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COMPARISON OF SELECTED KINEMATIC PARAMETERS OF THE BALL MOVEMENT AT FREE THROW AND JUMP SHOT OF BASKETBALL ADULT PLAYERS

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ABSTRACT

Nowadays, basketball is one of the most popular sports in the world and basketball shot is the only mean to earn points in basketball. The aim of this study was to compare the kinematic parameters of the ball movement at free throw and jump shot of male adult basketball players of Alborz Province. In this study, six selected basketball adult players of Alborz province with the mean age of the $18/2 \pm 2.2$ years old, 188.16 ± 13 cm tall, $62/13 \pm 8.8$ kg weights, $5/2 \pm 3.4$ year of experience attended through accessible and targeted sampling. Subjects after completing the consent form and personal information were successful at three jump shots and three free throws and it was filmed by using two camera and by using the software of Kinovea and Skillspector, values of releasing height, releasing angle, releasing speed and entrance angle to the rim were measured and analyzed. In descriptive statistics, was used of personal data characteristics and paired t-test was used in inferential statistics. The results of the study showed that there was only a significant difference between the entrance angle to the rim and releasing height at free throws and jump shots ($0.05 \geq p$). The finding results showed that there is a difference between some kinematic parameters of the ball movement at free throws and jump shots of male adult basketball players of the Alborz province, and it is necessary to train and instruct each technique separately.

Keywords: Basketball, Jump Shot, Free Throw, Kinematic and Movement of the Ball

INTRODUCTION

Nowadays, basketball has become one of the most popular sports across the world. Basketball attractiveness is not only because of its competitiveness, but also because of the implementation of complex and fast skills by players. Among the skills of this field of sport, shooting is an important factor in determining the outcome and for winning the match (Sadeghi *et al.*, 2005). We have different kinds of shots in basketball that can be referred to jump shots, free throws, hook shots and lay up shots that each technique has its own conditions. Free throw is done by the protection of referee from the player who is shooting the ball and preventing from presence of the defense near that player but jump shot and other shots are done by the presence of defense and with the jump of player who is shooting the ball before performance the techniques. Also jump shot is the most powerful technique for gaining points which has got the most attention of coaches and players toward itself in this field, so that it has allocated about eighty percent of shooting in the high-level matches (Nikkhah, 2013).

Free throws are also have great importance and decisive role in sensitive and close games and it perform in easier physical conditions but in more difficult mental conditions toward the jump shot. Despite the differences between the jump shot and free throw, both techniques are usually implemented the same within the country. Based on the carried out assessments, one of the weak points of the players in the various categories is the low percentage of free throws in the heavy and close games that this problem may be due to a variety of reasons, such as psychological reasons, mental reasons, biomechanical reasons or training methods. The researcher in this study, investigated this disadvantage from the stand point of biomechanics, so that might be taken a step toward solving this problem. In terms of biomechanical reason, a lot of research had done by putting emphasis on different aspects of basketball

Research Article

shooting (Nikkhah, 2013; Sadeghi *et al.*, 2007; Sadeghi *et al.*, 2007; Miller *et al.*, 1996). According to this, Miller and Bartlett (2006) accordingly showed that the releasing height is in a same direction with the individuals' height and has the opposite relationship with the distance of the ball from the rim. And also it has the indirect relation with the releasing angle and distance of the ball from the rim and entrance angle to the rim has a direct relation with the releasing height (Miller *et al.*, 1996). Silverberg and colleagues (2008) showed that the releasing angle of the ball at 52 degrees towards the horizontal plane with three Hz twisting backward of the ball and landing of the ball at the back of the rim and in the maximum releasing height, created the best conditions for the accomplishment of the free throw (Silverberg *et al.*, 2008). As Raoul and *et al.*, (2002) showed, the Kinematic body joint parameters of basketball players are significantly different in performance free throws that this issue is related to the success or unsuccessful free throws (Raoul *et al.*, 2002). Elliott (1992) has observed the difference in the joint angles while increasing the distance to the rim. While he claimed that the male players at the moment of releasing the ball, have higher moving on the hips than women (Elliott *et al.*, 1992). However, inconducted research, no study was found to be conducted toward finding the difference between the kinematic parameters of the different shooting techniques. In this study, the difference in Kinematic parameters of the ball movement in jump shot and free throw was investigated which are the most basic techniques in basketball.

MATERIALS AND METHODS

Methodology

Six selected basketball adult players of Alborz province with the mean age of the $18/2 \pm 2.2$ years old, 188.16 ± 13 cm tall, $62/13 \pm 8.8$ kg weights, $5/2 \pm 3.4$ year of experience attended in this research, all of which were right-handed. Firstly, the necessary clarifications were provided on how to run subjects and they signed the individual consent form. Then, the subjects were prepared for measurement. Thus, the markers which were detected by camera on the prominence of body joints were installed. Two markers also were installed on wall, next to the subjects in a way that the display of horizon line and the frame of work located in the picture. Then training and the initial test were carried out in order to meet the subjects and the examiner of the work and any subjects aimed to shotten free throws and ten jump shots from a distance of 580 cm. For the shooting was used of a high-speed camera that was located on the sagittal plane of subjects on the camera's tripod with a height of 80 cm in the auto recording mode. Digital video cameras were *Casio Exilim Zr 200* which could film at 100 frames per second. Each participant performed 10 free throws and 10 jump shots that from each technique three successful shots were taken as selection and those throws which led to goals (successful) or not led to a goal (unsuccessful) were recorded specifically to each person at the table. Subjects in performance the jump shot techniques had limited time while in free throws, complete freedom was given to them.

To minimize the lateral rotation of the camera, the frame coincided with markers placed on the wall. Images after transferring to the computer, were analyzed with *Skillspector* Software and mean and standard deviations were used to describe the data. To compare the performance of subjects, paired t-test at ($0.05 \geq p$) was used.

RESULTS AND DISCUSSION

Results

After running the test and using the statistical methods following results were obtained that are presented in two tables:

Values of Kinematic variables of three free throws and three jump shots of six subjects are presented in Table 1. It can be seen that the average of the releasing height and the entrance angle to the rim in jump shots were more than free throws, and average releasing speed and emancipation angle is more than free throw in jump shots with little differences.

Research Article

Table1: Mean and Standard Deviation of Variables in Three Attempts at Free Throws and Jump Shots

Subjects	the Repeating Throw	Free throw				Jump shot			
		Releasing Height cm	Releasing Speed m / s	Releasing Angle Θ	Entrance Angle to the Rim Θ	Releasing Height cm	Releasing Speed m / s	Releasing Angle Θ	The Entrance Angle to the Rim Θ
1	1	255.47	1.50	45	40	279.51	1.48	48	48
	2	254.82	1.53	48	43	276.43	1.46	48	48
	3	254.22	1.53	46	43	272.11	1.49	48	49
2	1	238.97	1.44	50	42	260.84	1.58	50	45
	2	243.95	1.60	51	41	258.24	1.72	52	46
	3	244.33	1.59	51	42	255.30	1.58	49	48
3	1	216.25	1.18	50	40	238.99	1.30	51	43
	2	211.94	1.18	52	43	234.68	1.56	52	48
	3	216.27	1.18	53	39	232.83	1.58	51	43
4	1	232.97	1.42	51	43	269.90	1.17	49	47
	2	238.38	1.44	49	42	273.45	2.88	51	45
	3	236.07	1.31	53	40	279.57	2.22	52	46
5	1	233.76	1.32	49	44	271.89	1.46	49	45
	2	229.80	1.30	49	41	272.18	1.44	51	45
	3	234.22	1.45	50	42	266.91	1.58	50	46
6	1	216.73	1.84	52	45	259.62	1.58	51	48
	2	220.27	1.83	50	47	257.45	1.44	49	47
	3	219.69	1.70	49	46	256.39	1.72	52	49
Average (The Standard Deviation)		233.23 (14.85)	1.46 (0.20)	49.89 (1.90)	42.39 (1.85)	262.01 (17.15)	1.62 (0.24)	50.17 (1.15)	46.44 (3.17)

Results of dependent t test, did not show any significant difference between the releasing speed and releasing angle on free throws and jump shots of Alborz adult basketball players while the releasing height and entrance angle to the rim in free throws and jump shots of Alborz adult basketball players designated significant difference (Table 2). Although there are some differences, although the differences between the means are not significant.

Table 2: The Results of T-Test for Dependent Variables Between Twenty Adult Basketball Players

Variables	Mean Differences	Standard Deviation	Degrees of Freedom	Significant Level.
Releasing Height in Free throw and Jump Shot(cm)	28.78	10.66	17	0.00
Releasing Speed in Free Throw and Jump Shot(Meters Per Second)	0.16	0.43	17	0.13
Releasing Angle in Free Throw and Jump Shot(degree)	0.28	1.64	17	0.48
Entrance Angel into the Rim in Free Throw and Jump Shot(degree)	4.05	2.99	17	0.00

Research Article

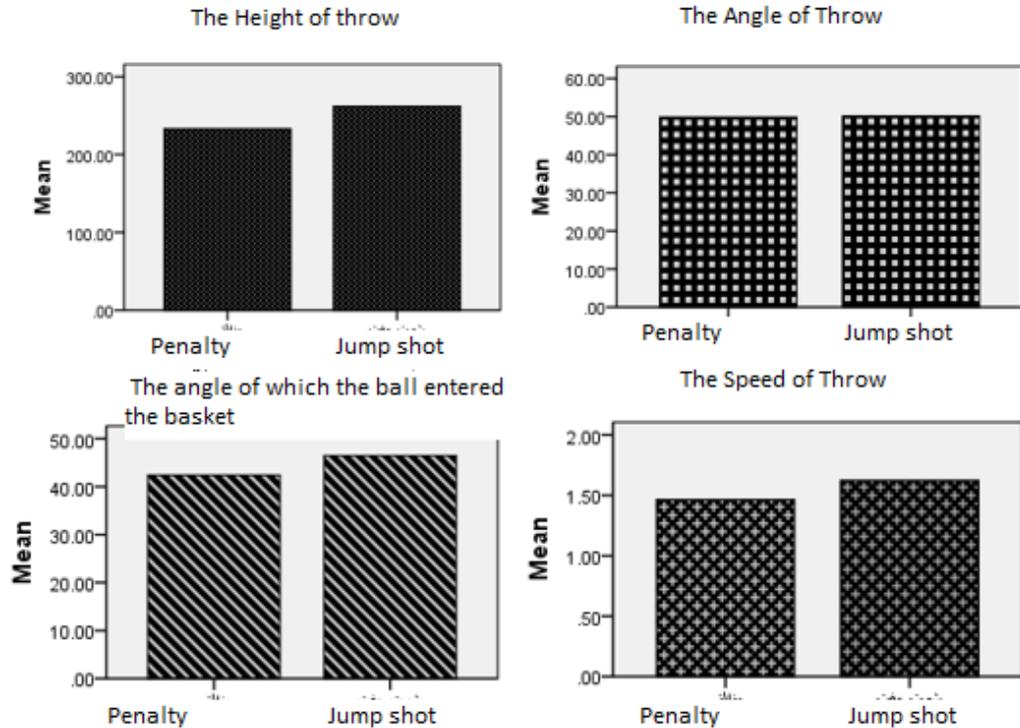


Figure 1: The Diagram of the Average of Dependent Variables in both Techniques

Conclusion

The purpose of this study was to compare the kinematic parameters of the ball movement between free throws and jump shots of selected adult basketball players of Alborz Province. The releasing height among adults at free throws and jump shots had significant differences. According to jumping of the player who jump shot the ball before releasing it, the releasing height the ball at the jump shot is higher than the releasing the ball at free throws and may be the difference between these two techniques is due to the jump of the player who shot the ball before the ball is released. This kind of finding is corresponding to Miller and Bartlett (1996), (Miller *et al.*, 1996). The results of this study showed that there is no significant difference between the releasing angle of the ball in jump shot and free throws. It seems that this issue due to the mental fixation of releasing angle in the performance of both techniques of jump shot and free throw that causes the lack of a significant difference in the releasing angle of the both techniques. The rate of the releasing speed between free throw and jump shot was not significant. Perhaps because of the difference of releasing height is very low, both techniques are performed at the same releasing speed and there is no need to speed up the throw. It is clear that the releasing speed rate has the same direction with the distance of releasing the ball and in this comparison due to the same distance of releasing the ball in both shots, there is no need to change the speed. According to the findings of Miller and Bartlett (1996) the angle of which the ball entered the rim has the same direction with the releasing height (Miller *et al.*, 1996). This kind of findings is corresponded to Silverberg findings (2008) (Silverberg *et al.*, 2008). Reduction of the entrance angle into the rim reduces the likelihood of success in the free throws, because the entrance angle into the rim has a direct relation with the successful shot (Silverberg *et al.*, 2008). We can gain better performance with increasing the releasing angle and entrance angle to the rim and finally increasing the likelihood of success rate of free throw.

Due to the significant difference in releasing height between the free throws and jump shots in basketball and also due to the absence of a significant difference in the releasing angle and releasing

Research Article

speed of the ball and by taking into account the laws of ballistics movement, the difference in the entrance angle to the rim which is the most important success factor of releasing the ball, seems logical. The average entrance angle into the rim which has direct relation with the success, for the jump shot is more than free throws. So, success of free throw could be affected due to entrance angle to the rim. Therefore, it is suggested during the training that these two techniques should be taught separately and free throw should be done with the greater releasing angle that couldn't have negative impact on the success rate of free throws.

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