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Biomechanical Analysis of Cricket Ball Throwing Techniques

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Abstract

This research article looks at the kinematic features of different throwing techniques (under-arm, side-arm and over-head) with particular emphasis on the techniques of throwing in cricket. The technique is subdivided into: (1) Wind up phase, (2) late cocking Phase and (3) arm acceleration phases. The study was used to form the samples as, sixty (60) elite cricket players. The mean age of the cricket players were (21.82±3.08) years, height – (62.38±7.22cm), weight (168.07±6.68kg). Each throwing techniques successful attempt for throwing distances 30m with 45^0 approach angle at 45^0, 90^0 and 180^0 target angle from the stump were recorded using Canon Legaria SF-10, 8.1 Mp cameras in a field setting with (1/2000 shutter speed and at 30-60fps). The cameras were set-up on a rigid tripod and secured to the floor in the location. First camera was located to obtain maximum accuracy and second camera located to view the throwing performances, at given specified distance in the reconstruction of the two dimensional co-ordinate. The location of camera were chosen so that the optical axes of camera intersected perpendicularly to the designated plane .The accuracy of throwing performances were considered in identify the footage for addition and were subjected to analysis. Result revealed that the significant mean difference were found among different throwing kinematics as well as ball velocity and accuracy and the ball speed had to be high to carry the full distance of the throw in the shortest time.

Keywords: *cricket, kinematics, throw, two-dimensional analysis, velocity and accuracy.*

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1. Introduction:

The main aim of the study biomechanical analysis of throwing techniques in cricket was to asses, the role of mechanical factor that may affect effective throwing in cricket. In this study the effect of selected biomechanical analysis of throwing techniques in the different angle of approach at different direction and distance, with maximum velocity and accuracy was investigated. There are considerable numbers of different joint involved in throwing, but the purpose of the study the focus was on upper extremities and more specifically shoulder complex.

The biomechanical analysis of throwing technique is the answer to full fill existential vacuum, refinement and stabilization of the game and sports in growing competitive sporting world to the changing demand. At the international level of competition a minute variation may result in win or lose. Every nation is backing their sports person with biomechanical researches to accomplish the need.

However there have been fewer researches in the field of cricket ball throwing technique at inter-national level specially relevance of throwing mechanism. (Fruston et al., 2007), has studied the factor involved/associated with throwing velocity and accuracy in elite/ sub elite cricket players. (Sachlikidis and Salter., 2007), found that non dominant arm throws had significantly lower maximum lead knee lift, had significantly less elbow flexion before extension, had significantly less shoulder external rotation at the start of the arm acceleration phase. (Cook and Strike., 2007), found the greater elbow flexion at lead foot contact and less external rotation during the preparation phase.(Bartlet., 2001), cited that the practical value of performance analysis was that well-chosen performance indicators highlight good and bad technique or performance. More emphasis has been given in biomechanical analysis of throwing technique in bowling throws in cricket at international level.

2. Methodology:

Sixty (60) All-India intervarsity and National level cricket players were randomly selected for the purpose of the study. They performed under-arm, side-arm and over-head throws at maximum velocity toward 45^0, 90^0 and 180^0 target/ stump situated at a distance of 30 meters with 45^0 approach angle. The mean age of the cricket players were (21.82±3.08) years, height – (62.38±7.22cm), weight (168.07±6.68kg). For the acquisition of kinematical data, two digital Canon Legaria SF-10 video recording cameras, operating at 1/2000 with a frame rate of 60 frames per second, were used to capture the whole procedure. The subject's throwing motion were recorded using Canon Legaria SF-10, 8.1 Mp video camera in a field setting operating at a nominal frame rate of 60 Hz and with a shutter speed of 1/2000 s *and at 60fps* . The camera was set-up on a rigid tripod and secured to the floor in the location at a distance of 10 meter from the point of throw. The camera was positioned perpendicular to the sagittal plane and parallel to the mediolateral axis (camera optical axes perpendicular on the sigittal plane) as their throwing arm giving approximately a 90^o between their respective optical axes. The camera was also elevated to 95 cms and tilted down in order to get the image of the subject as large as possible while that all points of interested within an one frame.

The recorded video footages were downloaded, slashed and edited by using the downloaded version of STHVCD55 software. Digitization, smoothing and analysis were conducted using the Silicon Coach Pro7 motion analysis software. The kinematic variables selected were angles displacement, time, speed, acceleration and number of frames were analysed with the help of the software. The numeral data of the variables were acquire by digitizing video data with the help of software (Silicon coach pro 7). Acquired data were subjected to statistical analysis ANOVA and Correlation for the comparison of the kinematic parameters between different throwing techniques of cricket players. All statistical procedures were conducted using the SPSS 18.0 software at 0.05 level of confidant.

3. Results

30 DISTANCE -45 APPROACH ANGLE

DESCRIPTION OF JOINTS ANGLE AT DIFFERENT TECHNIQUES OF CRICKET BALL THROWS

ANOVA

Table-1

		Df	45^0 T A	90^0 T A	180^0 T A
			F	F	F
WRIST	Between Groups	2	15.37*	8.68*	7.97*
	Within Groups	177			
ELBOW	Between Groups	2	24.66*	26.40*	19.99*
	Within Groups	177			
SHOULDER	Between Groups	2	757.98*	614.91*	481.90*
	Within Groups	177			
HIP	Between Groups	2	16.16*	1.66	2.97
	Within Groups	177			
KNEE	Between Groups	2	21.63*	4.34*	4.75*
	Within Groups	177			
ANKLE	Between Groups	2	16.49*	9.96*	15.59*
	Within Groups	177			

Tab $f._{0.05}$ (177, 2) =3.04

* The mean difference is significant at the 0.05 level.

Result of ANOVA (Table 1) reveals that the calculated value of wrist, elbow, shoulder, hip, knee and ankle joint angles respectively, during the acceleration phase of cricket ball throws of different techniques (under-arm, side-arm and over-head) at different throwing angles (45^0, 90^0 and 180^0) with 45^0 approach angle of 30m distance male cricket players showed significant differences. Whereas calculated value of hip joint angle 90^0 and 180^0 throwing angle showed insignificant difference respectively.

Linear velocity

ANOVA

Table 2

		Df	45^0 T A	90^0 T A	180^0 T A
			F	F	F
WRIST	Between Groups	2	30.82*	28.93*	18.82*
	Within Groups	177			
ELBOW	Between Groups	2	99.60*	78.72*	76.75*
	Within Groups	177			
SHOULDER	Between Groups	2	55.80*	53.72*	44.46*
	Within Groups	177			
HIP	Between Groups	2	91.42*	61.73*	46.41*
	Within Groups	177			
KNEE	Between Groups	2	203.18*	146.95*	109.93*
	Within Groups	177			
ANKLE	Between Groups	2	51.81*	44.51*	8.61*
	Within Groups	177			

Tab $f._{0.05}$ (177, 2) =3.04

* The mean difference is significant at the .05 level.

Result of ANOVA (Table 2) reveals that the calculated value of wrist, elbow, shoulder, hip, knee and ankle joint linear velocity respectively, during the late-cocking phase to acceleration phase of cricket ball throws of different throwing techniques at different throwing angle with 45^0 of approach angle of 30m distance male cricket players showed significant differences.

Angular velocity **ANOVA**

Table 3

		Df	45^0 T A	90^0 T A	180^0 T A
			F	F	F
WRIST	Between Groups	2	73.65*	53.64*	12.51*
	Within Groups	177			
ELBOW	Between Groups	2	243.98*	320.08*	37.37*
	Within Groups	177			
SHOULDER	Between Groups	2	11.44*	19.02*	2.05
	Within Groups	177			
HIP	Between Groups	2	6.19*	3.61*	2.87
	Within Groups	177			
KNEE	Between Groups	2	19.40*	16.39*	5.12*

	Within Groups	177			
ANKLE	Between Groups	2	7.25*	11.63*	1.07
	Within Groups	177			

Tab $f._{0.05}$ (177, 2) =3.04

* The mean difference is significant at the 0.05 level.

Result of ANOVA (Table 3) reveals that the calculated value of wrist, elbow, shoulder, hip, knee and ankle joint angular velocity respectively, during the late-cocking phase to acceleration phase of cricket ball throws of different throwing techniques at different throwing angle with 45^0 of approach angle of 30m distance male cricket players showed significant differences except shoulder, hip and ankle joints at 180^0 angle.

DESCRIPTION OF BALL VELOCITY FOR DIFFERENT TECHNIQUES OF CRICKET BALL THROWS

ANOVA

Table 4

		Df	45^0 T A	90^0 T A	180^0 T A
			F	F	F
BALL VELOCITY	Between Groups	2	95.01*	89.02*	134.69*
	Within Groups	177			

Tab $f._{0.05}$ (177, 2) =3.04

* The mean difference is significant at the .05 level.

Result of ANOVA (Table 4) reveals that the calculated value of F = 95.01, 89.02 and 134.69 of ball velocity at 45^0, 90^0 and 180^0 throwing angle with 45^0 approach of 30m distance cricket ball throws of different techniques male cricket players showed significant differences.

DESCRIPTION OF ACCURACY FOR DIFFERENT TECHNIQUES OF CRICKET BALL THROWS

ANOVA

Table-5

		Df	45^0 T A	90^0 T A	180^0 T A
			F	F	F
BALL ACCURACY	Between Groups	2	1.39	3.33*	4.37*
	Within Groups	177			

Result of ANOVA (Table 5) reveals that the calculated value F = 3.33 and 4.37 of throwing accuracy of different throwing techniques male cricket players showed significant differences. Whereas calculated value F=1.39 of accuracy of different throwing techniques showed insignificant difference.

DESCRIPTION OF ACCURACY FOR DIFFERENT TYPE OF CRICKET BALL THROWS

Correlation:

Table 6

Variable	T A	**Throws**	**N**	**Mean**	**S.D**	**Accuracy 'r'**
Ball Velocity	45^0	Under Arm	60	17.25	3.51	0.07
		Side Arm	60	26.80	4.57	-0.23
		Over Head	60	29.13	6.46	-0.21
Ball Velocity	90^0	Under Arm	60	17.86	3.83	0.15
		Side Arm	60	28.17	4.59	0.02
		Over Head	60	28.78	6.35	-0.14
Ball Velocity	180^0	Under Arm	60	16.61	3.48	0.22
		Side Arm	60	26.25	3.12	-0.13
		Over Head	60	27.19	4.90	0.00

P>r =.250

* The mean difference is significant at the .05 level

Result of CORRELATION (Table 6) reveals that the calculated value of under-arm throws at 45^0, 90^0 and 180^0 throwing angles, side arm throws at 90^0 throwing angle and over-head throws at 180^0 throwing angle showed insignificant positive correlation between ball velocity and accuracy. Whereas calculated value side-arm throws at 45^0 and 180^0 throwing angle, over-head throws at 45^0 and 90^0 throwing angle showed insignificant negative correlation between ball velocity and accuracy.

4. Discussion:

The result shows that the ball velocity of underarm, sidearm and overhead throws at 30m distance, different throwing angle and approach angle differs significantly. When the ball velocity analyzed in term of joint angles of underarm, sidearm and overhead throws of wind-up phase for wrist, elbow, shoulder, hip, knee and ankle joint angle; 45^0 approach angle at 45^0, 90^0 and 180^0 throwing angles of 30m distance throws showed maximally significant mean differences. Some of the previous studies are Elliott et al. (1994) reported elbow flexion of approximately 50° when the catcher in baseball was throwing to second phase (38.8 m).This difference could be due to the nature of the throwing actions. The throwing is essentially a closed skill initiated from a static position, whereas throwing from the field often requires the movement of the whole body before the delivery of the throw.

The result of the study indicated for linear velocity at various joint of different throwing techniques (under-arm, side-arm and over-head) at 45^0 approach and 45^0,90^0 and 180^0 throwing angles that the linear velocity of wrist, elbow, shoulder, hip, knee and ankle joints maximally showed significance mean

differences in late cocking to acceleration phase. The linear velocity of joint is not a factor to causes variation in the ball velocity for side-arm and over-head throwing techniques. But in case of Under-Arm throws all joint linear velocity as countable factor to causes variation in ball velocity.

The result indicated for late-cocking to acceleration phase of wrist, elbow, shoulder, hip, knee and ankle joint angular velocity; 45^0 approach angle at 45^0, 90^0 and 180^0 throwing angles of 30m distance throws maximally showed significant mean differences except; angular velocity of hip and ankle joints angles at different throwing angle of 30m distances showed insignificant difference between different throwing techniques. As the hip and ankle have to move very small angle for different throwing techniques at the other hand due to curving movements have resulted in much variation of the movement and have much differences in angular velocity to draw significance due to different pattern of movement in each throwing techniques. The better coordination and muscle power to quicken the extension and flexion of shoulder, elbow and wrist joint but as throwing distance decrease extension and flexion of the shoulder, elbow and ankle joint decrease same amount vice-versa by different throwing techniques at different approach and throwing angle of different distances have brought about the differences in the angular velocity to correlate the significance of the ball velocity.

5. Conclusion:

The elite Indian cricket players' different throwing techniques, who are the major focus for this study, knew apart distinctly in their throwing kinematics at a particular approach with different throwing angle of 30m distance. It was found that no single body segment independently lead to throwing ability, but the integration of the whole body segments, through meaningful practice of the different types of throws. Skillful performance characteristics of throwing therefore must include efficient motion through well-coordinated body segments, proper timing and good muscular control.

Reference:

Fruston. J, Ferdinands. R, Rochey, (2007). K, "The European Journal of Sports sciences, volume 7.

Sachlikidis, A, Salter. C, (2007). "Biomechanics comparison of dominant and non dominant any throw speed and accuracy", Australian Journal of Sport Biomechanics , volum 7.

Cook. D.P, Strike, S.C, (2000). "Throwing in Cricket", Journal of sports sciences, Volume, 18:12,965 - 973

Bertlett, R, (2001). "International journal of performance analysis in sports", volume 6, (I).

Elliott, B., Sakurai, S. and Grove (1994)., R, "Technique related differences in high-performance throwing by the catcher in baseball", Applied Research in Coaching and Athletics Annual: 1-14