Effect of Stationary and Moving Defenders on the Biomechanics of the Cutting Movement

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Why Study ACL Injuries?

- 100,000 to 200,000 ruptures per year
- Increased costs
- Not simply a short term injury
- Prevention strategies possible?
Knee Anatomy

[Diagram of knee anatomy with labels for femur, patella, lateral collateral ligament, medial collateral ligament, posterior cruciate ligament, anterior cruciate ligament, fibula, and tibia. On the right, a complete tear of the ACL is indicated.]
How do ACL Injuries Occur?

• Contact

• General Movements
  – Rapid change of direction
  – Deceleration
  – Landing from a jump
  – Pivoting with knee in extension
How do ACL Injuries Occur?

- Mechanisms
  - Anterior translation force
  - Knee close to full extension
  - Inadequate hamstring recruitment
  - Large valgus angle/collapse
How do ACL Injuries Occur?

- Sport Movements
  - Cutting/sidestep
  - Drop landing
Cutting/Sidestepping Variables

• Unknown Direction
• Gender
• Fatigue
• Footwear
• Defender…
McLean et al. (2004)

- Tested Gender, Defensive Opponent
- 8 male/female participants
- Simulated defender: skeleton
- Increases in peak medial GRF, hip flexion, hip abduction, knee flexion, and knee valgus
Methods

• Participants
  - 6 male; 4 female
  - Age (yr): 23.2 ± 3.85
  - No previous R Leg injuries/surgeries
  - Non-athletes
Methods

- Instrumentation
  - 8 Vicon Nexus motion capturing cameras
  - 21 reflective markers
  - One AMTI force platform
  - Stopwatch
Methods

• Set-Up
  – 45 degrees taped off
  – 3 meter starting mark taped off
  – 45 cm defender mark taped off
Methods

• Procedure
  – Approach speed 4.5-5.5m/s
  – 45 degree cut off R leg
  – 4 conditions
    • No defender
    • Static defender
    • Defender moving forward
    • Defender stepping left
  – Last 3 conditions randomized
  – Three good trials
Hypothesis

• The implementation of a defender into the lateral cutting movement will increase the severity of mechanisms that are known to be risk factors for ACL injuries

• The conditions where the defender is moving will have a further increase in the severity of said mechanisms than the static defender condition
Results

• To be determined
Limitations

• Human error
  – Velocity
  – Defender movement
    • Timing
    • Degree
    • Tenacity
• Participant cutting technique
• Fatigue
• Adaptations
Future Studies

- Same defender; defined start time
- More accurate mechanism of measuring velocity
- Standardized, extended teaching of movement
- Standardized rest periods
- Combine defender with another variable: unknown direction
- EMG: quadriceps/hamstrings activation
References


