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ORIGINAL

The Effect of Types of Initial Drive-in Steps on Technical Factors in Basketball

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Objective: The purpose of this study was to investigate the effect of types of drive-in initial steps in basketball on technical factors, to provide basic information for the enhancement of basketball skill.

Method: Ten men (age: 24.70±2.26 years; height: 181.00±5.72 cm; weight: 75.70±8.23 kg; career length: 10.00±3.59 years), each with a career length of over five years and no history of injury to the lower extremities within the prior six months, participated in this study. They were asked to perform four types of drive-in movements at 35~60°, wearing their own shoes, after running from a start line 5 m away and catching a basketball passed by an expert passer. The drive-in movements were measured by eight infrared cameras (Oqus 300, Qualisys, Sweden). Collected raw data were used to calculate total initial step time, displacement, velocity, center of mass (COM) height, and COM velocity.

Results: Total initial step displacement and velocity of cross drive-ins (JC, SC) were greater than that of direct drive-ins (JD, SD; $p < .05$). COM velocity of cross drive-ins (JC, SC) was also greater than that of direct drive-ins (JD, SD; $p < .05$).

Conclusion: Our results indicated that cross drive-ins, regardless of stop step type, are more effective than direct drive-ins. This is because cross drive-ins are technically bold due to less influence from walking violations and double dribble rules in basketball. However, using one-sided movement is too difficult to play in competitive game; therefore, basketball players should develop the ability to choose appropriate movement frequency.

Keywords: Basketball, Drive-in, Dribble, Technical factors, Center of mass

INTRODUCTION

Basketball is one of the most popular competitive sports in the world. Games are played by a total of 10 athletes, competing in teams of five players each on a rectangular court 28 m wide and 15 m long (International Basketball Federation [FIBA], 2012). During a basketball game, players compete for points by disrupting the opponents' defense through various applications of movements and tactics, and perform movements such as running, pausing, jumping, and landing (Yang, 2003; Lee & Jung, 2010).

Among the basic rules of basketball, to ensure smooth movements players must be constantly conscious of walking violations and double dribbles. These rules prevent players from taking more than three consecutive steps without dribbling, or from dribbling again after holding the ball with two hands once dribbling begins (FIBA, 2012). A basketball player must move using dribbles, and personal skill is required to move freely between defenders without violating either the walking violation or the double dribble rules (Bang, 2006). A drive-in is one dribbling technique that is effective in disrupting the defense and accomplishing instant breakthroughs, and it is frequently used in one-to-one offense and defense contexts. Additionally, using drive-ins in basketball games offers many benefits. First, the offense can create opportunities for easy and high-chance shooting, prevent mark opportunities for other team members, and disrupt the defensive formation (Lee, 1997). As a result, effective use of the drive-in technique is a highly important factor in improving players' individual ability and winning the game.

All movements in basketball are based on slow-quick movement, referring to consecutive pausing and movement, and drive-ins are no exception. The drive-in incorporates a stopping motion to get the ball in hand as the player faces the defense; the stride stop and the jump stop are two typical stopping movements. A stride stop comprises two steps, the first of which reduces the impact, and the second of which brings the player to a full stop. A jump stop refers to a full stop with both feet in one step (Yoon, Yoo, & Ko, 1997; Bang, 2006; Krause, Meyer, & Meyer, 2008; Shuji, 2011; Paye & Paye, 2012). These stopping movements are the foundation for performing successful techniques as setup for the drive-in without violating the basic walking violation and double dribble rules.

Based on the inevitable determination of the pivot foot by the two stopping movements and the walking violation rule, drive-ins are limited to four types. First is a drive-in with a stride stop that is limited to the right-hand side, called a stride-cross drive-in (SC: stride stop & cross drive-in); the player performs a stride stop ending with the right foot and begins the drive-in step with the left foot. Second is a stride-direct drive-in (SD: stride stop & direct drive-in); the player performs a stride stop ending with the left foot and begins the drive-in with the right foot. For drive-ins using a jump stop, either foot can be the pivot, because both feet contact the ground simultaneously in the stopping movement. Thus, either foot can be used for the first drive-in step. However, when the drive-in is limited to the right-hand side, only the cross drive-in and direct drive-in movements can follow a jump stop. These movements are classified as a jump-cross drive-in (JC: jump stop & cross drive-in), which begins the drive-in with the left foot after a jump stop, and a jump-direct drive-in (JD: jump stop & direct drive-in), that begins the drive-in with the right foot after a jump stop.

According to a review of various prior studies on drive-ins, Bang and Park (2009) showed, in a study on offense patterns in basketball using video analysis, that offensive tactics based on drive-ins can increase a team's offensive rating because it not only leads to direct offense, but can also induce secondary offense. Kim (2008) showed that drive-in techniques performed near the free throw line and end line are effective in disrupting the opponents' defense formation. Wang, Liu, and Moffit (2009), in their study on the offensive techniques and tactics of 3-on-3 basketball, one of the newest popular sports, suggested that drive-ins (41.3%), cut-ins (36.8%), and screen plays (14.3%) are the most frequently performed techniques. Krause et al. (2008) mentioned the importance of the first step in a drive-in, emphasizing that the success of the first step is directly connected to the success of the drive-in dribbling offense. They additionally described technical factors affecting a successful first step, including a quick first step and low posture motions using long strides, and suggested that the body should ideally be positioned with the head and shoulders at the level of the defender's torso when taking the first step. In the context of determining the ideal direction of the drive-in in a one-on-one situation, watching the defenders' feet and hands was described as a necessity for an effective drive-in. Esteves, Oliveira, and Araújo (2011), in their study on the direction of drive-ins according to the posture of offensive and defensive players, reported that in contrast to unexperienced players, experienced offensive players can actively choose the direction of the attack based on the location of the defensive player's forefoot.

Various studies address the importance of and effective methods for performing dribbling drive-ins. However, most of these are movement studies that do not involve frequency analysis or ball handling, resulting in a lack of quantitative studies on effective performance of techniques based on the four types of drive-in resulting from the stopping movements that occur in actual games. Therefore, the purpose of this study is to investigate the effect of different types of drive-in initial steps resulting from various stopping movements on technical factors, and in so doing to provide basic information to enhance game performance.

METHODS

1. Participants

From among male students in the K University basketball club playing for Seoul, 10 men were selected as participants of the present study, all of whom had more than five years of experience in basketball, had no history of injury to the lower extremities during the prior six months, and preferentially dribbled to the right side (n: 10; age: 24.70±2.26 years; height: 181.00±5.72 cm; weight: 75.70±8.23 kg; career length: 10.00±3.59 years).

2. Experimental procedure

Participants' entry movement began at a start line positioned 5 m behind the point at which they received the ball, consistently thrown toward the chest by an experienced passer. A speed timer (SR-200, Seed Technology) was set up 1.5 m away, as shown in Figure 1, to control entry speed to 2.9~3.9 m/s, thereby minimizing the influence of entry speed on the drive-in based and controlling the entry speed to simulate that of an actual game (McLean, Neal, Myers, & Walters, 1999;

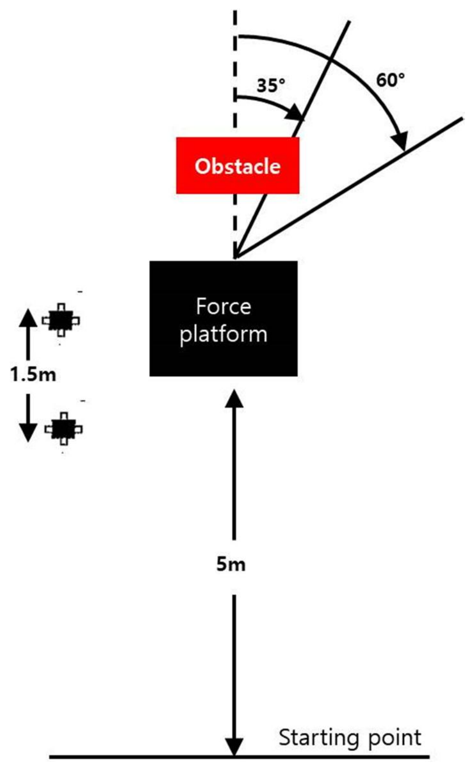

Figure 1. Experimental view

Table 1. Entry speed unit: m/s

	JC	JD	SC	SD	F (*p*)
Mean ± SD	3.6 ±0.16	3.25 ±0.20	3.22 ±0.15	3.29 ±0.24	1.68 (.20)

Kristianslund, Faul, Bahr, Myklebust, & Krosshaug, 2014; Table 1).

Each of the four drive-ins was performed five times at 35~60° to the right side (McLean, Neal, Myers, & Walters, 1999; Kristianslund et al., 2014; Figure 1). Each movement was performed with a defensive player dummy in the front. The four types of drive-in movements were as follows (Figure 2):

1) Cross drive-in movement using a jump stop, stopping with two feet and taking the initial drive-in step with the left foot (JC)
2) Direct drive-in movement using a jump stop, stopping with two feet and taking the initial drive-in step with the right foot (JD)
3) Cross drive-in movement using a stride stop, stopping on the right foot and taking the initial drive-in step with the left foot (SC)
4) Direct drive-in movement using a stride stop, stopping on the left foot and taking the initial drive-in step with the right foot (SD)

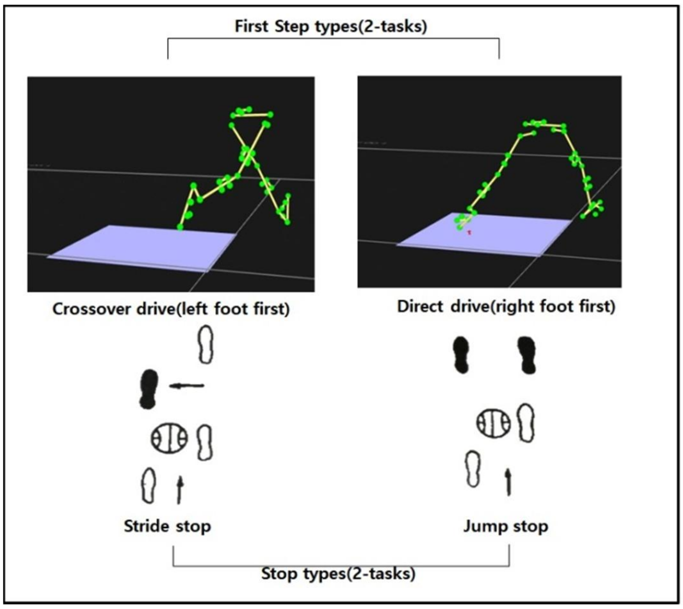

Figure 2. First step types (2*2 tasks)

To obtain three-dimensional coordinate values, a total of eight infrared cameras (Oqus 300, Qualisys, Sweden) were installed, and the sampling rate was set to 240 Hz (Cowley, Ford, Myer, Kernozek, & Hewett, 2006). To analyze movement, 51 reflective markers were attached to the participants' joint points and segment surfaces, and clusters including four markers per individual were attached to both lower and upper extremity segments. The analysis section for computing the initial step technique factor in this study was set as the period beginning the moment one foot came off the ground after supporting with both feet (E1) and ending the moment the initial step touched the ground (E2).

3. Data processing

To reduce error due to three-dimensional spatial data noise obtained from the eight infrared cameras, we applied a Butterworth second order low pass filter, for which the cut-off frequency was set to 15 Hz (Cowley et al., 2006). The technical factors of this study—total initial step time from the moment one foot comes off the ground after supporting with both feet to the moment the initial step touches the ground (E1-E2), total initial step displacement, initial step velocity, and height and velocity of center of mass (COM)—were computed using Matlab R2009 (MathWorks, USA) (Winter, 2009).

4. Statistical analysis

One-way ANOVA with repeated measures was performed to verify the difference among kinematic variables of drive-ins based on the types of stopping movements and initial drive-in steps, and Bonferroni correction was performed for the post hoc test. The significance level was set to $\alpha = .05$.

RESULTS

1. Results of the first step technical factors

There were no statistically significant differences in total initial step time based on the type of initial drive-in step (Table 2). However, total initial step displacement for both JC and SC were significantly greater than that for JD and SD (Table 3, $p < .05$). The difference in step displacement also led to statistically significant differences in initial step velocity among different the types. Compared to JD and SD, the initial step velocity of JC and of SC was significantly faster (Table 4, $p < .05$).

Table 2. Total initial step time unit: s

	JC	JD	SC	SD	F (*p*)
Mean ± SD	0.28 ±0.03	0.26 ±0.05	0.27 ±0.02	0.25 ±0.04	2.11 (.12)
Post hoc *p*-value					
JC-JD	JC-SC	JC-SD	JD-SC	JD-SD	SC-SD
1.00	.52	.15	1.00	1.00	1.00

*: indicates significant differences

Table 3. Total initial step displacement unit: m

	JC	JD	SC	SD	F (*p*)
Mean ± SD	1.70 ±0.17	1.00 ±0.20	1.66 ±0.17	1.04 ±0.19	41.84 (.01)*
Post hoc *p*-value					
JC-JD	JC-SC	JC-SD	JD-SC	JD-SD	SC-SD
.01*	1.00	.01*	.01*	1.00	.01*

*: indicates significant differences

Table 4. Initial step velocity unit: m/s

	JC	JD	SC	SD	F (p)
Mean ± SD	6.01 ±0.95	3.88 ±0.98	6.15 ±0.75	4.15 ±0.85	51.26 (.01)*
Post hoc p-value					
JC-JD	JC-SC	JC-SD	JD-SC	JD-SD	SC-SD
.01*	1.00	.01*	.01*	.75	.00*

*: indicates significant differences

2. Height and velocity of Center of Mass (COM)

The height of COM did not show statistically significant differences based on the type of initial drive-in step (Table 5), but there was statistically significant differences observed in COM velocity. The COM velocity of both JC and SC was significantly greater than that of JD and SD (Table 6, p < .05).

Table 5. Height of COM during initial step unit: m

	JC	JD	SC	SD	F(p)
Mean ±S D	0.78 ±0.04	0.76 ±0.04	0.78 ±0.04	0.77 ±0.04	2.05 (.20)
Post hoc p-value					
JC-JD	JC-SC	JC-SD	JD-SC	JD-SD	SC-SD
.21	1.00	.39	1.00	1.00	1.00

*: indicates significant differences

Table 6. Velocity of COM during initial step unit: m/s

	JC	JD	SC	SD	F(p)
Mean ±SD	2.79 ±0.39	2.23 ±0.50	2.78 ±0.36	2.23 ±0.52	11.92 (.01)*
Post hoc p-value					
JC-JD	JC-SC	JC-SD	JD-SC	JD-SD	SC-SD
.01*	1.00	.01*	.01*	1.00	.01*

*: indicates significant differences

DISCUSSION

The success of the initial step is known to be closely related with the success of a drive-in offense, and initial steps taken with fast, long strides and low posture are suggested as very important factors resulting in successful drive-ins (Krause et al., 2008). In this study, although no significant differences in total initial step time based on initial step type were found, cross drive-ins (JC, SC) generally showed about 64% longer strides and 51% greater speed in the initial step than direct drive-ins (JD, SD; Tables 3-4, p < .05). These results should be considered in light of the characteristics of basic basketball rules, specifically walking violations and double dribbles. A cross drive-in method is performed with a fixed pivot foot; the initial drive-in step is taken by crossing the supporting leg. This allows for bold movement because it prevents walking violations, which occur when the pivot foot loses contact with the ground before dribbling begins. However, direct drive-ins face a high chance of incurring a walking violation, as the pivot foot comes off the ground if the initial drive-in step does not cross the supporting leg prior to dribbling. Thus, the results of this study show that cross drive-ins have greater displacement than direct drive-ins because cross drive-ins allow for movements using bolder steps. Additionally, when drive-in movements are performed in basketball, the player's in-the-moment senses and arbitrary judgement determine the movement's form. Therefore, the relationship between the type of drive-in, which can be psychologically influential, and basketball's rules affects the speed of the initial drive-in step by providing boldness of movement, and as a result, the speed of the initial step increases, an important technical factor in the success of the drive-in (Kretchmar, 1982).

According to previous studies, low posture when taking the initial drive-in step effectively reduces the space between the floor and the dribbling hand, enables quick changes of direction, and protects the ball, making it a very important factor in the success of a drive-in (Bang, 2006; Krause et al., 2008). In this study, the COM height and velocity were compared. COM velocity was about 25% faster in cross drive-ins than direct drive-ins (Table 6, p < .05). However, no statistically significant differences in COM height were observed between the initial step types. These results show that compared to direct drive-ins, the bold initial steps taken in cross drive-ins move the body farther forward, thus pushing the ball farther forward to increase the efficiency of the drive-in movement (Cho & Jung, 2001). Altogether, cross drive-ins appear to be a more effective step type in basketball, resulting in faster initial steps and body movement than direct drive-ins. Therefore, to reduce the restrictions of the walking violation and double dribble basketball rules and to perform movements quickly and boldly, cross drive-ins are more effective than direct drive-ins, regardless of the stopping movement used. However, in actual basketball games it is difficult to restrict drive-in movements, which serve various purposes, to certain specific types types (Trninić, Dizdar, & Lukšić, 2002; Oliver, 2004).

In other words, although cross drive-ins are more effective than direct drive-ins, even with respect to the characteristics of their simple movements, no single movement can be preferred over all others to disrupt and pass by the defense because of the unique nature of dribbling, a distinct movement in basketball, and the game's rules, including walking violations and double dribbles. Thus, effective frequency of use based on the offensive player's judgement is required, and appropriate training is necessary. This study's results identified the characteristics of the techniques based on the initial drive-in steps, and these should be applied in training to improve individuals' skills and complement the advantages and disadvantages of specific techniques.

CONCLUSION

The purpose of the present study was to provide objective evidence for improving drive-in performance through technical factor analysis according to initial drive-in step types. The results of the study showed that cross drive-ins result in longer strides and faster initial steps compared to direct drive-ins. However, no differences were observed in COM height, which was identified in previous studies as a major factor in drive-in success. In conclusion, due to the unique nature of dribbling, a distinct movement in basketball, and the rules regarding walking violations and double dribbles, cross drive-ins can be more effective than direct drive-ins, even with respect to the characteristics of their simple movements. However, because no one movement can be preferred over all others to disrupt and pass by the defense in actual basketball games, effective frequency of use based on offensive players' judgement and appropriate training are necessary.

REFERENCES

Cho, P. H. & Jung, N. J. (2001). Dynamic analysis of the lower extremities during the Parhunbal Dolyeochagi in Taekwondo. *Korean Journal of Sport Biomechanics*, *10*(2), 165-177.

Cowley, H. R., Ford, K. R., Myer, G. D., Kernozek, T. W. & Hewett, T. E. (2006). Differences in neuromuscular strategies between landing and cutting tasks in female basketball and soccer athletes. *Journal of Athletic Training*, *41*(1), 67-73.

Esteves, P. T., de Oliveira, R. F. & Araujo, D. (2011). Posture-related affordances guide attacks in basketball. *Psychology of Sport And Exercise*, *12*(6), 639-644.

International Basketball Federation (2012). Official Basketball Rules 2012. FIBA.

Kim, N. S. (2008). The analusis on Drive-in Patterns of Each Player in Korean basketball League (Masters dissertation). Myongji University, Yong-in, Korea.

Krause, J. V., Meyer, D. & Meyer, J. (2008). Basketball skills & drills. Human Kinetics.

Kristianslund, E., Faul, O., Bahr, R., Myklebust, G. & Krosshaug, T. (2014). Sidestep cutting technique and knee abduction loading: implications for ACL prevention exercises. *British Journal of Sports Medicine*, *48*(9), 779-783.

Lee, D. J. & Jung, I. S. (2010). Kinetic Analysis of Three-Point Jump Shot in Basketball. *Korean Journal of Sport Biomechanics*, *20*(1), 49-55.

Lee, W. J. (1997). *Basketball*. Seoul: Samho Media

McLean, S. G., Neal, R. J., Myers, P. T. & Walters, M. R. (1999). Knee joint kinematics during the sidestep cutting maneuver: potential for injury in women. *Medicine & Science in Sports & Exercise*, *31*(7), 959-968.

Oliver, J. A. (2004). Basketball fundamentals. Human Kinetics.

Pang, Y. (2006). *Basketball Bible Ⅰ*. Seoul: DKbooks

Park, S. J. & Park, K. M. (2009). An dissection of th attack pattern through the video analysis method. *The Korea Journal of Sports Science*, *18*(1), 1185-1199.

Paye, B. & Paye, P. (2012). Youth basketball drills. Human Kinetics.

Scott Kretchmar, R. (1982). "Distancing": An essay on abstract thinking in sport performances. *Journal of the Philosophy of Sport*, *9*(1), 6-18.

Shuji, O. (2011). NEW Basketball. Seoul: Samho Media

Trninić, S., Dizdar, D. & Lukšić, E. (2002). Differences between winning and defeated top quality basketball teams in final tournaments of European club championship. *Collegium Antropologicum*, *26*(2), 521-531.

Wang, J., Liu, W. & Moffit, J. (2009). Skills and offensive tactics used in pick-up basketball games. *Perceptual and Motor Skills*, *109*(2), 473-477.

Winter, D. A. (2009). Biomechanics and motor control of human movement. Wiley.

Yang, D. Y. (2003). The Analysis of the transfer of angular momentum on upper extremity during Free Throw Motion in Basketball. *Korean Journal of Sport Biomechanics*, *13*(1), 185-204.

Yoon, H. J., Yoo, H. H. & Koo, G. H. (1997). *Basketball*. Seoul: Mountain and Field.