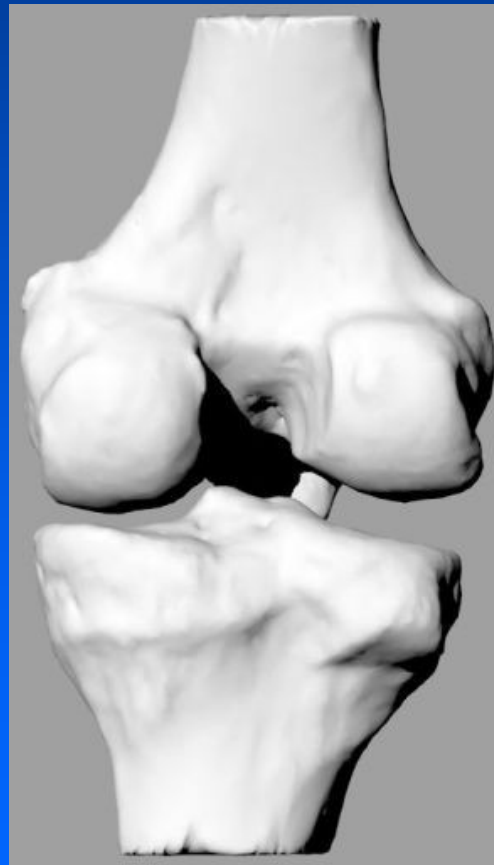


Total knee replacement

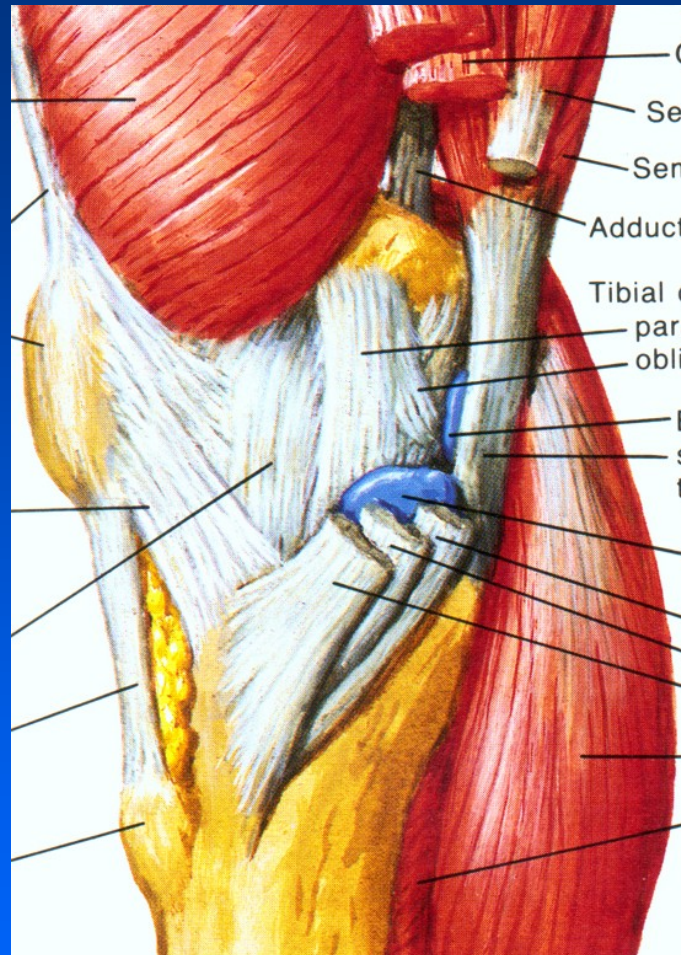
J. Emmer, Z. Rozkydal, L. Nachtnebl,
T. Tomáš

Knee has a complicated structure

Articulating bones: Femur, tibia and patella

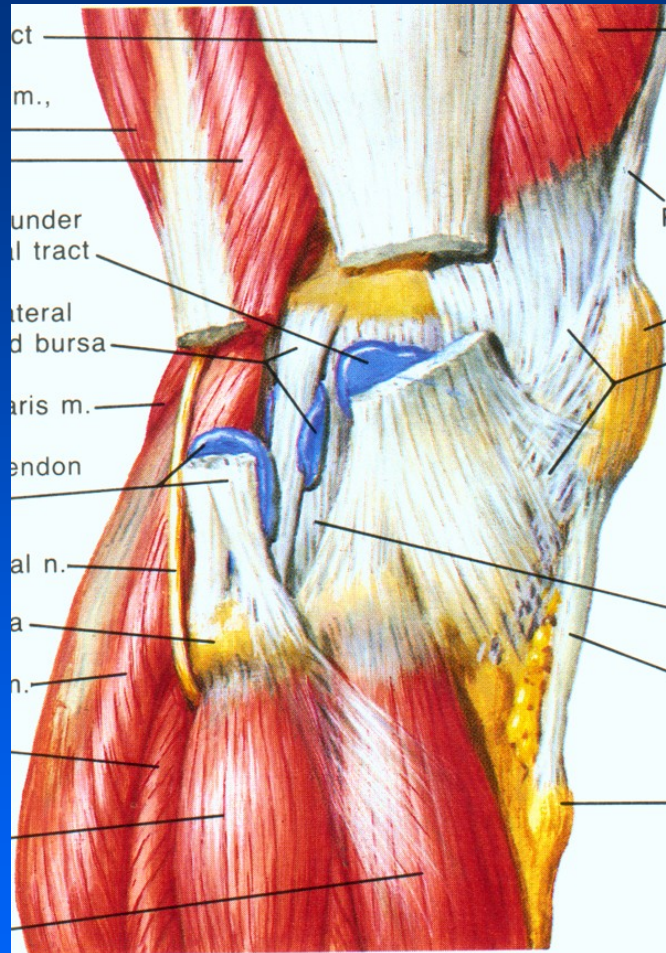


Stability of the knee



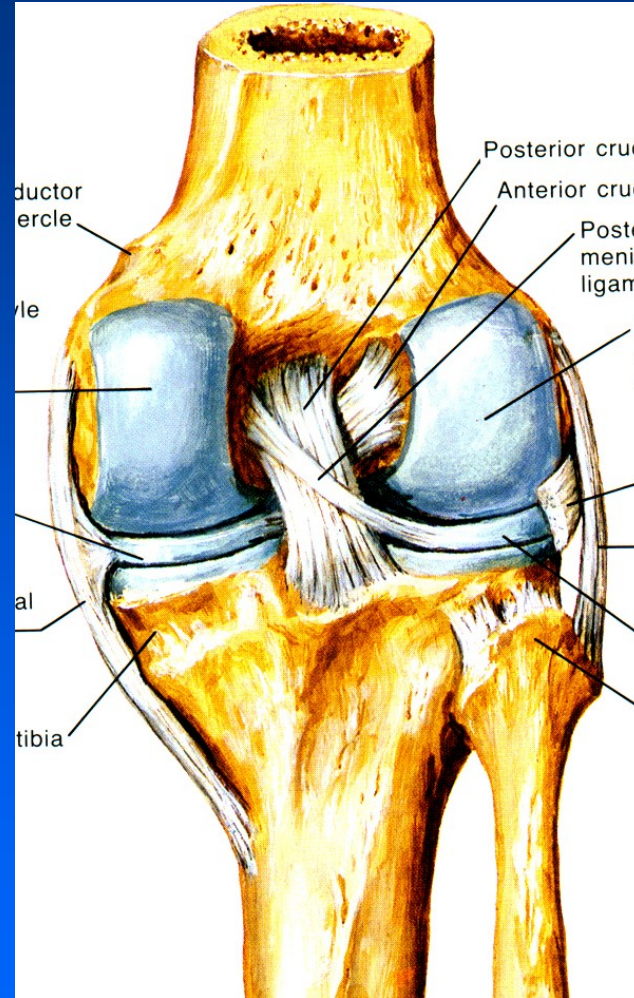
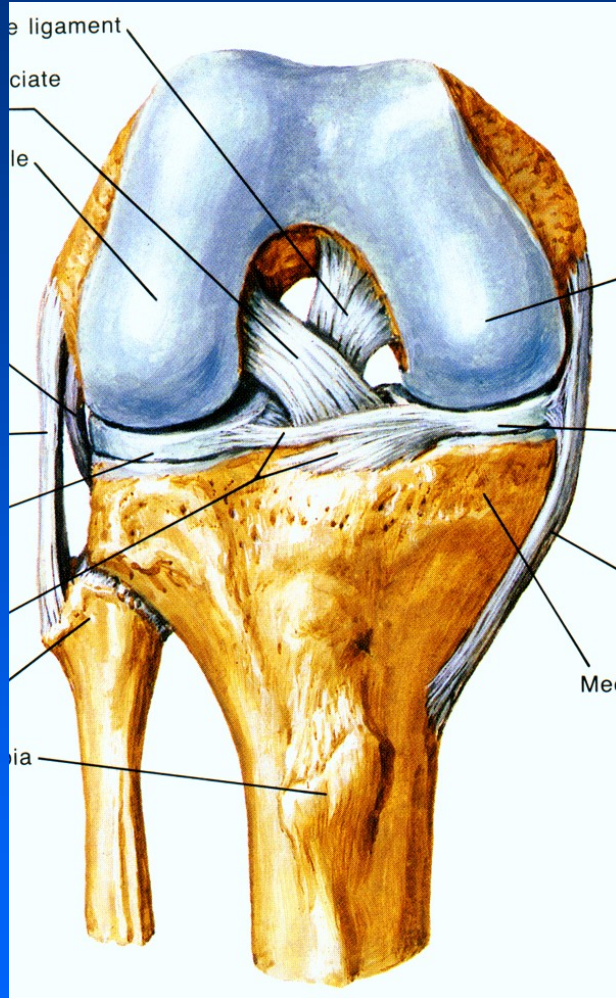
Medial side

Stability of the knee



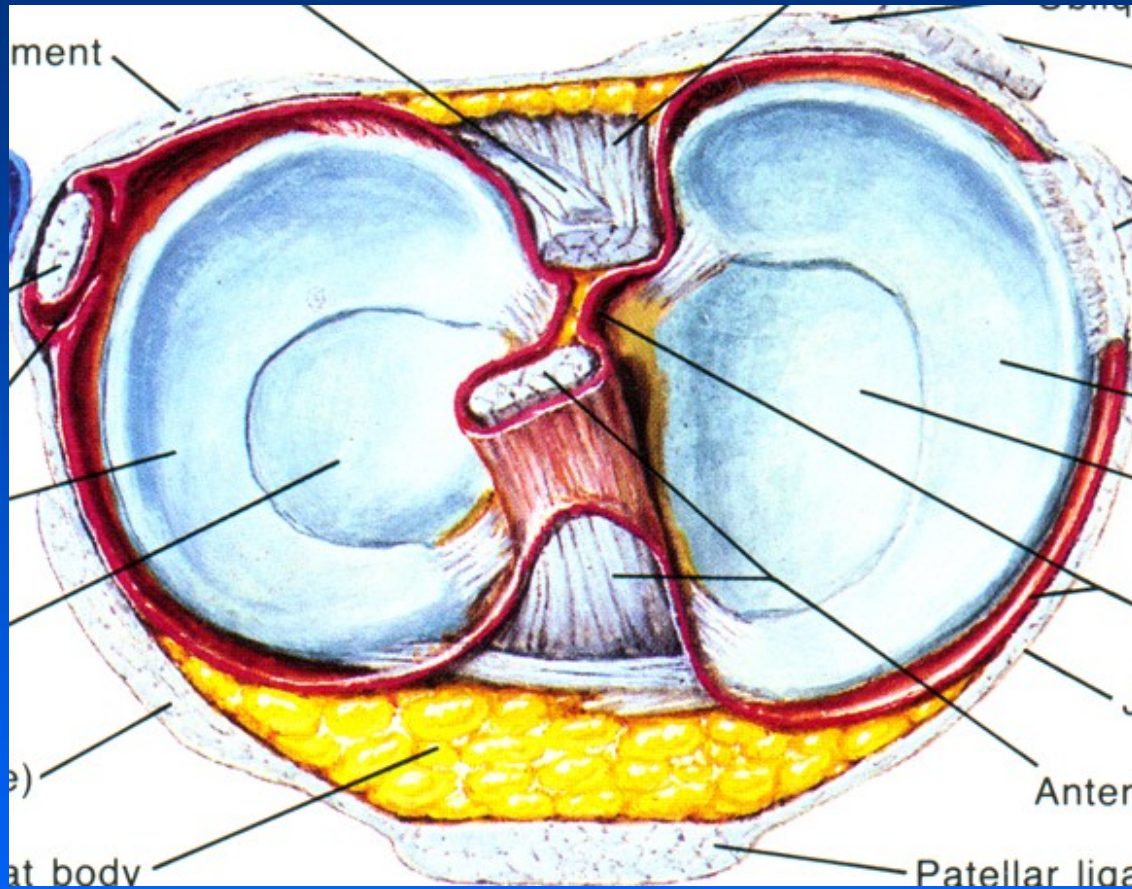
Lateral side

Stability of the knee



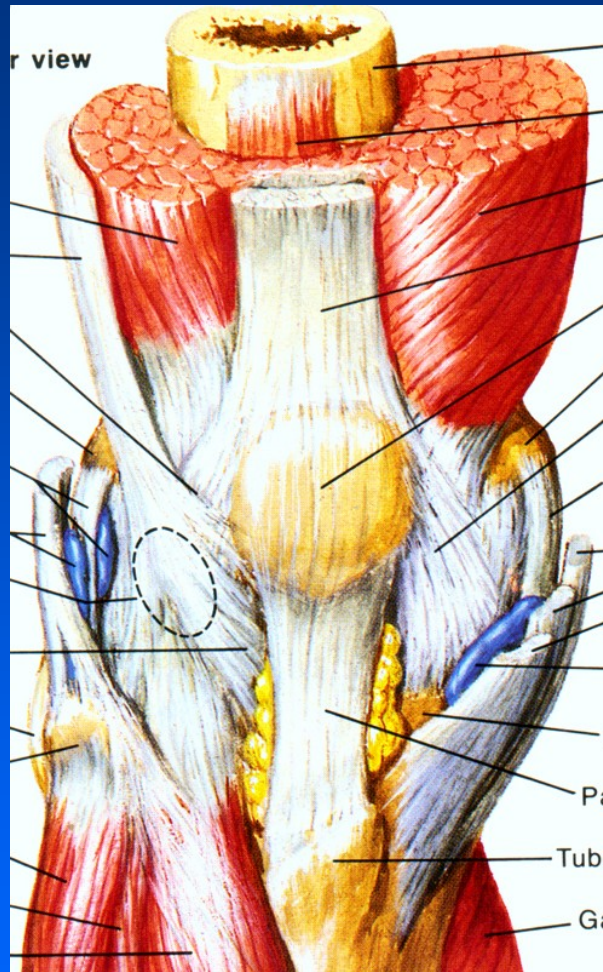
Cruciate ligaments

Stability of the knee



Menisci

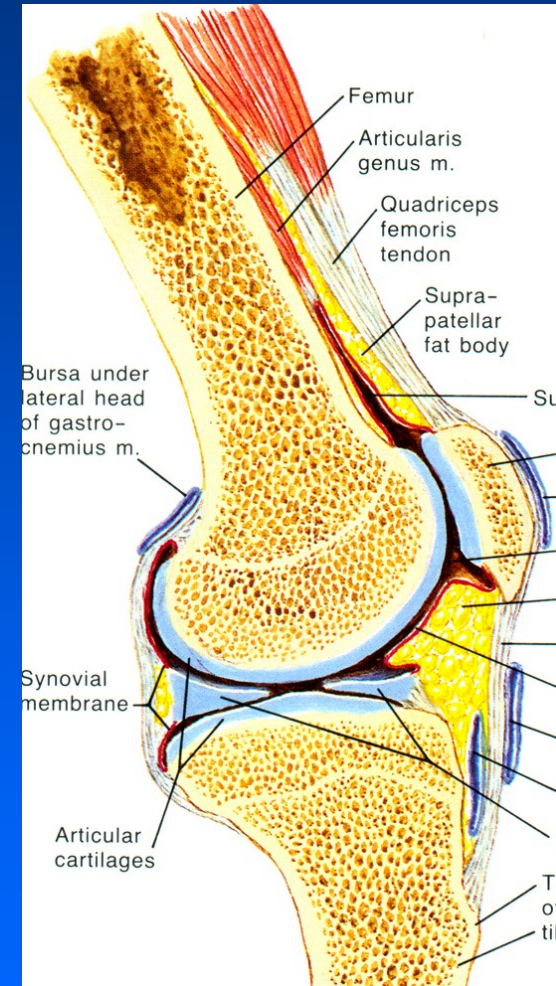
Stability of the knee



Muscles

Movements in the knee joint

Level	Movement
Sagittal	flexion/extension rolling gliding
Transversal	ext./ internal rotation
Frontal	adduction /abduction

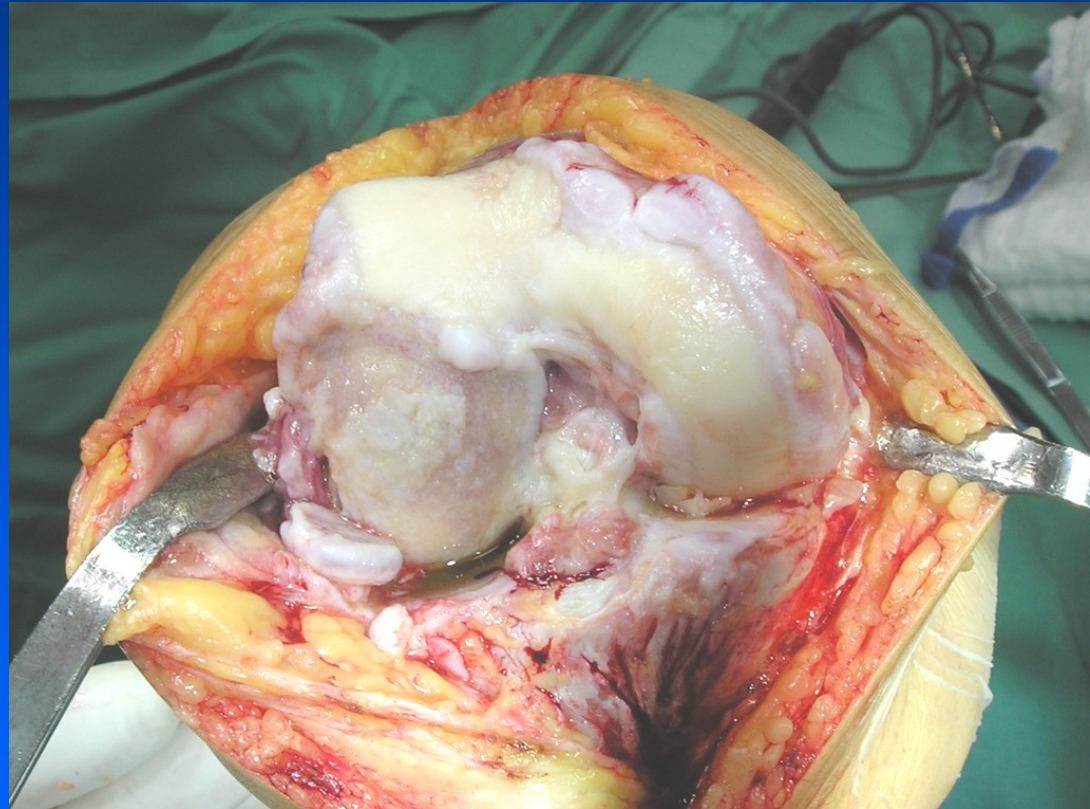


Indications for TKA

Painful condition
+ unsuccessful
conservative treatment

No other procedures
for maintaining of good
function are available

Severe dyscomfort



Indications

Osteoarthritis

- primary
- secondary

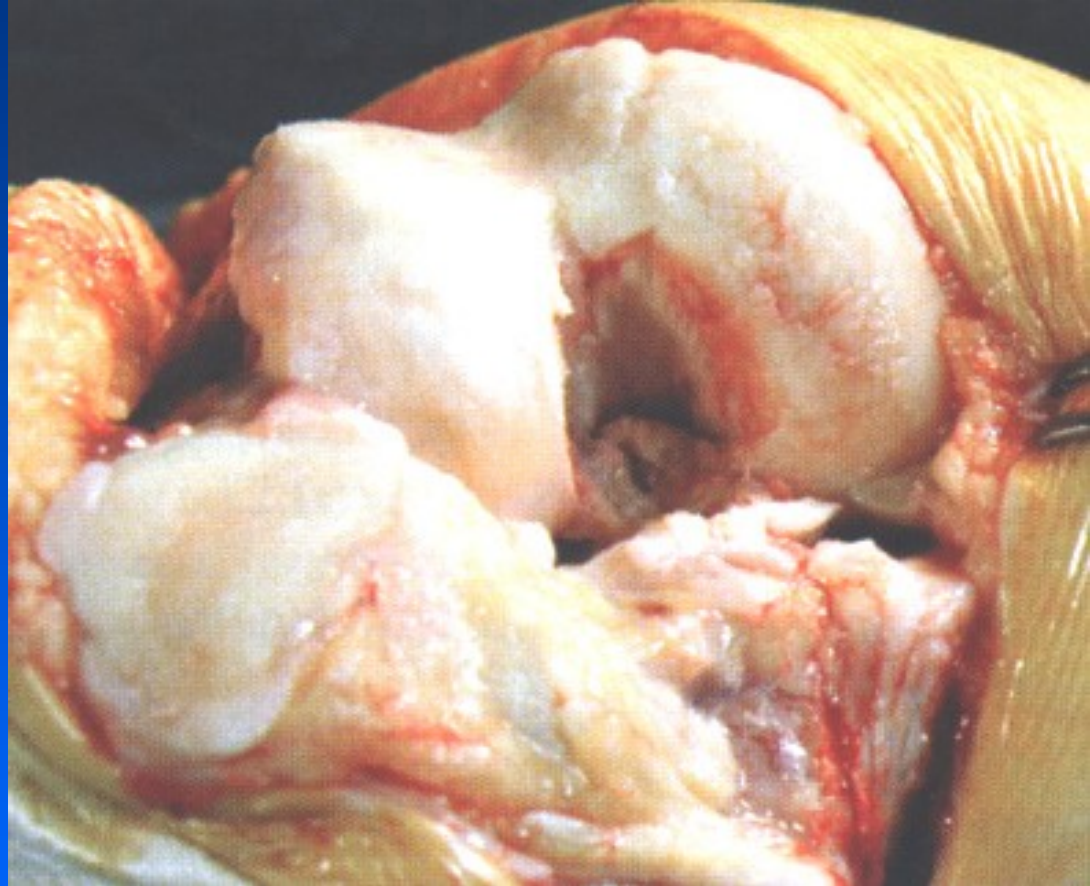
Aseptic necrosis of femoral condyle

Rheumatoid arthritis

Psoriatic arthropathy

Tumors

Haemophilic arthropathy



TKR contraindications

- Poor general condition, poor physical status (ASA IV)
- Persistent infection
- Severe comorbidity with poor prognosis
- Poor vascular status of extremity
- Neurogenic arthropathy
- Extreme obesity
- Strong malcompliance

TKA

- Cemented
- Hybrid
- Uncemented



TKR fixation options

- Cemented
 - Most frequent
 - Good results
 - Usus of departement/clinic
 - Price



TKR fixation options

- Hybrid
- Tibia cementless (most cases)
- Better life expectancy



TKR fixation options

- Cementless
 - Good results
 - Young patients
 - Bone cement allergy
 - Price?



Material

- Femoral component
 - Alloys (Fe, Ni, Co, Cr, Ti)
 - Metal allergy: Ceramic

Composite (ZrN coated)



Materials

- Tibial component + articulation plateau - requirements
 - Biocompatibility
 - Wear resistance!!
 - Modulus of elasticity similar as bone
 - Osteointegration (cementless implants)
 - Antiallergic implants (if metal allergy presented)
 - Future? Biofilm resistance

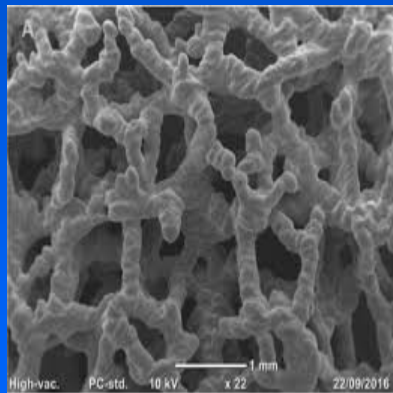
Materials

- Tibial component
 - Metalback – titanium alloys
 - PE plateau
 - UHMWPE - Ultra high molecular weight polyethylen)
 - golden standard, good elasticity modulus x wear resistance ratio



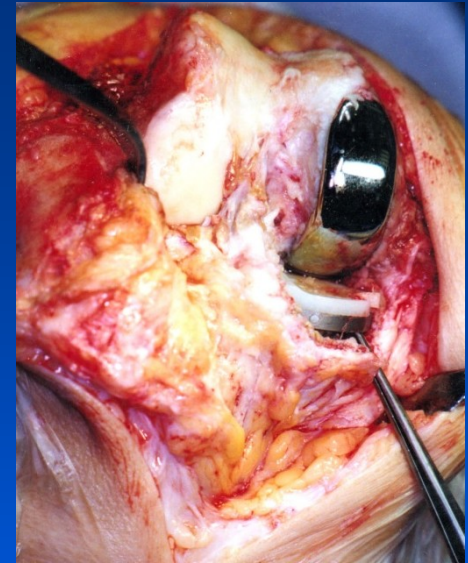
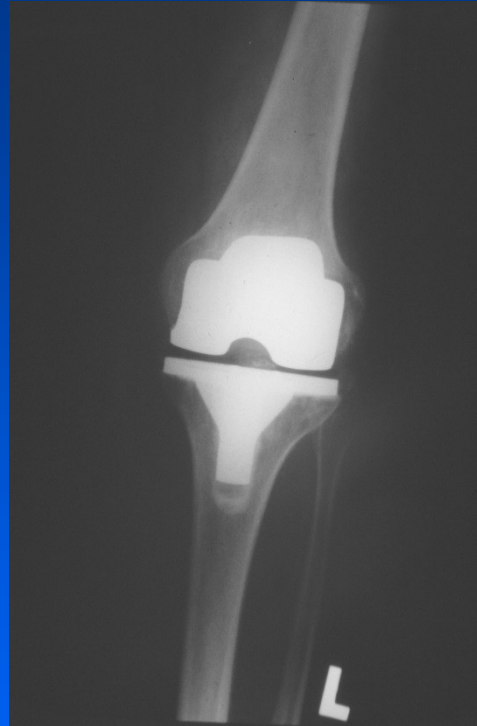
Materials

- Cementless implants requirements – bone adjacent surface
 - Biocompatibility
 - Osteoinductive material
 - Rapid bone ingrowth and reliable incorporation
 - Trabecular titan
 - Trabecular tantal



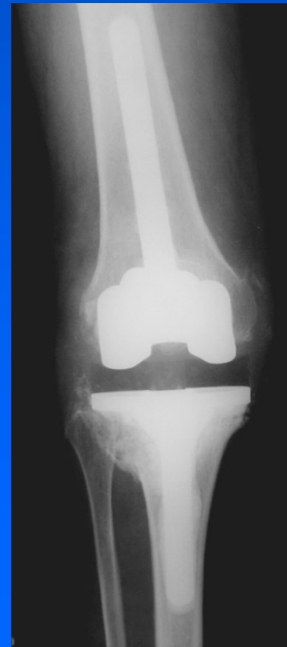
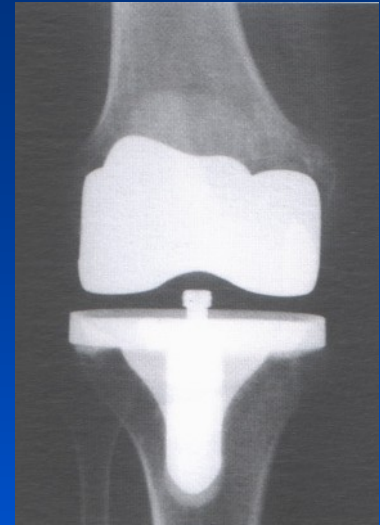
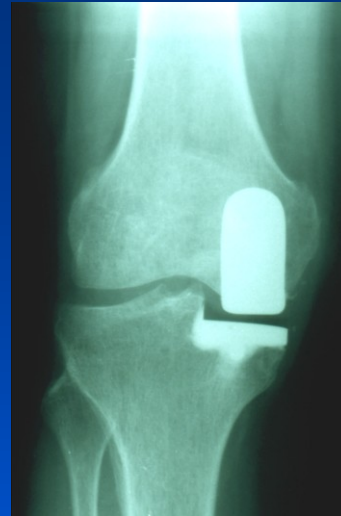
TKA

- Unicompartmental
- Bicompartmental
- Tricompartmental



TKA

- Unicondylar
- Condylar
 - PCL retaining
 - PCL sacrificing
- Condylar with stem
- Hinge
- For tumors



UKR – Unicompartmental knee replacement

- Medial (very most cases), lateral (rare)
- Indications:
 - Medial OA
 - Intact all ligaments (ACL included)
 - Varus/valgus up to 10°; reponible
 - Extension deficit up to 5°, flexion over 120°
 - Asymtomatic FP compartment
- Benefits:
 - Bigger ROM
 - Proprioception
 - Natural kinematics
 - TKR conversion possible



Unicondylar replacement TKU

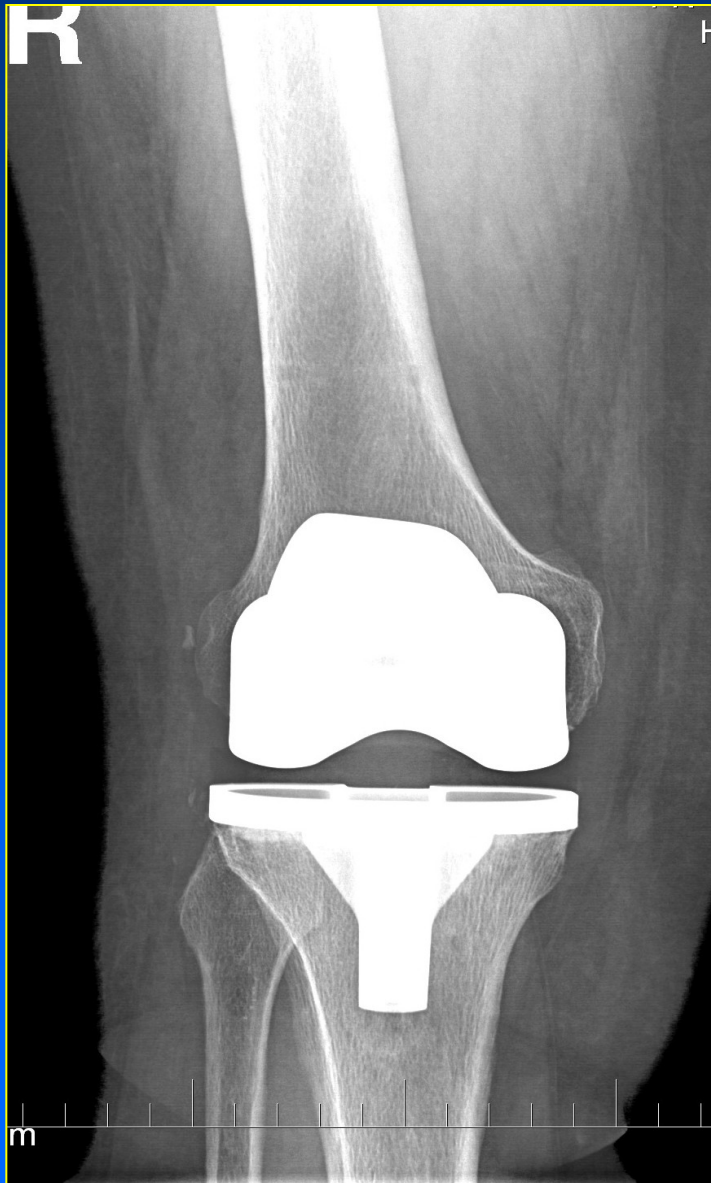


TKR – condylar replacement

- Very most implantations
- All poly/ metal backed tibial c.
- ACL resection
- Intact functional PCL, LCM, LCL



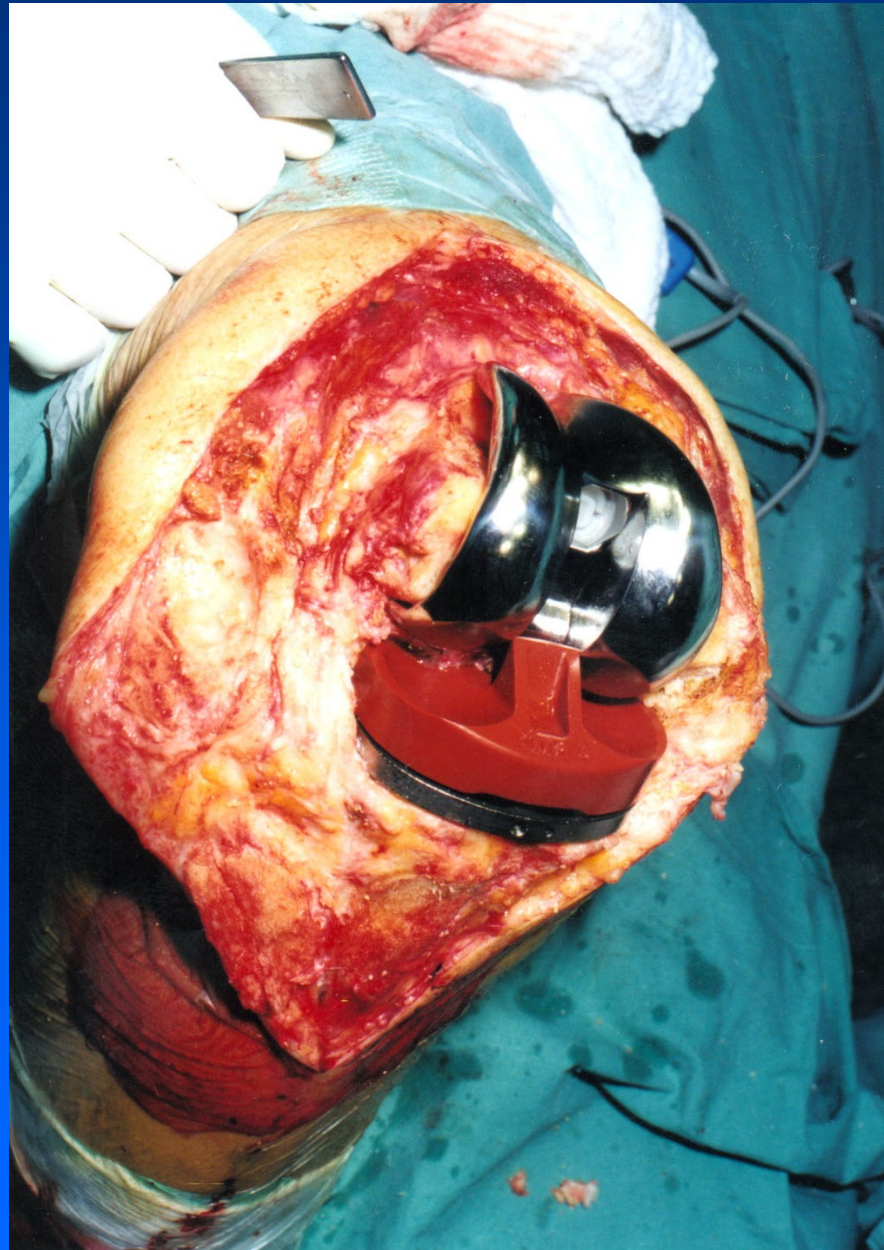
Condylar – PCL retaining



TKA – all poly type



Condylar TKA – PCL sacrificing



TKR Stems, augments, posterior stabilized (PS)

- Poor bone quality
- Bridging of bone defects
- Posttraumatic OA
- Revisions
- PS if PCL deficient/missing
- Intact functional LCM, LCL!



Condylar TKA with stems

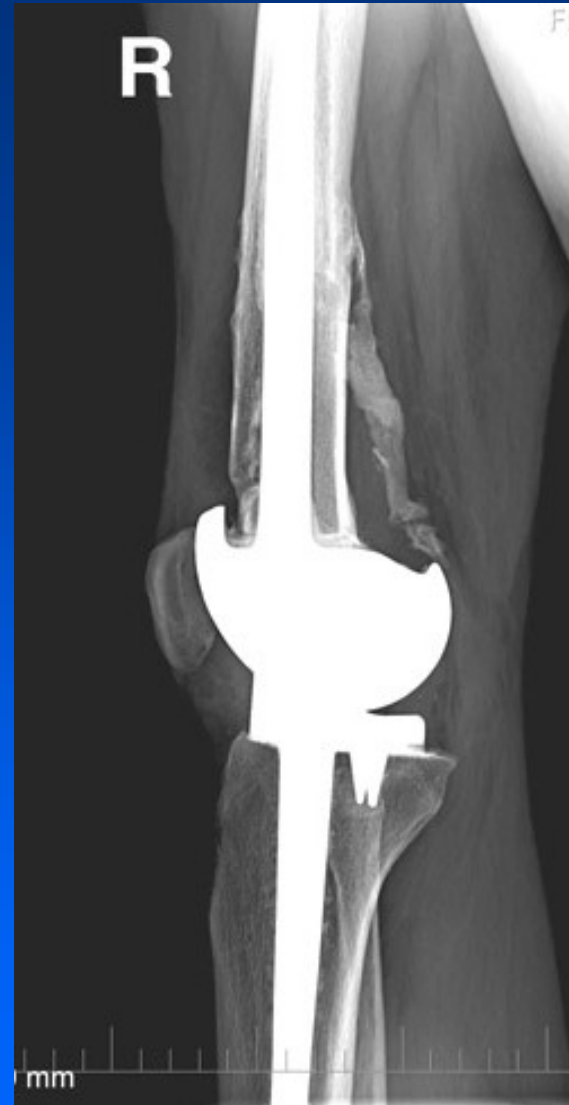


Tu - TKR

- Resection Tu/meta around knee joint
Onkological radicality first!!
- Custom - made implants
- Inferior outcome (compare TKR)
- Higer complication ratio



TKA for tumors

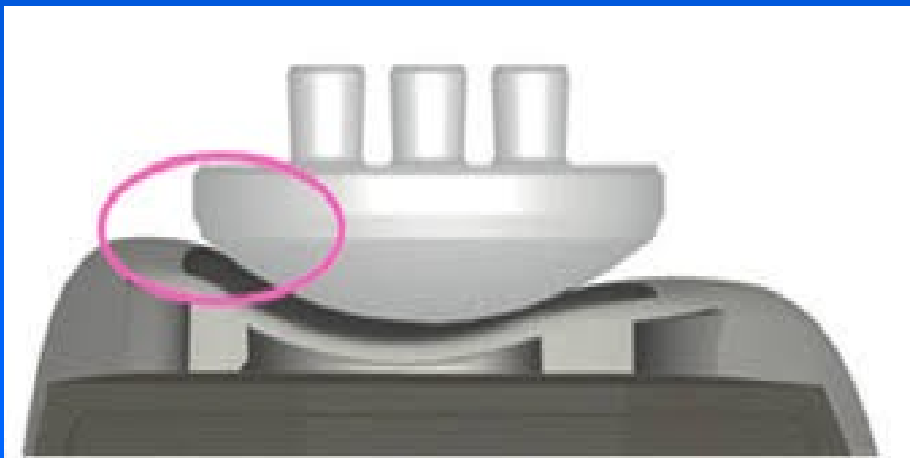


TKA for tumors

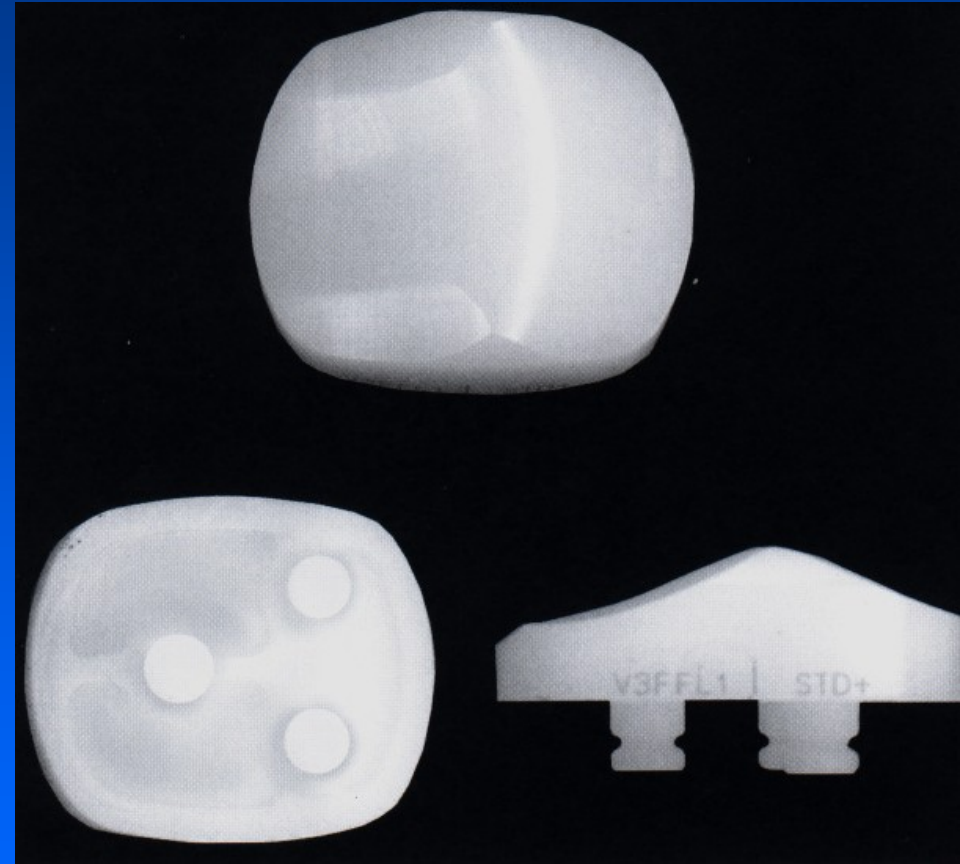
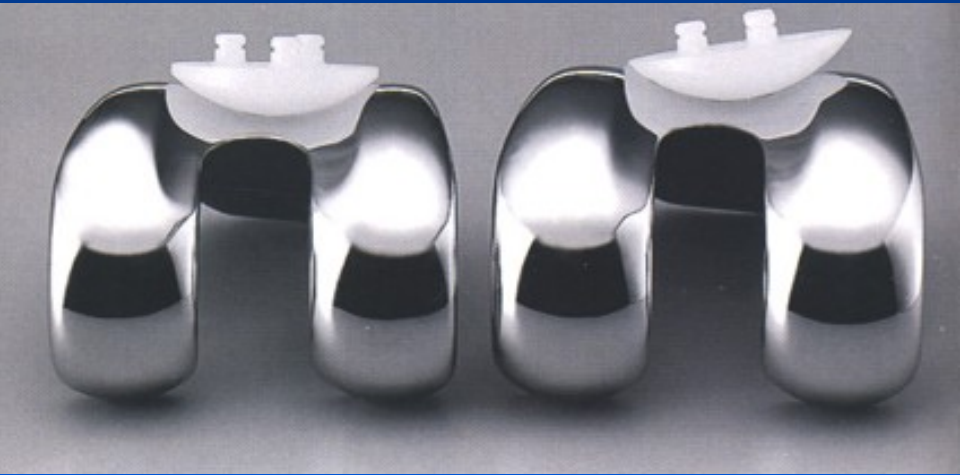


TKR – patelar replacement

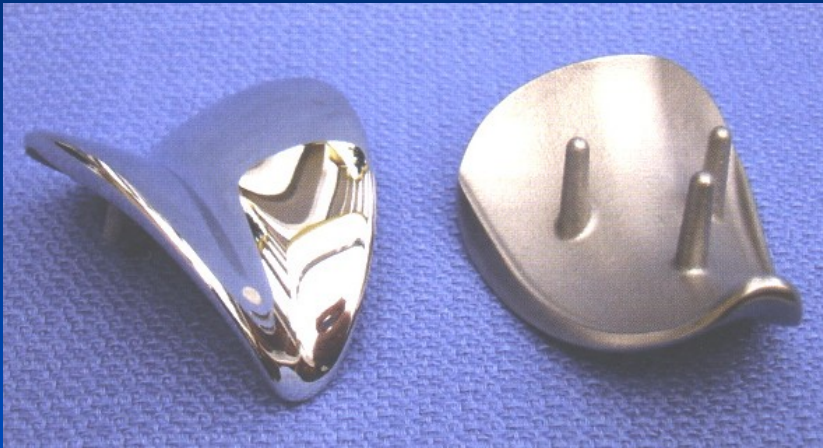
- Second stage surgery – if FP compartment symptomatic after TKR (philosophy?)
- If rotation of femoral component correct, no need in very most cases
- If femoral component malposition – patellar maltracking



Replacement of the patella



Femoropatellar replacement

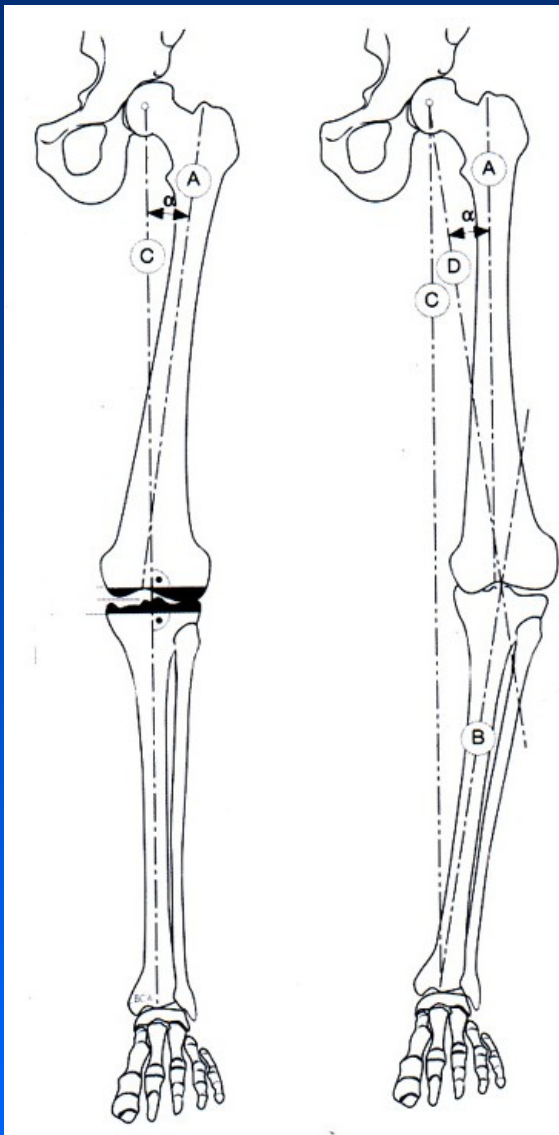


Resection of the patella

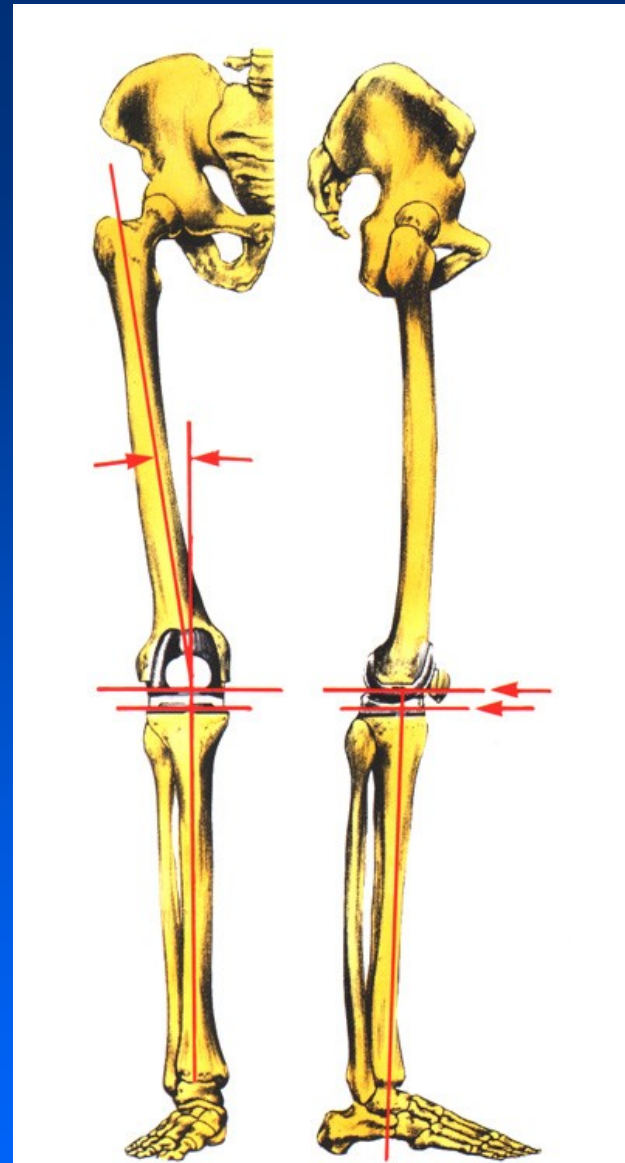


Preoperative examination

- ASA
- Infection focus exclusion (neg ESR, CRP),
stomatological examination
- Attention:
 - Warfarin
 - NSAID
 - PAD
 - Vascular status



Mechanical alignment



Anatomical alignment

X ray in standing position



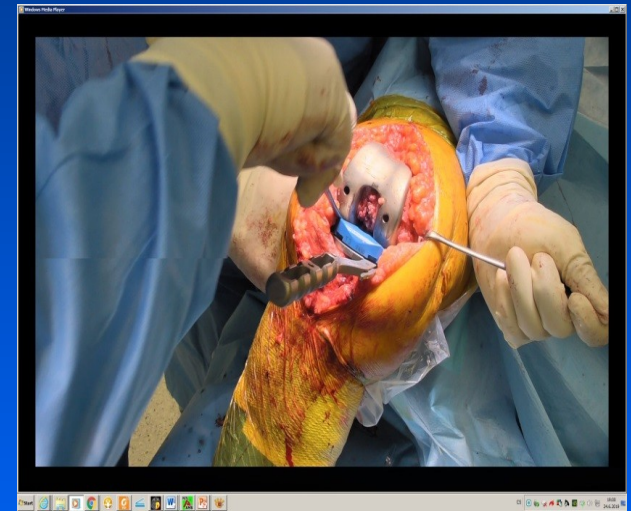
Operation technique

- Standardized
- Medial parapatellar approach x mid x subvastus
- Partial Hoffa fat pad resection
- Patella – eversion, denervation + cheilectomy x parc. resection x patellar replacement implantation
- Distal femoral cut
- Proximal tibial cut
- Soft tissue balancing!!



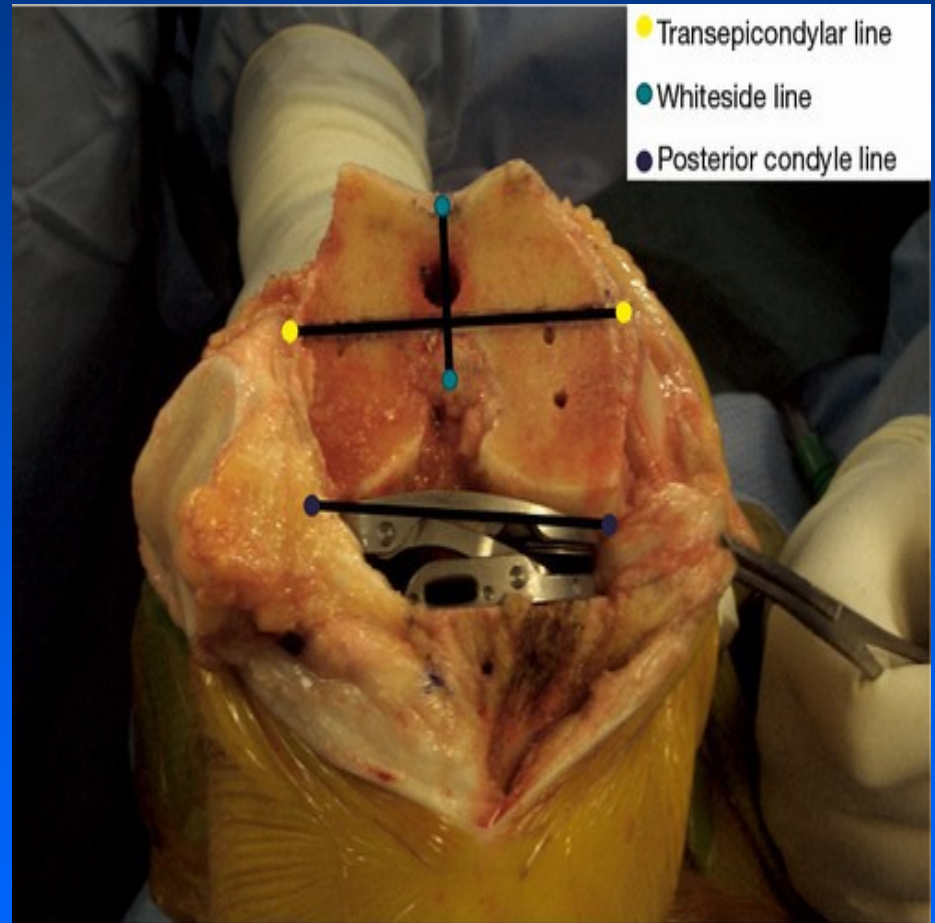
Operation technique

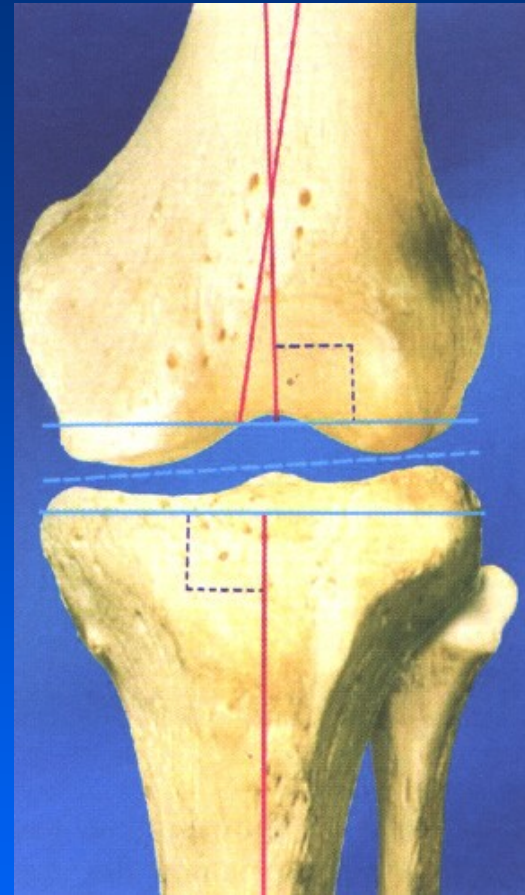
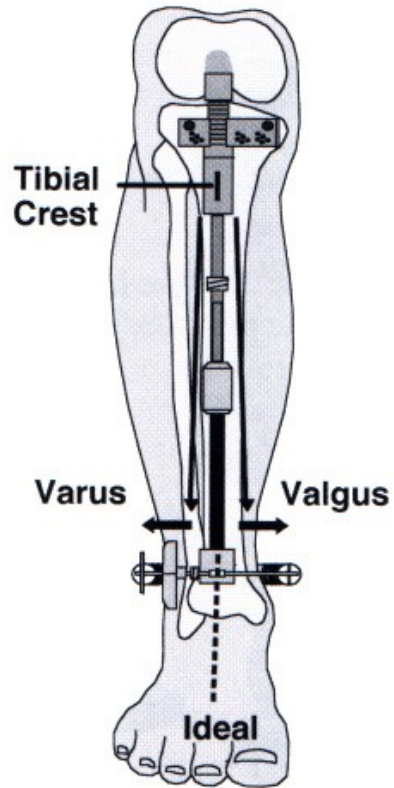
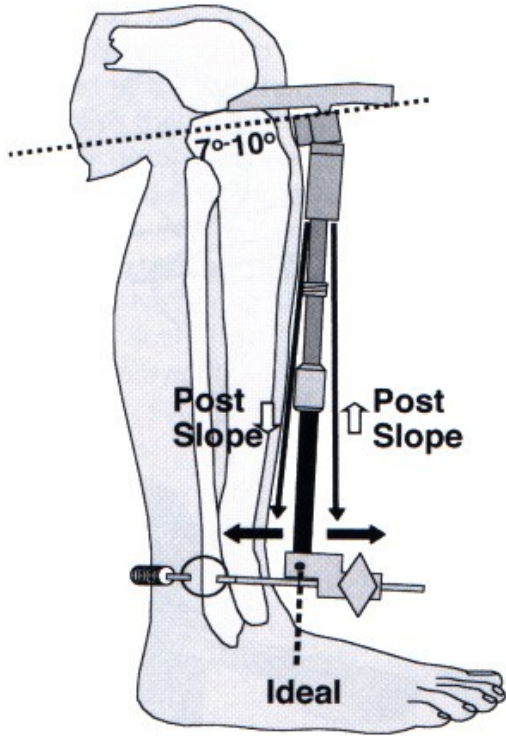
- Flexion x extension gap
- Femoral component rotation
- Femoral resection
- Probe component (soft tissue balance test)
- Tibial preparation (correct rotation!)
- Pulsed lavage
- Original components + bony cement
- Reliable suture!



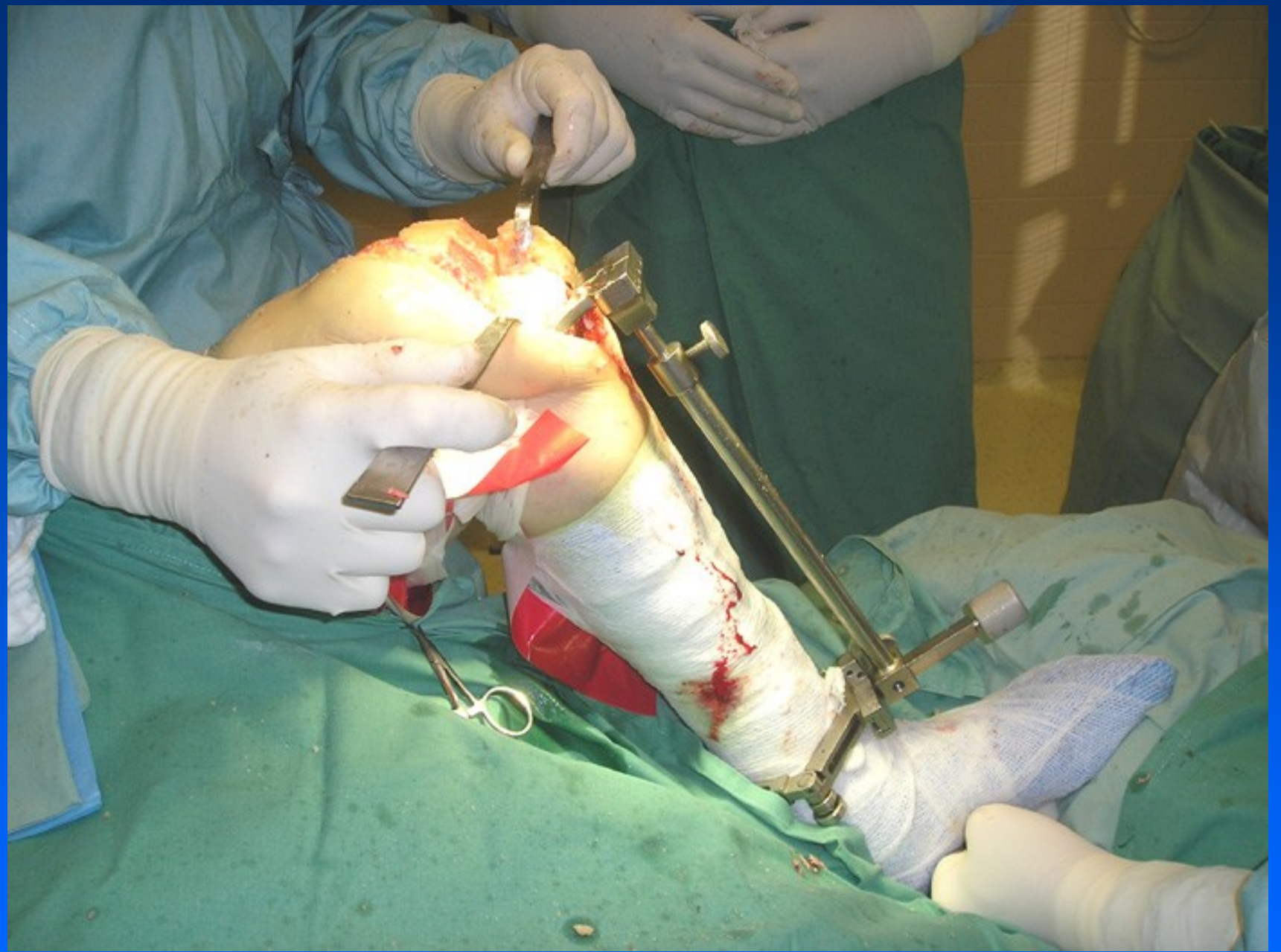
Operation technique

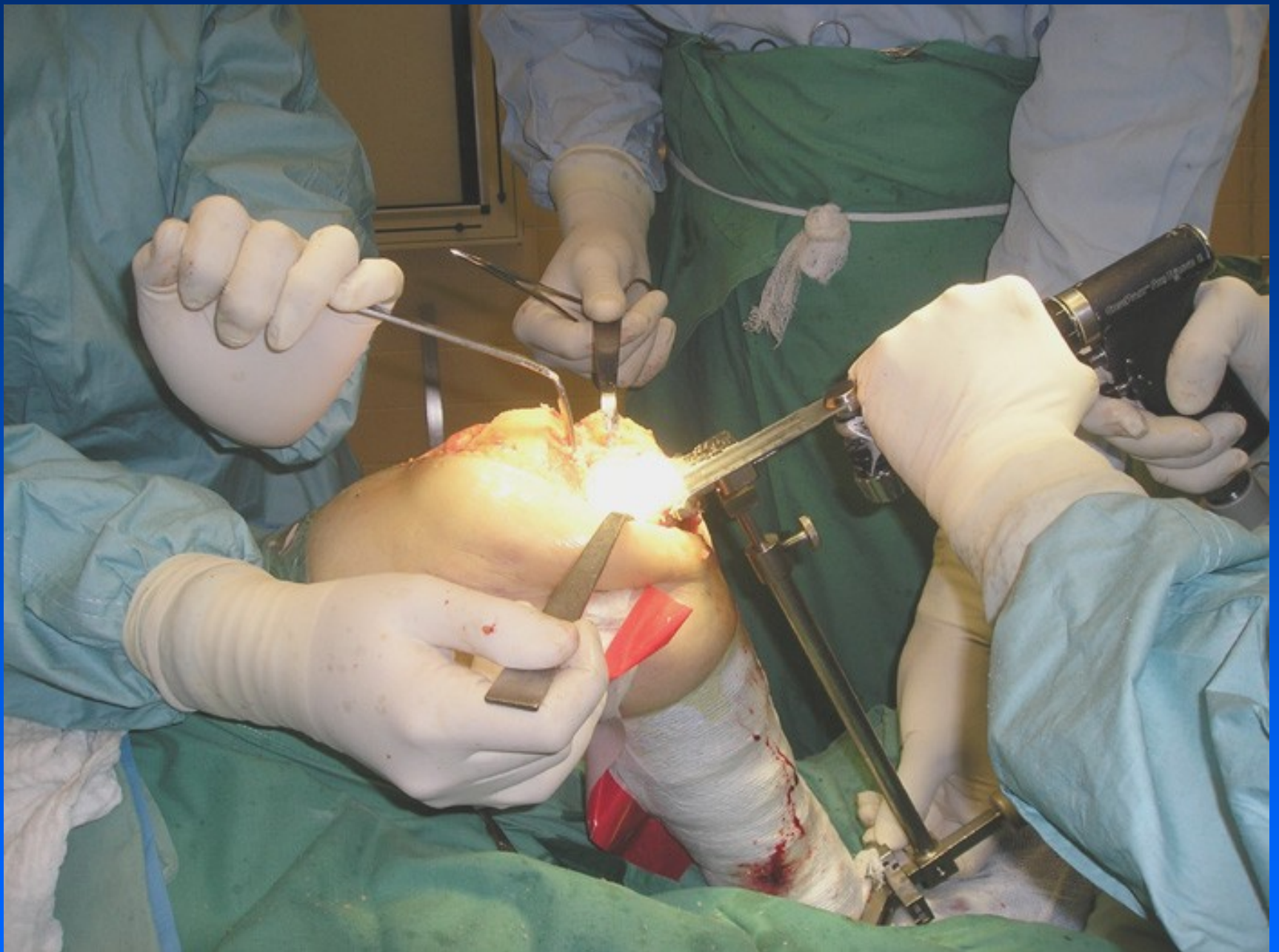
- Tibia first
X
- Femur first
X
- Extension gap technique



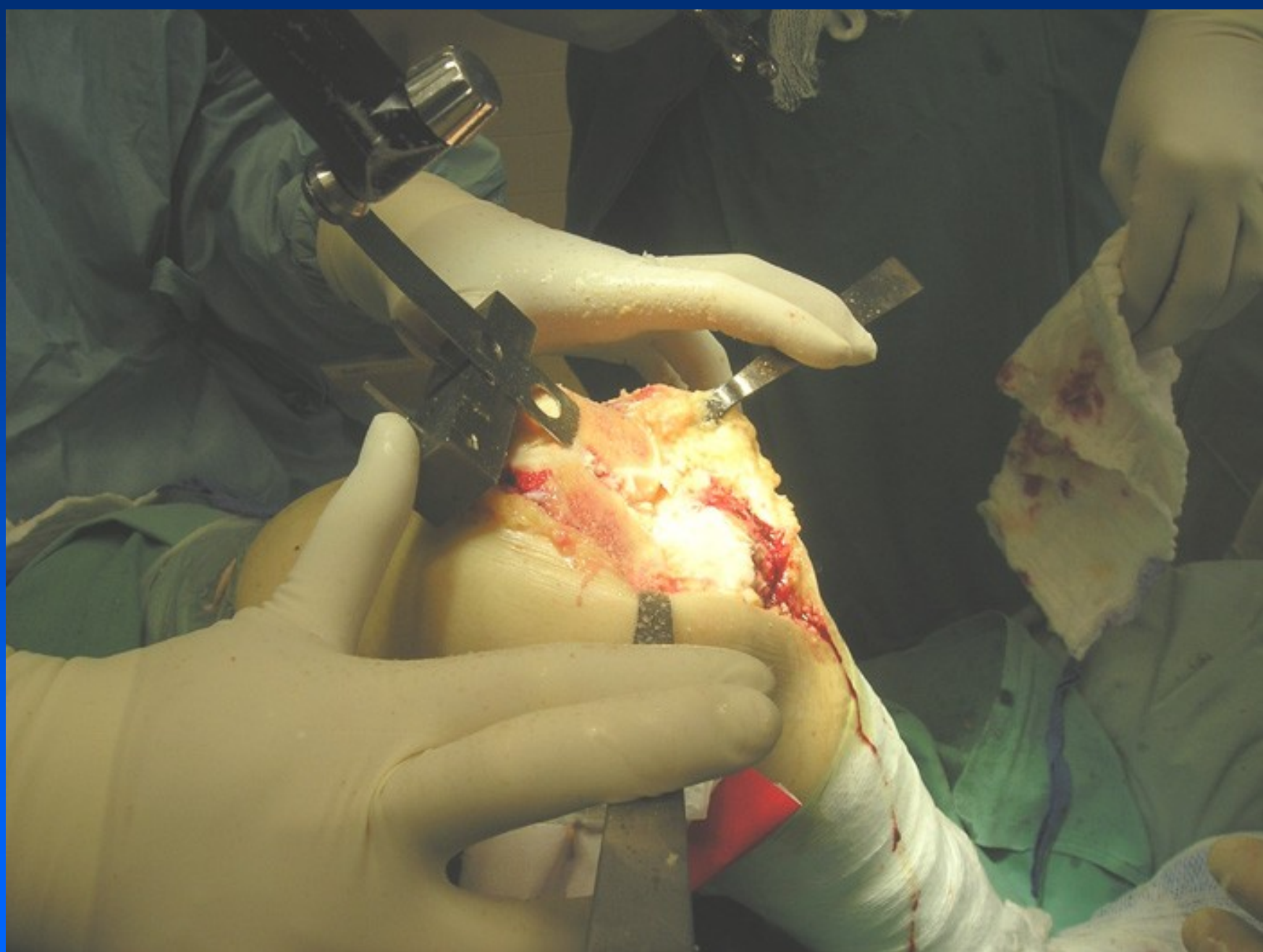


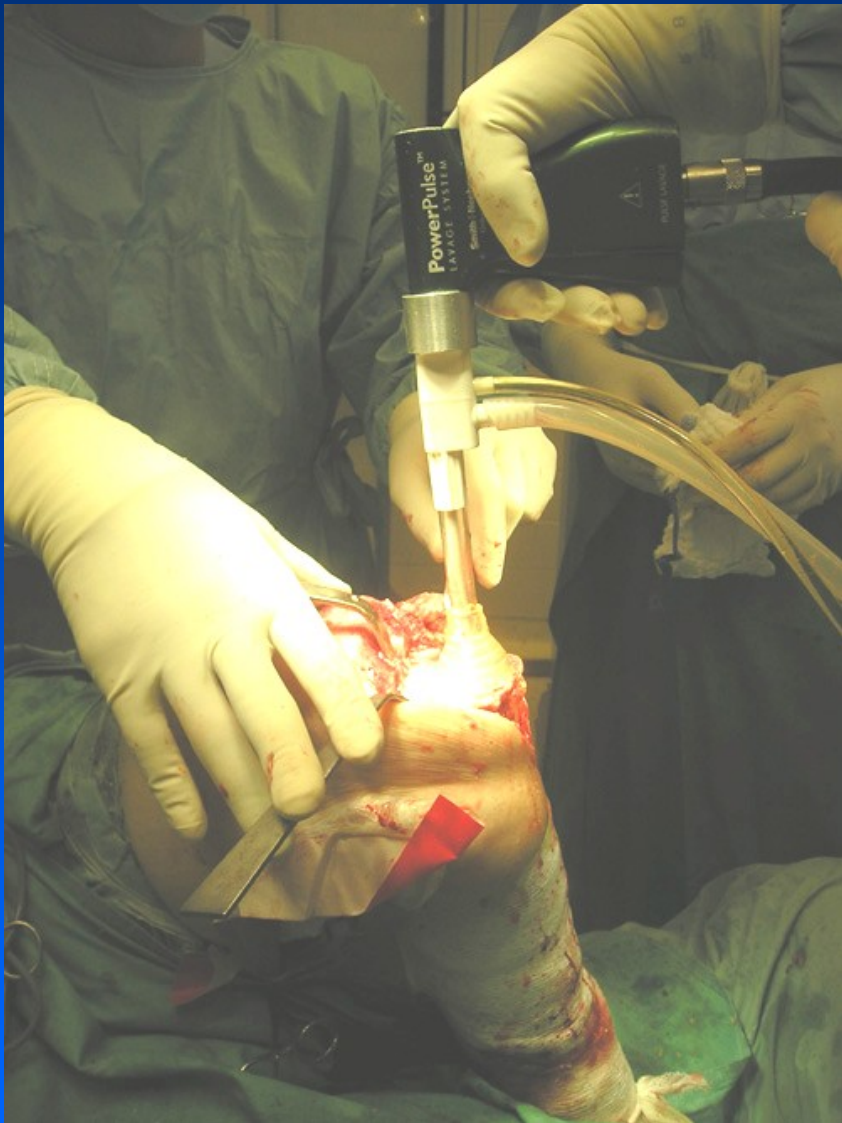
Resection levels





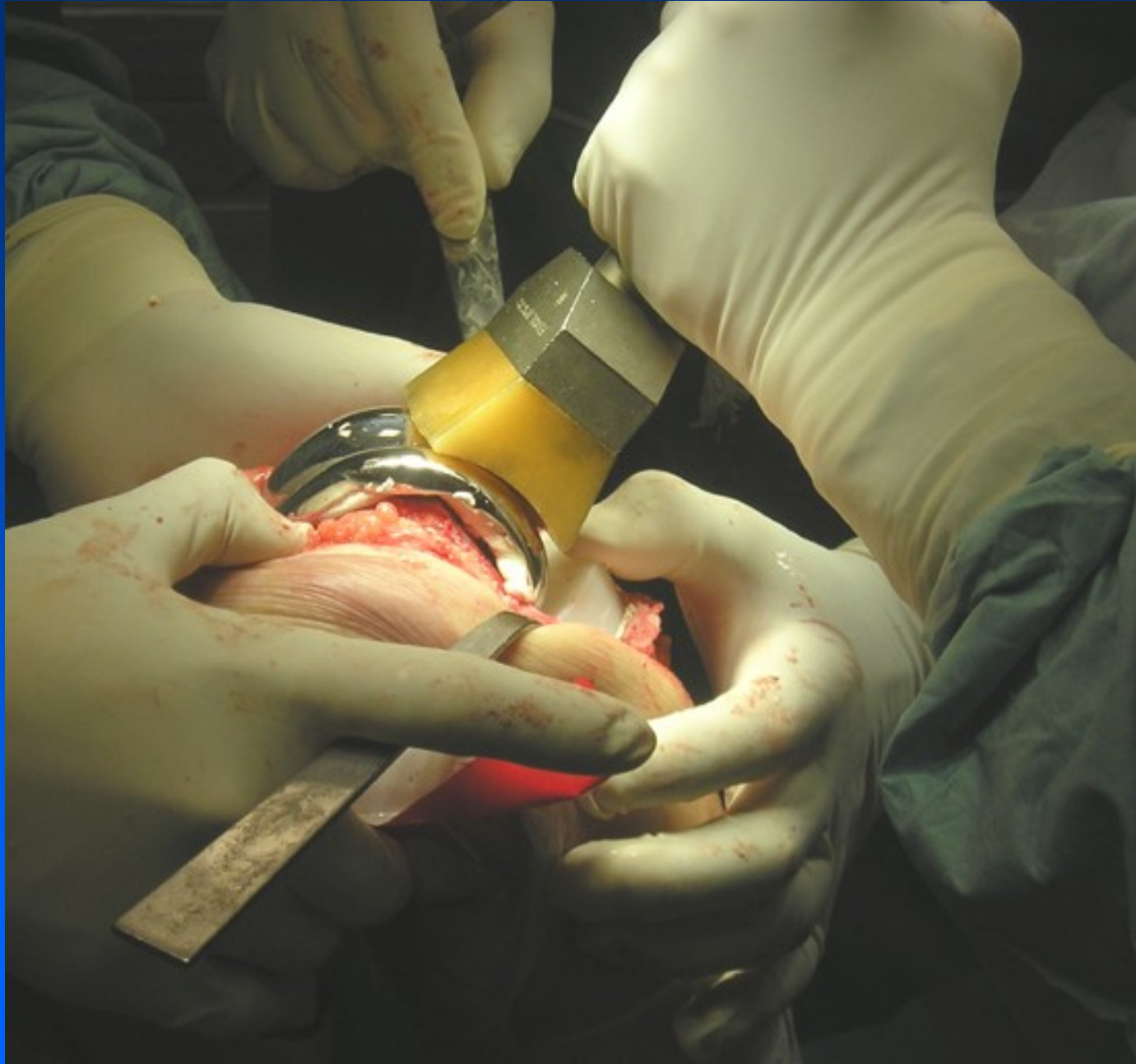


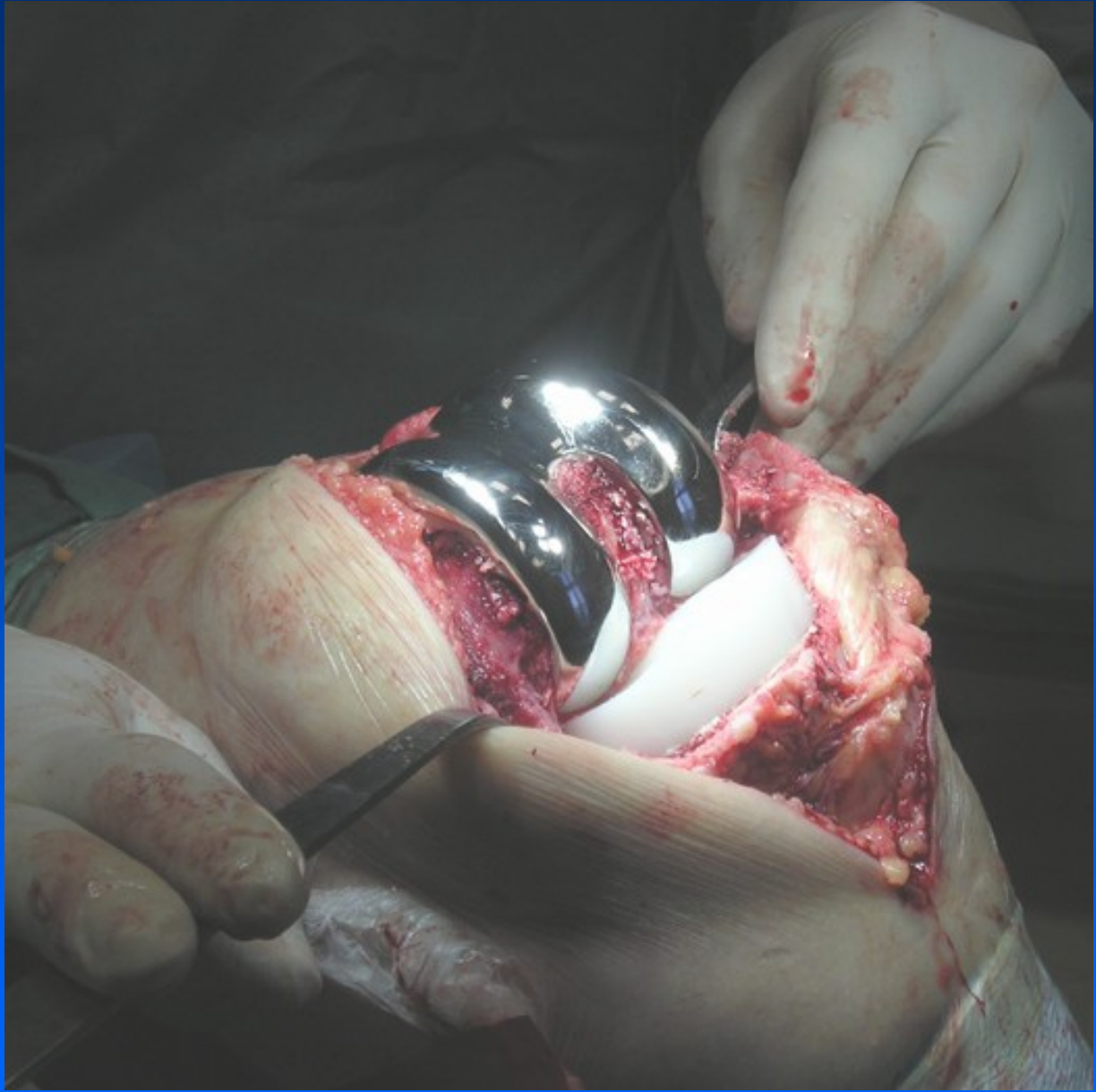








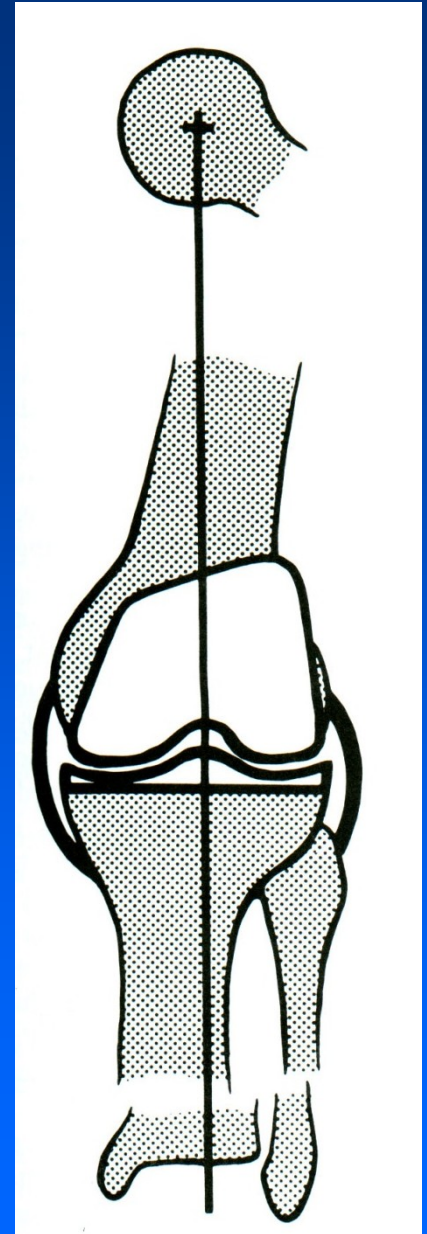


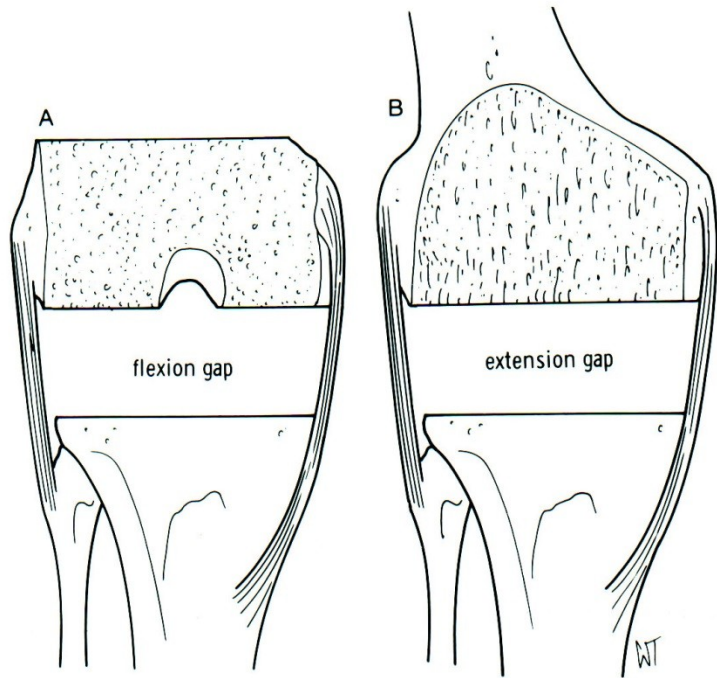




Principles

- Correct tension of soft tissues
- Correct alignment 5 -7° valgus
- Correct joint level

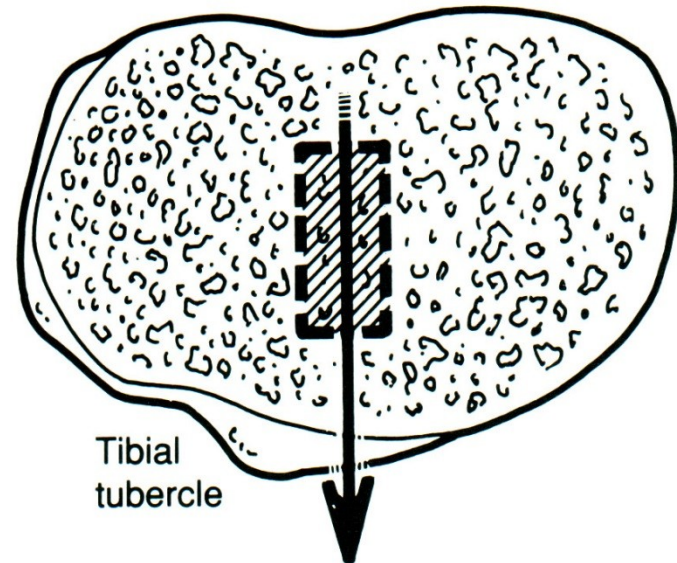




Flection gap

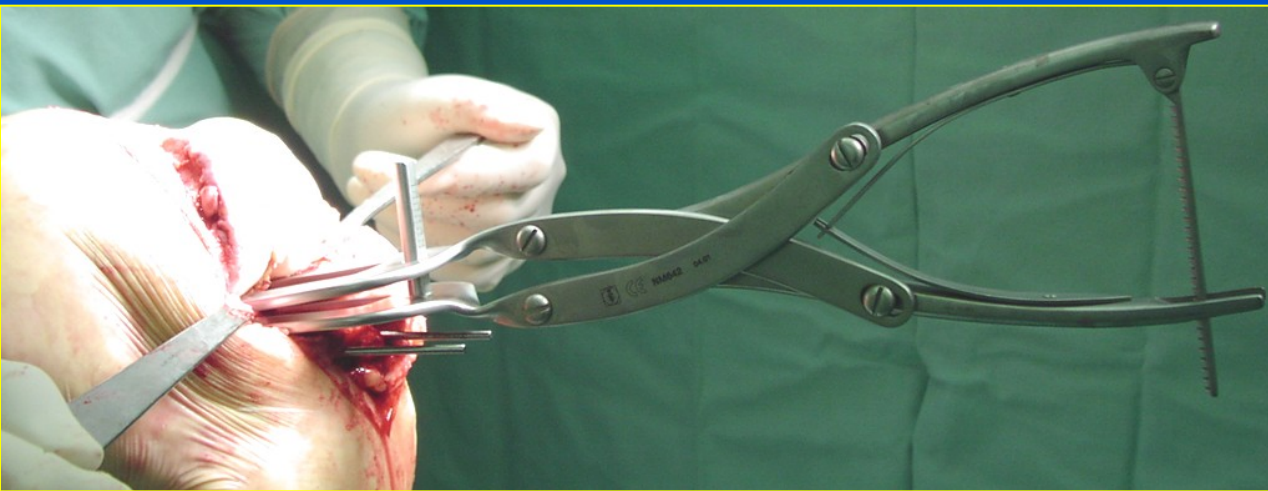
Extension gap

External rotation
of tibial component



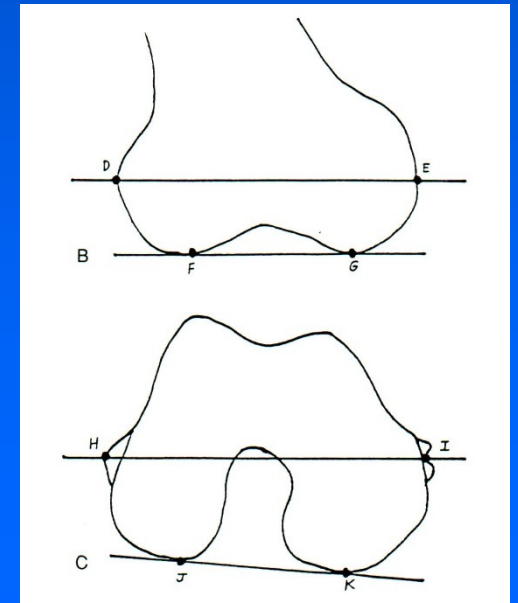
Implantation

- Flexion and extension gap

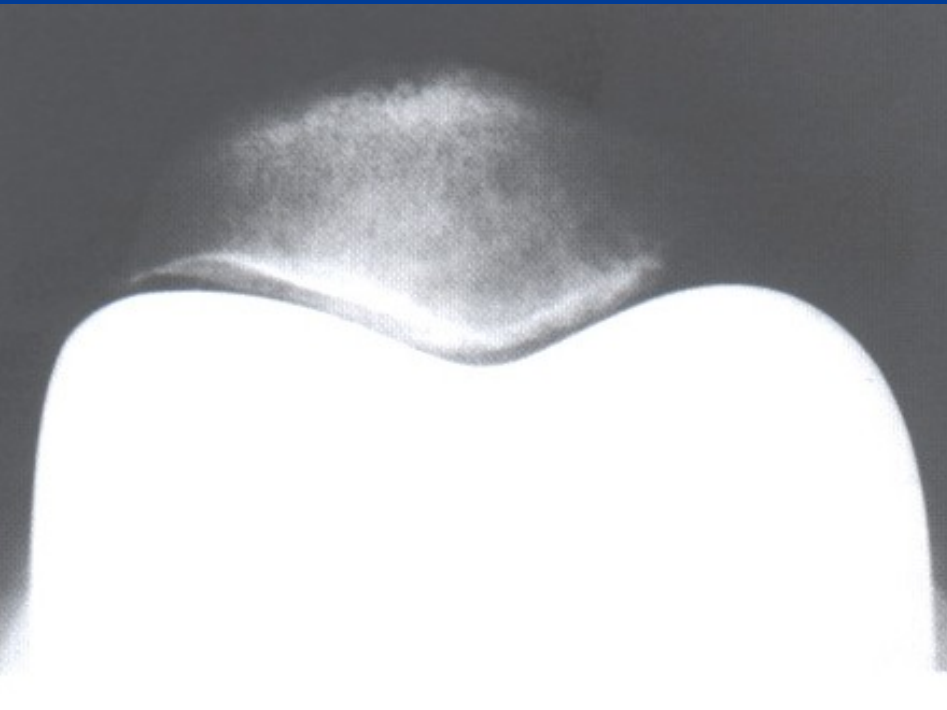


Femoral component

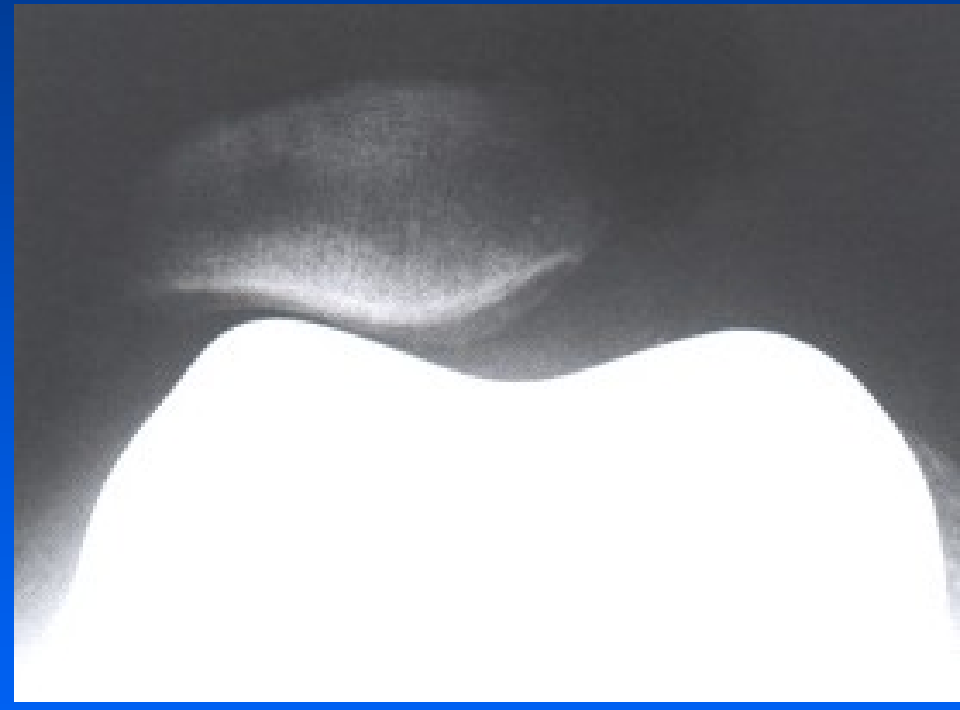
- On anterior cortex
- Parallel with transepicondylar line
- External rotation 3



Patellar tracking



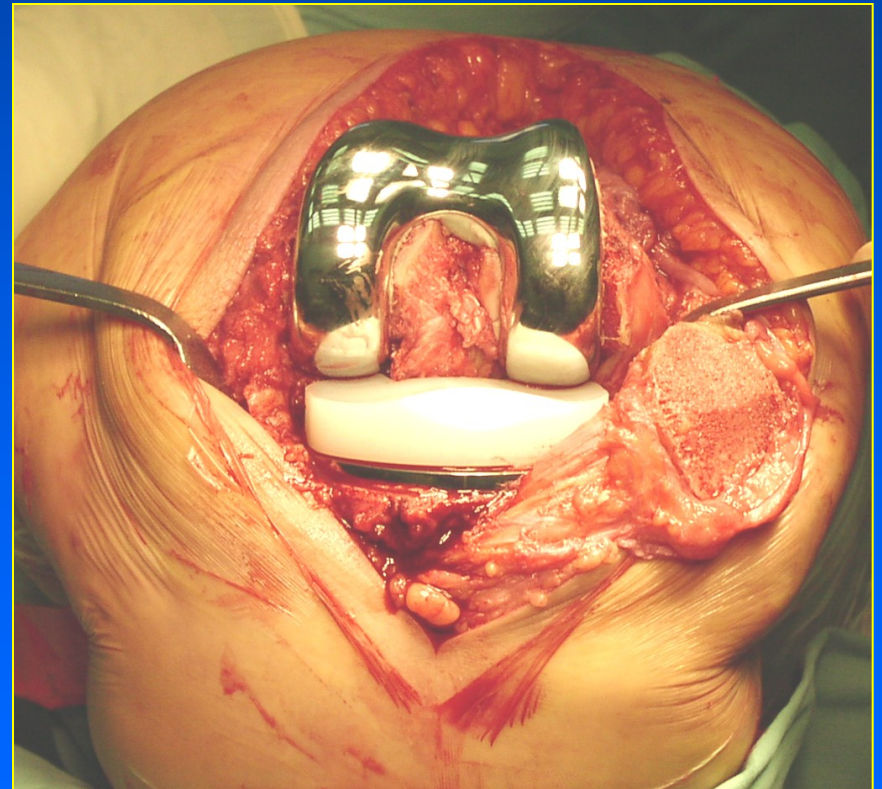
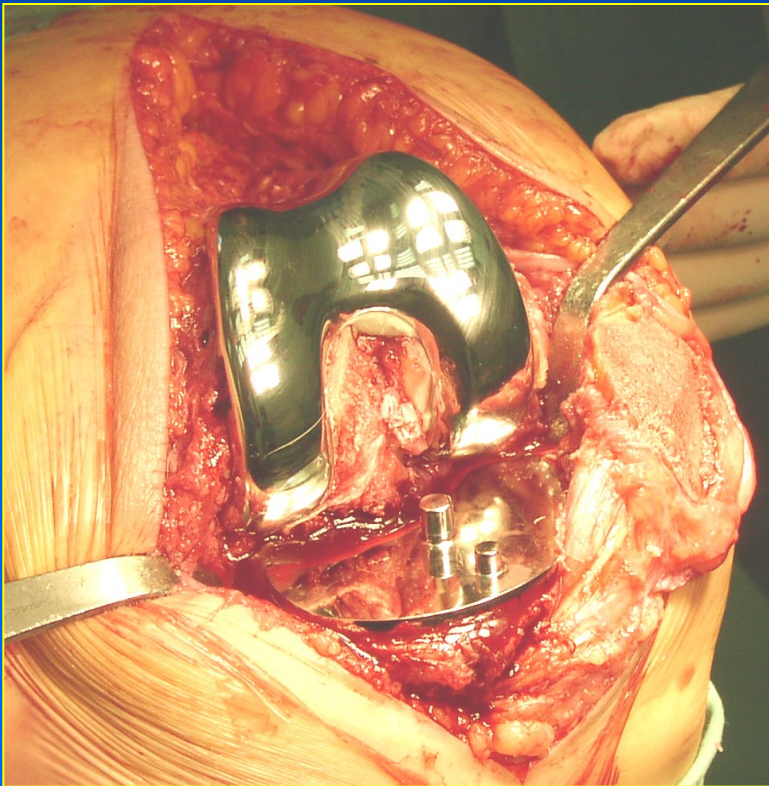
Correct



Incorrect

Implantation

balancing of soft tissue

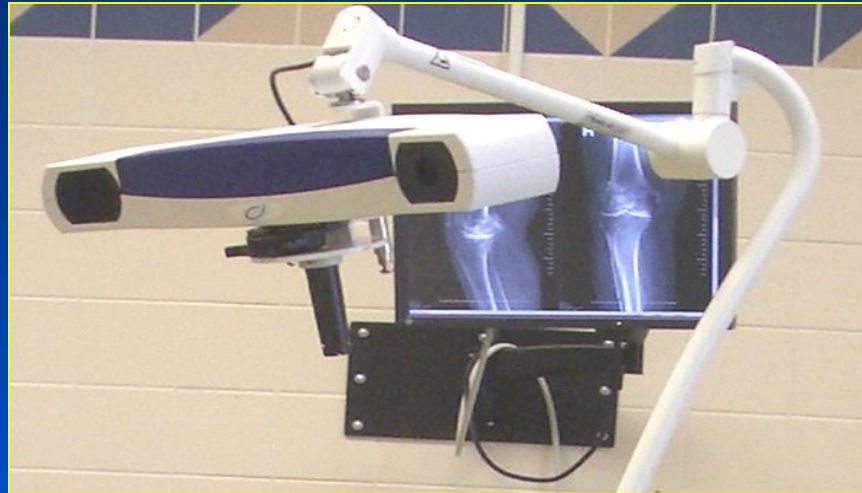


Computer navigation

- Optional, some hospital /countries obligatory
- Mapping reference points and kinematics into SW
- Special instrumentary
- Surgeon is guided
- Necesserry if intramedular instrumentary
- impossible (trauma)

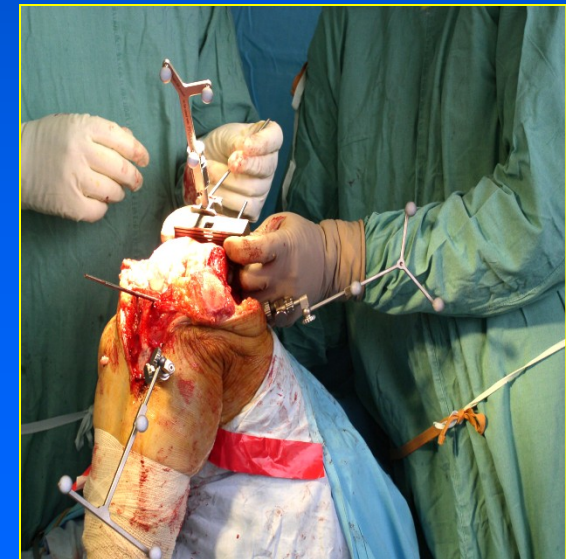
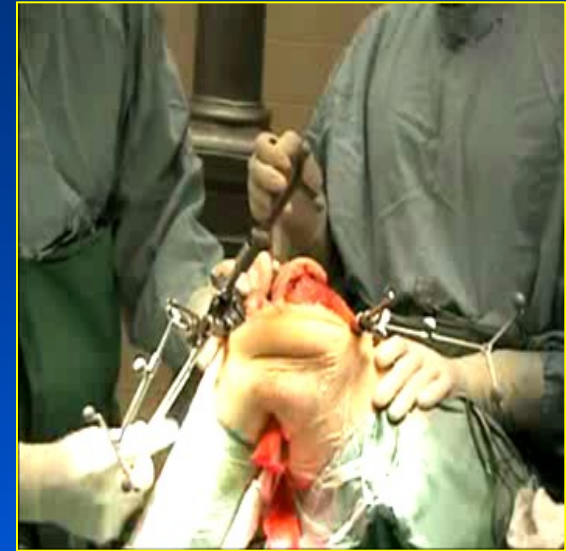


CI navigation



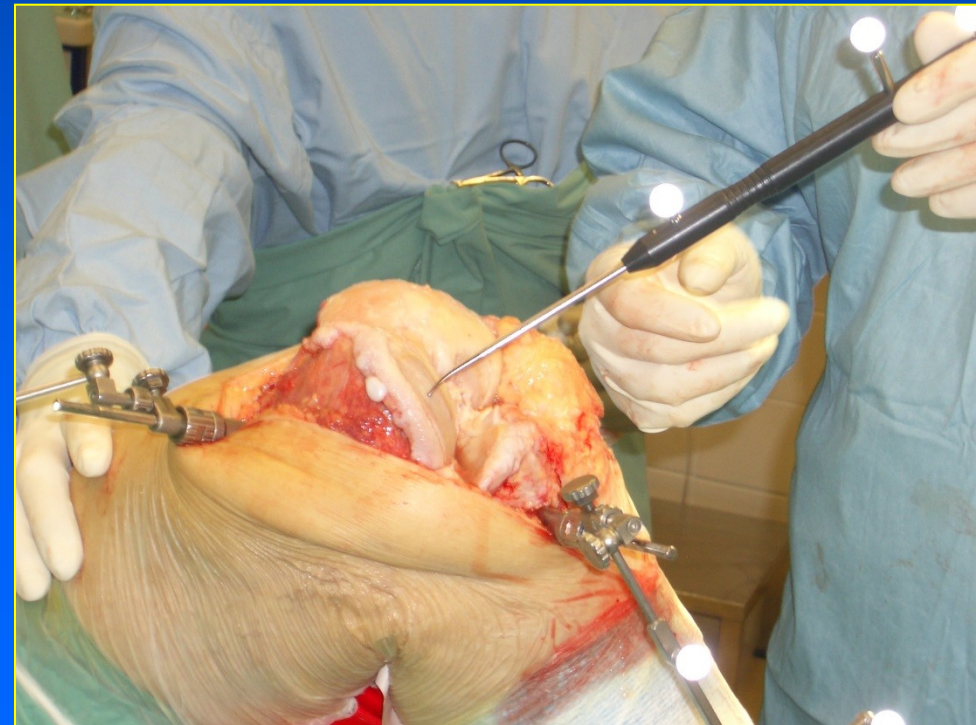
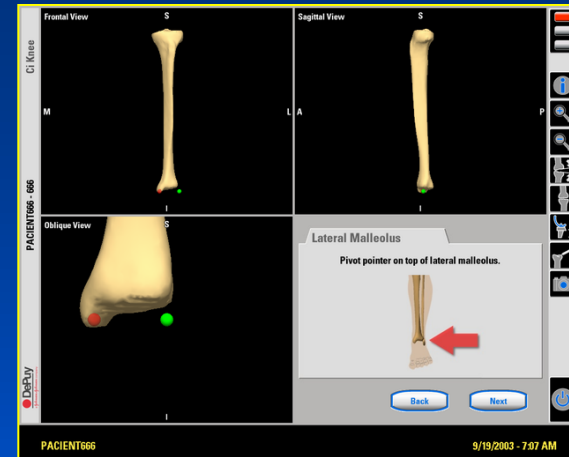
Computer navigation

- Proximal tibial cut planning
- Distal femoral cut planning

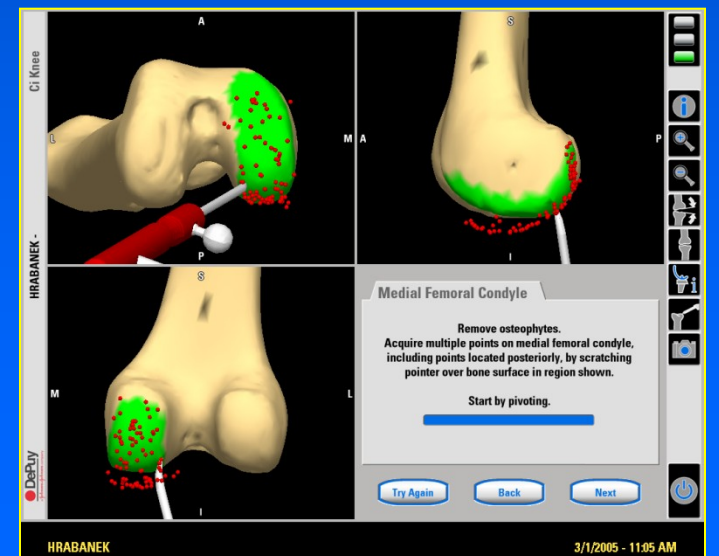
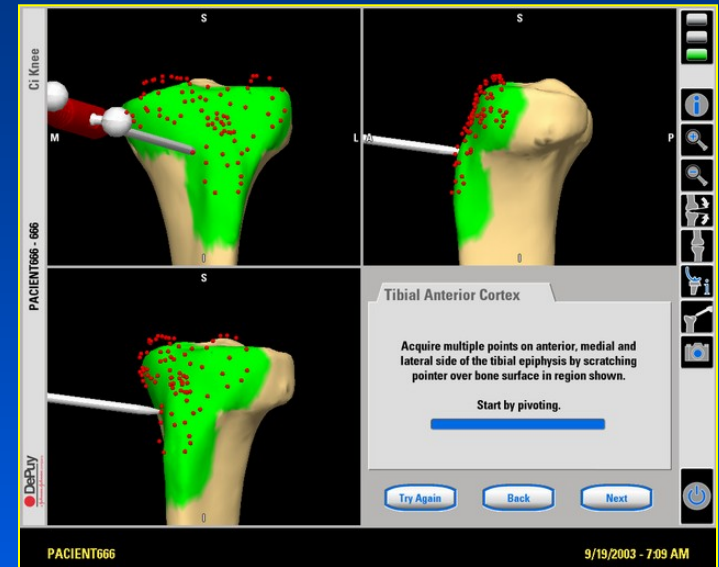


Pointer

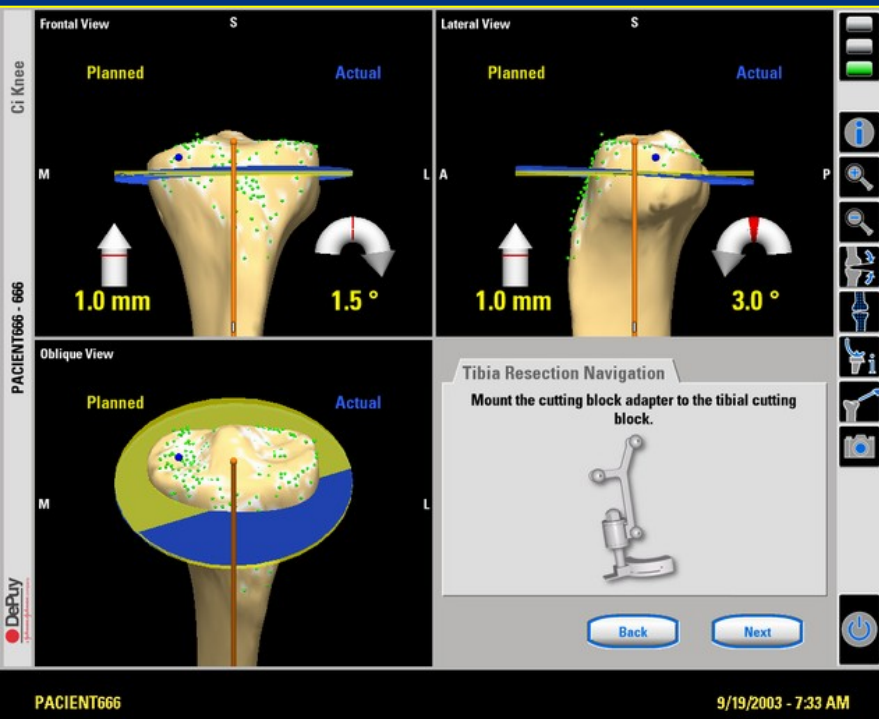
- Centre of the hip
- Centre of the ankle
- Centre of the knee



Multiple points



Tibial resection



Resection of the femur

CI Knee

Planned Actual

Frontal View

M L

3.0 mm 7.5°

Planned Actual

Lateral View

M L

3.0 mm 16.0°

Oblique View

Planned Actual

M L

DePuy

CI PACIENT - 1

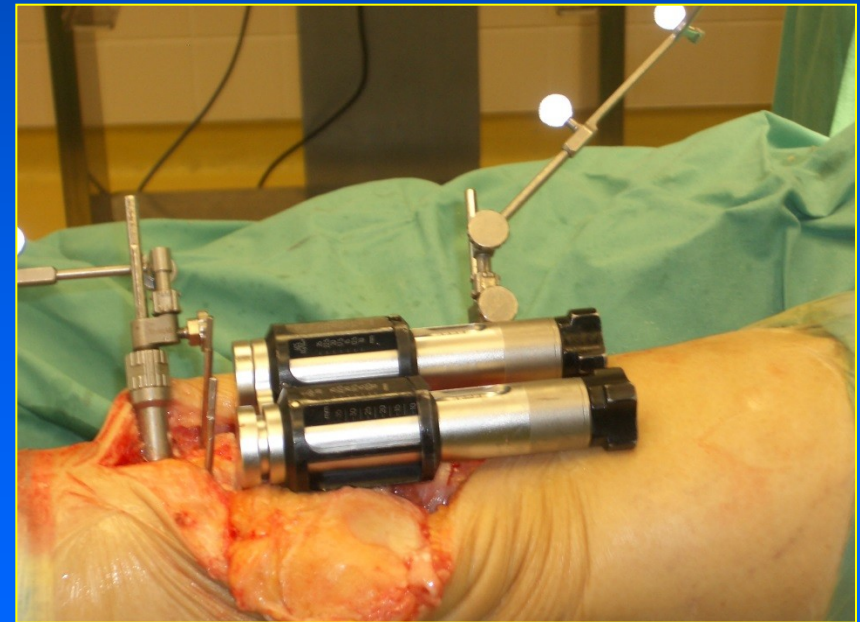
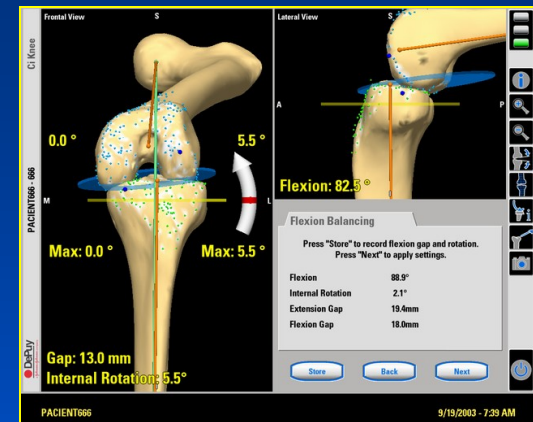
Distal Femoral Resection

Mount the cutting block adapter to the distal cutting block.

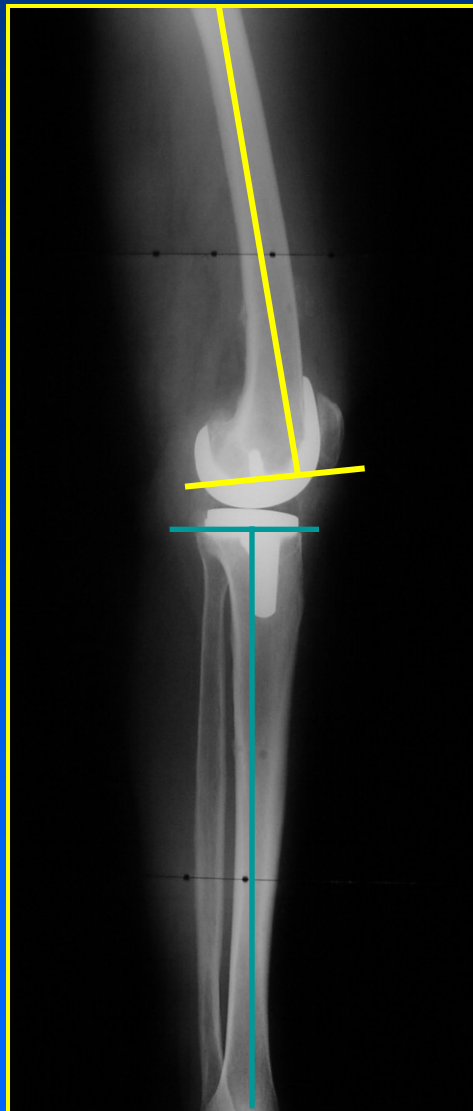
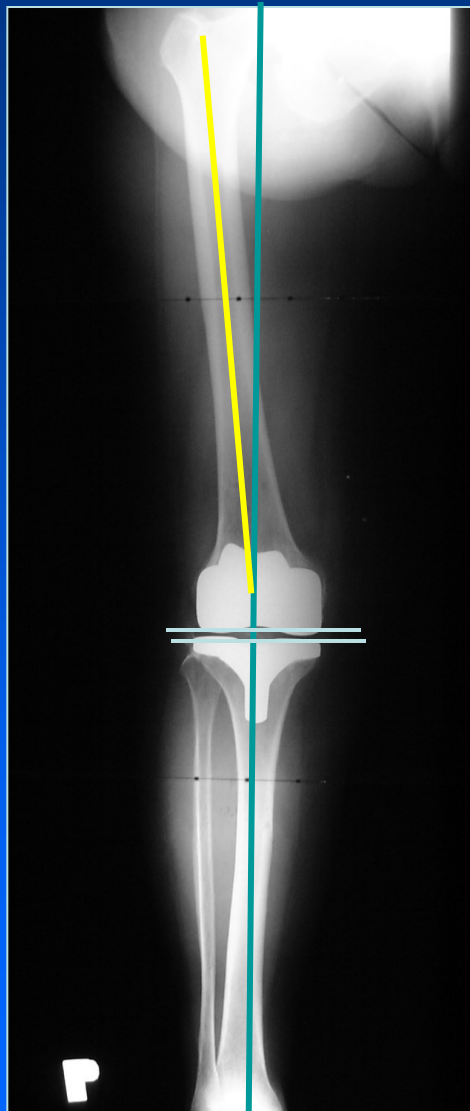
Back Next

CI PACIENT 9/17/2003 - 10:38 AM

Balancing of soft tissues



Alignment of the knee



Physiotherapy

The goal- to get active flexion and extension 0-90 up to 15 days

1. Isometric exercise, breathing, vessel gymnastic
 2. Removal of drainage, start flexion and extension active
 3. Walking on crutches, leg- touch down
 4. Active flexion and extension of the knee
passive splints- continuous passive movements
 5. Self independence on walking
 6. Stairs
 7. -8 day- discharge to physiotherapy unit
- 10 days - 2 weeks in physiotherapy unit
Then exercise at home or ambulation units
Full weight bearing after 3 months
Up to 3 months- spa resort admission for 4 weeks

In special centres- fast track physiotherapy

Complications - local

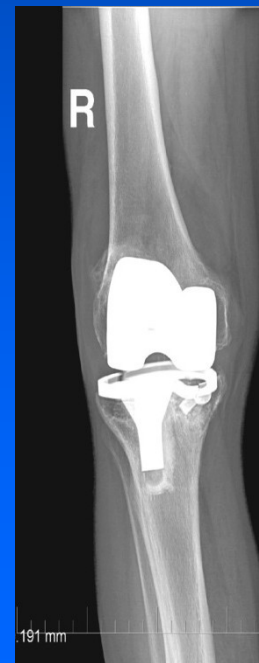
- Perioperative: nerve lesions, vessel lesions,
- bleeding
- Postoperative: hematoma, wound problem, early infection
- Late: PE wear, osteolysis, aseptic loosening
- instability, limited joint movement
- patellar pain
- periprosthetic fracture, dislocation
- infection

Complications

- Pulmonary embolism
- Myocardial infarction
- General decompensation
- Development of delirium

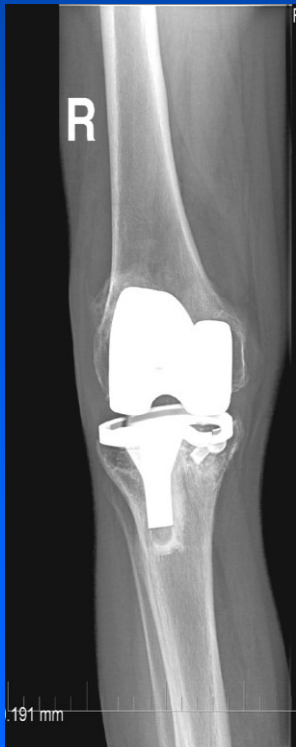
Aseptic loosening

- Most frequent TKR revision reason
- Macrophage-induced inflammatory response resulting in bone loss and implant loosening
- PE particle induced granuloma

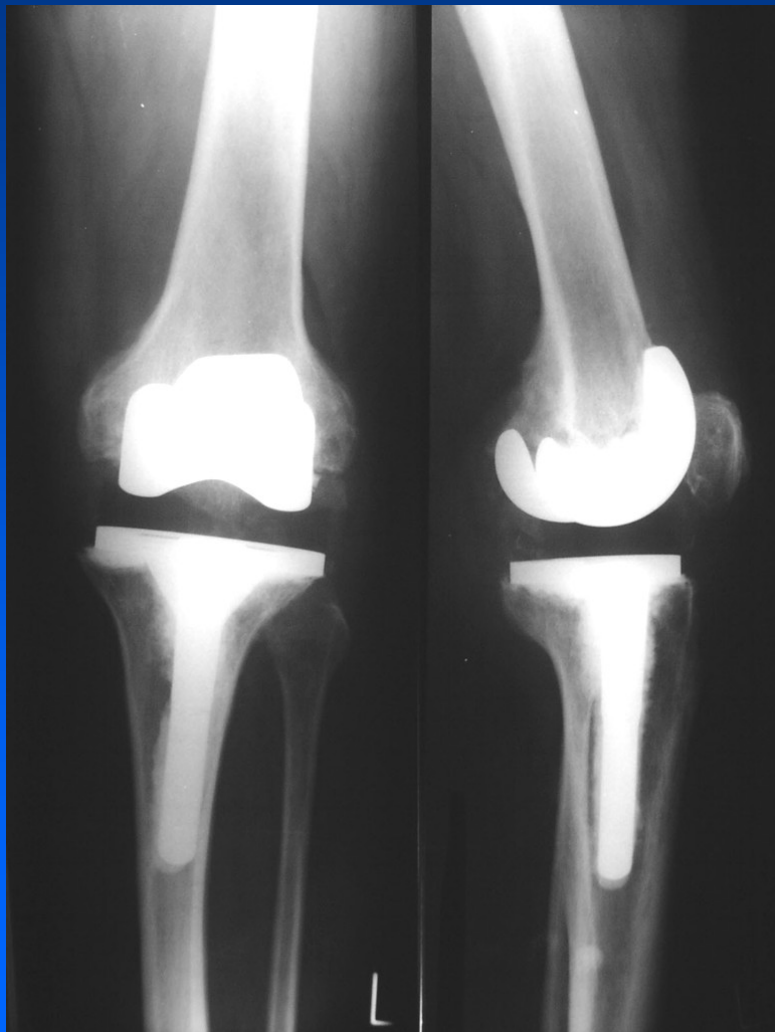


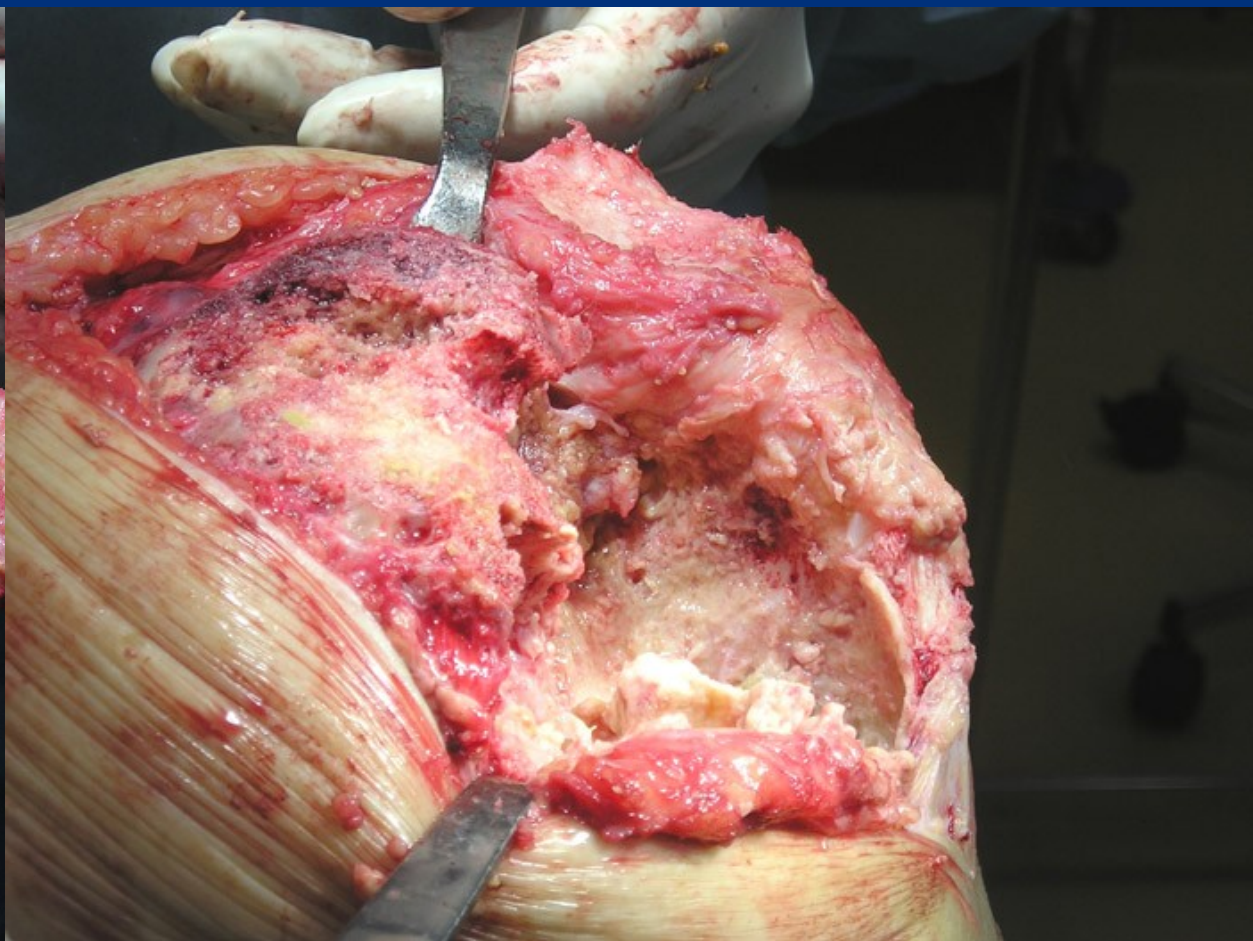
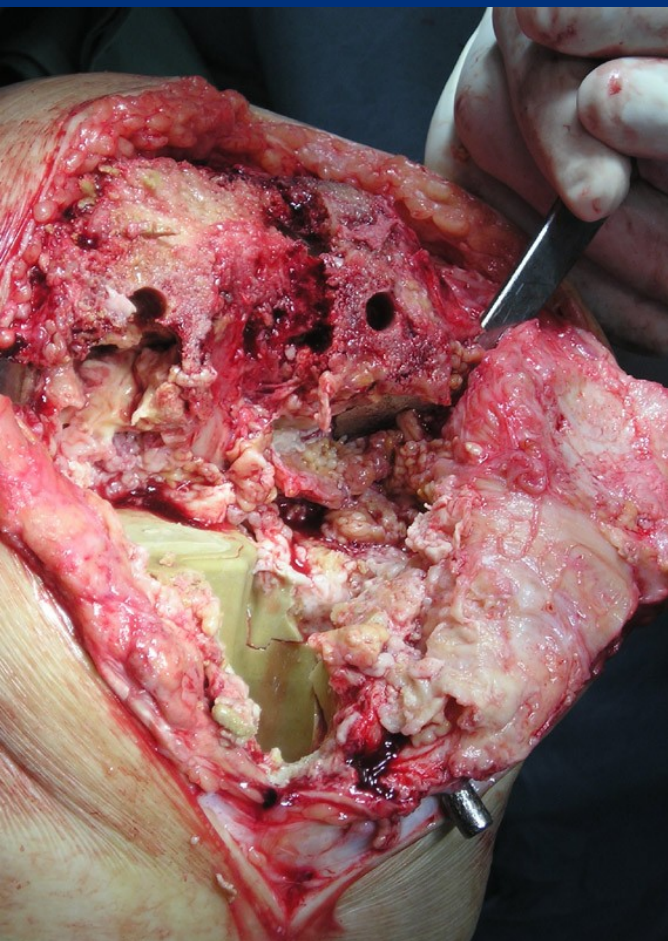
Aseptic loosening - therapy

- Revision, replantation
 - Revision implant, stems, augments. Cement with ATB
 - Double ATB combination – higer infection risk

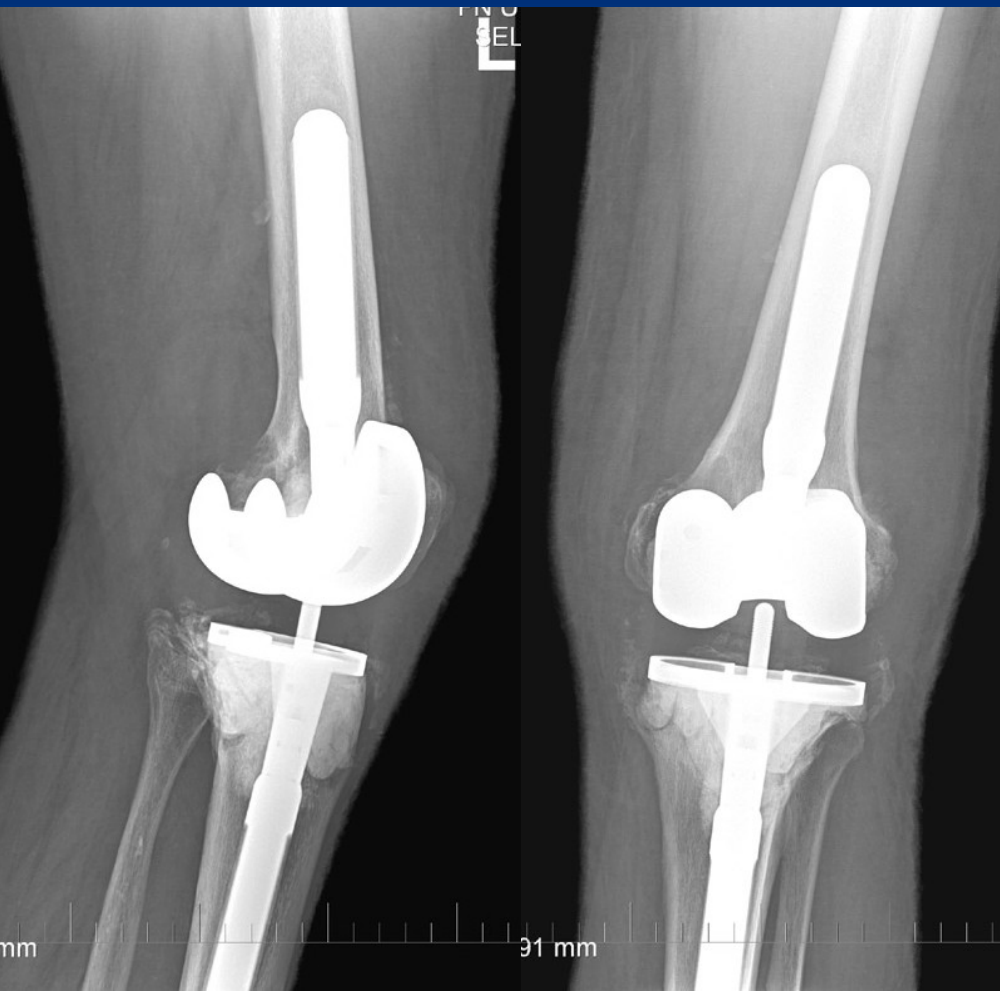


Revision TKA





M., 1927., primary TKR in 1997
Large defect of bone in the tibia



2004

Revision TKR ,PFC Σ Modular Knee System
Bone cement in the tibia





2006



M., 1927., revision TKR ,PFC Σ Modular Knee System
Bone cement in tibia, cortical contact of the stems

Aseptic loosening - prevention

- Modern quality PE (minimal wear rate)
- Correct surgery technique - ballancing
- Reasonable régime after TKR
- Follow up, early revision indication.



Complications

- Periprosthetic infection (PJI) – 1-2% primo, 5-10% revision
 - Early – up to 2 weeks after surgery
 - Late hematogenic
 - Diagnostic
 - General symptoms of infection
 - Local condition
 - Arthrocentesis + aspiration - cultivation + PCR
 - Fistula with purulent secretion
 - Radiolucent periprosthetic lines around implant on X ray (chronic PJI)



Periprosthetic infection (PJI)

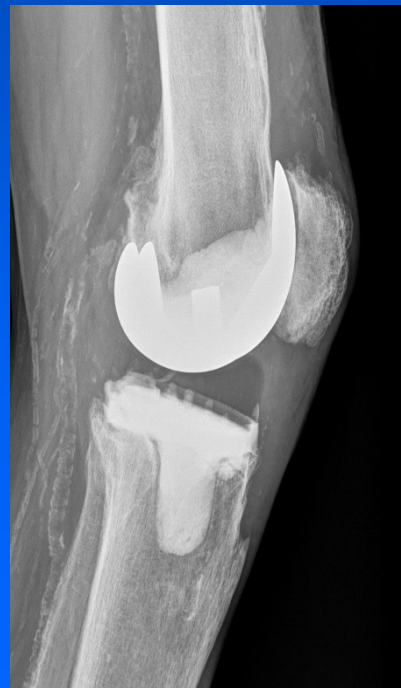
- Therapy
 - Up to 2 weeks from manifestation - DIAR (debridement, ATB, implant retention)
 - Upward of 2 weeks – revision, debridement, replantation
 - One stage – dubious outcome
 - Two stage – cemented ATB spacer, after healing infection revision and new implant possible
 - ATB suppression of chronic infection optional (old patients with no perspective to surgery)
- ATB therapy
 - Cultivation (puncture + aspiration, perioperatively samples, sonication of implant)
 - ATB i.v. 2 weeks minimum
 - 6 weeks p.o.

Periprosthetic infection (PJI)

ATB spacer

Rigid (stiff)

Articulation



Periprosthetic infection (PJI)

- Revision, new TKR implantation



Periprosthetic infection (PJI)

- Recurrence of infection – ultimum refugium
 - Fusion
 - Amputation (rarely)



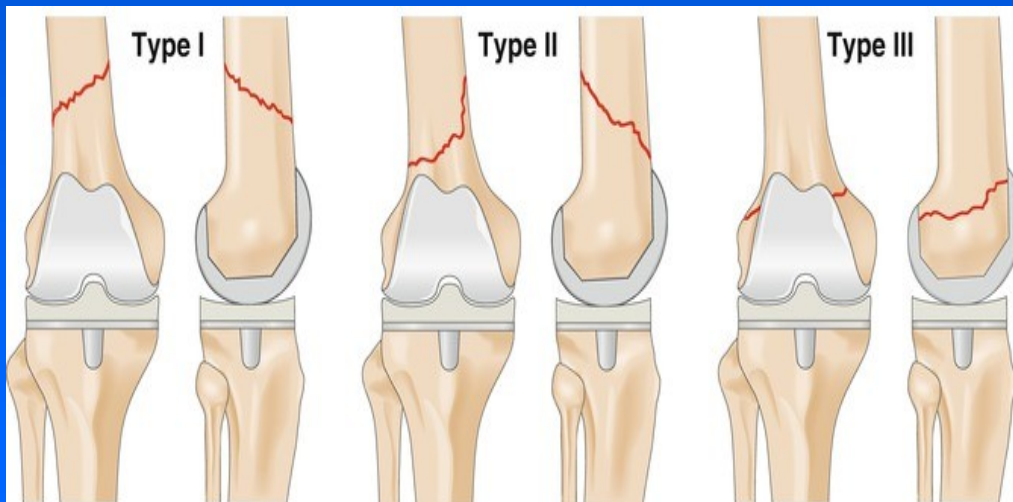
Prevention of infection

Preop. examination
Asepsis in operating theatre
Perioperative antibiotics
Correct technique
Cement with antibiotics



Periprosthetic fracture

- Dist. femur x prox tibia x patella
- Older patients, worse general condition
- Osteoporosis, poor implant retention
- High mortality and morbidity rate
- High complication rate
- Demanding surgeries (experienced surgeon)



Periprosthetic femoral fracture; therapy

- conservative – no/minimal displacement + implant retention; poor general condition
- IM stem (implant retention + fr. above fem. component)
- OS (LCP, condylar plate –implant retention + fr. In the level of fem. component)
- Femoral component replantation + stem (loosening of fem. component)



Thank You for Your attention