

## ACL Prevention Program

### Anatomy and Biomechanics

The knee is a hinge joint connecting the femur and tibia bones. It is held together by several important ligaments. The most important ligament to the knee's stability is the **Anterior Cruciate Ligament (ACL)**. The ACL attaches the front part of the tibia to the back part of the femur. The purpose of this ligament is to keep the tibia from sliding forward and rotating on the femur.

### Risk Factors

There are many factors that can increase the risk for an ACL injury. Due to the ACL's primary role in stabilizing the knee joint, the ACL is most susceptible to injury when twisting or rotational forces are placed on the knee. Although this can happen with contact, approximately 70% of ACL tears occur during non-contact events when athletes are cutting, decelerating or landing from a jump. Many studies have confirmed that muscle strength imbalances, poor coordination and inadequate sports-specific conditioning can increase the risk of an ACL injury.



### Prevention

ACL prevention programs have been shown to reduce this risk of ACL injuries by establishing proper jumping and cutting techniques. Our prevention program consists of three distinct components: a dynamic warm-up, a strengthening regimen and a plyometric training series. This protocol targets the muscles of the lower extremity that help support the knee. The progressive nature of our program ensures the athlete establishes the balanced muscle strength necessary to execute proper jumping mechanics. The initial focus on strength reduces the risk of knee cap pain that can be associated with early plyometric training programs. Our program then builds off these strength gains and progresses toward a comprehensive plyometric program simulating sport specific movement patterns. By promoting gains in strength, coordination and power, this program is designed to improve your team's athletic performance and reduce their risk of an ACL injury.

It is extremely important that your athletes demonstrate proper technique during all of these exercises. Athletes should be instructed to land each exercise softly with their knees slightly bent. Coaches should

emphasize a wide, athletic stance. Athletes should keep their knees and feet shoulder-width apart and not let the knees collapse inward (“knock knees”) while jumping or landing. Landing with good control and the correct posture will prevent injury and reinforce good mechanics.

This program is designed to be performed at the beginning of practice and serve as a warm-up. It should only take 15-20 minutes to complete each phase. After completing six weeks of this progressive strengthening and plyometric program, your team can transition to the maintenance phase. Performing the advance plyometric series 2-3 times a week will help your team maintain their acquired strength, power and coordination required to prevent future injury.

## **Phase 1 (0-2 weeks)**

### **Strengthening Phase**

#### **Goals**

Establish good core and lower extremity strength

Decrease patella femoral (knee cap) load

Prepare for plyometrics

#### **Dynamic Warm-up** (perform each exercise for 10-15 yards) **5 minutes**

Knee-to-chest

Heel-to-butt

Figure four

Tin soldier walk

Jog

Shuttle run (perform with each leg leading)

Backward running

High knees

Butt kicks

Spiderman

Inch worm

#### **Strengthening** **10 minutes**

Single-leg dead lift walk 10 yards

Forward lunge 10 yards

Lateral lunge 10 yards each way

Single-leg pelvic bridge 2 Sets of 10 Repetitions

Superman 2 Sets of 10 Repetitions

Plank 2 Sets of 30 seconds

Side plank 2 Sets of 30 seconds

## **Phase 2 (Week 3)**

## Balance/Proprioception Phase

### Goals

Continue to improve core and lower extremity strength  
Improve coordination, balance and reaction time  
Prepare for plyometrics

### Dynamic Warm-up (perform each exercise for 10-15 yards) **5 minutes**

Same as Phase 1.

### Strengthening **10 minutes**

Single-leg dead lift backwards walk 10 yards  
Backward lunge 10 yards  
Lateral lunge 10 yards each way  
Single-leg pelvic bridge on ball (basketball, soccer ball, etc.) 2 Sets of 10 Repetitions each leg  
Plank with punch 2 Sets of 30 seconds  
Side plank with leg raise 2 Sets of 30 seconds

### Balance/Proprioception **5 minutes**

Single-leg balance with partner passing (basketball, soccer ball, etc.) 2 Sets of 30-60 seconds each leg **\*maintain a slight bend in the knee and avoid knee collapsing inward ("knock knee" posture)\***

## Phase 3 (Week 4-5)

### Early Plyometric Phase

**\*In order to perform plyometrics safely, athletes must land each jump softly, maintain a slight bend in the knees, keep knees shoulder-width apart and chest up\***

### Goals

Improve endurance and power  
Continue to improve coordination, balance and reaction time  
Stress good jumping and landing techniques

### Dynamic Warm-up (perform each exercise for 10-15 yards) **5 minutes**

Same as Phase 1.

### Balance/Proprioception **5 minutes**

Single-leg balance with partner passing (basketball, soccer ball, etc.) 2 Sets of 30-60 seconds each leg **\*maintain a slight bend in the knee and avoid knee collapsing inward ("knock knee" posture)\***

### Plyometrics **10 minutes**

**Week 4:** (perform each exercise for 30 seconds)

### **Simple Double-limb Jumps**

Double-leg lateral hops over line- athlete stands to the left of the line, hops back and forth over the line softly landing on the balls of the feet. Emphasize soft landings, maintaining a slight bend in the knee.

Double-leg forward/backward hops over line- athlete stands behind the line, hops back and forth over the line softly landing on the balls of the feet. Emphasize soft landings, maintaining a slight bend in the knee.

Double-leg vertical jumps- athlete stands with hands at side, knees slightly bent and jumps straight up for maximum height. Emphasize soft landings, maintaining a slight bend in the knee. Hold each landing for 3-5 seconds.

Double-leg long jump- athlete stands with hands at side, knees slightly bent and hops forward for distance. Emphasize soft landings, maintaining a slight bend in the knee. Hold each landing for 3-5 seconds.

**Week 5:** (perform each exercise for 30 seconds)

### **Combination Double-limb Jumps**

Double-leg forward bound- athlete stands with hands at side, knees slightly bent and hops forward 3 times for distance, holding the last jump. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee.

Double-leg lateral bound- athlete stands with hands at side, knees slightly bent and hops to the right, then quickly left and then back right. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee.

### **Simple Single-limb Jumps**

Heiden/speed skater hop- athlete stands on one leg with knee slightly bent then jumps for maximum vertical height and lands on the opposite leg. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee.

Single-leg forward/backward hop over line- athlete stands one leg, hops over the line softly landing on the ball of the foot. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee. Perform each leg.

## **Phase 4 (Week 6)**

### **Advanced Plyometric Phase**

**\*In order to perform plyometrics safely, athletes must land each jump softly, maintain a slight bend in the knees, keep knees shoulder-width apart and chest up\***

### **Goals**

Improve endurance and power

Continue to improve coordination, balance and reaction time

Stress good jumping and landing techniques

**Dynamic Warm-up** (perform each exercise for 10-15 yards) **5 minutes**

Same as Phase 1.

**Plyometrics 10 minutes**

**Week 6:** (perform each exercise for 30 seconds)

**Complex Double-limb Jumps**

Scissor jumps- athlete starts in a lunge with right leg forward, keeping the knee over the ankle, push off with the right foot and bring the left leg forward. Avoid “knock knees” with each landing. Emphasize soft landings, controlled transitions and maintaining a bend in the knee.

**Complex Single-limb Jumps**

Single-leg bounding- athlete stands on one leg, knees slightly bent and hops forward 3 times for distance and holds the last jump. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee. Perform with each leg.

Single-leg hop with 90<sup>0</sup> turn- athlete stands on one leg, knees slightly bent and hops 90<sup>0</sup> left, then back, alternating each direction. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee. Perform with each leg.

Single-leg cross over hop (“Z hop”)- athlete stands on one leg, knees slightly bent and hops at a diagonal forward, alternating both to the left and to the right. Emphasize soft landings, controlled transitions and maintaining a slight bend in the knee. Perform each leg.

Time	Recommended Exercises	Goals	Precautions
<b>Phase 1</b> (Week 0-2)	<b><u>Dynamic Warm-up</u></b> Knee-to-chest, heel-to-butt, figure four, tin soldier walk, jog, shuttle run (perform with each leg leading), backward running, high knees, butt kicks, spiderman, inch worm <b><u>Strengthening</u></b> Single-leg dead lift walk, forward lunge, lateral lunge, single-leg pelvic bridge, superman, plank, side plank	*Increase core and lower extremity strength *Decrease patella femoral (knee cap) load *Prepare for plyometrics	*Monitor form, emphasize quick ballistic movements *Keep hips and back level in plank position
<b>Phase 2</b> (Week 3)	<b><u>Dynamic Warm-up</u></b> Continue same warm-up as Phase 1. <b><u>Strengthening</u></b> Single-leg dead lift backwards walk, backward lunge, lateral lunge, single-leg pelvic bridge on ball, plank with punch, side plank with leg lift <b><u>Balance/Proprioception</u></b> Single-leg balance with partner passing (basketball, soccer ball, etc.)	*Continue to increase core and lower extremity strength *Improve coordination, balance and reaction time *Prepare for plyometrics	* Monitor form, keep knees slightly bent, hips level and chest up
<b>Phase 3</b> (Week 4-5)	<b><u>Dynamic Warm-up</u></b> Continue same warm-up as Phase 1. <b><u>Plyometrics</u></b> Week 4: Double-leg lateral hops over line, double-leg forward/backward hops over line, double-leg vertical jumps, double-leg long jump Week 5: Double-leg forward bound, double-leg lateral bound, heiden/speed skater hop, single-leg forward/backward hop over line	*Introduce plyometrics *Instruct proper jumping and landing techniques *Increase endurance and power	* Monitor form, land with soft knees, knees shoulder width apart and chest up
<b>Phase 4</b> (Week 6)	<b><u>Dynamic Warm-up</u></b> Continue same warm-up as Phase 1. <b><u>Plyometrics</u></b> Week 6: Scissor jumps, single-leg bounding, single-leg hop with 90° turn, single-leg cross over hop ("Z hop")	*Demonstrate good jumping and landing mechanics *Improve endurance and power *Transition to maintenance phase	* Monitor form, land with soft knees, knees shoulder width apart and chest up

\*Reviewed by Michael Geary, MD