



## KINEMATIC ANALYSIS OF FRONT FOOT OFF-DRIVE AT EXECUTION PHASE IN CRICKET

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### ABSTRACT

The study was conducted in order to the kinematical analysis of front foot off drive at execution phase in cricket. Twenty randomly selected male students aged 19 to 28 years and who have participated in the C.K.Naidu Trophy from U.P Team, Players of Combined University Camp and the players of Under 22 national Cricket Championship were selected as subjects for this study. For the biomechanical analysis of selected batting skills in cricket High speed videography technique was employed. The two Casio Exilim EX-F1 high speed cameras used for this purpose. Performance of subjects was recorded in control and favourable conditions. The data were recorded from both planes i.e. Sagittal plane and frontal plane. Siliconcoach Pro 7 Software was used in order to obtain the values of selected angular kinematics variables ankle, knee, elbow, hip, shoulder and wrist joint and height of centre of gravity from develop stick figures selected. The data was analyzed by use of descriptive statistics. The results have shown the values of descriptive statistics of selected angular kinematics variables at downswing and impact phase in front foot off- drive the mean, median and mode for selected angular kinematic variables were nearly equal.

**KEYWORDS :** Angular Kinematical analysis, linear Kinematical analysis, Kinematical analysis, Front foot off-drive, High speed videography.

### Introduction

Biomechanics is an applied form of mechanics and consequently the methods used to investigate it must be derived from those of mechanics. However, bio-mechanics have not developed in the wake of mechanics, but as a bordering science in other scientific disciplines such as anatomy, physiology and technique of sports. (Hochmuth, 1984)

Kinematics is the branch of biomechanics that is concerned with describing the motion of the bodies. It deals with such things that how far a body moves, how fast it moves and how consistently it moves (Hay, 1993).

The best method to analyze or evaluate is called cinematography. This is a quantitative method which is very accurate but at the same time costly and time consuming. The role of cinematography in the biomechanical research involved from a simple form of recording motion to a sophisticated means of computer analysis of motor efficiency. Over the year, new technique in filming and timing having been perfected to aid the research in achieving time measurement of both simple and complex locomotion pattern. (Newton, Aroncher and Abramson, 1971)

The forward off drive stroke is played to score the runs without growing a catch against a half volley ball with pitches in line or just outside the line of off stump (Ali, 1981).

### Objective of the Study

The objective of the study was to assess the variation in angle of selected joint of body parts and centre of gravity of front foot off-drive at execution phase.

### Methodology

#### Subjects

Twenty male cricket players aged between 19 to 28 years were selected for the purpose of this study. These subjects participated in the C.K. Naidu Trophy from U.P Team, Players of Combine University Camp and the players of Under 22 national Cricket Championship were selected as subjects for this study.

The study includes the following selected kinematical variables for analyzing the execution phase of front foot off drive in cricket.

#### Angular Kinematics

1. Angles of ankle
2. Angles of knee
3. Angles of elbow
4. Angles of hip joint.
5. Angles of shoulder
6. Angles of wrist

#### Linear Kinematics

- a) Height of Centre of Gravity of the body

#### Filming protocol

For the biomechanical analysis of selected batting skills in cricket High speed videography technique was employed. The two Casio Exilim EX-F1 high speed cameras were used for this purpose. Performance of subjects was recorded in control and favourable conditions. The data were recorded from both planes i.e. Sagittal plane and frontal plane. Camera-1 was placed perpendicular from the subject at a distance of 8.00 meters and was mount at 1.30 meters height. Camera -2 was placed perpendicular to camera-1 and in front of subject performing the skill at the distance or 24.00 meters and mount at 2.00 meters. The frequency of camera was set 300 frames/second.

#### Statistical Technique

To analysis data, descriptive statistic was used for the Kinematic Analysis of Front Foot Off-Drive at Execution Phase in Cricket.

#### Result and Findings

The descriptive statistics of angular kinematics variables of front foot off drive in execution phase are presented in the Table.



Figure: Front foot-Off Drive at Execution Phase

**Table : Descriptive Analysis Of front foot-Off Drive At Execution Phase in Cricket**

Angle	N	Range	Minimum	Maximum	Mean	Std. Deviation
Right Ankle	20	10	55	65	60.15	3.09
Right Knee	20	19	82	101	90.85	5.93
Right Hip	20	19	159	178	167.75	6.56
Right Shoulder	20	28	92	120	104.45	8.71
Right Elbow	20	10	119	129	124.1	3.29
Right Wrist	20	30	137	167	143.95	7.09
Left Ankle	20	20	78	98	91.7	4.87
Left Knee	20	38	91	129	104.8	10.31
Left Hip	20	13	65	78	70.7	4.09
Left Shoulder	20	21	141	162	153.45	7.37
Left Elbow	20	31	145	176	161.7	7.53
Left Wrist	20	34	145	179	168.55	9.96
CG	20	0.15	0.7	0.85	0.783	0.46

The mean, standard deviation and range of angles for angular kinematics for different variables in degree are as follows: Right Ankle Joint ( $60.15 \pm 3.09$ ), range of angle is 10, Right Knee Joint ( $90.85 \pm 5.93$ ), range of angle is 19, Right Hip Joint ( $167.75 \pm 6.56$ ), range of angle is 19, Right Shoulder Joint ( $104.4 \pm 8.71$ ), range of angle is 28, Right Elbow Joint ( $124.1 \pm 3.29$ ), range of angle is 10, Right Wrist Joint ( $143.95 \pm 7.09$ ), range of angle is 30, Left Ankle Joint ( $91.7 \pm 4.87$ ), range of angle is 20, Left Knee Joint ( $104.8 \pm 10.31$ ), range of angle is 38, Left Hip Joint ( $70.7 \pm 4.09$ ), range of angle is 13, Left Shoulder Joint ( $153.45 \pm 7.37$ ), range of angle 21, Left Elbow Joint ( $161.7 \pm 7.53$ ), range of angle is 31, Left Wrist Joint ( $168.55 \pm 9.96$ ), range of angle is 34. The height of centre of gravity shows value of mean and standard deviation ( $0.78 \pm 0.46$ ) respectively. The maximum value is 0.7 and minimum value is 0.85.

### CONCLUSION:

The front foot off drive is an extension of the defensive stroke. It is the action of the hips ( $167.75 \pm 6.56$ ) ( $70.7 \pm 4.09$ ) that generate much of the power in the stroke. The batsman starts from the perfect batting stance and moves the front foot behind the pitch of the ball. The shoulders ( $104.45 \pm 8.71$ ) ( $153.45 \pm 7.37$ ) are pulled forward and rotated when the hips are laterally shifted forwards. It is important that the hips and shoulders stay in line with the intended direction of the ball at this stage. The shoulder rotation initiates the downswing of the bat. Then when the shoulder motion decelerates the wrist extend rapidly until ball contacts, which occur in front of the eyes. At this point the front knee ( $104.8 \pm 10.31$ ) is bent, the rear foot lifted and turned, and the weight fully transferred into the stroke. Excessive rotation of the hips is prevented because the front knee is bent and the front foot pointed towards the off side, which effectively lock the motion of the hips. However, some rotation of the hips towards the front must occur to facilitate momentum transfer into the stroke.

The results have shown the values of descriptive statistics of selected angular kinematics variables at execution phase in front foot off drive the mean, median and mode for selected angular kinematic variables were nearly equal. Multiple modes existed for right shoulder ( $104.4 \pm 8.71$ ), right wrist ( $143.95 \pm 7.09$ ), left knee ( $104.8 \pm 10.31$ ), left hip ( $70.7 \pm 4.09$ ), left shoulder ( $153.45 \pm 7.37$ ). These joints are very important for the execution of front foot off drive because these joints help the player to enhance stroke accuracy.

### Recommendations

Based on the conclusions drawn in this study the following recommendations have been made.

1. A study may be undertaken with large number of variables and subjects such as different angles as the factors contributing to performance of batting skills.

2. A study may be undertaken with large number of variables and subjects such as different angles as the factors contributing to performance of different forms of batting.
3. Similar study can also be conducted on female cricket players.
4. Similar study can also be conducted on different level cricket players.

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