Strength and Conditioning for Throwing Arm Injury Prevention in Baseball

Rotator cuff tears are a common source of shoulder pain. The rotator cuff consists of four shoulder muscles and their tendons. Tendons are strong fibers that connect our muscles to our bones. The shoulder muscles and tendons cover the upper end of our arm bone forming a cuff. The natural risk of rotator cuff tears increases with age. The aging process can cause the tendons and muscles to degenerate and weaken. Rotator cuff tears can also result from sudden shoulder movements or overuse, for instance during sports, such as pitching in baseball or playing tennis, or falls. The rotator cuff muscles form a single cuff of tendon that connects to the head of the humerus bone. The muscles allow the arm to rotate and move upward to the front, back, and side. The bursa sac lubricates the rotator cuff tendons allowing us to perform smooth and painless motions. Rotator cuff injuries are very common in baseball.

We use the rotator cuff muscles to perform overhead motions, such as lifting up our arms to put on a shirt, comb our hair, or reach for an item on a top grocery shelf. These motions are used repeatedly during sports, such as throwing or pitching a baseball. The rotator cuff also provides stability when our elbow flexes and as we lift objects. The decision on how to treat rotator cuff tears is very individualized. Some rotator cuff tears can be treated with non-surgical methods. However, surgical procedures, often with long recovery periods, are very common in treating rotator cuff injury. Rotator cuff maintenance guided by a proactive exercise program can be used to strengthen these essential muscle groups to avoid arm injuries and keep players off of the disabled list.

The risk of rotator cuff damage increases with age as the blood supply to our tendons decreases. This causes the tendons and muscles to degenerate, weaken, and become susceptible to tearing. Additionally, the tendon degenerates with age. The body's ability to repair the tendon decreases over time because of the reduced blood supply. Sometimes the aging process can cause bone spurs to grow on the scapula. Shoulder problems and injuries occur when bone spurs and bursa inflammation restricts the space that is available for the rotator cuff tendons. The tendons can tear as they rub across the bone spur, particularly when the arm is elevated. Inflammation of the tendon membranes may develop causing tendonitis. Weakness in the key muscle groups, overuse, or repetitive activity can cause rotator cuff tears. This includes athletes that perform overhead movements during such sports as baseball. Pitchers regularly suffer rotator cuff injuries.

The symptoms of a rotator cuff tear tend to appear gradually. Pain may first develop in the front part of the shoulder. This pain may spread down the side of the arm. The pain may be mild at first and increase when the athlete lifts their arm or lowers their arm from a fully raised position. Over time, the pain may be present when they rest and it may even wake them while they sleep. However, some rotator cuff tears are not painful at all. The shoulder may feel stiff. It may be difficult to move the arm. They may hear a crackling noise when attempting to move the arm. The arm may feel weak, especially when they lift or rotate it. The symptoms of a rotator cuff tear caused by traumatic injury occur

suddenly. The athlete may feel a snap and sudden pain and their arm will immediately feel weak and they will have difficulty moving it.

Pitcher's elbow, also called Little League elbow, results from excessive throwing motions used in sports. It most frequently occurs in baseball, but is associated with other sports that involve throwing. Pitcher's elbow causes pain and interferes with motion. Many cases of pitcher's elbow respond to rest and treatment. Pitcher's elbow, if left untreated, can lead to significant problems that require surgery. The two bones of the forearm, the ulna and radius, and the upper arm bone, the humerus, form an individual's elbow joints. Muscles, nerves, tendons, and ligaments allow the elbow joints to bend, straighten, and rotate. Tendons are strong fibers that attach your muscles to your bones, and ligaments connect your bones to each other. Pitcher's elbow occurs in players that participate in sports that require repetitive throwing. It most frequently affects pitchers, but may also develop in outfielders, catchers, and infielders.

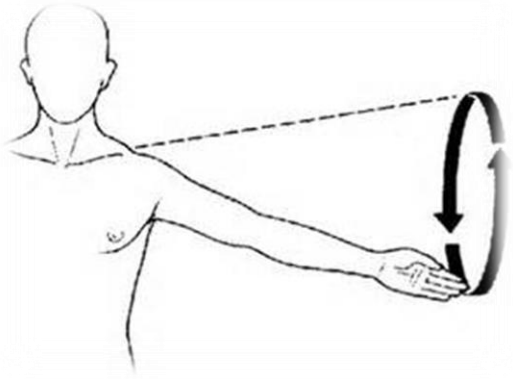
Pitcher's elbow is also known as Little League elbow because it occurs in children and teenagers that play sports. The condition is especially concerning for this population because their bones are growing and injuries can affect the growth process. Additionally, their skeletal systems may not be developed enough for the demands of competitive sports. Pitcher's elbow results when repetitive throwing puts an excessive strain on the tendons and ligaments in the elbow. The strong movements can cause the ligaments and tendons to stretch, tear, or pull away from the bone. If some of the bone is also torn away in the process, it can interfere with normal bone growth and cause deformity. If the forces are great enough, the bones may slam together, causing the bones or cartilage to fracture, and resulting in further injury. Pitcher's elbow causes pain on the inner side of the elbow. The elbow joint may feel like it locks or gets stuck. It may be difficult to move the elbow and it will adversely affect pitching performance.

A doctor can diagnose pitcher's elbow by reviewing the individual's medical history and examining their elbow. The doctor should be told about the amount and frequency of sports participation, the number of throws typically performed, and the length of the practices or playing season. This information will help the doctor determine the magnitude of the stress on the elbow. X-rays or magnetic resonance imaging (MRI) scans will be ordered to view elbow structures. The athlete should stop performing throwing activities and allow the elbow to rest if they experience pain. Ice packs may help relieve pain and swelling. Following rest, throwing should be returned to gradually. Therapy can be helpful, and sometimes a review of the athlete's pitching motion and mechanics may be beneficial. If pain persists or recurs with throwing activities consult with a doctor again. Arthroscopic surgery can both diagnose and treat conditions associated with pitcher's elbow. Arthroscopic surgery is associated with shorter recovery times and less pain and bleeding than open procedures.

Following surgery, physical or occupational therapy is helpful for regaining mobility, strength, and function. Arthroscopic surgery is not appropriate in every case, with some problems requiring open procedures. Recovery from pitcher's elbow is different for everyone. It depends on the extent of the condition and the type of treatment received. Most players can return to play when their rehabilitation is complete. An athlete may prevent pitcher's elbow by taking breaks from pitching, limiting the amount

of throwing that is performed, and making corrections to their throwing motion or mechanics if necessary. Strengthening exercises and proper warm-up are both essential in increasing the strength, flexibility, and longevity of the arm. Below are a series of strength and conditioning exercises that proactively work to help maintain throwing arm health. The goal of these exercises is to improve the strength and flexibility of the arm in order to prevent injuries. The only specialized equipment required for this program is a set of surgical bands or exercise bands. Many of these types of bands that have been specifically designed for baseball are readily available from sporting goods and equipment retailers. Generally speaking the program can be followed 2-5 times a week, preferably during the off-season. However, the program can also be used on a less frequent and intense basis during the season. If followed properly, the athlete will gain significant strength in the arm and shoulder which will lay the groundwork for preventing injuries and increased levels of arm performance.

<u>Exercise 1:</u> *Rotator Cuff Arm Circles*



Purpose: This is one of the most critical exercises for warming up the rotator cuff. They will help prepare those muscle and tendon groups for throwing a baseball. These tendons and muscles keep your arm bone in the shoulder socket and provide the flexibility to perform circular arm motions. A set of arm circles is the first exercise that is done to warm up the smaller muscles in the shoulder. Arm Circles will also build up flexibility, balance, strength and stamina in the rotator cuff muscle group. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: Begin by rotating your arms forward in a circular motion beginning with 5 small, then 5 medium sized, and lastly 5 large rotations. Perform this warm up in a controlled and slow manner. Immediately following the forward rotations, proceed with reverse rotations beginning with large rotations first, medium second, and small last. Pitchers can use variation with this dynamic stretching exercise by changing your hand positions. The first set of forward and reverse rotations will be with your thumbs facing the sky to simulate a curveball grip. The second set of rotations will be with your palms facing the ground to simulate a fastball grip. Finally, the third set will have your thumbs facing the ground to simulate a changeup grip. Perform each set with 15 repetitions forward and backward. This dynamic stretch will ensure that your rotator is properly prepared for throwing. Add weight to the exercise by having the player place a baseball(s) in their hands while performing the circles.

Equipment: None or several baseballs to place in hands during arm circles.

Exercise 2: *Internal Shoulder Rotation (Throwing Arm)*

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arms, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: Place clip of exercise bands at approximately hip height. Attach the wrist band to your throwing arm. Position your body so that your throwing arm is on the side of your body closest to the fence where the exercise bands are attached. Place your throwing arm's elbow on your hip with the arm pointed outward so that it is at a ninety degree angle to the hips. Place off-hand under the armpit of the throwing arm. Position yourself so that the bands are under tension but not so tight as to make the exercise uncomfortable. Make sure that your shoulders and hips remain square at a ninety degree angle to the fence and that your toes remain pointed forward. Keep your chin up and breathe normally thru the exercise's repetitions. The throwing arm's hand or palm should rotate flat onto the stomach of the body. Now slowly allow the arm to revert back to its starting position. Start with about 5-10 repetitions increasing to 10-25 repetitions as your strength increases over time. If the exercise is painful, position your body so that there is less tension on the bands.

Equipment: Exercise bands and a fence to clip them onto.

<u>Exercise 3:</u> *External Shoulder Rotation (Throwing Arm)*

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arm, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: This exercise is conducted the same as the Internal Shoulder Rotation exercise but in the opposite direction. The exercise band clip should remain at the height of the hips. Attach the wrist band to your throwing arm. The off-hand should now be positioned on the outside elbow to help with stabilization through the exercise. Position your body so that your throwing arm is on the side of your body farthest from the fence where the exercise bands are attached. Your shoulders and hips should remain square at a ninety degree angle to the fence. Keep your chin up and breathe normally thru the exercise's repetitions. With the hand of your throwing arm lying flat on your stomach position your body so to create tension in the band. Once positioned slowly rotate the the hand of your throwing arm until it points straight forward at a ninety degree angle to the hips and shoulders. Now slowly return the hand to its starting position on the stomach. Start with about 5-10 repetitions increasing to 10-25 repetitions as your strength increases over time. If the exercise is painful, position your body so that there is less tension on the bands.

Equipment: Exercise bands and a fence to clip them onto.

Exercise 4: *Elevated Internal Shoulder Rotation (Throwing Arm)*

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arm, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: Reposition the exercise band clip so that it is at shoulder height. Attach the wrist band to your throwing arm. Position your body so that your throwing arm is closest to the fence and the exercise band's clip. The hips and shoulders should be square and at a ninety degree angle to the fence. Feet should be positioned a bit further than shoulder width apart with the toes pointing straight forward. The throwing arm should point directly forward with the elbow at shoulder height and bent at a ninety degree angle with the arm and fingers of the hand pointing straight upward. The off-hand should be positioned under the elbow of the throwing arm in order to help stabilize its height thru the exercise's repetitions. Reposition the body so that the exercise band has tension with the throwing arm's hand in this upward pointing position. Slowly rotate the throwing arm away from the fence so that the palm faces downward and the arm reaches a position that is parallel with the ground. Slowly return the arm to its starting position. Start with about 5-10 repetitions increasing to 10-25 repetitions as your strength increases over time. If the exercise is painful, position your body so that there is less tension on the bands.

Equipment: Exercise bands and a fence to clip them onto.

<u>Exercise 5:</u> *Elevated External Shoulder Rotation (Throwing Arm)*

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arm, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: This exercise is conducted the same as the Elevated Internal Shoulder Rotation exercise but in the opposite direction. Keep the exercise band clip so that it is at shoulder height. Keep the wrist band attached to your throwing arm. Position your body so that your throwing arm is farthest away from the fence and the exercise band's clip. The hips and shoulders should be square and at a ninety degree angle to the fence. Feet should be positioned a bit further than shoulder width apart with the toes pointing straight forward. The throwing arm should point directly forward with the elbow at shoulder height and bent at a ninety degree angle with the arm and fingers of the hand pointing straight upward. The off-hand should be positioned under the elbow of the throwing arm in order to help stabilize its height thru the exercise's repetitions. Reposition the body so that the exercise band has tension with the throwing arm's hand in this upward pointing position. Start with the palm of the throwing arm at shoulder height and parallel to the ground. Slowly rotate the throwing arm upward and away from the fence so that the palm faces towards the fence and the arm reaches a position that is at a ninety degree angle with the ground. Slowly return the arm to its starting position. Start with about 5-10 repetitions increasing to 10-25 repetitions as your strength increases over time. If the exercise is painful, position your body so that there is less tension on the bands.

Equipment: Exercise bands and a fence to clip them onto.

Exercise 6: *Reverse Throwing*

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arm, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: Attach the exercise clip to the fence at shoulder height. Attach the wrist band to your throwing arm. Position your body so that you are facing the fence and the exercise clip. Keep your shoulders and hips square to the fence. Take a large stride forward with the opposite foot as your throwing arm. The back leg should now be straight and the front leg should be bent but not all the way to ninety degrees. The toes should remain pointed at the fence and the shoulders and hips square. Allow your throwing arm to dangle with the wrist strap and then reposition your body so that the tension pulls the arm so that it is now pointing at about the level of the clip on the fence. Take the arm in a reverse motion of throwing so that the back of the hand moves straight back behind the head with the back of the hand facing away from the fence. The hips should remain as square as possible to the fence while the shoulders rotate back with the throwing arm so that they are at about a ninety degree angle to the fence. Slowly take the arm forward and back to its original starting position. Start with about 5-10 repetitions increasing to 10-25 repetitions as your strength increases over time. If the exercise is painful, position your body so that there is less tension on the bands.

Equipment: Exercise bands and a fence to clip them onto.

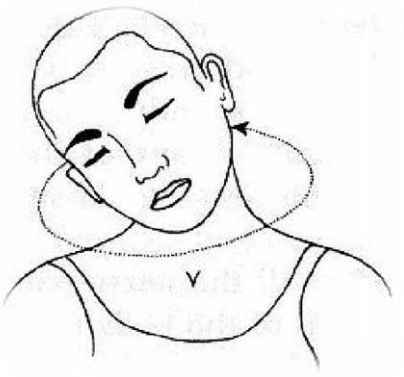
Exercise 7: ***Forward Throwing Motion***

Purpose: Throwing arm specific exercise that strengthens and warms the muscles of the shoulder, elbow, arm, and upper back. The drill warms and oxygenates the shoulder, promotes good flexibility and range of motion, creates endurance, and lays the ground work for better recovery from throwing.

Description: Place the exercise band clip at about chest height. Try to use the two fingers of the throwing arm in the wrist strap or end of the exercise band to simulate the grip on a real baseball. Start by positioning your body with the throwing arm closest to the fence where the clip is attached. The shoulders and hips should be at a ninety degree angle square to the fence. Feet should be placed outside of shoulder width apart with toes pointing straight forward. Player should be balanced with weight slightly over the balls of the feet. Player should start by positioning themselves so that the throwing arm is loose and is hanging freely on the fence side of their body with the band in their hand with the proper grip. Now reposition the body further away from the fence so that the band gains tension and the throwing arm is pulled so that it starts at about shoulder height and parallel to the ground. Once this position is obtained the player will rock slowly back towards the fence so that their weight shifts almost entirely to their back foot. The front leg should straighten out as this shift backward occurs. Their back should remain straight. Now the player will simply move in their regular throwing motion from this position being sure to keep the band in line with their arm slot. Proper throwing mechanics should be maintained as the arm moves through its regular throwing motion and the player ends with their weight and arm forward. Start with a single set of 10-20 repetitions until the arm is ready for more.

Equipment: Exercise bands and a fence to clip them onto.

<u>Exercise 8:</u> *Neck Stretches*

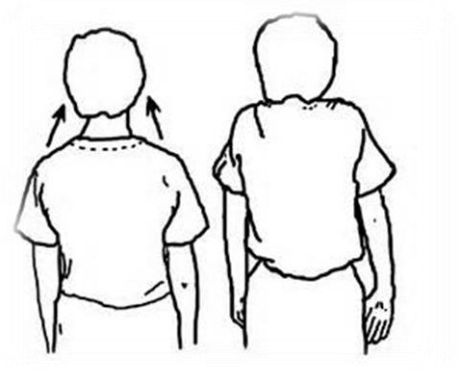


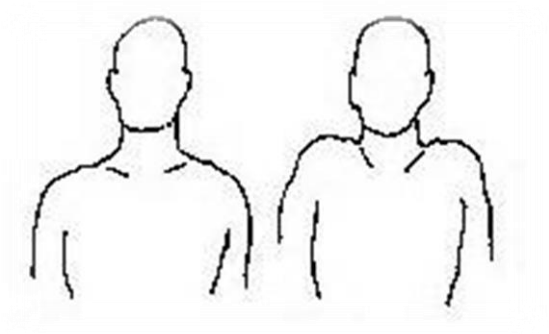
Purpose: Gaining flexibility in the muscles of the neck, upper back, deltoids, and shoulders helps prepare these muscles groups for the dynamic and often violent movements of the baseball throwing motion. These muscles groups are frequently overlooked by many players when warming up and preparing to pitch or for regular position play. Neck stretching should always be a part of any normal throwing routine in training or while preparing to practice or play in a game. The movements will also allow for a certain amount of relaxation to be obtained as these muscle groups are often tense.

Description: The first series of stretches are performed in a side to side motion of the neck. While standing the athlete will bend their neck to the left and hold for 1-2 seconds. Repeat the bend to the right, and repeat. Perform 8-10 repetitions per side. The second portion of the exercise incorporates the downward flexion of the head. The athlete should keep the shoulders relaxed then will proceed to bend their neck or head straight down so that the chin almost reaches your chest. Hold for 1-2 seconds, return to the starting position, and repeat 8-10 times. The final sets of exercises are the neck rotations. While looking forward the athlete moves their head down into the flexion position. They will then rotate their head to their left shoulder. Now they will rotate their head so that they are looking at the sky and the back of the head is almost touching the upper back. Finally, continue to the right shoulder, and back to starting position. Perform five rotations each way.

Equipment: None

Exercise 9: ***Shoulder Shrugs***





Purpose: This exercise is a three part dynamic stretch. Performing this exercise will help to warm up the muscles of the shoulders, upper back and neck and can be considered a general progression of the neck exercises described in the previous section. Tension in the neck and shoulders can be considered a possible precursor to injuries involving a players throwing motion. Again, these types of exercises that focus on the muscle groups of the neck, shoulders, and upper back are frequently overlooked by players and coaches as a part of preparation to pitching and throwing.

Description: Start with your arms and your hands pressed up against your sides. Maintain good posture with a straight back, chin and chest out, and shoulders square but relaxed. The exercise begins by simply raising the shoulders upward until a squeeze is felt. Once this squeeze is felt the shoulders should be lowered back down slowly and into a relaxed position. The arms should remain loose and relaxed while performing the stretch movements. In the second part of this dynamic exercise the athlete will bring their shoulders up exactly like the previous motions except that they will slowly roll their shoulders backwards. The final variation is performed by having the athlete roll their shoulders

Equipment: None

Exercise 10: *Long Toss Throwing Program*

Purpose: Long toss is a systematic throwing routine that is designed to provide the throwing arm with maximum health, strength, endurance, accuracy and recovery period. One of the most important things a baseball player can do is to understand and know their own arm. Long tossing will give them this opportunity because they have to follow the pace of their arm, rather than throw just for the sake of throwing. Long toss is one of the most dynamic throwing exercises that a player and coach can learn and perform. A good long toss program generally takes many weeks to properly establish. The following description allows that an athlete has learned to long toss properly and has an established routine that is specific to their arm's development. For someone who is new to long toss it might take a couple of weeks at a relatively short distance (100-150 feet) to stretch and lengthen the arm, to where it feels good , before moving on to the more pivotal extension and strengthening phase.

Description: The first key to conditioning the arm is learning how to stretch out the arm the right pace. Generally speaking this type of throwing can take four to six weeks to establish for players who are new to this type of exercise. Initially the player must focus on allowing the arm to stretch out while throwing. The key is to focus on a loose arm action. Throwing should feel good and a player must learn to allow themselves to throw as far a distance as the arm will allow without discomfort or pain. The athlete must always focus on good throwing mechanics for consistency and arm support. The idea is to learn how to allow the arm to stretch out naturally while throwing without any strain. Allowing the muscles of the arm to lengthen and stretch naturally during the throwing motion does not promote swelling of the arm muscles and promotes faster recovery periods which will allow for throwing on a daily basis. Though the goal (out of season) is to throw on a daily basis it is typical that the arm will need to be rested periodically until a base is firmly established. While warming up the arm before a practice or a game during the season the long toss dynamic warm up can still be used on an as needed basis.

As the arm begins to develop endurance it will allow the player the ability to throw more often and to throw for more distance. The stretching phase of throwing will generally go from 150 feet to 250

feet for more physiologically advanced individuals. Length and distance will come in time if this type of smarter and more consistent throwing is maintained. Younger players will likely throw at shorter distances. Also, it should be noted that when a player goes beyond 150 feet, he should use his legs to "crow hop". This will help take pressure off the arm. The stretching out phase of the long toss throwing exercise program is critical in stretching and warming the arm up, the extension and lengthening of the arm muscles without strain, and creating increased arm speed, all of which help optimize the pull-down and strengthening phases of the player's throwing arm development.

The pull down phase helps to further generate blood flow and warmth to the arm, increase arm speed and arm strength, lower the player's release point and acceleration or "finish" through the release point. Because the arm muscles that are involved in throwing have been lengthened and the arm loosened, there is more flexibility created for the arm to generate a quicker response. As the arm opens up there is more "freedom" in the arm to maximize a natural whip. In effect, pulling down is not a stressful action because the arm has length in it. The pulling down phase becomes acceleration through the arm's stretch. Arm strength is created during the pulling down phase because the additional distance provides the arm with an opportunity to generate more arm speed on longer, looser and well-conditioned muscles. The amount of throws during the pull down phase will vary but a rule of thumb is to come in 10 feet at a time with each throw. Once the player gets to about 60 or 70 feet they are free to pull down as long as the arm is not stressed or fatigued. For some players this may last for several minutes after the base has been established. Players generally can take a few minutes to warm down once they are satisfied with the amount of pull downs.

After peaking through the stretch phase, players will come back toward their throwing partner in a very methodical manner. This is to maximize the length that has been created in the arm that will promote greater arm speed. As the players come in closer they will notice that it will take concentration to pull through their stretch without decelerating their arm. If they decelerate or ease up on their throw they will have missed the opportunity to increase their arm speed and enhance their arm strength. In order to pull down correctly they must learn to accelerate through their release point by taking their maximum effort throw into each throw on the way back in toward their throwing partner. For example, each throw on the way in is still a maximum distance or effort throw. The difference is that the length of the throw is happening at a shorter and shorter distance. Though the player will be throwing the ball a lot harder, if done correctly, they will be throwing through a stretch without any additional effort. For this to happen correctly they must stay relaxed over their balance point, have great downward extension through their release point and stay mechanically sound and consistent.

Final Key Points:

1. The player's body language should be loose and relaxed
2. The player must stay aware of their direction and their mechanics.
3. Players must keep their back hip over their back heel to maintain their balance for as long as possible.
4. After their last peak throw players should come in approximately 10-15 feet per each throw.
5. Each pull down throw should have the same effort as a peak throw.

6. Players should always finish through their release point and maintain low and not high throws.
7. A Player's focal point should get lower as they get closer to their throwing partner.
8. Players must work on finishing through your partners opposite knee without "flying open".
9. A player's throwing mechanics must be consistently maintained throughout the long toss exercise.

Equipment: Large throwing area with flat ground and well maintained surface. Players will need a baseball, gloves, and a partner to throw with.