Bone Plates and Screws in Fracture Management

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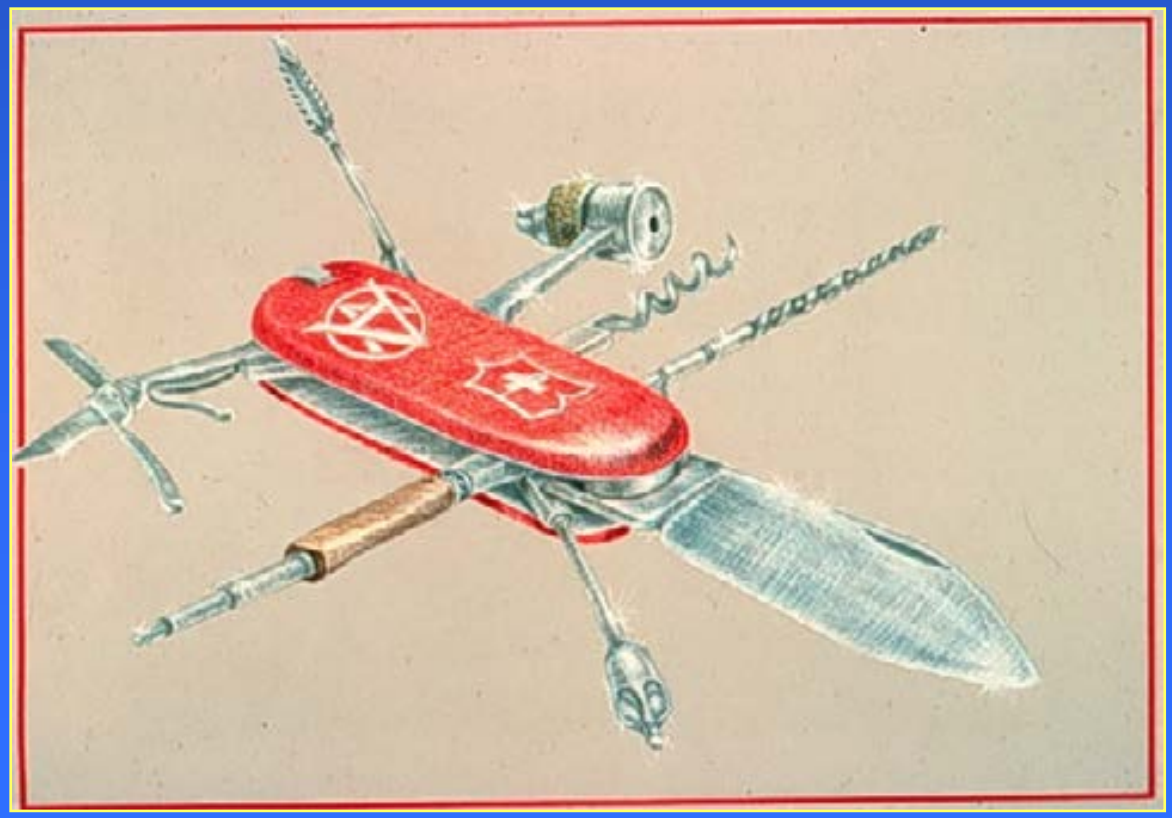
Introduction

- ASIF/AO popularized method in the 1960's
- Versatile fixation system applicable to most fractures



Fracture Assessment Indications

- 8-10,4-7, 0-3: Articular and pelvic fractures
- 4-7,0-3: Transverse or short oblique fracture
- 4-7,0-3: Long oblique or spiral fracture
- 4-7,0-3: Comminuted fracture

Indications for Plates and Screws

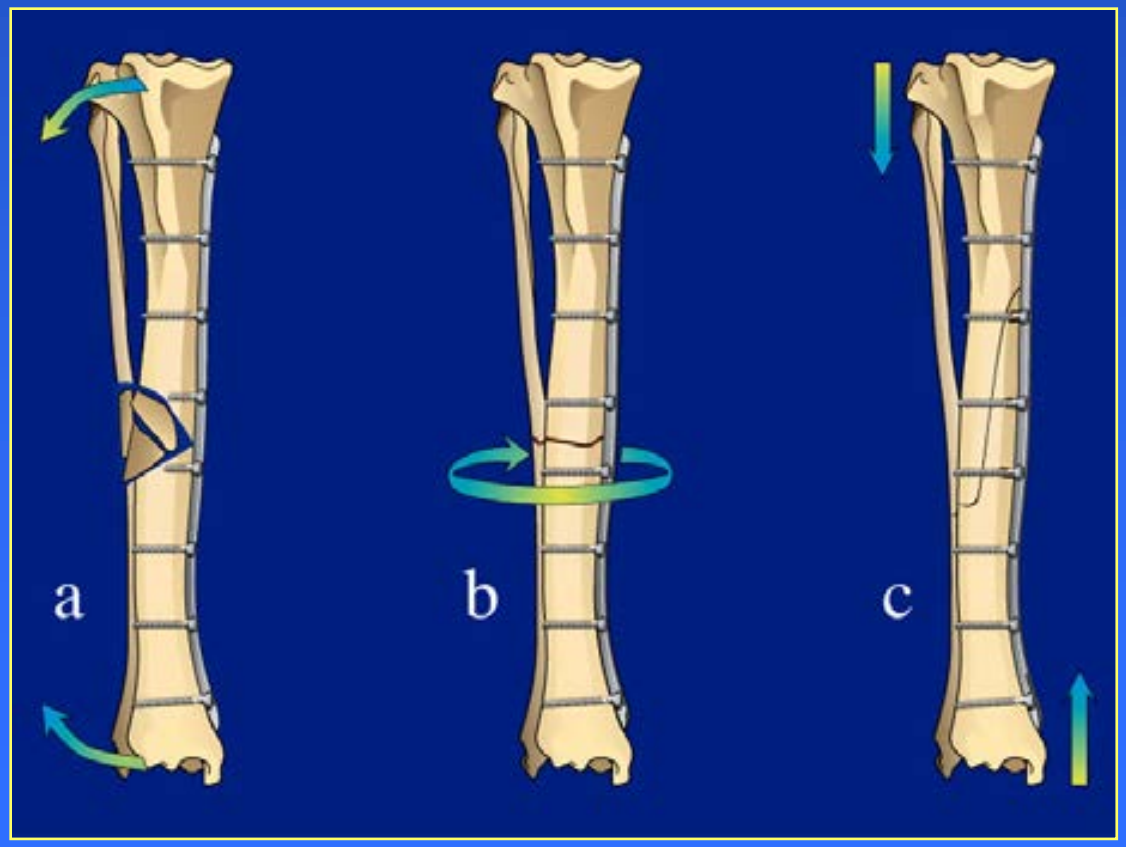
- Long bone fractures
- Multiple fractures
- Articular fractures
- Pelvic fractures
- Mandibular fractures
- Scapular fractures
- Spinal fractures
- Joint arthrodesis

Mechanical Properties - Screws

- “Lag screws” compress the fracture
- Combined with plates in diaphyseal fractures
- Can be used alone in articular fractures
- Bending strength ↑ with core diameter
- Pullout strength ↑ with thread diameter

Mechanical Properties - Plates

- Plates resist axial loading, bending, and torsional forces
- Fatigue failure is possible

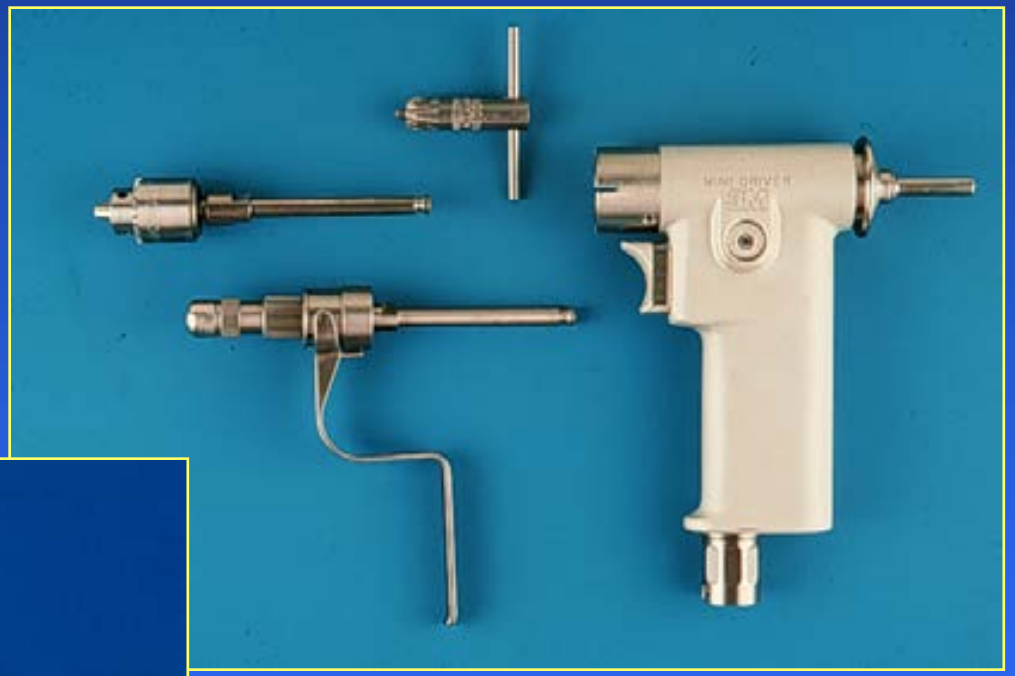


Equipment and Supplies

- Drills
- Drill guides
- Depth gauge
- Tap
- Tap sleeve
- Countersink
- Screw driver
- Plates and screws

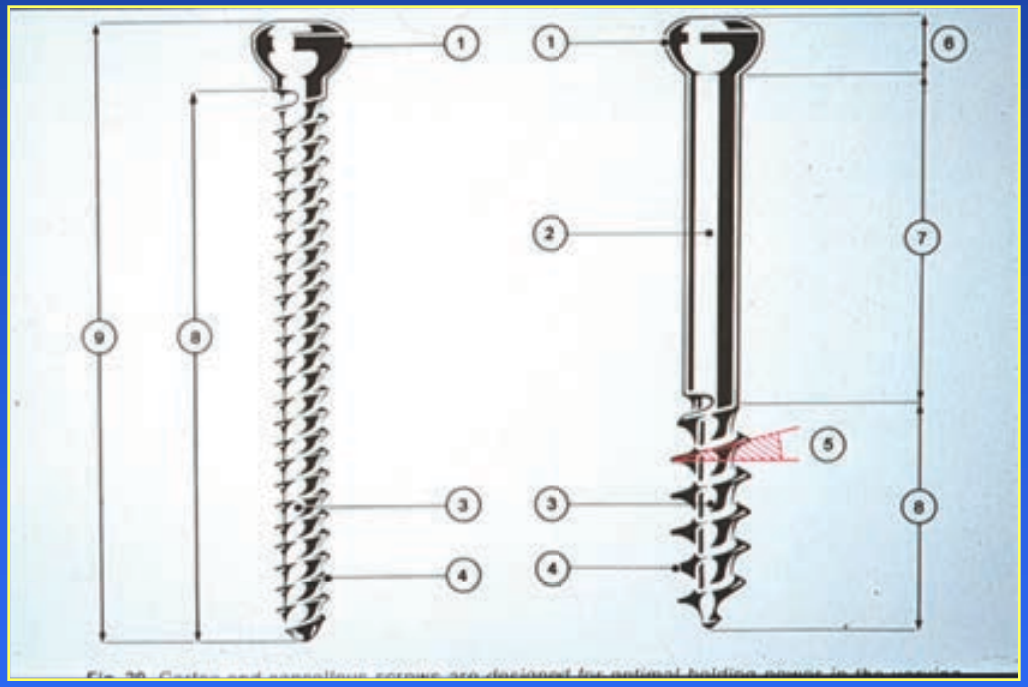
Equipment and Supplies

- Power drill
- Equipment to contour the plate



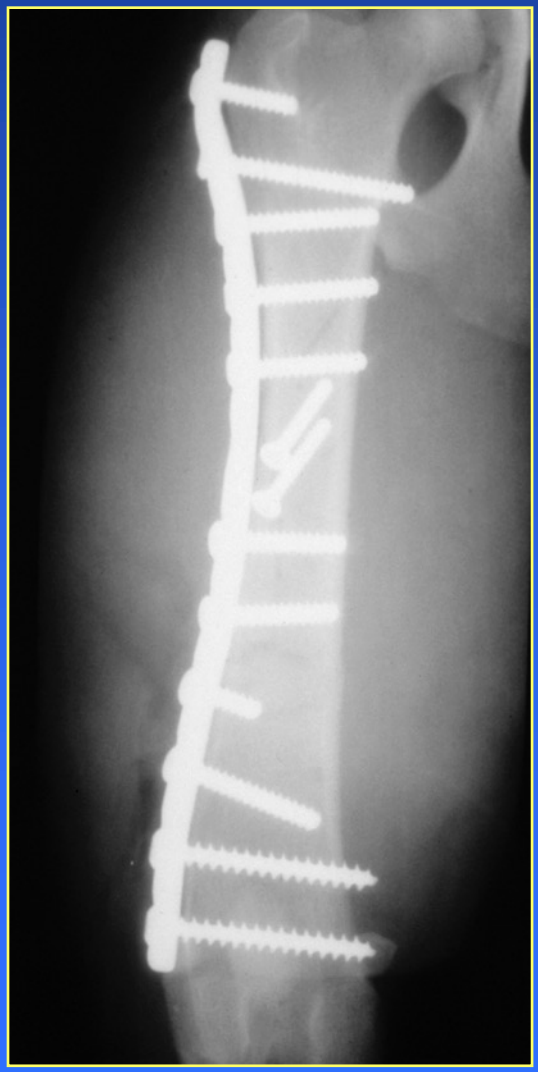
Bone Screws

- Cortex screw
- Cancellous screw
- Partially threaded screw
- Locking screw
- Self tapping or non self tapping
- 316L stainless steel or titanium



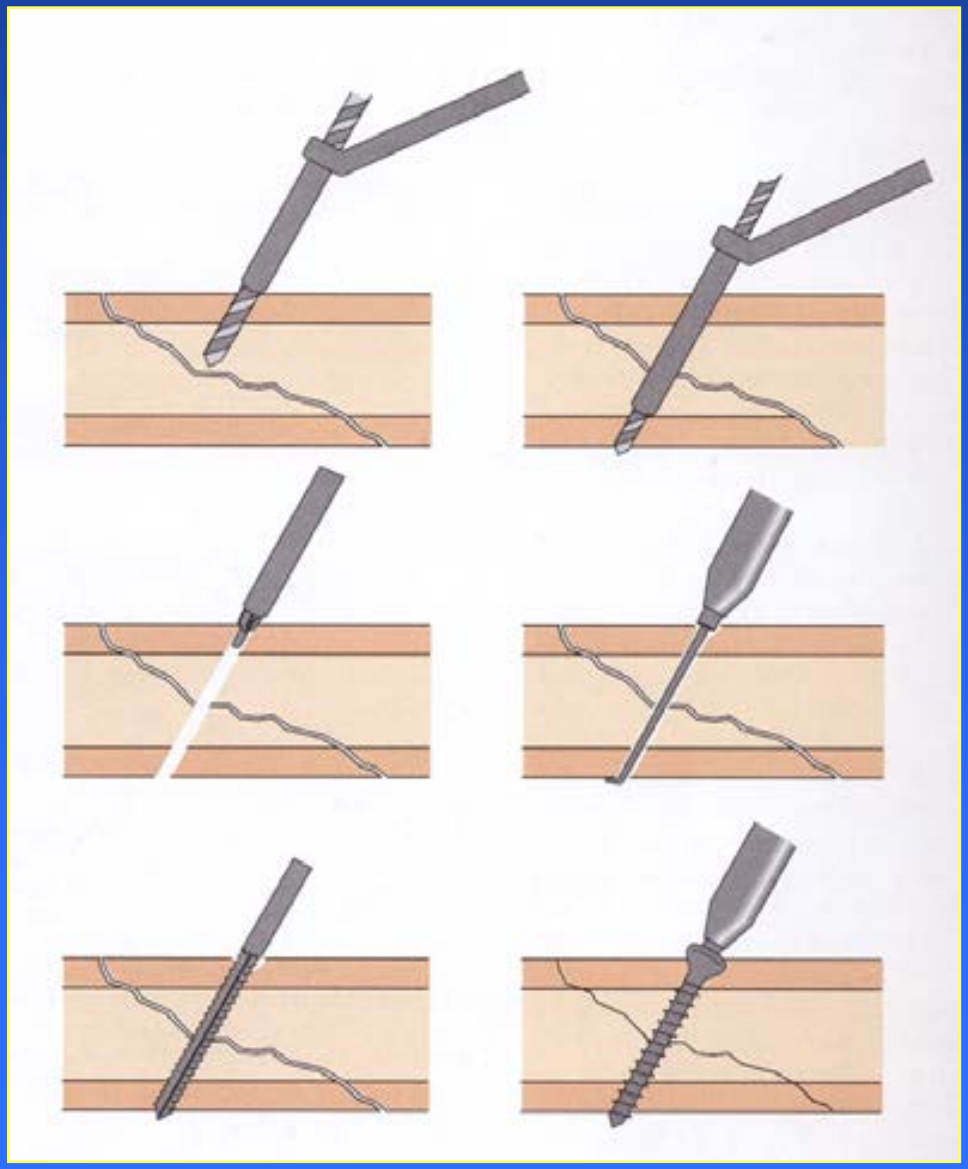
Function of Screws

- Lag screw – applies compression across the fracture
- Position screw – holds the fragment apart
- Plate screw – secures the plate to the bone

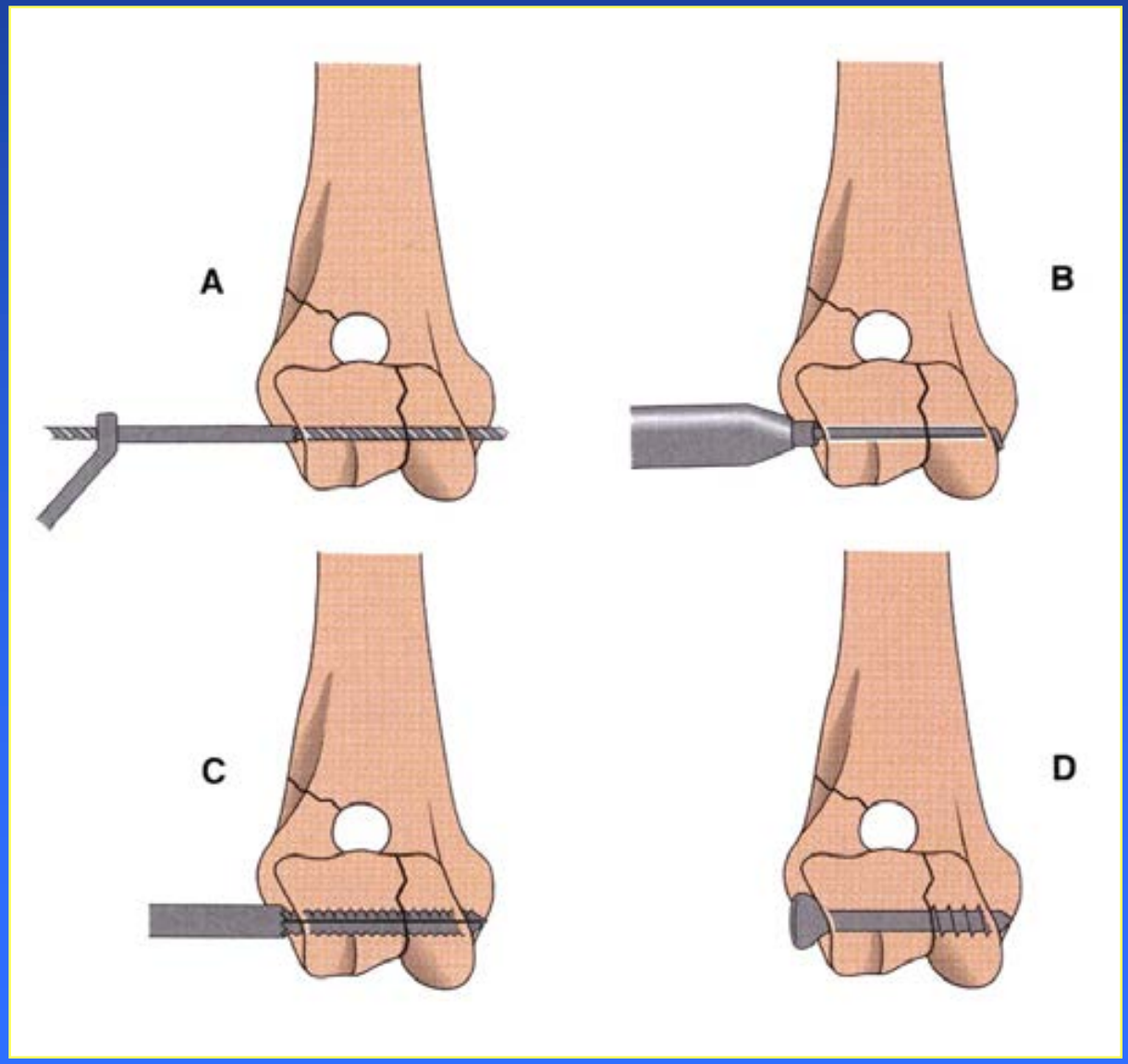


Instruments for Screw Placement

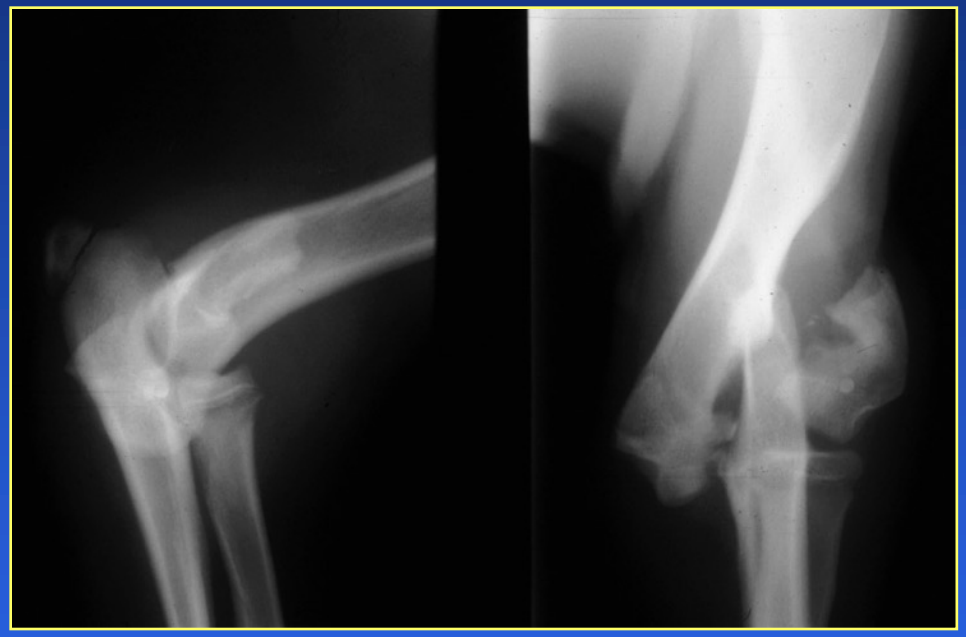
- Screw named for thread width
- Glide hole, bit size = to thread diameter
- Thread hole, bit size = to core diameter
- Countersink
- Depth gauge
- Tap size = to thread diameter

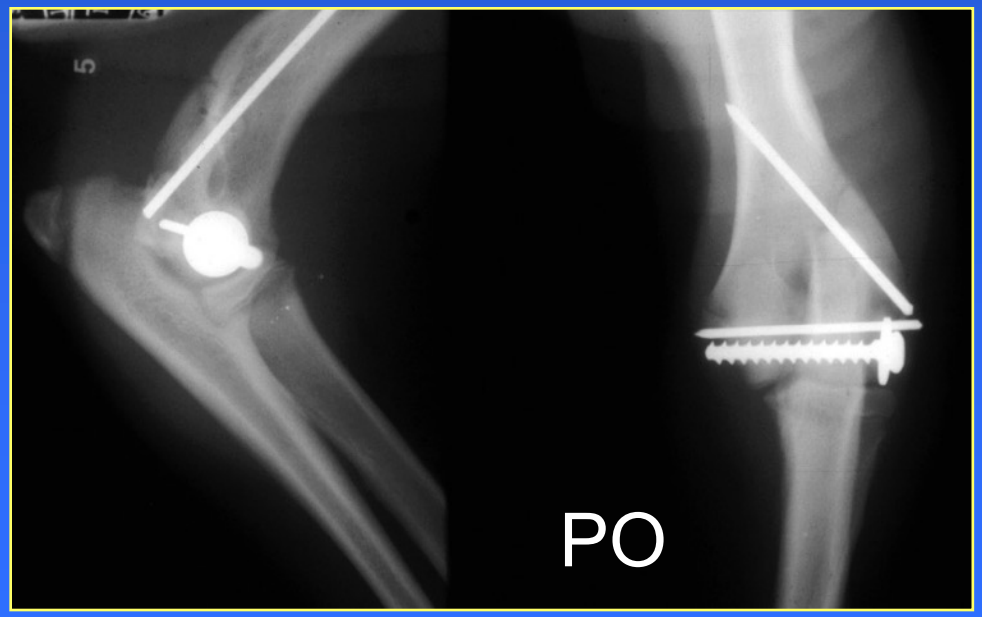


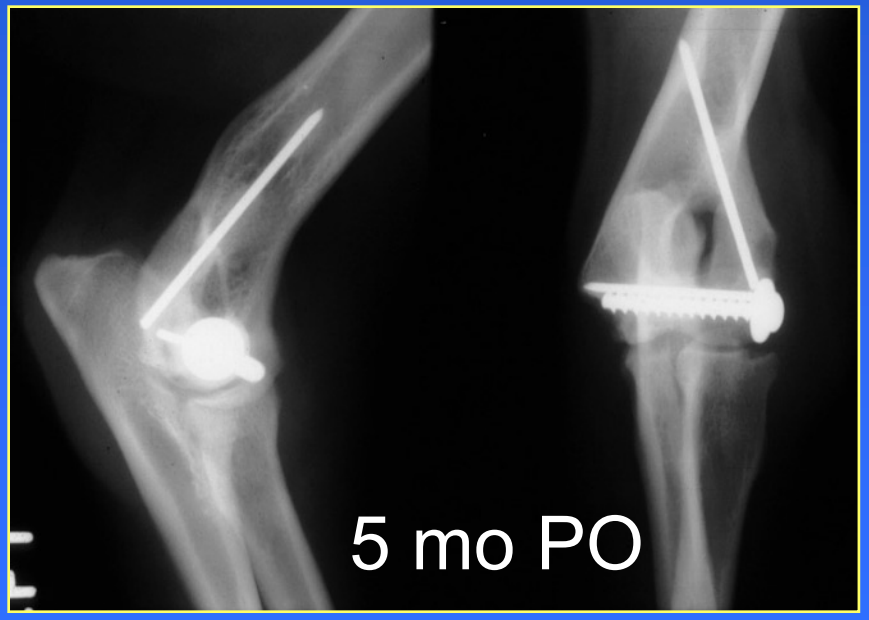
Partially Threaded Lag Screw



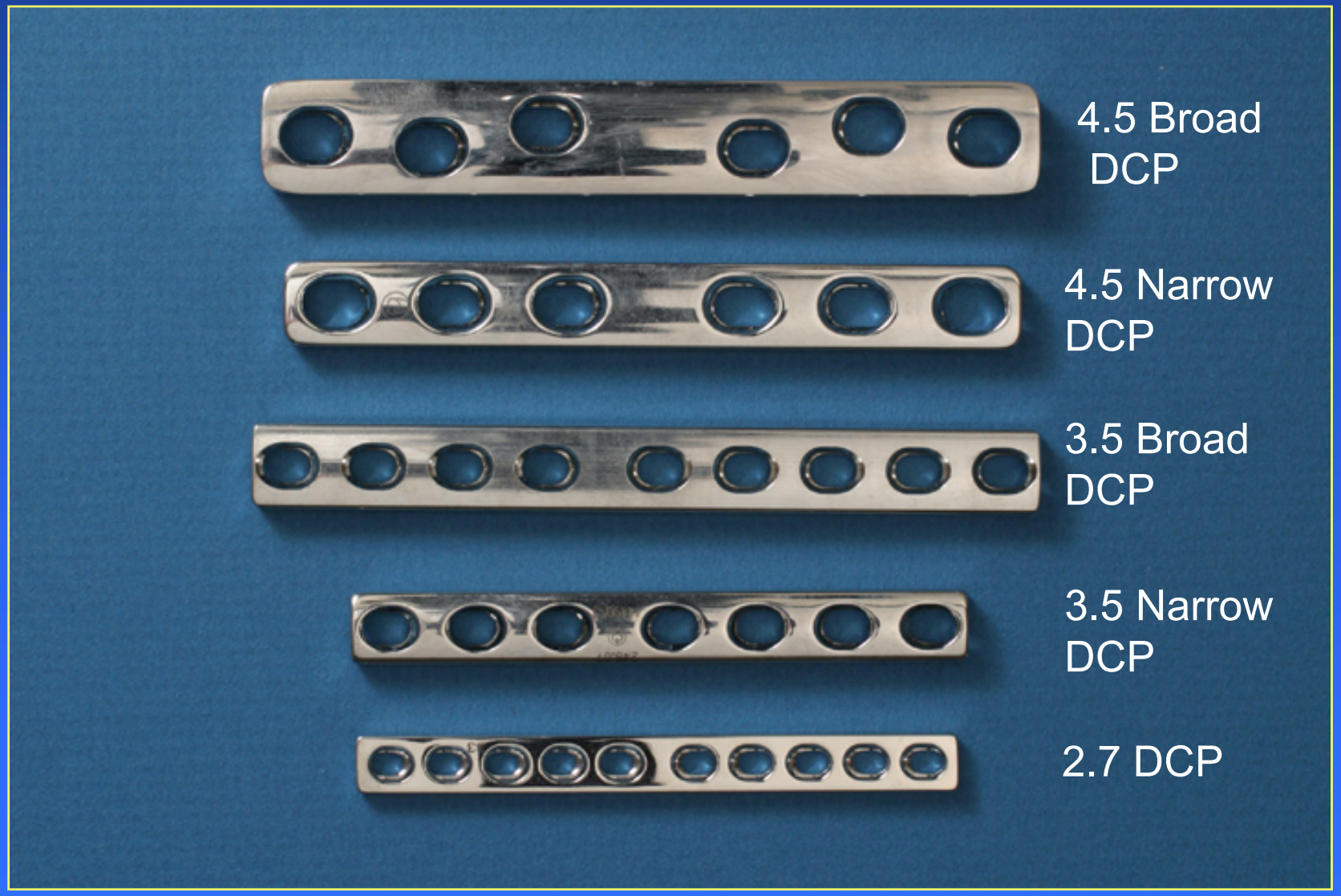
Post Op Evaluation







Bone Plates



DCP Hole Geometry

- Incline plane toward the plate center
- Allows 25^{o} screw inclination longitudinally
- Allows 7^{o} screw inclination transversely

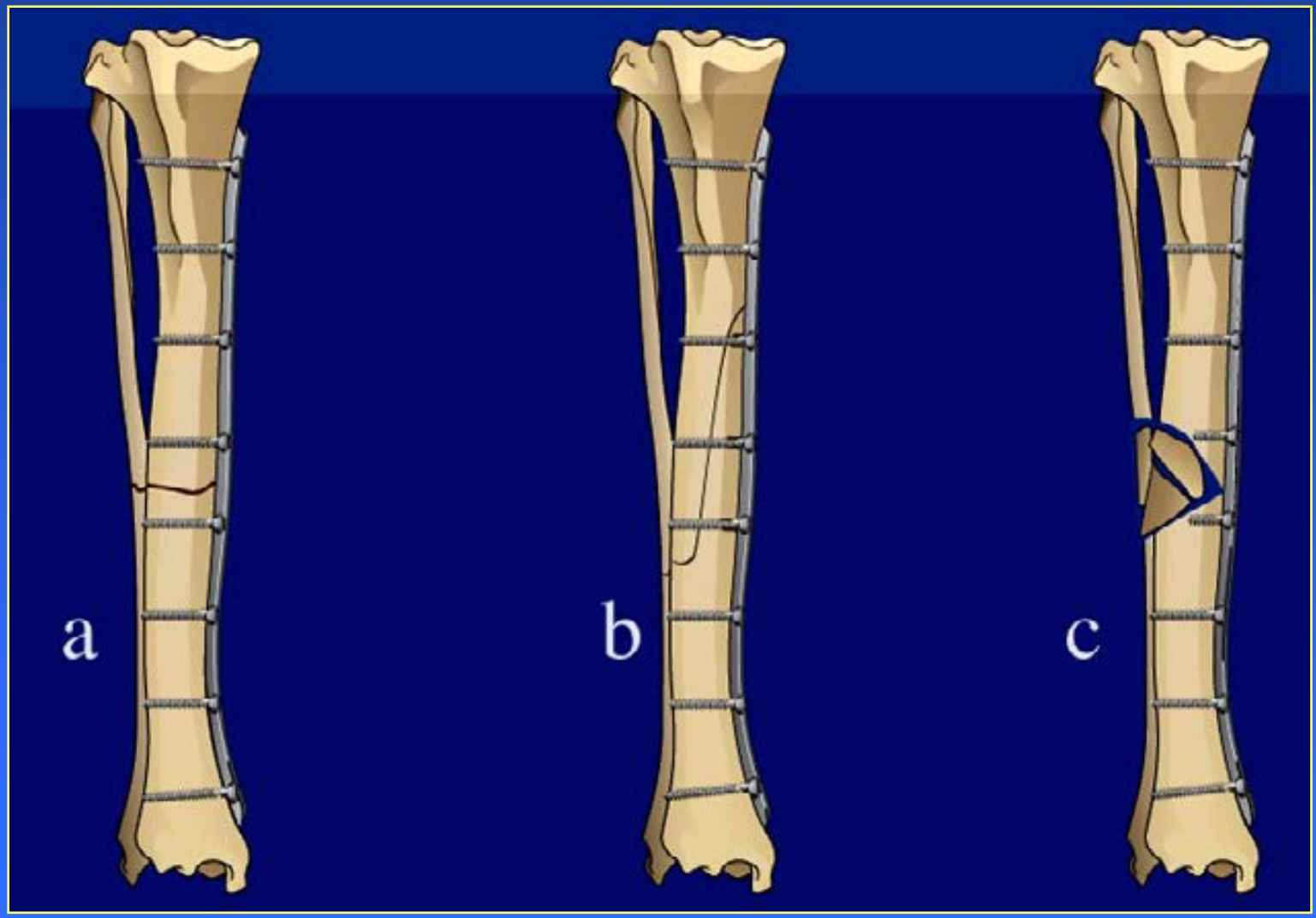
Limited Contact Dynamic Compression Plate (LCDCP)

- Biological plate design
- Undercut surface limits plate bone contact
- Increases blood supply to plated bone
- Allows callus formation at fracture site

Locking Compression Plate

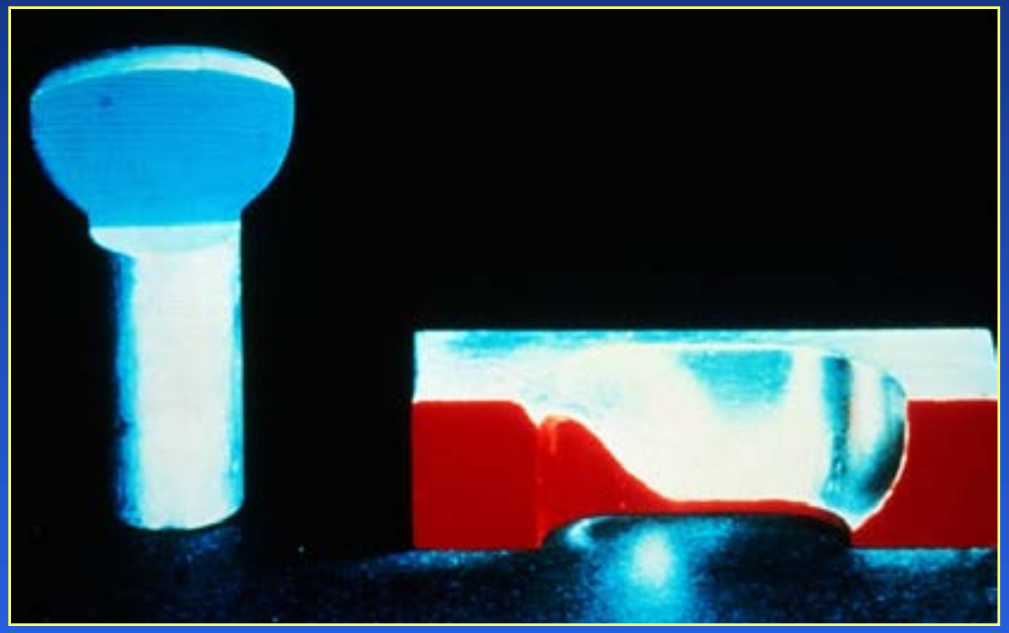
- Combihole allows locking and plate screws
- Increased construct yield strength of the plate, locking screw, and bone connection

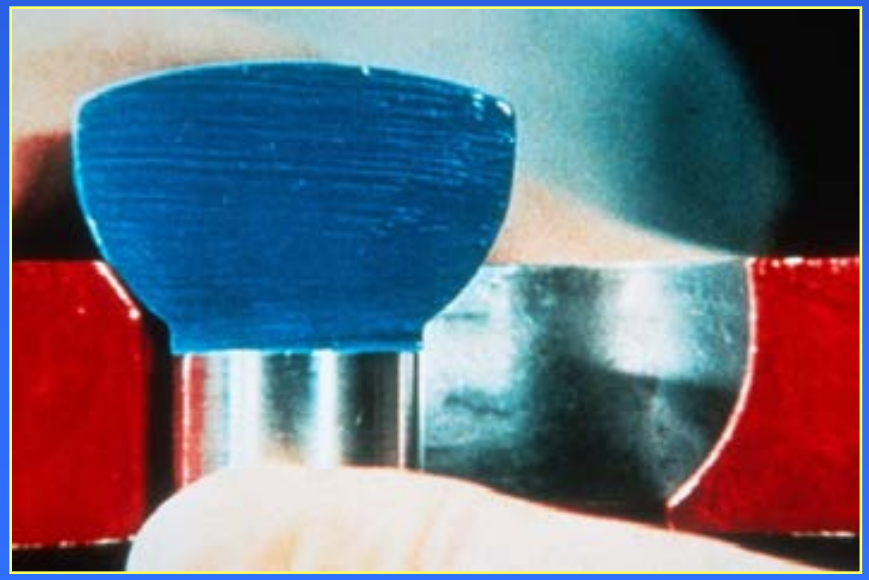
Plate Function

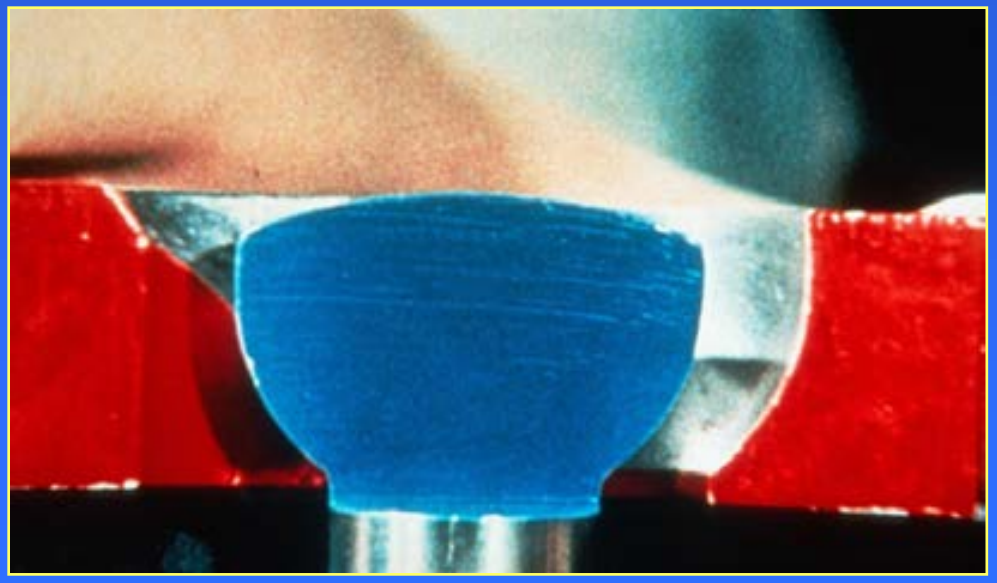


Compression Neutralization Bridging

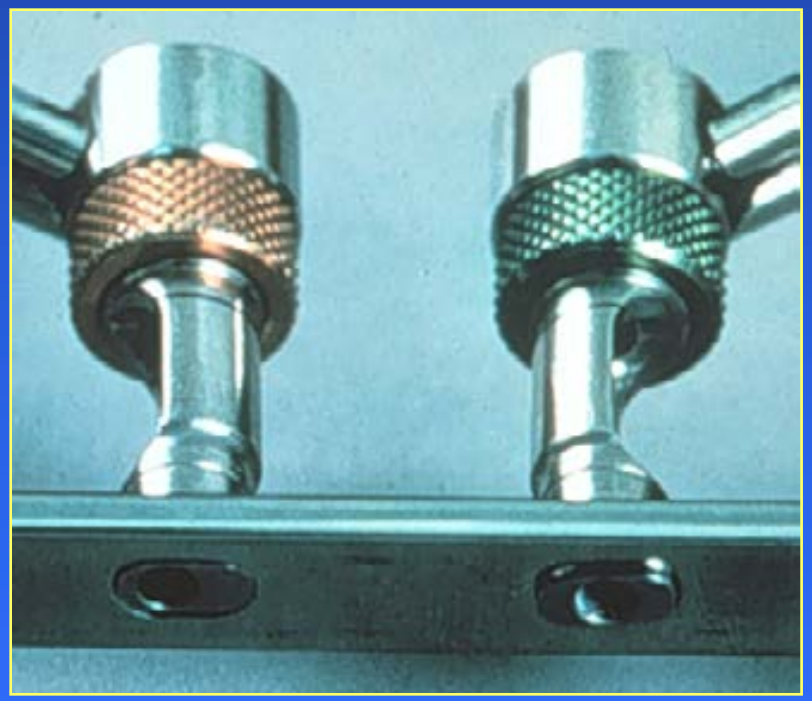
Incline Plane Function for Compression







Drill guide dictates screw location and bone movement



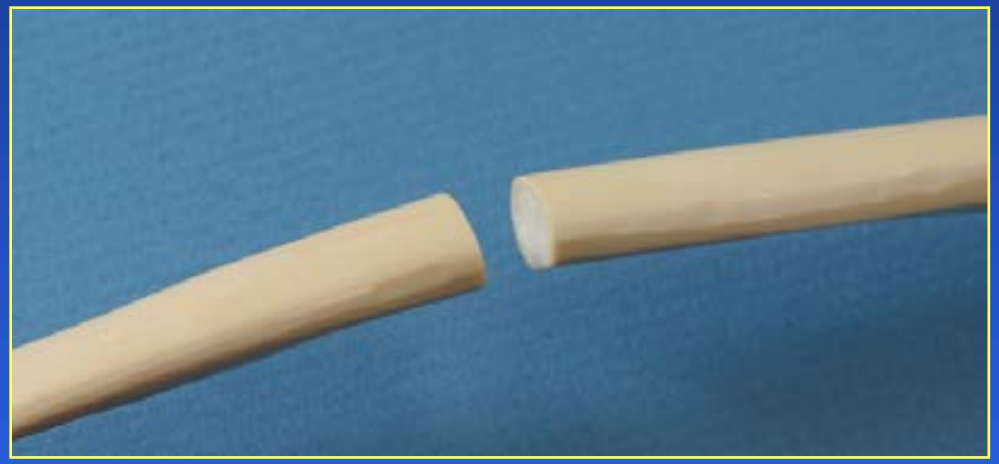
- Gold or load guide offsets screw initially 1.0 mm from the neutral position for the 3.5 and 4.5 plates and 0.8 mm for the 2.7 plate
- Green or neutral guide offsets screw 0.1 mm

Indications for Compression Plate

- Transverse diaphyseal fracture
- Short oblique (<45°) diaphyseal fracture
- Hypertrophic nonunion

Compression Plate Application

- Reduce the fracture



- Use the aluminum template to approximate the contour of the bone

Compression Plate Application

- The contour of the plate directly affects the end result of fracture reduction

Pre-stressing for Compression

- Contour the plate to match the bone, then increase the contour to lift the plate off the bone by 2 mm

Compression Plate Application

- Use the appropriate drill bit for the screw
- Use the double drill sleeve as a guide
- Drill a hole approximately ¼ to ½ centimeter from the fracture

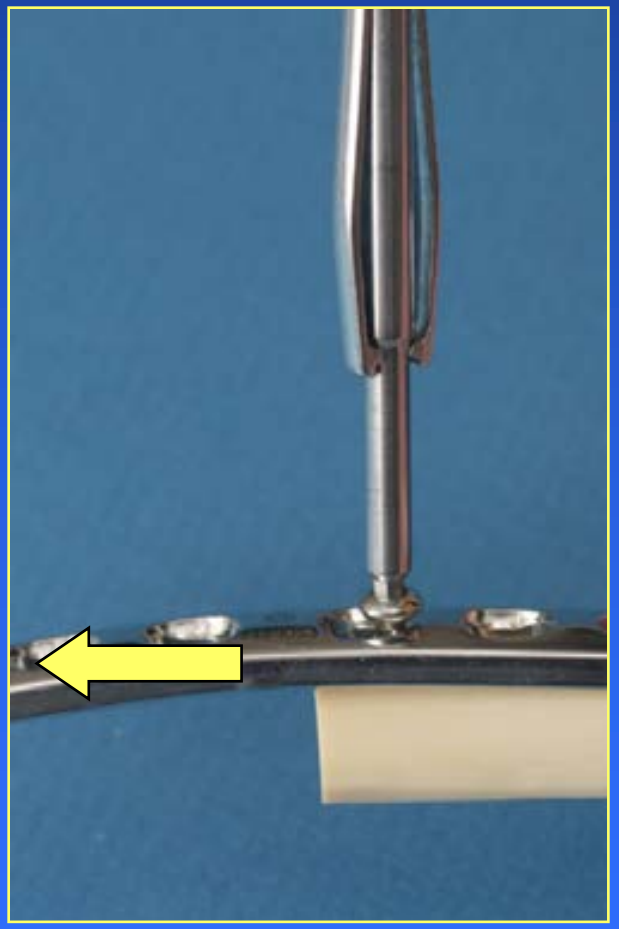
Compression Plate Application

- Measure the hole
- Add 2 mm to the measured length to allow for the plate width
- Select the screw and confirm the length

Compression Plate Application

- Tap the hole
- Use the double drill sleeve as a guide to steady the tap and to protect soft tissues
- The tap cuts the threads for the screw
- Be sure to tap both cortices

Compression Plate Application



Slide the plate toward the fracture and partially tighten the screw

Compression Plate Application

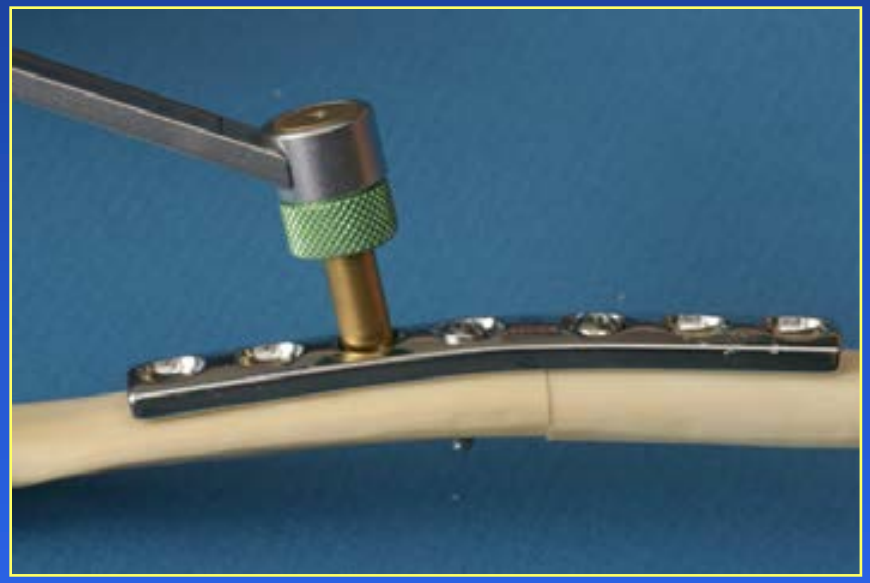
- Reduce the fracture and secure the plate
- Use the gold or offset drill guide to drill the hole

Compression Plate Application

- Tighten both screws to compress the fracture line

Compression Plate Application

- Fill the remaining screw holes using the neutral or green drill guide
- Additional compression may be gained by loading one more screw on either side of the fracture

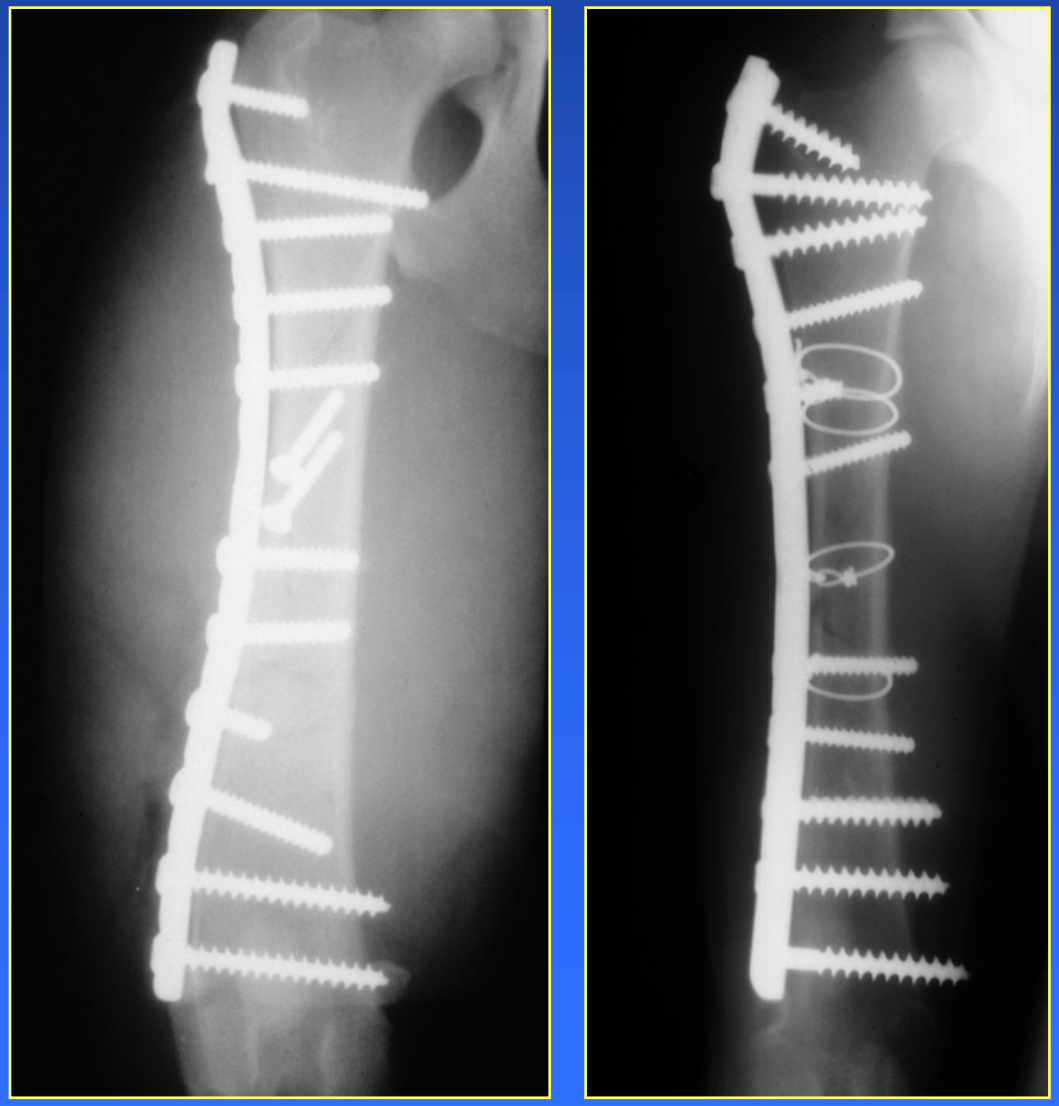


Post Operative Evaluation

- Alignment
- Apposition
- Appliance
- Activity

Indications for Neutralization Plate

- Long oblique fracture(s) stabilized with lag screws or wire
- Anatomic reconstruction of cortex
- Plate neutralizes forces crossing fracture



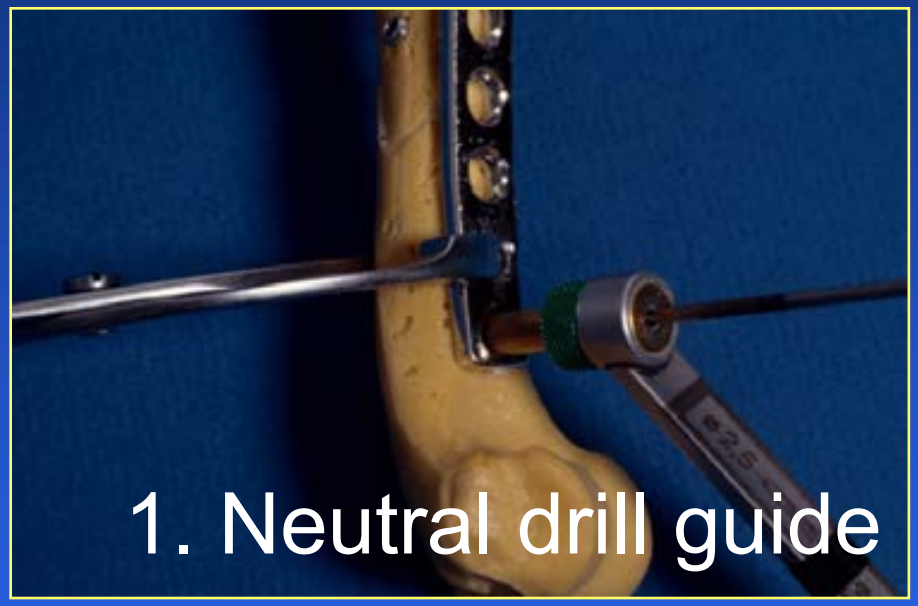
Neutralization Plates

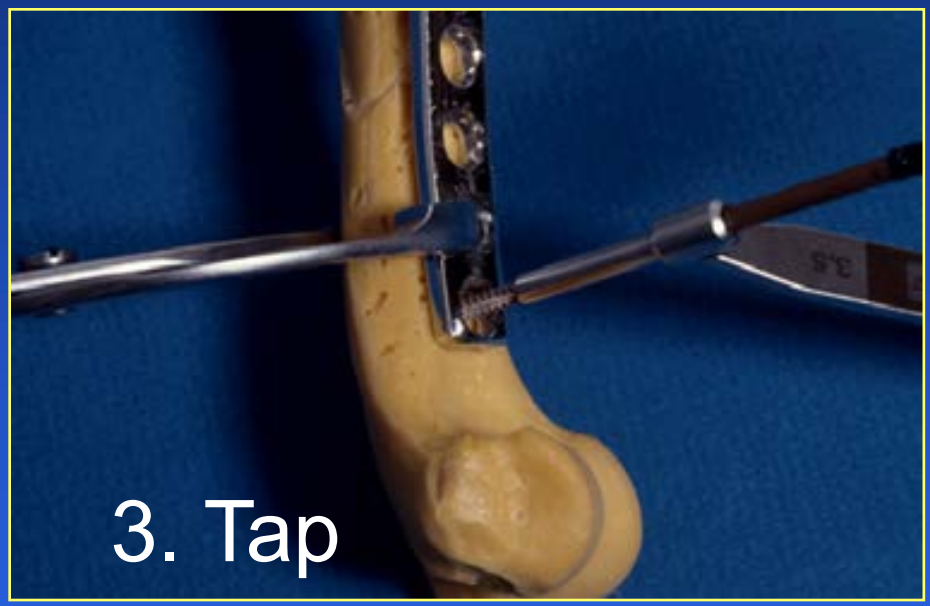
- Span the bone
- 6 cortices on either side of the fracture line(s)
- Neutral drill guide
- Insert screws starting at the ends of the plate

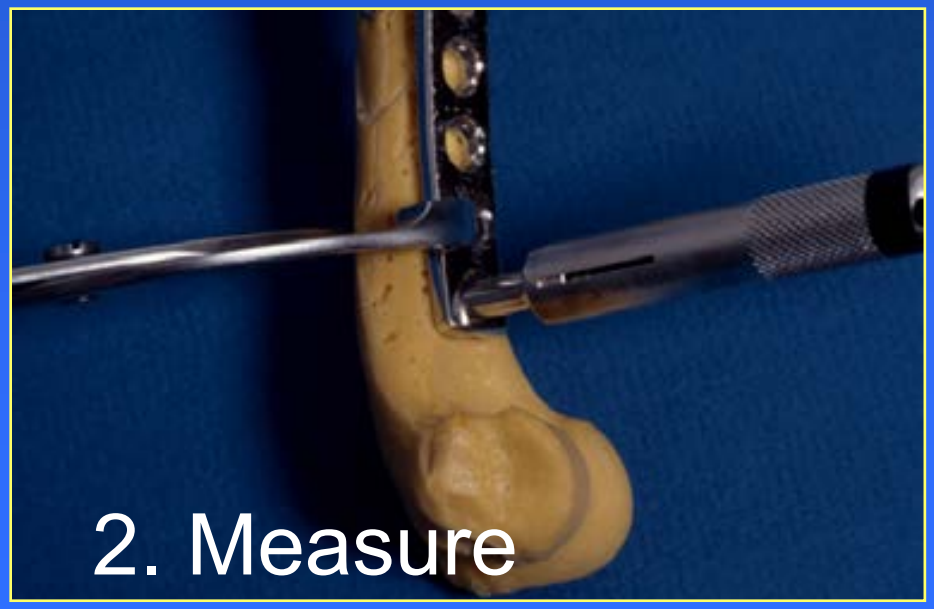
Application of a Neutralization Plate

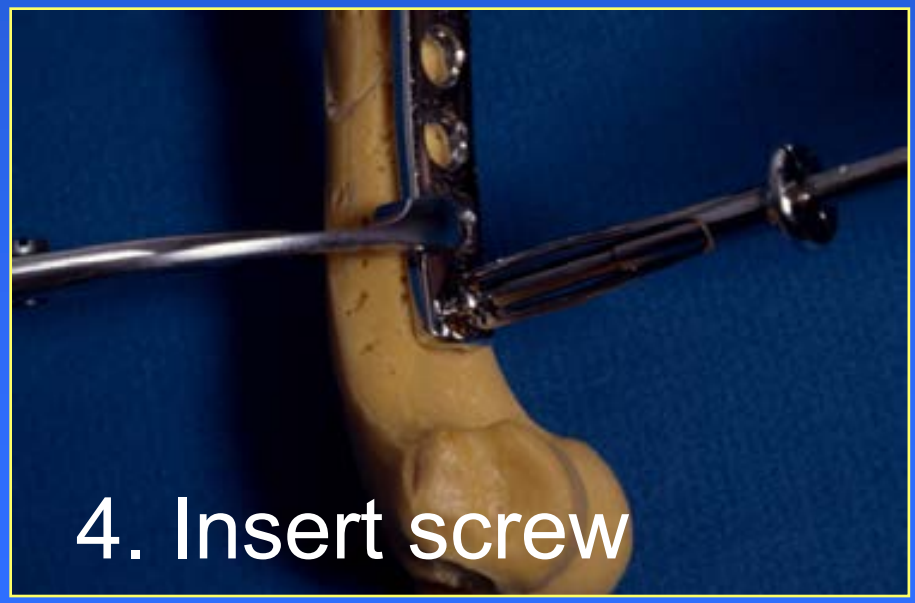
Reduce the fracture and stabilize with lag screws

Application of a Neutralization Plate

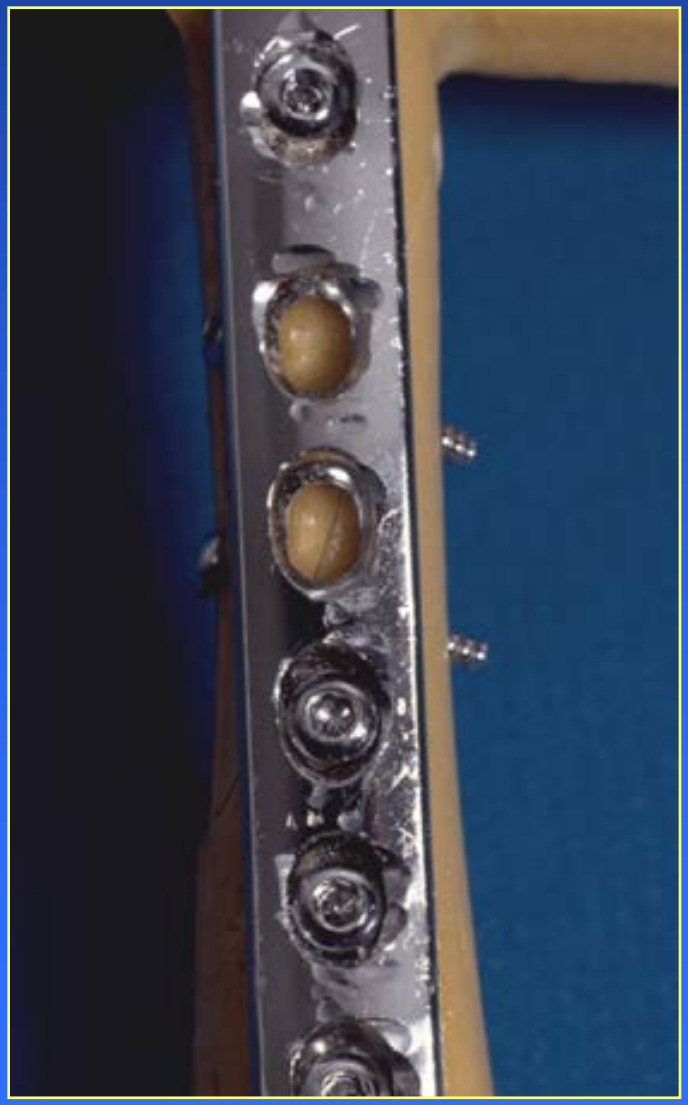

1. Neutral drill guide


3. Tap


2. Measure

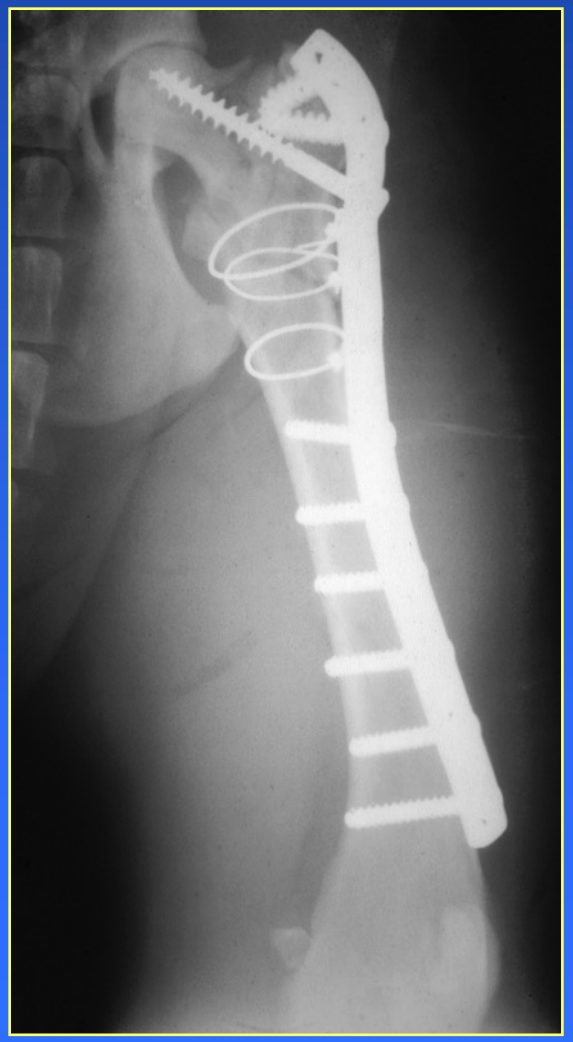

4. Insert screw

Post-operative Evaluation



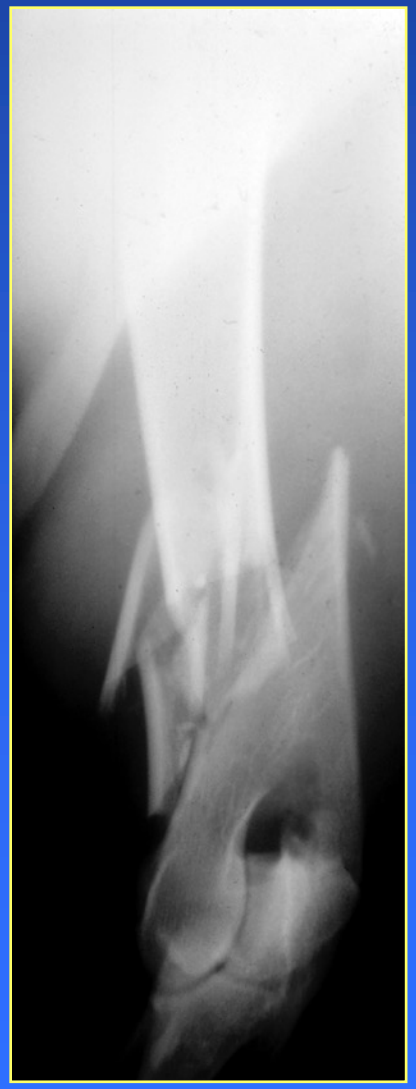
Indications for Bridging/Buttress Plate

- Bridging a nonreducible comminuted fracture
- Buttressing an epiphyseal fracture
- Plate takes the load of weight bearing



Bridging Plates

- Longer and stronger plate
- 8 cortices on either side of fracture
- Combine with IM pin to increase strength and fatigue life
- Contour plate to match normal bone



Application of a Bridging Plate

Contour plate

Distract to length


1. Neutral drill guide


3. Tap


2. Measure


4. Insert screw

Post-operative Evaluation

Functional Period and PO care for Plates and Screws

- Long functional periods for implants
- Technical errors lead to cyclical failure
- Excellent return to function
- Exercise restrictions with minimal care
- Implant removal if causing problems