Osteotomy for Correction of Malalignment Femur and Tibia

Does it Help Unicompartmental Osteoarthrosis?

How Much to Correct?

Felix Fernández-Madrid MD was the Chairman of Rheumatology at Wayne State University School of Medicine Detroit, Michigan, USA

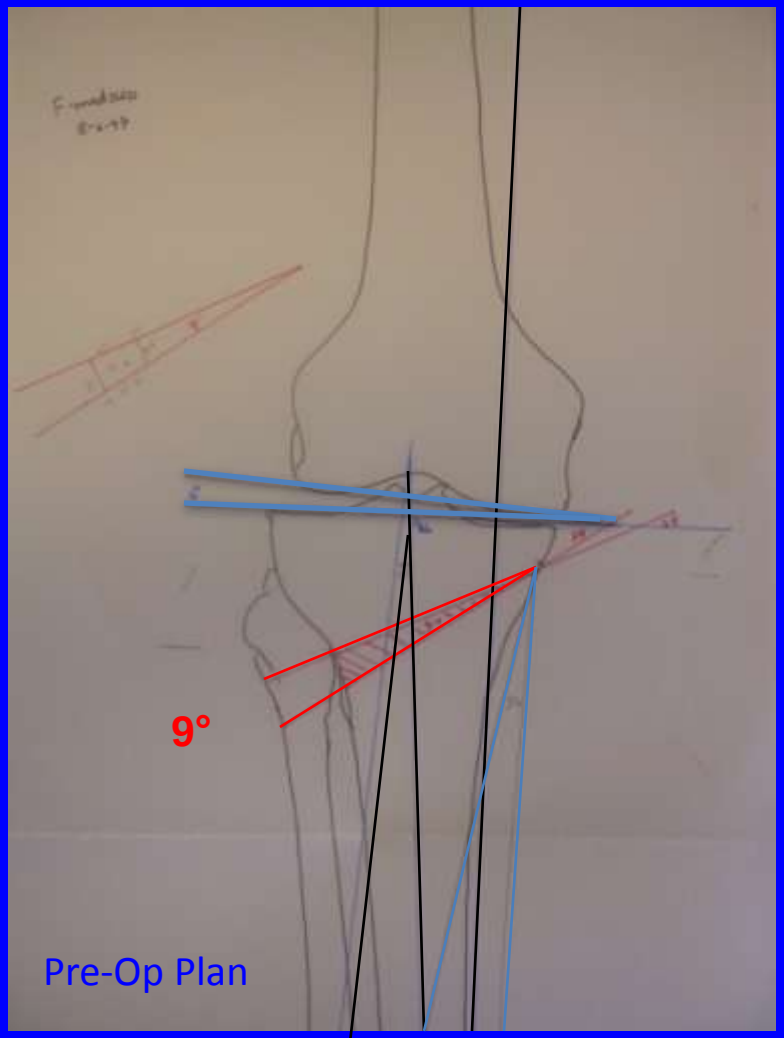
Felix Madrid

Felix Madrid is a National Level amateur Tennis Player
At age 70 he presented me with his MRI

and asked for help to continue playing.

I obtained radiographs:

And, I suggested Osteotomy as I was unsure of the effect of arthroplasty on his continued Tennis Success



Felix Fernández-Madrid MD continues to play singles tennis at a high level at age 82
13 years after osteotomy

He also maintains an active clinical and research program

Why is alignment important?

Osteoarthrosis is most often a disease of mechanical overload

This Mechanical overload is most often due to malalignment of the limb

Realignment is a necessary part of the treatment of osteoarthrosis

Osteotomy may be either Opening Wedge or Closing Wedge

either

Femur or Tibia

Goal of Osteotomy Surgery:

Restore a Neutral Mechanical Axis + 3-4^{o}

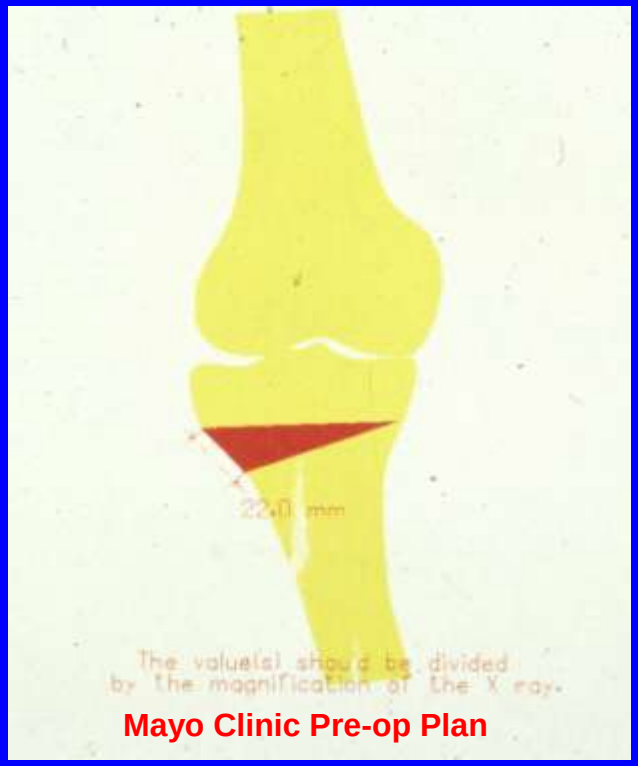
Maintain Horizontal Joint Line

Special Considerations

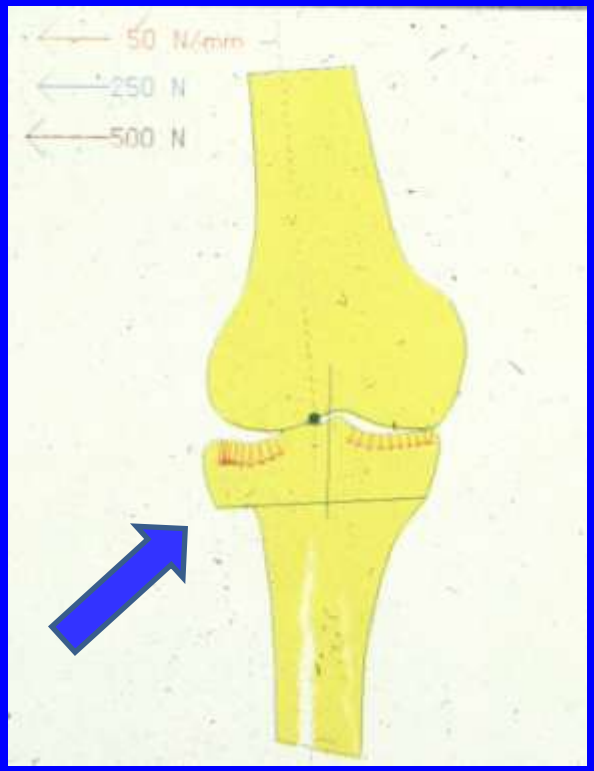
Flexion Contracture Needs Soft Tissue Releases

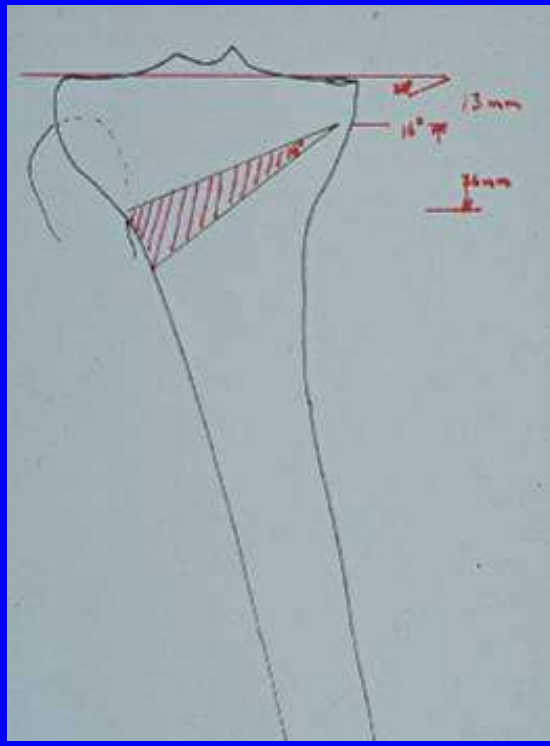
Rotational Deformity Changes where the Load crosses the knee joint

To Avoid Overhang
Make the Osteotomy Oblique
Improved Stability with Cortical Contact



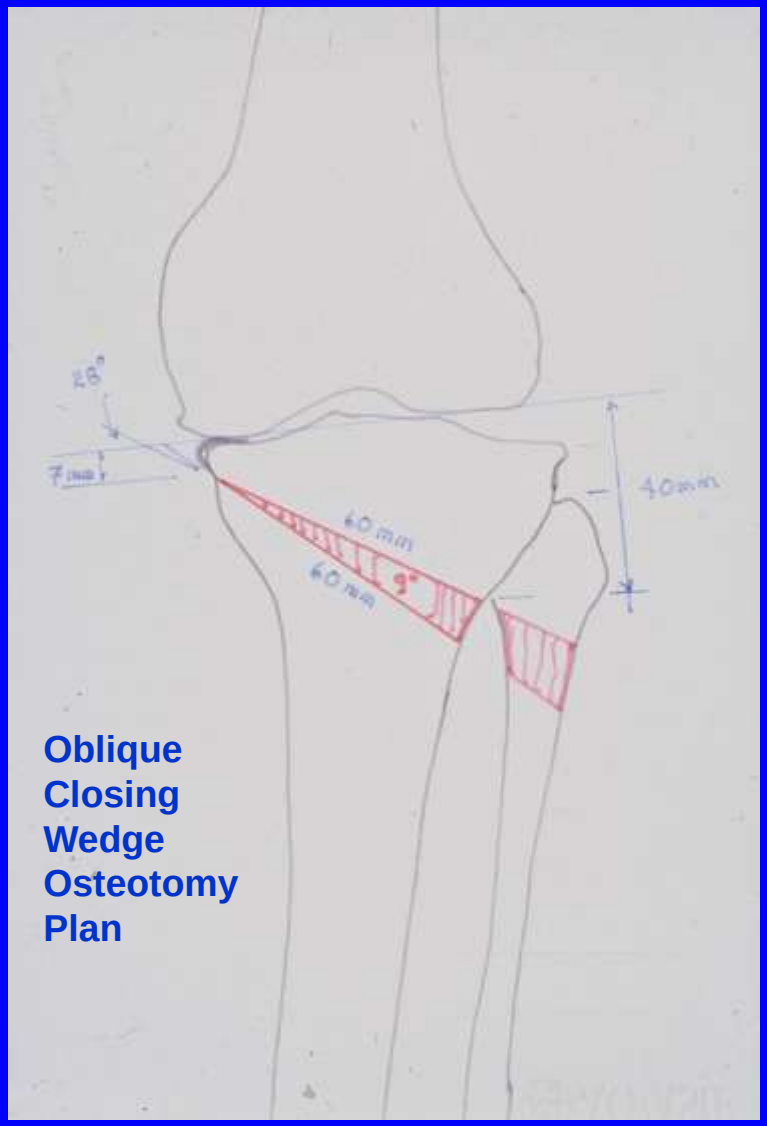
Mayo Clinic Pre-op Plan



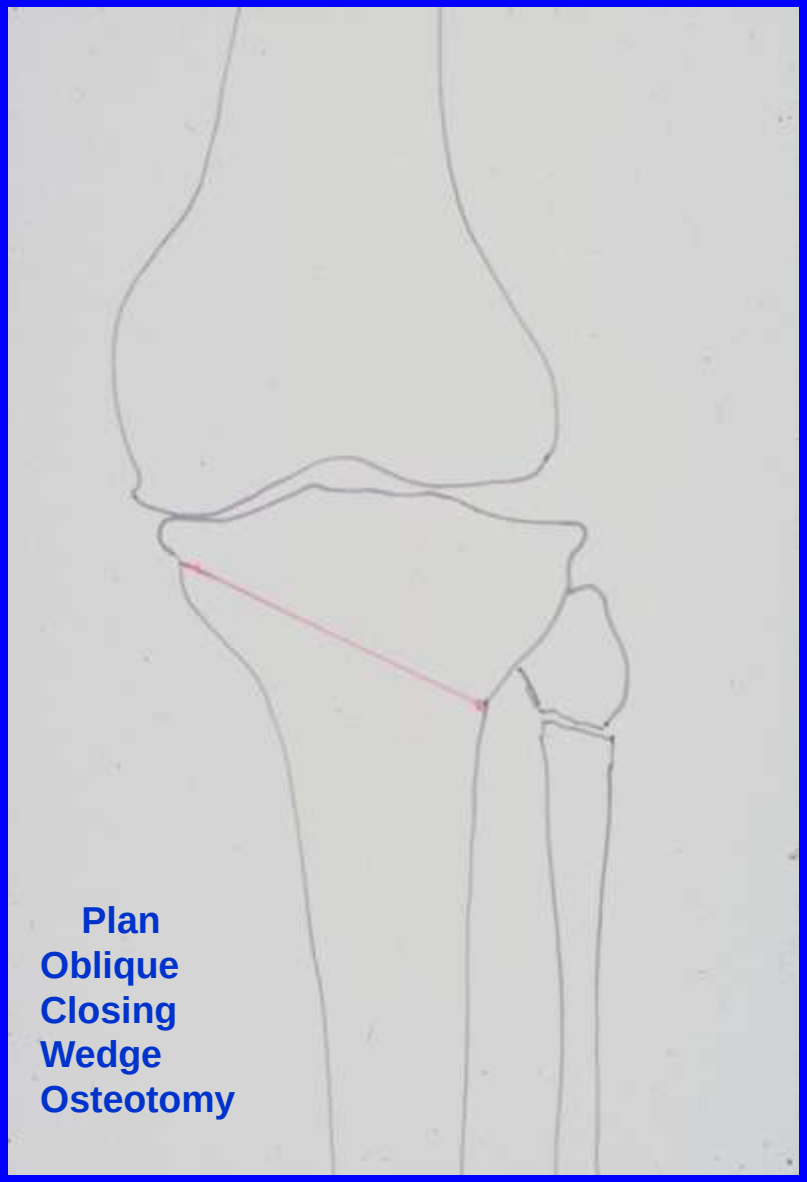


Experiences with Closing Wedge

1991



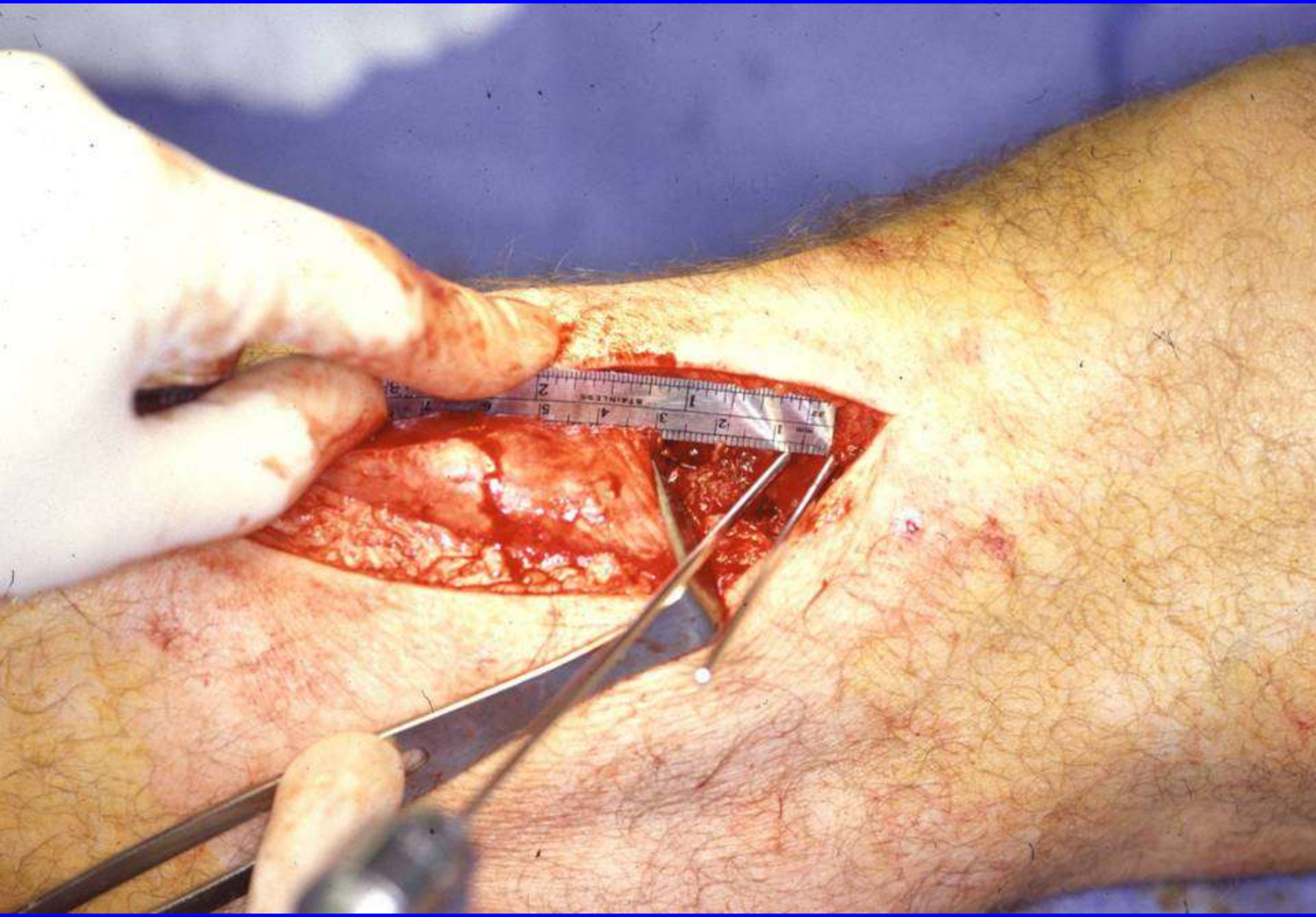
Oblique Closing Wedge Osteotomy Plan


Plan
Oblique
Closing
Wedge
Osteotomy

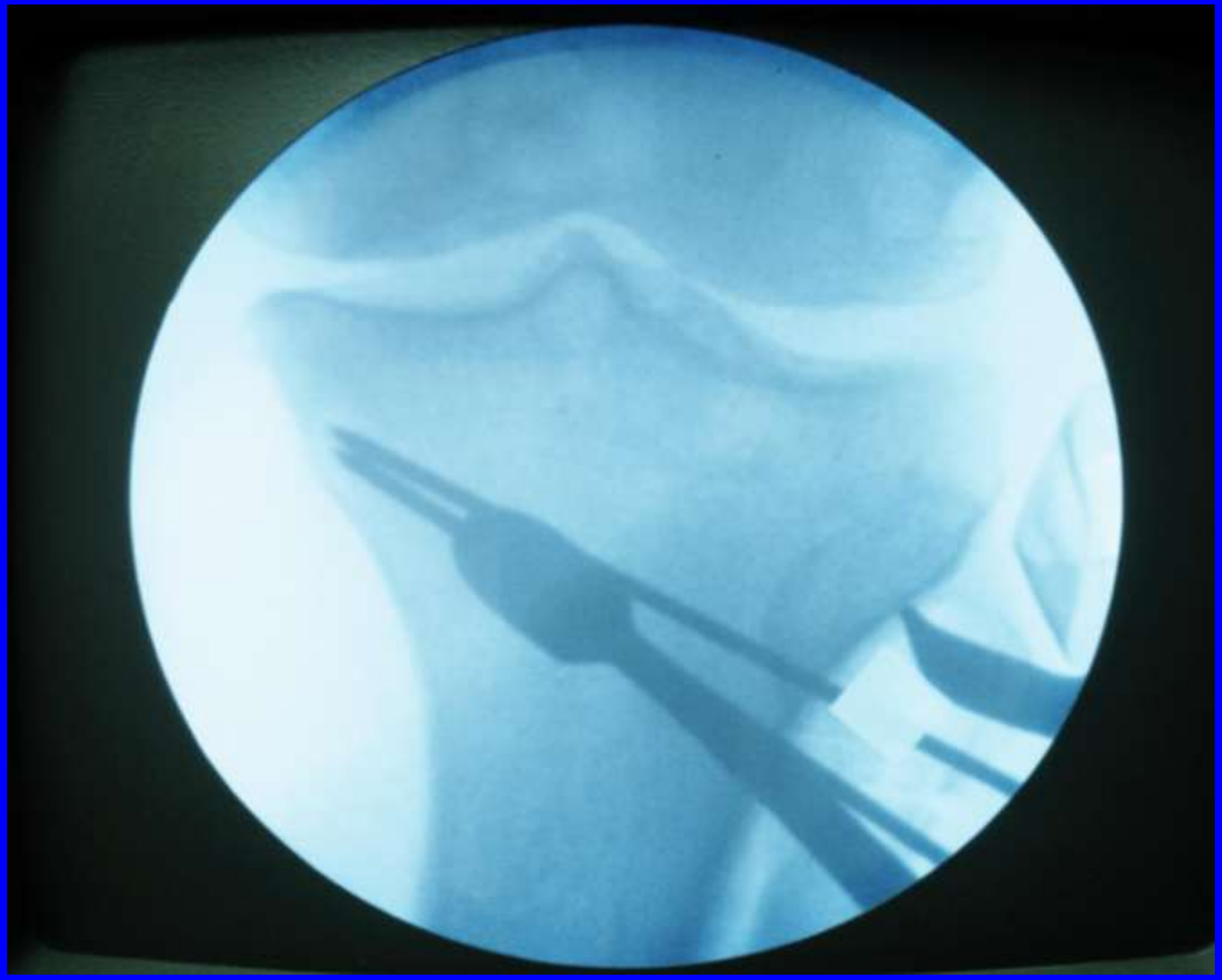

SR
10-25-91
2wks PO
2 Weeks PO

Roll the Pelvis to Put the Knee Joint Axis Horizontal

Be Able to See the Whole Limb and Foot



Use the Image to Know Where your Elevators and Saws Are

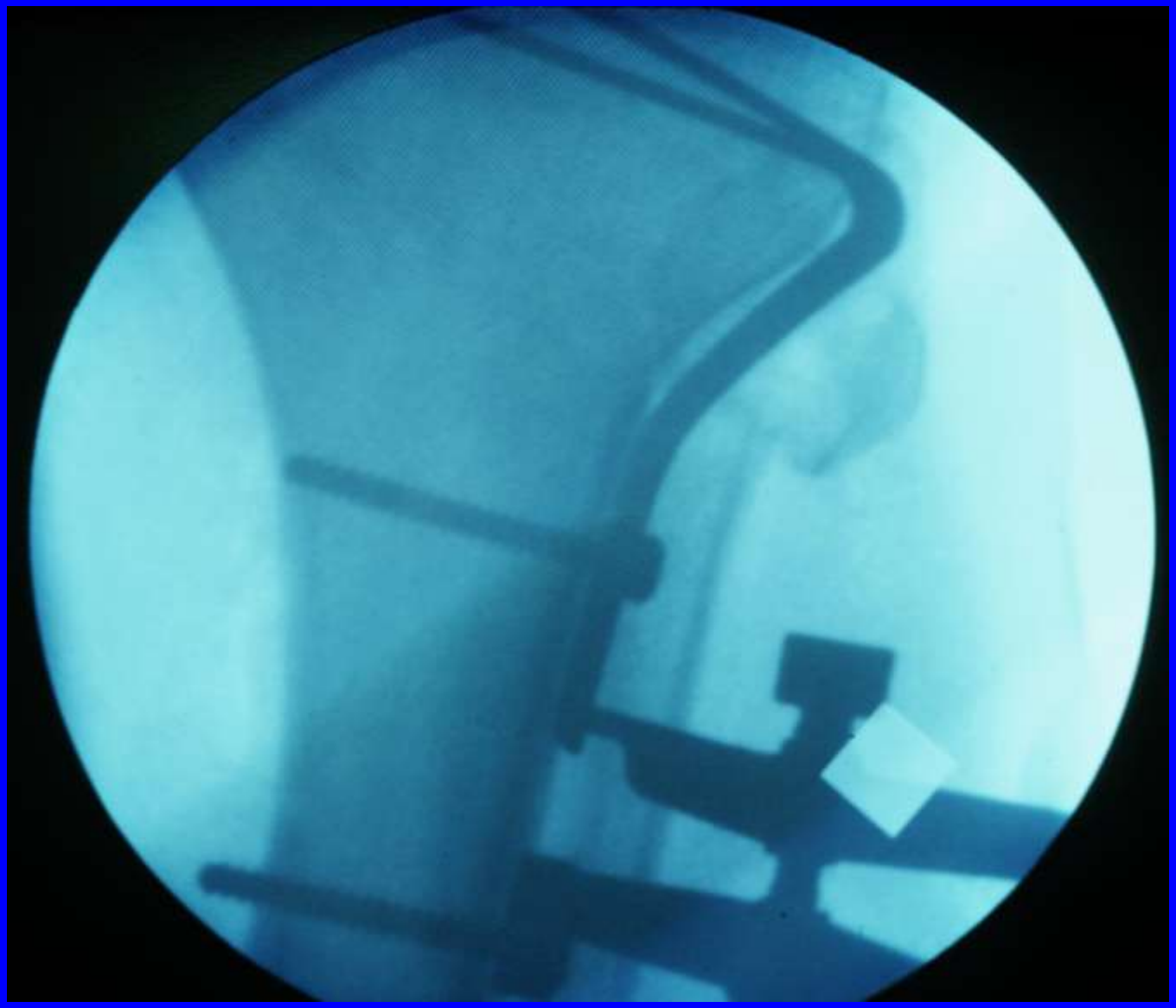


One Type Fixed Angle Blade Plate

Remove the Wedge, Insert the Blade Plate, Close the Wedge

The Articulated Tension Device Is Used to Compress the Cut Surfaces

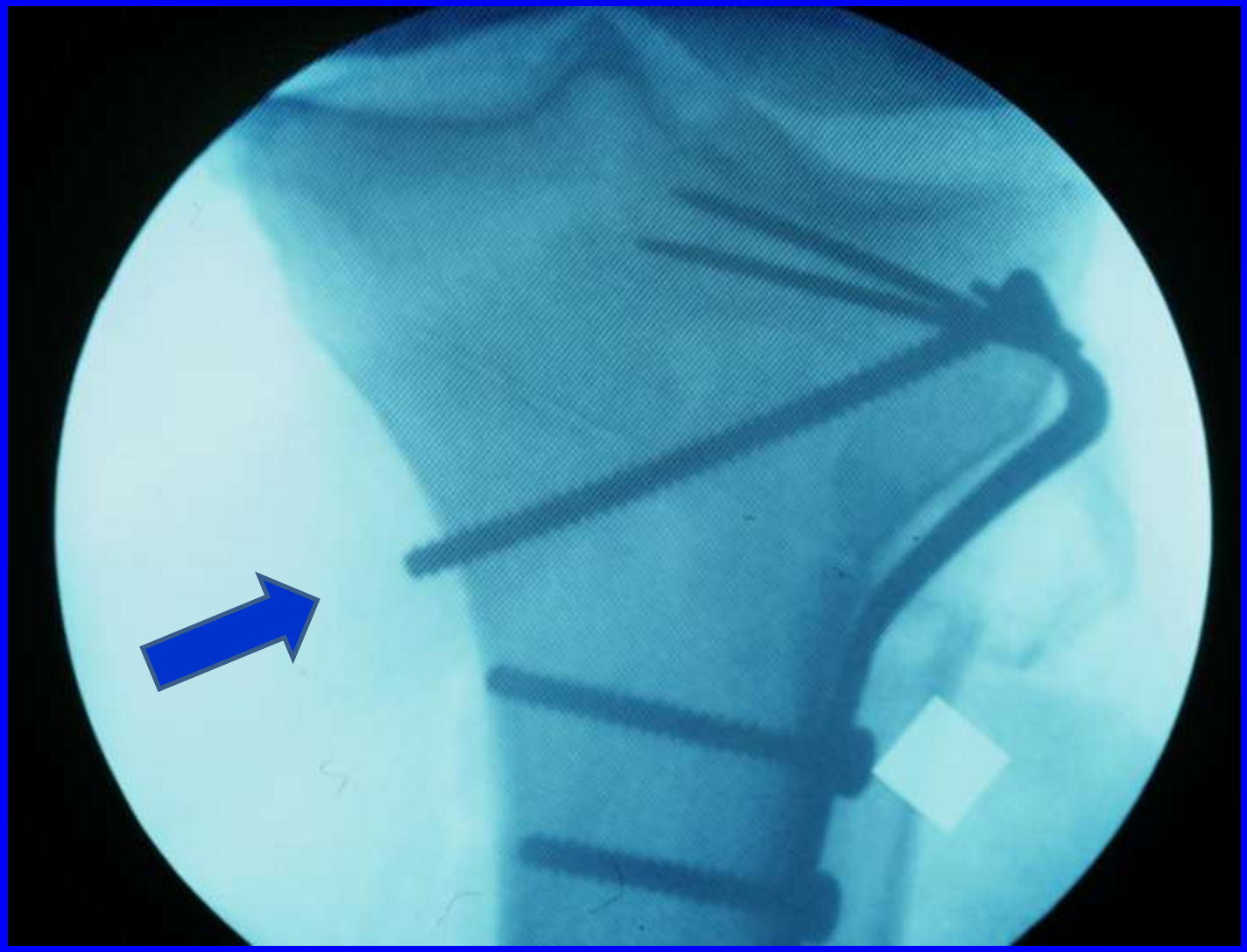
Compress the Osteotomy Surfaces

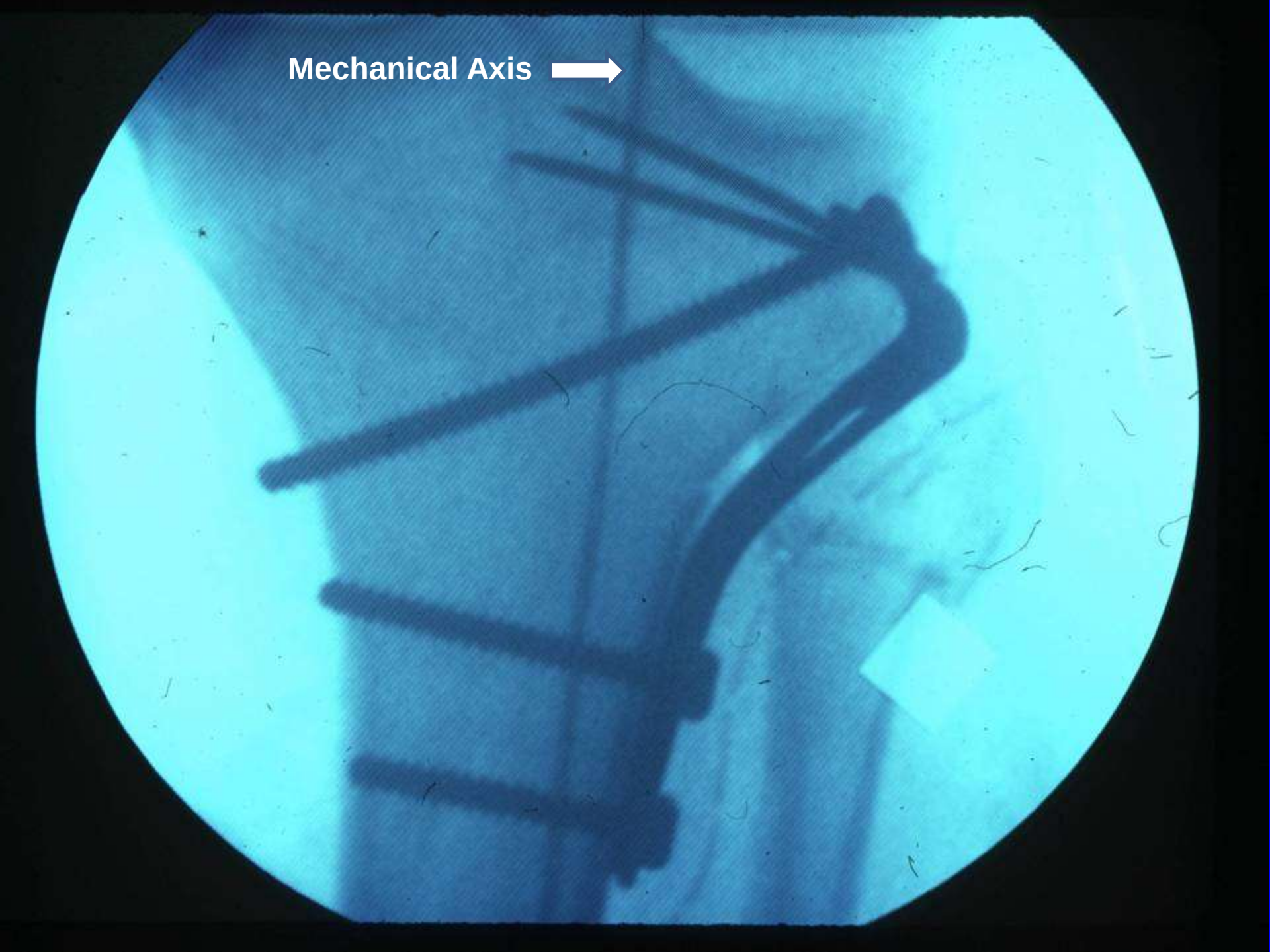


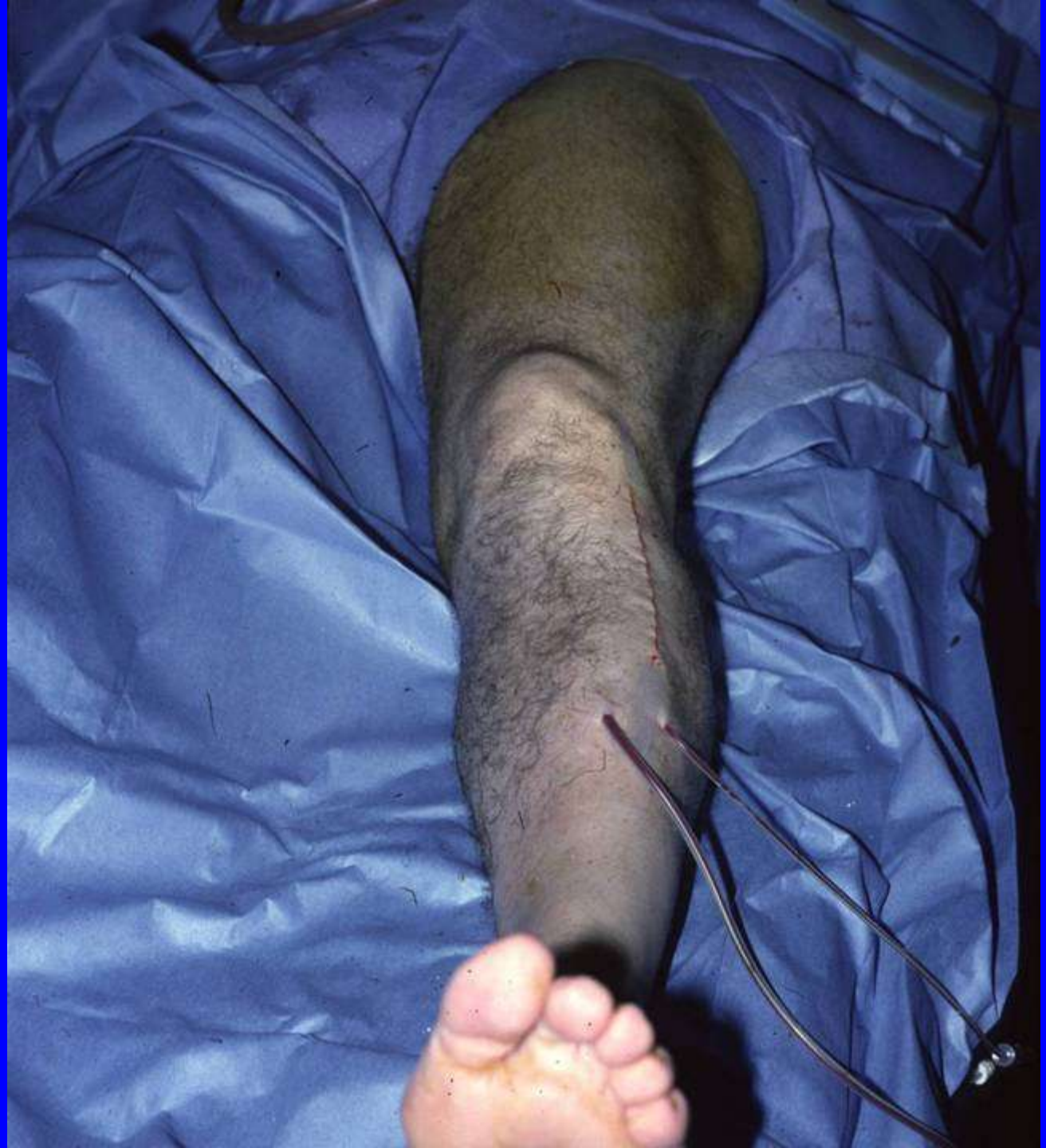
When the Tension applied through the tension device is enough to bend the screw

Then I am confident I have applied enough compression to the osteotomy.

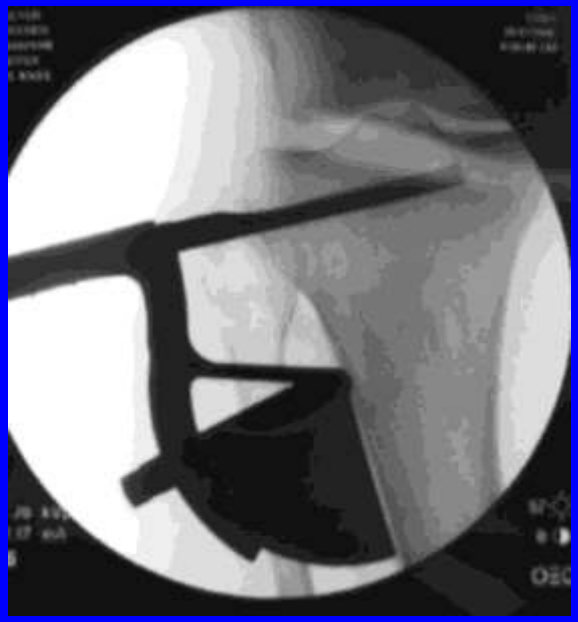
Lag Screws give extra compression




Mechanical Axis



The Angle of Insertion of the Seating Chisel is Altered so the Side Plate will Contact the Shaft after Correction



Examples of Osteotomy

40 Yr Old
steel worker 15yr p menisectomy


14°


KL
10-11-91

47 Yr Old Handball Player

Age 47 in 1986

Adolescent osteotomy blade plate Fixation

3 weeks post op

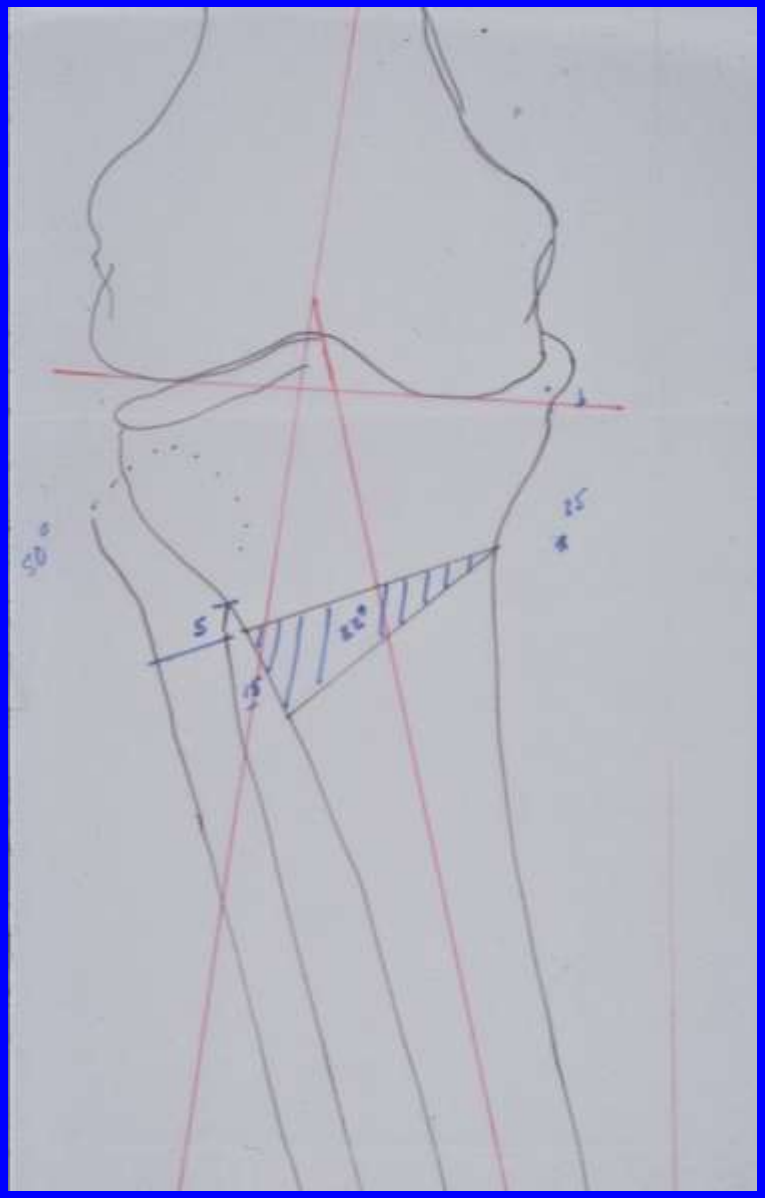
Intact medial cortex provides stability

Still Playing Handball after 23 years

84 year old with friends unhappy with their total knees.

"Will not have a knee arthroplasty!"

A 24° varus knee deformity



Happy with
Result
of 26°
Osteotomy

Wants to correct
other knee


Age 41
Polytrauma
8°


Age 50

- 9 years post op osteotomy
- “Better than pre-op. Not ready for joint replacement”
- “No real complaints”, works all day behind counter at a store

Genu Varum

Left Knee in Varus

Right Limb has had Tibial Osteotomy

Age 65
Until Recently played Tennis every day

Too Painful to Continue playing


“Osteonecrosis MFC”
Pre-op


“Osteonecrosis MFC”
Post op

4 Year Follow-up

Playing tennis daily.

Medial Femoral Condyle Defect has Filled

Alignment is very Sensative

Coventry, Istrup, Wallrichs,
"Proximal Tibial Osteotomy"
JBJS 75:196 (1993)

10 Year Survival Rate After HTO

Ranged from 94% to 63% (31% Difference)
With 8^{o} Tib-Fem Angle vs 5^{o} Tib-Fem Angle

A 3^{o} Difference in Alignment caused a 31% Difference in 10 year survival!

Pat H. is 80 years old, skis all winter but this year was limited because of pain in the right knee.

Osteotomy Left Femur 1987 for Left knee Pain. Unable to ski in 2005 because of Right Knee Pain.

1986

Left Knee at 22 years post osteotomy

No Pain!

1987

Age 55

1989 age 40
Before
Osteotomy

1989

2004
15 Years After
Osteotomy
No Knee Complaints

Medial Valgus Opening Wedge Osteotomy

1. Classic Paper – Hernigou 1987
2. MCL must be released
3. Multiplanar correction easier but Malalignment also easier
4. However - No improvement in Accuracy – Marti 2004

Opening Wedge

Advantages

1. Only One Cut
2. Small Adjustments of Opening Wedge are possible
3. Tomofix Allows Earlier Weight Bearing

Disadvantages

1. Slower Healing
2. Med Col Lig Release

Opening Wedge Osteotomy Stretches the Soft Tissue

At Medial Tibia the MCL gets tight

At Lateral Femur the IT Band gets tight

MCL: The Medial Compartment Loading is Increased with Medial Opening Wedge Valgus Osteotomy Unless the MCL is Released

Agneskirchner *Arthroscopy* 23:852-861 (2007)

But

The MCL is Necessary to Decrease the Potential of Late Valgus Instability

Pape: *Knee Surg Sports Trauma Arthroscopy* 14:141 (2006)

"Proximal Tibial Osteotomy for Osteoarthritis with Varus Deformity. A Ten to Thirteen-year Follow-up Study"

93 knees

Mean Follow-up 11.5 years

73% Undercorrected, 5% Overcorrected, 22% Desired

90% Excellent or Good at 5 years

But only 45% were Excellent or Good at 10 years

Of the 22% with the desired post-op correction (3-6^{o} overcorrection)

These were good at 11.5 year follow-up

Hernigou: *J.B.J.S.* 69A332-354 (1987)

The Problem with Osteotomy is

Obtaining and Maintaining the Desired Correction

(3^{o} - 6^{o} Correction Beyond the Normal Mechanical Axis)

Open Wedge Valgus Osteotomy Pivots around one point Laterally

There is only one point at which to pivot and obtain a pure valglus correction

Open anterior to that point and a valgus, flexion and rotation occurs
Open posteriorly to that point and a valgus, extension and rotation occurs

There is no clinical way to determine that spot at surgery

"Accuracy of Frontal and Sagittal Plane Correction in Open-Wedge High Tibial Osteotomy"

Of 38 opening wedge High Tibial Osteotomies

Only 50% Ended with Desired Correction

31% Were Undercorrected

19% Were Overcorrected

Marti, Gautier, Wachtl, Jakob *Arthroscopy* 20:366-372 (2004)

Medial Tibia

Most Patients want Their Plates Removed

Other Complications

Under Correction
Inadequate Medial Buttress
Collapse into Varus

Overcorrection

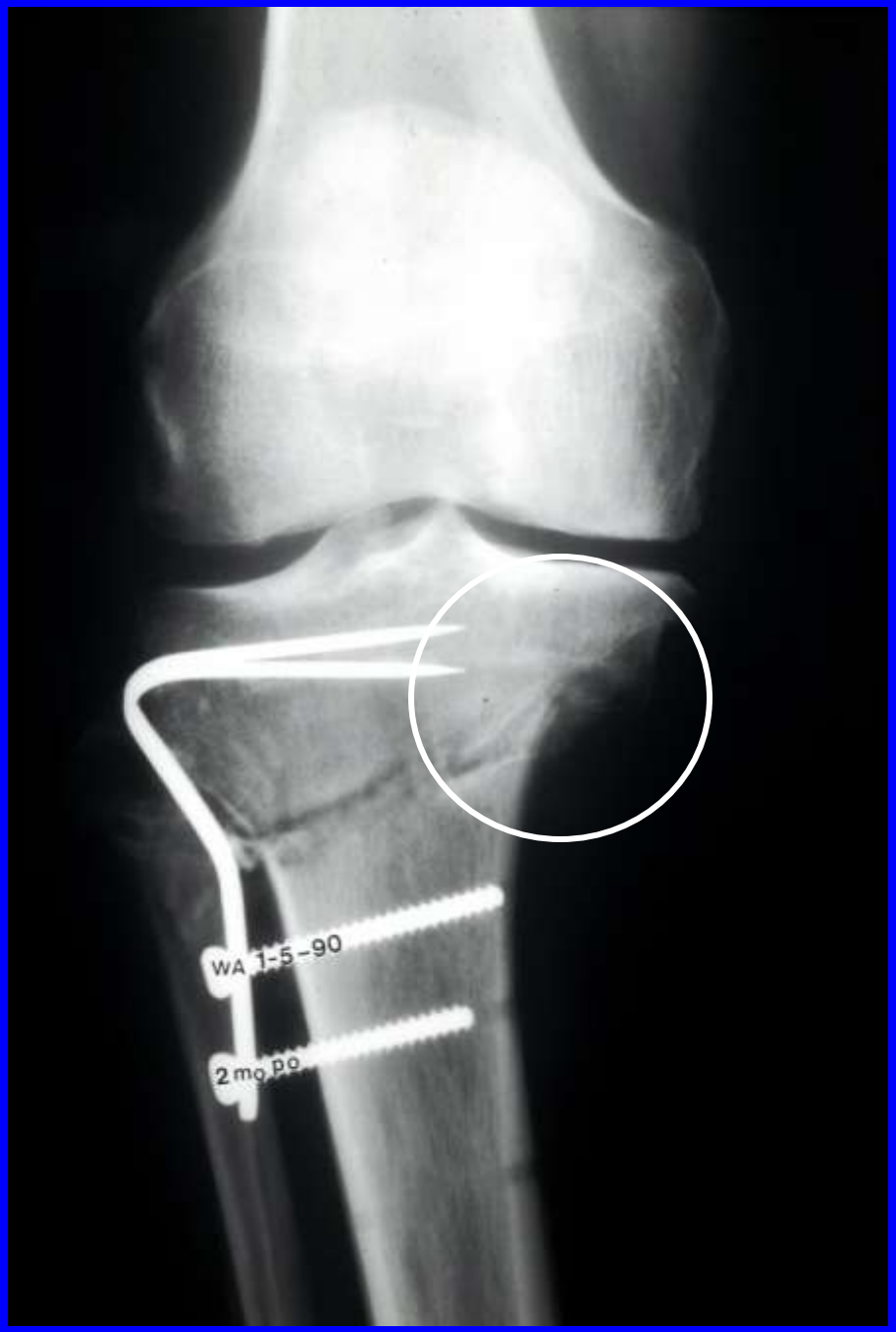
12 months with
Circular Frame

Overcorrection

Due to Opening of the Medial Cortex When Lateral Cortex is Compressed

Medial lag screw to compensate for fractured medial cortex

Note healing at lag screw 6 wks post op



2 mo. Post op

Distal Medial Cortex has collapsed into medial proximal fragment.

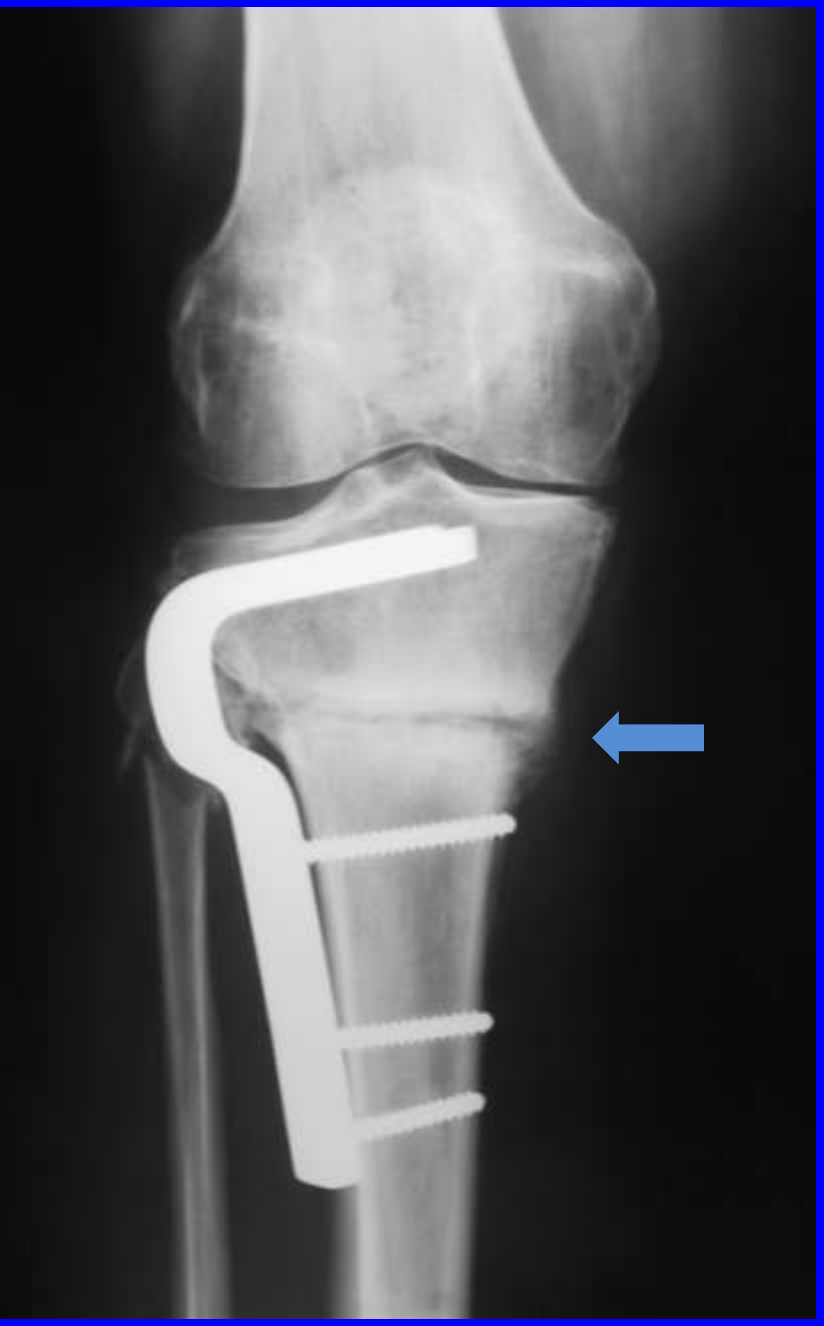
4 mo post-op reapplication of compression without changing blade,

Note how blade was pulled down laterally

Long screws were necessary to reach far cortex when the plate was off the lateral cortex

Pain 1 Year after opening wedge osteotomy with "Orthofix" external Fixator

Gross Motion with stress radiographs



3 weeks After compression of Non-Union

No Pain

Medial callus beginning to calcify

4 mo post-op Varus Collapse

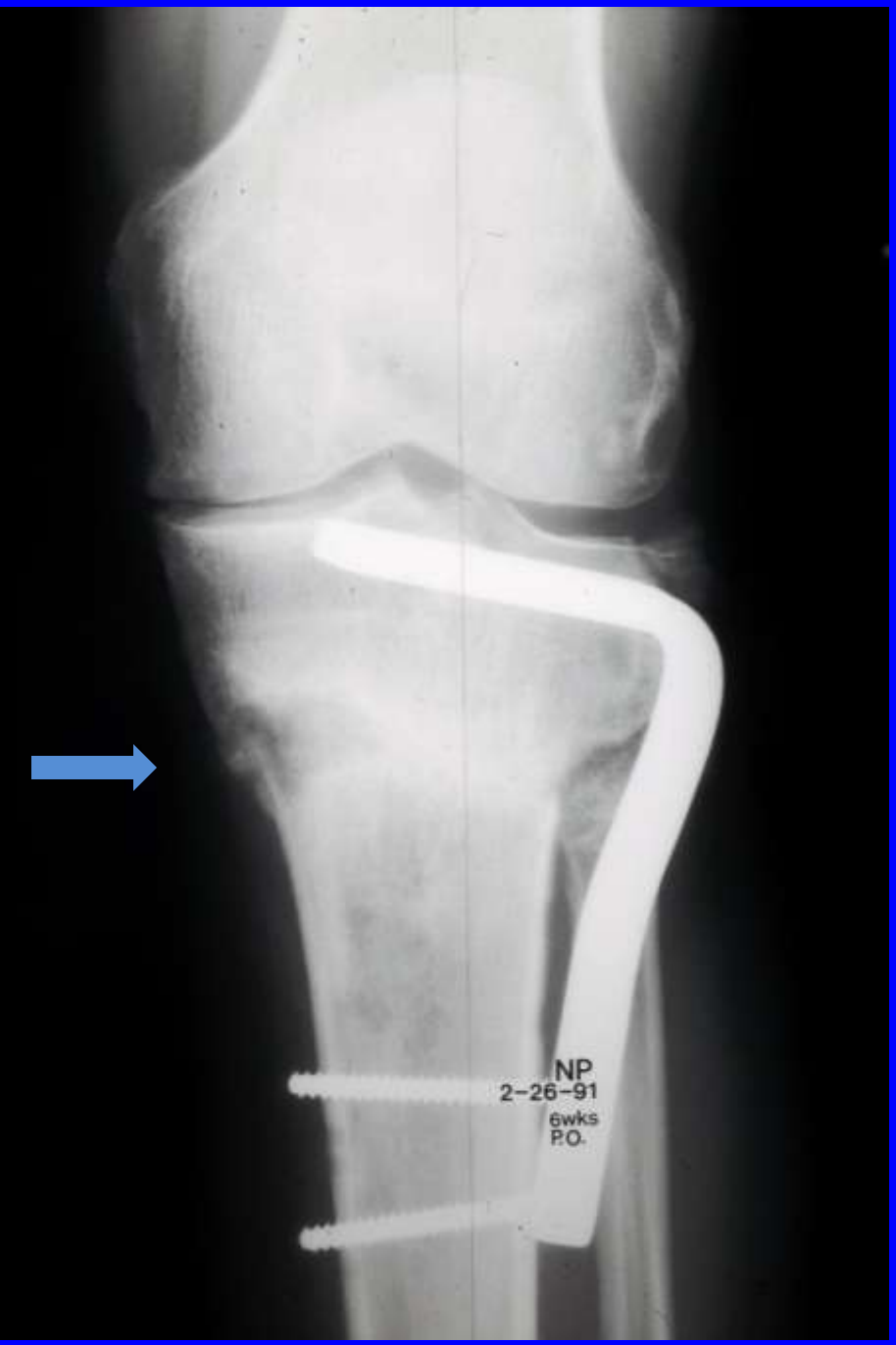
Return to Surgery due to loss of correction

3 weeks post op
recompress laterally

No Pain

Note Gap Medially

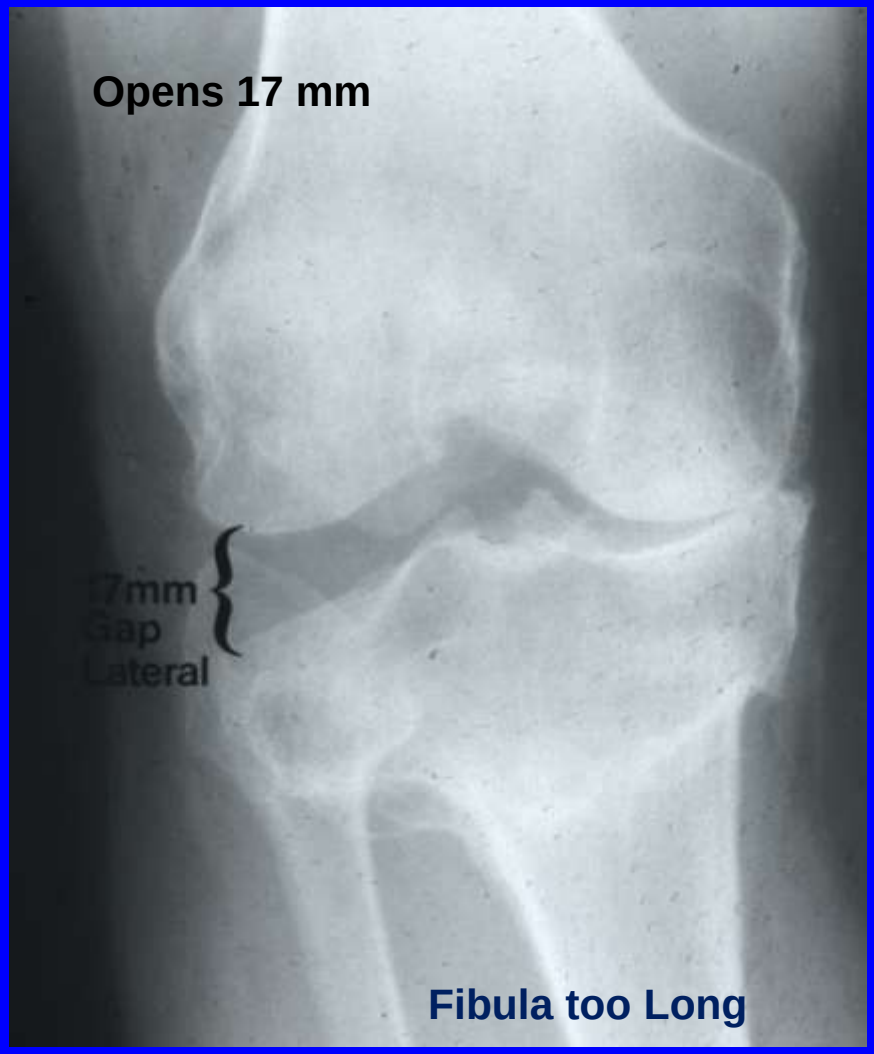
From opening 2nd to lateral compression



6 weeks post recompression of delayed union

Medial Callus has calcified filling defect

Gross Instability and Pain
3 years post HTO - Stress Radiographs
10mm increased lateral opening



Stability and Alignment regained by Shortening Fibula

Recurvatum

- Remove more bone anteriorly from a closing wedge

  Or

- Insert Plate too Anterior so more anterior compression

Rotational Deformity

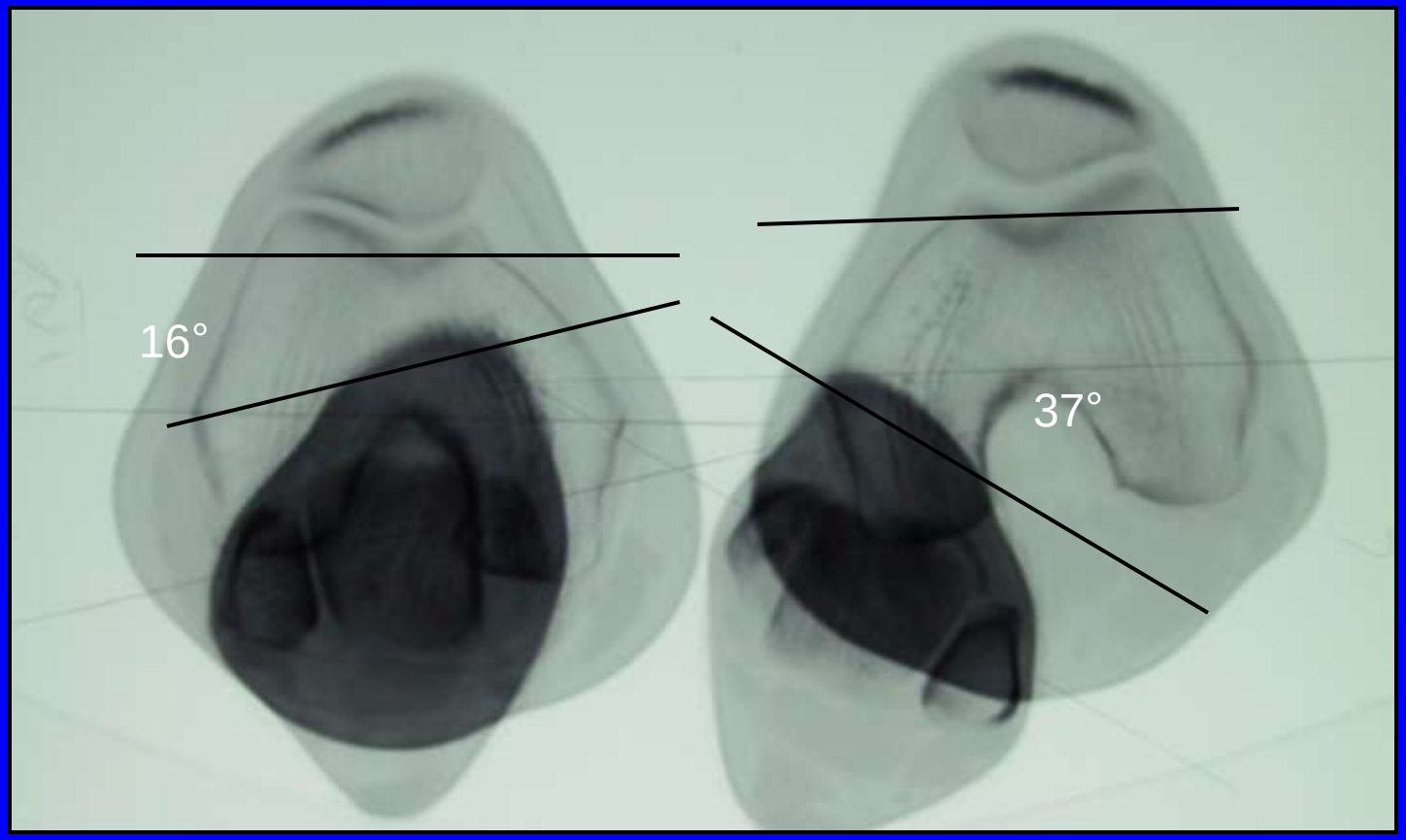
- Improper Blade Insertion
- Oblique Osteotomy Direction

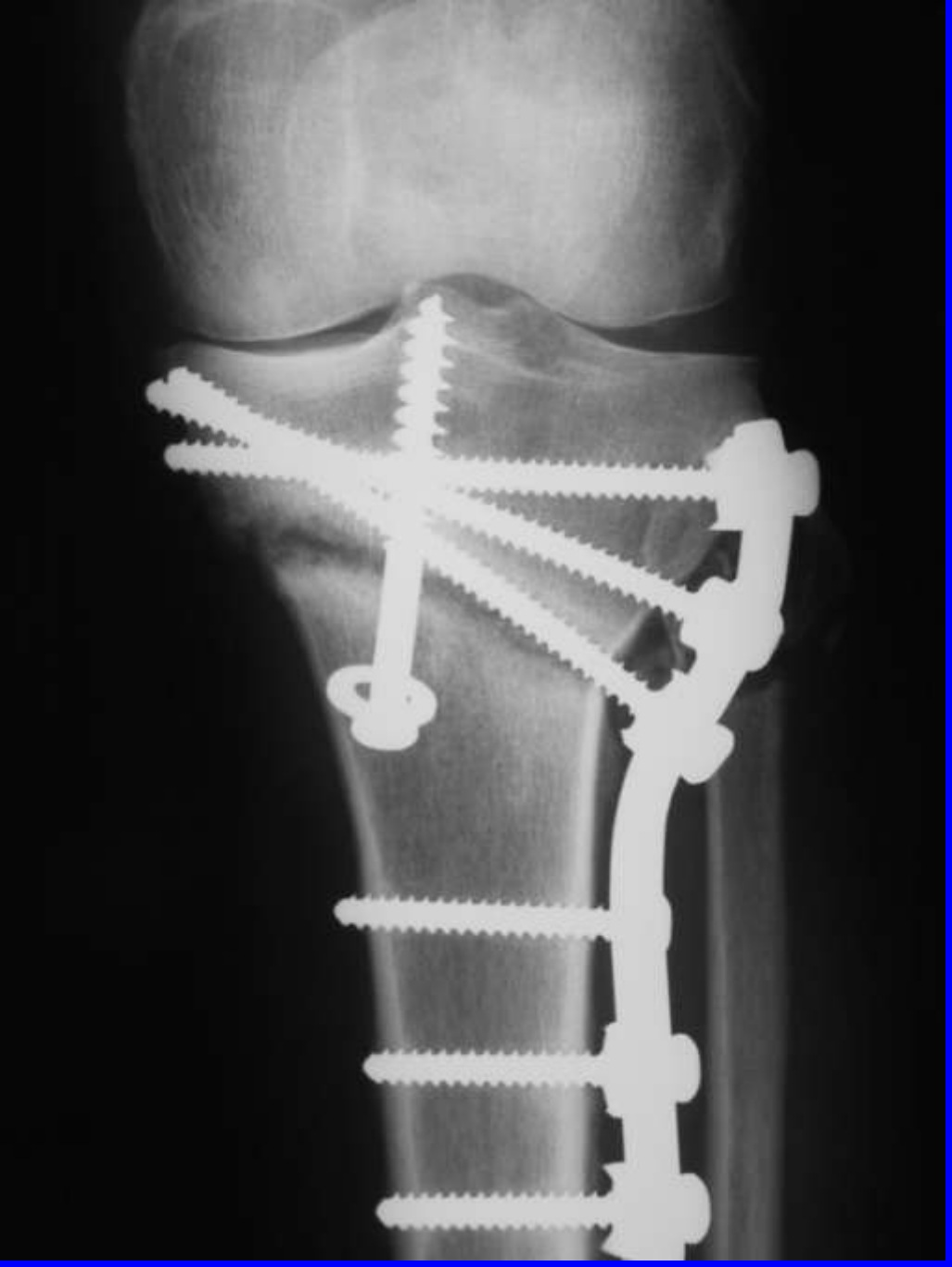
This patient had Persistent Tripping and Instability post HTO.

Frontal Alignment correction is Good

Rotation Malunion Measured on CT

Corrected with 20^{o} ER Osteotomy





Locked Plate

No Union at 5 mo post osteotomy

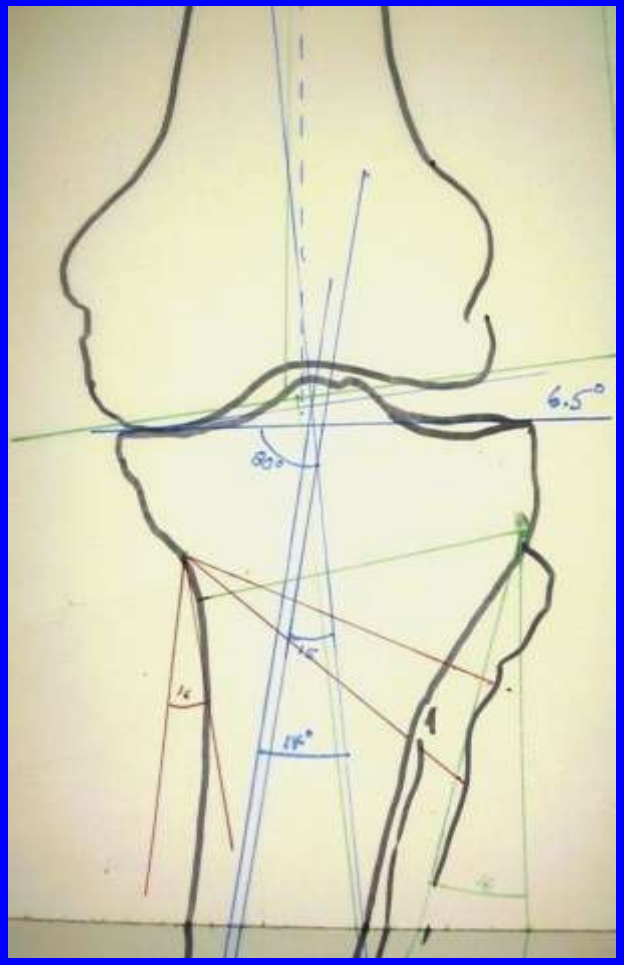
The **Same Plate was used to re-compress the osteotomy plane by Distal Tension.**

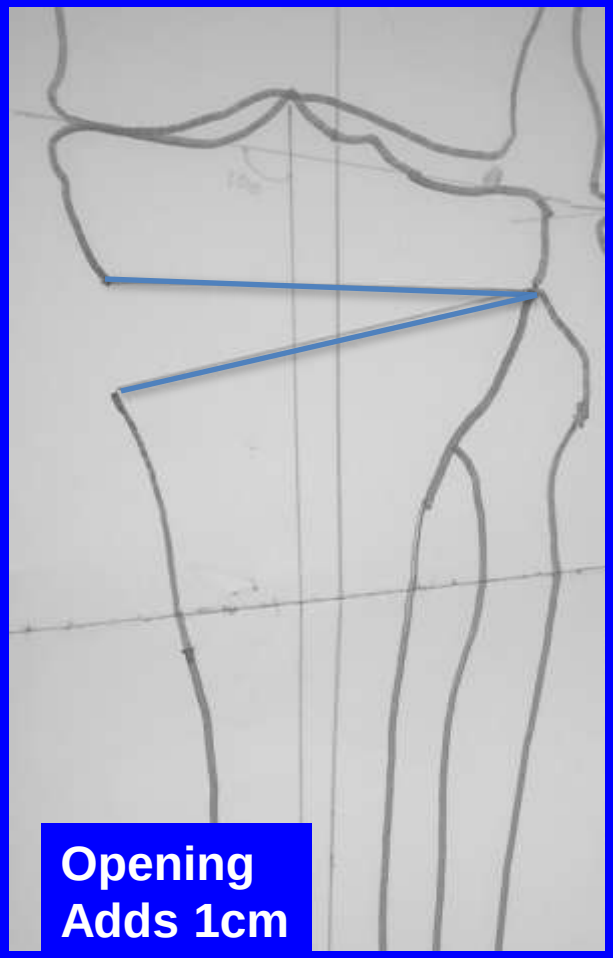
- **Note change in location of plate and bending of s.s. screws by pulling down the lateral cortex**

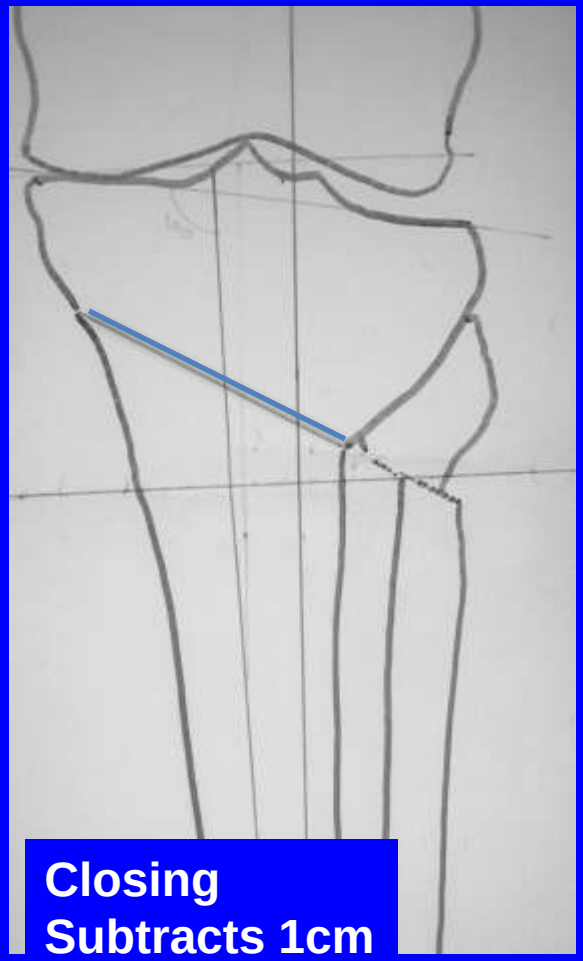
26^{o} Posterior Tibial Slope

Lacks 20^{o} Knee Extension After Opening Wedge and Puddu Plate

This 16° Correction either increases or decreases the limb length 1cm







A Good Osteotomy
is very Good

A Poor Osteotomoy
is very Poor