PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

HTTPS://WWW.YOUTUBE.COM/WATCH?V=LQVPGNNYFBA&LIST=PLUBRB5B7FA_EYBVGZ4XB_AQLGCXLIEYRA&INDEX=9

Management of diaphyseal fractures
Principles of reduction and fixation

AO Trauma Basic Principles Course

Learning objectives

- Describe the importance of injury mechanism – high vs low energy
- To match mode of fixation and implant to fracture pattern
- Describe the roles of direct/indirect reduction in diaphyseal fractures
- Describe the importance of strain theory in fixation
- Understand the concept of the working length of plates and IM nails

Higher energy injury = worse soft-tissue injury

Diaphyseal fractures

- Simple fractures require anatomical reduction/compression
  - Direct reduction and absolute stability

- Multifragmentary fractures require length/rotation/alignment
  - Indirect reduction and relative stability

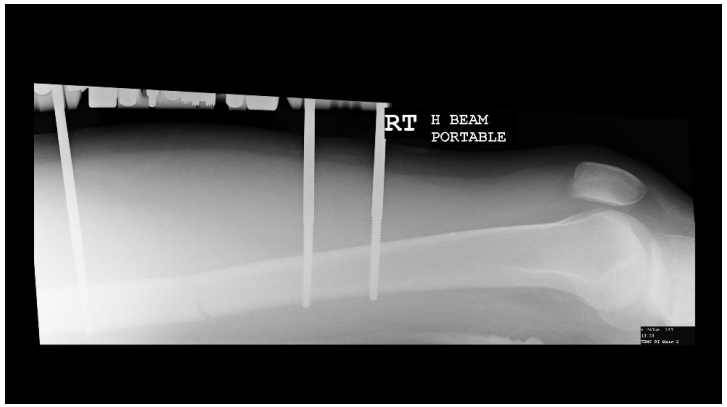
- Select appropriate reduction technique
- Select appropriate method of fixation
- Apply while minimizing further softetissue injury

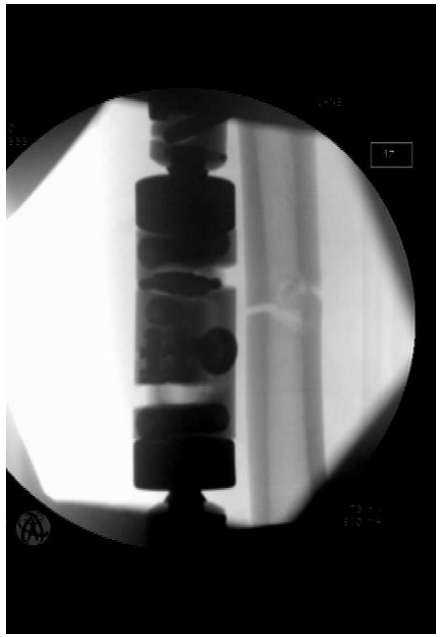
Soft tissues

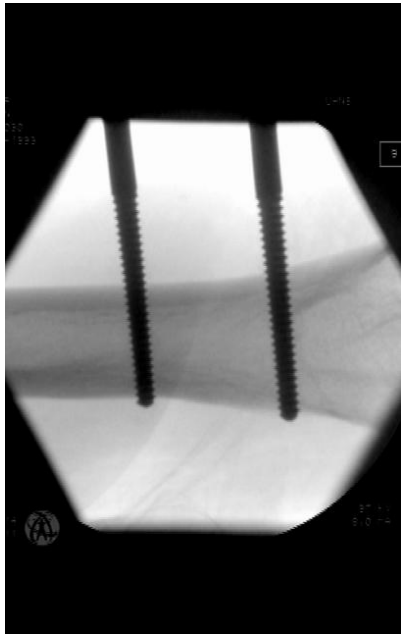
- Soft-tissue injury
  - Determined by mechanism
  - Determines outcome of fracture
  - Determines the initial managemnt plan
  - Determines the timing of definitive fixation

Soft tissues

- If soft tissues are too bad
- If patient is too sick
- Temporize with external fixation





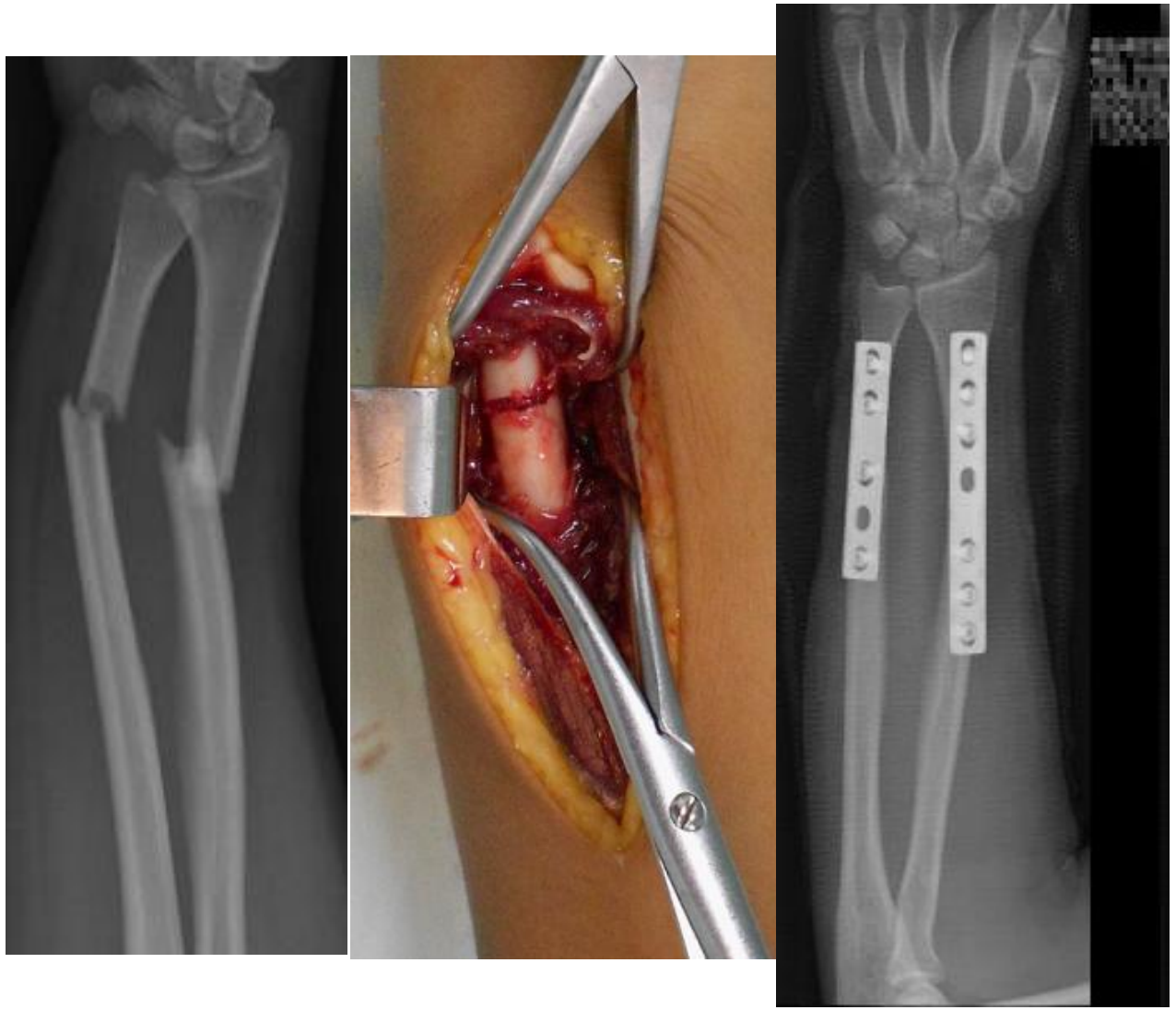


Diaphyseal fractures

- Generally, length, alignment and rotation
- Indirect reduction
- Relative stability
- Secondary healing
- Callus

Diaphyseal fractures—exceptions

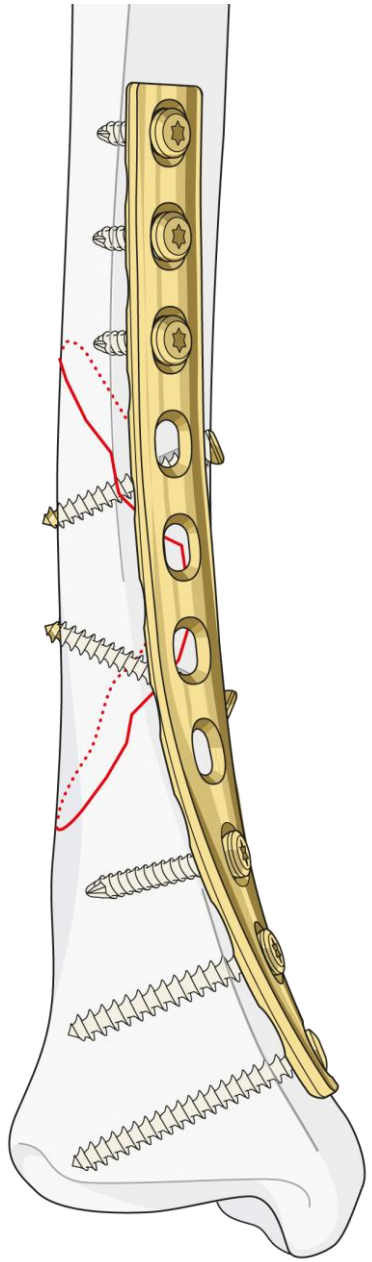
- Radius and ulna
- Foream is a “two-bone joint”
- Malunion will compromise prono-supination
- Anatomical reduction
- Direct reduction techniques
- Rigid fixation
- Early movement

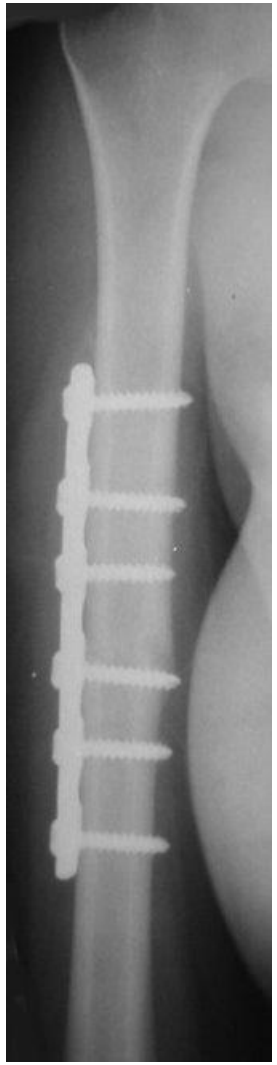


Diaphyseal fractures—exceptions

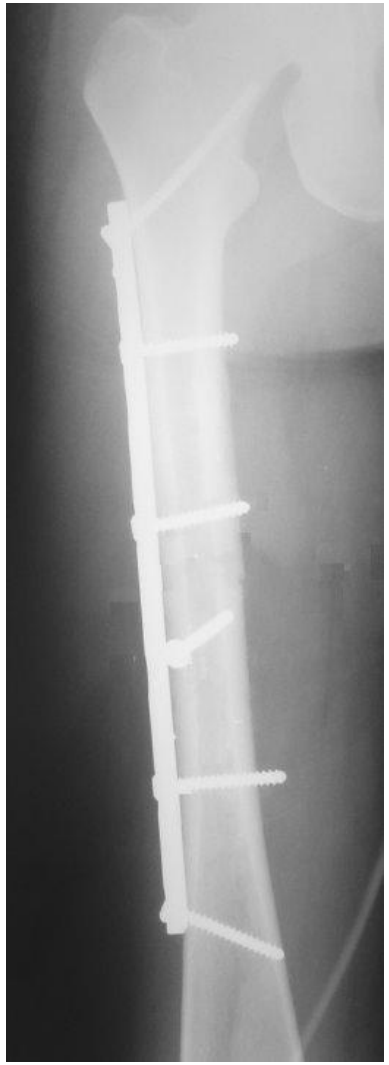
- Simple fractures A B
- Soft tissues in good condition
- Direct anatomical reduction
- Preserve vascularity

- But..... could nail or bridge plate





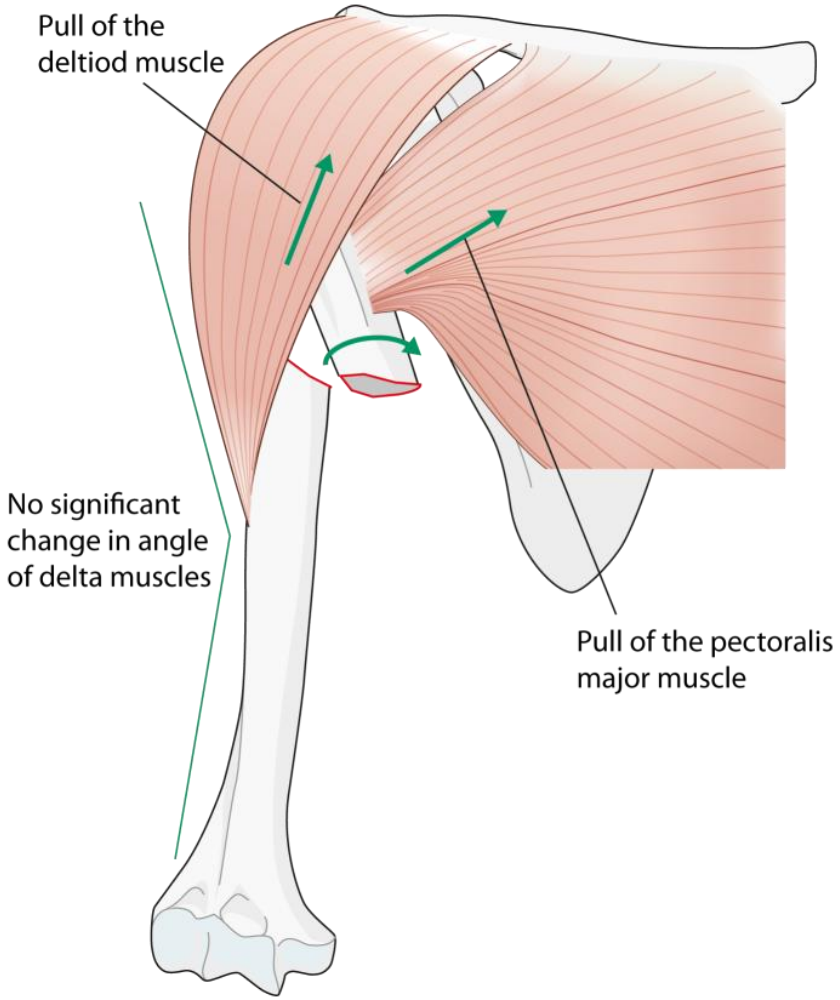
Compression plating
- must prebend!

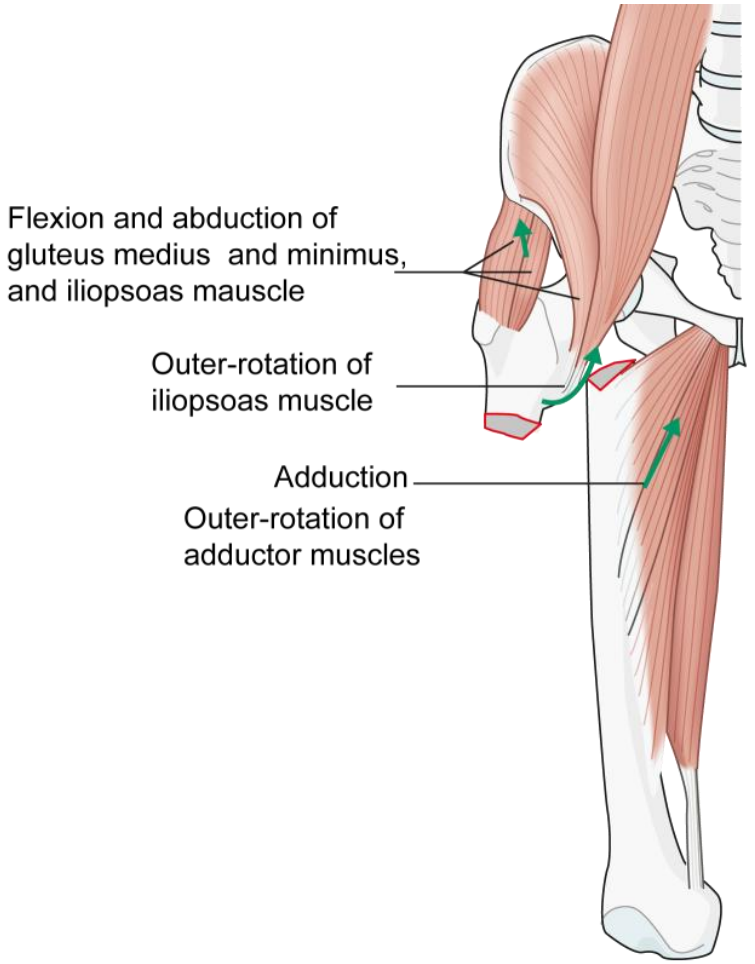


Lag screw plus neutralization plate

Diaphyseal fractures—reduction techniques

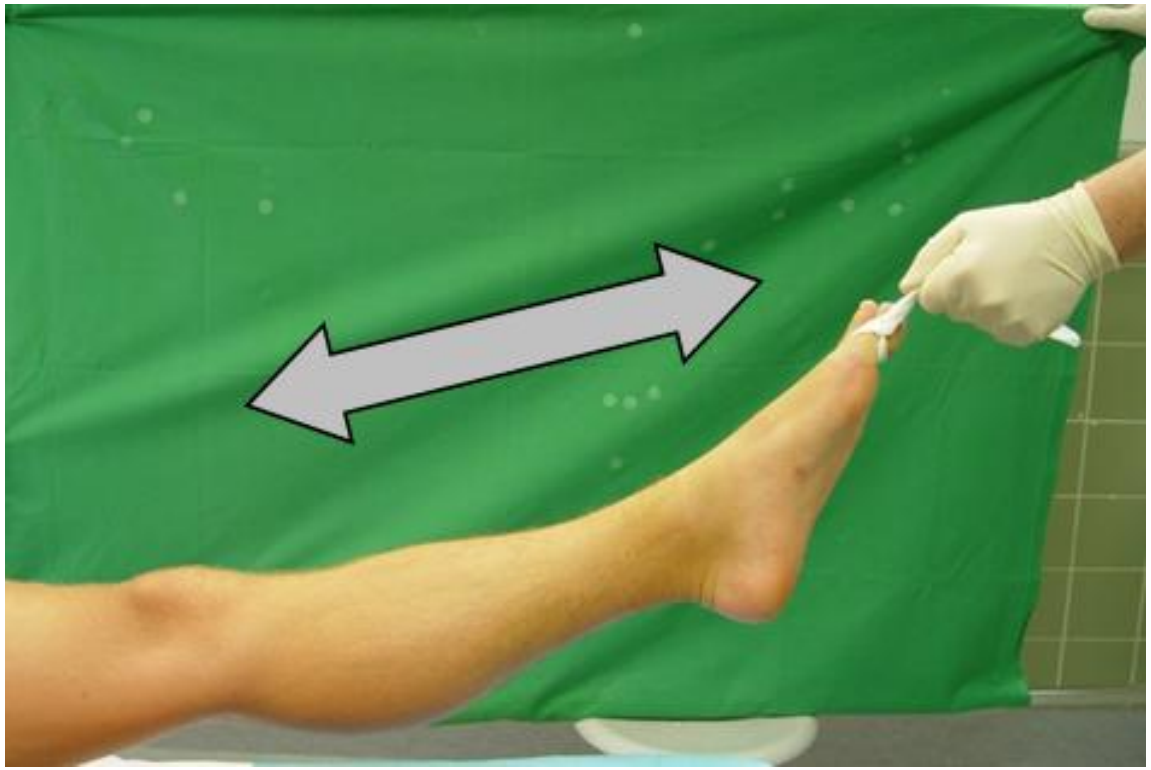
- Displacement occurs secondary to muscle pull
- Reduction techniques should overcome/reverse this pull





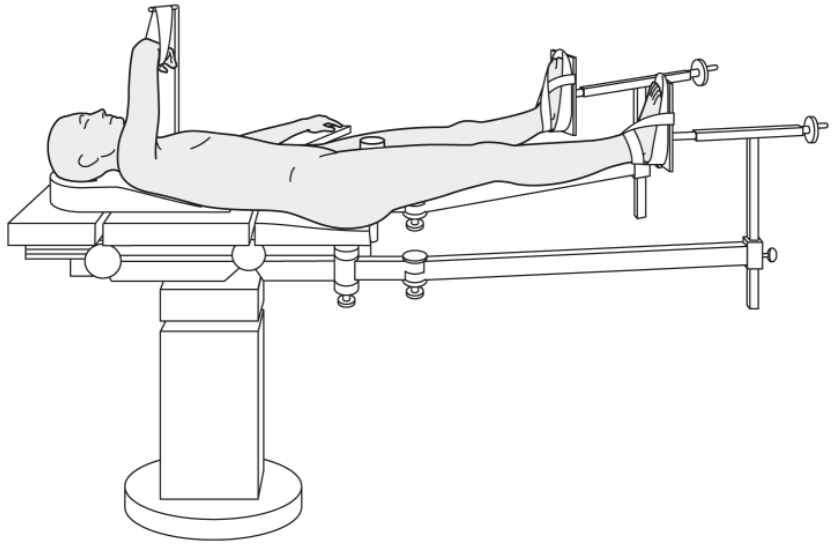
Basic fracture management—distraction

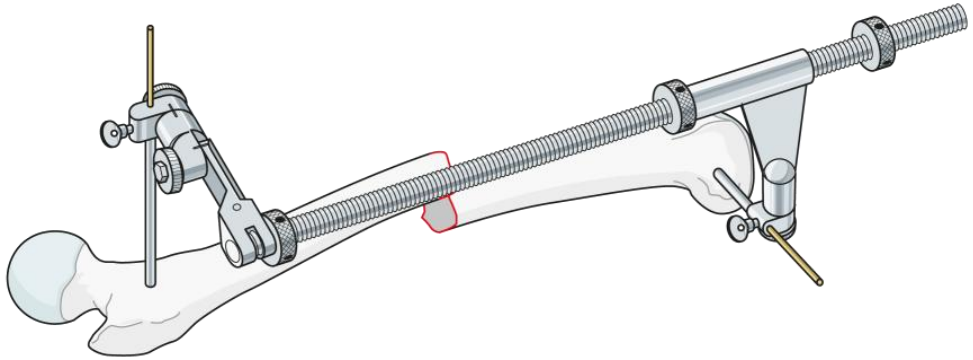
- Stabilizes
- Provides pain relief
- Protects soft tissues
- Gives approximate fracture reduction
- Skin traction
- Thomas splint
- Assess neurovascular status before AND after traction



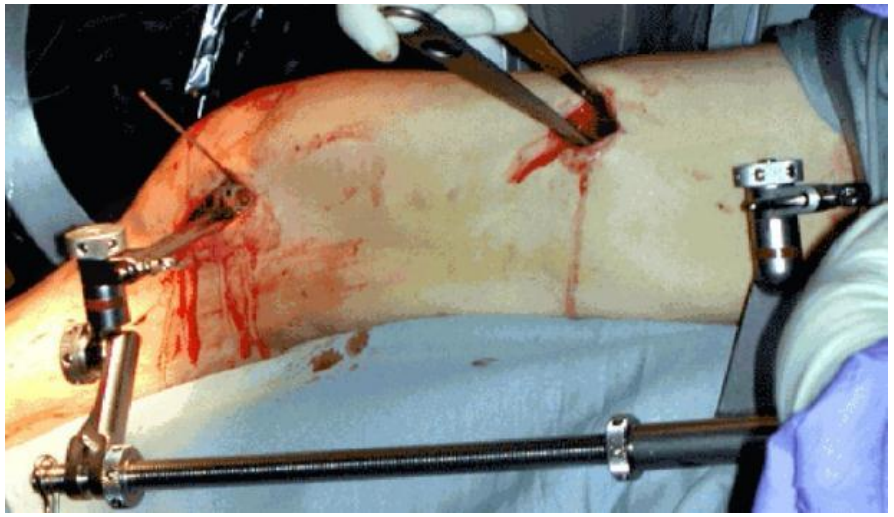
Diaphyseal fractures—reduction techniques

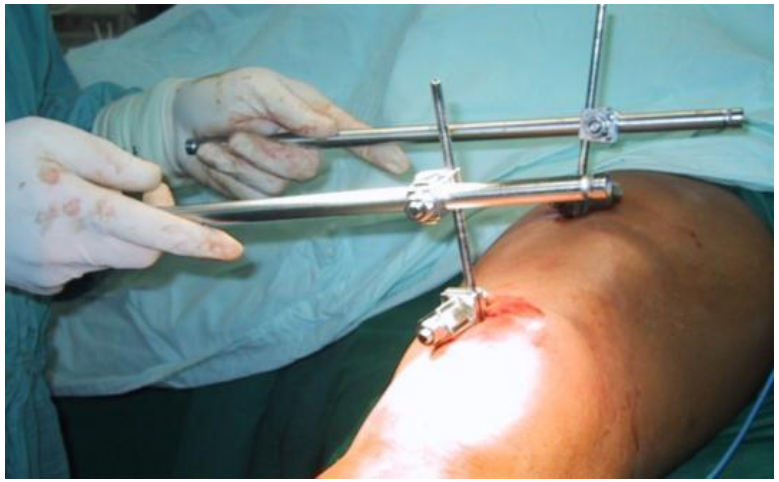
- Distraction
- Traction table
- Distraction device
- Uses soft tissues to reduce fracture
  - Muscle, skin, ligaments
- Regains length and rotation
- Improve reduction with direct manipulation





Diaphyseal fractures—reduction techniques





Diaphyseal fractures—reduction techniques

- Assess rotation
  - Radiologically

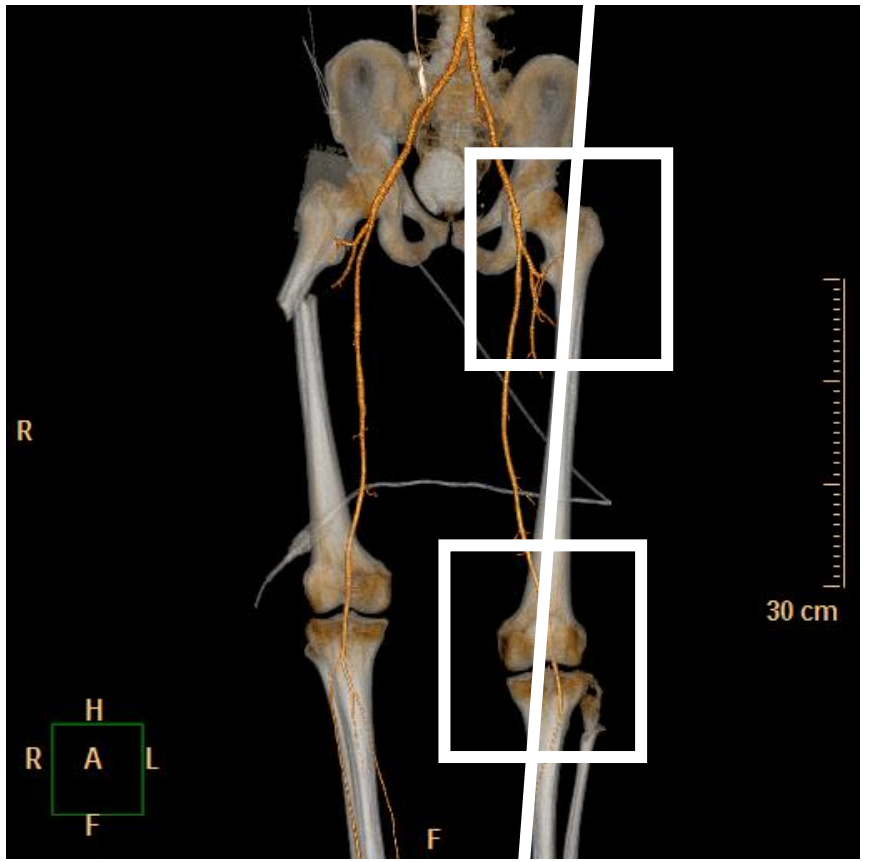
Cortical thickness should match

No

Yes

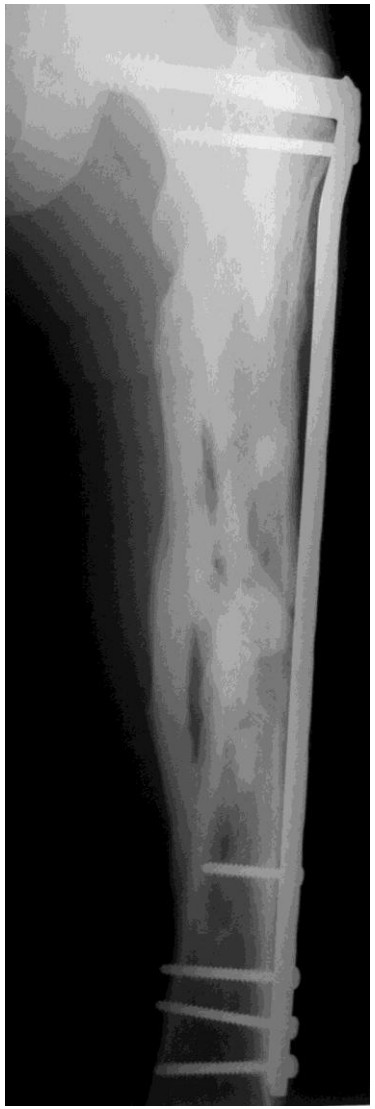
Diaphyseal fractures—reduction

- Assess alignment
  - Clinically
  - Radiologically with diathermy lead



Diaphyseal fractures—fixation

- Generally relative stability techniques
- Intramedullary nail
- Bridge plating – minimally invasive plate osteosynthesis
- External fixation



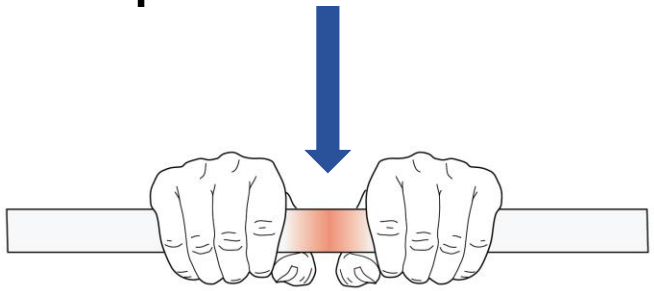
Diaphyseal fractures—fixation

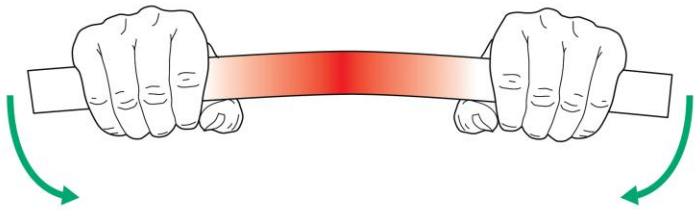
- Concept of “working length”
- Length of bone/fracture unsupported by implant

= Working length

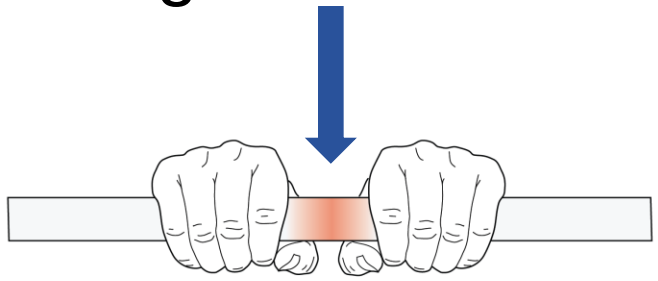
Diaphyseal fractures—working length

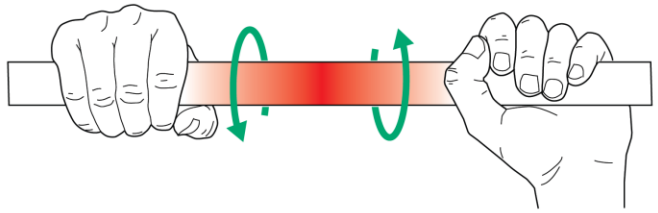
Bending stiffness is inversely related to working length squared





Torsional stiffness is inversely related to the working length





Implant—working length

- Allows controlled motion at fracture site
- Minimizes risk of stress concentration in implant
- Reduces risk of implant failure
- Minimizes risk of hypertrophic nonunion

Implant—working length

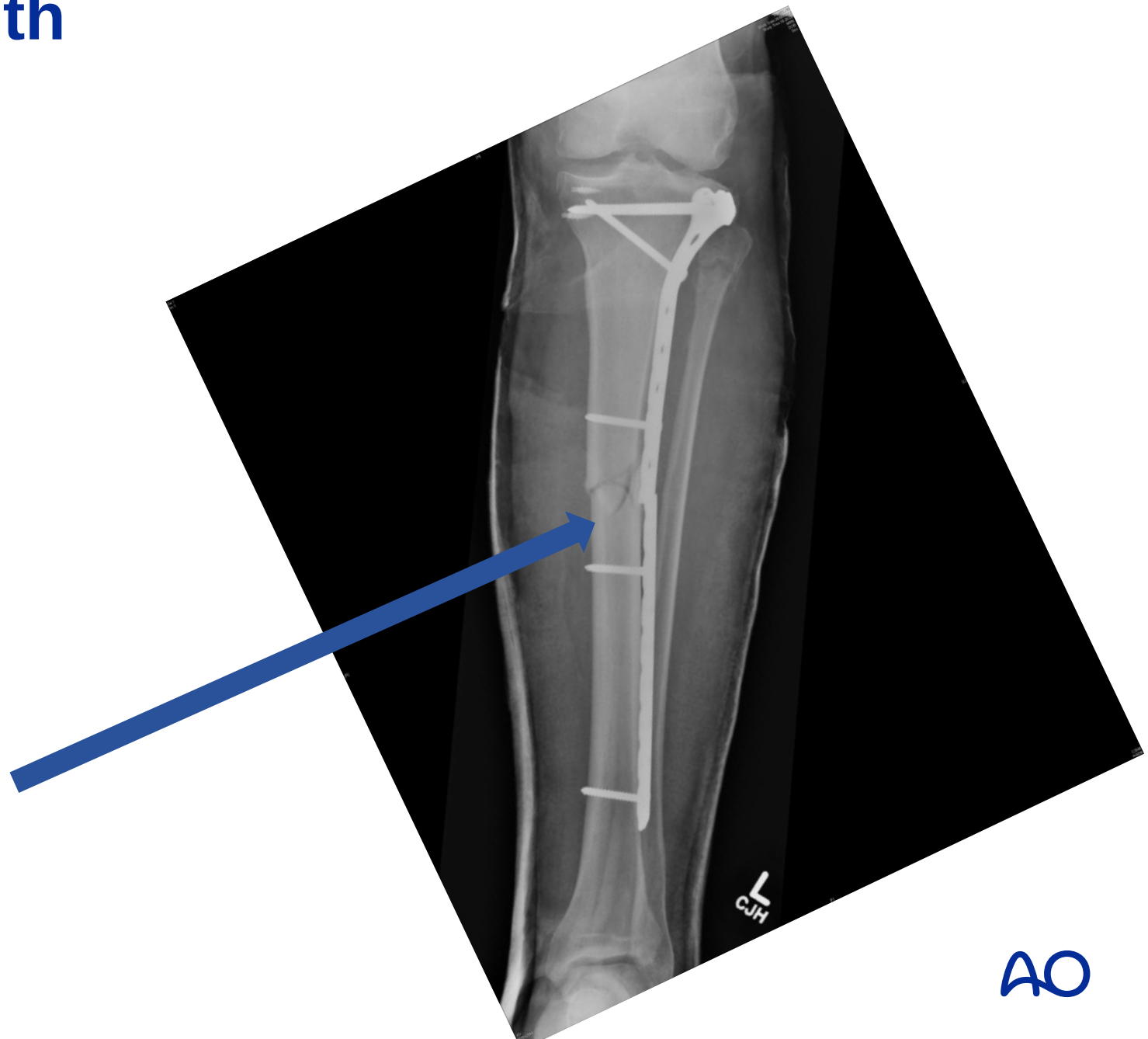
- Narrow nail
- Long working length
- Simple fracture
- High strain at fracture
- Nonunion

Implant—working length

- Multifragmentary fracture
- Long working length
- Better strain environment
- Abundant callus
- Fracture union

Implant—working length

- Simple fracture
- Short working length
- High strain at fracture
- Stress concentration
- Implant failure



Diaphyseal fractures—fixation

Advantages of intramedullary nailing

- Biomechanically better in osteopenia
- Preserves periosteal blood supply
- Early weight bearing which promotes healing
- Prevents disuse osteoporosis
- Easier removal of implant
- Less chance of refracture after implant removal


R

Diaphyseal fractures—fixation

Advantages of plates and screws

- Less damage to endosteal circulation
- Useful if metaphyseal/articular extension of fracture
- Indirect reduction available in MIPPO technique
- Can achieve both absolute/relative stability as required

Plate—working length!!!!

Diaphyseal fractures—fixation

Postoperative management

- Muscle rehabilitation
- Active range of motion exercise/CPM
- Early weight bearing as tolerated
- Avoid prolonged nonweight-bearing
- Prevent osteopenia, muscle wasting, cartilage atrophy

Take-home messages

- Assessment of injured soft tissues and fracture classification
- Indications for operative treatment
- Difference between functional and anatomical reduction
- Absolute and relative stability
- Choice of implants determines strain environment
- Avoid high strain in simple fractures