

EID424 Bioengineering Applications in Sports Medicine

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1 What is sports medicine

- Treatment vs. promoting fitness
- How do we get people back to what they want to do? ("more aggressive approach to rehabilitation")
- Examples of athletes

2 Sports medicine practitioner

- Orthopaedic surgeon – musculoskeletal injuries, often via surgeries
- Internist/general practitioner – usually the first one you see
- Cardiologist, nephrologist (renal/kidney – hydration, hyponeutremia), neurologist, endocrinologist (hormones and glands, diabetes)

- Psychiatrist – MD
- Psychologist – cannot prescribe drugs
- Physical therapist – in care of rehabilitation after injury – no MD
- Athletic trainer – on field when injury happens
- Coach

3 History of sports medicine

- NISMAT
- Linkage
 - All body's systems are interrelated
 - Weakness in one area can result in/from weakness/pathology in another
- Seven P's
 - Performer, performance, pathology, prescription, practitioner, practice, prevention
- Performance factors (different demands on the body)
 - Neuromuscular and physical
 - Mental and psychometric
 - Environmental
 - (Highest-rated: football and ballet)

4 Terminology

4.1 Anatomy

- Tendon: collagen fibers (strength) and elastic fibers (allow stretching, important for energy return); connects bones to muscle
- Ligament: similar in composition to tendon; bone to bone; stability of joints; tendons can be used to graft ligament
- Cartilage: smooth tissue: chondrocytes in water, nutrients, collagen

- Hyaline: flexible, compressible (top of drumstick)
 - Fibrocartilage: tough, strong
 - Helps distribute load across joints, provide lubrication
 - Currently no good way to replace; difficult to repair; little blood flow for healing and nutrition
- Sesamoid bone: not connected to other bones via ligaments; usually develop floating in a tendon; e.g., patella (kneecap), in hands and feet, ball of foot; hard to heal
- Three planes of the body (relative to the body, not the viewer):
 - Sagittal (view from side)
 - Coronal (front)
 - Transverse (above)
- Positions relative to anatomical positions (think Leo da Vinci)
- Relative locations (relative to center of mass; think belly button):
 - Proximal: close end
 - Distal: far end
 - Superior/inferior: closer to head/feet
 - Superficial/deep: closer to surface/further
 - Anterior(ventral)/posterior(dorsal): closer to front/back
 - Medial/lateral: closer/farther from central line of the body
 - Ipsilateral/contralateral: same/other side of
- Joint rotations:
 - Flexion/extension, hyperextension, dorsiflexion (extension at ankle and wrist); plantarflexion
 - Abductions/adduction: movement away from the midline of the body; movement toward the midline of the body
 - External/internal rotation: internal is toward, external is away
- Pathologies:
 - Tendonitis: irritation/inflammation of a tendon, often caused by rubbing against a bone spur or other foreign body; usually caused by overuse; take anti-inflammation (e.g., ibuprofen, aspirin)

- Tendonosis: degenerative process; damage has occurred and tissue is weakened; no inflammation
- Sprain: injury to ligament; stretched too far (may be completely torn); plastic deformation
- Strain: injury to muscle or tendon by overstretching; also plastic deformation; acute (trauma/single event) or chronic (long-term overuse); acute is common in steroids (b/c tendon doesn't develop along with tendons)
- Dislocation: joint is no longer a joint; sometimes easily undone, sometimes not
- Flexibility: lots of motion: "good motion"; controversial role of stretching; not always good to be very flexible; (controversial) conflict between strength and flexibility; form follows function
- Laxity: lots of motion: "bad motion"; too much range of motion caused by tissue weakness; ligamentous laxity tests
- (Osteo)Arthritis: degeneration of articular cartilage; bone rubs against bone with little lubrication, causes pain; joint replacement when the pain is too much; body mass causes it; osteoarthritis, not rheumatoid arthritis (autoimmune)
- Sex vs. gender: in most medical/sports performance contexts matters, due to hormonal milieu (need testosterone is needed to build muscle)

4.2 Things to look up

- pathology: "the science of the causes and effects of diseases, especially the branch of medicine that deals with the laboratory examination of samples of body tissue for diagnostic or forensic purposes." (tl;dr. A disease or condition)
- anti-inflammatory drugs: aspirin, ibuprofen, naproxen
- cracking knuckles -> osteoarthritis? (probably not: see <https://www.health.harvard.edu/pain/does-knuckle-cracking-cause-arthritis>)
- milieu: a person's social environment
 - hormonal milieu: the environment of hormones; the hormones, collectively