this test the players achieved an average efficiency by areas of 47.11%;
- by analyzing the results of the average efficiency, it

Table I

Serve - final test - 10 float (S) or jump (SQ) serve executions in each area.

Subjects	Area 1			Area 2			Area 3			Area 4			Area 5			Area 6			Area 7			Area 8			Area 9			X
	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%	+	-	%	%
SA	7	3	70	2	8	20	1	9	10	1	9	10	9	1	90	9	1	90	4	6	40	4	6	40	5	5	50	46.67
CL	9	1	90	1	9	10	1	9	10	0	10	0	8	2	80	9	1	90	6	4	60	5	5	50	5	5	50	48.89
IR	8	2	80	0	10	0	0	10	0	1	9	10	10	0	100	8	2	80	5	5	50	5	5	50	4	6	40	45.56
IF	9	1	90	1	9	10	0	10	0	2	8	20	7	3	70	8	2	80	3	7	30	3	7	30	6	4	60	43.33
TA	10	0	100	2	8	20	1	9	10	1	9	10	9	1	90	7	3	70	6	4	60	6	4	60	6	4	60	53.33
GV	8	2	80	0	10	0	0	10	0	1	9	10	10	0	100	8	2	80	5	5	50	5	5	50	4	6	40	45.56
PA	9	1	90	1	9	10	0	10	0	2	8	20	7	3	70	8	2	80	3	7	30	3	7	30	6	4	60	43.33
MC	10	0	100	2	8	20	1	9	10	1	9	10	9	1	90	7	3	70	6	4	60	6	4	60	6	4	60	53.33
TG	7	3	70	2	8	20	1	9	10	1	9	10	9	1	90	9	1	90	4	6	40	4	6	40	5	5	50	46.67
FG	7	3	70	0	10	0	0	10	0	1	9	10	8	2	80	9	1	90	5	5	50	4	6	40	6	4	60	44.44
TOTAL	84	16	84	11	89	11	5	95	5	11	89	11	86	14	86	82	18	82	47	53	47	45	55	45	53	47	53	47.11

can be noted that the highest rates were obtained by MC no. 12, playing as a main striker, with 53.33%, as well as TA no. 9, playing as a second striker in area Z4;

- the most inefficient were IF no. 8, playing as a striker, with an efficiency percentage of only 43.33%, preceded by FG no. 15, playing as a second striker in area 4, with 44.44%;

- out of the 10 players attending this test, 8 had an efficiency rate below 50%;

- the players who had the highest efficiency in this test executed float serve hits in a controlled manner, with a high precision index and a reduced strength index;

- taking into account the average efficiency by areas, it can be noted that 2nd line areas recorded higher values compared to other court areas: 86% in Z5, 84% in Z1 and 82% in Z6;

- in the middle of the court, efficiency by areas was the following: 53% in Z9, 47% in Z7 and 45% in Z8;

- the lowest efficiency was recorded in the area next to the net, namely in the 1st line; thus, in Z2 as well as in Z4, there was an 11% efficiency, while in Z3, only 5 of the 100 hits were executed, with the achievement of only 5% efficiency.

The 2012-2013 Division A National Championship return comprised 9 matches for the C.S.U. Medicina Tg. Mureş team, where the average efficiency recorded was 20% out of a total number of 726 serves, while in the round, there were 11 matches with a total number of 845 serves, the efficiency recorded being 38%.

Conclusions

1. The implementation of the training program using the Servo-Volley platform resulted in an 18% increase of efficiency between the 2012-2013 return and the 2013-2014 round of the official matches.

2. Taking into account the average efficiency by areas, it can be noted that the areas behind the 2nd line recorded higher values compared to other court areas: 86% in Z5, 84% in Z1 and 82% in Z6. In the middle of the court, efficiency by areas was the following: 53% in Z9, 47% in Z7 and 45% in Z8.

3. The lowest efficiency was recorded in the area next to the net, namely in the 1st line; thus, in Z2 as well as in Z4, there was an 11% efficiency, while in Z3, only 5 of the 100 hits were executed, with the achievement of only 5% efficiency.

4. Efficiency is satisfactory given that we worked in 3/3 metre areas, which at senior level is rather easy. In order to achieve the desired efficiency, it is necessary that the serve hit training should be conducted in a continuously reducing area.

Conflicts of interests

There are no conflicts of interest.

Acknowledgments

The article highlights partial results of the preliminary study for implementing the innovative platform called Servo-Volley conceived by Ramona Ungur.

This paper is based on the preliminary research data of the first author's doctoral thesis, submitted to the Transilvania University of Braşov.

The research on the use of the Servo-Volley platform for the improvement of service, in addition to the relevance of the results obtained, also materialized in registering and obtaining from OSIM (The State Office for Inventions and Trademarks) the invention patent number A/00231/2014 on behalf of Ramona Ungur.

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