TOTAL KNEE ARTHROPLASTY

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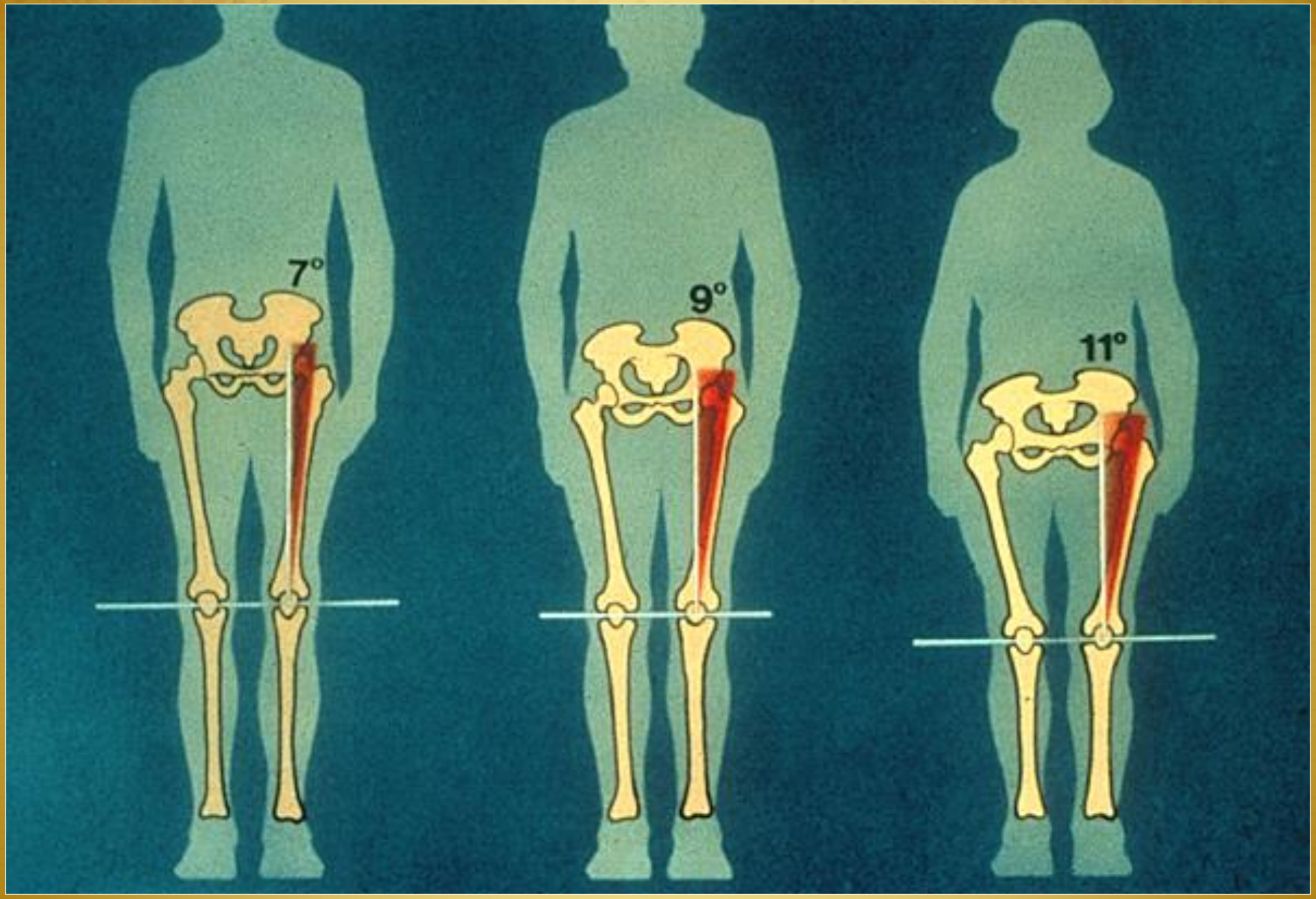
Total Knee Arthroplasty

- Goal
  - Restore mechanical alignment
  - Restore joint line
  - Balancing ligament
  - Maintaining or restoring a normal Q angle

Normal Knee Anatomy

- Position in single leg stance
- Mechanical axis valgus 3°
- Femoral shaft axis valgus 6°
- Proximal tibia varus 3°


7°
9°
11°

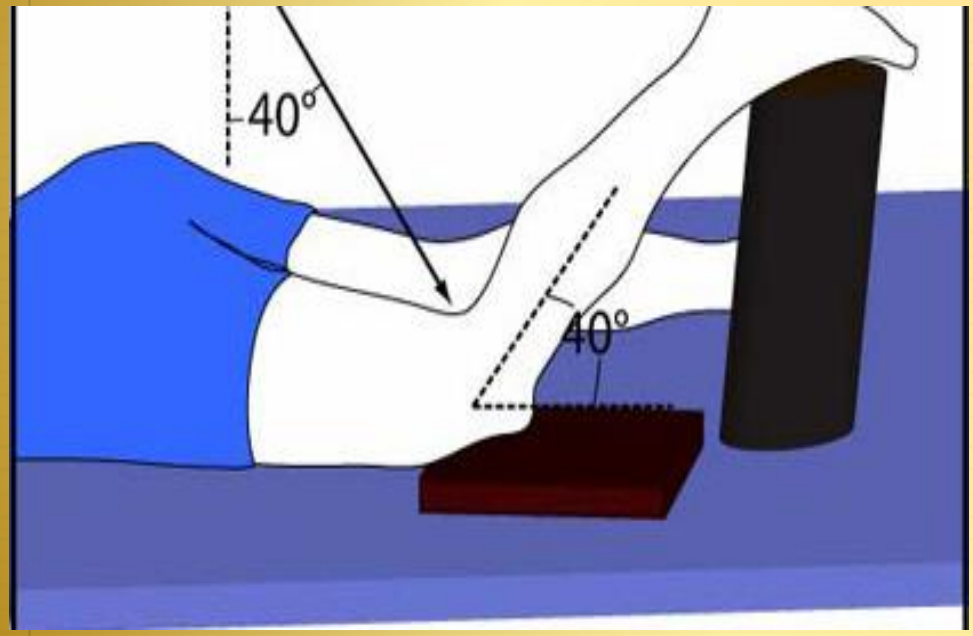
Total Knee Arthroplasty

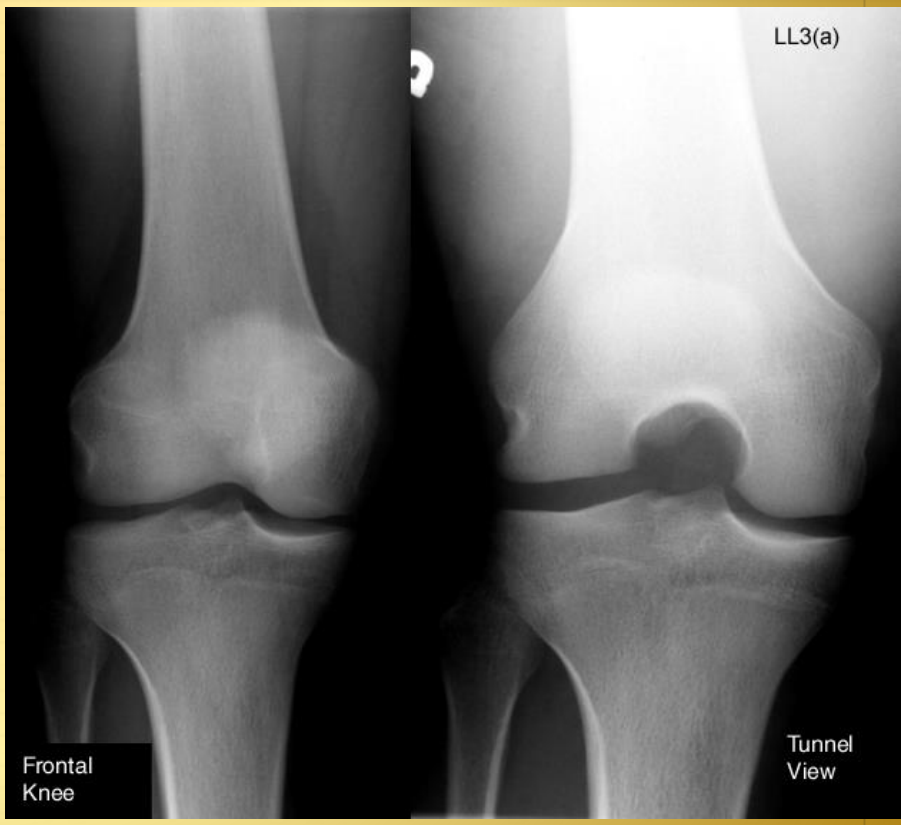
- Radiographic Evaluation
  - Standing full length – AP from hip to ankle when angular deformity is present
  - Standing AP
  - Lateral view Extension/Flexion laterals
  - Tunnel view
  - Sunrise view

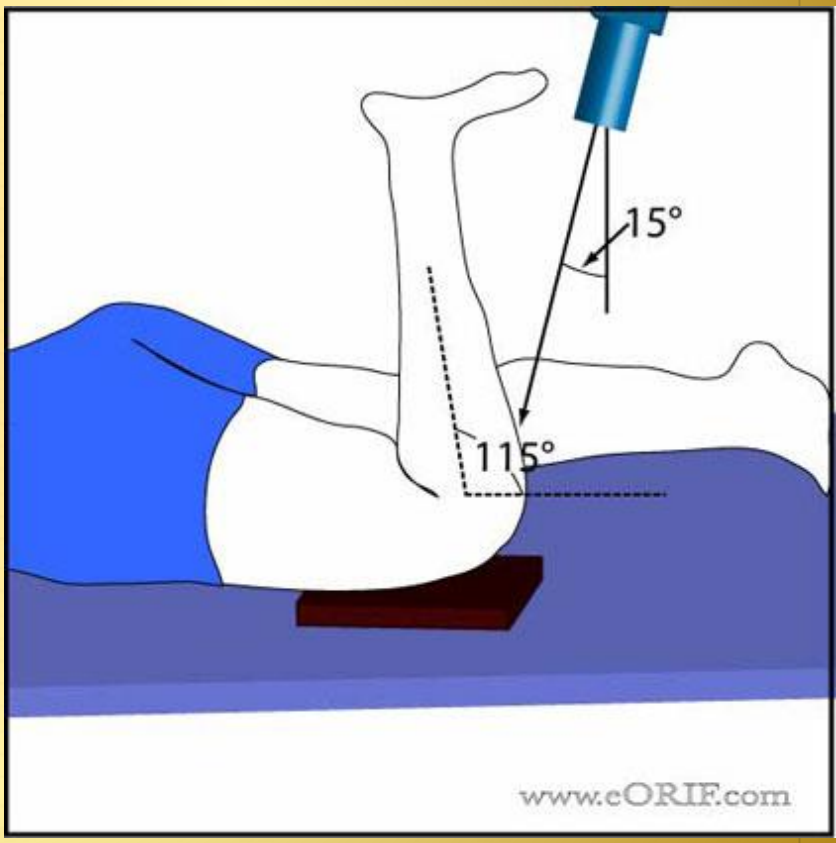
Total Knee Arthroplasty

- Radiographic Evaluation
- Weight Bearing X-rays
  - Extent of joint space narrowing
  - Ligament stretch out
  - Subluxation of femur on tibia

Lateral Flexion and Extention


40°
40°


LL3(a)
Frontal
Knee
Tunnel
View


15°
115°
www.eORIF.com

Total Knee Arthroplasty

- Radiographic Analysis
- Anatomic Axis – Femur

  Line that bisects the medullary canal of the femur

  Determines the entry point of the femoral medullary guide rod
- Mechanical Axis – Femur (MAF)

  A line from center of femoral head to center of distal femur

Total Knee Arthroplasty

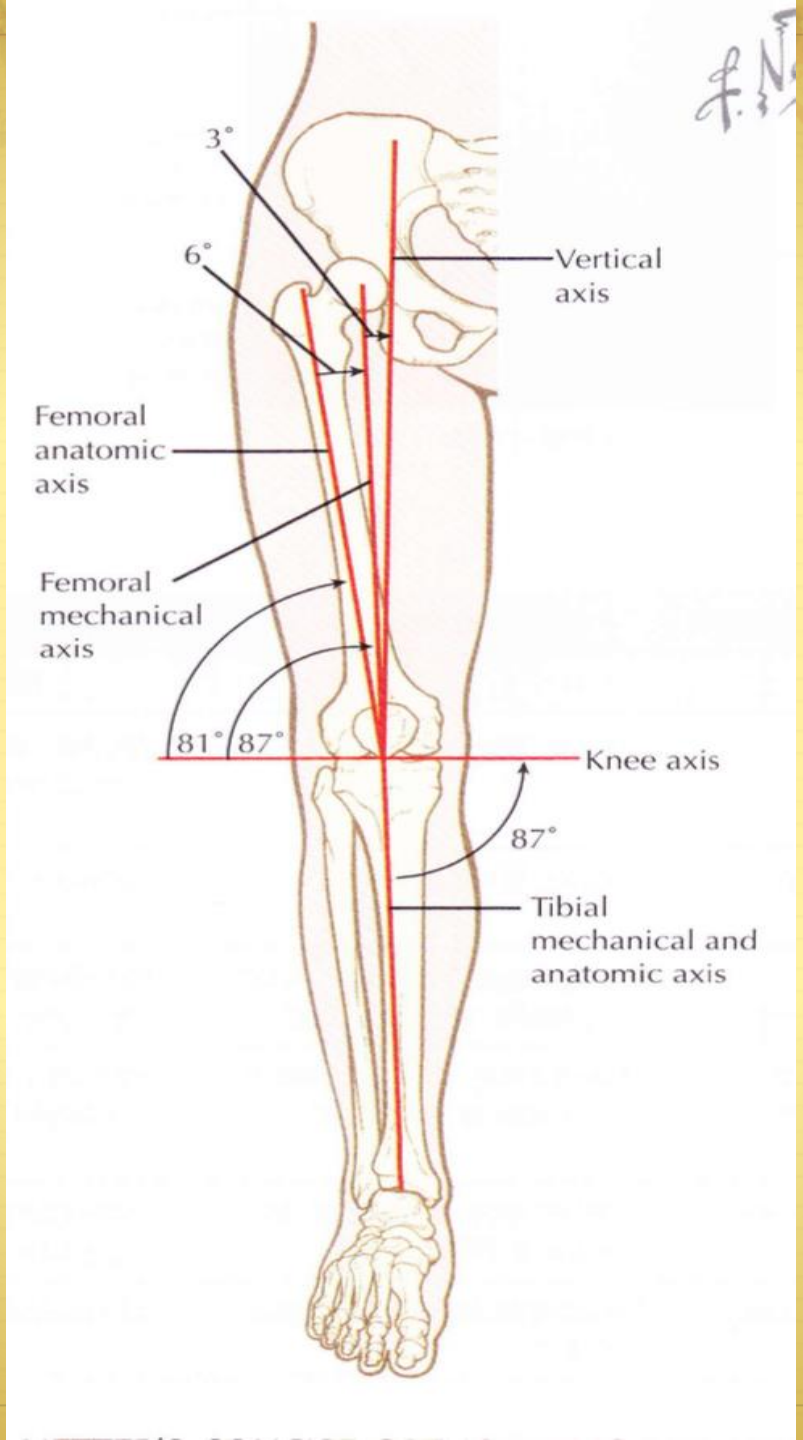
- Radiographic Analysis
- Anatomic Axis Tibia (AAT)

  A line that bisects the medullary canal of the tibia

  Determines the entry point of the guide rod
- Mechanical Axis – Tibia (MAT)

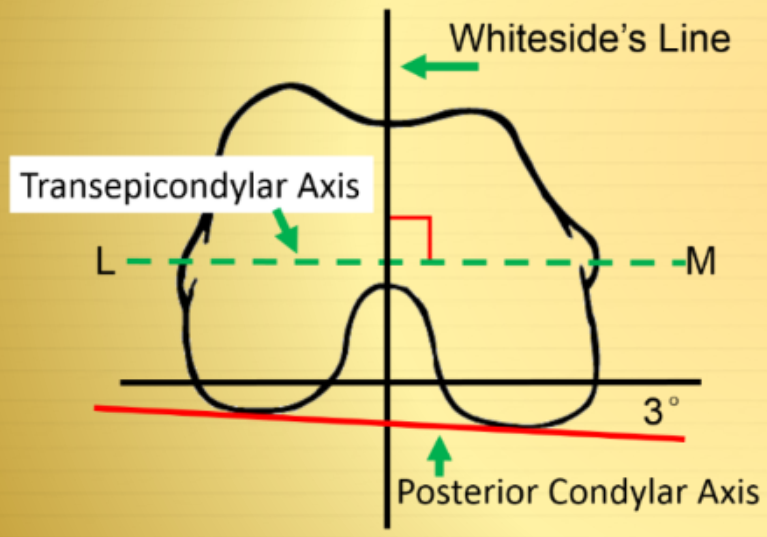
  Line from center of proximal tibia to center of ankle

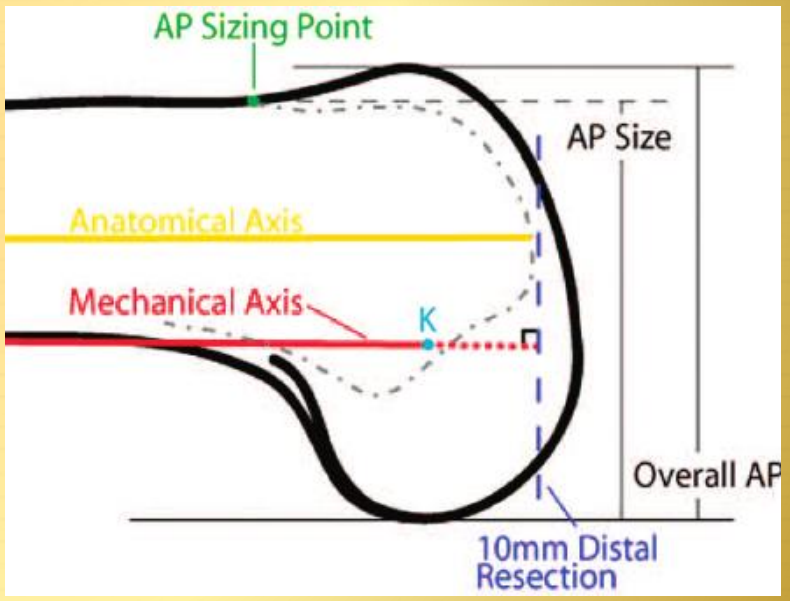
  Proximal tibia is cut perpendicular to (MAT)

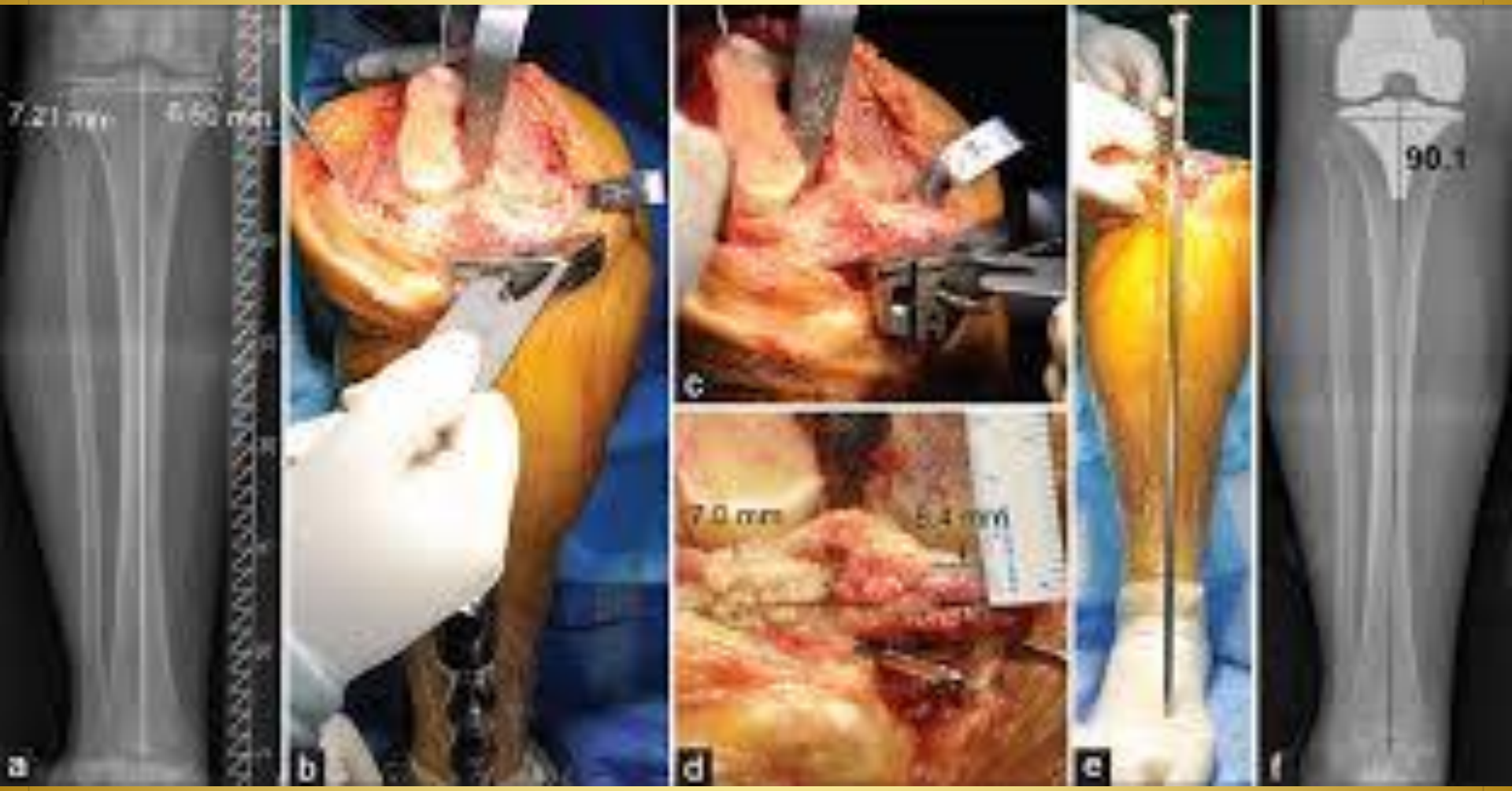

3°
6°
Vertical axis
Femoral anatomic axis
Femoral mechanical axis
81°
87°
Knee axis
87°
Tibial mechanical and anatomic axis

Issues with Surgical Techniques

- Traditional Joint Line Orientation
  - Tibial cut perpendicular to the MAT
  - Femoral shaft at a valgus angle 5° to 8° valgus based off the long standing x-ray


Whiteside's Line
Transepicondylar Axis
L
M
3°
Posterior Condylar Axis


AP Sizing Point
AP Size
Anatomical Axis
Mechanical Axis
K
Overall AP
10mm Distal Resection


7.21 mm
6.60 mm
a
b
c
7.0 mm
5.4 mm
d
e
90.1
f

Restoring the Joint Line

- Using cutting jigs , but the surgeon should always double check cuts and alignment. If there is bone defect, if it is small< 1 cm deep it can be filled with cement, if it is big using bone graft.

Ligament Balancing

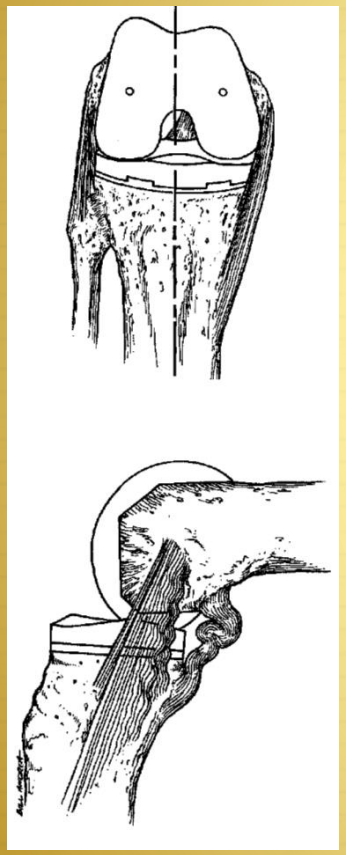
In degenerative process ligament become scarred and contracted or become streched for excessive bowing deformities. The balancing should be achieved in coronal and sagital planes

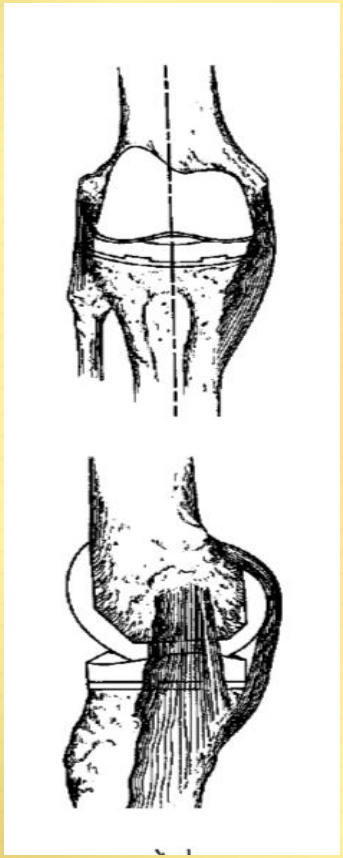
- Coronal plane (valgus and varus deformity)

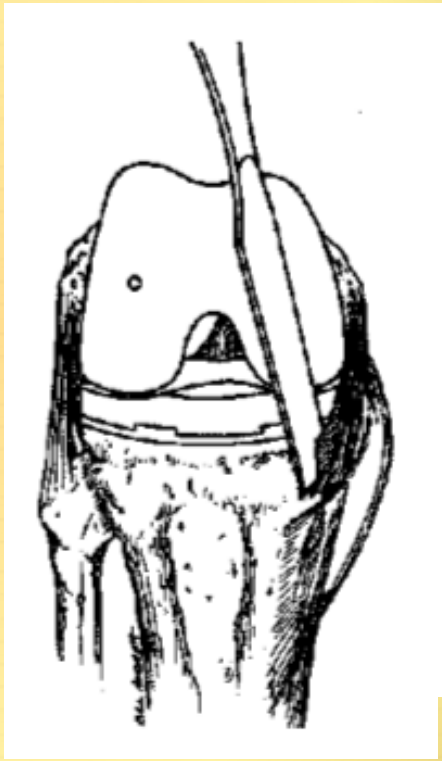
Principle is release the concave side and fill up the convex side.

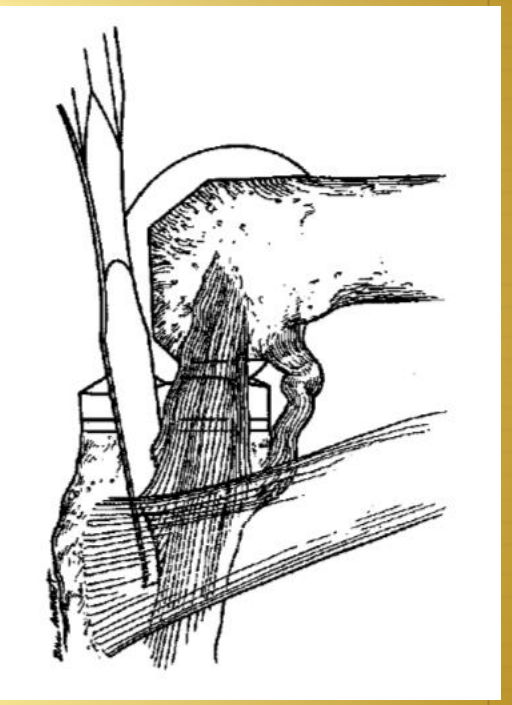
- Varus
  - Osteophyte release
  - Deep medial collateral ligament to be symetrical
  - Release the posteromedial corner with the semimembranosus muscle.
  - Subperiosteal elevation of the superficial MCL and pes anserinus complex
  - PCL release

Tight Medially in Flexion
Loose in Extention



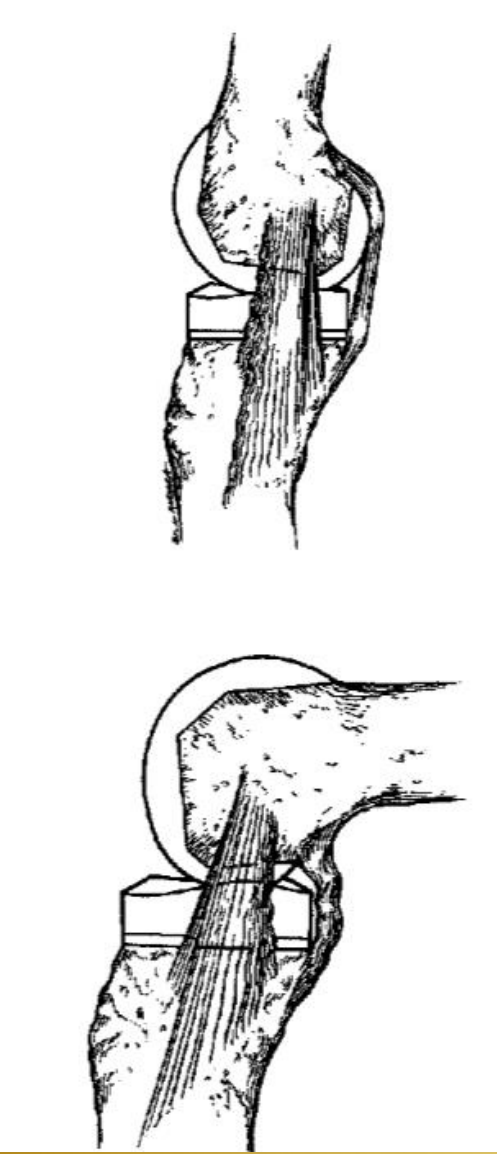


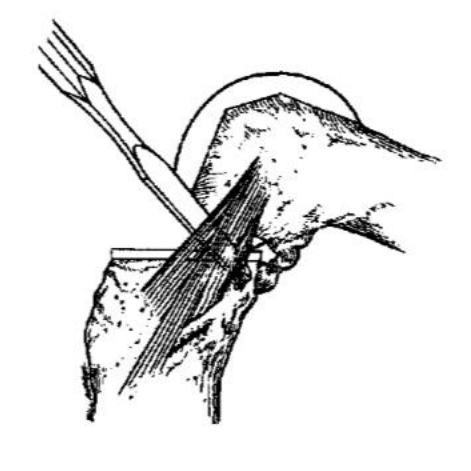




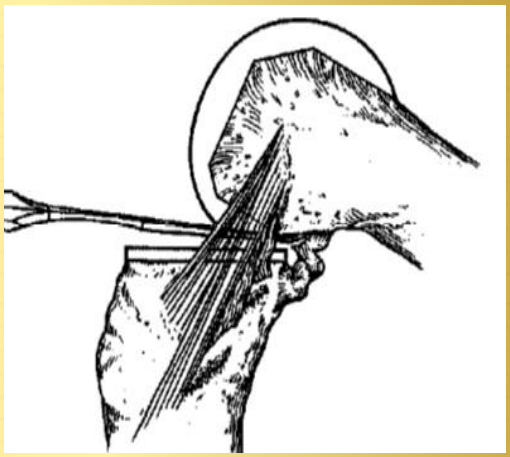
Release the anteromedial portion of MCL while Knee bend 90^{o}, subperiorteally while keep pes anserius remain intact

Tight Medially in Extention, Balanced in Flexion



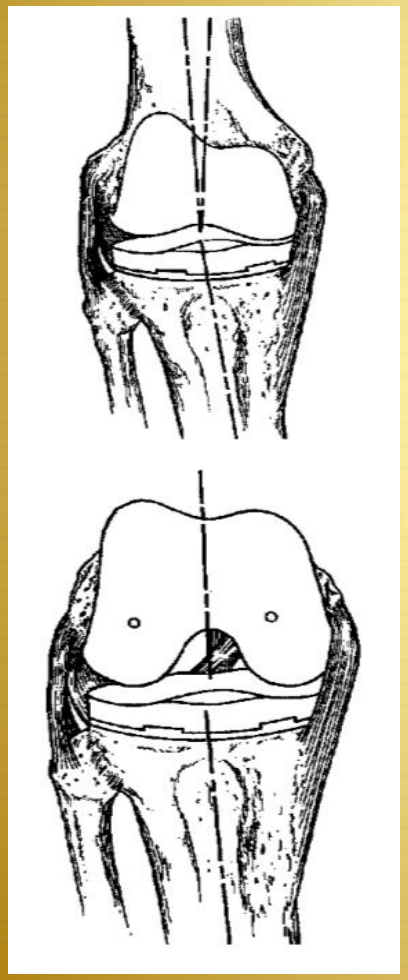


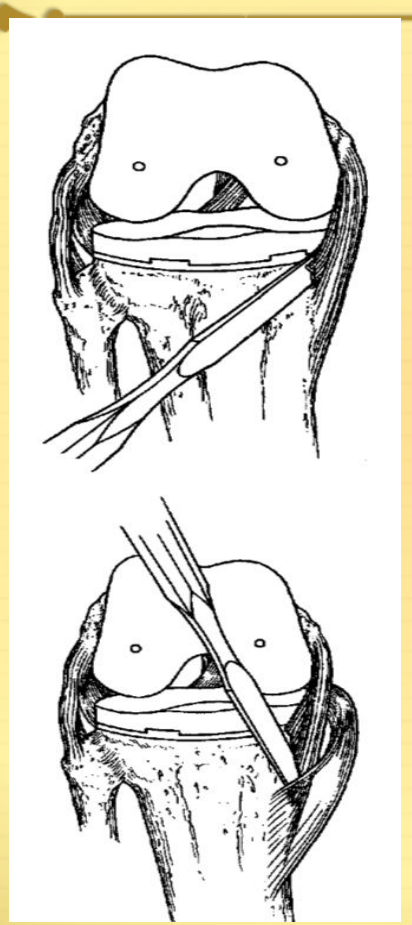
Release posterior Portion of MCL

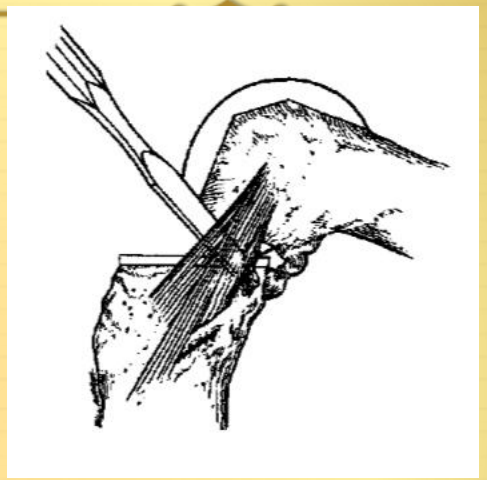


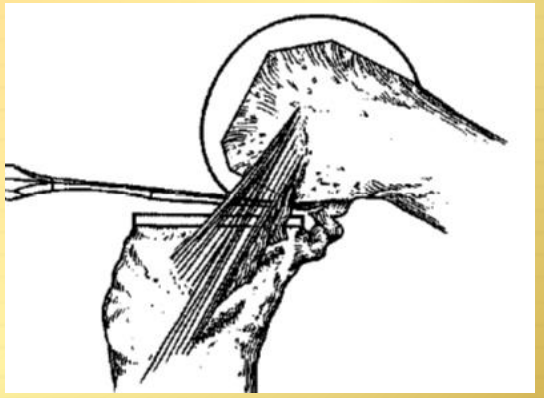
Release posterior medial capsule

Tight Medially in Flexion and Extention



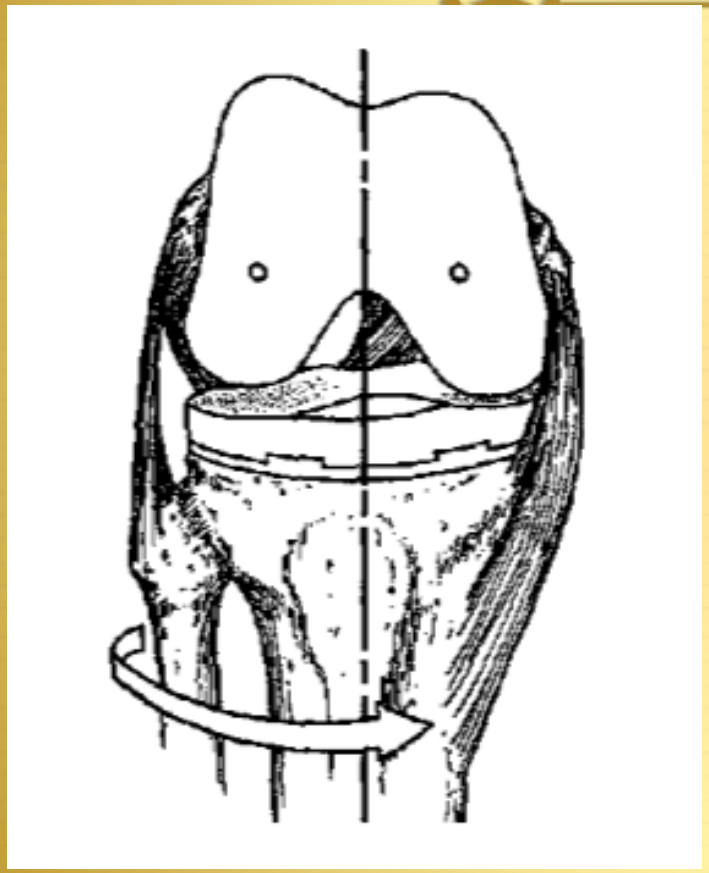


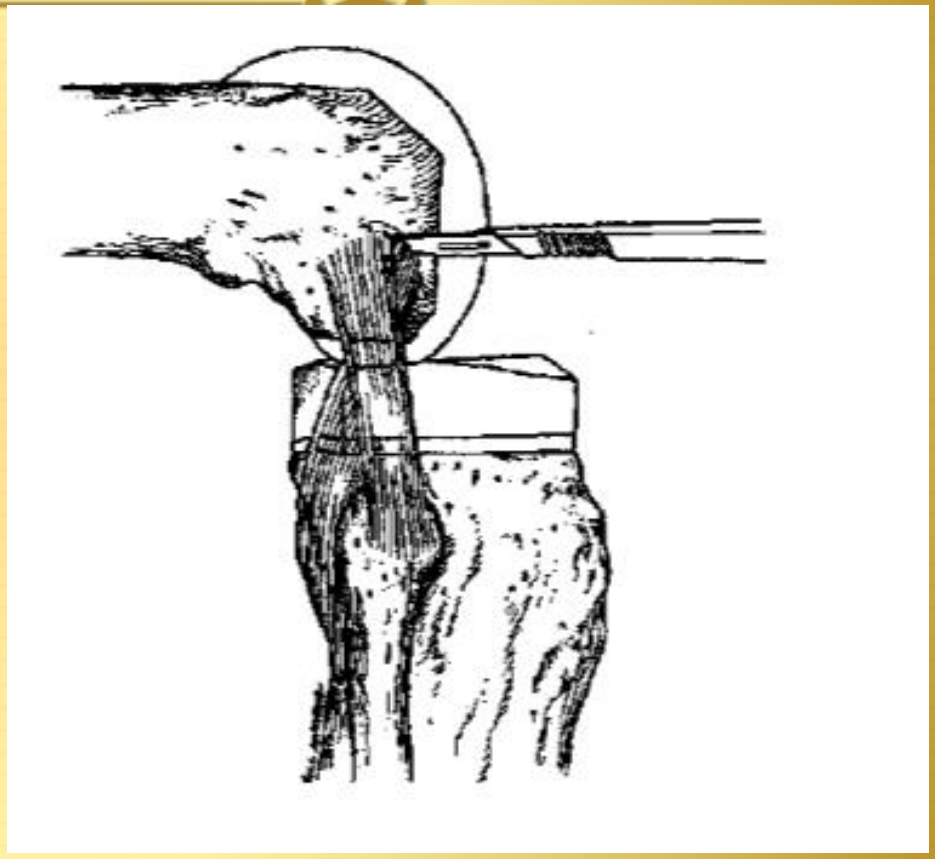




Released anterior posterior portion of MCL, Pes anserinus and Posterior medial capsule

Tight Popliteus Tendon



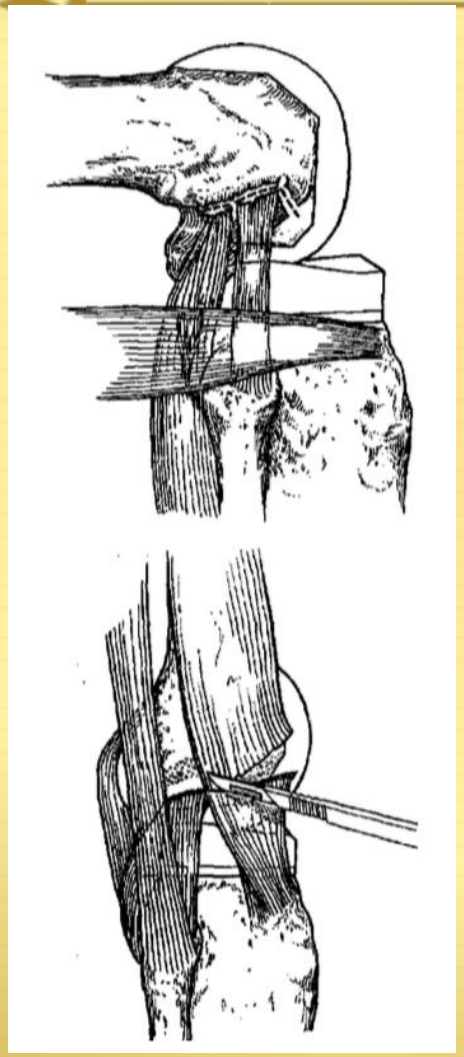


Release the Popliteus

- Valgus
  - Osteophytes
  - Release lateral capsule
  - Release iliotibial band with either Z type or release off gerdy's tubercle if remain tight in extension
  - Release popliteus tendon if remain tight in flexion
  - Release LCL if severe valgus deformities

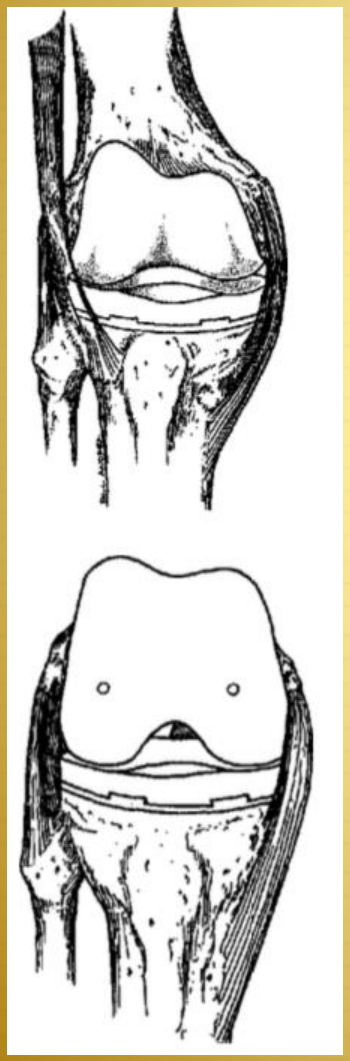
  In combined deformities with peroneal nerve palsy with valgus deformity and flexion contracture release all the dressing and flexion the knee. If the function does not return after 3 months, exploration via posterolateral knee.

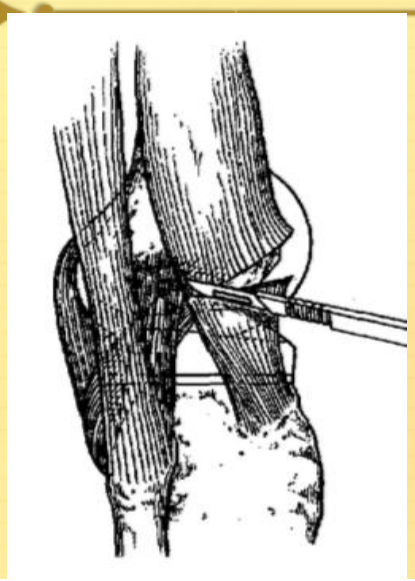
Tight Laterally Flexion and Extension

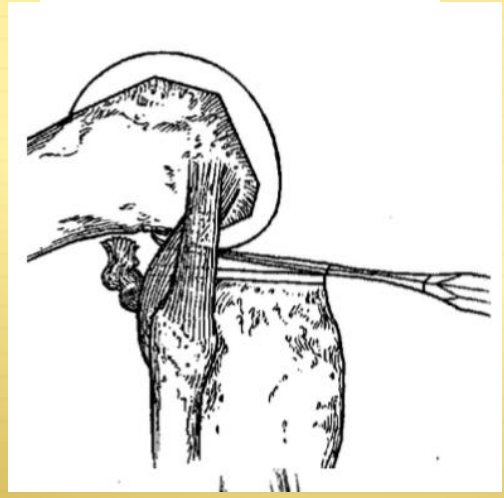


Release the Popliteus, LCL and Iliotibial Band

Tight Laterally in Extention, Normal stability in FLexion

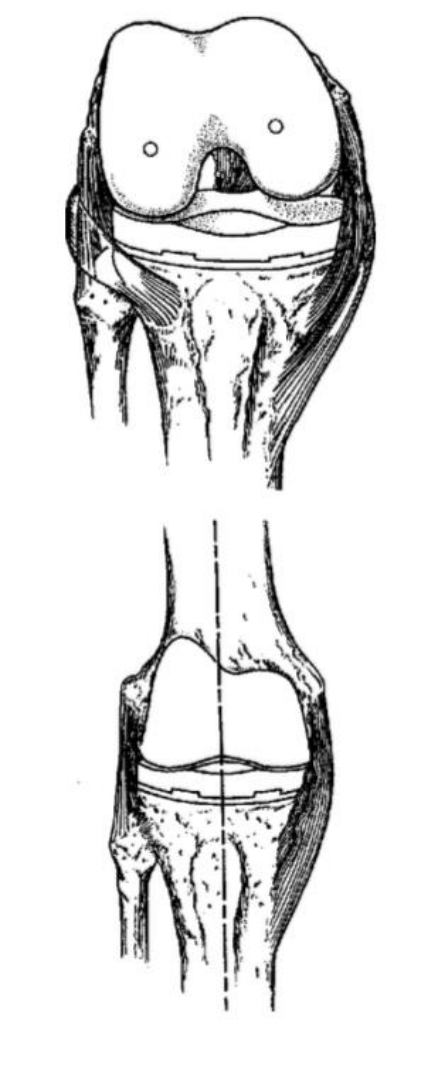


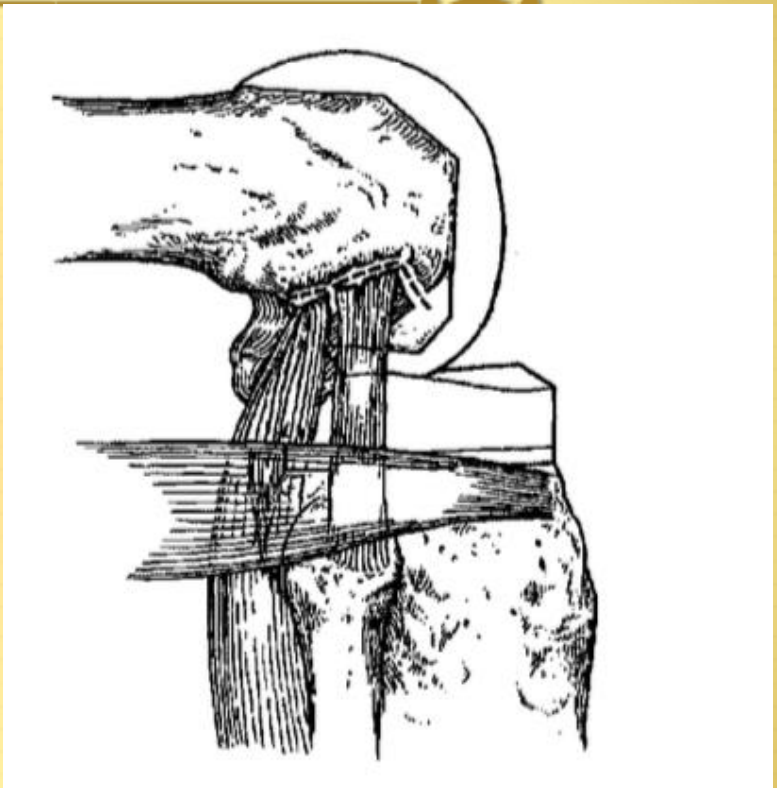




Release Iliotibial Band and Posterolateral Capsule

Tight Laterally in Flexion, Normal in Extention





Release popliteus, LCl and Posterolateral corner

Fixed Flexion Deformity in TKA

Complex Combinations:

- musculotendinous contracture
- ligamentous contracture
- capsular contracture
- osteophytes of posterior condyle

Fixed Flexion Deformity in TKA

Biomechanics

— increased forces are placed on posterior tibial plateau

— femoral condyles sink into the tibial plateau

— contact between intercondylar notch and tibial eminence form a boney block

Ligament balancing

- Sagital plane

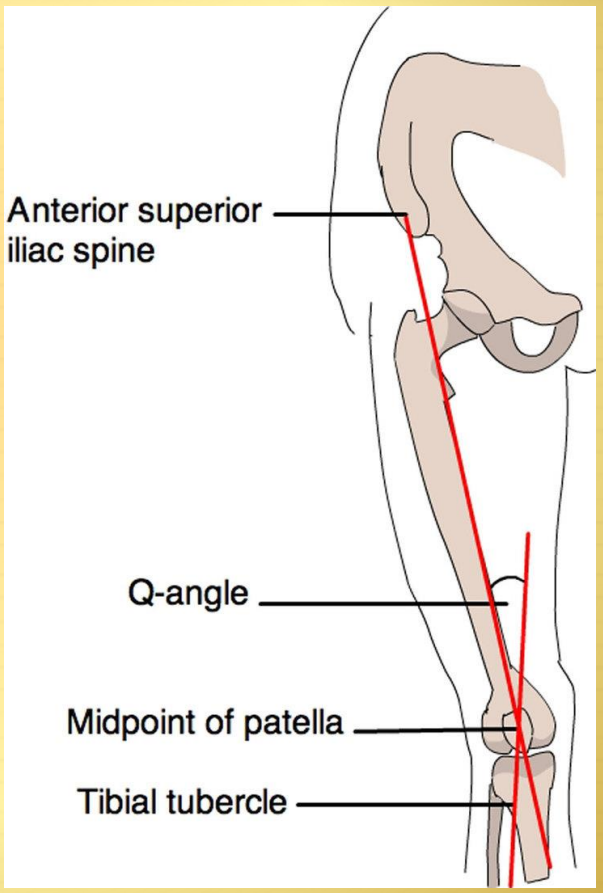
the goal is to obtain a gap ekstension equal to the gap in flexion. The rules is:

- If the gap is symmetrical adjust the tibia
- If the gap is asymmetrical adjust the femur

Scenarios	Problems	Solution
Tight in extension	Symmetrical Gap	Cut more proximal tibia
Tight in flexion	Did not cut enough tibial bone	
Loose in extension	Symmetrical gap	Use thicker polyethilen inseert
Loose in flexion	Cut too much tibia	Perform metalic tibial augmentation
Extension good flexion loose	Asymmetrical gap Cut too much posterior femur	Increase size of femoral component from anterior to posterior, fill the gap with cement or metal augmentation Use thicker polyethylen insert and readdress as tight extension gap
Extension tight Flexion good	Asymmetrical gap Didn't cut enough distal femur or release enough posterior capsule	Release posterior capsule Take off distal femur bone (1-2mm at time)
Extension good Flexion tight	Asymmetrical gap Didn't cut enough posterior boneor PCL scarred and too tight No posterior slope in tibial cut	Ddecrease size of femoral component from anterior to posterior Recess PCL Check posterior slope of tibia and recut if anterior slope is present
Extension loose	Asymmetrical gap, cut too much	Perform distal femoral augmentation

Maintaining Q angle

- It is important to avoiding increase Q angle
- Increase Q angle leads to lateral subluxation forces which affect patellofemoral tracking.



Surgical Approaches

Surgical approaches may be dictated by

- Surgeon preference
- Prior incision
- Degree of deformity
- Patella baja
- Patient obesity

Surgical Approaches

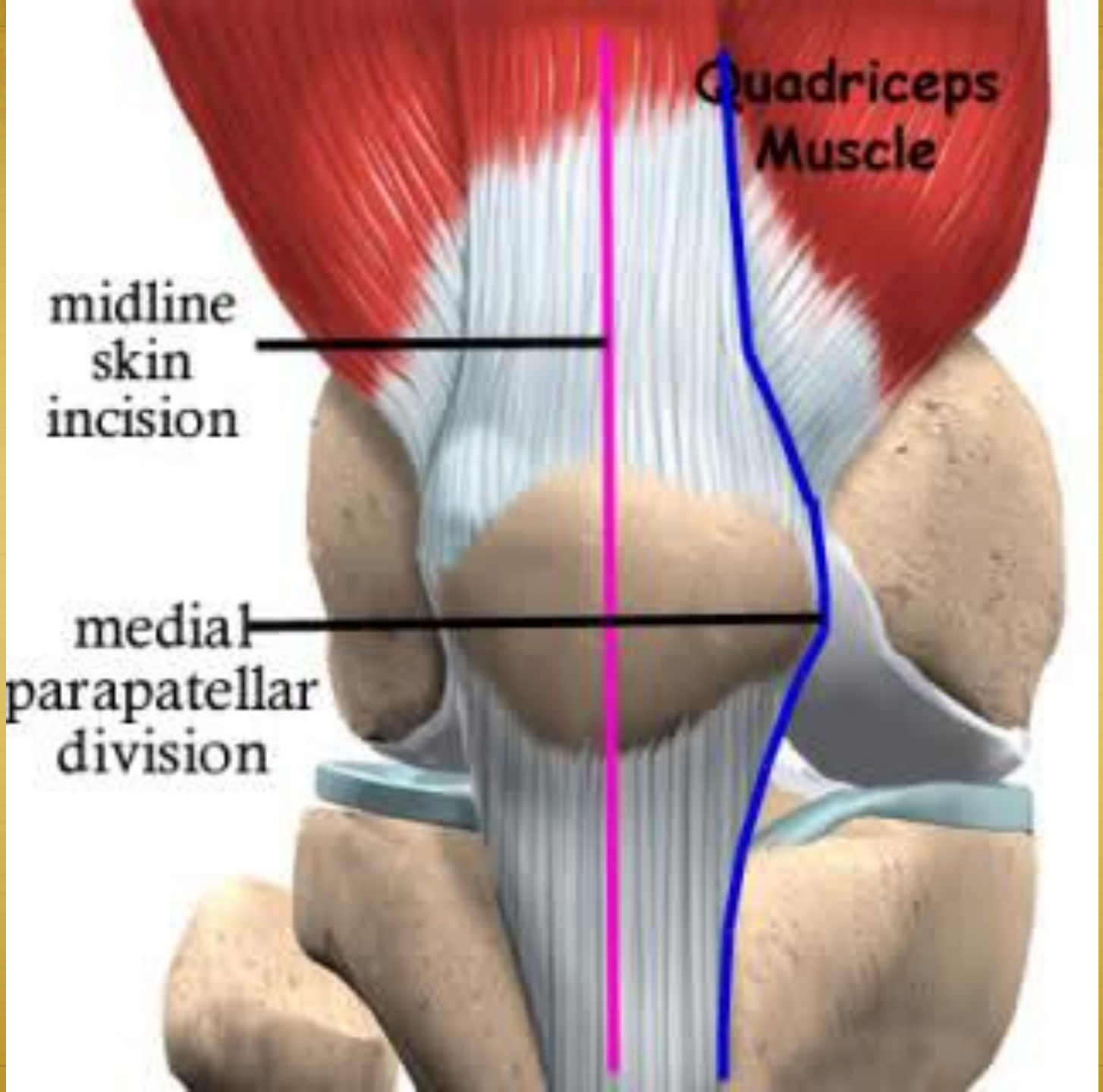
- Medial Parapatellar
- Lateral Parapatellar Approach
- Midvastus
- Subvastus
- Minimally Invasive

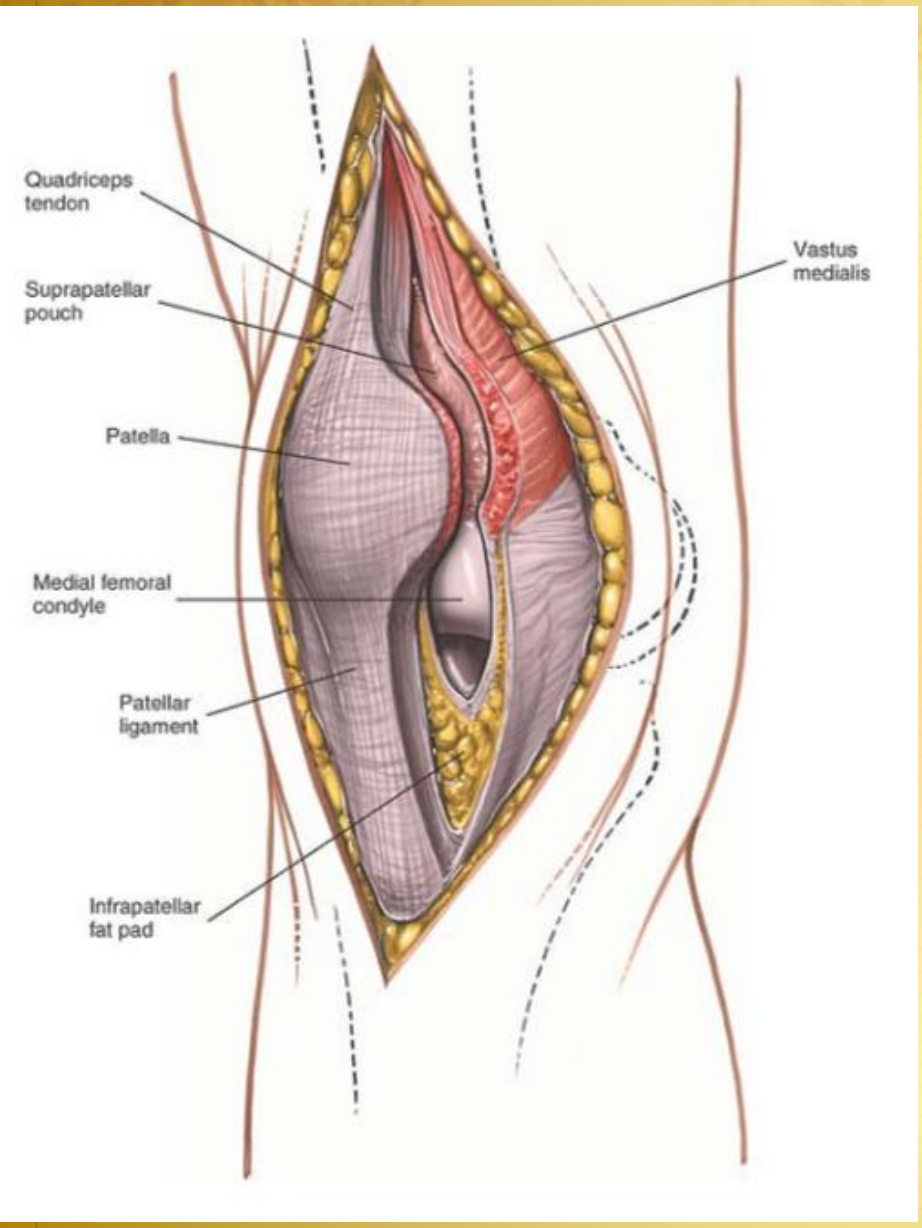
Extensile approach:

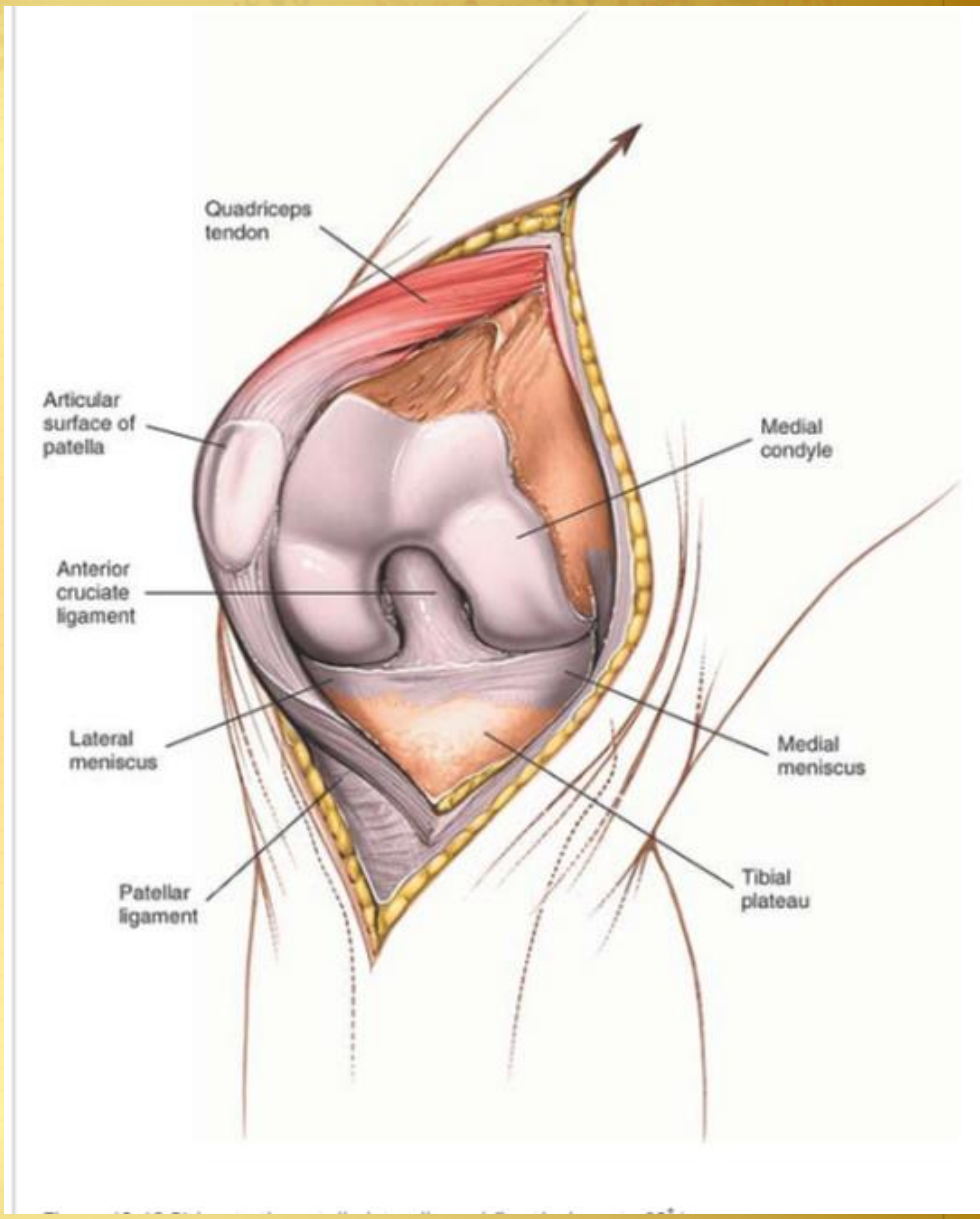
- Quadriceps snip
- V-Y turndown
- Tibial tubercle osteotomy

Medial Parapatellar

- Most commonly completed trhrough straight incision
- Advantages:
  - Familiar
  - Excellent exposure even in challenging cases
- Disadvantages
  - Possible failure of medial capsular repair
  - Development of lateral patellar subluxation
  - Access to lateral retinaculum less direct
  - Many jeopardize patellar circulation i

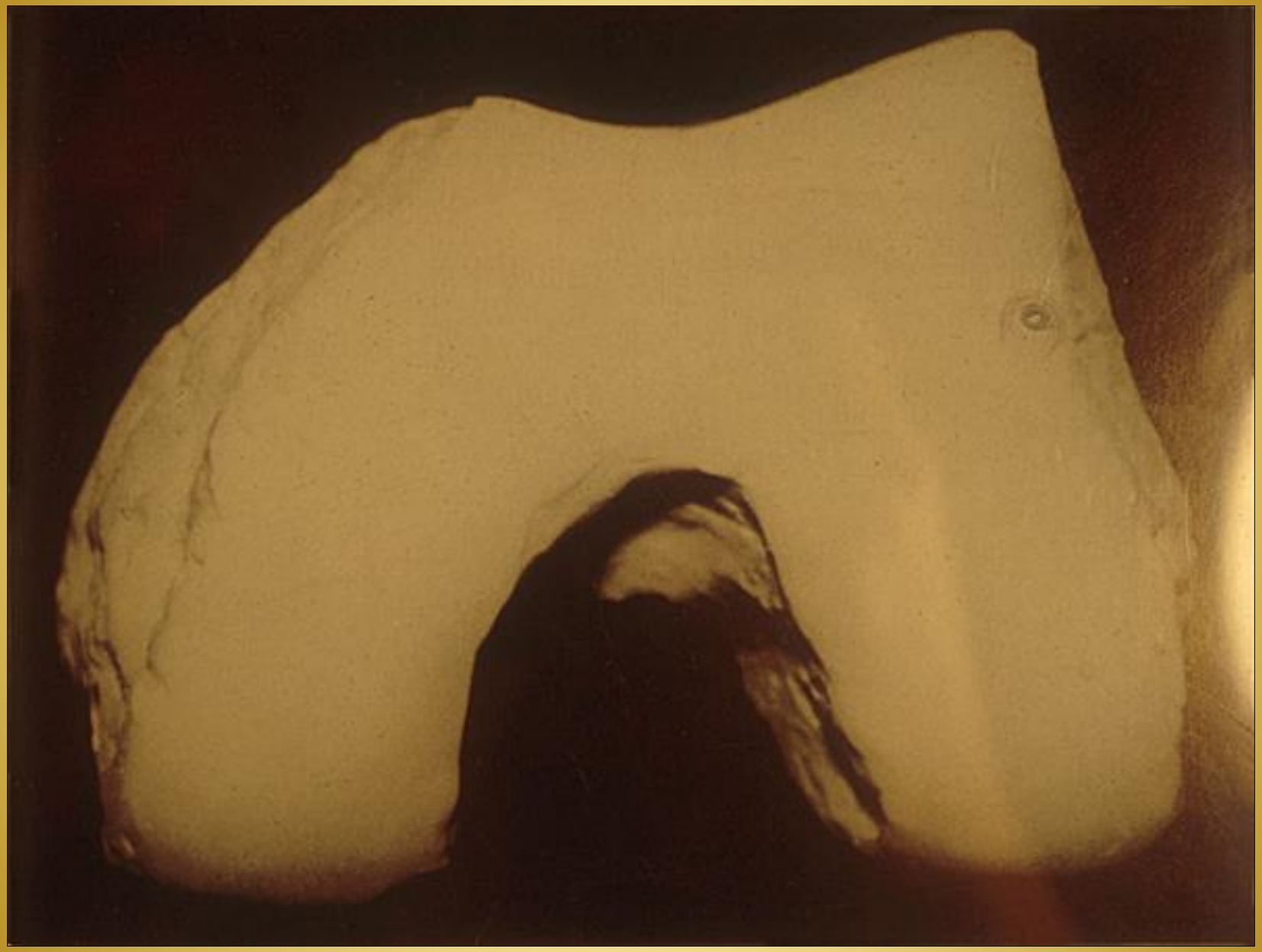

Quadriceps
Muscle
midline
skin
incision
medial
parapatellar
division

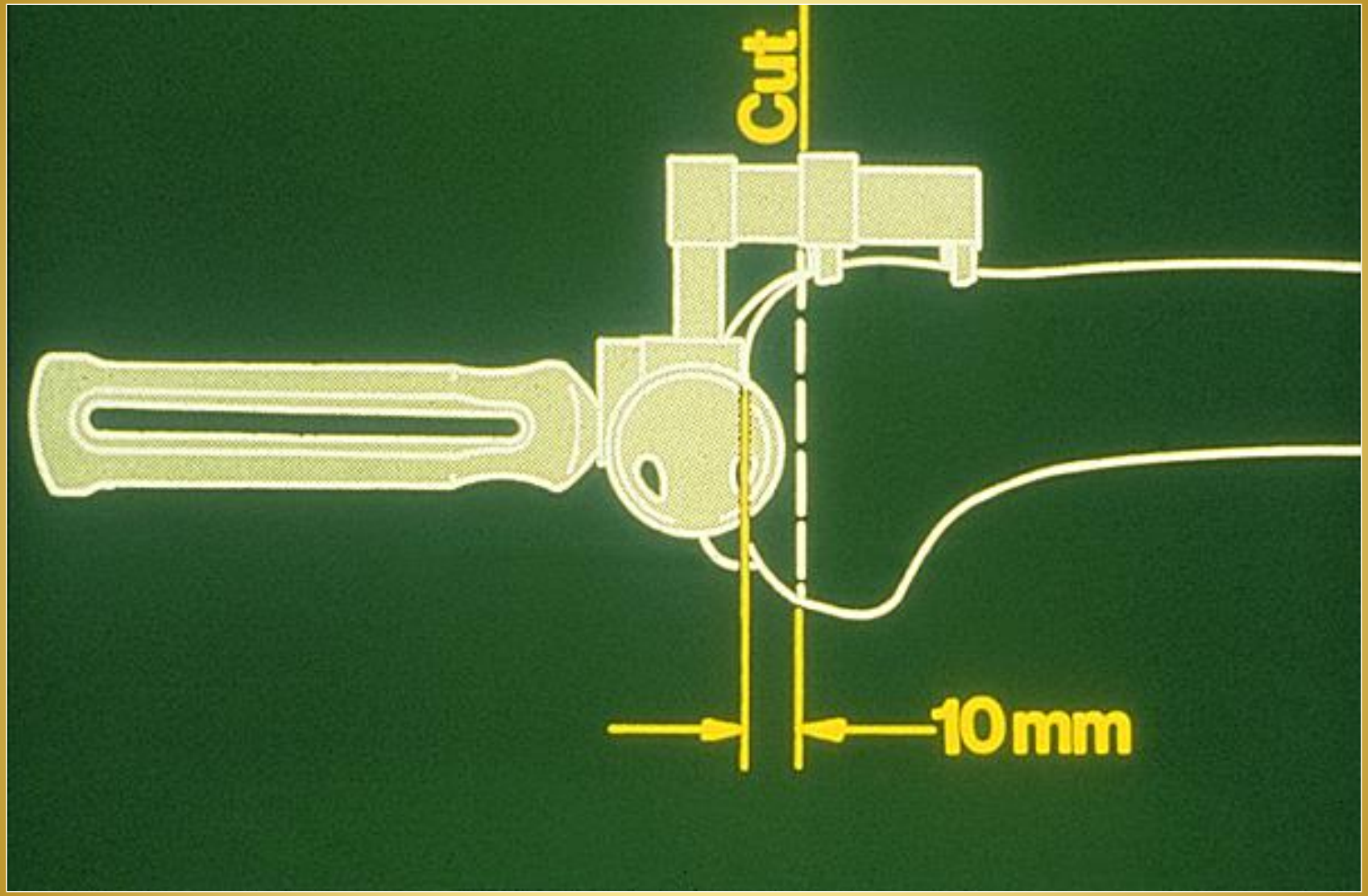

Quadriceps tendon
Suprapatellar pouch
Patella
Medial femoral condyle
Patellar ligament
Infrapatellar fat pad
Vastus medialis

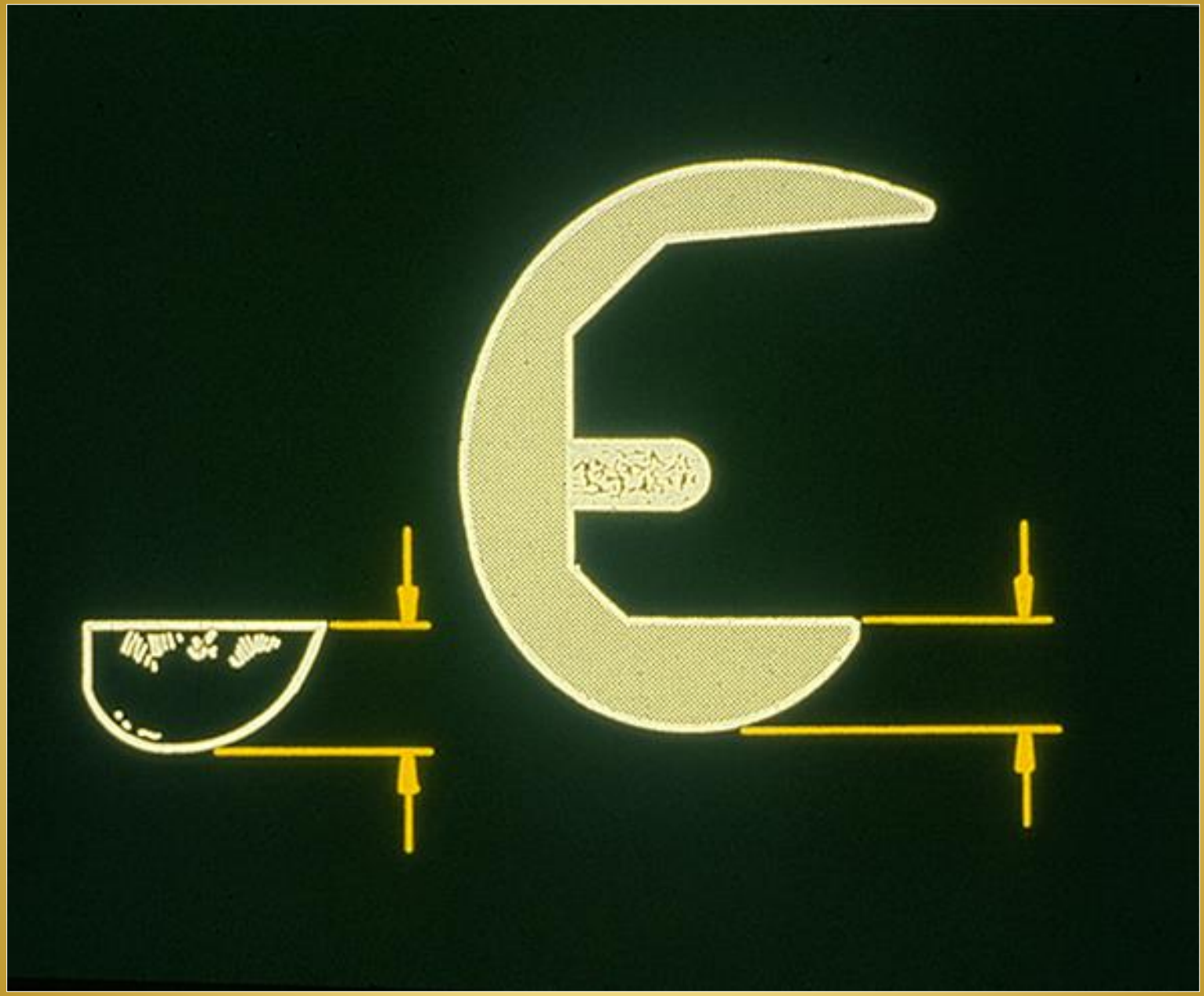

Quadriceps tendon
Articular surface of patella
Anterior cruciate ligament
Lateral meniscus
Patellar ligament
Medial condyle
Medial meniscus
Tibial plateau

Surgical Techniques

- Femoral Rotation
  - Landmarks
    - Posterior femoral condyles
    - Epicondyles 5° external rotation to the posterior condyles

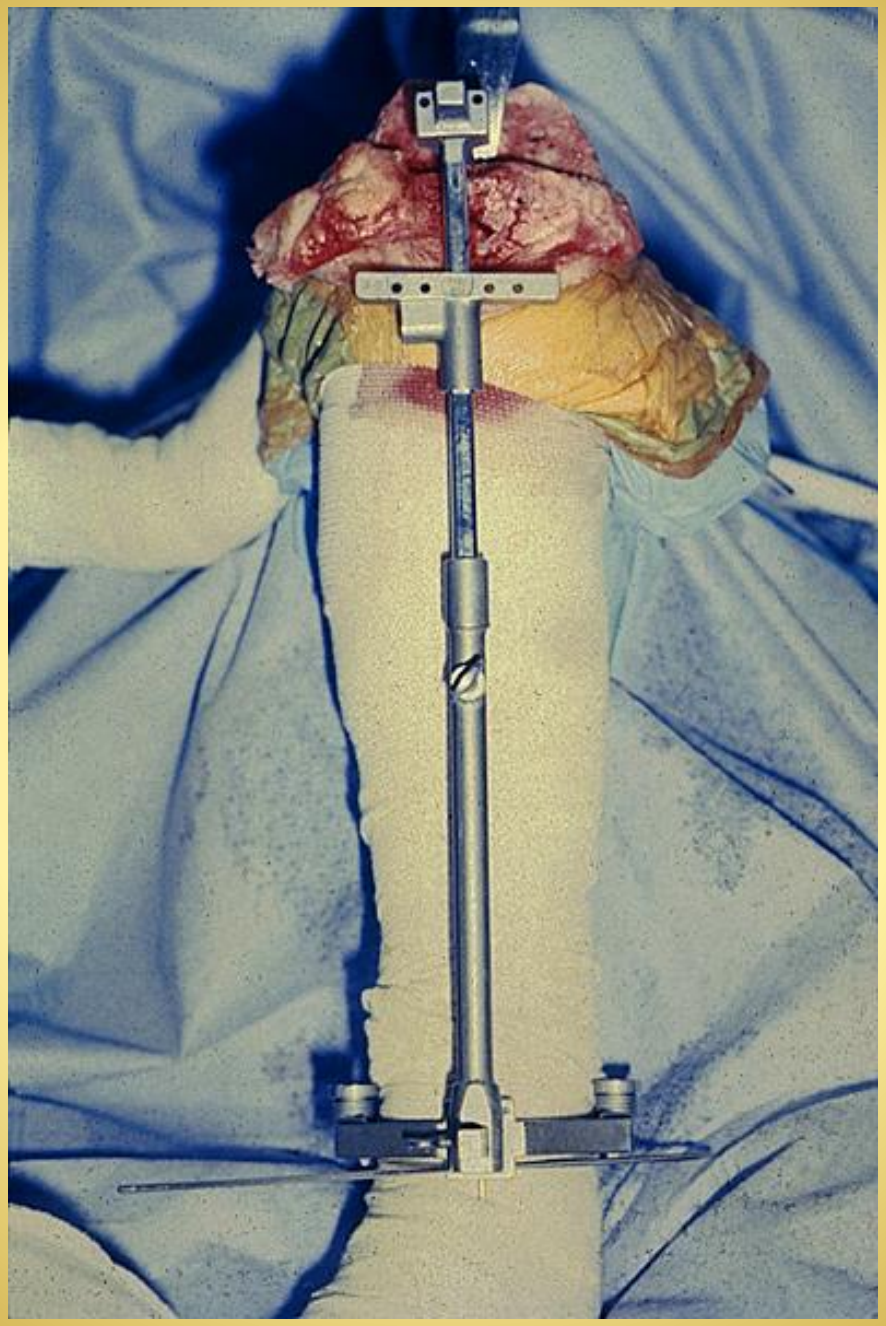


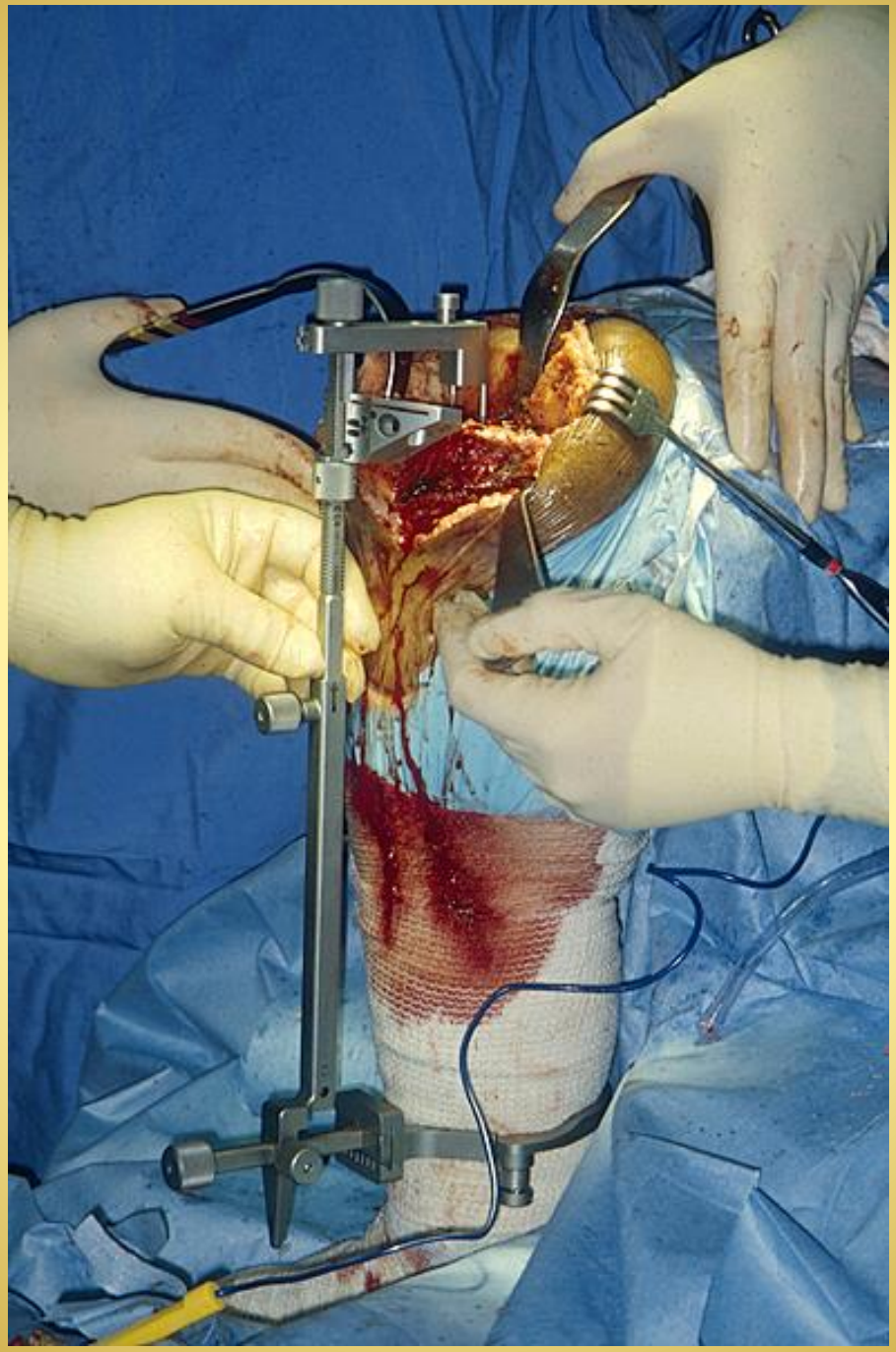

Cut
10mm



Surgical Techniques

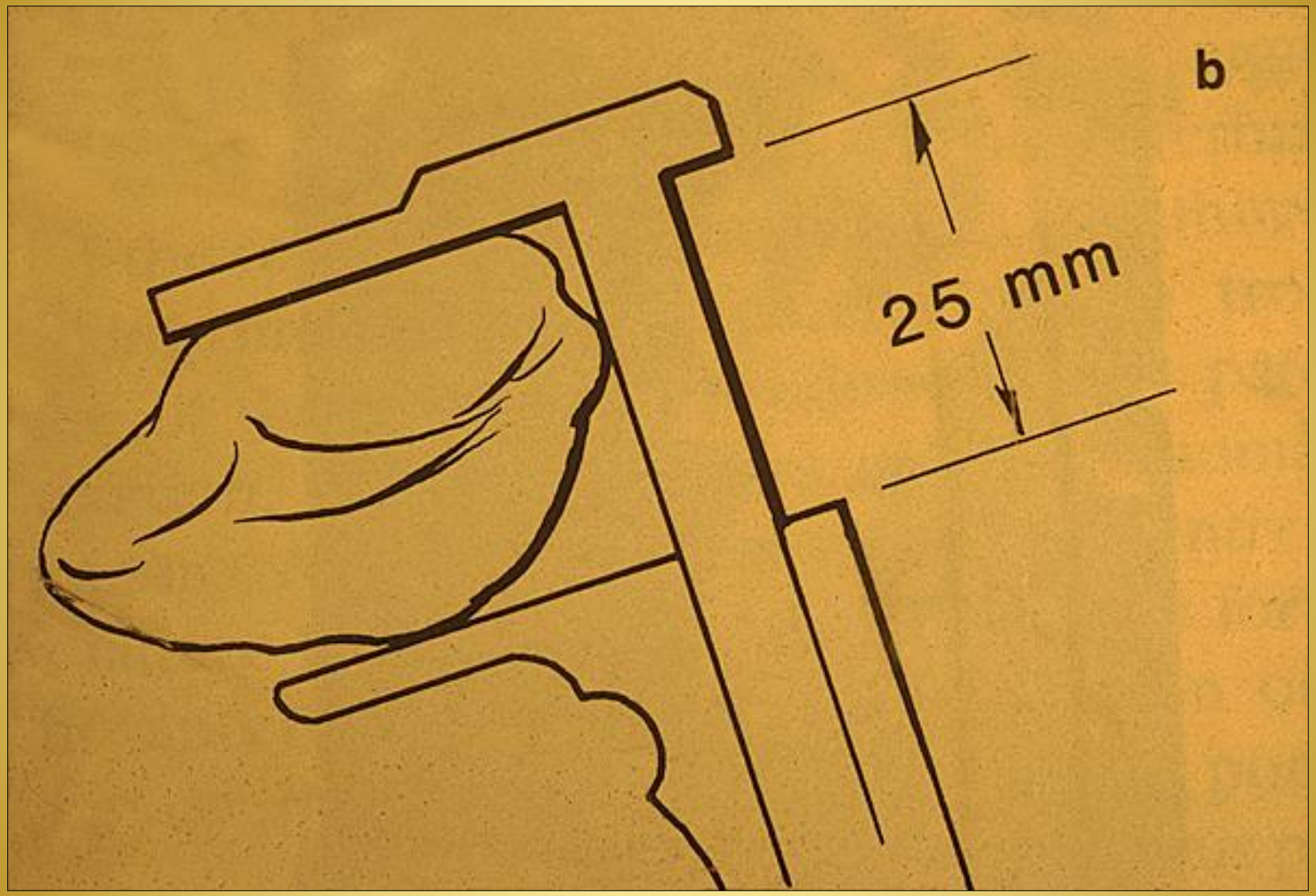
- Tibial Component Rotation
  - —Transmalleolar axis
  - —Posterior tibial plateau
  - —Tibial tubercle — lies lateral





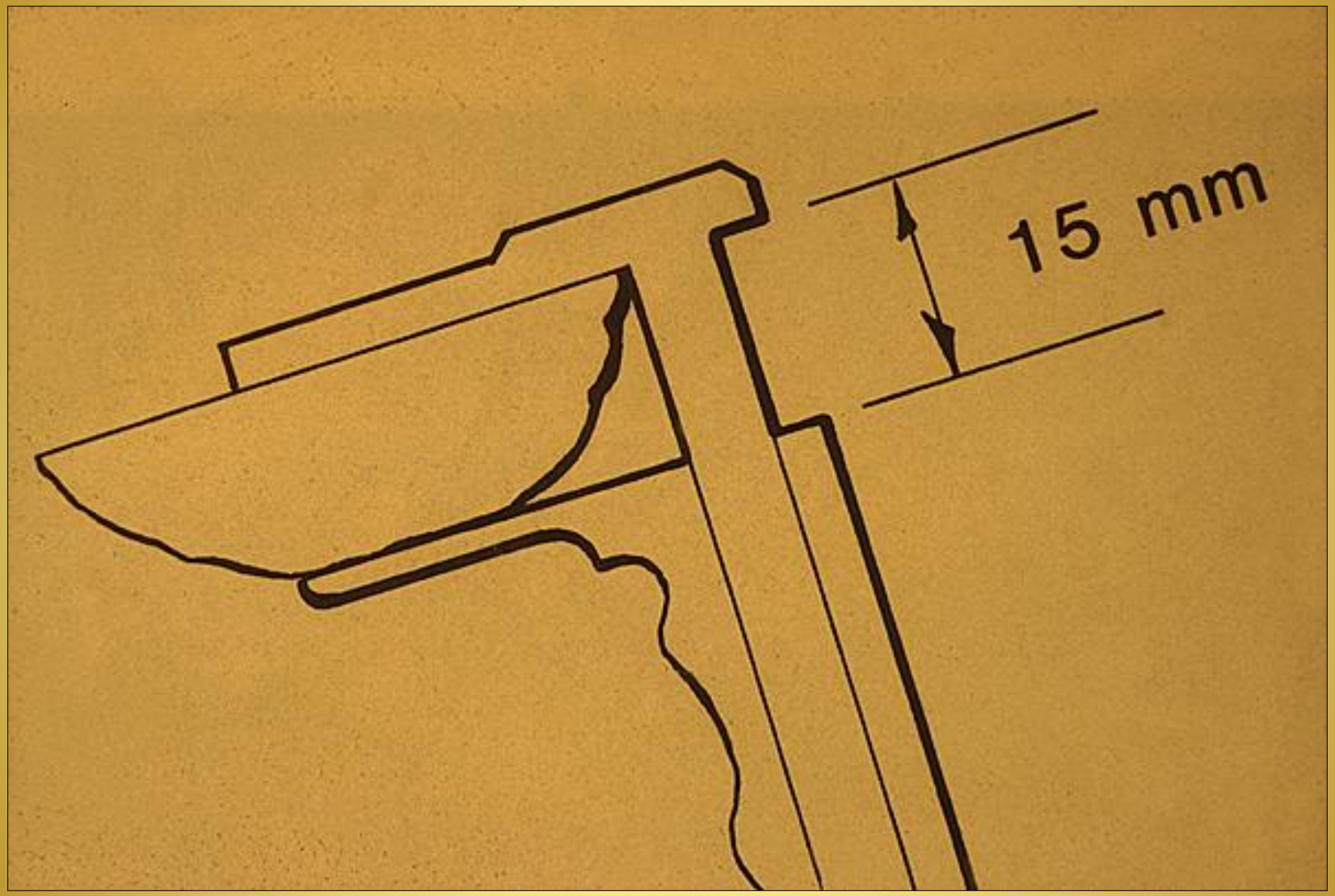
Issues with Surgical Techniques

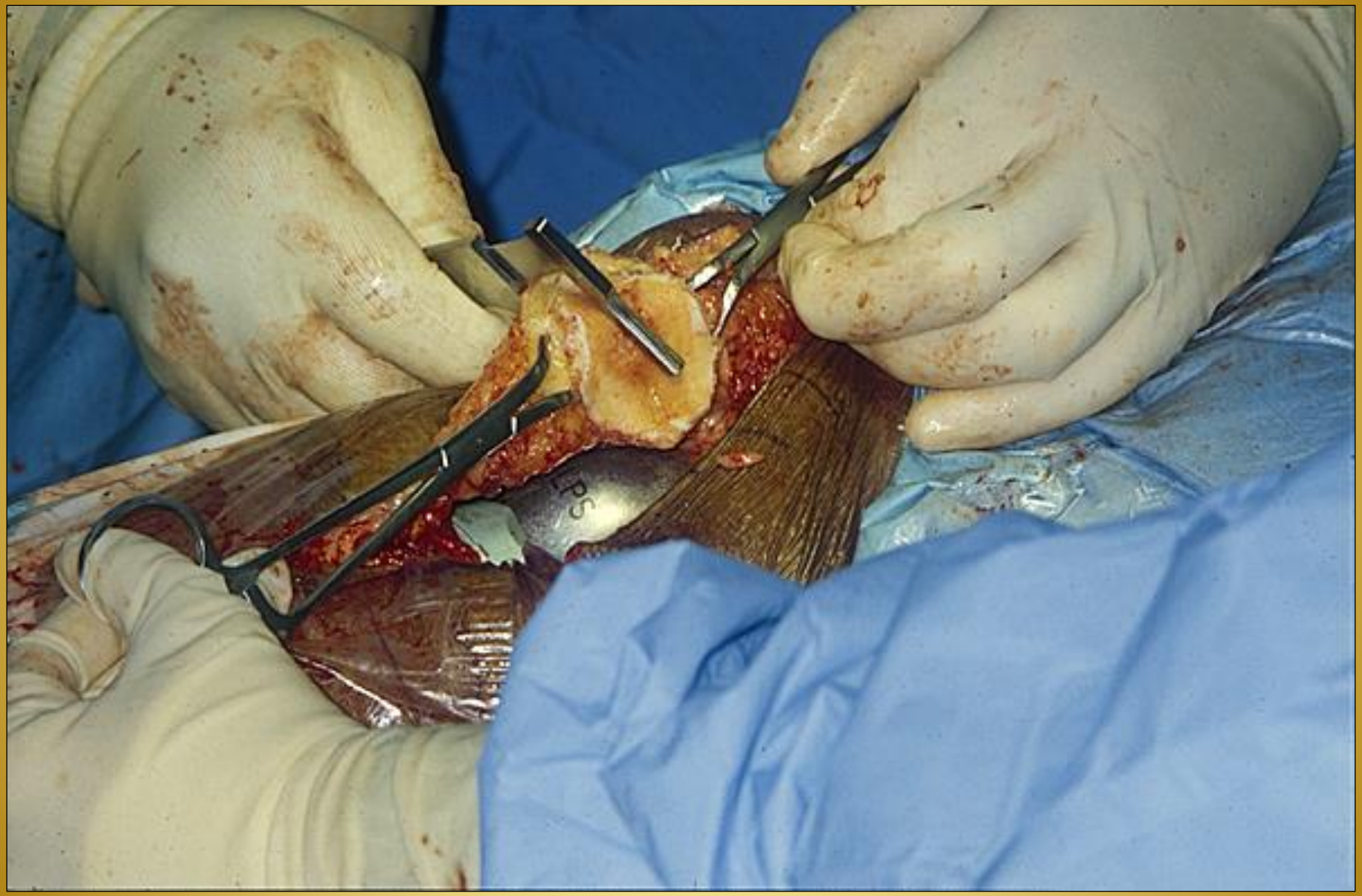
- Patellar resurfacing
  - Recommended for all RA patients
  - Without resurfacing 4% to 6% incidence of anterior knee pain
  - With resurfacing increased incidence of fracture


b
25 mm

Issues with Surgical Techniques

- Patellar resurfacing
  - Thickness shouldn't exceed 25 mm
  - For every 1 mm thicker reduces flexion by 3°


15 mm



Complication of TKA

Periprosthetic fracture
Infection

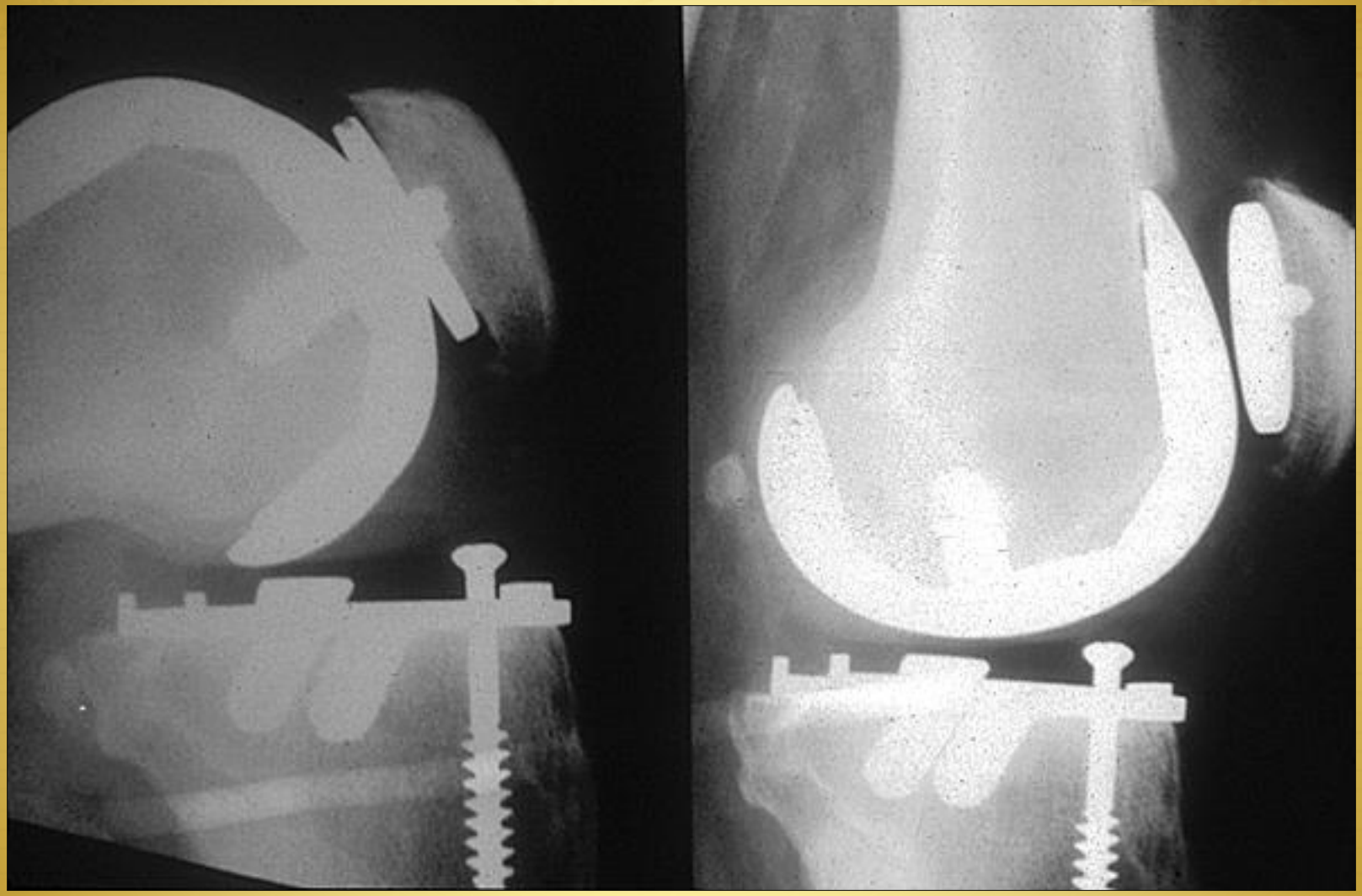
Supracondylar Fractures After TKR

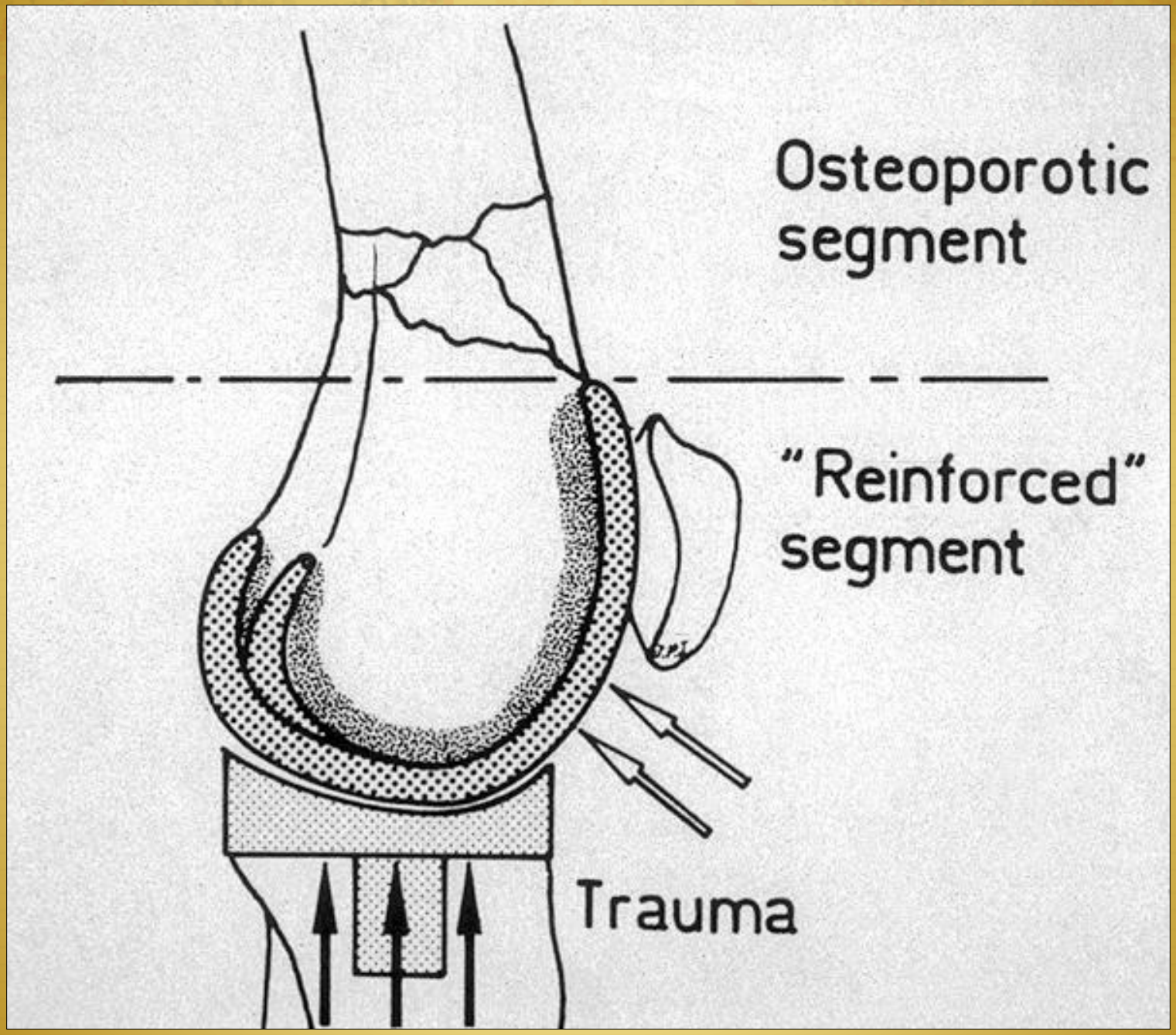
Notching of the femoral cortex

Osteoporosis

Prolonged steroid use

Preexisting neurologic disorders




Osteoporotic segment
"Reinforced" segment
Trauma

Supracondylar Fractures After TKR

Non Operative Method

Casting

Traction followed by rest

Supracondylar Fractures After TKR

Operative Method

Plates / Screw fixation

Intramedullary rods

Rush pins

External fixation

Primary arthrodesis

Revision arthroplasty

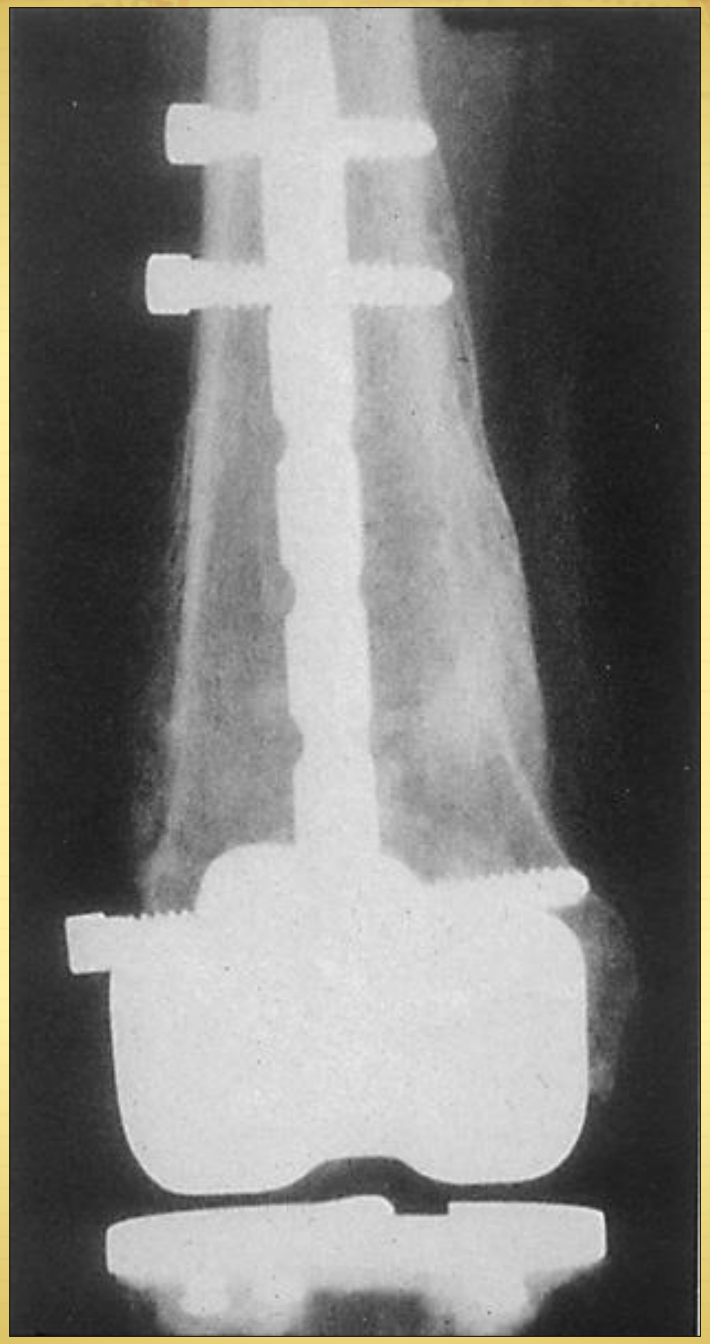
Supracondylar Fractures After TKR

Type 2 Considerations

Patient's ability to tolerate traction

Ability of bone to hold screws

Ability of the surgeon



Supracondylar Fractures After TKR

No one form of treatment gives uniformly good results

Infection in Total Knee Arthroplasty

Complications in Arthroplasty

✧ *Infection – Risk Factors*

Skin ulcerations / necrosis

Rheumatoid Arthritis

Previous hip/knee operation

Recurrent UTI

Oral corticosteroids

Complications in Arthroplasty

- *Infection – Risk Factors*

Chronic renal insufficiency

Diabetes

Neoplasm requiring chemo

Tooth extraction

Complications in Arthroplasty

- *Infection – Clinical Course*

Pain

Swelling

Fever

Wound breakdown drainage

Windsor et al
JBJS; 1990

Complications in Arthroplasty

- *Infection – Surgical Techniques*

1. Avoid skin bridges
1. Avoid creation of skin flaps
1. Hemostasis
1. Prolonged operating time