Kinesiology of a Baseball Swing

C.J. White, Brody Rollins, and Jack Hoey

INTRODUCTION

The ability to hit a baseball is a skill in which has many components that need to flow smoothly in order to be successful in competition. Different areas of the body will need to perform flexion, extension, abduction, adduction as well as rotational movements,. These movements will occur through the sagital, frontal and transverse planes to provide the optimal swing path and bat velocity to produce maximal force and best results in the sports setting.

Subject Description : The subject of this analysis is a 6ft 2 inch male , he is hitting a baseball off a tee with maximal effort.

Swing phases : Stance , Load , Contact and Follow-through phases

Purpose statement : The purpose of this analysis is to provide feedback of optimal swing analytics that will produce maximal force and the best results in a sport setting.

STANCE PHASE

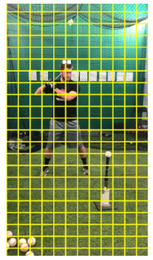
According to the first source listed The effects of baseball bat mass properties on swing mechanics, ground reaction forces and swing timing "A batter has approximately 400–500 ms (ms) from ball release until the time the pitch crosses the plate to evaluate the pitch (wind-up), decide to swing (pre-swing), and complete the motion of swinging (swing)"

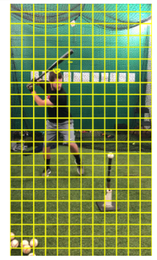
It also states that "Due to neuromuscular restrictions, it takes 100–150 ms for a hitter to decide to swing, and about the same amount to set their motor program in the pre-swing. This leaves only about 150–200 ms for the hitter to swing the bat and make contact with the ball"

During the Stance phase the feet are shoulder width apart with both knees slightly flexed. The right arm is abducted, while the left arm is adducted. This is the closest the movement will adopt the defined athletic position with the weight being evenly distributed on both sides of the body.

A good drill for the stance phase is to hit while standing on a wooden board. This requires the athlete to stand in the same spot every time and grooves the muscle memory of the stance phase.

LOAD PHASE





The load phase is the key position for generating the force and power that will transferred in the swing and exerted on the baseball.

In this phase you can see the movement in the frontal plane backwards as compared to the first phase as the head has moved backwards and lowered in the frontal plane. This is easily seen by comparing the stance and load phase pictures and using the grids and markers to locate the movement of the head and body down and back in the frontal plane.

Also in this phase you can see the external rotation of the shoulders along with the full abduction of the right shoulder, the flexion in the knees, and the plantar flexion of the front foot.

It is critical in this phase to be balanced and to maintain that balance while also creating torque between the upper and lower body, like stretching a rubber band.

A great drill to help with the sequencing of the load phase is the "David Ortiz" drill in which the hitter practices touching their left elbow to their left knee before swinging which will improve balance and torque.

CONTACT PHASE

The hard part about making contact with a baseball is not only just trying to hit it, but also trying to hit it hard and far. Launch angles and exit velocities are important in determining how well a ball was hit. Recent studies have shown that a launch angle between 25 and 35 degrees is optimal for performance.

According to the third source very large forces, reaching values as high as 8,000 lbs are required to change the motion of the 5 1/8-oz. ball from as speed of 90 mph toward the plate to a speed of 110 mph toward center field in the 1/1000th of a second during which the bat contacts the ball. The ball is compressed to about one-half its original diameter; the bat about 1/50th as much.

In the contact phase you can see the internal rotation of the shoulders and the adduction of the right shoulder that was previously abducted, the flexion of the left leg and knee. The front foot begins to plantar flex while the back leg drives off of the ground and moves forward in the frontal plane. The extension of the arms and the front leg generate the force and guide it from the load phase.

A great drill for enhancing the contact phase and the amount of force exerted onto the baseball is to swing a lighter bat which will allow the body to move faster and the muscles to exert more force so when swinging the normal bat it will exert the same force and speed.

FOLLOW-THROUGH PHASE

According to the second source, bat swing velocity (BV) can be trained and "significant relationships do exist between sports performance variables and BV, but one cannot interpret this to mean a cause and effect relationship. Other variables, such as hitting mechanics and bat properties (mass and moment of inertia), are also important in producing greater BV."

Finally, in the follow-through phase we fully enter the transverse plane as left leg and hip have both now extended, the left leg has become the dominant weight bearing area. The back leg is used for support and guidance as the foot is just returning to the ground.

During this phase we see the right shoulder and arm have moved into hyper adduction whilst the left arm is in an abducted state.

A good drill for the follow-through phase is to swing a heavier bat which forces you to keep your

CONCLUSION

Overall, as previously stated there are many vital components in a successful hitting movement.These critical components vary throughout the different stages of the movement, but are equally key to producing maximal force. There are so many moving parts that need to synchronize correctly in a short amount of time that make hitting extremely difficult.

Optimal performance in hitting a baseball is reliant on having a consistent and smooth swing, which is extremely difficult to achieve. There are so many moving factors, body parts extending, flexing, rotating, abducting, etc. that makes it extremely difficult. It takes many hours to create and groove a swing that is consistent and even then it is still not close to perfect, but all professional hitter's swings can be broken down into the four stages talked about in this poster.

REFERENCES

1. Laughlin, W. A., Fleisig, G. S., Aune, K. T., & Diffendaffer, A. Z. (2016). The effects of baseball bat mass properties on swing mechanics, ground reaction forces, and swing timing. *Sports Biomechanics, 15*(1), 36–47. Retrieved from https://ezproxy.gardner-webb.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=114607491&site=ehost-live
2. Szymanski, D. J., Beiser, E. J., Bassett, K. E., Till, M. E., & Szymanski, J. M. (2011). RELATIONSHIPS BETWEEN SPORTS PERFORMANCE VARIABLES AND BAT SWING VELOCITY OF COLLEGIATE BASEBALL PLAYERS. *Journal of Strength and Conditioning Research, 25,* 1. Retrieved from http://ezproxy.gardner-webb.edu/login?url=https://search.proquest.com/docview/1284354967?accountid=11041
3. Morton, Elizabeth. (2007, May) *Forces on a baseball.* Retrieved from https://www.grc.nasa.gov/www/k-12/airplane/ballforce.html