Sports medicine professionals who work with throwing athletes are all too familiar with early-season throwing related injuries. The typical scenario often occurs in the first week of the competitive season. The athlete begins the season throwing at speeds and frequencies far surpassing those of the off-season. Within a few days the athlete presents with a sore arm. The pathologies may include, but are not limited to, biceps tendonitis, medial epicondylitis, and rotator cuff strains.

Throwing injuries are not exclusive to pitchers; field players can suffer them as well. Often the injuries are explained away as the required yearly rite of passage to get the arm in shape for throwing. Many of these athletes have participated in their sport since youth and have become accustomed to tolerating an early-season painful arm, which may not be necessary. Conventional treatments for these conditions, such as rest, anti-inflammatory medication, various therapeutic modalities, and occasionally a corticosteroid injection, may relieve the symptoms.

However, once these treatments have run their course and the symptoms have subsided, the athlete returns to throwing. The typical scenario described above is repeated. The athlete jumps from a period of rest into high intensity, high frequency throwing. It is not unusual to have recurring problems. Symptomatic treatment alone is not adequate. Unless the cause of the problem is identified, it will continue to be problematic.

The fundamental cause of these injuries is directly related to the dramatic increase in intensity and frequency of throwing. A good off-season program could prevent this annual trauma. This article describes an off-season exercise program that has been effective in preventing early-season injuries.

It takes a basic understanding of throwing mechanics to effectively manage throwing related injuries. Over the years, many studies have involved electromyographic (EMG) analysis to determine the specific muscle actions during each phase of the throwing motion (Jobe et al., 1983, 1984).

The overhead baseball throw is an explosive, high-velocity movement requiring strength, power, coordination, and synchronicity of muscular contraction. During the 4 phases of throwing—windup, cocking, acceleration, and follow-through—the shoulder and arm move through consistent motor patterns (Wilk et al., 1995).

Following is a basic overview of the throwing motion. The first phase, the windup, is as unique as the individual. It is the stage that prepares the body to throw. During the cocking phase the arm travels backward. It is late in this phase that the flexor-pronator group of the elbow fires eccentrically to decelerate the backward motion of the arm. In the third phase, acceleration, the body (legs, hips, and torso) generates the force that is transmitted through the arm to the ball. EMG studies by Jobe et al. (1983, 1984) showed very little muscle activity occurring during this phase.

The final phase of throwing is the deceleration or follow-through. It is during this phase that peak eccentric muscular activity in the posterior rotator cuff occurs and maximum compressive force is generated at the shoulder (Fleisig et al., 1995).

The eccentric contractions that occur during peak activity cause the early-season muscle soreness that can lead to overuse injuries. This microtrauma combined with the inherent laxity of the shoulder joint makes maintaining joint stability even more difficult, further increasing the chance of injury (Fleisig et al., 1995).

This repeated wear and tear can significantly shorten a pitching career. Therefore, any successful exercise or rehab program must incorporate both eccentric muscle contractions and joint stabilization exercises.
The typical off-season workout is a 20-min throwing session 3 to 5 times a week. Suddenly, with the start of the competitive season, the athlete is expected to throw for several hours a day as each throw is scrutinized for speed and accuracy. Thus the demands placed on the throwing musculature are significantly increased in a very short time. Therefore, these injuries are better classified as "underprepared" rather than overuse injuries, because the off-season workout was neither skill-specific nor progressively demanding enough.

A good off-season regimen will effectively prepare the throwing athlete for the competitive season and reduce early season soreness. Research has shown that for an off-season program to be effective, it must accurately reflect the demands of the game (Axe et al., 1996). Therefore the program should combine elements of strength training for specific muscular development and a progressive throwing program.

Various methods of strength training have traditionally been used for isolated muscle strengthening (Jobe exercises, surgical tubing, free weights, etc.). While a weight training program is needed for general muscle development, the motor patterns used in traditional weight training are not specific to throwing. A sport-specific exercise for throwing should include concentric and eccentric contractions at high speed.

The following off-season program combines the use of the slide board and a progressive throwing program for muscle strengthening and joint stability. We have found the slide board to be effective as a specific strengthening exercise for throwing athletes. It is a 3 x 6' (or larger) masonite slab mounted on plywood with 2 x 4" borders.

The slide board is a closed kinetic chain exercise requiring high-speed concentric and eccentric contractions. The exercises described below involve virtually all the muscles of the shoulder girdle and will increase proprioception and speed of muscular contraction. This form of exercise is quick, demanding, and allows for bilateral work to be completed simultaneously. The athlete will notice improvements very quickly.

Three basic positions can be used to strengthen the shoulder girdle using the slide board: glenohumeral flexion/extension, glenohumeral horizontal abduction/adduction, and glenohumeral circumduction. Each exercise can be performed in the push-up or modified push-up position, depending on the athlete's strength and comfort. Hand paddles made of padding covered with a stockinet material can be provided to allow smooth motion across the board (covered football knee pads work well for this).

The muscles used in these exercises include the deltoid, pectoralis major, pectoralis minor, supraspinatus, infraspinatus, teres minor, subscapularis, latissimus dorsi, trapezius, teres major, biceps, triceps, wrist flexors, and wrist extensors.

In the first exercise, glenohumeral flexion/extension (Figure 1), the athlete kneels perpendicular to the slide board with hands on pads and arms fully extended and shoulder-width apart. The back is straight, abdominals are tight, and the head is in a neutral position. The athlete is instructed to perform shoulder flexion on one side with simultaneous shoulder extension on the other side. This reciprocal motion should be continued for sets of 10 seconds.

The starting position for glenohumeral horizontal abduction/adduction (Figure 2) is the same as that described for the first exercise. The athlete is instructed to