

RUNNING HEAD: DEVELOPING PROPER PITCHING MECHANICS

Developing Proper Pitching Mechanics for a High School Baseball Player

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**Abstract**

A skill is defined as a specific set of movements primarily learned in practice that is goal-directed, under some conscious control, and volitional (Driska 2017 *What*). This means that one can learn skills and better develop them over time. With adolescent baseball pitchers, proper instruction in proper throwing mechanics is vital to insure the health and longevity of the adolescent's throwing arm. The overhand throwing motion can place a significant amount of strain on the throwing arm so effective coaching must include proper mechanical instruction. This study focuses on the development of proper pitching mechanics with a 10<sup>th</sup> grade baseball player with little experience as a pitcher. Using a constraints-based approach and video feedback and analysis, the instructor and subject worked to develop an overhand throwing motion that limited the strain on the subject's throwing arm, while also maximizing his physical efficiency and ability to throw a pitch in the strike zone. After three sessions of working with the new throwing motion, the subject reported less strain on his throwing arm but continued to lack complete comfort with the motion. His ability to throw an overhand pitch for a strike remained consistent with both motions.

Keywords: baseball, pitching, pitching mechanics, adolescent, overhand throwing

## **Introduction**

A skill is defined as a specific set of movements primarily learned in practice that is goal-directed, under some conscious control, and volitional (Driska 2017 *What*). This means that one can learn skills and better develop them over time. As a result, skill instruction is an integral part of what makes one an effective coach. When one learns a skill, that learning can be divided into two components: explicit and implicit learning. Explicit learning occurs when one is conscious of the learning process and improvement whereas with implicit learning one is not consciously aware of one learning the skill (Driska 2017 *Motor*). Studies have demonstrated that skills learned implicitly last longer and remain more consistent under pressure than skills learned explicitly (Masters 2013). According to Stephen Scott, “movement skill consists of three components...brain, biomechanics, and behavior” (Patterson & Lee, p. 133). This means that each skill consists of the brain understanding the goal of the skill, developing an effective movement pattern to achieve the goal, the ability of the athlete to precisely perform this movement pattern, and the observed behavior of the athlete during and after the movement pattern (Patterson & Lee, p. 134)

Using a constraints approach, coaching skill instruction involves working with the athlete by manipulating the task, environmental, or individual constraints to achieve the desired movement pattern and result (Driska 2017 *Constraints*). While manipulating these constraints, a coach has options as to how to deliver augmented feedback. Some of these options include: explicit instruction (Driska 2017 *Explicit*), analogy learning (Driska 2017 *Explicit*), questioning (Driska 2017 *Questioning*), and implicit learning (Driska 2017 *Implicit*). While each has its own set of benefits and drawbacks, it is up to the coach to best

determine the approach that is most effective with the athlete based upon the athlete's feedback and the coach's observations during instruction and practice.

In youth baseball, the skill of throwing the ball with velocity and accuracy is a master skill. Due to the nature of the overhand throwing motion and the make-up of the human body, injury is a significant concern, "the anatomy of the human elbow allows for instability that is a predisposing factor to injury" (Childress 2003 p. 28). Given this, it is imperative that when coaching the skill of throwing a baseball and pitching, a coach is cognizant of the appropriate throwing mechanics and load for a youth baseball pitcher.

In the article by Snyder-Mackler et al, "Data-Based Interval Throwing Programs for Little High School, College, and Professional Pitchers" (2001), the authors argue that given the strain the act of pitching a baseball entails, pitchers at all levels must build shoulder stamina with systematic throwing at varied distances. While this is important, it is equally important to insure that pitchers are throwing with proper mechanics as, "with improper mechanics, force in the biceps tendon may be unusually large" (Feilsig et al, p. 239). A basic breakdown of pitching mechanics for baseball consists of 5 parts: wind-up, early cocking, late cocking, acceleration, and follow-through. As a pitcher begins their wind up, their weight should be positioned over their back leg with their hands together and shoulders perpendicular to home plate. As they move into early cocking, their hands begin to separate, their front hip leads their lower body while they drive from the back side. As their hands get to shoulder height, they should mirror each other, so one could draw a straight line from one shoulder to the other and one elbow to the other. The late cocking phase begins when the pitcher's lead foot hits the ground and ends as they release the ball. In this phase, the stride foot should land in line with the back foot and a pitcher wants to achieve

maximum external elbow rotation. As the pitcher releases the ball, they move into the follow-through phase, where the throwing arm continues across their body, “burying” their throwing shoulder and the back leg comes through, following the body’s momentum (Schultz 2013).

Even with proper mechanics, a coach should not underestimate the physical stress of pitching a baseball. As stated above, a coach should implement a specific throwing program designed to build arm strength in their pitchers. There are specific signs, such as elbow drop and decreased trunk bend, that indicate when a pitcher is tiring (American). As Erkel (2007) notes, it is especially important to emphasize mechanics and to be alert for signs of fatigue in high school pitchers due to their developing ability to consistently control their bodies in a constant movement pattern (p. 25).

Due to the variability of their movement patterns, adolescent pitchers must receive repeated instruction in proper pitching mechanics. Using the proper mechanics can alleviate stress on their throwing arm as well as correct inefficient movement patterns that they have previously developed. When instructing an adolescent pitcher, a coach must emphasize the proper mechanics, while allowing the pitcher the freedom to find their most comfortable and natural motion. When considering the stages of the pitching motion, one must note that there is a sizable gap between each step. These gaps allow for the individuality of each pitcher and recognize that while there are certain benchmarks that place a pitcher in the best position to succeed, each individual will achieve these benchmarks in different ways.

The purpose of this study is to refine a high school baseball player's pitching mechanics to lessen the tension on his throwing arm during the overhand throwing motion while maintaining, if not increasing, his ability to pitch a baseball with accuracy.

## **Method**

### **Participants**

There were two primary participants in this study. The first, the subject, is a sixteen-year old, male baseball player at Millbrook School in Millbrook, NY. The subject is left handed and has primarily played in one of the three outfield positions over the course of his baseball career. The subject is 5'6" tall and weighs 115lbs. Starting this year, the subject has begun to perform as a pitcher as well, so the timing of this study was well-timed. Previously, the subject had very little experience as a pitcher and stated that any time he had spent on the mound prior to the study was "just messing around."

The second primary participant in this study was the instructor. The instructor is a twenty-seven-year old male faculty member at Millbrook School. The instructor has worked and coached at Millbrook School for five years. Prior to Millbrook, the instructor played first base while studying English at Colby College in Waterville, ME. There was also a secondary participant in the study in another member of the baseball team who received the subject's throws during the study.

As a baseball player, the subject is inefficient in the use of his body. Whether throwing or hitting, he takes a rotational approach, which sacrifices much of the potential power in his body and places stress on specific joints. This is especially apparent on the pitcher's mound, where the subject has a tendency to pull his glove (right) hand to the side

as he releases the ball, which in turn pulls his body to the side as well, causing his elbow to drop below shoulder height, placing a sizable amount of strain on his elbow. In addition, this falling off to the right side causes the throwing arm to lag behind the rest of the subject's body, typically resulting in the subject throwing to the left (his throwing side) of his target or partner. The goal of this study was to create and maintain a movement pattern in the subject where he was able to take a more linear approach to pitching and, specifically, the release and follow through of the pitching, generating and maintaining his momentum on a straight line from the mound to the catcher. A desired side effect of this new movement pattern would be a heightened elbow throughout the throwing motion, resulting in a decreased amount of stress on the throwing elbow. The subject's command of a fastball was average in the beginning as he demonstrated an ability to throw six of ten fastballs in the strike zone. Thus, an additional goal of this study was to at least maintain this percentage using the new movement pattern, while also maintaining the subject's velocity (ten-pitch fastball average: 68.4mph). Ideally, the new movement would enable the subject to not only maintain this command and velocity but to increase both as well.

Prior to the study, as stated above, the subject demonstrated average fastball command. Relative to the other pitchers on the Millbrook School Varsity Baseball team, the subject's average fastball velocity is slower (team average unavailable). Currently, the subject occupies a role as an outfielder and potential relief pitcher. The subject stated that he is "excited" to work on his pitching ability as he "never thought of myself as a pitcher before." The subject expressed a degree of nerves and doubt about his abilities as well but also an enthusiasm for the process. As stated above, the subject has little to no prior experience with pitching but reported that he has been playing baseball for five years and

believes he has thrown the same way since he began playing. Based on this, the instructor believes that the subject's rotational approach and low elbow slot are the result of the subject's still developing body and a carry-over from playing on the smaller Little League field. Now, as the subject has moved to a larger field upon graduating from Little League, the longer throws require the subject to attempt to throw harder, from which the strain on the elbow in the current movement pattern originates.

### **Procedures**

This study began by filming the subject performing ten pitches on an indoor pitcher's mound in the school gymnasium using his current movement pattern. Next, the subject and instructor viewed the film together and discussed and analyzed the tendencies introduced in the previous section. Using freeze frames of the same film, the instructor showed the subject where pieces of his body (throwing elbow, glove hand, lead foot, throwing hand, lead hip, back foot, throwing shoulder) would be using the new, desired movement pattern. Without a mound, ball, or glove, the subject and instructor walked through the new movement pattern, focusing only on the subject's familiarity and comfort with the movement. During this process, the subject expressed some discomfort with the lack of familiarity with the movement pattern.

The subject and instructor next returned to the gym and the subject threw fifteen times with a partner using the new movement pattern. This was not on the pitcher's mound and the instructor told the subject to focus on hitting his partner in the chest. During throws 10-12, the subject appeared to be reverting to the old movement pattern so the instructor stopped the exercise. In response to the subject's reversion, the instructor



moved the subject to stand twelve inches from a wall on his right. They then continued the throws to the partner. The wall on the right of the subject limited his ability to fall off to his right side during and after release and enabled him to focus on maintain a high throwing elbow throughout hand-break, release, and follow through.

After 25 throws next to the wall, the subject professed more comfort with the new movement pattern and demonstrated an improved ability to maintain a consistent pattern. The subject and instructor moved onto the mound and the subject went through an entire pitching motion with ten throws to a target at 45 feet. The subject was initially erratic but finished with four straight strikes. The instructor then moved the target to the regulation 60 feet 6 inches and the subject pitched ten more fastballs to the target, using a full pitching motion and the new movement pattern.

In his final ten pitches, the subject again achieved strikes on five of the pitches. The velocity of these pitches was not recorded but they appeared to be similar, visually, to the velocity of the first set of ten. The subject reported that while the new movement pattern seemed to place less stress on the elbow, he was still not entirely comfortable with it. The instructor recommended continued practice and awareness of the new movement pattern while throwing, either on or off of the pitcher's mound. The instructor will continue to monitor the subject moving forward and plans to use athletic tape to make lines on the pitcher's mound that will enable the subject to see the lane in which he should stay while going through his pitching motion.

After consulting with Professor Driska, the instructor and subject were able to get together for one other brief session. While there was no catcher present, the instructor introduced a degree of variability to the pitching sequence by asking the subject to locate a

fastball in a different part of the strike zone with each pitch. This gave the subject an external focus of attention and increased the variability of the exercise, enabling the subject to focus on the result and location of the pitch while the instructor focused on mechanics.

### **Results**

As stated above, the subject maintained his pitching accuracy using both movement patterns. This is encouraging, as the instructor was more concerned with the subject's accuracy than his velocity. Given practice, the instructor is confident that the subject will be able to maintain, if not increase, his velocity. After pitching with the new movement pattern, the subject reported a lessened amount of stress on his elbow. To the instructor, this indicated a successful result.

Initially, the subject struggled to comprehend the new movement pattern or to acknowledge the weaknesses in his original throwing motion. The video analysis was particularly effective in demonstrating to the subject the areas of the motion that placed this strain on his elbow. This heightened comprehension appeared to give the subject additional motivation to embrace and learn the new movement pattern.

When throwing with the new movement pattern for the first time, the subject adhered to the mechanics he and the instructor had walked through, at first. As he threw more, however, he reverted to old habits and the instructor witnessed his throwing elbow begin to drop and the subject began to fall off to his right again, returning to his original rotational habits. When this occurred, the instructor paused the throwing session. It was at this point that the instructor incorporated the use of the gymnasium wall to limit the

subject's ability to fall off to the right and to encourage him to use a more linear approach to his partner. This physical constraint appeared to be beneficial to the subject.

Interestingly, the subject was more consistent with the new movement pattern when completing a full pitching wind up. He appeared less aware of his movement pattern when simply throwing without the wind up. Perhaps this was because the video that the subject and instructor analyzed also depicted the subject going through a complete pitching motion. Throughout the study, the subject responded best to the visual cues of himself on the video and the physical constraint of the wall. While earnest in his approach to the study, the subject was less responsive to verbal cues from the instructor such as "keep a high elbow", "stay in your lane", or "drive through the target".

As the subject did not lose accuracy with the new movement pattern, the instructor is confident that increased practice with new pattern would enable a greater degree of comfort and familiarity with the subject. This should also lead to greater self-awareness for the subject and ability to self-diagnose should inaccuracy appear. Prior to the intervention, the subject most frequently missed the target to the left side. After the intervention, the subject's misses were more frequently on the vertical plane (above or below the strike zone). This indicates that the subject is adhering to the new movement pattern and that his throwing arm is more properly timed with the rest of his body.

During the third session, the subject struggled to locate his pitches in the small sections of the strike zone that the instructor dictated. This produced a visible level of frustration with the subject, which the instructor attempted to meet and calm by posing questions related to the subject's movement. Given the subject's age and experience level, this degree of variability was not surprising, and the instructor believes that further

instruction sessions with an external focus of attention and variability will result in the subject's improved ability to locate a fastball in a randomly selected portion of the strike zone.

The instructor believes that as the subject grows more accustomed to the new movement pattern, he will find the consistent release point that creates a pitch that ends in the desired quadrant of the strike zone.

### **Discussion**

The purpose of this study was instruct a high school baseball player in the basics of pitching mechanics and work with him to develop a new movement pattern in his throwing motion to lessen the amount of strain on his ability and increase his ability to pitch a baseball accurately. While this study did not accomplish all of these goals, as the pitcher's accuracy did not change, the study was successful in establishing a new movement pattern in the throwing motion that did not strain the subject's elbow as much as previously. Given that the subject has not had a significant amount of practice with the new movement pattern, the instructor and author hopes that the subject will increase his accuracy and potentially his velocity as he gains more practice and familiarity with the movement. In all, the instructor was pleased with the subject's report that his elbow felt better with the new movement pattern. The instructor believes that the subject's physical health is the foundation for any future success he has on the mound so establishing a movement pattern that enabled this health was the primary purpose of this project.

Throughout this project, the instructor was struck by the emotional constraints that the subject initially brought to the project. As previously stated, the subject was somewhat

apprehensive about his ability to perform as a pitcher. Through discussion with the subject, it became apparent that he had never considered himself a pitcher before and had always admired those on his team who could perform this role. He saw himself as less talented than these individuals and, as a result, had some anxiety about performing this central role. Thus, the initial work of the project was to attempt to create a level of self-confidence in the subject that he could achieve this task. As a high school baseball player with five years of experience, the subject falls into the intermediate category and the instructor tailored the instruction to fit this level of experience.

Of particular value to the instructor was working with the subject during the video analysis. During these conversations, it became quickly apparent that the subject had never seen himself throw before. The discomfort of the motion was quickly obvious to him, and he responded well to seeing how one tendency (falling off to the right during and after release) led to others (elbow dropping at release point creating strain on elbow). This reinforced to the instructor the value of this exercise and it is one that he intends to incorporate more frequently with other players and other tasks, such as hitting. After viewing the film, while walking through the new pitching motion with the subject, the instructor attempted to refrain from using a large amount of explicit instruction. Instead, the instructor asked the subject questions as he moved through the motion, such as “where is your elbow now” or “what is the next step”. These questions were designed to increase the subject’s awareness of his movement pattern and the sequence of the movement.

When observing the subject performing the new movement pattern, the instructor was initially encouraged by the results and expressed this to the subject. Almost immediately, the subject began reverting to aspects of his prior throwing motion,

necessitating intervention from the instructor. To the instructor, this signifies the vigilance that skill instruction requires and the possible deleterious effects of compliments as this seemed to distract the subject from their focus on the movement pattern. The instructor was unconcerned with the outcome of the throws in this context and most concerned with the subject's ability to perform the new throwing motion.

As stated previously, the subject performed the new movement pattern more effectively when using a complete pitching wind-up. Perhaps this was because the wind-up was less familiar to the subject and thus he was focusing more intently on his entire body, rather than the more familiar throwing motion without the wind-up which allowed him to revert to his prior movement pattern. The use of the wall as a constraint is an example of using non-linear pedagogy to respond to the subject's needs or actions. In this case, the wall provided a constraint that limited the space in which the subject could perform the master skill, which forced him to perform the skill with the desired movement pattern.

## **References**

American Sports Medicine Institute | Research. (n.d.). Retrieved from

<http://www.asmi.org/research.php?page=research&positionStatement>

Childress, R. G. (2003). *Elbow and Shoulder Pain in Youth Baseball Players* (Doctoral dissertation,

The University of Alabama, 2003). Ann Arbor, MI: ProQuest Information and Learning Company.

Driska, A., Ph. D. (Producer). (2017). *Analogy Learning* [Video file]. Retrieved from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/0\\_tr1q1zi0/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/0_tr1q1zi0/embed/dynamic)

Driska, A., Ph. D. (Producer). (2017). *Constraints Model of Skill Development (Part 1)* [Video file].

Retrieved from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/1\\_ejaso0os/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/1_ejaso0os/embed/dynamic)

Driska, A., Ph. D. (Producer). (2017). *Explicit Teaching* [Video file]. Retrieved from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/0\\_1z8nlxs8/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/0_1z8nlxs8/embed/dynamic)

Driska, A., Ph. D. (Producer). (2017). *Implicit Learning* [Video file]. Retrieved from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/0\\_hfs82cil/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/0_hfs82cil/embed/dynamic)

Driska, A., Ph. D. (Producer). (2017). *Motor Performance vs Motor Learning* [Video file].

Retrieved

from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/1\\_zgp80ume/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/1_zgp80ume/embed/dynamic)

Driska, A., Ph.D. (Producer). (2017). *What Is Skilled Performance?* [Video file]. Retrieved

from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/1\\_fs1nze15/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/1_fs1nze15/embed/dynamic)

Driska, A., Ph. D. (Producer). (2017). *Questioning* [Video file]. Retrieved from

[https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/811482/uiconf\\_id/27554931/entry\\_id/0\\_mfl2wt05/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/811482/uiconf_id/27554931/entry_id/0_mfl2wt05/embed/dynamic)



Erkel, J. J. (2008). *The Changes in Pitching Mechanics and Pitch Velocity During a Seven-Inning*

*Simulated Game in High School Baseball Pitchers: A Prospective Descriptive Study* (Master's thesis, West Virginia University, 2007). Ann Arbor: ProQuest Information and Learning Company.

Fleisig, G. S., Ph. D., Andrews, J. R., MD, Dillman, C. J., Ph. D., & Escamilla, R. F., MS. (1995).

Kinetics of Baseball Pitching with Implications About Injury. *The American Journal of Sports Medicine*, 23, 233-239. doi:10.1177/036354659502300218

Masters, R. (2013). Practicing Implicit (Motor) Learning. In *Developing Sport Expertise: Research*

*and Coaches Put Theory Into Practice* (2nd ed., pp. 154-174). Oxon, OX: Routledge.

Patterson, J. T., & Lee, T. D. (2013). Organizing Practice: Effective Practice is More Than Just Reps.

In *Developing Sport Expertise: Research and Coaches Put Theory Into Practice* (2nd ed., pp.

132-153). Oxon, OX: Routledge.

Shultz, D., PT. (2013, November 10). *Basic Evaluation of Pitching Mechanics* [PPT]. 2013

Sports

Medicine Update.

Snyder-Mackler, L., Sc.D., Axe, M. J., M.D., & Wickham, R., M.S.P.T. (2001). Data-Based

Interval

Throwing Programs for Little League, High School, College, and Professional Pitchers. *Sports Medicine and Anthroscopy Review*, (9), 24-34.

doi:10.1097/00132585-200101000-00003