



Little League Elbow (LLE)

Risk Factors and Prevention Strategies

The following information was captured from the December 2010 Strength and Conditioning Journal authored by Darrin Marsh, PT, ATC, CSCS, Department of Physical Therapy, McCarter Health Center, Parkersburg, West Virginia.

Little League Elbow is a common overuse injury brought on by the motion of throwing at high speed in a repetitive manner. The primary mechanism of overuse is Valgus Stress applied to the elbow. Skeletally immature athletes are vulnerable to overuse because of the existence of growth cartilage. At this young age between 7 and 18 the growth plates are not yet fused together which opens up the possibility of damage in this area. Approximate ages of fusion of secondary ossification center at the elbow happen between the ages of 13 and 18 years old.

The incidence of elbow pain in youth baseball players is reported to be between 20% and 40%. Most common injury is medial epicondyle or the inner elbow. This condition is often characterized by medial elbow pain owing to valgus stress placed upon the elbow during the cocking and acceleration phases of pitching.

Over Use Injuries can be classified into 4 stages:

1. Pain in the affected area after physical activity
2. Pain during activity without restricting performance
3. Pain during the activity that restricts performance
4. Chronic unremitting pain even at rest

The 2 major areas of concern for overuse at the elbow in youth baseball players are the medial epicondyle and the articular surface at the capitellum-radial junction. ***Other factors related to overuse that contribute to LLE include the following:***

1. Pitching Mechanics
2. Pitch Volume
3. Pitch Type
4. Physical Conditioning

Pitching Mechanics

Pitching mechanics entails the fundamental movement skills required in baseball pitching in youth athletes. Youth baseball pitching requires ***fundamental movements such as stepping, lunging, squatting, twisting, balancing and lifting***. A main contribution to LLE is pitching / throwing mechanics. The mechanics of baseball pitching may be divided into 6 phases for analysis and understanding. ***The phases of baseball pitching include the following:***

1. *The windup*
2. *Stride*
3. *Cocking*
4. *Acceleration*
5. *Deceleration*
6. *Follow-through*

1. ***The Windup*** begins the first movement and ends when the hand leaves the glove. The windup is the longest phase of baseball pitching at all levels and requires elevation of the stride leg while balancing on the posting leg.
2. ***The Stride*** begins as the hand leaves the glove and ends when the front foot contacts the ground. During the stride phase the athlete continues to balance on the posting leg while the hips and upper torso rotate forward and the arm is elevated to the throwing position.
3. ***The Cocking*** phase begins when the stride foot contacts with the ground and ends when the shoulder has reached maximum shoulder external rotation. During this phase significant medial tension and lateral compression forces are applied to the elbow.
4. ***The Acceleration*** phase is perhaps the most studied phase of baseball pitching. Acceleration begins with maximum shoulder external rotation and ends when the ball leaves the hand.

5. **The Deceleration** phase begins the ball leaves the hand and ends when the shoulder has reached maximum internal rotation range of motion (ROM). This is the shortest phase of youth baseball pitching.

Of the 6 phases of pitching the windup and stride may be most critical in youth baseball. This is because body movement and positioning early in the pitch sequence impact subsequent pitch mechanics. ***The 5 critical features during the windup and stride phase of pitching are as follows:***

1. **Lead with the hips.** Pitchers who consistently point their hip toward the target promote pelvic and trunk translation as well as weight transfer during the windup phase of pitching. Translation of the trunk and pelvis significantly impacts arm speed during the acceleration phase of pitching.
2. **Placement of the hand on the ball.** Placing your hand on the top of the ball as the ball is removed from the mitt during the stride phase is the second critical feature. Placement of the hand on top of the ball promotes forearm pronation and shoulder internal rotation. This early positioning of the forearm and shoulder facilitates proper shoulder abduction and shoulder external rotation later in the pitching sequence.
3. **Elevation of the arm.** This serves to position the elbow as or slightly above shoulder height before significant trunk rotation. Proper arm elevation reduces upper extremity stress during the cocking and acceleration phases of pitching.
4. **Foot place on ground.** How youth pitchers place their foot on the ground at the end of the stride phase is the fourth critical feature. For a right hand pitcher the foot should land either directly toward the target or slightly to the right. This positions the body properly, allowing optimal hip and trunk rotation during the acceleration phase.
5. **Closed front shoulder position.** The last critical feature is the ability to assume a closed front shoulder position. The closed front shoulder position keeps the shoulders and arms aligned toward the target during the stride. This prevents the common error referred to as “opening up”. The term “opening up” refers to the pitchers trunk facing home plate during acceleration.

Youth baseball pitchers who properly perform these critical features early in the pitching sequence impart less stress on the throwing arm and increase pitching efficiency, likely reducing their risk for developing LLE.

Pitch Volume

Pitch volume has been identified as a main contributor to LLE. Pitch volume may be defined as the number of pitches thrown in a game and the number of pitches thrown during a season. A study confirmed that there was a ***35% increase in elbow pain in athletes aged 9-12 years old who are throwing greater than 75 pitches a game and 600 pitches in a season.***

Another study found that adolescent pitchers who competed ***more than 8 months a year were 5 times more likely to sustain elbow injury requiring surgery.*** The same study found that baseball pitchers who ignore arm fatigue and continue to pitch are ***36 times more at risk for injury. These results appear to implicate muscle fatigue as a factor in LLE.***

Pitch Type

Another main contributor of LLE is pitch type. Most studies have investigated the impact of 4 pitch types:

- 1. Fast ball***
- 2. Curveball***
- 3. Change-up***
- 4. Slider***

Several investigators have ***recommended youth baseball pitchers not to throw breaking pitches (curveball and slider).*** This recommendation is based on the fact that throwing breaking pitches requires increased forearm supination and increased wrist movement when compared with the fastball. The difference in hand, wrist and forearm positioning and movement may lead to elbow injury.

Overall, it is recommended that youth baseball pitchers focus on the ***basic fundamental movements related to baseball including running, throwing, and catching.*** After mastery of these fundamentals, youth baseball pitchers should ***focus on fastball pitching mechanics followed by change-up pitching mechanics.*** Both pitches should be executed with accuracy.

Physical Conditioning

Lack of physical conditioning has been associated with LLE. Physical conditioning programs should focus on maximizing the performance and minimizing the risk of injury. Examples of programs that enhance physical conditioning are:

- 1. Warm-up activities,***

2. **Static stretching,**
3. **Resistance training,**
4. **Trunk strengthening**
5. **Neuromuscular training.**

Warm-up Activity. The warm-up component of physical conditioning is encouraged before throwing or pitching in youth baseball. The warm-up has been proved effective at reducing injuries in all sports. Overall, warm-up activities serve to elevate core body temperature, enhance motor unit excitability, improve kinesthetic awareness, and maximize active Range of Motion (ROM).

Static Stretching. Static stretching is best achieved after warm-up when the temperature of the soft tissues is elevated.

Resistance Training. Resistance Training has been shown to reduce the incidence of injuries in young and adult athletes participating in sports. Cahill and Griffith reported a reduction in knee injuries and knee injuries requiring surgery after the inclusion of resistance training into the preseason conditioning of high school football players. Also Lehnhard reported a significant reduction in ligament injuries with the addition of a resistance training program in men's college soccer. All youth resistance training should include proper lifting technique, safety procedures and specific methods of progression.

A possible mechanism of injury prevention is the effect resistance training has on connective tissue structures such as ligaments, bones, tendons, and cartilage. Resistance training may reduce the risk of injury in youth sports by changing the size, density and mechanical properties of connective tissue structures. Other benefits of resistance training include recruitment and activation of muscles and enhanced coordination within and between muscle groups. Strengthening muscles and connective tissues offers a means to increase the forces that athletes are capable of sustaining and helps to make the younger player more resistant to injury. Strength gains of approximately 30% to 50% are typical after short term (8-20 weeks) youth resistance training.

Resistance training that includes trunk strengthening may reduce the risk of injury in youth baseball pitchers. The muscles of the trunk are particularly important in pitching a baseball where the force generated by the legs and trunk must be transferred to the throwing arm and ball in a coordinated manner to maximize pitching efficiency.

The timing of trunk rotation may be related to elbow injury. A study found timing of the trunk rotation to be significantly different among youth, high school, college and professional pitchers.

According to the authors of the study, higher level pitchers begin trunk rotation towards home plate after stride foot contact, whereas lower level pitchers begin trunk rotation toward home plate before stride foot contact. Trunk rotation that occurs before stride foot contact leads to increased valgus stress at the elbow. Overall proper training of the trunk should focus on increasing rotational ROM, strength, endurance, and velocity potential.

Regulation of Pitching Volume

AGE	2010 Little League Baseball Mandatory Daily Pitch Limit
7-8	50
9-10	75
11-12	85
13-14	95
15-16	95
17-18	105

Youth Rest Requirements guidelines according to Little League Baseball

Pitches thrown in 1 day	Days of Rest Required
1-20	No rest days required
21-35	1 day
36-50	2 days
51-65	3 days
Greater than 66	4 days

Youth baseball pitchers must be empowered by coaches and parents to communicate feeling of fatigue and pain. Prevention of LLE must include all aspects of physical conditioning including a proper warm-up such as a light jog around the bases to static stretching. Static stretching is a safe way to improve muscle flexibility and joint ROM.

Youth resistance training should contain exercises that work the core and trunk such as pushups, lunges, shoulder exercises, knee exercises, back exercises and abdominal exercises with a twist. Youth athletes can benefit from properly designed age appropriate resistance training programs.

Inclusion it has been proven that the reduction in pitch volume played a big factor in the reduction of LLE injuries. Along with proper form and strength training your little league pitcher can have a safe and fun season playing one of the greatest sports baseball.