# Pitching with Accuracy While Improving Velocity & Preventing Injury

## By Dan Galaz at Galaz Baseball Technologies © 2021

**Introduction**

Without question, the best pitch in baseball is a well-located fastball. Pitching with accuracy is not a topic many cover in detail or avoided since the MLB's standard for selecting young prospects that throw with high velocity. The new standard is pitching with a higher spin rate (SR). Most cover the mental aspect of command and make an effort to talk about the physical side of accuracy. When talking about accuracy or command, they use such words or phrases like:

- **Visualize**
- **Mindset**
- **Conviction**
- **Confidence**
- **Aim small miss small**
- **Get more linear**
- **Need more energy toward home plate (HP)**
- **Be consistent with mechanics**

All these in the list above are great cues, but if the physical aspect of throwing with accuracy is not addressed, this list is less effective. The cue that should be used is, "**trust your hand-eye coordination**." Where the sub-conscience takes over to move instinctively without thinking. The example I use explains how a laser-guided missile system works. The missile has a computer onboard that processes the coordinates when it is close to the target. When the missile is near its mark, it locks on where the laser is pointing until contact. Those that designed and built the missile trust that the missile hits its mark. So for the pitcher, the brain is the computer, the eyes are the laser, and the ball is the missile. The eyes lock on the catcher's mitt send the coordinates to the brain, which tells the hand when to release the ball. All the pitcher has to do is trust their hand-eye coordination to hit the catcher's mitt where it is placed. However, some pitchers have difficulty trusting, so they aim or steer the ball as a dart thrower does. This problem can get so bad that they may get the yips. The yips happen when the pitcher allows himself to be aware that he has the ball in his hand, and he has to throw the ball from point A to point B and starts processing if he will be successful doing so, with some doubt. It can be due to self-inflicted mental pressure to perform at a high level or an overbearing coach or parent who may not allow the ballplayer to fail, where failure is a big part of development.

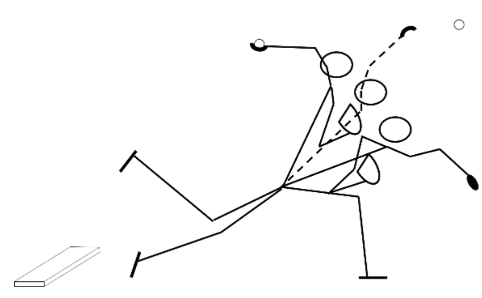
All that said, understanding how to throw with accuracy physically must first begin with creating and maintaining good direction toward HP.

**The Geometry for Throwing with Accuracy**

Throwing with accuracy has to do with how much the pitcher can extend toward HP before he releases. The key contributions to release the ball further out in front before release is:

- How far the pitcher drives efficiently off the rubber
- Keeping the center of gravity (CG) moving toward HP as long as possible before release
- How far the trunk finishes over the front thigh
- How well connected the trunk and arm working together as one link as long as possible through release (similar to how a trebuchet functions)

Simultaneously accomplishing all four in the list above allows the ball to stay on the target longer before being released, as shown below.

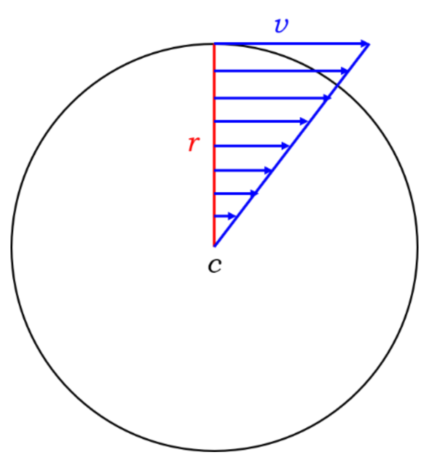


Therefore, a higher chance that the ball ends up closer to where the pitcher is looking. This concept aligns with the phrases "**get more linear**" or "**need more energy toward HP**," mentioned earlier. Although the status quo contends with this theory, that bending the front knee in this fashion leaks energy. Below is a sequence of images from start to finish showing how once the pitcher lands on his front foot, the knee does not cross the green line at the shoelaces, starting from images 8 to 10.


The pitcher landed 7 to 8 feet from the rubber before releasing the ball, which means the ball remained on the right side of his body 7 to 8 feet before releasing the ball, guaranteeing the ball stayed on the target longer for superiorly better ball placement. It almost seems as though he is placing the ball in the catcher's mitt. In addition, notice how his landing foot is perfectly aligned with his back foot (the back foot is on the white line and the front foot landed on the white line), which is vital for throwing with accuracy. Most avoid working with foot alignment because they can not fix it or are convinced it helps with performance. On the contrary, striding off-center affects accuracy and velocity and puts the pitcher joints in compromising angles and positions. If the pitcher strides across his body, he has to redirect his arm away from where he is striding. Suppose the stride opens off-center causes his throwing arm to be flung out by a centrifugal force or centrifugal effect. Centrifugal force means center-fleeing force – arm fleeing from the center of the pitcher's body. Without question, foot alignment must be dealt with to satisfy all three subjects covered in this paper.

**The Geometry for Increasing Velocity**

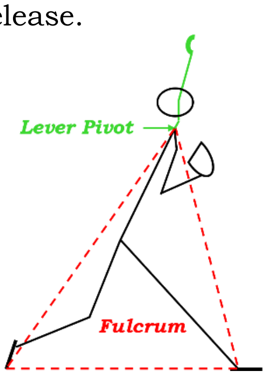
The geometry for throwing with accuracy should also imply the improvement of the physics when the geometry is altered positively. For instance, in the concept of uniform circular motion, as the radius $r$ of a circle increases, so does the velocity $v$, and it increases linearly from the center $c$, as shown below.



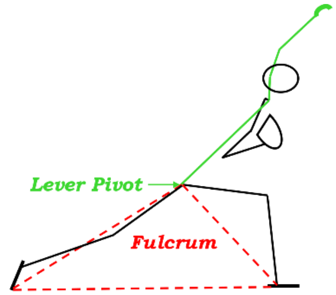

Images 9 and 10 illustrate how the pitcher increases the radius $r$, increasing the velocity $v$ of the ball off the fingers as his trunk hinges at the hips. The power is generated from the drive of the back leg until the front foot lands. Then when the trunk has transversally rotated to when the hips are square to HP, the abdominals forcefully forwardly rotate the trunk. Therefore, the faster that pitcher wants to throw the ball faster, he must bend more quickly. Transverse rotation must be limited to when the trunk is square to HP and emphasize more forward trunk rotation.

As opposed to how the pitcher in the image below posts his front leg and hinges at the shoulder. Hinging at the shoulder clearly reduces the length of the radius *r*, which in turn reduces velocity.


Not only does the velocity decrease, but the hinging at the shoulder requires it to do most of the deceleration in the deceleration of the arm at release. Throwing the ball this way is like putting the fulcrum of a trebuchet at the shoulder, as shown below, which means that the shoulder is where redirection of energy begins after release.



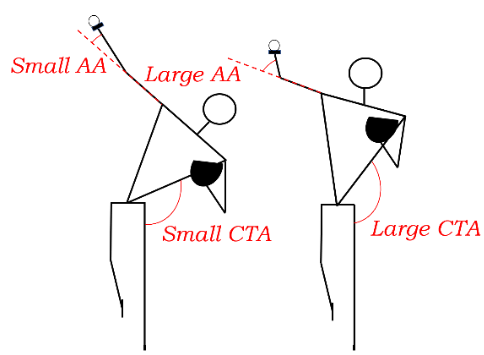

In other words, the tensile stresses go back to the ground from the shoulder and not ideal for protecting the shoulder. Notice in image 9 of the pitching sequence how the pitcher continues to bend and the hips. This position after release would be like putting a fulcrum of a trebuchet at the hips, as shown in the following image.




Then the transfer of energy returns to the ground from the hips. In other words, the energy is redirected through the shoulder to the hips and back to the ground. So we do not want the energy to go back to the ground from the shoulder but the hips. The key phrase is "**energy is redirected through the shoulder**," and not "**energy is redirected to the shoulder**." So not only does the geometry of throwing with accuracy have performance correlations, but injury as well.

## <u>The Geometry for Preventing Injury</u>

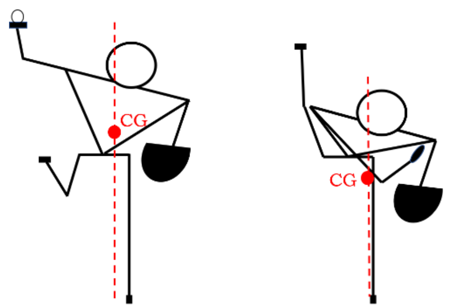
In image 9 of the pitching sequence on page 2, notice how the pitcher extends his arm as he continues to rotate his trunk about the hips as he releases the ball. This position allows the bigger muscles (left quadricep, left gluteus, and right latissimus dorsi) to help decelerate the arm after release. So the geometry of the pitching motion also has injury implications inferring that proper limb orientation helps prevent injury. In other words, the positioning of the joints with each movement of the pitching sequence must have proper limb angles or alignments that eliminate mechanisms of injury. In the image below is one example of limb and joint orientation.



Notice the relationships of the arm angles *AA* to the contralateral tilt angles *CTA*. As the *CTA* increases, so does the *AA* and vice versa when the *AA* decreases. A small *CTA*, making the *AA* smaller, positions the UCL to withstand more tensile stress. As mentioned earlier, as the pitcher rotates the trunk forward about the hips, image 9 of the pitching sequence on page 2 allows the larger muscles (left quadricep, left gluteus, and right latissimus dorsi) to assist in the deceleration of the arm after release. If the *CTA* is too extreme (huge tilt glove-side), it restricts the large muscles from assisting fully in arm deceleration. Therefore, the arm is hung out to dry.

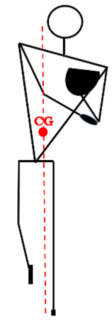
**<u>Visualizing Proper Alignment Toward HP</u>**

A good visualization of how a pitcher keeps the ball on the target longer is to draw a line down the middle of the pitcher's body just as he lands with his front foot. Let us say that the line is where the CG drops to the ground, as shown below.




The more he keeps bending over his front thigh, keeping his truck and arm moving as one link as long as possible, the longer the ball stays on the throwing arm side of the red centerline, as viewed from the front. Hence, improving accuracy.

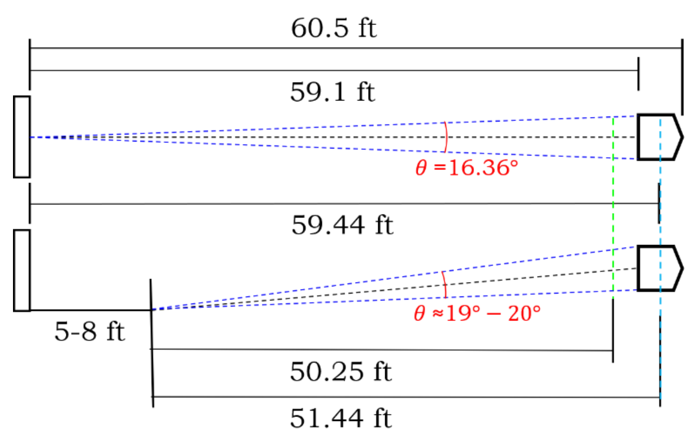
Most teach to post up the front leg, making it challenging to continue bending unless the pitcher is hypermobile in the hamstrings. Therefore, the throwing hand crosses the red center line too early, pulling the ball off target, as shown in the following image.




When pitchers post the front leg causes several issues.

- It puts the landing leg's hamstring in a compromising position to be pulled or torn
- The shoulder is forced to do most of the acceleration and deceleration of the arm
- It causes accuracy problems
- It reduces velocity
- It reduces pitch count since the pitchers' arms fatigue sooner
- It reduces the effectiveness of the entire bullpen

Therefore, keeping the ball on the arm side longer before release improves a pitcher's accuracy. This fact is illustrated using the following image, as we look from a top view of the rubber and HP.




The obvious distance is from the rubber to HP at 60.5 ft. The measurement is from the front of the rubber to the back of HP. The 2nd measurement is from the distance from the front of the rubber to the front of HP. 3rd is the distance from the front of the rubber to the center of HP. The distance of interest is at the pitcher's release of the ball 8 feet in front of the rubber; the hitter tries to make contact with the ball in front of HP at 50.25 feet away from the release. It should be apparent that if hitters have less time to see the ball, releasing it closer to HP is a big part of deceiving the hitter. A little number crunching illustrates this fact by using ratios. We use the ratio below to calculate the perceived velocity from the hitter view of a 90 mph fastball released 8 ft in front of the rubber.

$$\frac{90\ mph}{50.25\ ft} = \frac{x\ mph}{1\ ft} \implies x = 1.80\ mph$$

Each foot closer to HP makes the perceived velocity 8 ft times 1.80 mph, which equals 14.33 mph faster than 90 mph, so the hitter perceives it as a 104.33 mph fastball. As the velocity increases from the pitcher, so does the perceived velocity per ft. A 95 mph fastball would be perceived to be a 110.12 mph fastball. In this case, we have to give the hitter credit to get to a perceived 104 mph or 110 mph fastball, which is why pitchers need to release the ball further in front of the rubber to stay ahead of hitters.

The angle θ has significance from the standpoint that the pitcher's hand at release can stay in the same position as he moves the ball in and out at HP. Also, pitchers that can make the ball come out of the same arm slot are the most successful at any level of baseball.

As mentioned earlier, the best pitch in baseball is a well-located fastball. Secondly, pitchers must be able to command their off-speed pitches. They must understand that their off-speed pitches have two targets; where to start the pitch and where they want it to finish. This is possible if the throwing arm stays on its side as long as possible, ensuring all of the pitches in the pitcher's arsenal hit the target with more consistency, as demonstrated in this material.

## Conclusion

Without question, pitching for accuracy is both mental and physical, although some tend to lean toward just the mental side. The bottom line, if understanding the physical aspect of throwing with accuracy is mastered, the mental side is a lot easily attainable. In other words, if the physical side is locked in, the cues on page 1 are more easily achievable. In addition, as demonstrated throughout this material, pitching with accuracy directly correlates to performance and injuries.