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Three Dimensional Analysis of Variation between Successful and Unsuccessful Drag flick Techniques in Field Hockey

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Abstract: *Three dimensional Biomechanical Analyses of drag flick techniques in hockey is the best way to determine different mechanical parameter of the performance. The focus of this study was to analysed kinematical differences between successful and unsuccessful drag flick and find out those parameters which is given convinced contribution in the accuracy. For this study one (01) main drag flicker from Aligarh Muslim University, Aligarh (U.P) India (mean age 19 years; height 180.50 cm and weight 65 kg) was selected as a subject. The movements of the drag flick techniques were recorded with two Canon video cameras. Trials were digitized by the Max Track 3D motion analysis software. The result of this study shows that there are little or no movement variations in the individual technique of drag flick.*

Keywords: *Drag, Kinematical, Three Dimensional, Motion analysis, performance*

1. Introduction

Technique of biomechanical analysis is the best way to find out the key mechanical factors of performance. Biomechanical analysis is not limited for the few sports; it is well versed in testing specific skills in open sports. For example, serve in tennis, Bowling and throwing in cricket, shooting in basketball, drag flick in hockey; these are the few examples of open sports for the biomechanical analysis to find out the factors responsible in skills (Gomez et al., 2012)

3D motion analysis always performed like 2D analysis as well as advanced motion analysis technology with advance plate data. In 3D analysis reflective markers are placed on the subject and tracked with infrared camera to create model of the athlete during the activity. 3D analysis is the best way to visualize and track progresses over time.

Drag flick is an attacking technique in the sports of field hockey. Drag flick is known as the most scoring technique in the field hockey, it is mainly use in penalty corner. The drag flick is mostly use by the men than women in penalty corner and its more effective then pushes or hits during penalty corner.

Approximately half of all goals have been scored from the penalty corner. Direct hit and Drag flick are two shooting style used for a direct shot on goal from penalty corners set play. During direct hit the ball must be played low around the wooden area of the goal post, and the drag flick in which the ball is allowed to be lifted at any part of the goal post. Drag flick is the combination of common flick and scoop stroke. Drag flick is a very effective goal-scoring weapon because ball mostly travels above the level of the goalkeeper into the top corner of the goal post with accuracy and speed. For the analysis the drag flick can be broken into the four phases: 1- preparation, 2- force generation, 3- ball contact with the ball, and 4- follow through phase.

Mechanics of each phase of the drag flick has significant with the performance (Bari et al. 2014). Main aim of this study to find out kinematical factors which are responsible for better performance in relation to accuracy.

2. METHODOLOGY

One main drag flicker of Aligarh Muslim University, Aligarh (U.P) India (mean age 19 years; height 180.50 cm and weight 65 kg) participated as a subject in this study. Participant was free of injury and had a hockey drag flick experience of 06 years.

Player wear specified tight clothing during the data collection. Reflective marker were placed on Clavicle, Sternum, Shoulder (right and left), elbow (right and left), wrist (right and left), pelvic left and right axis, Knee (right and left), medial knee (right and left), ankle (right and left)and three point in hockey stick.

The three dimensional (3D) motion of the drag flicks, stick and ball were ascertained from digitized video analysis using 2**1**-point body model together. The complying markers were digitised; Joint centres and points describing the stick and the ball were estimated (Bari et. al, 2014).

The data recording of drag flick conducted on sunny and clear weather condition in the Astroturf Hockey field during regularly practice scheduled. The target 1×1 square feet was fixed at upper left corner of the goal post. Twelve drag flicks toward target were selected (Six successful and Six unsuccessful) for the analysis.

The movements of the drag flick were captured using two Canon Legria SF-10, 8.1 video cameras in a field setting operating and with a specified shutter speed and frame rate field setting (sampling at 50 Hz). Cameras intersect to each other at 60^0 angles. Placement of the first camera on the right side at 34 ft from the ball points at 90^0 of mediolateral axis parallel of latitude to the ground, second camera placed laterally at the distance of 31.5ft. Cameras were fielded synchronized, static calibration method was used to calibrate both the cameras (Bari et. al, 2014).Videos of all trials were digitized using the Max Track 3D motion analysis software.

3. RESULTS

The main purpose of this study was to determine kinematical differences between successful and unsuccessful drag flick and find out those variables which has given positive contribution in ball accuracy. T-test and correlation analysis were used to find out differences and relationship between successful and unsuccessful drag flicks.

Table 1.

Variable		N	Mean	Std.Deviation	Std. Error Mean	t-value
DD (m)	SF	06	2.14	0.50	0.20	0.53
	UF	06	2.00	0.39	0.16	
BV (m/s)	SF	06	18.61	3.30	1.34	1.35
	UF	06	16.29	2.63	1.07	
SV (m/s)	SF	06	16.39	3.86	1.56	0.83
	UF	06	14.92	1.96	0.80	
SAO (°)	SF	06	63.67	12.74	5.20	1.30
	UF	06	54.17	12.56	5.13	
HAO (°)	SF	06	49.17	9.11	3.72	0.14
	UF	06	48.33	11.20	4.57	

*Significance at 0.05 levels.

DD=Drag distance (m)

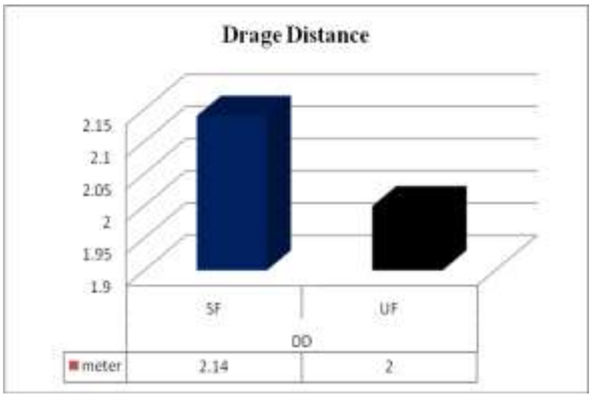
BV= Ball Velocity after ball release (m/s)

SV= Stick velocity (m/s)

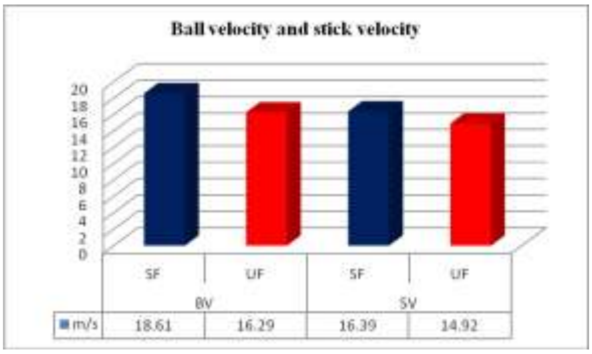
SAO= Shoulder axis orientation in follow-through (°)

HAO= Hip axis orientation in follow-through (°)

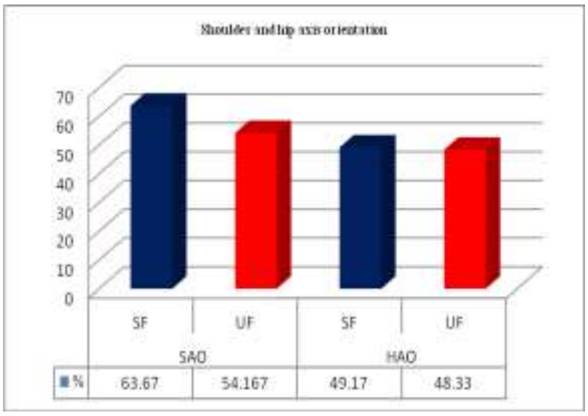
The analysis of data table-1 shows that there is an insignificant differences shows between successful and unsuccessful drag flicks kinematics i.e. drag distance (DD), Ball velocity after ball release (BV), stick velocity (SV) during follow-through phase as obtain 't' ratio is less than the required 't' value of 2.30



Graph 1. *Drage distance (m)*



Graph 2. *Ball and stick velocity (m/s)*



Graph 3. *shoulder and hip axis orientation (m/s)*

Table 2. *correlations*

Subjects	Dependent variable	Predictors	R
Successful	Ball velocity after ball release	DD	0.52
		SV	0.71
		SAO	-0.10
		HAO	0.24

*Significance at 0.05 levels.

DD=Drag distance (m)

BV= Ball Velocity after ball release (m/s)

SV= Stick velocity (m/s)

SAO= Shoulder axis orientation in follow-through **(°)**

HAO= Hip axis orientation in follow-through **(°)**

The analysis of data table-2 shows that there were no significant relationship between ball velocity after release with Drag distance (DD),stick velocity (SV), shoulder axis orientation (SAO) and hip axis orientation (HAO) in follow through phase during successful drag flick.

Table 3. *correlations*

Subjects	Dependent variable	Predictors	R
Un-Successful	Ball velocity after ball release	DD	0.515
		SV	0.858*
		SAO	0.645
		HAO	0.046

*Significance at 0.05 levels.

DD=Drag distance (m)

BV= Ball Velocity after ball release (m/s)

SV= Stick velocity (m/s)

SAO= Shoulder axis orientation in follow-through (°)

HAO= Hip axis orientation in follow-through (°)

The analysis of data table-3 shows that there is a significant positive relationship between ball velocity after release with stick velocity in follow through phase. Whereas insignificance relationship exit between ball velocities after ball release with drag distance, shoulder axis orientation and hip axis orientation in follow through phase during unsuccessful drag flick.

4. Discussion

The main purpose of this study was to find out the kinematical differences in the drag-flick pattern between successful and unsuccessful drag flicks in order to render to the point selective information for goalkeepers. Many researchers have studied the kinetic and kinematical pattern of the drag-flick technique, with the propose to find the reminds for an optimum performance (Subijana et al., 2010; Yusoff et al., 2008). In addition, some research was focused on the goalkeepers' anticipation when facing a penalty corner (Canal-Bruland et al., 2010).

Result of this study has shown no significant differences between successful and unsuccessful drag-flick pattern depending on the direction of the shot. Result of the study contradicts with the result of (Gomez et al., 2012) as the direction of the shot occurred before the dragging action of the stick (Gomez et al., 2012).

The participants in the study by Gomez et al., 2012 had more experience and skillful than the participant in this study. They were skilled drag-flickers, their patterns could have been more consistent than the one described in the present study. This may be a reason that no significant differences were shown between successful and unsuccessful drag-flick pattern.

Furthermore, there were no significant differences between successful and unsuccessful drag-flick patterns. Successful and unsuccessful drag-flick patterns showed the same kinematic sequence of drag distance (m), Ball Velocity after ball release (m/s), Stick velocity (m/s), Shoulder axis orientation in follow-through (%) and Hip axis orientation in follow-through (%). This kinematic sequence differed from that described by Subijana et al. (2010), again with successful drag flick where higher stick and ball velocity of the stick preceded maximum shoulder axis orientation in follow-through (%) and Hip axis orientation in follow-through (%) as compare to unsuccessful drag flick.

In this study, the drag-flicks shot in set target showed lower ball velocities (18.61 ± 3.30 m/s successful drag-flicks; 16.39 ± 2.63 m/s unsuccessful drag-flicks) than in the study by López de Subijana et al. (2010) with male hockey players (21.9 ± 1.7 m/s) and female hockey players (17.9 ± 1.7 m/s). These values were also lower than those reported by McLaughlin (1997) (19.1 to 21.9 m/s) and Yusoff et al. (2008) (19.6 to 27.8 m/s). It was noticeable that there were no significant differences in ball velocities between successful and unsuccessful drag-flicks, but successful drag flick recorded higher mean ball velocity as compare with unsuccessful drag flicks, so velocity of ball were equally efficient to get accuracy.

The drag distance successful and unsuccessful drag flicks shows insignificant relationship with ball velocity after ball release. Therefore the drag distances of drag flick were 2.14 m (Successful) and 2.00 m (unsuccessful) drag flick techniques. Successful drag flick technique toward target had greater mean drag distance as compare with unsuccessful drag flick techniques.

Average drag distance was lower than the value found for junior players by (Subhijana et. al, 2012) and elite and sub elite players by (Mc laughem, 1997) . there was not a big difference between the mean value of drag distance of successful and unsuccessful drag flick.

Drag distance highly correlated with criterion ball velocity. Additionally importance of create higher ball velocity after release (Mc laughem, 1997). These studies also supported with, the successful drag flick techniques had greater ball velocity and greater drag distance as compare with unsuccessful drag flick (Gonez et al. 2012).

In successful drag flicks, drag distance, stick velocity and hip axis orientation produced insignificant positive contribution and shoulder axis orientation insignificant negative contribution on ball velocity after release. Unsuccessful drag flicks, drag distance, and hip axis and shoulder axis orientation insignificant contribute in ball velocity after release. Therefore stick velocity shows significant positive contribution on ball velocity after release.

An accurate motor execution of the drag flick techniques is essential to construct a proper skilled of drag flick performance (Canal-Bruland et al., 2010). Furthermore, in high-speed sports such as drag flick in hockey, the speed of play and ball velocity dictate that decisions must often be made in advance of the action (Savelsbergh et al., 2002).

There are little or no movement variations in the individual technique of drag flick between successful and unsuccessful drag flick. Some movement's variations are necessary to accommodate with experimental constraints in successful and unsuccessful drag flick situations (Beckmann et al., 2010).

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