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Analysis of selected kinematic variables with the performance of volleyball players in float serve

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Abstract
The purpose of this study was to analyze the relationship of selected kinematic variables with the performance of Volleyball players in float serve. The subjects for this study were ten male volleyball players of match practice of Lakshmi Bai National University of Physical Education, Gwalior. The performance of subjects was evaluated by Russell Lounge test.
The digital photography was used as a technique for Biomechanical analysis of Float serve in volleyball. The Pearson's Product moment Correlation was calculated between selected kinematics variable and performance of the subject in float serve. For testing the level of significance was set at 0.05.
The variables which might have contributed to the effectiveness of the technique could be identified and undertaken to analyze the technique of float serve were:-

1. Angular Kinematic variables :
   a) Knee joint (right)
   b) Knee joint(left)
   c) Shoulder joint (striking arm)
   d) Elbow joint(striking arm)
2. Linear Kinematic variables :
   a) Height of center of gravity of volleyball players at the moment execution (strike).
   b) Height of the center of gravity of ball at moment execution (strike).

The results have exhibited that the obtain value of correlation coefficient in case of the height of center of gravity of player at moment execution and height of center of gravity of the ball from the ground at moment execution has shown the significant relationship with the performance of subjects in float serve whereas other selected kinematic variables show an insignificant relationship at the 0.05 level of significance.

Keywords: Centre of Gravity, Float Serve, Kinematics

Introduction

Volleyball serving is one of the most fundamental skills in volleyball. Anyone can do it – you don't have to be tall or unusually strong. All you have to do is practice. And you're in luck, because it is the one skill in volleyball you can practice by yourself. Just find a court, get a bucket of balls and keep serving.

If you can master the art of the serve and keep your opponents off balance, they won't be able to make a perfect pass. If they can't make a perfect pass, they will likely not get a perfect set. If they can't get a perfect set, they will have trouble putting the ball away and your blockers will be able to set up on their hitter early since it will be obvious where the ball is going. But it all starts with the serve.

The float serve has little or no spin at all. Because a ball with no spin is very unstable, the float serve travels through the air with a wavering, breaking, sinking action, moving from side to side and up and down like a knuckleball. This unpredictable flight pattern makes it a very difficult serve to pass. The fairly low risk involved in serving the floater, and its high effectiveness have made float serves the most popular among top men's and women's teams.

To produce a float serve, the force of the impact must pass through the ball's center of gravity in the direction of the desired flight. The center of gravity in a symmetrical round object is in its center. It is generally considered that the ball's floating; wavering action is due to what is known as Bernoulli's effect. This theory states that when a flying stream of gas speeds up, its pressure decreases, and vice versa. If an air foil is made to move through air, the stream of air entering the region just above the air foil is forced to flow into a constricted area and its speed is increased. When the speed increases, the pressure decreases. A ball has the shape of a three dimensional foil and therefore when travelling through the air, it creates a funnel or a tunnel of low pressure around it. If the low pressure areas around the ball are exactly balanced, the ball will fly with no wobbling effect at all.

The best method to analyze or evaluate is called cinematography. The role of cinematography in biomechanical research involve from as simple form of recording motor movement to a sophisticated mean of complex analysis of motor efficiency. Over the years, new techniques in filming, timing have been perfected to aid the research in achieving accurate time measurement of both simple and complex locomotion patterns.

Hypothesis

It was hypothesized that there may not be significant relationship between the selected kinematic variables with the performance of the volleyball player in float serve.

Methodology

Selection of Subjects

Ten male volleyball players of Lakshmi Bai National Institute of Physical Education were selected as subjects for the study. The ages of subjects were between 19 to 23 years.

Criterion Measures

The Criterion measure for the study was the performance of the subjects as assessed by Russell-Lounge test with only difference the subjects used jump serve instead of Overhead Serve.

Filming protocol & analysis of the film

The digital photography was used as a technique for Biomechanical analysis of Float serve in volleyball. A standard motor driven camera i.e. Nikon D -100 was used to obtain photo sequences of selected movements during the float serve, moment execution in sagittal plane by a Professional photographer (figure 1)

Fig 1: Float Serve at Moment Execution

The photographs as obtained by the use of digital photography were analyzed by standard analysis method. The scholar develop stick figure on the photographs (figure 2) from which the selected angular kinematic variables were calculated using joint point method. The center of gravity of each subject, at selected moment i.e. execution was located by using segmentation method

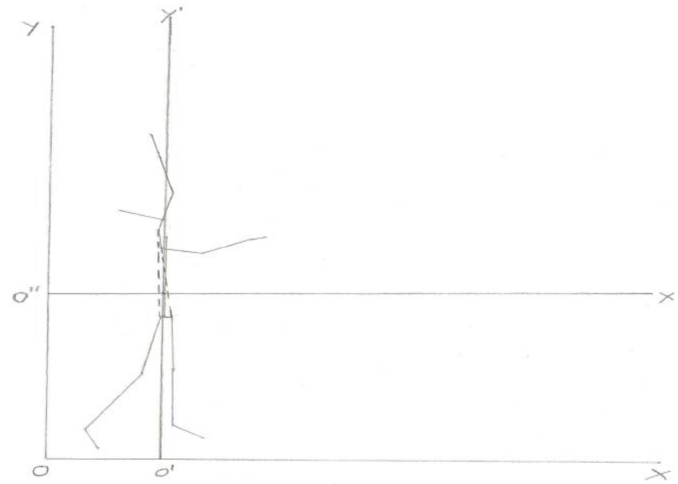

Fig 2: Stick Figure of Float Serve at Moment Execution

Table 1: Location of Center of Gravity of Body Segments

S. No.	Segments	Center of gravity Location expressed as percentage of total Distance between reference points
1.	Head	46.4% to Vertex; 53.6% to chin neck intersect
2.	Trunk	43.8% to Supra-sternal notch; 56.2% to hip axis
3.	Upper Arm	49.1% to shoulder axis; 50.9% to elbow axis
4.	Forearm	41.8% to elbow axis; 58.2% to wrist axis
5.	Hand	82% to wrist axis; 18% to knuckle III
6.	Thigh	40% to knee axis; 60% to knee axis
7.	Calf	41.8% to knee axis; 58.2% to ankle axis.
8.	Foot	44.9% to heel; 55.1% to tip of longest toe

Table 2: Weight of Body Segments Relative to Total Body Weight

S. No.	Segments	Relative Weight
1.	Head	0.073
2.	Trunk	0.0507
3.	Upper Arm	0.026
4.	Forearm	0.016
5.	Hand	0.007
6.	Thigh	0.103
7.	Calf	0.043
8.	Foot	0.015

Scoring

Each service was scored according to the value of the target area in which the ball landed, as shown I figure3. A ball landed on a line separating two areas was given the higher value. A ball landed on a line separating two areas was given the higher value, a ball landed on a side or the end line scored the value of the area adjacent. Trials in which foot fault occurred scored zero (Appendix-M)

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Fig 3: Russell – Lounge Test

Findings

The score of each independent variable of angular and linear kinematic variables were correlated with the performance of subjects in volleyball float serve. Selected moment was moment execution of float serve in Volleyball. The values of correlation of selected angular Kinematic variables i.e. angle of selected joints at selected moment with the performance of subjects in float serve are presented in Table 3.

Table 3: Relationship of selected angular kinematic variables with the performance of subjects in float serve

S. No.	Variables	Mean (Degrees)	Coefficient of Correlation(r)
1.	Knee Joint (Left)	177.2	0.601
2.	Knee Joint (Right)	169.50	0.200
3.	Shoulder Joint (Striking Arm)	164.1	0.501
4.	Elbow Joint (Striking Arm)	144.50	0.236

*significant at 0.05 level

Required value of 'r' for 8 degree of freedom is 0.632.

As shown in Table 3 the obtained value of correlation r = 0.632 for 8 degree of freedom. However the calculated value of coefficient of correlations in all variables were less than the required value at selected level of significance, therefore, these selected angular kinematic variables at selected moment have shown insignificant relationship with the performance of subjects in float serve of volleyball.

The relationship of selected linear kinematic variables at selected moment with the performance of subjects in float serve is given in Table 4.

Table 4: Relationship of selected linear kinematic variables are selected moment with the performance of subjects in float serve

S. No.	Variables	Mean (mts)	Coefficient of Correlation (r)
1.	Height of Center of Gravity of player at moment Execution	1.02	0.963
2.	Height of Center of Gravity of the ball from the ground at moment execution	1.79	0.671

*Require value of 'r 'for 8 degree of freedom is 0.632

Since the required value of coefficient of correlation for 8 degree of freedom to the significant at 0.05 level is 0.632 and the calculated value were more than that, therefore, selected linear kinematic variables at selected moment (i.e. height of center of gravity of player at moment execution and height of center of gravity of the ball from the ground at moment execution) have exhibited significant relationship with the performance of subjects in float serve of volleyball.

Discussion of Findings

As shown by the table 3 and table 4 those only two variables (i.e. height of center of gravity of player at moment execution and height of center of gravity of the ball from the ground at moment execution) have exhibited a positive significant relationship at 0.05 level of significance. It may be due to the nature of score that it showed the relationship but mechanism of float serve depends upon the point of application of force on ball. The force of the impact must pass through the ball's center of gravity in the direction of the desired flight and to avoid spin. The center of gravity in a symmetrical round object is in its center. It is generally considered that the ball's floating; wavering action is due to what is known as Bernoulli's effect. A ball has the shape of a three dimensional foil and therefore when travelling through the air, it creates a funnel or a tunnel of low pressure around it. If the low pressure areas around the ball are exactly balanced, the ball will fly with no wobbling effect at all. However all the angular kinematic variables left knee joint, right knee joint, shoulder joint(striking arm), elbow joint(striking arm)did not shows the significant relationship with the performance of float serve in volleyball.

Significance of the study

The modern age of sport is the age of excellence. Accordingly the perfection and purification of skills has got its immense importance. The research in this field may add lot in improvement in the performance of volleyball players.

1. The findings of the study may help to form the basis of efficient structure of the float serve.
2. The findings of present study may reveal the contributing factors to the performance of float serve in volleyball.
3. The study may help in drawing conclusions and generalizations which may be used by physical education teachers and coaches for better teaching and coaching.
4. The findings of the study may also help to make the biomechanical module of float serve.

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