Linear Kinematical Analysis of Successful and Unsuccessful Free Shot in Basketball

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Abstract

The study aimed at revealing the linear kinematical variables responsible for a successful free shot in basketball. Five subjects of homogenous nature in terms of anthropometric measurements and training age was selected. Casio Exilim EX-F1 high speed camera was used for recording of performance and Silicon Coach pro 7 software and Kinovea software were used for the analysis of data. The mean height of release for successful shot was 240.20 cm and that of unsuccessful shot was 233.13 cm. The mean releasing velocities for successful shots were 16.17 m/s and that of unsuccessful shots were 15.36 m/s. The mean distance travelled by ball of successful shots was 198.86 cm and that of unsuccessful shots were 219 cm.

KEYWORDS: Basketball, Free shot, kinematics, Analysis

INTRODUCTION

Shooting is the principal method used to score points in Basketball and for this reason it is the most frequently used technical action (hay 1994). The free throw shot is distinguished as the most important of all the shooting actions (Hess 1980).efficacy in shooting is identified with the ability to perform well in this sport and consequently it is extensively practiced.

The free throw is the single most important shot in the game of Basketball, a close to 20% of all points in NCAA division. The shot becomes more important later in the game, as the free throws comprise a significant greater percentage of the total points scored during the last 5 minutes than the first 35 minutes of the game for both the winning and losing team (Kazan et al, 1994).

The free throw should be one of the easiest shots in Basketball (Okubo & Hubbard, 2006), since the player is all alone, 15 feet from the basket, with no defence and no close distractions, all the player has to do is to get ready, aim, cock the ball and shoot.

The majority of coaches identify shooting as the most important skill of Basketball. It doesn't deny the importance of other skills- dribbling, passing or foot work- but only assumes that all offensive actions end in shooting. With this level of significance in the game, all fundamentals in the teaching methodology of shooting should be assured by the coaches. Usually it's based on permanent adjustment of theoretical sentences of performance and individual characteristics of the players. Shooting is the first technical content of Basketball that youngsters want to learn. The youngster's feeling of success in the game result from the efficacy of shooting performance (Krausse, 1984). The quality of the shooting learning process is very important in the development of young players. Such a process must be conducted by coaches with care and knowledge. It is reasonable to accept the theory that, "shooters are not born but made" (Newell & Benington, 1962).

Biomechanics is most useful in improving performance in sports or activities where technique is the dominant factor rather than physical structure or physiological capacity. One of the major problems in this field is the measurement of what one might call good body mechanics, objectively, without undue dependence upon inconsistent subjective judgments. A Kinematics assessment is provides information on the relationship of parts of the body to each other. This is useful in measuring joint angles during complex movement and has provided the basis of understanding functional activities that comes from kinematics assessments. Thus the current study intended to:

1. Find out the pattern of successful and unsuccessful free shot of basketball during different phase in light of selected linear kinematic variables.

2. Find out the linear kinematic variable responsible for successful free shot during different phases.

METHODS

Subjects

Five right handed male university level basketball players with an age range from 18 to 23 years having same playing experience were selected for this study. Purposive sampling was used to select the sample. All the subject were with equal arm length and almost equal height (180cm± 1 cm) without any anatomical deformity and also free from any orthopaedic or neurological disorders.

Variables

Based on literary evidence, correspondence with the expert and scholar's own understanding and keeping the feasibility criterion in mind, the research scholar selected the following kinematic variables for the study.

- Height of ball release at moment execution phase.
- Distance of ball travelled.
- Instant Velocity of ball release.

Instruments

Casio Exilim EX-F1 high speed camera was used for recording of performance and Silicon Coach pro 7 software and Kinovea software were used for the analysis of data.

Filming Protocol and Analysis

The two video cameras (Casio Exilim EX-F1) were adjusted on a tripod at a height of 1.20 mts from the ground. The camera was positioned perpendicular to the saggital plane and parallel to the medio-lateral axis (camera optical axes perpendicular on the saggital plane) so as that the shooter's arm gives approximately a 90^{o} between their respective optical axes.

The 300 frames per second as obtained by the use of high velocity videography were analysed (the best trail) by Silicon coach Pro-7 software. Only

selected frames were obtained and the Research Scholar developed the stick figures from which various kinematic variables were obtained. The stick figures were developed by using joint point method in which the body projections at the joints facing the camera were considered for the study.

FINDINGS

Table 1

GROUP WISE COMPARISON OF LINEAR KINEMATIC VARIABLES

Variables	Group	Mean	SD	SEM	t-ratio	df	p-Value
Height of Release (cm)	successful	240.20	3.93	1.02	3.01	20	0.01*
	unsuccessful	233.13	8.18	2.11			
Releasing Velocity (km/hr)	successful	16.17	2.52	0.65	0.70	28	0.48
	unsuccessful	15.36	3.67	0.95			
Distance Travelled by Ball (cm)	successful	198.86	9.71	2.50	-2.68	18	0.02*
	unsuccessful	219.00	27.39	7.07			

Note: df less than 28 are due to the adjustment during Levene's Test for Equality of Variances

The descriptive statistics of successful linear kinematic variables are presented in the above table. The mean, standard deviation, and standard error of mean for height of release for successful shots in centimetres were 240.20, 3.93 and 1.02 respectively, whereas mean, standard deviation, and standard error of mean in km/hr of releasing velocity were 16.17, 2.52 and 0.65 respectively. Finally 198.86, 9.71 and 2.50 were mean, standard deviation, and standard error of mean respectively for distance travelled by ball for successful shots in centimetres.

The descriptive statistics of unsuccessful linear kinematic variables are presented in the above table. The mean, standard deviation, and standard error of mean for height of release for unsuccessful shots in centimetres were 233.13, 8.18 and 2.11 respectively, whereas mean, standard deviation, and standard error of mean in km/hr of releasing velocity were 15.36, 3.67 and 0.95 respectively. Finally 219.00, 27.39 and 7.07 were mean, standard deviation, and standard error of mean respectively for distance travelled by ball for successful shots in centimetres.

The findings of independent ‘t’ test discloses that there lies significant difference between the scores of successful and unsuccessful shots in height of release and distance travelled by ball linear kinematic variables as the p-values were found to be < 0.05. Whereas in the variable releasing velocity no significant difference is found between the scores of successful and unsuccessful shots as the p-value is > 0.05.

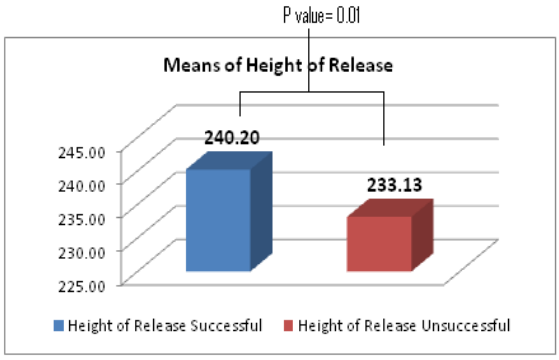

Fig. 1: Means of Height of Release of Successful and Unsuccessful Shots

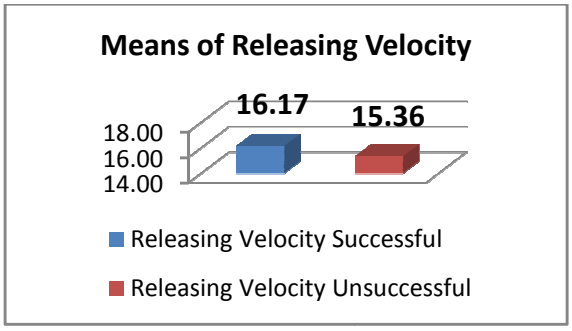

Fig. 2: Means of Release Velocity of Successful and Unsuccessful Shots

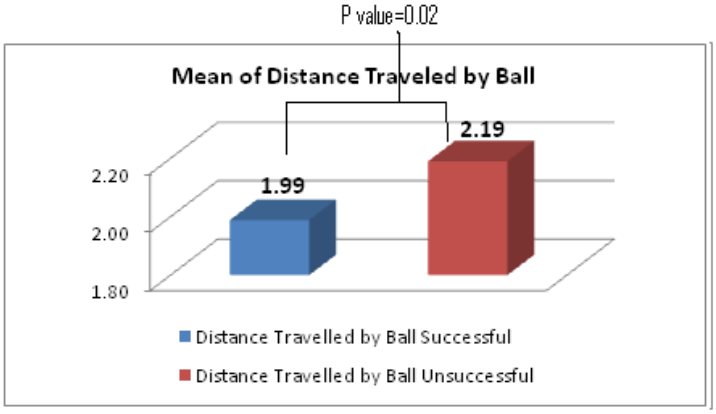

Fig. 3: Means of Distance Travelled by of Successful and Unsuccessful Shots

DISCUSSION

Significant differences were found between the scores of successful and unsuccessful shots in height of release and distance travelled by the ball. Average values of height of release for successful shot (240.2 cm) were greater than the height of release for unsuccessful shot (233.13 cm). The angle of projection of ball is greatly determined by height from which the ball is released. An optimized height of release decreases the distance the ball travel to reach the basket and decrease the ball velocity needed to provide an optimal angle of entry. Studies have found that if the point of release of ball is lower than the point of landing i.e. basket, the angle of projection should be greater than 45^0, in order to cover the maximum horizontal distance. The lower the point of release the greater the angle is needed for maximum distance covered by the ball. Roland, T and Gertjan, E. (2009) had also find the similar results.

Average distance travelled by ball for successful shot was 198.6 cm whereas for unsuccessful shot, it was 219 cm. This may be because more the distance travelled by the ball more time it will take to reach the point of release, which take more time as compared to successful may shot.

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