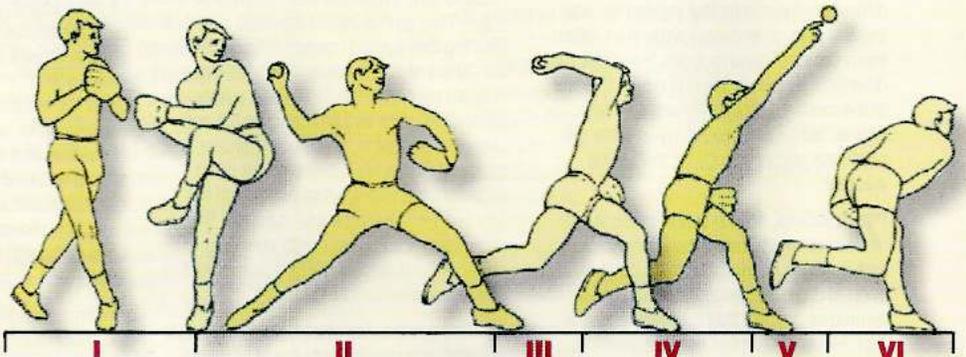


THROWER'S



THROWING MOTION SEQUENCE

The throwing motion has been divided into six phases, a complex sequence that takes less than two seconds:



ELSEVIER ORTHO JOURNAL

SHOULDER

ACROSS CENTRAL NEW YORK,
PITCHERS ARE WARMING UP AND
SHOULDERS ARE BREAKING DOWN

BY TODD C. BATTAGLIA, MD, MS

High-speed throwing represents the pinnacle of function for the human shoulder. Talented pitchers have a combination of tissue composition and structure that produces a shoulder with a perfect balance of mobility, strength and stability. But this balance is easily disrupted. Shoulder injuries are common in pitchers and other competitive throwers, such as those who toss the javelin. Shoulder pain is, in fact, the most common complaint from the throwing athlete. An estimated one in 20 professional pitchers has had shoulder surgery.

Most shoulder problems respond to a good rehabilitation program, but treating the injuries can be quite challenging. Critical to understanding throwing injuries is an appreciation of throwing biomechanics. The throwing motion has been divided into six phases, a complex sequence that takes less than two seconds:

For athletes, throwing creates repetitive stresses that can change both the soft tissues and bone. Most critical are the changes that allow more backward rotation during the cocking phases, specifically a gradual stretching of ligaments in the front of the shoulder. Throwers also can lose forward rotation. At first, these improve performance. Ultimately, they might disrupt the shoulder's perfect balance, causing pain and a decrease in performance. A number of specific abnormalities may occur in the thrower's shoulder. Many are highly interrelated and often occur in combination.

develop instability from a sudden injury, such as diving for a ball, that dislocates the shoulder. Most commonly, however, instability in throwers develops gradually from the repetitive stresses of throwing. Over time, the ligaments in the front of the shoulder are stretched out in response to the extreme external rotation of the shoulder that occurs during the early and late cocking phases. Accordingly, pain is usually gradual, with fairly subtle looseness limited to the one joint. This can eventually produce pain by itself. More commonly, pain is caused by subsequent labral and rotator cuff tears.

INSTABILITY

Instability, or excessive looseness of the shoulder joint, can occur several ways. Some athletes have a generalized, systemic laxity of all joints. Others may

INTERNAL IMPINGEMENT

Internal (that is, occurring inside the joint) impingement is only newly understood. Internal impingement usually happens when the shoulder ►

Through repetition, even a sophisticated throwing motion such as the New York Yankees closer Mariano Rivera's can injure the shoulder, the common complaint from professional pitchers. AP PHOTO BY KATHY WILLENS

PHASE I: Wind-up — called the “coiling phase.”

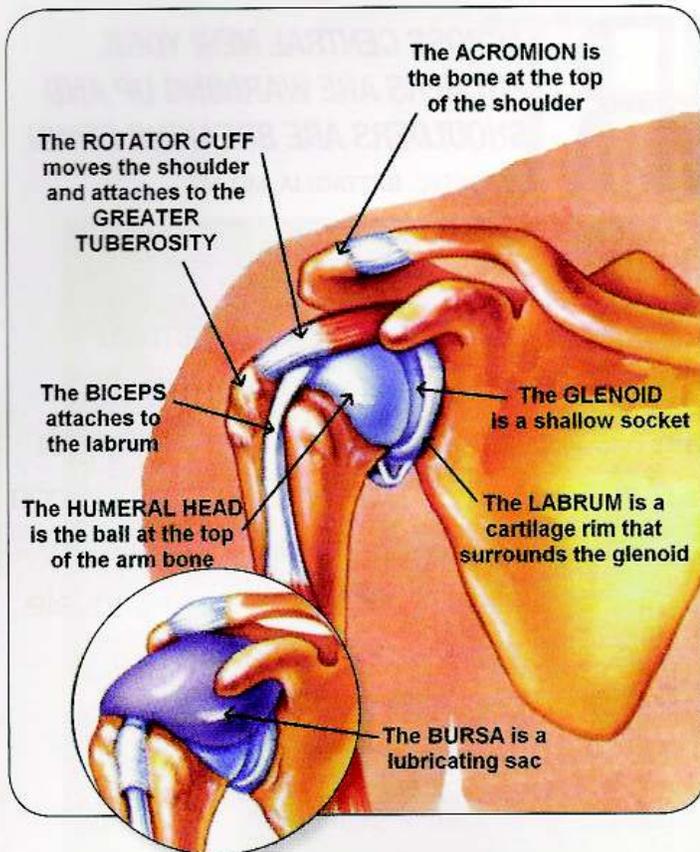
PHASE II: Early cocking — here, the arm moves to the side and prepares for maximum rotation.

PHASE III: Late cocking — this is the point of maximum rotation and maximum stress on the shoulder.

PHASE IV: Acceleration — shoulder rotation reverses, reaching speeds of up to 7,000 degrees per second until ball release occurs.

PHASE V: Deceleration — sudden muscle contraction abruptly slows the arm.

PHASE VI: Follow through — muscles rebalance and return to resting position.



has developed a degree of laxity. Most often, those injured say it hurts in the back of the shoulder when they throw. Over time, they may develop a loss of rotation and often see lower velocity and less control.

LABRAL TEARS

The labrum is a rim of cartilage tissue that surrounds the socket of the shoulder joint, and is where the biceps attach. Labral tears are quite common in the throwing athlete. Some studies have found tears in all high-level throwers. Labral tears may occur in the front of the shoulder as a result of instability, or in the back of the shoulder as a result of internal impingement.

ROTATOR CUFF INJURY

Although tendon tears in rotator cuffs are uncommon in very young throwers, there is an increased risk of tendon breakdown over time in older throwers. Bone spurs may develop causing direct irritation of the rotator cuff tendons. Early stages may only cause an inflammation of the bursa that cushions the rotator cuff. Further stress may also lead to inflammation and degeneration of the rotator cuff tendons themselves, and possibly result in tendon failure and tearing in advanced stages.

GLENOHUMERAL INTERNAL ROTATION DEFICIT

A condition known as GIRD, which stands for glenohumeral internal rotation deficit, is a loss of motion specifically seen in throwers. This occurs from a thickening and tightening of the ligaments in the back of the shoulder, probably as a result of forces in the last phases of the throwing motion. Initially, this results in a shift in the shoulder's rotation point, and may actually allow even greater backward rotation during wind-up

and cocking; this may temporarily improve the performance of the athlete. Over time, however, this can also contribute to internal impingement, increase stress on the labrum and biceps, and lead to labral and rotator cuff injuries.

TREATMENT

By far, the most effective treatment for all of these injuries is prevention. Every competitive thrower should maintain a regular, structured regimen of stretching and strengthening. Once a problem occurs, rehabilitation and physical therapy are usually the solution. In both situations, these programs focus on reducing pain, restoring and maintaining range of motion (including aggressive internal rotation stretches to prevent GIRD) and concentrating on strengthening, with particular emphasis on the rotator cuff and the muscles around the shoulder blade. One well-established, proven program is called the "Thrower's 10 Program" and is widely available online, including through the website of the American Sports Medicine Institute.

Surgery is rarely a quick fix, because recovery is typically quite long. Surgery is generally the last treatment option and reserved for those who fail to improve after an extended course of rehabilitation or those with clear structural abnormalities such as a labral or rotator cuff tear.

After surgery, a rigorous course of physical therapy is needed, followed by a very gradual return to throwing with strict adherence to proper throwing mechanics. In most instances, it can take nine to 12 months to return to competitive throwing. Unfortunately, many studies show that after shoulder surgery, less than half of players ever return to their pre-injury level of competition. ■

A SPECIAL NOTE: LITTLE LEAGUER'S SHOULDER

A condition unique to the young thrower is called Little Leaguer's shoulder. This is essentially a stress fracture of the growth plate at the top of the arm bone. Interestingly, adolescents nearing the end of their growth (13- to 16-year-old athletes) are at greatest risk for this injury. Typically, pain occurs only with hard throwing, although in more severe cases, dull, aching pain during rest may occur. There is often tenderness at the side of the shoulder, directly over the growth plate.

The injury is usually benign but the shoulder needs rest before throwing again. The player should not throw until all symptoms have gone away, which may take more than three months. Rotator cuff-strengthening exercises can help.

To prevent the injury, managers should count pitches. Age-based limits on the number of throws per game and per week have been established and should be closely followed for all adolescent pitchers. Certain pitches, especially curveballs and sliders, can increase the risk of Little Leaguer's shoulder. Specific pitch and pitch count recommendations are available through various online sources — including the American Orthopaedic Society for Sports Medicine and the American Sports Medicine Institute.

Todd Battaglia is an orthopedic surgeon specializing in sports medicine and arthroscopic surgery of shoulders and knees. He practices at Syracuse Orthopedic Specialists, PC. He may be reached at 251-2100 or orthodoc.aaos.org/ToddBattaglia.