ACL and Knee Injury Prevention

Presented by:
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ACL Anatomy

Extended (straight) knee:
- Femur (thighbone)
- Patella (kneecap)
- Meniscus (cartilage)
- MCL (medial collateral ligament)
- Tibia (shinbone)
- Fibula

Flexed (bent) knee:
- Patella
- Femur
- PCL (posterior cruciate ligament)
- Torn ACL (anterior cruciate ligament): a common ligament injury in basketball
- LCL (lateral collateral ligament)

Fig. 1
ACL Mechanism of Injury

Contact ACL Tear

Noncontact ACL Tear
ACL MOI and Pathology

• Common in young individual who participate in activities that involve pivoting, deceleration and jumping
• 30% are direct contact injuries
• 70% are indirect injuries
• In a study of female soccer players, 62% suffered some form of ligamentous or muscular injury to the knee
  - Factors – Smaller and different size of intercondylar notch, wider pelvis with greater Q-angle, greater ligamentous laxity, neuromuscular factors (HS to Quad to Gastroc)
• Most common Sports (in order)
  - Men’s spring football
  - Women’s gymnastics
  - Women’s Soccer
  - Women’s Basketball
  - Men’s Football
• Following surgery
  - 4.4% of patients re-tear on the same side
  - 3.5% of patients tear on the opposite side following surgery
ACL Risk Assessment

At our facility we use a multi-faceted approach to determine the athlete’s risk of a knee injury

• We use the following
  • YBT
  • SL Squat
  • Tuck Jump
  • Cutting
  • Drop Jump

• For return to play we use the following:
  • FMS
Lower Quarter Y-Balance Test

- Reliable and valid tool for assessing dynamic single leg balance
- Scoring based on symmetry or composite
  - >4cm asymmetry in anterior reach = 2.5x risk of LE injury
  - >6cm asymmetry in PM & PL reach correlates with increased injury
  - <89% composite increases probability of injury from 37.7% to 68.1%
Drop Jump to vertical jump

- Uneven take off/landing
- Knee collapse at take off and landing
- Lateral shift on landing
- Uneven/narrow/base BOS on landing
- Poor posterior weight shifting
- Unable to squat to 60 degrees of knee
Single leg squat

- Unable to squat past 60 degrees
- Knee collapses
- Poor quad control
- Forward or lateral trunk lean
- Pelvic drop
- Unable to maintain a neutral spine
- Poor posterior weight
Single leg hop

- Knee collapse at take-off or landing
- Poor use of knee, hip and ankle to stabilize
- Less than 45 degrees of knee flexion
- Poor posterior weight
- Unable to stick landing
- Unable to maintain
Cutting 45 degrees

- Loads plant leg less than 45 degrees
- Excessive trunk lean
- Unable to maintain a neutral spine
- Rotation of plant foot
- Plants on wrong foot
- Plants outside of BOS (more than 2 foot widths outside of)
Lateral hurdle hop

- Knee collapse with take off and landing
- “Cork Screwing”
- Brace knees together
- Multiple hops between hurdles
- Rotated shoulder/hips
- Poor balance
- Less than 45 degrees
Tuck Jump Assessment

- This allows for some of the best real time information on how an athlete performs jumping and landing activities.
The tuck jump assessment can show multiple biomechanical faults

1. Ligament dominance
2. Quadriceps dominance
3. Leg dominance
4. Trunk dominance
Tuck Jump Assessment

Ligament dominance

- Occurs due to an imbalance between neuromuscular and ligamentous control of dynamic knee stability resulting in the inability to control the LE frontal plane motion during landing and cutting.
- Presentation – LE valgus at landing, foot placement not shoulder width apart.
Tuck Jump Assessment

Ligament dominance correctives

- Education on proper athletic positioning – knee comfortably flexed, shoulders back, eyes up, feet shoulder width apart, body mass over balls of feet
- Wall jumps – minimal deep knee flexion, most vertical movement is from PF, give feedback to correct valgus positioning (keep knees apart while landing)
- Tuck jumps – high level of effort
- Broad jump and hold – moderate intensity, allows athlete to address dynamic knee control in different planes, forces athlete to gain and maintain dynamic knee control, d/t hold patient gains awareness of foot positioning and knee control
- 180 degree jump – teach dynamic body and LE control in transverse plane, teaches patient how to recognize and control dangerous rotational forces
- Single leg hop and hold
- Unanticipated cutting movements
Tuck Jump Assessment

Ligament dominance correctives

¬ Wall Jumps
¬ Tuck Jumps
¬ Broad Jump
¬ 180 Degree Jump
Tuck Jump Assessment

Quadriceps dominance
- Occurs due to imbalance between knee extension (quad) and flexion (HS) strength, recruitment and coordination
- Presentation – excessive landing contact noise
Tuck Jump Assessment

Quadriceps dominance correctives
  - Exercises to emphasize co-contraction of the knee flexor-extensor muscles
    - Deep knee flexion movements can teach activation of HS
    - Squat jumps
    - Broad jump and hold
    - Hop and hold
Tuck Jump Assessment

Leg dominance
- Occurs due to imbalance between the two LEs in strength, coordination and control.
  - Presentation – thigh no equal side to side during flight, foot placement not parallel (front to back), foot contact timing not equal
Tuck Jump Assessment

Leg dominance correctives
- Training must progressively emphasize DL to SL movements. Equal leg to leg strength, balance and foot placement are stressed
- Do NOT allow the athlete to land with one leg back
- Bounding exercises
- Power jumps
- Single leg balance – on BOSU
- Jump, jump, jump, vertical jump
Tuck Jump Assessment

Trunk dominance

- also known as “core dysfunction” this is an imbalance between inertial demands of the trunk and control/coordination to resist it.
  - Presentation – thighs do not reach parallel (peak of jump), pause between jumps, does not land in the same footprint
Tuck Jump Assessment

Trunk dominance correctives
  • Address core strengthening and activation patterns with dynamic knee control movements
Injury Prevention

Warm-up

FIFA “11+” Warm-up

- Developed by FIFA and Medical Assessment and Research Center (MARC)
- Used a series of research based exercises in order to reduce risk of injury
- Consistent implementation of this warm up can result in a 30-50% reduction in non-contact knee injuries
- Intended to coaches instructed who then instruct the captains or team leader to take the rest of the team through warm-up prior to practice and games
- Exercises address endurance, agility, speed and a technical and tactical understanding of the game
Injury Prevention
Warm-up

FIFA “11+” Warm-up Exercises

- Part 1: running exercises performed at a slow speed with active stretching and partner contacts

- Part 2: 6 sets of exercise to focus on core and leg strength, balance and plyometrics and agility at 3 increasing levels of difficulty

- Part 3: running exercise at moderate and high speed with cutting and planting motion

- A copy will be provided to the head coaches

- We will also take the teams through this today
Injury Prevention
Exercise
Loop Band Squats
Injury Prevention
Exercise
Lateral band walks
Injury Prevention Exercise
Bridge with External Rotation
Injury Prevention Exercise

Plank
Injury Prevention

Exercise

Single leg band kicks
Injury Prevention

Exercise

Single leg band kicks
Injury Prevention
Exercise
Hamstring Stretch
Injury Prevention

Exercise

Half kneeling hip flexor stretch
Athletico – Germantown Hills/Metamora

Location
• 123 Spring Creek Road, East Peoria, IL, 61611

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We provide free injury screens, FMS and ACL...
References

Physio-pedia – ACL

Risk Factors and Predictors of Subsequent ACL Injury in Either Knee After ACL Reconstruction

Risk Factors for Lower Extremity Injuries in Elite Female Soccer Players

Real-Time Assessment and Neuromuscular Training Feedback Techniques to Prevent Anterior Cruciate Ligament Injury in Female Athletes