Learning Objectives

1. Understand some characteristics of force, in addition to force magnitude, that influence injury risk:
   1. Area of force application & corresponding pressure
   2. Force application location
   3. Load rate
   4. Force direction
   5. Force frequency

2. Understand potential relationships between force frequency and magnitude, recovery time, and injury risk

3. Understand some intrinsic and extrinsic injury factors

Force and Injury

Area of force application

Moon boot surface area = 97 cm$^2$
Total surface area of 12 golf spikes = 0.36 cm$^2$
Max weighs ~204 N

The area of force application significantly affects injury risk.

Force and Injury

Application Location

The running professor... and another perspective.
Force and Injury

Loading Rate
ACL rupture and gymnastics padding

What biological tissue characteristic is this related to?

Force and Injury

Direction
Shoulder impingement...

What biological tissue characteristic is this related to?

Force and Injury

Frequency
Controlling the frequency and magnitude of applied stress is important when training; e.g.,
- pitchers
- gymnasts
- football players
- runners

Force Frequency
Often the time between training sessions determines whether a chronic injury is experienced

Stress Distress
Not only does recovery time affect tissue's ability to resist overuse injury, but so do genetics, diet, and sleep habits.

Intrinsic Factors in Injury
Intrinsic factors (characteristics related to the individual) that influence injury risk
- Body mass
- Skeletal: density, alignment, asymmetry
- Muscular: strength, endurance, firing patterns
- Previous history of injury
- Psychological: motivation and tolerance for pain

Extrinsic Factors in Injury
Extrinsic factors (characteristics related to the task or environment) that influence injury risk
- Nature of task: frequency, speed, intensity, and duration
- Level of participation: opponent, recreation vs. competitive
- Equipment: footwear, padding
- Environment: playing surface, condition of playing surface, weather
Summary

• Force characteristics that are related to injury prevalence:
  – magnitude, area, location, rate, direction, and frequency of force application

• Factors to consider in injury prevention
  – Frequency and magnitude of force application
  – Recovery time
  – Intrinsic and extrinsic factors