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ANALYSIS OF THE BATTING STROKE PULL SHOT IN CRICKET

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Abstract: The pull shot is a crucial horizontal batting stroke in cricket, used by batsmen to counterattack against seamers and disrupt spinners. This study aimed to analyses the mechanics of the pull shot in intervarsity level batsmen. The linear displacement of body segments and kinematic variables were examined to understand the execution of the pull shot. Five male cricket players from Visva-Bharati University, aged 22-26 years, participated in the study. Video footage of pull shots was captured and analyzed using Kinovea software. The results revealed a reduction in stride length from back lift to follow-through, indicating a tightening of the stride as the batsman approached and executed the shot. The percentage of stride length relative to body height decreased during impact and follow-through. Kinematic variables such as knee angles, hip angles, shoulder angles, elbow angles, and bat blade position were also analyzed. The findings contribute to the understanding of pull shot mechanics in intervarsity level batsmen. Further research with larger and more diverse samples, including female cricketers and elite-level players, is recommended to enhance the generalizability of the findings. The knowledge gained from this study can be utilized by coaches to improve training methodologies and enhance player performance in executing the pull shot effectively.

Index Terms **- Analysis, Horizontal Batting Stroke, Cricket, Pull Shot.**

1.0 INTRODUCTION

Cricket, as a sport, revolves around the skillful act of batting, which entails using a cricket bat to strike the ball and score runs while safeguarding one's wicket. Within the realm of batting, there exist two primary types of shots: horizontal bat shots and vertical bat shots. Horizontal bat shots occur when the bat's position is in a horizontal direction during the point of impact between the bat and the ball. These shots are typically employed against deliveries that pose less risk of hitting the stumps, such as those that are wide or short.

Unlike vertical bat shots, horizontal bat shots carry a higher probability of failing to make contact with the ball. However, they are vital for establishing dominance over bowlers. Among the various horizontal shots, the pull shot stands out as a crucial stroke. Batsmen employ the pull shot to counterattack fast bowlers or disrupt the length of spinners, making it an essential weapon in a batter's arsenal (Coaching Cricket Excellence, 2008).

The execution of a pull shot involves initiating the movement with a back foot stride and a clockwise rotation of the body parts (Sobers G, Smith P.,1985). This loading phase shifts the upper body towards the stumps at the back. Once the stride movement is completed, the lateral movement begins in the direction of the bowler (Welch C, Banks S, Cook F, Draovitch P., 1995). The pelvis of the batsman rotates towards the bowler, aligning the trunk and upper body with the short-pitched ball (Lund RJ, Heefner D, 2005). By extending the elbows, the hands and bat are brought into the line of the short-pitched ball (Kelly MG, Curtis KM, Craven MP, 2003; Land M, McLeod P., 2000). The movement of the body segments occurs in a sequential manner, aiding the batsmen in maintaining the position of the bat within the striking zone (Hay JG, Reid JG., 1988).

Previous studies on cricket batting have primarily focused on investigating batsmen's reactions when facing short-pitched balls (McLeod P., 1987). However, there is a paucity of research examining the kinematics of pull shots using two-dimensional or three-dimensional techniques, particularly in different age groups. Moreover, limited research has been conducted on non-elite cricket batsmen, and there is a lack of reviews elucidating the mechanics of the pull shot specifically performed by Indian batsmen. Therefore, a comprehensive mechanical analysis is required to elucidate the kinematics of the pull shot and validate coaching descriptions of the stroke.

Hence, the purpose of this study is to analyze the pull shot executed by intervarsity-level batsmen in cricket. By examining the kinematics of the pull shot, this study aims to provide valuable insights into the mechanics and technique of this stroke. The findings will contribute to a better understanding of optimal body positioning, movement patterns, and coordination during the execution of the pull shot. This knowledge will be beneficial for coaches, experts, and cricketers seeking to enhance their skills and performance in executing the horizontal batting stroke, specifically the pull shot.

In a nutshell, this study focuses on analyzing the pull shot in intervarsity-level batsmen in cricket. By investigating the kinematics of this stroke, we aim to provide valuable insights that can enhance the development and training of batsmen in executing effective pull shots.

1.1 Purpose of the study:

The purpose of this study is to analyse the mechanics and kinematics of the horizontal batting stroke, specifically focusing on the pull shot, performed by intervarsity-level batsmen in cricket. By conducting a mechanical analysis, the study aims to provide a detailed understanding of the pull shot technique, validate coaching descriptions, and contribute to the existing knowledge on this stroke.

1.2 Objectives of the study:

The specific objectives of this study are as follows:

i. To investigate the kinematic parameters involved in executing a pull shot, including footwork, body rotation, bat position, and hand movement.

ii. To analyse the timing and coordination of body segments during the pull shot.

iii. To provide insights and recommendations for coaching and training methods to enhance the proficiency of the pull shot.

2.0. MATERIALS AND METHODS

In the Materials and Methods section, the study describes the sources of data, variables chosen, procedure for data collection and filming, and the statistical analysis conducted.

2.1. Sources of Data:

The study included five male cricket players from Visva-Bharati University who had represented the university consistently for five years. The participants were right-handed batsmen, aged between 22-26 years.

2.2. Selection of Variables:

The kinematic variables chosen for analysis were left knee angle, right knee angle, left hip angle, right hip angle, left shoulder angle, right shoulder angle, left elbow angle, right elbow angle, and bat blade.

2.3. Procedure:

The batting was conducted on an outdoor cricket pitch measuring 20.12m long x 3.05m wide.

Prior to the trials, the batsmen performed warm-up shots against short-pitched balls to familiarize themselves with the experimental conditions. Six pull shot actions of each batter were captured for analysis. Video footage of the pull shots was qualitatively assessed by an accredited cricket coach to select the appropriate shots for further analysis.

2.4. Collection of Data and Filming Protocol:

Videography technique was used to capture the pull shots.

Two digital video cameras, recording at 50 frames per second (fps), were positioned 13 meters away from the batting crease, with a height of 1.40 meters from the ground.

One camera was placed in front of the batter (parallel to the batting crease), and the other was placed at the side near the bowling crease.

Video data from the cameras were transferred to a computer, and the most successful pull shots of each batter were selected for kinematics analysis.

Stick figures were developed on the photographs using Kinovea Software (Version 8.25), and the selected kinematic variables were calculated using the joint-point method.

2.5. Statistical Analysis:

Descriptive statistics, including mean and standard deviation, were calculated for all variables using MS Excel Data Analysis Pack (Version 2010).

The described methodology provides a clear overview of the data collection process, variables measured, and the software used for analysis. The statistical analysis conducted allows for a quantitative assessment of the kinematic variables during the pull shots.

3.0 RESULTS:

In this section, the findings of the study on the analysis of the horizontal batting stroke pull shot are discussed. The results are organized according to the specific variables analysed during the study.

Table No: 1
General and Anthropometric Characteristics of the Batsmen

Sl.No	Variables	Mean±SD
1	Height (cm)	166.2±2.13
2	Body weight (kg)	55.2±4.95

Table 1 presents the general and anthropometric characteristics of the batsmen involved in the study. The mean height of the batsmen was 166.2 cm, while the mean body weight was 55.2 kg. These measurements provide insights into the physical attributes of the batsmen participating in the analysis of the pull shot. Understanding the players' height and weight can help in assessing their biomechanical capabilities and their ability to generate power and execute the pull shot effectively.

Table 2: Linear displacement of the body segments at back lift, impact and follow-through during pull shot

Sl.No	Variables Phases of shot	Mean	SD	Percentage of the stride length with the body height
1	Stride length (m)	.74	3.92	44%
		.69	1.72	41%
		.65	1.01	39%

Table 2 provides the linear displacement of the body segments at back lift, impact, and follow-through during the pull shot. The variables analyzed include stride length and the percentage of stride length relative to body height.

During the back lift phase, the mean stride length was recorded as 0.74 meters. This indicates the distance covered by the batter's stride during the initial phase of the pull shot. At impact, the mean stride length reduced to 0.69 meters, suggesting a slightly shorter stride taken by the batter as they prepare to make contact with the ball.

In the follow-through phase, the mean stride length further decreased to 0.65 meters, indicating a continued reduction in the stride length as the batter completes the pull shot. The percentage of the stride length relative to body height provides additional information. During the back lift, the stride length accounted for approximately 44% of the batter's body height. At impact and follow-through, the percentages decreased to 41% and 39%, respectively. These measurements provide insights into the linear displacement of the body segments during different phases of the pull shot. The reduction in stride length from back-lift to follow-through suggests a tightening of the stride as the batter approaches and executes the shot. The percentage values highlight the proportion of stride length relative to body height, which can be important for understanding the biomechanics and efficiency of the pull shot.

Table No: 3

Table 3: Angular kinematics of the joint segments at Back Lift Impact and Follow Through during pull shot

Variables (Angles in Degree)	Phases of Pull Shot	Mean (Degree)	SD
Left Knee	Back Lift	138.17	0.78
	Impact	149.01	2.55
	Follow Through	143.08	0.69
Right Knee	Back Lift	125.65	0.02
	Impact	140.8	1.72
	Follow Through	145.6	1.36
Left Hip	Back Lift	130.2	1.17
	Impact	147.4	1.36
	Follow Through	156.4	2.58
Right Hip	Back Lift	144.8	1.94
	Impact	157.6	1.02
	Follow Through	165	0.89
Left Shoulder	Back Lift	68.2	0.75
	Impact	66.6	1.02
	Follow Through	48.2	0.75
Right Shoulder	Back Lift	35.4	1.02
	Impact	49.6	0.8
	Follow Through	68.6	1.5
Left Elbow	Back Lift	121	0.89
	Impact	146.6	3.44
	Follow Through	150.4	1.02
Right Elbow	Back Lift	57.8	1.17
	Impact	116.4	1.02
	Follow Through	146	1.41
Bat Blade	Back Lift	86.2	1.47
	Impact	80.4	1.85
	Follow Through	80.6	1.02

The table 3 presents the angular kinematics of joint segments at back lift, impact, and follow-through during the pull shot. The mean values of the angles for each phase of the shot are provided.

- Left Knee: The mean angle at back lift was 138.17 degrees, 149.01 degrees at impact, and 143.08 degrees at follow-through.
- Right Knee: The mean angle at back lift was 125.65 degrees, 140.8 degrees at impact, and 145.6 degrees at follow-through.
- Left Hip: The mean angle at back lift was 130.2 degrees, 147.4 degrees at impact, and 156.4 degrees at follow-through.
- Right Hip: The mean angle at back lift was 144.8 degrees, 157.6 degrees at impact, and 165 degrees at follow-through.
- Left Shoulder: The mean angle at back lift was 68.2 degrees, 66.6 degrees at impact, and 48.2 degrees at follow-through.
- Right Shoulder: The mean angle at back lift was 35.4 degrees, 49.6 degrees at impact, and 68.6 degrees at follow-through.
- Left Elbow: The mean angle at back lift was 121 degrees, 146.6 degrees at impact, and 150.4 degrees at follow-through.
- Right Elbow: The mean angle at back lift was 57.8 degrees, 116.4 degrees at impact, and 146 degrees at follow-through.
- The mean angle of the bat blade at back lift was 86.2 degrees, 80.4 degrees at impact, and 80.6 degrees at follow-through.

These results provide insights into the angular positions of the joint segments during the pull shot, indicating the movement and positioning of the body during different phases of the stroke.

3.1 Discussion on Findings

The findings of the study provide valuable insights into the kinematics of the pull shot performed by intervarsity-level batsmen in cricket. The analysis revealed several important aspects of the pull shot technique:

Stride Length: The result of the study shows a longer stride length when the feet moved back and across which can be beneficial, particularly when facing slower deliveries. A longer stride length allows the batter to reach the ball at the appropriate time, enabling better timing and execution of the shot. When facing slower bowlers or spinners, the reduced pace of the delivery gives the batter more time to adjust and position themselves for the shot. In these situations, a longer stride length can be advantageous as it helps the batter cover the distance to the ball and generate power through the shot. By extending their stride back and across, batsmen can effectively time their pull shots against slower deliveries, allowing them to hit the ball with greater force and control. The longer stride length enables the batter to reach the ball at the optimal moment, ensuring a well-executed pull shot.

If the ball is delivered at a high speed, a long stride length may lead to a delayed or mistimed impact with the ball. This can result in mistimed shots, missed opportunities, or even the risk of getting out. Timing is crucial in cricket, and a long stride length can potentially disrupt the coordination between the batter's body movements and the ball's trajectory.

It is important for batsmen to find the right balance between stride length and timing, considering the pace and trajectory of the incoming delivery. This may involve modifying the stride length or adopting different strategies to adapt to various bowling conditions and speeds.

Knee Angle: The study observed higher right knee angles at the time of bat-ball impact and follow-through. This suggests that the extension of the right knee is dependent on the stride length of the batsmen, which was approximately 44% of their body's height. This finding aligns with previous research by Welch et al. (1995) and indicates that the stride length plays a crucial role in the positioning of the right knee during the pull shot.

Hip Extension: The study found that batsmen exhibited a higher angle of extension of the left hip at impact and follow-through. This extension of the hip helps maintain an upright position and allows the batsmen to execute the pull shot in a downward direction. This finding supports coaching suggestions that emphasize the importance of maintaining an upright position during the pull shot (Kidger, 2011).

Shoulder and Elbow Extension: The analysis revealed that both the left and right shoulders extended at the time of impact, allowing the arms to remain parallel to the trajectory of the short-pitched ball. Additionally, the left and right elbows extended, enabling the batsmen to extend their arms and execute the pull shot in front of their chest. These findings are consistent with coaching suggestions by Bradman (1958), and Woolmer et al. (2008).

Bat Blade/ Face Angle: The study observed a range of bat face angles between 79° and 85° at the point of impact for the pull shot. This finding supports the coaching suggestion that the bat face angle should be less than 90° (Bradman, 1958) and higher than 45° (Woolmer et al., 2008) to effectively execute the pull shot.

Overall, these findings provide empirical evidence that aligns with coaching recommendations and enhances our understanding of the kinematics involved in the pull shot. The study contributes to the existing body of knowledge on the pull shot technique and can be used to inform coaching methodologies and training programs aimed at improving batsmen's proficiency in executing this stroke.

4.0. CONCLUSION

Based on the findings of this study, several key conclusions can be drawn:

i. The stride length of batsmen during the pull shot significantly influences the extension of the right knee. A longer stride length results in higher extensions of the right knee at impact and follow-through.

ii. The extension of both the left and right elbow at the time of impact is crucial for batsmen to extend their arms and execute the pull shot effectively. This extension allows for greater control and power during the shot.

iii. The range of bat angle observed during the pull shot, between 45° and 95°, helps to prevent the batsmen from hitting the ball with the top edge of the bat. This is in line with coaching recommendations that suggest keeping the bat angle below 90° to avoid mistiming and mishits.

These conclusions highlight the importance of proper technique and body positioning in executing a successful pull shot in cricket. Coaches and players can utilize this information to refine their training

methods and emphasize the key elements of the pull shot, such as stride length, elbow extension, and bat angle.

5.0 Limitation of the study:

It is important to acknowledge the limitations of the study, such as the focus on intervarsity-level batsmen and the small sample size. Future research should aim to include a larger and more diverse sample to provide a broader understanding of the pull shot technique across different skill levels and player populations. Additionally, incorporating biomechanical measurements and analysing the impact of external factors, such as ball speed and pitch conditions, would further enhance our understanding of the pull shot in cricket.

6.0. Recommendation:

Based on the findings and limitations of the study, the following recommendations can be made:

a) It is recommended to capture the execution of the pull shot in real match situations.

b) To gain a comprehensive understanding of the pull shot technique, it is suggested to analyse it against faster and slower deliveries, as well as higher and lower bounce deliveries.

c) Analysing the pull shot against in-swing and out-swing deliveries can provide valuable insights into the batter's ability to adapt and execute the shot effectively in different game scenarios.

d) It is recommended to analyse the pull shot technique on different types of pitches, including bouncy and dry pitches.

e) Examining the pull shot technique against both new and old balls will also provide insights into its effectiveness throughout different stages of the game.

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