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ANALYSIS OF UPPER BODY THREE-D MOTION OF BATTERS FOR EXECUTION OF PULL SHOT IN CRICKET

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KEYWORDS

Batters, Pull Shot, Short Pitch Ball, Upper Extremities

ABSTRACT

In modern international cricket pull-shot is used as deadly weapon against fast bowlers by the batters that is why the technique of pulling the short pitch deliveries has clinched importance and improved. The researcher has tried to investigate kinematics of the batters' upper extremities in the cricket during executing pulling the short pitch ball. It was investigated that how the batters manage ball's speed, bounce, and uniformity during playing pull shot during competitions. Cricket players participating in HEC Pakistan, universities cricket championship from the Gomal University, Dera Ismail Khan, and KP, Pakistan were targeted sample of the study. The kinematic analysis was performed by using analysis software. The kinematics of upper extremities of the 12 batters for successful and unsuccessful pull shots were compared by using repeated measure (ANOVA). In better pull shot it was observed that the movement of the shoulders and arms were rapid, while, batters position was closer to line of short pitch ball. The results have shown that best and successful pull shot batters upper extremities joints extension and thus adjustment abilities were comparatively better than the others.

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INTRODUCTION

In cricket pull-shot is a cross-batted stroke executed by a batter on ball bouncing around his waist height with forceful swinging of bat in the horizontal arc in front of his body. The stroke is dispensed to leg side of batter's ground which may be mid-wicket or square leg (Haq, Fook & Bendri, 2017). Pull-shot known as horizontal bat stroke needs more courage as compared to skill. It is known as the most effective stroke with maximum opportunity of scoring in shape of boundaries. Due to the dangerous line and length of ball, this stroke is considered risky one for batter's life and called bravest act on part of batter (Haq, Badar & Nazeer, 2019). It is considered as the attacking strategy of the batter against fast bowlers

especially bowling bouncers and sharp short pitch deliveries, it is considered as one of the bravest acts in the cricket (Stuelcken, Portus & Mason, 2005; Headrick, Renshaw, Pinder & David, 2012). In initial years of the world cricket Sir Don Bradman and in 1980's Sir Vivian Richards of West Indies started trend of pulling short pitch deliveries with perfection and accuracy at class. He is known as one of brave batters who came up with plan of attacking and executing bouncer and short pitch deliveries through successful pull-shot (Weissens, Abernethy & Farrow, 2011). For pull-shot batter sets back foot movement and gets ready to tackle short pitch ball, with the in time rotation of his body rapidly as he connects the short pitch ball or bouncer. Front foot of the batter supports body rotation and back foot helps in maintaining balance.

LITERATURE REVIEW

The pull shot in cricket is played with swing of bat in horizontal position to take maximum benefit of short-pitched delivery and smash it in most suitable direction (Semwal, Mishra, Raj, Sharma & Mittal, 2018). In cricket pull shot the upper arm elbow position is important for maximum benefit from the short pitch ball of bowler (Moodley, Haar & Noorbhai, 2022). The speed of body changing position and faster arms movement makes pull shot of batter more successful (Khan, Hassan, Farooq & Khan, 2018). Alignment of batter's body is also important for the good pull shot. When body of batter will be properly in line with the short pitch delivery of the bowler it will produce better results (Dias & Ferdinands, 2010). During execution of pull shot batter must concentrate on the stroke and keep the ball downward, so that to minimize the chances of being caught (McGrath, Neville, Stewart & Cronin, 2019). Accuracy of pull shot in cricket is mostly dependent on prompt flexion and extension of joints of arms and upper extremities. The good cricket pulls shot has positive link with the angular kinematics of elbows and allied joints (Noakes & Noorbhai, 2015). Furthermore, it was reported that downward pull shot in cricket is directly related with faster elbow joint extension (Moodley et al., 2022).

The timely bat swing of the batter is also associated with the accuracy of cricket pull shot (Bagchi, 2014). World class batters and club level batters proved differ in accuracy of pull shot. Club level batters' performance was reported as lower in comparison to international cricket players (Haq, Badar & Nazeer, 2019). Studies have been conducted on the angular kinematics of upper body extremities role during pull shot and qualitatively results have been reported (Stuelcken, Portus & Mason, 2005). The biomechanical details of cricket pull shot have been very less discussed in the research studies as compared to the technique by researchers (Noorbhai, 2020). It is prominent from the review of literature that quantitative analysis of batters pull shot in cricket is crucial and need to be compared with kinematics of successful and unsuccessful shots. For this purpose, videography analysis is most suitable mode to better explain the kinematics of the batters pull shot technique used previously in cricket (Moodley, 2022). Researcher conducted present research on Pakistan universities cricket players representing Gomal University, Dera Ismail Khan, and (KP) Pakistan. It was

tried to compare the kinematics of upper extremities during successful and unsuccessful pull shots of all the batters.

RESEARCH METHODOLOGY

The present research study was semi-experimental research project in nature. In study 12 batters of Gomal University, participating in HEC Pakistan Universities' cricket championship. Consent and permission was sorted out as per ethical consideration of the research. The experimental process was carried in Pakistan Cricket Board cricket ground established in Gomal University. Researcher used ball machine for repeated testing of ball speed, bounce, control and uniformity (James, Uroda & Gibson, 2005). Distance of machine from batting crease was 17.80m. Two high-speed video cameras were installed for capturing pull shot actions of batters, with a 1.40-meter height and were operated at 60Hz. One of the camera was positioned 13 meters in front of batter, and the other was installed to side nearer to bowling crease. Researched focused a 24-point aluminum calibration frame for capturing video volume (Moodley et al., 2022). Calibration volume was set at 3-meters on the X-axis for sagittal plane motions, 1.5-meters on Y-axis for frontal plane, and 2-meters on Z-axis in vertical position for sloping plane motions (Bagchi, 2014). For upper extremities joints reflective markers were used, while for kinematics of shoulders two markers were installed on right and left both angels.

For elbow joint extension and flexion two markers were placed on lateral side of epicondyle. To determine linear and angular displacements of batters wrist joints, two markers were installed on both (right & left) radial styloid. Researcher digitized as per industry standards, two spots on the handle of the batters bat and four at corners of the bat blade (Noakes & Noorbhai, 2015). In this connection, for measurement of the batter head movement one marker was placed. The average ball releasing height was ranged between 2.25 to 2.35m. All the batters were properly directed to take warm exercises accordingly before starting of the experimental trails. The distance of ball projection machine was kept 17.80 meters from the batting crease and the ball was released from the heights with the range of 2.25 to 2.35 meters. Speed of ball varied between 25 and 30 meters/second, likewise related to other front foot batters shot studies (Bagchi, 2014). Thus, experienced coaches selected three successful and three unsuccessful pull shots from each batter trials. Thus, "each stroke played with the full face of the bat, downward and directed toward the square leg position of the ground," called as the successful orthodox pull shot towards the batter in the cricket (Stuelcken et al., 2005).

On the other hand, failed stroke was not correctly executed by batter, was the ball floating in the air and producing chance to be caught easily by the nearby fielders. In pull shot's kinematics the researcher had to check three phases; 1) the stance, 2) the back lift of the bat, and 3) the bat-ball contact of batter. In vertical the Y-axis direction the height of the bat and batter center of gravity from the ground surface were measured. For examination

of bat-ball impact in X-axis direction, head and ball distances were measured. In response to the direction of incoming short-pitch delivery batter's bat displacement was measured along with the X-axis. Batter joints' angular kinematics were 180 degrees in full extension and zero degrees in full flexion of the joint movement (Dias & Ferdinands, 2010). Shoulder angles were determined from intersection of; 1) the hips and shoulder vector and 2) the shoulder to elbow vector. For declaration of elbow angles intersection of; 1) the shoulder to elbow vector and 2) elbow to wrist vector were used. Batter bat angle was measured through the distance between 1) the upper corner of bat and the lower corner of the bat toe vector, 2) the distance between the lower corner and ground surface vertical position with direction as a vector.

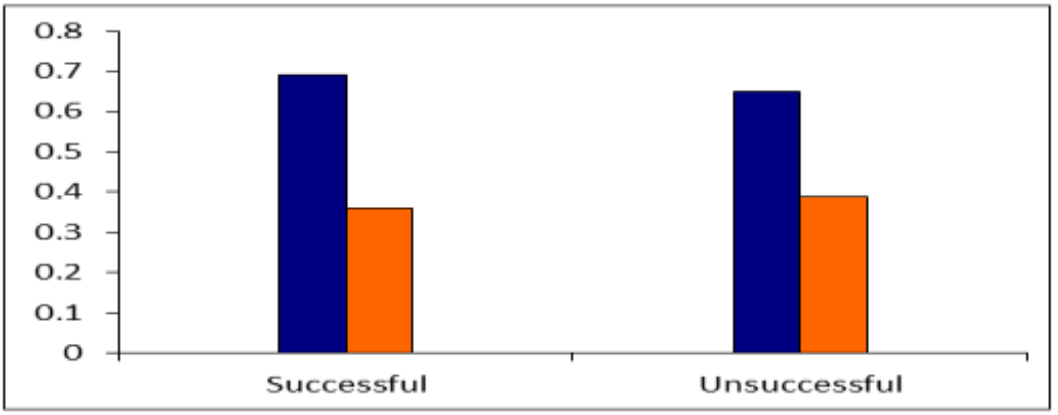
In findings of research study variability of kinematics data was lowered by taking the mean score of two successful and unsuccessful pull shots through standardized (Soomro, Sanders & Soomro, 2015). Researcher used coefficient of the variation for inter-tester dependability. Bat height was 5.4%, velocity was 8.1%, bat-ball impact was calculated 6.2%, bat the angle remained 7.8 percent, shoulder angle was percent, elbow angle was 6 percent, and wrist velocity was 8 percent. The linear kinematics ranged between 3.1 to 10.7 millimeters, and the angular kinematics range remained as 3.1 to 10.7 degrees (McGrath et al., 2019). Thus, descriptive statistic, mean and standard deviation was used for linear and angular kinematics of the variables. Analysis of variance with repeated measures to examine the three levels (stance, back lift, & impact) with two situations (successful vs. unsuccessful pull-shot) were used. Nature of data such as normality, the homogeneity of the variance, and multi-collinear assumptions were properly verified (Moodley et al., 2022). Level of significance was kept as $P < .05$ and the significance of the difference between the successful and unsuccessful pull shots was calculated.

RESULTS OF STUDY

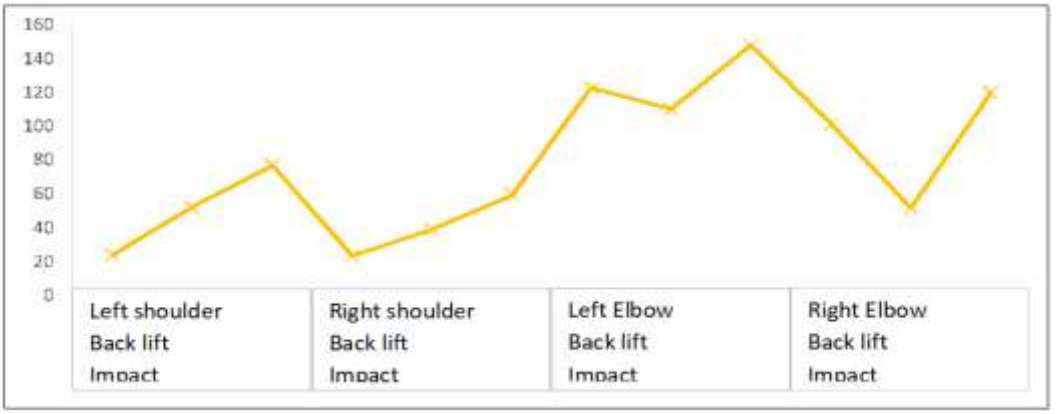
Results of the analyzed data have shown that in successful cricket pull-shot the height of bat was comparatively higher than as in unsuccessful pull-shot. It had significant impact on the success of the pull-shot of batters. The left shoulder angle during successful and unsuccessful pull shots, there significant main effects existed. The faster movement and extension of shoulder, elbow and wrist joints were substantially higher in successful pull-shots as compared to the unsuccessful pull-shots. There was significant main impact of left elbow angle on successful and unsuccessful pull-shots of cricket batters. The results have depicted that extension of both left and right elbows were apparently higher in successful pull-shots than unsuccessful pull-shots. Velocities of left and right shoulders were reported faster in successful pull-shots as compared to unsuccessful pull-shots of the batters. Right elbow velocity in successful pull-shot much faster reported than the unsuccessful pull-shots. Same was case with velocity of left wrist which was substantially faster reported in successful pull-shots than in failed pull-shot. In this connection, the results have shown that

right wrist velocities were substantially faster in the successful pull-shots than unsuccessful pull-shots.

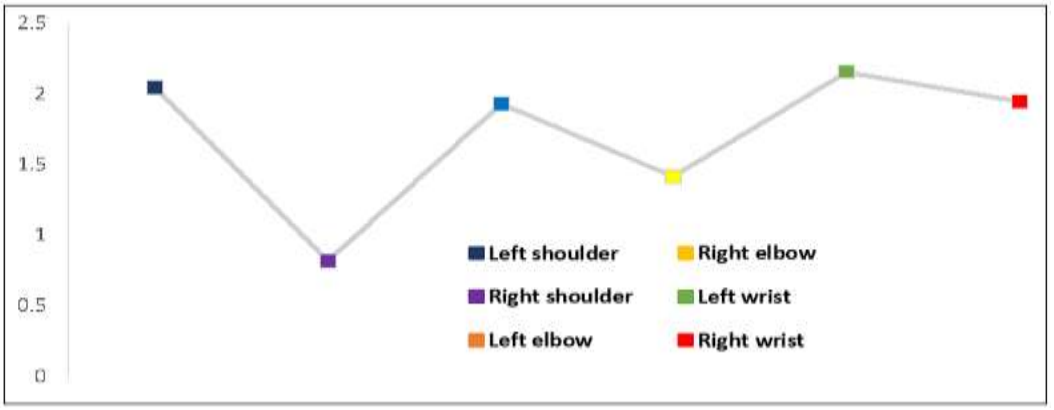
Graph 1 Results Showing Comparison of Successful and Unsuccessful Pull Shots



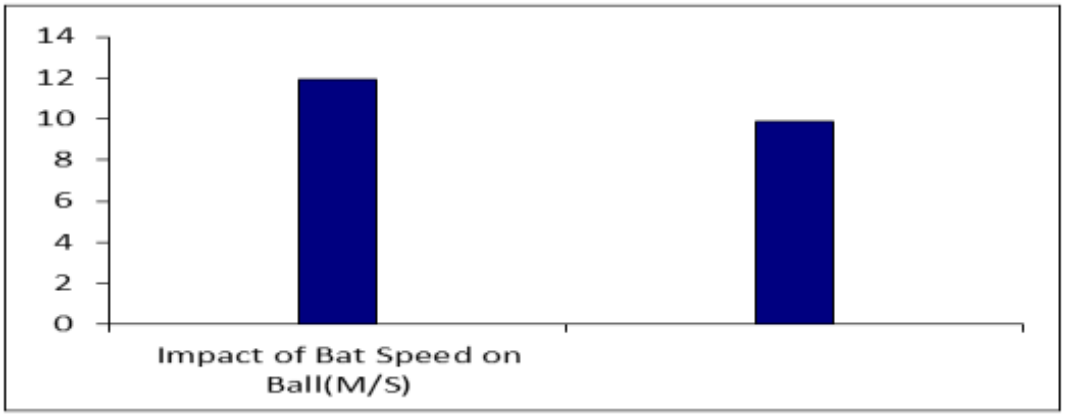
Graph 2 Showing Impacts of Successful & Unsuccessful Pull Shot



Graph 3 Showing Body Segments During Pull Shot



Graph 4 Results showing Impact of Bat Speed on Ball



DISCUSSION

The goal of present study was to analyze kinematics of successful and unsuccessful pull shots made by University level cricket players of Pakistan. In past cricket professionals on their personal experiences used to define causes of successful and poor pull shots without any solid research-based mechanical evidence of strokes. Contrary to that in this research study video analysis of the pull-shots of cricket batters through Ariel performance analysis system software suite was made. Statistical variance between successful and unsuccessful pull-shots of the batters were investigated using repeated ANOVA measure. The variables were stance, back lift, and bat-ball impact phases of the pull-shots. Batters bat height was (+0.03 to 0 .05 meters) higher in successful pull-shot as compared to unsuccessful strokes. The batters benefit from high back bat lift was that they executed the short-pitched ball from a higher position (-0.35 to -0.37 meters). The Impact of downswing from the back lift, and height lowered at (-0.39 to -0.41 meters). Benefit of such pull-shots demonstrated that that batters drew safely with minimum chances of catching ball by fielders (McGrath, Neville, Stewart & Cronin, 2019; Moodley et al., 2022). In this connection, in successful pull-shots more elbow flexion at back lift was reported (-10.30 to -10.48 degree) in as compared to the unsuccessful strokes. Thus, the results have shown higher elbow extension is linked to a successful pull shot.

The higher flexion of the elbows during the back lift resulted in the higher the extension of the elbows at bat-ball collision and batters pull-shots were thus more successful (Noakes & Noorbhai, 2015; Noorbhai & Noakes, T2016). The shoulder extension was reported much more in successful pull-shots of batters as compared to unsuccessful pull-shot. Velocity of batters bat was increased due to higher shoulder extension and batters were benefited (Moodley & Haar, 2020). It was found that in the successful pull-shot shoulder velocity was faster than that of unsuccessful pull-shots. It is pertinent to mention that shoulder velocity is crucial in bringing the arms and bat timely in line with short-pitched ball for converting stroke into a successful shot (Soomro, Sanders & Soomro, 2015). The results of this study

back up coaching theory that faster shoulder movement is linked to a successful pull shot (Semwal et al., 2018). In successful pull-shots of batters elbows were reported faster (+ 0.33 to 0.39 m/s) than the unsuccessful pull-shots. Current study backs up (Noorbhai, 2020). Results depicted that in successful pull-shots wrists of batters were faster as compared to unsuccessful pull-shots. Faster wrist movement resulted batters in speedier rolling over the bat to make prompt contact with short-pitch ball. It helps in playing key role in executing successful downhill pull stroke. Rapidity of the bat swing is directly linked with faster wrist movement (McGrath et al., 2019).

CONCLUSION

Researcher concluded that while comparing successful and unsuccessful cricket pull-shots of batters, various kinematics factors revealed significant differences. Successful cricket pull-shot was reported to be directly linked to batter's bat vertical height and its position. Faster elbow extension brings speedily bat closer to the line of the short-pitched ball and successful pull-shot is thus easily executed. Shoulders of batters extension is beneficial in successful pull-shot. Higher extension of elbows proved helpful for batters to retain arms and bat position parallel to the trajectory of the short-pitched ball. Faster wrist movements of batters, on the other hand, helped them to bring the bat in time as well as rolling over the bat for execution of the better pull-shot downward rather than up into the sky. Rapid movement of shoulders, elbows, and wrists is directly linked with the increased velocity of the bat. Consequently, researcher recommends modern and scientific analysis of the skill and technique levels of athletes representing our homeland for improving their performance and achievement standards.

The results and discussion of present study depicts that applicability of modern technology for skill development in various sports is essential. In recent arena of sports the coaching, conditioning and training technology has replaced old traditional methods and techniques. Coaches and trainers are advised to switch over to technology and use the most modern and recent equipment for coaching and training. For excellence and perfection in the skill requires expertise of coach and technology which must be made available in all the centers. In this linking, world is advancing with tremendous pace in sporting events by switching over to technology and its implementation at grass root level in Pakistan is essential. For talent hunt, identification and grooming usage of technology is recommended on initial stages for better results. The biomechanical laboratories are suggested to be established in schools, colleges, universities and coaching centers. Thus, present study provides significant information about the pull shot in different situations and thus significantly validated over the previous studies results.

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