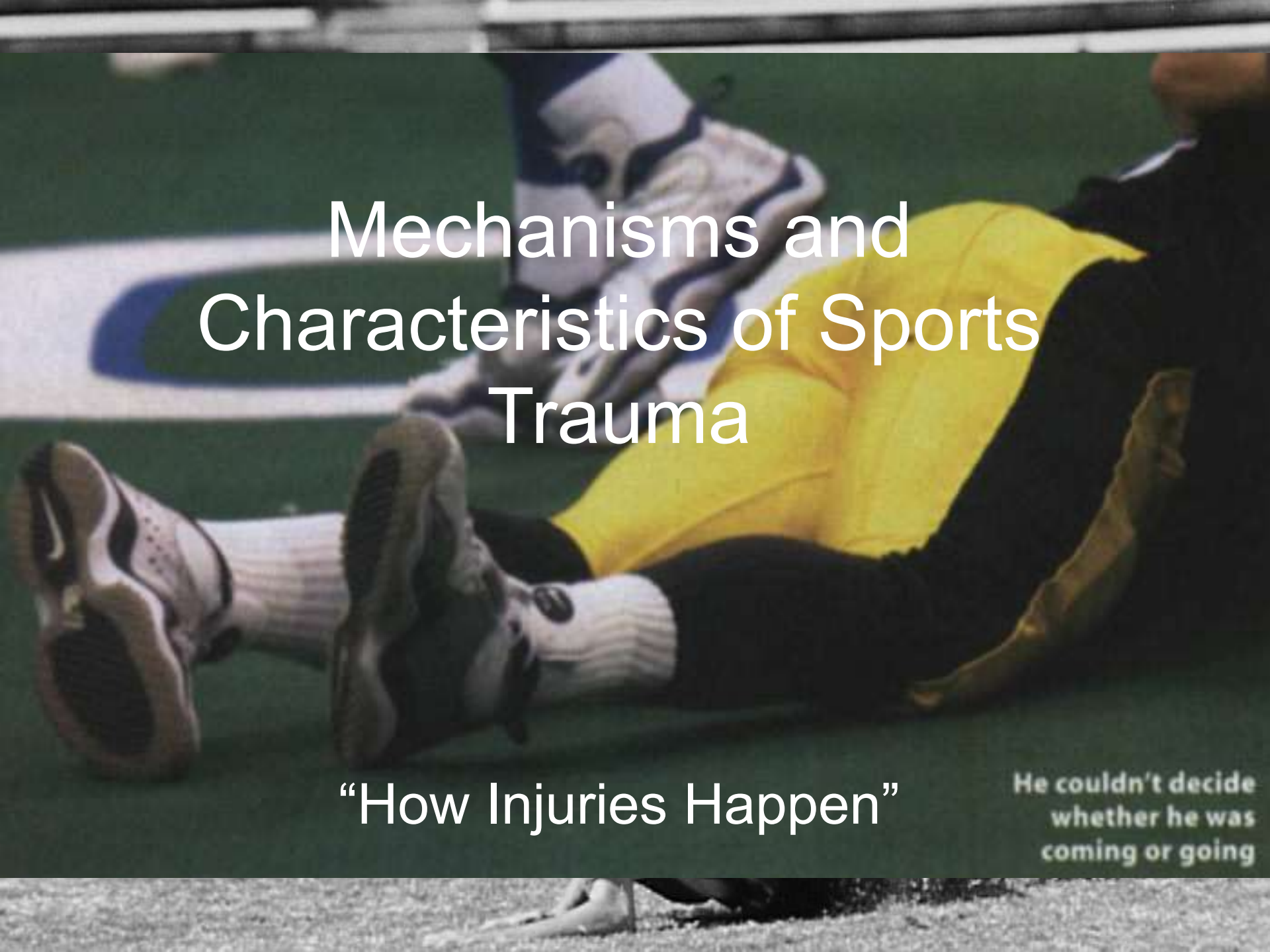
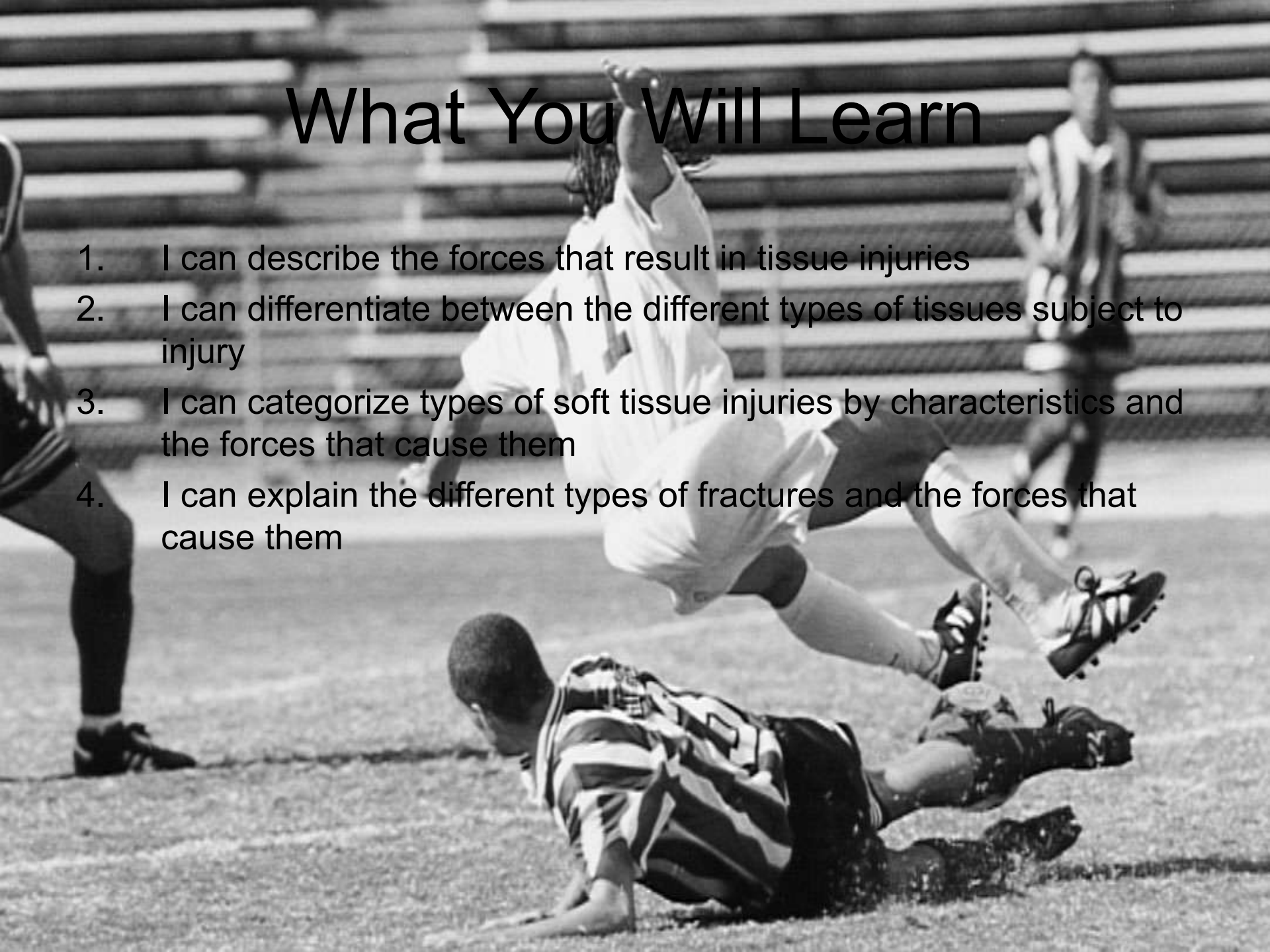
# Mechanisms and Characteristics of Sports Trauma




"How Injuries Happen"

# What You Will Learn



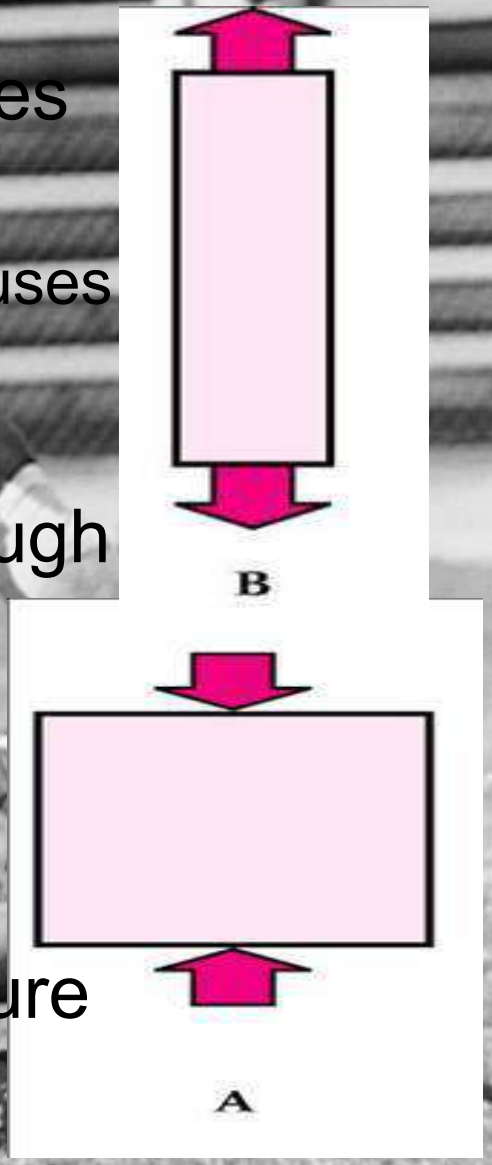
1. I can describe the forces that result in tissue injuries
2. I can differentiate between the different types of tissues subject to injury
3. I can categorize types of soft tissue injuries by characteristics and the forces that cause them
4. I can explain the different types of fractures and the forces that cause them

# Mechanical Injury


- With any injury, a force is placed on any part of the body resulting in the changing of function or structure.
- Three types
  - Compression
  - Tension
  - Shear

# Mechanical Forces

- Tension – a force that pulls or stretches the tissue.
  - Stretching beyond the YIELD POINT causes a structure to tear or break
    - LaffyTaffy
- Compression – a force that, with enough energy crushes tissue
  - Compression fractures
    - Pop can
- Bending – Compression and tension forces applied together upon a structure
  - Tongue depressor



# Mechanical forces

- Shearing – a force that moves parallel with the tissue
  - Blisters,
  - Abrasions, and
  - Disk Injuries

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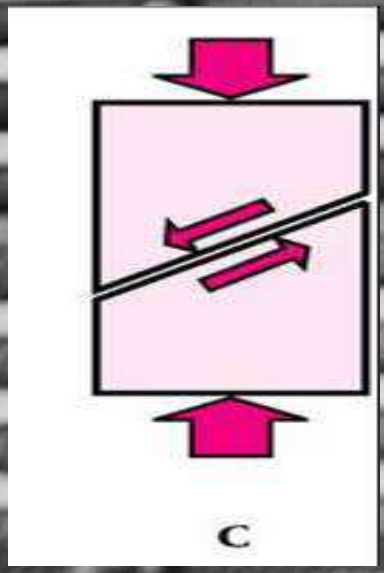
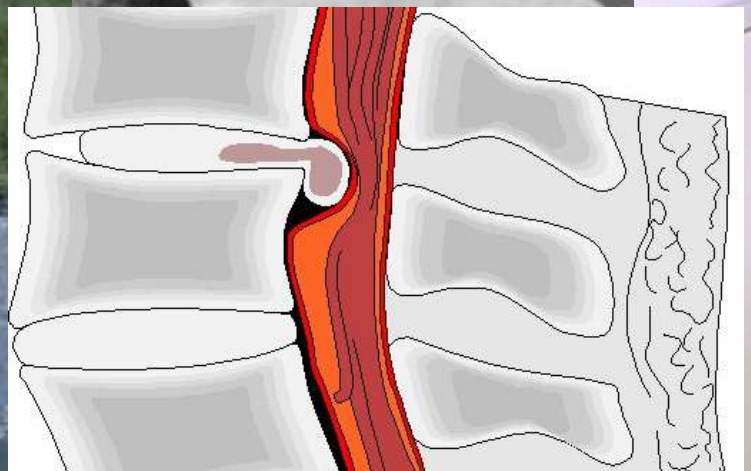
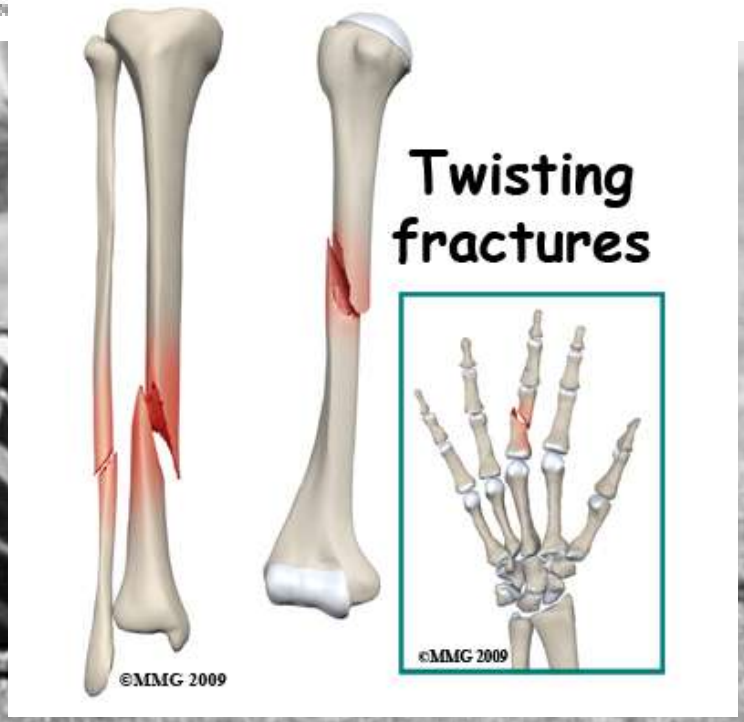


# Mechanical forces

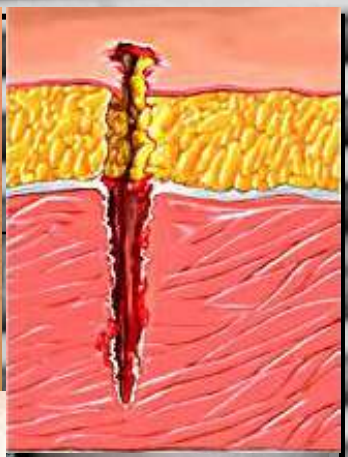
- Rotation
  - the action or process of rotating on or as if on an axis or center
- Torsion
  - the twisting or wrenching of a body by the exertion of forces tending to turn one end or part about a longitudinal axis while the other is held fast or turned in the opposite direction

# Soft Tissue Injuries

- T.P.S. – what are the different types of soft tissue in your body?
- Wound Types/ Classifications
  - Blisters-Abrasions
  - Bruise- Laceration
  - Avulsion- Incision
  - Puncture

| | |
|---|---|
| Abrasions | Surface layer of skin is scraped off |
| Puncture | Penetration by a sharp object |
| Incision | A straight/ sharp cut |
| Avulsion | Tissue is ripped from its source |
| Blister | A collection of fluid below or w/in the top layer of skin |
| Laceration | A jagged cut |
| Bruise | Bleeding under the |



# T.P.S.

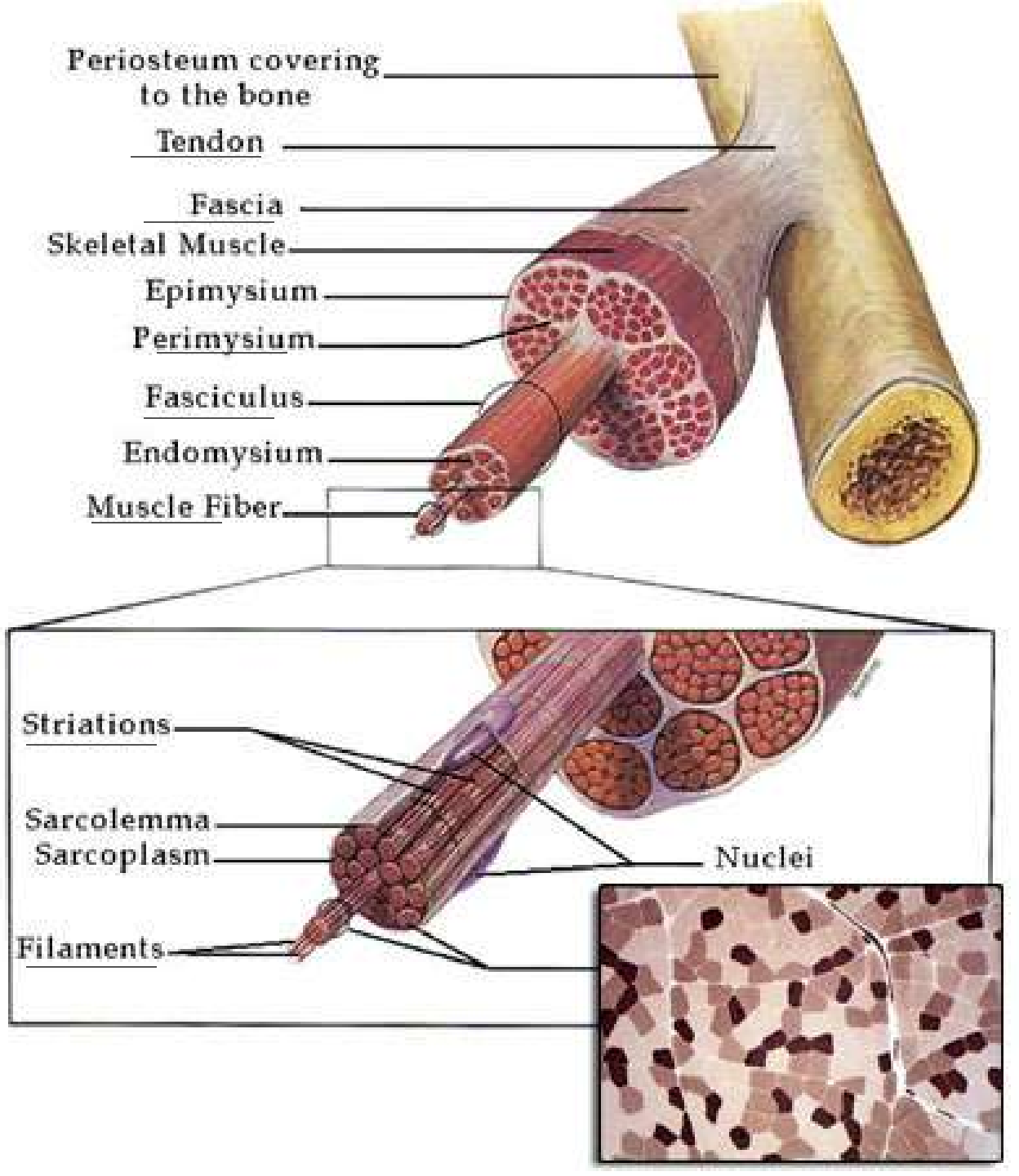
- A soccer player (in this picture) has just made a slide tackle.
  - What types of forces are being applied?
  - What are some of the possible injuries that either player could receive from this motion?

## Muscle Types

- Smooth
- Cardiac
- Striated/ Skeletal

## Musc. Inj.

- Contusions
- Strains
- Overexertion
- Spasms/ Cramps



# Muscle Strains

- All Strains and Sprains are graded on a 3 tier scale
  - Grade 1 – Mild
    - Local pain w/ little bruising (ecchymosis).
    - Little to no loss of strength.
  - Grade 2 – Moderate
    - Moderate pain/ bruising/ swelling
    - Impaired muscle function (i.e. limping)
  - Grade 3 – Severe
    - Loss of muscle function
    - Palpable defect

# Muscle Contusions - Grading

- Contusions
  - Ecchymosis (Superficial bleeding)
  - Hematoma (Hardening of the blood)
- 1st degree- Little or no range of motion loss.
- 2nd degree- Noticeable loss or range of motion.
- 3rd degree- Severe restriction of range of motion. Fascia may be ruptured causing muscle tissue to protrude.

# Cramps and Spasms

- Cramp - A painful involuntary contraction of a skeletal muscle or musc. group.
  - Caused by _____
- Spasm – reflex reaction caused by trauma
  - Clonic – contracting and relaxing
  - Tonic – constant contraction

Find a partner…. Massage time!

# Muscle Soreness

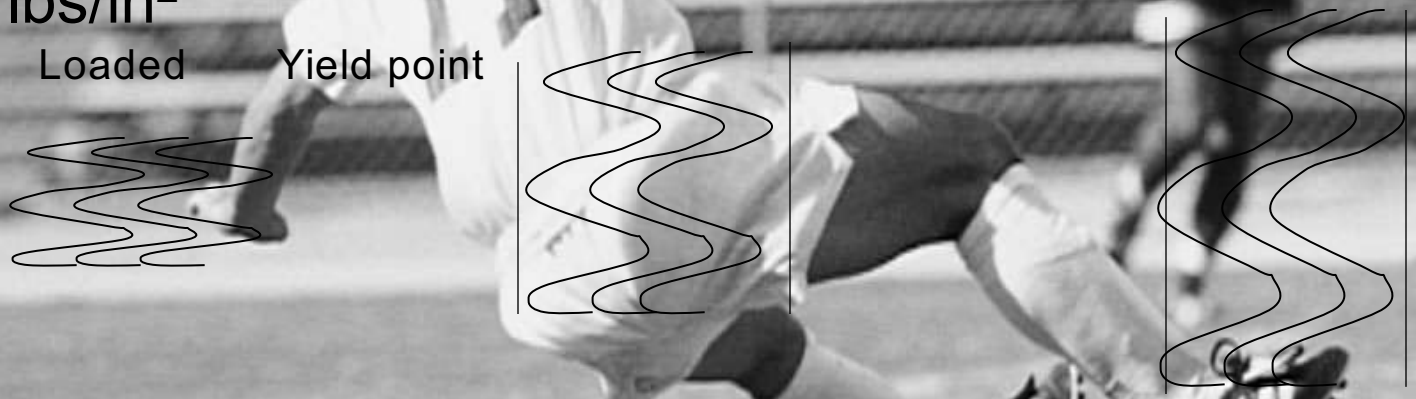
- Acute Onset Muscle Soreness
  - Decreased circulation
  - Lactic Acid and potassium collect within the muscle
    - Which stimulate pain receptors
- Delayed Onset Muscle Soreness
  - Caused most by eccentric exercise
  - Cell/ Fiber death within the muscle
- Prevention
  - Good Warm-up
  - Extended cool down
  - Stretching before and after activity

# Chronic Muscle Injuries

- - itis
  - An inflammation or irritation of the structure
    - Tendonitis – inflammation of the tendon
    - Fasciitis – inflammation of the fascia
    - Myositis – inflammation of the muscle
- Caused over a longer period of time by the wearing away of a structure or repeated acute injuries

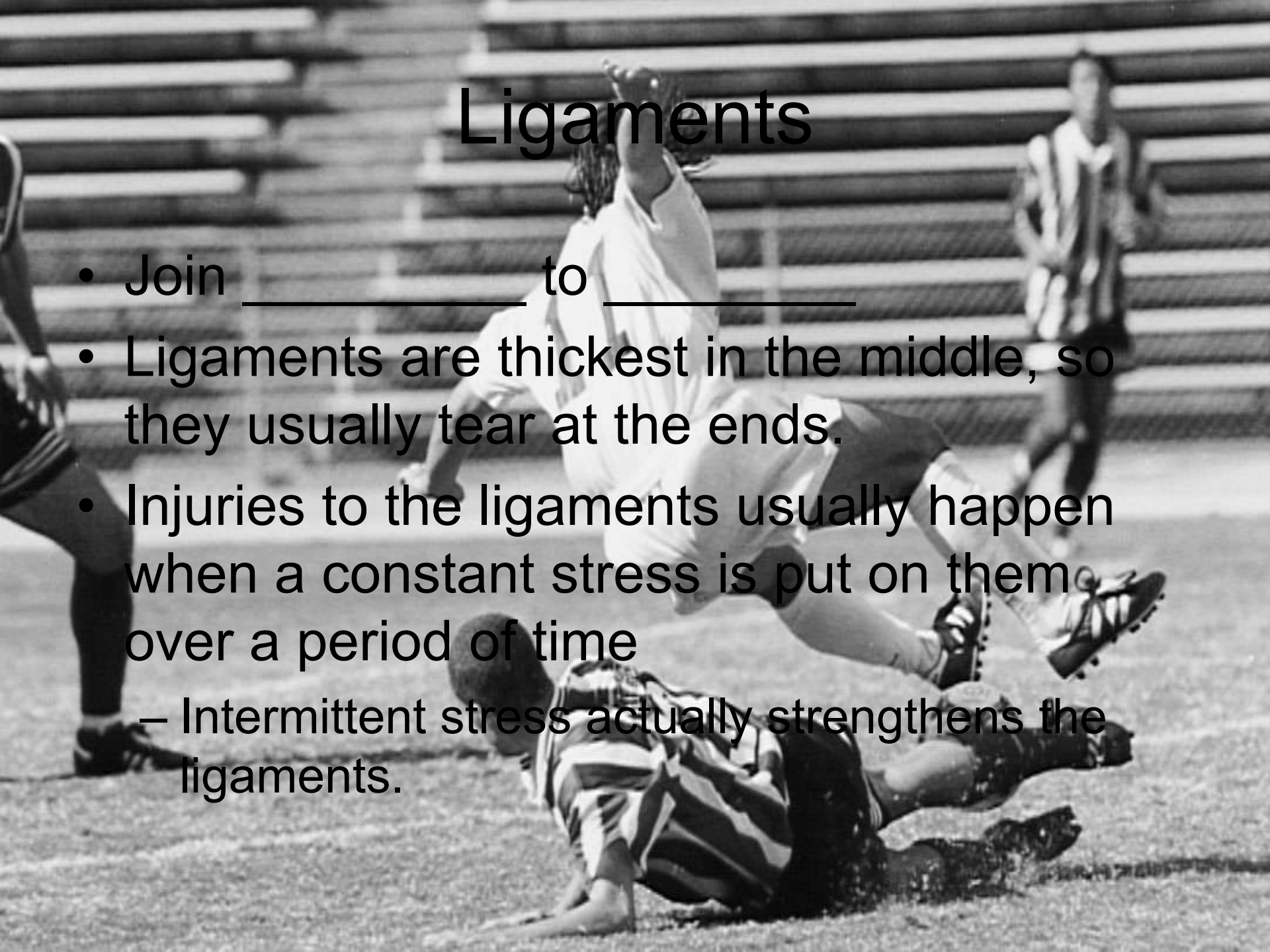
# Tendons

- Join _____ to _____
- Tendons can produce/ maintain a pull from 8,700 – 18,000 lbs/in$^2$
- Unloaded Loaded Yield point



- What happens when you stretch a slinky too far???
- Tendons are actually 2x the strength of the muscle it serves.

- injuries, therefore, usually occur at the muscle or at the attachment.

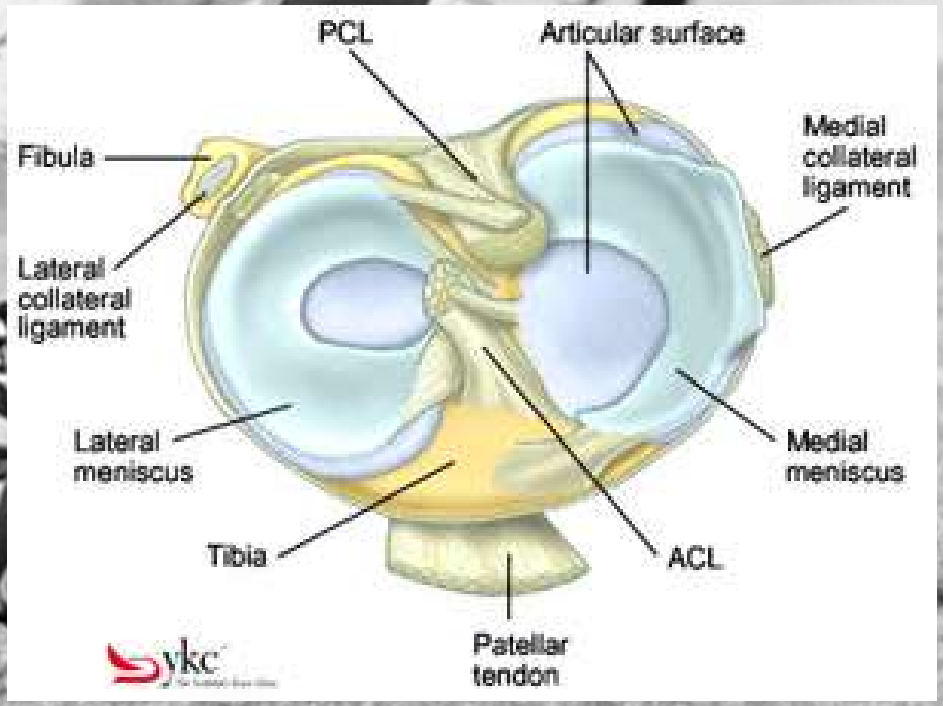


# Ligaments

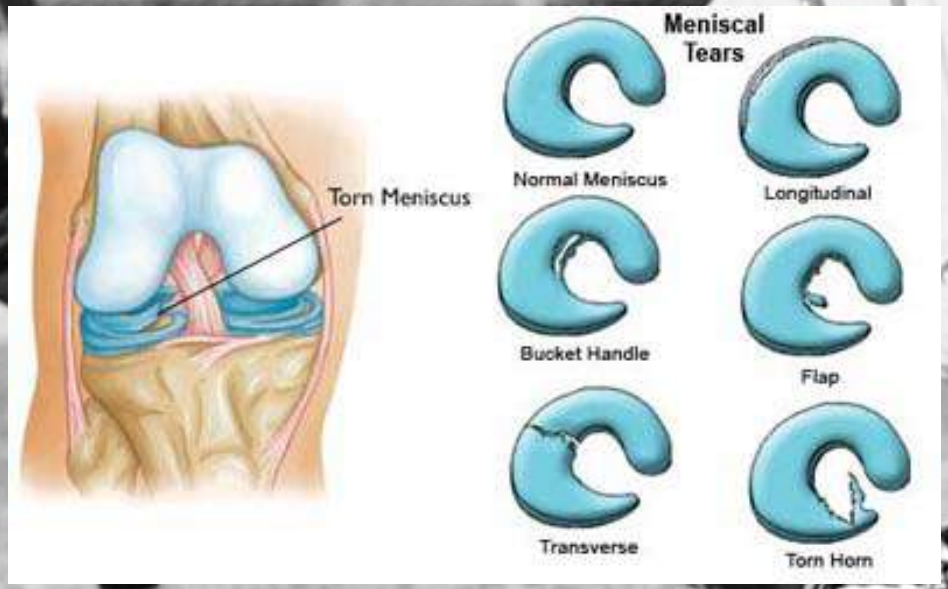
- Join _____ to _____
- Ligaments are thickest in the middle, so they usually tear at the ends.
- Injuries to the ligaments usually happen when a constant stress is put on them over a period of time
  - Intermittent stress actually strengthens the ligaments.

# Cartilage

- Cartilage is the shock absorber between two bones.
  - Injuries occur after repeated irregular stress
  - Cartilage Images

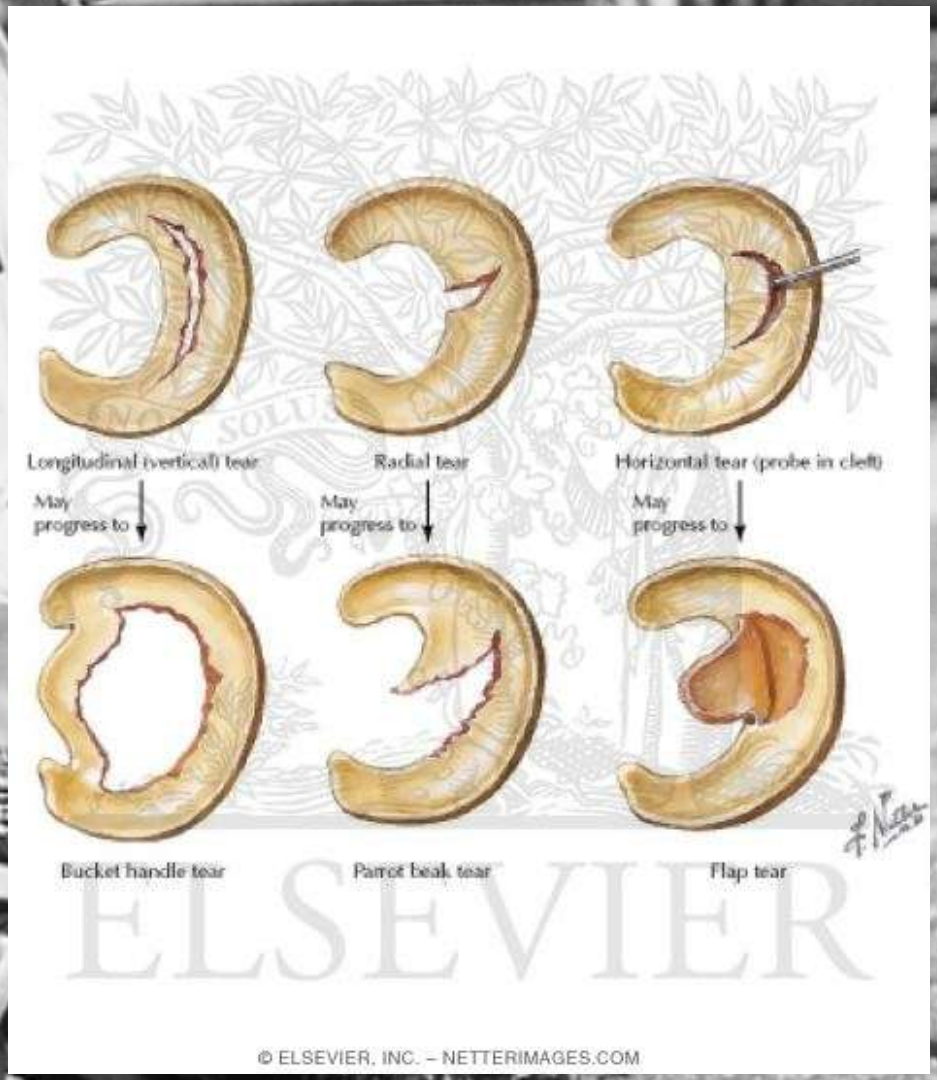


# Cartilage



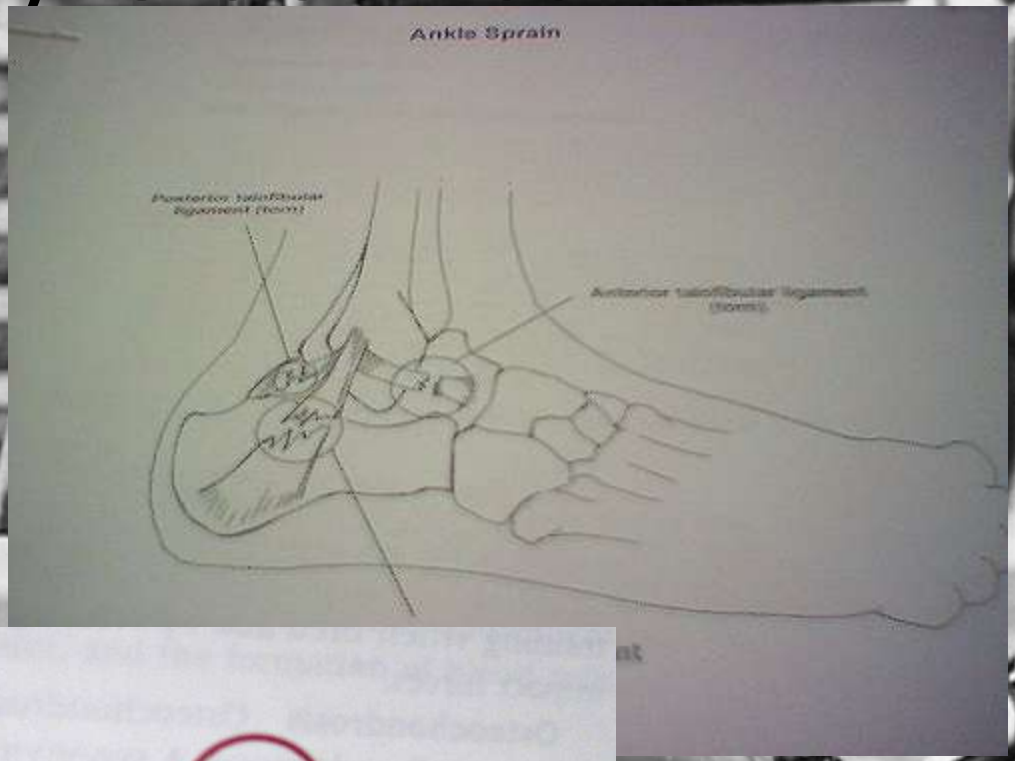

- Traumatic Mechanism
  - Shearing with rotation
  - Rotation with lateral force
  - Posteroanterior force with rotation
- Degenerative Mechanism
  - Less elastic and compliant
  - Minor trauma causes damage
- Longitudinal tear – extends along length of meniscus; also called circumferential tear
- Radial tear – medial to lateral rim; also transverse tear
- Torn Horn tear – tear of either anterior or posterior horn of the medial meniscus

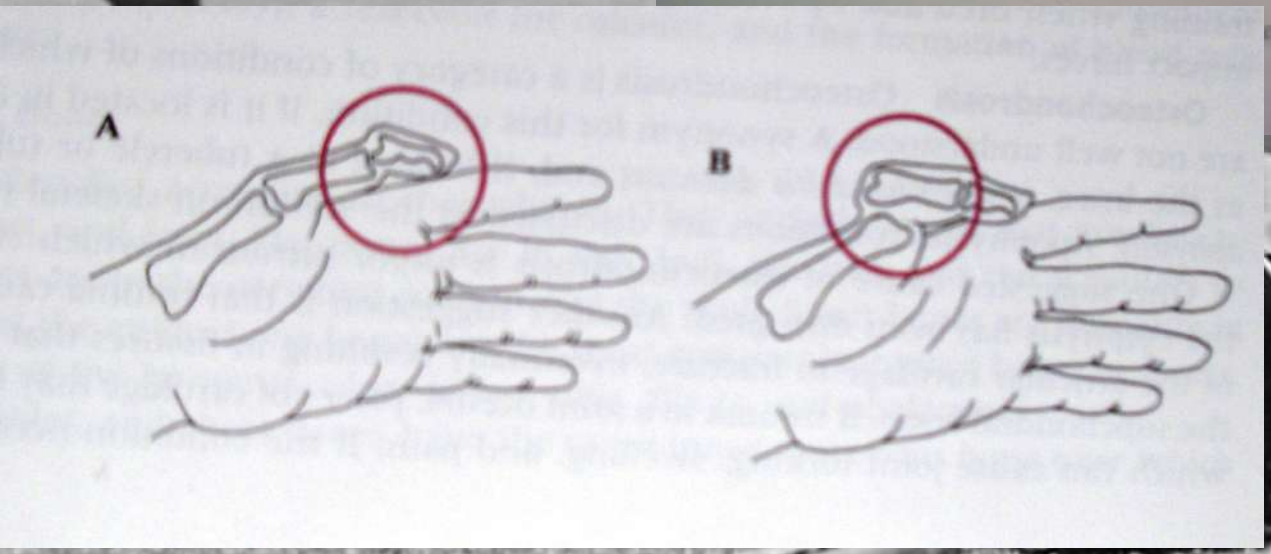
- Parrot beak tear – neglected radial tear
  - can catch in joint
- Horizontal tear – splits the body of meniscus
  - Usually starts inside
  - Splits into top and bottom through degeneration
  - Can progress to Flap tear
- Bucket handle tear – complete torn through
  - can catch and “lock” the knee
  - typically doesn’t heal depending on where located (inner v outer)



# Injury Classifications

- Sprain
- Strain
- Subluxation
- Dislocations




- Sprains are graded on a scale 1-3 just like strains.

# Review Questions

1. As a runner, Jen puts a lot of daily stress on her knees, now her patellar tendon is irritated. That is called _____
2. Sliding into home Mike scraped off the top layer of skin on his thigh and got pegged by the ball.
   a. What forces were being applied?
   b. What injuries did these forces cause?
3. When Jon ruptured (completely tore) his Achilles tendon, where did it most likely tear?
4. What would you recommend to someone who is constantly going to practice sore?

# Skeletal Trauma

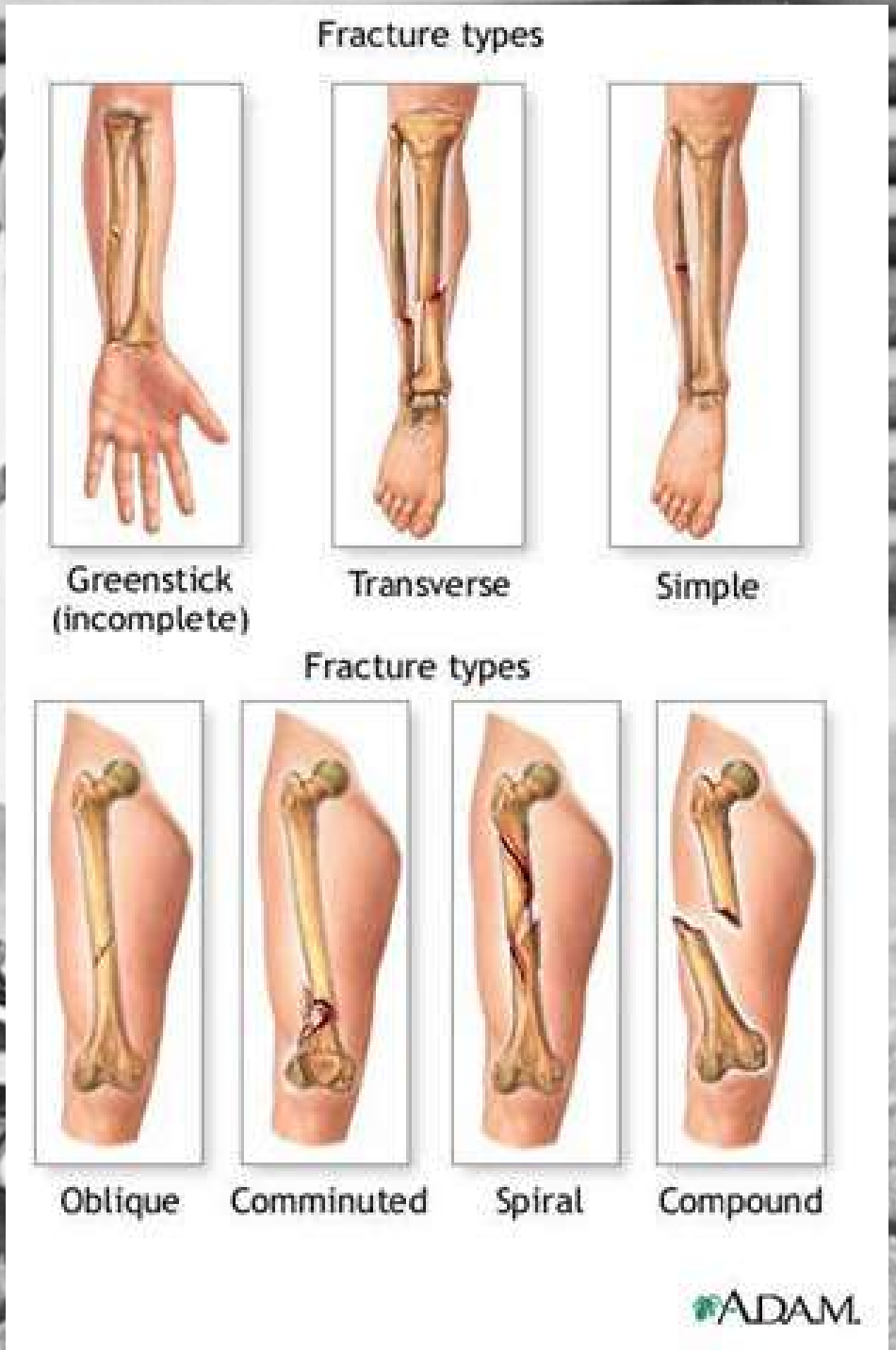
- Bone Functions
  - Body support- Stores Calcium
  - Organ Protection- Formation of RBC
  - Movement
- Types of Bone
  - Flat – skull, ribs, scapula
  - Irregular – vertebral column, skull
  - Short – wrist and ankle
  - Long – humerus, ulna, femur, tibia, fibula, phalanges

# Weaknesses

- Bones are weak where they change shape and/or direction.
  - Clavicle changes shape and direction at approx. the same spot, therefore that is where the majority of the fx occur.
- Depending on the force applied there are 11 different types of fractures (fx)

# Fractures

- Types of Fractures
  - Comminuted Fracture
  - Greenstick Fracture
  - Oblique Fracture
  - Spiral Fracture
  - Transverse Fracture
  - Union Fracture



# Fractures

- Articular fracture
  - Involves a joint surface. Articular is cartilage at the end of the long bones where bones articulate, or meet.

Avulsion fracture

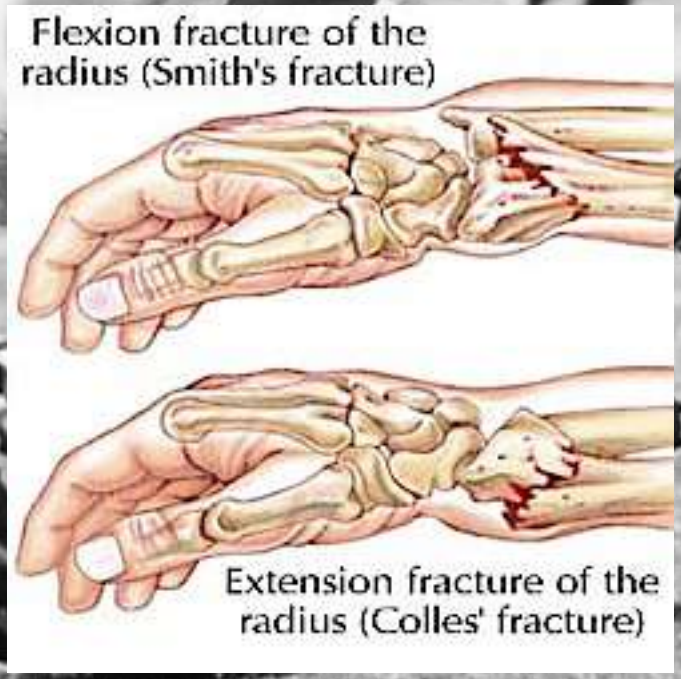
- A separation of a small bone fragment from the bone where a tendon or ligament is attached.

Blow out fracture

- occur to the wall of the orbit of the eye as a result of a blow to the eye

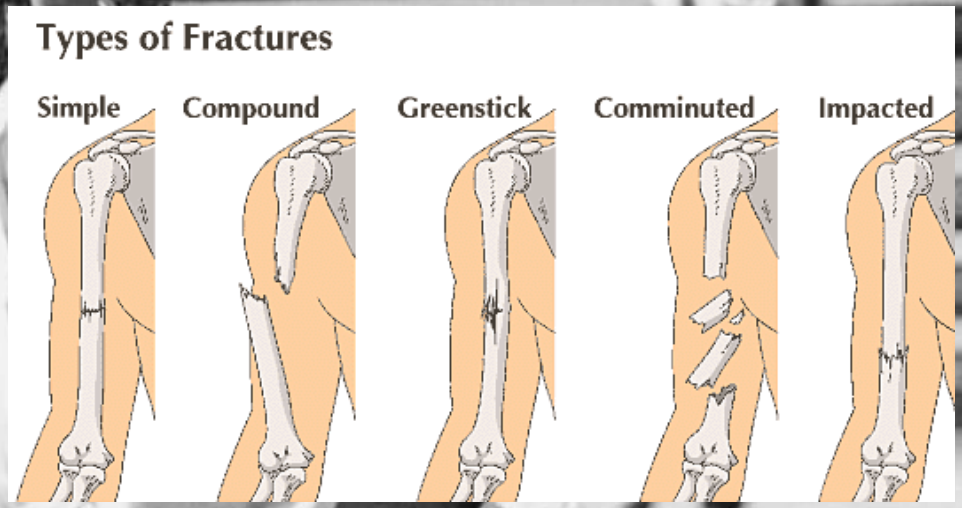
# Fractures

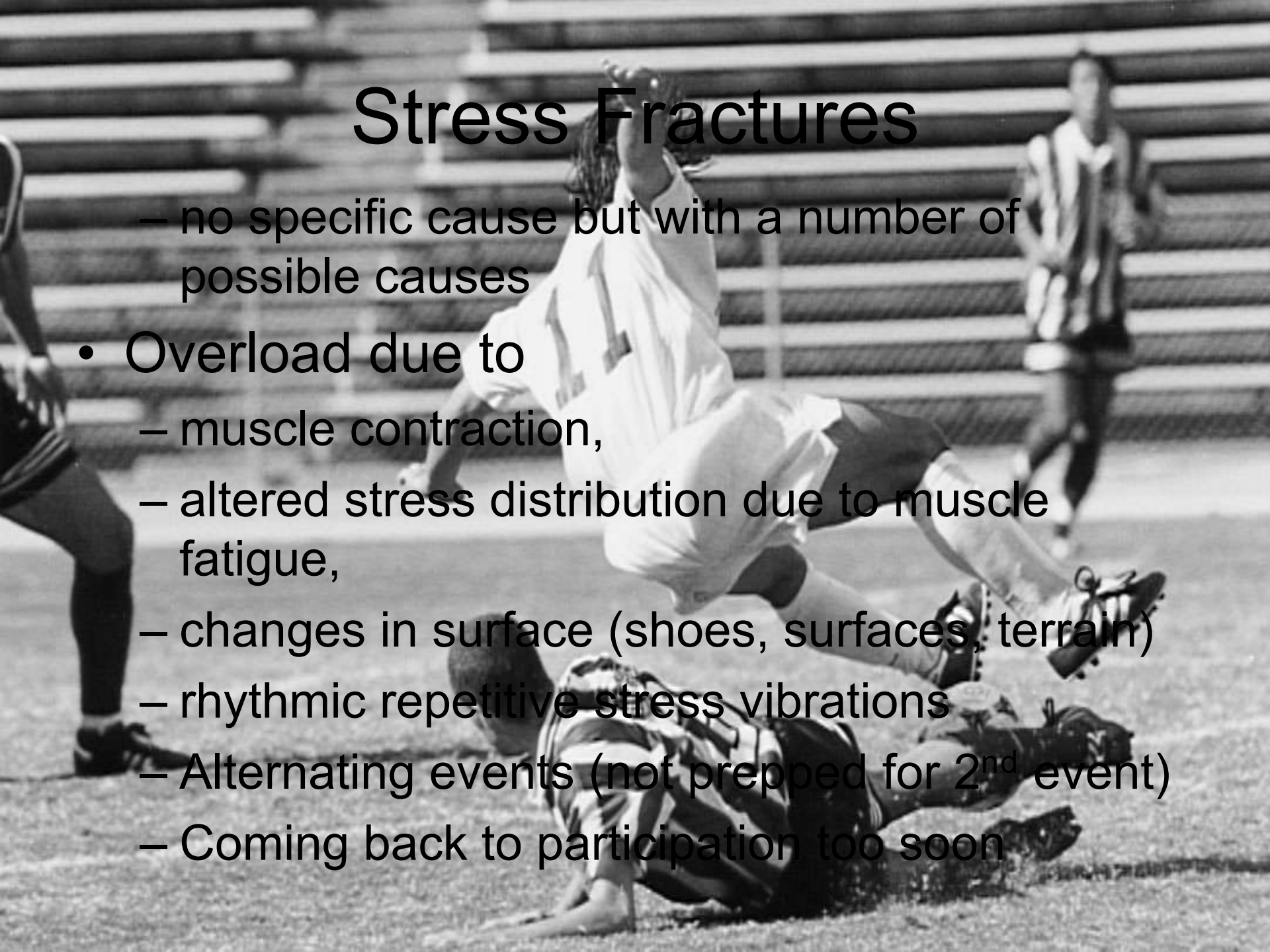
- Closed/simple fracture
  - Does not break the skin.
- Colles' fracture
  - The lower end of the radius (wrist) with displacement of the fragment.
- Complete fracture
  - Completely through the bone.



# Fractures

- Impacted fracture
  - ends are driven into each other. This commonly occurs with arm fractures in children and is sometimes known as a buckle fracture.
- Longitudinal fracture
  - follows the long axis of the bone.
- Serrated fracture
  - where two bony fragments have a saw tooth, sharp edged fracture line secondary to a direct blow. Severe internal damage to vessels, nerves, and muscles may occur due to the sharp edges.



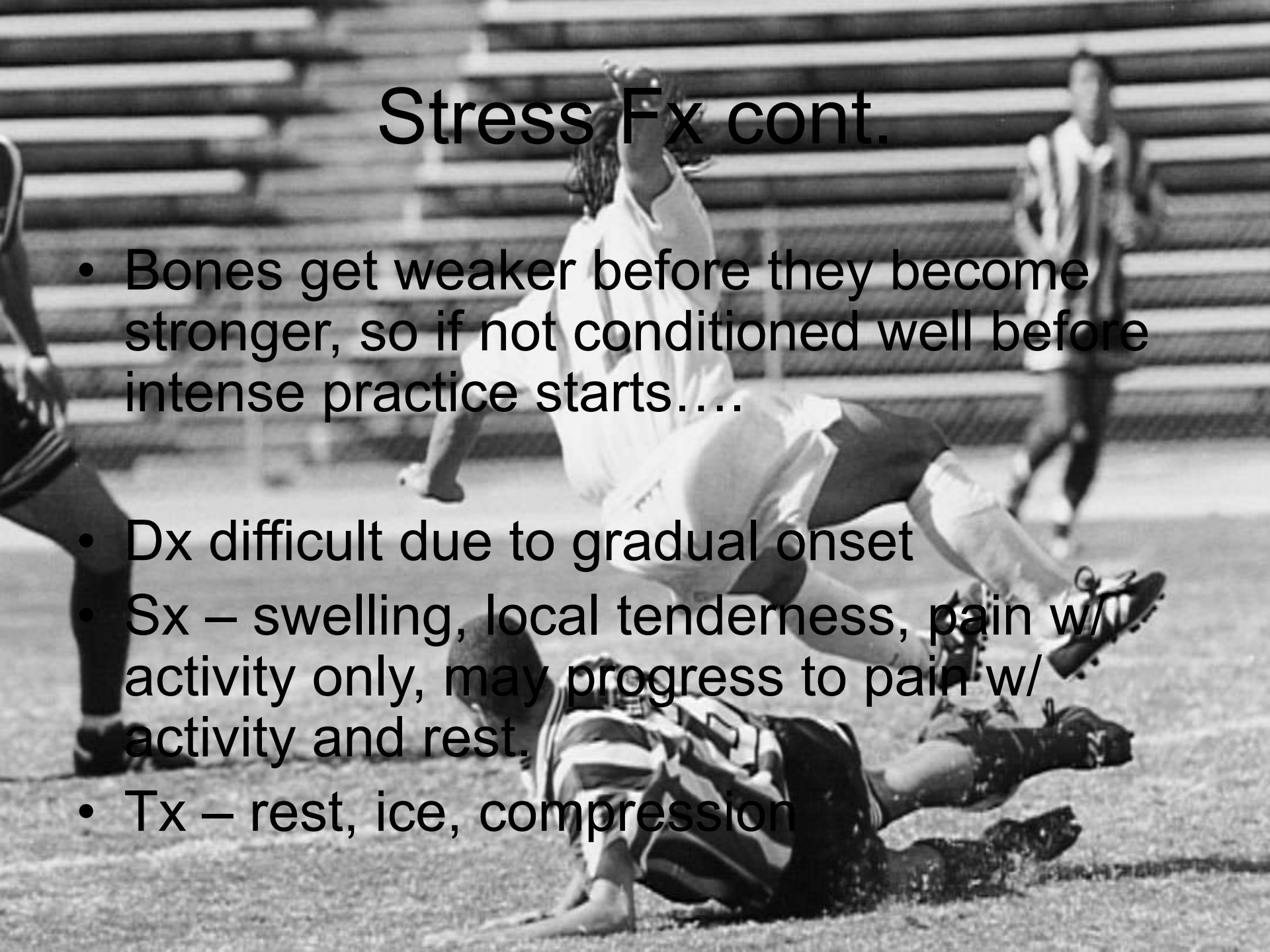
# Stress Fractures

- no specific cause but with a number of possible causes

- Overload due to
  - muscle contraction,
  - altered stress distribution due to muscle fatigue,
  - changes in surface (shoes, surfaces, terrain)
  - rhythmic repetitive stress vibrations
  - Alternating events (not prepped for 2nd event)
  - Coming back to participation too soon

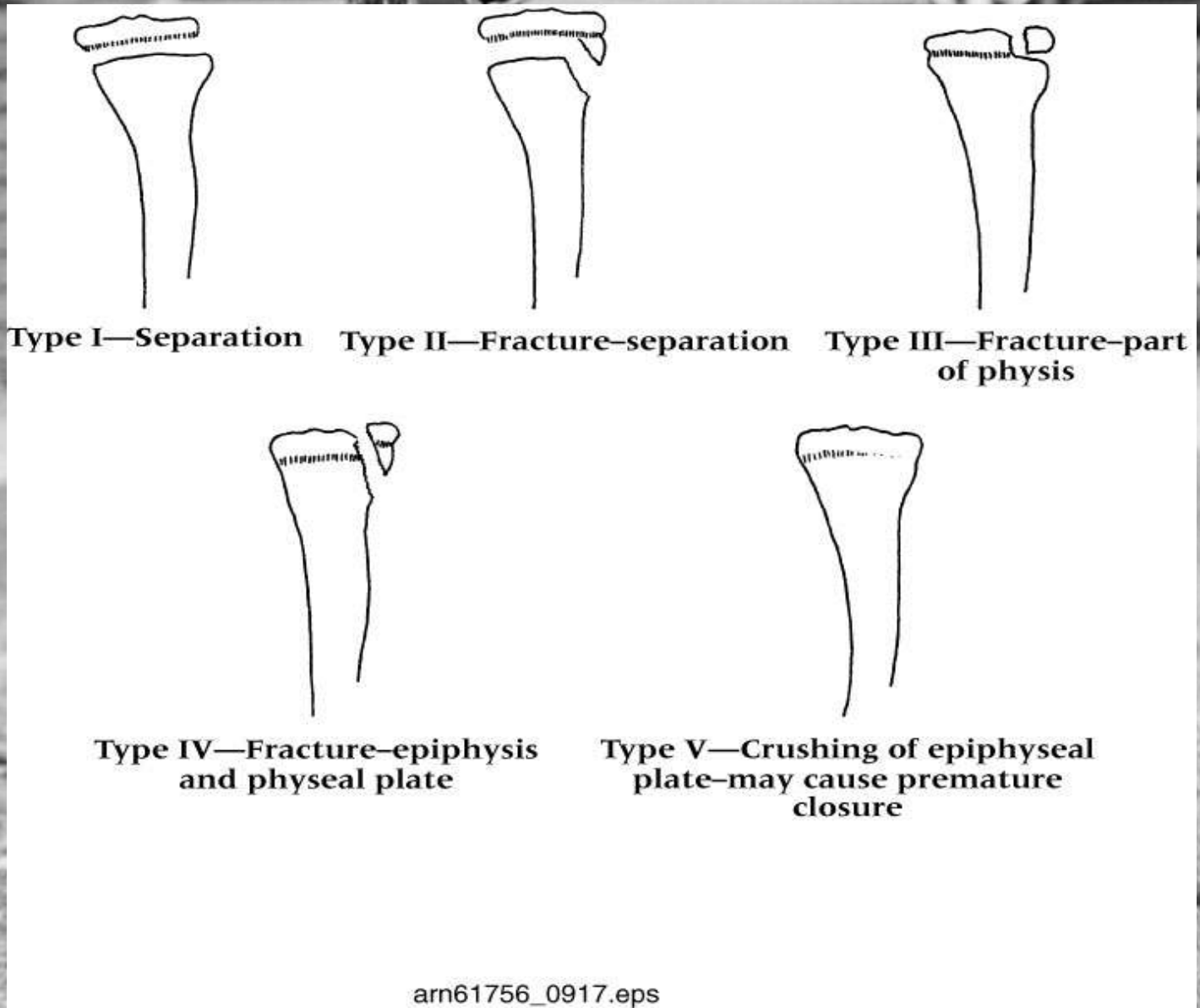
# Stress Fx cont.

- Bones get weaker before they become stronger, so if not conditioned well before intense practice starts….
- Dx difficult due to gradual onset
- Sx – swelling, local tenderness, pain w/ activity only, may progress to pain w/ activity and rest.
- Tx – rest, ice, compression



# Epiphyseal (Growth) Plates

- through age 16 or so
- NOT GOOD!
  - growth probs.



# Review

- A bowling ball fell on your arm. What type of fracture do you most likely have?
- What are 3 reasons that cross country runners see the most stress fractures of any other type of athlete?
- Where is the bone weakest?
- Why are we so concerned with younger athletes injuring themselves?

# Nerves

- Afferent Nerves (Affectors)
- Efferent Nerves (Effectors)
- Tensile forces cause stretching of the nerve fibers.
  - Grade I: Neurapraxia: temporary loss of sensation and/or motor function.
  - Grade II: Axonotmesis: significant motor and mild sensory losses.
  - Grade III: Neurotmesis: motor and sensory losses persisting for up to one year.