AO TRAUMA

Mechanics of bone fractures

Deformation and fracture pattern under torque

Tasks

1 Insert artificial tibia into fracture machine; tibial plateau goes to the right

2 Pull on the left lever to break the tibia under torque

3 Examine the fracture pattern created

Learning outcomes

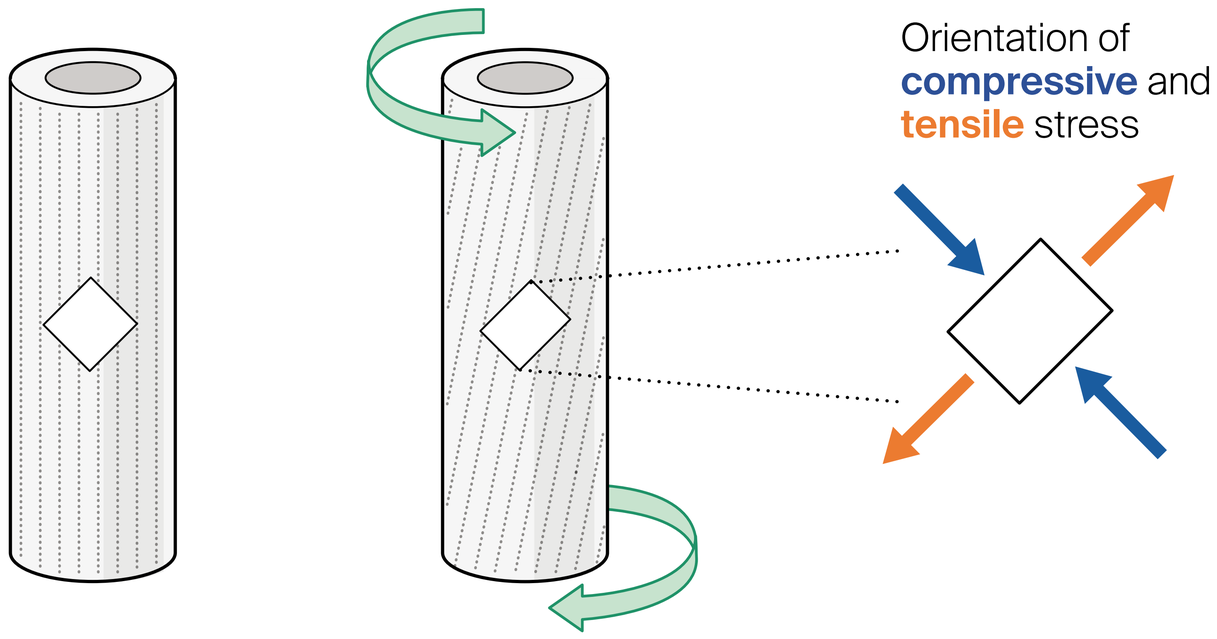
- Describe deformation of material under torque
- Discuss typical fracture pattern under torque
- Describe orientation of compressive stress and tensile stress
- Discuss possible implications on soft-tissue envelope

Take-home message

Deformation under torque first creates a spiral fracture inclined 45° on the side under tension, then a longitudinal split on the side under compression

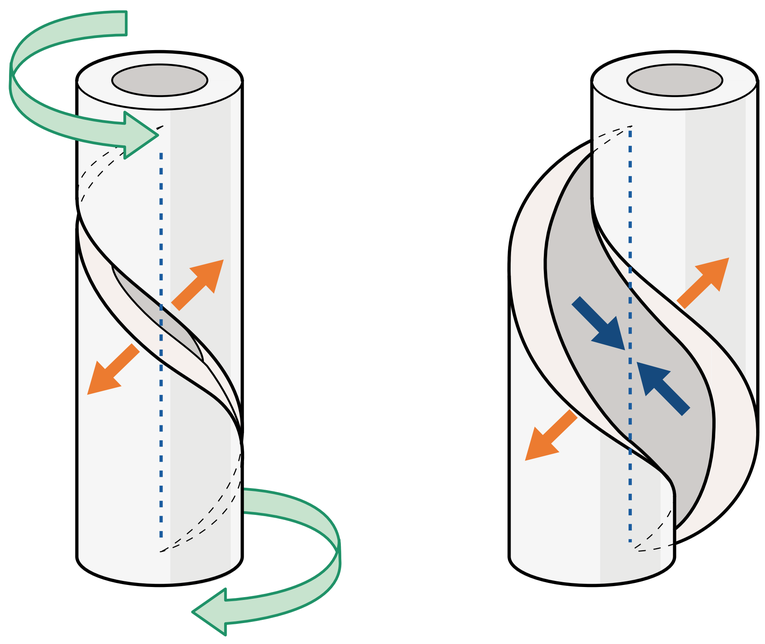
Deformation under torque

- **Compressive stress** inclined 45°
- **Tensile stress** inclined 45°



Fracture under torque

- Failure occurs first on side under tension resulting in a spiral fracture inclined 45° with respect to long-bone axis, **then**
- Longitudinal split on the side under compression



AO TRAUMA

Mechanics of bone fractures

Deformation and fracture pattern under bending

Tasks

1. Insert generic bone tube into fracture machine with the smiley face visible
2. Pull on the lever to break generic bone under bending
3. Examine the fracture pattern created

Learning outcomes

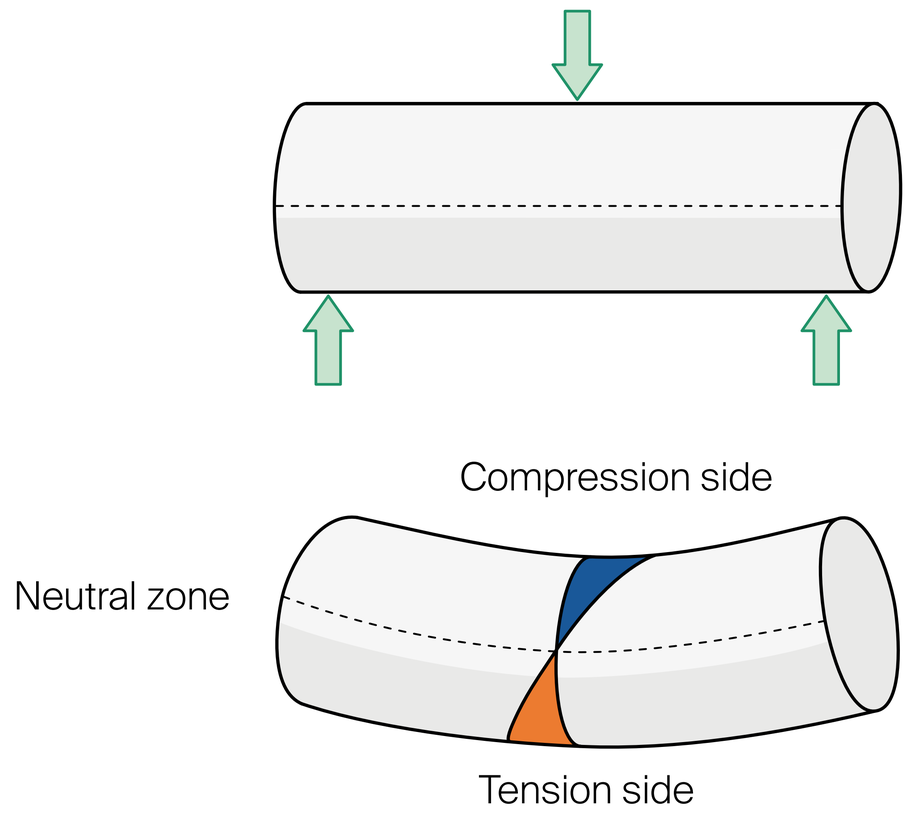
- Describe deformation of material under bending
- Discuss typical fracture pattern under bending
- Compare compression and distraction sides
- Discuss possible implications on soft-tissue envelope

Take-home message

Deformation under bending first creates a transverse fracture on the side under tension, then an oblique fracture, with or without wedge, on the side under compression

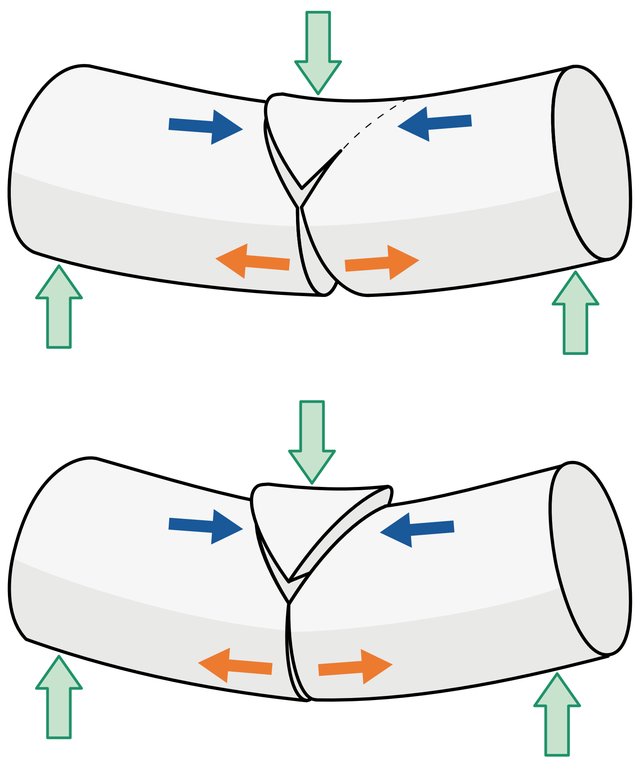
Deformation under bending

- Shortening on the side under compression
- Lengthening on the side under tension
- Neutral zone in between



Fracture under bending

- Failure occurs first on the side under tension resulting in transverse distraction fracture, **then**
- Failure on the side under compression results in oblique fracture with or without bending wedge



AO TRAUMA

Mechanics of bone fractures

Deformation and fracture pattern under axial load

Tasks

1 Place artificial cancellous bone in vice and apply axial load until it fractures

2 Remove material from vice and examine fracture pattern

Learning outcomes

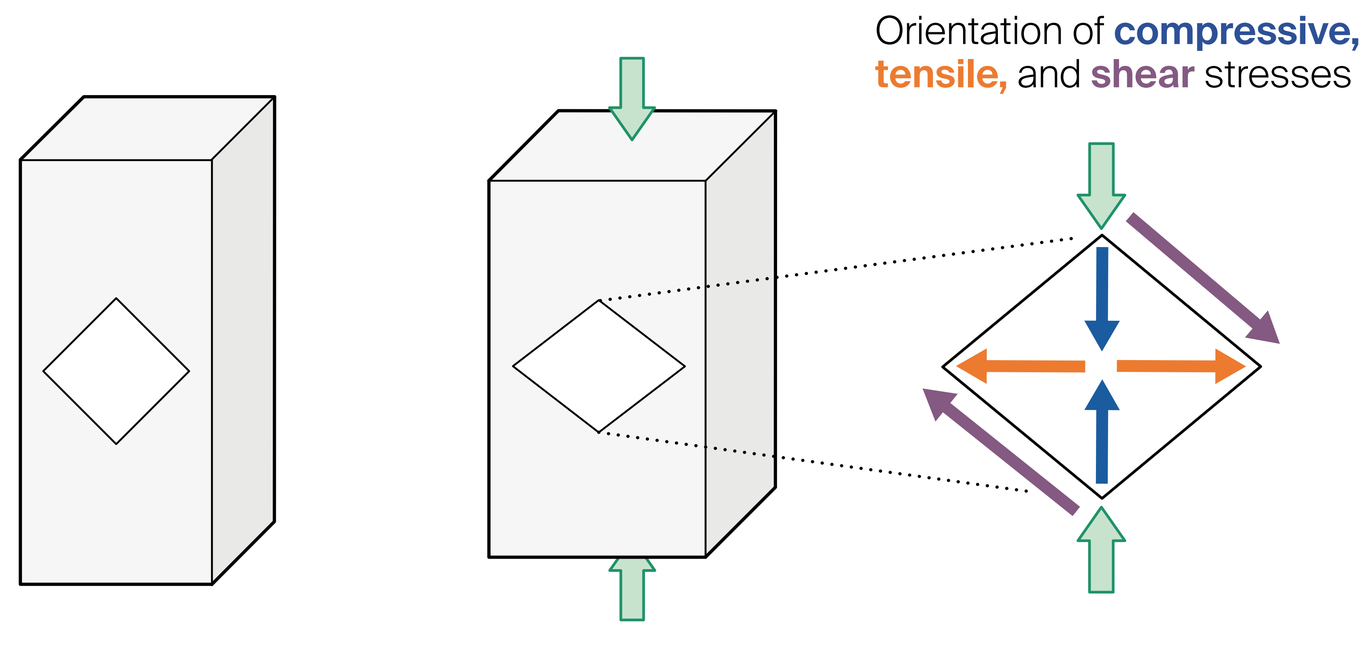
- Describe deformation of material under axial load
- Discuss typical fracture patterns under axial load
- Distinguish between compressive, tensile, and shear stresses
- Discuss possible implications on soft-tissue envelope

Take-home message

The resultant stress of compressive and tensile stress is **shear**, which is the main reason for failure of bone in compression

Deformation under axial compression

creates not only compressive but also tensile stress, where the resultant of these is shear stress



Fracture under axial load

- **Short bone:** oblique fracture or double oblique fracture with longitudinal split (see illustration)
- **Long bone:** buckling, similar to failure under bending (without illustration)