

# Lecture 12

Wednesday, July 14, 2021

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## Principles of Biomechanics

- If you wear shoes, specificity of adaptation happens
- Feet and shoes: the point of contact between specificity of adaptation and biomechanics
- No such thing as a good or bad shoe - instead only *appropriate* and *inappropriate* shoes
  - o Shoes create mechanical environments as they change the loads experienced by your feet
  - o Depending on the context and your goals that may be good or bad
- Physiology and biomechanics share much of the same domain of "exercise science"
  - o Biomechanics applies to plants, animals, etc.
  - o Biological response
- Biomechanics include baseball swing, type of equipment in hockey, tight turns in soccer, etc.
  - o Essentially, what will happen to the body and how the body will mechanically respond to certain stressors
- Vertical jump example
  - o Do a low jump, then medium, then max jump
  - o Calves and quads do the same thing - height of jump changes by what's happening in your hips (glutes)
- Planes: sagittal, transverse, frontal
- Vocab:
  - o Anatomy - the study of components that make up the musculoskeletal "machine"
  - o Biomechanics - the mechanisms through which these components interact to create movement
  - o Statics - study of systems with motions that are constant; either not moving at all or moving at a constant velocity (generally deals with loads on non-moving things)
  - o Dynamics - study of systems that involve acceleration

- Kinetics - causes of a motion; internal and external forces associated with motions
- Kinematics - the motions themselves (big picture); don't consider what is *causing* the motion, look at the appearance of a biological thing moving around (speed and patterns of movement, etc.)
- Work and power
  - Strength is a component of power
  - Maximum strength is slow (velocity)
- Uniaxial, biaxial, multiaxial
- Fleshy attachment: muscles directly attaching to bone
- Fibrous attachment: connect to bone through tendon
- Myotendinous junction: where the muscle becomes the tendon
- Torque: tendency for a force to produce rotation (rotating that rigid bar about a fixed point); measure in ft/lb.
- Levers: a rigid bar that moves on a fixed point
  - Purpose - an absolute effort can move a heavier load and/or move a load farther or faster than it could lever-less
- Moment arm: perpendicular distance from an axis to the line of action of muscle force
  - Muscle force: the force generated by biochemical activity in the muscle
- 3 types of levers:
  - 1) Class I - teeter totter
  - 2) Class II - mechanical advantage
    - i. Axis/fulcrum at back -- load/resistance in middle -- force at opposite end of axis
  - 3) Class III - mechanical disadvantage
    - i. Axis/fulcrum at back -- force in middle -- load/resistance at opposite end of axis