Supracondylar Femur Fractures: Overview & Updates

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Dignity Health Medical Group

Creighton University Health Sciences Phoenix

Mechanism

Low Energy

Fall or Twist

High Energy

Axial Load

Open Anteriorly Through Quads

High Risk Hoffa Fracture

Increasing Numbers of **Periprosthetic Femur**

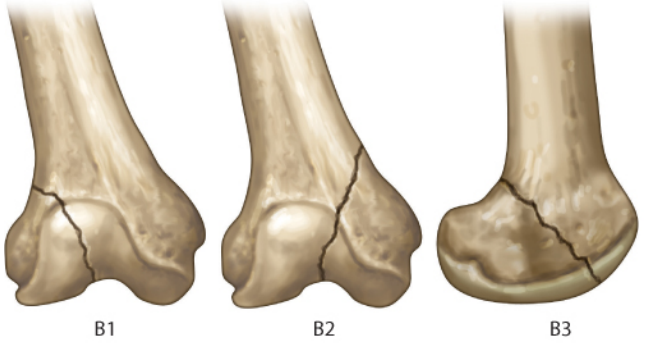
Four points to Keep

1. Understand distal femoral geometry
2. Reduce joint first
3. Correct axial alignment
4. Fixation must resist varus collapse AND permit early motion

AO/OTA Classification

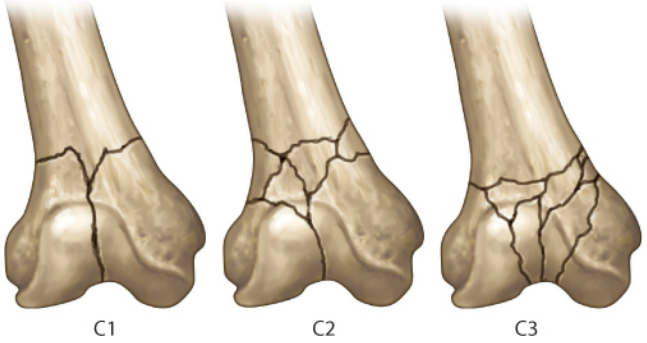
Extra Articular

Uni Condylar



Hoffa Fracture

Bicondylar



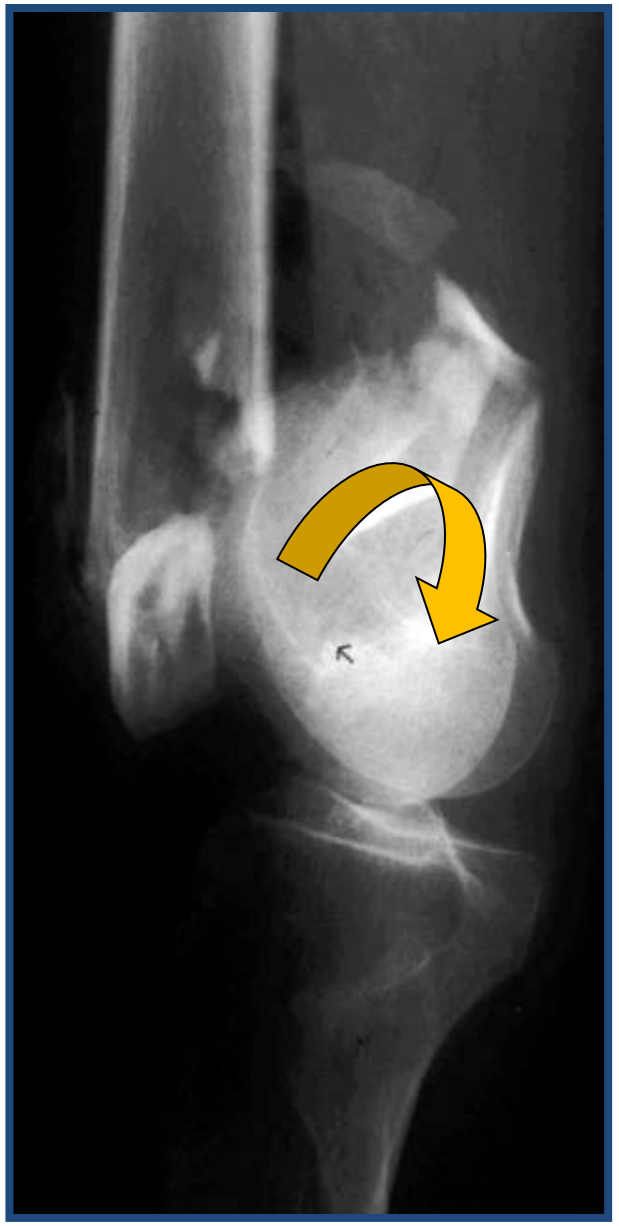
What deformity will the fracture present with?

Deforming Forces

Quadriceps → Shortening

Adductors → Varus

Gastrocnemius→ Hyperextension



Surgical Goals

- Obtain/Secure Articular Reduction
  - Reduce Condylar Width
  - Restore Axial Alignment
  - Restore Coronal Rotation
  - Neutralize Meta-Diaphysis
- Secure Short Segment Fixation
  - Early ROM

- Appropriate Soft Tissue Handling

Surgical Goals

Obtain/Secure Articular Reduction → Direct Visualization

Reduce Condylar Width
Restore Axial Alignment
Restore Coronal Rotation → Radiographically

Neutralize Meta-Diaphysis → Lateral or Medial Antiglide
Lateral Fixed-Angle Plate
Medial/Lateral Plates
IMN

Secure Short Segment Fixation

Early ROM

Appropriate Soft Tissue Handling

Problems with SC Femur ORIF

Fixation

- Short Distal Segment, metaphyseal fragmentation (A3, C3)
- Frontal Plane Fx / Multiplane Fx (C3)
  - Inability to utilize traditional fixed angle devices
- Osteoporosis

Surgical Exposure/Blood Loss

Scarring/Stiffness

Supracondylar Femur Fxs: Problems

Results

Loss of fixation

Varus collapse

Malunion / Nonunion

Problems with SC Femur ORIF

- ***Fixation***
  - –Short Distal Segment, metaphyseal fragmentation (A3, C3)
  - –Frontal Plane Fx / Multiplane Fx (C3)
    - •Inability to utilize traditional fixed angle devices
  - –Osteoporosis
- ***Surgical Exposure/Blood Loss***
- ***Scarring/Stiffness***

Supracondylar Femur Fxs: Problem

Results

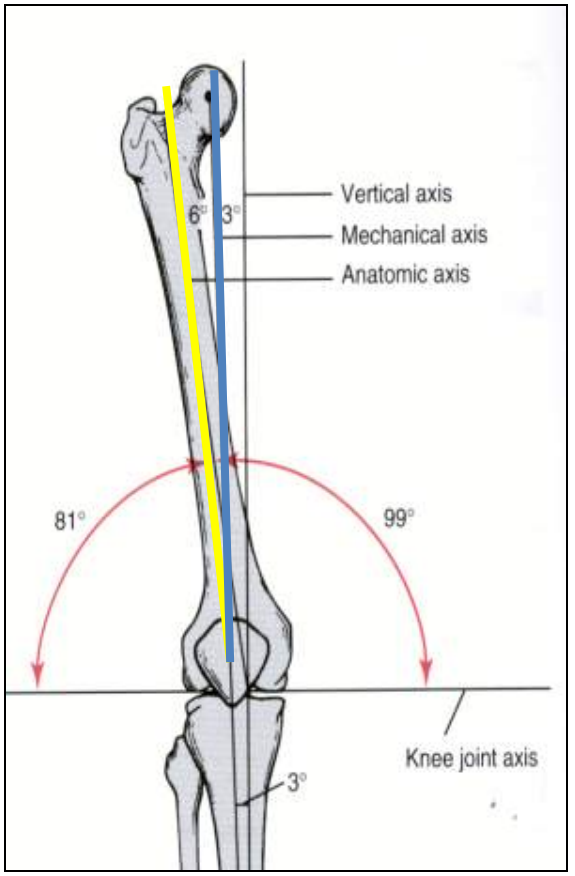
Loss of fixation

Varus collapse

Malunion / Nonunion

When Considering Fixation: What are your treatment goals?

1. Restore femoral axes
2. Restore articular congruity
3. Minimize soft tissue injury
4. Early knee motion
5. Fixation resists varus collapse

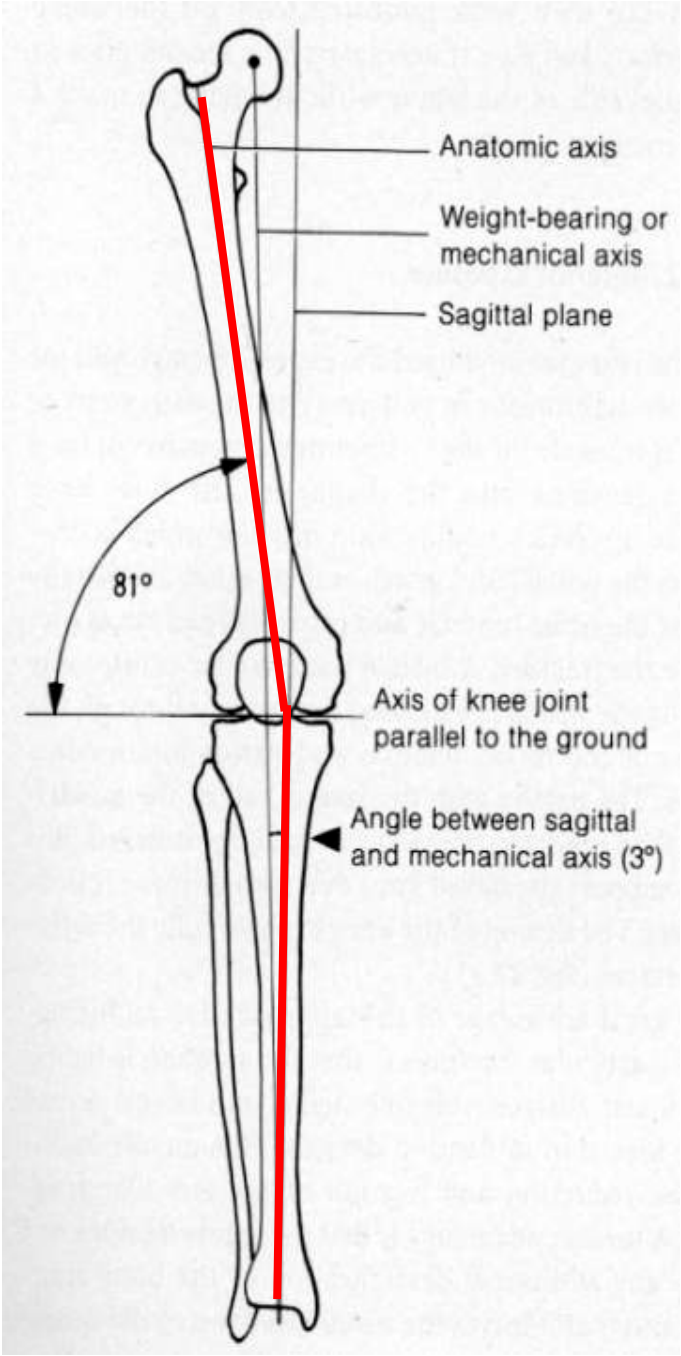


Distal Femoral Geometry

- Mechanical axis
- Center of hip, knee, ankle

- Knee joint axis

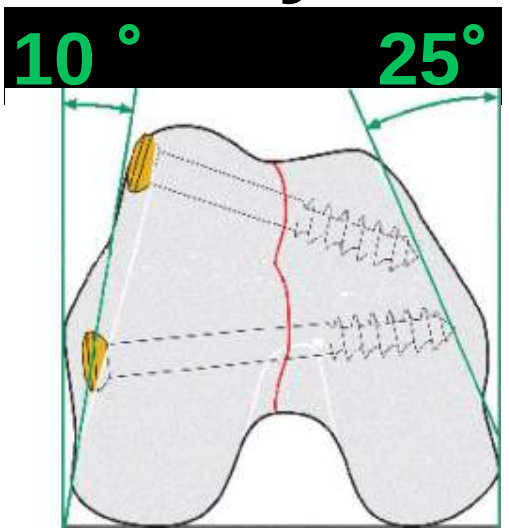
- Anatomic axis
- 7 - 9° valgus



Plain Radiographs
intra-op

Long Standing AP
in follow-up

Distal Femoral Geometry



- Trapezoidal shape
- Patellar sulcus
- Lateral cortex slopes 10º
- So…must “internally rotate” a lateral implant

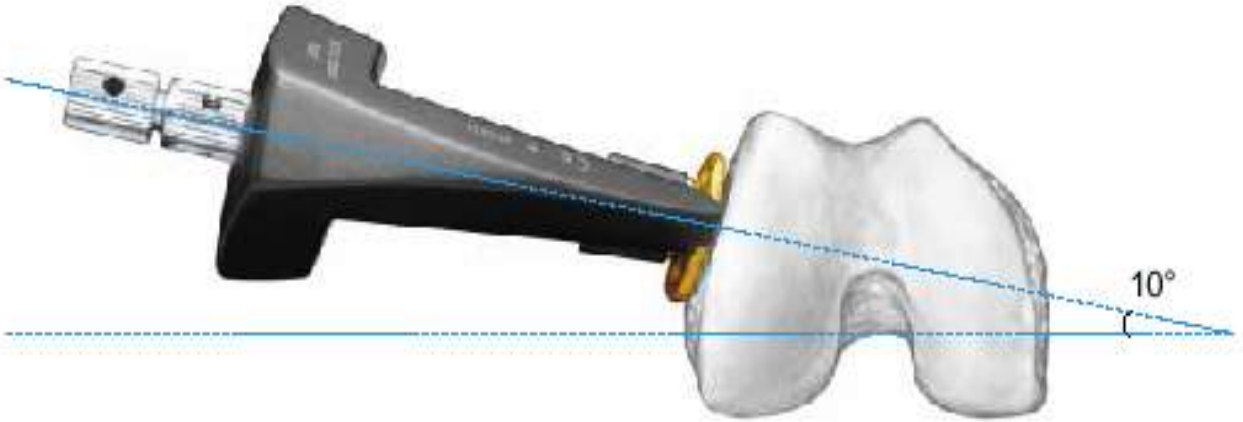
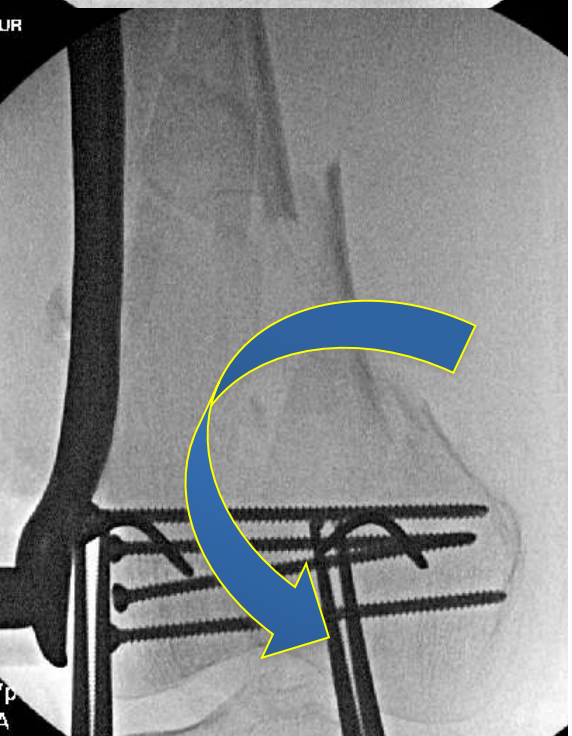
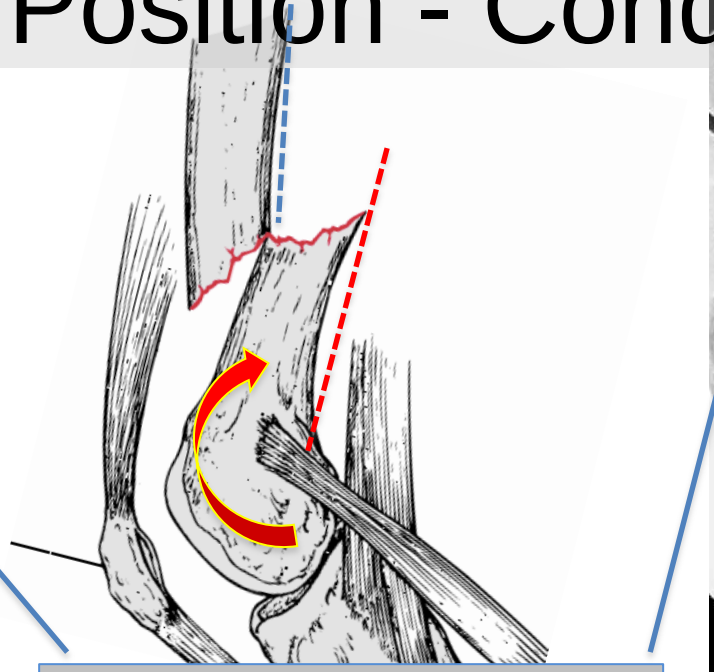
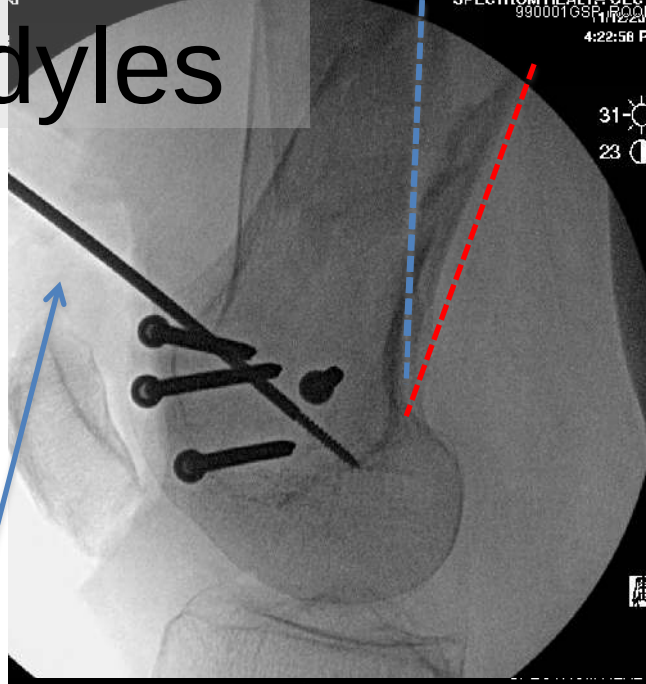
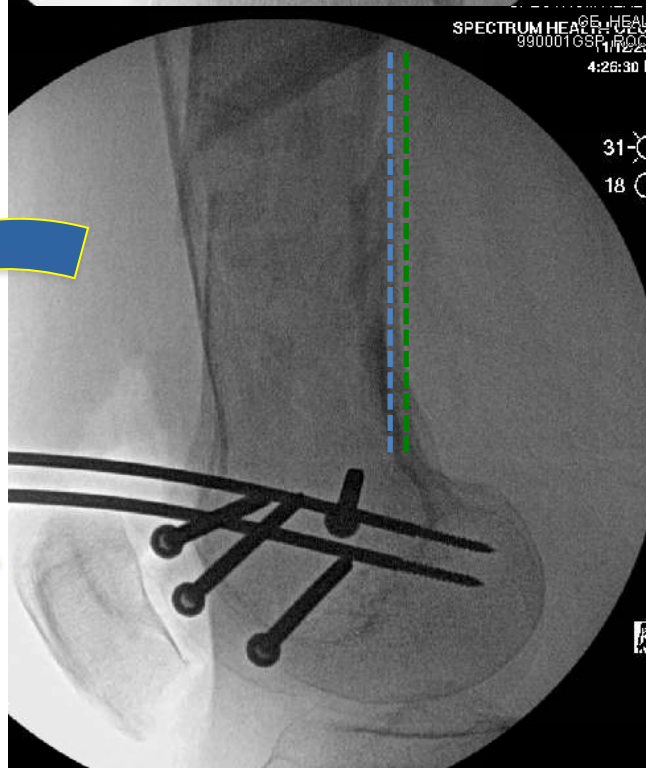


Plate Position - Condyles



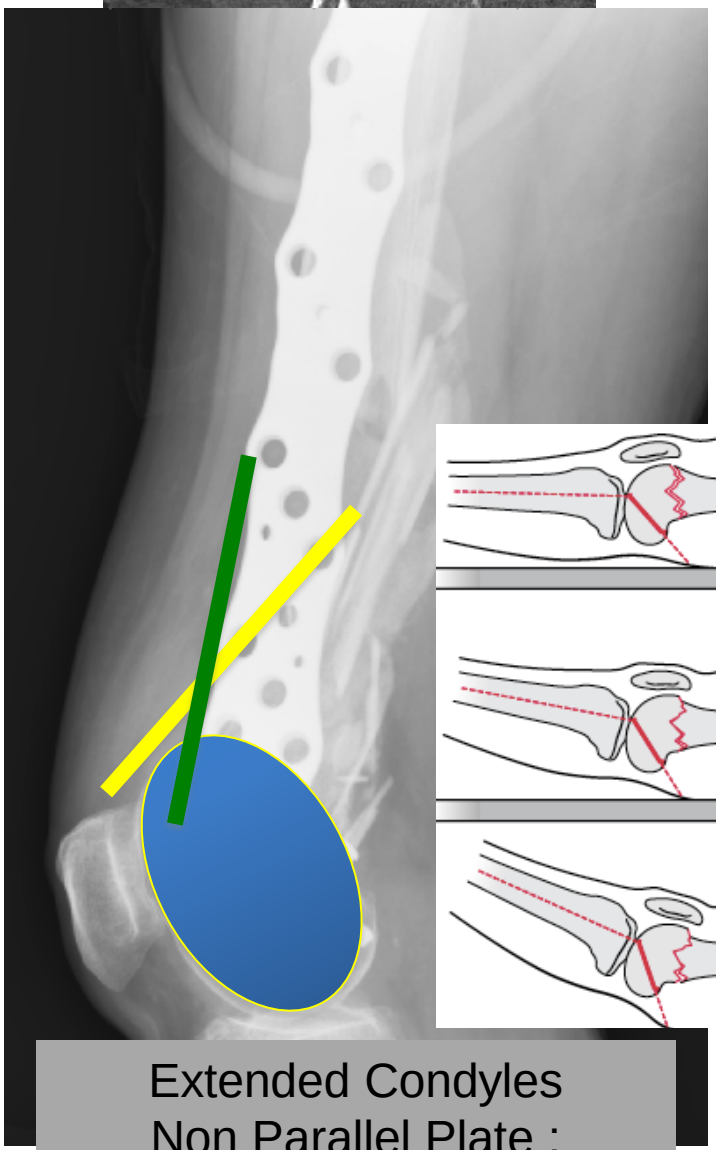


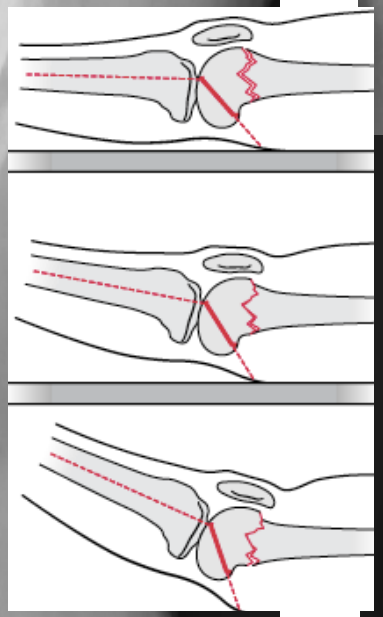




2.5 mm Condylar Schanz Pins

Plate Position - Condyles

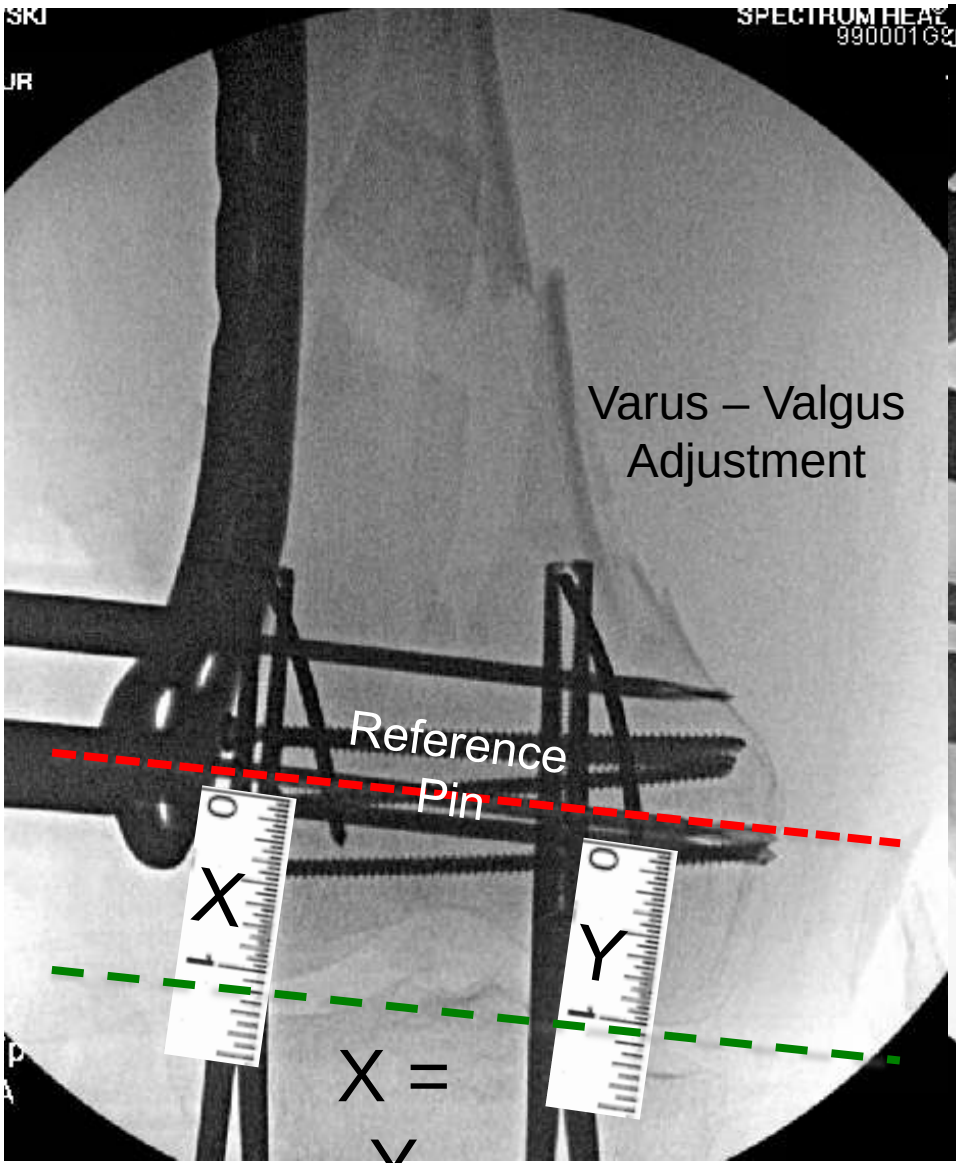




Notch View - AP

Extended Condyles
Non Parallel Plate :

Plate Position - Condyles



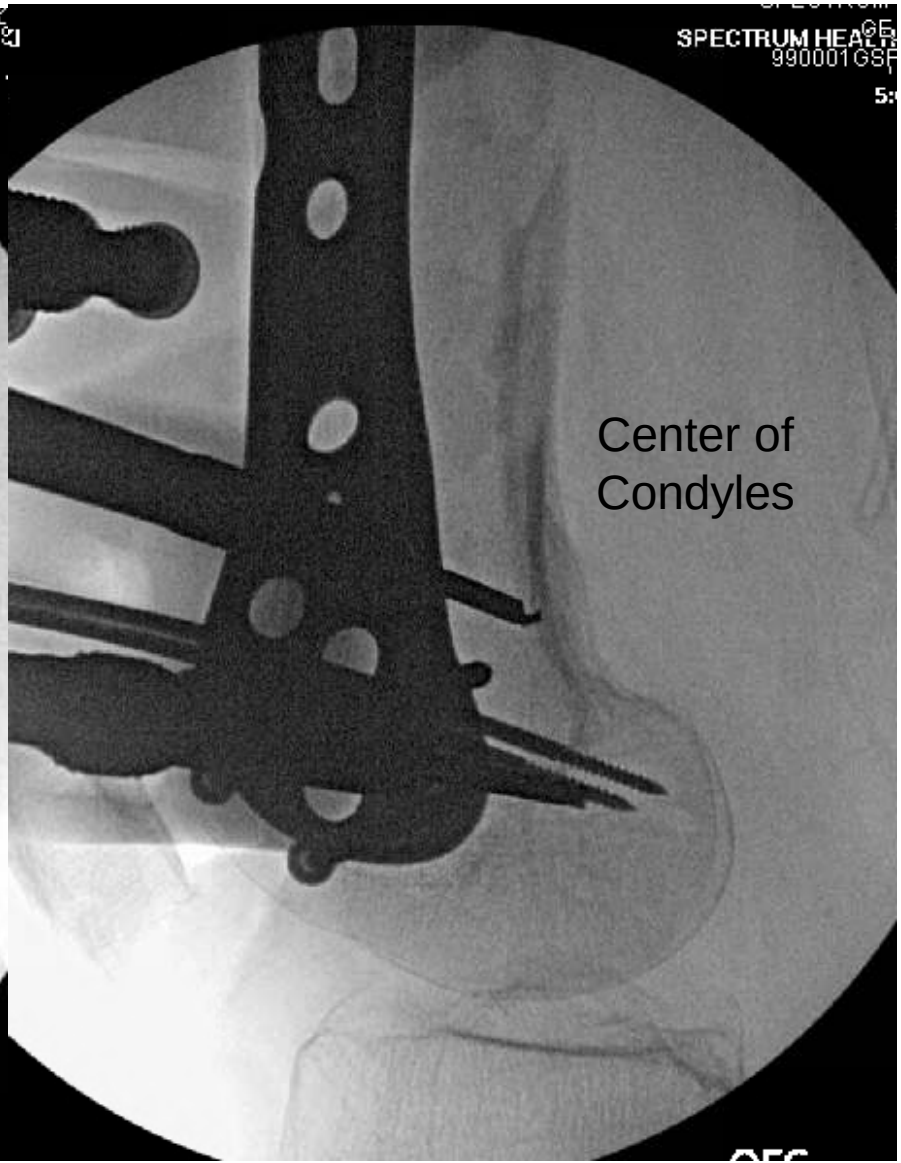
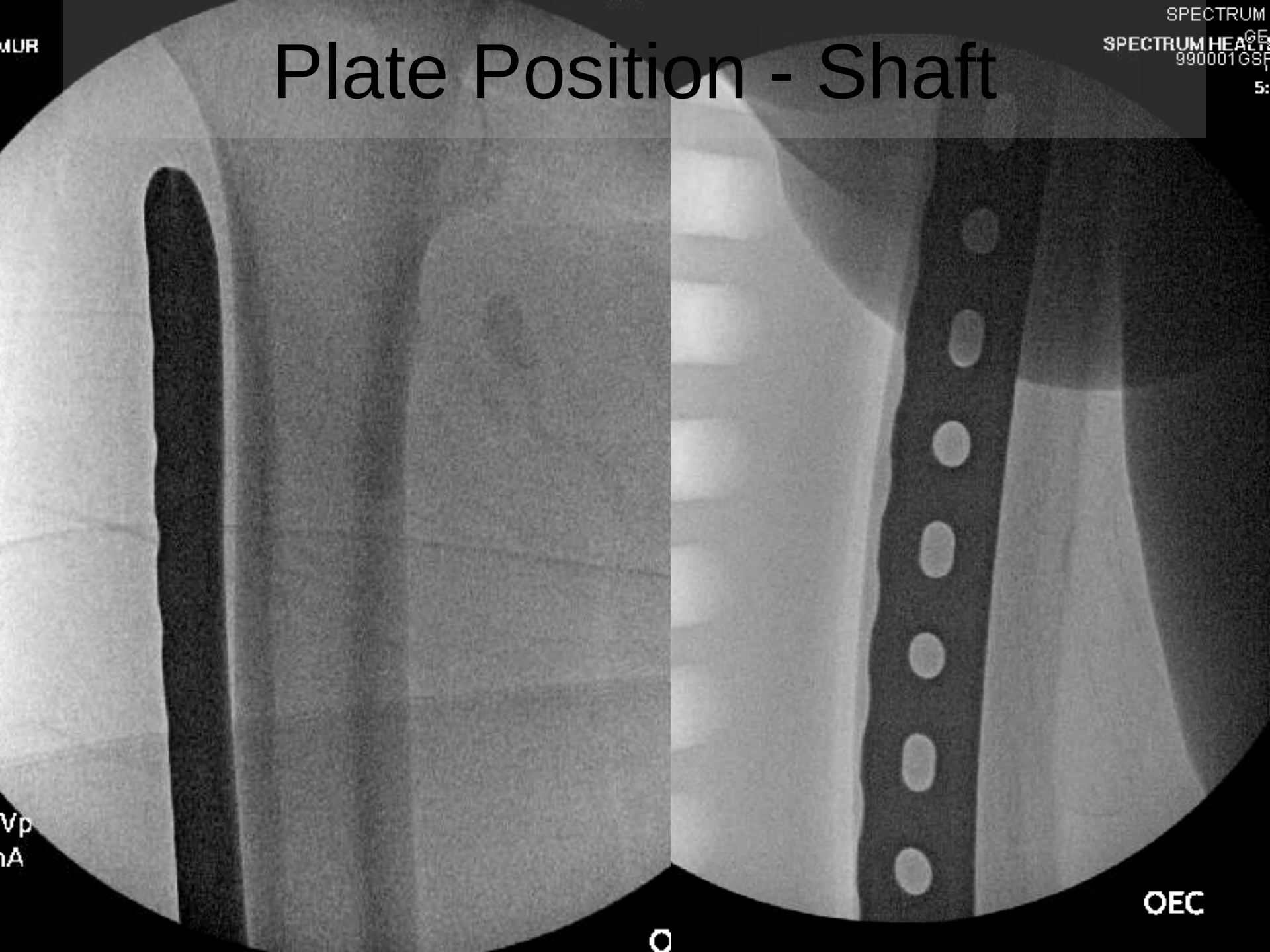
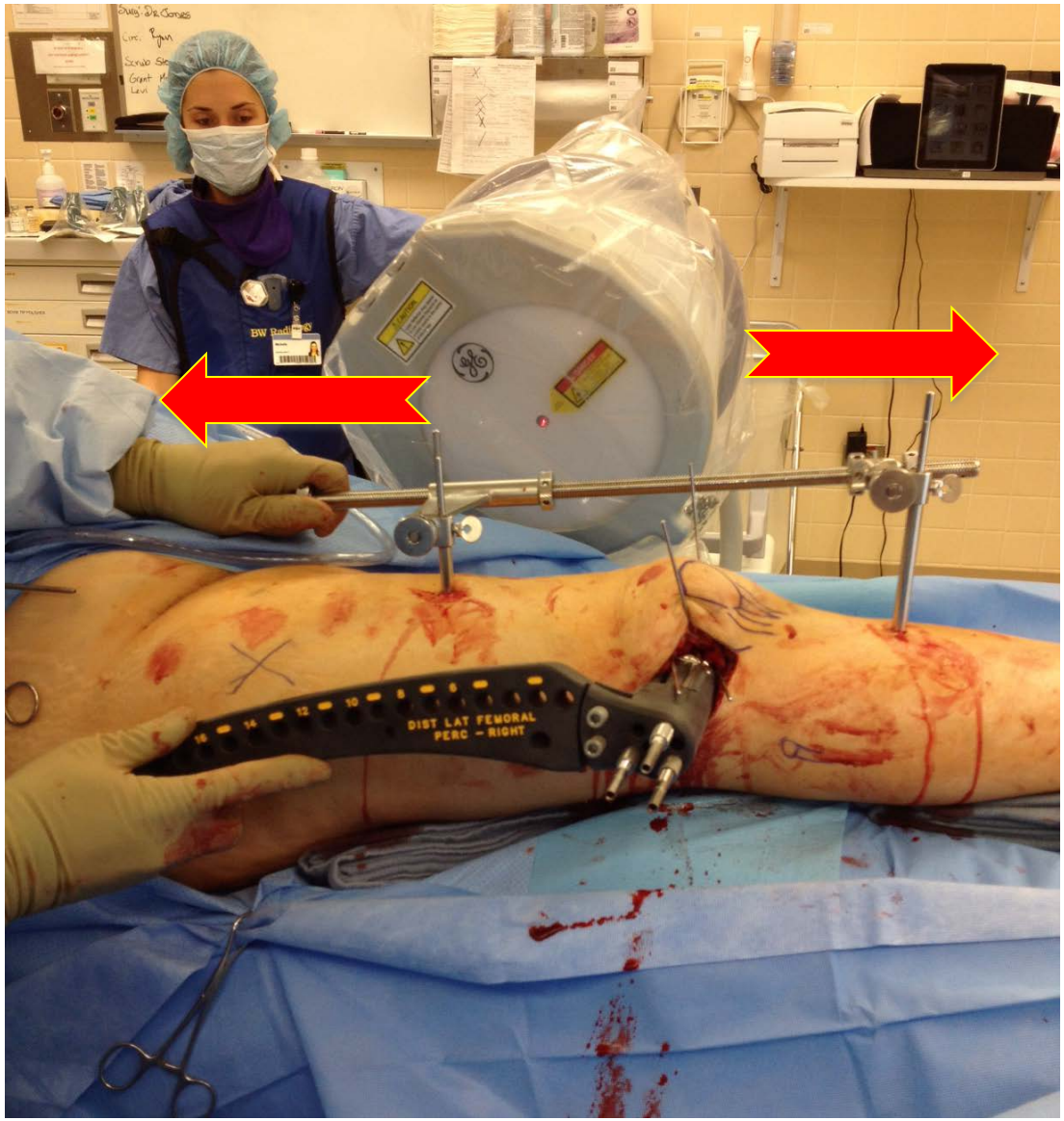
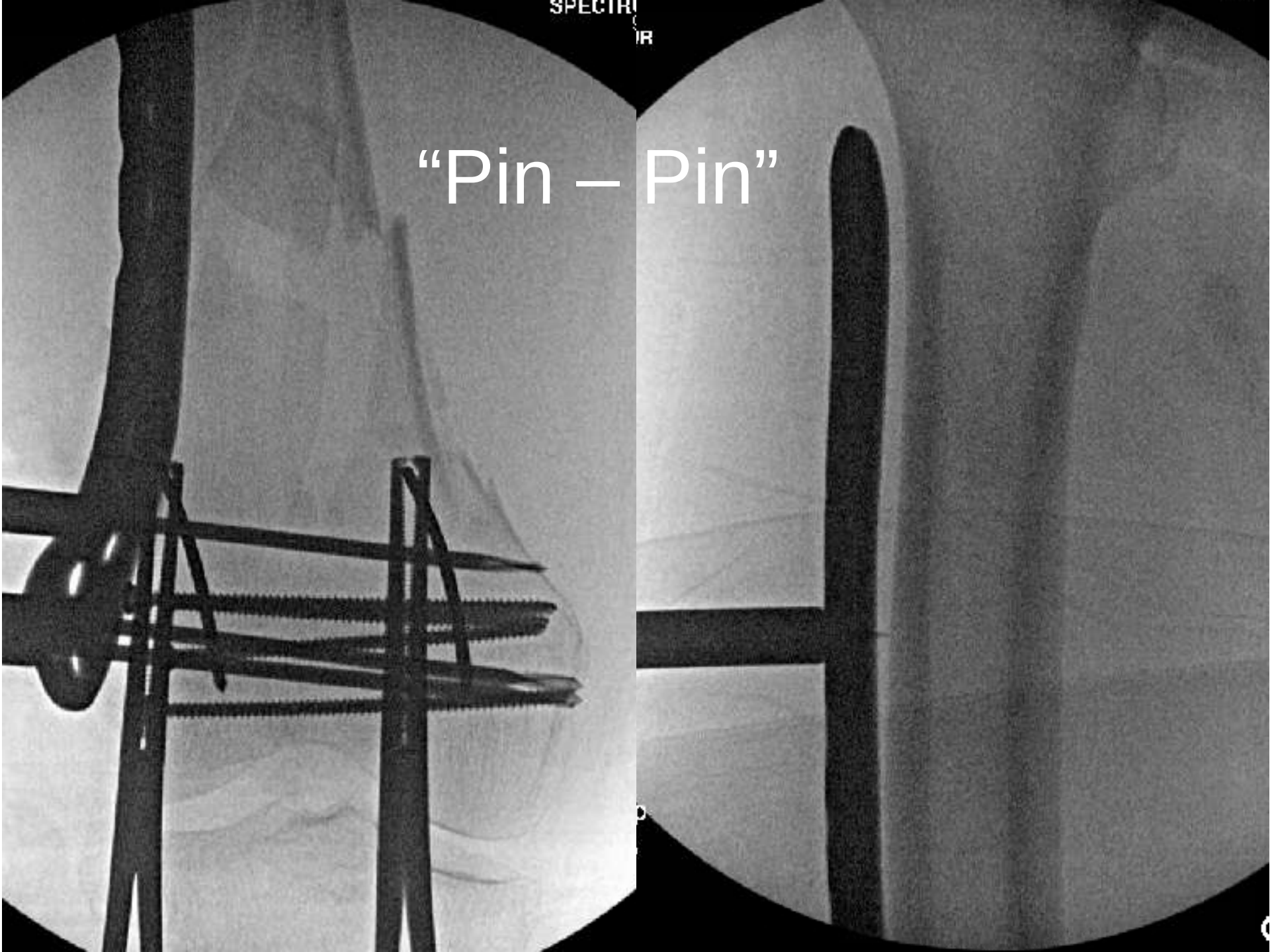


Plate Position - Shaft

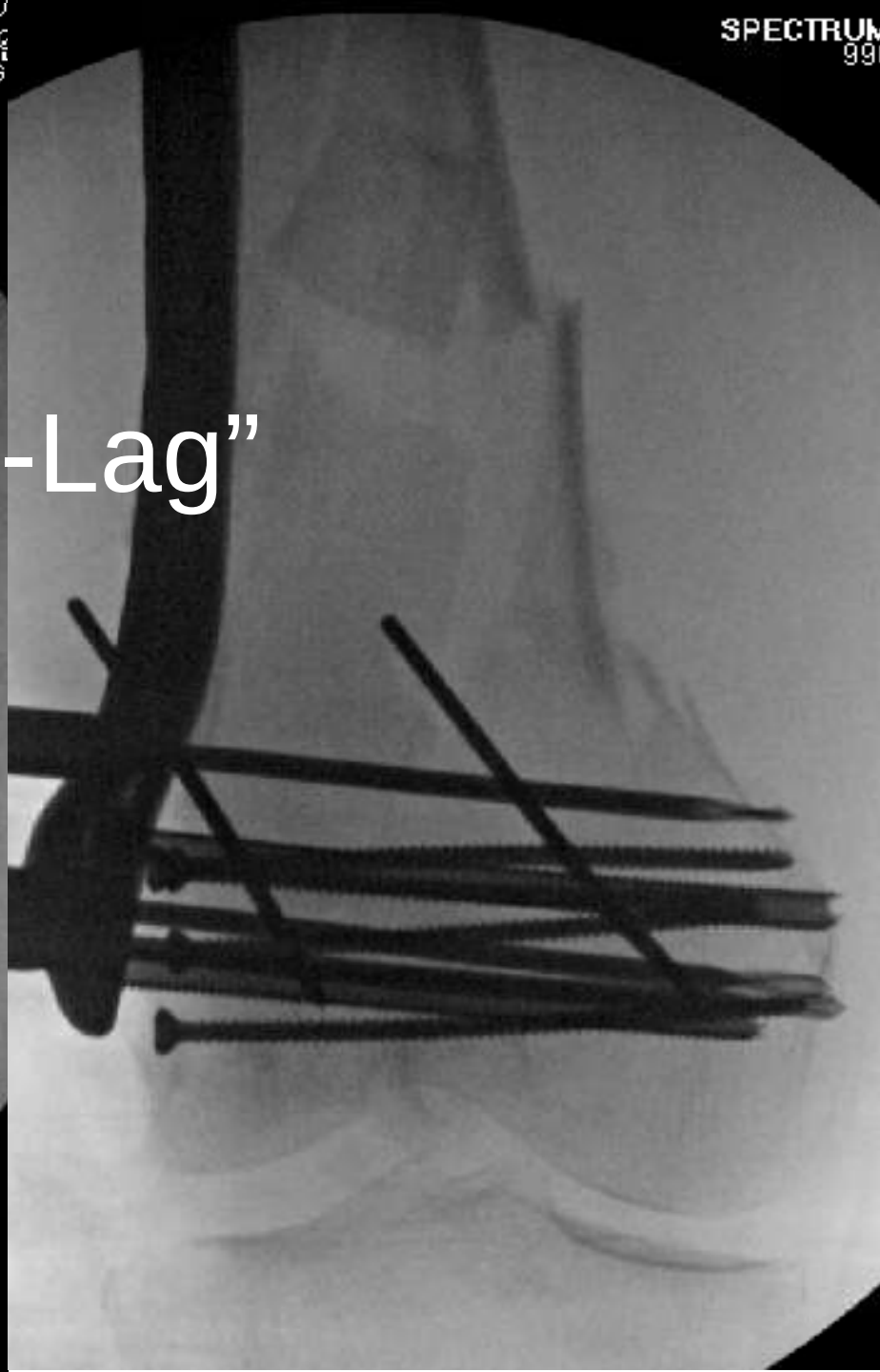


Obtain Length




“Pin – Pin”

“Lag-Lag”




“Lock-Lock”

Golf Club Deformity

- Medial Translation of Femoral Condyles
- Axial and Translational Problem
- Etiology
  - Plate Too Posterior on Condyles
  - Condyles Fixed Too Short

Axial and Rotational Malreduction (Golf Club Deformity) in Distal Femur Fractures

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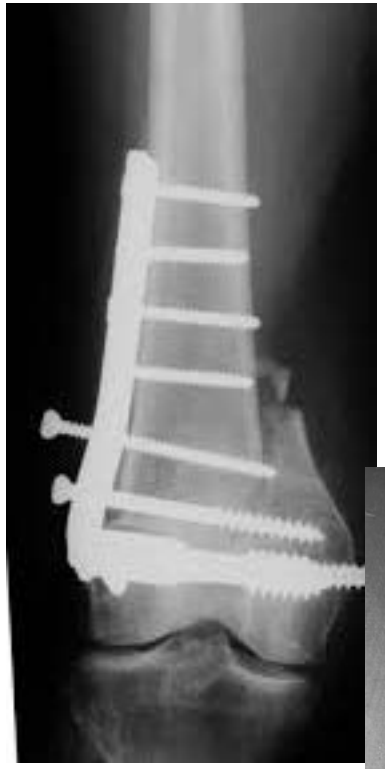
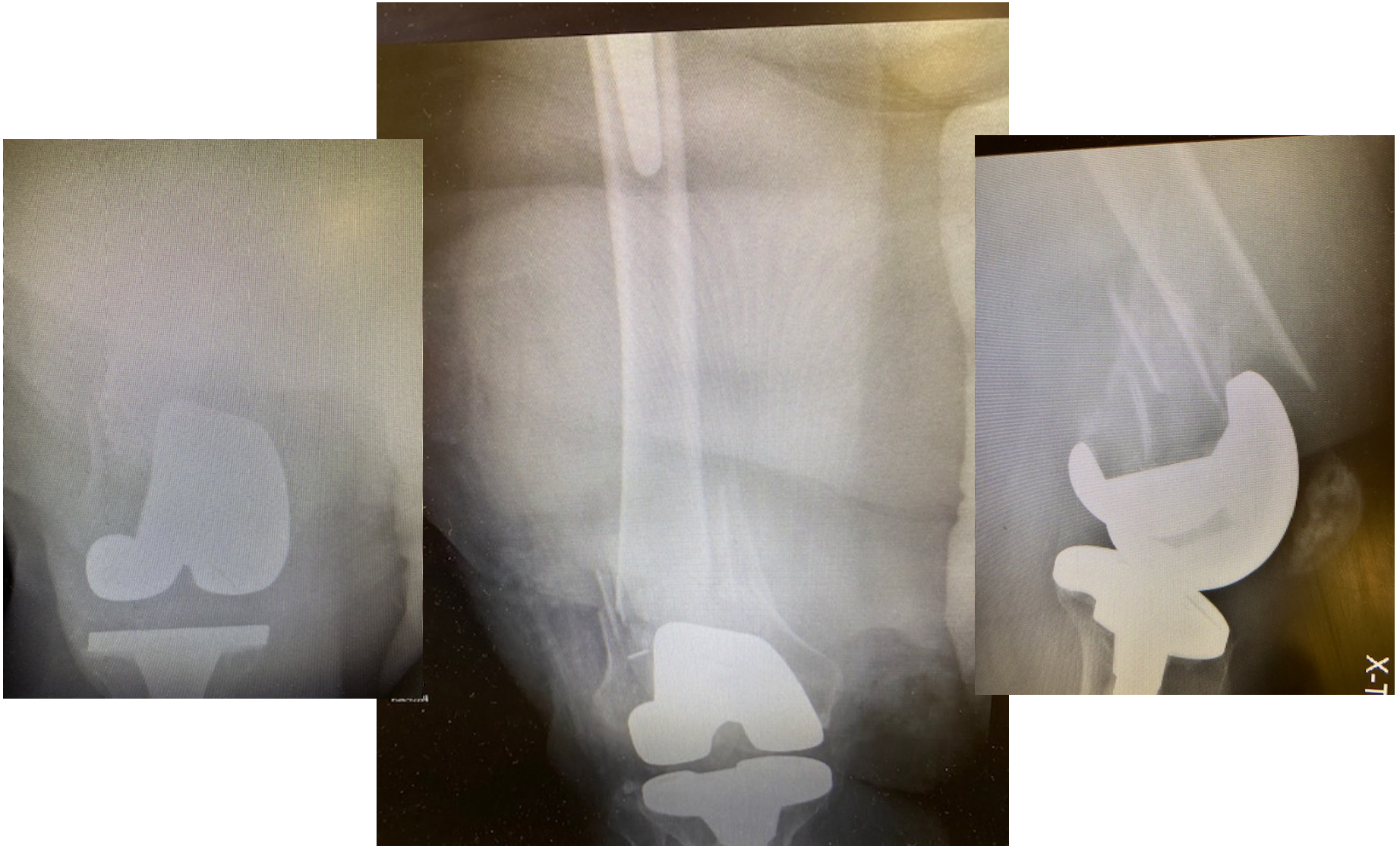
[2]*University of Miami, Miami, Florida, USA;*
[3]*Max Biedermann Institute for Biomechanics, Miami Beach, Florida, USA*

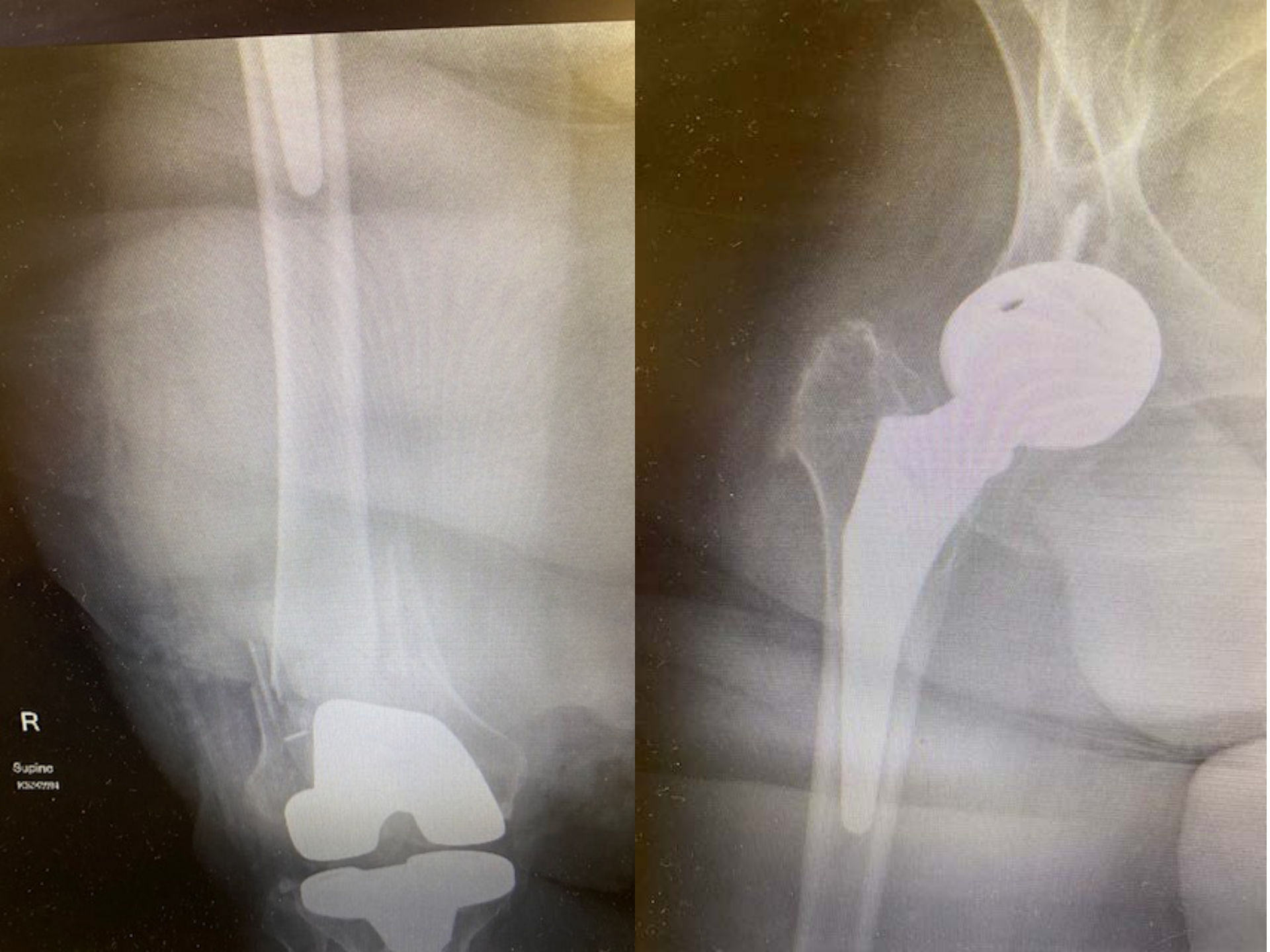
Conclusion: Data presented here demonstrate significant medial translation (17 mm) and external rotation (12.2°) despite appropriate plate placement, as described in the literature. Placing the plate in 10° of external rotation was noted to largely, but not completely, correct the malalignment. Future studies will investigate other means of correcting the malalignment, especially considering the 16.5° posterior anterior inclination of the condyle.

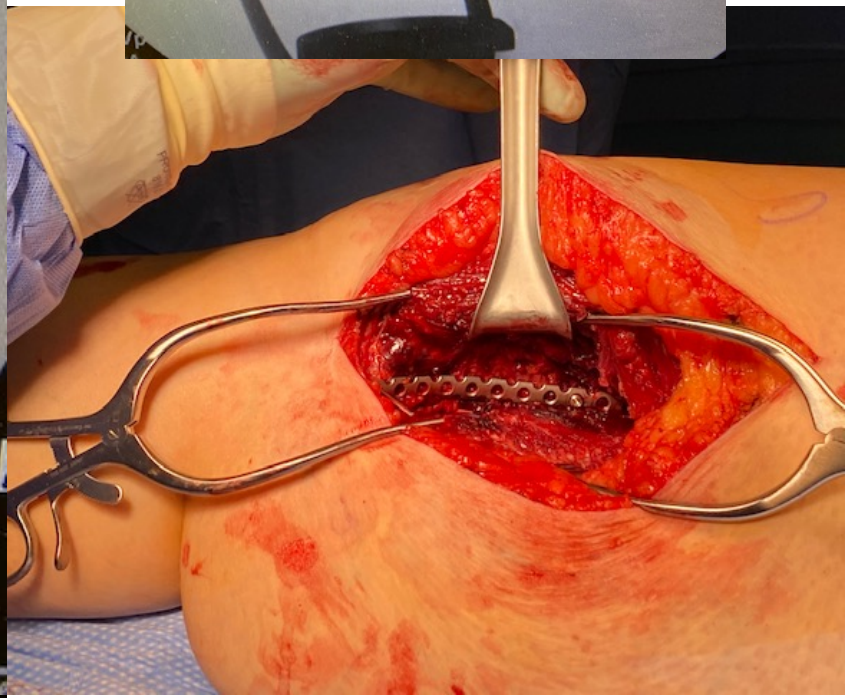
Deformity Confirmed



Interprosthetic Femoral Fx




R
Supine



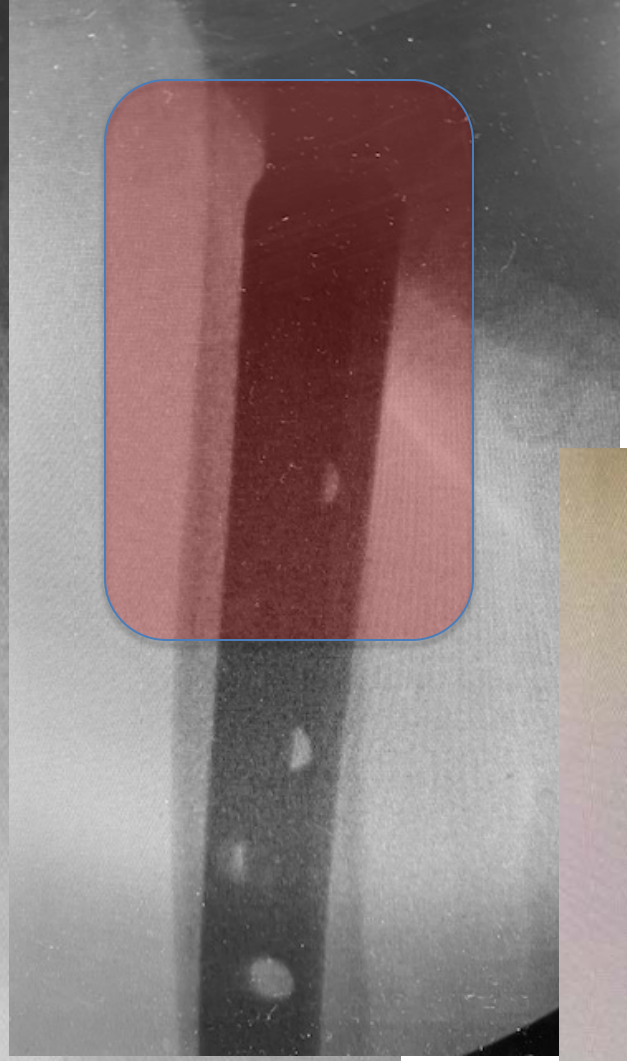
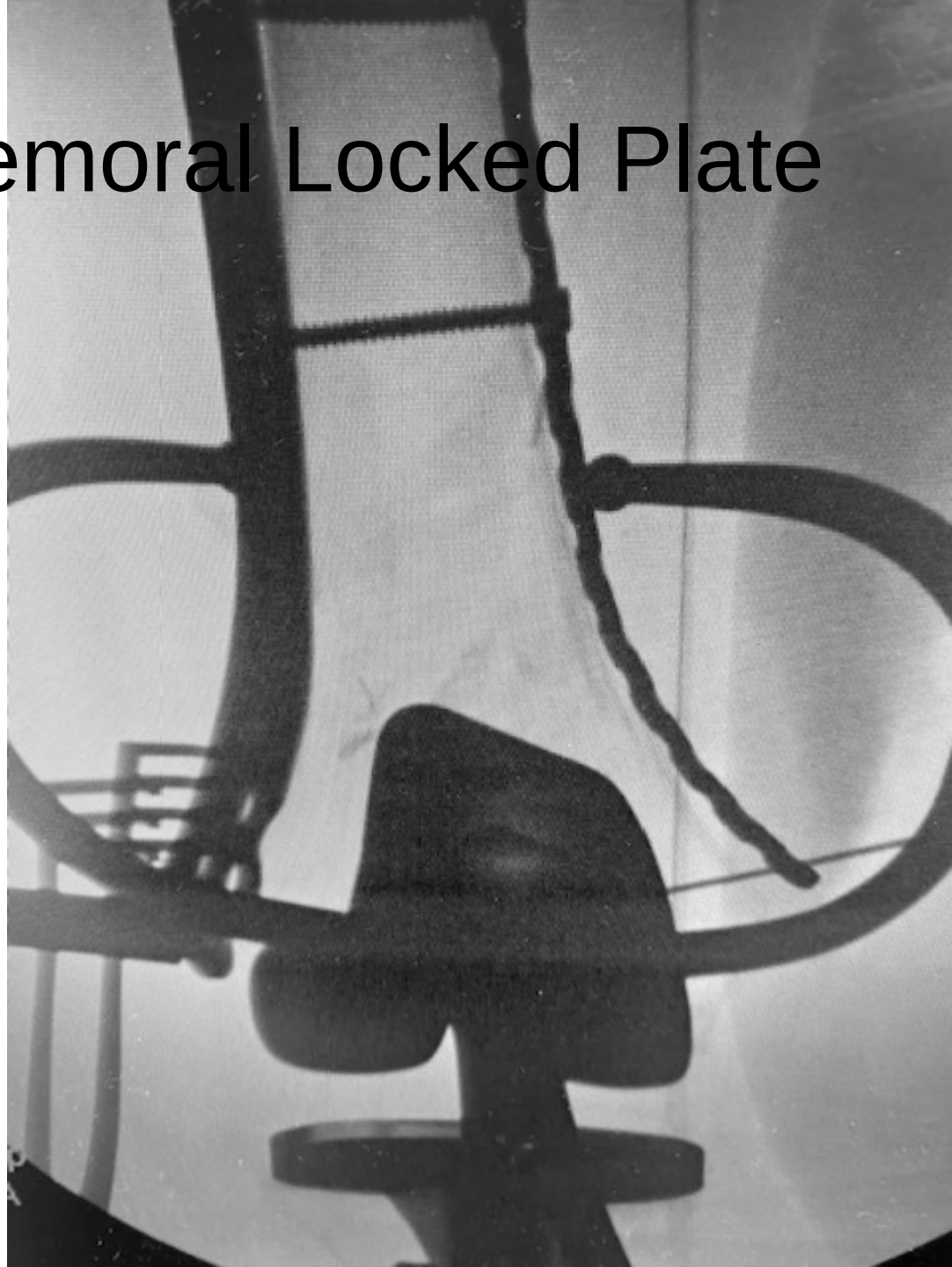


Plate Eccentric
Allows for Screws Anterior or Posterior to Nail
Do not use Locked screws

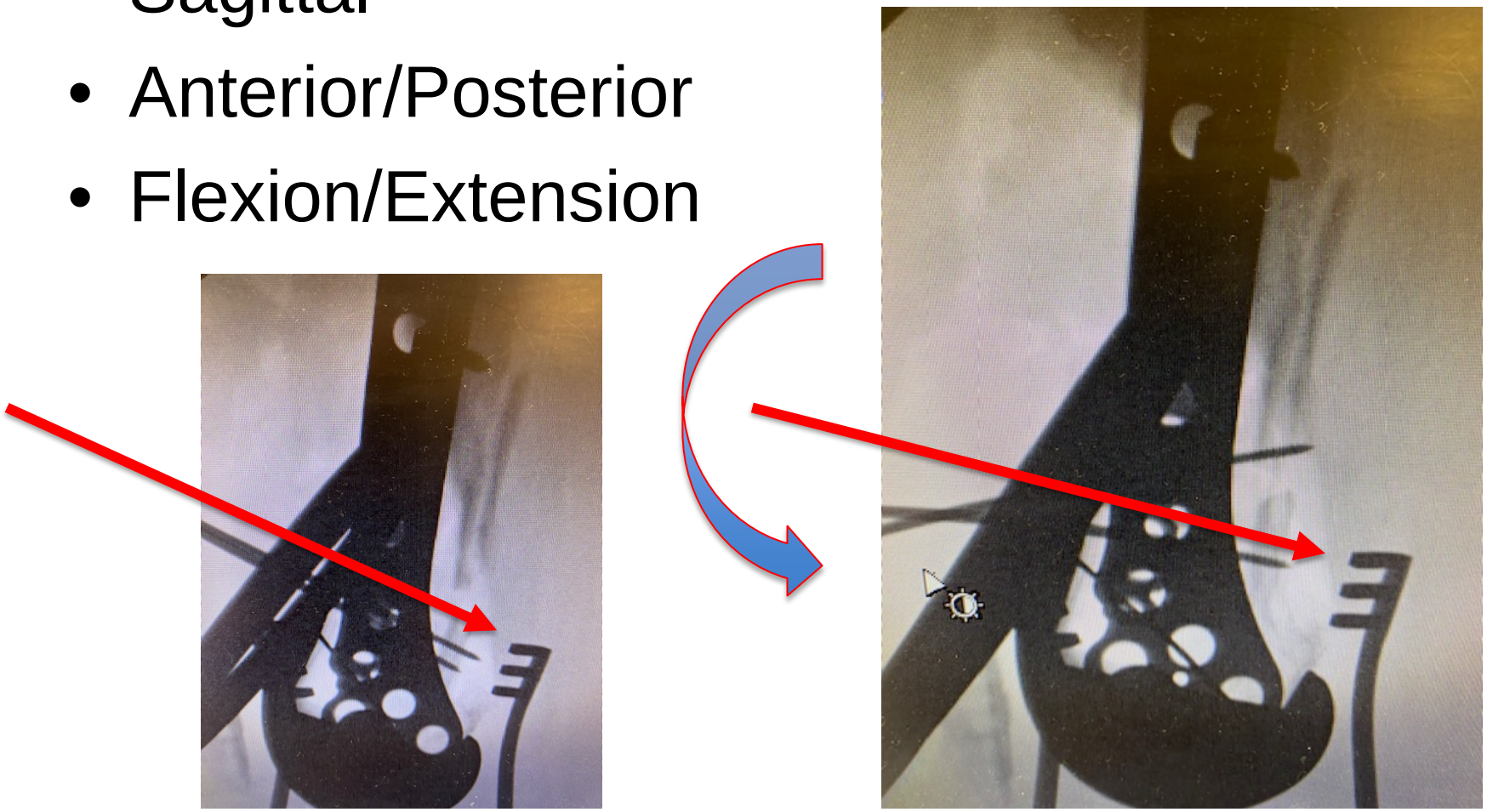
Insert Distal Femoral Locked Plate

- Coronal
- Proximal/Distal
- Compress
  - Bone to Plate
- Confirm
  - Varus
  - Valgus



Correct

- Sagittal
- Anterior/Posterior
- Flexion/Extension

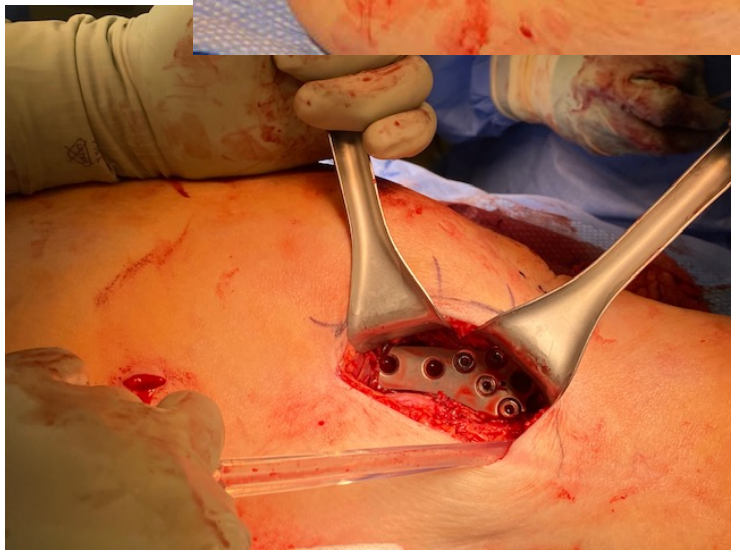


Lock in Proximal Plate Position

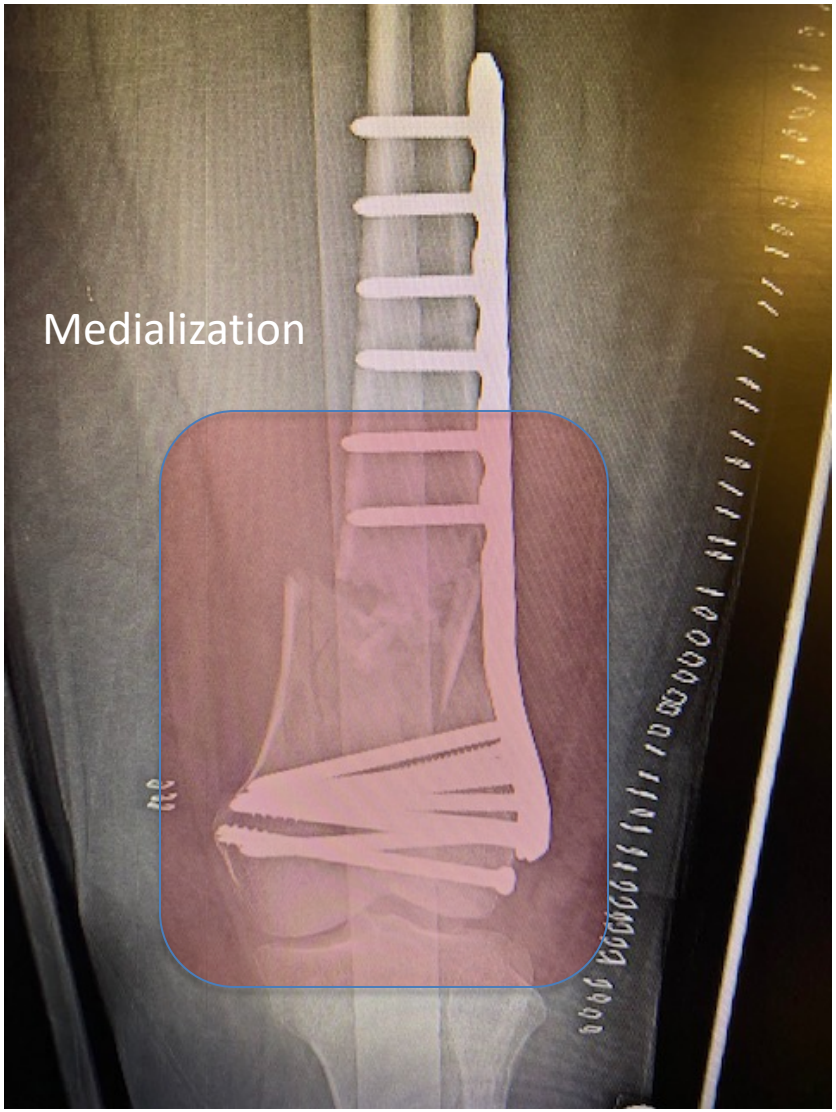
Final Distal Position

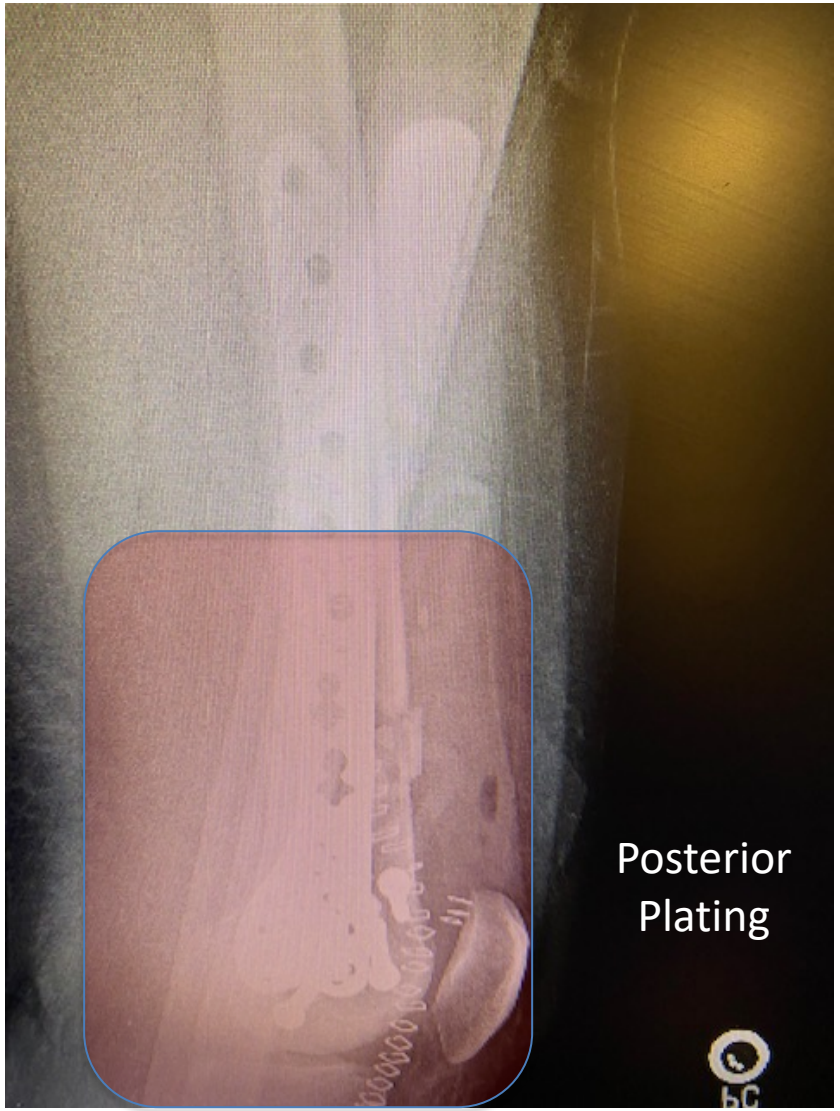

OEC


OEC



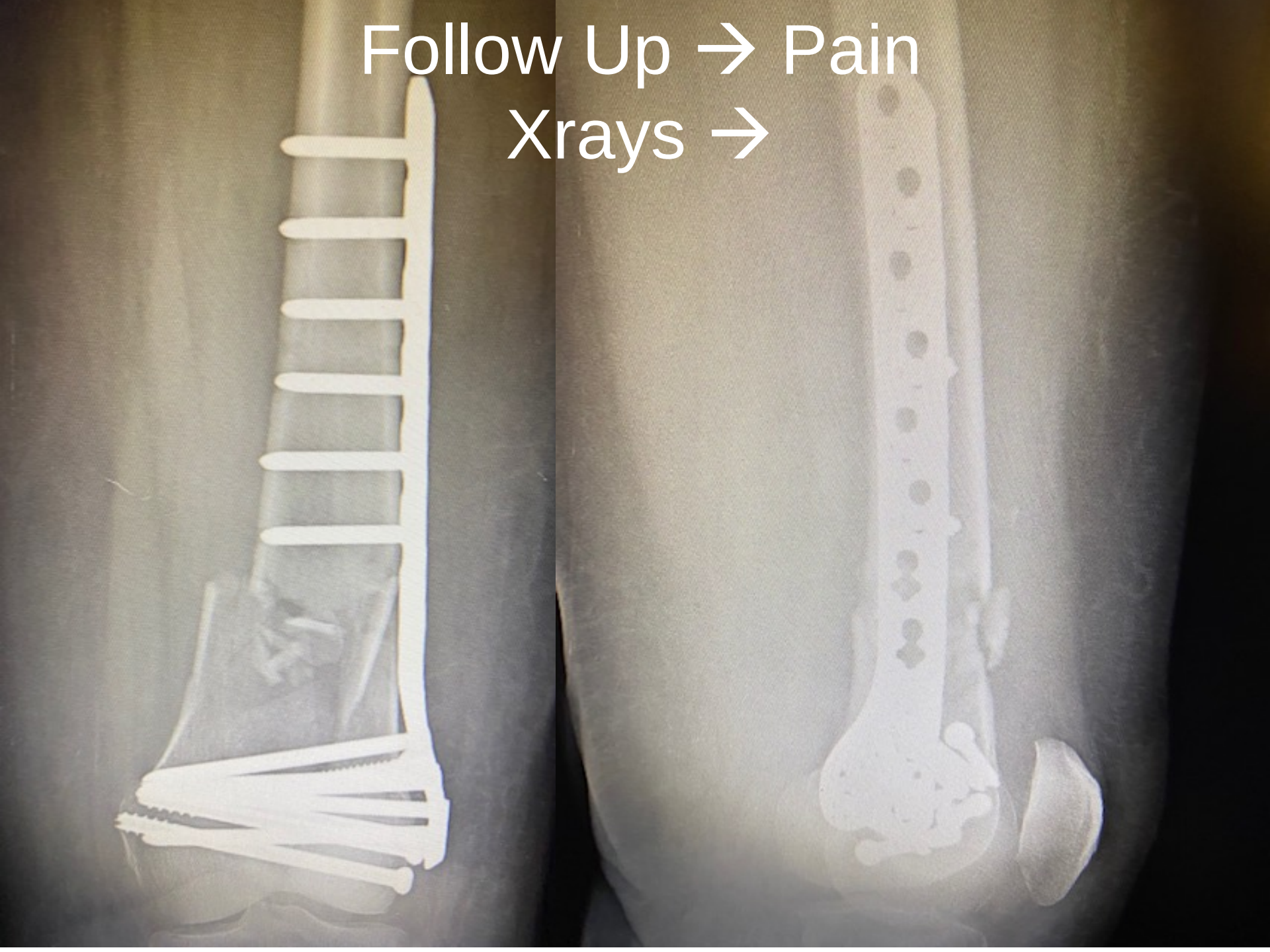
Primary Surgery



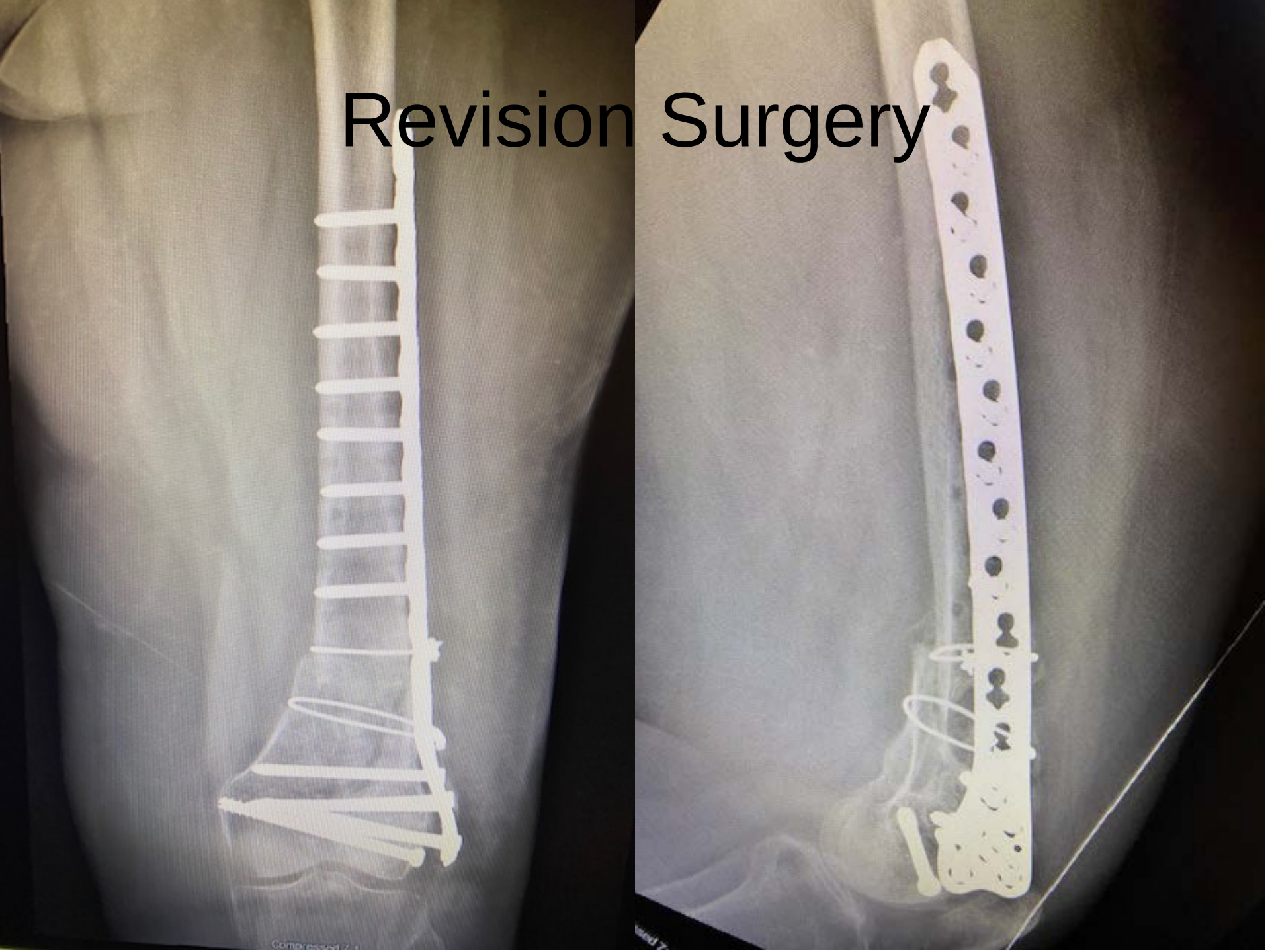


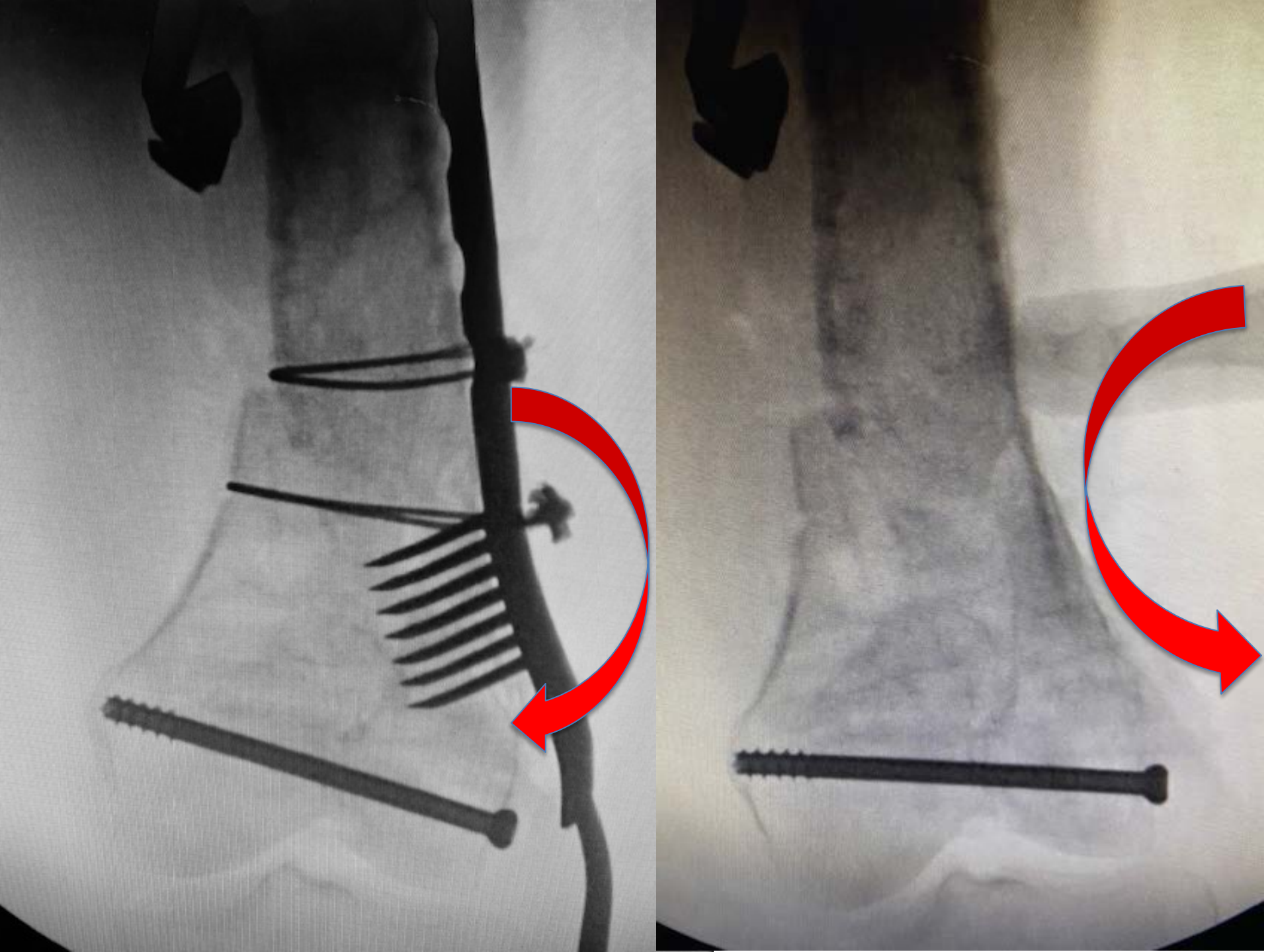
Follow Up → Pain

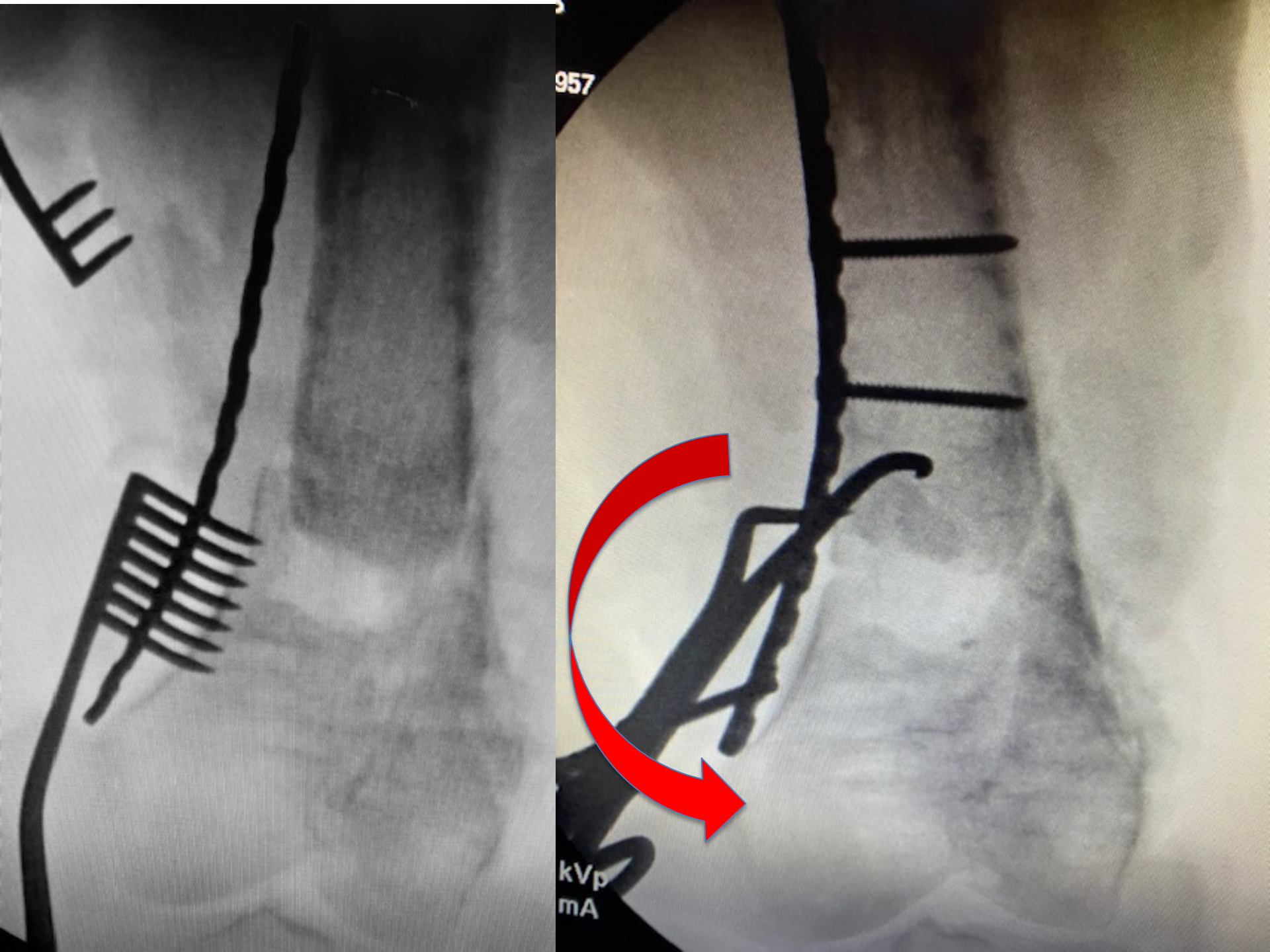
Xrays →

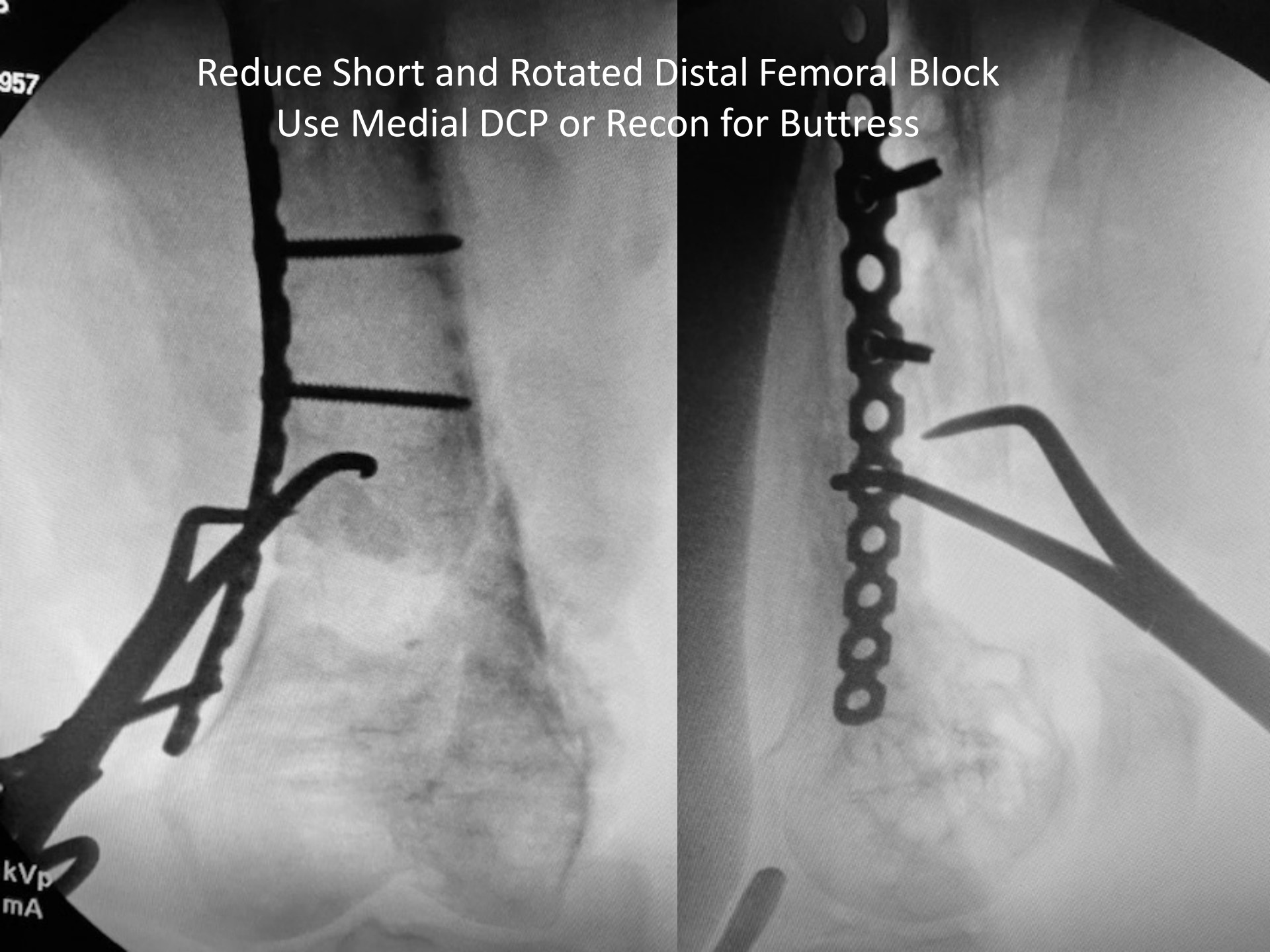


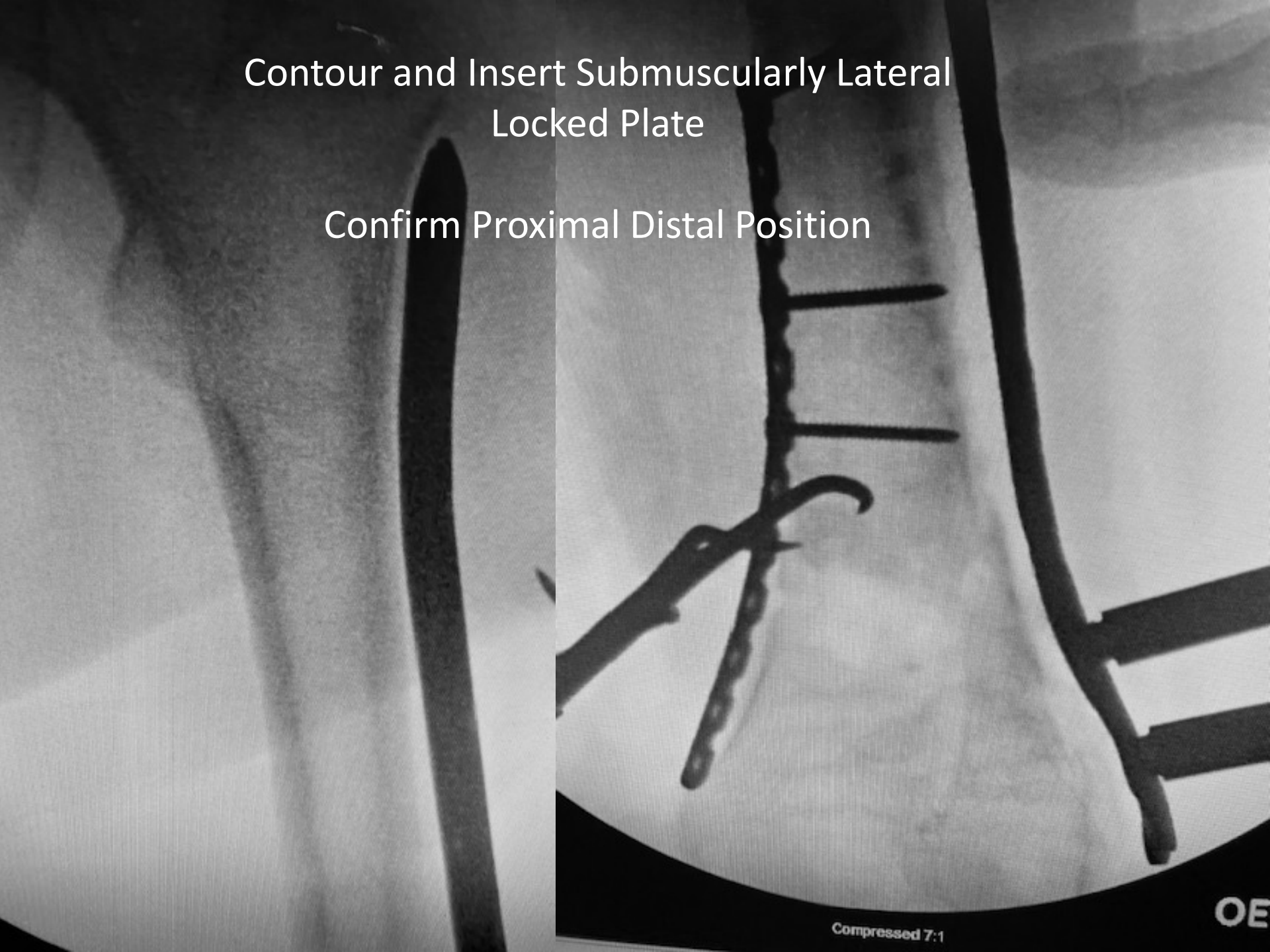
Revision Surgery






957
kVp
mA


Reduce Short and Rotated Distal Femoral Block
Use Medial DCP or Recon for Buttress


Contour and Insert Submuscularly Lateral Locked Plate
Confirm Proximal Distal Position
Compressed 7:1

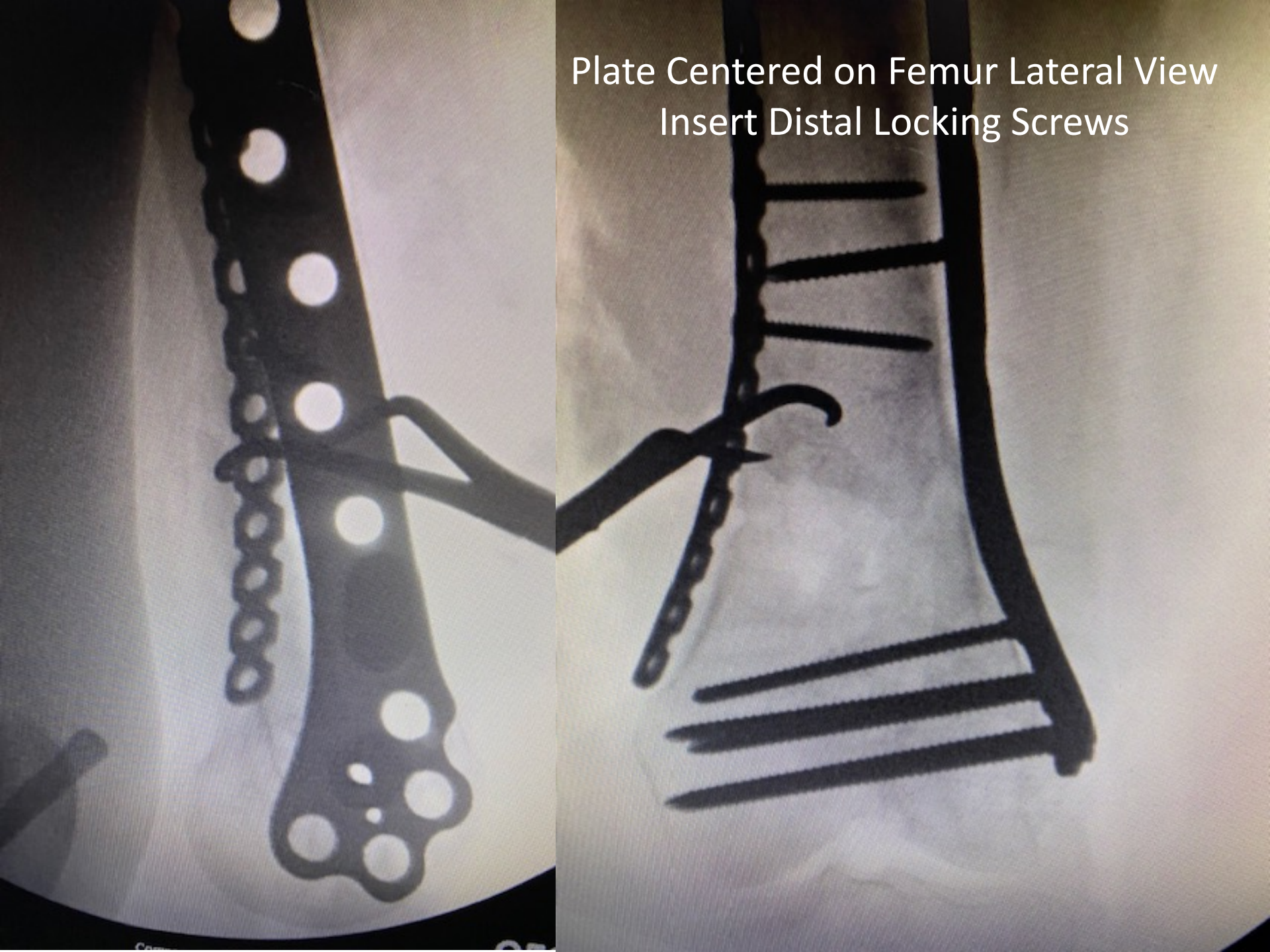
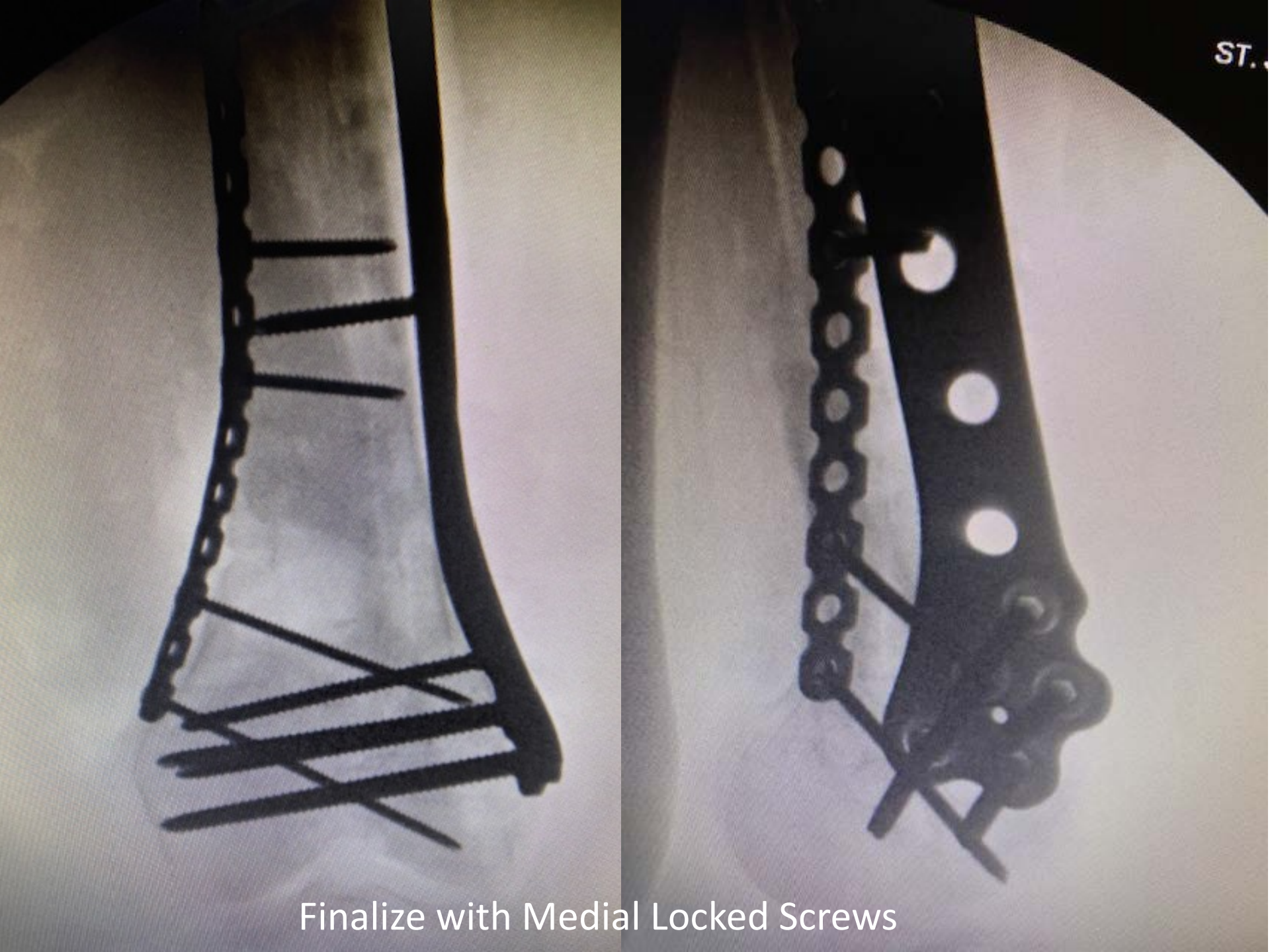
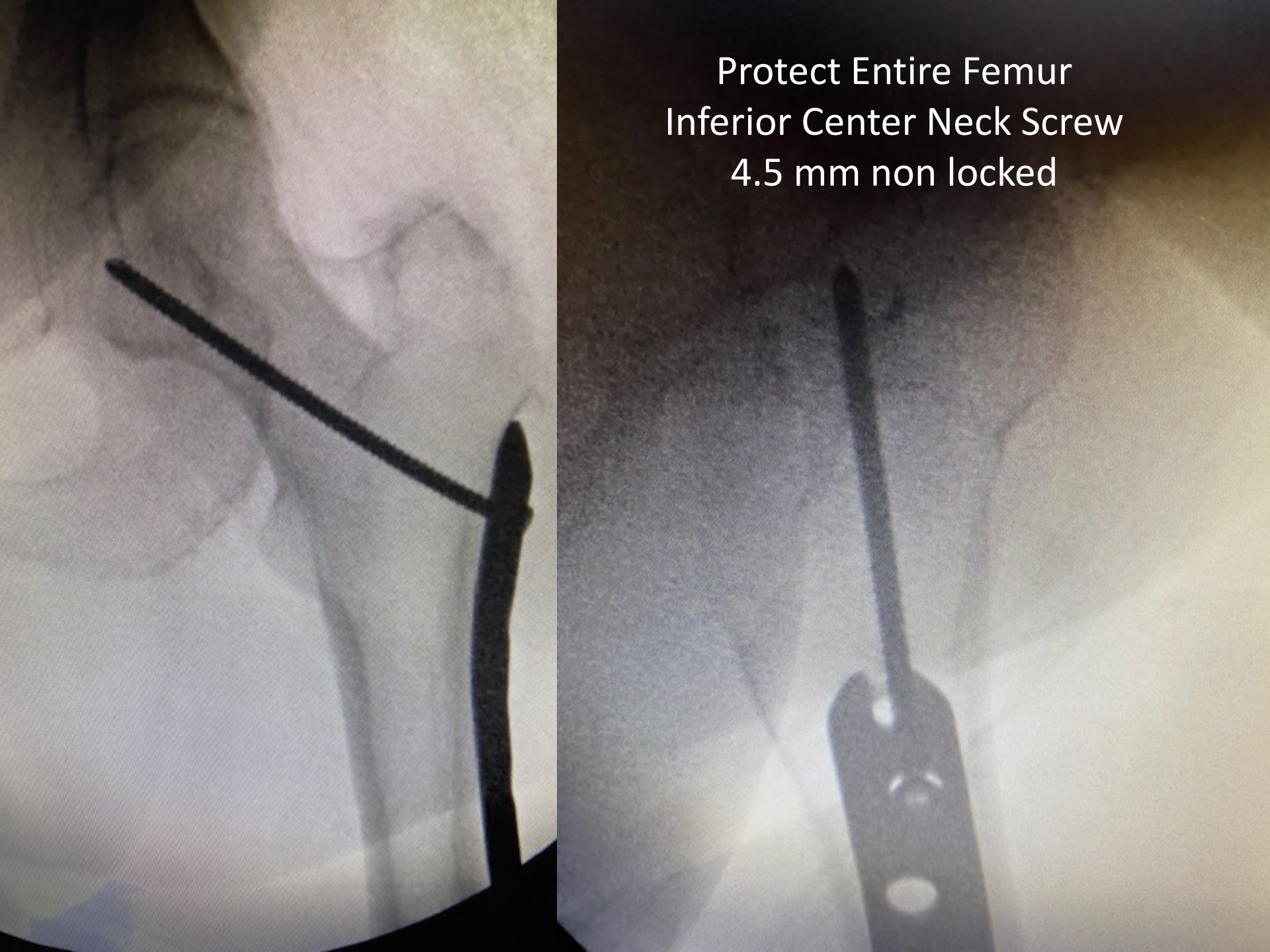


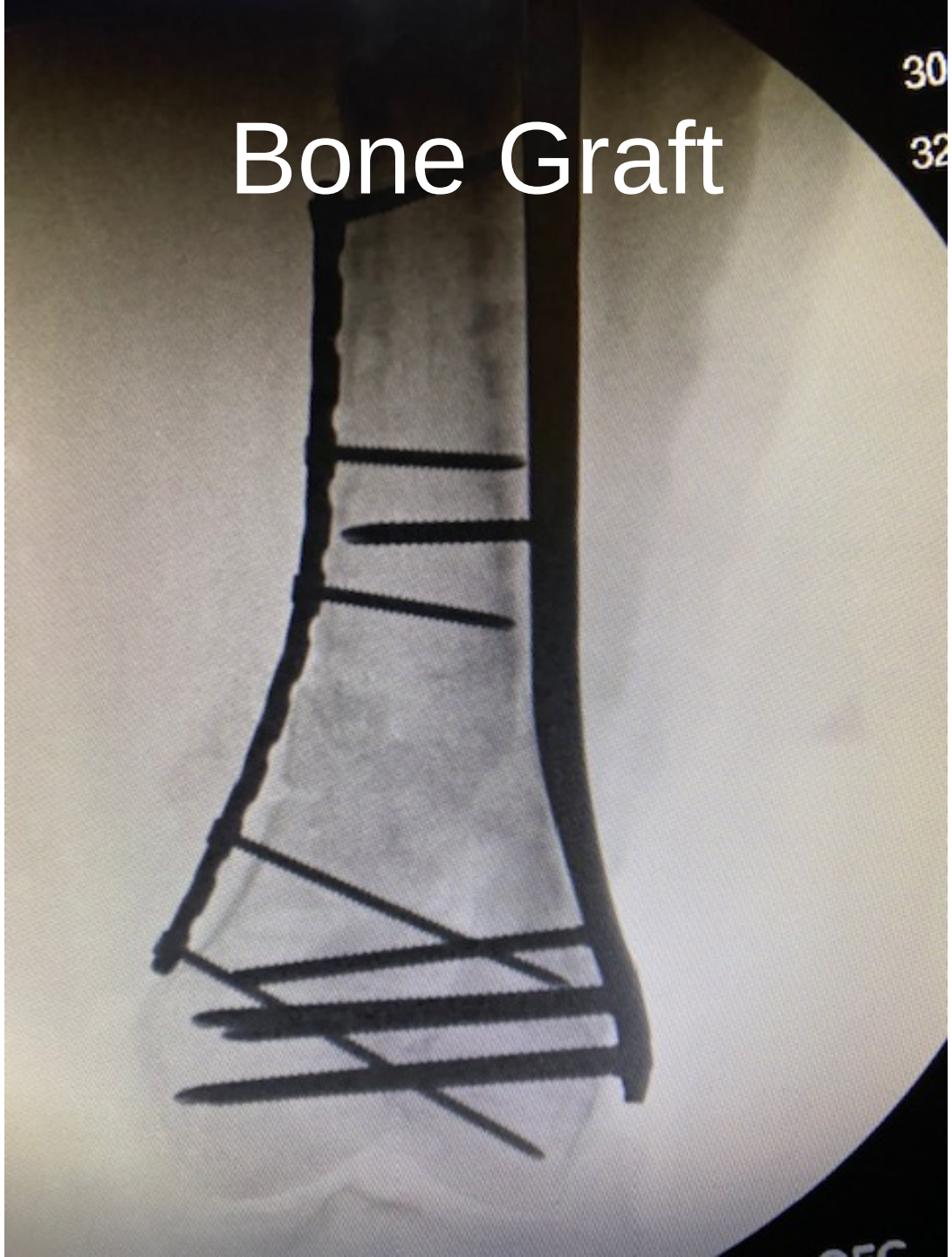
Plate Centered on Femur Lateral View
Insert Distal Locking Screws



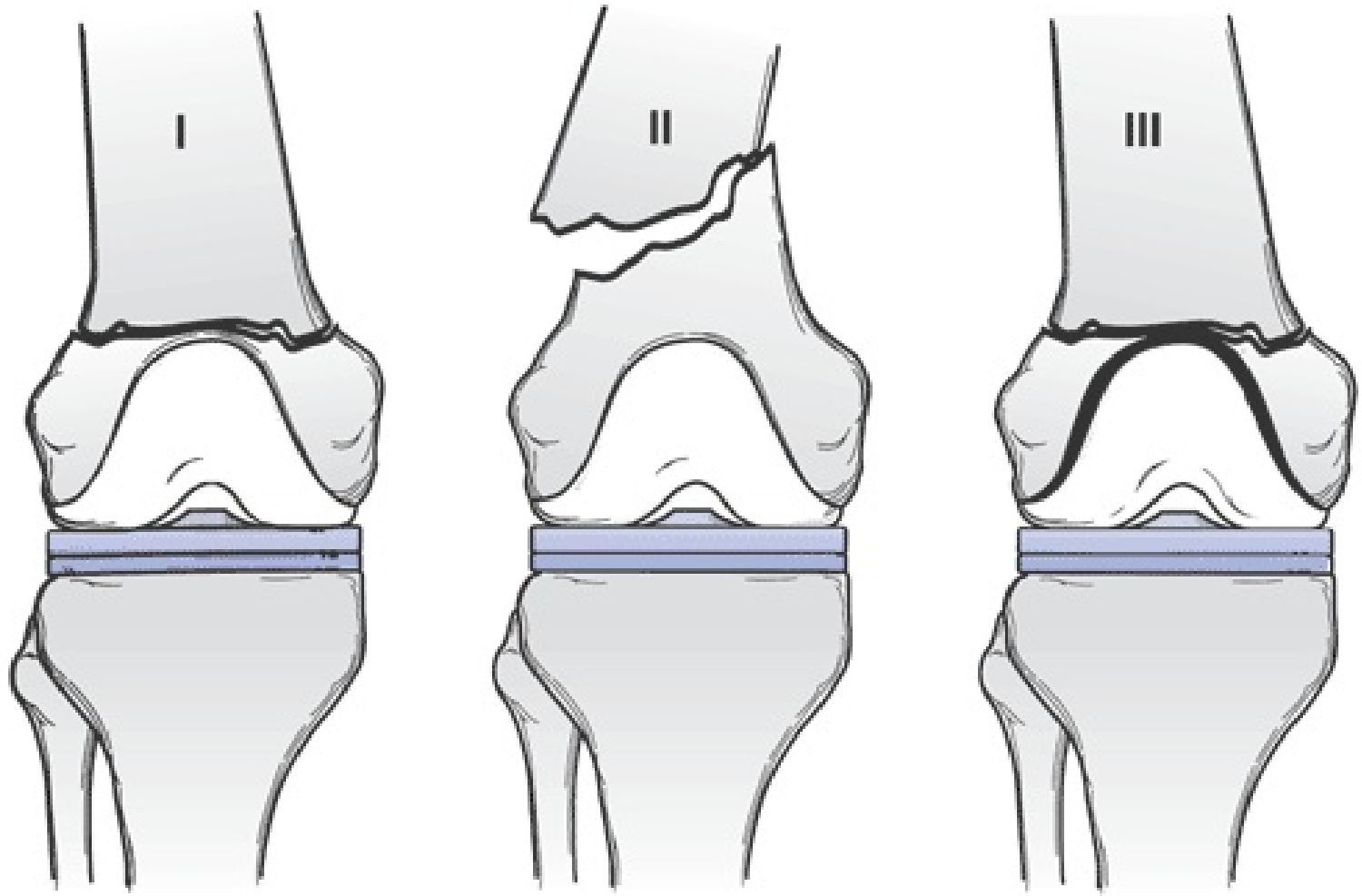
Finalize with Medial Locked Screws


Protect Entire Femur
Inferior Center Neck Screw
4.5 mm non locked

Bone Graft



Periprosthetic Supracondylar Femur Total Knee Arthroplasty



Classification

Type I

- **Undisplaced fracture**
- **Prosthesis intact**

Type II

- **Displaced fracture**
- **Prosthesis intact**

Type III

- **Displaced or Undisplaced fracture**
- **Prosthesis loose**

Lewis and Rorabeck (1997)

Treatment Options

- Retrograde intramedullary nail
- Conventional plating
- Locked plating
- Revision with stemmed prosthesis, allograft, or tumor prosthesis

The Problem(s)

- Usually elderly
- Osteolysis
- Limited distal fixation due to TKA
- PS Cam design of TKA
- Notch – Canal diameter mismatch
- Early ROM desired

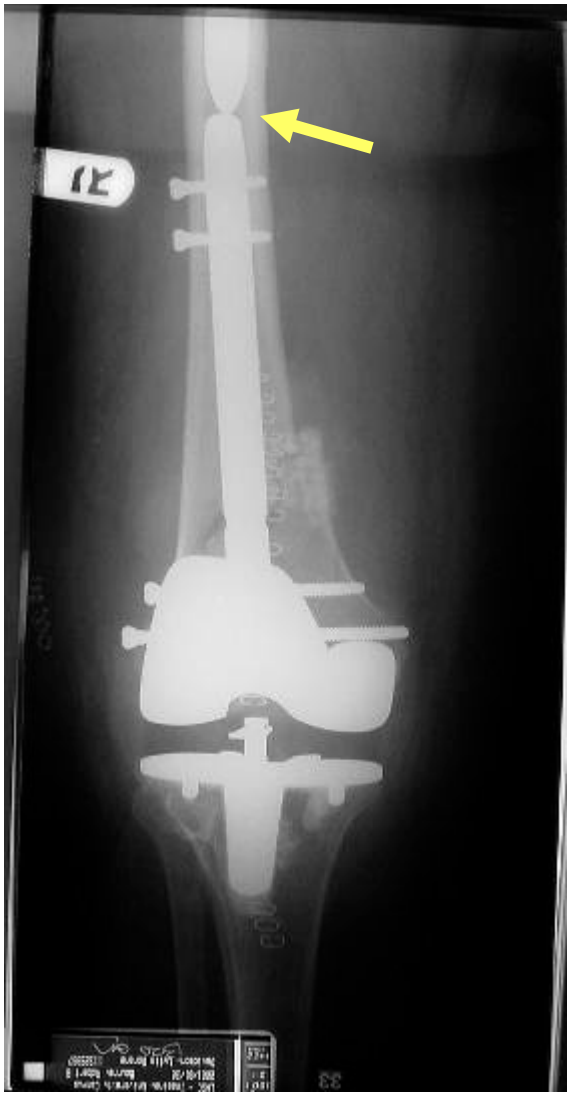
The Problem(s)

Distal Fixation

Retrograde IMN vs ORIF

- Limited literature
- PS vs CR
- Canal diameter considerations
- TKA Notch vs canal diameter
- Femoral stem above?

Inter-Device Distance (IDD)

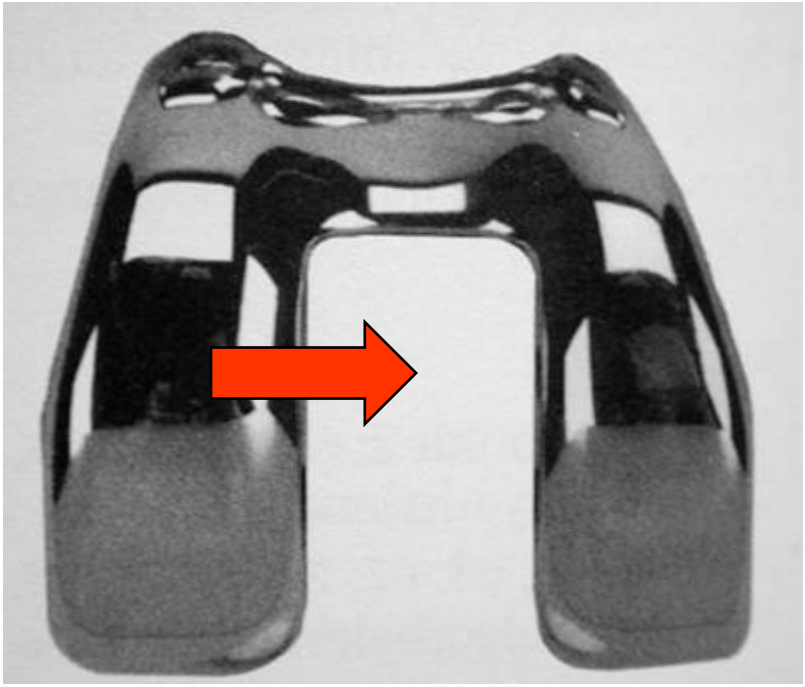


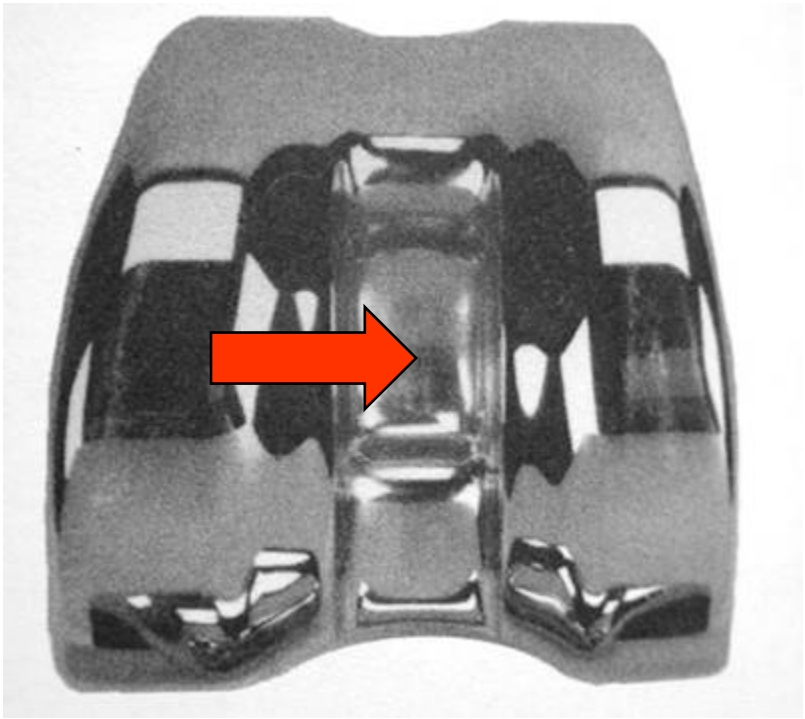
Retrograde Nailing

Is the notch open or closed?

If open, is it large enough?

- Narrow notch and closed box seen in posterior stabilized knees





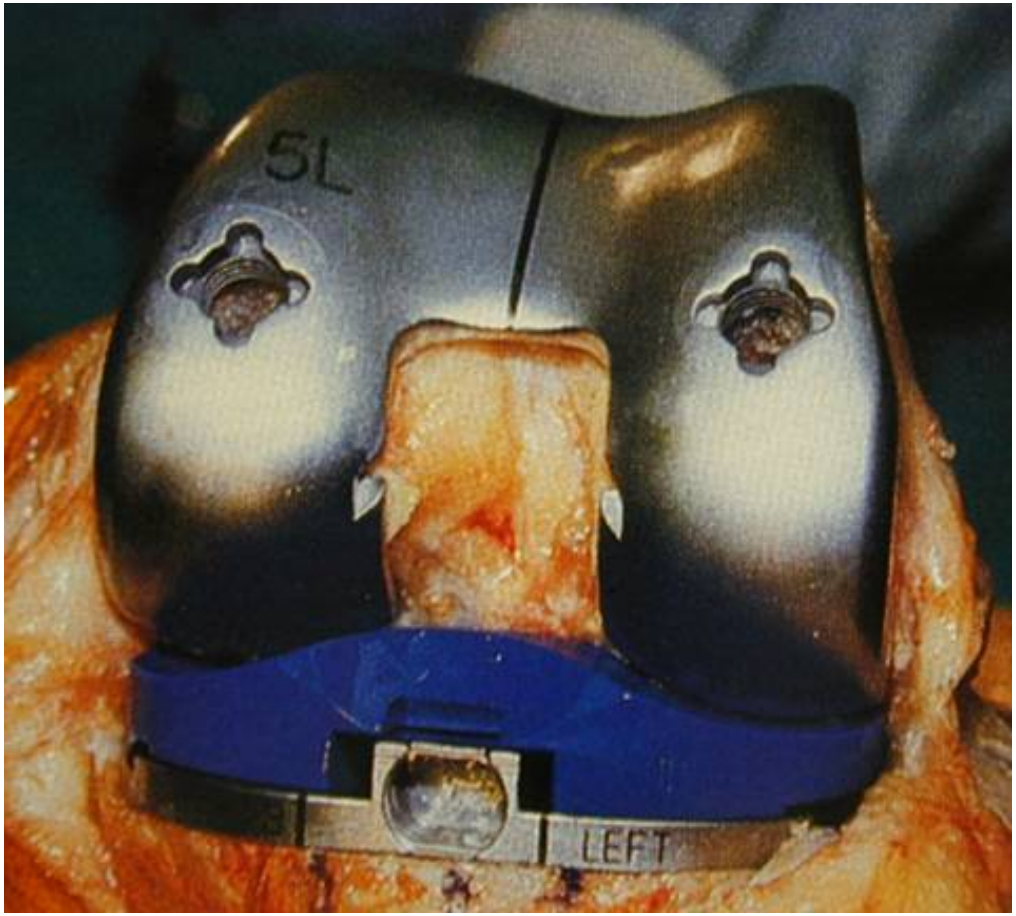
Retrograde Nailing

Problems:

- Stability of distal segment with interlocking bolts
- Toggle of the nail in the distal metaphysis

↓

- Nail size
- Uniplanar interlocking bolts
- Bone quality
- Capacious distal metaphysis
- Distal fracture patterns



Retrograde Nailing

Nail size canal diameter mismatch

Limited fixation distally

Poor stability

Poor quality bone

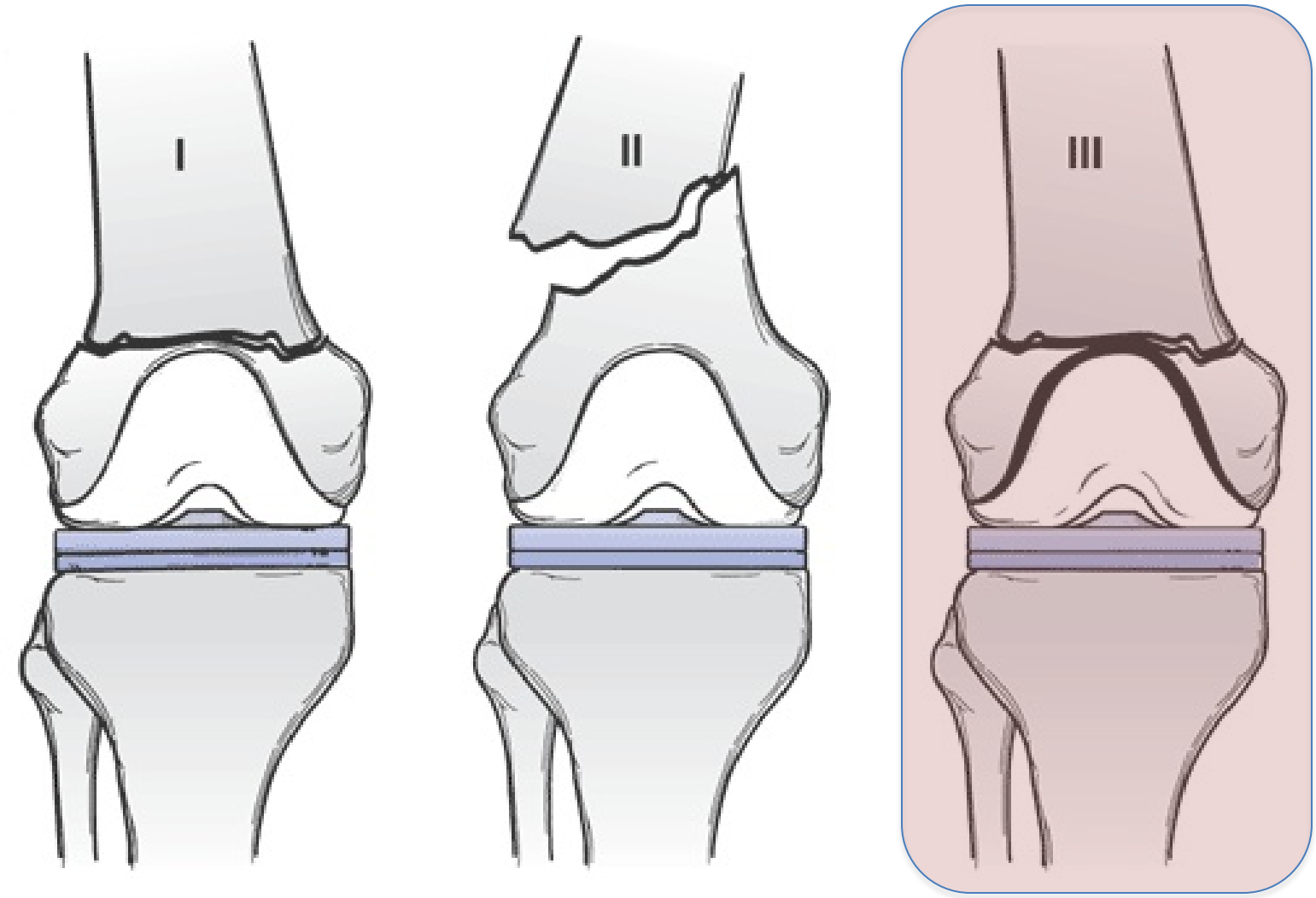
Largely replaced by locking implants

Retrograde Intra-medullary Nail

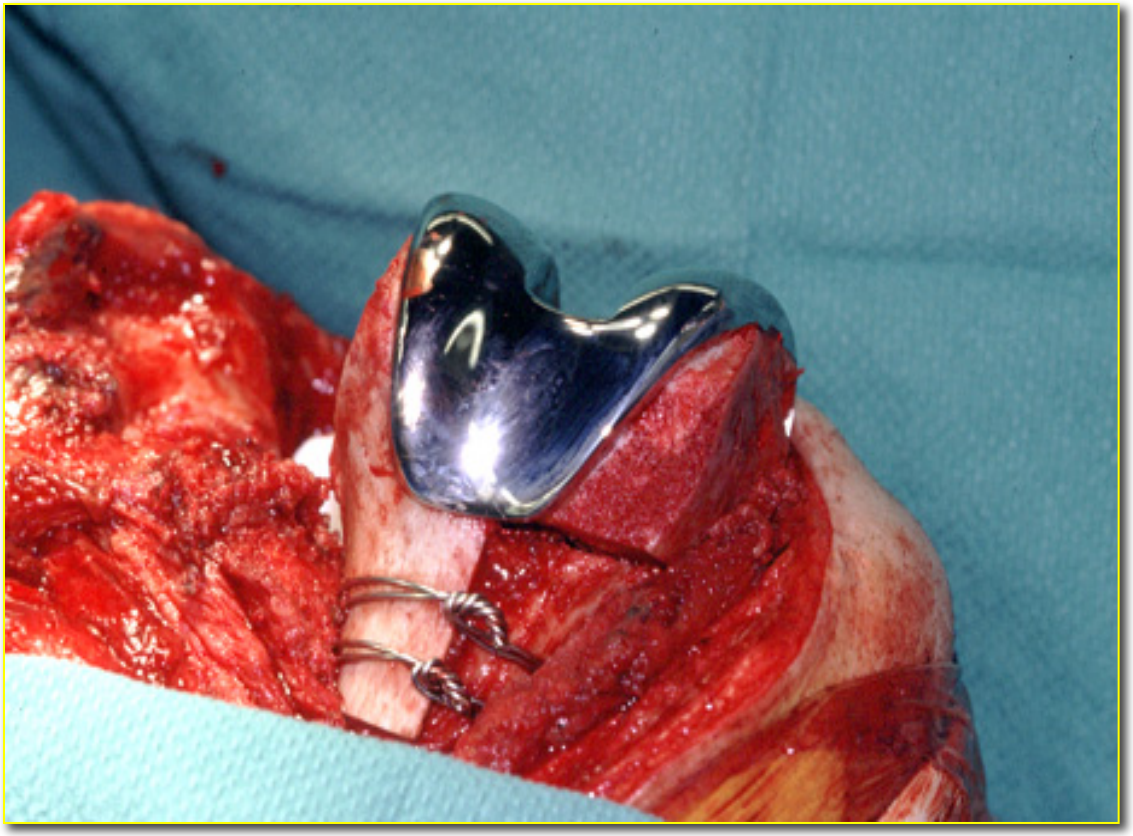
Nail size canal diameter mismatch

If Too Posterior → Hyperextension

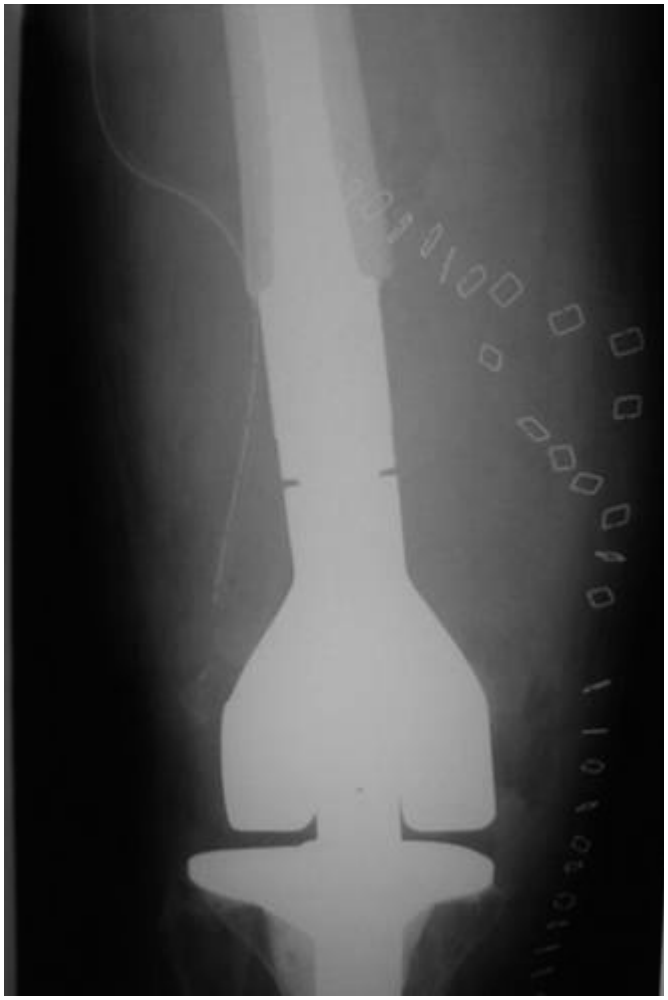
Femur – Total Knee Arthroplasty

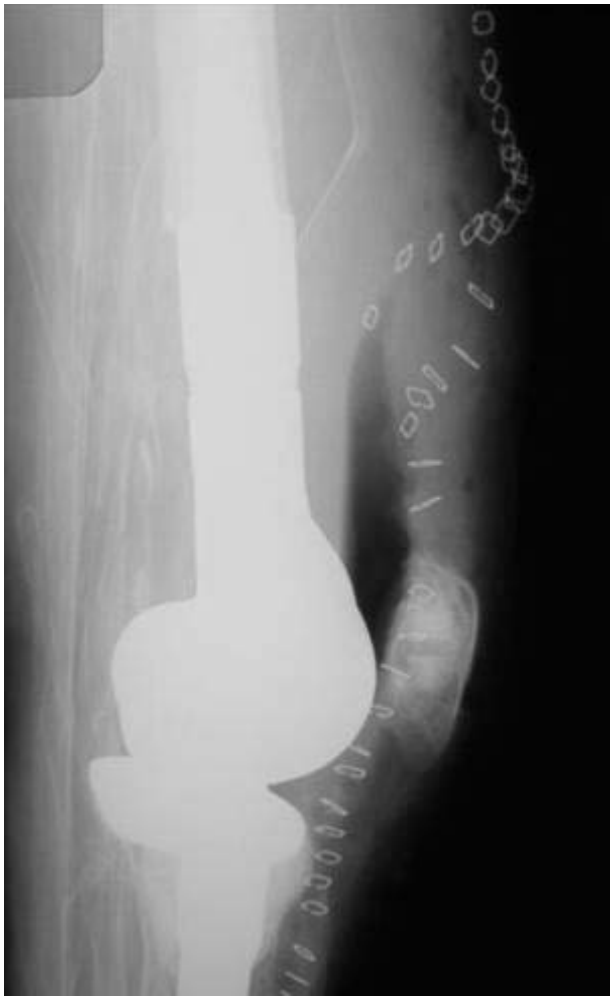


Allograft-Prosthetic Composite

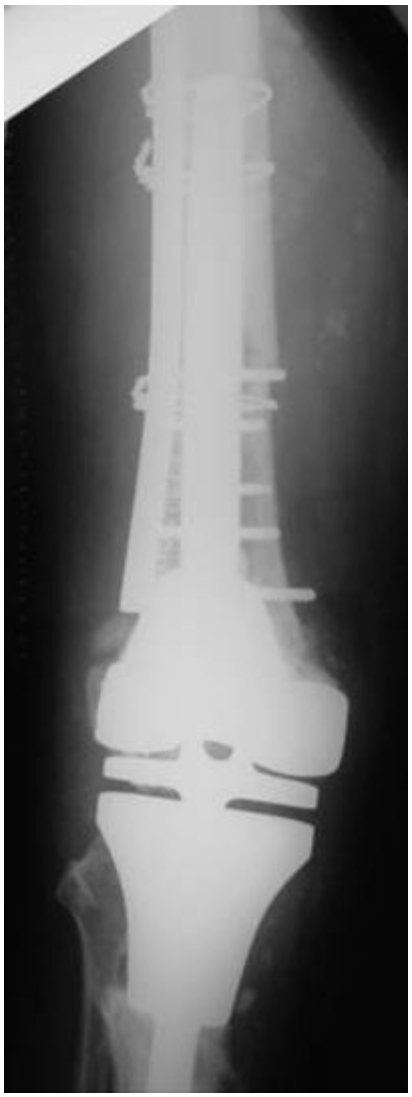


Constrained Rotating Hinge

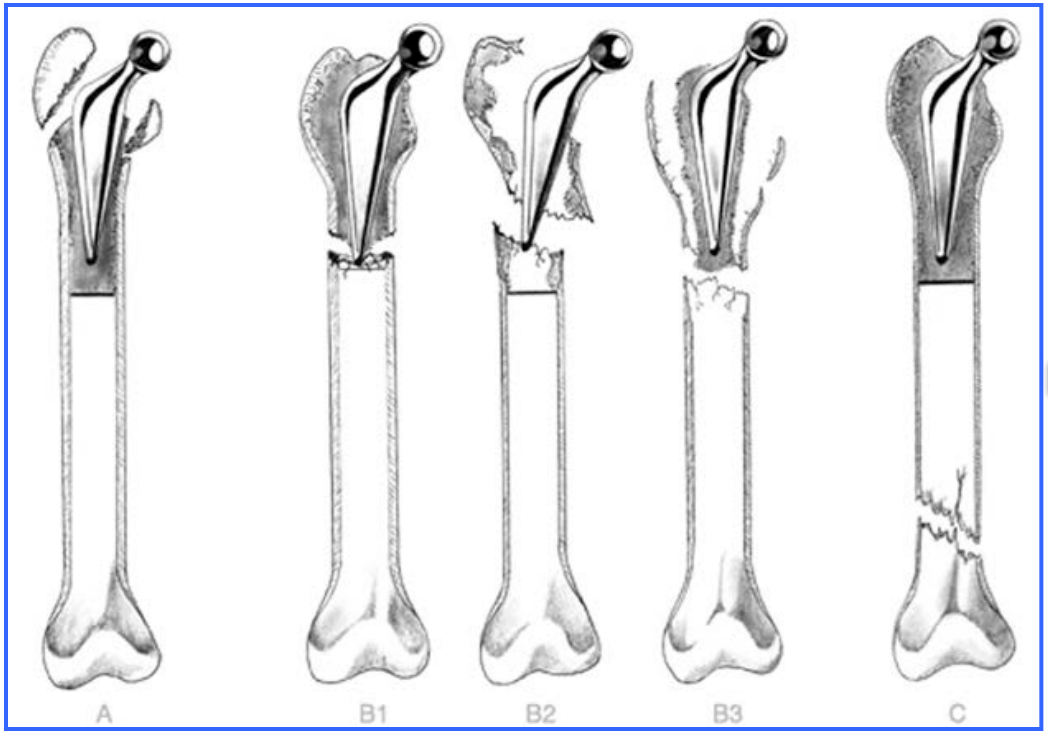


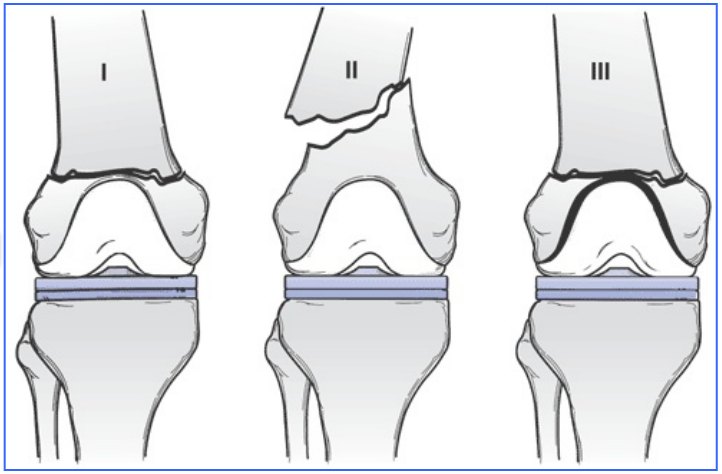


Constraint comes at a price!

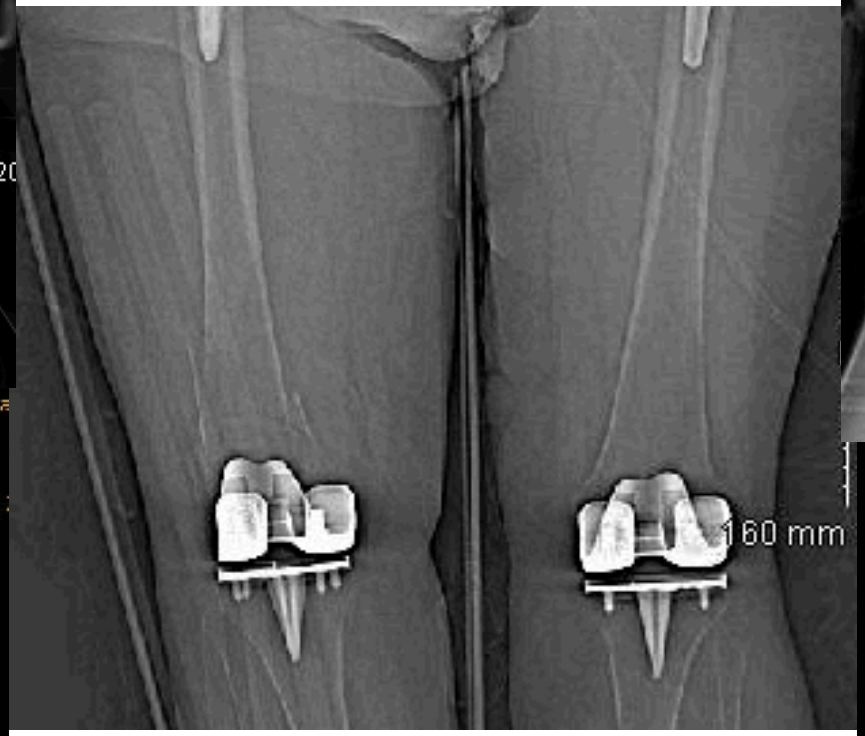


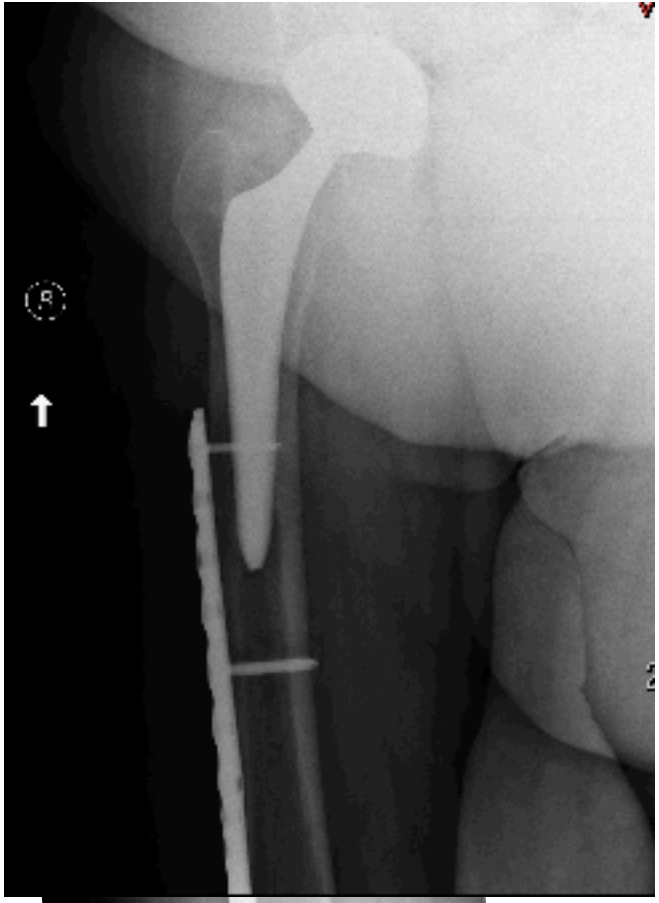
Femur – Total Hip & Knee Arthroplasty



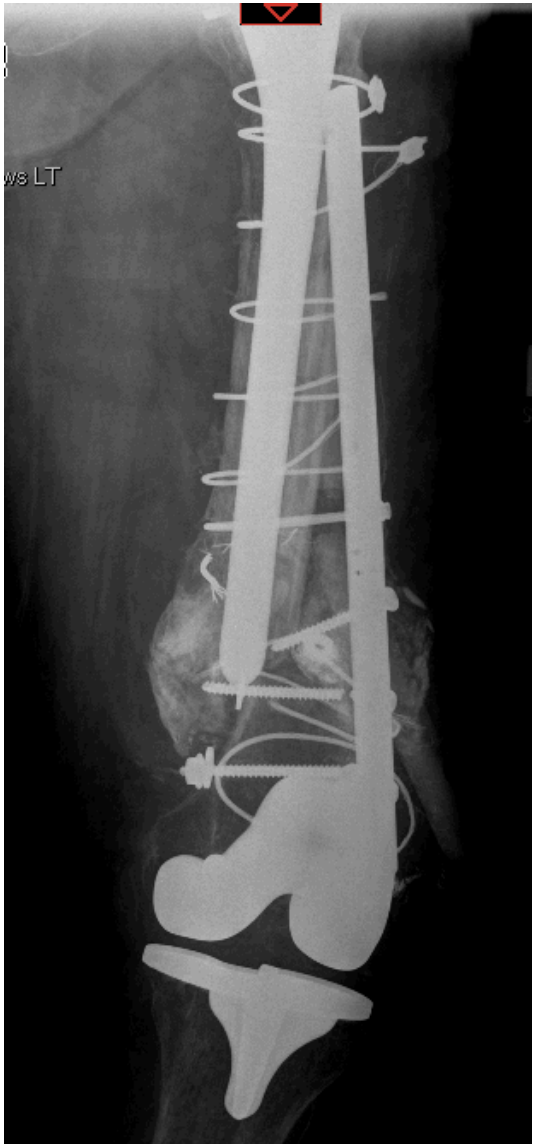


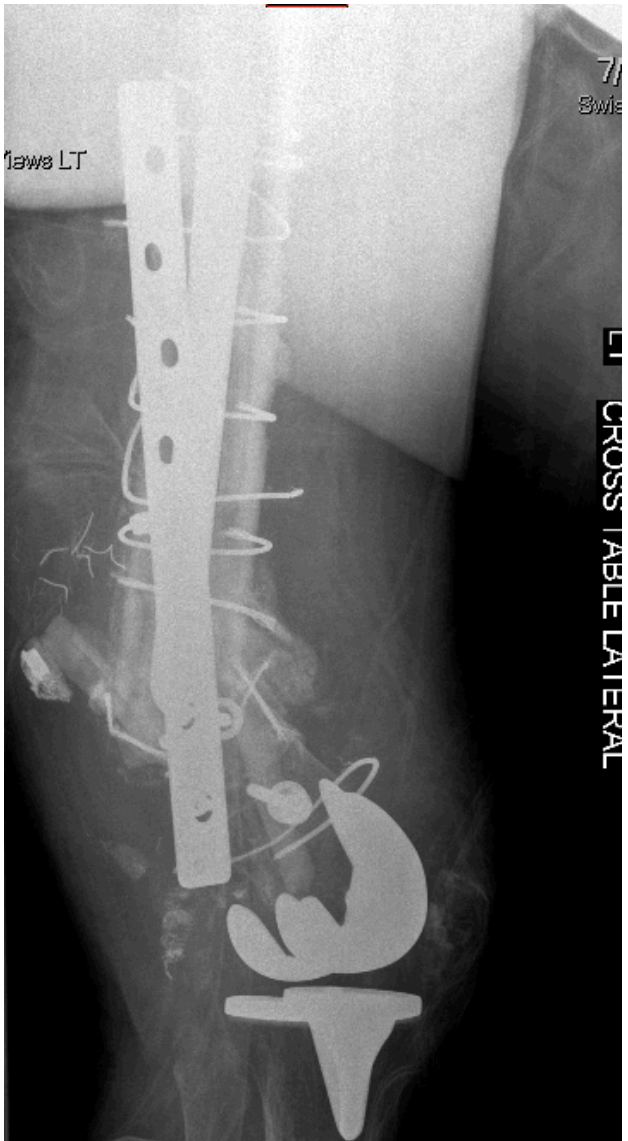
83F, LGF



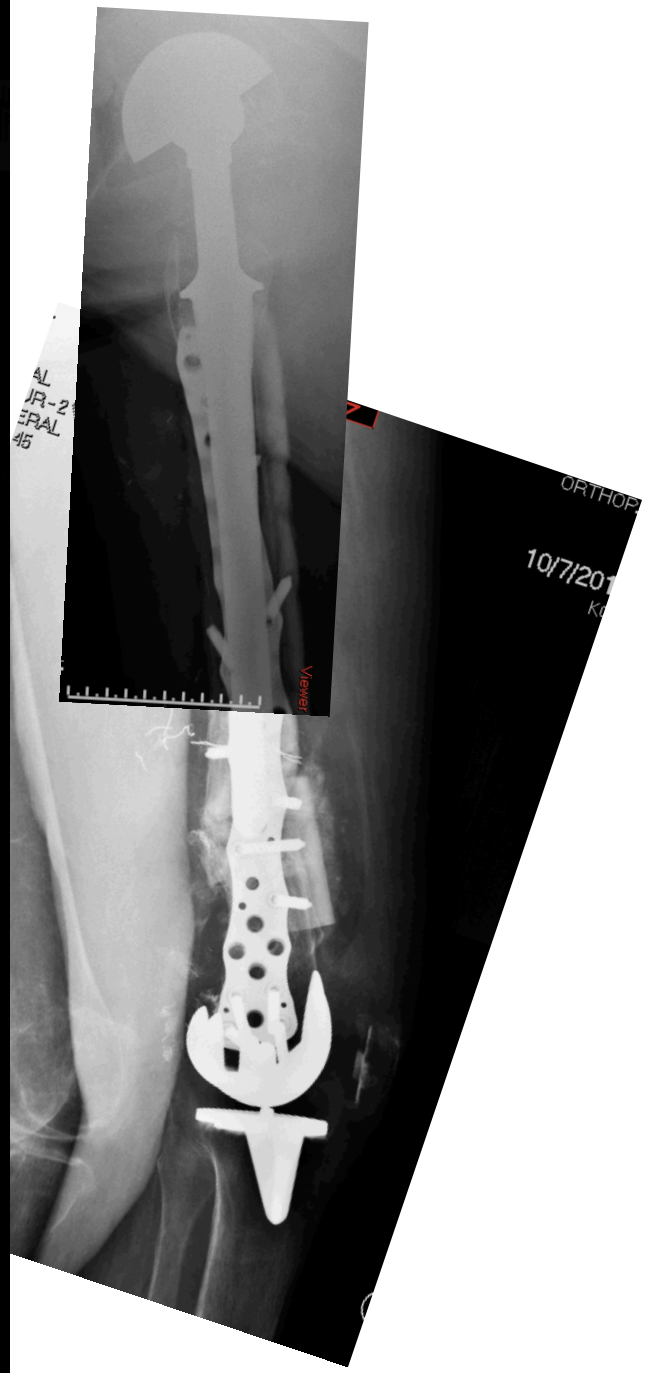


86F, RA, 6 yr MVA

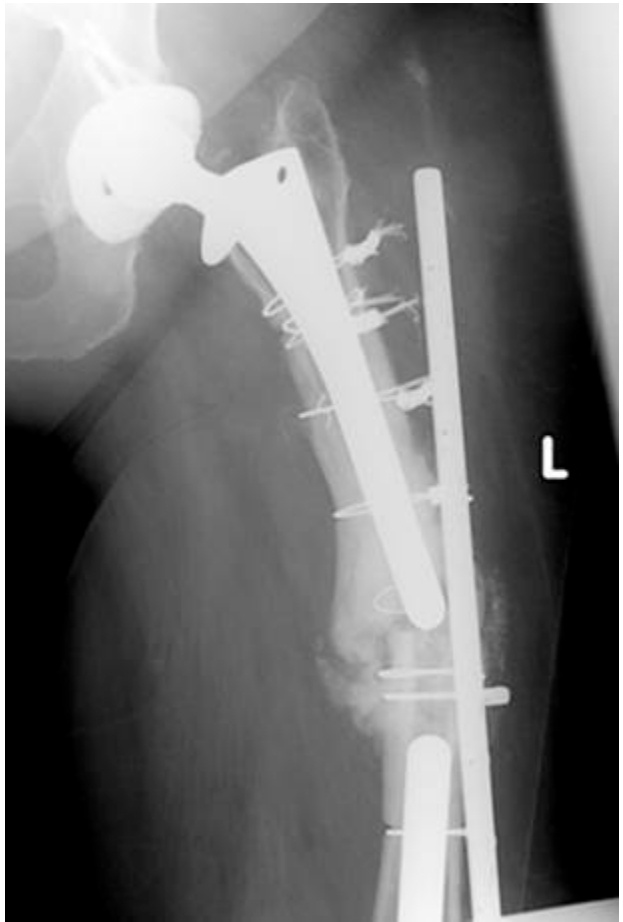








70 yo
280 pounds
TMTC previous ops



Clinical Evidence?

LISS

- Schultz M, Injury, 2001
- Kregor PJ, Injury, 2003
- Althausen PL, J. Arthroplasty, 2003
- Markmiller M, CORR, 2004

Retrograde Nail

- McLaren AC, CORR, 1994
- Murrell GA, J. Arthroplasty, 1995
- Rolston LR, JBJS-A, 1995
- Jabczenski FF, J. Arthroplasty, 1995
- Bezwada HP, J. Arthroplasty, 2004

What is going to drive prognosis?

1. Longitudinal alignment
2. Articular congruity
3. ROM
4. Muscle injury
    - What kind of shape is the Quad in?
    - This will help determine motion

Post-op Care

- Immediate ROM
- ? CPM
- NWB → FWBAT
- Strengthening at 6 wks
- WB driven by age, fracture, compliance
- ? Early WB in water ?

Four key points in Conclusion

1) Understand distal femoral geometry
2) Reduce joint/articular surface first
3) Correct axial alignment & length
4) Fixation must resist varus collapse AND permit early motion

Thank You

Dignity Health
Medical Group

Creighton
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