ORIGINAL RESEARCH article

Front. Psychol., 28 June 2021 | https://doi.org/10.3389/fpsyg.2021.658102

Mechanics of the Jump Shot

The "Dip" Increases the Accuracy of Elite Basketball Shooters

Luke S. J. Penner

- Department of Kinesiology, University of Manitoba, Winnipeg, MB, Canada

The present study assessed the mechanics of the basketball jump shot to determine whether or not the "dip" increased shot accuracy. There remained a debate between coaches who believed "dipping" was too slow and coaches who believed "dipping" increased accuracy. A mixed design was used for the present study with elite high-school and university players all performing shots with and without the "dip" at four distances: the last hash mark before the free throw line (3.125 m), the length of an imaginary hash mark beyond the free throw line (4.925 m), the top of the free throw circle (6.025 m), and the three-point line (6.750 m). These distances best emulated where the majority of shots were attempted in a game. Thirty-six athletes completed the study, with accuracy and shot quality being measured using Hardy-Parfitt's six-point scale. The results of the present study indicated that the "dip" led to approximately a 7–9% increase in accuracy of the jump shot for both high school shooters, and university shooters, suggesting that coaches should begin to teach the "dip" in a player's shooting motion to improve scoring results.

Introduction

In basketball, the goal is to outscore the opponent by scoring more baskets. One of the most common techniques to score is the jump shot (Knudson, 1993; Gryko et al., 2018; Okazaki and Rodacki, 2018). In order to optimize accuracy, a player must be efficient and consistent with his shooting motion. Therefore, an elite athlete will attempt to reduce movement variability, the noise that impacts performance, in order to achieve maximal success with shooting the basketball (Button et al., 2003).

Basketball is a dynamic sport, and as a result, there is a lot of variability that can impact a player's shooting motion. Knudson (1993) states that there are six key biomechanical components to optimize shooting success: staggered stance and a vertical jump; aligned shooting plane to the basket; high point of release; proper angle of release; coordination of upper and lower limbs; and backspin on the ball. Identifying which components might be more impactful to improving any of these teaching points will ultimately help a team win a game. One such movement is the "dip" in the shooting motion of the jump shot.

The “dip” is defined as the movement of lowering the ball below a player’s shooting pocket, the area of the body when all parts of the shooting arm are in a vertical plane out in front of the shoulder holding onto the ball. By lowering the ball, the shooting fingers would leave the vertical plane, the “dip.” The “dip” decreases the chance of an angular release, a lateral movement from the shot path plane (Okubo and Hubbard, 2015). Without using the “dip,” an awkward lift to the player’s set point, the point at which the ball moves toward the basket, would occur. As a result, movement variability is reduced.

As a coach, it is important to recognize and understand one’s personal biases in what makes an effective jump shooter. Drysdale (1972) explained that until scientific evidence is provided to coaches, they will use their own interpretations and create their own hypotheses as to what makes an athlete a successful jump shooter. Each coach will focus on different components of the jump shot, from the “dip” to visual cues. These teaching points are often ones that are familiar to the coach. These different styles of teaching result in different styles of shooting, which may impact accuracy. This variety is often because the player develops a comfort for their specific shooting style.

However, tweaks to a player’s shooting motion often occur, guided by a coach, as the player grows and develops. These decisions are always made in order to increase accuracy. Therefore, as more scientific evidence for different mechanics of the jump shot, like the “dip,” are researched, the more coaches will embrace and utilize the motion in their teachings. The game of basketball provides many variations of a situation, such as a catch and shoot, off a screen, off the dribble, and defenders. In order to isolate the “dip,” the catch and shoot scenario allows the most control for studying and will create a foundation for future studies with more variables. The natural form of a shooter, whether a “dipper” or “non-dipper,” will be easily identified. The “dip” is often seen as a poor shooting decision by coaches because of increased shooting time once the ball is caught by the player. There is a subset of coaches who believe in the value of “dipping” because of anecdotal evidence of increasing accuracy. This belief is often backed by the fact that many elite shooters, including Steph Curry, Klay Thompson, and Ray Allen are seen “dipping” the basketball prior to shooting (see Figure 1). However, no scientific data exists on the efficacy of “dipping” the basketball. Therefore, the aim of this study is to assess the relationship between “dipping” the basketball in one’s jump shooting motion and shooting accuracy, regardless of position and current shooting motion. The hypothesis is that “dipping” will result to higher shooting accuracy.

Discussion

The present study implies that the “dip” increases the accuracy of both the “dipper” and “non-dipper” at the high school and university levels. The scale discerns both whether or not the shot is made, but also identifies the quality of the shot. This scale also shows that the higher the group averages, the better the shot quality. The four groups, university “dippers,” university “non-dippers,” high school “dippers,” and high school “non-dippers,” all average a successful shot, represented by averages above four, when using the “dipped” shooting motion. Conversely, three of the four groups, university “dippers,” high school “dippers,” and high school “non-dippers,” average an unsuccessful shot, represented by

averages below four, when using the “non-dipped” shooting motion. These results mean that only the university “non-dippers” average a successful shot using the “non-dipped” shooting motion.

In basketball, where accuracy is seen as an important factor for winning, the implication is that “dipping” the ball after catching would be an advantageous decision for all players to use in their jump shot shooting motion. The player’s natural shooting motion does not have an impact on whether or not the “dip” is effective as all four groups experience increased accuracy. The university “non-dippers” were the only group who had less of a benefit from “dipping,” but even they have increased accuracy and shot quality. This study implies that teaching the “dip” may be an effective way to increase accuracy is appropriate for elite level basketball players.

Analytics of Basketball

In basketball, similar to other sports, the current approach to the game is becoming dependent on data analytics in order to improve every facet of the game. Situationally, the catch and shoot shot is seen as more accurate when compared to the dribble pull-up (Shea, 2014). During the 2013/2014 NBA season, the effective field goal percentage of catch and shoot shots was 52% while the effective field goal percentage of dribble pull-ups was 41% (Shea, 2014). Using the “dip” helps to mitigate some of the effects of distance on accuracy, particularly for high school shooters, implying the movement’s importance. Using the “dip,” and increasing accuracy, will also be more important as the game of basketball moves to a “three and key” style of play. This style emphasizes three-point shots, which were affected by the “dip” positively, and those in the key, mainly dunks and lay-ups.

Goldsberry (2012) evaluates the spatial accuracy of individual players all over the court. He suggests the use of the metric “range percentage” to better capture shooting ability (Goldsberry, 2012). The metric is calculated by dividing the basketball court into 1,284 scoring regions and highlighting which of those regions the athlete averages more than one point per attempt. For example, in the 2010/2011 NBA season, Steve Nash averages more than one point per attempt in 406 regions, meaning that his range percentage was 31.6%, the highest of the season. He is followed by Ray Allen. They are the only two players above 30%, suggesting that theirs was the best shooting ability during that season. While no metric may be perfect, this approach helps demonstrate who is a high-quality shooter. Marty and Lucey (2017), and Marty (2018) further discuss variables, such as left-right value, and depth consistency, tailoring them to demonstrate the shot quality. The more accurate the shooter, the better these values appear. The majority of basketball analytics end with the offensive contribution of a player. Therefore, the accuracy of a player, as demonstrated by Goldsberry (2012), Marty and Lucey (2017), and Marty (2018) are paramount for his overall positive evaluation. “Dipping” the basketball yields the most desirable results according to the present study.

Theoretical Considerations

The warm-up shots are used in a way that mimics the study and helps create a baseline for the players. This method allows for confirmation that the player did or did not have a bad shooting effort. If the player has a bad shooting effort, then the data is harder to trust. Inconsistent warm-up methods are a way that may affect overall study results. Methods such as participants conducting their own 10-min warm-up (Okazaki and Rodacki, 2012; Podmenik et al., 2017), having no warm-up (Myrtaj, 2012), or having the participant create their own warm-up (Liu and Burton, 1999) are all ways to negatively impact athlete readiness for the experimental shots. Therefore, the uniqueness of the warm-up is viewed as being more supportive of the current results.

The quality of the shot is the chosen evaluation, rather than purely whether or not the ball went in the basket. A player learning a new shooting motion might experience lower shooting percentages but a strong shooting form, implying that players who naturally did not "dip" have the potential to learn to "dip" without much effect on their shooting percentage initially, increasing their ability as they train the motion more often. Therefore, the training of the "dip" earlier in an athlete's career can provide more of an advantage in using the "dipped" shooting motion. The high school shooters experienced a much larger difference between "non-dipped" and "dipped" shots, especially from farther distances. This difference suggests that there may be a "scaling effect," meaning that small improvements to an athlete's biomechanics and movement patterns may yield smaller benefits for the more "elite" player.

According to Nordland (2018), when a player "dips" the ball, there are three levels where the ball ends up: chest, waist, and thighs. This ending position of the backswing of the jump shot is seen as the "dip" position. From the "dip" position, according to Rick Penny, a shooting coach, there are three distinct shooting motions: "head pause," "catapult," and "one-motion" (Penny, 2016). Each shooting technique is using the "dip" because of the increase in wrist and elbow angles being greater than 90°. A player that uses the "head pause" shooting motion has a "dip" position near his waist. This motion results in a change in elbow angle of approximately 10°–15°, while the wrist angle would be between 75° and 90°. A player that uses the "catapult" shooting motion has a "dip" position near his thighs. This motion results in a change in elbow angle of approximately 45°, while the wrist angle would be greater than 45°. A player that uses the "one-motion" shooting motion has a "dip" position near his chest. This motion results in no or little change in the elbow angle, while the wrist angle would be 90°. These specifications imply are that there are many successful "dipping" motions, but a player must identify the motion that fits best with their shooting rhythmicity. Once this rhythm is achieved, then the quality of training and development increases, resulting in the athlete's comfort and improvement in accuracy.

In order to incorporate the "dip" into a player's jump shot, there are several practice methods that can be utilized. Firstly, developing an analogy for the "dip" will aid in the learning process by making the movement implicit (Masters, 2000). Secondly, athletes can utilize mental training techniques, such as mental rehearsal and self-talk, to improve comfort levels with the "dipping" shooting motion. Lastly, two types of practice should be used to improve the "dip."

Blocked practice, the repetition of the skill until some improvement is seen at a specific distance, should be used until the skill feels natural (Ragan, 2014, October). Random practice, practicing multiple skills in a random order with limited repetitions of the same skill, should be used to better retain the skill for long-term use (Ragan, 2014, October). Using these techniques in concert are important because many coaches suggest that block practice is best for those learning a new skill and random practice is best for those mastering a skill (Oliver, 2017).

Strengths and Limitations

The present study has strengths and limitations. Within the scientific community, the "dip" has not been investigated and only anecdotal evidence provides support for the motion. The strengths of this study relate to the ability to experimentally demonstrate the "dip" and its effectiveness. Firstly, the isolation of the "dip" as the main contributor to a player's accuracy is important because it eliminates concerns over distance or "dippers" naturally being better shooters. Secondly, the result provides coaches with scientific evidence that the "dip" increases accuracy and provides recommendations for incorporating into the player's shooting forms. Lastly, the study is a template for future studies to address that the speed of the shot needs to be effective against defenders. In terms of limitations the sample should have equal numbers of athletes being "dippers" to "non-dippers." This inequality is most prevalent in high school shooters, with only five "non-dippers." Additionally, in a perfect situation, all playing styles are present, from the true center to the playmaking guard. This representation helps identify which players will truly benefit most from the "dip." Lastly, one major limitation, however, is that even though sample size was calculated, the study was conducted with a convenience sample. This may have introduced selection bias to our results as players who shoot better and are more confident, may have volunteered.

Conclusion

The results of the present study indicate that the "dip" increases the accuracy of all shooter types from every distance for both high school and university shooters. Anecdotally, players who use the "dip" often speak about how the motion improves their rhythm while those who do not use the "dip" suggest it slows their release time. These are important to consider in future coaching of the jump shot.

The present study creates a foundation for future studies on the effectiveness of the "dip." From a coaching perspective, one might suggest that "dipping" could lead to the ball being stolen or blocked. Additional research needs to be conducted on release times and other parameters specifically to provide a basis on whether to use the "dip" beyond accuracy and address this concern. The laboratory setting is how the present study was conducted; therefore, it would be advantageous to observe games to determine when elite shooters use the "dip" and if accuracy improves in a game setting. For younger athletes, additional research needs to be conducted to see if there is more value in using the "dip" earlier in a basketball player's career. Lastly, for elite athletes, additional research needs to be conducted to see if the scaling effect is outweighed by the amount of time needed to train the "dip" at a certain age.