

Preventing Injuries and Enhancing Power

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A *P.A.C.E.*TM Program Lecture [Performance=Athletic Competitive Enhancement]

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Tonight's Discussion

- Common injuries
- Gender differences in injury rates
- Normal growth and development
- Impact of growth spurts on performance
- Training to Prevent Injuries and Enhance Performance (PEP *PLUS* program)

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Why are we talking about injuries?

- Youth soccer leagues (ages 12 to 18) report injury rates of 2.4 to 4.9 injuries/1000 Athletic Exposures. *Yard et al, 2008; JAMA, 2006; Kucera et al, 2005*
- Context
 - Football: 4.4 injuries/1000 AE's
 - Wrestling: 2.5 injuries/1000 AE's
 - Softball: <2 injuries/1000 AE's

Greatest risk factor for injury = history of previous injury: 1 previous injury, 2x more likely to injure again; 2 previous injuries, 3x more likely to injure again.



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Most Frequent Diagnoses

- Ligament sprains (26.8%)
- Muscle strains (17.9%)
- Contusions (13.8%)
- Concussions (10.8%)

Yard et al, 2008 [2005-06/2006-07 seasons; 100 U.S. high schools; 1524 soccer injuries, 2.39 injuries/1000 AE]

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Most Commonly Injured Sites

- Ankle (23.4%)
- Knee (18.7%) [# 1 cause for surgery]
- Head/face (13.7%)
- Thigh/upper leg (13.1%).

Yard et al, 2008 [2005-06/2006-07 seasons; 100 U.S. high schools; 1524 soccer injuries, 2.39 injuries/1000 AE]

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Mechanisms of Injuries

- Non-contact
 - More common in practice
 - Usually a traumatic twisting force with dynamic movement (e.g, landing a jump, cutting, or changing directions)
 - 70% of ACL injuries are non-contact
- Contact injury
 - More common during competition
 - Usually results from a tackle from behind



Mechanism of Anterior Cruciate Ligament Injury in Agility Sports

When trying to pivot around an opponent, an athlete decelerates and pivots on a planted foot, causing the ACL injury.

Yard et al, 2008 [2005-06/2006-07 seasons; 100 U.S. high schools; 1524 soccer injuries, 2.39 injuries/1000 AE]

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Gender Differences

- For minor injuries, similar proportions of boys (57.9%) and girls (53.9%) return to activity in <1 week.
- For major injuries requiring surgical intervention (Yard et al, 2008)
 - Girls: 26.4 operable ACL injuries/100,000 AE's
 - Boys: 1.98 operable ACL injuries/100,000 AE's
- In general girls are 4 to 6 times more likely to sustain an ACL injury requiring surgery than boys (all Title 9 sports categories, Huston et al, 2000)
- Girls between the ages of 15 to 20 years are at highest risk
- 1 in 100 female athletes may rupture their ACL

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Why are girls more vulnerable?

- Hormonal changes that affect the ACL [vulnerable in pre-ovulatory phase]
- Technique in landing jumps
- Structural and biomechanical alignment
- Muscle balance and strength of the lower extremity

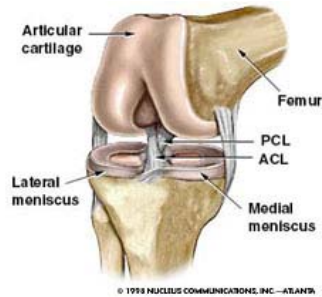
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Anatomy of the Knee Joint

- The knee joint connects the femur or upper thigh to the lower leg which consists of the fibula and tibia
- There are four major ligaments that form this connection:
 - anterior cruciate ligament (ACL)
 - posterior cruciate ligament (PCL)
 - medial collateral ligament (MCL)
 - lateral collateral ligament (LCL)



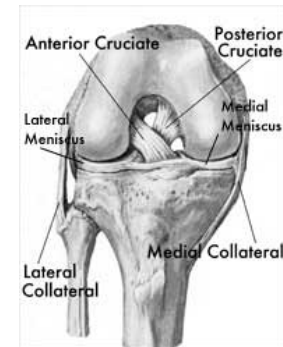
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Anatomy of the Knee Joint

- The ACL and PCL are found deep within the knee joint, while the MCL and LCL are more superficial on either side of the knee joint.



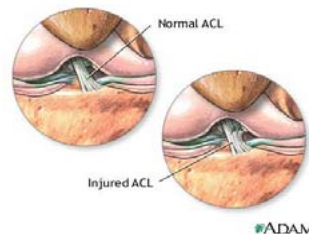
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Anterior Cruciate Ligament

- The ACL is a broad ligament within the knee that joins the tibia to the femur and provides a large amount of stability for the knee.



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Functions of the ACL

- Prevents anterior or forward translation of the tibia
- Prevents hyperextension of the knee
- Assists the MCL with stability from the side by checking lateral or valgus forces
- Controls the rotation of the tibia with movements like side-stepping and pivoting

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Injuries to the ACL

- Knee experiences a hard twist or excessive pressure on the ACL such that it fails/tears
- Knee gives out and can no longer support the body; especially with rotational movement



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The Growth Spurt Years

	Girls	Boys
Growth Spurt	·Age 9-13	·Age 11-15
Height	·3.6 in/yr ·6-12 mos prior to menarche ·Peak: Age 17	·4.2 in/yr ·Peak: Age 19
Weight [about 6 months after Peak Height]	·18 lbs/yr ·Increased body fat % [compared to boys]	·20 lbs/yr

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This is a problem because...



- Longer and heavier limbs
- Requires 30% more force to accomplish same work as before growth
- Requires learning new movement patterns

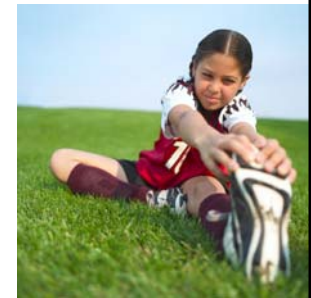
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What about Flexibility and Posture?

- Bones grow faster than muscles; muscles are playing catch-up
- Short muscles are inefficient; harder to control or achieve desired power output
- Long muscles are weak and inefficient
- Girls tend to play in a more erect posture than boys (straighter knees = more pivot strain through ACL)



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...Coordination and Balance?

- Lag time between growth and “sensorimotor adaptations”
- Leads to less balance and coordination
- Harder to look away from feet/ball and down the field



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... and Jumps and Landings?

- Girls tend to keep their knees straighter than boys when landing jumps
- Pre-adolescent boys and adolescent girls tend to let their knees cave in when landing jumps, cutting, or pivoting
- Proper landing, cutting, and pivoting techniques are a must for preventing injuries (and increasing efficiency)

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The Good...



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The Bad...



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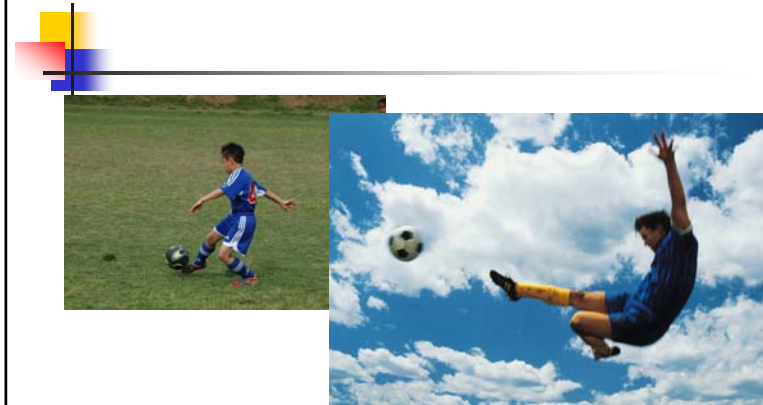
And the Ugly!



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PEP: Prevent Injury and Enhance Performance

- Developed by the Santa Monica Orthopaedic and Sports Medicine Research Foundation
- 15 to 20 minute program
 - Warm up
 - Stretching
 - Strengthening
 - Plyometrics
 - Sport-specific agilities

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PEP: Prevent Injury and Enhance Performance

- Decreases lower extremity injuries (70 to 80% reduction in ACL injuries in girls over a 2 year study period)
- Increases max jump height
- Increases power and agility
- Teaches proper technique for jumping, landing, cutting and turning

When done at least 2x/week

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PEP PLUS

- PEP, plus modifications based on our clinical experience
- Performance results
 - More power
 - More speed
 - Players able to outcompete for the ball

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Phases of PEP PLUS

- Warm-up
 - Increase blood flow to arms, legs, and trunk
- Stretching
 - Calves, Quads, Hamstrings, Groin, Hip Flexors
- Strengthening
 - Quads
 - Hamstrings/Gluts
 - Lats and abdominals (rule of the back)
 - Calves
- Plyometrics
 - Jump technique and vertical power (rule of the knee)
- Agilities
 - Speed and coordination (rule of the knee)
- Cool Down (while you're debriefing)

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Warm up



Light Jog
Forward



Side Shuttles



Backward Jog



Grapevine

Elapsed Time: _____ → 2 minutes

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Stretching



Calf



Quads



Hamstrings



Groin



Hip Flexor

Elapsed Time: _____ → 5 minutes

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Strengthening



Walking Lunges



Russian Hamstrings



Planks



Single Calf Raises

Elapsed Time: _____ → 4 minutes

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Plyometrics



Lateral Hops



Front/Back Hops



Single Leg Hops



Vertical Jumps



Scissor Jumps

Elapsed Time: _____ → 3.5 minutes

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Agilities



Front/Back Shuttle Run



Diagonal Runs



Bounding Runs

Elapsed Time: _____ → 4 minutes

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PEP PLUS

- Coach/player training
- Detailed instructions
 - Field Set-up
 - Purpose/Instructions
 - Helpful Cues
 - Photos

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PEP *PLUS* Homework

- Supplemental training guidelines for the athletes (especially the girls), who need some additional targeted strengthening

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- Thank You!!!
- Questions???



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