STAR
Research Journal

Available online at www.starresearchjournal.com (Star International Journal)

PHYSICAL EDUCATION

Star. Phy. Edn 2 (2014)

Biomechanical Analysis of Penalty Corner Drag Flick in Field Hockey

***R. Sathesh Franklin*[1] *& Dr. P. Rajinikumar*[2]**

Ph.D, Scholar, Tamil Nadu Physical Education and Sports University, Chennai – 600 127.[1]

Assistant Professor, Dept. of Exercise Physiology and Biomechanics, Tamil Nadu Physical Education and Sports University, Chennai – 600 127.[2]

Abstract

The purpose of the study was to analyze the selected biomechanical variables of drag flick in field hockey. Five male hockey players were randomly selected from Tamil Nadu state, India for this study. The subjects were experienced in penalty corner drag flick technique. The age of the subjects ranged from 18 to 30 years. The Pylon Basler Gige and Canon EOS 5D Mark II cameras were used to capture the movement of the penalty corner drag flick.. The first camera was mounted at the height of one meter, at 90 degree and 21 meters away perpendicular to the movement of the drag flick in sagittal plane. The second camera was mounted at the height of one meter, at 90 degree and 8 meters away from the stationary ball in a field setting or in front of the goal post to record frontal plane movement. The shutter speed was fixed (1/2000), with a frame rate of 100 frames per second. The video footage was digitized using Kinovea Software for the data analysis of the selected biomechanical variables namely distance of right foot from the ball, time of left foot contact with ground, distance of left foot from the ball, time of ball release after left foot contact with ground, drag length, drag velocity, stance width, stick velocity, total time of drag flick and ball velocity of drag flick technique. The collected data was statistically analyzed by using descriptive statistics and person's correlation coefficients. The finding reveals that the drag length, drag velocity, stance width, time of left foot with ground, time of ball release after left foot contact with ground, had significant relationship with the ball velocity of drag flick.

Keywords: *Penalty Corner, Drag Flick, Biomechanics, Field Hockey, Ball Velocity.*

Introduction

The Field Hockey is one of the most popular games in India. It was introduced in India by the British (Hendricks, 1988). It is a game in which players attempt to score goal by hitting, pushing or flicking the ball with hockey sticks into the opposing team's goal (Miroy, 1986). The performance of Indian men's hockey team has been highly depended on the success of its penalty corners. The penalty corner was introduced in 1908 for offence against defenders in the 'D' circle and the rules have been amended from time to time. The penalty corner is one of the most important game situations in field hockey, with one third of the goals resulting from this tactical situation (Laird and Sutherland, 2003; Pineiro, 2008). In recent years, the penalty corner, particularly with the advent and popularization of the drag flick, has gained vital importance in the game as a goal scoring opportunity.

The drag flick was introduced in the penalty corner by Dutch International, Van den Honert in 1992, after a change in which the penalty corner rules permitted shots higher than 45cm. The drag flick is capable of producing goals which if executed well by the attacking team is possibly even more efficient than a hit. In the most simple terms, a player pushes the ball from the baseline to another player standing at the top of the circle who stops it. A third player waiting behind the 'stopper' then hits to the goal (Glencross, 1985; McLaughlin, 1997). The innovation of drag flick becomes a vital part of a team's attacking arsenal. It is impressive technique that makes the game more spectators orientated. (Lees, 2002).

The drag flick is a technical learning process. It requires co-ordination, power and timing and takes years to master it. The training is physically changing (Meulnan et al., 2012). The average success rate for teams converting penalty corners to goals at the 1994 World Cup in Sydney was 15.2% with the most successful team's conversion rate being 32%. In the same competition, there were fewer drag flicks taken at goals than direct hits (22% compared to 30%). The drag flick was 1.4 times more successful than the direct hit (Yusoff, 2008). In the FIH Challenge Champion Trophy –I for men 2011, the average 60.15% of goals were scored through field goals, 36.09% of goals scored in penalty corner (30% of the goals were converted by drag flick technique (Franklin and Rajinikumar, 2014). In the Commonwealth Games 2014 at Glasgow, Australia scored 33 goals but Chris Ciriello, the drag flicker of Australia converted 9 goals out of 33 goals from the penalty corner drag flick. Ashley Jackson, the drag flicker of England successfully scored 9 goals through penalty corner drag flick method (Thyagaraja, 2014).

Biomechanical analysis of the techniques depend on the way in which skills are executed with respect to all parameters of biomechanics (O' Donoghue, 2010). An accurate motor execution of the drag flick techniques is essential to reconstruct a skilled drag flick performance (Canal-Bruland et al., 2010; Bari et al., 2014). Furthermore, in high -speed sports such as drag flick in hockey, the speed of play and ball velocity dictate that apt decisions be made in advance of the action (Savelsbergh et al., 2002; Bari et al., 2014). Only a few studies have analyzed the drag-flick. Some of them have provided kinematic information about players from different levels (McLaughlin, 1997; Yusoff et al., 2008; Subijana et al., 2010). Therefore, the aim of this study was to analyse the selected biomechanical factors determining of the exection drag flick in field hockey.

Methodology

Subjects

Five male right handed drag flickers were randomly selected from Tamil Nadu state as the subjects for this study. The subjects were experienced in penalty corner drag flick techniques. They represent the different departments of Tamil Nadu State namely, Indian Overseas Bank, Indian Bank, Customs Central Excise. The age of the subjects ranged from 18 to 30 years.

Equipment

The drag flick was recorded in sunny and clear weather at synthetic hockey field at YMCA College of Physical Education during morning session. All the subjects instructed to wear complete specified hockey kit in order to perform successful penalty corner drag flick. The Pylon Basler Gige and Canon EOS 5D Mark II cameras were used to capture the movement of penalty corner drag flick performances. The Pylon Basler Gige and Canon EOS 5D Mark II cameras were used to capture the movement of penalty corner drag flick performances. The first camera was mounted at the height of one meter, at 90 degree and 21 meters away perpendicular to the movement of the drag flick in sagittal plane. The second camera was mounted at the height of one meter, at 90 degree and 8 meters away from the stationary ball in a field setting or in front of the goal post to record frontal plane movement. The shutter speed of the camcorder was adjusted at 1/2000 of a second and exposure time was kept 1500 in order to eliminate the blurring effects while processing the recordings. The drag flick performance was captured at 100 frames per second. A cage with the dimensions of 1.0 x 1.0 m at four control points was used to calibrate the space, in which drag flick was performed. Each subject performed 10 trials after the specific warm-up. The successful trials were subject to analyze.

Variables

The distance of right foot from the ball, time of left foot contact with ground, drag length, stance width, stick velocity distance of left foot from the ball, time of ball release after left foot contact with ground, total time of drag flick, and ball velocity taken as variables including drag flick trial was analyzed through the Kinovea Software.

Statistical Technique

Descriptive statistics and Pearson's product correlation coefficients were applied to establish the relationship among the selected biomechanical variables measured. The statistical packages for social sciences (SPSS, version 19.0 for Windows XP) was used to analyze the data. An alpha level of 0.05 was used to determine statistical significance.

Result and Discussion

The results of the statistical analysis of the mean and standard deviation is listed in the following table

Table 1: Descriptive Analysis of the Selected Biomechanical Variables of Drag Flick in Field Hockey

VARIBLES	N	MIN	MAX	MEAN	SD
DRFB	05	1.06	1.61	1.34	0.21
TLFG	05	0.20	0.24	0.22	1.01
DL	05	2.19	2.37	2.25	0.07
DV	05	6.35	6.93	6.66	0.21
SW	05	1.25	1.53	1.32	0.11
SV	05	22.3	27.27	25.5	2.01
DLFB	05	0.89	1.22	1.02	0.13
TBR	05	0.17	0.22	0.19	0.02
TTDR	05	1.48	1.65	1.59	0.07
BV	05	27.51	29.85	28.93	0.90

DRFB = Distance of Right Foot from the ball (m)
TLFG = Time of Left Foot Contact with Ground after cross over steps (s)
TBR = Time of Ball Release after left foot contact with ground (s)
DL = Drag Length (m)
DV = Drag Velocity (m/s)
SW = Stance Width (m)
SV = Stick Velocity (m/s)
DLFB = Distance of Left Foot from the ball (m)
TTDF = Total Time of Drag Flick
BV = Ball Velocity (m/s)
(m: meter s: second and m/s : meter by second)

Table 1 shows that the group achieved a range of ball velocity from 27.51 to 29.85 m/s, resulting in a mean value of 28.92 m/s with a standard deviation of 0.09 m/s. The ball velocities of drag flick were larger to the 19.6 to 27.8 m/s range reported by Yusoff et al. (2008), 15.2 to 21.8 m/s reported by McLaughlin (1997), 25.4 m/s reported by Subijiana (2010) and 22.49m/s presented by Gomez (2012).

The drag length ranged from mean of 2.25 m with a SD 0.07 m among in drag flickers with larger drag distance was associated with the higher ball velocity. The longer to the value of 2.18 m reported by McLaughlin (1997) but smaller than the value of 2.30 m presented by Bari et al. (2014). The stance width at left foot contact with ground ranged from a mean of 1.33m (SD range 0.11 m) over the five drag flickers but smaller than the values 1.5 m to 1.81m reported by Yusoff et al. (2008), 1.49 m reported by Subijana et al. (2010). The group achieved a range of stick velocity from 25.88 m/s to 29.5 m/s with a standard deviation of 1.41 m/s. The group achieved a range of total time of drag flick from 1.48 s to 1.65 s with a standard deviation of 0.007 s.

The distance of the left foot from the ball at ball release ranged from a mean of 1.02 m with a SD 0.13 m but larger than those 0.80 m reported by Yusoff et al. (2008), 0.32 m to 0.9 m presented by McLaughlin (1997) and 0.67 m reported by Gomez et al. (2012). The time of left foot contact with ground after cross over step ranged from 0.20 s to 0.24 s, and resulting mean value of 0.22 s with a SD of 1.01s but higher than 0.16 s reported by McLaughlin (1997).

Table 2: Relationship between the Selected Biomechanical Variables and Ball Velocity of Drag Flick

VARIBLES	N	VALUE	REMARKS
DRFB	05	0.22548	NS
TLF	05	0.8741	S
DL	05	0.8774	S
DV	05	0.8094	S
SW	05	0.8798	S
SV	05	0.89003	S
TBR	05	0.80803	S
DLFB	05	0.06536	NS
TTDR	05	0.1026	NS
BV	05	1	

*** Significant at 0.05 level. NS:** Not Significant. **N:** Significant**.**
(Table value with df 3 is 0.805)

The co-efficient data show that the stance width (r=0.879), drag length (r=0.877), stick velocity (r=0.890) are highly significant relationship with the ball velocity at release.

It is inferred from the above table that there is significant relationship between time of left foot contact with ground after cross over step (r=0.874) and ball velocity of drag flick.

It is inferred from the above table that there is significant relationship between drag length (r=0.877) and ball velocity of drag flick.

There is a significant relationship between time of ball release after left foot contact with ground (r=0.808) and ball velocity of drag flick. The distance of right foot from the ball and total time of drag flick did not have significant relationship with the ball velocity.

Conclusion

From the present study, it is concluded that, the stance width, drag length, drag velocity have significant relationships with ball velocity of the drag flick. The high ball velocity is very important to ensure a goal. When the ball travels at a high speed, the defenders have little time to respond thus giving an advantage to the shooter (Yusoff et al., 2008). Total time of drag flick is very important to execute the technique. In a game situation, the quicker the flick can be executed, the less time the opponents have to stop the ball. Finally the successful drag flick depends largely on the speed and accuracy with which the ball is delivered to the flickers by their pusher and stopper. This study would provide information to the coaches, trainers and drag flick specialists to perfect the drag flick technique.

References

Bari, M. A., Ansari, N. W., Ahmad, F., & Hussain, I. (2014). Three dimensional analysis of drag-flick in the Field Hockey of University players. *Advances in Physics Theories and Applications*, *29*, 87-93.

Bari, M. A., Ansari, N. W., Hussain, I., Ahmad, F., & Khan, M. A. (2014).Three dimensional analysis of variation between successful and unsuccessful drag flick techniques in Field Hockey. *International journal of Research studies in Science, Engineering and Technology*, *1*(2), 74-78.

Canal-Bruland R, Van der Kamp J, Arkesteijn M, Janssen RJ, Van Kesteren J & Savelsbergh GJP. (2010).Visual search behaviour in skilled field –hockey goalkeepers. *International Journal of Sports Psychology*, *41*, 327– 339.

Franklin. R. S. and Rajinikumar. P. (2013). Analysis of Penalty Corner Drag Flick in FIH Champions Challenge-I Men Competition 2011. *International Research Journal on Health Fitness and Sports Sciences. 1* (1). Tiruchirapalli: National College, 113- 188.

Glencross, D. (1985). *100 Hockey Tips*. Rigby, Australia.

Gomez, M., López De Subijana, C., Antonio, R., & Navarro, E. (2012). Kinematic pattern of the drag-flick: a case study. *Journal of human kinetics*, *35*(1), 27-33.

Laird, P., and Sutherland, P. (2003). Penalty corners in field hockey: A guide to success. *International Journal of Performance Analysis in Sport, 3* (1), 19–26.

Lees, A. (2002). Technique Analysis in Sports: a critical review. *Journal of sports Sciences, 20*, 813-828.

Lopez de Subijana, C., Hernández, C., Juarez Santos-Garcia, D., & Navarro Cabello, E. (2011). The application of biomechanics to penalty corner drag-flick training: a case of Study. *Journal of Sports Science and Medicine, 11*, 590-595.

Lopez De Subijana, C., Juárez, D., Mallo, J., & Navarro, E. (2010). Biomechanical analysis of the penalty-corner drag-flick of elite male and female hockey players. *Sports Biomechanics*, *9*(2), 72-78.

Meulman H.N, Berger. M., Zande M. E., Kok, P.M., Egbert J.C. Ottevanger. E. J. C and Crucq M. B. (2012). Development of a tool for training the drag flick penalty corner infield hockey. *9th Conference of the International Sports Engineering Association.* Netherland, 508-513.

McLaughlin. P. (1997). Three dimensional biomechanical analysis of the hockey drag flick. National sports research centre. Australia.

Pineiro, R., Sampedro, J., and Refoyo, I. (2008). Differences between international men's and women's teams in the strategic action of the penalty corner in field hockey. *International Journal of Performance Analysis in Sport, 7* (3), 67–83.

Subijana, de, C. L., Juarez, D., Mallo, J., & Navarro, E. (2011). The application of biomechanics to penalty corner drag-flick training: a case study. *Journal of sports science & medicine*, *10*(3), 590.

Yusoff. S., Hasan. N and Wilson. B. (2008). Three-Dimensional Biomechanical Analysis of the Hockey Drag Flick Performed In Competition. *ISN Bulletin, National Sports Institute of Malaysia, 1* 36-43.

Savelsbergh GJP, Williams AM, Van der Kamp J & Ward P. (2002). Visual search anticipation and expertise in soccer goalkeepers, *International Journal of Sports Science, 20*, 279– 287.