ACL Injuries and Risk Reduction/Prevention Program

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Epidemiology

- 100,000-200,000 ACL ruptures annually in the US
- Incidence is 1 in 3,500
- In NCAA athletes, American football accounts for 53% of all ACL injuries.
  - Gymnasts had the highest rate at 0.33 ACL injuries per 1000 athletic exposures
## Risk Factors

### Sports associated with increased risk of ACL injury

<table>
<thead>
<tr>
<th>Sports</th>
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<tr>
<td>Football (ie, Soccer)</td>
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<tr>
<td>American football</td>
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<tr>
<td>Basketball</td>
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<td>Volleyball</td>
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<tr>
<td>Gymnastics</td>
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<td>Team handball</td>
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<td>Downhill skiing</td>
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Note: virtually any sport that involves explosive running, jumping, or sudden changing of direction places the athlete at risk for ACL injury.

ACL: anterior cruciate ligament.
Risk Factors

- **Extrinsic**
  - Footwear/playing surface
    - Conflicting studies
  - Biomechanics
    - Clear risk associated with compromised or unstable position of the limb or body

- **Intrinsic**
  - Increased BMI, joint hyperlaxity, hamstring weakness, poor core strength, poor proprioception, fatigue, and gender
Role of Gender

- Females at higher risk than males when playing the same sport
  - Quadriceps-dominant deceleration
  - Increased knee valgus angles during deceleration, landing, and pivoting activities.
  - Effects of estrogen on ligament laxity
  - Discrepancies in Q-angle and bone length
  - Decreased inter-condylar notch width
ACL injuries

- The cost to society
  - The mean lifetime cost to society for a typical patient treated with rehabilitation was $88,538
  - ACL reconstruction was $38,121

- What is the cost of prevention?
ACL Prevention

- Cannot make risk zero
  - However we can reduce risk.

- Not all risk factors can be modified
  - Gender, joint laxity, etc...

- Some risk factors can be modified
  - This has been the focus of Prevention programs.

- There is a consensus amongst several medical specialty groups, including the American Academy of Orthopedic Surgeons, that ACL Prevention programs for female athletes involved in high risk sports.
  - It is likely that male athletes benefit especially during rapid growth phase of adolescents
The Programs

- The Henning Program
- The Carraffa Program
- FIFA +11
- Sportsmetric
- Vermont Safety Research group
The Studies

- Meta analysis of 6 studies looking at prevention programs in female athletes demonstrated 29 ACL injuries in the test groups and 100 in the control groups
  - Hewett, Ford, Meyer AJSM 2006
- All four programs that incorporated high-intensity jumping plyometric exercises reduced injury rates.
- All three programs that included biomechanical analysis and provided direct feedback to the athletes about proper position and movement reduced injury rates.
- Programs that incorporated strength training reduced injury rates, although strength training alone did not.
- Balance training alone is unlikely to reduce injury rates, although it may enhance other prevention techniques.
- Athletes must participate in prevention training at least two times per week for a minimum of six consecutive weeks to accrue any benefit
ACL Prevention

- The cornerstones of all programs consist of:
  - Proprioception training
  - Core strength
  - Neuromuscular training
  - Muscle memory
  - Proper technique

- All of which control body and limb position

- If the athlete is trained appropriately, will help decrease the risk of compromised positions
ACL Prevention

- There is a consensus amongst several medical specialty groups, including the American Academy of Orthopedic Surgeons, that ACL Prevention programs for female athletes involved in high risk sports.
- It is likely that male athletes benefit especially during rapid growth phase of adolescents.
- The goal is to take the existing literature and identify the essential exercises for addressing the risk factors that can be modified.
“The Six”

- dynamic warm-up to get blood flowing and working on stability/control through movement (hamstrings, quads, hip flexors, lunge, reverse lunge, lateral lunging, inch worm, forward kicks, etc)

- monster walks/sidesteps with band

- alternating jumping lunge and skaters avoiding knee valgus

- Side plank with good form/ prone plank

- double leg jump/ single leg jump with soft knee/quite feet/ eccentric control

- ladder drills with back pedal between sets.
ACL Prevention

- Demonstration.