PREVENTION OF ANTERIOR CRUCIATE LIGAMENT (ACL) INJURY AND ENHANCE PERFORMANCE PROGRAM

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ABSTRACT

BACKGROUND: Faulty mechanics during dynamic movement that cause excessive valgus force at the knee increases the risk of ACL injury. Faulty mechanics may be a result of lateral displacement of the trunk, unequal limb loading, and lack of control to avoid the valgus knee position. Altered movements that place the ACL at risk are best identified in a fatigued state; however, could be recognized in a standard dynamic assessment. The faulty movement patterns are modifiable and should be addressed in an injury prevention program. Prevention programs include various modes of exercise such as plyometrics, neuromuscular training, and strength training. This review concludes that those programs which utilize neuromuscular training and strength training at a young age show the most promise in reducing ACL injuries. An ongoing thorough dynamic examination is necessary for all athletes while adjusting the intervention program in order to decrease the risk of ACL injury.

PURPOSE OF REVIEW:
Mechanisms leading to anterior cruciate ligament (ACL) injury have been identified, yet re-injury or a secondary injury persists in the athletic population. The purpose of this review is to identify risk factors associated with ACL injury and investigate programs to prevent injury.

KEYWORDS: Anterior cruciate ligament (ACL); Knee injury; neuromuscular training; Plyometrics; Prevention program; Strength training.

INTRODUCTION:- Athletes who participate in high demand sports like: soccer, football, & basketball are more likely to injure their ACL. ACL injuries cause many problems for an athlete. Besides the chance of having to sit out an entire season, they might face loss of funding, lowered academic performance, & long-term disability from O.A. More than 50,000 debilitating ACL injuries occur in athletes every year.

Anatomy of ACL:- Originated from Lateral femoral condyle and inserted at Tibial plateau medial to anterior horn of lateral meniscus.
Functions of ACL:-
1. Primary restraints to anterior tibial displacement: Accounting for 85% of the resistance to anterior drawer test, when the knee is at 90° of flexion & neutral rotation.
2. Secondary restraints to tibial rotation & varus: valgus angulation at full extension.
3. Proprioceptive function: presence of mechanoreceptors in the ligaments.

Mechanism of injury:-
1. Contact injuries v/s Non-contact injuries
2. ~80% Non-contact injuries.
3. ~20% Contact injuries.
4. Non-contact injury usually with landing, rapidly stopping, cutting, or change in direction.
5. ~Altered biomechanics & neuromuscular patterns.
6. Female athlete have 3.5x risk of non-contact injury as compared to males.
**Non-contact ACL injury**

1. External loads of valgus & external rotation do not load the ACL b/w 10°-30° flexion.
2. Quadriceps activation can load the ACL b/w 10°-30° flexion, this is increased if no hamstring activation.
3. Strong quadriceps activation during eccentric contraction a major factor in injury to ACL.
4. Neuromuscular factors appear to be the most important reason for the differing ACL injury rates b/w males & females.

**Biomechanics of ACL injury:**

- Abduction & internal tibial rotation
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- Decelerating from running without changing directions
- Decelerating from running with change in direction
- Jumping
- Landing
Clinical presentations:
When injury occurs, there is "popping" noise & feel of knee out. Other typical symptoms include:
1. Pain with swelling.
2. Loss of full ROM.
3. Tenderness along the joint line.
4. Discomfort while walking.

Risk factors:
A. Intrinsic factors:
1. Anatomical.
2. Physiological.
B. Extrinsic factors:
1. Environmental.
2. Clothing.
3. Appliances.

Phases of Prevention Program:
A. Should be performed at least 2-3 times per week during the season & includes:
   1) Warm Up.
      - Warming up & cooling down are a crucial part of a training program.
      - The purpose of the warm-up section is to allow the athlete to prepare for activity.
      - By warming up muscles first, their will be great reduction in injury.
2) Plyometrics.

- These exercises are explosive & help to build, power, strength & speed.
- The most important element is to performance good technique is the landing. It must be soft!
- For eg. when you Land from a jump, you want to softly accept your weight on the balls of your feet slowly rolling back to the heel with a bent knee & a straight hip.
- These exercises are basic, however, it is critical to perform them correctly.
- Time taking to ensure safe & correct completion of these exercises.
Strengthening.

- Having adequate strength in hips & thighs is key to providing support for knees & preventing ACL injuries. It includes: Squatting, Lunges, Core strength training.
1 STEAMBOATS
30 seconds/leg
Place band around ankles. Begin with feet shoulder width apart. Slightly bend one knee so the foot is off the ground. Balancing on one leg, begin kicking the bent leg forward and backward at the hip. Be sure to keep upper body still, not swaying back and forth. Body control is key.

2 LATERAL STEP
30 seconds/direction
Place band around ankles. Start with feet shoulder width apart and step out to the side approx. 10 to 12”. Slowly and under control, follow with the other foot to return to the initial position. Repeat for the allotted amount of time, then switch direction so other leg leads.

3 SUPINE HAM BRIDGE
30 seconds/leg
Lie flat on back, bend one knee and place heel close to the gluts. Extend other leg straight up in the air. Push with the heel to lift gluts off the ground and the extended leg higher in the air. Keep abs tight and upper back on ground. Repeat for the allotted amount of time, then switch legs.

4 AB CRUNCH
60 seconds
Lie on back with knees bent and feet flat on the floor. Raise upper body off the ground until shoulders are no longer touching the ground. Hold for 3 seconds and return to start. Repeat for the allotted amount of time. Hands can be placed behind head or across the chest as long as the neck remains neutral and relaxed.
4) Flexibility/Stretching.
  - Being flexible enough to move freely can help to maintain ideal form.
  - Never stretch a “cold muscle”.
  - By doing these stretching outlined here, it helps to:
    - improve & maintain your range of motion,
    - reduce stiffness in your joints,
    - reduce post-exercise soreness,
    - reduce the risk of injury &
    - improve overall mobility & performance.
  - Don’t bounce or jerk during stretch. Gently stretch to a point of tension & hold.
  - Hold the stretch for 30 seconds.
5) Agility Drills.

- Run to a line or cone, plant your outside foot without letting your knee collapse inward to change direction.
- Move in patterns that take you front to back, side to side & diagonally.
- Start by running slowly so you can concentrate on good position.
- Pick up the pace & maintain good technique.
- Remember: HIPS over KNEES over ANKLES!
Jump side-to-side with both feet over the line

Jump from your left to right foot over the line
Jump forward-&-back with both feet over the line

Jump forward-&-back over a line leading with your right foot. Keep feet hip width apart.
Now lead with your left.

5) Proprioception training.
- Proprioception is for balance.
- Many injuries occur when an athlete is off-balance.
- It helps to gain in stability will pay off on the playing field.
- Commonly used in injured athletes, but can be used for prevention, too. It includes:
  - One-leg squat &
  - Reach exercises.

7) Jumping & landing safely.

8) Cool Down.
- Do not skip it.
- It allows the muscles that have been working hard throughout the training session to elongate & deters the onset of muscle soreness.
- Athletes should have a water bottle by their side during the cool down.
- The cool down should take approximately 10 minutes. It includes:
  - slow jog
  - Followed by light strength training exercises.
  - Finally, stretch the hamstrings, calves, inner thigh, quadriceps, & low back.

9) Rest.
- Rest is physically necessary so that the muscles can repair, rebuild, & strengthen.
- Optimal sleep is essential who exercise regularly, during sleep body produces GROWTH HORMONE (GH) which is largely responsible for tissue growth & repair.
- Adequate sleep, rest days, & alternating hard workouts with easier workouts are all important strategies in reducing risk of injury

**ACL injury programs:**

A. PEP Program (Prevent injury & enhance performance)
   - it includes:
     1. Area 1: Warm Up
     3. Area 3: Strength.
     5. Area 5: Agilities.

B. FIFA 11+ Program: it is an ACL injury prevention program designed to be performed by players prior to training & competitive games. Players & teams can reduce their rate of ACL injury using a series of simple warm up exercises.

C. The exercises take around 20 minutes to perform, & involve:-
   1. Core stabilization.
   2. Eccentric training of thigh muscles.
   3. Proprioceptive training.
   4. Dynamic stabilization.
   5. Plyometrics with straight leg alignment.

**Conclusion:-**
- Prevention of ACL injury is possible by:
  - Neuromuscular training
  - Focus on knee position.
  - Proprioceptive training.
  - Change the plant & cut & landing technique.
- There should be a study strictly upon the long term effects of various methods of prevention programs.
- There are far too many programs & prevention methods to narrow down to just one specific most effect one until further research is done.
ACCENTUATE BALANCED BODY MOTION

CONTROL LIMB ROTATION

LAND WITH BEND HIP & KNEE

Practice these guidelines, exercises, & drills on your own & with your team. Don’t wait until the season starts.

Get in shape to play; don’t play to get in shape!

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