

Adolescent Female Knee/ACL Injuries and Prevention

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ProOrtho

Background

- Native Seattleite
- Played most sports, but primarily soccer
 - High school, select, ODP, college
- College at Notre Dame
 - Hurt first game of freshman year
- Medical School at Georgetown
- Orthopedic Residency Georgetown
- Sports Medicine Fellowship Hospital for Special Surgery
 - Women's Sports Medicine Center, Coverage of college and professional sports teams
- Practice in 2008
- Board Certified in Orthopedic Surgery
- Certification of Added Qualification Sports Medicine

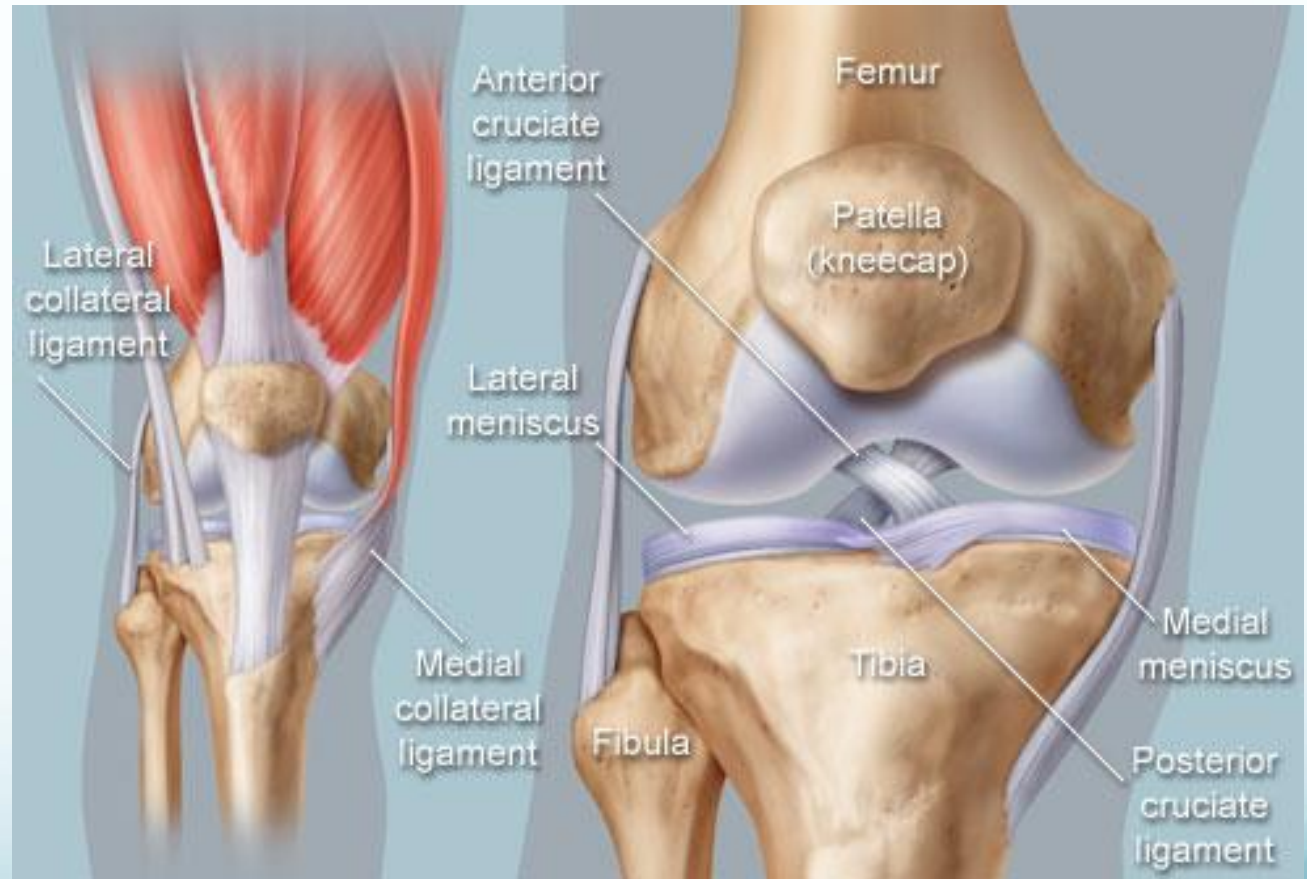
ACL/Knee Injuries and Prevention

- Basic knee anatomy
- Common injuries
- ACL injuries
- ACL prevention



Knee Anatomy

- Bones
- Ligaments
- Cartilage
- Meniscus



Knee Injuries

- Overuse Injuries
 - Patellofemoral pain
- Traumatic injuries
 - ACL tears
 - Patella (kneecap) dislocations
 - Meniscus tears
 - MCL/LCL/PCL tears
 - Cartilage injuries



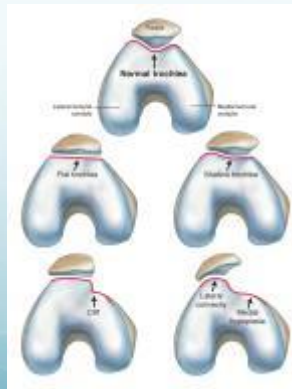
Evaluation of Knee Injuries

- Overuse vs. traumatic
- Mechanism of injury – contact, noncontact
- Swelling → No playing until evaluation, probably need MRI
- Loss of motion, especially loss of extension → needs further evaluation
- Some ACL and meniscus injuries will not have much swelling



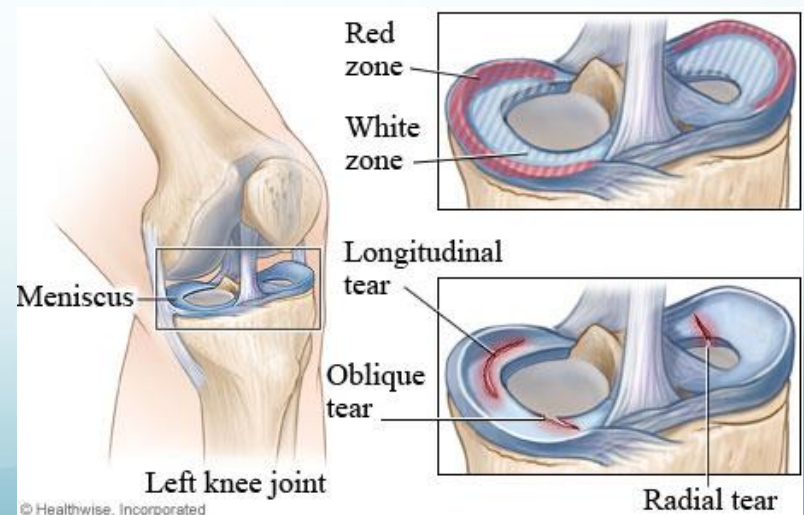
Knee injuries

- Patellofemoral pain
 - Overloading between kneecap and groove it sits in
 - High forces – 6-7x bodyweight depending on activity
 - More likely with high Q angles, foot pronation, tight IT bands, hip weakness, VMO weakness
 - Common in adolescents
 - Usually gets better with PT, activity modification
 - If not, in certain settings realignment of kneecap works well



Meniscus Tears

- Meniscus –
 - Cartilage pad in the knee
 - Often twisting injury
 - May accompany ACL/ligament tears
 - In this age group repair if at all possible.
 - Still risk of re-tear/not healing
 - Long term bad injuries, especially if meniscus (or part of it) is removed



Cartilage injuries

- Overuse/chronic versus traumatic
- May be associated with ligament/other traumatic injuries. Less common with ACL injuries in girls than boys
- Multiple options available to repair/replace



Ligament Injuries

- MCL
 - Often heal even with ACL injury
- LCL
 - If partial/isolated may heal. If combined with ACL/PCL often require reconstruction/repair
- PCL
 - Relatively rare in sports. May heal. Can do well with non-operative treatment. Less studied than ACL tears

Patella Dislocation

- Knee cap dislocation
- Anatomy may predispose – valgus knee (knock-kneed), laxity, shallow trochlear groove
 - About 50 % chance of recurrence, higher with certain risk factors
 - First time often non-operative treatment unless other injuries



Patella Dislocation

- Recurrence → patella stabilization with bony/soft tissue reconstruction depending on anatomy, age, predisposing factors
- Low recurrence rates – return to sports in 4-6 months



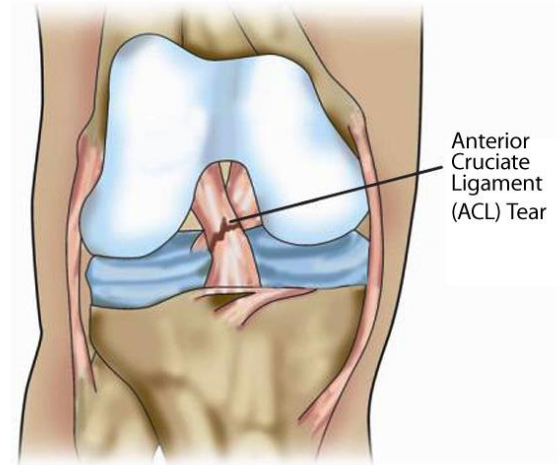
ACL Tears

- ACL prevents anterior translation and rotation in the knee
- ACL is not needed for walking, riding bike, activities in a straight line
- Very important for cutting, pivoting activities
- Most are noncontact injuries (70-80%)
- Often there are associated injuries – meniscus/cartilage
- Non-operative treatment in athletic populations leads to poor results → more injuries, and further damage in the knee.
- Increased risk of future arthritis



ACL Tears

- Becoming more common
 - 150,000-200,000/year, Costs \$1-2 billion
- Treatable → ACL reconstruction
 - Can be safely reconstructed even in young children
 - Multiple options available
 - High success rate
 - Not everyone returns to prior level of sports
- Long rehab > 6 months
- Psychological strain



Female ACL Injuries

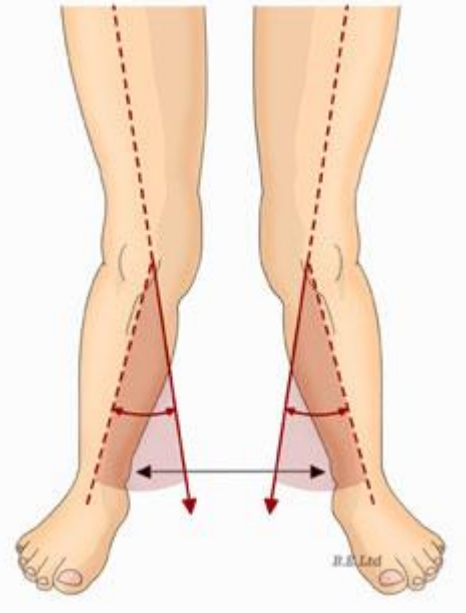
- Why so much press??
 - ACL tears increasing in frequency, especially among females
 - Female athletes have 2-6 times the incidence of ACL injuries as male athletes
 - For collegiate soccer/basketball 4.5% per year vs. 1.7% in males. High school athletes up to 1/60
 - Lost scholarships, lost school days, psychological strain
 - Fear of injury/re-injury could lead to decreased sports participation which we know is valuable in girls
 - Increased risk of future arthritis

Female ACL injuries

- ACL reconstruction has high success
- Recurrent injury rates may be higher than originally thought – younger patients have a higher risk. Females have a higher risk. (Also technique issues can play a role.)
 - Risk of additional ACL injury in females within 2 years after return to play 20-29.5% (depending on study)
 - 70% occur in the contralateral knee
 - Overall 6 times more likely
 - Up to 15x more likely in the first year returning to play

The Female Knee

- What's the difference?
 - Anatomy –
 - wider pelvis, greater angle at knees (Q angle)
 - Puts more strain across knee
 - Narrow notch?
 - More tibial slope
 - Ligamentous laxity
 - Hormonal differences? → more risk during certain portions of menstrual cycle – data inconclusive



FACTORS WE CAN'T CHANGE

The Female Knee

FACTORS WE CAN CHANGE

- Strength differences
 - Higher Quad/hamstring strength and recruitment, slower hamstring activation
 - Hamstring contraction has protective effect – pulls tibia back
 - Quad contraction increases strain on ACL – pulls tibia forward
 - Athletes with ACL injuries had lower hamstring strength/recruitment, higher angular motion in the knee, more vertical position

The Female Knee

- Mechanical/Dynamic differences
 - Jump landing and cutting with knee more extended
 - Hips more adducted
 - Knee more likely to fall into valgus (fall in)
 - more valgus → more strain on ACL
 - Upper body not over legs (core strength)



ACL Prevention

- Additional risk factors to be aware of (not gender specific)
 - Fatigue
 - Shoe Wear
 - Playing Surface
 - Family History



ACL Prevention

- Does it really work???
- YES
 - Significant reduction in ACL tears and knee injuries
 - Up to 50-80% reduction – greatest reduction in noncontact injuries
- Barriers
 - Knowledge
 - Time
 - Compliance
 - Monotony



ACL Prevention

- When should we start?
 - Sooner is probably better
- What are the key components?
 - At least 10 minutes, at least 3 times a week – bare minimum, more is better
 - 8 weeks prior to season
 - Warm-up
 - Strength/power exercises
 - Hamstrings
 - Hips
 - Core
 - Plyometrics
 - Proprioception/Balance
 - Agility
 - Flexibility



ACL Prevention

- Proper form is key when doing exercises
- PEP (SMSF) , Sportsmetric – proven success
- Programs work better with feedback to athlete
 - Jump landing on ball of foot → decrease ground reaction force
 - Knees bent and pointed straight ahead
 - Trunk over legs
 - Feet apart

ACL Prevention

- Other benefits
 - Increased vertical jump
 - Possible increased speed
 - Increased power/strength
 - Decreased rate of other knee injuries (not just ACL)



ACL Prevention

- Identify at-risk athletes – although recent study shows we should treat everyone (63% vs 40%)
 - Landing error scoring system
 - Start on box, land on floor and immediate vertical jump up
 - Post-operative patients
 - Attention to operative AND non-operative knee
 - Return to play criteria
 - Highest risk for contralateral knee within one year of return to play

ACL Prevention

- All cutting/pivoting athletes should be in an ACL prevention program
- Try to catch athletes not in a program, especially at risk athletes
- Programs should start in pre-adolescence
- Including as part of the warm-up may increase compliance
- We should also be aware of overtraining/fatigue as risk factors
- If an injury occurs best surgical treatment and rehabilitation following
- Potentially adjust return to play criteria

References

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THANKS