Myology of the Knee

PTA 105 Kinesiology
Objectives

- Describe the planes of motion and axes of rotation of the knee joint
- Visualize the origins and insertions of the muscles about the knee
- List the innervations of the muscles of the knee
- Knowing the above objectives, justify the actions those muscles act upon the knee joint
- Understand the kinematics of the patella
The Knee Joint

- One degree of Freedom
  - Flexion/Extension (Sagittal plane)
  - Medial/Lateral axis
    - Anterior to axis will ____ the hip
    - Posterior to axis will ____ the hip
The Knee Joint

- Patellofemoral joint
  - Normal functioning patella will increase internal moment arm of the quads by about 2 inches
  - Equivalent of producing 25% more torque
Patellar Kinematics

- Forces acting on the patella
  - Medial: Medial retinaculum and vastus medialis
  - Lateral: Lateral retinaculum and vastus lateralis, ITB
  - Superior: Quads
  - Posterior: Patellar Tendon
Lateral Patella Tracking

- Vastus lateralis is stronger than the Vastus medialis
- Tight IT band or lateral retinaculum
- Large Q angle
- Weak hip ABD or Ext Rotators
Rectus Femoris (part of Quadriceps)

- **Origin:**
  - Anterior inferior iliac spine

- **Insertion:**
  - Tibial tuberosity via the quadriceps tendon

- **Action:**
  - Hip flexion
  - Knee extension

- **Innervation:** femoral nerve
Vastus Medialis
(part of Quadriceps)

- **Origin:**
  - Medial lip of linea aspera; intertrochanteric line of the femur

- **Insertion:**
  - Tibial tuberosity (via the patellar tendon)

- **Action:**
  - Knee extension
    - Mainly responsible for last 10-15 degrees of knee extension

- **Innervation:** Femoral nerve
Vastus Intermedius
(part of the Quadriceps)

- **Origin:**
  - Upper 2/3 anterior shaft of femur
- **Insertion:**
  - Tibial tuberosity (via the patellar tendon)
- **Action:**
  - Knee Extension
- **Innervation:** Femoral nerve
Vastus Lateralis
(part of the Quadriceps)

- **Origin:**
  - Lateral lip of the linea aspera
  - Intertrochanteric line
  - Lateral region of the gluteal tuberosity

- **Insertion:**
  - Tibial tuberosity (via the patellar tendon)

- **Action:**
  - Knee extension

- **Innervation:** Femoral nerve
QUADRICEPS

Vastus Intermedius
Vastus Lateralis
Vastus Medialis
Primary Knee Extensors

- Rectus Femoris
- Vastus Medialis
- Vastus Lateralis
- Vastus Intermedius
Q – Angle of the Knee

- The line of force of the quadriceps can be described by the Q-angle. It identifies patellofemoral tracking.

- Females:
  - greater angle
  - greater incidence of patellar dislocation and joint pain
Biceps Femoris
(Part of the hamstrings)

- **Long Head**
  - Origin:
    - Ischial Tuberosity
  - Insertion:
    - Head of the fibula

- **Short Head**
  - Origin:
    - Lateral lip of linea aspera
  - Insertion:
    - Head of the fibula

- **Action:**
  - Hip extension (Long only)
  - Knee flexion

- **Innervation:** sciatic nerve (tibial portion)
Semimembranosus
(Part of the hamstrings)

- **Origin:**
  - Ischial tuberosity

- **Insertion:**
  - Medial condyle of the tibia (posterior)

- **Action:**
  - Hip extension
  - Knee flexion

- **Innervation:** sciatic nerve (tibial portion)
Semitendinosus (Part of the hamstrings)

- **Origin:**
  - Ischial tuberosity
- **Insertion:**
  - Prox/medial surface of the tibia (pes anserine)
- **Action:**
  - Hip extension
  - Knee flexion
- **Innervation:** sciatic nerve (tibial portion)
Popliteus

- **Origin:**
  - Posterior aspect of the lateral femoral condyle
- **Insertion:**
  - Posterior surface of the proximal tibia
- **Action:**
  - Initiates knee flexion via unlocking screw home mechanism
- **Innervation:**
  - Superior gluteal nerve
Gastrocnemius

- **Origin:**
  - Medial head: posterior aspect of the medial femoral condyle
  - Lateral head: posterior aspect of the lateral femoral condyle

- **Insertion:**
  - Calcaneal tuberosity via the Achilles Tendon

- **Action:**
  - Flexion of the knee
  - Plantarflexion of ankle

- **Innervation:** Tibial nerve
Sartorius

- **Origin:**
  - Anterior Superior Iliac Spine

- **Insertion:**
  - Proximal/Medial tibia (pes anserine)

- **Action:**
  - (Slide your heel up your opposite shin)
    - Hip flexion
    - Hip Abduction
    - Hip external rotation
    - Knee flexion

- **Innervation:** femoral nerve
Gracilis

- **Origin:**
  - Inferior ramus and body of pubis

- **Insertion:**
  - Proximal/medial aspect of tibia (pes anserine)

- **Action:**
  - Hip ADDuct
  - Hip flexion
  - Knee flexion (accessory)

- **Innervation:** Obturator n.
Primary Knee Flexors

- Hamstrings
  - Biceps Femoris
  - Semimembranosus
  - Semitendinosus
- Popliteus
- Gracilis
- Sartorius
- Gastrocnemius
What is the Pes Anserinus?
The semitendinosus, sartorius and gracillis all attach to the proximal medial tibia through a broad sheet of connective tissue known as the pes anserinus.

The 3 muscles:
- originate from different bones on the pelvis
- perform different actions at the hip
- are innervated by different nerves

The all perform the following at the knee:
- flexion
- medial stability
- internal rotation
Rotators of the Knee

- **Internal Rotators**
  - Medial muscles of knee
    - Semimembranosus
    - Semitendinosus
    - Gracilis
    - Sartorius
    - Popliteus

- **External Rotators**
  - Lateral muscles of knee
    - Biceps femoris
      - Both heads
Optional Project
Up to 5 points on next exam

- One page paper about why you should hold and use a cane in the opposite hand of the injured or weak leg
Exam #4 Review

- All muscles, O/I/A/I
- Trendelenburg sign
- Pes anserine
- By picture, identify O/I/A/I of that muscle
- Ligament of the knee and hip and their purpose
- Piriformis and sciatica
- Force couple of pelvic tilt
- Hip, tibiofemoral, and patellafemoral joints
  - Type of joint
  - Motions available
  - Articulating bones