

PREVENTING ACL INJURIES IN SOCCER

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ACL injuries can be devastating to a soccer player's competitive season. For this reason, reputable medical institutions like the Cincinnati Sports Medicine Foundation and Santa Monica Orthopedics have designed and published ACL prevention protocols. These programs focus on preventing knee injuries and enhancing athletic performance. From a review of literature, the concentration of most programs is placed on stretching, strengthening, plyometrics, and agility. The following article will discuss important concepts in preventing ACL injuries and make recommendations for implementing prevention into your teams' training.

The ACL can be ruptured via contact and non-contact mechanisms. Understanding the mechanism and possible contributors is an important factor in preventing these injuries. Typically, non-contact ACL injuries occur during deceleration, landing, and sudden directional change on a planted foot. The ACL can also be torn when a valgus force is delivered to an already planted leg, or by landing on an opponent's foot with fully extended leg, causing hyperextension.

Although most contact injuries cannot be prevented, we can prevent the non-contact type by training athletes to have more neuromuscular control of the knee. Functional knee stability is established by muscle power and recruitment pattern between the quadriceps and hamstring muscles. Soccer mechanics emphasize repetitive kicking motions. Kicking primarily contracts the hip flexors, knee extensors, and abductors. Because of this, soccer players are notorious for having larger quads and tight, weak hamstrings. There should be a 3:2 ratio in strength between the quadriceps to hamstring. Numbers favoring the quads over hamstrings may predispose an athlete to a non-contact ACL injury.

Implementing Prevention Into Your Teams Training

Soccer is a very dynamic sport. There are many athletic components to train to prepare for the demands of competition. Players must be able to stop and change directions, jump and land properly, sprint at top speed, ward other players off with their bodies, and have the ability to perform at a high level for 90 minutes. Take the time to assess the needs of each one of your players. Some of your athletes may be predisposed to ACL injuries because of inflexibility, instability, improper biomechanics, or history of previous injury. From your assessments, implement individual and team pre-hab exercises into your weekly training routine.

ACL prevention protocols will differ depending on gender, level of athlete, and pre, in, or post-season training. Like most strength and conditioning programs your prevention protocols should be periodized based on the soccer season. In Major League Soccer (MLS), we have a six to eight week pre-season, followed by a seven-month regular season. The pre-season is an ideal time to evaluate the needs of your

athletes. Sportmetrics recommends implementing six weeks of stretching, strengthening, and plyometrics at a frequency of three times per week, to help prevent knee injuries.

Since the MLS season is so long, you should continue prevention by implementing a maintenance program into your teams training. A typical week features one game on Saturdays. Most coaches in our league conduct a ninety-minute practice Monday through Thursday and taper Friday. Try to incorporate dynamic flexibility, speed, and agility drills into practice each day. On Mondays and Wednesdays, incorporate a 30-45 minute weight training and plyometrics session. Exercises should be performed when your athletes are fresh. I recommend picking 10-12 exercises that concentrates on total body strengthening and maintaining explosive power. Perform exercises in a circuit-training manner for two sets of 10-15 repetitions, at a 60-80% max. On Tuesdays and Thursdays, prevention can be implemented into your post practice by performing sport specific agilities, core strengthening, and static stretching sessions. Obviously this will need to be adjusted with the mid-week game, but should be used as a general guideline for an in-season prevention program.

Stretching and Flexibility

During the pre-season evaluate your players' flexibility. The purpose of stretching is to achieve maximum muscle length in order to balance muscle strength and flexibility. Static stretching for the calf, quad, hamstring, hip flexor, adductors, and abductors is recommended for 3 x 30 seconds. Important flexibility tests to perform are the deep squat (look for asymmetry and limitations in the calf, quad, or lower back) supine single leg raise (look to see if the leg can make a 90 degree angle at the hip) and the Thomas Test (to assess hip flexor flexibility).

Warm Up

The warm up is one of the most important parts of a soccer players prevention program. Incorporate dynamic stretching movements that challenge proprioception and the neuromuscular system. Movements should include: walking pulling the knee to chest, heel to rear, cradle walk, jogging, back pedaling, lateral shuffling, carioca, skipping, leg kicks, round house kicks, high knees, high heels, forward and backward shuffling, hip changeovers, drop steps, accelerating forward and backward, and lateral shuffling changing directions. These movements should be performed for approximately 10 minutes and be mastered over a 20-yard area. I like to refer to this as movement preparation.

Balance

Balance and coordination are basic to soccer, and fundamental to every ACL rehab protocol. Caraffa et al in Italy prospectively followed 600 male soccer players over three seasons. Half of the athletes were placed in a proprioceptive training program consisting of 20 minutes per day for a minimum of six weeks of balance training with and without various types of balance boards. The authors found a sevenfold reduction of ACL injuries in the proprioception group when compared with the controls.

Test your athletes' balance. Perform the Trendelenberg test (Stand on 1 leg, and bring contra-lateral leg to the chest. Look for a lag or giving in of the support leg hip). Can they balance on 1 foot for at least 30 seconds with and without eyes closed? Have your athletes stand 1 footed on a wobble board that challenges both medial-lateral and anterior-posterior balance. Use the same board and have your athlete perform a squat. Look to see in which plane your athletes are stronger or have a deficit in. Try to incorporate balance drills in your warm-ups and cool-downs. The best proprioceptive exercise for a soccer player is one-legged kicking with a partner. This can be progressed to kicking on a balance boards, mini disc cushions, and altering the type of kick (laces, instep, volleys, and two touch).

Functional Strengthening Weight Training

Your athletes should master low intensity body weight activities at high repetitions before adding external resistance.

The lunge is the most functional strengthening exercise to mimic sport specific actions. Perform lunges forward, forward diagonal, lateral, backwards diagonal, and backwards. These exercises will stretch and strengthen the hamstrings in the sagittal, frontal, and transverse planes of motion. Coaching cues: knee doesn't go in front of toes, keep head, chest, and shoulders up and back. Challenge balance with walking lunges, unilateral resistance, and bilateral rotation (helicopter lunges).

To prevent forward translation of the tibia on the femur, it is important to have strong hamstrings. It is especially important to strengthen the hamstrings eccentrically. This can be done by: Single legged ground touches (standing on a slightly bent leg, slowly reach down and touch the ground with one hand to the opposite side of your balance foot), Russian hamstrings (kneeling, have partner hold feet, and slowly lower the body to the ground), Romanian dead lifts (stand on box with dumbbells in hands, knees slightly bent, touch beyond toes), and Curls on the physioball (supine, feet on ball, lift butt and curl heels, return slow and in control).

Many ACL rehab protocols concentrate on strengthening the quadriceps especially in the final 10-15 degrees of knee extension. The single legged squat is a good functional test and exercise for preventing ACL injuries. Check that the angle of knee flexion is equal bilaterally. Can your athletes' squat to at least 90 degrees. Also, look at stability of the knee and distance of a single legged reach forward and medially. Exercises recommended to strengthen the quadriceps are: Single legged step downs; Forward and lateral bench/box step ups; Leg extensions with a pause at top; Backwards walking on treadmill; or Backwards running with resistance cord.

Core Strength and Stability

The primary function of the core is to maintain dynamic stability of the body's center of gravity. In soccer it is important to have a strong, stable core to help prevent against ACL injuries. Stability must

first be established by doing exercises like four way pillar bridges (holding the body in straight position, with weight resting on elbows and feet) and dead bugs (lying prone with arms and legs straight up, drop opposite arm and leg and hold 6-12 inches from the ground for 10 seconds). When strengthening the core make sure to include multi-plane diagonal and rotational patterns. It is also important to strengthen the lower and upper trunk extensor. So much of the soccer players mechanics is forward flexion of the trunk we neglect the extensors. Core strength should be concentrated on during every phase of conditioning. The pre-season should emphasis core stability and muscular endurance.

Plyometrics

Plyometrics are used to build speed, explosive power, and reaction time of the ground. It is important to monitor each athlete's technique to promote a strong foundation and ensure proper safety. Good tests to evaluate knee stability for plyometric training include a one and two legged depth jump from a 1-1.5 foot box. (Look for buckling of the knees, this is also a great exercise for teaching athletes proper landing technique); single leg broad jump (look for stability upon landing, and equal distance bilaterally).

Coaching cues for plyometric exercises include:

- Land on the balls of the feet with knees flexed and chest over knees
- Emphasize landing "softly", "light as a feather", "recoil like a spring"
- Jump straight up and avoid excessive side to side and forward and back rocking of the knees during landing

Plyometric exercised should be progressed from low intensity repetitive jumps, to multidirectional bounding and small hurdle/cone jumps, to high box depth and hurdle jumps. Emphasis lateral hopping and jumps with a change of direction. This will help prepare the ACL and muscles around the knee for sudden, often unpredictable movements in the frontal plane. A good drill to teach this is lateral bounding. Bound out with a single leg as far as you can and immediately load hip and return to starting position. Progress this with right and left hand signals to work on reaction time.

Soccer Agilities

Agility is the ability to keep the body under control during a change in direction. Since soccer involves frequent changes of direction it is important to teach proper biomechanics of planting, cutting, and decelerating. Teach planting with positive angles. When you plant to change directions the hip should load, with knee bent. The pressure should be placed on the ball of the foot and the knee should not externally rotate over the toes. A good drill to teach this is the lateral cone shuffle, (place two cones 5-7 yards apart, shuffle, and touch each cone with outside hand). Start with repetitions of ten.

To develop a strong base for ACL agility training it is important to strengthen lateral movements in the frontal plane. Exercises include lateral sumo walks with resistance cord around the ankles, lateral shuffling on a treadmill, and lateral shuffling with the Mr. Resistor Cord (24' rubber cord with waist belt,

that can be fixed to a stationary object or a partner). This is an excellent piece of equipment to use to provide resistance against multi-directional movement. It can also be used for acceleration speed, backpedaling, and bounding.

Popular drills to teach change of direction include: the 5-10-5 agility (place two cones 10 yards apart and one in the center, start in the center, sprint one way, plant, sprint 10 yards the other way, plant with opposite foot, and sprint 5 yards back to the center), Illinois agility (place cones in a ten yard square, with 4 cones placed along the 5 yard mid-line separated every two and a half feet. Start on stomach and run 10 yards, around top cone, down to the lowest center cone, weave up through the center cones and then back down, accelerate up to the top of the box, change directions and sprint through the last bottom cone). Cone Shuffling (place 4 cones 7 yards apart, place a second line of 3 cones 5 yards away and staggered in between the first line. Start off by sprinting forward around first cone in second line, then backpedal back to second cone in first line, repeat this sequence through the cones. Also, side shuffle to first cone, plant, and accelerate to second cone, plant, and repeat sequence. Be sure to train both sides). Multi-directional Hand Signal Reaction Drill (have athlete face you and change direction to your hand signals, forward, backwards, right, left, up, or down. Go for approximately twenty seconds).

Each player on your team has specific actions they must master to excel at their position. For example, running forward with the ball, making a sharp cut, and passing / shooting the ball; Receiving the ball, and turning and pivoting to run forward; Jumping up for a header or to catch a ball and land properly. These actions need to be trained and re-conditioned. This will help prepare the body and neuromuscular system for the demands of competition. It is important for the coach and / or trainer to implement these sport specific exercises into your ACL prevention programs.

Additional Contributing Factors

Hormonal and anatomical factors may predispose athletes, particularly women, to ACL injuries. Women sustain two to eight times more ACL injuries in soccer than men. Research shows an increased incidence of ACL injury in women during the ovulatory phase of the menstrual cycle. Estrogen has shown to relax soft tissue, which may diminish neuromuscular control. Other factors that may predispose a woman to injury is the size of the intercondylar notch, also having a wider pelvis and greater than average q-angle. Additional anatomic factors that may contribute to ACL injury are ACL size, lower leg malalignment, abnormal extensor mechanism anatomy, knee joint laxity, and muscle flexibility. These factors cannot be prevented but trainers and coaches should be aware of them.

Environmental factors may also contribute to injuring the ACL. In one study of ACL injury mechanics, many patients reported landing or stepping on an uneven surface at the time of landing. Australian research found that playing on dry playing fields (caused by low rainfall) significantly raised the likelihood of ACL damage. The theory posed by this is that athletes run with slightly greater knee flexion on hard surfaces, which can put added stress on the ACL during sudden stops.

Cleat selection may be an additional contributor. Some cleats provide a higher torsional resistance than other cleat designs. Special attention should be made especially when playing on turf surfaces.

Ensure that your athletes are properly hydrated. Dehydration can cause a decrease in neuromuscular control, loss of contractile strength, and loss of speed.

Lastly, research has shown that the effect of knee braces for ACL protection is negligible.

Possible Hypothesis To Consider:

Because of the repetitive kicking mechanics of soccer we should evaluate the strength ratios between the hip adductors and abductors. I find that many soccer players tend to have tight piriformis and gluteus medius muscles and are very weak in comparison to the hip adductors. I feel this may cause a possible imbalance to medial-lateral and rotational stability of the knee. This tightness may predispose your players to ACL tears by not being able to support the plant leg of during kicking. No research was found with in the literature.

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