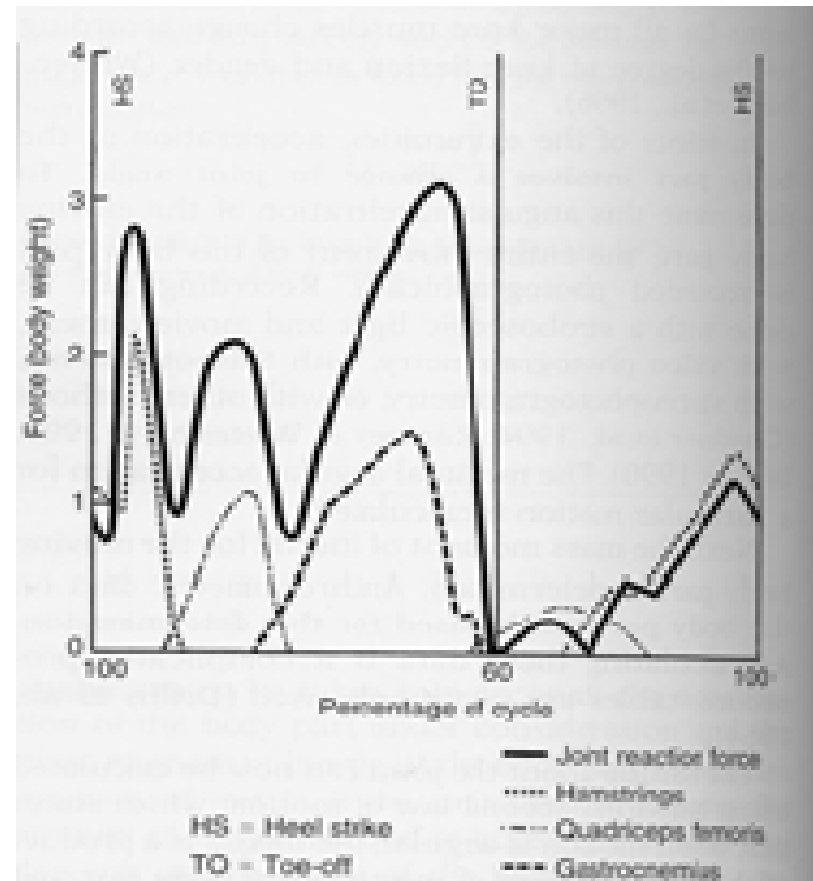


Section 30: Knee Biomechanics

Movement and Forces

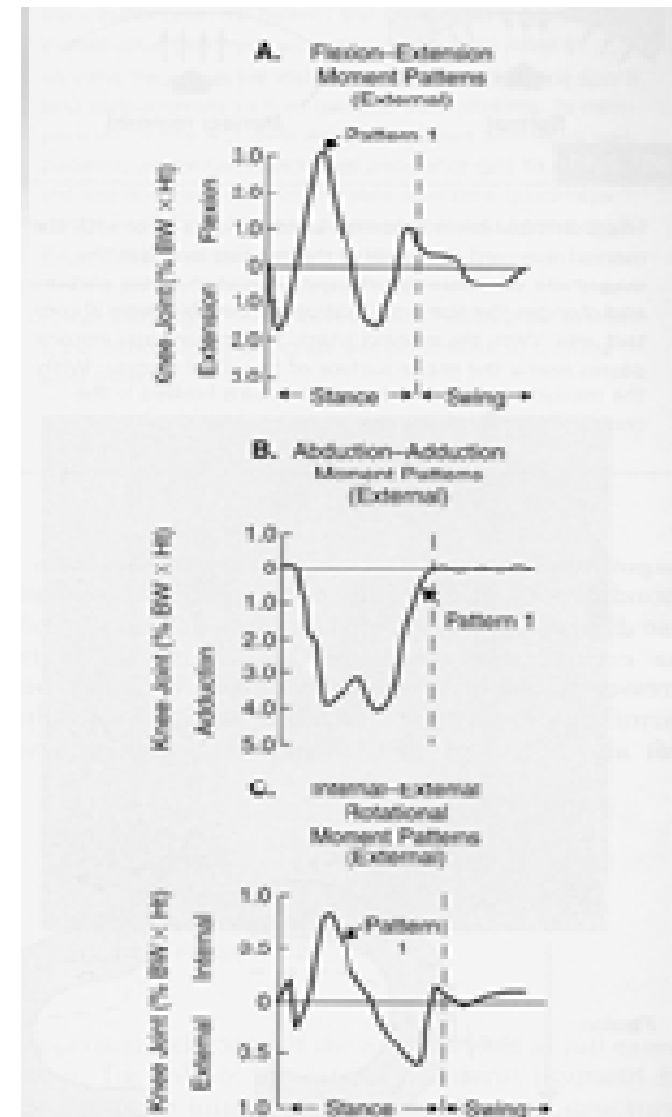
Joint reaction forces during gait

- Joint reaction forces as a fraction of body weight during gait
 - Largest muscle force is the gastrocnemius during late stance
 - Hamstring is active at end of gait cycle



Moments on knee during gait

- Moments on knee joint during gait normalized by individual's body weight and height



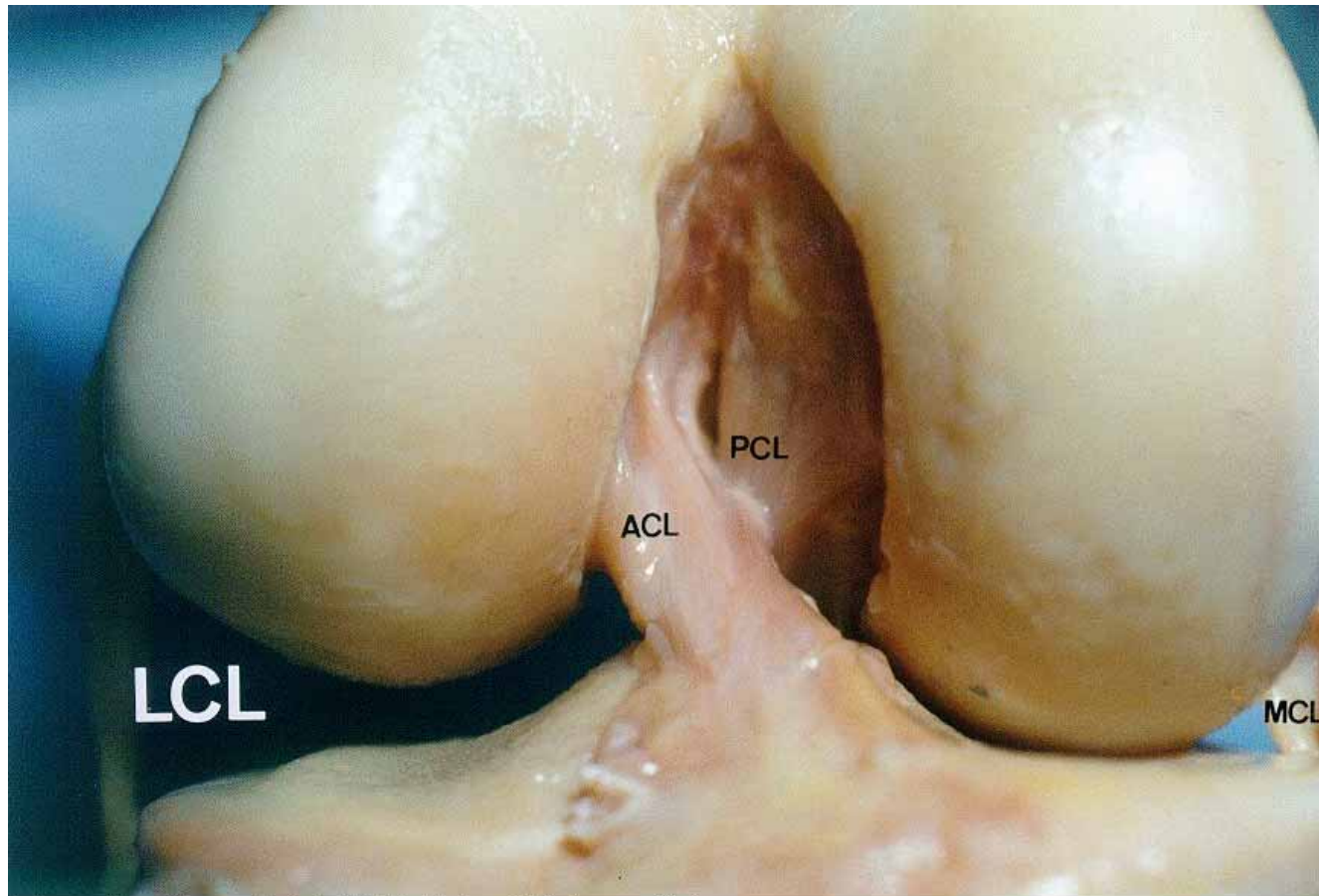
Joint Stability Dependent Upon...

- Bony congruence
- Ligamentous structures
 - Ligaments
 - Joint capsule
 - Meniscus
- Muscles
 - Flexibility
 - Strength
 - Co-contraction

Ligaments

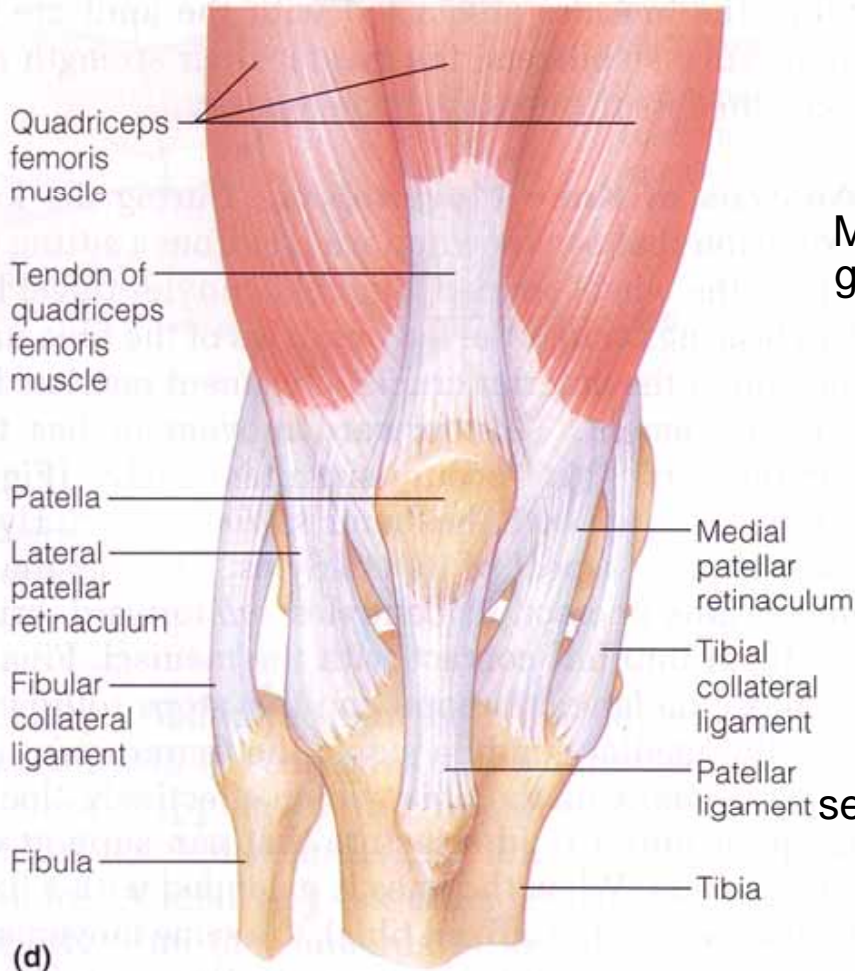
- Medial (tibial) collateral
 - 50% of max load in ext.
 - As knee flexes, loads shared by capsule, Ant and Post Cruciates
- Lateral (fibular) collateral
 - 55% of max load in ext.
 - Loads increase as knee flexes because post. structures become lax
- Anterior cruciate ligament
 - 75% max load in full ext.
 - 90% max load in full flex.
- Posterior cruciate ligament
 - Up to 100% load at 30° and 90° of knee flex.

Special Tests

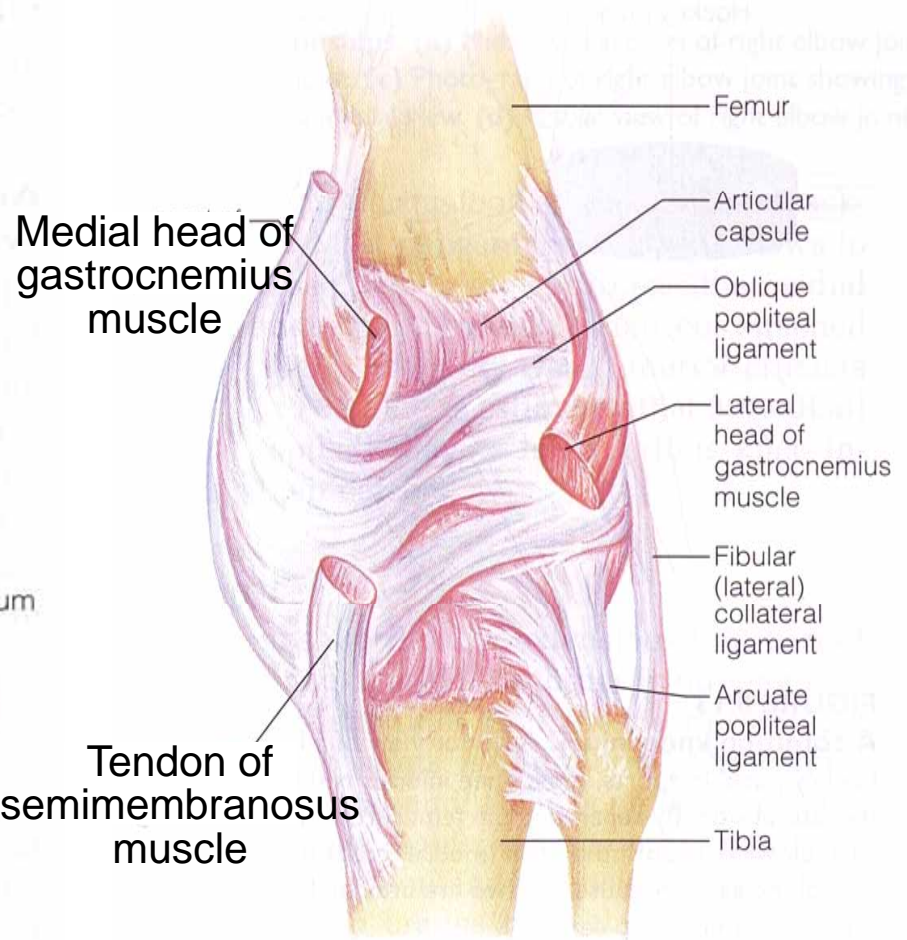


Interactive Knee 1.1 © 2000 Primal Pictures Ltd.

Right Knee



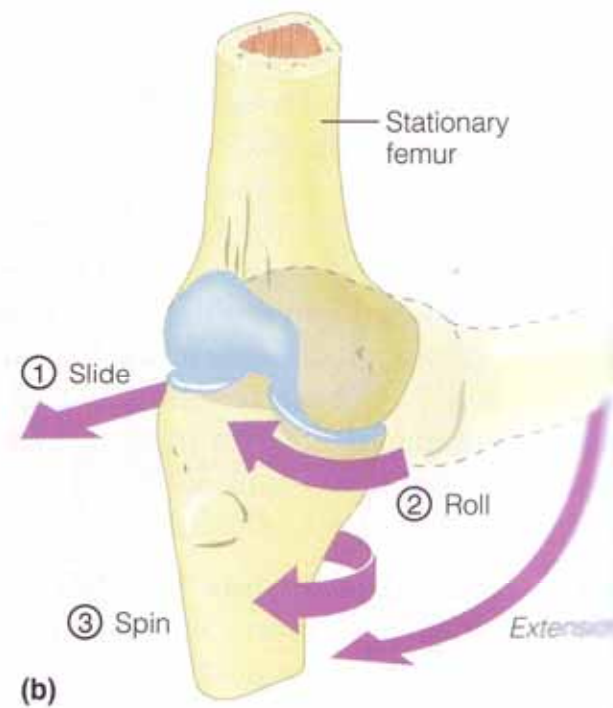
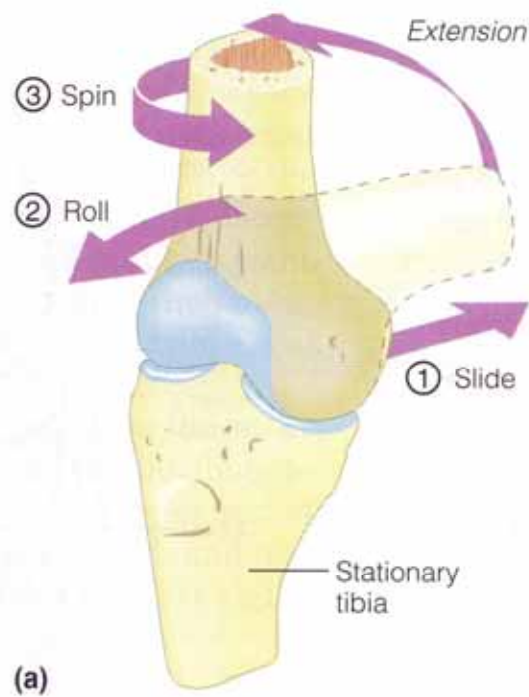
Anterior View

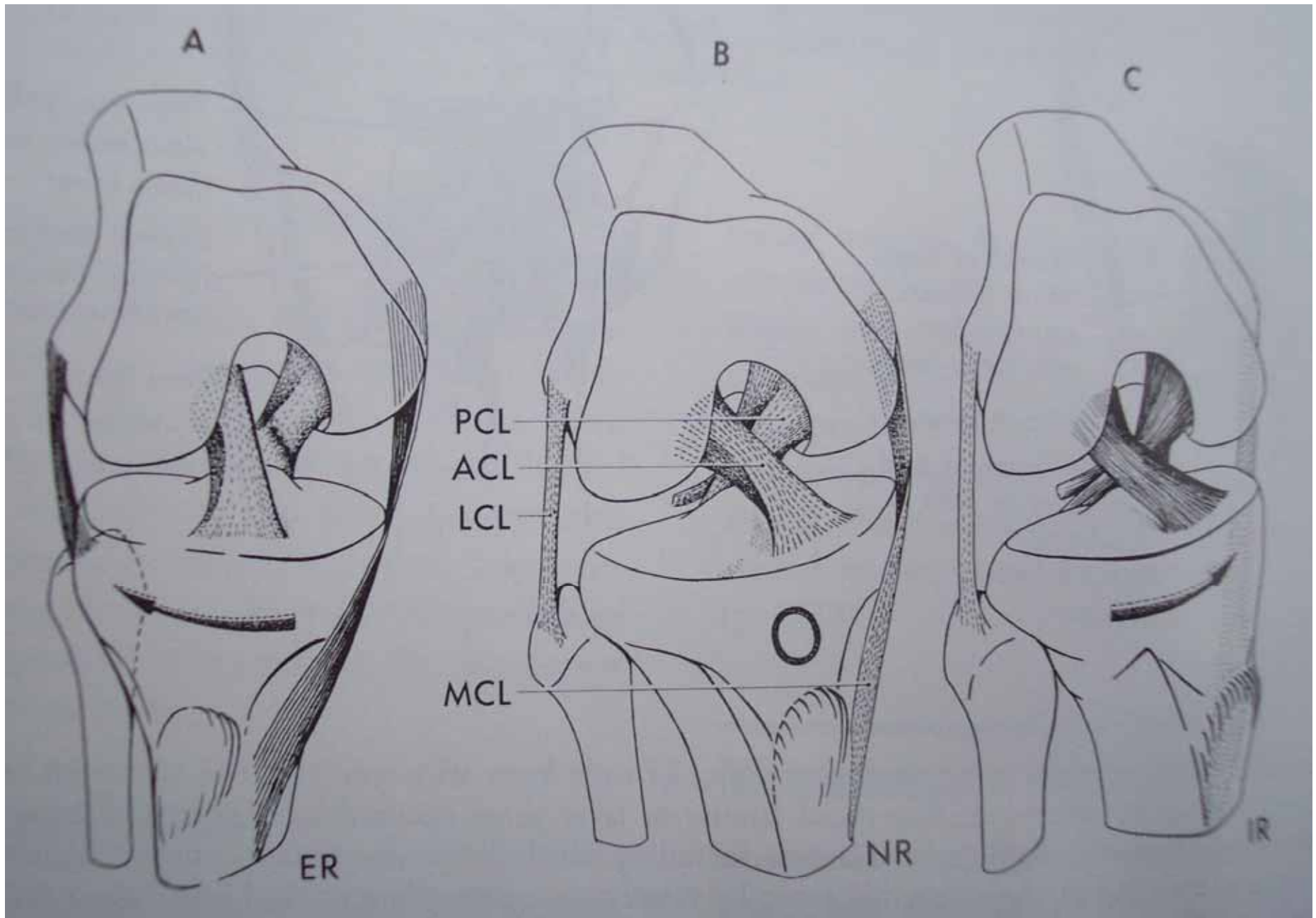


Posterior View

FIGURE 8.12

Knee joint movements. Analysis of articular movements occurring during extension of the right knee joint (viewed from medial aspect; patella, menisci, and other structural features omitted). **(a)** With a stationary tibia and moving femoral condylar surfaces. **(b)** With a stationary femur and moving tibial condylar surfaces. Notice that in each case elements of slide, roll, and spin occur together. In (a) the roll and slide are in opposite directions; in (b) they are in the same direction.

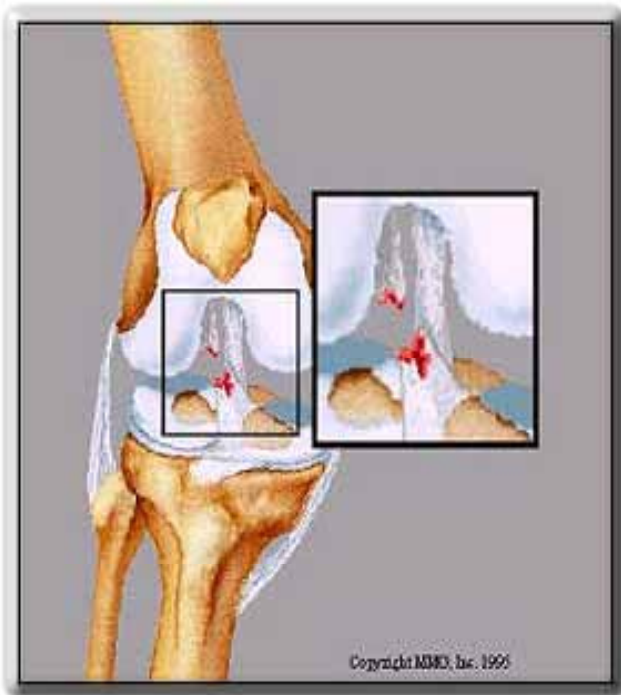




30-9

From: Crosby

ACL Tears



- Most common mechanisms
 - Contact:
 - **CKC with foot ER w/ valgus stress**
 - **Hyperextension**
 - **direct hit on the posterior tibia**
 - Non-Contact:
 - **Most common**
 - **Due to sudden deceleration**
 - **Sudden landing, cutting, or pivoting**
- Patient will c/o “buckling” or “giving away”, typically will hear and/or feel a “pop”

Mechanism of Injury

- Trauma
 - Compression
 - Rotational Force
 - Valgus Force
 - Usually Combination of Forces
- Degenerative Changes
 - Greater than 30 years old
 - No PMHX required
 - Often due to MOI that “seemed harmless” at time

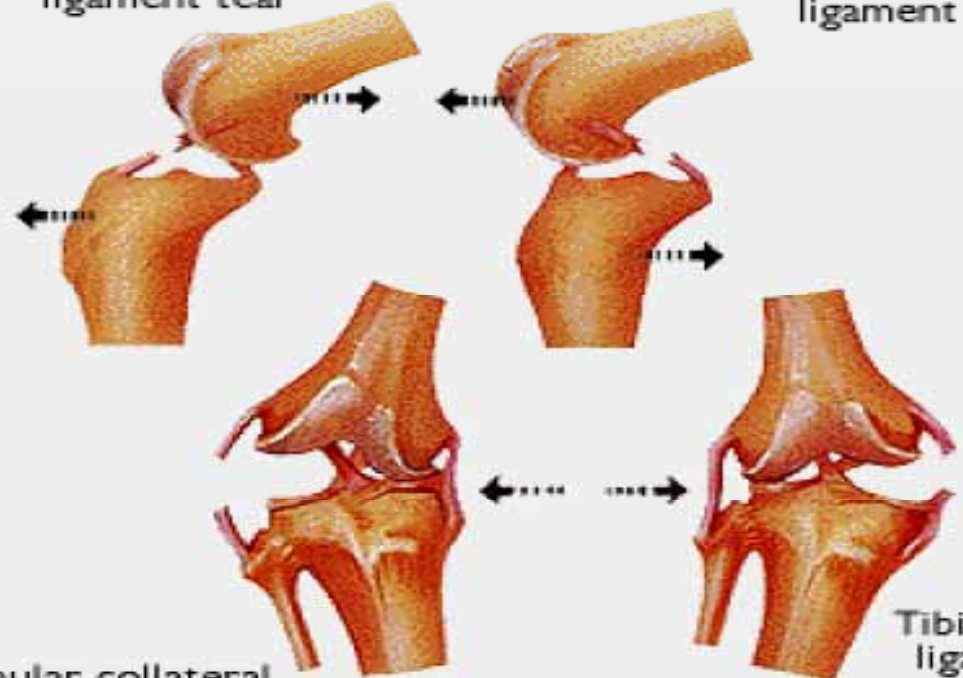


Noyes, 2002 states 60% of meniscal injuries associated with ACL injury

Meniscus and Ligament Tears

Anterior cruciate ligament tear

Posterior cruciate ligament tear

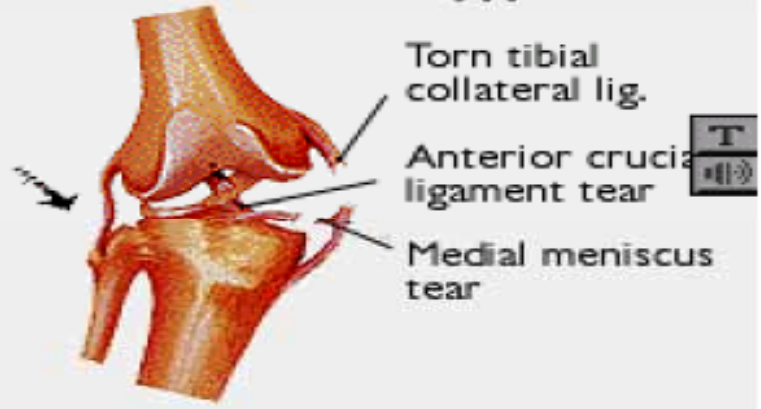
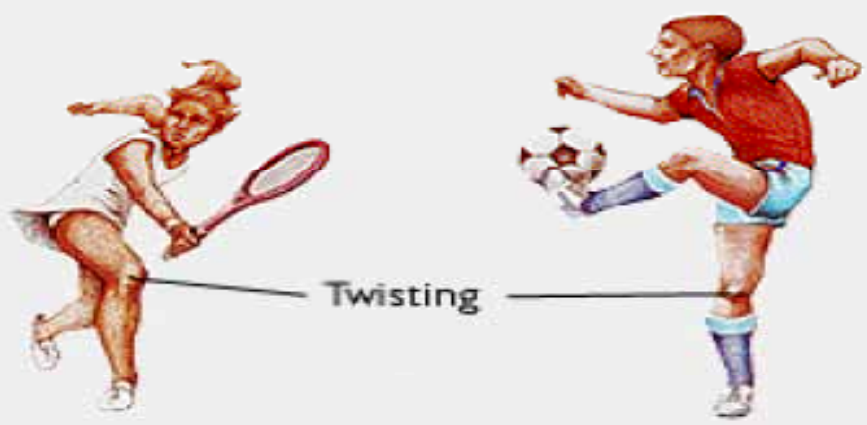


Tackling can result in an "unhappy triad"

Fibular collateral ligament tear

Tibial collateral ligament tear

"Unhappy triad"



Torn tibial collateral lig.
Anterior cruciate ligament tear
Medial meniscus tear