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Relationship of selected biomechanical variables on shooting accuracy among basketball players: A correlational study

Hem Chandra Joshi[1], Abhishek A Raju[2]
[1] Assistant Professor, Department of Physical Education, L.N.I.P.E., NERC, Guwahati, Assam, India
[2] Department of Sports Coaching, L.N.I.P.E., Gwalior, Madhya Pradesh, India

Abstract
The aim of the study was to find out relationship of selected biomechanical variables on shooting accuracy among basketball players with age group of 18 to 22 years from L.N.I.P.E. total ten [N=10] male basketball players by using purposive sampling was used to select the sample. To acquire selected biomechanical data, a digital Nikon D-3100 video recording camera with a frame rate of 30 frames per second, were placed perpendicular to the sagittal plane for analysing free throw shoot. The biomechanical (Linear and Angular) digitization of the free throw shot at the moment of release was done by using Kinovea software and then statistically analyse by Pearson's product moment correlation (r) at 0.05 alpha level. The findings of the study came with the no any significant relationship in case of all the selected biomechanical (Linear and Angular) variables with shooting accuracy among basketball players.

Keywords: biomechanics, linear, angular, free throw shot, sagittal plane

Introduction

Good Sports Techniques in sport involves a well-timed and coordinated sequence of muscle actions. Through the experience of players, coaches and the analysis provided by sport science, "best practice" techniques have been developed for many of the skills in sports. These techniques have evolved and been refined so that the movements involved produce the best performance and are least likely to cause injury. In sport it is often the best coaches who get to coach the better or most experienced players. New coaches or well-meaning but technically unskilled coaches often coach new players in sport. This means players are at risk of injury from being taught incorrect technique. Coach education is an important factor in reducing this problem. (Hall, 1995).

Shooting is the most important skill in basketball. The fundamental skills of passing, dribbling, defence, and rebounding may enable you to get a high percentage shot, but you must still be able to make the shot. A large part of shooting is mental attitude. In addition to shooting skill, you must have confidence in yourself to shoot well. The integration of the mental and mechanical aspects of shooting fosters shooting success.

Development of an accurate shot forces your defender to play you tight and become vulnerable to a fake, allowing you to pass and drive as well as shoot. If you lack an accurate shot, a defender can play back in anticipation of a drive or a pass and be less susceptible to your fake. When you do not have the ball, your defender can play farther off you and be in better position to give defensive help to a teammate guarding another player. To be successful, a team must have players who can make the outside shot. Great shooters are often called pure shooters because they have a smooth, free-flowing shot or a soft touch. Some players think a pure shooter is naturally gifted - born that way. This is a misconception. Great shooters are made, not born.

Basketball Jump Shot Phases Prior to analysing the biomechanical principals within a basketball jump shot, it is essential to understand the importance of technical phases involved within the shot. By ensuring the technique and technical phases are presented and performed appropriately/fittingly, the accuracy of the shot can translate in resulting to more beneficial results for the team due to more points (Lichtenberger, 2014). These crucial technique elements of the shot can be broken down into three movement phases which if successfully linked together will create a perfect shot, thus meaning optimal accuracy. These phases include; Preparation phase, Execution phase and follow through phase.

Hess, 1980 & Miller, 1996 has discussed the relationship between basketballs shooting kinematic, distance and playing position. Chin (2002) also analysed the basketball shooting of different distance and movement. In 2002 the international basketball federation (FIBA) decided to decrease the short clock violation to 24 sec. So, the players have to improve their fitness to avoid fatigue.

The purpose of this study is to expand the horizon of knowledge by introducing new facts and ideas by determining the association between selected biomechanical (Linear and angular) characteristics and shooting accuracy among basketball players. As a result, the researcher investigated the hypothesis that all selected biomechanical factors have a strong relationship with shooting accuracy among basketball players (two tail hypothesis).

Methodology

Selection of subjects: For the present study, total ten [N=10] national level male Basketball players of L.N.I.P.E. using purposive sampling were selected as the subjects. The selected subjects were of least deviation in height, right-handed and were almost similar in all other profile such as playing level, playing experience and their fitness profile and all the subjects selected for the study were completely free from any kind of chronic injuries. Since the subjects had been undergoing training for a considerable period, therefore it was considered that subjects possess reasonable level of technique of free throw shooting. There range of mean age and weight was 21.2±.91 years and 67.8±4.83 kg respectively.

Experimental filming protocol

Cinematography technique with Video recording was employed for the selected kinematics analysis of free throw shooting from inside three pointer of free throw line. The camera opted in this study was a Nikon D-3100 with a 30 frame per second frame rate. At a height of 1.06 metres from the floor, the video camera was positioned on a tripod stand. At a distance of 8.70 metres, the video camera was situated perpendicularly in the centre of the subjects' line to the sagittal plane. The subjects were asked to repeat the skill three times, with the best trail being chosen for analysis.

Fig 1: Experimental Protocol of Data Collection

Procedure of data collection: Videography recording was done in order to register the performance of free throw shooting from the free throw line. The moment at which ball was released from the hand of the shooter were filmed and taken into consider for analysis. The videography sequence was taken under controlled conditions. After the video recording, the video was played with the help of the computer software and the final positon of selected phase were obtained on the screen by snipping tool software as trial and error method. The digitization of the photographic sequence of selected position was done with the help of Kinovea Software for obtaining the selected angular biomechanical (Linear and Angular) shown in table 1 in results.

Statistical Technique: The relationship of selected kinematic variables with the free throw shooting performance on Basketball were obtained by employing the Pearson's product moment correlation technique at 0.05 alpha level.

Results

The relationship of selected biomechanical (Linear and Angular) variables with the free throw shooting performance were obtained by employing the Pearson's product moment correlation (r) technique at 95 percent confidence interval. All the assumptions of applying correlation (testing normality, dependant variable in interval or ratio and outliers in the scores) were taken into consideration while analysis of data. The outcome of the relationship of all selected variable with the shooting performance is given below:

Table 1: Relationship of Selected Biomechanical (Linear and Angular) Variables with the Performance of Free Throw Shooting

Variables (At point of Release)	Correlation (r)
Ankle joint (left)	.211
Ankle joint (right)	-.211
Knee joint (left)	.306
Knee joint (right)	.398
Hip joint (left)	-.156
Hip joint (right)	-.093
Shoulder joint (left)	-.445

Shoulder joint (right)	-.266
Elbow joint (left)	-.595
Elbow joint (right)	-.626
Wrist joint (left)	-.080
Wrist joint (right)	.141
Height of COG at the time of Release	-.086

* Significant at $r_{(0.05)}(8) = 0.632$

The findings of table 1 clearly showed the insignificant relationship of all selected angular and linear biomechanical variables with the free throw shooting performance on basketball as the calculated value of coefficient of correlation in case of all selected variables was more than the critical value ($r < 0.632$). In that case, the null hypothesis is failed to rejected for the selected variables.

Discussion of Findings

In case of selected angular kinematic variables, none of the angular kinematic variables has exhibited significant relationship with the shooting accuracy. But this trend does not mean that the angles at different joints do not play any important role in shooting accuracy. The entire subjects were gone through considerable period of training of basketball and they are professional player so there might be possibility that they are acclimatized with shooting accuracy. As in this study research scholars have ascertained the comparison, individually at selected joints of right side and left side, there might be a significant difference when we study comparison of upper body joints and lower body joints.

On the other hand, the selected linear kinematic variable (height of centre of gravity) in shooting was also not found significant. However, the centre of gravity plays an important role in shooting. As in this study the research scholars were confined to compare the centre of gravity during the release of ball by the players/subject's hand, but significant difference might be obtained by the studying the path or displacement of centre of gravity. A significant result may also be obtained by increasing the sample size or by using the sophisticated equipment.

During the last decade, a number of similar studies have addressed the descriptive and causal (kinematic and kinetic) aspects of various games and sports, and the researchers discovered very few variables with significant relationship between the selected biomechanical parameters and sports performances (Joshi et. al., 2014; Bal et. al., 2011; Kumar D. et. al., 2013; Pandey et. al., 2012) [6, 1, 7, 10, 11]. Whereas, the researchers Dixit and Joshi, 2022 [2]; Kumar, 2015 [8] and Patel *et al*. (2012) [11] has found insignificant relationship of all the selected biomechanical (kinematic) variables with the performance in their selected sports specific.

However, Small sample size, players' level of performance and the lack of advanced equipment could all be factors in the negligible association ship between selected linear and angular biomechanical variables and shooting performance in basketball.

Conclusion

Based on the findings and within the constraints of the present study, this can be concluded that all the selected angular biomechanical variables did not show any significant relationship with shooting accuracy among basketball players. On the other hand, selected linear biomechanical variable also did not show any significant relationship with shooting accuracy among basketball players. As these selected biomechanical variables keeps an key role in sports technique improvement, There may be the chance of significant results if the Similar study may be conducted with higher sample size and then the coming results of the study may be helpful for coach as well as the players in preparing a technique model for basketball players.

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