

# Noncontact Anterior Cruciate Ligament Injuries in Collegiate Female Soccer Players: The Effects of a 4-Week Prevention Program on Landing Kinematics

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Tess Marcordes

Dr. Scott Armstrong

# Introduction

- 127,000 ACL reconstructive surgeries were performed in the U.S. in 2011. (Bates et al., 2016)
- ACL reconstructive surgery requires up to 24 months of recovery (Otzel et al., 2015)
- 25% of athletes may never return to their original level of play prior to the injury (Padua et al., 2015)

# Risk Factors of Noncontact Injuries

- 70 to 84% of ACL injuries in athletes are noncontact (Kaneko et al., 2017)
- Extrinsic factors vs. Intrinsic factors
- Quadriceps and hamstrings relationship
- Hip range of motion
- Muscle fatigue
- In soccer
  - “Stop-start movements, changes in direction, jumping and landing both with and without passing and/or shooting a ball” (Weiss & Whatman, 2015, p. 1326)

# Female Susceptibility to ACL injury

- Women are 2 to 5 times more susceptible to ACL injuries (Padua & Marshall, 2006).
  - Weaker hamstrings and quadriceps
  - Tissue structure of the ACL
  - “Q” angle

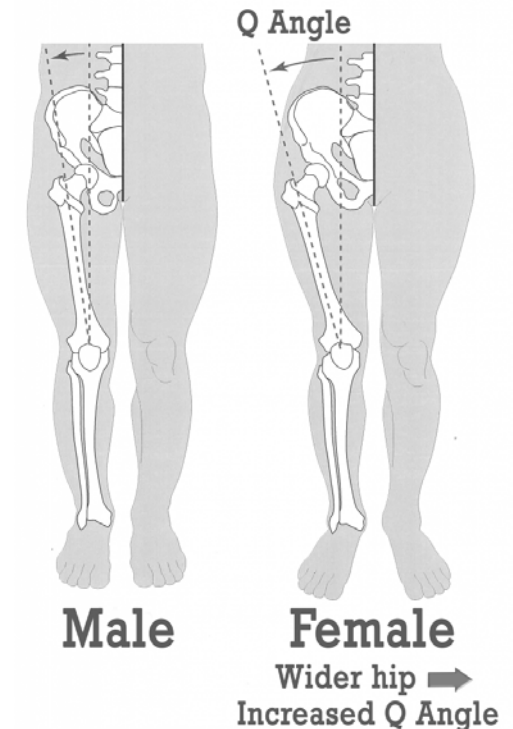


Image from: <https://runnersconnect.net/understanding-q-angle-and-role-with-injuries/>

# The Effects of Plyometric Versus Dynamic Stabilization and Balance Training on Lower Extremity Biomechanics (Myer, Ford, McLean, & Hewett, 2006)

- Observed the reaction of the knee and its flexion angle when landing from a vertical jump and a horizontal jump.
- Plyometric training reduced the risk of injury when landing from a vertical jump
- Dynamic stabilization training reduced the risk of injury when landing from a horizontal jump

# Prevention of Non-Contact Anterior Cruciate Ligament Injuries in Soccer Players (Alentorn-Geli, Myer, Silvers, Samitier, Romero, Lazaro-Haro, & Cugat, 2009)

- Part 2: A Review of Prevention Programs Aimed to Modify Risk Factors and to Reduce Injury Rates
- No standardized ACL injury prevention program
- Multiple component programs vs. single component programs
- Most programs lasted 6 to 8 weeks

# Decreasing Landing Forces: Effect of Instruction (McNair, Prapavessis, & Callener, 2000)

- Technical instruction
  - Biomechanical prompts - “position yourself on the balls of your feet with a bent knee just prior to landing” (p. 294)
- Auditory instruction
  - Listen to the sound of their landing, using this information to create less sound in future jumps
- Metaphorical imagery
  - “bubbles floating down toward the ground” (p. 294)

- The goal of the 4-week ACL injury prevention program was to improve the participants' landing kinematics, resulting in a decrease in the scores of the Modified Landing Error Scoring System (LESS).



# Materials and Methods

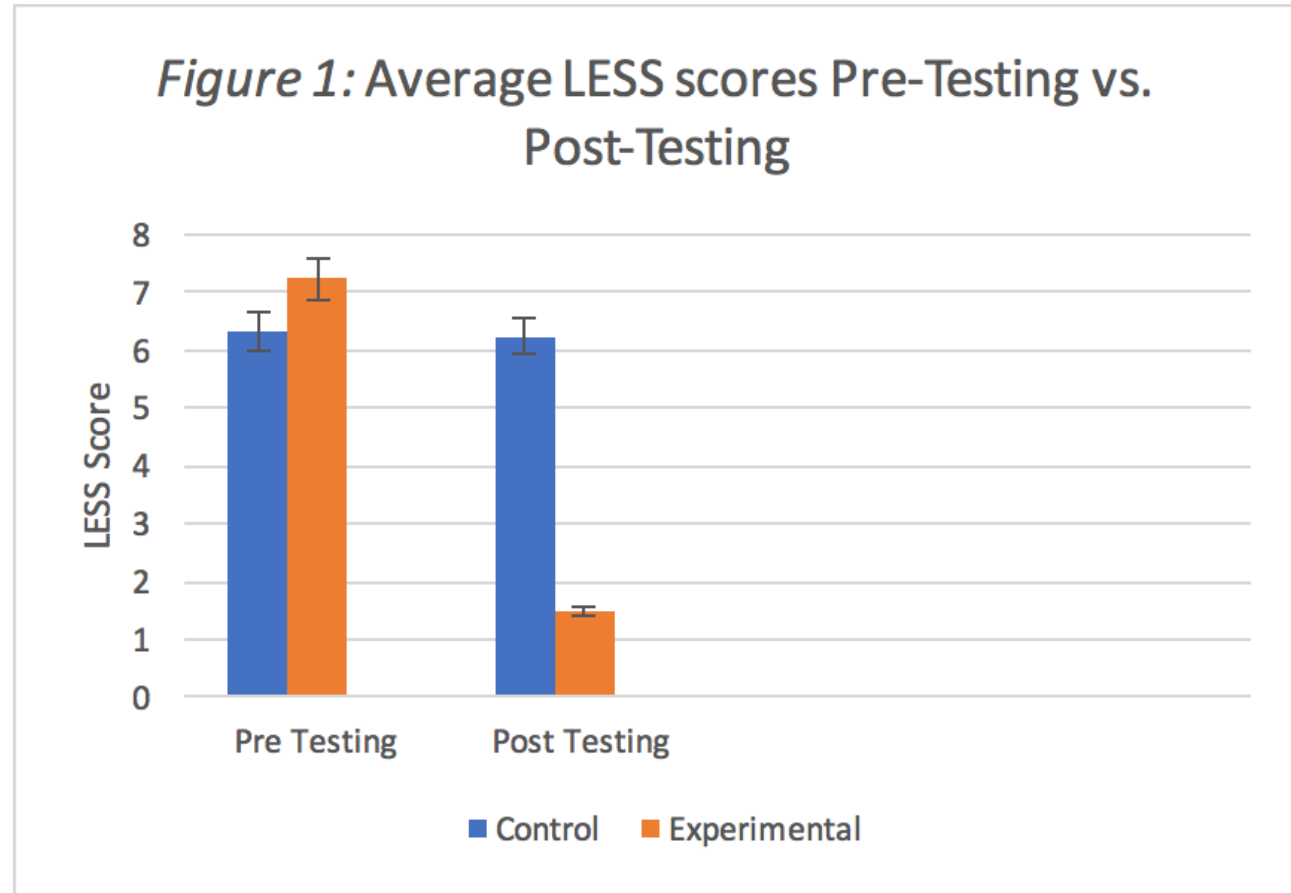
- 10 female collegiate soccer players
- No prior ACL injury
- Participating in off-season practices and training sessions
- Modified LESS

# Procedure

- Each session occurred after the participants' off season training
- 3 progressions over 4 weeks
  - High intensity, dynamic exercises → low intensity, stabilizing and strengthening exercises
  - Plyometric, strengthening, balance, and sport-specific exercises
  - 10 minute warm up, 5 minute cool down
- Technical and auditory cues

# Results

- Pre-Testing LESS Averages
  - Control group: 6.33
    - 42.2% overall risk
  - Experimental group: 7.25
    - 48.33% overall risk
- Post-Testing LESS Averages
  - Control group: 6.25
    - 41.67% overall risk
  - Experimental group: 1.5
    - 10% overall risk



# Discussion

- Risk factors based upon the Modified LESS were decreased in 4 weeks by using a progressive, multi-component ACL injury prevention program
  - Explanation and demonstration of each exercise
  - Technical and auditory cues
- Trend observed: reduction seen in the same five categories on the Modified LESS
  - “Stance width”
  - “Amount of lateral trunk flexion”
  - “Amount of knee-flexion displacement”
  - “Total displacement in the sagittal plane”
  - “Overall impression”
- 0% incidence of ACL injury

# Limitations

- 3 participants in the experimental group
- Confirmation bias
- Athletes in their off-season

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