

Kinematical Variation of Different Distance Throwing Techniques in Cricket Fielding

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Abstract –

Introduction: In the cricket bowling, batting and fielding three different skills are there, and most of the biomechanical researches have focused on about bowlers and batsman's related skills. In practice players will undergo specialized batting skill and bowling skill training but fielding is not always afforded the same degree of attention, that's why the researcher chosen fielding (different distance throwing technique: short & long distance) related cricket research.

Methodology: For this study five male cricketer of University level with no severe previous injury were selected as the subject, age ranging from 20 to 25 years. The ball throwing actions of different distance throwing techniques (*SDT & **LDT) in cricket fielding were recorded by two fixed video camera. The captured movement was then transferred from the camera to the PC and with the help of appropriate software (Motion Analysis Software KINOVEA 0.8.24), the motion of throwing for all subject was analyzed separately for collecting the required data for the present study. Descriptive statistics and dependent, t"-test were applied to analyze the data statistically.

Results and Discussion: The result of the study shows that, the average release angle (SDT-35.80±4.30degree, LDT-20.40±7.73degree), average approach speed (SDT-11.61±1.14 km/h, LDT-10.17±1.12 km/h), mean hip joint angle in left sagittal plane (SDT-143.67±11.1degree, LDT-133.27±15.14 degree) were significantly differ for SDT and LDT throwing techniques.

Conclusions: From the study it may be concluded that the different distance throwing skills in cricket fielding mechanically vary in some extent.

Keywords: kinematic, different distance throwing techniques, fielding, cricket (*SDT- Short distance throws. **LDT- Long distance throws).

1. INTRODUCTION

In the modern era cricket is a very popular game all over the world. India is the most popular cricket playing nation. It is a game played by both male and female across many age groups and levels of participation from recreational to professional sports. In India, the game also played at all levels from amateur to professional competitions. India has been successfully represented at both levels, from district level to world championship, in both junior and senior in men and women categories.

Internationally, cricket format is divided into three categories those are Test, One Day and Twenty20. A cricket team is combined with specialized batsman, specialized bowler, all-rounder and a specialized wicket keeper. All players can bat, bowl and field.

There were no special categories for a fielder for selecting in a team. All players have to field when opposite team does batting. Fielders are contributing for dismissing a batsman in the form of taking a catch and throwing a ball for run out. For effectively perform those skills, speed and accuracy is the important element. The other role of the fielders is save boundary and save single run. Therefore, the purpose of this review was to investigate and critique the existing knowledge of fielding in cricket, with an intension of understanding the fielding skills and to developing the skills for the future and helps coaches for improvement skills.

Batting, bowling and fielding techniques are minimum requirement for playing cricket, where batsman and bowler are selected separately as a specialist based on specified skill for a team. But spatially fielders are

not selected for a team. Those batsman's and bowlers are acting as fielders when their teams bowl. Most of biomechanical research has based on batting and bowling, because of specialization demands of players for a team. Role of a fielders on his team to field a ball quickly to save a single or getting a batsman to dismiss as run out, to take catches and to save a boundary. In other sport, analysis of throwing techniques has been already performed, including track and field (Best et al., 1993) and baseball (Escamilla et al., 1998). There are few studies related on cricket fielding, those are directly applicable for elite level. From the different studies it has been conclude that throwing technique is an important aspect of many sports and understanding segmental parts of technique helps to improve throwing performance. It may be say that three or four quality fielders in a team are as important as a bowler who has the ability to take wickets.

In cricket, the playing field is not of fixed dimensions. Field should be oval shape. Due to the large size of the playing field, the skills of fielding in cricket will vary considerably depending on where fielders are placed by using excellent throwing technique a fielder able to throw a ball over significant distance quickly and accurately, aiming for run out or to stop single runs. The throwing requirements are specific for the various field positions. The slips and closer fielders are mostly intercept a fast moving ball coming from the edge or middle of the bat and reaching them below chest height or over chest height. In those cases those fielders require to throw little distance because they are nearer fielder. These fielders have to good reflexive ability to grab a ball and strong side-arm throwing ability for run-outs. Out fielders are require to travelled a greater distance, so they need to have a good sprinting quality, and long distance throwing quality. A sound throwing technique has an impact in the game as well as it reduced the risk of injury.

Biomechanical analysis is the assessment techniques, whether in sports, an industry or in everyday life. The method of uses for analysis in biomechanics is varying from techniques to techniques and for that need many costly and complex types of equipments. The technique is more prominent than acute eye to understanding the movements. Sports kinematics analysis studies include the position, angles, velocities, and acceleration of body segments and joints during motion.

However, a little number of studies has been conduct about throwing technique in cricket at elite specially considering on throwing mechanism.

It is considered that batting skill and bowling skill are an inherent talent which players naturally possess (or not), where fielding is a branch of skills which can be taught and improved (Woolmer et al., 2008). While an

excellent all round performance is required in all format of cricket. A little number of researches has been conduct approaching cricket fielding. For example, on the subject of cricket batting there has been few research into the physical and psychological demands (Christie, 2012; Christie, Todd, & Gray, 2010) and visual information hint and decision making (croft, Button, & Dicks, 2010; Muller et al., 2009). In contest, while there have been less time-motion analysis studies of cricket fielding (Petersen et al., 2010; Petrsen, Pyne, Portus, & Dawson, 2009, 2011), fielding research lacks the breadth and depth of other areas of the game. In practice players will undergo specialized batting and bowling training but fielding is not considered with the same degree of attention, that's why the researcher chosen biomechanical research in cricket fielding (short-SDT & long distance throw-LDT).

2. METHODOLOGY:

2.1 Selection of the Subject: Five male cricketer of University level with no severe previous injury were selected as the subjects for the study.

2.2 Criterion Measure: The main objective of this study was to investigate some selected kinematic variable of the movement during the execution of throwing techniques (SDT and LDT) for male university level cricket players. There were three types of kinematical parameter were considered for the present study.

I. Release Parameters-

- a) Ball release height
- b) Ball release angle
- c) Speed of release

II. Approach Parameters-

Approach speed

III. Joint Angle-

- a) Shoulder joint angle
- b) Elbow joint angle
- c) Knee joint angle
- d) Hip joint angle

In addition, age, height and weight of the subjects were also taken.

2.3 Instruments & Tools: For collecting data the following instruments and tools were used:

- i. Two Video Cameras (Right sagittal plane- Nikon 5100D & Left sagittal plane- Cannon

1200D)-with two tripod stands were used to record the action of throwing technique.

- ii. 10th Pass Certificate – for calculate chronological age.
- iii. Stadiometer - for measure the standing height of the subjects in meter.
- iv. Weighing Machine- was used for the body weight measurement in Kg.
- v. Standard cricket ball and standard cricket ground
- vi. Computer System with Analysis Software of Motion (KINOVEA 0.8.24) - were used for analysis the throwing action.



Photograph 1: Measurement of Speed of Release



Photograph 2: Measurement of Height of Release



Photograph 3: Measurement of Knee Joint Angle (Left Sagittal Plane)

2.4 Recording of Movements:

For the acquisition of kinematic data, two digital video cameras, fixed a frame rate of 25 frames per second,

were used to capture the whole action. The subject's throwing motion was recorded by using two fixed video cameras in a field setting. The camera was fixed on a camera stand focuses on the location at a distance of 10 meter from the throwing area. The setup of the camera was perpendicular to the movement. The camera was also positioned 150cms from the ground.

To measure the selected kinematics variable the video was analyzed. The captured movement was transferred from the camera to the PC and analysis the movements with the help of Kinovea 0.8.24 motion analysis software, the motion of different distance throwing techniques for each subject were analyzed for collecting the required data for the study.

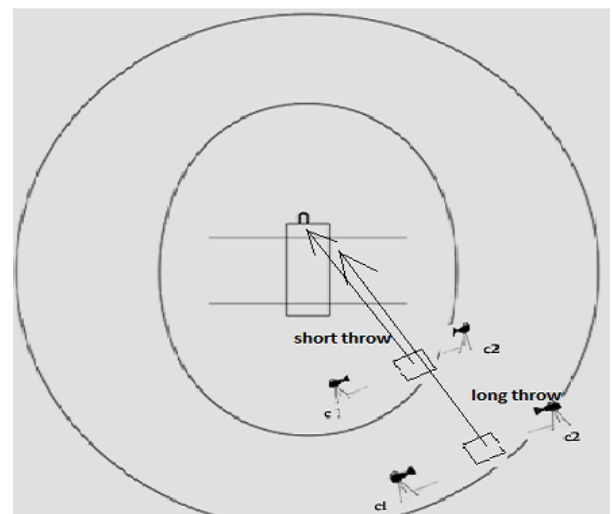


Figure 1:- Filming Environment

2.5 Design of the Study:

Purposive random sampling design was employed to perform this study.

2.6 Statistical Procedures:

Descriptive statistics and dependent „t“- test were applied to analyze the data statistically.

3. RESULTS & DISCUSSIONS:

At first the mean age, height, and weight of the subject were considered. The mean values of age, height, and weight of the subjects have been presented in table No. 1.

Table 1: Details of personal data

Variables	(Mean±SD)
Age (years)	22.20±1.10
Height (meter)	1.69±0.07
Weight (kg)	63.9±7.40

In the above table it clearly shows that the mean and standard deviation of the age, height and weight of the subjects are 22.20 ± 1.10 years, 1.69 ± 0.07 mt. and 63.9 ± 7.40 kg respectively.

Parameters	SDT (Mean \pm SD) LDT (Mean \pm SD)	Calculated 't' Value
Height of Release (cm.)	172.61 \pm 8.64 181.50 \pm 6.95	1.641
Angle of Release ($^{\circ}$)	20.40 \pm 7.73 35.80 \pm 4.30	5.624*
Speed of Release (km/h)	110.30 \pm 9.42 106.00 \pm 11.35	1.390
Approach Speed (km/h)	10.17 \pm 1.12 11.61 \pm 1.14	4.614*
Shoulder Joint Angle at Right Sagittal Plane ($^{\circ}$)	130.73 \pm 37.20 169.17 \pm 12.03	2.206
Elbow Joint Angle at Right Sagittal Plane ($^{\circ}$)	81.46 \pm 16.79 90.87 \pm 17.71	0.913
Elbow Joint Angle at Left Sagittal Plane ($^{\circ}$)	100.20 \pm 25.73 105.00 \pm 19.63	0.684
Hip Joint Angle at Right Sagittal Plane ($^{\circ}$)	179.06 \pm 8.07 182.07 \pm 4.86	1.145
Hip Joint Angle at Left Sagittal Plane ($^{\circ}$)	133.27 \pm 15.14 143.67 \pm 11.14	3.103*
Knee Joint Angle at Right Sagittal Plane ($^{\circ}$)	120.33 \pm 8.56 121.13 \pm 3.02	0.278
Knee Joint Angle at Left Sagittal Plane ($^{\circ}$)	154.20 \pm 16.78 157.53 \pm 17.15	0.580

*Tab $t_{0.05}(4) = 2.776$

Table- 2 shows that there were considerable differences in angle of release (5.624); approach speed (4.614); hip joint angle at left sagittal plane (3.103) between SDT & LDT in cricket. Because in those cases calculated value of „t“ was greater than that of table value (2.776) at 0.05 level of significance with 4 degree of freedom. And there were no considerable difference of height of release, speed of release, shoulder, elbow (both right and left sagittal plane), hip (only right sagittal plane), knee (both right and left sagittal plane) joint angle between SDT and LDT in cricket. Because in those cases calculated value of „t“ was lower than that of table value (2.776) at 0.05 level of significance with 4 degree of freedom.

4. DISCUSSIONS OF FINDINGS:

The angle of release for long distance throws (LDT) was significantly greater than short distance throws (SDT) in cricket, because in long distance throw the ball need to travel a long distance, so angle of release need to be closer to 45° , so with the aim of the ball move a far distance by following an oblique projectile principles. For achieving greater horizontal distance the best possible angle of projection should be 45° (According to the principles of projectile motion). Taken as a whole mean release angle (35.80°) for long distance throw (LDT) was close to the optimum angle of 36° (Linthorne & Everett, 2006). In case of approach speed it is also significant difference between SDT and LDT in cricket because in LDT the ball was required to travel a long distance, so approach speed must be higher to achieving greater horizontal momentum than SDT in cricket. (Momentum = velocity X mass). And in case of hip joint angle there was also significant difference, and the reason is for LDT the ball required to throw long way, so height of release should increase for that basis hip joint need to more extend, so hip joint angle was greater in LDT than SDT (left sagittal plane).

On the other hand, there were differences in mean among selected remaining kinematic parameters between LDT and SDT. But these differences were not considerable according to statistic. Mean height of release is grater in LDT because according to principle of projectile, we know that, if projection angle and projection speed are remain constant then the straight distance travelled by a projectile can be increased by increasing the relative height of projection. Mean speed of release of SDT (110.30 ± 9.42 km/h, Jegede et al. 2005; Timmann et al. 2001 showed that for baseball throw speed of release was between 97-100km/h for unskilled participants.) is greater; it may be due to fact that in SDT, generally, fielders of 30 yards circle, throw the ball quickly aiming to make run out the opponent and because of that they try to cut down the trajectory. In order to cut down the trajectory, they have to cut down the release angle. According to principle of projectile, as they throw the ball almost with the horizontal velocity, they utilize their hand power for increasing projection speed to carry the ball up to wicket keeper (Horizontal displacement), where long distance fielders utilize the projection angle instead of speed of projection. So, speed of release must be greater than LDT in cricket.

5. CONCLUSIONS:

On the basis of the result obtained from the present study following conclusions may be drawn-

- 1) SDT and LDT significantly vary in case of angle of release, approach speed and hip joint angle at left sagittal plane.

- 2) The LDT have a greater value (insignificant) in case of height of release; shoulder joint angle (right sagittal plane), elbow joint angle (right and left sagittal plane), hip joint angle (right sagittal plane), knee joint angle (right and left sagittal plane) than SDT.
- 3) The ball release speed by the hand is greater (insignificant) in SDT than LDT.

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