Some Terminology

EID424
Bioengineering Applications in Sports Medicine
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Overview

- Anatomy
  - From a mostly orthopaedic point of view
- Viewing and moving the body
- Pathologies

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Tendon

- Tough, fibrous tissue
  - Collagen fibers
    - Provide strength
  - Elastic fibers
    - Allow stretching
    - Important for energy return
- Links muscle to the bone which it moves

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Ligament

- Tough fibrous tissue
  - Similar in composition to tendon
- Links one bone to another bone
- Large role in joint stability

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Cartilage

- Smooth tissue
- Special cells (chondrocytes) in a matrix of mostly water, nutrients, and collagen fibers
- Hyaline cartilage
  - Flexible, compressible
- Fibrocartilage
  - Tough, strong
  - Lots of collagen fibers

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Cartilage

- Helps distribute load across joints, provide lubrication
  - e.g., meniscus
- Articular cartilage
  - Provide smooth surface for bone contact
- Currently no good way to replace
- Difficult to repair
  - Little or no blood supply for healing and nutrition
  - Useful hyaline cartilage often replaced by fibrocartilage

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Sesamoid Bone

- Not connected to other bones via ligaments
  - Exception to the rule
  - Usually develop floating in a tendon
- Kneecap (patella) is largest sesamoid bone
- Lots of little ones in hands and feet

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Planes of the Body

- View the body in three planes
- Planes are *relative to the body*, not to the viewer
  - We typically don't like global coordinate systems

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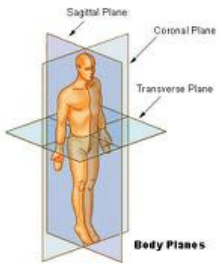
Planes of the Body

- Sagittal
  - View from the side
- Coronal
  - View from front
  - Often referred to as frontal plane
- Transverse
  - View from above
- Remember parallax error!



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Describing Position

- Positions are described using relative terms
- All terms are defined in reference to standard *anatomical position*
  - Standing straight
  - Arms, legs fully extended (straight)
  - Palms of hands forward

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Relative Location

- Proximal
  - Close end
- Distal
  - Far end
- Describe position relative to (more or less) center of mass
- Examples
  - Hip is proximal relative to the knee
  - Wrist is at distal end of the arm

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Relative Location

- Superior
  - Closer to the head
- Inferior
  - Closer to the feet
- Superficial
  - Closer to the surface
- Deep
  - Further inside the body

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Relative Location

- Anterior
  - More in front
  - Also *ventral*
- Posterior
  - More towards the back
  - Also *dorsal*
- Medial
  - Closer to the center line of the body
- Lateral
  - Farther from the center line of the body

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Relative Location

- Ipsilateral
  - Same side
- Contralateral
  - Other side
- Example
  - A patient has an injury to his right leg
  - Right foot is on ipsilateral lower extremity, left leg is contralateral

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Joint Rotations

- Flexion/extension
- Abduction/adduction
- External/internal rotation

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Flexion/Extension

- Extension
  - Straighten the joint (generally)
  - Going too far past straight (neutral) position called *hyperextension*
  - Referred to as *dorsiflexion* at ankle and wrist
- Flexion
  - Bending the joint
  - Referred to as *plantarflexion* at ankle
- Motion occurs in sagittal plane

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Abduction/Adduction

- Abduction
  - Movement away from midline of body
    - Or midline of hand/foot for fingers/toes
  - Lateral movement in coronal plane
- Adduction
  - Movement toward the midline of body
    - Or…
  - Medial movement in coronal plane

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External/Internal Rotation

- Rotation of moving bone about its own axis
- Internal rotation
  - Toward the body
- External rotation
  - Away from the body

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Tendonitis

- Irritation
  - Often caused by rubbing against a bone spur or other foreign body
  - Overuse
- Inflammatory process
  - Swelling
- Tendinitis

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Tendonosis

- Degenerative process
  - Some damage has occurred!
  - Tissue is weakened
- Not swelling!

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Sprain vs Strain

- Sprain
  - Injury to ligament
  - Stretched too far
  - Can have some (or complete) tearing
- Strain
  - Injury to muscle or tendon
  - Acute
    - Trauma/blow
    - Single lift/throw/step/etc that overstresses muscle/tendon
  - Chronic
    - Overuse
      - Prolonged repetitive motions
      - Training errors

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Dislocation

- Joint is no longer a joint
  - Movement of one bone relative to the other
- Sometimes easily undone
  - Sometimes not
  - Instability

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Flexibility vs Laxity

- Flexibility
  - Greater range of motion about a joint
  - Usually thought of as good
  - Role of stretching?
  - Conflict between strength and flexibility
  - Form follows function
- Laxity
  - Not usually a good thing
  - Range of motion increase caused by tissue weakness, not enough resistance to force
  - Ligamentous laxity tests

Women > Men

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Arthritis

- Degeneration of articular cartilage
  - Bone rubs against bone
  - Little lubrication
  - Ouch!
- No good way to generate/replace cartilage
  - Deal with the pain as long as possible
  - Joint replacement
- *Osteo*arthritis, not *rheumatoid* arthritis
  - Rheumatoid arthritis is an autoimmune disease

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Sex vs Gender

- Sex: physiological characteristic
- Gender: psychological or social
- In *most* medical or sports performance contexts, we are interested in sex *as assigned at birth*
  - Largely due to the hormonal milieu in which development occurred

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