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KNEE INJURY PREVENTION PROGRAM



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Athletes involved in sports that require jumping, cutting, and pivoting have an increased risk of serious knee injuries, specifically non-contact anterior cruciate ligament (ACL) tears.<sup>1</sup>

- 7,000,000 High School students participate in team sports in the United States
- 3-11% of those student athletes advance to the collegiate level
- 10-25% of all sports related injuries occur at the knee
- An estimated 250,000 ACL-related injuries occur annually in the United States
- Female athletes are 2-8 times more likely to injure their ACL

The **Sanford Knee Injury Prevention Program** was developed to help reduce an athlete's risk of knee injury and improve overall athletic performance by using a multifaceted approach of neuromuscular and proprioceptive training. The known risk factors of knee injury include modifiable movement patterns: dynamic knee valgus (diving in at the knees), stiff landings, quadriceps dominance, leg dominance and lack of core control.

Correct



Incorrect



The **Sanford Knee Injury Prevention Program** specifically focuses on modifying those risk factors by emphasizing proper biomechanical movement patterns through:

- dynamic stretching
- hip and core activation
- lower extremity strengthening
- agility training
- plyometric training
- movement re-education

Many injury prevention programs for the knee are already in use and there is evidence that several of these programs have succeeded in reducing knee injuries by 27% and ACL injuries by 51%.<sup>1</sup> Although these programs have illustrated a reduction in overall knee and ACL injury rates, often times they are not being implemented in the high school and collegiate settings and do not specifically address activation of the hip musculature in preparation for proper movement patterns.

The **Sanford Knee Injury Prevention Program** has a unique component (activation of the hip muscles) that other injury prevention programs have not specifically addressed. Several studies have demonstrated that hip stability is an integral part of decreasing dynamic knee valgus (diving in at the knees) during athletic movements.<sup>2,3</sup> Dynamic knee valgus is one of the most common biomechanical factors associated with ACL tears.<sup>2,3</sup> By activating the hip muscles, athletes are more likely to use them during physical activity, therefore, reducing the amount of dynamic valgus and inherently reducing the risk of ACL injury. Not only does this program focus on decreasing dynamic valgus but it also promotes awareness of high-risk positions, enhances sport-specific agility, and improves technique.

The **Sanford Knee Injury Prevention Program** should be:

- implemented in middle school, high school, collegiate, and professional athletics
- incorporated into pre-activity routines such as before team strength and conditioning sessions or team practice sessions
- completed in 15-20 minutes as athletes become familiar with the program
- performed 2-3 times per week for a minimum of 8-12 weeks for best results

# Sanford Knee Injury Prevention Program

## Dynamic Warm-up

- A. Single-leg RDL Stretch
- B. Quad Stretch
- C. Knee Hugs
- D. Leg Cradle
- E. High Knees
- F. Butt Kicks
- G. Carioca
- H. Normal Skip
- I. Skip for Height
- J. Backpedal
- K. 75% Run

## Activation

- A. Clamshell (30 sec. hold; each side)
- B. Quadruped fire hydrant (30 sec. hold; each side)
- C. Plank + side plank (30 sec. plank; 15 sec. side plank; each side)
- D. Standing fire hydrant (30 sec. hold; each side)

## Strengthening

- A. Bodyweight squats with band (10 x)
- B. Lateral band walks (20 steps; each side)
- C. Walking lunges – forward (10 steps; each direction)
- D. Walking lunges – backward (10 steps; each direction)
- E. Walking lunges – lateral (10 steps; each direction)

## Plyometrics

(15 – 30 sec. REST between each exercise)

- A. Lateral squat jumps over line (6 x)
- B. Forward/backward squat jumps over line (6 x)
- C. Squat jumps + 90 degree turn (3 x; each direction)
- D. Lunge jumps (4 x; each side)  
DO NOT ALTERNATE
- E. 2 to 1 hop (4 x; each side)
- F. Single-leg side-to-side hop (4 x; each side)

## Agilities

(15 – 30 sec. REST between each exercise)

- A. Forward run with three step deceleration (2 x; 5 yd. or 15 ft.; each side)
- B. Three-step shuffle (2 x)
- C. Zig-zag cutting (3 x; 5 yd. or 15ft.; each side)

# Dynamic Warm-up:

The purpose of the warm-up is to prepare athletes for activity. Current research suggests dynamic warm-up activities can decrease injury risk and may be more beneficial than static stretching.

## Dynamic Warm-up

- A. Single-leg RDL Stretch
- B. Quad Stretch
- C. Knee Hugs
- D. Leg Cradle
- E. High Knees
- F. Butt Kicks
- G. Carioca
- H. Normal Skip
- I. Skip for Height
- J. Backpedal
- K. 75% Run

## Activation:

This section focuses on activating the gluteal and core musculature to promote proper technique and decrease the likelihood of using compensatory movements during strengthening, plyometric and agility exercises.

### A. Clamshell with band:

Hold for 30 sec. on each side.

First, pull a resistance band around and just above your knees.

Lay on your side with your knees bent (approximately 90°, and hips flexed approximately 60-70°).

With your feet together and hips stacked on top of each other, raise your top knee up like a clamshell.



## Start



## End



## DO NOT



\*\* Make sure your top hip does not roll backward and your back does not arch as these are compensatory movement strategies. \*\*

## B. Quadruped fire hydrant with band:

Hold for 30 sec. on each side.

Pull a resistance band around and just above both knees.

Starting on your hands and knees (all fours), raise one leg at a diagonal while keeping your hips parallel to the ground.

Maintain a flat back and tight core.



## Start



## Hold



## DO NOT



\*\* Do not let your hips over rotate and your back arch \*\*

## C. Plank + side plank with band:

Plank hold for 30 sec.

Side plank holds 15 sec. each side.

Place a resistance band around and just above both knees.

Get in a plank position on your forearms.

Keep your abdominals and gluteals tight, while maintaining tension on the band.

The band will remain loose during the side plank.

Perform the plank and side plank combination on each side.

## Front Plank



## Side Plank



**DO NOT** \*\* Do not let your back or hips drop. \*\*



## D. Standing fire hydrant with band:

Hold for 30 sec. on each side.

Place a resistance band around and just above both knees.

Stand on one leg with your stance knee slightly bent.

Lift the opposite leg back at a diagonal (similar to the quadruped fire hydrant).

## Hold



## DO NOT

\*\* Do not let your stance knee cave inward and keep your trunk forward. If you are unable to hold proper form with the band, do not use it. \*\*



## Strengthening:

These exercises are used to strengthen the hip and knee stabilizers. The resistance band in the first two exercises is important because it helps engage the gluteals.

### A. Bodyweight squats with band:

10 times.

First, place a resistance band around and just above your knees.

Squat down so your thighs are parallel with the ground, while pushing your knees out against the band.

Keep your hips back, trunk forward, and weight through your heels.

Once you reach parallel, rise back to a standing position by pushing through your heels and squeezing your glutes.





## DO NOT



\*\* Do not allow your knees to go in front of your toes. \*\*

## B. Lateral band walks:

20 steps each direction.

Place a resistance band around and just above both knees.

Get into a semi-squat position by bending slightly at the knees.

Keep your hips back, trunk forward, and weight through your heels.

Push your knees outward against the band and step sideways for twenty steps.

Repeat this in the opposite direction, keeping your hips and core tight.

## Start, During & End



## DO NOT

\*\* Do not allow knees to cave inward on either leg while sidestepping. \*\*



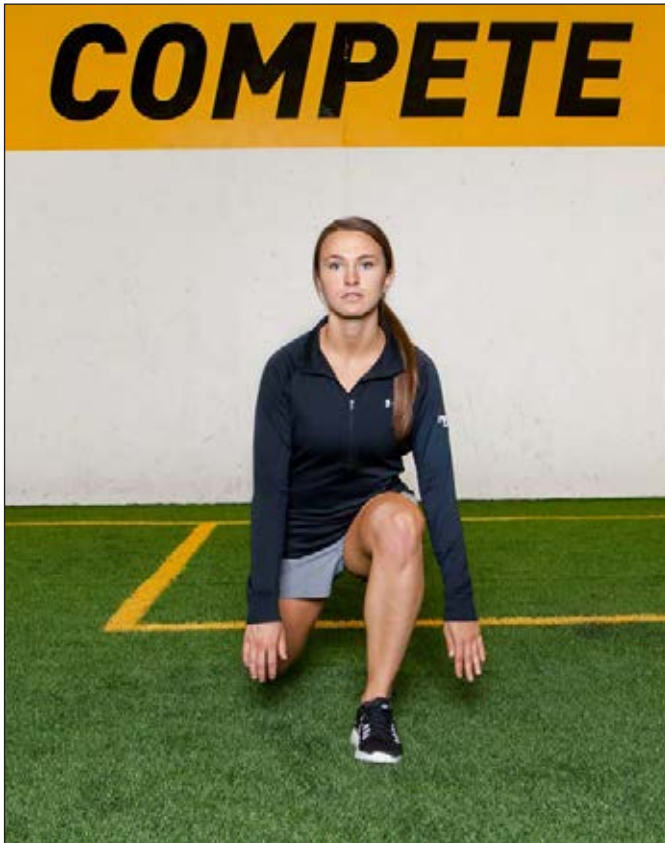
## C. Walking lunges (forward)

10 lunges; five on each side.

Take a step and lunge forward, creating a 90° angle with your thigh and lower leg.

Keep your trunk forward and allow your back leg to drop straight down.





## DO NOT



\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not allowing it cave inward. \*\*

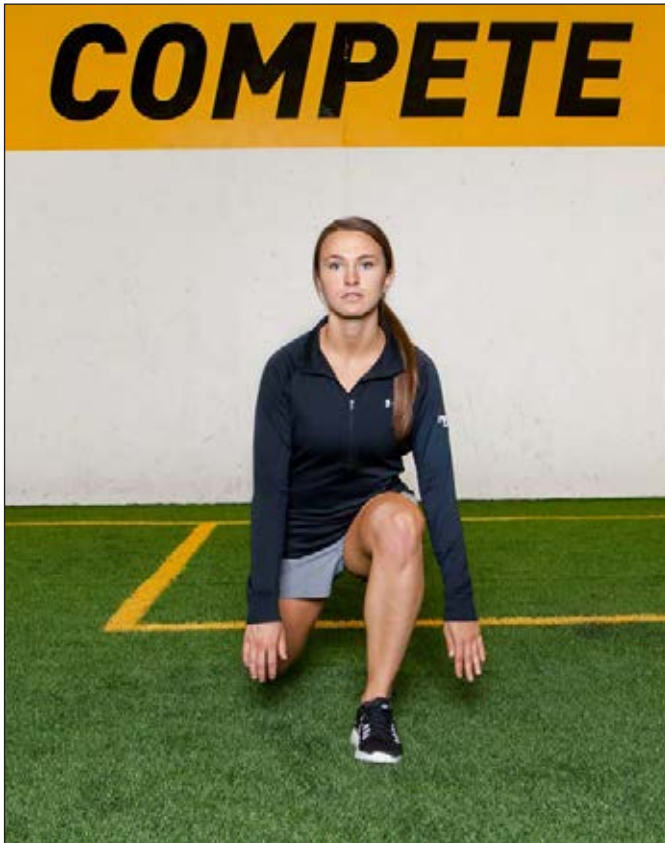
## D. Walking lunges (backward)

10 lunges; five on each side.

Take a step backward into a lunge position.

Keep your trunk forward. Push up through the heel of your forward leg and return to a standing position.





## DO NOT



\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not allowing it cave inward. \*\*

## E. Walking lunges (lateral)

10 lunges, 5 on each side.

Take a step and keep your opposite leg straight.

Push your hips back and keep your trunk forward.

After you reach the lunge position, push through the heel of your lead leg and return to a standing position.



## DO NOT



\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. Do not go lower than parallel. \*\*

## Plyometrics:

The following exercises should be performed explosively to help improve strength, power and speed during athletic activity. Focus on proper jump/landing technique during each exercise. Make sure to land soft. To ensure a soft, quiet landing, keep your knees about shoulder-width apart. Your hips should almost be parallel and your trunk should stay forward.

### A. Lateral squat jumps over line

6 times, 3 each side.

Start in a squat position.

Jump up and sideways over a line, landing in a squat position.

Make sure to land soft and quiet. Keep your trunk forward, knees bent, and hips back, just above parallel.

Jump side-to-side, landing on each side three times.

## Start, Jump & End



### DO NOT

\*\* Do not allow your knees to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*





## B. Forward/backward squat jumps over line:

6 times, 3 each side.

Start in a squat position.

Jump up and forward over a line, landing in a squat position.

Make sure to land soft and quiet, keeping your trunk forward, knees bent, and hips back, just above parallel.

Jump backward over the same line, again landing in a squat position.

\*\* Do not allow your knees to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*





## Start



## Jump



## End



## C. Squat jumps + 90° turn: 3 times each direction.

Start in a squat position.

Jump up and turn 90° to one side while in the air.

Land in a squat position and immediately jump up and return to the starting position.

This counts as one repetition.

Perform three consecutive repetitions to each side.

Make sure to land softly during each jump.

**\*\* Do not allow your knees to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\***



Start



Jump



Land



## D. Lunge jumps:

4 times each side.

Start in lunge position.

Jump straight up into the air, pushing mostly through your front leg.

Land softly in the lunge position.

Perform this jump four consecutive times and then switch so your other leg is in front.



## Start



## Jump



## Land



## DO NOT

\*\* Do not alternate legs. Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*



## E. 2 to 1 hop:

4 times each side.

Start in a squat position.

Propel yourself forward jumping off both feet.

Land on one leg, keeping your knee bent, hips back, and trunk forward.

Hold this position for two sec. and then go back to a squat position.

Perform eight jumps, landing on each leg four times.



## Start, Jump & End



Start



Jump



End



**DO NOT**

\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*



## F. Single-leg side-to-side hop:

4 times each side.

Standing on one leg, keep your knee bent, hips back, and trunk forward.

Hop up and sideways over a line, landing softly in the starting position.

Perform this hop four times on each leg.

## Start, Jump & End



## DO NOT



\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*

## Agilities:

These movements help encourage and reinforce proper technique and neuromuscular control during sport-specific movements. **Pay careful attention to the technique when first performing these movements, then work on becoming faster.**

### A. Forward run with a three-step deceleration:

2x each side at 5yds/15 ft each.

Run forward about five yd., or 15 ft., and use a three-step deceleration approach to stop.

The three steps should be short and choppy.

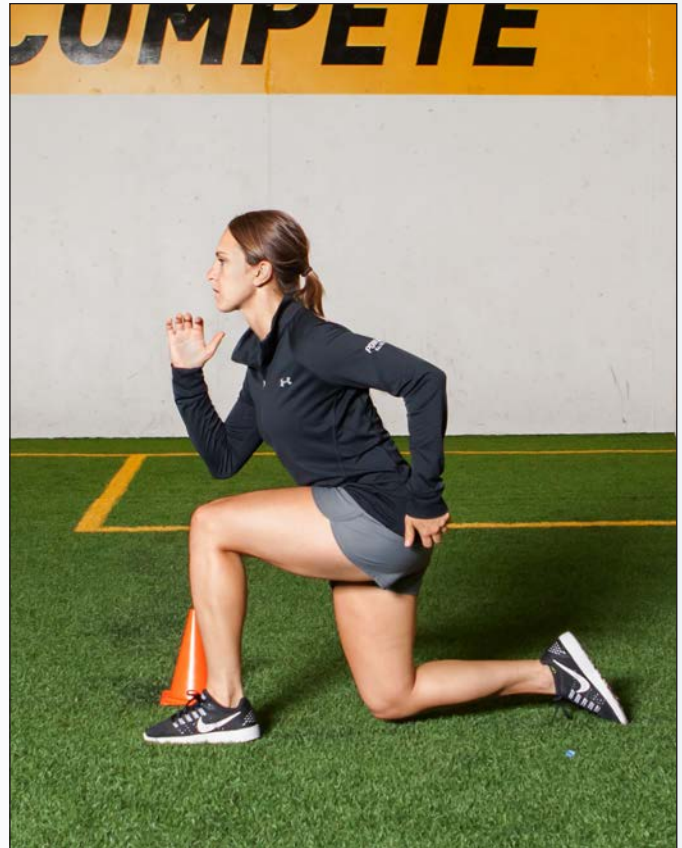
You will end with one leg in front of the other.

Your front knee should be bent, your hips should be back (just above parallel), and your trunk should be forward.

Backpedal to your starting location and repeat this movement.

After two repetitions, repeat the same movement with the opposite leg.





## DO NOT



\*\* Do not allow your knee to go in front of your toes and keep your knee pointed straight forward, not letting it cave inward. \*\*



## B. Three-step shuffle:

2x each direction.

Start in an athletic position with feet positioned a little wider than shoulder-width apart.

Shuffle three times to one side, then change direction and shuffle three times the other way.

Make sure to stay low, keeping your knees bent, hips back, and trunk forward.



## DO NOT



\*\* Do not allow your knees to go in front of your toes and keep your knees pointed straight forward, not letting it cave inward. \*\*

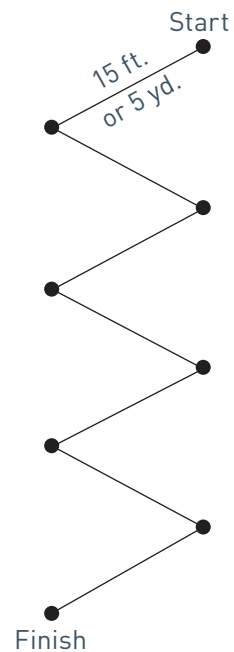
## C. Zig-zag cutting: 3 cuts each side.

Run five yd., or 15 ft., in a diagonal direction toward the left or right.

Use the three-step deceleration technique to slow down.

Cut the opposite direction, pushing off your outside leg.

Run five yd., or 15 ft., in a diagonal direction to the opposite side and make another diagonal cut.





## DO NOT



\*\* Do not allow your knees to go in front of your toes and keep your knees pointed straight forward, not letting it cave inward. \*\*





## References:

1. Donnell-Fink LA, Klara K, Collins JE, et al. Effectiveness of Knee Injury and Anterior Cruciate Ligament Tear Prevention Programs: A Meta-Analysis. PLoS ONE. 2015; 10(12): e0144063.
2. Hewett TE, Myer GD, Ford KR, et al. Biomechanical measures of neuromuscular control and valgus loading of the knee predict anterior cruciate ligament injury risk in female athletes: a prospective study. Am J Sports Med. 2005; 33:492-501.
3. Powers CM. The Influence of Abnormal Hip Mechanics on Knee Injury: A Biomechanical Perspective. J Orthop Sports Phys Ther. 2010; 40(2): 42-51

## Disclaimer:

The information provided in this Sanford Knee Injury Prevention Program is for informational purposes only. This program should not be used to determine whether any technique or exercise is appropriate for you and it is not a substitute for professional medical advice. Your provider may use different procedures, techniques, and exercises than those that are depicted or described in this program. Always contact your physician or other qualified health provider prior to starting any new treatment or with any questions you may have regarding a medical condition. The information provided is intended to be a general overview of the medical topic. This program does not constitute an attempt to practice medicine nor does it establish a doctor-patient or hospital patient relationship.

Although we attempt to keep this program current, health care information changes rapidly and thus the program should not be relied upon as representing the current state of treatment as comprehensive or as error-free.

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